The 1888 map shows the route of the St. Louis and San Francisco Railroad, 8 kilometers north of Newonia. Successfully bypassing the alleged incrusted lake, the track was laid without problem, or so the railway men might have claimed.

The skeptic might accuse the railway men of imaginations run amok by what was no more than profound mud, but as we noted early in our journey, were we to dismiss speculation regarding underground waters that seem nonsensical, what a short study ours would be.

Scenic Kansas (1935) by Assistant Kansas State Geologist Kenneth Landes, featured several sinkholes among the state's geologic attributes.

> *Kansas has been the scene of a number of sinkings in historic times. In 1897 a sink of 175 feet in diameter formed directly in the path of the cross country trail near Meade. A year later an acre of land in western Pawnee County slumped and took with is the Rozel railroad station. In 1926, a sink formed southeast of Sharon Springs in Wallace County which aroused country-wide interest.*

Meade Salt Sink, later known as the Great Salt Well, had in fact breached the Jones and Plummer wagon road not in 1897, but 18 years earlier with a 50 to 70-meter diameter crater, 20 meters deep, filled with 7-percent saline water to 5 meters of the top. Cracks 2 to 5 meters deep, 3 to 20 centimeters wide, radiated 40 meters outward.

Meade Salt Sink, 1898 or 1899

Subsidence near Sharon Springs on March 9, 1926, created sinkhole 15 meters in diameter. Within two days, it was 40 by 80 meters, and later yet, 80 by 100 with a depth of 100 meters. Its volume was in the order of 450,000 cubic meters.

Landes could have cited a number of dramatic collapses within the previous few decades. Kansas has hundreds of sinkholes, some caused by limestone solutioning, some by gypsum solutioning and others due to salt solutioning.

Major sinkhole locations are shown in red. The Hutchinson salt formation is marked in green.

The location Landes' lost Rozel, Kansas railway station is indicated in blue. Unfortunately for Scenic Kansas, however, the author was victim to a tall tale of the stripe we came to know in Chapter 87 as a "Mulhatton," except in this case the perpetrator wasn't Mulhatton, but probably a station agent.

Rozel was founded in 1886 on a two city-block acquisition from the Atchison, Topeka & Santa Fe Railroad. Within a decade, the town boasted a bank, a mill, a grain elevator, several retail stores, a telegraph and express office and a post office.

But in 1897, according to the national press, the town was swallowed up by a giant sinkhole. "Kansas Town Swallowed Up," being the New York Times report of November 19.

> *A Bottomless Pit Replaces Rozel on the Santa Fe Road*
>
> *Last night the railroad station at Rozel, on the Santa Fe Road, was supposed to rest on a firm foundation. This morning the place, which the night before had consisted of a station, two or three small elevators, and a few other small buildings, had disappeared completely from the face of the earth.*
>
> *Investigation proved that the bottom had actually dropped out of the land upon which the village was situated and that it had disappeared into the bottomless chasm, the depth of which cannot be determined. The place was not inhabited.*
>
> *The hole is about an acre and a half in extent, of an uneven oblong shape, with rough and almost perpendicular walls. It is filled to within about 75 feet of the surface with dark, stagnant-looking water, into which everything thrown, even lumber and light boards, immediately sinks. The depth of this water is unknown, as the longest ropes have as yet been unable to touch bottom.*

"Engulfed in a Night, Small Kansas Village Sinks Beneath the Prairie," was in the Chicago Daily Tribune, that same day.

> *Railroad Depot, Two Elevators, and Several Small Buildings Swallowed Up by the Earth and Disappear Completely at the Bottom of a Deep Chasm, Which at Once Fills with Water -- No Lives Lost, as the Hamlet Is Deserted at Night.*
>
> *One of those remarkable freaks which go to confirm the belief that a great river of sea underflows all of Western Kansas has just occurred near here. When the shades of evening lengthened into darkness last night, the railroad station of Rozel on the Jetmore branch of the Atchison, Topeka and Santa Fe Railroad, eighteen miles northwest of here, nestled peacefully on the bosom of the prairie, and no one doubted that the morrow's sun would but awaken its little industries to their usual life and activity. This morning when those who lived in the*

neighborhood turned their attention toward the little hamlet they were thunderstruck to discover that the place which the night before had consisted of a depot, two or three small elevators, and a few other small buildings, had completely disappeared from the face of the earth.

Investigations proved that the bottom had actually dropped out of the land upon which the village was located, and that it had disappeared into a bottomless chasm, the depth of which cannot be determined. The hole is about an acre and a half in extent, of an uneven, oblong shape, with rough, almost perpendicular walls. It is filled to within seventy feet of the surface with dark, stagnant-looking water, into which everything thrown, even lumber and light boards, immediately sinks.

The depth of this water is unknown, as the longest ropes have as yet been unable to touch bottom. The theory is that whatever is thrown into the water is drawn under and carried along by an undertow, but there is no current or agitation on the surface water in the hole to strengthen this theory. The fact alone remains that everything thrown into the water immediately disappears in its inky depth, never to be recovered.

The Great Round World and What Is Going On In It featured the story on December 9,

A strange freak of nature is reported from Kansas.

The railroad station of Rozel, eighteen miles from Larned, has been swallowed up.

When the people in the neighborhood went to bed at night, the station was in its usual place; in the morning the station, two or three small elevators, and a few other small buildings had disappeared.

Investigation proved that they had been swallowed up, and had disappeared in a chasm.

The depth of this rent in the earth cannot be determined. The hole is said to be about an acre in extent, of oblong shape, with walls reaching straight down for seventy feet, at which depth the hole is filled with dark, stagnant water, into which anything that is thrown immediately sinks.

No lives were lost, as no one remains at the station overnight.

The interest of the surrounding country is intense, and many theories are advanced as to the cause of the catastrophe.

Some think that the station dropped into an immense cave, and others that it was caused by the underflow of the Arkansas River, which is overflowing its banks at the present time. Others think that this section of Kansas is over an immense underground river or sea.

The devastation came as a shock to the 200 residents of Rozel, as the railroad station and surrounding buildings were all still there, intact. The c 1900 photo shows the depot in good health.

The story, however, continued to fool people, even assistant state geologists, for decades.

The story-of-the-story is perhaps best pieced together in "Hoary Western Kansas Hoax Still Being Accepted as Something True," Hutchinson News-Herald, October 20, 1952.

One of the hardiest Grade A hoaxes ever perpetrated in Western Kansas -- the famous 1890 "Rozel sink hole" canard apparently is still deluding Kansas historians, geographers and geologists.

After more than 80 years the new historic gag that was swallowed hook, line and sinker still is accepted as fact in some quarters.

The Larned Tiller & Toiler this week undertook once more to debunk the yarn, although the newspaper admitted nobody ever ferreted out true facts in the case, except there never was any such hole in the western Pawnee County town...

The newspaper gives the following version of the hoax.

Nobody has ever ferreted out the facts of the case, but there wasn't any sink hole, that's for sure, although some of the eastern newspapers built up the story until they had the whole town of Rozel swallowed into a bottomless lake inhabited by blind fish.

Most credible explanation of how the story got started is this: The Santa Fe depot at Macksville burned down. Macksville, on the main line, was a more important station than Rozel on the Jetmore branch. So the Rozel building was loaded on a boxcar one night and transported to Macksville to replace the one that had burned.

Later that night it rained and filled the shallow depression where the Rozel depot had stood with water.

The station agent at Larned, Dick Beeth, had a reputation as a practical joker and he is believed to have started the story about the depot sinking into a bottomless pool.

Other contemporary residents of Lamed credited the late E.E. Frizell with having a part in the prank.

Those who contend that Beeth was the instigator claim that the railroad man put the phony story on the wire and that it was picked up by eastern Kansas newspapers and relayed by them to other papers through the medium of the press services.

Rozel is still somewhat as it was when its fate was nationally lamented, though its population has decreased by about 40.

Railway officials were duly thankful for the sun-bonneted lass, reported Outlook, September 7, 1895, whose diligence thwarted the malfeasance of the underground stream.

A Brave Little Girl. A little girl was picking berries recently near the track of one of the Western railroads. A locomotive with one car, having some officials of the road on board, passed rapidly. Almost as soon as the special train had passed, the little girl saw twenty feet of the track sink out of sight. She knew a regular train would soon pass, and, dropping her berries, she ran past the bend and waved her sun bonnet when the train came in sight. The engineer stopped the train. The little girl told the man what had happened. The trainmen went forward and found that an underground stream had undermined the track for quite a distance. The passengers would have been hurt and probably some would have been killed but for the presence of mind of this little girl.

"Road Commissioners Waste $900 in Dirt on Bottomless Hole," Daily Illini, January 31, 1924, reported a road-building difficulty from Sheridan, Michigan

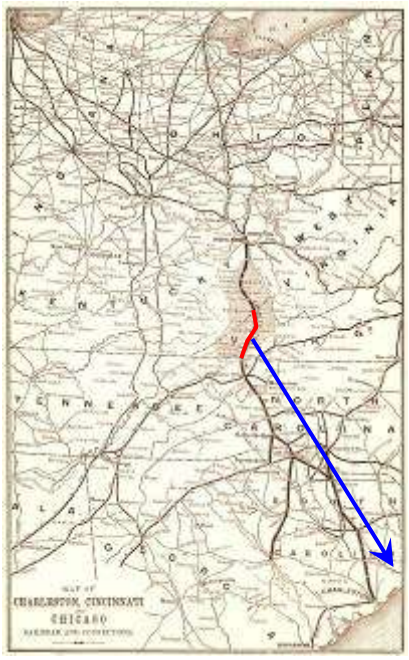
The county road commissioners have found a "bottomless hole" a short distance west of this city. At least, they have decided that the sink hole that have been trying to fill up has nor bottom, for after spending $900 buying dirt to fill in the hole they have been compelled to survey a new route around it. The $900 worth of dirt disappeared and the sink hole seems to be no nearer full than when the work started. It is considered likely that the great hole is an opening to an underground river and that the dirt is washing out.

This one's an automobile road, not a railroad, of course, but the problem's much the same.

And not all railroad stories even make sense. "Farmer's Department, A Supposed Subterranean River," New York Evangelist, November 8, 1888, relates a rail-line "discovery" to the south.

> *A telegram from Charleston... says that a discovery which indicated the existence of a subterranean river running from the mountains of Virginia through North and South Carolina has been noted in these dispatches. Recent additional discoveries seem to confirm this theory...*
>
> *At Black's, two farmers were digging a well on their farm, which is on the line of the Charleston, Cincinnati and Chicago Railroad... At a depth of twenty feet they struck a limestone formation which gave out a hollow sound. A few feet of the stone was removed and a workman striking the point of a bar into the seam of the rock was surprised -- first, to see a hole open him and then to see his bar disappear from sight. The rush of air following this break through the roof of the cave or cavern was accompanied by a loud noise, which continued into the next day... Later the depth of the hole was attempted to be measured by the use of a long pole, but it failed to reach anything solid, and when dropped gave back no sound to those who listened.*

The red line on the 1889 map indicates possible locations of the well "on the line of the Charleston, Cincinnati and Chicago Railroad." The blue illustrates the suggested underground route.



The story was carried in the Atlanta Constitution of October 25, 1888, adding,

> *It is remembered that a well dug upon the northwest side of Whittaker Mountain, some years ago, was abandoned for the same reason, the discovery of a large cavern without apparent bottom. Parties familiar with the rock formation of this section say they are probable openings into one of the same hollow places extending under ant through the mountain. Whether this is a mammoth cave or subterranean river remains to be proven. An investigation will be had at once.*

As surmised in "Found an Underground River, The Strange Discovery Made While Sinking a Southern Well," Chicago Daily Tribune, November 16, 1888,

> *All agree that it is the sound of rushing water over a shoal, perhaps 100 feet lower down, and it must be a large stream. Rocks that were taken from an old excavation still on the ground show unmistakable signs of the action of swift moving water. The sounds now heard are unmistakable those of a large underground river. It is probable that twenty more feet of excavation will have to be made before it will definitely be known what is the nature and extend of this body of moving water.*

The story from Virginia seems reasonably likely, as the west end of the state has numerous karst formations. And the South Carolina coastal zone indeed has sinkholes. As the Carolinas are otherwise sparse in karst geology, however, --North Carolina has but one major cave and South Carolina, none -- the Evangelist title's "Supposed" reflects the actuality

Severed Drainageways?

Surely a portion of the railroad's hydrologic misfortunes stemmed from the speed of railway expansion. Rivers were to be crossed, mountains tunneled and marshes made dry. While Farm

Drainage, The Principles, Processes, and Effects of Draining Land with Stones, Wood, Plows, and Open Ditches, and Especially with Tiles (1860) by Henry Flagg French wasn't about railroading, even French recognized the implication.

> *The water falling on the surface would very slowly find its way downward, at first. But after the heat of summer, aided by the drains underneath, had contracted and cracked the soil, passages for the water would soon be found, and, after a few years, the whole mass, to the depth of the drains, would become open and permeable. As an old English farmer said of his drains, "They do better year by year; the water gets a habit of coming to them." Although this be not philosophical language, yet the fact is correctly stated. Water tends towards the lowest openings. A deep well often diverts the underground stream from a shallower well, and lays it dry. A single railroad cut sometimes draws off the supply of water from a whole neighborhood. Passages thus formed are enlarged by the pressure of the water, and new ones are opened by the causes already suggested.*

The railroads were indeed major forces, but the force of water was greater.

Incrustation?

Nathaniel Langford, the first Superintendent of Yellowstone National Park may have had something to do with the railroad builder's thinking. The Discovery of Yellowstone Park wasn't published until 1905, but as Langford had been promoting the national-park-to-be since 1870, the explorer's observations were in broad circulation.

> *Around them all* [the hot springs] *is an incrustation formed from the bases of the spring deposits, arsenic, alum, sulphur, etc. This incrustation is sufficiently strong in many places to bear the weight of a man, but more frequently it gave way.*

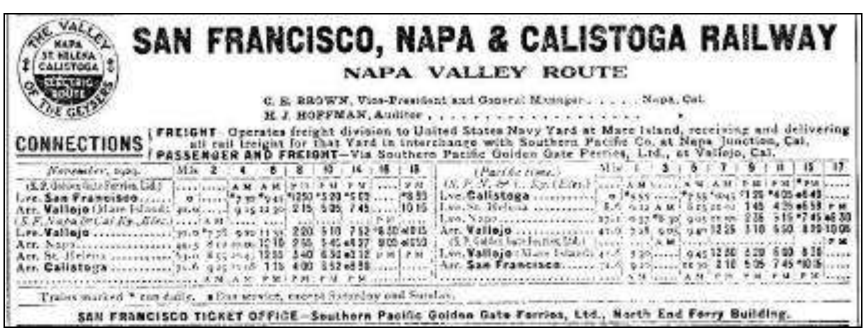
While Langford's "incrustation" was a sulfurous matrix incapable of vegetation, nothing resembling the terrain perplexing the railway builders, it seems possible that Langford's work provided the engineers a hypothesis about their own challenge.

Geological incrustation might be considered as the underground river process in reverse. In the former, a surface comes to be above the fluid. In the latter, water tunnels its way beneath that which is the solid. In either case, resulting order of strata is somewhat the same.

Others have employed the crust allusion elsewhere.

Robert Louis Stevenson linked railroads and encrusted lakes with just a passing reference The Silverado Squatters (1906) Calistoga, California travelogue.

> *The whole neighborhood of Mount Saint Helena is full of sulphur and of boiling springs. The Geysers are famous; they were the great health resort of the Indians before the coming of the whites. Lake County is dotted with spas; Hot Springs and White Sulphur Springs are the names of two stations on the Napa Valley railroad; and Calistoga itself seems to repose on a mere film above a boiling, subterranean lake.*



Fortunate for the San Francisco, Napa & Calistoga crew, the engine didn't break through the "mere film."

We of the Never-Never (1908) is an autobiographical novel by Jeannie Gunn, an account of the author's experiences in Australia's Northern Territory.

> *It is in appearance only the pools are isolated; for although many feet apart in some instances, they are linked together throughout by a shallow underground river, that runs over a rocky bed; while the turf, that looks so solid in many places, is barely a two-foot crust arched over five or six feet of space and water -- a deathtrap for heavy cattle; but a place of interest to white folk.*
>
> *The Maluka and I wandered aimlessly in and out among the pools for a while, and, then coming out unexpectedly from a piece of bush, found ourselves face to face with a sight that froze all movement out of us for a moment -- the living, moving head of a horse,... a grey, uncanny, bodyless head, nickering piteously at us as it stood on the turf at our feet. I have never seen a ghost, but I know exactly how I will feel if ever I do.*
>
> *For a moment we stood spellbound with horror, and the next, realizing what had happened, were kneeling down beside the piteous head. The thin crust of earth had given way beneath the animal's hindquarters as it grazed over the turf, and before it could recover itself it had slipped bodily through the hole thus formed, and was standing on the rocky bed of the underground river, with its head only in the upper air.*

In an era of accolade for robber barons, the highest praise for a railroad tycoon could be that of conquering an incrusted lake. From "A Study of Harriman, Master of Railroads, and his Methods of Work," New York Times, August 1, 1909,

> *The best illustration of Mr. Harriman's constructive gift is not so much the plan of the Lucin cut off, involving the construction of a viaduct across the Great Salt Lake, as the fact that Mr. Harriman ventured where other railroad managers had only sighed and hoped. He dared to sink millions in the then unmeasured abyss of that salt sea, never wavering, not believing that he was throwing good money after bad, fighting constantly against nature, until at last, having sunk some thirty million in those incrusted waters, he conquered nature, stretched his viaduct across the sea, and was able to reckon that the saving in time and cost far more than met the interest upon the cost of this investment.*

The correspondent for Scientific American, November 16, 1867, wasn't much impressed by the citizens of Milan,

> *The inhabitants are generally slovenly, listless, lounging set, who appear to vegetate in a condition of dreamy unconcern about the present or the future.*

But more to our point.

> *We were informed that several months before the roadway that led across the spur of the mountain suddenly sank beneath the water, carrying with it a portion of the village, together with several of the inhabitants, who were hopelessly engulfed in this subterranean stream, which for ages had been gradually wearing away under the crust of the mountain.*

Perhaps the Milanese were disconsolate because of their geological precariousness. Could such fluvial "wearing down of the crust" have been likewise vexing the American railways?

Unfortunately we must conclude that encrustation's geotechnical aspects indicate to the contrary.

Geothermal-derived incrustations -- which yet may be readily seen in Yellowstone -- are sterile surfaces, far different from the forests of eastern railroad right-of-ways.

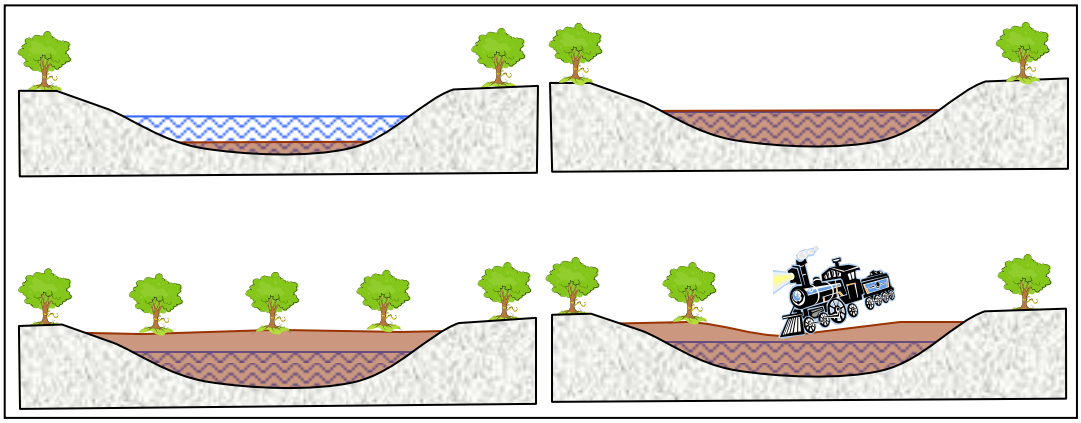
Mineral incrustations are brittle, shattering, rather than deformational.

Organic incrustation -- though "incrustation" isn't quite the word, as the mat wouldn't be crusty -- would be planar, pliable and capped with aquatic flora. A surveyor proceeding forward would have found himself wading and more solid route immediately scouted.

No, we must conclude, the railroads weren't intruding onto a crust.

Few, if any, American railroad builders had ever encountered, casually or professionally, rivers under earth or land upon lakes, but the engineers' imaginations were ripe for such possibilities when their tasks encountered difficulties.

American railroading was occasionally behind schedule, but rarely for long, and not due to hidden waters. The culprit was nothing more than bogs.



The following account, "A Lost Lake," McKean [Pennsylvania] Democrat, October 30, 1891, would be more correctly classified as a sinkhole story than as one dealing with an encrusted lake, but we'll put it here, as it's also about railroads.

> *A curious spectacle was to be seen on the outskirts of Gainesville, Fla., recently. Alachua lake, from ten to fifteen miles in length and covering more than 40,000 acres of land, is no more... This was the second time since 1823 that a similar occurrence has taken place. At that time the bed of the lake was a large prairie -- Payne's prairie -- having in it a body of water called the Sink and a small creek. In 1868 heavy rains filled the prairie, but the water disappeared after a short time, and the prairie was again dry land. In 1873, after a series of heavy rains, the Sink overflowed and the creek swelled to the dimensions of a lake. During several years the waters increased till a larger lake was formed, and for fully fifteen years sufficient depth of water stood over the prairie to allow small steamers. During the last two years, however, the waters have been gradually lowering, and about four weeks ago they commenced going down with surprising rapidity, the lake falling about eight feet in ten days, until now there is nothing left of Alachua lake but the memory of it. There is evidently an underground passage connected, and for some reason not understood, this underground passage has been acting as a drain until all the water in the lake has been drawn out.*

In 1871 the sink was plugged with logs and debris and so Paynes Prairie became the Alachua Lake, plied by low-draft steamboats like the "Cicola" which shipped citrus. In 1892 the sink became unplugged and rapidly drained, once again reverting to its prairie state.

Below and to the left is an 1890s painting by James Calvert Smith of the railroad trestle skirting part of Alachua Lake. To the right is a photo of the drained waterbody.

A Brave Engineer and the Report of a Doctor

Before we leave our railroading, we'll include an inspirational story, one set at no less than River Styx, Ohio, a stop we made in Chapter 60, A Superfluity of Surficial Stygian Streams.

On March 22, 1899, Engineer Alexander Logan ran Train No. 5 along the Erie Line near the River Styx, traveling at some 130 kilometers/hour. The engine mysteriously jumped its tracks, turned over and crushed the engineer to death. No one knew what caused the train to derail, but most agreed that Logan's heroic decision to stay on the train saved the lives of the crew. Witnesses said that when Logan's body was recovered, his hand was still clutched to the throttle.

The River Styx Bridge is shown to the right.

On November 8 of that same year, the Wooster Republican reported.

A Phantom Train, Uncanny Happenings Reported from Rittman.

Word has been received here that several Rittman people have seen a phantom train at the River Styx bridge on the Erie Railroad. The first appearance of this awe-inspiring train was last week, Saturday night and was witnessed by Dr. Wm. Faber, coroner of Wayne County, and a companion.

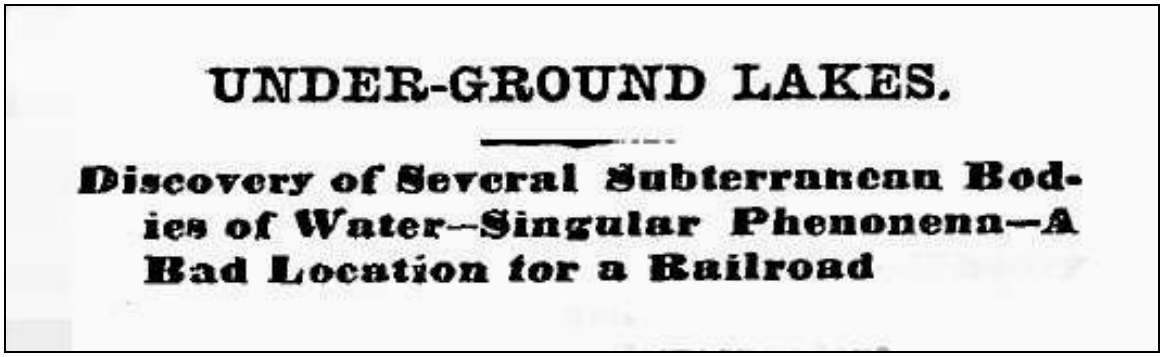
The doctor had been to see a sick patient and was driving leisurely along about 11 o'clock, when his attention was attracted by the noise of a swiftly moving train. He casually watched the train and saw its glaring headlight and dense clouds of smoke rolling up from the smokestack. He paid no more attention to the train, but just before it reached the bridge the shrill whistle of the engine calling for brakes caused for the men to glance back. On came the train with the speed of a whirlwind as it swept down the grade, throwing out great sparks of fire from the wheels. Just then they heard the "chuck chuck" of the engine, as it had been reversed, and the escaping of the air of the air-brakes. Then a strange sight met their gaze as they sat spellbound. The train was enveloped in flames which shot up the escaping steam making a terrific noise, and the cracking of timber and breaking of iron bars was plainly heard, but above

all came the piercing shrieks of human beings pinned beneath the wreckage. The noise was plainly heard by a number of others.

The Doctor and his companion started immediately for the place of the wreck for the purpose of rendering assistance, but to their surprise they found everything perfectly quiet and no sign of a wrecked train.

Near this spot the ill-fated train No 5 jumped the track last spring, and the engineer was killed, ever since that time many people have believed that the place is haunted.

River Styx or not, we advise heeding the advice the New York Times, September 5, 1871, when railroading near underground waters.



UNDER-GROUND LAKES.

Discovery of Several Subterranean Bodies of Water—Singular Phenonena—A Bad Location for a Railroad

CHAPTER 81
MAINLINING THE SEWAGE

We're too familiar with dismal tales of toxic wastes dumped on sites erroneously assumed to be disconnected to subsurface waters. We will deal in this chapter with a less-excusable environmental practice, that of deliberately mainlining raw waste directly into the river below.

We'll begin with a bit or French history, and then move to Ohio.

Loi Relative à la Santé Publique du 15 Février 1902

In 1891, cave pioneer E.A. Martel (Chapter 54, Subterranean Watercraft) was made ill from drinking from a cave river 250 meters below a sinkhole where a farmer had dumped a dead cow. He didn't need a CFU count to identify the issue. In his complaint to the Prefect, "The presence of decaying matter at the bottom of a pit could contaminate a distance of several hundred meters or several kilometers."

In 1899, Martel pled his case to the Chamber of Deputies, and from it came the first legislative regulation of the quality of groundwater used for drinking, the Public Health Law of 15 February 1902. From Article 28,

> *It is forbidden, under the same penalties, the abandonment of dead animals, remains of butchery, smokehouse, fecal matter and, in general, animal waste that could rot in crevices in chasms, pits or excavation of any nature other than the pits for the operation of establishments classified.*

The law didn't end the problem, however. From Martel's "Grottoes as Sources of Water Pollution," La Nature, October 19, 1907,

> *It is pointed out that under the law of the 15th February, 1902, it is interdicted in France to throw the dead bodies of diseased animals into caverns or grottos, but from the account given by the Author, with illustrations of his exploration of the Grotto des Corbeax... this law is more honored in the breach than in the observation.*
>
> *Some 1-1/2 miles distant, at a lower level, is the famous intermittent spring of Fontestorbes, which is used as part of the water supply of the commune of Belesta. It is shown by hypothetical sections through the strata that the "broth of ptomaines" arising from the dead beasts, slaughtered because of the cattle-plague, glanders, and other hideous diseases, in undoubtedly served up to the inhabitants of the surround villages for drinking purposes. Photographs are given to show the access to the underground cavern, the upper entrance and the outflow of the Fontestorbes spring.*

As noted by the editor of Norbert Casteret's (whom we met in Chapter 49, Finding the Underground Rivers) Ten Years Under the Earth (1939), the flagrant pollution of cave waters was still an issue a quarter of a century later,

> *The public-health Law of February 15, 1902 is still flagrantly violated by the throwing of dead animals and other offal into natural abysses. Its decay contaminates the resurgences, or false springs, and makes them deadly.*

As recalled by Casteret concerning the Cavern of Cagire,

> *At the village, where I told of my discovery, they assured me that the shaft was very deep bottomless, in fact, and that the dead animals of the whole countryside were flung down it. I took the liberty of doubting the first statement, but long experience led me to fear that the second was too true.*

Bellevue, Ohio

Bellevue, Ohio, a middle-American small city where they still remember their "Whiz Kids," the 1945 State of Ohio basketball champs.

As described by the 1918 Encyclopedia Americana:

> *Bellevue city in Sandusky County, on the Lake Shore and Michigan Southern, the New York, Chicago and Saint Lewis, the Lake Shore Electric and other railroads, about 16 miles south of Sandusky. It contains a Carnegie library and a hospital and has railroad repair shops, canning factories, lumber yards, manufactories of agricultural and drainage machinery, fixtures and stoves. It is the trade center for a thriving agricultural region.*

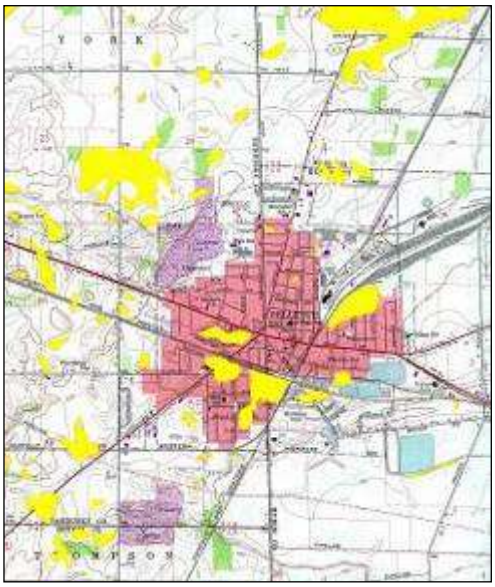
We'll quote the remainder of the entry later in this chapter.

Hydrogeology

The Bellevue-Castalia Karst Plain bordering Lake Erie is underlain by up to 55 meters of Devonian carbonates. Surficial karstification characteristics slight where the limestone is overlain by glacial drift.

The landscape is marked by irregularly shaped, closed depressions (yellow on the topographic map) of up to 110 hectares which in turn encompass smaller, circular depressions 2 to 25 meters in diameter. Surface drainage is limited and many streams disappear into sinkholes.

These zones rarely retain water, however, because the sub-drainage is not overtaxed by normal rainfall events. Such depressions w the urban area drained by storm sewers.



Seneca Caverns, discovered in 1872, the self-proclaimed "Caviest Cave in the USA." Colorfully illuminated "Ole' Mist'ry River" runs through the lowest cavern, 35 meters below the surface.

Seneca Caverns $14.00

A like-named Seneca Caverns located in West Virginia is that state's largest cave and has on display a biscuit tin from its days as a fallout shelter. Both Seneca Caverns boast gift shops. One would think that there were enough cavern names to go around.

But even before 1872, the area was known to contain subterranean rivers.

Frank Leslie's Illustrated Newspaper, November 20, 1869, provides an account of discovery.

> *It is not generally known that there exists, about a mile west of Fremont, Ohio, a remarkable underground stream, with a swift current, and no outlet above the surface of the ground this side of Lake Erie. It was discovered several years ago by a man who was returning from a day's chopping in the woods. In walking over a slightly sunken place, he noticed a hollow sound, and. turning, struck the ground with his ax.*
>
> *The ax broke through, and disappeared, and never has been seen since. Further investigation showed a rock about six feet above the surface, with a crevice a foot or more wide, in which water could be seen for several feet below. By tracing its course further down, and breaking through the crust, the same phenomenon appeared again, and by dropping a piece of wood or other floating substance in the upper aperture, it was seen to pass the lower one, showing a string current. A lead and line, let down to the depth of seventy feet, found no bottom.*

As chronicled by Henry Howe in Historical Collections of Ohio, Containing a Collection of the Most Interesting Facts, Traditions, Biographical Sketches, Anecdotes, Etc. (1851), just a kilometer or two south of the soon-to-be-discovered caverns,

> *In the township of Thompson, is a subterranean stream, about 80 feet underground. The water is pure and cold, runs uniformly, and in a northern direction. It is entered by a hole in the top, into which the curious can descend on foot, by the aid of a light.*

North of Bellevue is a tourist attraction of bygone decades, the Blue Hole. Hole came into being about 1820 when pressure caused by damming Castalia Creek weakened the strata and occasioned its collapse. A subsequent cave-in left the hole roughly 25 meters in diameter. Contrary to prevalent belief, the depth is not unknown; it's 15 meters. Discharge is about 0.3 cubic meters/second of crustal clear water.

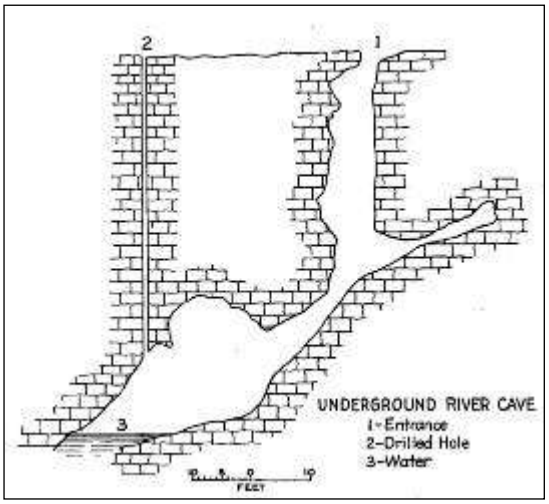
African American artist Robert S. Duncanson painted portraits, landscapes and murals. His 1851, “Blue Hole, Little Miami River,” is shown to the left. A 1920s postcard is to the right.

In 1997, the Ohio Department of Natural Resources Division of Wildlife purchased the site, re-naming it the Castalia State Fish Hatchery.

While the cavern itself isn't particularly noteworthy, we cite "Underground River Cave," Limestone Caves and Caverns of Ohio (1873), Geological Survey of Ohio, by George W. White, for the description of its water.

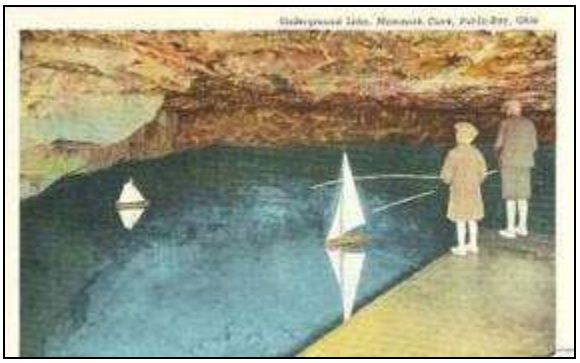
Underground River Cave is in the northern part of Ridge Township, northwestern Wyandot County.

No groundwater drains into the cave, but the surface of the water in it fluctuates as much as 31 feet. When visited it was 65 feet from the exterior surface, but during the winter it is reported to fall at least 20 feet below this. Many stories exist as to the depth of the water. The owner states that when it reaches the lowest mark there is a current which flows eight to ten miles an hour. It is popularly supposed that this stream comes to the surface in the Blue Hole at Castalia, 44 miles distant, but this seems improbable.



This cave is lighted by electricity and plank steps lead to the water. A commodious rest house stands over the entrance. A hole has been drilled from the surface of the ground to the water in the cave which serves for ventilation and is occasionally used to mystify visitors by having someone talk from the surface to tourists below. A fee of 40 cents is charged for admission.

While it's surely a far-fetched hydrologic connection, Put-in-Bay, 20 kilometers north of Sandusky on Lake Erie's South Bass Island, has its own "Underground Lake," postcard pictures below.



Who's to say the region's mysterious underground stops at the lake shore? From Science Weekly, December 2, 1904,

The caves of Put-in-Bay have been long known to the public, but, with the exception of Mr. E.L. Mosely, no one seems to have discussed the evidences which they present as to recent changes of lake level. Daussa's Cave is probably the one which Mosely visited. In this cave there is an underground lake 80 feet long and 40 feet wide, which is connected with and fluctuates with the waters of Lake Erie.

As to what connects with what in the region, there's been no end to the speculation. From the Marietta Daily Leader, May 10, 1897,

A subterranean channel connecting with the immense cave recently discovered in Seneca and adjoining counties is believed to exist in the south-eastern portion of this [Sandusky] county. At least an underground stream has been discovered on the Ensminger farm. The bottom dropped out from two wells dug about 30 feet deep on the Ensminger farm. An underground

river was discovered that is eight feet deep and no one knows how wide. Eyeless fish were taken from the stream, which flows to the north, and is thought to connect with the Flat Rock [Seneca] cave.

The Federal Writers' Project Ohio: The Ohio Guide (1940) had this to say,

Left from Bellevue on State 18 ... are Seneca Caverns (open Decoration Day to Labor Day, adm. 57¢ -- $1.13), 4.5 m. These eight electrically lighted, located at different levels, have been produced by the slow action of water working in limestone strata. Hewn-rock steps lead to the lowest cavern, 165 feet down, through which flows an underground stream. A bottle thrown into it in 1930 was cast up in 1934 at Blue Hole, 15 miles away.

Regarding the bottle, we should remember that the Writers' mission was to record America's stories, not to fact-check them. Fifteen miles in four years is 0.7 meters/hour, an achievable velocity through a karst conduit. While the probability would seem for jar not becoming wedged in a constriction, the legend falls within the spectrum of underground river flotsam reports we've encountered in other chapters.

"Find an Underground River. Further Evidence of Mighty Stream Coursing Through Ohio" in the August 22, 1901, Syracuse Daily Journal saw a likely subterranean connection between Marion and Cleveland Ohio.

Roaring wells in widely separated parts of the State indicate the existence of a mighty subterranean river that flows across the State at a depth of comparatively few feet below the surface, at least in certain places. The latest of the roaring wells is at Chardon, a suburb of Cleveland. The men have refused to work on it and plans are being made to dynamite it.

The phenomena are exactly the same as those noticed in a well on the farm of Mrs. Amanda Ensminger hear here. When this well had been dug to a depth of about 50 feet, the roaring noise became alarming, and during the night the bottom fell out and left an opening into the subterranean stream that was so swift that it was impossible to sound it.

The wells at Chardon are evidently on the same underground river, for the phenomena are identical and indicate that the mighty unseen river extends across the State from north to south.

As Cleveland is some 100 kilometers east of Bellevue and Chardon is yet further, it seems unlikely that it's the same underground river, however. We do note that by removing one letter, "Chardon" becomes "Charon," but we refrain from claiming the fact to be significant.

Flooding from Below

We will begin our chronicle of Bellevue flooding with the New York Times, December 1.

Lake Formed in a Night. The Subterranean River which Sends its Water to Lake Erie

Flowing into Sandusky Bay, one of the most beautiful landlocked bodies of water in the United States, is a stream called Castalia Creek. It is fed from springs of ice-cold water. This creek has been utilized by a fishing club and stocked with brook trout. It is without doubt the most complete private fishing preserve in the United States, and the great catches made by successive anglers have often been given in publications devoted to out-door sports.

Whence comes the water which supplies these springs is a mystery.

"Whence comes the water" waxes poetic, but the whence is no mystery to those acquainted with geology. We'll read on, noting how personal story enlivens journalism.

That such an underground stream does exist there is no question. In going over some places the other day an interesting document signed by T.C. McGee, an old resident of Erie County, was discovered.

"My father, Thomas McGee," the old resident wrote, "came to the State of Ohio in 1818. While waiting for the Indian lands to be surveyed and come into the market he made a temporary stop in a vacant house in the southwest corner of Groton Township, Erie County. Near the house

was quite a large prairie. My father planted about two acres with corn. About the 10th of June that year, when the corn was some three inches high, on getting up one morning to go and put some fencing about his field, he looked where the field had been, and found a lake covering it and nearly all the depression in the land near it. He had heard nothing, but a neighbor who lived nearer the spot of land had heard in the night a loud but dull sound.

"My oldest brother, William, who always wished to know the reason of things, with my help, built a raft out of the floating rails and went out and over where the water was boiling up with great force from a space as large as a fair-sized haystack. No depth could be found with any appliance we had. The explosion had thrown up great quantities of limestone, much of it a distance of ten or twenty rods away. Another small crater was discovered in the same depression."

We earlier suggested that groundwater might rise like a geyser. Perhaps we could have used a metaphor closer to that of an artillery shell.

"The season had been very dry, and great numbers of animals and snakes came around this phenomenal lake to drink. The water thus thrown up did not subside for months, but continued to flow until the water had filled all the lowest land for miles around.

"We had occasion to go further west and were gone for four days, and on returning took the trail that we had gone out on, but found our lately-trodden path now waist deep with water. We had to go back and around on the higher ground to get back to the house.

"My theory of this outburst of water is that from some particular stoppage of the great underground flow of water from a marsh some forty miles south of its outlet in Castalia Creek it had to have vent, and came out through the surface where the crust was thinnest."

Given the explosive nature of the even, this well may be true, but more consistent with the geology would be water pushed up a re-opened sinkhole.

"In subsequent days an underground river course has been discovered in and near Bellevue, Ohio, which is now within one and one-half miles of then place I have attempted to describe. Written from memory, at the request of friends, this 28th day of May 1888, the writer being twelve days past his eightieth birthday."

The water of this underground stream is remarkably sweet, though it is so thoroughly impregnated with limestone that a calcareous crust rapidly forms in a tea kettle in which the water is boiled. The bubbling springs and the underground river have been sources of much curiosity for years. The story of the formation of a lake in a single night is not known to any extent among the younger farmers and their families. It is a fact, however, that the same thing is likely to happen again should the subterranean stream become dammed, and then people of that part of Ohio may wake up some morning to find their farms afloat.

Note the concern that the subterranean stream may someday be dammed. We'll see like accusations a century later.

This excerpt "A Flood From Underground Waters at Bellevue, Ohio," Engineering News Record, May 1, 1913, illustrates the confusion regarding the direction of subterranean flow.

But the flowing of the sinks is not the most peculiar part of the present phenomenon. One would suppose that the water flowing from the sinks would be flood water admitted to the underground passages at a higher level and discharged at a lower one. This supposition seems to be disproved, because the water flowing from the sinks in many instances is wholly different from the flood water. In that it is crystal clear and Impregnated by mineral deposits resembling the water coming from the immense Blue Hole spring at Castalia, seven miles north of Bellevue, or the famous Green Spring at Greenspring, twelve miles to the west.

Sinkholes in Bellevue, right in the midst of lakes of flood water are spouting aqua pura from unknown underground reservoirs. Unquestionably there exists an underground water channel under the section of the state referred to, but all attempts to locate its place of discharge have

met with failure. Corks and cork dust and other material of buoyancy have been introduced in the sinks at Bellevue in an effort to locate the mouth of the underground river, but nary a sign of any of these telltales has been found either In the Blue Hole at Castalia or in Sandusky Bay.

Nearly 20 centimeters of rainfall in 3 days of June 1937 caused numerous sinkholes to up-flow. As reported by the June 29 Evening Independent, the "mysterious" aspect remained.

George Burgess, safety director of this northern Ohio City of 6,000, said mysterious underground rivers -- which with heavy rains caused the flood in the first place -- would not permit the surface water to drain away normally for several days.

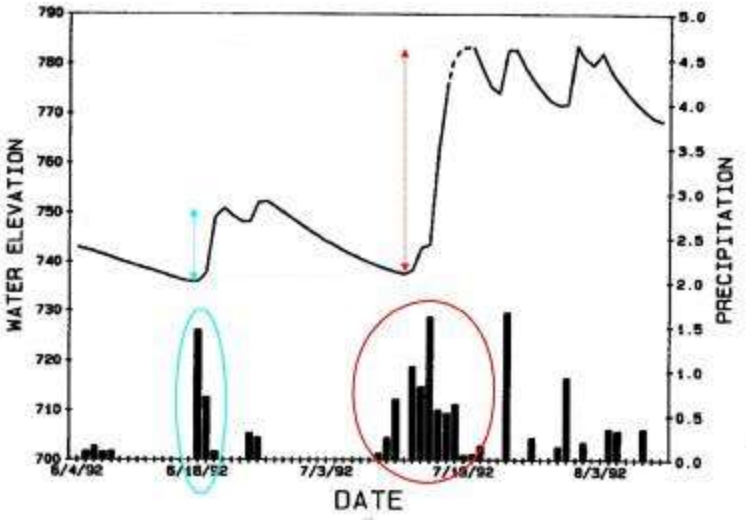
The report by engineer Myron Jones in the April 1, 1938, Bellevue Gazette was at least on the right track.

The City of Bellevue, a large part of Thompson Township in Seneca County, most of York Township of Sandusky County and the south-west part of Groton Township in Erie County have no other drainage than sinkholes. The whole district has an underlying strata of corniferous limestone... Some of the sinkholes are natural, others artificial, being constructed by drilling and testing until a crevice or fracture capable of taking a sufficient quantity of water to be useful is found. Some of the sinkholes are connected underground. Tests have been made to determine whether the Kinney sinks have any connection with the underground river emerging from the Blue Hole at Castalia which tended to prove they did not. Sinkholes in the lower areas have been known to spout water during flood times, which could only have been caused by pressure through connected fractures from higher land... If the water from the region south of Bellevue can be taken care of by surface drainage facilities much of the trouble existing in the low lying sinkholes area around Bellevue will be eliminated.

But oh, as we shall see, were remediation that simple!

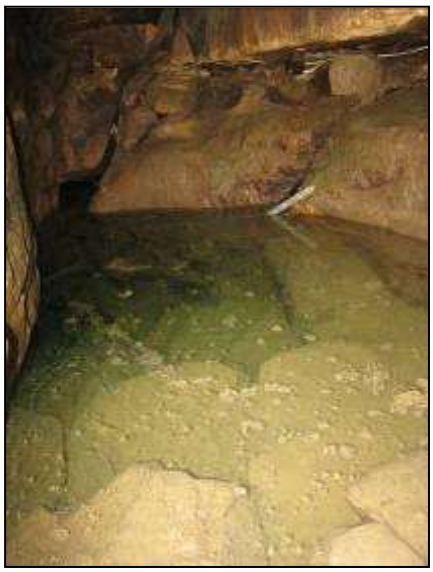
Bellevue was again inundated in 1969, this time by 25 centimeters of rain in just 16 hours flooded some 1,100 basements

A 6-centimeter 2-day storm in 1992 caused the water table to rise roughly 5 meters. After 21-days of recovery, 16 centimeters of additional precipitation over 9 days raised the groundwater level 15 meters.



Cumulative precipitation from October 2007 through March 2008 was 23 centimeters above normal, and 14 centimeters in March was the third wettest for that month in 126 years. An April storm then brought 13 centimeters of rain over 6 days, elevating the water table by 15 meters causing the United Church of Christ to rally relief for victims of "The Flood from Nowhere."

The owner of Seneca Caverns noted that the groundwater on April 1 was but 11 meters below land surface. Ole' Mist'ry River had become a rapidly filling column. After a month of intermittent rains, the level was still 9 meters higher than before the rainy season. It would take more than two additional dry months to return to the initial state.



Bellevue, Ohio, U.S.A.

1883

1913

1937

1969

"The Flood form Nowhere," 2008

2008

What could be more disconcerting than inundations from geysers?

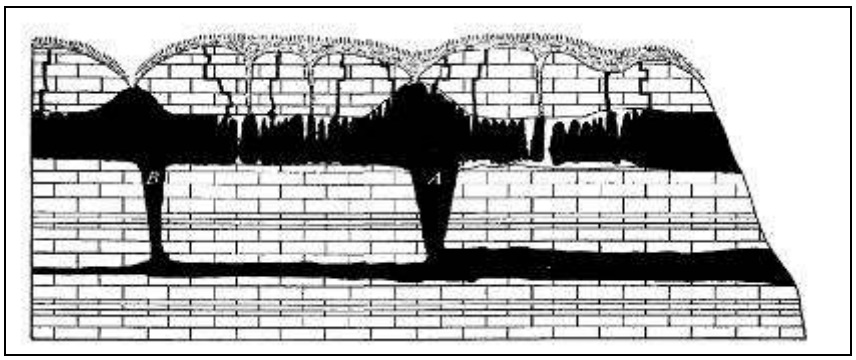
How about geysers of sewage?

Sewage Disposal

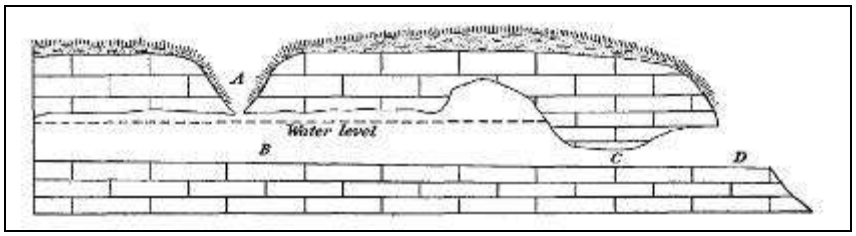
"Pollution of Underground Waters in Limestone," Water Supply Paper 258, USGS (1910) by George Matson,

> *The practice of putting rubbish, barnyard filth, etc., into sinks should be abandoned. Still more reprehensible is the custom of running sewage into sinks, thus converting the underground channels into natural sewers. This practice, which is by no means uncommon, is often defended by the assertion that the water in limestone channels beneath a city is unfit for drinking even without the sewage.*
>
> *The correctness of this assertion cannot be disputed, but there are persons who are ignorant of the danger and who continue to use the underground water. Moreover, those living at some distance from the city may use water from the underground channel which receives the sewage. For these reasons any city which proposes to convert an underground watercourse into a sewer should be forced to trace the channel to its destination so that others may be protected. There is need of legislation to prevent the unnecessary pollution of underground streams. Such legislation has been enacted for the protection of surface water, but the protection of underground water has been entirely neglected.*

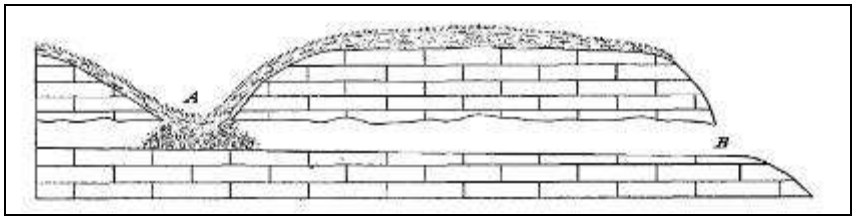
Matson's agreement that "the water in limestone channels beneath a city is unfit for drinking even without the sewage" is incorrect, but indicative of understandings a century ago. As the paper raised the issue of pollution of karst streams to the highest levels, we'll show a few it its illustrations.



Different levels of underground streams



How sediment may be deposited by the underground stream.



How sediment may be obtained by the underground stream

Again from The Ohio Guide (1940),

> *Bellevue has a unique sewerage system. Throughout the underlying rock strata flow many streams, honeycombing the area with sinkholes. Through these the town disposes of its sewage. In times of heavy rains, however, the streams back up and geysers spout of the earth; the low-lying parts of the city are flooded, and Bellevue becomes a beleaguered city until the water evaporates or seeps away.*

When settlement began, homeowners employed two wells, one for water and one for wastewater disposal, the latter drilled until the bit dropped into a subsurface void and often equipped with a hand-operated ramrod to keep it open. By the time a municipal reservoir was constructed in 1872, domestic, industrial and municipal wastes were routinely mainlined into what was known as the "Bellevue Underground River."

We use the verb "mainline" deliberately. Groundwater pollution most commonly stems from waste disposal on or into the upper soil horizon. To get to the water table, the constituents percolate through the granular media with opportunity for biodegradation, physicochemical reaction and filtration. What enters the groundwater may still be of objectionable quality, but is probably many less toxic than product.

Mainlining into a subsurface stream not only decreases the mitigation afforded by natural processes; it injects the pollutants into rapid downstream conveyance. The downstream neighbor receives wastes not only less-degraded, but more quickly. The reader who associates "mainlining" with heron use isn't far afield. Mainlining is about shooting strong chemicals into a vein flowing directly to the heart.

While a municipal strategy of sewage mainlining is woefully short-sighted from today's environmental perspective, the Ohio State Board of Health took it in stride at the turn of the century.

> *Bellevue has a unique method of disposing of sewage. Some 50 to 60 feet down there seems to be an underground stream or vein of considerable size, which is said to come to the surface at Castalia, north of there. Down to this current, wells or sinks are drilled into which all sewage and a great deal of the storm water is emptied. There are a number of these holes drilled by the city for street drainage and many more drilled by private parties to dispose of sewage. --* Report, Ohio Dept. of Health (1899)

The agency wasn't entirely comfortable with the practice, however, as evidenced by Ohio's Health (1917).

> *The Board does not consider the discharge of sewage into the underlying rock formations to be a proper practice. The existing method of sewage disposal in general use throughout the city is objectionable, as pollution of the underlying groundwater thereby results, endangering all water supplies in the vicinity which are obtained from this source. The drilled well maintained at the water works pumping station of the city should be plugged and made inaccessible as a source of water supply.*
>
> *In view of the extent of the practice of discharging sewage through sink holes at Bellevue and the likelihood that the use of this method, unless checked, will continue to increase, the officials of the city should give careful consideration to its suitability and safety as a permanent method. This department would advise its abandonment and the use of properly constructed sanitary sewers for the following reasons:*
>
> *1st. The practice of discharging sewage through sink holes pollutes the groundwater supply within an undetermined radius from the city and in this connection it is pertinent to consider the possibility of future use of such supply as a source of public water supply for the city;*
>
> *2nd. The method in use is contrary to the accepted principles of sanitary science and cannot be considered as a permanently satisfactory method of sewage disposal; and.*
>
> *3rd. Taking into account the installation cost for the use of this method and the likelihood that sooner or later it must be abandoned, it is probable that from an economical standpoint alone properly constructed sanitary sewers will be found superior.*

And Bellevue's practice was by now a national curiosity. Here's the remainder of the 1918 Encyclopedia Americana entry.

> *The most unique feature of the city is its sewerage system. An underground stream flows beneath the city into Lake Erie and on each block is a hole drilled to this stream which thus serves to dispose of all sewage and surface water as well.*

An enthusiastic engineer, LeFever M. Lee, touted subsurface mainlining's economic advantage in "Caves Form Bellevue's Sewage System," Ohio State Engineer, November 1929.

> *What is probably the most unique and cheapest sewage disposal system in the country is found at Bellevue, Ohio, located about one hundred miles north of Columbus on the county line between Huron and Sandusky counties. This area is underlaid by limestone which dissolves by the action of water, forming caves, fissures, and sink-holes. In this locality the fissures are found close to the surface and have water flowing through them the year around.*
>
> *The city of Bellevue takes advantage of these conditions to dispose of its sewage by drilling holes through the limestone in much the same manner as people living on a farm drill a well. If an opening in the rock is not found within a depth of about two hundred feet, the drilling machine is moved to another place within ten or twenty feet of the first attempt and another hole is bored. It is a rare occasion when a third try must be made, because the fissures are very numerous and close to the surface. The majority of the homes of the town have their own sewers, but it is not unusual for two houses to share the same one, thus lessening the cost for each family. Nearly all of the streets drain into pipes that lead to natural sink-holes located in various sections of the city.*
>
> *This sink-hole area varies from three to eight miles wide and extends to the west of Carey, which is approximately forty miles to the southwest. West of Carey is a cave that leads to an underground stream which is as close to the origin as anyone has been able to trace. From here the stream flows through the cracks in the limestone to Bellevue and then probably finds an outlet somewhere in Sandusky Bay. There are many places along this subterranean river where it comes to the surface in the form of springs and wells. On one or two occasions the river has become too full and turned a number of the sinkholes into springs, but these always*

subsided when the river receded. After the flood of 1913 water stood on many of the farms north of Bellevue in ponds of as much as 10 or 12 acres, because the fissures were filled with water from the neighboring country. It is a matter of conjecture as to where the final outlet for this river is located.

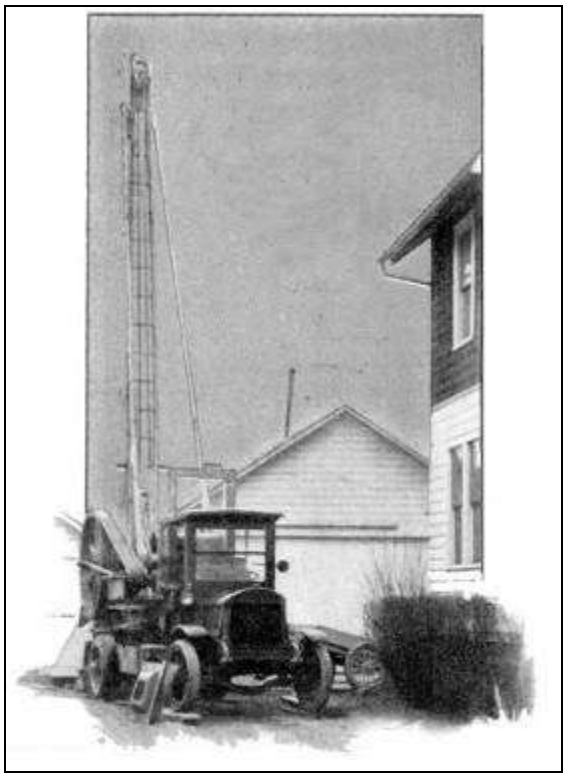
Experiments by the state health authorities with chemicals to determine this outlet settled nothing farther than a northward trend of the current which was already known. Other experiments, by Professor E.L. Mosely of Bowling Green and E.F. Warner of Bellevue, with ground cork and small corks proved nothing. In the floor of Sandusky Bay there are springs, but it has never been proved that they are a part of the rest of the system. None of the wells or springs in this neighborhood show any impurities from the use to which the river is put when it passes under Bellevue. Thus it is that this little city has one of the cheapest and most sanitary sewage disposal systems known.

We can indeed agree that it was the cheapest, but 40 years later when Lake Erie was near death, the final outlet was no longer a conjecture.

The assertion that "None of the wells or springs in this neighborhood show any impurities from the use to which the river is put when it passes under Bellevue," suggests that the author was not aware of the Ohio Department of Health's reservations 12 years before.

"Mysterious Lost Rivers Run Mills and Power Plants," Popular Science, November 1934, again brought Bellevue's practice to national, if yet again uncritical, attention.

Where does the waste material go? No one knows. It is believed that an underground stream caries the sewage away. A single well can handle two houses. Fortunately, the waste material dumped down the garbage wells of Bellevue does not remain to contaminate the surrounding soil. Excellent fresh-water wells have been drilled with success within the city limits.



Drilling a well into an underground river for garbage disposal.

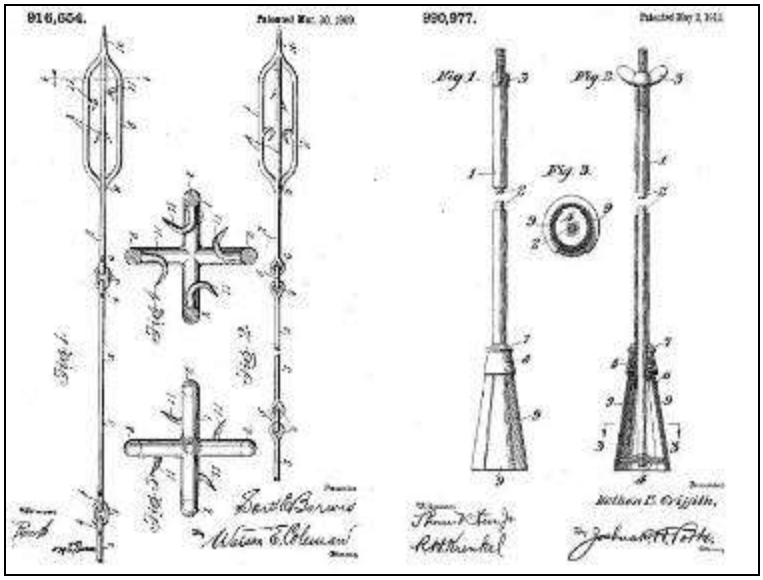
One of the drilling outfits used in this work. In some towns the wells do the work of sewerage systems.

Perhaps, as you read this, you are sitting above a subterranean river that would rank with many a fair-sized surface stream. Where do these unseen streams flow? What causes them? What influences do they have on surface conditions? Are they of any value? These are a few of the questions that have gained the attention of geologists. Answers have been provided in some cases. But, on the whole, the underground creeks, rivers and lakes of the United States and the rest of the world remain very much a mystery.

The "very much of a mystery" is but a ploy to garner reader interest.

We note the story's two-time use of "garbage," hoping that the writer thought the term synonymously with "sewage." On the other hand, a standpipe to an unseen cavern might indeed have seemed a convenient place to dump any manner of refuse.

Some 1500 brick-sheathed or perforated pipes conveyed wastewater from 5 to 30 meters into the karst under-layer. As for maintenance, American ingenuity is indefatigable.



The expression "The shit hit the fan" describes the impact of the 1937 flooding earlier. More accurately for Bellevue, however, would be "The feces floated into the parlor," the indicator often being E. coli (Chapter 52).

"Sunken Stream Gives Up and Floods a Town," Chicago Daily Tribune; June 28 of that same year,

> *Natural Sewer Reverses in Bellevue, Ohio*
>
> *Bellevue is built from 20 to 50 feet above the level of an underground stream that, for want of a better name, had been known colloquially as the "Bellevue underground river." It empties into Sandusky bay, an arm of Lake Erie.*
>
> *Even in the days before indoor plumbing, and by some folks since, it was considered godsend. You could did almost anywhere in town to bedrock, where its natural slope would carry the drainage into the sunken stream. When some areas of the town were joined by a common sewage system it too was run into the underground river. It saved a good deal of money.*
>
> *Last Friday, early in the morning, it started to rain. It poured for eight hours. The sunken stream, already swollen by several days fall of water over the area it drains, couldn't take it. The pressure forced the water back up the sewers, back up the sinkholes, and through the crypts the citizens not on the sewer system had dug.*

Although 90 percent of the city's basements flooded with raw sewage, remediation was opposed because of the costs of a treatment plant, sewer lines and redoing the plumbing in thousands of homes.

Additional municipal water wells were drilled in the early 1940s at depths ranging from 42 to 61 meters. But by 1944 several were contaminated and plans for an industrial well for soybean processing were abandoned due to contamination at 70 meters. All commercial and municipal water wells were relocated by 1946.

By 1960, there were more than 1400 privately-owned sewage disposal wells or sinkholes within the city and more than 200 municipally operated disposal wells discharging toilet flushes, restaurant and laundry wash water, kitchen garbage, bath water, mortuary and hospital refuse into the underground cesspool.

We don't want to know more about the mortuary waste.

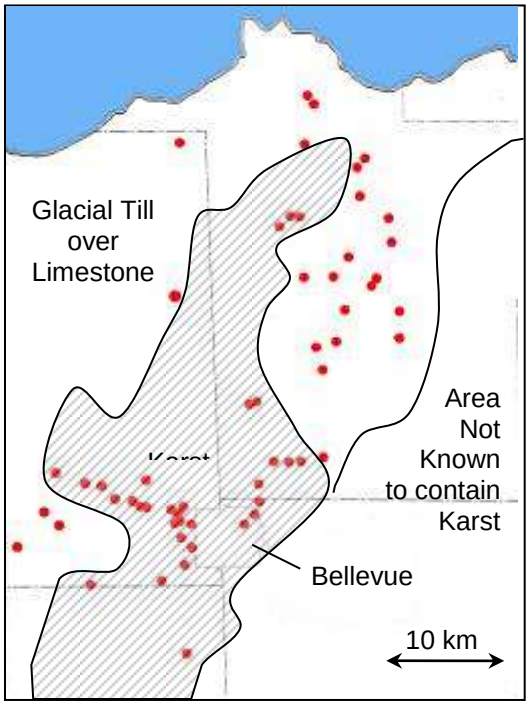
It wasn't until 1961, however, that the state recognized the broader consequence of mainlining -- a 200 square-kilometer northward swath of pollution.

Contamination of Underground Water in the Bellevue Area, ODNR (1961),

> *Contamination of a highly-permeable limestone aquifer had resulted from the dumping of household, municipal and industrial wastes into scores of sink holes and drilled wells. In many instances septic tanks were used, but overflow from the tanks was allowed to discharge into wells. The sewage effluent contaminated the groundwater as it moved down the water-table gradient toward Lake Erie.*

Red circles show reported sites of contamination.

> *Of 32 samples of groundwater collected in the vicinity of Bellevue, 27 contained ammonia. Detergents (alkyl benzene sulfonate or ABS) were found in 22 samples, and all contained nitrate and phosphate.*



> *The ground-water resources in the Bellevue area, and in areas down-gradient from the town, are obviously grossly contaminated and have been for more than a half century. The Division of Water report states.*
>
> *Stories have been related to us during this investigation, of wells which yielded easily recognizable raw sewage (including toilet tissue) while being drilled. Others have foamed because of high detergent content, and still others, the contents of which are best left to the reader's imagination.*

As toilet paper and surfactants seem sufficiently undesirable, we need not specify what else might be imagined. We should note, however, Bellevue's secondary drilling service sector, drillers who replace disposal wells unmanageably clogged with the items we're not imagining.

Municipal officials, however, weren't promoting action.

Official	Position	Source
City of Bellevue	*The only place to discharge* [treated] *effluent would* [still] *be into the underground caverns and this is what the state water commission objects to now.*	Toledo Blade, April 19, 1962
Commissioner of the Bellevue Health Department	*Officials of Bellevue, since the original inception of the use of sink holes, had made studies in the area and could find no evidence of water contamination.*	Freemont News, June 24
Public Service Director	*The geologists' report ... failed to prove that contamination originated in the city.*	Springfield Daily News, June 28

Nine out of ten citizens objected to treatment and plans to construct a wastewater plant were shelved.

But the times, they were a-changin' and the opposition faded when federal funds became available for wastewater treatment. The July 10, 1969, Toledo Blade, recorded the turn-around,

> *Bellevue Maps Cleanup to End Disease Threat. Plans to disinfect areas of stagnant water containing raw sewage in the flood-ridden city of 9,000 are being completed.*

A flood the week following drove home the urgency.

> *Four sections of Bellevue were still under water late last week. The Bellevue storm drainage system is mainly a natural network of underground solution channels in limestone. The torrential rains raised the water table so high that water mixed with sewage rose out of the ground from sink holes, and the residents are still trying to pump water off to ditches that drain into Lake Erie. The flooding caused an estimated $250,000 damage to Bellevue's $4.5-million sewage interceptor and treatment plant started last spring.* -- "Ohio Storms Burst Two Reservoirs," Engineering News-Record, July 17, 1969

The treatment plant was completed in 1971 and America's mainlining of sewage into underground rivers ended.

While one would hope that Bellevue's sewage woes were thus ended, complaints were yet in litigation as late as 2006 regarding contamination by a storm that raised well levels 9 meters in 3 hours. The class-action suit was against the hospital -- recently rurally relocated -- for its storm water injection, but the counter claim was that up-flow from the plaintiffs' septic systems was flowing onto hospital property.

Concrete Plugs?

If there's a common theme in the many aspects of underground rivers, it's that preconceptions don't die easily. Halting -- or at least substantially reducing -- Bellevue's blatant pollution didn't decrease the karst flooding and a chronic problem breeds renewed speculation regarding cause.

"Fountains of the Deep Break Open," the Plain Dealer, May 8, 2008, catches the public frustration regarding frequent inundation, albeit now of somewhat less septic quality.

> *Precipitation measured at nearby Fremont was 69 percent above normal for the period of February 1 through March 18.*
>
> *Finally, the subterranean labyrinth could hold no more. As the pressure built, it drove groundwater up -- up through fissures in the underlying limestone, up through storm sewers and up through the concrete walls and floors of basements.*
>
> *Spontaneously formed ponds still cover basements, farms and roads. No one has put a dollar figure on the damage yet. But in all, 200 or more homes have been afflicted, local officials say.*
>
> *This kind of flooding isn't unprecedented here -- but it is rare. The floods came in 1969 and 1937 and 1913, said Jeff Crosby, Bellevue's safety and service director.*

A mile down Ohio 269, residents blame each other. One says neighbors up Strecker Road prevailed on the county to knock down levees two years ago so a drainage ditch wouldn't overflow onto their new homes. Others suspect neighbors -- even friends -- have filled sinkholes with concrete, a practice that hydrologists and geologists condemn.

From WKYC-TV's "New Theories about Bizarre Flooding in Bellevue, Ohio," aired April 25, 2008,

Residents in this small town in Huron County have been coping with floods for five straight weeks. Some of them theorize that something has plugged up one or several of the underground sink holes, pushing millions of gallons of water to the surface.

Viewed from the air, it's hard to imagine that the dozens of small lakes and ponds all suddenly appeared five weeks ago. The earth has pushed up millions of gallons of spring water to the surface of this rural community against logic and against gravity.

There are no visible rivers or streams for miles around that would explain the destruction.

79-year-old Dick Bell has been studying the cave system in the county for more than fifty years. He says there may be hundreds of similar caves and sink holes in the area surrounding Bellevue. He says that normally all the water flows like an underground river toward Sandusky Bay.

"It's all loaded with water down there and it's all flowing downhill to the north," Bell said. "Every 30 years or so, something happens to block that flow and, boom, the flood appears."

"I can't say for sure what's doing this, but I sure hope somebody hasn't filled up sink holes on their property and shifted the way the water flows out," he said.

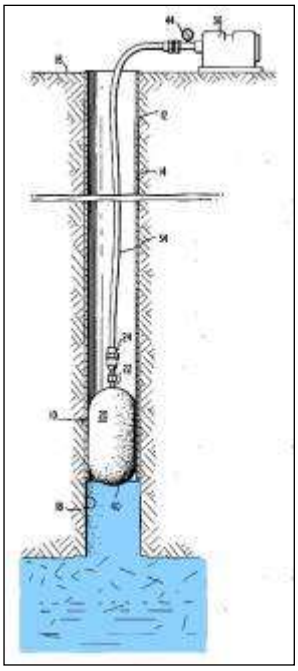
[Resident, Bob] *Hammersmith believes that his neighbor plugged up several sink holes with concrete and changed the way the artesian spring water drains from the surrounding properties.*

While most hydrologists and geologists may doubt that dumping concrete down a few holes would do the job, there's a solution at the US Patent Office.

United States Patent **3,995,694**
Freiburger **Dec. 7, 1976**

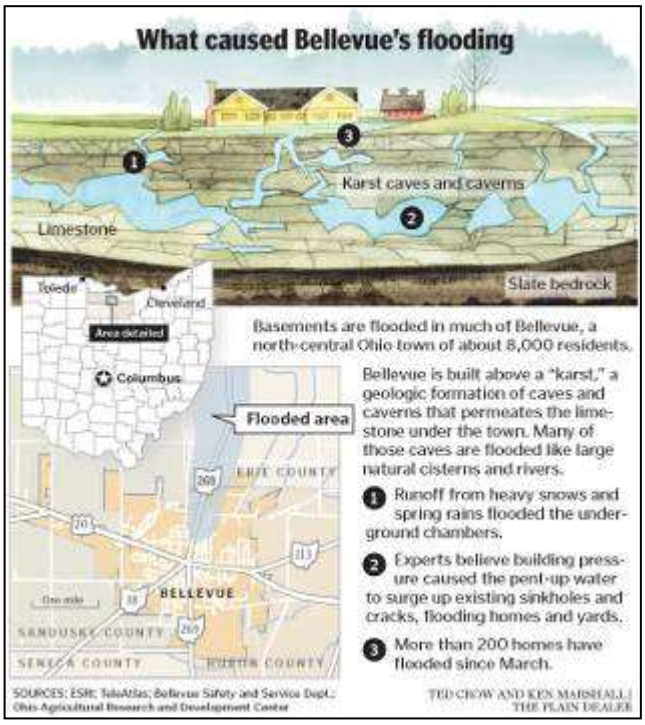
INFLATABLE WELL SEAL AND METHOD OF USE THEREOF

Inventor: **Cletus N. Freiburger**, Dubuque, Iowa



The abandoned wells can pollute these operational wells because the wells are usually connected by underground rivers or streams... Due to the great depth of these wells, and the fact that the bottom of the well shaft opens directly into the water source, it would be quite impractical and nearly impossible to merely pour concrete or other hardenable substances into the well shaft to seal the well without first implanting a base structure in the shaft of the well

Let's look again at WKYC's title, "New Theories about Bizarre Flooding in Bellevue, Ohio." There are no new theories. The television reporter simply appears to have missed the previous day's Plain Dealer, its graphic shown to the right. 1, 2, 3 can hardly be called bizarre.



ODNR likewise attempted to the blockage question in Ground Water Induced Flooding in the Bellevue Ohio Area (2009),

> *Q: Has the flow in the aquifer been blocked?*
>
> *ODNR: No. However, the number of sinkholes and the pathways for groundwater movement change over time.*

But who's going to believe the government?

Bellevue Alone?

Although the 1934 Popular Science reported, "In some towns the wells do the work of sewerage systems," the plurality was not elaborated. The 1961 ODNR study described the Bellevue situation as "an unusual, but by no means unique," but again without expanding.

So we'll note similar cases.

"Florida," Medical Record, October 17, 1891, touts Ocala, Florida for recuperation.

> *Ocala has been called "one of the best planned and most picturesque cities of the South," possessing paved streets, street railways, an electric light plant, a wholesome and desirable water-supply, and a remarkable system of natural sewerage formed by a swiftly flowing underground river eighty to one hundred feet beneath the surface.*
>
> *The indications for a sojourn at Ocala are pulmonary and throat troubles, chronic rheumatism, gout, senile debility, and an enfeebled nervous system.*
>
> *It seems to be an underground river that has come to the surface for a glimpse of daylight.*

Ocala still disposes of nitrate-laden storm water runoff into 28 sinkhole inlets. The Rinker Truck Cleanout Pit empting into a sinkhole is shown to the right.

Not until 1960 did the city of Live Oak, Florida abandon its wastewater disposal wells. Why it wasn't decades earlier, however, speaks poorly of state enforcement, given the Florida Statutes Act of June 7, 1915.

> *367.02 No municipal corporation, private corporation, person or persons within the state shall use any cavity, sink, driven or drilled well now in existence, or sink any new well within the corporate limits, or within five miles of the corporate limits, of any incorporated city or town, or within any unincorporated city, town or village, or within five miles thereof, for the purpose of draining any surface water or discharging any sewage into the underground waters of the state, without first obtaining a written permit from the state board of health.*

Popular Science, October 1885

> *The authorities of Albany, Georgia, have efficiently drained a troublesome pond by boring a well hole through the ground to a deep subterranean stream. An outlet for the sewerage of a large Western university has been found in one of the numerous "sink-holes" with which the cavernous limestone of the country is marked, where a similar underground stream carries the stuff to parts unknown. Such expedients are good, provided the subterranean stream selected for the sewer-outlet is not a source of supply for some well.*

St. Louis, Missouri is another example of the murky (literally) history of subterranean sewage disposal. From "Natural Sewage, Subterranean Passages Honeycomb the Ground Beneath St. Louis" in the San Francisco Call, February 28, 1892,

> *"Do you know," said Sewer Commissioner Southard, "that before the present sewerage system of the city was put in there existed a system of natural underground sewers which carried off the drainage of the city? Go down to the southern outskirts of the city and you will see scattered here and there square shafts of rough stone sticking up out of the ground, from one to ten feet above the surface. Look into one of these and it seems bottomless. Some of them, however, are different; you can see the bottom, and they appear to be just ordinary shallow holes. They have outlets, however, underground passages that wind far away into the earth, and through these the drainage escapes emptying eventually, I presume, into the river. Some of these holes, however, are over half a mile from the river.*
>
> *"Before the shafts were built they were simply sinkholes, generally in the middle of a wide and deep depression. They were walled in, however, the shafts built up, and the dirt washed down was held by them and the land leveled.*
>
> *"I think that they were caused by some great upheaval of the Mississippi Valley, possibly the same that caused the New Madrid earthquake in 1805. The land about them looks as if had been lifted up and let down, causing a sinkhole in the middle. This same eruption doubtless produced the underground passage between the layers of limestone. Some of these shafts were built to the height of twenty feet; but the dirt has filled in about them until sometimes they are level with the surface of the ground. Twenty five years ago there were hundreds of them,*

and there are now between 100 and 200 that have been walled up. I have never seen anything like such an extensive system of natural underground sewage as this."

As the St. Louis Sewer Commission of the time dealt with both wastewater and storm water, we can't be sure of the nature of this particular sewage, but in a hydraulic sense, it's the Bellevue story.

Robert E. Criss documents another Bellevue correspondence in "Human Modification of Karst in the St. Louis Area, Missouri" in National Cave and Karst Management Symposium, 2007.

Several homes along Conger Dr. were constructed along the side of a large sink that according to one lifelong resident formerly hosted a cave entrance. The area was partly filled and graded, and is now traversed by an MSD [Metropolitan St. Lewis Sewer District] *storm sewer. Several homes in the immediate vicinity still have septic systems, while others are connected to municipal sewer lines.*

The residence of Alice Bradenberg at 11606 Tescord Drive has experienced repeated flooding since 1966 due to backflow from a sinkhole into which too much storm water has been diverted). Ms. Bradenberg reports that the water from the "drain" can "geyser" several feet into the air following storms.

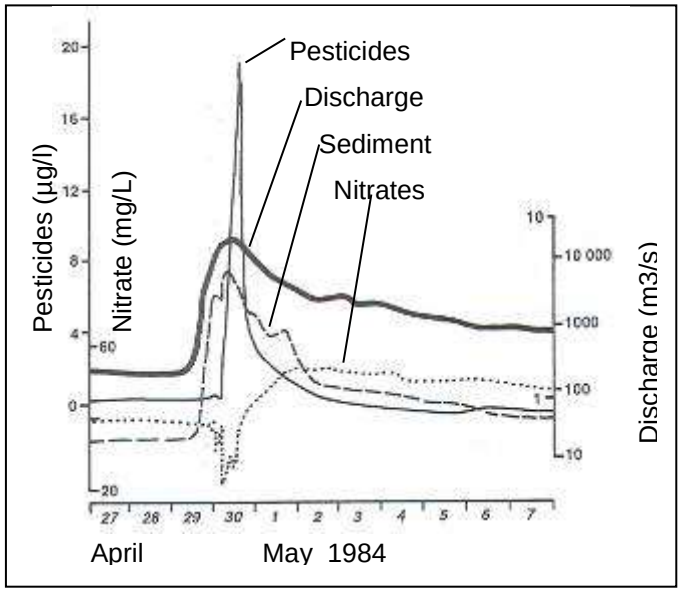
A photo illustrates a sinkhole collapse.

Collapse near a storm drain situated in a sinkhole in the Concord area. The capacity of the natural bedrock conduits is too small to drain storm water as fast as it is delivered, so this yard frequently floods to depths of several feet.

"Agricultural Impacts on Ground Water Quality: The Big Springs Basins Study, Iowa," Proceedings, Agricultural Impacts on Ground Water Quality, National Water Well Association (1986) by R.D. Libra, G.R. Hallberg, B.E. Hoyer and L.G. Johnson describes the effects of sinkhole-capture on environmental quality in a 267 square-kilometer groundwater basin.

Impacts of a 7.4 centimeter storm during the late hours of April 29 are shown to the right.

A karst system's response to a rainfall event can indeed be rapid.



"Ground Water Flow in Limestone Terrains," Proceedings, Fifth National Symposium and Exposition on Aquifer Restoration (1985) by J.F. Quinlan and R.O. Ewers describes how sewage,

creamery waste and heavy metal effluent was spread to 56 springs along an 8-kilometer reach of the Green River in Kentucky's Sinkhole Plain.

Research at Huazhong University of Science and Technology suggests that advantages of underground river-style dry fermented garbage processing include,

Large quantities of refuse can be treated,
Refuse can be immediately treated on site, and
Little land is required.

For those who read Chinese, see Yuan Yuan, et. al., "Medium-Scale Experiment Study on Biomass Anaerobic Digestion by Underground River," Renewable Energy, June 2006, and Cheng-Bao Leng, et. al., "Study of House Refuse by Dry Anaerobic Digestion in Underground River," Environmental Engineering 19:4, 2001.

And let us not forget the End of the World. From "Sonia, A Story from the End of the World" by Michael Crane, Meanjin, June 2007,

> *I am the storyteller at the End of the World. Everyone asks me what the place looks like. The End of the World is a huge sprawling metropolis built on rock-hard clay, and beneath it runs a 100-mile-wide underground river that ends at the End of the World and becomes a giant waterfall. The river acts as the sewerage of the physical life, and also for the souls of people at the End of the World. In every kitchen there is a hole in the floor where the people deposit their garbage and this is carried by the river and over the edge of the waterfall.*

Wherever and whenever, we endorse the advice given in "Water and its Dangers," Maine Farmer, June 13, 1895.

> *Wells within a hundred feet of the house may be pure, but there is great possibility of underground streams reaching it from far-away barns, if not from those at hand.*

And to the End of the World

Michael Crane's subterranean river, 100 miles wide, a waterfall to the End of the World, resonates with dark magnificence, but less so, the kitchen garbage disposal. From Crane's "Sonia: a Story from the End of the World," Meanjin 66.2, June 2007 by

> *I am the storyteller at the End of the World. Everyone asks me what the place looks like. The End of the World is a huge sprawling metropolis built on rock-hard clay, and beneath it runs a 100-mile-wide underground river that ends at the End of the World and becomes a giant waterfall. The river acts as the sewerage of the physical life, and also for the souls of people at the End of the World. In every kitchen there is a hole in the floor where the people deposit their garbage and this is carried by the river and over the edge of the waterfall.*
>
> *At night when they dream, the people's fears and worries are also carried by the river and over the edge. The river exists in the hearts of the people at the End of the World, and no matter what tragedy befalls them they are washed clean as they sleep at night.*
>
> *Only one person has ever leapt over the waterfall and observers say that she fell for miles and is still falling to this day. There is a theory that Sonia, the most beautiful girl at the End of the World, did not commit suicide, but that she wanted to be one with the waterfall. There is a ritual at the End of the World: on each person's birthday they throw a garland of roses over the edge and say a prayer of thanks. They then walk back home to the End of the World as the roses keep falling for all eternity.*

CHAPTER 82
REPERCUSSIVE URBAN SUBVERSIONS

The brook was thrown
Deep in a sewer dungeon under stone
In fetid darkness still to live and run --
And all for nothing it had ever done
Except forget to go in fear perhaps.
No one would know except for ancient maps
That such a brook ran water. But I wonder
If from its being kept forever under,
The thoughts may not have risen that so keep
This new-built city from both work and sleep.
from "A Brook in the City" by Robert Frost, 1923

A river relegated underground bodes unanticipated repercussions for a metropolis above. This chapter deals with unintended consequences of naturally-flowing waters subverted into municipal sewers.

We'll begin with three examples from the City of Brotherly Love.

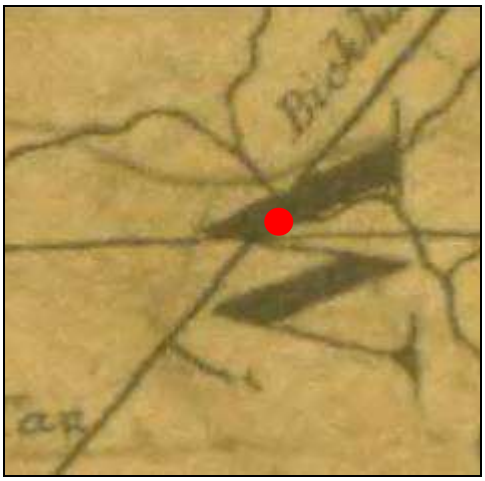
In the late 1800s, Philadelphia undertook a progressive plan to encapsulate its surface streams, eventually sewering 73 percent of its waterways, roughly the same percentage as that achieved by Washington DC.

Such sewers were meant to convey natural discharge, augmented flow from paved surfaces, and effluent from indoor plumbing, an increased concern when it became known that typhoid fever and cholera were transmitted by foul water. Between 1860 and 1909, more than 27,000 Philadelphians died of typhoid.

Wingohocking Creek, Philadelphia

Wingohocking Creek once drained some 25 square kilometers in the Germantown area with about 35 kilometers of channels.

The maps that follow chronicle a portion of the urbanization and creek disappearance as sewer pipes, some exceeding 6-meters in diameter, subsumed the drainage. The red dot is the intersection of today's Musgrave and Haines Streets, a location to which we'll return.

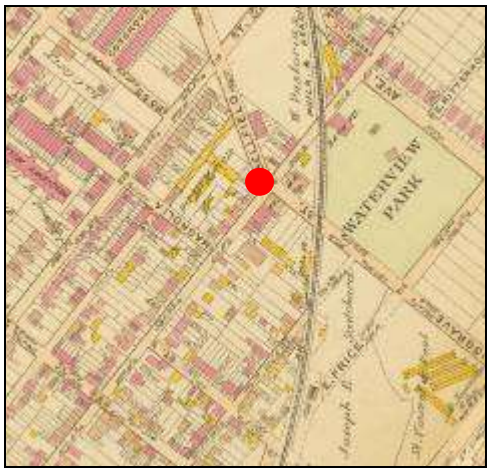


1808

1843

1862

1890-1910



1910

Today

Wingohocking Sewer under construction

1890s

1909

1914

1914

1914

1916. The pipe temporarily carried cross-flow.

"Wingohocking Creek is to be Put Under Ground," Philadelphia Record, October 5, 1924,

> *The construction of the Wingohocking sewer will have the ultimate result of eliminating Wingohocking Creek which at the present time is an open sewer... It is estimated that aside from eliminating the health menace as represented by the open creek, the completion of the sewer will open up for development approximately 400 acres of ground.*

"Put Under Ground," perhaps, but not knocked out of the ring, Philadelphia being a city that merits a boxing metaphor.

The overbanks along the Wingohocking were filled with as much as 12 meters of ash and rubble, and the row houses built on such foundation began settling almost as soon as they were completed. More than 1,000 dwellings of this "Logan Triangle" had to be razed in the 1980s.

Logan Triangle, 1999

On September 8, 2011 a young woman drowned in a flash flood while driving at East Haines and Musgrave, an area on high ground and miles from open water.

"Driver Drowns in Flash Flood in East Germantown," Philadelphia Inquirer, September 10, 2011,

> *A 27-year-old woman whose father is a Philadelphia police officer apparently drowned in her car after it was caught in a flash flood in East Germantown, police said Friday.*
>
> *The woman, whose name has not been released, called her father early Thursday and said she was trapped by flooding at Musgrave and Haines Streets, police said.*
>
> *The woman told her father that she had called 911, police said. She never arrived home, and when her father did not hear from her, he filed a missing-person report.*
>
> *Shortly before noon Thursday, police found the woman's SUV and, believing it to be abandoned, had it towed to a lot in West Philadelphia.*
>
> *Later, officers discovered the woman's body in the backseat. Hers is believed to be the city's first flood-related death this year.*

WHYY NewsWorks, September 8, 2011,

> *A 27-year-old woman died Thursday after calling her father -- a city police officer -- and 911 to report she was trapped inside her car because of flash-flood waters near the Waterview Recreation Center in East Germantown.*
>
> *The woman, whose name is not being released by police, made those calls from E. Haines and Musgrave streets around 2:30 a.m. When her father didn't hear back from her, he reported her missing at 10:35 p.m. Her Chrysler Pacifica had already been taken to a South 52nd Street lot by Top of the Line Towing, at the father's request.*
>
> *An hour later, police detectives investigating the missing persons report discovered her body in the back seat of the vehicle.*

It did not escape the reporters that the fatality occurred above the long-buried Wingohocking. From "History Offers explanations for deadly Germantown Flood," NewsWorks, October 3, 2011,

> *Since combined sewers are necessarily connected to people's homes, when they are overwhelmed the water backs up into basements. Outside on the streets, water begins to pour out of sewer grates and manhole covers, at the same time that surface water has no place to drain. In an event like the one on September 8, when this section of Philadelphia received four inches of water in two hours, subterranean water pushes aboveground with enough force to create major flooding in basements and streets.*
>
> *According to the interactive mapping website Philageohistory.org, the location of the fatal flooding on September 8 is exactly above the buried Wingohocking.*

Buried streams exhume themselves when and where the public is least prepared.

Mill Creek, West Philadelphia

Draining 20 square kilometers of West Philadelphia, Mill Creek once powered grain, textile and other mills along the banks of the Schuylkill. Fast-flowing and fast-flooding, Mill Creek could discharge 150 cubic meters/second, destroying crops and creating seas of mud.

Near right, Mill Creek, 1852.

The Hopkins Atlas of 1872 shows the creek, hospital, home for orphans and mills within an overlay of platted properties.

The Bromley Atlas of 1895 no longer shows the creek. Row houses have replaced the mill buildings.

In the 1927 Bromley Atlas, a sinuous sewer line beneath blocks of row houses is the only vestige of the waterway.

Far right, stream route superimposed on modern photo.

Benjamin Boggs, an area resident, wrote about the creek in 1912:

> *Standing upon City Line bridge over the railroad one may see... the headwaters of Mill Creek, a tiny stream sparkling in the sun shine beneath the line of old willows which border it for hundreds of feet. The creek is only a baby here, scarcely three feet wide, and runs in* [a] *carefully stoned bed. It disappears into a tunnel under the railroad tracks at Overbrook station (thanks be to the poetically inclined person who perpetuated its memory in the name of the depot) and then, for all the long miles to the Schuylkill at Woodlands, it burrows foul and unpleasing beneath the surface.*

1850s	Beginning of West Philadelphia “streetcar suburbs.”
1866	Mill Creek surveyed to be drained
1869-1895	Construction of 6-meter concrete and brick pipe said to be the largest sewer pipe in the world.  1883 Photo
1930	Two injured when truck plunges into collapsed sewer, 43rd, south of Walnut.  1910 Map. Sansom-43rd-Walnut-44th block in green.
1930s	Homes collapse, Walnut between 43rd and 44th.
1945	Neighborhood of row homes destroyed.
1952	10-meter cave-in, Sansom near 43rd, swallowed car and delivery truck, along with front steps, porches and furniture. Car fished out. Truck never found.
1955	Roadbed undermined trolley crossing, Sansom between 43rd and 44th. Block condemned.
1958	Home collapse, Walnut near 43rd. One fatality.
1961	10-meter sinkhole, Funston near 50th and Parrish (2 kilometers upstream from the other locations). Three fatalities, including 9-year-old. City razed 115 homes and upgraded sewer. Muscatine Journal, July 18, "Philadelphia, PA House Collapses" *Four row houses, built over an antiquated sewer line collapsed Monday night, burying seven persons. Four were dug out alive, and practically unhurt. One of them a six-year-old girl, lay under the tons of rubble for nearly three hours. Many hours after the collapse which rocked the neighborhood, firemen searched the ruins for the other three.* *At 4:30 a.m., another neighboring house collapsed, imperiling firemen and rescue crews. But by then the occupants of that house had been evacuated together with about 600 other persons living in the same block.*

1961 (cont.)	Associated Press, July 18, *Firemen and other rescue workers use huge crane and shovel as they continue their search for at least three persons believed buried under the debris after a section of Philadelphia row houses collapsed. The house dropped into an underground creek used as a massive sewer.*	
1972	Cave-in, 43rd and Sansom. 116 evaluated. Sewer rebuilt.	
Today	Supreme Supermarket parking, 43rd and Sansom	

Streamflow that once powered mills above the surface can become a powered mole below.

Gunner's Run, North Philadelphia

Gunner's Run - named after a Swedish settler whose farmstead it traversed - drained almost all of Nicetown, Fairhill, Upper Kensington and Port Richmond.

We've no early photo of the stream, but it would have resembled Dobson's Run, the creek that drained parts of East Falls, Nicetown and Germantown.

Dobson's Run, 1910

Investors paid $100 a share in 1847 to convert the lower reach of Gunner's Run into an 8-kilometer canal, the Aramingo, but urbanization was soon weigh against the waterway.

Capitalization was only sufficient to complete a quarter of the improvements.

A slaughterhouse dumped carcasses into the waterway and within 20 years, the channel was inky black with a meter of ooze on the bed. In 1878, Gunner's Run was subverted into a 3-meter, 2-course brick channel, conveying 0.9 cubic meters/second in dry weather, and more after a rain. (Dobson's Run was likewise buried in the 1890s.)

Water transport yielded to rail and roadways and the Aramingo was refilled between 1896 and 1902.

A waterway thus out of sight, out of mind, but like nearby Wingohocking and Mill creeks, not out of the ring.

On August 1, 1959, 10:51 p.m., patrolman Joseph A. Reiss and his partner were called to check a pavement collapse at the intersection of Fifth and Clearfield. We'll follow the papers.

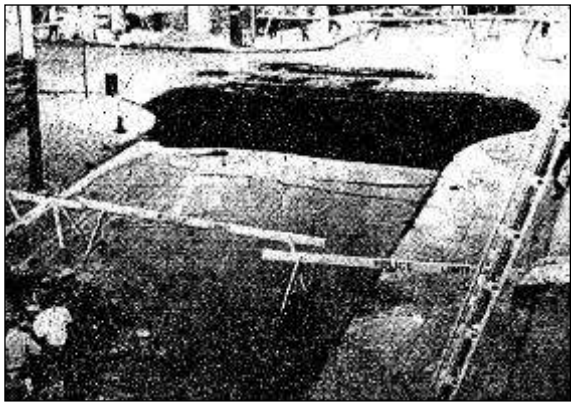
"Street Caves In, Hurls Policeman into Water," Los Angeles Times, August 2,

Reiss peered over the edge of the hole. Suddenly the edge crumbled and he plunged out of sight.

"Policeman Lost in Street Cavern," Washington Post, August 3,

A policeman checking a cave-in at a street intersection last night was swallowed in a sudden collapse that left a hole 40 feet long and 40 feet deep. The accident apparently resulted from the crumbling of an old sewer line 30 feet below the surface of the intersection in northeastern Philadelphia.

Water Commissioner Samuel Baxter said that the section was originally built on filled land over the Gunner's Run Creek and had a history of cave-ins.



Baxter further elaborated that the calamity was due to the collapse of a 3.5-meter buried arch, a sewer structure built to support horse traffic, not trucks.

"Policeman's Death in Cave-in Feared," New York Times, August 3,

A gap 20 feet deep and 36 feet in diameter marked the spot where the officer disappeared.

As the crater was elsewhere reported to be 43 feet deep, 60 feet long and 60 feet wide, it's difficult to be sure of its extent. Flooded cavities are more often measured by eyeball than by tape.

"Policeman's Body Found in Pit," Los Angeles Times, August 9,

The body of Patrolman Joseph Reiss was found at the bottom of a 40-ft. pit.

On August 8, Officer Reiss's body was retrieved under the intersection of Richmond and East Somerset, some 3 kilometers from where he went down and less than two blocks short of being swept into the Delaware.

1892 ● Cave-in ● Recovery of body

The speech by George Shotzbarger at the dedication of Patrolman Reiss's hero plaque, July 22, 2010, merits quotation.

On August 1, 1959, I was just a pint-sized 7-year-old, enjoying my carefree summer vacation, when Officer Reiss went down -- literally -- at 5th & Clearfield Streets.

My father was walking my older sisters and me to 9 o'clock Mass on Sunday morning, August 2nd, when he figured out that something was very wrong. There was three times the normal traffic westbound on Indiana Avenue, as a result of the sewer collapse on 5th Street. Once we were in church, moreover, the old German priest asked all of Saint Bonaventure Parish to pray for "that poor policeman" who got caught in the terrible cave-in of the previous night. Needless to say, my dad stopped at the corner store and bought the Sunday morning paper to see exactly what had happened. The news was horrific, of course, and day by day it didn't get any better.

For a young lad like me, it was the strangest, most memorable week: one "watershed" moment after another. For example, we weren't allowed to take collected newspapers to the junkman on the 31 hundred block of 5th -- which is how we used to earn our money for baseball cards, candy, and snow cones. We had to walk a different route to the pool at Mann Recreation Center, 5th & Allegheny. We remained on "close watch" outside our house, because the City decided to switch the one-way direction of traffic on 7th as a northbound detour to 5th Street, which would remain closed for months as the Streets and Water Departments repaired the huge sewer line and hole in the ground. The wives and women prayed and cried for Officer Reiss, his widow, and his children. And the men? Well, the men finally had something to talk about besides how much the last-place Phillies were stinking up the National League. There was, simply put, a new stink to discuss: even two blocks away, on certain days, we could smell the sewer water, especially because the collapsed cobblestones had effectively dammed up an underground stream, originally known as Gunner's Run.

The grown-ups, however, wouldn't stop talking about Officer Reiss, and how it was such a damn shame that all those police, firemen, and sewer workers wouldn't just go down into that "culvert" and retrieve the dead cop's body. Misters Prouse, Forbes, Devine, Jones, Carr, Fedyna, Imwald, Rowan, Anderson -- all of them -- had been trained never to leave a brother-in-arms behind, but here the City seemed not to care about Officer Reiss enough to go down -- despite the risks -- and get him the heck out of there. They said they'd do it themselves, if the City would only let them. I can't know whether that level of neighborhood concern offers any consolation to the surviving family members of Officer Reiss here today, but the men in Fairhill were aghast at the eight days it took for the City to locate his remains.

Fifteen meters of the Aramingo Canal's wooden wall were discovered in 2008 under the lattice of I-95 lanes. The long-forgotten Gunnar's Run had kept the wall waterlogged, sparing it from microbes that otherwise would have destroyed it.

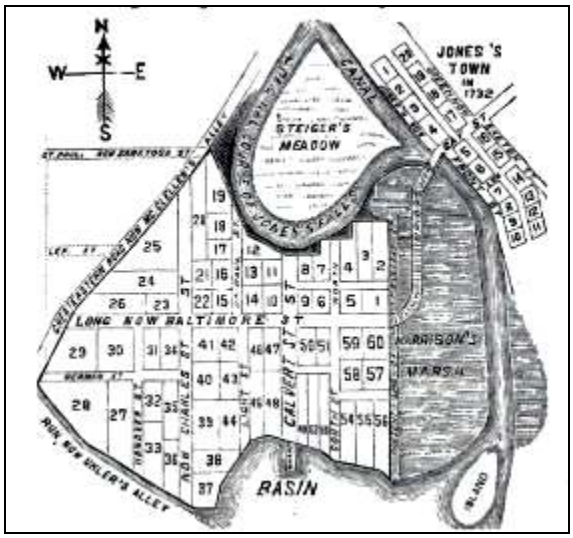
Buried streams kill people, but then again, they can preserve wood.

Jones Falls, Baltimore

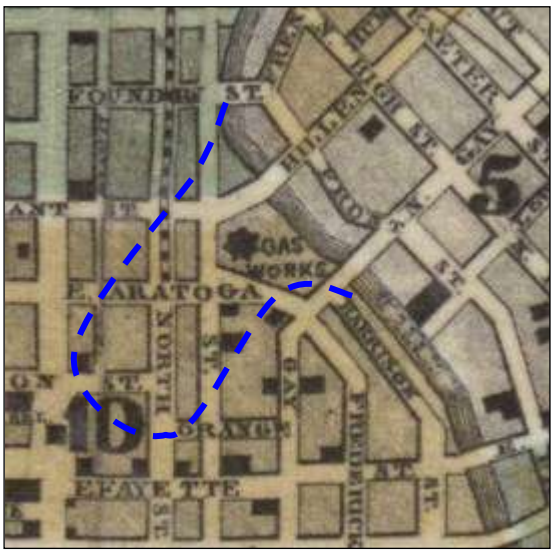
Jones Falls River once horseshoed from where Baltimore's Gay Street crosses today's channel to where Battle Monument now stands, a bluff then 12 meters higher than today. The 25 hectares within the bend comprised what was known as Steiger's Meadow.

The meadow was drained in 1758 and converted into pasture. In 1789, a channel was sliced from Bath Street so the peripheral course could be filled and leveled for development.

1792



Route of obliterated channel bend overlaid on 1853 map.



Baltimore was one of the last American cities to ban cesspools; there were 80,000 of them in 1879, most illegally overflowing into the storm-water drainage.

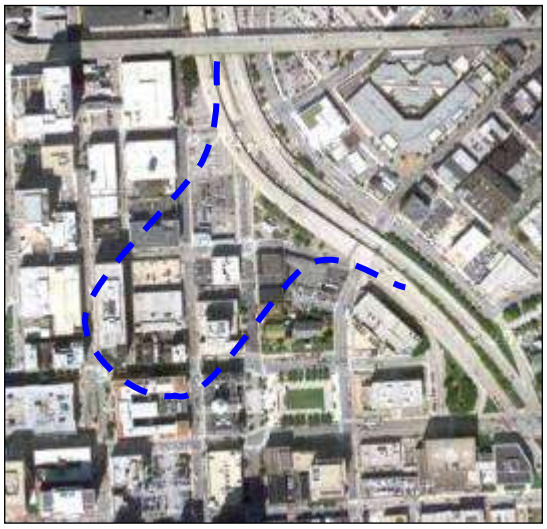
Raw sewage in Jones Falls gave Baltimore the highest typhoid rate of any city in the country.

The Fallsway, a 6.5-meter diameter tunnel, was completed in 1916 to convey Jones Falls to the harbor.

"I've come to bury the Jones Falls, not to praise it," proclaimed the Master of Ceremonies before igniting the dynamite to Davy-Jones the polluted waterway.

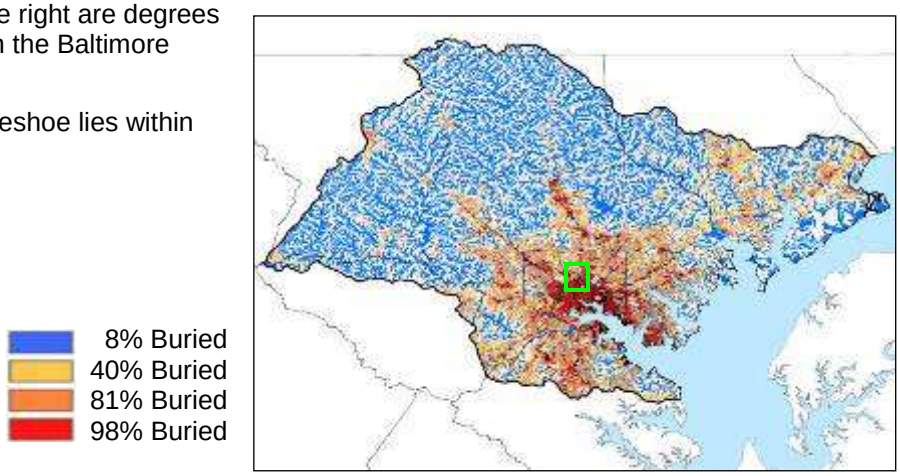
An automobile tour of Fallsway before it was opened to the river.

The Jones Falls Expressway opened in 1962, a torrent of traffic, not water.



For perspective, to the right are degrees of stream burial within the Baltimore watershed.

The Jones' Falls horseshoe lies within the green box.



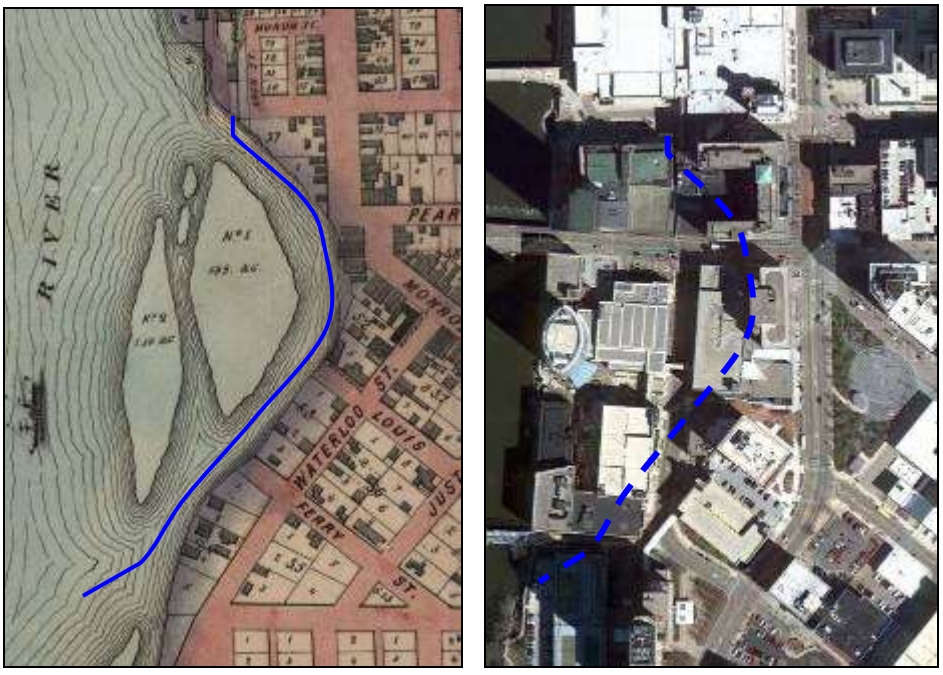
Unlike the three Philadelphia buried streams, here we've no fatalities, but there's been a price. Wrapped in sewer, water, gas and electric lines, the old Jones' Falls River Bridge can't be excavated from beneath the City Hall parking lot, precluding further development.

We can sometimes bury a channel easier than we can excavate its legacy.

Grand Rapids, Michigan

A side-channel of Grand River once separated Islands No. 1 and 2 from the City of Grand Rapids, but with industrial development, the islands were merged with the mainland by boarding and bricking over the channel.

With time, however, the wood rotted and the bricks loosened. When the pavement collapsed in 1903, the underlying torrent was rediscovered, 3 meters deep and 4 to 6 meters across. As the gates to the forgotten channel had long ceased to function, a coffer dam was required to excavate a cavity 65 meters long, 6 meters wide and 7 meters deep for proper backfilling.



1853 Today

Exhuming a subverted channel can be more arduous than its burial.

Park River, Hartford, Connecticut

Once called the "Little River," so as to not be confused with the Great (Connecticut) River, and later called the "Hog River" for its sewerage function during Hartford's pursuit of prosperity, Park River acquired its current name when Bushnell Park was created around it in the mid-19th century.

In the center, Park River, 1864

Park River through Bushnell Park

But, in fact, it never ceased being "Hog River." An 1880 resident complained that the waterway was “fed by fifteen sewers and drains, while three factories, a fish market and a dye house, and a score of tenements are constantly defiling its water with their refuse.”

Report of the Board of Street Commissioners, Health Committee and Joint Special Committee of the Court of Common Council on the Park River Nuisance (1880),

> *It has been said that Hartford has no sewer system, but that seems to be an error, at least in part...*
>
> *Of the 8,358 acres within the city limits, 5,100 are comprised in the Park River basin, and the sewage from this section flows into the Park River through 29 sewers from 18 inches to 10 feet in diameter.*
>
> *The river forks at 13,889 feet from the Connecticut River, and from Capital Avenue to this point the water, though dark in color, seems free from odor, and not very foul; but in the North Branch, at the outlet of the Laurel Street (Noon Farm) sewer, the water is ponded by a bar which forms a natural dam, and there the pollution is apparent and offensive.*

Offensive, perhaps, but at least a place to hang the laundry.

1895.

1907

Through Bushnell Park, at least, the foul water was still scenic.

1909

A flood in 1936, “the greatest disaster that has ever befallen Hartford,” led to the formation of the Hartford Flood Investigation and Improvement Commission, a body ill-funded, but politically primed to respond to the hurricane of 1938, the “worst disaster” in the history of the city.

Roosevelt's New Deal had the funds and conversion of the waterway's lower 1.5 kilometers into a reinforced concrete conduit was approved by the Work Projects Administration within a week of the storm.

The river was run into twin tubes, roughly 9 meters wide and 6 meters high, under Commerce, Front, Prospect and Main Streets. The section under Bushnell Park, a 9x4 tunnel 10 to 15 meters below the surface, was covered by grass and a small pond. Construction began in September 1940 and was largely completed in November 1943.

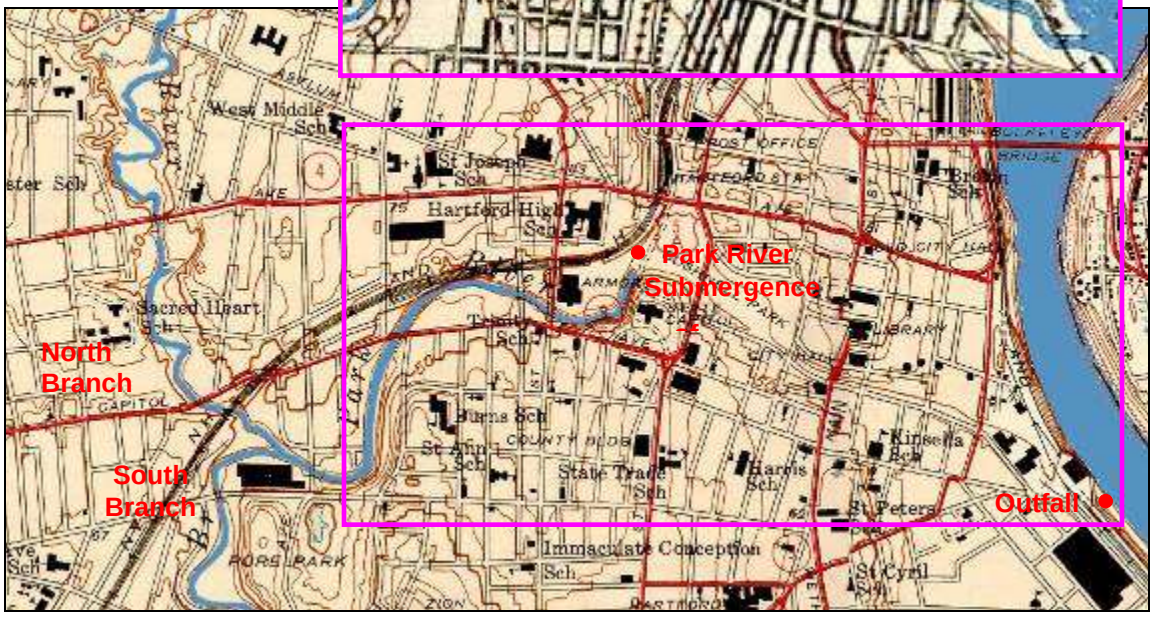
Construction on the first phase, 1941

Paving of the conduit top where a highway would eventually run, 1945

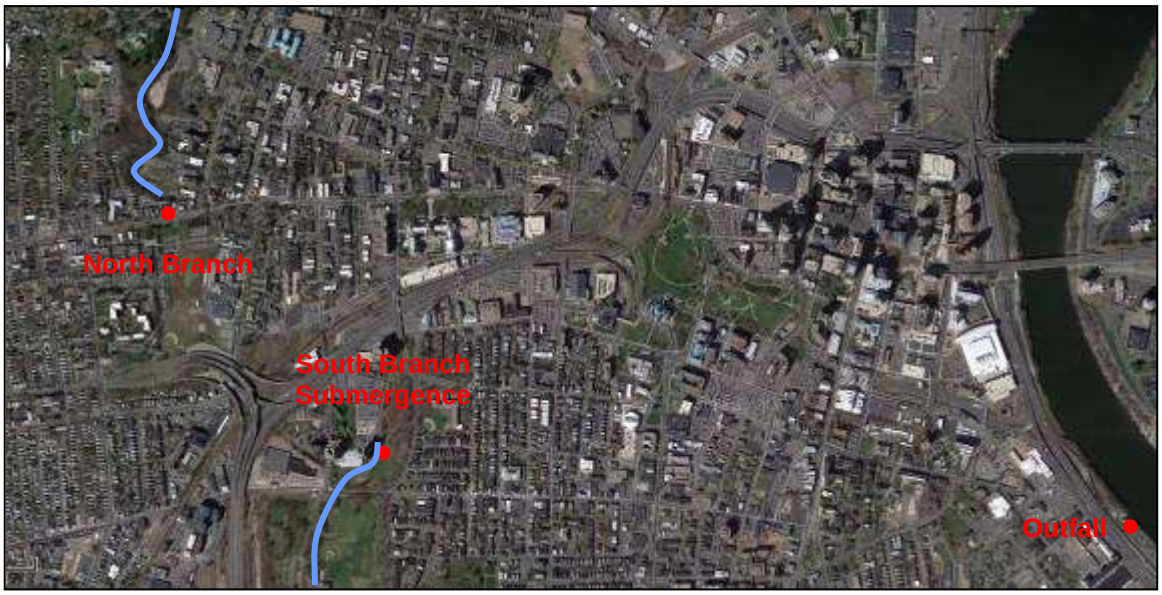
The subversion of Park River is chronicled in the maps that follow.

1892 Topography, Park River flowing to the Connecticut River

1944/45 Topography, Park River submergence in Bushnell Park



Below, the system today.



In 1966 the Corps of Engineers recommended yet more flood control and, as shown in the aerial photo, the covering was extended up the North and South branches in the decade following, making the burial 15 kilometers in total. Construction dewatering revealed a 3-meter dam composed of concrete blocks, truck tires, steel cables and other debris.

Today's subterranean channel is essentially a straight shot under the Capitol and Bushnell Park. Proceeding down the tunnel's length, one comes to a massive cavern where the two branches join and then split again into two parallel boxes to the Connecticut.

Above, the North Branch entrance near Woodland and Farmington Avenues. Mark Twain would have looked down upon this site from his mansion and seen the full swoop of the river.

South Branch entrance in Pope Park Outflow into the Connecticut River

Hartford formed a task force in 2004 to consider uncovering the channel, but after consultation with the Corps, the idea was deemed too costly. Chapter 93 discusses "daylighting" projects elsewhere where has succeeded.

Hartford's subversion of the Park River has worked in large part according to plan. The river has not flooded since 1955. Hartford encouraged industry to discharge waste into the Park's South Branch as late as that year, but with the advent of environmentalism, the waterway is at last reasonably clean.

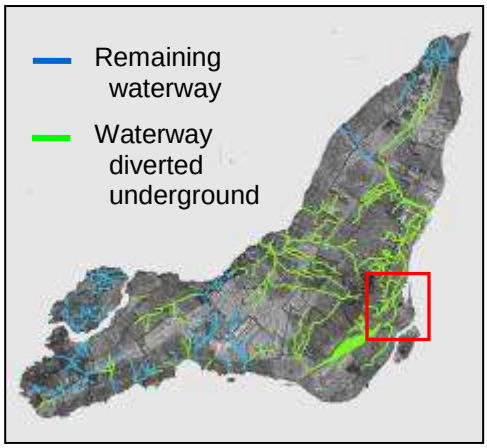
Reasonably clean, and somewhat of an art gallery, it seems.



We'll have more to say in the chapter to follow about the legality of the canoeist in the top photo.

St. Pierre River, Montreal

In what's by now a somewhat familiar hydrologic sequence of urbanization, streams of Montreal Island have been likewise relegated to the underground.



Creeks prior to Montreal City urbanization superimposed on modern aerial photo
- 2012 Sinkhole
- William Collector

> *Near this Place Royale, there is a small river, which leads to some distance into the interior, alongside which are more than 60 arpents* [3.5 kilometers] *of land, which have been cleared and are now like meadow, where one might sow grain and do gardening.* --- Samuel de Champlain, founder of Montreal, 1611

Champaign's "small river" was the St. Pierre, the tangled red web on the aerial photo showing its drainage as pieced together from historical records, though it seems to have never been fully mapped. The circuit looped clockwise from the left-center to an outlet in the lower-right, inland of today's extended shore.

Montreal's first covered sewer, the William Collector, 4.25 meters wide by 4 meters high, was built beneath the city's old quarter in the 1830s to convey the polluted St. Pierre to the St. Lawrence.

A century later, Montreal's aging collectors were systematically replaced by concrete conduits pursuing the expanding urban limits.

1933 Construction

The William Collector was pulled out of service in 1989 and partially backfilled in 1992.

Virtually no trace of the historic St. Pierre remains today, other than a diminished remnant of the branch along a parkway in the areal-photo's lower left.

The St. Pierre was thus removed from Montreal's mind until it regained a few days of daylight in May, 2012, via a 4-meter-diameter, 6-meter-deep sinkhole in Sherbrooke St. The street collapsed just hours after tens of thousands of students protesting tuition hikes and demonstration restrictions had marched over it.

But there is -- or at least promises to be -- an illuminated future for the William Collector.

Pointe-à-Callière, Montreal's Museum of Archeology and History, will convert one kilometer of the sewer into the spine of its complex, the longest underground exhibit in the world.

Pointe-à-Callière
$18.00

Future World Record
Longest Underground River to Museum Conversion
1 kilometer

Dry Run Creek, Waterloo, Iowa

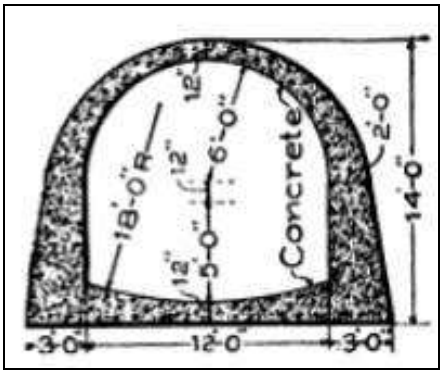
Dry Run Creek flowed through Waterloo from marshes west of city to the Cedar River, but as evidenced by a "A Fearful Deluge" in the Waterloo Courier, July 14, 1880, it wasn't always dry.

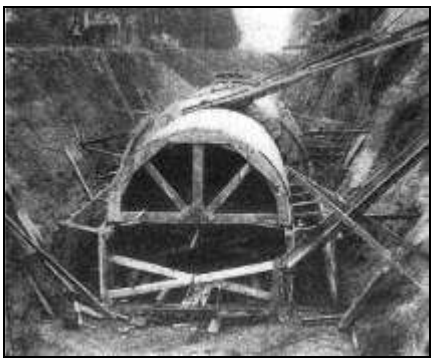
> *A Dry Run becomes the Bed of a Mighty Torrent which Floods the West Side! Alter the Waters Subside Six Lives are Lost -- Full Particulars of the Terrible Affair -- List of Losses, &c., &c.*
>
> *At almost three o'clock last Sunday morning an alarm was given from the Red Jacket engine house which soon called out the entire fire department, who found out that instead of having to fight fire, their assistance was needed to aid in the rescue of life and property threatened by a sudden rush of water from the dry run which passes through the second ward.*
>
> *The run is probably the bed of some ancient stream. It extends out into the country several miles where it drains an extensive area from which during heavy rains a large amount of water is collected, with no other outlet except to the river through the city.*

When in 1902, the creek twice rose 3 meters within a few minutes and flooded the city's business district, the citizens resolved to contain the channel.

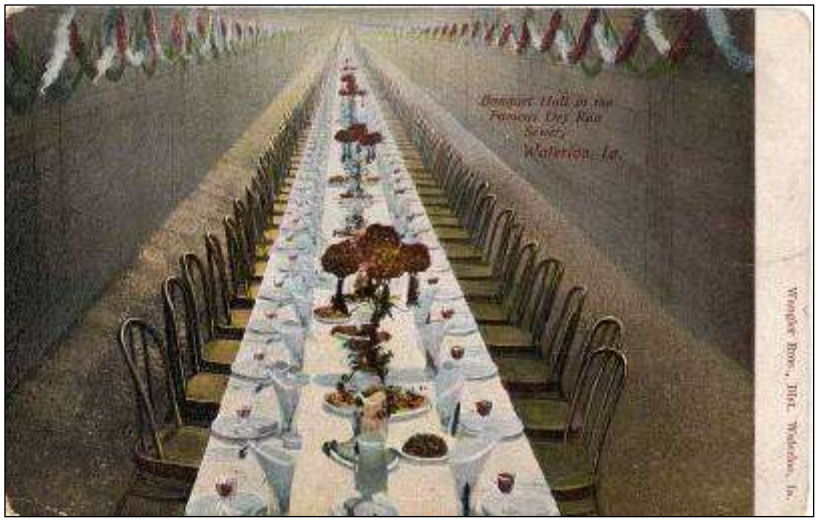
"A Flooded Street in Waterloo, Iowa, Where the Great Urban Drain Was Constructed," The Strand Magazine, February 1904

Contain it they did, subverting the flow into 1000-meters of conduit, its 3.5 square-meter cross-section dwarfing the natural channel.





To celebrate the work's completion, the Iowa League of Municipalities held its 1903 banquet within the conduit. Four-hundred formally-attired dignitaries descended a staircase between Randolph and Wellington Streets into a sewer section containing a banquet table 125 meters in length.



"Banquet Hall in the Dry Run Sewer, Waterloo, Iowa." a period postcard

The October 15, 1903 edition of the Waterloo Daily Reporter hailed the feast as a "Grand Success. Visitors Went Away Well Pleased." A few excerpts:

> *Most Beautiful Sight. A number of powerful arc lamps were strung about the banquet hall entrance which was elegantly decorated with evergreens and bunting, flags, etc., giving the exterior a magnificent appearance. As one actually entered the sewer, however, the view was long to be remembered. Not one of those in attendance had ever before witnessed such a dazzling sight and without exception the visitor would remain standing on the final flight of stairs to obtain a good view of the long table and banquet hall.*
>
> *Because of the limited capacity of the hall, the first course of oyster cocktail, etc., had already been placed on the table before the visitors were seated. The balance of the courses, however, were all served and in the best manner, although the space left for attendees to pass through the files of those seated was comparatively small.*
>
> *Dry Run Punch, a delectable dish, attracted no little attention.*

Indeed it must have, as the toasts lasted 90 minutes.

> *Placed at each place of the banquet table was a souvenir glass containing cigars and matches. The glasses bore an appropriate inscription and in each case were carried away as a remembrance of the banquet. The menu cards were also preserved by those attending and the thoughts of the sewer banquet will linger long in the minds of everyone who has actually eaten in a sewer.*

Apollinaris ***Oyster Cocktail***

Kennedy's Wafers

✣ ✣

Escalloped Oysters

Celery

✣ ✣

Cold Roast Turkey ***Cranberry Sauce***

Mashed Potatoes, Brown Gravy

French Pea Patties

✣ ✣

Soterian

Vienna Bread ***Parker House Rolls***

✣ ✣

Dry Run Punch

✣ ✣

Sliced Cold Tongue ***Pressed Veal Loaf***

Sliced Ham

Olives ***Radishes***

✣ ✣

Fruit Jelly

✣ ✣

Colfax

Scott Beason, "the well-known Illinois Central official," remarked,

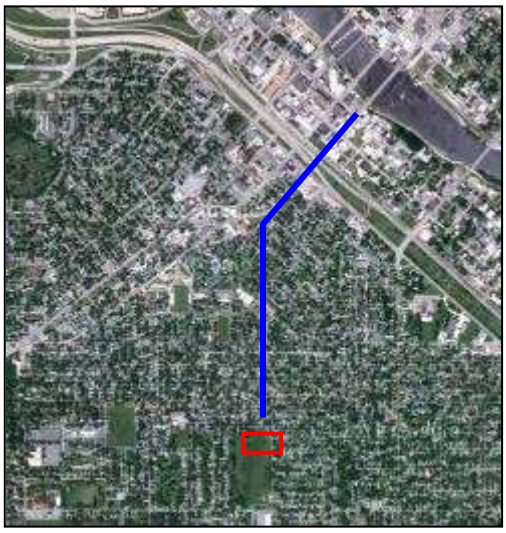
I have attended banquets in New York, Chicago, the west, north and south, but never in my life have I enjoyed an affair of that kind more than I did last evening. Waterloo people can now hardly appreciate the value of such a unique event. It was great.

The cost was $3 a plate, pricy, but two weeks later for just $0.25, the ladies of the Progressive Brethren Church offered their own dinner from the same table. Not the same bill of fare, of course, but including "oysters, coffee, cold meats and the usual accompaniments" and free of speeches. "All are invited."

Newspapers around the world carried the story of the magnificent banquet, the October 15 New York Times headlining, "Banquet Given in a Sewer, League of Iowa Municipalities Entertained in the Storm Drain at Waterloo,"

Dry Run has since been further enclosed, and had the structure not hosted the famous celebration, it would be just another urban creek-to-sewer conversion.

To the right, the route superimposed on a modern aerial photo. Below, the entrance at Liberty Park -- the 1903 starting point.



In the late 1960s, firemen were again called for a Dry Run rescue, but this one for a youth stranded in the concrete tract during an unanticipated rainstorm. He was attempting to become one of the few to take the great Waterloo underground express all the way to the Cedar River.

Cedar River levees suffered some damage, but held back most of the record floodwaters of June 2008, according to the Army Corps of Engineers, Rock Island District.

The system of levees, floodwalls and closure structures performed remarkably well, especially considering the severity of the event. Flooding in the city of Waterloo was mainly due to the inability to close off gatewells along Dry Run Creek in the westerly downtown area and due to the inability to effectively close off railroad and road gate closures along Black Hawk Creek.

Apparently no one at City Hall was aware of the arch gate where Dry Run connects to the Cedar and its closing mechanism had rusted in place.

Due to the flooding event, the closure gate to Dry Run Creek needed to be closed. Upon further investigation, this gate closure was not listed in the (operation and maintenance) manual for the project and was not maintained by the city since construction of it was completed in 1986.

A dual legacy for Dry Run, it seems:

An epicurean event more splendid than that at any other underground river.
A forgotten flood gate.

Nashville, Indiana

In the early 20th century, a small stream was confined in a 1.5-meter-diameter sewer for portions of its brief passage through Nashville, Indiana, by all measures a small-town story compared to the urban works of Philadelphia, Baltimore, Hartford and Montreal.

In the 1920s, the back of Nashville's movie theater stood near where the conduit passed under Main Street. Noise from the hidden creek did not bother silent moviegoers, but when the "talkies" came in, the primitive sound system lacked the volume to compete with the runoff.

Topography, late 1940s

Photo, by location, showing the cinema, 1927.

Let Us Not, However, Always Blame a Buried Stream

Streets can collapse for reasons other than being above a waterway.

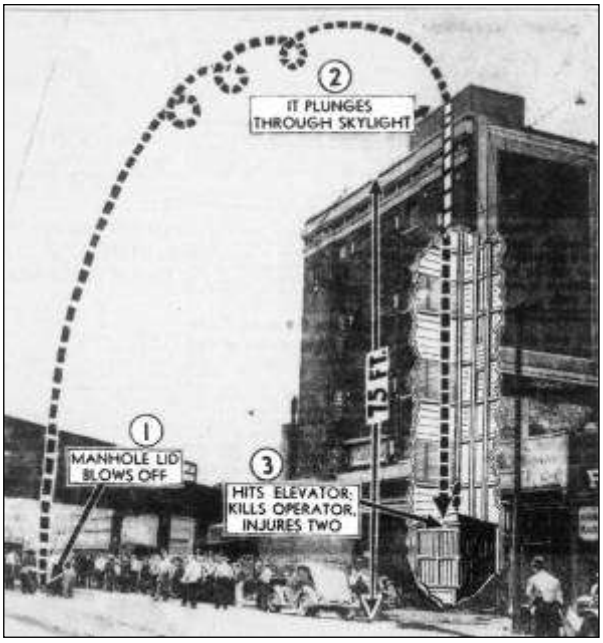
Progressive erosion of backfill around even a minor pipe leak is well-documented. Popular Mechanics, June 1923, "Leaking Sewer Wrecks City Street," features a Philadelphia sinkhole caused by leakage erosion.

> *The noise of the cracking of the slab before it collapsed averted possible loss of life, warning, as it did, a number of boys who were playing in the street.*"

Urban structures can be built over karst sinkholes-to-be (Chapter 41). The Springfield, Missouri street just happened to be in the wrong place.

Unventilated sewers can explode.

Above, "The Pittsburgh Sewer Explosion," Engineering News, January 1, 1914



To the right, "One Killed when Blast Flips Manhole Cover," Chicago Tribune, May 30, 1937

Leakage, solutioning and gas accumulation can cause sewers to fail, but when sewers misbehave, be sure to consult the pre-development maps.

CHAPTER 83
PUBLIC ACCESS TO UNDERGROUND RIVERS

Some may suppose that the greatest impediment to underground river access relates to physical safety, but that's not necessarily the case. The greatest impediment is frequently the law.

As we will see, the law applicable to underground river access varies between jurisdictions, but in large part, the legal principals are similar.

Criminal Mischief

Keeping in mind that a sewer is one form of an underground stream (Chapter 64), we begin our legal primer with a case of alleged underground river mischief. On Easter weekend, 2010, journalist and urban underground explorer Andrew Emond and photographer Michael Cook were arrested during a foray into the Toronto storm sewer labyrinth.

A passerby spotted the head-lamped and hip-wadered culprits entering the sewer system and called police, who showed up with four fire trucks and a hazardous materials team.

Four hours later, Cook and Emond were arrested for "mischief to interfere with property."

Garrison Creek Reserve Sewer
in which the two were apprehended.
Photo by Andrew Emond.

Toronto Police Detective Dan Hoffmeyer said that storm sewers can be dangerous.

> *Down there, there's poisonous gasses. Hazmat crews here go down with breathing apparatus, or they just* [send] *down* [a] *video camera. They don't go down personally.*
>
> *There's* [also] *a chance of the tunnel filling up in a matter of minutes and people drowning. If there was a storm somewhere, they'd fill up in a matter of seconds.*

"Mischief to interfere with property," per the Canadian Criminal Code 430(1), applies when someone willfully:

> Destroys or damages property.
> Renders property dangerous, useless, inoperative or ineffective,
> Obstructs interrupts or interferes with the lawful use enjoyment or operation of property, or
> Obstructs, interrupts or interferes with any person in the lawful use, enjoyment or operation of property.

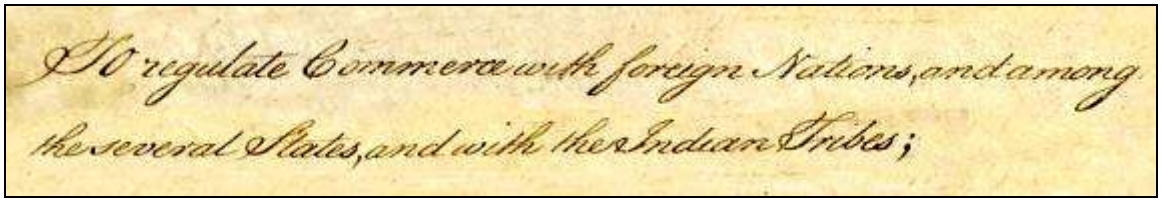
One suspects that the authorities were overplaying their hand in an attempt to discourage sewer exploration. The public, who enjoyed Emond's urban-adventure travelogues, was displeased and the charges were dropped.

Federal Navigability

The larger portion of this chapter deals with "navigability," a judicial determination that can enhance public access to a waterway. Physical "navigability" allows a cave to be explored by boat -- generally more easy than by foot -- but legal "navigability" may determine if the cavern can even be entered.

To make sense of the law regarding travel upon water in the United States -- on the surface or below, the legal issues are much the same -- we turn to the common law Doctrine of Public Trust, government's right to hold certain resources for the benefit of the general public. Streambeds of “navigable” waters in the United States thus belongs to the federal government and jurisdiction over such waters -- how the waters are used, by whom, and under what conditions -- is a federal prerogative. It's generally legal for the public to navigate upon such streams if it can be done without trespassing on private land.

The key term is “navigable.” and here we enter a spectrum of legal definitions stemming from Article I, Section 8, Clause 3 of the United States Constitution, the Commerce Clause.


To regulate Commerce with foreign Nations, and among
the several States, and with the Indian Tribes;

The federal government gets first crack at the meaning of "navigability," its interpretation derived from an 1870 federal court ruling oddly known as The Daniel Ball.

> *Those rivers must be regarded as public navigable rivers in law which are navigable in fact. And they are navigable in fact when they are used, or are susceptible of being used, in their ordinary condition, as highways for commerce, over which trade and travel are or may be conducted in the customary modes of trade and travel on water.*

Lakes and large rivers having an historical record of commerce are indisputably subject to federal regulation because as the Supreme Court has repeatedly held, “rivers that are navigable in fact are navigable in law." But smaller waterbodies may also qualify by any of a 1979 Supreme Court set of tests.

Waters of navigable capacity,
Waters subject to tidal ebb and flow, or
Waters connected to a continuous interstate waterway,

Federal agencies can further interpret “navigability” for their own purposes, and such agencies are prone to interpretations that increase their authority. In enforcing the 1972 Clean Water Act, the Environmental Protection Agency interprets "navigability" as,

Waters navigable in fact, or

Watercourses having "a significant nexus to navigable waters."

This "nexus" criteria was immediately taken by wags to be that of "being capable of floating a legal document," but the EPA has come to construe the test more narrowly. A watercourse not navigable in fact can be considered "navigable" only if it possesses a "significant nexus" to waters that "are or were navigable in fact or that could reasonably be so made."

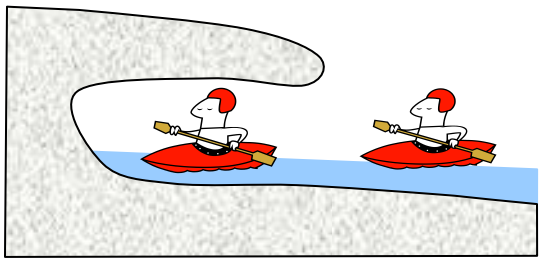
As "nexus" means "connection or series of connections linking two or more things," a "significant nexus" would be direct, indisputable water-to-water linkage.

To the EPA, a small watercourse may thus be classified "navigable" if it flows directly into a watercourse that is navigable in fact. "Mere hydrologic connection," does not necessarily satisfy the test.

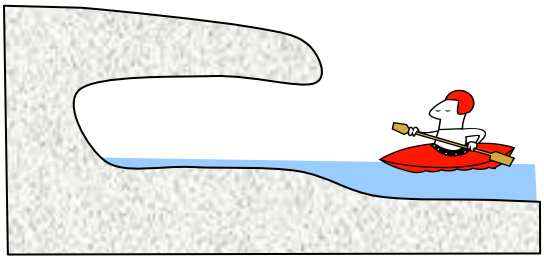
Subterranean streams that would likely be deemed navigable by the EPA nexus test:

An underground segment of a stream that alternates between navigable surface segments and subterranean segments.
A cave river flowing directly to or from an external navigable waterbody.

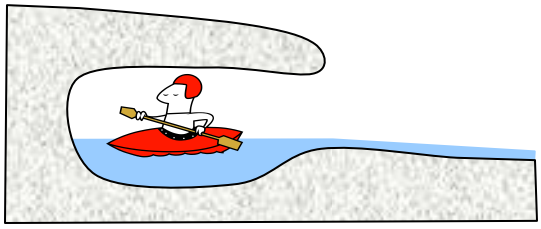
Of the four examples below, only the cave on the lower-right appears not within EPA jurisdiction.



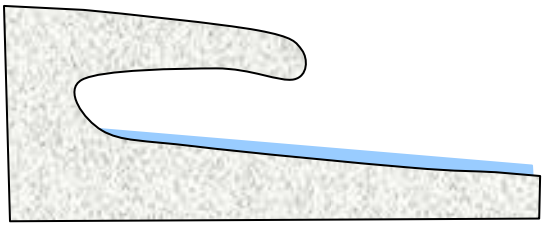
Navigable in Fact Navigable in Fact



Navigable in Nexus Navigable in Fact



Navigable in Fact Non-Navigable



Non-Navigable Non-Navigable

Designation of a waterway as "navigable" for purposes of water quality control, however, doesn't in itself make the waterway "navigable" per the Commerce Clause, and thus there should be no presumption of public access.

The federal government retains authority over (and under) lands which it owns. Echo River in Mammoth Cave National Park is thus subject to National Park Service jurisdiction. We're not aware that anyone has sued to re-launch that river's boat ride (Chapter 55), but if it were done, the challenge would be in federal court and would deal with the impact of the closure, not the NPS authority to make the decision. That the Echo happens to be subterranean would be inconsequential to the judge.

Federal regulation of waterway accessibility can be summarized as follows:

> Determination of "navigability" is made, based on interpretation of the Commerce Clause, which -- as might be expected -- largely deals with commercial carriage. Waterways passing this test tend to be large, often with long histories of shipping.
>
> If the waterway is found to be navigable, the federal government owns the streambed and the public tends to have substantial rights of access, though certain agencies can curtail uses in accord with the agency's charge.
>
> If the waterway is found to be non-navigable, or if the federal government refrains from making the determination, the states decide.

State Navigability

Absent federal pre-eminence, the state can undertake steps similar to those above or it can establish its own determination of waterway accessibility. In many cases it is the former, often with a somewhat relaxed standard of navigability which brings smaller waterways to state ownership.

State constitutions are prone to assert that “all surface water” is owned by the state for use by the public. In Montana, "all surface waters that are capable of recreational use may be so used by the public without regard to the ownership of the land underlying the waters." But do such "surface water" references imply that all waters not on the surface are subject to other law?

Probably not.

Unlike the distinction between streamflow and percolating groundwater (Chapter 69), the record of cave river litigation has tended to regard cave water as a channelized stream, not diffuse groundwater. The law regarding cave rivers is the law regarding rivers in general, law in which navigability plays a significant role.

As no two states approach the question of waterway access in identical manner, similar waterbodies may be deemed publically accessible in one jurisdiction, but not so in another. In states where "navigability" is difficult to prove, riparian landowners tend to retain property rights to -- and control over -- streambeds that in other states might be held in public trust.

We'll begin with a rough split of the states into those in which laws and judicial decisions suggest that a case for public access would seem to have a sound footing. As any particular outcome depends on the facts and arguments, we'll not suggest that our list foretells the ruling, but were we the party seeking access, we'd rather be in the list.

States in which public access to cave rivers may have strong legal basis

Alaska	Maine	New York	South Dakota
Arkansas	Maryland	North Carolina	Tennessee
California	Minnesota	North Dakota	Texas
Hawaii	Mississippi	Ohio	Utah
Idaho	Montana	Oklahoma	Washington
Indiana	Nebraska	Oregon	Wisconsin
Iowa	New Mexico	South Carolina	Wyoming

A few examples

Arkansas, **Idaho**, **Maine**, both **Carolinas**, both **Dakotas** and **Tennessee** employ the "recreational boating test" as pro-forma proof of navigability. If a boater can float the river, it's navigable. In South Dakota, for example,

> *The people of the state have a paramount interest in the use of all the water of the state, and that the state shall determine what waters of the state, surface and underground, can be converted to public use or controlled for public protection.*

Idaho is one of the more boater-friendly states in the nation. Channels floatable by kayak are open to the public for any recreational purpose, including scouting and portage.

Texas considers watercourses to be navigable when they are "capable of being used in their ordinary condition as highways for commerce over which trade and travel may be conducted in the customary modes of trade or travel on water." Such capacity must

Result from natural causes,
Ordinarily recur from year to year, and
Persist for a sufficient duration to be useful as a highway.

A body of water is useful to the public if it is used for pleasure boating, hunting or fishing.

A Texan's right of free passage in such streams includes the right to pleasure boat and fish. As the beds of navigable rivers are owned by the state, wading is permissible. The right of portage around natural obstructions, however, is doubtful.

A Texas watercourse having an average width exceeding 30 feet to the mouth is considered to be navigable, regardless of use. While Texas caves contain isolated pools of this size, none, however, are a watercourse of that dimension to the cave mouth.

Waterway width is measured at the ordinary high water line, the line between land that is affected by water discharge and land that is not. Below the line, the surface is sand, gravel, rocks and aquatic vegetation; above the line is soil. Gravel bars and sandy beaches formed by frequent river deposition are by definition within the ordinary high water line. As cave beaches may be the undisturbed artifacts of higher flows millennia earlier, however, the modern ordinary high water line would be that evidencing geologically-recent sediment transport.

A **Wisconsin** court has interpreted the navigability test to be satisfied where "a stream is capable of floating any boat, skiff or canoe of the shallowest draft used for recreational purposes." The period must

> Regularly occur, and
> Last long enough to allow recreation.

Navigability in an artificial channel not connected to a natural stream or lake, however, does not by itself create or enhance public rights. The rights of the public include recreational enjoyment of the waters, which encompasses fishing and boating. Wading and touching the bottom is generally permissible as an incident to navigation.

California and Oklahoma define navigability as the capacity to float an oared craft such as a kayak or canoe, though differences exist regarding the right to use the bed for anchoring, standing, or other purposes.

Oregon and **Washington** define navigability as the capacity to float shingle bolts. While we can imagine Northwestern cave explorers packing cedar shingles into a flooded cavern to prove it navigable, we find no record of such in court records.

Postcard, Shingle bolts boom on on Skagit River, Washington.

The only **Hawaiian** island having streams navigable-in-fact is Kauai and very little law deals with public rights in those streams. Little law likewise discusses the public right to recreate in non-navigable rivers. State statute provides that

> *Springs of water, running water, and roads shall be free to all, on all lands granted in fee simple; provided that this shall not be applicable to wells and watercourses, which individuals have made for their own use.*

Hawaiian law requires lava-tube travelers to secure permission from land owners along the route, but a sea cave can be kayaked as far as one can penetrate.

States in which public access to cave rivers may have weaker legal basis

Alabama	Georgia	Michigan	Rhode Island
Arizona	Illinois	Missouri	Vermont
Colorado	Kansas	Nevada	Virginia
Connecticut	Kentucky	New Hampshire	West Virginia
Delaware	Louisiana	New Jersey	
Florida	Massachusetts	Pennsylvania	

A few examples:

Colorado, **Kentucky** and **Michigan** have explicitly rejected the "recreational boating test." The fact that a boater can float a river does not prove it navigable.

Arizona and **Nevada** deem their respective portions of the Colorado River to be navigable, but their internal waterways to be non-navigable. If one owns the land upon (or under) which a stream flows, one owns the waterway. Whether one can divert or consume that water is, of course, a different question.

Georgia's view of navigability is perhaps the nation's most restrictive. A navigable stream must be capable of transporting boats loaded with freight in the regular course of trade. State courts

have even defined the length (200 feet), width and draft of barges required under the test. Mere rafting of timber or the transporting of wood in small boats does not make a stream navigable. Furthermore, the publics' rights in navigable rivers to wade, fish and portage only extend to the ordinary low water mark.

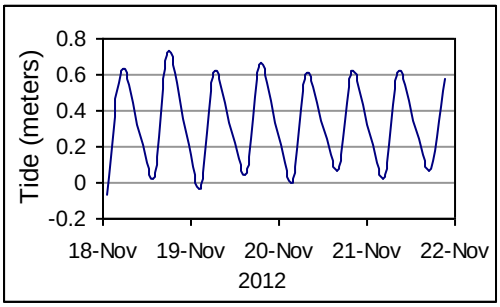
We described the enclosure of Hartford **Connecticut's** Park River in the previous chapter and now we'll consider an attendant legal question -- does relegating a navigable river underground render it non-navigable?

The Connecticut public has the right to boat, hunt, and fish in "navigable waters which are physically capable of supporting waterborne traffic, and subject to the ebb and flow of the tide."

Connecticut case law has imposed an additional requirement.

> [Such] *water* [must be] *navigable for some useful or valuable purpose... There must be some commerce or navigation which is essentially valuable... A hunter or fisherman, by drawing his boat through the waters of a brook or shallow creek, does not create navigation.*

The tidal influence on the Connecticut River at Hartford is illustrated by a snippet of its stage.



Park River was found to be likewise navigable in Edward Balf Co. v. Hartford Electric Light Co., 1927, albeit before the stream's covering in the 1940s, but tidal action doesn't cease because of darkness.

John Kulick of Huck Finn Adventures used to make the three-hour suburban Park River canoe trip almost daily with groups of about 10 clients. That Kulick derived $55/head from the tours would seem to satisfy the commerce aspect.

Kulick received informal permission from the city in 1997 to do so, but the city then reneged, saying that possible gas leaks, sewage and the difficulty of rescues created liability.

Kulick argued that the ventures were safe and that his insurance would protect the city from claims. After officials took the trip in 2003, the council voted 5-4 to allow him to resume business, which he did until the city's counsel, John Rose, intervened. A covered waterway is no longer a "normal river," according to Rose, but a dangerous place of “controlled access,” like a bear cage at a zoo in a public park.

> *If you ask Fire Chief Teale, he’ll say within 50 yards of entering the tunnel there is no communication with anyone but God. If somebody has a heart attack in there, they’ll die.*

That the city had pondered the issue for years would make it all the more liable for knowingly allowing the trips to continue.

Kulick said the city should partner with him because his knowledge of the subterranean reach could help the fire department understand rescue issues and flood control authorities identify debris. He continues to view the underground river as a natural resource, telling the New York Times, July 31, 2003,

> *We've seen eels, carp, stripers, just like you would in a normal river. If you point your headlamps into the water, you'll more than likely see a fish.*

According to Curt Johnson of the Connecticut Fund for the Environment, the court ruling designating the Park as “navigable” subjects it to public access requirements. Without subsequent law giving the city additional authority regarding the underground portion, the earlier designation holds sway.

> *Even if it was the city of Hartford that had put a conduit on this, it doesn’t magically transform this river into an ownership right to the city.*

Austin Carey, another environmental lawyer, suggested that it might be up to the state, rather than an individual, to force Hartford to recognize the right of public access.

> *There’s a good argument that the city is trying to interfere with the right of navigability. Who can enforce that is a different equation. There might be changes in the law that allow an individual to try to enforce that right. Or John Kulick could go in the river and try to get himself arrested, and let the city try to prove he did something wrong.*

Huck Finn Adventures remains yet prohibited from the very river that Mark Twain overlooked as he wrote of Huck's adventure on a larger waterway. The question of which government makes the Park's navigability call remains unresolved and Kulick remains busy where whitewater is white.

Trespass

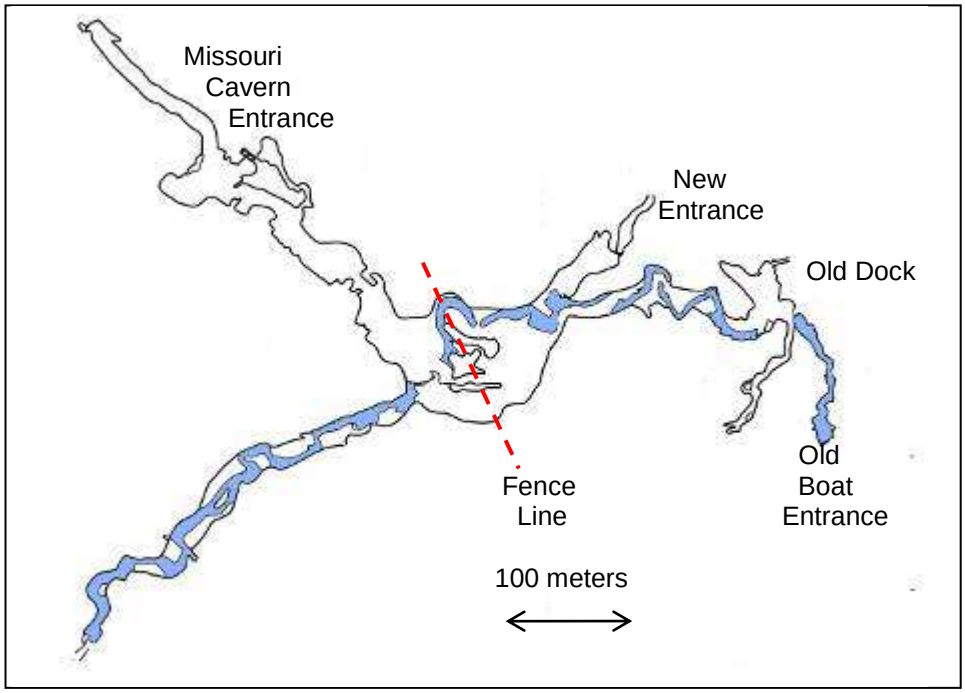
We are aware of any number of subterranean channels upon which a recreational craft might float. If such a stream is “non-navigable,” however, by federal and state legal tests, it doesn't fall under the Doctrine of Public Trust with its attendant rights of public access.

For legal purposes, property ownership extends from the surface to the center of the earth. A cave and the non-navigable waters within it belong to the owner of the property above. Should a cave extend under two properties, one owner's subterranean real estate might be inaccessible because the entrance is on the neighbor's property. We've two examples from the karst states.

An "underground stream" in **Missouri** must follow a definite channel that is reasonably ascertainable, for which A Summary of Missouri Water Laws (2000), by that state's Department of Natural Resources and Attorney General, shows Onondaga Cave (Chapter 57) as an illustration.

> *The court held that the rule is that all underground waters are presumed to be percolating and therefore the burden of proof is on the party claiming that a subterranean stream exists. (See Figure 5, Onondaga Cave Map, showing an example of an underground stream.)*

A simplified rendering of the document's Onondaga map,



Note the "Fence Line."

1930 Half of the cave discovered to lie under land owned by the rival Missouri Caverns, Inc. Barbed wire strung across the chamber at the property line.

1934 Senatorial candidate Harry S. Truman toured Missouri Caverns with an entourage of Democrats on the same day that a group of Republicans toured Onondaga. The parties exchanged political disparages across the fence.

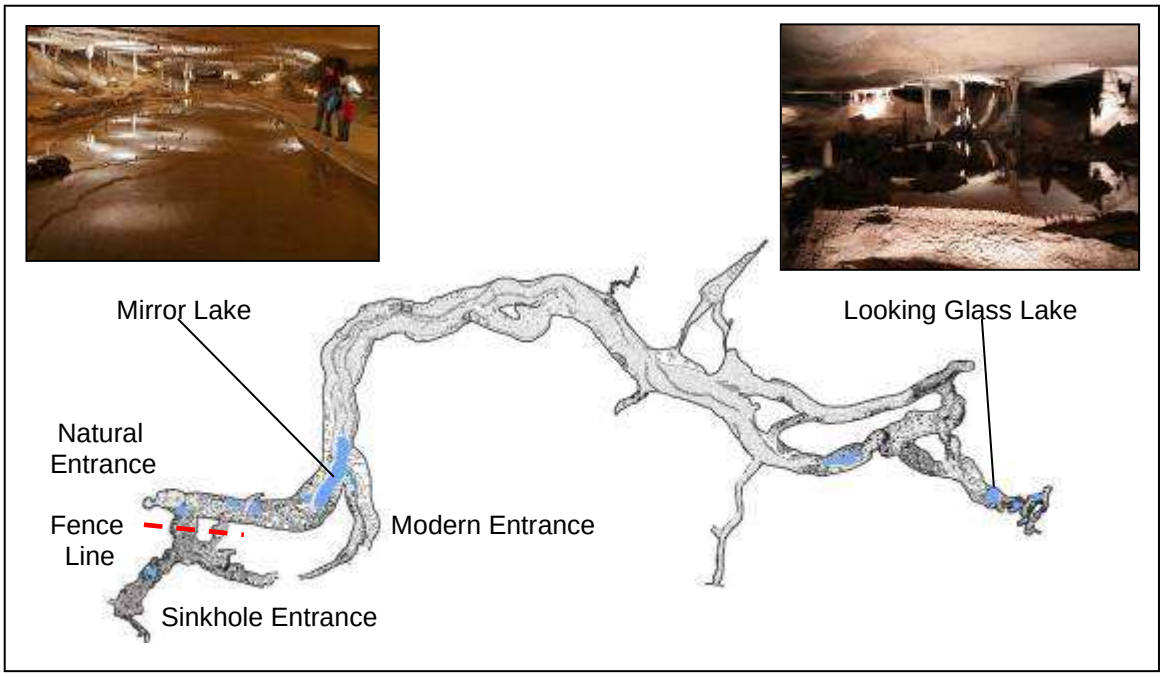
1935 Missouri Supreme Court ruled in favor of Missouri Caverns.

To be "navigable" by Missouri law, a stream must in its natural state be capable of floating vessels used in the customary pursuit of commerce, “whether foreign or inland, and whether steam or sail." It is not sufficient that a small boat can pass through a tortuous course.

While the boating record does not appear to satisfy state criteria for navigability -- Chapter 57 shows a few tourists ferried a short distance, and certainly not by steam or sail -- the venture was indeed commercial, and thus "navigable" in the over-riding Constitutional sense. Being a recognized by the state as a "stream" and "navigable" by the federal government, even within private property, the cave river would seem to be open to the public.

There's a cavern caveat, however. As there is no public right to cross private land, a cave river navigable or otherwise, accessible only by foot, remains out of public reach.

A similar cave-splitting occurred near the turn of the century in Marengo Cave, Indiana. The natural entrance was near the property line between two brothers and the sibling without the portal excavated sinkhole to form a second entry. Each brother gave tours of the portion under his land, a wire fence separating the two.



Unlike Onondaga, however, Marengo contains nothing even arguably a navigable river, and thus the fence stood on solid ground, both literally and legally.

If a non-navigable cave river accessible from public property extends beneath private property, one cannot boat into the private portion without permission, any more than one may cross a surface boundary just because there is no fence. Entering without invitation invites prosecution for the misdemeanor of trespass.

As with the definition of "navigability," the prohibition of trespass varies by state, but most jurisdictions hold that a person may not enter the property of another without consent if

The property is fenced or enclosed in a manner intended to exclude intruders, or
The property is posted in a conspicuous manner against entry.

In many cases, as we've noted however, cave entry via a navigable waterway is not trespass. In some states, the trespass prohibition does not apply to streams which while legally non-navigable, can be traveled entirely within the banks.

As the laws against trespass by land tend to be fairly rigid and consistent, it may be safer to violate the property line -- above ground or below -- by boat. Or better yet in a Constitutional sense, a hold-full of goods to sell to the cave dwellers.

The government can bar even an interstate cargo boat, however, if it has other reasons. In 2009 the Forest Service ordered an emergency closure order for all caves and mines in the National Forest Southern and Northeastern Regions

> *No one, except rescue personnel in the performance of their official duties, will be allowed within the closed areas unless authorized by the Regional Forester or Forest Supervisor. Violation of these prohibitions is punishable by a fine of not more than $5,000 for an individual or $10,000 for an organization or imprisonment for not more than six (6) months, or both, under authority of Title 16 U.S.C. 551, Title 18 U.S.C. 3559 and 3571.*

Unlike Crystal Cave of Kentucky (Chapter 57) which once featured tourist boats, "navigable" by federal standards, Crystal Cave of Pennsylvania contains only a "small pool of water about the size of a large pasta bowl," and the prohibition is legitimate.

Trespass laws also protect publically-owned utilities, which in Minnesota, include gas, power, telephone, water, wastewater or other related service, owned, controlled or regulated by a local or regional government unit.

To enter an underground structure containing a utility line and not open to the public for pedestrian use, without proper consent, is a trespass. The underground structure need not be posted.

Government has the right to regulate or prohibit access to public spaces for purposes of environmental protection, historical preservation, public health and wellbeing, security, and the like.

El Malpais National Monument, New Mexico closure due to outbreak of a fungal disease killing millions of bats, need to preserve delicate geological formations, cave ice, and sensitive biologic communities, and need to implement a cave management program.

Conclusion

We've touched on three legal considerations potentially relevant to underground river access.

Criminal mischief harming property.

Navigability, a deep-rooted public right, strongest when related to commerce and sometimes tied to recreational use.

Trespass upon private property and public utilities.

To the right is an illustration of the court-room quandaries that can arise. Does the public have the right to enter the cave?

Arguments against.

The property is private and posted, thus protected by laws against trespass.

The stream seems too shallow for commercial transport and perhaps even for recreational boating, and thus is non-navigable.

Arguments for:

Access appears possible within the stream banks.
There may be a navigable pool within the cave to which the entrance is but a portage.

The determination likely depends on the particulars of state law. When embarking upon an underground river, an attorney may be as necessary as a rubber raft.

CHAPTER 84
NATIVE AMERICAN LEGENDS

We've encountered Native American in previous chapters and we'll meet others in chapters ahead, but in most cases in stories told by others. Chapter 97, Extraterrestrials and Lost Races of the American West, for example, speculates about subterranean ties between early humans and alien beings -- bizarre fabrication thinly linked to cherry-picked segments of folklore. It plays well with UFO scholars.

This chapter deals with stories from Native Americans themselves, stories reflecting how subterranean waterways were envisioned before the arrival of UFOs, so to speak.

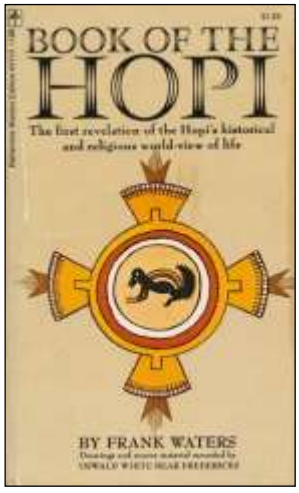
As with mythology from much of the world, Native American traditions tell of ancestral emergence from the earth and occasional forays back down. As we've done in other chapters, we'll confine our perusal to such accounts involving waterways.

Fountain Cave in Minnesota is discussed Chapter 59, Three Tales of Two St. Pauls, but we'll use an early photo of the site to set the tone. To the right, a photograph from Indian Legends of Minnesota (1893) by Cordenio Severance.

We'll by no means cover the range of legends, but we'll at least try to give our survey some geographic breadth.

Southwest

The tradition of the Hopi Indians is that in the ancient past, their ancient ancestors migrated through four different cavern worlds, eventually emerging from a cave called Sipapu in the Grand Canyon near the confluences of the Colorado and Little Colorado Rivers.



Frank Waters, Book of the Hopi (1963).

> *Upon their Emergence [into the Fourth World, the world we know, a number of clans, headed by the Bear Clan, and including the Coyote and Parrot Clans, chose to go south. They were accompanied by a number of kachina people. These kachina people did not come to the Fourth World like the rest of the people. In fact, they were not people. They were spirits sent to give help and guidance to the clans, taking the forms of ordinary people and being commonly regarded as the Kachina Clan.*
>
> *Having reached the southern páso and left their signatures, the clans returned north until they reached the red-earth place where the kachina people instructed them to settle and build. From a small village it grew into a large city, a great cultural and religious center, the mysterious Red City of the South.*

> *Under the supervision of the kachina people, Palátkwapi* [the Red City] *was built in three sections. Completely surrounded by a high wall, the first section was reserved for ceremonial purposes; the second section, adjoining it, containing storage rooms for food; and the third*

section comprised the living quarters for the people of all clans. Underneath all three sections ran the river.

So Palátkwapi grew and prospered... The time came, however, when evil entered. Perhaps it was because the people found life too easy and did not resume their migrations. Other people lay the blame on the Spider Clan…..where they used their powers wrongfully… The Spider Clan was refused admittance to Palátkwapi for this reason. So one early dawn the clan attacked the city.

Immediately a council meeting was called in the barricaded city. It was decided to dig a tunnel underneath the [subterranean] *river, through which all clans could escape. Immediately all men were put to work, and in several days the tunnel was completed.*

"This is the way it will be done," said the kachina leader. "The Bear Clan will go through [the tunnel first. Then the Corn Clan and the Parrot Clan. The Coyote Clan will go last, as always. As each clan emerges on the other side of the [subterranean] *river it must resume its migration immediately in the direction ordained for it. The day will come when your migrations are completed and you are all united again.*

The Hopis yet hold their rituals in an underground chamber, the kiva, the center of which holds a sunken fire pit a small hole in the floor having the same name as their cave of tribal origin, the "Sipapuni."

Northeast

William M. Beauchamp's Iroquois Folklore (1967) notes the Iroquois tradition that first of their people emerged from a subterranean world, but the Iroquois tell another subterranean tale that's a staple of Niagara Falls tourist literature. The region's original inhabitants were the Ongiara, an Iroquois tribe, and "Niagara" is said to originate from the Iroquois "Onguiaahra," meaning "Thunder of Waters."

Here's the tale, The Maid of the Mist.

> When the a beautiful maiden Lelawala was married off by her father to a king whom she despised, she stepped into her white canoe, singing a death song, and paddled into the current of Niagara River where the canoe was caught in the torrent. But as she pitched over the falls, Heno, the god of thunder who lived within the falls, caught the maiden and carried her to his home beneath the thundering waters.
>
> It is said they stayed together after that and their spirits yet dwell in the caves beneath the falls where she reigns as the Maid of the Mist. An echo of Heno's voice can be heard in the mighty waters.

"Maid of the Mist" may at first seem unrelated to underground rivers, but in Chapter 85, Beneath the Great Lakes, we'll see the tie.

Southeast

History of Crawford County (undated) contains a similar Indian Princess story set in what's not Arkansas, but with something of an Old Testament parallel, Pharos's army being the enemy braves.

> *It is said that the bluff now known as Lee's Creek Point was formed when an Indian Princess, fleeing from the warriors of enemy tribes, called upon the Great Spirit for safety. He, loving the maid for her kindness and mercy, opened a great chasm, across which the pursuing army could not follow, and they plunged headlong into an underground river, and were all drowned. The chasm is supposed to be the valley below the bluffs.*
>
> *While the bewildered braves were descending the newly formed abyss, Lelehya* [the Princess] *disappeared into the depths of a nearby creek and the current bore her downstream into the river. This creek, now named Lee's Creek, was forever held sacred and worshiped by her tribe.*

Alexander, Hartley B., North American Mythology (1916) recounts a Cherokee belief in a subterranean world with mountains and rivers much like our own.

> *There is another world under this, and it is like ours in everything -- animals, plants, and people -- save that the seasons are different. The streams that come down from the mountains are the trails by which we reach this underworld, and the springs at their heads are the doorways by which we enter it, but to do this one must fast and go to water and have one of the underground people for a guide. We know that the seasons in the underworld are different from ours, because the water in the springs is always warmer in winter and cooler in summer than the outer air.*

Midwest

Some 30 kilometers in length, Devils Lake is the largest natural body of water in North Dakota. The Little Shell Tribe of Chippewa Indians tells this story.

> The Sioux planned to attack the Chippewa, but as they set off, they saw the water of Devils Lake rise and boil. A monster with short legs, a short chubby neck and a large head came out of the water, and made for them. They fought for their lives, but one by one he swallowed all but a few.
>
> Their medicine man returned a few days later to find the lake water salty and the fish gone. Not even a dead fish could be found. He prepared a seance while his followers feasted, danced, sang and prayed. They set off in their largest boat to an area which had suddenly turned stormy and came upon a bubbling whirlpool.
>
> The men were panic stricken. "Our medicine man is crazy to bring us face to face with the sea monster. We have no chance of overpowering him."
>
> The vortex pitched one of the Sioux overboard and he began spinning deeper and deeper until he disappeared "to the grave of the sea monster," his companions thought.
>
> This was enough. The men sharpened their knives to kill their leader.
>
> "Don't you know," the medicine man announced, "that this problem is not a matter of one man, but is of concern to all. It is our mission to solve the problem."
>
> They rowed along the boiling hole until the warier who had fallen into the water emerged and described what he had discovered. Deep in the water he had found the mouth of an underground river from the Gulf of Mexico.

Then they realized that when monster came from the sea, the salt drew the fish into the underground stream from where they could never return.

Pacific Coast

The February 18, 1988 Modesto Bee's feature "Trout, Legends Flourish at Pyramid Lake" includes "An underground river system connects Pyramid Lake to Lake Tahoe, Walker Lake and a lake in South America," a tale we'll revisit in Chapter 94, The Rio San Buenaventura, but we'll include it here as a bit of an antidote to supernaturalism. Here it's the Native American with the scientific skepticism.

Of all the legends about Pyramid Lake, the underground river connection is probably the most bizarre.

Steve Cerocke is production manager for the hatchery system at Pyramid Lake. Cerocke is a member of the Paiute tribe which owns all but 35 acres of the land surrounding the lake. Cerocke heard many tales of the lake from his grandmother, but says he doesn't believe any of them,

He explains that origins of the South American connection. "Supposedly they found a fish in South America that is similar to the Cui-ui, which is only found in Pyramid, and that is why they think that there is an underground like." And about the channel to Lake Tahoe, Cerocke says, "If that were true, Pyramid would drain Lake Tahoe because Tahoe is much higher than Pyramid."

But the recent plane crash of a Navy training jet on the north end of the lake may keep the theory alive for a few more years.

Navy divers, working the bottom to locate any remains of the jet or the pilot, remarked time and time again about the heavy weights they had to wear to fight the strong current.

The only movement of water is 23 miles away on the south end where the Truckee River enters

Hmmmmmmm.

The North American Indian (1915) by Edward Curtis is an extensive compilation of Native American lore, illustrated with Curtis' photography. In the Kwakiutl (a British Columbian tribe) narrative, "The Magician Who Was Killed by His Brothers," a novice shaman travels into a mountain interior where he encounters three men traveling by canoe on an underground river.

Nahanagyilis felt drowsy and fell asleep. Suddenly he awoke with a start, to find himself on the side of a steep mountain in a little niche with the rock falling away below him in a perpendicular cliff, while above him it sloped outward and projected above him. He looked about and said to himself. "Now you have made a mess of it!" For he had taken too much of the hwela, and the power of it had flown away with him. Again he became sleepy, and again he awoke suddenly. He found himself carried across the channel to a similar niche in the mountainside.

"Oh," he said, "that is the way you are going to be treated by your tlugwi!" Once more he fell asleep, and now he was carried nearly to the top of another mountain, where he heard trees and rocks rolling down above him. "This is the death of me," he exclaimed. But he took out his hwela and held it above him, and the rushing mass of trees, earth, and rocks divided and went past him on each side.

Then Nahanagyilis came down the mountainside. When he was near the water he saw a canoe containing three men with black-painted faces.

The strangers offer to make him a powerful hunter of seals and a master builder of canoes. To further convince him, they give him urine to taste and tell him that it is the Life Bringer with which he will be able to restore life even to someone long dead.

In Legends of the River People (1976), Norman Lerman records the Chilliwack story of how Cultus Lake in Canada's Fraser Valley was once an inhabited basin until a young man named Koothlak constructed a dike on the mountainside.

At that time there was no Cultus Lake and the people lived in the basin where the lake is now. The creeks form the mountain came down into this basin and disappeared into an underground river.

Koothlak went the next morning to swim in his lake as usual, but as he ran from the village, the other boys teased him again. Koothlak became angry once more and when he reached the lake he began to pull on the branches in the dike. The water had become very heavy and was ready to wash the dike right out. As soon as Koothlak pulled out the first branches, the dike broke with a sound like thunder! Koothlak started to run down the mountain, the water splashing at his legs. Below him the people heard the rumble of the water but they couldn't run away fast enough. The water filled the basin and drowned all the people who lived there. The branches form the dike went into the underground river, stopping it up, and the lake which we call Cultus Lake covered the place.

Gus Commodore told Lerman a later story about the lake.

[Some youth] *wanted to see if they could conquer the lake. If they could, they would become pretty good medicine men... There was a story about one young man who didn't take anyone with him at Cultus Lake, and when he came to, he was on the beach, way down there in Bellingham.*"

Mr. Bob Joe, also talking to Lerman,

There were other young men watching when the undercurrent took him right under. Well, he was lost -- drowned. Sometime after, down there at Mud of the community buried by the young man who formed Cultus Lake. In some versions of the story they then become the underwater people of Cultus Lake Bay, between White Rock and Point Roberts... They didn't know where this underground river was until this young man was drowned and came out at Mud Bay.

While the tunnel remains active underneath Cultus, according to Mr. Joe, the exact location of the entrance has been lost.

Diamond Jenness' The Faith of a Coast Salish Indian, Victoria: British Columbia (1955) notes further lore from the area.

Some of the Indians still believe in the existence of subterranean channels extending from Point Roberts to places far distant, and they related the following anecdotes in partial substantiation... A youth who had performed for the first time at the winter dances went to bathe at a deep pool in Pitt Lake, hoping by that means to augment his supernatural powers.

His companions tied a long rope round his waist and advised him to dive to the bottom and to ascend with the first object he grasped with his hands. The youth dived into the water and disappeared from sight. Suddenly an irresistible force pulled the rope through the hands of the watchers above. Anxiously they waited for a short time, and when the youth failed to emerge, returned home and reported that he had drowned. Soon afterwards the Tsawwassen Indians sent word that the corpse was lying on the beach at Point Roberts, carried there evidently through an underground channel from Pitt Lake.

"Myths of the Carrier Indians of British Columbia," by Jenness in Journal of American Folklore 47, 1934, tells if a Carrier brave who entered a cave in a mountain beside Stuart Lake, central British Columbia, and from which a stream flowed. He followed a strange "little man" into the cave and eventually -- after following the passage deep into the earth -- emerged into a great underground country inhabited by the "Little People."

A Stuart Lake Indian who was hunting on the ice saw ahead of him a dwarf carrying on his back a huge grizzly bear. The Indian tried to pull the animal from him, but the dwarf walked steadily on as if he felt nothing. At last he turned and said, "You can't take the grizzly from me, so you had better come home with me."

They entered a cavern in a mountain from which a creek flows into Stuart Lake, and came to a great country like this earth, thickly inhabited by dwarfs. The Indian married two dwarf women and liven in this country of several years; but at last he became homesick and his father-in-law consented to let him take his wives to his own home. The three of them emerged from the cavern and traveled over the ice of Stuart Lake towards his settlement. His people saw them coming and mistook then at first for three swans, for their clothing, like that of all dwarfs, was decorated with white dentalia shells.

Another story recorded by Jenness is of a boy at Point Roberts who had been given power over “all the underground channels that lead from Point Roberts to Sechelt, Pitt Lake, and other places” and transformed his mother into the south wind and father into the north wind.

Jenness footnotes this legend with anecdotes of other tunnel systems, including one running from the Orcas Islands to Point Roberts, Pitt Lake to Point Roberts and “certain other deep pools were supposed to communicate subterraneously with Point Roberts. The Indians carefully refrained from bathing in them lest they be drawn under and drowned.”

Claude Lévi-Strauss, in The Way of the Mask (1982), notes lore that Beaver and Coho salmon dug the tunnels, and goes on to say that in some renditions, there are even more animals.

Re-Imagining S'ólh Téméxw: Tunnel Narratives in a Stó:lo Spiritual Geography (2008) by Margaret Robbins, contains similar stories, one being,

> *A young man canoeing on the Fraser River. He was using the edge of the whirlpool to propel himself up the river when he was sucked into it. His family, waiting for him to come up in the water near Hémq'eleq, heard him yell. They looked up and saw their son in the cave of Tekwóthel. Travel through this channel was almost instantaneous for the youth, appearing in the cave one or two minutes after falling into the whirlpool.*

Darren Charlie, quoted by Robbins, suggests that that, "In English terms it's a tunnel but actually it's a spiritual tunnel... It's like a channel or a tunnel to another dimension."

The Far North

The Stefansson-Anderson Arctic Expedition of the American Museum of Natural History (1914), by Vilhjalmur Stefansson, describes the Eskimos of the Canadian Northwest Territories. A tale, "The Underground River,"

> *There are two fishing lakes near Fort Liard, one a day from the fort and the other, half a day from the fort. The two are on opposite sides of the river and opposite directions from the fort. A man fishing in the lake a. day from the fort used a birch-bark dish as a buoy for a hook, the line being sewn to the middle of the bottom. He thought, "No fish is strong enough to swamp this dish, it will be an excellent float." But the next day the dish was gone; a fish had taken the hook and swamped the dish, pulling it down with him. The man looked long in vain for the dish.*
>
> *A man of another group of Indians was fishing on the other lake, a half day from the fort. He saw something floating and moving. He paddled to it and picked up a birch-bark dish with a jackfish fastened to it by hook and line. He thought some "mad men" might have been fishing in the lake and this was their dish. He did not, therefore, try to find the owner.*
>
> *When next fur trading time came, all people from all sides gathered at Fort Liard. The man who had lost the birch bark dish happened to see it in the tent of the finder, he knew it by the arrangement of some porcupine quills on it. He asked, "Where did you find that dish?" The other replied, "It was afloat on a jackfish I picked up on our fishing lake." That is why people think there is an underground channel between these lakes; the channel must lie under the Liard. The lake where the dish was lost has never been successfully sounded. Once a man cut a big bull caribou into babiche and sounded with a big stone. He found no bottom. He then took the babiche of half a second hide, but this was not enough, so he gave up, and no one else has succeeded. The men concerned in the losing and finding of the dish are both dead, hut they died not so very long ago.*

CHAPTER 85
BENEATH THE GREAT LAKES

For general reference, the map below shows the Great Lakes. Niagara Falls separates Lakes Erie and Ontario and the St. Lawrence River empties Lake Ontario to the northeast.

We preface our Great Lakes exploration with the "Ontario, Lake" entry from The Student's Cyclopaedia, A Ready Reference Library for School & Home (1893) by Chandler Belden Beach.

> *Ontario, Lake, one of the five great lakes of North America. It is the smallest, covering 7,240 square miles, and being 190 miles long and 55 miles wide. It forms the connection between the Niagara River and the St. Lawrence. The level of its waters varies about three and a half feet at regular periods of from four to seven years, which it is thought may be due to an underground river.*

We will follow the purported underground river, lake to lake, or entirely under lakes, depending on the reference. Concerning subterranean headwaters to the west, we have "What Supplies the Great Lakes?" in the January 10, 1867, Charleston Daily News

> *Mr. George A. Shufeldt, Jr., replies that they get water from underground rivers. He calls attention to the fact that the surface tributaries of the great lakes will hardly make good the wear and tear of atmospheric absorption and evaporation. Yet the lakes are of immense size, and constantly discharge vast volumes of water through their outlets, Sault St. Marie, Mackinaw, etc., without sensible diminution. Hence, as there are no adequate sources of supply above the surface, we must look for them beneath it.*
>
> *That the crust of .the earth is full of watercourses is a familiar fact..* [Wells] *discharging great volumes of water-all tend to demonstrate the fact that the crust of the earth is penetrated in all directions and at all depths with these streams and watercourses.*
>
> *Mr. Shufeldt asks his readers to "turn to the map of North America" and note particularly the point where the thirty second degree of west longitude crosses the forty fourth parallel of north latitude. Within a radius of five hundred miles, of which this is the center, will be found the great water-producing region of the West*
>
> *In this elevated and comparatively uneven surface of the country, nearly all of the great rivers of the West have their sources and fountain-heads. First, the Missouri, with its innumerable branches and tributaries, among which are the Yellowstone and the North Fork of the Platte, the Arkansas, the Red River, the Rio Grande, all flowing from the eastern and southern slopes of the Becky Mountains, and finding their way through thousands of miles of country to the Gulf of Mexico. On the western slope is the Rio Colorado, which empties into the Gulf of California,*

and which is formed by the union of the Grand and Green Rivers, the sources of which are also within the territory above mentioned.

The .statement is true of the Columbia River, flowing through the State of Oregon in the Pacific, and or the other great streams and rivers which flow northward and westward into the Pacific and the Northern Oceans. Here, then, we have a radius from which a system of rivers proceeds in all directions but one. Oh the side of the Great Lakes there is no surface-river of any size. Mr. Shufeldt puts this fact and the equally unquestionable one of the existence of the lakes together, and constructs his theory that the lakes are fed by subterranean members of this river system, which find inlets "at different points on the bottoms of the lakes, and maintain the supply with as much certainty and regularity as if the streams were running on the surface of the ground."

To the right is Shufeldt's circle. Most of the great rivers of the American West do indeed have "sources and fountain-heads" within this radius.

The Great Lakes watershed map lacks a major western tributary, evidence in the mind of Shufeldt that it must be subterranean from his circle.

As to whether the circle feeds a subterranean southerly drainage, we'll get there in to the chapter to follow.

Great Lake Linkages

Could there be subterranean rivers connecting the Great Lakes, one to another? Following are a few speculations.

Old Mackinaw, or The fortress of the Lakes and its Surroundings (1860) by William P. Strickland,

The fathers of the missions in and around the Straits of Mackinaw gave it as their opinion, that the waters of Lake Superior entered into the Straits by a subterranean passage, and in support of it, mention the wonderful fact that the current float against the wind, and notwithstanding it drives furiously in one direction, vessels are enabled to sail in a contrary direction as rapidly as though the wind were not blowing. In addition to this, they refer to the constant boiling up of the waters. Without admitting this theory, they affirmed that it was impossible to explain two things. The first is, that without such subterranean passage, it is impossible to tell what becomes of the waters of Lake Superior. This vast lake has but one visible outlet, namely, the river of the Saut, while it receives into its bosom the waters of a large number of rivers, some twelve of which are of greater dimensions than the Saut. What then, they ask, becomes of all these waters if they do not find an issue through a subterranean river? The second reason for their belief in this theory is the impossibility to explain from whence come the waters of Lake Huron and Lake Michigan? But very few rivers flow into these lakes, and their size is such as to justify the belief that they must be supplied through the subterranean river entering into the Straits.

"The Great Lakes," Atlantic Monthly, February 1861,

Father Dalton is of opinion that the waters of Lake Superior enter into the Straits by a subterranean passage. This theory, he says, is necessary to explain two things, namely:

1st. Without such a passage, it is impossible to say what becomes of the waters of Lake Superior. The vast lake has but one visible outlet, namely the River of St. Mary; while it

receives the waters of a large number of rivers, some which are of greater dimensions than the St. Mary. What, then, becomes of the surplus water?

2nd. The difficulty of explaining whence comes the waters of Huron and Michigan. Very few rivers flow into these lakes, and their volume of water is such as to fortify the belief that it must be supplied through the subterranean river entering the Straits.

I.A. Lapham, "The Supposed Subterranean Sources of the Waters of the Great Lakes," Chicago Academy of Sciences, April 9, 1867, raised the same perplexity.

It is quite certain that the whole quantity of rain water falling into the Great Lakes, and the country drained into them, will be found to be two or three times as much as in discharged at Niagara, and hence the wonder is what becomes of the excess, rather than to account for deficient supply.

Thunder Bay, Michigan is separated from Lake Huron on the northeast by North Point and across the Point is Little Thunder Bay, well-guarded by thickly wooded Islands. From this bay, says Mr. Franklin S. Dewey in Outing, October 1913,

I entered a narrow, shallow passageway, and there was revealed a secluded little inland lake surrounded by rocky bluffs. The little skiff swam through the weedy shallows and out over a patch of blue, almost black water.

But it was almost noon, and soon I had a brisk fire blazing on the sand, and a bass sputtering over it. Then I saw that the water was slipping up to the fire. It surrounded it, enveloped it, put it out. I built a new fire out of reach of the rising "tide," but all the afternoon I watched a curious phenomenon. Twenty minutes' ebb and twenty minutes' flood -- It never failed. I picked up a stone, attached it to my trolling line and sounded the depth of the singular pond. It was just a hundred feet deep.

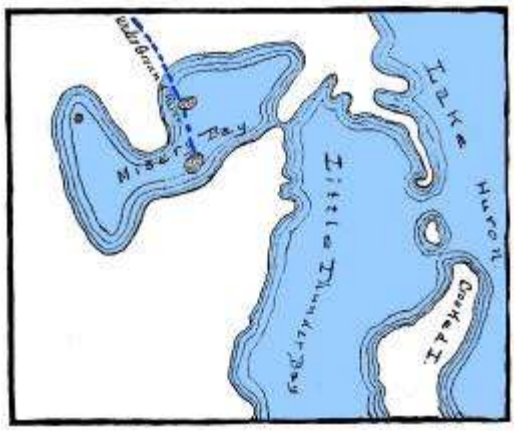
I determined to sift this natural curiosity to the bottom, and I began to ply everybody who knew the woods with questions. At last I was directed to the Narrows, some six miles north. There was nothing strange there. Just a long, slim lake. Long Lake poured a little river into it, and a creek crept out into Caroline Bay. There came a dry spell and I visited the Narrows a second time. The lake had disappeared. In its place was a long ravine and at the bottom flowed the little river from Long Lake.

Then I heard; of "The Devil's Soup Bowl," some three or four miles to the northwest. Here I found a dry hole a hundred feet deep. Farther on I found more pits, some filled with water and others dry. Following the line of wells I came to the largest, some twenty miles from Alpena. It was full of water to the brim, and it took three hundred feet of line to fathom it. The line of wells led steadily northward into Presque Isle. Suddenly, between the trees, I found a long, deep defile, with a foaming river rushing down it. It was a mile in length and terminated a pool or pit surrounded by high walls. In the great throat of this pit 150 feet deep, the river was swallowed up and disappeared. Far to the north I found scores of other pits with their great mouths open to the sky; some of them swallowed surface s reams of lesser magnitude. Some of them became at certain seasons a veritable porridge of fish. Later the same wells ran dry

I followed the general direction of these pits for thirty miles farther; the last of the series close to the Michigan meridian. It cannot he doubted that they clearly mark the sixty-mile course of a subterranean river which issues in the tidal lake off Little Thunder Bay, and mingles with Lake Huron.

The entire course of the river is in Hamilton limestone. Ancient earthquakes have shattered the rock and the surface streams, creeping into the clefts, have gnawed the walls away.

Dewey's maps are shown below.



Where the First Hint Came of the Subterranean River

The Course of the River from Source to Mouth

The red dot added to the right-hand figure represents Sunken Lake, the timber-swallowing sinkhole mentioned in Chapter 63, Cargo Conveyance.

"On the Subterranean Sources of the Waters of the Great Lakes," American Journal of Science and Arts, March 1867, by George A Shufeldt argues for subterranean watercourses much longer.

> *If we take down the map of North America, and follow around the borders of our chain of Great Lakes, we find that the tributaries for supplying the mighty torrent of water which pours in immense volumes over the Falls at Niagara, and thence through the St. Lawrence to the sea, are few in number and insignificant in effect... Now the question arises, whence comes this great volume and mass of running water?*
>
> *Geologists are tolerably familiar with the subject of underground streams and water courses. They know that the crust of the earth is full of these streams, and although from the fact that they are generally concealed from sight, there must be considerable speculation concerning them, yet there are cases, such as in the Mammoth Cave, Kentucky, the Adelsberg mountains in Switzerland, and numerous artesian wells scattered all over the world, the lost rivers on our western prairies, &c., from which a positive knowledge may be derived concerning the nature and history of these rock bound rivers.*
>
> *Adopting this as a conceded fact, let us once more turn to the map of North America and note particularly the point where the thirty-second degree of west longitude crosses the forty-fourth parallel of north latitude. Within a radius of five hundred miles, of which this is the center, will be found the great water producing region of the West.*
>
> *It is a well-known fact to travelers on our western plains that large streams, often rivers in size, suddenly disappear, falling away into great fissures and chasms, sometimes reappearing, but more frequently lost forever; where and in what manner does this water find an outlet? What becomes of the mass of water which falls upon the earth and is absorbed by the soil and the rocks below the beds of rivers and streams?... If the Great Lakes are not supplied by means which are upon the surface and apparent to the eye, it follows as a natural consequence that their sources of supply must be underneath the ground... This water probably finds inlets at different points on the bottoms of the lakes, and maintains the supply with as much certainty and regularity as if the streams were running on the surface of the ground.*
>
> *It is also probable that the great under-ground stream, penetrated by these wells, once discharged its waters into the bottom of Lake Michigan; but this outlet was closed by the upheaval of the earth's crust, which is visible at the point of the location of these wells, and at the present time there is no outlet except the artificial one made by the drill... As soon as an opening or outlet was made, and a quantity of water was discharged, this mineral matter*

decreased in proportion, and the probability now is that the water will become softer and purer as the amount discharged becomes greater, and that eventually, and probably at no distant day, the water will come from its fountain-head, simply filtered and purified by its passage through the sandstone and gravel beds.

In The Great Lakes Triangle (1977), Jay Gourley claims that the Great Lakes account for more unexplained disappearances per unit area than the Bermuda Triangle. Were those lost, lost to a maelstrom?

Fish Passage

Let us begin with a news item, "The Mystery of the American Lakes."

Lake Erie is only 60 or 70 feet deep, but the bottom of Lake Ontario, which is 452 feet deep, is 230 feet below the tide-level of the ocean, or as low as most parts of the Gulf of St. Lawrence; and the bottoms of Lakes Huron, Michigan, and Superior, although their surface is so much higher, are all, from their vast depth, on a level with the bottom of Lake Ontario. Now, as the discharge through the river Detroit, after allowing for the full probable portion carried off by evaporation, does not appear by any means equal to the quantity of water which the three upper great lakes receive, it has been conjectured that a subterranean river may run from Lake Superior to Huron, and from Huron to Lake Ontario. This conjecture is by no means improbable, and accounts for the singular fact, that salmon and herring are caught in all the lakes communicating with the St. Lawrence, but in no others. As the Falls of Niagara must have always existed, it would puzzle the naturalists to say how these fish got into the upper lakes without some such subterranean river; moreover, any periodical obstruction of this river would furnish a not improbable solution of the mysterious flux and reflux of the lakes.

Perusal of digitally-archived period periodicals -- but a few percent of the era's prodigious output of newsprint -- yields the verbatim text in the following publications.

The Dublin University Magazine	August 1851
The Eclectic Magazine of Foreign Literature, Science and Art	October 24, 1851
Montreal Pilot	December 27, 1851
Detroit Daily Free Press	March 27, 1852
New Zealand Spectator and Cook's Strait Guardian	June 2, 1852
The Adams Centinel (Gettysburg)	June 7, 1852
The Plough, the Loom, and the Anvil	Vol. 4, 1852
Baltimore Sun	November 10, 1858
Daily Morning Press (Adrian, Michigan)	September 25, 1874
Orangeburg (South Carolina) Times	November 26, 1874
Sydney Morning Herald	January 11, 1875
California Farmer and Journal of Useful Sciences	November 4, 1875
Grey River Argus (New Zealand)	January 26, 1876
Evening Auburnian (Auburn, New York)	January 20, 1879
Oswego Morning Herald	January 28, 1879
Daily Free Press (Easton, Pennsylvania)	February 6, 1879
Sacramento Record Union	October 4, 1879
The Princeton (Minnesota) Union	November 5, 1879
St. Paul Daily Globe	May 9, 1880
Geneva (New York) Gazette	March 17, 1882

"The Mystery of the American Lakes" persisted over three decades, and we're not including repeats in which the editor took the time to re-write a portion of the content.

We've quoted a good number of underground river news articles in our journey so far, and there are more yet to come. What might seem to be a minor story in an obscure newspaper was probably mirrored in hundreds of sister publications.

"A Summer on the Great Lakes," Bay State Monthly, October 1884, also wondered about the fish.

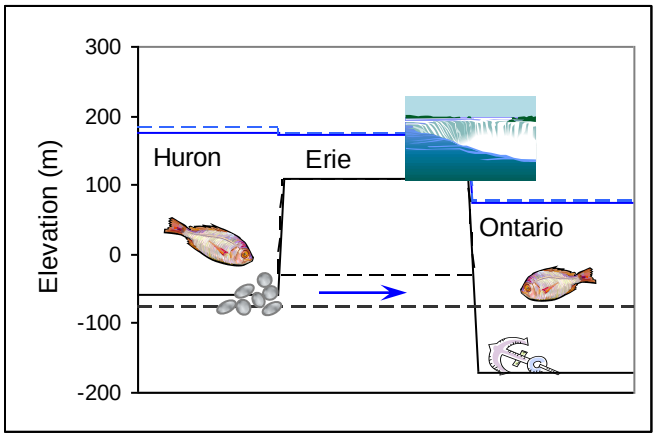
> *Lake Erie is about two hundred and forty miles in length and has a mean breadth of forty miles. Its surface is three hundred and thirty feet above Lake Ontario, and five hundred and sixty-five above the level of the sea. It receives the water of the upper lake by means of the Detroit River, and discharges them again by the Niagara into Lake Ontario. Lake Ede has a shallow depth, but Ontario, which is five hundred and two feet deep, is two hundred and thirty feet below the tide level of the ocean, or as low as most parts of the Gulf of St. Lawrence, and the bottom of Lake Huron, Michigan, and Superior, although their surface is much higher, are all, from their vast depths, on a level with the bottom of Ontario. Now, as the discharge through Detroit Rivet, after allowing all the probable portion carried off by evaporation, does not appear by any means equal to the quantity of water which the other three lakes receive, it has been conjectured that a subterranean river may run from Lake Ontario. The conjecture, not improbable, and accounts for the singular fact that salmon and herring are caught in all the lakes communicating with the St. Lawrence, but no others. As the Falls of Niagara must always have existed, it would puzzle the naturalists to say how the fish got into the upper lakes unless there is a subterranean river; moreover, any periodical obstruction of the river would furnish a not improbable solution of the mysterious flux and influx of the lake.*

And for a few more numbers, the Farmer's Advocate of June 12, 1884, quotes a "resident of Ithaca, who has a taste for geological research,"

> *I believe there is a subterranean river running from Lake Superior through Lake Huron and Michigan, under Lake Erie, and emptying into Lake Ontario. There is no other way in which to explain certain mysteries connected with our great lakes. The surface of Lake Superior is about 650 feet above tide, while its bed is about 260 feet below tide level. Lake Huron's surface is 50 feet below that of Superior's... The Erie's surface is nearly as high as Lake Michigan's, being 565 feet above tide, but its bed is also above tide, being 350 feet higher than the ocean level, consequently its bed is 250 feet higher than those of the lakes above it. Lake Ontario's surface is the lowest of all the great lakes, being less than 500 feet above tide, but its bed is 260 feet below the ocean, or about the same level as Michigan, Huron, and Superior. So there is a continuous fall from Lake Superior to Ontario, and all the outlet that the upper lakes have is known as the comparatively insignificant Detroit River. That stream never can care for all of that great pressure and volume from above, and the theory of an underground river such as I mentioned, seems to be most reasonable. All the St. Lawrence fishes are taken in every one of the lakes but Lake Erie. Why? Because they follow the course of the subterranean stream, passing 300 feet beneath the bottom or Lake Erie, and enter the waters of the upper lakes. The great lakes above Lake Erie have occasional flux and reflux of their waters, corresponding with ocean tides save in regularity.*
>
> *The subterranean river, according to my theory, becomes occasionally obstructed by great obstacles that are constantly moving down lake bottoms. Then the channels of outlet are insufficient to carry off the great volume of water, and they dammed back and the lakes rise. Finally these obstructions are swept away by the irresistible pressures, the river flows naturally once more, and the dammed waters subside. That is the whole mystery of the rise and fall of the tides in the great lakes.*

In short, where does the upper lakes' excess water go and how did the fish pass Niagara Falls?

The diagram below illustrates the elevations of Huron, Erie and Ontario. The solid line shows the true values and the dashed line, those given in the Farmer's Advocate. Note that the underground river outlets in the pool below Niagara Falls. The underground river below is shown temporarily blocked by the "great obstacles that are constantly moving down lake bottoms."



If the Farmers Almanac seems too geologic, the Farmer's Cabinet of January 9, 1868, covered the human aspect.

> *It was discovered several years ago by a man who was returning from a day's chopping in the woods. In walking over a slightly sunken place he noticed a hollow should, and turning struck the ground with his ax. The ax broke through and disappeared, and never has been heard from since... A lead and line let down to the depth of seventy feet found no bottom... It is certainly quite a remarkable stream.*

For non-farmers, the 1889 Encyclopedia Britannica's entry for Lake Ontario surmises that,

> *As the Falls of Niagara block the way, would seem that the fish reached the upper lake by way of an underground river. The theory of an underground river has also been adopted by several scientists who have been watching the variations in the levels of the great lakes.*

If nothing else, the source of salmon in the upper Great Lakes provided fodder for newspaper wars.

The April 24, 1852, Scientific American reported an assertion made by the Welland Advocate,

> *Now, as the discharge through the River Detroit, after allowing for the full probable portion carried off by evaporation, does not appear by any means equal to the quantity of water which the three upper great lakes receive., it has been conjectured that a subterranean river may run from Lake Superior to Huron, and from Huron to Lake Ontario. This conjecture is by no means improbably, and accounts for the singular fact that salmon and herring are caught in all the lakes communicating with the St. Lawrence, but in no others.*

To which Scientific American subscriber J.E. Holmes responded in the May 8, 1852, issue.

> *As Lake Huron is at least 280 feet above Lake Ontario, no large body of water could pass from one to the other without occasioning a vast whirlpool at one end of the passage, and an immense boiling jet at the other.*

The Scientific American of April 16, 1859, quoted the Golden Era, "a very sprightly paper published in San Francisco," which in turn was quoting an Ohio newspaper.

> *In answer to the rather absurd assumption of the editor of the Scientific American that the salmon and herring found in the lakes above Niagara must have passed into these waters originally through some subterranean stream connecting with the ocean, a writer in the Defiance (Ohio) Democrat says it is much more reasonable to believe the fish entered the Upper Lakes by way of the Fox River, which connects the Mississippi with Green Bay and Lake Michigan, and through a passage connecting Georgian Bay and the Ottawa. If this be rejected, we are driven to the less rational presumption that fresh water possesses the elements of Animal creation.*

To this, Scientific American responded,

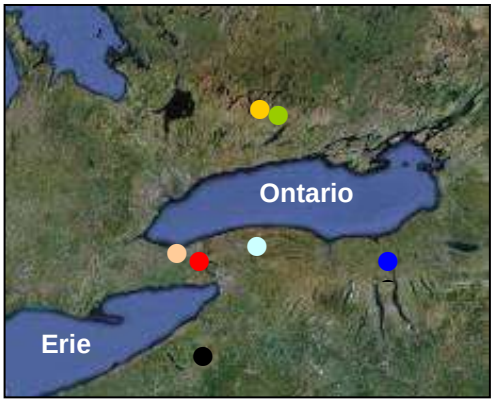
> *The writer of the Defiance Democrat seems to be unacquainted with the nature of salmon; they are a northern cold-water fish, and are therefore not very likely to make a journey to the Lakes through the warm Gulf of Mexico and thence up the Mississippi. The idea is absurd.*

A lively editorial debate sells papers, but it may leave a perplexed readership.

Perplexed for decades to come, as a matter of fact, as evidenced by February 26, 1914, Urbana Daily Courier,

> *London, Ont. There is a condition approaching panic in Turnberry, hear here, as a result of a series of occurrences which indicate that the land within its borders is sinking into an underground river. Farmers in the vicinity fear that their farms and stock will be lost in the quicksands which have developed, and the government has been asked to make an investigation.*
>
> *The first indication of the menace came when a section of road 200 feet long sank 50 feet and was found to be a spongy mass at its base. Within a few days a plot many rods long sank just outside of Belgrave and a pool of water formed in the bottom of the hole it made.*
>
> *A geologist who stopped in Turnberry said that scientists believe a large subterranean river connected Lake Huron and Lake Erie, as small fish peculiar to Lake Ontario had been found in Lake Huron within the last few months.*

It would be well to clarify some geography, locations in the vicinity of Niagara Falls.



- Niagara Falls
- Turnberry and St. Catharines, Ontario
- Warsaw Caves, Ontario
- Petroglyphs Provincial Park. Ontario
- Chautauqua Lake, New York
- Lockport, New York
- Wayne County and Finger Lakes, New York

As St. Catharines lies on the isthmus between Lakes Erie and Ontario, readers of the February 8, 1906, Niagara Falls Gazette would have had reasons for concern regarding "Underground Rover Found."

> *The river was struck on a farm at Nelles Corners, by some men who were drilling for natural gas. The drill had got down to 500 feet when it suddenly took a drop of 39 feet. Upon being taken out, it was marked by 39 feet of water. The men were able to hear a rumble on the water as it rushed along under the earth. Some of the water was pumped out, and some small fishes came to the surface. The water had the taste of lake water. The men could not tell which way the river was running. The general impression about the neighborhood is that the river is an underground channel connecting two of the great lakes. All of the bored wells around Nelles Corners have given out, probably being drained by the river under the earth.*

That the men were uncertain regarding the direction of flow seems odd, given the Niagara Falls elevation difference between Lakes Erie and Ontario, but pending the river's verification, its direction is of secondary concern.

"Florida's Underground Streams," Los Angeles Herald, December 15, 1907, describes in wonder the sinkholes and subterranean waterways of Florida, Chapter 41. The article then continues,

> *It is a well-established fact that there is a river flowing under the bed of Lake Erie, connecting the waters of Lake Ontario with those of the upper lakes. The peculiarity of Florida's system of natural underground drainage is its proximity to the surface. Understanding this subject, many of the State's peculiar topographical features are easily explained.*

The river beneath Lake Erie is a "well-established fact," or perhaps more accurately, as we have seen, a well repeated fact. And then there's Professor Denton's plan to drain the lake entirely in, but that must wait until Chapter 90.

And much more recently, the Kitchener, Ontario Record of October 26, 2007 featured "The Quest for an Ancient River."

> *Geologists think there's an ancient riverbed under southwestern Ontario, which, amid layers of sand and gravel, might hold a huge supply of drinking water for an area that has known drought as recently as this summer.*
>
> *The ancient underground riverbed is known as the Dundas Buried Bedrock Valley.*
>
> *"This is very much a practical program," said Desmond Rainsford, a geophysicist at the Ontario Geological Survey in Sudbury.*
>
> *He's overseeing a gravity survey that researchers hope will reveal a riverbed carved in bedrock by a monster river that flowed from Lake Ontario towards Lake Huron, more than 10,000 -- and perhaps hundreds of thousands of -- years ago. Slight variations in gravity will show researchers how far the bedrock lies beneath the surface.*
>
> *Geologists suspect the riverbed is now filled with sand and gravel trapping and holding huge amounts of pristine water.*

The map shows the route. While the direction seems wrong, it agrees with geological evidence that the upper Great Lakes at one time drained southward, the topic of the chapter to follow, "Veins of the Heartland."

We include it in this chapter, however, since we're in the area.

In the video games discussion of Chapter 28, we didn't mention Duck Tales in which Uncle Scrooge and his nephews ascend Niagara Falls. The screenshot makes clear that the route's subterranean.

A different sort of river-under-Niagara story stemmed from the fall's erosion. From "Niagara Falls," Christian Advocate, January 30, 1868,

> *If the limestone ledge over which the river now falls is, as supposed, in the course of being an undermined by a subterranean stream, breaking through as far back as nearly half a mile, of course the consequence, inevitable and liable to ensue at any moment, must be an immense breaking away of the face of the cataract, changing its whole form and appearance, perhaps converting the perpendicular fall into a shooting rapid, down a steep decline.*

We saw in Chapter 68 that the Mississippi's St. Anthony Falls did indeed degenerate in much the above manner. While Niagara is abrading its way upstream at approximately 0.3 meters/year, there's little expectation of a catastrophic conclusion.

As for from-whence-came-the-fish? quandary, the answer predates even the glacial periods. No underground river would have been needed to populate the fishery, as the region was once covered by a shallow tropical sea.

> *From about 16 million to 2 million years ago, the giant shark megalodon dominated the seas as the largest marine predator to ever live. Despite being extinct for millennia, the megalodon caused a stir in southeast Michigan last August when 15-year-old Port Huron resident David Wentz discovered a fossilized tooth in the St. Clair River*. -- Michigan Science, July 8, 2008

And Onward Toward the Sea

If an under-falls passageway made sense, why not run the conduit yet onward to the east? We only have to look to the Province of Ontario for evidence.

Warsaw Caves has hundreds of "kettles" -- bowl-shaped depressions in the limestone ranging from 5 centimeters to more than 2 meters in diameter and 4 meters in depth. Kettles develop in the bed of a fast flowing river where an eddy causes bed material to swirl in the same place over a long period, and thus are evidence of a previous large channel.

The Warsaw area is characterized by limestone bedrock shaped by the glaciations which 12,000 years ago created the present-day Great Lakes. The rebound of the bedrock means there is no longer water in the upper caves, though there are still flowing channels beneath.

Petroglyphs Provincial Park has a large collection of ancient petroglyphs thought my most to have been created by the Algonquian people around 900-1400.

The site is that it is also believed to be a portal to the spirit world. There are cracks in the rocks and an underground river underneath such that when the river is flowing, there are sounds resembling human conversations.

Or maybe the subterranean stream lies under Yankee soil. As evidence, we have the ambitious Thomas Milner's The Gallery of Nature, a Pictorial and Descriptive Tour Through Creation, Illustration of the Wonders of Astronomy, Physical Geography, and Geology (1882) account of Lockport, New York, just a few kilometers below the falls.

> *There is in Lockport, New York, an artesian well four hundred feet in depth, from the bottom of which rises a vein of salt water, holding in combination a large percentage of diliquescing chlorides, which, mingling with waters of other veins, produce instantaneous crystallizations of beautiful selenite in flattened eight-sided prisms of about an inch in length, an eighth of an inch in width, and a sixteenth of an inch in thickness. The laminae of these are so perfect that a single crystal may be divided, by means of heat, into two dozen distinct sheets. This well is*

accustomed to spout salt water for but a few moments at a time, and then, subsiding, remains quiet for the space of an hour, at the conclusion of which it again begins to puff and roar, and shoot forth its saline jets, when the workmen were sinking this well, the, auger, upon attaining a depth of two hundred and thirty-five feet, fell suddenly about fourteen feet, find reached the bottom of a subterranean river, flowing with so strong a current as to produce a perceptible motion in the upper part of the stem of the anger.

"Extraordinary Well," Christian Secretary, November 24, 1843, has this to report.

I have received from a gentleman residing in Wayne County, a bottle of water of great specific gravity... It is from a depth of 360 feet below the surface, and is from a subterranean river, the volume of which is composed of that fluid. When the augur reached the surface of this river, it fell 14 feet; the water at once rose to the surface, and in a short time inundated the building in which the shaft was sunk. It was accompanied by a large volume of carburetted hydrogen gas.

The current of the subterranean stream is so strong as to cause the stem of the augur to vibrate when held with the hands, and of force sufficient to denote the course of the flow of water. The power of the current is increased by the specific gravity of the fluid.

Chautauqua Lake below Lake Erie is another site where underground streamflow has been supposed. From "Why Do Springs and Wells Overflow?" Popular Science Monthly, November 1879,

Chautauqua Lake rests like a jewel in the crown of a high mountain-ridge... The lake has the appearance of being lifted up above its shores; you seem to be looking up to a "hanging lake," and you wonder the whole concern does not fall over into some of the valleys close around it. It is a wonder to the unpracticed observer where the water supply of Chautauqua Lake comes from. The lake nearly fills its own valley.

There is not a live stream emptying into it, save one, and that would run through a six-inch pipe. Of course, it is supported like a weary sleeper by the springs in its bed. These must be innumerable to maintain a body of water 20 miles long and two miles wide. Where the water is shallow you can plainly see these springs bubbling up from the bottom of the lake. Their warmth cuts the ice out in large spots in winter at points where they are most numerous. You see floating in the lake tufts of water-grass, which have been uprooted from the bottom by these under-currents.

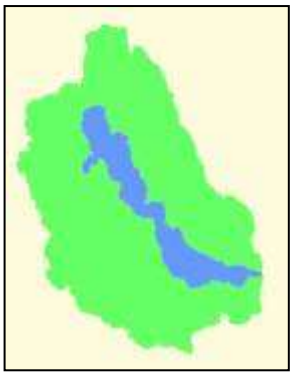
This lake is on the highest land in the State, west of the Catskill Mountains, and yet it is but a vast overflowing spring from which issues a large mill-stream. To account for this large flow from the top of this elevated region by supposing it to fall from some other higher elevation is absurd, since there is no such higher ground from which it could flow without being exhausted.

"A Village Sea Serpent," Will Carleton's Magazine, Everywhere, June 1907, by Jennie Long,

Rev. John W. Sanborn, the distinguished Indianologist, who lived there at one time, and knows all the circumstances, says that in one part of the lake was a place that had never been sounded -- no matter how deeply the plumb-line had gone. "It may be," he asserts, and many agree with him, "that there is an underground river connecting it with Lake Erie, or Ontario -- not so many miles distant -- or even with the ocean. We cannot tell what feeds Lake Chautauqua with water; there is no inlet at the surface, and it is hundreds of feet higher than any other water within hundreds of miles: there must be subterranean streams to feed the giant springs. If

there are underground passages leading into this little lake of the sea-serpent, there was no doubt room for him to make his way through."

Local geography, however, doesn't need such sea-serpent-sized conduits. Chautauqua Lake and its watershed are mapped to the right, the water surface approximately one-eighth of the total. The area's 115-centimeter annual precipitation is easily sufficient to maintain the lake.



"Rise and Fall of Lake Ontario," The Merchants' Magazine and Commercial Review, June 1, 1853, provides another hint of cavernous channels in the Empire State.

The Cratean Lakes of Manlius, which are tributary to Lake Ontario, are, no doubt, of volcanic origin.

As a modern atlas doesn't show lakes of this name, we show the finger-lakes regional geography to the right. What's important is that by no means is the landscape of volcanic origin; it's glaciated limestone

The Merchant's account that follows makes more sense in that light.

A farmer who resides near the "Lower Lake" informed me that one afternoon, while plowing near the shore of the Lake, he heard a sudden rush of water behind him, on turning around, on seeing the Lake rising over the land he fled, with his team, but the water soon returned to its basin. The "Lower Lake" has low banks, which appear to have sunk down; it receives the surplus water of the "Upper Lake" through a chasm in the bank of that Lake, and discharges a small stream that runs under the Erie Canal... There are deep fissures and chasms around the border of the "Upper Lake," and also deep sinks, in which large trees are swallowed up. Such is the condition of some of the districts that border Lake Ontario, and therefore belong to the history of the Lake, as connected with its mysterious changes of surface.

The Tourist's Guide Through the Empire State, Embracing all Cities, Towns and Watering Places by the Hudson River and New York Central Route (1871), edited by S.S. Colt, then moves us again eastward.

At Clarksville, twelve miles from Albany, and eight or tell miles southeast from the Indian Ladder, are more caves. Two of these are well known; the entrance of one is in the back-yard of one of village houses. The subterranean river is the house well; a trail of steps leads down into a crevice in the rock. They have no other water. For drinking it is unsurpassed, but it issues from lime rock. This same river bursts forth nearby in the bed of the Oniskethau, and aids that stream to run a saw and paper mill. Chaff thrown upon the river in the cave is soon

found floating on the mill-pond. The stream empties into the Hudson at Coeyman's. It was once remarked that an amphibious animal might make its way through the caverns from Hudson River to Niagara Falls without once coming forth to daylight!

Elmira Star Gazette, March 14, 1896, "Underground River, An Authority Says the Notion is Erroneous,"

Even since the subject of a new water supply for Elmira [about midway between Lockport and Clarksville] *has been discussed there have been frequent references to an underground river, which according to popular theory would furnish an inexhaustible supply of water if it could be reached by wells. Belief in this underground river and in the purity of its water has been strong and widespread, and the imagination and ready tongues have embellished the accepted fact with all manner of extravagant details concerning its source, course, outlet, etc.*

A scientist of considerable note, who probably knows more about the geological formations of Chemung valley than does any other man in Chemung valley, said yesterday that this popular notion of an underground river is erroneous. "There is," he said, "below the gravel and above the living rock a sheet of water moving very slowly toward Newtown creek..." This sheet of water, technically known as "groundwater," is the water that has filtered down through the sand and gravel and is practically pure.

The Albany Evening Journal, April 28, 1923, had this follow-up, "Underground River Only Figurative," however.

The term "underground river" applied to any source of water supply in the vicinity of Schenectady and Rotterdam [30 kilometers north of Clarksville] *is purely figurative, according to Dr. John M. Clarke, state geologist... "We cannot have an underground river unless there is a limestone foundation, and this does not exist around Schenectady."*

So perhaps there's no subterranean Great Lakes River, at least under New York, but it's not for lack of speculation.

CHAPTER 86
VEINS OF THE HEARTLAND

In the chapter just completed, Beneath the Great Lakes, we followed an underground river flowing eastward, as do the waterbodies above. But could the runoff from the upper watersheds flow to the Gulf of Mexico as veins beneath the American heartland?

Such a great southward-flowing underground river has long been pondered, sometimes literarily and sometimes geographically. In this chapter we'll follow the path of the Mississippi, or at least paths in such a direction.

The table below lists some of our encounters to this point with underground rivers flowing towards the Gulf of Mexico.

Chapter	
12 Underground Rivers in English Fiction	T.S. Elliot's “At what point in its course does the Mississippi become what the Mississippi means?” Mark Twain
13 Boys Club Serials 14 Boys Club Singles	Old Olaf's report of interior rivers "larger than our Mississippi and Amazon Rivers combined, in point of volume of water carried." O Brother, Where Art Thou?
24 Underground Rivers in the Fine Arts	George Catlin's theory of a subterranean river carrying the drainage of the Rockies to the Gulf.
26 Hydrogeology	Subterranean channels of petroleum The Ogallala aquifer
41 More Hydropower from the Deep	St. Anthony Falls, Minneapolis

Author Grace Kings' Little Convent Girl (1893) entwines issues of race, gender and identity. After spending most of her life in a convent, a young girl travels by riverboat to New Orleans to join her mother who turns out to be "colored." The riverboat pilot is the tale's philosopher.

> *It was his opinion that there was as great a river as the Mississippi flowing directly under it -- an underself of a river, as much a counterpart of the other as the second story of a house as of the first; in fact, he said they were navigating through the upper story. Whirlpools were holes in the floor of the upper river, so to speak, eddies with rifts and cracks. And deep under the earth, hurrying toward the subterranean stream, were other streams, small and great, but all deep, hurrying to and from that great mother-stream underneath, just as the small and great overground streams hurry to and from the mother Mississippi.*

Little Convent Girl's tragic conclusion:

> *No one was looking, no one saw more than a flutter of white petticoats, a show of white stockings, as the little convent girl went under the water. The roustabout dived, as the roustabouts always do, after the drowning, even at the risk of their good-for-nothing lives. The mate himself jumped overboard; but she had gone down in a whirlpool. Perhaps, as the pilot had told her whirlpools always did, it may have carried her through to the underground river, to that vast, hidden, dark Mississippi that flows beneath the one we see; for her body was never seen again.*

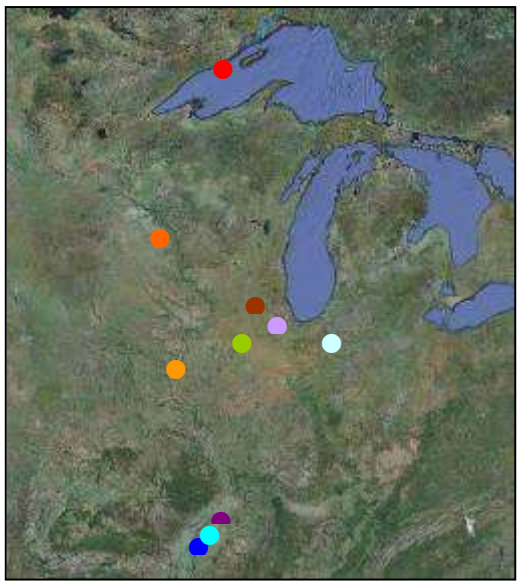
The "dark Mississippi that flows beneath the one we see" images the American experience.

From very much a different library shelf, George P. Marsh provides this account of Floridian hydrogeology in The Earth as Modified by Human Action (1874).

> *In January 1857, a submarine fresh-water river burst from the bottom of the sea not far from the southern extremity of the peninsula, and for a whole month discharged a current not inferior in volume to the River Mississippi, or eleven times the mean delivery of the Po, and more than six times that of the Nile. We can explain this phenomenon only by supposing that the bed of the sea was suddenly burst up by the hydrostatic upward pressure of the water in a deep reservoir communicating with some great subterranean river or receptacle in the mountains of Georgia or of Cuba, or perhaps even in the valley of the Mississippi.*

This "deep reservoir communicating with some great subterranean river or receptacle... perhaps even in the valley of the Mississippi" isn't allegorical; it's what the author takes to be fact, a subterranean outlet of Mississippian magnitude.

But let us become more geographic and locate such a river. For quick reference, here are some of the locations where we'll peer into the ground.



- Devil's Kettle, Minnesota
- Niagara Cave, Minnesota
- Quincy, Illinois
- Lake Geneva, Wisconsin
- Oak Park, Illinois
- Buffalo Rock and Starved Rock, Illinois
- Indiana Dunes, Indiana
- Bird's Point, Missouri
- New Madrid, Missouri
- Big Lake, Arkansas

We'll begin at the top of the map, Devil's Kettle, Minnesota. The Great Lakes have long been associated with mysterious disappearances.

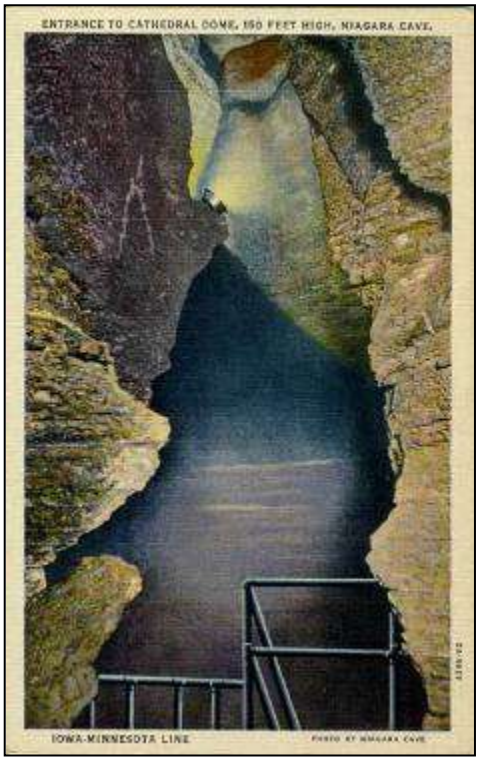
> *Devil's Kettle is a puzzling geological phenomenon located on the North Shore of Lake Superior. Where does the water go? No one seems to know.*

But perhaps we do know. South.

Niagara Cave in Minnesota, the next down on the map, features an 18-meter waterfall and a chapel in which there have been over 400 weddings.

Niagara
$10.50

The cave is said to be named after Niagara Falls at Lake Ontario -- a less flamboyant Niagara Falls for Norwegian settler weddings, perhaps, but could it not also be another Niagara Falls, this one pointed south?



We extend our line the dot for Quincy, Illinois. From the Quincy Daily Journal, February 13, 1895,

> *Papers published in neighboring towns are vividly describing an underground lake just discovered near Quincy... The discussion of artesian wells as a means of supplying the city with water, led some of the older citizens to put on their thinking caps, and then came stories of underground lakes and rivers which are large enough (the stories are at least) to supply the city's every need with water pure as crystal. One citizen remembers that about fifty years ago...*

The story then recounts a tale of a well shaft revealing a "great body of water, above which the rocks form an arch."

> *Another story which comes from the same region, is to the effect that five years ago Peter Horn sunk a well on his place and ever since there has been a continuous supply of pure, fresh water, no matter in what season of the year. Farmer Horn and others have always believed that this well tapped a subterranean river which is fed by one of the Great Lakes and the river is believed to flow in the Direction of Quincy. Neither of these lakes or rivers have been explored.*

From Quincy, we'll meander to the shore Lake Michigan. Whether the underground river makes such a loop or if we've discovered a tributary isn't clear, but either supports our hypothesis.

While most of our citations are from the archives, not all accounts of underground rivers are as old. From the May 31, 2005 edition of the Wednesday Journal, Oak Park and River Forest, Illinois, a northern suburb of Chicago,

> *In the 1920s, construction crews digging foundations for a handful of buildings uncovered water that appeared to be rushing through sand pockets, giving rise to a long-held myth that underneath downtown Oak Park runs a mysterious "underground river."*
>
> *Starting around 1925, the rumor grew out of a spate of ground breakings for various downtown area buildings.*
>
> *Water and sand were found a second time at the Community Bank site during excavation for an addition in 1952. Shortly thereafter, the Oak Leaves published a story, titled "Geologist unveils underground 'river' mystery." In the article, River Forest geologist Isabel Wasson (one of the first women to have a degree in petroleum geology) said the sand could be explained as the remains of the ancient glacial "Lake Chicago" beach.*
>
> *"The so-called underground river, revealed by excavations in Oak Park, is not a river running below the ground, but is water filling the porous spaces in a long, narrow sandbar which diagonals across Oak Park," Wasson explained at the time.*
>
> *Oak Park Village Engineer Jim Budrick, who said he occasionally gets some inquiries about the mysterious "river," said downtown simply seems to have a particularly high water table.*
>
> *"There's been an awareness [of the water] in downtown for a long time, but people are coming into contact with it more," Chen said, adding that some who cope with the geological conditions of downtown still call the phenomenon a river.*
>
> *Chen said the water "seems to have some flow to it," but he clarified, "this is not the Mississippi River drifting past the back door. This is not a raging river. It's water that is something a little less than standing if you encounter it," he said.*

Moving yet southerly, there's been speculation about what's under the confluence of the Upper Mississippi and the Ohio Rivers. From the Crittenden Record-Press, January 7, 1909,

> *A government diver, while trying to locate an incline of the Iron Mountain Railroad Company, which disappeared at Bird's Point, Mo., a short while ago had discovered an underground river which runs under Bird's Point and Cairo and under the waters of Mississippi and Ohio Rivers near their confluences at right angle... This underground river is believed to be as large as the Mississippi, though with not so swift a current, and the water is of a different color and will not mix with the waters of the Mississippi. The scarcity of fish at this point is attributed to the new-found underground river where they are supposed to have gone.*

The aerial photo shows the confluence of the Mississippi River from the left and the Ohio River from the right. The dashed line suggests the underground river "as large as the Mississippi.

"

The New Madrid Earthquakes

There's nothing like a good earthquake to foster speculation regarding a mysterious subterrain.

The New Madrid Earthquakes of 1811 and 1812 were strongly felt over roughly 130,000 square kilometers, and moderately across nearly 3 million square kilometers. In comparison, the 1906 San Francisco earthquake was moderately felt over 16,000 square kilometers.

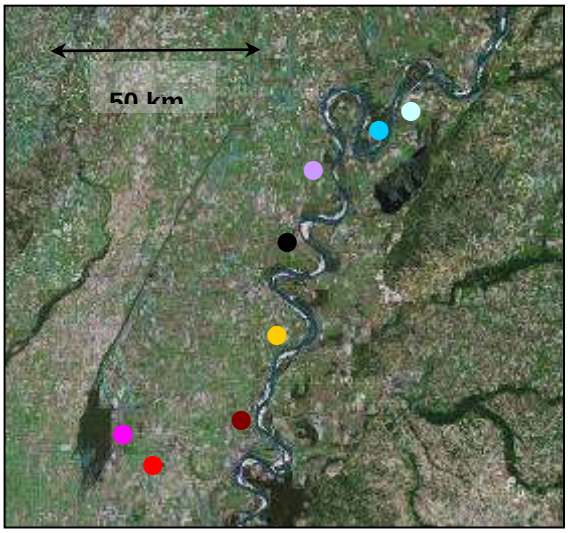
The events were caused by reactivated faults formed when North America began to split apart 750 million years ago. The resulting rift system has since been buried by younger sediments, some of which are karst.

The New Madrid earthquakes weren't volcanically-induced, but as the fiery subterranean engine of Kircher (Chapter 8) was yet in scientific vogue, accounts such as "Letter from Salt River," Home Journal, June 23, 1849, were common.

> *Then the whole valley was shaken by earthquakes which were so violent just below the mouth of the Ohio, that the old town of New Madrid was nearly destroyed; many boats laden with the products of the upper country were stranded or sunk; thousands of acres of forest were swallowed up by the river, and lakes were formed in its vicinity, where strange sounds have since been heard from the depths of the earth like the hissing of subterranean streams over beds of volcanic fire.*

While the earthquake indeed altered aquifer conditions, the subterranean magma never came close enough to the surface to boil groundwater.

The map below shows the New Madrid earthquakes' epicenters and hydrogeologic consequences.



Event and Richter Magnitude	
December 16, 1811, 2:30 AM	8.6
December 16, 1811, 8:00 AM	8.0
December 16, 1811, 11:00 AM	8.0
January 23, 1812, 9:00 AM	8.4
February 7, 1812, 3:15 AM	8.8
February 7, 1812	River ran backwards
February 7, 1812	Temporary waterfalls
Big Lake, Arkansas	

Noting the reach of the river running backwards, we recall a similar event involving a punctured underground cavern beneath Louisiana's Lake Peigneur (Chapter 72).

A more permanent hydrogeologic change was that of Big Lake, Arkansas. Once a free-flowing branch of the Mississippi, Big Lake was changed to a shallow lake by the earthquakes.

Circa 1900.

According to the New York Times, April 15, 1928,

> *Big Lake, Arkansas, is one of the best known outlets of underground rivers. It is supposed that this lake has a connection with the Mississippi, as it rises and falls with the ebb and flow of the river.*

Given that the lake is embedded in riverine deposits, it is not difficult to believe that its elevation might increase at times of main-stem flooding.

"Many Underground Streams: Frequent Instances Where Rivers Sink into the Ground, and Form Rivers," in "Youth's Companion," Los Angeles Times, May 15, 1915, painted a more dramatic picture, not one of "ebb and flow," but a Poe-like maelstrom.

> *Big Lake, Arkansas, is supposed to have a subterranean connection with the Mississippi River, for the lake rises and falls with the rise and fall of the Mississippi. Off the Missouri shore the big river has a whirlpool that is a menace to small boats. The water always eddies about this whirlpool; but when the river is high there is an intake, and when the stream is low the water is driven upward. When the river is high, small craft have been sucked down and never seen*

again, and tradition says that even steamboats have foundered in this eddy. An underground stream from Big Lake is believed to emerge at this point.

Given sufficient difference in water surface elevation, a river-to-lake conduit could, in theory, generate a Mississippi vortex, but Mississippi whirlpools are more easily explained by riverbank eddies. The reported lake-to-river conduit, on the other hand, makes no sense whatsoever for a sucking river whirlpool. That the nearest Missouri shore lies more than 100 kilometers distant only adds to the unlikeliness of the report.

In terms of hydraulics, Big Lake poses no mystery, but its association with the New Madrid earthquake is enough to fan the fires of subterranean supposition.

Scribner's Monthly

"Is There a Subterranean Outlet to the Upper Lake Region?" in Scribner's Monthly, April 1876, isn't just one more news item of underground mystery, a staple of the era's newsprint. For its day, "Is There a Subterranean Outlet..." was a work of investigative journalism. We'll go through the article piece by piece.

In answer to the title's query, yes, according to the article, there does seem to be such an outlet.

Whether the great lakes are the true reservoirs from which our Northern wells, springs and subterranean streams receive their constant supply of water, is a question of sufficient interest and significance to merit a thoughtful consideration. The data upon which the advocates of this theory found their conclusions are certainly manifold and forcible, and though there may be breaks in the line of evidence, the facts as now established would seem to favor the views which the author of this paper now proposes to define and defend.

The article summarizes lake areas, impressively large acreages, and then continues.

There is a vast volume which, it is believed, is checked in its course over the surface to the south and east, by the elevations beyond Lakes Superior and Huron, and seeks an exit, as some think, by subterranean channels through the crust of the earth. It is also possible that some of the water escapes by contact with the deep recesses of Superior and Huron into their gigantic reservoirs; while other channels, fissures, and crevices in the earth's crust probably carry away in other directions, in their course, an unceasing flow for man's ultimate benefit and use.

Water surface elevations are given and the case is made -- as we saw in the preceding chapter -- for a subterranean channel paralleling the surface course.

A subterranean channel may connect Superior and Huron with Ontario, giving to the latter, through this source, to be discharged by the St. Lawrence, a greater volume than is given through St. Clair or the Niagara. It is also a well-demonstrated fact that the volume of water escaping from the lakes through the mighty St. Lawrence is far greater than the amount discharged from the upper lakes into Ontario by the proper channels -- the St. Clair and Niagara; and it is also well settled that the supply to Lake Erie from the St. Clair is about equaled by its discharge through the Niagara; showing that it receives from no subterranean source any perceptible surplus of water.

Here, however, the article introduces another, but non-exclusive possibility, that of a southern exit.

There are those also who entertain the belief that while Lakes Superior and Huron are supplied largely through such subterranean channels on the one hand, they suffer severely through losses by similar channels at some point in their vast expanse...

And if it can be demonstrated as to what these sources of supply could then muster up, and that the same average discharge still continues through other but unseen channels, then is it not possible that the causes which brought about this recession of the waters of the lakes, and finally closed this old outlet, wrought other and corresponding changes by which a new passage was supplied for the escape of the outpouring of this region -- in other words, may not

the same territorial convulsions which elevated the plateau at the foot of Lake Michigan, and shut off the outflow into the valley below, have opened up subterranean passages through which these waters find such easy access in their course to the sea?

According to Scribner's, Lake Superior and possibly Lake Michigan may outlet into the Illinois Valley and from there, on southward. The article's "Track of Subterranean Outlet from Lake Superior" graphic is shown to the right.

Scribner's recalls the legend told by Ottawa chief Shabbona of a Lake Michigan outlet to what now would be the Kankakee River, tributary to the Illinois, tributary to the Mississippi. The Chief's name, we must note, is remarkably similar to "Shambhala," Chapter 77's Buddhist kingdom of the inner world, but we'll not pursue the possible connection. The article continues,

A trip over to the south-east comer of Lake Michigan, near Michigan City, reveals to us huge mountains of sand which have been drifted about for years, and much reduced in height.

This sand is from the lake, and is cleanly washed, and interspersed with shells of the present period. There they lie, some goo feet high; many far inland, and all in the track of those fierce gales which swept the lake from the north-west. These are not mere heaps of loose sand, the natural accumulation of successive storms, but mountains.

Below is a 1950s postcard of Indiana Dunes State Park on Lake Michigan.

Indiana Dunes State Park

Buffalo Rock State Park

Far inland, and directly in the track of these prehistoric gales, a broad expanse of level land appears; very unlike the usual formation, as seen throughout this great country. The surface resembles the long unbroken swell of the Pacific. For miles away, and stretching far into

> *Indiana, the surface recedes and swells in a continuous line, each line having a trend north-east and south-west, marking with exactness the great swell as it coursed over shallows...*

We must note that such inland sand dunes are still derived from Lake Michigan, but at the time of the writing the formation may have seemed like undulations in an ancient streambed.

> *Nowhere along this valley are there indications more striking than at Buffalo Rock, five miles below Ottawa. Here we not only have the water lines in bold outline, but the depth of this great stream becomes plainly apparent. Here the perpendicular face of the rock stands fronting the stream. Though somewhat washed and weather-beaten, the lines are well defined.*

The above photo of Buffalo Rock stratification -- water created, to be sure, as sandstone formation is a sedimentary process -- isn't, however, evidence of catastrophic flooding. It's a story of lamination.

We may be confused as to why Scribner's devotes so much discussion -- much of which we've not reprinted -- to a surface river that is no more, but then we see the logic.

> A mighty river once flowed south from Lake Michigan.
> Geologic uplift blocked the outlet.
> In relation to upper lake volume, today's Lake Michigan discharges relatively little to Lake Huron.
> Therefore, much of Lake Michigan's outflow must be where we now can't see it.

And thus in the article's title, "Subterranean Outlet."

> *It is a well-known fact that throughout the extent of this valley, at no great depth are vast basins and subterranean streams of pure water, in all respects corresponding in its general characteristics to the water of Lake Superior, containing the same ingredients in solution, save where, in its passage to the surface, it may have passed through the coal measures, and become impregnated with sulphuretted hydrogen.*

As to how this subterranean route evolved, Scribner's didn't have a full understanding of karstology, but we can see the rudiments as it cites geochemistry.

> *Or when, coming, as it does, from its source, charged with carbonic acid, it may have passed, in its course to the surface, through the various limestones, and become charged with the carbonates of lime or magnesium; or, again, by infiltration through a thin seam of bog ore or iron pyrites, it springs forth, bitter with impregnations of iron or its sulphates. But, where it finds its way to the surface through the sandstone and supernatant strata of gravel, it becomes shorn of its chemical properties, and bursts ort in its virgin purity from the hidden recesses. The unlimited outpouring of this crystal water is too well known here to require comment. Away up in Wisconsin, in the track of this under-ground current, the waters reach the surface in unprecedented protrusion. At where the Niagara limestones crop out in strange contrast with the regular stratifications, it comes rushing to the surface in huge volumes.*

The last chapter's from-whence-came-the-fish? perplexity provided more evidence for subterranean passages.

> *The writer was present at the digging of one of the many wells at that place during the summer of 1874 when several live fish came through a hole made in the rock with a crowbar. The flow of water was so great -- at a depth of eight feet -- that the workmen were compelled to cease. As there was no means by which these fish could have reached this well other than the one mentioned, it is evident that it had communication with some subterranean current where fish existed.*
>
> *At Lake Geneva, in Wisconsin, it is well known that a fish, known as the Cisco, comes and departs at regular periods every year; it remains but a few days and is gone.*
>
> *These same fish are found in Lake Superior, only, and it is believed by many that there is a subterranean passage by which they come and return.*

The why-the-tides? quandary was good for a paragraph.

> *It is a fact well known to many who have visited Northern Wisconsin, that there are lakes near Superior whose waters rise and fall with those of Superior. When the wind is strong from the east, the waters of the western shore pile up, and a corresponding rise occurs in these smaller lakes, while a change of wind brings about a corresponding recession.*

And the from-where-come-artesian-springs? question provided more to ponder.

> *All along Lake Michigan, as in the region of Superior, we find this water springing to the surface, save where it is checked by a heavy substratum of clay. It is reached by artesian wells at Chicago, Joliet, Morris, Marseilles, Ottawa, and far down the valley. At Marseilles it is reached at a depth of from eighty to one hundred and fifty feet, and comes in volumes. At Debolt's Springs, near Ottawa, it comes to the surface in such quantities that, were it not for the fact that , the outlet is so near the edge of the river, it might well be utilized for manufacturing purposes. At Ottawa it supplies a part of the city, and the railroad stations have their wells which flow without ceasing. Here are located upward of twenty artesian wells, each seeming to outdo the other in the voluminous delivery of its pure crystal water. And here on the bank of the old Illinois, opposite the junction of the Fox River, are the celebrated mineral springs of this valley.*

The referenced Ottawa-to-Chicago line of artesian wells is shown to the right. The municipality of Ottawa has not the reported 20, but rather 150 such springs. The "celebrated mineral springs" produce "Sanicula" water, a homoeopathic remedy marketed today for enuresis, seasickness, constipation and rickets.

Scribner's continues,

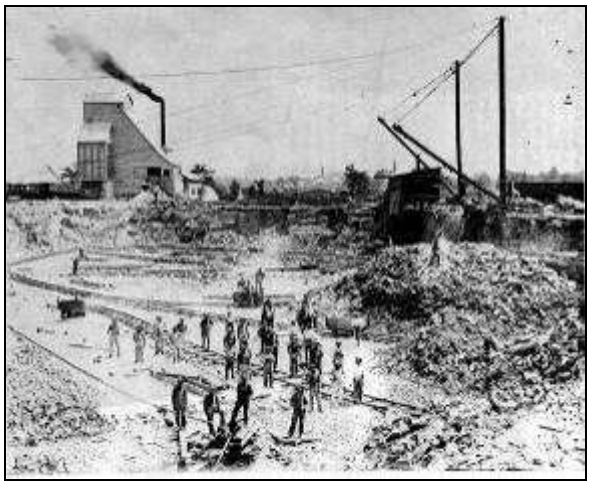
> *Along the valley, lower down and near Peoria, for many miles, vast tracts of land are rendered useless in consequence of the great rush of these waters to the surface through the supernatant seams of gravel, endless swamps, fields of wild rice, and, in some places, whole tracts of densely matted bog and thicket, oftentimes covered with a sparse growth of timber, are buoyed up by the gushing waters, and, like floating islands, remain suspended there; and, after a hard winter has left the mass frozen, the heavy gales of early spring sway the entire tract back and forth until the winds subside. A long pole penetrating this tenacious mass glides down uninterruptedly through several feet of clear water, until finally arrested by the hard bed of gravel below.*

The article then speculates,

> *Farther down the valley, and, we think, in Schuyler County, near the river, the sandstone formation crops out in bluffs of various altitudes; and, at a point where a saw-mill has been in operation for some years, a natural outcropping of very wonderful character is seen. Here, from the very interior of the rock, comes a torrent of clear, pure water, falling about seventy-five feet has been used for years as a water power, and a more valuable one is seldom found. Around the mouth of this subterranean torrent, which will average some eight cubic feet of solid water, innumerable specimens of fossils are found, and basketfuls have been picked up here at one visit; from this it is very evident that the subterranean current is in the Old Red Sandstone, and, in its escape to the surface through the fissures and crevices, it passes through the fossiliferous rocks, which are gradually being disintegrated by the constant flow. Such is the case at Waukesha, where the Niagara group of fossiliferous limestones comes to the surface.*

There are no major waterfalls in Schulyer County, but to the east and near the Illinois River are falls set in sandstone, some as high as 80 feet. The falls at Horse Shoe Canyon at Starved Rock State Park is shown below in the 1904 postcard as well as a photo of a Waukesha limestone operation of the same vintage.

Horse Shoe Canyon



Waukesha limestone operation

Scribner's concludes

> *To give an account of the many and though not peculiarly interesting cases in which these salt, waters make themselves manifest at the surface in this valley, would require a volume; but these are mere fingermarks of the vast of currents which rush along in this track wells are through the subterranean channels.*

In short, "Is There a Subterranean Outlet to the Upper Lake Region?" employed most of the folk arguments in favor of underground rivers:

> Native American lore,
> Mysterious waters in the profundity of caves,
> Unexplained fish,
> Inland tides,
> Great artesian wells,
> Water lost and found,
> Evidence of ancient floods and
> Earthquakes.

All are arguments we've seen employed at many times in many places, but here, as one big package.

"The Great Lakes," Messenger, July 26, 1876, was in full accord.

> *Martin B. Howell, Jr., in Scribner's Magazine propounds the query, is there a subterranean outlet in the upper lake regions and brings forth evidence to show that there is... The data upon which the advocates of this theory found their calculations are certainly manifest and forcible; and though there may be breaks in the line of evidence, the facts as now established would seem to favor the views which the author of this paper now proposes to define and defend.*
>
> *Lakes Superior, Huron, Michigan, Erie, and Ontario... make a very formidable area of fresh water receptacles for this chain alone; while there remain yet an innumerable multitude of smaller but similar bodies dispersed through the great northwest territory of the Hudson Bay country. Here is a vast and comparatively unproductive region, penetrated in every direction by streams of greater and less magnitude, interspersed with lakes und bays, which in many cases*

> *cash their broad mantle of water for hundreds of miles... While much of the outpouring of these waters is directed toward the Polar Sea,*

"Toward the Polar Sea?" That's one we've not pursued, but we'll let it pass. Back to the passage,

> *and through the valley of the Mississippi, yet there is a vast volume; which, it is believed, is checked in its course over the surface to the South and the East by the elevations beyond Lake Superior und Huron, and seeks an exit, us some think, by subterranean channels through the earth's crust. It is also possible that some of` the water escapes by contact with the deep recesses of` Superior and Huron into their gigantic reservoirs; while other channels, fissures, and crevices in the earth's crust probably carry away in other directions, in their course, an unceasing flow for man's ultimate benefit and use. The depth of penetration of' some of this chain of great lakes into the solid matter of the earth's surface affords a good illustration of their adaptation as recipients of a great influx from subterranean sources.*

While "Is There a Subterranean Outlet to the Upper Lake Region?" can be dismantled in the light of geological knowledge, its case for the affirmative is a good comprehendum of late 19th-century popular opinion.

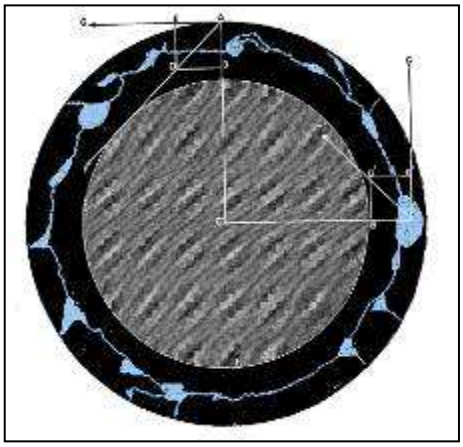
The Scribner's feature also engaged the era's increasing-pursuit of geophysical basis, albeit fallacious or sound. Nelson W. Green's "Why Do Springs and Wells Overflow?" Popular Science Monthly, November 1879, picked up on the subject.

> *Scribner's Monthly has a very interesting article by Martin A. Howell, Jr., entitled "Is there a Subterranean Outlet to the Upper Lake Region?" While we are sorry to quarrel with Mr. Howell as to his conclusions, we are very happy to accept his facts.*

Green agrees with the existence of subterranean channels, but disputed that such channels operate under gravity alone, citing a score of waterbodies -- many of which we've encountered or will encounter in other chapters -- which, in his opinion, are significantly larger in volume than could be sustained by their surficial watersheds.

The quandary's solution, Green contends, is found in physics. Referring to the diagram, he attempts to prove that water enclosed within the earth's crust will naturally flow outward.

> *The resultant of the earth's centripetal and centrifugal forces acts impulsively upon the subterranean water-deposits, and tends to force them into and through the natural channels of the earth's crust.*



Green's physics, however, didn't find many takers, Joseph J. Skinner being a vociferous respondent. Excerpted from Skinner's reply in Popular Science Monthly, January 1880,

> *Mr. Green's two propositions that differ most essentially from the commonly accepted theory of artesian wells are*
>
> 1. *That the flow of water from them is not due to pressure transmitted from water at a higher level, but to "some force not yet identified"; and,*
> 2. *That the supply of water for such wells, and indeed for ordinary springs, comes from "subterranean waters, seldom if ever influenced by rains."*

*Mr. Green identifies the required force as "the resultant of the earth's centripetal and centrifugal forces," and, having found that the tendency of this resultant is to force water **out**, wherever there is an opening upward in the earth's crust, of course it is necessary to suppose that there is a plenty of subterranean water already down. He seems to think it entirely unnecessary to suggest any means of replenishing the supply of this subterranean water, or even to imagine that it could ever need replenishing.*

Without insisting further on the fact that the rain-waters, dews, and snows falling on higher grounds must be sufficient to account for all flowing springs and wells (except, possibly, such cases as the geysers), let us see how Mr. Green's subterranean water-deposits are to be driven to the surface of the earth by his "newly discovered force."

As a specimen of mechanical exposition this is almost unique, but it is too ludicrous to mislead. In point of fact, as every schoolboy ought to know, the centrifugal force due to the earth's rotation, on a particle at any place on the earth, does not act in the direction of the tangent to the earth's surface, but in the outward direction of the radius of the circle of latitude of the place; a diagonal of a parallelogram is frequently shorter than either of its sides; the centrifugal force acting on a particle, due to the rotation of the earth, is never more than about the 1/289 part of the force of gravity; the direction of the resultant of this centrifugal force and of gravity is always very nearly that of gravity; the intensity of this resultant is always less than that of gravity; and instead of increasing with the distance from the center of the earth it decreases. Perhaps these are points that make no difference in the value of Mr. Green's theory; but still they are worth the consideration of any one who proposes by contraries to upset the doctrines of such men as Arago, Faraday, Garniei, and Halley.

Not even the wonderful fact mentioned by Mr. Green, that "by inclosing an overflowing spring tightly, and allowing the enclosure to be terminated by a tube with an opening carried to a level below the fountain, the flow was increased" -- not even this will overthrow the principles of mechanics, as anyone who ever understood a siphon would know of artesian wells.

As we're aware from Chapter 46, an artesian well might spring from an inverted siphon, but not as the last sentence might suggest, a true siphon.

Without expressing an opinion of my own as to whether there really is or is not a subterranean water-channel between Lakes Superior and Ontario, it is evident enough that, even if there is, its size and character, as being more or less obstructed by solid or porous materials, together with its length, would have some influence in determining the quantity of water which could flow through it, even with a difference of water-level over its extremities equal to three hundred and sixty-five feet. Unless, therefore, Mr. Green's "newly discovered force" should suddenly cease to make Lake Superior an "overflowing spring of subterranean water," or, rather, unless the region from which Lake Superior gets its water should be deprived of its yearly rains, we need not immediately look for a common level of the water in Lakes Superior and Ontario.

In short, while there may or not be subterranean conduits, the earth does not spin water up them.

Other Speculations

Some writers supposed other routes of subterranean runoff from the American heartland.

In his report Account of an Expedition from Pittsburgh to the Rocky Mountains, Performed in the Years 1819, 1820. Compiled from the Notes of Major Long, Mr. T. Say, and Other Gentlemen of the Party (1822), Edwin James, botanist and geologist to the party, speculated that rainwater sinking through the Great Plains soil might "be collected into rills, and even considerable streams" upon encountering a resistant stratum of rock, and flow in this fashion "in the direction of the general inclination of the country to emerge in the form of huge springs" in the area of the Ozark Mountains.

"A Romantic Voyage," The Round Table, A Saturday Review of Politics, Finance, Literature, Society and Art, March 20, 1869, had this to offer.

> *It is surprising, after the many exploring expeditions and prospecting parties which have penetrated into our mountain vastnesses in the West, how superficial is our knowledge of those remote districts. The fields are indeed white unto the harvest, but the laborers are few compared with the extent of territory yet lying an almost terra incognita, and strange discoveries will doubtless yet be made, when parts now difficult of access shall have been minutely explored. We confess, however, that our credulity is sorely taxed by the startling assertion that Mr. Catlin, the prairie traveler of Indian notoriety, has announced the existence of a great river, larger than the Mississippi, flowing under the Rocky Mountains; Yet such an hypothesis -- for it is nothing more -- is not so improbable as might at first be imagined. Many entirely subterranean rivers we know exist, running through deep mines and caves, coming and going no one knows whence or whither,*

We must applaud the picturesque "coming and going no one knows whence or whither." Modern journalism's lost such flair. We continue,

> *while others, in parts of their career, burrow through wound natural tunnels, to reappear as suddenly miles away; but that a river larger than the Mississippi, flowing under any mountains on the North American continent, could have existed so long without being discovered, is simply impossible, and we shall await with some curiosity the publication of the evidence upon which this singular speculation is based. Without any fanciful theories or colored exaggerations, Western rivers do present many features of peculiar interest, well worthy of examination and study; one of the most singular being the mountain defiles through which, for many miles, they often run.*

Might the subterranean pathway pass through New Mexico? "Unexplored Cave at the Gran Quivira," Las Animas Leader, January 29, 1875, provides some insight.

> *We have just had an interview with Mr. J.S. Poor, one of the parties spoken of in the New Mexican, and from him we glean the following. Himself and Mr. Brainard found the entrance of the cave situated upon the top of a ridge... They then proceeded into the cave a short distance lighted only by matches, when they heard unearthly noises, as described in the New Mexican, and withdrew for the night. The next morning the noises were the same.*
>
> *Upon our suggestion that the noises arose from a subterranean stream, he informed us that he could discover nothing in the sound that indicated it. Yet we are satisfied that such must have been the case. We are of the opinion that it is the same stream that runs through the cave near Fort Stanton and breaks out just below.*
>
> *If our theory is correct, we may yet see that stream brought to the surface by artesian wells and a fine agricultural section opened and improved by its means.*

As Ft. Stanton 120 kilometers from Gran Quivira, it's a lengthy tunnel.

Suffolk County News, Aug 4, 1894, melds western legend and a reasonably-correct description of the Ogallala aquifer discussed in Chapter 39, Hydrogeology.

> *Believed to Come from Rivers Which Drain the Underground of the Rockies.*
>
> *It has often been remarked that the Missouri, which is the principal drain of the vastness of all North American basins, is but a small stream in comparison with the country which supplies it, and the conclusion seems irresistible that there are subterranean channels by which its waters are carried off.*
>
> *The underground rivers of Dakota, from which the extensive artesian water supply of that region is obtained, are believed to be directly connected with the upper Missouri River where it passes through the canyons of the mountains. It is known that there are enormous subterranean rivers flowing under Texas, for they have been tapped by artesian wells at many places, and notably at Waco. There are in the heart of the continent several basins of great*

extent which receive large drainage from the surrounding country, but have no surface issues. There is good reason to believe that enormous volumes of water find their way into every sea by submarine debouchments and the conformation of the continent makes the Gulf of Mexico a most likely recipient for such discharges.

Texas artesian spring

"Exploring an Underground River. Remarkable Watercourse beneath the Surface of Texas," Chicago Daily Tribune, July 6, 1891,

Kendall County possesses one of the wonders of the world. The winding cave, with its underground river, which was explored a short time ago, has been found a wonder of the first magnitude...

It was understood that a boat would be on hand to convey the explorers over the dark river, but in this they were disappointed. Lumber had been procured with which to build a raft. This craft was constructed inside the cave's mouth and at the point where the water began to deepen, but it was found inadequate to carry even one passenger, and could therefore be used only to carry some of the lights necessary to search out the way...

There can be seen large stalactites hanging down from the domes above on either side of the wide and lofty passage until their nethermost tops touch the inky surface of the water that flows black and impenetrable through the clear cut channel of this subterranean river. At other places the stalagmites rise from the river's bottom and point with snow-white fingers over the water surface to the domes overhead...

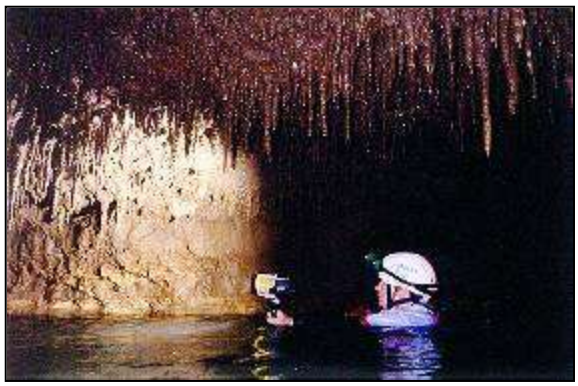
After traveling a distance of about 200 yards, and turning a sharp angle that cut off the last ray of daylight, the exploring party reached the edge of the water, where the entire floor of the cave is occupied by the stygian stream. Here the raft was launched and proved to be almost useless, and here the hardy and venturesome explorers stripped themselves and waded into the water and chattered their teeth. It was a great pity that no boat was there...

The party continued the journey into the bowels of the earth, sometimes wading and at other times, swimming, for a depth of ten feet of water was found in several places... But the party went bravely on, floundering to and fro and trying to keep warm by exertion and good-natured romping and jostling of each other...

There was one feature especially worthy of notice and consideration, and that was that the farther the explorers went into the earth and the farther they followed the sluggishly flowing river, the deeper became the water and the wider the channel and more expansive the black void of the cave...

Far away could be heard a low, deep murmuring as of distant thunder, now advancing and then receding, while around and over the explorers, heads were damp, cold, silent walls, dark, dreary, and despotic in their awful grandeur.

Honey Creek Cave, which this appears to be, is the state's longest at 33 kilometers.



The river-under-Texas report was widely circulated. From the Phelps Citizen, September 11, 1911,

> *According to geologists, the largest underground river in the world flows from the Rocky Mountains underneath New Mexico and Texas, emptying itself in the Gulf of Mexico. The river is thought to be in places several miles wide, and it is believed that it feeds rivers that flow on the surface. The artesian wells of Texas are said to take water from this river, often from 800 feet below.*

Change a few words and we have the October 2, 1911, Sabbath Recorder.

> *Geologists are claiming that the greatest underground river in the world flows from the Rocky Mountains underneath New Mexico and Texas, emptying itself in the Gulf of Mexico. This river is thought to be in places several miles wide, and it is believed that it feeds rivers that flow upon the surface. The artesian well belt of Texas is pointed to as the uplifting of the water from this river, often from 800 feet below.*

Or from the Tombstone Epitaph, January 14, 1912,

> *Geologists are claiming that the greatest underground river in the world flows from the Rocky Mountains underneath part of Arizona, New Mexico and Texas, emptying itself in the Gulf of Mexico. This river is thought to be in places several miles wide, and it is believed that it feeds rivers that flow upon the surface. The artesian well belt of Texas is pointed to as the uplifting of the water from this river, often eight hundred feet below.*

Or as simply stated by the Wichita Daily Times of October 5, 1911,

> *A subterranean sea has been discovered under Texas, but whether it is water of brimstone is not yet apparent.*

As brimstone is a name for sulfur, however, the nose would have answered the question.

"Underground Rivers of Arizona," Mohave County Miner, January 20, 1912, heralded a bright future.

> *Recent investigations of the underground waters of Arizona and Texas, completed by the geological survey, his developed the theory that there is a great underground river extending through Arizona and Texas, and emptying into the Gulf of Mexico. No attempt has yet been made to secure water from this great river, but as it is being traced out it is probable that it will be used for the irrigation of a great acreage, if it can he made available. The survey has for many years been investigating the underground flows of the different states and its discoveries have been of material advantage in the securing of artesian water in sections heretofore believed to be waterless. Should the further investigation of the underground flow prove that waterless sections of our new state can secure artesian water it will make available some of the richest lands in the world. The peculiar ebb and flow of water in the Silver Creek section of this county, would lead to the belief that there is a flow from some point far to the north, which rises*

with the Colorado River and forms springs high on the mountainside, to diminish and fail as the river subsides late in the summer.

"Strata of Water" in the Florida Mirror, March 24, 1891, saw great advantage for the West.

The theory has been advanced that the earth abounds to an extent more than is now believed in underground rivers which flow in various directions at different depths. What becomes, for instance, of the waters that melt from the everlasting snows of mountain tops? They do not all run off upon the surface, that is plain. Rivers have frequently been discovered in caves far underground, rivers that had, as far as could be found, no outlet, yet they flowed on with a current as swift as that of streams above ground.

One explorer of subterranean waters claims that there is at least as much water in the underground river streams and lakes as there is upon the surface. He himself is confident that he has located and traced for a distance of eighteen miles one stream in Dakota which is from ten to fifty-five feet wide and over four feet deep.

From these subterranean streams the water for irrigating the arid plains of the west will be obtained, it is expected. In mountainous regions the subterranean streams will he found to take their origin. If, then, shafts are sunk and tunnels dug in the proper direction an exhaustless supply of water can be obtained from this underflow. The underflow of water is, in fact, now earnestly engaging the attention of the United States department of agriculture.

To this point, the article is fairly standard in the enthusiastic promotions of the era. Here, however, the writer ventures further, implying that the vast underground caverns might be a suitable shunt for those pesky Mississippi floods.

Artesian wells, tunnels and- reservoirs near the head waters of rivers are the means looked to irrigate the great west, and perhaps in time many parts of the east, too. Persons with brains in their heads are beginning to wonder seriously why the great rivers like the Mississippi, Ohio and Missouri should be unchained and play havoc with the country along their banks when the water might be drawn off' into great reservoirs at flood time and kept to irrigate parched fields in the dry season.

Not all were equally enthusiastic, however. We quote the Coconino Sun of Flagstaff, Arizona, September 28, 1901.

Someone desiring to exercise their imaginative powers sent a yarn to the El Paso Times to the effect that a vast underground river had been discovered near Safford, and that our sister city was all excitement and jubilation. The article has been copied and recopied all over the territory, and should now be branded and turned out. The valley has been as sleepy as an "amen corner" in church. It would take two or three such rivers us the imaginary one described to stir up anything resembling excitement around here.

But as we seen time and time again, beliefs resurge, as illustrated in "Disaster, Part 1, Lubbock is Running out of Water," Texas Monthly, December 1974.

But even if the available land had been endless, that rush would be dwindling nevertheless. There are still some mossback farmers in the region who will tell you that the Ogallala aquifer will never run dry. "Fills back up when it rains," a terse cotton farmer from Floyd County said. But those poor souls are clinging to an illusion that in slightly different form was widely believed even as late as the Forties -- that the Ogallala was inexhaustible because it was actually an underground river. Its source was supposedly either melting snows in the Rockies or melting glaciers in Canada.

Perhaps the flow crosses below the Rio Grande.

An abundance of water beneath the Texas plains was recognized, but inadequately understood. "Underground Texas River, Enormous Flow Several Miles Wide at Depth of 800 Feet Traverses State," Washington Post, May 8, 1911, did little to help the latter.

> *For a time there was a theory that a portion of the southwest section of the State was underlaid by a subterranean lake, but this theory has given place to the later idea of an underground river.*

Underground lake or underground river? We tried to differentiate between the two in Chapter 27, Subterranean Waterbodies, though truth be told, both terms usually prove to be exaggerations. In the State of Texas, however, exaggerations are to be expected and "Big Underground River," Oregonian, May 28, 1911, strives to clarify the Texas quandary.

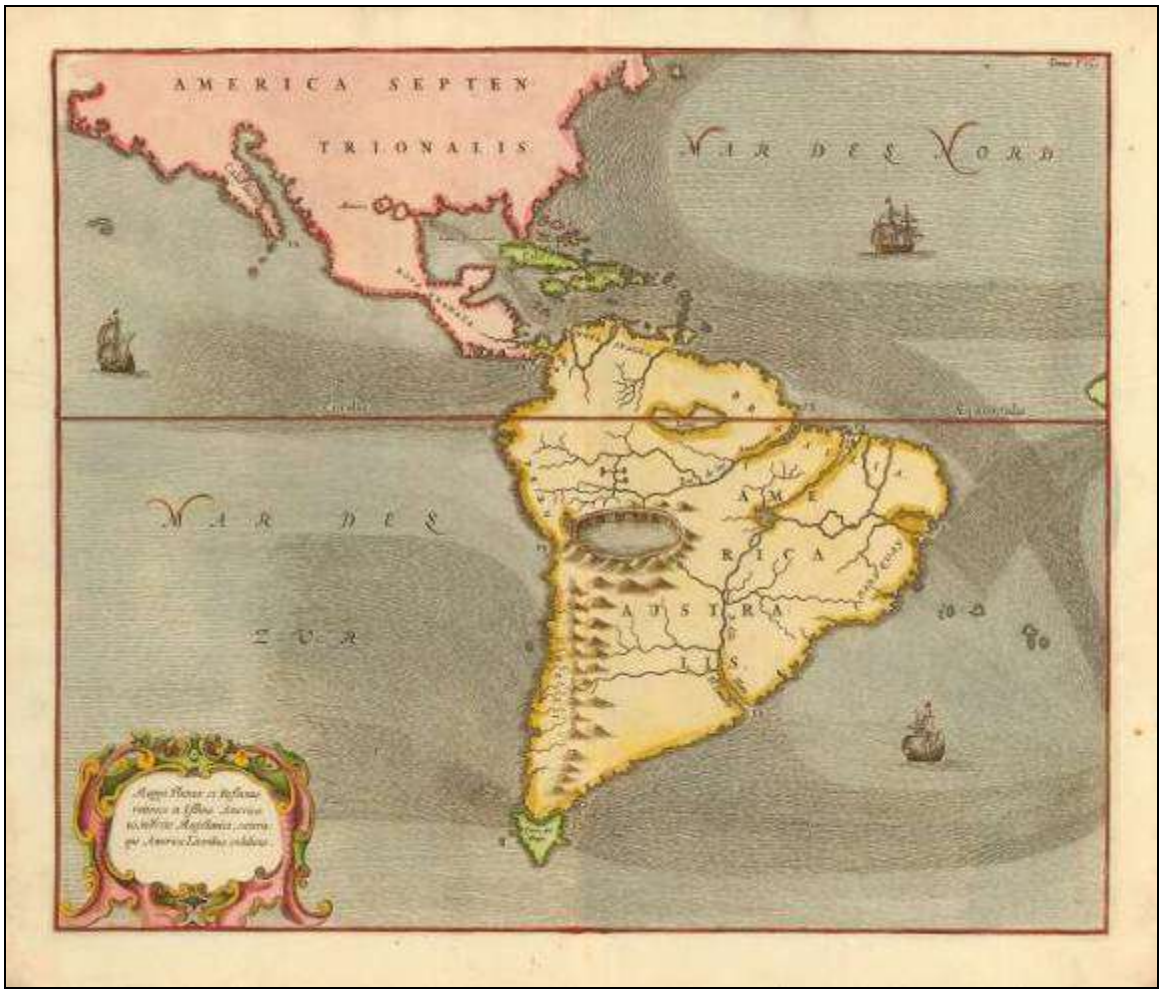
> *It is maintained by geologists that Texas has the greatest underground river in the world. It is thought that this is an underflow from the Rocky Mountains and that this stream, several miles wide, sweeps across New Mexico and the northwestern part of Texas, and from it the water supply of several streams, such as the Guadalupe and others is obtained.*
>
> *The proof that this is a stream flowing underground in the same direction as the Rio Grande is emphasized by the fact that the wells sunk north and south of a certain belt of country extending to the northwest have failed to find water, although going to greater depth.*
>
> *Geologists say that this underground stream flows almost southeast from the Rocky Mountains to Sutton County, Tex., and directly south for at least 100 miles and thence southeasterly to the Gulf. Upon this theory the great artesian belt of Texas is accounted for.*

The piece concludes with what seems to be a scientific update.

> *For a time there was a theory that a portion of the southwest section of the state was underlain by a subterranean lake, but this theory has given place to the later idea of an underground river.*

It's neither a lake nor a river. It's a collection of aquifers.

Nowhere in our journey do we seem to evade Father Kircher. "Mappa Fluxus et Refluxus rationes in Isthmo Americano," in his d'Onder-Aardse Weereld (1682) shows Lake Titicaca as the crater headwater of the Amazon, the Andes as a range of live volcanoes, and Mexico City floating on one of two lakes connected underground to the Gulf of Mexico. Note the turbid plume.



We'll encounter yet more of this great subterranean vein of the American heartland in our concluding chapters. Citations to come include:

> *Some of the maps consulted... showed the lake in the vicinity of where Salt Lake now is, it was reported as a long lake, three of four hundred miles in extent, narrow with two outlets... either apparently larger than the Mississippi River.* -- Chapter 99, Why Do We Believe What We Believe?

> *I am convinced that the river which brought me here flows on into the Gulf of Mexico, and that, sooner or later, my log will be picked up. Perhaps this river is really the source of the Gulf Stream.* -- Chapter 94, The Rio San Buenaventura.

Just as the destination of waters from the American Midwest has been the subject of bold speculation, so has the source. Perhaps it's not the Rockies.

"Captain Livermore" who supposedly conducted a topographical survey of West Texas in the 1880s for the US Army claimed the groundwater to be of Arctic origin. In "Uncle Hank Smith, Down the Reminiscent Line, Crosbyton Review. February 29, 1912, settler H.C. Smith recalled Livermore's theory.

> *The only power that could ever exhaust the Plains water supply would be an earthquake that would crack the flint bottom of the underground river and give the water another channel.*

The Arctic underground river theory persisted for some decades. "Exploration and Tests of Underground Water on the Pains" by Don Biggers in the 1941 West Texas Historical Association Year Book concluded,

> *Livermore was right. It was not melted snow from distant mountains but glacier water from the Arctic, thousands of miles. How it gets to the Plains and then spreads out is a matter to be worked out.*

In installing one of the earlier irrigation pumping plants near Lubbock in 1911, Biggers recalled that he had noticed a movement of water across the bottom of his shallow well "at the rate of about a mile an hour."

Conclusion

If in fact no Mississippi-scale subterranean river actually flows to or from the American heartland, we're not distraught. Where geology doesn't provide, we have our imagination.

As T.S. Elliot wondered, “At what point in its course does the Mississippi become what the Mississippi means?”

To which Mark Twain's might have replied, "It's not about the water's depth, Huck; it's when our imaginations draw us into the current."

CHAPTER 87
TO LIE LIKE A MULHATTON

"To lie like a Mulhatton" -- prevarication in the superlative degree, a tall tale

This chapter deals with the subterranean river beneath Birmingham, Alabama.

What subterranean river? we may ask.

The one below the Pittsburgh of the South, we are informed, a well-known geologic feature, albeit one eluding confirmation.

Consider, for example, this excerpt from the Birmingham Iron Age, August 5, 1886.

> *Every place has its mystery. Birmingham has its underground stream of water, and other places have their haunted houses, but our county has lately been visited by a mysterious occurrence which baffles the skill of those who have attempted to unravel it.*

The Age then describes the inexplicable bombardment of a remote cabin by falling stones, but our interest is in article's the lead-in, Birmingham's mysterious underground river.

Knowledge of the underground stream predates European settlers, it seems. From The Valley and the Hills: An Illustrated History of Birmingham & Jefferson County (1981) by Leah Rawls Atkins,

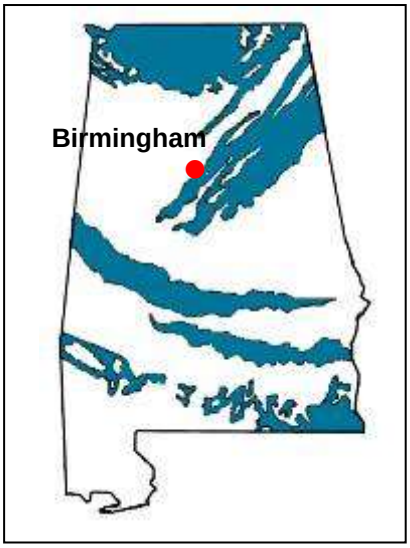
> *The early settlers of Jefferson County knew the Indians well, and as time passed and the tribes vanished from the valley, they shared their childhood stories of Indian legends with their children. One of the most popular stories tells of two Indian braves*
>
> *Another Indian legend of the valley told of an underground river that ran the length of Jones Valley. Indian children, when they came into the white settlements to trade at the stores, would play with pioneer children and tell them stories of how they had come from a long canoe ride on this underground river.*

But indeed, the story is much more than vaguely-recollected lore.

To understand the nature of subterranean boating beneath Birmingham, we should be aware of two facts, one relating to geology, the other, to a particular personality.

Fact 1: Birmingham's Karst

As indicated by the map of Alabama's karst, the floor of Jones Valley consists of limestone. There would be karst caverns and with them, some likelihood of subterranean water.



That much said, however, the Birmingham environs don't rank high in the ranks of karst wonderlands.

The city has had its share of sinkholes, "Man's Front Yard Goes Underground," Tuscaloosa News, January 15 1961, providing an example.

> *A Birmingham resident said Saturday that about 25 square feet of his front yard and two pieces of shrubbery disappeared in an underground river Friday night.*
>
> *David Holland of the Midfield community said the water is about 15 feet below ground level and that the river measured nearly 70 feet deep at that point.*
>
> *Neighbors speculated that the river probably stems from a spring a few blocks away which dried up a few years ago.*

But in the spectrum of south-eastern United States sinkholes (Chapter 41), Birmingham's instances are not particularly noteworthy.

The Birmingham area sports two tourist caves, each terminating in a small pool, but neither fed by a flowing stream. Both caves have been popularly said to extend to underground channels, but hydrologic evidence fails to support the supposition.

Rickwood Caverns
State Park
60 kilometers north of Birmingham

Length 1,600 meters. Blind cave fish. A 20-meter deep underground pool from which there is said to be a connection to an underground river. Divers exploring the pool prior to 1974 found nothing.

Rickwood Caverns
$8.00

DeSoto Cavern
Private Enterprise
60 kilometers south-east of Birmingham

Formerly known as Kymulga Cave. 12 stories high main chamber. Legend that the cave extends for kilometers, but it ends at a small pool 300 meters beyond the main chamber.

DeSoto Caverns
$9.99

The city has had its share of foundation flooding, but little different from the building history of most cities. It's why excavation contractors have pumps.

Access to an "underground stream" near Highland Avenue and 12th Avenue South was sealed by the city in the early 1900s because it posed a danger to children.
Construction of the Tutwiler Hotel in 1914 was delayed by the need to add steel beams to the foundation in order to span a subterranean cavern.
The never-completed Roden Hotel was limited to a single-story basement because of groundwater.
The Florentine Building (1927), which was planned to be ten stories, only went to two stories, partly because of the expense of shoring the foundation.
Excavation for the Federal Reserve building's 1957 annex had to be pumped out continuously during construction.
Construction of the Daniel Building in 1967 was delayed as engineers searched for areas of solid bedrock between limestone cavities on which to erect its caissons.

Testimony in "Letter from the Secretary of War, Transmitting, with a Letter from the Chief of Engineers, Report on Preliminary Examination of Valley Creek, Jefferson County, Ala., June 6, 1919. -- Referred to the Committee on Rivers and Harbors," United States Congressional Serial Set, Issue 7643, refers to the Birmingham underground river.

Further Statement of T.A. Weller, Member of the Birmingham Chamber of Commerce.

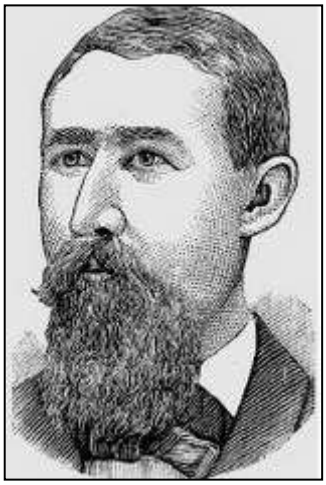
> *Right here are artesian wells [indicating]. They went down to 130 feet and then put powerful machinery on them to get them lower, but they could not go lower. The water is there. The president of the pipe works told me that if you go down 30 feet you will strike an underground river. That would give us all the water we want at this point here.*

Mr. Weller can tell Congress what he likes, of course, but his choice of words is hardly proof of anything resembling a river.

The fact that the Birmingham region has some of karst features is not ipso facta geological evidence of a subterranean channel beneath Birmingham. This isn't to say that no such river exists, of course, but rather to say that the assertion of such a feature is no stronger than what might be speculated regarding most any south-eastern city.

But there's more to subterranean streams than the karstology.

Fact 2: Joe Mulhatton, Traveling Salesman



Joseph Mulhatton (1851-1913) was a traveling salesman notorious for his farfetched tales reported as news. Newspaper editors surely recognized Mulhatton's stories to be fabrications, but in the spirit of one-upsmanship journalism, they printed them anyway, and in so doing spread the hoaxes across the nation.

Mulhatton described his creations as “novelistic journalism." In a December 1900 article, the Syracuse Sunday Herald, stated of Mulhatton, “He never made a cent by his lies and in ordinary business affairs he spoke the truth, but he had a mania for giving misinformation to the newspaper and indulged himself in the mania to the injury of his other business.”

By the beginning of the 20th century, "to lie like a Mulhatton" was a common expression for a preposterous tale.

Stories by or attributed to Mulhatton include:

George Washington Petrified (1877) Upon opening Washington’s tomb for repairs, it was discovered that the former President's body had been petrified, “the features perfectly natural, with the exception of eyes and ears, no trace of which can be seen. The body is of a dark leathery color, and may be said to be soft sandstone, which would likely break should an attempt be made to remove it from the sarcophagus.”	Grand Crystal Cave (1878) According to the Cincinnati Commercial, June 22 of that year, the cave is at least 23 miles long. “A span of horses can easily be driven through for a distance of eleven miles." There are “three rivers, wide and very deep,” one of which “is navigable for fourteen miles, until the passages become too narrow to admit a boat." A local entrepreneur has intention of offering steamboat rides. In 1883 Mulhatton told an interviewer: “I am prouder of my Glasgow Cave story than any of the others. It showed more invention and more imagination.”
Carried Away by Balloons (April Fool's Day, 1880) A Galveston lady bought a bundle of toy balloons from an Italian peddler and tied them to her child's wrist, upon which a sudden gust of wind carried the innocent aloft. The child would have been carried over the water if a skilled marksman who happened to be present hadn’t shot the balloons one at a time.	Texas Meteor (1883) A giant meteor has killed several head of cattle and completely destroyed the home of a Mexican herdsman, Martinez Garcia. Afterward, "the air was filled with sulphurous gas." The meteor, still hot and steaming, imbedded 200 feet deep in the earth and towering 70 feet above ground resembles the Court House at Fort Worth.
Star of Bethlehem Discovered (1887) Professor Klein has sighted the star of Bethlehem. As the star appears once in 300 years, astronomers had been looking for it for some time.	Monkeys Pick Hemp (1887) J.B. Parkes, a local farmer, has trained monkeys to pick hemp. If other farmers imitate his example, honest laborers will be put out of work.

North Carolina Breathing Cave A strong air current is emitted with a loud roar from a cave for several hours of each day. When the outward current ceases, the air rushes back with a roar equally as loud. People in the neighborhood believe that the earth is a huge animal and the cave is the mouth. Mulhatton seems to be rehashing a viewpoint of Aristotle. Chapter 50, Wrecks of Ancient Life, noted a similar breathing cave reported in 1910, the cause attributed to a subterranean stream.	Magnetic Saguaro Cactus In the Arizona desert grow two kinds of cacti -- those positively charged by the copper in the soil and those negatively charged. Approaching too close to the positively charged variety, one is drawn into its prickly embrace. Negatively charged saguaros, on the other hand, will repel one's body, flinging it into a waiting, positive-charged counterpart.
Carload of Cats On a certain date a buyer was said to be arriving to purchase a carload of cats. Cats were brought from all directions, but when the purchaser failed to materialize, the owners were doomed to disappointment and the freight agent had to return an empty car, instead of one loaded with felines.	The Cave in Pike County. Rooms filled with magnificent jewels. Long halls lined with great blocks of virgin gold. Subterranean rivers rippling over beds of diamonds. It's Sinbad, Chapter 17, Underground Rivers in English Fiction

We'll slip in another underground river yarn, this one in Montana, to illustrate how Mulhatton became a standard for tall-tale spinning. "Unlicensed Mendacity" from the Daily Yellowstone Journal, May 17, 1891,

> *The Glendive Independent promulgates in its last issue a yarn that dwarfs the most robust productions of the fertile brain of Mulhatton. It is about a mysterious circular basin hidden away in the buttes a few miles from Glendive, containing a lake, a river, and abounding with all sort of game, including buffalo. Caves in the cliffs indicate former occupation by man, and broken pillars and other remnants of pre-historic architecture show the dwellers to have been highly accomplished in the mechanical arts.*
>
> *The river having reached the end of the valley or basin, takes a short cut through the mountain, and this route the discoverers -- who are insufficiently described as "two gentlemen of Glendive" -- determined to pursue. Taking possession of a raft which they found handy, they entered the underground course of the river and after a time -- how long is not stated -- emerged into plain every day Dawson County sailing on what is known as Beaver Creek and fetching up at* Mingesville [Wibaux]*, from where they returned to Glendive. "The gentlemen" propose if possible to again find the entrance to this wonderful locality and explore it more minutely.*

The terrain between Glendive and Wibaux suggests how mysterious must be such a valley for it to have remained hidden from human eye.

The Montana account reduces to much the same plot as that of any number of fictional works we encountered in Chapters 17-26, except, of course, this one made the newspapers.

In the scope of falsifications, the Atlanta Daily Constitution, March 30, 1880, caught Mulhatton red-handed.

> *The report of the discovery of oil in or near Birmingham is entirely unfounded. Mr. Mulhatton, who sent the statement, is altogether too sudden and sanguine as a news gatherer. There are no signs of oil, or any prospect of an oil well.*

If a small lie fails, perhaps thought Mulhatton, try a bigger one.

Mulhatton's 1884 report of Birmingham Alabama's failing stone crust, to which we will devote more attention, drew national attention, but first, let us note that the period's interest in waters below the metropolis. Mulhatton was astute at striking where the iron was hot, and by 1884, the topic of a subterranean stream beneath Birmingham was on people's minds.

In 1871, R.H.L. Wharton purchased the "water privilege" for the city and dug wells on 2nd Avenue at 20th and between 20th and 21st Streets. The latter well was reported to have struck an underground stream and to be inexhaustible. Wharton's wells were closed after the establishment of the Birmingham Water Works in 1872.
In 1881, the area near 18th Street and 5th Avenue attracted a "large number of new settlers around the big spring."
In 1883, it was reported that men engaged in boring an artesian well in the city struck what seemed to be a small flowing stream of water at a depth of 100 meters.
An office in the vicinity of 5th Avenue and 22nd Street advertised "Mystic Underground River" excursions during the 1880s

”Birmingham's Wonder: The Curiosities of an Underground Stream -- How It Was Discovered," Atlanta Constitution, August 17, 1884,

While Atlanta is anxiously awaiting the slow descent of the dismal drill into the archaean rocks upon which she rests, with the fond hope than from these rocks there will gush forth 'ere long streams of limpid water, her young sister city has made a discovery that promises to be of incalculable benefit. This important discovery being nothing less than the finding of a bold subterranean stream of pure water passing from one end of the city to the other, and supposed to be about fifty feet underground.

How It Was Discovered. During a hard rain a few days ago it was observed that the water flowing along the large open sewer on Fifth Avenue suddenly disappeared at a certain point. Investigation showed that it was flowing into a newly made aperture in the bottom of the sewer. This aperture at first seemed but an insignificant hole, but upon peering down into it one could see that the water was dashing down into a large dark cavern.

Thursday under the direction of Mayor Lane, two strong men with ropes tied around their waists descended into the cavern forty feet. They did not go down perpendicularly but took a stopping direction, stepping from crag to crag, following the dip of the huge limestone rocks. In a short while after they had gone down the signaled their comrades on the surface to draw them up. Upon reaching daylight the men stated that they did not get to the bottom, but heard what sounded like a large stream of water rushing along beneath them.

A Lime Sink Known Years Ago. Some of the old citizens in this section before Birmingham came into existence... say this stream was known to them years and years ago; that farm hands were accustomed to going to a "lime sink" about where Fifth Avenue and Twentieth Street intersect, and attaching a plough-line to a small tin bucket, would lower this vessel into a small aperture, and then drawing it up would quench his thirst with the cool refreshing draught.

As reported in the Birmingham Iron Age, August 21, 1884,

Hands are busy at work opening up the inlets to the underground river. One of the openings is on Fifth Avenue behind Twenty-second and Twenty-third Streets, the other in East Park, near the public school building.

In the same issue, "The Subterranean Stream,"

Exploration Made for Thirty Feet -- Water Not Found, but Thought to be Heard.

Mr. Lacy, boss of the street gang, and a Negro man made an exploration a few days ago for the subterranean river. They went under the ground from the big sewer, through a hole in its side in front of a tenement house on Fifth Avenue between Twenty-first and Twenty-second Streets. Stepping from ledge to ledge, with ropes around their waists, they descended about thirty feet, but their heads began to ache from the impure air that they returned. They first reached down for water, however, with poles about nine feet long, but as they didn't touch bottom they were little the wiser for their trouble, though both thought they could hear a stream.

Local News. The same issue of the Birmingham Iron Age noted another advantage of such a stream.

> *Mayor Lane says he intends to have investigations made until the question of the existence of a good-sized stream is settled one way or the other. Even though it couldn't be made a water supply for the city, he explained, it could be made a valuable draining duet.*

Regional News. As reported by the Atlanta Constitution, August 28, 1884,

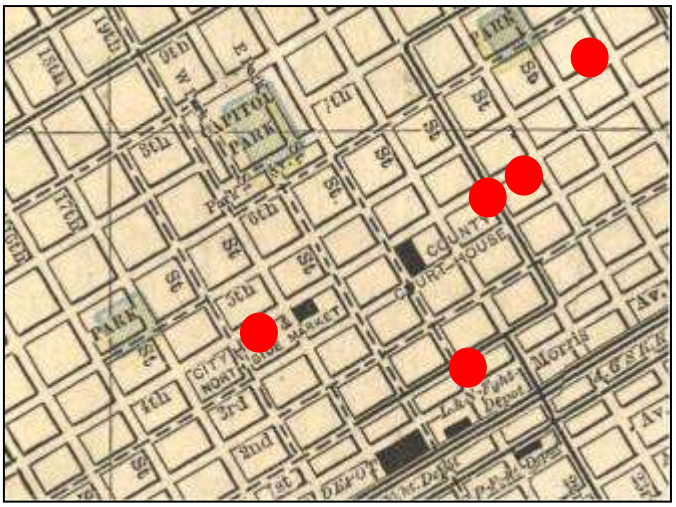
> *Birmingham, Ala. The underground stream is still the topic of conversation. It is about settled that it can be utilized as a main sewer.*

National News. "News Notes," Saturday Evening Post, November 29, 1884, contained the following.

> *An underground stream flows beneath the city of Birmingham, Ala. It is said to be used for a sewer.*

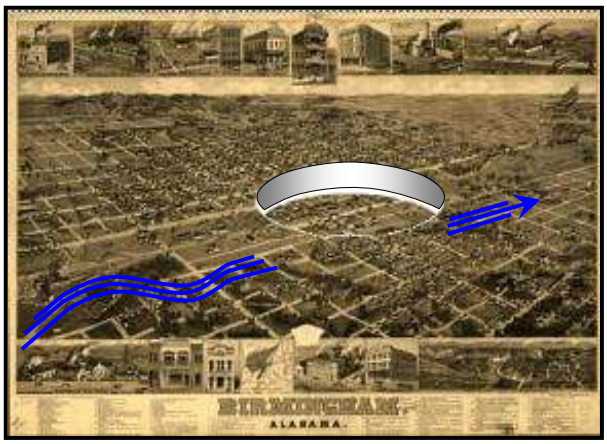
Unlike the Bellevue, Ohio scheme described in Chapter 81, Mainlining the Sewage," however, this particular possibility never came to be.

We've noted the locations on an 1892 map. The location of Birmingham's underground river seems well pinpointed.



Mulhatton expanded the artesian well news item into a headline-grabbing account of a subterranean river endangering the entire city. In excavation for large building, according to the report, the stone crust bridging Birmingham's underground river had been pierced and was now giving way. Buildings were collapsing and a corner of the City Hall had settled a meter into a fissure which was yet widening. Soon the entire structure, along with much of the downtown area, would disappear.

We've doctored a period sketch of Birmingham to indicate the consequence of the fabricated disaster.



Mulhatton sent his story to the Louisville Courier-Journal -- Birmingham readers would know that their City Hall wasn't collapsing -- from where it was relayed by newspapers across America. Birmingham was flooded with telegrams requesting details.

While Joe Mulhatton made no money from the yarn, others saw opportunity. "The Water Under the Earth: An Exaggerated Idea Prevalent Concerning Birmingham's Subterranean Stream," Atlanta Constitution; October 12, 1884, cites one such case.

> *Birmingham, Ala. Inquiries from all sections of the United States are being made relative to the stream that is supposed to beneath this city, and it is very evident that an erroneous impression with regard to the size of the stream prevails throughout the country, produced, no doubt, by articles apparently written in a spirit of Joe Mullatonism. A shrewd Selma negro took advantage of the exaggerated idea and got up the biggest excursion of the season in Birmingham. He advertised that a boat plying the subterranean river would give a free ride to the excursionists. They came by the train load, and spent the hottest day of the year vainly endeavoring to find the hole that led to the boat landing.*
>
> *The negro who got up the excursions has not returned to Selma.*

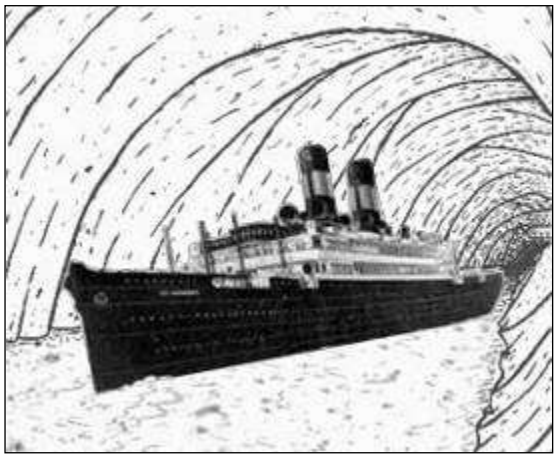
Pleased with the hoax, Mulhatton followed up with "Underneath Us." That this story first appeared in the Birmingham Iron Age, August 28, 1884, attests to Mulhatton's skill at keeping his story close to the believable.

"Underneath Us" is prefaced with "To the Age," as if from a commissioned correspondent. That the story's main character is one "Prof. Joseph Mulhatton" makes the joke all the more ludicrous.

> *The discovery of a great subterranean river under Birmingham has been the great topic of conversation the past week. Great excitement has prevailed, and so great was the interest taken in it that Dr. Jos. R. Smith, W.S. Brown, Wm. Hood, T.J. Brown, T.J. Brown, Wm. Burney, Geo. C. Kelly, J.B Earle, and other leading citizens held a meeting at which it was decided to telegraph Prof. Joseph Mulhatton, the great Kentucky scientist and cave expert in the facts of the case and urge him to come at once and make a thorough exploration. The result was that Prof. Mulhatton arrived from Louisville on Friday evening, and spent all day Saturday exploring the great subterranean wonder. A strong boat was quickly improvised in the cave from lumber which was lowered through the narrow inlet and the party proceeded down the river for at least fifteen miles before there was any obstruction to prevent them from going forward, and then it was a narrow formation of recent origin that can easily be cleared away. The natural tunnel through which the river flows is almost uniform width, and say about 300 feet for the distance of the fifteen miles navigated, and for height is at least 150 feet, so that a steamship of the largest class could navigate it with ease; the depth of the stream varies from 45 to 70 feet. It is connected with tide water, and this will give Birmingham a wonderful and cheap direct outlet to the sea, for the products of it furnaces, its mines and industries generally.*

We cited Horace Mann's 1851 suggestion of a Mammoth Cave underground steamship in Chapter 55, Then, Madam, You Should Go and See the Great Cave in Kentucky.

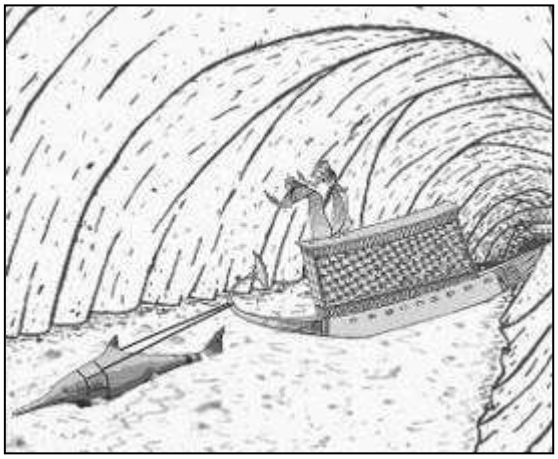
To the right is our rendition of Mulhatton's vessel which we'll dub one of the Birmingham-Gulf Steamship Line.



The above is Mr. Mulhatton's first impression of the wonder, which is fully corroborated by all of his party of daring explorers. But this is not all; Prof. Mulhatton has this to say of it: "The great subterranean stream recently discovered under the city of Birmingham is undoubtedly the most remarkable discovery ever made on the American continent. The river is greater in volume than the mighty Mississippi. Its vast subterranean bed is undoubtedly due to the grinding and cutting of immense icebergs during the glacial period. Then at a subsequent preadamite period violent upheavals of the earth toppled over the mountains which forms the present grand archway through which the iceberg continued to cut leaving it as it now -- a natural ship canal to the Gulf of Mexico. A prehistoric race undoubtedly utilized it for the transportation of metals from this section to the sea where they were transported to various points of the world. Furnaces on a scale scarcely so magnificent yet as satisfactory in results to those prehistoric people undoubtedly existed on the present site of Birmingham, as ruins of those, and of ancient sun-temples are found in various parts of the country."

"Added to this," says Professor Mulhatton, "we discovered in niches of the cave numerous articles of bronze, also statuary, numerous Masonic emblems, and mummies with sandals on their feet -- all in a perfect state of preservation. We also discovered the remains of marine monsters on the dais or old red sandstone period, prominent among them the huge ICHTHYOSAURUS, which was undoubtedly used by these prehistoric races to drag their ships from what is now Birmingham to the Gulf of Mexico. These extinct sea monsters were docile and harmless, and were harnessed to the ships laden with pig iron, which they pulled to the sea with the greatest of ease. They were more powerful than the most powerful locomotives of the present day. Hulls of these subterranean ships are scattered all along the banks of this great subterranean stream."

Assuming Mulhatton's ancient Birmingham civilization to be somewhat Egyptian-like, here's an idea of how the ichthyosaurus might have been harnessed.



Further explorations will be made today by Prof. Mulhatton and his scientific party, and the next reports will be eagerly looked for by the readers of the Age as the wildest excitement now prevails over these latest developments. Thousands of people have been crowding around the entrance to the river clamoring for admission. Prof. Mulhatton saw numerous eyeless fish and eyeless sea-monsters of the shark species; also eyeless amphibian animals of the alligator and reptile tribe. He says a company should be formed at once to clear the river of any obstructions, and that boats and barges to navigate it should be constructed at once. As the entrance to it is on one of the streets of the city, it will therefore belong to the city and cannot be claimed by any private individuals.

"An Underground Wonder" in the Birmingham Iron Age, September 25, 1884, illustrates the public reaction.

A Greenville N.C. Gentleman Wants to Know About the Mystic River

The following letter has been received by a citizen of Birmingham:

Dear Ed.: Last night I read an article copied from the Birmingham Age, which gives an account of the discovery of a wonderful subterraneous river at Birmingham. There are some things in the article that sound like the truth, but there are others that sound like the work of a vivid imagination. I am very anxious to know the "whole truth and nothing but the truth." For this I write to you. Your friend, Z.D.M.

Mulhatton would have been doubly pleased, as a well-tempered hoax snares the gullible, while at the same time, leaves the victim scratching his or her head.

Local lore of a subterranean stream was enhanced by "A Voyage on the Underground Stream," Birmingham Iron Age, June 3, 1886, written by "H," possibly "Mulhatton" sans first syllable, but more likely someone simply lying like a Mulhatton.

The fact that there is a large stream flowing under this city is well known, but the writer and a companion are doubtless the first voyagers upon this mysterious stream.

Sunday afternoon my friend George and myself went to Avondale for the purpose of exploring the cave. We carried a lantern, and by the aid of its light we penetrated to what was apparently the end of the cave, where we paused to rest a moment before returning. While seated on the rocks, we both distinctly heard the sound of running water.

"Let us see what it means," said George, pulling away a large boulder from a small opening through which the sound seemed to come. When the stone was removed it left an opening large enough for a man to crawl through, and just beyond this opening we discovered a stream of clear, flowing water, about thirty feet in width and apparently about five feet in depth. The

bed of the stream seemed to have been tunneled through solid rock, and there was an open space six to eight feet above the water.

"Let us get a boat and take a ride on this creek," said George... We at once decided to do so and strolled around the park until night fall, when, after considerable difficulty and hard work we succeeded in getting a boat from the lake to the cave and finally launched it upon the underground stream.

"Farewell, vain world," exclaimed George, as we pushed out into the stream and began to row against the current... Talk about Egyptian darkness! Why it could have been a brilliant light in that place.

Rowing steadily up the stream for about half an hour we were brought to a halt by the stream branching in half a dozen different directions. Turning our boat around we let id drift downstream with the current which seemed to be flowing about four or five miles an hour. George and I were both satisfied with our voyage and intended to return through the cave the way we came, but we failed to discover the opening by which we entered, and after an hour we were forced to admit that we were adrift underground.

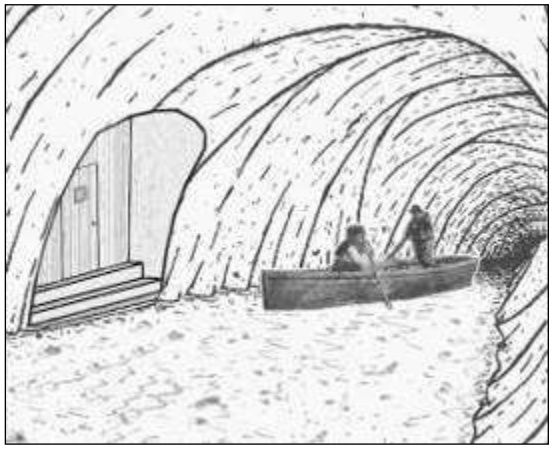
We saw there was nothing to do but drift with the current and trust to luck. We surmised from the course of the stream that we would pass directly underneath the city and the heavy rumbling of passing trains which we could distinctly hear directly overhead, assured us that we were beneath the railroads.

Gazing in silence at the wall of darkness around us, horrible little goblins with wild eyes would glare at us of a moment and then fade into the darkness from whence they came.

When we were probably two miles below the city we discovered just ahead of us a small light which flashed dim and weird in the gloom. As we came nearer to the light we could distinguish the sound of voices and the regular clanging of a small printing press. "What can this mean?" whispered George, as our boat came close to the light and we discovered it came from a small opening in the wall. With a slight dip of the oars I brought the boat directly beneath the mysterious light, and there we found a small boat anchored and steps leading from the water's edge up to what appeared to be the entrance to an underground chamber.

Securing our boat, we climbed silently up the rude steps until we could see into the mysterious room from which came the noise and light. The sight we beheld made our blood run cold for a moment. Beyond the opening was a rock-walled room about 12x12 feet containing a few articled of furniture and a small job printing press. Reclining upon a small lounge at the far end of the room was a beautiful young woman who seemed to be asleep. Seated at a small table was a dark featured man who seemed to be engraving, a negro was running the press and turning our twenty dollar bills at a very rapid rate, while at his side, apparently the ruling spirit of the place, stood the notorious and escaped convict, Steve Renfro. We had found a counterfeiters den, there was no mistaking that, but the only satisfaction afforded us by the discovery was the assurance that there was a way out of the horrible place in which we were.

Here we'll suggest another graphic, "H" at the stern and his companion George at the bow approaching the lair of the notorious Steve Renfro and his counterfeiting gang.



We'll jump ahead to where the boaters make their escape and fall asleep in their drifting craft.

> *Our first thought upon awakening was, is this not some sort of horrid dream? But the hoarse murmur of the now swiftly flowing stream and the wall of darkness around us proved a stern and fearful reality.*
>
> *The current of the stream was growing swifter with every mile massed and by 12 o'clock we seemed to be going at a rate of ten miles an hour.*
>
> *About four o'clock we saw what appeared to be a star in the distance which kept growing larger and larger as we sped on through the gloom, and in half an hour from the time we first saw the light our boat shot out of the darkness upon the Warrior River.*

It's hard to suppress a popular concept, it seems, as illustrated in "Underground Streams: Birmingham as Rich in Water as She is in Coal," Atlanta Constitution, March 25, 1886.

> *Much excitement exists over the report made today by W.C. Kerr, who is boring artesian wells for the water supply of the Birmingham rolling mills. Two holes have been bored a depth of five hundred feet beneath the surface. Water, pure and clear, filled the wells within twelve feet of the top. It was announced by Mr. Kerr that the water came from an underground stream, the size of a village creek, on which is built the city water works. The stream is large enough in places for boats. Persons placed their ears to the top of the hole, and heard the water rushing below.*

The topic of underground rivers encompasses the spectrum of truth and falsity; to swear by the Styx (Chapter 69) has long been a guarantee of utmost voracity, yet at the same time, tales of underground rivers have been renowned hoaxes.

The Verdict

It's but geologic speculation if Birmingham, Alabama sits above an underground river. There's no data supporting the assertion, but karst can be elusive. Not much of a story, here.

In terms of fiction, however, the city's underground river is well established. Mulhattons will long be told. As our journey has made us well aware, underground rivers are about so much more than geology.

Let us thus end our Birmingham visit with some poetry.

The August 21, 1884, Birmingham Iron Age shouldered the mantle of civic leadership and named the subterranean stream

> *The Age has assumed the responsibility of naming Birmingham's underground stream. It shall be called the "Mystic River." This name is not only a fit appellation of the wonderful unknown waters, but has a poetical ring about it which will prove of much value to aspiring poets and poetesses to illustrate.*

The Age then illustrates for us the poetic ring.

We'll idly float
In fairy boat
Where moonbeams never quiver.
Well pull an oar
To foreign shore
Down on the Mystic River

That's just the first of first of several verses, but suffice to note the poetic potential.

We'll leave the underground river in Alabama with another poem about Birmingham, the wrong Birmingham, we realize, but the British city is also an inland industrial metropolis with its own traditions of disappeared waters. As with the lost rivers of London, Chapter 79, The Sinking of the Fleet, however, the lore from England tends to stem from sounder history. We quote "Birmingham River" by Roy Fisher from The Long and the Short of It: Poems (2005).

Where's Birmingham River? Sunk.

Skipping a few lines,

Caught on the right shoulder
by the wash that's run under Birmingham,
a slow, pretty river with no memory of an ancient name

And ending,

Sank out of sight under streets, highways, the blank walls of workshops;
collected metals, chemicals, aquicides. Ceased
to draw lines that weren't cancelled or unwanted; became
drains, with no part in anybody's plan.

Offered the choice of dreary British despondency or a boldly-penned Alabama hoax, we'd rather mull the underground river of Mulhatton.

We'll end the chapter with another underground river newspaper hoax, but this one not by Mulhatton.

As chronicled in Robert L. Perkin's The First Hundred Years: An Informal History of Denver and the Rocky Mountain News (1959) with a citation to "Early Day Reminiscences of Col. T.C. Dickson," The Trail VII:7, December 1914,

Some of the early Denver bunco schemes were scarcely less imaginative than the tall tales and hoaxes which delighted nineteenth-century newspapers, including the Rocky Mountain News. Joseph E. Hood, who became an associate editor of the News, whipped up one which was republished throughout the country as a fabulous advance in geologic and geographic knowledge. Hood had been with Samuel Bowies' Springfield, Massachusetts, Republican before he came west with his Jules Verne fantasies.

With a perfectly straight face he told of an interview with a man who had made an underground voyage from the Great Salt Lake to southern Colorado. Salt Lake, he pointed out, has no known outlet. In southern Colorado there was a lake with no known inlet. The mystery of how this could be now was solved. Hood's voyager had been boating on Salt Lake and was caught in a whirlpool which bore him straight downward into the earth to a great underground river flowing in a tunnel-like cavern hung with varicolored stalactites of great beauty. The man's boat was whipped along this nether-world river for a distance of something over six hundred miles at breath-taking speed. Finally he shot upward and popped out on the surface of the Colorado

lake. Hood, by virtue of the great and cost-scorning enterprise of the News, had obtained an exclusive interview.

S.T. Sopris, late night telegraph editor for the paper, said Hood's story was copied from the News by many papers, East and West, and a goodly number of people swallowed it whole. It was the sensation of the day.

While the Great Salt Lake outlet to southern Colorado seems not to exist, we still have the reputed subterranean outlet to the Pacific revealed in Chapter 94, The Rio San Buenaventura.

CHAPTER 88
EAST SIDE, WEST SIDE, ALL AROUND THE TOWN

We include in this chapter several items which could have been thematically placed in previous chapters, but together relate to a particular location, New York City. We'll take some liberty with the chapter's title, however, and cross both the Hudson and East Rivers as needed.

Here are a few of the City's underground rivers.

The New York City Aqueducts

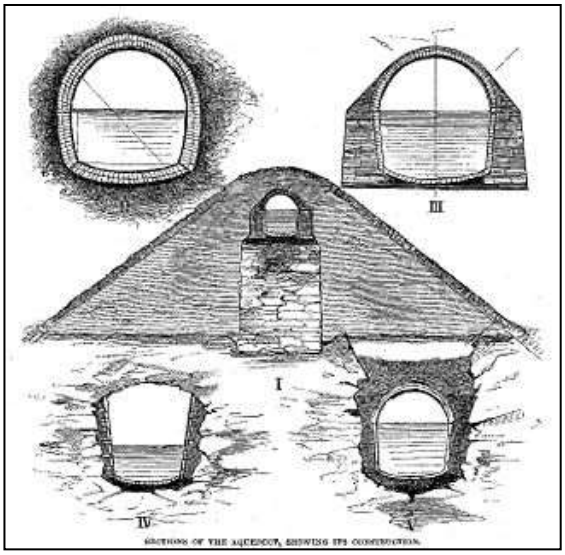
Eight million residents of New York City, and another one million upriver, daily consume 4 to 5 million cubic meters of water that flow through a network of reservoirs and aqueducts stretching from the Delaware River watershed to the Connecticut border.

The Croton system in Westchester County, which began providing water in 1842, meets about 10 percent of the city's needs.

The Catskill system, "City Tunnel Number 2," built in the first quarter of the 20th century, provides 40 percent.

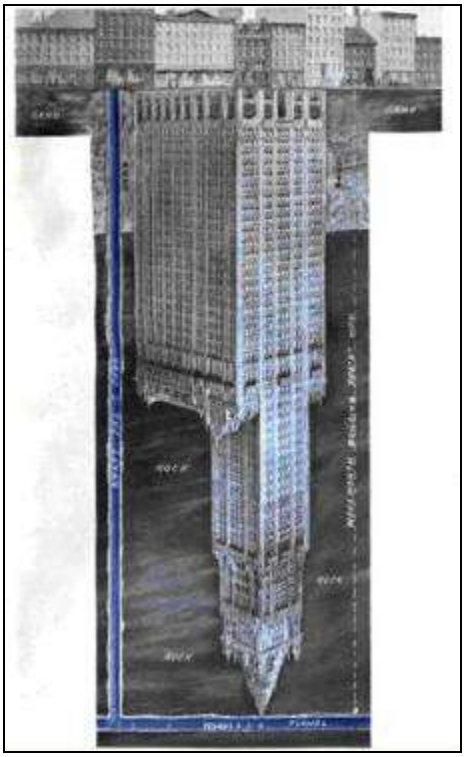
The remaining 50 percent also come from the Catskills, but through the Delaware Aqueduct, completed in 1945.

The Croton Aqueduct was a large and complex water distribution system constructed between 1837 and 1842 to transmit water by gravity from the Croton River in Westchester County 66 kilometers into reservoirs in Manhattan. The cross-sections to the right are illustrations from Harper's Magazine, December 1860.



SECTIONS OF THE AQUEDUCT, SHOWING ITS CONSTRUCTION.

To the left below, the March 1913 Scientific American lead story, "Underground Rivers...," chronicles the progress of New York City's 100-kilometer 5-meter diameter underground aqueduct to the Kensico Reservoir near White Plains.



Above to the right, the authors J. Bernard Walker and A. Russell Bond of Creating a Subterranean River and Supplying a Metropolis with Mountain Water (1914) invert a Woolworth Building illustration to comparatively demonstrate the "Subterranean River's" depth. We've highlight the excavation in blue.

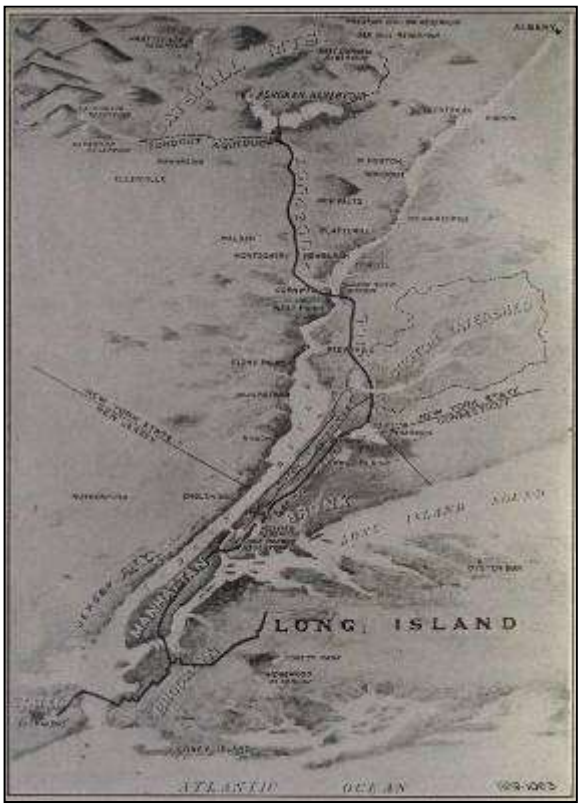
The project's objective,

> *To conduct the Catskill water into Brooklyn and Queens, it was decided to build... a course for a subterranean river which could be tapped as needed for the city's supply, and which at the same time would be so completely buried that it would never menace the safety of structures above it.*

The author's subsequently clarify, however, that it's actually not a "river."

> *The system under construction and now nearing completion consists of a large reservoir in the Esopus Basin, an underground aqueduct 17 feet in diameter by which the water is led for 64 miles to another large basin, the Kensico Reservoir*

The map to the right is from The Catskill Aqueduct and Earlier Water Supplies of the City of New York with Elementary Chapters on the Source and Uses of Water and the Building of Aqueducts and an Outline for an Allegorical Pageant (1917) by the Mayor's Catskill Aqueduct Celebration Committee.



As for the allegories,

The first symbolizes the gift of water for food production, at the same time typifying the manner in which Nature gives water to man.

The second symbolizes the gift of water for drink, and the curse of drunkenness.

The third represents the gift of water for health; in this are included the general ideas of personal cleanliness, domestic hygiene and public sanitation.

The fourth represents the use of water for fire extinguishment.

And the fifth typifies the use of water for power, its use in the industries, and its function in bearing commerce.

New York City was yet building underground rivers in the 1930s, as excerpted from "World's Largest Water Tunnel" in the December Popular Science.

Far beneath the feet of tramping millions, the longest tunnel of its kind in the world is nearing completion in New York City. Twenty miles in length, it will help distribute a billion gallons of water a day to New York homes and factories. Officially, the shaft will be known as City Tunnel Number Two.

City Tunnel Number One, completed fifteen years ago, has long been overtaxed. Hence 2,500 workmen have been toiling day and night for the last three years to construct the supplementary tunnel. To cut it through solid rock, they exploded 8,000,000 pounds of dynamite... A railroad train could be driven through the new fourteen-foot shaft.

Now abandoned -- except by tree roots -- the Old Croton, shown her beneath the Bronx.

We'll not delve into the Delaware Aqueduct because we fear becoming sucked into the leak mention Chapter 49, Finding the Underground Rivers.

Now the nation's glory days of infrastructure construction have passed and time takes its toll. According to the Environmental Protection Agency, 240,000 water main breaks occur each year in the United States. Those living in New York City are instructed to call 311 if they see one.

East Side

To the east lies Long Island, bedroom to Manhattan commuters, and the abundance of Long Island groundwater has long been a topic of popular discussion.

"From Subterranean Streams, Capacity of the Jamaica Water Works to be Largely Increased with Another Plant at Richmond Hill," Brooklyn Eagle; August 22, 1899, notes the resource.

> *President Charles Lockwood of the Jamaica Water Supply Company... offered to supply the city* [of New York] *at 50 cents or less per thousand gallons, and the entire supply was to be obtained from the inexhaustible underground rivers of pure water which exist on Long Island...*
>
> *The large property owners who now object to the draining of the ponds and surface waters of Nassau and Queens say that they have no objection to the tapping of the deep underground supply.*

But from where does this subterranean resource come?

In the memory of Golden Hill Native Americans of the Paugussett Nation is a lake in what's now downtown Bridgeport, Connecticut fed by what was said to be an underground river flowing 60 kilometers from the north.

Or is this underground river even longer?

To explain a gruesome history of western Long Island drownings, the October 8, 1900, Lewiston Evening Journal noted,

> *There are several branches to the underground river, but that no one has ever found the spot where they emptied. It is known that there is a system through the sandy soil a hundred feet or more below the surface of Long Island. It is said that the main underground system, which is as wide as a small river, comes down from the White Mountains, dives down under the Sound somewhere near New London and upon reaching Long Island branches out into a system with subterraneous veins, reinforced by springs, ponds and lakes, that threads the entire undersoil of the island.*
>
> *The fact that the underground outlet of Secut, now Success Lake, has more than one branch would account for the bodies of a great many persons drowned in its waters never having been recovered.*

Lake Success today, where success is measured on the many golf courses

Three decades later, however, the question of Long Island's water source would seem to have been settled. As reported in "Relation of Geology to Ground Water Supplies of New England," Journal of the New England Water Works Association, March 1933,

> *It was once supposed that the water on Long Island came from Connecticut. More than twenty years ago a very extensive study of the groundwater conditions of Long Island was made by W.O. Crosby. His conclusions were that the water-bearing beds under Long Island are not continuous from under Connecticut. We do not have those coastal plain deposits exposed at all in Connecticut. They have been eroded, washed away from the Connecticut side of Long Island Sound, and the hard rocks, with a little veneer of glacial drift, are exposed right down to the Sound. The water-bearing beds which pass under Long Island probably come to the surface under the Sound unless they are controlled by impervious layers of clay. The groundwater of Long Island is entirely the water that falls as rain on Long Island. It is not possible to draw large supplies there from New England. It is possible that some of the water that might be found in the hard rocks on the western end of Long Island comes from the mainland, hut there is not sufficient evidence to be sure about that.*

On November 20, 1949, however, the Sunday Herald was still perpetuating the "underground river" concept.

> *Drought Doesn't Hurt Bethel's Water Supply. While the rest of Fairfield County's well-users suffer from the "underground drought" which has dried up their water supplies, the Town of Bethel steadily pumps 380 gallons-per-minute out of a mysterious subterranean source...*
>
> *Supt. of the Water Dept., Herbert A. Webb ... said that Bethel draws its water from a mysterious underground river, which geologists believe extends from Long Island beneath the Sound, into Bethel and finds its source in the hills of Litchfield...*
>
> *Intrigued, Webb and Selectman Thomas H. Mannion queried hydraulic engineers and geologists about the seemingly bottomless well.*
>
> *A check-up showed that only one other community in the East has water whose characteristics are the same as Bethel's.*
>
> *This area is on the Western tip of Long Island and the water is obtained from an underground river which geologists have traced beneath the Sound.*

And today?

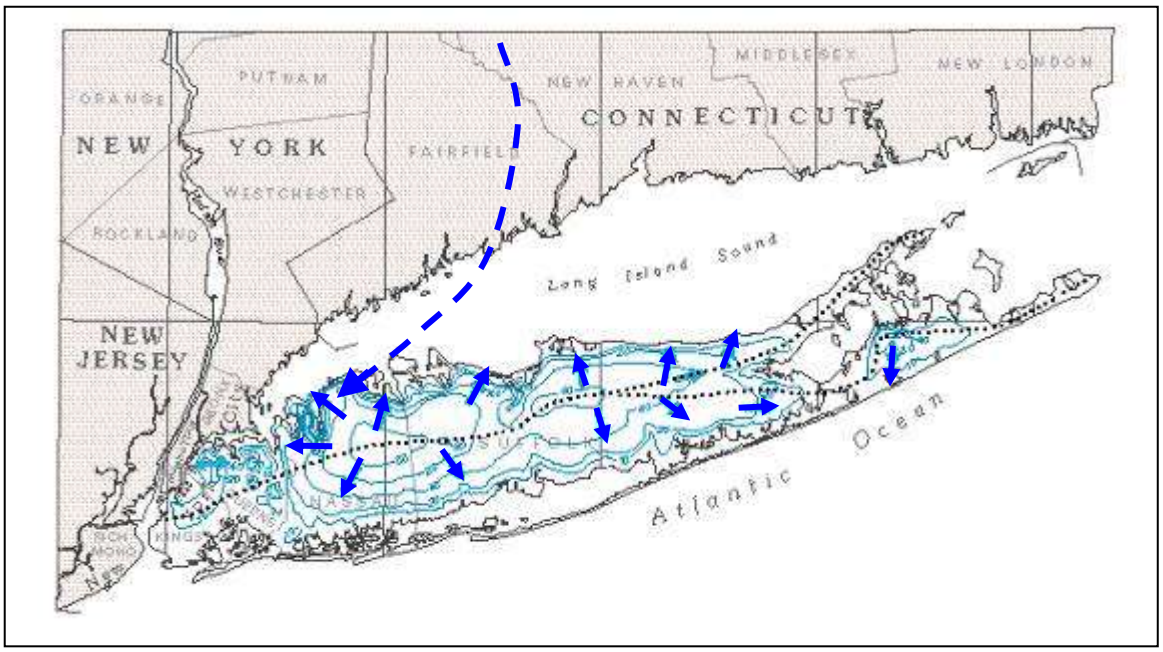
The waters yet resurface, but in the form of urban legend. From the New York Times, November 13, 2005,

> *Q: I once heard a story about a lake in Queens that people thought was practically bottomless. This sounds like a summer camp ghost story. Is it true?*

A: You must mean Oakland Lake, but the truth about it wouldn't scare a mouse. Oakland Lake, in Alley Pond Park south of Bayside, is a 15,000-year-old glacial kettle pond, formed by the melting of a large chunk of glacial ice, according to the Parks Department. The pond is fed by underground springs and a ravine, and the story was told that the pond was as deep as 600 feet, with an underground river leading northeast to Little Neck Bay. In 1969, amateur divers searched for the lake bottom, fearing dangerous currents from the suspected river. It turned out that Oakland Lake was about 20 feet deep, and there was no River Styx.

In 1988, the state declared that the lake area was officially freshwater wetlands; the marsh supports many birds, and some of the original forest remains.

The path of the perceived underwater, underground river is mapped below as the dashed line. The short, solid arrows, on the other hand, show the direction of Long-Island's groundwater gradient, how the groundwater actually flows. As the Long Island Sound stratigraphy is not particularly porous -- much less, a riverine submarine pathway -- the island's groundwater comes from local precipitation, not from under the Sound, a fact known before 1933. The submarine underground river no more than an imagined dashed line.



But the Long Island legend will surely rise again.

As for the dashed blue line, it's a tale we'll save for Chapter 90, Professor Denton's New England Underground River.

Alas we seem to have been on the path of a nonexistent underground river, but we can find solace in the fact that we weren't the first to do so.

West Side

To the west of 19th-century New York City lay land barely touched by urbanization.

"Crossing the Brook near Plainfield, New Jersey" by Thomas Moran (1837-1926), a painter of the American Hudson River School, reflects the influence of the American Pre-Raphaelites' fascination with the natural world.

But Moran's natural world was already making way for commuters. As reported by the March 14, 1892, New York Times, "An Underground River Flowing Rapidly Beneath the City of Plainfield, N.J.,"

> *The people of this city are greatly puzzled at the discoveries made by the Plainfield Water Supply Company, and the wonder of what sore of floating municipality they live in. For a week the company has been endeavoring, by crucial tests, to determine the exact magnitude of its water supply... Further investigation has established the fact that the wells actually tap a vast underground river flowing from northwest to southeast directly under the city, many feet below. Soundings have been taken, and other tests have been made, and it is now announced by competent engineers that a stream of extraordinary extent actually exists under the city. It has a swift current, and sweeps over a bed of beautifully white, smooth pebbles. The quality of the water is then purist and the supply is practically inexhaustible.*

The April 15 "An Extensive Water Service" reinforced the "underground river" perception.

> *The Union Water Company, an organization virtually the same as the Plainfield Water Supply Company, has completed arrangements for extending its mains to Cranford and Rosella. Ex-Congressman John Kean, Jr. is President of the company whose water supply is the inexhaustible wells which have been sunk at Netherwood, tapping an underground river.*

Remember that name, Ex-Congressman John Kean.

As pondered in "Under the Florida Sands, A Five-Acre Lot that Broke Through the Sands," the May 29, 1892, New York Times,

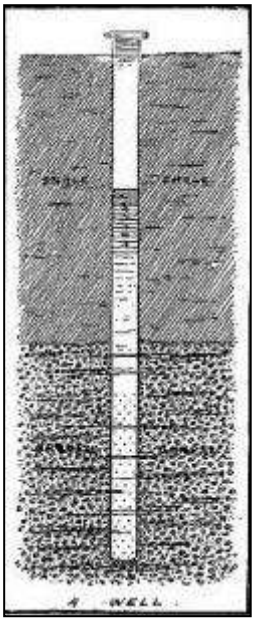
> *There is a mystery about the foundation of the Florida peninsula that none of the geologists has yet given a satisfactory explanation of,*

followed by a recounting of Floridian sinkhole and artesian springs tales. So why do we cite this news item in relation to the New York area? The answer's both Tartarussian and cigar-chomping politics.

> *These things lead me to the sage conclusion that there is an immense hollow in the rocks that underlie the Florida peninsula, a great cavern by the side of which Luray and Mammoth Cave are toys. A cavern with rivers running through it, one of those rivers having an outlet in the fresh-water spring near St. Augustine and another in the Silver Spring. Where these underground rivers rise I am not yet prepared to say -- perhaps New Jersey -- for I see that the Hon. John Kean, Jr. discovered a river of pure water under Plainfield two days before he called the Republican State Committee together.*

This report falls into the interim between Kean's service in the House of Representatives ending in 1889 and his time in the Senate, beginning ten years later. We question the Hon. John Kean

being the "discoverer" of water beneath Plainfield, but then as now, politicians claim credit for good news.



As reported in "Plainfield, N.J., Water Supply," Scientific American, November 5, 1892,

> *An underground river, with the cleanest and purist of water, has been discovered near the city of Plainfield, N.J. A few months ago the water company began to drive wells, and, after going over about five square miles of country and striking inferior qualities of water they struck pure water at Netherwood... The earth thought which these wells are driven is a hard shale, running down to a depth of 27 ft. It is so compact that no drainage or surface water can get through it, and below it is a bed of sand and gravel, through which the pure and clear water flows. The wells run down to a depth of 20 ft. into this bed, the gravel which is smooth and polished, showing that the water is constantly moving.*

The article's illustration makes clear that the well doesn't encounter what might construed as a "river," but the lead sentence coupled with the reference to stream-polished gravel paints its own picture.

Other than the atmospheric reference, "A Great Natural Feature, The Explanation of Plainfield's Pure Water Supply," New York Times, January 8, 1893, described Plainfield's actual hydrology in terms far ahead of the times.

> *The abundant water supply is not caused by an underground river, as claimed by the Scientific American in a recent issue, but is received from superficial earth twenty-five to seventy-five feet deep, lying upon basement rock, consisting of loam, sand, and gravel, saturated its whole depth from about eighteen feet below the surface.*
>
> *The particular soil through which geologists call moraine or glacial drift, laced thousands of years ago, has been shown by recent experiments to be the best kind of a purifier. Through this compact mass there is no rushing river, as has been described, but only the steady movement of water among the interstices of consolidated sand and stones, which, being nature's perfect filter, gives Plainfield its pure water and healthy atmosphere.*

Such accurate journalism didn't persist, however. In promoting Plainfield real estate in its August 26, 1894, feature, "Plainfield, City of Homes, Attractive Features of the Old New-Jersey Town," the newspaper reverted to the time-honored "underground stream" illusion,

> *It was found that a current of water ran under the city from the near-by mountains, and dredging produced glistening pebbles, as from the bed of a stream.*

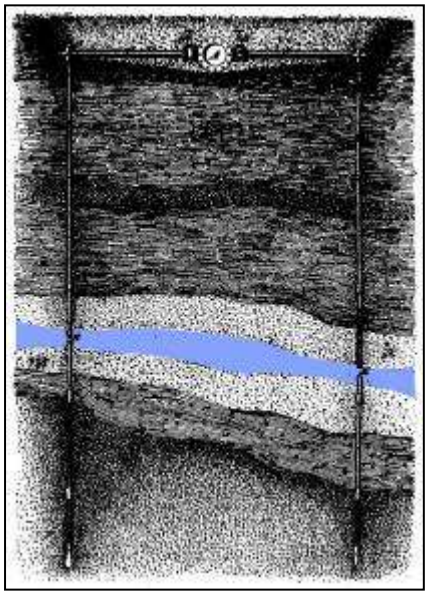
In an engineering document, Report on the Water Supply of Plainfield, New Jersey (1910), James Hillhouse Fuertes summarized his findings.

> *Source of Water -- Many suppositions have been made as to the probable source of the water found in the gravels and sands under the plains between the moraine and the mountains, the commonly expressed idea being that it is an underground river flowing in a southwesterly course towards the Raritan River having its headquarters at or near Springfield. While confirming the view that the general natural direction of the' movement of the groundwater is towards the southwest, as has been observed by the levels of the water in local wells, my observations lead me to the belief that the source of the water is purely local.*

Fuertes' conclusion:

> *The source from which the Netherwood wells derive their supply is local; and from 3 to 4 square miles in effective superficial area.*

In other words, there's no underground river.



Brooklyn

If A Tree Grows in Brooklyn, a 1943 novel by Betty Smith, perhaps it gets its water from a stream below. Such a stream has long been believed to exist.

The drawing to the right (the blue added to better show the perceived watercourse) is a Scientific American illustration of "underground water courses pierced by driven wells" from "City Water Supply from Driven Wells," February 12, 1887.

> *These underground waterways are generally not difficult to find in comparatively level country, and usually at a surprisingly slight distance below the surface. The manner in which these streams are frequently formed, one above another, at various depths is clearly indicated in one of our illustrations.*

Ah, for the era of unbridled Yankee optimism.

New York Times; January 7, 1907;

> *Driving 200 Wells to Supply Brooklyn. Thorough Search Made for an Underground Stream... Chief Engineer McKay Skeptical. By means of a chain of deep driven wells, extending from a point near Jamaica eastward into Nassau County for a distance of about fifteen miles, the engineers of the Water Department in Brooklyn believe they will be able to determine within a short time whether there are streams flowing under Long Island big enough to supply Brooklyn for all time, and possibly furnish a large part of the water consumed in Manhattan.*

Chief Engineer McKay was correct.

We introduced the subject of subterranean stream piracy in Chapter 40, Karstology, but that was just about karst chemistry, the details already having faded from our minds. Most of us would find more interesting the topic of actual buccaneers who sail below.

"The Atlantic Avenue Tunnel, A Romance," New York Times, January 23, 1893, told of a Brooklyn's vicious Smoky Hollow river pirate gang whose den opened into the abandoned 1844 railway tunnel.

Thomas Edison filmed a 2-minute simulated river-pirate capture by a New York Harbor Police boat in 1902.

The "river pirate" connection stuck, as seen in a 1911 issue of the Brooklyn Eagle.

The fact of the matter is that these river pirates didn't actually sail below Atlantic Avenue -- the tunnel being dry -- but launched from below the waterfront docks. None the less, their dastardly legacy's now part of the public association between "underground," "river" and "pirates."

Today's Big Apple is rife with underground rivers, but as demonstrated by Steve Duncan, "Urban Explorer," in his June 2008 web report on rediscovering the Manhattan waterways, exploration's not easy.

Minetta Brook

In New Amsterdam times, Minetta Brook was a placid Manhattan stream. By the 1800s, however, the brook was diverted beneath Washington Square the West Village. Today's Minetta Street in the Village bends to follow the stream's original path.

The brook's concealment wasn't an easy bit of engineering, however. As reported in the New York Times, March 27 1901,

> *Minetta Brook's Course. Imprisoned Underground, It Shows Itself in an Excavation for a Mammoth Store. Minetta Brook, once a placid stream dividing Manhattan Island from the North of the East River, is responding to the rains in a way that results in trouble for Thomas P. Galligan, who is digging in its Sixth Avenue channel... According to Mr. Galligan, Minetta Brook asserts itself still in wet weather in the sub-cellars of many big buildings.*

When Fifth Avenue was constructed just north of Washington Square, a tube was installed, allegedly connected to the old brook. Gen. Egbert L. Viele's "Sanitary & Topographical Map of the City and Island of New York" (1874) shows the original channel. The red circle identifies the site.

The stream map was reprinted in "Who Stole the Creek?" in the September 13, 1907, edition of the New-York Tribune with subheadlines "Manhattan's Famous Underground Stream Has Disappeared" and "The Northwesterly Bed of the Creek Cannot Be Found."

The 1874 mapping of Manhattan's historic watercourses is yet consulted for skyscraper foundation design.

New York Times, December 4, 1930,

> *Minetta Brook Out Again, But This Time Historic Old Stream Will Flow from Fountain... The waters of Minetta Brook, covered over time and time again in efforts to stem their flow, found their way to the surface again in the Washington Square section yesterday. However, this time the persistent stream was aided by pipes, designed to convey the water to a fountain built in the lobby of a new apartment building...*
>
> *The brook has not always waited for faucets to be turned. It has been the bane of builders in the Greenwich Village section for many years. A favorite trout stream in the Dutch Colonial days, Minetta Brook, or Minetta Water, as it was called then, still flows underground into the Hudson, fed by underground springs, as nearly as can be determined.*

The plaque beside the "fountain,"

The connection to the subterranean stream may be more symbolic than hydraulic, as some say that the Minetta dried up in the 1800s and the water at the bottom of the pipe nothing but plumbing seepage, but it's in the tour guides.

Queens and the Bronx

Sunswick Creek, Queens, appeared on maps in the 1870s, but is now completely covered over.

Tibbetts Brook flows into the Bronx's leafy Van Cortlandt Park, where it fills a small lake dammed in 1690 to power a sawmill and gristmill. The brook then dives underground at Tibbett Avenue and flows through a double-channeled sewer to the Harlem River Ship Canal.

Perils of Life in the Big Apple

New York Herald, August 30, 1869,

> *We advise timorous people who one property below Canal Street to look out. There are geologists who would insinuate that the southern end of Manhattan rests on a basaltic arches, against which the currents of a vast subterranean river dash, and thus 500 or 1,000 years hence the lower part of the island will cave in!*

The Fantom of the Fair comic book first appeared in 1939. The Fair was the New York World's Fair of 1939-40. The Fantom's headquarters beneath the Fair was equipped with a modern laboratory and was located right next to an underground river, apparently flowing below sea level. His mission was to protect visitors from the City's many criminals. His regular name was never revealed. Also unmentioned was a motive for becoming involved.

Basement Fishing

In an August 22, 1971, New York Times letter to the editor, columnist Jack Gasnick, reminisced in "A Manhattan Reminiscence" about the day some fifteen years before when he caught (and later consumed) an almost-three-pound carp in the basement of his hardware supply house at 53rd and Second.

> *We had a lantern to pierce the cellar darkness and fifteen feet below I clearly saw the stream bubbling and pushing about, five feet wide and up-on its either side, dark green mossed rocks. This lively riverlet was revealed to us exactly as it must have appeared to a Manhattan Indian many years ago.*

With plum-bob and line, I cast in and found the stream to be over six feet deep. The spray splashed up-wards from time to time and standing on the basement floor, I felt its tingling coolness.

One day I was curious enough to try my hand at fishing. I had an old-fashioned drop line and baited a hook with a piece of sperm-candle. I jiggled the hook for about five minutes and then felt a teasing nibble. Deep in the basement of an ancient tenement on Second Avenue in the heart of midtown New York City, I was fishing.

Feeling a tug, I hauled up in excitement and there was a carp skipping before me, an almost three pounder. I was brave enough to have it pan-broiled and buttered in our upstairs kitchen and shared it with my brother...

But this is all in the past. My little stream is no more! The Corning Glass Building at 56th Street and Fifth Avenue has used up all the water….

The Viele map shows the proximity of 53rd and Second to an historic stream course.

Gen. Viele wasn't as accurate in hydrogeologic matters, however, as he was in his mapping. As interviewed in the April 28, 1901, New York Times "Subterranean Brook Tapped in Building,"

Manhattan Island is on a spur of the upland ledge of the Appalachians, and in my study of Central Park territory I became familiar with the natural scheme of the island's gridiron of water connections. All these natural outlets for water, some of which, for all we know, may come from Lake George, should have been attended to as we attended to them on the west Plateau.

As Lake George is in New York's Adirondacks, some 300 kilometers to the north, the General perhaps should have stuck to his knowledge of Central Park.

John Waldman, an aquatic biologist at Queens College and the author of Heartbeats in the Muck, The History, Sea Life and Environment of New York Harbor, found the fish yarn “very interesting,” adding, “It is possible, but it would have taken very peculiar and unlikely circumstances for this to have happened.”

According to Dr. Waldman, it was possible that these hardy creatures survived in this unlikely habitat after having been spawned prior to the complete landfilling of the stream. It also was possible that someone dumped them into this underground rivulet at a later point. The least likely scenario would have been that they were maintaining an ongoing population. But regardless of how they got there, what food sources could have sustained them? As food must be exported to subterranean waters in the absence of photosynthesis, such carp must either have been receiving food from scraps derived from the photosynthetic-based ecology of surface waters or someone was feeding them.

When asked whether any carp could be found swimming under Manhattan today, Dr. Waldman said it was virtually impossible. “Fish don’t live in the dark for generations. It just doesn’t happen.”

We can't abandon the sport of basement fishing, however, without noting a news item, "Chinese Farmer Digs Hole in Kitchen to Fish," World Entertainment News Network, June 22, 2009.

> *A Chinese farmer hired 30 villagers and spent six months digging a hole to reach an underground river he suspected was full of fish underneath his kitchen.*

We're left unsure if the farmer's catch was better than that achieved in Manhattan.

Notice

As warned in the New York Herald of August 30, 1869,

> *We advise timorous people who own property below Canal Street to look out. There are geologists who would insinuate that then southern end of Manhattan rests on basalt arches, against which the currents of a vast subterranean river dash, and that 500 or 1,000 years hence the lower part of the island will cave in.*

And if that's not enough about which to worry regarding subterranean streams beneath the famed city, we have the 1989 movie sequel Ghostbusters II. To quote the publicity,

> *Sidelined after their spectacular save of New York City five years ago, the heroes once again answer the call when an underground river of ghoulish goo threatens to rot the Big Apple to the core.*

And here we'll depart New York City, Gotham of many underground rivers, and head to Massachusetts, where there was said to be just one.

CHAPTER 89
ALLIGATORS BELOW

We've all heard it:

> A pet alligator raised in New York City becomes too large for the apartment and is flushed down the toilet. In the Manhattan sewers, tropically-warm and abundant in meaty rodents, the reptile thrives...

The legend's part of what makes New York, New York.

As we've come to discover, tales of underground rivers braid and migrate. As our journey is one of sequential chapters, however, we must place this particular portion in a single section, though it might also fit in others.

This chapter, for example, might be slipped into

Chapter 74, More Aquatic Perils, as illustrated to the right.

Chapter 22, Boys Club Singles, as a seminal event involved a 1935 Boys Club, one member fortuitously "an expert on Western movies" with requisite skills.

Chapter 50, Wrecks of Ancient Life, as we are very much concerned with an animate creature.

Chapter 86, Veins of the Heartland, as our particular creature is the species Alligator mississippiensis.

Chapter 64, The Grand Tour, European Sewers of Distinction, as this is also about sewers.

Chapter 88, East Side, West Side, All Around the Town, where our en-situ alligator witness, according to the May 31, 1954, New York Times,

> *Knows some fifty underground streams -- where they are trapped into the sewers and where they trickle and course around them, stubbornly burbling under the countless tons of asphalt and concrete, in approximately the same beds they followed when the island was lush green.*

This material could even be slipped into Chapter 79, The Sinking of the Fleet, because Londoners of 1851 believed that the by-then-subterranean River Fleet to be inhabited by feral pigs, the folklorific antecedent to the remainder of this chapter.

Among the Hampstead, London shore-workers ran the story that a sow by accident entered the underground river through an opening, and in the drain littered and reared her offspring, feeding

on the offal washed into it. The breed multiplied exceedingly, becoming almost as ferocious as they were numerous. The subterranean animals could only return to the light by reaching the Thames, but to do so, they must negotiate the Fleet ditch, which runs with great rapidity. Given the obstinate nature of a pig to enter a current, the wild hogs kept to their new-found quarters. There were, however, no records of Hampstead residents having seen such animals pass beneath the gratings, nor having been disturbed by their gruntings.

And now we go to America, where pigs become alligators.

As reported by The Planet, Union Village, N.Y., July 18, 1831,

> *A live alligator, it is said, was seen Friday in the slip between Murray's and Pine Street wharves, New York.*

The New York Times continues the chronicle of like stories.

July 21, 1907, "Alligator in the Sewer, Quite a Baby, But it Nipped the Hand of the Finder,"

> *Charles Gidds of Duke Street, Kearny, N.J., is employed as Superintendent in the Kearny Street Department. He was clearing out a sewer Friday, when a workman called his attention to a strange object in the water. Gidds, picked it up, but suddenly dropped it with a yell.*
>
> *Workmen then examined the object, which proved to be a young alligator about eighteen inches long. It had nipped Gidds in the right hand, but inflicted little injury.*
>
> *It was learned later that the alligator had escaped a week ago from Freeholder John W. Roache, and who welcomed its return with many thanks.*

September 4, 1927, A "good-sized Florida alligator" found in a storm-swollen stream in Middletown, NY.

> *It was later discovered that the alligator had escaped several months ago from a pan on the premises of Dr. F.E. Fowler.*

July 3, 1929, A 2-foot alligator found in the grass at a residence in Port Jervis, N.Y.

May 22, 1931, Another 2-foot specimen found in the bushes on a Westchester County estate

June 30, 1932, An alligator hunt by Westchester County police after

> *Two small boys had appeared at headquarters last night to show the chief a dead alligator, about 36 inches long, which they said they had captured along the shore of the lake. The boys told the chief that the Bronx River, of which the lake is a part, had been 'swarming' with at least two or three other alligators.*
>
> *The start of the explorers was delayed today because of fear on the part of the police chief that a species of human beings, known as baseball players, who congregate on the shores of the lake, would interfere with the expedition.*

What civic-minded Boys Club wouldn't want to assist?

> *The proper method of catching an alligator alive was the subject of a conference this afternoon between the police chief and his men... Someone suggested that one of the police explorers, who sings bass in the police quartet, ought to practice the alligator mating call, which the police chief learned was a cross between the bark of a dog and the grunt of a pig.*
>
> *A hurried visitor to Police Headquarters told the police chief that a piece of liver would make an alligator literally walk across the water to shore and that it could be captured alive easily with the type of net generally used by butterfly chasers.*
>
> *The police chief put in a requisition for enough liver to feed a good-sized alligator, and one of his men promised to lend the explorers a fishing net for the expedition.*

July 2, 1932, The hunt was called off after it was deemed that the boys had seen snakes or lizards in the river, not gators. The carcass they'd found was identified as a pet crocodile which had escaped from a neighbor's backyard a few weeks before.

Perhaps we should pause to note some issues of reptilian identification. In reporting a sighting, the newspapers almost inevitably used "alligator." The size of the creatures, however, is often more in the range of a caiman. As for crocodiles, according to the account above, at least, they might be present, as well.

American Alligator	Common Caiman	American Crocodile
(Alligator mississippiensis)	(Caiman crocodilus)	(Crocodylus acutus)
Maximum length: 4 to 4.5 meters	2 to 2.5 meters	3.5 to 5 meters

September 12, 1933, Belleville, N.J.,

> *A squadron of riflemen was organized here today to hunt for alligators in the Passaic River... Belleville police said it is probable the alligators were some of the six reptiles which disappeared last year from a lagoon in Military Park, Newark.*

Subterranean Abode

All exciting reptilian stories, of course, but above ground. Not until 1935 did the lair shift to beneath the sidewalks.


ALLIGATOR FOUND IN UPTOWN SEWER

Youths Shoveling Snow Into Manhole See the Animal Churning in Icy Water.

SNARE IT AND DRAG IT OUT

Reptile Slain by Rescuers When It Gets Vicious—Whence It Came Is Mystery.

February 10, 1935,

> *Youths Shoveling Snow into Manhole See the Animal Churning in Icy Water, Snare it and Drag it Out*
>
> *Reptile Slain by Rescuers When it Gets Vicious -- Whence it Came is Mystery.*
>
> *The youthful residents of East 123rd Street, near the murky Harlem River, were having a rather grand time at dusk yesterday shoveling the last of the recent snow into a gaping manhole.*
>
> *Salvatore Condulucci, 16 years old, of 419 East 123rd Street, was assigned to the rim. His comrades would heap blackened slush near him, and he, carefully observing the sewer's capacity, would give the last fine flick to each mound.*
>
> *Suddenly there were signs of clogging ten feet below, where the manhole drop merged with the dark conduit leading to the river. Salvatore yelled, "Hey, you guys, wait a minute," and got down on his knees to see what was the trouble.*
>
> *What he saw, in the thickening dusk, almost caused him to topple into the icy cavern. For the jagged surface of the ice blockade below was moving; and something black was breaking through. Salvatore's eyes widened; then he managed to leap to his feet and call his friends.*
>
> *"Honest, it's an alligator!" he exploded.*
>
> *Others Look and Are Convinced.*

There was a murmur of skepticism Jimmy Mireno, 19, of 440 East 123rd Street, shouldered his way to the rim and stared.

"He's right," he said.

Frank Lonzo, 18, of 1743 Park Avenue, looked next. He also confirmed the specter. Then there was a great crush about the opening in the middle of the street and heads were bent low around the aperture.

The animal apparently was threshing about in the ice, trying to get clear. When the first wave of awe had passed, the boys decided to help it out. A delegation was dispatched to the Lehigh Stove and Repair Shop at 441 East 123rd Street.

"We want some clothes-line," demanded the delegation, and got it.

Young Condolucci, an expert on Western movies, fashioned a slip knot. With the others watching breathlessly, he dangled the noose into the sewer, and after several tantalizing near-catches, looped it about the 'gator's neck. Then he pulled hard. There was a grating of rough leathery skin against jumbled ice. But the job was too much for one youth. The others grabbed the rope and all pulled.

Slowly, with its curving tail twisting weakly, the animal was dragged from the snow, ten feet through the dark cavern, and to the street, where it lay, non-committal; it was not in Florida, that was clear.

And therefore, when one of the boys sought to loosen the rope, the creature opened its jaws and snapped, not with the robust vigor of a healthy, w ell-sunned alligator, but with the fury of a sick, very badly treated one. The boys jumped back. Curiosity and sympathy turned to enmity.

"Let 'im have it!" the cry went up.

Rescuers then Kill It.

So the shovels that had been used to pile snow on the alligator's head were now to rain upon it. The 'gator's tail swished about a few last times. Its jaws clashed weakly. But it was in no mood for a real struggle after its icy incarceration. It died on the spot.

Triumphantly, but not without the inevitable reaction of sorrow, the boys took their victim to the Lehigh Stove and Repair Shop. There it was found to weigh 125 pounds; they said it measured seven and a half or eight feet. It became at once the greatest attraction the store ever had had. The whole neighborhood milled about, and finally, a call for the police reached a nearby station.

But there was little for the hurrying policemen to do. The strange visitor was quite dead; and no charge could be preferred against it or against its slayers. The neighbors were calmed with little trouble and speculation as to where the 'gator had come from was rife.

There are no pet shops in the vicinity; that theory was ruled out almost at once. Finally, the theories simmered down to that of a passing boat. Plainly, a steamer from the mysterious Everglades, or thereabouts, had been passing 123rd Street, and the alligator had fallen overboard.

Shunning the hatefully cold water, it had swum toward shore and found only the entrance to the conduit. Then after another 150 yards through a torrent of melting snow -- and by that time it was half dead -- it had arrived under the open manhole.

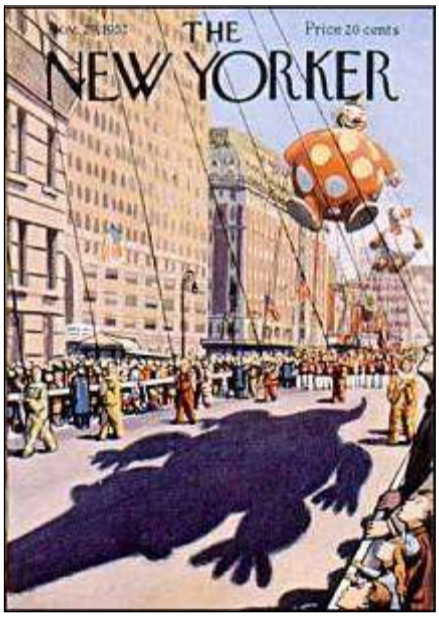
Half-dead, yes, the neighborhood conceded. But still alive enough for a last splendid opening and snapping of its jaws. The boys were ready to swear to that.

At about 9 p.m., when tired mothers had succeeded in getting most of their alligator-conscious youngsters to bed, a Department of Sanitation truck rumbled up to the store and made off with the prize. Its destination was Barren Island and an incinerator.

After this oft-cited adventure, however, New York area alligator encounters reverted to those above ground.

March 8, 1935	"A 3-foot gator was found in Northern Yonkers by Joseph Domomico yesterday morning. Another twice that size was found, dead, on the east side of Grassy Sprain reservoir."
June 1, 1937	A 4-foot alligator captured by a barge captain at Pier 9 in the East River. The gator "was clearly exhausted and seemed in no humor to fight."
June 7, 1937	"Passengers waiting on the eastbound platform of the Brooklyn Museum station of the I.R.T. subway just before midnight were startled by the sudden appearance of a 2-foot alligator which had emerged from a refuse can. Passengers on the station told the police that shortly before the alligator appeared a man put a large bundle in the refuse can."
August 16, 1938	Five alligators caught in Huguenot Lake (Westchester, NY), the largest of which was 19 inches.
August 17, 1942	A 4-foot alligator (thought to have escaped from an outdoor aquarium in a local home) found in Lake Mindowaskin near Westfield, NJ).

New Yorker, November 29, 1952. The magazine provides no comment on this illustration, but it's clearly inspired by the sewergator legend.



From Where Come the Gators?

Alligator sighting were generally attributed to creatures recently escaped from captivity. The May 31, 1954, New York Times report on Superintendent of Sewers, Edward P. May's retirement at age 80 included this tidbit, however.

> *He has cleared the system of a rash of alligators. Dropped in by harassed parents when the reptiles were tiny pets, they grew amazingly.*

Thus an urban legend is established.

"They say that sewer workers sometimes escape to the above where they grow to enormous size."

While the New York Times dutifully called May "Superintendent of Sewers" and subsequent sources frequently promote him to "Commissioner of Sewers," his April 14, 1960, obituary noted that he was made "Honorary Commissioner of Sewers" at his retirement at age 80, some six years earlier.

One who would know of such rank would be John T. Flaherty, Chief of Sewer Design, Bureau of Sewers, NYC, as quoted by Jan Harold Brunvand in Too Good to Be True (1999).

> *Yes, Professor, there really was a Teddy May... almost as much of a legend as the New York City Sewer Alligator itself...* [He] *was a sewer worker who, in the fullness of time, rose to become a Foreman or, perhaps, a District Foreman.*

May's proper title is not the issue, of course, but rather his sway, and that he wielded over his administrative superiors. He alone knew the workings.

Flaherty continues,

> *Teddy was a very outgoing, ebullient man with a wide circle of friends and an even wider circle of admiring acquaintances. Part of his charm was his undoubted abilities as a raconteur and a spinner of yarns*

"Chew-tobacco Teddy," they called the salty union-speaker -- professional evidence against the title "Commissioner" -- who knew first-hand every foot of the 560-mile sewer system.

Teddy May would come to be the source for Robert Daley's "Alligators in the Sewers" in The World Beneath the City (1959), the reference which would propel the alligator story from newsprint to library shelves.

According to May, sewer inspectors first reported seeing alligators in 1935, but he didn't believe them.

> *I says to myself, "Them guys been drinking." I'll go down there and prove to youse guys that there ain't no alligators in my sewers.'*

Once he looked, May saw the alligators, most about two feet long and living in the smaller pipes. May dispatched his men to dispatch the invaders, some by rat poison, others shooed into trunk

lines where rapid flow carried them to the harbor, and some by .22 rifles and pistols. New York City sewers were alligator-free in but a few months.

Somewhat surprisingly -- New York Times prone to relish alligator stories -- the extermination campaign wasn't reported in the press. No ex-sewer worker but May has recalled the task.

The war-against-the-reptiles saga thus entirely rests on the word of a crusty ex-bricklayer regaled for his entertaining stories.

May made no mention of blind or albino alligators -- a folkloric embellishment influenced by the characteristics of troglobites, we expect -- and suggested that the pets were dumped down storm drains rather than flushed down the toilet, a reasonable conjecture, given residential drain-pipe diameters.

Albino alligators do exist, however, though the condition is genetic, not environmental. Meet Dinah of Knoxville Zoo.

In the novel V (1963), author Thomas propelled the persistent rumors of sewer alligators into a major work of fiction.

> *Did he remember the baby alligators last year, or maybe the year before, kids all over Nueva York bought these little alligators for pets. Macy's was selling them for fifty cents; every child, it seemed, had to have one. But soon the children grew bored with them. Some set them loose in the streets, but most flushed them down the toilets. And these had grown and reproduced, had fed off rats and sewage, so that now they moved big, blind, albino, all over the sewer system. Down there, God knew how many there were. Some had turned cannibal because in their neighborhood the rats had all been eaten, or had fled in terror.*

Slithering through the underground rivers, the alligators were blind and albino, fat on rats. Pynchon's Alligator Patrol worked in teams of two, one man holding the flashlight, the other a 12-gage shotgun.

Weaving the alligators-in-the-sewers motif throughout, V thus brought the urban lore further into popular culture.

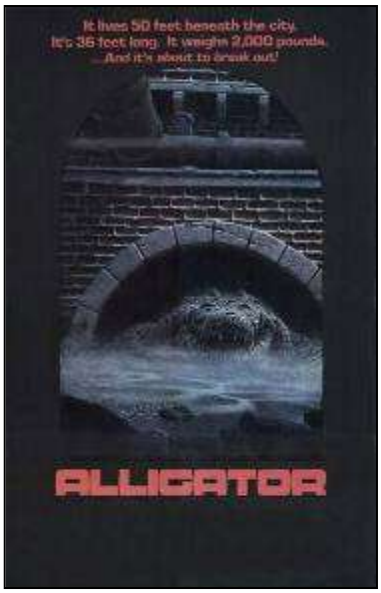
The alligators-in-the sewer tale was well known by the late 1960s, when, according to Richard M. Dorson's America in Legend (1973), seekers of the potent "New York White," an albino marijuana strain growing from seeds flushed down the toilet during drug raids, feared harvesting the product.

> *Because, according to a newspaper story, full-grown alligators prowled the sewers of New York. It seems that Miami vacationers returning to New York in the winter brought back baby alligators as pets for their children. The more the alligators grew the less ideal they appeared as playmates, and their owners, too tender hearted to skin them for their hides, mercifully flushed them down the toilet. Some survived in their new environment and confronted sewer maintenance workers, who publicly protested at this unnecessary additional hazard to their occupation.*

Those most affected, the pot-growers, of course couldn't publically protest.

The line underground river alligator outside of New York appears to be the monster prowling Chicago sewers in John Sayles's 1980 Alligator, a Jaws knock-off.

The movie predictably spawned Alligator II -- The Mutation (1996), but despite the Roman numeral, the second film shared no characters or actors with Sayle's original.



The Debate

By now, the underground river tale was evoking academic attention.

"Debunking the Myth of Subterranean Saurians," New York Times, May 19, 1982, by Anna Quindlen merits substantial quotation.

> *Like Captain Hook, John T. Flaherty is dogged by crocodiles, and, in addition, alligators. Mr. Flaherty is chief of design in the New York City Bureau of Sewers, but he is also the resident expert on the most durable urban myth in the history of cities, reptiles or waste disposal.*
>
> *"Dear Sirs," writes a correspondent from Stockholm, where sewers are called cloaks, "I take the liberty to write to you, since I from many sources have been informed that, for many years, a substantial number of crocodiles have found themselves a suitable atmosphere of living in the cloak tunnels of New York."*
>
> *And a man from Celoron, N.Y., writes: "I disagree with a coworker whom insists that an alligator which had lived in a sewer system over a long period of time does not change color. I said I believe the pigmentation of the alligator would become much lighter and in some cases turn almost white." To all these Mr. Flaherty, a good-humored man with an alligator cigarette lighter on his desk, must reply, "No, Virginia, there are no alligators in the New York City sewer system."*
>
> *In the "sewer game," as Mr. Flaherty calls it, which is not a glamour business; this has made John T. Flaherty something of a celebrity. There is even a makeshift star on his door, and a mock-up of a Variety headline that reads, "Flaherty says new alligator in sewer movie is a flimflam and is nothing but a croc."*
>
> *Alligators have become Mr. Flaherty's sideline, and he handles them with flair. The myth is that travelers to Florida adopted the baby reptiles, tired of them and flushed them down the toilet and into the city sewer system, where they grew to immense size.*
>
> *To the man from Celoron who thought alligators would pale below ground: "I could cite you many cogent, logical reasons why the sewer system is not a fit habitat for an alligator, but suffice it to say that, in the 28 years I have been in the sewer game, neither I nor any of the thousands of men who have worked to build, maintain or repair the sewer system has ever seen one, and a 10-foot, 800-pound alligator would be hard to miss. Of course, following the*

thought that you advance in your letter to its ultimate conclusion, perhaps the pigmentation affect has been so radical that they have been rendered invisible."

There are, however, no alligators, because, Mr. Flaherty says, there is not enough space, there is not enough food -- "the vast majority of it has been, to put it as delicately as possible, predigested" -- and the torrents of water that run through the sewers during a heavy rain would drown even an alligator.

He adds that one clear proof of the absence of alligators is that not a single union official has ever advanced alligator infestation as a reason for a pay increase for sewer workers.

Donald F. Squires, Director, New York Sea Grant Institute, responded a month later with "On the Incidence of Alligators and Hard Times." A Richard Mock linocut provided some artwork.

To the Editor:

Anna Quindlen's May 19 news story "Debunking the Myth of Subterranean Saurians" did a great disservice to true believers. John Flaherty (Chief of design in the New York City Bureau of Sewers), whom she quotes, professes that "there are no alligators in the New York City sewer system." I protest!

No less a source than "All the News That's Fit to Print" reported a veritable rash of "saurian sightings" in the city sewers through the 1930s. Our research on this subject is limited, because, in truth, we were looking for giraffes. The alligators were serendipitous.

At any rate, we refer Miss Quindlen and Mr. Flaherty to The Times for February 10, 1935, which reports a brave lad, Salvatore Condulucci, and his friends attacking an eight-foot alligator with snow shovels on East 123rd Street. Some other reports that appeared in The Times:

June 30, 1932 -- alligators in the Bronx River;
September 12, 1932 -- alligators in New Jersey;
June 1, 1937 -- alligators in the East River;
June 7, 1937 -- alligators in the Brooklyn subway!

As I have suggested in our newsletter, Coastlines, there may be a relationship between economic hard times and an outpouring of alligators, as evidenced by the reports in The Times. Perhaps Mr. Flaherty should become prepared.

An official of the Sea Grant Institute would of course defend resident aquatic reptiles.

Flaherty, as we might expect, could not let the challenge pass. From "New York Underground Still Free of Alligators," New York Times, July 17,

To the Editor:

I read with interest the June 9 letter of Donald F. Squires protesting my contention, as reported by Anna Quindlen in her excellent May 19 news article, that there are no alligators in the New York City sewer system. Yet, examined dispassionately, his letter seems to bear out my position.

For example, when one looks at the synthesis of the five Times articles of the 1930s offered by Mr. Squires as evidence of the existence of Alligator Cloaca Novum Eboracum, one finds reports of alligators in the Bronx River, in the East River, in New Jersey (a gratuitous thrust, as I have never commented on the presence of alligators in the Garden State) and even on East 123rd Street, Manhattan. However, in none of these articles, at least as Mr. Squires reports

them, is there any mention of an alligator actually being found in a sewer! (I do not know his feelings about the Brooklyn subway, but, despite certain similarities that go beyond the fact both are underground, I do not consider the Brooklyn subway to be a sewer in the classical meaning of that word.)

In the 28 years I have been in this business, neither I nor anyone else connected with the sewer game has ever spotted an alligator in a sewer -- or anywhere else, for that matter. Since the most recent article cited by Mr. Squires is dated June 7, 1937, fully 45 years ago and 17 years before my odyssey in the sewers began, and since I am sure that Mr. Squires, whose zeal for his cause is to be admired, would have produced more recent evidence had it been available, I feel that, however inadvertently, he has further vindicated my stand.

Mr. Squires' theory correlating the reported sightings of alligators in the Big Apple with economic hard times is fascinating. However, if one must search for a sociological explanation for this phenomenon of the 1930s, I, myself, would be more inclined to associate it with the repeal of Prohibition.

Related stories keep appearing.

Twenty-kilogram snapping turtles found in New York wastewater treatment plants in the late 1980s.

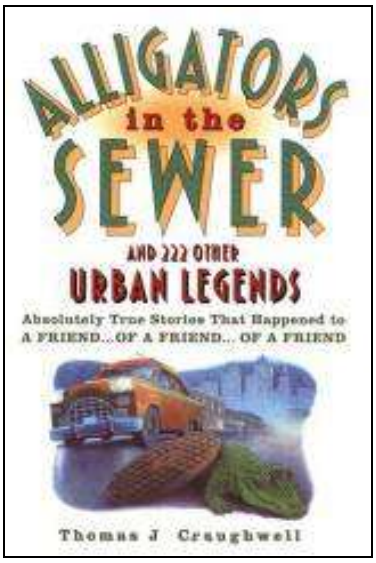
A 4-meter pet python found at Philadelphia's Northeast treatment plant -- dead.

In 1994, alligator spotted near a reservoir in Westchester County, probably a pet or an escapee from a wildlife park.

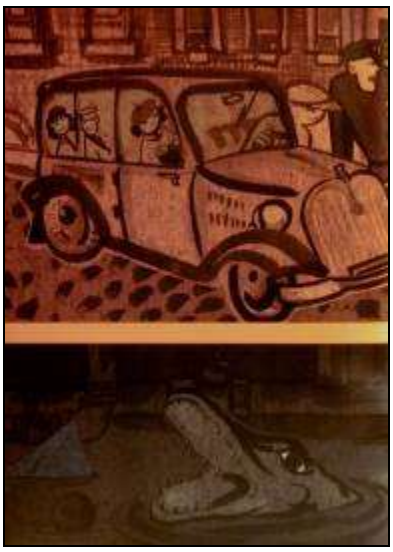
New York Times, July 1, 2001,

The baby alligator sighted in Harlem Meer in Central Park was actually a baby spectacled caiman.

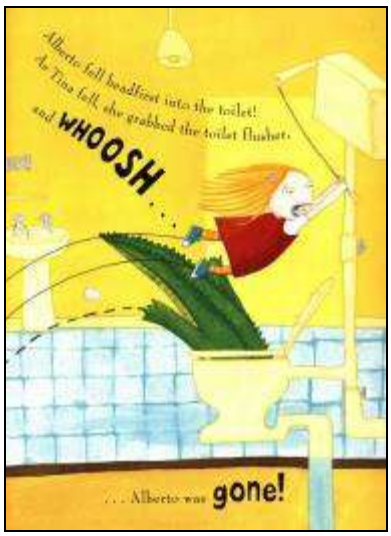
The bellwether of popular culture, "The Simpsons." From the episode of May 6, 1993. Bart: "We flushed the gator down the toilet, but it got stuck halfway, and now we have to feed it."



Alligators in sewers certainly merit a book, thus Thomas Craughwell's by that very title in 1999.



An illustration from Under New York (2001) by Linda Oatman High



The geologic strata from Richard Waring's Alberto the Dancing Alligator (2002) -- which does not appear to be situated under New Your City, by the way -- is shown below.

The band Radiohead's recorded "Alligators in the Sewers,"

Baby alligators in the sewers grow up fast,
Grow up fast,
Anything you want it can be done,
How did you go bad?

But perhaps, we must admit, our search of underground rivers hasn't netted actual 'gators, but that's proper for a lasting urban legend. We've enough pieces, each somewhat tying to something that might be so.

We'll conclude our alligator-and-human-made-underground-river chapter with a few quotations.

Herpetologists, Sherman and Madge Rutherford Minton,

One of the sillier folktales of the late 1960s was that the New York sewers were becoming infested with alligators, presumably unwanted pets that had been flushed down the toilet. In some accounts, these were growing to formidable size from feeding on rats. We have been unsuccessful in tracing the source of these legends but would assure New Yorkers that alligators are not among their urban problems.

Folklorist, Jan Harold Brunvand,

The theme of displaced creatures is an old one, and modern folklore has spawned many rumors of an animal -- usually a fearsome one -- lurking where it does not belong.

Herpetologist, Frank Indiviglio,

I would bring leftovers from lunch, a long line and a hook, and spend a part of each day in the sewers looking for alligators. I saw rats, cockroaches -- probably caught a lot of sicknesses -- but I never saw anything like an alligator.

Folklorist, Gary Alan Fine,

What could better serve as a metaphor for the city as a jungle than the belief that the New York sewer system is filled with albino alligators, which swim through toilet pipes and bite victims in public washrooms?

Nature writer, Diane Ackerman,

But they couldn't survive for any length of time in the sewers, only a few months at the most, because they can't live long in salmonella or shigella or E. coli, organisms that one usually finds in sewage. Also, alligators live at temperatures between 78 and 90 degrees... Despite the dearth of news stories about NY alligators and in the face of what we know about how gators are put together, the "alligators in the New York sewer system" stories persist.

New York City sewer worker, Esteban Rodriguez,

It's like the Loch Ness Monster or the Big Foot. People believe in those stories up to a point that it does make sense.

Acting Commissioner, Department of Environmental Protection, New York City, Steven Lawitts,

We have had no alligator sightings dead or alive, except on our T-shirts.

Official NYC
Alligator T-Shirt
$16.00

Salvatore Condolucci, 92, the "expert on Western movies" who roped the alligator in 1935, interviewed in the New York Times, November 24, 2009. Condolucci remembered the thrashing within the manhole, the creature's head, the lassoing and hauling it to the surface. But as to whether others lurk there today,

I don't know. I really don't know.

CHAPTER 90

PROFESSOR DENTON'S NEW ENGLAND UNDERGROUND RIVER

The Professor

We will begin with a brief biography of our central character, Professor William Denton. We will take care, however, to not confuse our protagonist with the William Denton, a few years older, an Anglican clergyman who shared an interest (though not a position) regarding matters of the spirit, and "Professor Denton" of Brooklyn, "the champion gin fizz drinker in America," the renown rascal of some decades later who shared our Denton's distaste for conventional opinion.

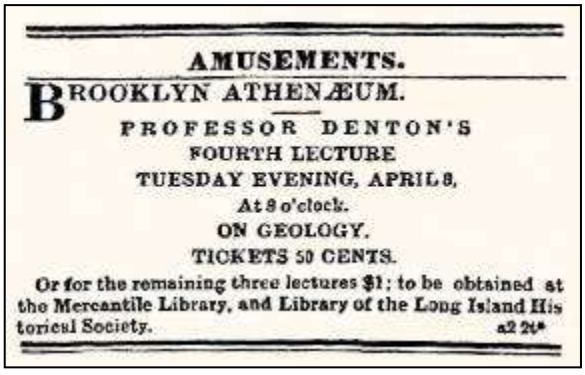
Our William Denton was born to a Durham County, England family of little means in 1823. Though his schooling was rudimentary, he was a quick learner and a born expositor. By age 16 he was a lecturer on temperance, Methodism and mesmerism and at age 25 he immigrated to America, penniless, but brimming with ambition.

Relentless self-education coupled with charisma secured him a series of school-teaching positions in Pennsylvania, western Virginia and Ohio, bur each was short-lived as his interests expanded to include abolition, Darwinism the new-found science of "psychrometry," a person's ability to see in a physical object all that has ever happened to that object.

At 31, Denton met and married a kindred spirit, Elizabeth Foote (she was known to wear bloomers) and made his way into the Lyceum circuit, propounding a mixture of spiritualism and modern science. He was good on stage, as four years he was debating future-president James Garfield in the subject of "Geology and Religion," arguing against the latter.

Denton's sister, Annie Denton Cridge, obviously of like stock, was meanwhile becoming a spokeswoman for feminism, cooperative kitchens and workshops and other disturbing ideals.

Denton toured throughout the United States and Canada, filling auditoriums at $0.25 or $0.50 a head and within seven years had earned enough to build a house on 13 acres in Wellesley, Massachusetts on what today is Denton Street.



AMUSEMENTS.

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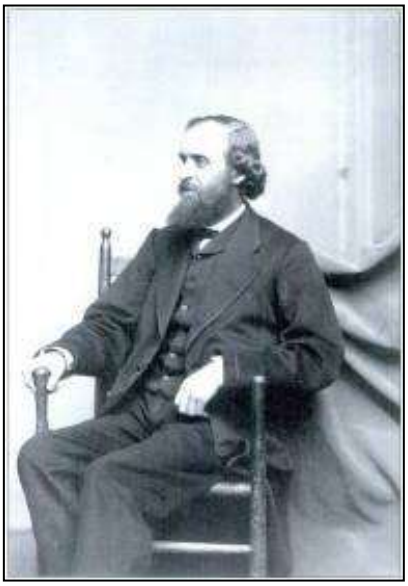
FOURTH LECTURE
TUESDAY EVENING, APRIL 8,
At 8 o'clock.
ON GEOLOGY.
TICKETS 50 CENTS.

Or for the remaining three lectures $1; to be obtained at the Mercantile Library, and Library of the Long Island Historical Society. a2 2t*

Books authored by Benton, for sale at his lectures at $1.00 or $1.50, included,



Nature's Secrets (1863)
The Soul of Things; or Psychometric Researches and Discoveries (1863), with his wife Elizabeth
Our Planet, Its Past and Future, or Lectures on Geology (1869)
The Deluge in the Light of Modern Science, A Discourse (1869)
Irreconcilable Records, or Genesis & Geology (1872)
What Was He? or, Jesus in the Light of the Nineteenth Century (1877)
Is Darwin Right?, or The Origin of Man (1881)

Denton's wife did the typesetting. As might be deduced from the titles, the author was smitten with the science of geology.

Excerpts suggest the author's intellectual framework. Psychrometry allowed him complex deductions from scant evidence.

> *From the first dawn of light upon this infant globe, when round its cradle the stormy curtains hung, Nature has been photographing every moment.* -- Nature's Secrets (1863)

His sense of nature was often accurate,

> *I have never visited the Mammoth Cave; but those who have will, I think, acknowledge the accuracy of the descriptions of the known parts of the cave. The truth of the statements with regard to the unknown portions future explorers may yet determine. The animal influence felt was probably owing to the fossils contained in the Mountain Limestone, in which the Mammoth Cave has been hollowed out, by the action of underground streams for ages.* -- The Soul of Things (1863)

At times, however, his geologic imagination got the best of him.

> *Small earthquake-shocks are often produced by masses of rock falling into subterranean cavities; some of these may be heard and felt for great distances. The motion of a passing locomotive can be distinctly felt in some houses a mile from the railroad.* -- Our Planet, Its Past and Future (1869)

And more than at times, his Darwinian bent propelled him beyond the pale.

> *The time will come when the land under Lake Erie will be of more value than the water within it; and, when that time comes, man will say to the waters, "March!" and they will go, leaving the land for man's occupancy. Its greatest depth is but too hundred and seventy feet, and its drainage would be an easy matter. In like manner, the lands of Lakes Michigan and Superior will be needed, demanded and obtained, and the sea be made to give up a large portion of its shallow shores to supply man's constantly-increasing demand for room.* -- Is Darwin Right? (1881)

In an April 16, 1881, review of Is Darwin Right?, the Scientific American noted of the author,

> *During his career as a popular lecturer he has undoubtedly done good work in combating the older unscientific traditions of the multitude. But the cast of his mind is essentially unscientific, and his knowledge would appear to have been gained essentially by reading. His book in interesting and suggestive, but it betrays throughout the incompetence of the author to grasp the exact conditions of the problem he attempts to answer.*

Denton was a news item, a snippet from the September 1, 1865, Buffalo Daily Courier being an example.

> *An exploring party, consisting of Professor Denton, Geologist, of Boston; Major Whitney and others returned today from an expedition through Western Colorado, between the Rocky Mountains and Utah. They report that they have made important discoveries of coal, petroleum and shale, on the proposed route of the Pacific Railroad. They also bring dispatches from General Hughes' corps, constructing the new wagon road to Salt Lake, which will shorten the distance fully too hundred miles.*

Denton was fearless in fostering his beliefs. From the Wanganui Chronicle, September 1, 1882,

> *It is stated that Professor Denton was hissed off the stage a few Sunday evenings ago, because he had said the Bible was a series of falsehoods.*

Perusing the newspapers of the day, one cannot help but note that our character seems to have had no given name; in news of his most-recent lecture, it's just "Professor Denton" this and "Professor Denton" that.

Even the government seems to have been uninformed regarding Denton's given name. Annual Report of the United States Geological Survey of the Territories, Wyoming (1872) quotes "Professor Denton" as follows.

> *Professor Denton, who made an exploration of the country about one hundred miles south of the railroad, has given a graphic account of his discoveries, which shows very clearly the geographical extension of this formation. Near the junction of White and Green Rivers, partly in Colorado and partly in Utah, he describes an immense tertiary deposit, composed of a series of petroleum shales, one thousand feet in thickness, varying in color from that of cream to the blackness of cannel coal.*
>
> *Professor Denton also discovered in this region a deposit of petroleum coal, which appears identical with and would yield as much oil as the Albertite coal of New Brunswick. Another bed, resembling cannelite, was noticed, ten to twenty feet in thickness, which Professor Denton believes would produce fifty or sixty gallons of oil to the ton.*

The title "Professor" is itself somewhat murky. Our geologist never earned a university degree and never held any sort of conventional faculty position. The periodicals that expanded on the title alternated between Professor at Harvard (for which there is no evidence), Professor at Wellesley College (Wellesley indeed being his home town), Professor at Boston University (an honorific possibility, perhaps) and Professor of the Boston Society of Natural History (which would have accorded no such rank). Denton himself remained above the fray, never correcting any of them. Perhaps wishing to side-step professional censure, Denton refrained for affixing any title or degree to the author page in his many books.

We'll not even mention that he was said to have been the Wisconsin State Geologist, a dubious appointment for having visited that state during the Civil War to survey for metals.

Nor will we comment on the Professor's knowledge of basic science. Christian Wisdom, A Key to Lessons in Earth Life (1915) by Franklin Ellsworth Parker, published long after Denton's demise, credits "Professor Denton" as author of the book's chapter on geology. A sample,

> *All matter when analyzed is reduced to four elements.*
>
> | | |
> |---|---|
> | *1. Carbon Magnetic* | *Solid Earth* |
> | *2. Oxygen Magnetic* | *Liquid Water* |
> | *3. Nitrogen Magnetic* | *Gaseous Air* |
> | *4. Hydrogen Electric* | *Solid or Gas Fire* |
>
> *Although the chemist bases his calculations on atoms or molecules, never has one been isolated, weighed, or defined by science.*
>
> *The oceans have a combination of 12 salts with which to cleanse the cruder atom.*

Aristotle might have agreed in principal -- recall the earth, water, air and fire of Chapter 2 -- but physical chemistry was by this time a great deal advanced.

But credentials and scientific background aside, Professor Denton was at times astute in his geological opinion, his crowning achievement being his identification of a fossilized saber-tooth cat tooth, 24 centimeters in length, the breadth of the crown 9 centimeters, at Rancho La Brea, California.

He took the tooth and some other bones back to Massachusetts, but his report failed to generate interest within the scientific community. We can be certain, however, is that the artifact generated attendance for his traveling lectures.

Unlike those who insisted that all lakes have outlets, subterranean as required, Denton recognized the actuality. From the Brooklyn Daily Eagle April 1, 1866, report on his lecture of the previous evening.

> *It is well known that any lake which has no outlet is necessarily salt, because the evaporation of water constantly going on leaves the salt, of which there is more or less in all water, in the lake... In Utah, Great Salt Lake in summer time, when water is low, furnishes water which produce one gallon of salt to three of water. Suppose the supply of fresh water be cut off such a body of water as has frequently been done by volcanoes in ages past, would not soon be a salt mine?*

We'll not expand upon Denton's association with the spiritualism movement of his time, other to say that he was an advocate. A web search today on the professor yields far more hits related to psychrometry than to geology. Regarding the latter, however, if we strip away the metaphysical extrapolation, what could be a better reduction of the science than the following?

> *Why could not rocks receive impressions of surrounding objects, with which they had been in immediate contact for years, and why could they not communicate the history of their relationship in a similar manner to sensitive persons?*

The lecture bill advertises Denton's topics.

Lectures.

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OF
ILLUSTRATED LECTURES.

TO-MORROW (SATURDAY) EVENING,
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THE BATTLE OF THE BOOKS;
Or, Genesis and Geology.
Does the Account of Creation in Genesis Harmonise with the Revelations of Science?

TUESDAY, 20TH MARCH,
THE BIBLE IN THE BALANCE:
Or, The Bible and Good Sense.
A Lecture of intense interest and great value

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The strongest arguments for the Divinity of the Bible carefully considered. This is a Lecture that every Christian should hear.

Questions relating to the Lectures may be asked at the close of each.

Single admission, 1s., 2s., 3s.
Lectures commence at 8 p.m.

SUNDAY NIGHT, 18TH MARCH
MR. WILLIAM DENTON
WILL GIVE
A LECTURE
IN
ALBERT HALL,
NEXT SUNDAY EVENING, AT 7.30 O'CLOCK,
ENTITLED
THE TRUE WORD OF GOD
WHAT IT IS, AND WHAT IT IS NOT.
Admission, 6d., 1s., and 2s.
Tickets may be obtained at Isatt & Mitchell; S. Smith and Co., Booksellers, Queen-street. 3652

The Professor left his audiences satisfied. From the Brooklyn Eagle of April 12, 1866,

> *Resolved, that we have heard with interest, gratification and profit, the course of six lectures on the Science of Geology, delivered by Professor Denton. That while they have evinced his own study and mastery of the subject, his ability as a teacher and expositor of it, in its wonderful scope and manifold relations, has been marked and conspicuous, and demands our grateful acknowledgement.*

Syracuse Daily Journal, November 15, 1868,

> *Imagine a beautifully written book, whose style is at once elegant, graphic, vivid and familiar; put that book on two legs, give it a ponderous finely balanced brain at the top, and an eloquent tongue of perfect fluency, and you have a facsimile of Professor Denton... A mind peculiarly adapted to the study of the earth's structure, history, present condition, and future career, has by tears of enthusiastic, but patient study, research, travel, analysis and logical inference, made itself just as familiar with this whole grand field of inquiry, as you and I are with our daily avocations. The talks, as it were, not in sentences, but in pictures. His own splendid faculty or realization compels his audience to see and think with him.*

But why, we may ask, have we devoted so many paragraphs to a suspect geologist, albeit a renowned Chautauqua lecturer?

Because, we must answer, our Professor, apparently in the course of a consultancy for New England's millenary industry, discovered a great underground river.

Well, we must hasten to admit, the discovery was not in the sense of personal inspection, but rather via psychrometry.

Once such a geologic marvel is discovered, of course, it persists even if no one else can find it.

The New England Underground River

In the preceding chapter, we noted the 1900 Lewiston Evening Journal's suggestion that the New York City water supply be taken from the White Mountains of New Hampshire.

The idea, it seems, wasn't a new one. "The Underground River of New England," Engineering Magazine, an Industrial Review, October 1896 to March 1897, reported the discovery of a stream adequate to "supply all central New England for all time," a revelation made by a certain Professor Denton while searching for a supply of water pure enough to bleach the material for fine summer hats. Engineering Magazine adds,

> *Not far from the time that this river was discovered a large bleachery in Providence drove a well which yielded a never failing supply of very pure water, doubtless from the same source as that of the water supply of Lowell. The New Haven & Hartford railroad have struck the stream by*

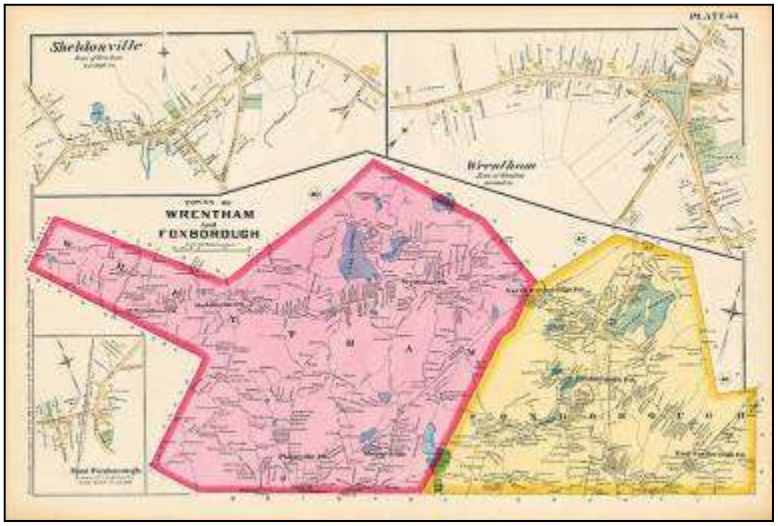
wells at Pawtucket. The water is said to be better than ordinary spring water, and admirably fitted for use in steam boilers.

The Journal of Commerce, September 26, 1896, provided additional details.

Witches' pond was so named years ago, on account of the many peculiar noises heard there. At intervals there were distinct rumblings beneath the surface. Superstitious persons were alarmed, and afraid to go near it. People who had no fear of ghosts watched the action of the water with interest. They always found the water icy-cold in summer, and it ever rolled and boiled. A water-pail would not cover the largest bubbles.

The pond covers fifteen acres, and in winter ice forms there long before there are signs of ice on other ponds. Ice six inches thick forms on Witches' pond to every inch of ice on other ponds in the vicinity in the same length of time. Only a few years ago four men who were fishing through the ice narrowly escaped losing their lives. There was a sudden upheaval while the men were on the pond, and ice fourteen inches in thickness, that covered the peculiar lake, was thrown about. The men, having heard the internal rumblings, took warning and reached the shore just in time to avoid being precipitated into the boiling pond. Lily-pad roots as large as one's arm were brought to the surface at the same time.

E. Robinson's "Map of Wrentham & Foxborough Massachusetts" (1888) shows Witches' Pond at the bottom, center.



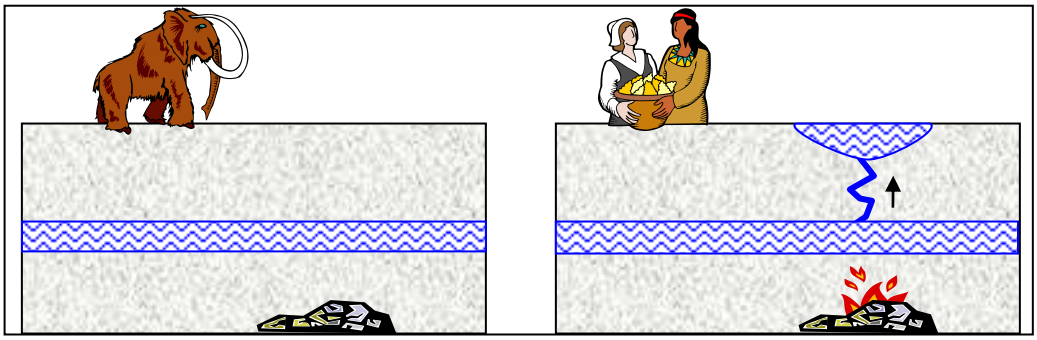
Professor Denton heard several stories about the pond, and out of curiosity made an investigation into the cause of the great boiling of the water which occurred at intervals. He tried to take soundings, but in several places he was unable to find the pond's bottom. Gases were detected rising from the pond, and he was led to believe that they issued from some distance below the surface. The water's remaining pure proved to him that the pond had an outlet as well as a source, and, as it was not visible, the investigation was all the more interesting.

Pipes were driven about the well, and coal and blue clay were brought to the surface. Over one hundred feet below the level the pipe struck a ledge, and, after drilling the ledge on the south side of the pond, water was found. The water, when examined, was found to be purer than any other found in New England. Several wells were driven, and Professor Denton came to the conclusion that Witches' pond was an outlet for an underground river. It was when he told of his discovery that people laughed at him.

The river located was one hundred and ten feet below the level. Above it was a covering of hard pan, and the bottom, twenty feet below the covering, was of rock. Professor Denton was of the opinion that there was no Witches' pond until there was an upheaval of the earth years ago, when the shelving rocks under and over the torrent were torn away. Aided by gases from

the coal and other substances in the earth, a rent was torn, through which the water made its way to the surface.

We'll pause to illustrate the process.



The streams in the vicinity of Foxboro are from a different watershed. The underground river is believed to come from a glacial spring in the White Mountains of New Hampshire, or beyond. It is known that the city of Lowell struck the river only a few years ago, and from that day to this has had a fine supply of water. At the time the Lowell wells were driven no one had heard of the river flowing under New England from north to south. The underground current has been followed by wells through Attleboro, Dodgeville, and Hebronville to Lebanon, where it swerves to the west and passes under Pawtucket falls on the Blackstone River, thence through Pawtucket southwesterly and under Providence, Cranston, Warwick, East Greenwich, and Wickford into North Kingston, and into the sea near Hazard's ledge.

That Professor Denton was being quoted speaks for his legacy, as he'd died 13 years earlier after contracting jungle fever on a trip to New Guinea. His death was extensively noted in the press, the illustration "Death of Professor William Denton, Argus Expedition, 1883."

While by no measure was Denton a discoverer of anything, the 1901 Engineering Index, Association of Engineering Societies, deemed him more.

River, Subterranean -- An Underground River. Remarkable subterranean stream of pure water flowing from the White Mountains, first discovered by the late Prof. Denton.

The White Mountain source indeed had its respected advocates, literarily respected, that is. While Henry David Thoreau, author of Walden, or Life in the Woods (1849), is today revered as a naturalist, the fact is that he was fooled by Walden Pond. Surely some of the water, he deduced, must come from a distant locale.

Excerpted from Man and Nature, December 1971.

Those who wondered why Walden does not seem to rise and fall with local weather long ago concluded that the source of Walden's water lay somewhere outside this locality. This theory has been strengthened by the facts that has no inlet, and is fed by springs whose source no man can see, and also by the common opinion that the slopes around it make a watershed too small to supply so large and deep a pond.

Tales are told around town of the hole in the bottom of and the stream that comes through it, connected perhaps to a river that is rumored to run underground from somewhere in the White Mountains, perhaps Lake Winnipesaukee, southward to Cape Cod.

Even though Thoreau lived by the pond for two years and visited it many more, he knew little about the matter, summing up what he did know in his book, "The pond rises and falls, but whether regularly or not, or within what period, nobody knows, though, as usual, many pretend to know."

He wrote (Journal, August 27, 1852) that "the watershed by the surrounding hills is insignificant in amount," and suggested that the slow rises and falls of Walden were due to changes in the amount supplied by the deep springs fed from some unknown source.

Although the writer was misled hydrologically, he recognized in much-broader context the analogy between the classical Greek underground rivers the American experience. From Thoreau's Walking (1861),

We go eastward to realize history and study the works of art and literature, retracing the steps of the race; we go westward as into the future, with a spirit of enterprise and adventure. The Atlantic is a Lethean stream, in our passage over which we have had an opportunity to forget the Old World and its institutions. If we do not succeed this time, there is perhaps one more chance for the race left before it arrives on the banks of the Styx; and that is in the Lethe of the Pacific, which is three times as wide.

But back to Prof. Denton's river; it kept being re-reported. From the Oswego Daily Palladium, April 15, 1902,

Underground Stream Said to Run under New England States according to Theory of Professor Denton, the Mad Torrent Rushes Far Under the Earth from New Hampshire to Rhode Island.

A law suit recently argued here before the Norfolk superior court of Massachusetts has revived interest in the theory that the people of the New England states are living on a crust of earth from 80 to 120 feet in thickness, beneath which there is a rushing torrent of water that makes its way from the White mountains in New Hampshire to Narragansett bay.

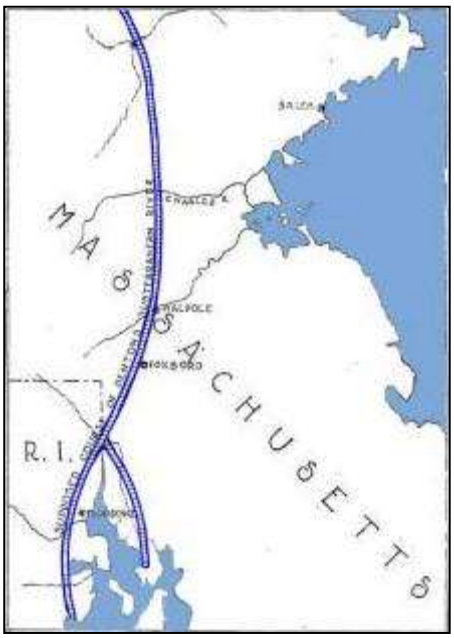
The case in which talk about the underground river theory was brought up was that of Hollingsworth and Vose against the Foxboro Water Supply district. The plaintiffs claimed that the town of Foxboro had been taking water from a privilege that belongs to them. Foxboro denied the allegation.

An effort was made to prove that Foxboro was taking its water from the Neponset River, of which the plaintiffs have full control. It was said that the peppermint was poured upon the surface of the Neponset in order to establish the case, it being contended that if the water sowed any signs of the essence when drawn from faucets in different places it would prove conclusively that the water was being taken from the Neponset River. No trace was found of peppermint, however.

Of Course the Foxboro people were delighted with the result of test, but another experiment was made. It is said that a mammoth steam pump was erected near one of the wells, from which the Foxboro district obtains water, and the pump was put to severe test, pumping thousands of gallons of water every hour. Notwithstanding this, Foxboro got its usual supply of water with the same heavy pressure.

The belief in the underground river owes its being to one Professor Denton, who used to deliver popular lectures throughout New England, his favorite theme being geology. Denton was a clever man who had evidently studies his subject earnestly. He was a convincing speaker. He could hold the attention of his hearers to the close of the lecture and in any town where he had once appeared he always found it easy to secure a re-engagement. He had a number of startling theories to expound, one of which related to a vast underground stream rising among the White Mountains and flowing southward.

Professor Denton's map, we show on the right. As we've done before, the blue is our addition for clarity.



Denton traced the course of this river from near the New Hampshire line down through the state of Massachusetts to the Rhode Island border, where, he declared, the stream separated, forming a Y, one branch of which passed down the eastern side of the Providence River and the other to the west of it. His underground river crossed, he thought, though the deep underneath it, the Blackstone at Providence Falls, one of its branches running beneath the Seekonk River to an embouchure into the bay, the other arm proceeding down the western shore, crossing under the Pawtucket and two or three smaller streams and finally into Narragansett Bay near Wickford.

While Professor Denton made no such assertion, the map shows the route just a bit west of the blue dashed line of Chapter 88 that's said to water Long Island.

This theory led the marvelous torrents underneath the town of Foxboro, where Denton claimed it comes closest to the surface, in fact where it finds an outlet in Which Pond. This idea is substantiated by the men of Foxboro who have tried to find the bottom of Which Pond. They have never succeeded, but startling tales are told of mysterious roarings below the surface. These roarings or explosions of gasses are followed by great commotions on the pond's surface. During these upheavals, report has it that lily pads as large as a man's thigh have been thrown up to the shore. In the icy water of the pond lurk mammoth pickerel.

The March 2, 1902, St. Louis Republic, "New England's Mysterious River" provided additional detail.

Prof. Denton, Formerly of Harvard, Claims to have Traced an Underground Channel.

Again, we must ask ourselves, what is the Professor's affiliation?

> *Is there danger of the earth's surface giving way and throwing thousands of persons and houses into the deep raving through which the river flows?*

A suggestion of danger never hurts newspaper sales.

> *Fish with no eyes have been found in the pond.*

This one's but a fabrication.

> *The entire distance of the course of the underground stream follows a natural channel made by the meeting of two ledges, one sloping from west to east and one sloping from east to west, and coming into contact from 80 to 120 feet below the surface of the earth.*

While it's bogus stratigraphy, as Professor Denton knew well, detail can sell a vague idea.

> *Professor Denton was of the idea the course was that of a flow during the glacial period, and that changes of the earth's surface in time caused the raving to become filled, still leaving the river to flow through its natural conduit.*

As the region had indeed been glaciated, the scenario is at least plausible and seems not to preclude the "natural conduit" being filled with porous media. Denton would surely have been aware of common aquifers, but deemed that "underground river" portrayed a more vivid picture.

The New York Times of February 6, 1902, ran a briefer version, adding, "Prof. Denton, who was at Harvard years ago."

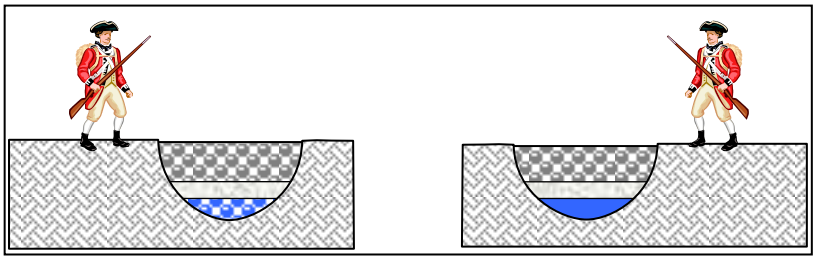
What no reporter makes clear is the source of Denton's opinion. None of his many books entertain the subject of geohydrology. His lectures were widely summarized in the news, but no archive indicates such a topic. As he indeed expounded regarding the glacial record, however, it does seem probable that New England stratigraphy would have been mentioned.

The scenario most likely is that the Professor's passing remarks -- eloquently presented, we may be sure -- had assumed a mantle of authority.

The McKean Democrat, March 31, 1893, printed the following.

> *Rev. Dr. Foster of Boston in his weekly letter to the Chicago Advance, states that there are reasons to suppose that there is an underground river about a hundred feet below ground, running through Massachusetts and Providence and emptying into the sea. It is supposed that this river, whose waters are ice-cold and exceedingly pure, starts from the White Mountain region and finds its way through an old ravine dug my a glacier, and then filled with gravel and covered with hard-pan. Water of that ice-cold quality and of great abundance has been found at about the same depth in Providence, in Foxboro and two miles west of Lowell. In two of these cases it is certain that there is a cavity scarcely a hundred feet below ground, through which the water flows, for in each case the drill dropped from ten to twenty feet after reaching water and then struck a ledge. If there is this stream of pure cold water traversing our Commonwealth, it will be hard to over-estimate its value to Eastern Massachusetts in years to move, to whom the problem or a pure water supply is one of great difficulty, but of vital importance.*

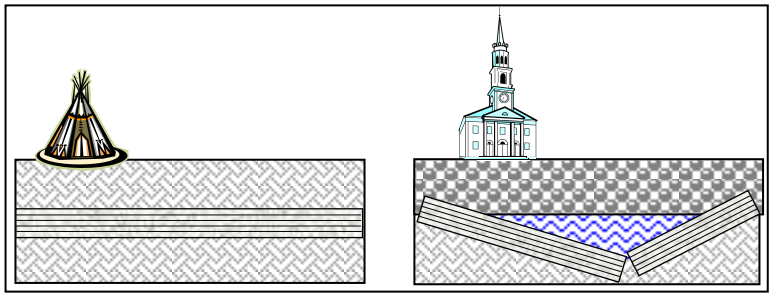
The Rev. Doctor isn't, in fact, too sure of how the underground river works. It's a gravely artesian aquifer. It's a perforatable cavity. In any case, it's an important discovery.



"Talk of a Subterranean River, Long Alleged to Exist in New England, Revived by a Case in Court," Brooklyn Eagle, February 23, 1902, however, wasn't impressed with the story's source.

> *The subterranean river was discovered by one "Professor" Denton. Twenty of twenty-five years ago one "Professor" Denton was wont to deliver popular lectures throughout New England, his favorite theme being geology. He was not, as some have claimed a Harvard professor -- in fact, it is doubtful if he took his title from connection with the faculty of any college -- he was just a "professor."*
>
> *Denton was a clever man who had evidently studied a good deal in his favorite science, and who was an earnest and convincing speaker... He had quite a number of rather startling theories to expound -- theories which none of the recognized authorities had ever promulgated, but which he argued with such plausibility that they seemed the veriest assertions of fact.*
>
> *One of these theories pertained to a vast subterranean stream, rising among the eternal snows of the White Mountains and flowing southward toward Narragansett Bay... He declared that is was a great natural trough at an average depth of 80 to 129 feet beneath the surface, caused by the meeting of two layers of rock, one dipping from east to west, the other from west to east.*

Again we'll pause for illustration.



> *Professor Denton's theory led to the marvelous torrent underneath the Town of Foxboro, where, he claimed, it comes closest to the surface; in fact, where it finds an outlet into Which Pond.*
>
> *Now, right here comes in the severest test to my credulity of the Denton subterranean river water supply hypothesis. If this wondrous river really comes to the surface in Witch Pond and the town is using any part of its water for domestic purposes, why should it have gone to the expense and labor of driving wells close to the Walpole line? Why not have set up a pumping station on the shores of Witch Pond and pumped those icy, pure and inexhaustible floods into the town mains?*

The article then recalls Foxboro's contention that its water supply was derived from groundwater independent of local streamflow vs. the counter claim of water integral with surface flow and thus subject to the same rules of use. (We pursued this legal distinction in Chapter 69, The Law of Subterranean Streams.)

The Eagle summarizes the opinions of the expert witnesses -- this time bona fide Harvard and MIT faculty -- who debated the specifics, but concurred that Foxboro sits on a stratified aquifer system of regional breadth. Foxboro's attorney, the Eagle notes, judiciously avoided Professor Denton's theory, which would have been evidence in the town's favor. The case was resolved by negotiation.

It's just so hard to keep good copy down. "The Water Supply of Nashua, N.H." in the December 1902 Journal of the New England Water Works Association by Horace G. Holden illustrates how Denton's thoughts made it into a respected engineering journal.

> *Professor Sedgwick informs me that this change of temperature is probably caused by the water flowing underground from a long distance, and if his theory is correct (as I have no reason to doubt) it may be possible that this water comes from a continuation of the*

underground river which Professor Denton, formerly of Harvard College, is said to have traced from Narragansett Bay to the New Hampshire state line, according to an item which was published in February 1902, in several Massachusetts papers.

The New Hampshire reference would be to the boulder gorge discussed in Chapter 42, but Denton would have needed to do little but listen to local lore, of which "Mystery of Underground River Flowing Through Area," Nashua (New Hampshire) Telegraph, January 17, 1974, provides a summary.

A river, trapped 800 to 1,000 feet below the earth's surface, running from the White Mountains in New Hampshire to Cape Cod and Rhode Island, was once the chief source of water for Lowell, Mass., and numerous other communities along its path.

Sounds Incredible? Only if you are a non-believer in what might have happened during the Ice Age, and if you believe that Witches' Pond in Foxboro, Mass., is merely spring -fed.

It was in that community, located about half way between Boston, Mass., and Providence, R.I., that stories gained most recognition in the 1800s of the body of water free of a visible outlet, and without a visible inlet.

The river was traced in that time by wells form Lowell, through Attleboro, Mass., under Pawtucket, R.I., Cranston and North Kingston, RI, eventually to the ocean.

The most elaborate of all theories was that it was the true course of the pre-glacial Merrimack River. The thought was that before the glaciers, huge valleys extended from the White Mountains, following a somewhat winding course to Rhode Island and Cape Cod.

These valleys were filled in and the present topography along these routes is chiefly the product of a period of intense erosion followed by one of dominant deposition. The theory is, and some believe, that Lake Winnipesaukee empties at, or near, Alton Bay, that the water rushes downward for a distance of about 800 feet below the earth's surface, then levels off and flows in what is now known as the Farmington River Valley, a southeast course to the sea.

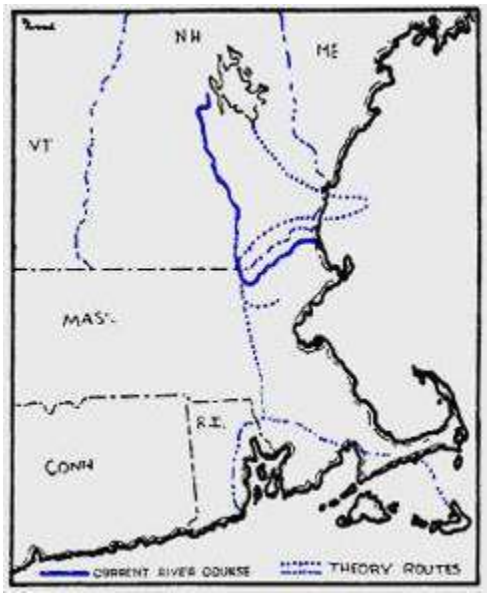
The river was said to travel beneath the ocean floor for a short distance, then swing back toward Rye, Exeter, Derry, eventually passing through Nashua along approximately the same course the river now follows in a southerly direction.

At Lowell the river turns east, northeast, but it is believed that at one time made a much wider sweep to the south side of the city, to Billerica before making a turn eastward.

Another theory advanced is that the river follows a winding course, about 200 miles from Wolfeboro, N.H., on the shore of Winnipesaukee, to Cape Cod, where it supposedly supplies groundwater to wells on the Cape.

A side theory of that, is that the fabled underground river flowing under Foxboro, divides in the area of Pawtucket, with one branch flowing due south, and the other going in the easterly direction of Hyannis, Mass., then southward under the ocean to Martha's Vineyard.

One theory states that the river flows about 600 feet below the surface of the ground from Winnipesaukee. It supposedly twists out to sea and back, then splits into two branches and returns to one again. In places it is reportedly 20 miles wide, truly an American or rivers..



As for what the locals have since come to believe, the feature in the Telegraph brings us somewhat up to date.

US Geological Survey, Department of the Interior, has made extensive studies in the area of Nashua and Lowell, but admits that beyond this point to the South, the path of the pre-glacial Merrimack is sketchy.

"If the fable were true," states a report from Geological Survey, "Lake Winnipesaukee would indeed be in danger. The total volume of water in this huge lake at the present is about 14,600 million cubic feet. If the underground river were 20 miles wide, as reported in legends, the lake would drain in three hours."

John Cotton, of Geological Survey in Concord, explains that the legend of the underground river must be just that -- a legend, and at best a theory.

"The most spectacular examples of a true underground river," he explains, "are found in areas where limestone rock exists, also in volcanic terrain."

"We don't have the extensive limestone covering that they have in Virginia," he said. "This is the source of water we hit when we drill a well," he said. "The cracks are very narrow, and not much water flows. The idea of an underground river, as such, is entirely impossible."

"The theory just can't be so," he says of the underground river. "The tunnel has to be in hard rock, and the only place you can have that is in limestone terrain. We have none."

As far as Witches' Pond having no inlet or outlet, Cotton explains there are many ponds of this sort, most of which are spring fed. The water merely filters through the soil, and some is lost to evaporation.

But the people of Foxboro are not so sure. They are determined there is an underground river feeding their Witches' Pond.

Even after 100 years of yarn-spinning about the infamous flow of water beneath the earth's surface, the residents of that town are still exploring the area in hopes of tapping a huge, unlimited source of water.

Conclusion

There is, of course, no such New England underground river. There was, however, an influential "professor" of modern science (plus a few other causes) whose flamboyant advocacy lent enduring credence to such a watercourse.

CHAPTER 91

GENERAL BOUTON'S SOUTHERN CALIFORNIA UNDERGROUND RIVER

In the chapter completed, Professor Denton was a Gilded Age showman. The public paid their quarter for a rousing lecture celebrating the latest scientific discoveries, often falsely gilded, perhaps, but nobody was checking. The public wanted an eloquent authority and Denton declared himself to be that luminosity. His hypothetical underground river both engaged the audience's imagination and lent itself to scientific gobbledygook in which the Professor of questionable professorship was fluent.

This chapter concerns another notable of roughly the same era who also benefited from the public's belief in underground rivers. In this case, however, the beneficiary's rank was duly earned and the underground river aspect wasn't purposeful deceit, but rather how news reporters worded the story.

Gen. William Bouton's artesian well near Long Beach California was a good well by any measure, a banner for California's economic future. To the press -- hyped by the general on occasion -- the amazing upwelling was glorious proof of the region's great underground river.

We'll see ties to Chapter 39, Hydrogeology; Chapter 67, Damming Underground Rivers; Chapter 76, On Some Repairs to the South American Company's Cable; and Chapter 94, yet ahead, The Rio San Buenaventura, to list a few. A great underground river, real or imagined, integrates a spectrum of our beliefs.

As recounted by James Guinn in A History of California and an Extended History of Los Angeles and Environs (1915),

> *In August, 1868... General Bouton first came to Southern California to make his home and ever since has assisted materially in the development and upbuilding of the section.*
>
> *The famous artesian wells north of Long Beach were bored by him, and what is generally known as the Bouton water introduced into Long Beach and Terminal Island.*

Edward Bouton was "General Bouton" to the press. A Civil War captain with the First Illinois Light Artillery and then a colonel and commander of the 59th United States Colored Troops, he garnered the rank of Brigadier General upon discharge as brevetted recognition of his services.

Bouton bought land north of Long Beach, California that included a marsh that was once a bed of the Los Angeles River. Bouton's land was situated on the groundwater up-gradient side of where underlying rock diked the artesian belt between the Los Angeles and San Gabriel rivers, halting the subterranean flow, building up its pressure under its impermeable cover, awaiting puncture.

Bouton's neighbors on Signal Hill had the fortune to drill holes that spouted oil. Bouton had the fortune, perhaps more lucrative in the long run, to drill holes that spouted water.

Reported in "Los Nietos Valley, A Region of Corn, Butter, Cheese and Big Pumpkins," Los Angeles Times, October 21, 1892, Bouton first struck water with an 18-centimeter well at 103 meters.

> *Artesia is another settlement in this artesian belt, which appears to have inexhaustible supply of water. It is believed that an underground river extends beneath this section. About a year ago, Gen. E. Bouton struck an immense flow beneath Clearwater, at a depth of 330 feet. The well is still flowing two feet above the surface.*

Note the label "underground river," a misleading nomenclature to be perpetuated.

The well was reported by other sources to have jetted 2 meters above its casing. It was also said to have thrown a "stream 20 feet above the mouth of a 2-inch nozzle situated 22 feet 4 inches above the surface."

"Artesian Water, A Large Flow Struck on Gen. Bouton's Ranch," Los Angeles Times, July 4, 1894, describes an adjacent bore.

> *A large flow of water was struck by the well borers on Gen. E. Bouton's ranch situated four miles north of Long Beach yesterday. The well reached a depth of 331 feet when the water broke through the thin crust holding it and began flowing over the top of the 10-inch pipe.*
>
> *Mr. Peck, who sunk the well, says that judging from the present prospects, he expects a flow of 250 inches* [0.18 cubic meters/second] *by sunrise this morning.*

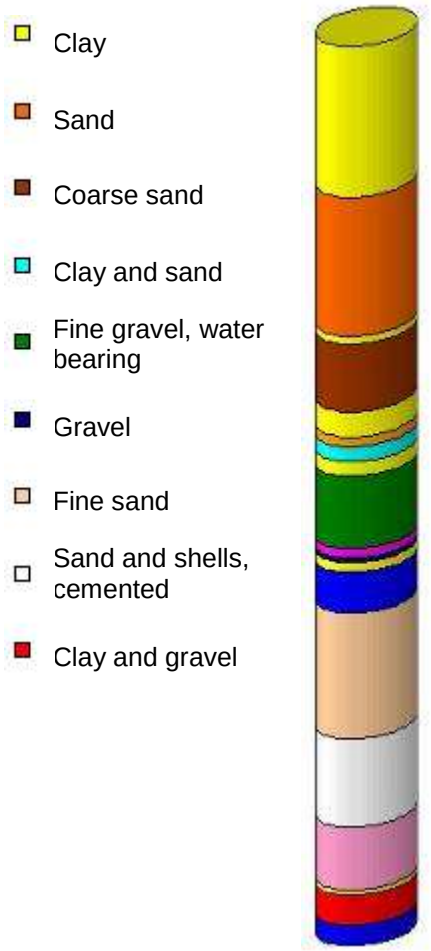
As noted in Chapter 39, an "inch" was a unit of water discharge in the western United States. In California, 250 inches would likely have corresponded to 0.18 cubic meters/second, but another Times article converts the value to 0.14 cubic meters/second. For comparative consistency, we'll employ the latter conversion factor.

From the Times "Increasing In Volume, The Flow of the Great Well on Gen. Bouton's Ranch Doubled," two days later,

> *The new artesian well on Gen. Bouton's ranch at Bixby Station on the Terminal Railroad... developed a flow estimated at three hundred inches* [0.17 cubic meters/second] *on July 4... According to a statement of Mr. Newland of the Interior Department, these are the largest wells in the United States, except for the ones at Huron and Miller in South Dakota.*

Bouton's third well ("Bouton No. 1" in state records), 30-centimeter casing and 230 meters deep, was brought into production the following year at 0.18 cubic meters/second. Its pressure ripped the 5-centimeter-thick iron cap from the wellhead and rocketed cobblestones and gravel 25 meters into the air. The strata are tallied below.

Material	Thickness (meters)	Depth (meters)
Deposits of upper Pleistocene age:		
Clay	37.5	37.5
Unclassified:		
Sand	34.4	71.9
Clay	1.9	73.8
San Pedro formation:		
Coarse sand	16.9	90.6
Clay	6.3	96.9
Sand	2.5	99.4
Clay and sand	3.8	103.1
Clay	3.8	106.9
Sitverado water-bearing zone:		
Fine gravel, water-bearing	17.8	124.7
Clay	2.2	126.9
Gravel	1.3	128.1
Clay	2.5	130.6
Coarse gravel, very little sand.	10.0	140.6
Fine sand	31.3	171.9
Sand and shells, cemented	21.9	193.8
Fine sand	15.6	209.4
Clay	1.3	210.6
Clay and gravel	7.5	218.1
Gravel	5.0	223.1



The lower clay layers are thin, but sufficiently impermeable to cap the pressurized water below. As Bouton No. 1 was only perforated between 211 to 223 meters, the artesian jet drew from just the lowest two strata.

Long Beach engineer Charles Goucher is quoted in History and Annual Report, 1943-44, Water Department, City of Long Beach.

> *The big Bouton well came in about 1895... The pressure was so great that they couldn't handle it -- threw mud and dirt and cobblestones until it choked itself and they had to get a rig and clean it out. They tried to cap it, but the force was too great: Dirt would fly -- you'd' think it was a geyser. It ran wild and made Bouton Lake. When they did get it capped, it spouted 80 feet above the ground through a two-inch pipe -- about 35 pounds pressure.*

Local papers said the column of water, shining with the afternoon sun behind it, could be seen from as far away as Whittier, 16 kilometers north. Rail excursions from Los Angeles brought gawkers.

The drilling log includes the notes:

> *All sand and gravel bears water on high pressure. The largest stream 210' in depth, from 320' to 530' so far as now known, constitutes the largest underground stream of artesian water in the world. For a continuous distance of 150' the gravel in this stream is coarse enough to permit perforating the well casing, which exceeds the entire depth of many of the artesian wells in California. The log of the formation passed through in boring this well shows a total of 467' of water-bearing sand and gravel.*

History and Annual Report, 1943-44, Water Department, City of Long Beach, remarks upon the casual usage of "stream."

> *The use of the word "stream" in this connection is misleading, for as been shown before in these pages, the artesian basin of the coastal plain from which Long Beach secures its water supply consists of saturated gravel beds confined between layers of clay and under pressure due to higher intakes. There are no underground rivers or "streams," although the varying porosity and thickness of the gravel beds makes for a more rapid percolation and a greater volume in some than in others. The "big Bouton well" undoubtedly penetrated one of the best of these.*

The Bouton Water Company was formed by the general and the owners of the Terminal Railroad to exploit a "cavern of pure, fresh water." A 60-centimeter redwood pipe supplied the City of Long Beach for almost a decade. Only in the early 1950s was the wooden line removed from service.

Only one-fourth of the flow could be utilized, the excess forming 80-hectare Lake Bouton, 4.4 meters deep, empting via a slough -- later known as Bouton Creek -- to Alamitos Bay.

The February 20, 1895, Los Angeles Times claimed the yield to be one of the greatest in the nation.

> *In some sections, such as that back of Long Beach, there seems to be a regular underground river, and a deep river at that. The great artesian well of Gen. Bouton at that point is one of the largest in the United States, and the boring of other wells in that vicinity does not appear to offset its flow in the river.*

At 0.18 cubic meters/second, however, the well wouldn't merit a "second magnitude" designation for natural spring flow. Florida, the Ozarks and Idaho's Snake River valley have roughly 50 springs that exceed 2.8 cubic meters/second.

"An Underground River: New Water Supply for Long Beach and San Pedro," Los Angeles Times, July 23, 1898,

> *There has been no diminution of the wonderful flow of the two wells bored by Gen. Edward Bouton on his ranch near Long Beach several years ago. There is a seven-inch well and an eight-inch well, each which has such tremendous pressure that the water spouts forty feet above the mouth of the pipe. The combined flow of the two is 220 inches, or about 2,860,000 gallons a day* [0.13 cubic meters/second].
>
> *"One of the experts of the Department of the Interior," said Gen. Bouton yesterday, "assured me that there were no such wells anywhere else in the country... I believe that we could get 50,000 inches* [a whopping 30 cubic meters/second] *by properly developing it."*

"Enormous Flow Struck in the Bouton Well at Long Beach," Los Angeles Herald, August 8, 1899, speaks of "four streams of water" in apparent reference to the log of water-bearing strata. Most readers, however, would have taken "streams" in the context with which they were familiar. The article continues,

> *The new Bouton well, lately sunk five miles north of town and upon which the well borers have been at work the past week, this afternoon developed an enormous stream, it flowing over the top of the pipe in a large sheet fifty feet from the surface*
>
> *Four streams of water were struck in sinking, either of which would yield a generous flow, the last stream of all being struck at a depth of 728 feet. The flow at present is 200 miner's inches which can easily be increased to 600 inches.*

"Gen. Bouton's Well, Big Flow of Water Has Been Tapped," Los Angeles Times, February 21, 1900, reported that the 30-centimeter boring hit a 66-meter-thick underground stream at 100 meters, a powerful lower stream at 196 meters and boulders at 220 meters, of which 9 meters had been penetrated at the time of publication.

> *Some curious things have been taken from the well. At a depth of 670 feet* [210 meters] *a pint cone was removed. Between the depths of 725 and 730 feet* [226-229 meters] *numerous pieces of pine wood and pine bark and a lot of what has the appearance of pressed tule leaves were taken out.*

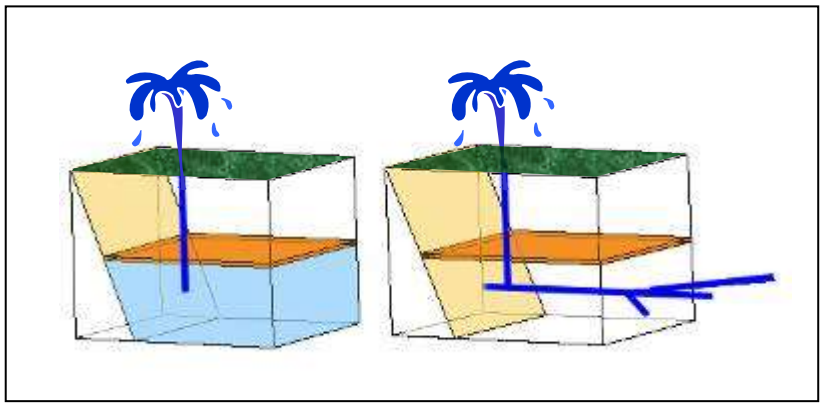
Whereas certain karst conduits receive surface detritus via sinkholes, the aquifer in question is of the classic granular variety into which coarse particulates do not infiltrate, much less travel. A bit or plant matter most likely tumbled down the boring.

"Offers a Water System, Proposition for a Pipe Line from Bixby Station," Los Angeles Times, May 17, 1899, presents Bouton's proposal to sell a 40-acre parcel possibly yielding up to 5.7 cubic meters/second to the Los Angeles City Water Company

> *As demonstrated by numerous borings, this immense body or stream of water is formed by three large underground streams forming a junction within my north line, and near the southern boundary of this forty acres, the stream is obstructed by a dike of clay some 240 feet* [75 meters] *thick, so the main body can only be struck on this forty acres.*
>
> *The flow of water from wells on this ground has never been affected by dry years, the pressure from below carrying the water 27 to 42 feet* [8-13 meters] *above the surface of the ground.*

Bouton's reference to a junction of "underground streams" again implies a network of waterways.

The first illustration to the right shows the actual case, an artesian aquifer blocked by a dike and capped by an impermeable stratum. As groundwater can laterally spread beneath the impermeable stratum, all real estate along the up-side of the dike would be equally suitable for drilling.

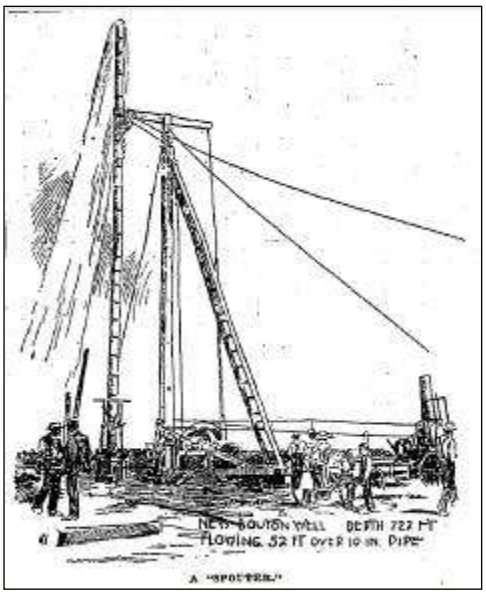


The second diagram illustrates Bouton's explanation, "three subterranean streams forming a junction" and then obstructed by the dike. Only a well from the parcel underlain by the pipe junction would tap the water. Bouton's hydrogeologic description is one of self-interest.

"Inspection Report," Los Angeles Times, August 15, 1899 summarized the state of development at the century's end.

> *There are vast underground lakes in which wells have scarcely a perceptible influence in reducing the water supply. The underground lakes at the higher elevations are those of the San Fernando Valley, the Upper Santa Anna Valley, near San Bernardino, the San Jacinto plains near Perris, and the Upper San Gabriel Valley near El Monte. The greatest body of land under which there is a vast quantity of water, however, is very well outlined in the interior by the Southern Pacific Railroad from Santa Monica to Los Angeles and by the Southern California Railroad from this city to Capistrano.*

One of the most remarkable wells ever dug in this country is that of the Bouton Water Company on the ranch of Gen. Bouton. Water was struck at a depth of 300 feet [94 meters]*, but drilling was continued to a depth of 722 feet* 226 meters]*, as shown in the accompanying illustration, where a terrific current was struck, which yields about 300 inches* [0.17 cubic meters/second] *of water. With such force this is impelled that when a stand-pipe 52 feet* [16 meters] *high was erected over the well, about 250 inches* [0.14 cubic meters/second] *of water poured out of the top. It is thought that with a motor attached, this well would not only furnish Long Beach with water, but it would generate sufficient electricity to light the town.*



Sufficient electricity to illuminate Long Beach? The well-powered generator would have produced less than 400 watts.

Bouton No. 1, c 1900. Water is flowing 30 centimeters above the pipe which sticks about 1.25 meters above the ground.

Water Quality

The well water was slightly yellow and tasted of hydrogen sulfide, Bouton imaginatively attributing the color to buried peat beds which also made the water naturally soft.

We've a few facts from "The Bouton Well," Los Angeles Times, August 14, 1898.

Reference was made in the Times to the remarkable artesian wells of Gen. Bouton near Bixby Station, on the Terminal Line. Gen. Bouton has received the following analysis of water from these wells, from the University of California at Berkeley.

In today's units,

Constituent	mg/L
Potassium sulfate, etc.	0.0063
Sodium chloride	0.0023
Sodium carbonate	0.0081
Magnesium carbonate	0.0070
Silica	0.0010
Organics	0.0025

At Bouton's request, Dean E.W. Hilgard of the College of Agriculture certified that the mineral content was "nothing beyond mere drinking water."

All in all, the interpretation seems reasonably correct. None but the last constituent is subject to today's EPA primary drinking water standards. For constituents which the EPA has secondary standards (related to aesthetics, not human health), the values are satisfactory. As organics are today regulated by specific compounds, we cannot be confident regarding the reported combined total of 0.0025 mg/L, but if the source were petroleum related -- a likelihood, given the proximity of Signal Hill -- the value appears within today's EPA primary standards.

Bouton -- as we might anticipate -- was even more laudatory, claiming that the water was known to cure kidney and rheumatic diseases. As such assertions were standard banter of the day's advertisements, the general can't be faulted for espousing a few.

Bouton's marketing slogan, "It does not see the light of day until it flashes and sparkles from the faucet in your home."

Submarine Springs

Here we have a claim of the type with which we became acquainted in Chapter 76, On Some Repairs to the South American Company's Cable, assertion of a sub-oceanic outlet, presumably for the subterranean flow that eluded Bouton.

"An Underground River: New Water Supply for Long Beach and San Pedro," Los Angeles Times, July 23, 1898,

> *A strange freak of the underground river now partially brought to the surface again has been to turn Alamitos Bay into an excellent oyster bed... Since the stream of fresh water from the underground river has been running into the bay, there has been just the proper admixture of salt and fresh water for the bivalves.*
>
> *It is said by the fishermen that there are places in the ocean a mile or so off Long Beach where the water is perfectly fresh. It is supposed that this is above the places where the underground stream tapped by the Bouton wells comes to the surface/*

We quote two historical anecdotes from Early Floods in Los Angeles County (1914) compiled by James Reagan, Chief Engineer of the Los Angeles County Flood Control District.

C.W. Caseboom:

> *Captain Polhoumas of San Pedro has told me that a ship could take on its supply of fresh water out in the ocean off Alamitos Bay. There was an immense volume of fresh water that emptied into the ocean at that section opposite the Alamitos region. People bathing in the sea at one of these places upon going to the other would at once notice the great difference.*
>
> *It has been the practice of the fishermen at San Pedro when they arrived at about one mile outside of the beach, and about midway between Long Beach and San Pedro, to lower a jug weighted so it would sink and corked up so that when it reached a certain depth the pressure would push the cork in, and the jug would fill with pure, fresh water.*
>
> *There is another place at Redondo where a great supply of fresh water empties into the ocean from the floor or bed of the ocean. There is a great hole in the bluffs in the cliffs near Redondo, where no doubt, fresh water came in from some subterranean waterway.*

C.H. Thornburg:

> *In the early days John McGarvin and many others have told me of being able to see the fresh water boil up in the salt water about … of a mile from the shore outside from Alamitos Bay. It was no trouble to distinguish the color of the fresh water from that of the salt water and for that matter, get a supply if necessary.*

While such submarine springs off Long Beach have not been geologically documented, the lore could have basis. Groundwater depletion in the early 20th century caused salt-water intrusion

beneath the shoreline, but under natural conditions, the zone flowed outward, and fresh water trapped under clay strata could indeed have fed submarine springs.

From the Great Salt Lake

Bouton's letter to the Times, "Our Artesian Water Supply," March 7, 1900, ties to another hydrologic fascination, the ever-elusive Great River of the West to be discussed in Chapter 94, The Rio San Buenaventura.

> *As early as 1869, William R. Olden, who was quite a noted scientist and contributor to scientific journals, after making numerous tests and observations regarding the underground flow of water in Southern California, and observing and examining several extensive fresh water streams rising from the bottom of the ocean, notably one near Redondo Beach, and another in a southwesterly direction from Long Beach, expressed the opinion that much of this water must have come from the Salt Lake Basin of Grand Plateau between the Rocky Mountains and the Sierras.*
>
> *He stated to me that it was well known that but a small part of the water from this great watershed of some 290,000 square miles in area, was carried out to sea by the Colorado River on the south and the Columbia on the north, and that he was satisfied after several years' study of the subject, that much of the water that had been unaccounted for was finding its way to the Pacific Ocean by underground passages through the Sierras or coast range of mountains.*

Bouton's source, William R. Olden, was, like Bouton, an ardent booster for the state. From Olden's Gold Rush Letters (1849-1877),

> *The country reminds me of the Arabian Tales, at a word a new country has been populated, large cities have grown up like magic, filled with an active, bustling people from all parts of the world, most of them Yankees. It is without exception the greatest country for making money that ever did exist.*

Orange Coast Magazine, June 1997, describes Olden as "a hustler." In "Orange County Almanac," Los Angeles Times, May 15, 1995, he's "a colorful real estate salesman." With a flair for public relations, Olden was the force behind the 1872 name change to "Orange County" for a county that had yet to product that fruit. Name it and farmers will accordingly plant, the logic subsequently demonstrated.

Olden foresaw the regional water bind and proposed bold solutions, the sand dam (Chapter 67) being one, as touted in "Damming the Santa Ana.: William R. Olden's Plan of Accomplishing that Object," Los Angeles Times, August 26, 1882, written unabashedly by himself.

> *In December last I called the attention of your readers to the feasibility of obtaining a superabundant supply of water for irrigation from the Santa Ana River by constructing a submerged dam at the head of the ditches at Bedrock Canyon, at the point where the channels of the river has the least width and depth.*

Unfortunately, however, engineering wasn't Olden's forte, as evidenced by his confusion between volume and discharge.

> [The well-driller for the State Irrigation Survey] e*stimates the underground current to be six hundred feet wide, with a depth of twelve feet -- or 7200 cubic feet; and if we estimate one-fourth of that current to be water, there would be 1800 cubic feet of water, or a stream 600 feet wide and three feet deep; or twenty times as much water as all the ditches on both sides of the river are able to utilize.*

Olden was not as Bouton credited him, "quite a noted scientist and contributor to scientific journals." In his younger days, Olden had likely heard gold rush yarns about Great Basin drainage sneaking under the Sierras and later extended the misconception to Long Beach?

To real estate promoters, though, a romantic source for an underground river made marketable sense.

Diminishment

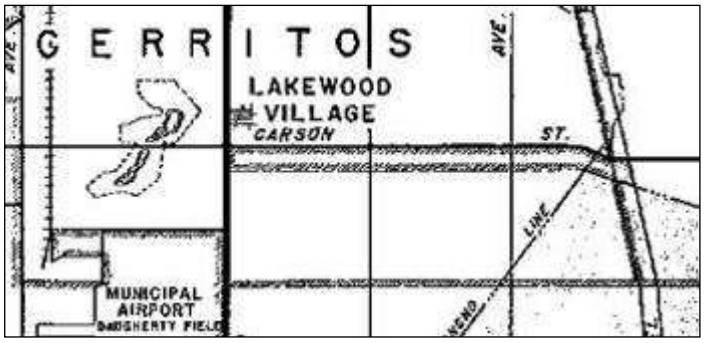
By 1903, the Bouton Well was still flowing, but at only 20 percent of its initial rate. The lake created by it had dried up. When the level of the well further dropped, electric pumps were required.

"Water Supply Is Limited," Los Angeles Times, September 27, 1912, reported in its Long Beach news,

> *For the past week the Cerritos Gun Club has been pumping water on its preserves northeast of the city to fill a new duck pond... When the pumps are in operation the decrease to the Burton wells has been so great as to be noticeable with the naked eye... The City Attorney is instructed to at once institute proceedings against the gun club to protect the city's water supply.*

The year 1914 was one of the wettest on record, but yield from Bouton No. 1 was sporadic, producing water just five months that winter, and only three months in the winter following.

To augment municipal water supply, Long Beach acquired a 200-meter "shotgun strip" of former beet fields and the associated water rights from the Montana Land Company in 1929. The 1940s map shows the strip in relation to Bouton Lake. As noted in relation to the earlier block schematics, an artesian aquifer can be harvested along the width of its pressure-inducing blockage.



As part of the transaction, the developer acquired the trough the former Bouton Lake. As the depression, the "airport bog," was too wet for building, it became a golf course with an 8-hectare water hazard and irrigation reservoir excavated at roughly the same location as Bouton's original lake, the new waterbody assuming the old name. The first ball teed-off at the 1933 opening festivities for Lakewood Golf Course was hit by Bobby Jones.

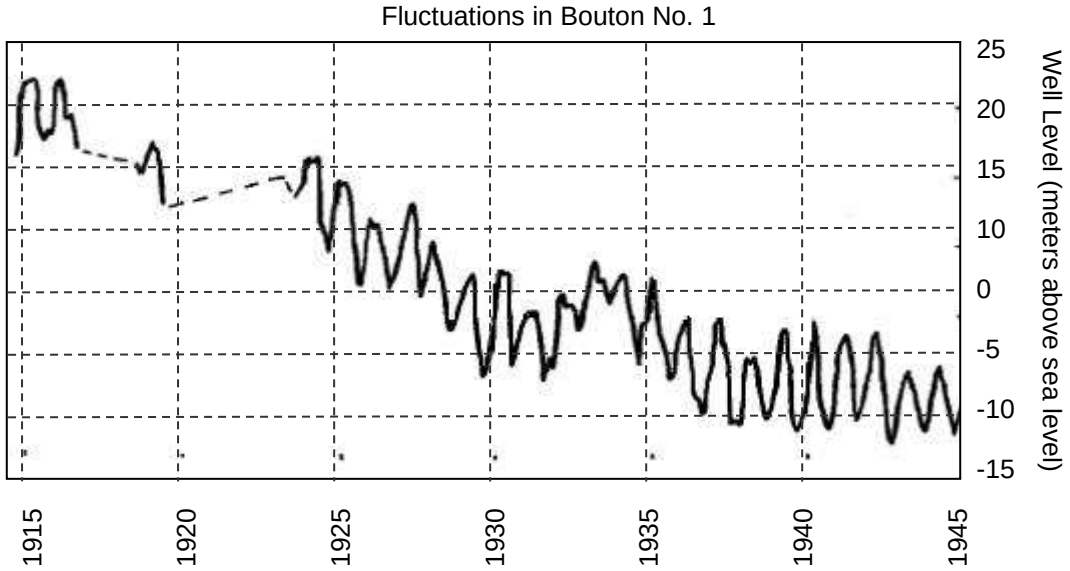
The "artesian belt" had once contained 43,000 irrigated hectares, but by 1919, there were but 13,000. The mayor of Long Beach boasted that the City's 20 wells remained inexhaustible, but by the mid-1930s, portions of the aquifer were drawn below sea level, proof that withdrawals were outpacing recharge. Bouton No. 1 was removed from service.

The inevitable consequence of overdraft was obvious to the experts, if not to developers and politicians. The Long Beach Water Department's History and Annual Report, 1943-44, stated it bluntly.

For two or three years, use of this water seems to have been limited to irrigation, supplying the Terminal locomotives and maintaining the level of Bouton Lake for the benefit of the Cerritos Gun Club. In fact, the well flowed so long and so abundantly that some concern was felt that it might "flood the whole country."

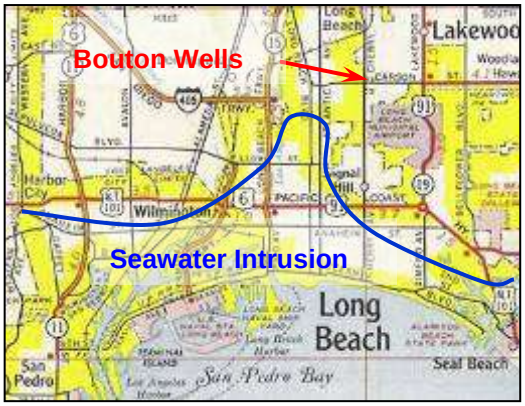
This and other Bouton wells, of which the Department has a record, were undoubtedly among the best artesian wells developed in Southern California, if not in the world. Yet in less than fifty yearn, because of excessive overdraft, the pressure and static water levels, combined, have dropped in the summer season from 80 feet above the surface to about 106 feet below the surface, or close to 40 feet below sea level. This corresponds to a drop of nearly four feet per year.

The United States Geological Survey is quoted further on to show that the preservation of the present Long Beach ground water supply depends absolutely upon checking the drop in water levels at a reasonable depth, which experts believe is at, or very close to, the present pumping levels. A fresh water head a few feet greater than the head of sea water must be maintained at the barrier; otherwise, continued lowering of the fresh water level will inexorably be followed by an inflow of ocean water.



Although Bouton No. 1 has been out of service for the good part as a century, surrounding wells continued to deplete the aquifer and the one-time tourist attraction never recovered.

The warnings of seawater intrusion have proven to be true.



Seawater Intrusion, mid 1950s

Conclusion

Bouton No. 1's casing remains employed for historically-benchmarked groundwater monitoring. As the July 20, 1952, Long Beach Press Telegram put it, "1895 Water Well in New, Dire Role."

The County of Los Angeles bought the golf course from the developers in 1952 to stop them from further subdividing the land.

The one-time drainage way for excess artesian flow passes through today's Bouton Creek Park, but as with most one-time urban channels, the creek's now a storm sewer.

But California is about progress. Lakewood Golf Course is now public and all can slice into Bouton Lake. Water for Long Beach arrives via the 400-kilometer Colorado River Aqueduct and the 630-kilometer California Aqueduct.

1925

Today

CHAPTER 92
UNDERGROUND RIVERS OF GOLD

A few economic topics in our underground river journey thus far:

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Victorian historian Thomas Carlyle viewed economics as "the dismal science," but had foreseen the rise of the modern social sciences, he'd have found more-deserving candidates. But we'll agree that economic scholarship has indeed been rather dismal as applied to underground rivers

But there's one economic topic that's dismal to no one -- the study of gold.

As observed in Rudyard Kipling's "Robin Goodfellow -- His Friends," McClure's Magazine, October 1906,

> *We Jews know how gold moves with the seasons, and the crops, and the winds; circling and looping and rising and sinking away like a river -- a wonderful underground river.*

Gold and underground rivers indeed circulate as one through history, literature, science and even our psyche.

In this chapter we will review the references to gold in previous chapters, add a few more, and in so doing, prepare for the chapters ahead, chapters that focus on our own beliefs.

Gold Fever

Underground waters -- we're forced to concede -- don't elicit much excitement in the market place. There may be money to be made, buying and selling what flows below, but most of us would rather invest in what transpires in daylight.

What draws our attention is gold -- gold dust, golden nuggets, golden artifacts, it hardly matters. Mention 24 carets and the financial crowd appears.

Cyrus Teed, the hollow-world visionary of Chapter 15, knew how to win disciples.

> *The earth shell consists of 17 layers of which the outermost seven are metallic, the golden layer having the greatest radius.*

Why the earth's outer shell is of gold -- as opposed to, say, nickel -- the Koreshens didn't seem to wonder; it stood to reason that revealed truth would be gold plated.

Among underground river proponents, Teed was by no means alone in such embellishment.

From Adam Seaborn's Symzonia of that same chapter,

> *Gold is abundant in the beds of rivers near the mountains, but it is not esteemed, because of its softness and great weight. It is chiefly employed in the fastening of their vessels, in place of iron, which is very rare, and much valued for its strength, and fitness for all the purposes of agriculture and mechanics.*

Given the common attribution that Seaborn was Symmes, himself, the meaning is clear: Go to the lands below, you Yankee merchantmen, where you can barter your iron for gold.

The Adventurous Simplicissimus (1669), Chapter 17, Underground Rivers in English Fiction, informs us that in the subterranean kingdom,

> *There are numberless silver mines within its borders; the sand of its rivers is colored by gold, and its coasts are paved with pearl oysters of the finest water.*

The stranger of Bret Harte's The Legend of Monte Del Diablo (1867) leads Father Jose into the earth.

> *"Step under the shadow of my plume," said the stranger.*
>
> *Father José stepped beside him and they instantly sank through the earth.*
>
> *When he opened his eyes, which had remained closed in prayerful meditation during his rapid descent, he found himself in a vast vault, bespangled overhead with luminous points like the starred firmament. It was also lighted by a yellow glow that seemed to proceed from a mighty sea or lake that occupied the center of the chamber. Around this subterranean sea dusky figures flitted, bearing ladles filled with the yellow fluid, which they had replenished from its depths. From this lake diverging streams of the same mysterious flood penetrated like mighty rivers the cavernous distance. As they walked by the banks of this glittering Styx, Father José perceived how the liquid stream at certain places became solid. The ground was strewn with glittering flakes. One of these the Padre picked up and curiously examined. It was virgin gold.*

We came upon lesser works in Chapters 20-24, fiction for boys and girls.

Tom Swift in the City of Gold (1912) by Victor Appleton
Desert Gold (1913) by Zane Grey
"River of Gold" (1951), the Roy Rogers comic book adventure
"Cloud City of Gold" (1967), the Spider-Man TV series
Inca Gold (1994) by Clive Cussler

And those were just the works with "gold" in the title. Perusing the content,

The Wonderful Adventure on the Yukon Tributary (1898) by W.M. Graydon, in which Quin traverses an underground river to a valley of gold.
The Three Young Ranchmen, or Daring Adventures in the Great West (1901) by Capt. Ralph Bonehill, in which the boys discover of a gold mine while exploring an underground river.
The Sunless City (1905) by William Miller in which Flin pilots his submarine through a hole lined with gold.
Under the Andes (1914) by Rex Stout, with the "golden, flaming urns."
"The Flying Legion," All-Story, November 15, 1919, in which the Legionaries discover a pyramid of solid gold and leap into an underground river.
Polly of Polly of Pebbly Pit (1922) by Lillian Elizabeth Roy, deducing,
> *The subterranean stream we found in there. Some big upheaval changed its outlet, or maybe this gold vein runs clean through and Montresor's claim is staked opposite this side.*

The Mystery of the Piper's Ghost (1954) by Zillah Macdonald, in which the boys search for a gold mine below the lake.
Callaghen (1972) by Louis L'Amour, advertised as following an "underground river of gold."

Golden threads woven into the fabric of fantasies makes the plot more vivid, the readers more engaged, and not surprisingly, the royalties more lucrative.

But gold-laden underground rivers extend far beyond popular fiction.

Lode Gold

We saw in Chapter 48, Subterranean Geophysics, that the effluent of a sub-oceanic black smoker bears sulfur, copper, zinc, iron, and -- not to our surprise -- gold, but we needn't limit the gold association to waters under the sea.

To understand the presence of gold in rivers beneath our feet, we need to understand what was there before the watercourse came to be.

Elemental gold is naturally present in much of the earth's crust, but only very diffusely, about 5 milligrams/ton or rock, and tightly bound within that rock. To free the gold, volcanic temperatures are what's needed, that plus a little sulfur.

The heat and pressure of molten magma is enough to cause gold molecules to geochemically react with adjacent elements -- sulfur being the most common partner-- to form water-soluble compounds.

As the magma cools, the volatile substances separate, but the once-inert elemental gold -- along with silicon, iron and sulfur -- is now in a hydrothermal solution which continues to force its way into the surrounding rock.

As the plume further cools and depressurizes, still deep underground, solutes begin to precipitate. Growth of coarse minerals requires stable conditions in which large crystals can grow over an extended period. Gold can emerge in crystalline shapes including dendrites, leaf, deformed octahedrons and cubes, but unlike for quartz, such conditions are rarely satisfied. More often the gold emerges as microscopically-agglomerated particles. The resultant masses may have a form suggesting that it once was melted, but that's almost never the case.

Such concentrations are known as "lode" or "hard rock" veins. A lode is rarely the result of a single igneous upwelling, but rather is the product of eons of geothermal intrusions, often through a history of repeated fault slip and fluid flow events aligned by a persistent structure which repeatedly directs the slippage.

Lodes can form at the meeting of different rock types, as water circulates more readily along the interface than through the solid rock itself. Where a zone of fractured rock develops with no strong single fault shear, a series of small parallel veins may develop.

The precipitate's yet embedded in rock, but the gold's now more recognizable.

> The gold is concentrated along a one-time geothermal flow path that, by virtue of surficial discontinuities, may be discernable to a geologist.
>
> The gold is embedded among geochemically-akin minerals -- quartz and sulfides such as pyrite, galena and arsenopyrite being common -- that may be known to a prospector.
>
> The gold's now particulate, flakes identifiable to the human eye.

Mining of lode veins involves shafts, pits and other means of penetrating the deposit to extract the ore. Water can be cause for mining distress, as noted in "Find Cave Full of Gold," Hickman Courier, November 15, 1901.

> *What is probably the greatest mining strike ever made in this or any other camp was made Oct 22 in the famous Elkton mine at Cripple Creek. At a depth of 700 feet in a level run to the south from the shaft there has been opened up a veritable cave containing fabulous wealth never before in the history of the Cripple Creek district has a find of such magnitude been chronicled and it is certainly the first time a strike has been made where experts were all in doubt as to whether the body encountered will prove to be the mother lode of Raven Hill or a volcanic chimney.*
>
> *This cave was originally broken into in January last but the next round of shots put in following its discovery tapped an immense underground river or lake permitting the water to enter the level. The water entered through the vent with tremendous velocity forcing the miners to hasten to the surface to avoid being engulfed in the flood. Within a few hours the workings of the mine up to and including the 700 foot level were submerged.*

Gold fever at Cripple Creek would endure and so would the pesky subsurface stream. "Cripple Creek Digs for Comeback," Business Week, December 23, 1939, reported the $2,000,000 tunnel system necessary to "drain off underground streams."

But let us not dwell on Cripple Creek, portraying underground water in such bad light. We who journey on underground rivers would rather see our subject more positively.

An advertisement in the October 30, 1869, Prairie Farmer illustrates the metaphor of the underground river of gold.

> *We have before us a beautiful specimen of ore from the Globe Mine, and we learn that the indications are rapidly improving as the miners approach the center of the great Mineral Belt that stretches along the Garson River like a subterranean stream of the precious metals -- arrested in the mountains and petrified in their channels.*

The Globe Mine didn't, in fact, measure up to its prospectus, but it did prove to be a productive source of copper.


THE
LAST CHANCE FOR INVESTMENT
IN THE
GLOBE
GOLD AND SILVER
MINING CO.
Incorporated in 1863, under the Laws of California.
Location, Monitor, Alpine Co., Cal.
Capital Stock $650,000, in Shares of $10 Each.

Placer Gold

To mine a lode's bounty, we must excavate mountains of earth and who wants to move all that muck?

Who would not prefer to pluck gold nuggets -- ones that have had millennia to agglomerate, preferably -- from the surface? Or if we simply must, wade a river underground and with the help of a flashlight, gather the glittering mineral lining the streambed?

This, then, brings us to "placer" or "alluvial" gold, veins formed in present and past watercourses.

Chemical oxidation and mechanical weathering eventually break down the stone matrix of a lode vein, exposing the encased minerals to the tractive sweep of runoff, first as rill erosion and then as bed-load in streams. Because gold is relatively heavy, its particles are more difficult to wash downstream and thus concentrate in alluvial deposits on the inside of river bends, in abandoned meanders, and anywhere else where sediment accumulates.

Placer gold is reasonably accessible to even the casual miner.

With time, the particles are welded by water action into larger flakes.

Placer gold is associated with gravel deposits, both current and abandoned.

The gravel can be immediately panned, or given the proximate water course, sluiced, reducing the human toil.

The world's great gold rushes -- that of the California 49ers being the most famous -- have been foot races to stake placer claims. There's money to be quickly made, and of course, as quickly squandered.

Following are a few popular-press associations of placer gold to rivers beneath the land, not necessarily geologically accurate, but sufficient to the get gold pans swishing.

"The Gold Placers of the West," Omaha Daily Bee, September 9, 1881,

> *In some instances the material of which these underground river beds are formed carries gold in considerable quantities, and, in California especially, the superincumbent mountains are also frequently rich placers.*

"A Gold Miner's Stories, Reminiscences of the Days of '57 and Afterwards," Springfield Daily Republic, December 31, 1887,

> *At a camp in Calaveras County, the miners for years ran their mud and stone from the sluice's mouth into a crack in the earth. It never filled up. The gurgling of running water could be beard in it. During one summer, while "waiting for water" (one third of our time in the mines was*

> *passed in this way), the "boys" concluded to explore this mysterious underground region. They built a small boat for the purpose, lowered it down, and Johnny Ward, who had volunteered to navigate this underground river, after it. He did go a little way, as far as he dared, but the river disappeared amid low overhanging rocks and darkness, and Johnny was hauled up again and the boat left to rot.*

The location is that of Samuel Clemens' first literary success, the 1867 tall-tale, "The Celebrated Jumping Frog of Calaveras County."

Getting Gold, a Practical Treatise for Prospectors, Miners, and Students (1896) by J.C.F. Johnson,

> *On an alluvial lead the object of every one is to "get on the gutter," that is, to reach the lowest part of the old underground watercourse, through which for centuries the gold may have been accretionising from the percolation of the mineral-impregnated water.*

We're reluctant to include Lost Cities of North & Central America (1992) as news, but regarding placer deposition, author David Hatcher Childress has the correct idea.

> *Underground rivers such as these are known for a fact to exist, and that gold would exist in the sand along beaches along the river is also natural occurrence. Since gold is indestructible and quite heavy metal, it tends to wash down streams and rivers and collect in pools and other areas... Almost all sand contains a little gold, but it is sand with a high percentage of gold that makes processing of the sane worthwhile. An underground river with beaches could have thousands, even millions, of years for gold to collect.*

Aqueous Gold

Geothermal water dissolves iron, magnesia, salt, borax, sulfur compounds, or even minute concentrations of precious metals and bears it through rock fractures until it precipitates as elemental veins. But why wait for geology to do the concentration? Why not just pump the water and draw out the metals?

Palisade Mine north of Calistoga, California produced 1.4 million ounces of silver in the 1880s and the 1930s. The Oat Hill Mine east of Calistoga yielded cinnabar (mercury ore) until the 1960s. Nearby McLaughlin Mine produced more than $1 billion worth of gold in 17 years.

Calistoga's Old Faithful was noted in Chapter 55 to illustrate the working of a geyser.

Why not mine the waterspout, or perhaps more practically, the surrounding hot springs? Better yet, why not mine the investors rushing to purchase a share of the operation?

Calistoga Hot Springs, 1868

Had even a portion of his offerings been legitimate, Anson C. Tichenor could have been the Rockefeller of Minerals. Had his fraud been somewhat sophisticated, Tichenor could have been a Rockefeller of Swindles. But Tichenor's mode of operation was one of claim salting -- precious metals, oil, cement, whatever the prospectus required -- deception that fooled but a few, and even when it did, barely long enough for Tichenor to have caught the out-bound train.

Calistoga Springs, California provided Tichenor the opportunity to market his secret, sure-fire process for extracting gold from water. One gallon of the mineral-rich thermal water contained as much as $5 worth of the metal, he assured potential investors. Why, he could prove it by a precipitation test, the reagent -- of which he of course happened to have at hand -- salted with Chloroauric acid, gold dust dissolved in aqua regia. Only finances were needed to extract the gold at industrial scale.

Samuel Clemens, himself a veteran of gold-rush frenzy, recognized the game and dashed off a satire to the New York Evening Post, September 16, 1880:

To the Editors of the Evening Post:

I have just seen your dispatch from San Francisco, in Saturday's Evening Post, about "Gold in Solution" in the Calistoga Springs, and about the proprietor's having "extracted $1,060 in gold of the utmost fineness from ten barrels of the water" during the past fortnight, by a process known only to himself. This will surprise many of your readers, but it does not surprise me; for I once owned those springs myself. What does surprise me, however, is the falling off in the richness of the water. In my time, the yield was a dollar a dipperful. I am not saying this to injure the property, in case a sale is contemplated; I am only saying it in the interest of history. It may be that this hotel proprietor's process is an inferior one -- yes, that may be the fault.

Mine was to take my uncle -- I had an extra uncle at the time, on account of his parents dying and leaving him on my hands-and fill him up, and let him stand fifteen minutes, to give the water a chance to settle well, then insert him into an exhausted receiver, which had the effect of sucking the gold out through his pores. I have taken more than $11,000 out of that man in a day and a half. I should have held on to those springs but for the badness of the roads and the difficulty of getting the gold to market.

I consider that gold-yielding water in many respects remarkable, and yet not more remarkable than the gold-bearing air of Catgut Canon, up there toward the head of the auriferous range. This air -- or this wind, for it is a kind of trade wind which blows steadily down through 600 miles of rich quartz croppings during an hour and a quarter every day, except Sundays -- is heavily charged with exquisitely fine and impalpable gold. Nothing precipitates and solidifies this gold as contact with human flesh heated by passion. The time that William Abrahams was disappointed in love he used to step out doors when that wind was blowing, and come in again and begin to sigh, and his brother Andover J. would extract over a dollar and a half out of every sigh he sighed right along. And the time John Harbison and Aleck Norton quarreled about Harbison's dog, they stood there swearing at each other all they knew how-and what they didn't know about swearing they couldn't learn from you and me, not by a good deal -- and at the end of every three or four minutes they had to stop and make a dividend: if they didn't their jaws would clog up so that they couldn't get the big nine-syllabled words out at all; and when the wind was done blowing they cleaned up just a little over $1,600 apiece. I know these facts to be absolutely true because I got them from a man whose mother I knew personally. I do not suppose a person could buy a water privilege at Calistoga now at any price; but several good locations along the course of Catgut Canon Gold-bearing Tradewinds are for sale. They are going to be stocked for the New York market. They will sell, too; the people will swarm for them as thick as Hancock veterans-in the South.

Mark Twain
Hartford, Conn., Sept. 14, 1880

Clemens's instincts were correct. By the time his letter was in press, Tichenor's underground river swindle had been exposed and its author was had caught the train to Washington -- an "inventor" in the district's professional listings -- where swindlers are tend to be more successful.

Buried Treasures

To this point, we've been prospecting for nature's bounty, but even with placer veins, it's hard labor. It would be easier to stash that for which someone else has labored or quicker to make off with what someone else has stashed.

"The Cave of Avarice," San Francisco Call, April 3, 1898, is Poesque in its prose, if not in its artwork.

The church declares that the wicked shall be burned forever. If that be indeed true -- and no man has ever come back to deny it -- it behooves me to prepare. I have thought of the treasure I gained evilly. Should I restore it to those whence I had taken? But the lust for gold makes more crime than the lust for women.

It has seemed to me, then, that I should put this treasure away where no man should find it. I know now my sin. I could not part with that which has cost me so much -- perhaps even my soul. To the cave of the underground river I had the casks carried. Then I had a wall built twenty rods from the cave entrance, and I walled the treasure there against the roar of the stream that sees no light.

The looting of hidden caverns stocked with golden artifacts -- their origin being ancient Americans, aliens from other worlds, or even the divine -- is often impeded by underground rivers.

"Lizard People's Catacomb City Hunted," Los Angeles Times, January 29, 1934, reveals the location of gold tablets, 120 by 35 centimeters, as measured remotely by what seems to have been a dowsing device wired for radio and X-rays. The map's in Chapter 94, The Rio San Buenaventura, with "GOLD" clearly labeled. For those planning to dig, however, a City of Los Angeles excavation permit will be required.

In 1982, Russell Burrows, so we're told, discovered a cave along the Little Wabash River in Illinois. In the cavern were golden objects of ancient Egyptian origin, an example of which is shown to the right.

Personal disillusionment with the reception of his news, however, led him to dynamite the cave entrance in 1989.

In 1999, the Ancient American got Burrows to disclose the location.

Philip Coppens, co-host of "The Spirit Revolution" radio show and contributor to NEXUS Magazine, Atlantis Rising and the History Channel's "Ancient Aliens," has a journalistic niche challenging paranormal propositions on one hand, while chumming the feeding pond of those who believe on the other.

"The Burrows Cave: African Gold in Illinois," an internet posting, traces the site investigation.

The problem was how to get in, considering that Burrows' explosion a decade earlier had destroyed the entrance. Unfortunately, it soon became evident that the explosion had not only blocked the entrance but had also damaged the interior of the tunnel. During May's various attempts to gain access, each time he stumbled upon huge quantities of water. This seemed to indicate that the explosion had diverted the flow of an underground river and as a result had caused water to gush into the

> *underground complex. It therefore looked like salvaging anything from the underground complex would be terribly complex -- and largely outside May's capabilities.*

There's nothing paranormal about a underground river in a karst terrain, but the river's role in obfuscating further excavation -- and thus archeological discovery that would revise our understanding of human history -- speaks to the literary utility of such rivers.

We should pause to note that the above picture is the sole graphic in this chapter. Rarer than gold artifacts found along underground rivers are photographs of such.

Our second artifact story is "Rich without Money," a cautionary tale in Architects of Fate, or Steps to Success and Power, a Book Designed to Inspire Youth to Character Building, Self-Culture and Noble Achievement (1897) by Orison Swett Marden.

> *In the year 1843 a rich miser lived in Padua, who was so mean and sordid that he would never give a cent to any person or object, and he was so afraid of the banks that he would not deposit with them, but would sit up nights with sword and pistol by him to guard his idol hoard. When his health gave way from anxiety and watching he built an underground treasure-chamber, so arranged that if any burglar ever entered, he would step upon a spring which would precipitate him into a subterranean river, where he could neither escape nor be heard. One night the miser went to his chest to see that all was right, when his foot touched the spring of the trap, and he was hurled into the deep, hidden stream.*

Here's another gold-and-underground-river story, one reviewed in the 1908 University of Texas Record.

> *From the Waters Under the Earth by Lynn Milam... is the story of a coward, a young college graduate who, while wandering in Peru in search of gold, falls into a cavern, is imprisoned for days, follows an underground river, writes an account of his experiences and encounters with indescribably hideous remnants of a human race, gradually loses his reason, consigns the diary to the underground river, and meets -- what fate?*

We'll deal with the geography of William Halliday's Adventure is Underground (1959) in Chapter 94, The Rio San Buenaventura, but here we'll mention that the particular subterranean river with black sand beaches was said to assay at 50 troy ounces/ton. In today's market ($1400/ounce), that's $77/kilogram of ore, not a bad return for hauling sand to the surface.

And a good yarn doesn't die, as evidenced by the leading line from the Los Angeles Times article of September 11, 2006,

> *River of Gold or Touch of Fever? A 1930s prospector said a Mojave peak hid waterborne ore. Some are chasing his dream.*

Potential investors can contact Larry Hahn, "who owns a military surplus store in Las Vegas."

We'll also note in Chapter 97, a June 27, 1990, Southern Utah News report of Montezuma's Aztec treasure being behind a "water trap" in the lower of the three ponds six miles north of Kanab.

When the boundary blurs between recognized fiction and proclaimed revelation, we can wonder what influenced what? Author Clive Cussler describes the literary process in a September 1996, The Writer interview.

> *I always start with the germ of a concept. I used to tramp around the deserts of Southern California looking for lost gold mines and ghost towns before I began writing about shipwrecks. There was a legend of an old mining engineer who went into a cave on a mountain and found a river flowing in a canyon under the mountain. One day, I read that a hydraulics engineer thought there was an underground river under Nevada that flowed out to Los Angeles. So, I thought, "There's the grain of the story, an underground river." Of course, I had to build it from there.*

The golden torch has been passed in like manner from the days of Charon.

Not all gold-and-underground-river stories are mine lore or adventure fiction, of course. As reported in "Secret, Flooded Moat Guards French Gold," Woodville Republican, March 17, 1928,

> *A fortress with a moat guards the gold of the bank of France. "Even American bankers admire it," say officials of the bank.*
>
> *Deep in the cellars of the last-built branch of the bank, in an old aristocratic palace, there is always an armed sentinel with orders to let no one but the chief director enter. The entrance to the strong room is a metal safe door seven feet thick. Inside the gold is stored in other -- supposedly burglar-proof -- boxes.*
>
> *The most, sixty feet deep, has a swift ten-foot flow of water in it, delivered from an underground river.*

American bankers were duly impressed because America's Fort Knox Bullion Depository is but a two-story building having no underground river for protection.

We cited The World Beneath the City (1959) by Robert Daley in Chapter 89, Alligators Below, but beneath the city, we also find treasure.

> *A great deal of money has been found in the sewers, particularly during the depression when WPA labor scraped out or rebuilt vast lengths of pipes on Manhattan's West Side. The current in New York's trunk mains is so swift that it will -- well, it will wash along a horse. The trunk mains, therefore, are self-cleansing. But the branch lines drop only a quarter inch per foot, an incline so slight that the sewage moves slowly at best, and not at all at worst.*
>
> *The sludge, which cakes on the bottom of branch mains, is what these desperately poor WPA workers were sent in to re- move. To their absolute delight they found that the sludge was impregnated with coins. Hundreds of them. Thousands of them.*
>
> *The regular procedure had been to chip loose slabs of sludge, load them into a pail, then yank on the rope attached to the pail, signaling topside that your pail was full. The men above would drag it out, empty it, and drop it down again. No one liked working in the sewers, but these were depression years and a man took what he could get. The crews alternated, four hours in the sewer, four hours outside emptying pails instead of filling them. A man outside felt himself an aristocrat, superior in every way to the moles under the street.*
>
> *The discovery of gold changed all that. A piece of sludge broke apart in a man's hand exposing a quarter. Immediately he dived for the pail he had just filled and began to crush slabs of sludge in his fingers. He found a dime, a penny, another quarter. He went through the pail a second time, dumping its content out and stomping on it until it was pulverized. More coins turned up. He began to yell excitedly. Other men began searching their pails. They, too, found coins.*
>
> *The men began to attack the sewer with frantic energy.*
>
> *When the next crew came to relieve them, they refused to go, shooing the others out of the tunnel. Soon the second crew, having discovered what was happening, clamored and fought to get down to the sludge.*
>
> *The WPA had struck a vein... that seemed as rich as the Klondike. Men staggered up to the street drunk with wealth, their pockets bulging with money. Gone were the previous social distinctions; the man in the sewer was a prospector (they called themselves "Klondikers"); the men who preferred outdoor work were fools.*
>
> *The West Side sewers became the most sought-after work in town. Soon the men instituted a share-the-profits plan such as countermen in diners employ, and each man went below with two pails, one for sludge, one for coins. The sludge was "klondiked" once in the sewer, then sent aloft where it was "reklondiked." All the money was kept in a neat pile beside the manhole, to be divided at the end of the day. All day the men took pleasure watching the pile*

grow (some attained a height of two or more feet) and toward quitting time they loved the way it glinted in the descending sun.

Like other veins of gold, the one in the sewers gave out after a time. Sewer prospecting does not exist anymore. The day of the "klondiker" is over.

From the tabloids near the grocery check-out: "Amateur Explorer Discovers Vast Cavern System Containing Underground River of Gold. Canadian Govt. Keeping Location Secret to Protect it from Gold Prospectors," National Enquirer, February 4, 1973,

Discovery of a strange cavern system located about 300 miles NW of Vancouver, British Columbia, Canada, in which large amounts of gold-bearing sand, huge unidentifiable footprints, white frogs and perfectly round polished stones, were found. These findings were immediately suppressed by the Canadian government.

According to the discoverer, Paul Griffiths,

"The river whose dry bed I had been following had gone underground, and, in one area of the caverns, welled up into a vast underground lake with strange fountain-like effects at its center."

Griffiths and a companion who joined him found black sand at the river's edge and began panning for gold. Within 4 hours they took out a gold nugget and two ounces of flake gold.

"If gold was what they wanted, we could have taken way more from the cave. There is plenty there."

The days of klondiking seem to waning, but in the future we' will surely witness additional gold rushes involving underground rivers. The two seem to flow together.

Gold -- or at least coins of lesser value -- can be found at the underground stream outlet on the Indian Ladder Trail near Albany, New York.

Generalizing on such riches, we can probably say that more gold had been thrown into underground rivers by tourists than has been extracted by miners.

A Marxist-Leninist-Maoist Perspective

We've focused on the acquisition of underground river gold, we admit, from a shamelessly capitalistic viewpoint. Find the gold and grab it. For the sake of fairness, however, the other side should be heard regarding the legitimately of such wealth.

To the right, àn hé, "underground river" in Mandarin, a product, it seems, of dialectical materialism.

暗河

From Karst in China, Institute of Hydrogeology and Engineering Geology, Chinese Academy of Geological Science (1976),

Under the leadership of our great leader Chairman Mao and the Communist Party of China, the Chinese people have overthrown the three big mountains (imperialism, feudalism and bureaucrat-capitalism) and have established a socialist country under the dictatorship of the proletariat. Following Chairman Mao's revolutionary line, the broad masses of workers, peasants and soldiers, together with the scientific and technical personnel, have attained gratifying results in applying Marxism-Leninism-Mao Tsetung Thought to the fields of class struggle, struggle for production and scientific experiment, as well as in recognizing and remaking nature with the viewpoint of dialectical materialism.

In the construction of water conservancy and hydro-electric projects, plants and mines, communication lines and engineering works for national defense, extensive investigations on karst have been carried out. Particularly since the Great Proletarian Cultural Revolution and the movement to criticize Lin Piao and Confucius, great changes have taken place.

The Democratic People's Republic of Korea honors the discoverers of underground rivers.

A mysterious-looking natural cavern and scenic underground spots were recently discovered in south and north Phyongan provinces. The newly-discovered cavern, which proved tens of thousands of years old, has some different aspects from other caverns. Stalagmites and stalactites of the Ryongmun and Paekryong caverns are large and beautiful, while those of the newly-discovered cavern are very fine, delicate and graceful... The water of the underground river and waterfall flows steadily at a fixed speed. Multitudes of stalactites and stalagmites surrounding them add beauty to their scenery. Secretary Kim Jong Il sent thanks to units which discovered the natural cavern and scenic underground spots. -- Korean Central News Agency, April 18, 1979

Karst is manifestly real to those of the Party, but garnering wealth from underground rivers is a bourgeois error of thinking.

CHAPTER 93
DAYLIGHTING

This chapter presents the antithesis of the topic of Chapter 79, The Sinking of the Fleet, the reduction of urban streams to enclosed sewers.

"Daylighting" projects uncover and restore creeks, streams and rivers previously confined in underground conduits. Daylighting restores a part of the natural hydrologic cycle, reduces peak discharge rates, enhances environments; habitat and provides recreational facilities.

We'll look at several examples -- one Asian, the remainder, American -- once buried beneath the urban landscape, but subsequently returned (or in process of being returned) to the sunshine.

Cheonggyecheon River, Seoul, South Korea

The Cheonggyecheon River was a centerpiece of Seoul since the city was established 600 years ago. The river's 23 tributaries, often dry in the spring and fall and flooded during the summer, supplied the metropolis with drinking water for the next 500 years, while the Cheonggyecheon washed away the wastes.

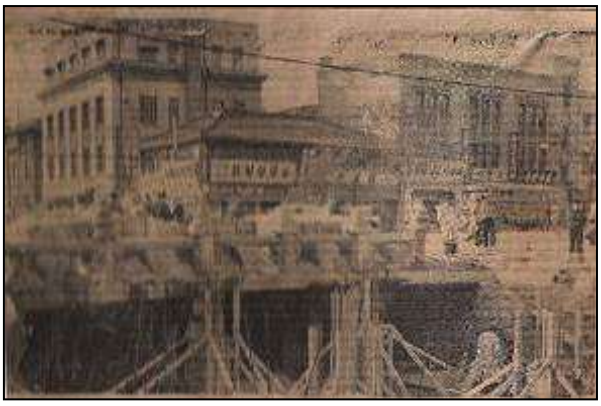
Beginning in the 1920s, the Japanese converted many of the tributaries into covered sewers and in 1935, they announced a plan to cover the river with an elevated railroad. Two years later, a small section was covered. In 1939, the plan was altered to cover the river with a motorway. In 1940, the plan was for a tram above and a subway below. Urban ambitions faded, however, with the war.

After World War II, South Korea developed plans to dredge the Chonggyecheon, but these plans were interrupted by the Korean War.

By the mid-1950s, the Chonggyecheon urban area was mired in poverty and filth, the legacy of colonialism and war. The open sewer in the city's center was an obstacle to the redevelopment and between 1955 and 1977, the river was at last covered. A freeway was built above the route between 1967 and 1971.

"Good Riddance…and yet -- 'Stream of Pure Ravine' Slowly Flowing Into Realm of Memories," Korean Republic, November 18, 1958, summarizes the fate.

> *One signpost in Seoul you can read with your eyes closed is Cheonggyecheon -- the Stream of the Pure Ravine. The deep, cloying whiff exuding from this muddy stream has been an odor that any Seoulite remembers from his days in primary school.*



Enclosing the Cheonggyecheon, 1958

> *Soon, this odor-binding signpost with all its merits and demerits will be no more as the currently-progressing highway projects comes to an end. And, together with it will go the old, bent men who have predicted thousands of futures from thousands of palms along the stream. Also, the little boys with their scrawny hands who have had what they will sometimes remember as the best years of their livings, shining shoes for men leaning against the bridge railings.*

This will also mean the loss of a fairyland playground for urchins who "fished" for the fish there never were after a summer showed added a torrent to the dirty water and spirited its malodor away – or who sledded over it after it was coated with ice.

All these will go by 1960 when the entire length of the Stream of the Pure Ravine – that has never been pure-- will be covered up as part of the City Plan.

By 2000, the area was the most congested part of the South Korean capital, badly in need of revitalization. There could be no significant change as long as the freeway remained.

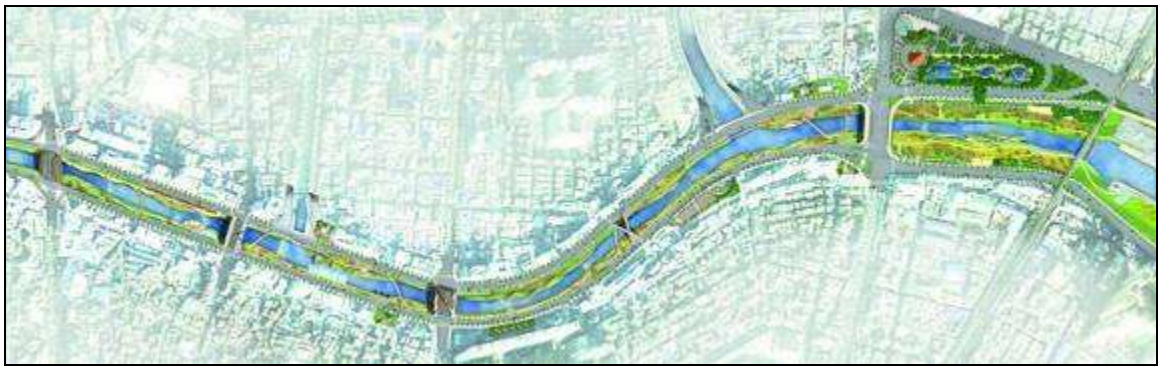
A master plan for stream restoration was adopted in 2003 and the freeway demolished. River reclamation began that same year and was completed in 2005.

Construction

Today

After a $384 million project which removed 5 kilometers of elevated highway, today's stream is liberated. Picnickers cool their feet in its water and carp swim in its pools, up to 8 meters wide and 1 meter deep.

The Cheonggye Sunken Stone Garden is located at the beginning of the project corridor. Since its completion in 2005, the plaza has seen 10 million visitors.



The ecosystem along the Cheonggyecheon has been enriched, the number of fish species increasing from 4 to 25, bird species, from 6 to 36 and insect species, from 15 to 192.

Jolly Giant Creek, Arcata, California

A mere 50 meters long, Jolly Creek's a miniscule public work, but as a daylighted stream on school property, students can study aquatic habitat. Total cost: $120,000.

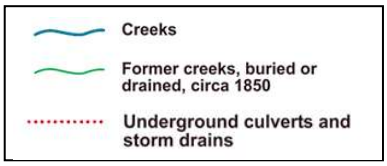
Before

After

Strawberry Creek Park, Berkeley, California

Santa Fe Railroad abandoned its rail yard in west Berkeley in 1974. Under city control, the site sat vacant for eight years until city transformed the property into a neighborhood park by daylighting 60 meter of a the creek.

As can be seen on the map below -- the park being in the red circle -- much of greater Strawberry Creek watershed remains culverted.



Designed for the 100-year storm event, daylighting has proven to provide storm water benefits, rather than the increased flood hazards that opponents had feared.

San Luis Obispo Creek, San Luis Obispo, California

Downtown San Luis Obispo experienced serious flooding in 1969 and 1973 when due to years of dumping, sedimentation, and neglect, San Luis Obispo Creek's 80-year old culvert could not accommodate the storm water.

Before

After

Daylighting included the partial closure of Monterey Street and the creation of a public garden, end result being Mission Plaza in the heart of downtown

Cow Creek, Hutchinson, Kansas

Like many growing cities, Hutchinson diverted its urban streamflow into a culvert.

Cow Creek, 1920s postcard

By the early 1990s, however, Cow Creek pipes beneath the streets were deteriorating, the downtown was flooding, a major bridge needed replacing, buildings were vacant and crime was increasing.

Pre-construction

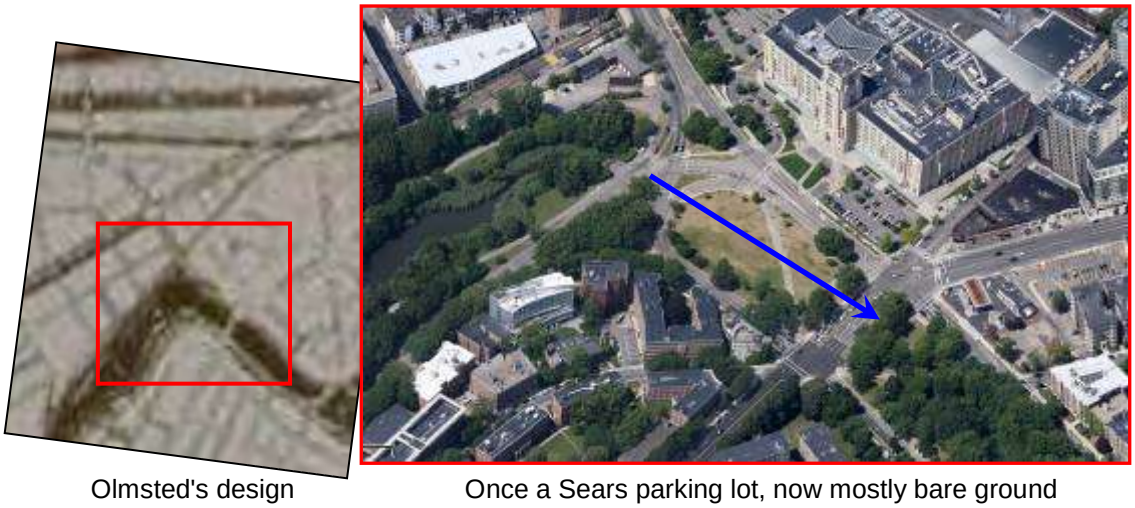
Post- construction

Three blocks of Avenue A were excavated to daylight 240-meters of Cow Creek. Four commercial buildings were moved. Cow Creek is now the centerpiece of a park that includes a grassy amphitheater and water-play.

Muddy River, Boston, Massachusetts

In anticipation of roadway widening, Boston's Muddy River was enclosed in the 1940s at the Fens Bridge and Brookline Avenue. The site became a Sears Roebuck parking lot in 1955, but is now just a field with sparse trees, a far cry from Frederick Olmsted's 1880 city park design.

The plan is to daylight some 200 meters as part of a $75 million project.



Olmsted's design

Once a Sears parking lot, now mostly bare ground

Arcadia Creek, Kalamazoo, Michigan

When an industrial city, Kalamazoo buried Arcadia Creek, but by the 1980s, the city center had vacant buildings, high crime and declining public use. The streets often flooded.

As part of a 13-block redevelopment plan begun in 1986, Kalamazoo daylighted 475 meters of Arcadia Creek.

The result has been spectacular. The new Arcadia Creek Amphitheater earns $12 million annually, more than paying for the park's $7.5 million price tag and its $50,000 annual maintenance. Annual property tax revenues near the opened creek have risen from $60,000 to $400,000.

Construction

Today

Arcadia Creek's name makes good on the slogan of Chapter 29, Et In Arcadia Ego.

Grand River, Jackson, Michigan

The Grand River was capped with concrete in 1937 to contain its smell and provide downtown parking.

Since 1978, six children have been trapped under the cap and drowned. The 600-meter Grand River Cap Removal project was undertaken in response to the deaths.

1910 postcard

Capping

Today

Sawmill River, Yonkers, New York

Sawmill River is the longest tributary of the Hudson, 37 kilometers. A subterranean flume completed in 1922 banished 1 kilometer beneath the Yonkers city center.

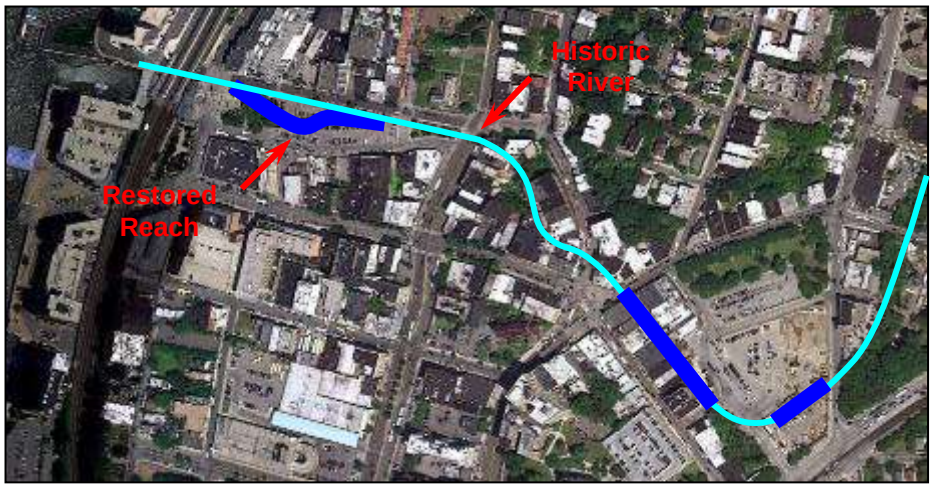
Enclosing the Saw Mill River, 1917

The subterranean river

A $3 billion urban core revival includes $42 million to re-expose 600 meters of the river and line it with paths and restaurants.

Another stretch will become a wetland park.

Daylighting began in 2007.



Meadow Creek, Charlottesville, Virginia

In its early years, the University of Virginia had marshes and ponds scattered throughout the campus. The largest waterbody, variously known as the "skating pond," the "ice pond," "the university pond," or, simply "the pond," was fed by Meadow Creek.

In 1864, Gen. George A. Custer's Union troops crossed "the creek at the bottom of the university pond."

David Culbreth's The University of Virginia: Memories of her Student-Life and Professors (1908) recalls the lake in 1874.

> *A number of old ladies also have participated in the sport under the escort of experienced friends -- one had the misfortune of taking the cold dip with her beaux companions, but was not intimidated, as on the morrow she again led the procession.*

In 1922, excavation began for the university's new gymnasium. From a contemporary account in the campus paper,

> *The work now under way consists in the removal of 7,000 cubic yards of dirt for the foundation of the new building. In disposing of this, a large portion will be dumped into the lower end of the University Pond.*

By 1940, the newspaper noticed that the shrunken pool was fouled by effluent from the gym showers and swimming pool.

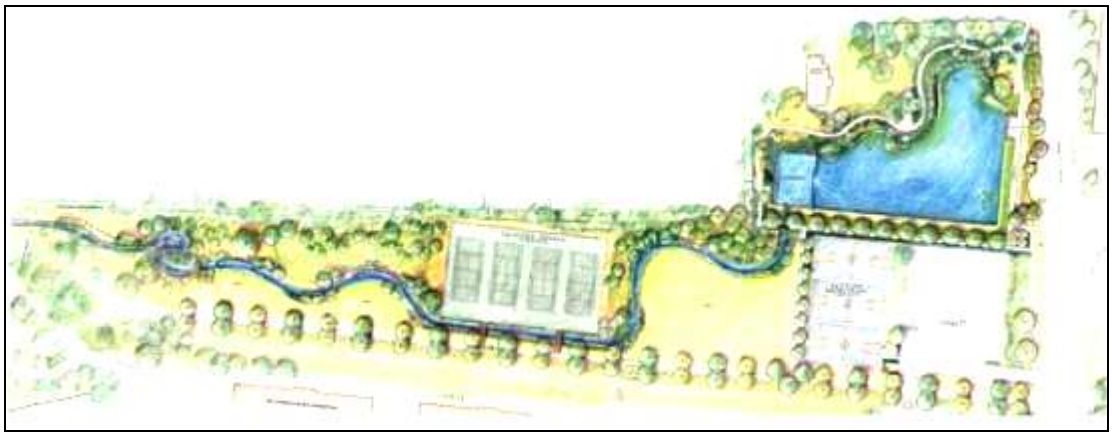
> *The Reflection Pool could very easily be a spot of beauty. Now it looks much like a mud hole.*

In the summer of 1952, the paper branded the feature as a "sunken mire," and the remainder was filled to create a new parking lot and athletic field.

1919

Today.

Restoration of the 4.5-hectare "Dell," as it's now called, featuring an L-shaped pond and daylighting 360 meters of Meadow Creek, was competed in 2004. The basin two has straight edges to blend with the surrounding built environment.



Unlike many daylighting projects, the effort's goal was not that of ecosystem restoration, but rather that of historical reclamation.

Costs

Urban Stream Daylighting, Case Study Evaluations (2007), Virginia Water Resources Research Center, by Tracy Buchholz and Tamim Younos, provide some cost comparisons

Length (meters)	Cost/linear meter
< 80	$220
80 - 300	$320
> 300	$2600

The values will inflate with time, of course, but the diseconomy of scale is obvious. It's cheaper to daylight 1 meter of a small project than 1 meter of a large one. The pipes are smaller, of course, but more than that, larger sewers underlay larger urban areas, and thus larger infrastructure needs to be removed.

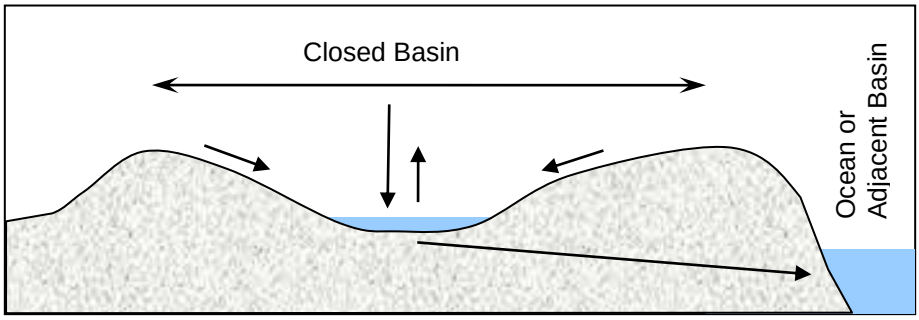
CHAPTER 94
THE RIO SAN BUENAVENTURA

This chapter can be divided into two parts.

The first section of this chapter, A River Discovered and Discarded, traces the quest for a river reputed to link America's Great Basin (the closed -- or "endorheic" -- watershed encompassing most of Nevada and western Utah) to the coast of California. The quest was doomed form the start, however, as by definitional, a river cannot flow out of a closed basin. Water ponded in a closed basis is a "terminal lake," of which a closed basin may have more than one. The largest terminal lake in the Great Basin is the Great Salt Lake.

The remainder of the chapters explores a possibility not considered by those who looked on the surface, the possibility that this river is subterranean. Such a river from Utah to California may seem preposterous, we admit, but we're just reporting what's been said. There is no hydrologic preclusion of subsurface water exiting a closed basin.

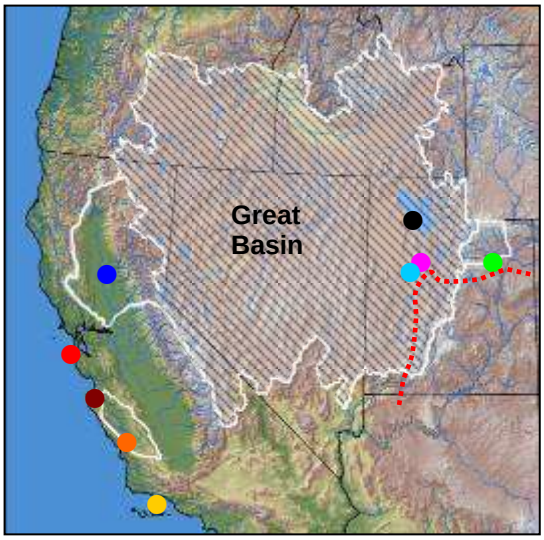
The schematic,



A River Discovered and Discarded

The map indicates geographic locations associated with this section.

- San Francisco Bay
- Monterey Bay
- San Buenaventura Mission
- Great Salt Lake
- Utah Lake
- Sevier Lake
- Green River Headwaters
- Salinas Watershed
- Sacramento Watershed
- Dominguez-Escalante, 1776



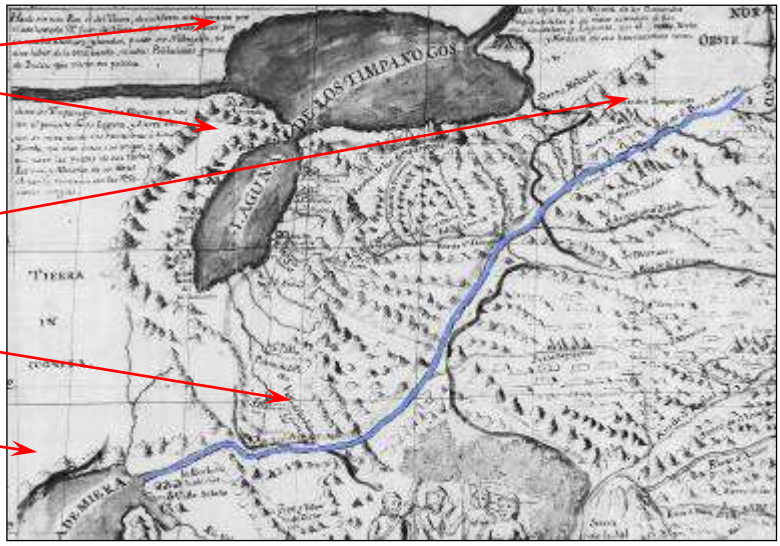
Bernardo Miera y Pacheco was cartographer on the Dominguez-Escalante 1776 expedition seeking a land route from Santa Fe to Monterey.

"Laguna De Los Timpanogos" comprises both the Great Salt Lake and Utah Lake.

The upper reach of "Rio San Buenaventura," as named by Miera, does not drain as drawn, but rather south to the Green River.

The lower reach is the Sevier River.

"Laguna de Miera" is Sevier Lake.



Bernardo Miera (1778)

Miera believed that a broad river makes its way from the Great Salt Lake to the California coast, but as seen by the expedition route, he never ventured that far north. There is no such outlet, but if there were, it would terminate in a lower sump within the Great Basin.

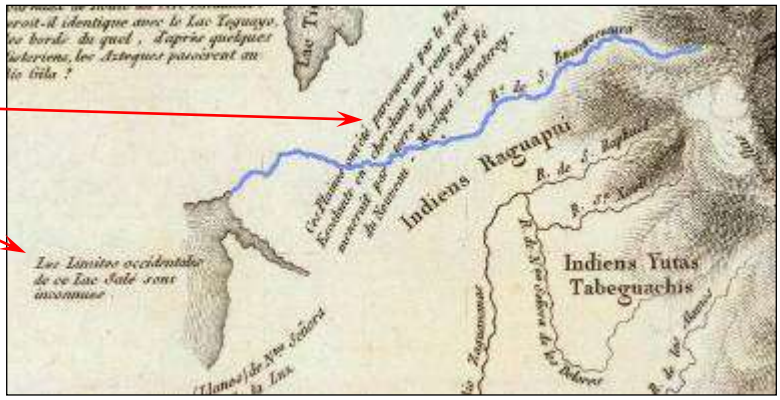
Miera's speculation that the Rio San Buenaventura may also continue to the Pacific is flawed for the same reason, but we're privy to topographic surveys. At the close of the 18th century, Miera's work comprised the totality of mapping for the region and the Rio San Buenaventura was to quickly become a fixture on geographies of the new continent.

Some Historians pretend that the Aretiqui comes from this Lake -- a reference to a Northwest passage to India.

Zebulon Pile (1810)

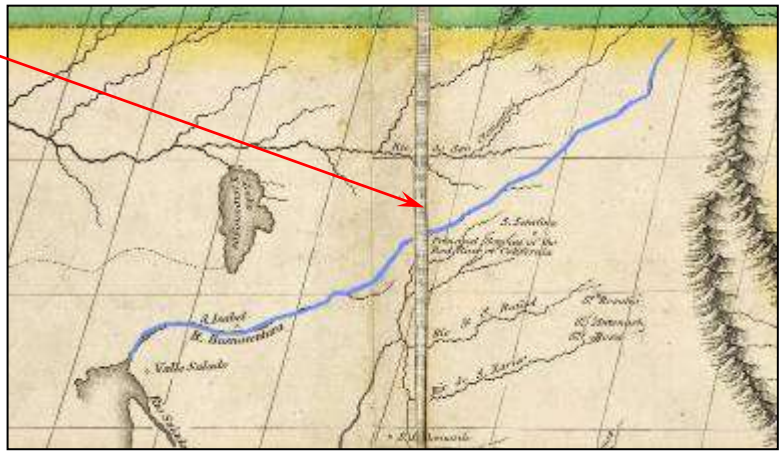
These Plains have been traversed by Father Escalante in search of a route by land from Santa Fe to Monterey.

The Western Limits of this Salt Lake are Unknown.



Alexander von Humboldt (1811)

Principle sources of the Red River of California, i.e., the Colorado.



J. Finlayson (1822)

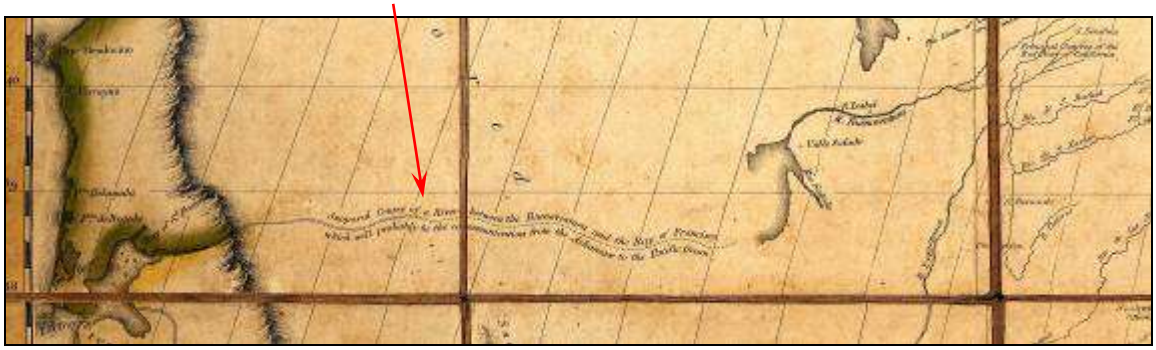
Jedediah Smith crossed the Great Basin in 1827 in search of the San Buenaventura, and in the following year searched the western flank of the Sierra Nevadas, but failed to find the river.

"A Map of America Denoting the Boundaries of the Yearly Meetings of Friends and the Locations of the Various Indian Tribes." Lake Timpanogos is "doubtful," but the river is not.

James Bowden (1844)

And to the west,

Supposed Course of a River between the Buenaventura and the bay of Francisco which will probably be the communication from the Arkansas to the Pacific Ocean



John Melish (1818)

Connecting Morse's waterways, if only by a dotted line, belies the confidence of a nation's Manifest Destiny.

Sidney Hall (1828)

Shown north of the San Buenaventura are two rivers from the Great Salt Lake: the Sacramento to San Francisco Bay ("navigable upwards of 50 Leagues") and the Mongos to the Rogue River in Oregon. The mouth of the San Buenaventura itself has dropped below Monterey.

The same rivers, but not with the uncertainty of dotted lines.

Henry Tanner (1822)

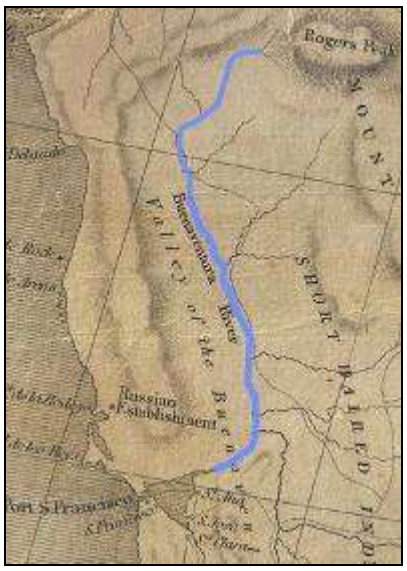
Disagreement persisted concerning where the San Buenaventura enters the sea, but all agreed that the river arrives.

Albert Finley (1826)

John Bidwell, guide the first wagons across Utah in 1841, noted that maps claimed the Great Salt Lake to have two outlets, each larger than the Mississippi, running into the Pacific

> *An intelligent man with whom I boarded had a map which showed these rivers (one was the Buenaventura) to be large, and he advised me to take tools along to make canoes, so that... we could descend one of these rivers to the Pacific.*

Unfortunately for Bidwell's party, canoeing didn't prove to be an option.



David Burr (1839)

There were, of course suspicions that the river might be less than advertised

David Burr wavered between the San Buenaventura as but the Sacramento familiar to residents of San Francisco, and a Sacramento completing the legendary San Buenaventura.

David Burr (1840)

The mapmakers were unanimous in endorsing a San Buenaventura, but couldn't agree on its location. We've seen a similar quandary earlier in our study. Until the Scientific Revolution, authorities were clear regarding the direction of subterranean channels. Natural philosophy was an exercise in thought, not physical examination, and it was Biblical truth that water ran from the sea to the mountaintops. The vexing aspect was that of physical confirmation.

In similar manner, there had to be a Great River of the American West because for so long, such a river was said to exist. That is until someone with sufficient authority actually looked.

The June 1833 notes of Zenas Leonard, Bonneville-Walker Expedition, are clear on the matter.

> *There is a large number of water courses descending from this mountain on either side -- those on the east stretching out into the plain, and those on the west flow generally in a straight course until they empty into the Pacific; but in no place is there a river course through the mountain.*

Why, we may ask, wasn't the San Buenaventura's nonexistence promptly made known to the mapmakers? As we'll see with the next explorer, refutation of the San Buenaventura perhaps wasn't what Washington cared to hear.

Rio San Buenaventura remained a river of uncertainty until 1843, when Lt. John Fremont, with Kit Carson scouting, led an expedition from the Columbia River to Sacramento via the Sierra Nevadas. Fremont planned to reach the river to refuge from the worst of winter.

From Fremont's journal,

November 18, 1843; The Dalles.

> *From this lake* [the modern Klamath] *our course was intended to be about southeast, to a reported lake called Mary's, at some days journey into the Great Basin; and thence, still on southeast, to the reputed Buenaventura River, which has had a place in so many maps, and*

countenanced the belief of the existence of a great river from the Rocky Mountains to the bay of San Francisco.

January 3, 1844; Mud Lake.

We were evidently on the verge of the desert which had been reported to us; and the appearance of the country was so forbidding, that I was afraid to enter it, and determined to bear away to the southward, keeping close along the mountains, in the full expectation of reaching the Buenaventura River.

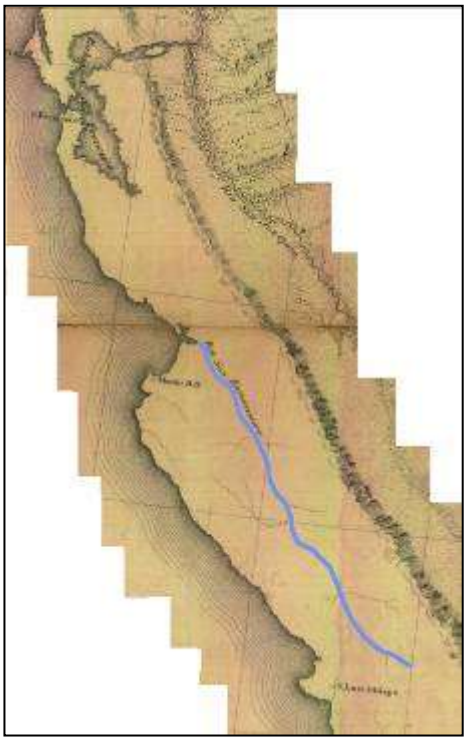
January 17, 1844; Pyramid Lake/Truckee River.

With every stream I now expected to see the great Buenaventura; and Carson hurried eagerly to search, on every one we reached, for beaver cuttings, which he always maintained we should find only on waters that ran to the Pacific; and the absence of such signs was to him a sure indication that the water had no outlet from the great basin.

January 29, 1844; Antelope Valley, West Fork of Walker River.

Walker subsequently informed me that, like myself, descending to the southward on a more eastern line, day after day he was searching for the Buenaventura, thinking that he had found it with every new stream, until, like me, he abandoned all idea of its existence, and, turning abruptly to the right, crossed the great chain.

Fremont was not quick to entirely dismiss the waterway, however, and found a satisfactory solution by deeming the river running to Monterey Bay from near the San Buenaventura Mission in Southern California to be the Rio San Buenaventura. Today, it's the Salinas. A portion of Fremont's map is to the right.



April 14, 1844; Leaving the southern end of the San Joaquin Valley.

It had been constantly represented, as I have already stated, that the bay of San Francisco opened far into the interior, by some river coming down from the base of the Rocky Mountains, and upon which supposed stream the name of Rio Buenaventura had been bestowed. No river from the interior does, or can, cross the Sierra Nevada -- itself more lofty than the Rocky Mountains; and as to the Buenaventura, the mouth of which seen on the coast gave the idea and the name of the reputed river, it is in fact a small stream [Salinas River] *of no consequence... There is no opening from the bay of San Francisco into the interior of the continent.*

Fremont's ended hope for a trans-Rocky waterway and for a time the name "Buenaventura" was applied to the Salinas River.

Julius Hutawa (1848-1849)

J.H. Colton (1849)

Although Miera's Rio San Buenaventura was now known not to reach California, his river remained on many maps until the 1850s.

John Smith (1849)

The higher reaches traversed by Miera drain southward to the Green River, not westward through a mountain pass. Sevier River is correctly shown as a short tributary to the lake.

Adolph Stieler (1856)

Fremont's diary from when he was in Washington in early 1845 suggests that the challenge of refuting the legendary river was more than cartographic.

> *The president* [Polk] *seemed for the moment skeptical... Like the Secretary* [of the Navy] *he found me "young," and said something of the "impulsiveness of young men," and was not at all satisfied in his own mind that those three rivers* [including the San Buenaventura] *were not running there as laid down* [on previous maps.]

No American President, of course, wants to lose his or her allotment of national destiny.

Fremont's final thoughts on the matter, from the April 1891 Century Magazine,

> *A river, the "Buenaventura," indicated upon a map furnished me by the Hudson's Bay Company as breaking through the mountains, was found not to exist.*

The Great Salt Lake was not fully circumnavigated until 1849 by Howard Stansbury who declared that no river flowed outwards and the hydrologic containment of the Great Basin was at last recognized.

We've highlighted the conceived boundaries in red, reasonably close to the mapping of today.

Marcius Willson (1854)

To this point we've been discussing a Rio San Buenaventura said to flow out of a closed basin. Not knowing that the Great Basin is a closed watershed, however, the river was discarded by mapmakers of 19th century simply because nobody could actually verify its existence.

There's much more that can be pieced together about a Rio San Buenaventura that flows to the sea underground.

The Great Salt Lake

In Chapter 36, Underground Rivers in the Fine Arts, we noted the thesis of painter George Catlin that a Mississippi-scale underground river drains Utah's Great Salt Lake to the Gulf of Mexico. Let us now consider an outlet in a westward direction.

A lake surface seeks the elevation at which the lake's losses equal its gains. When inflow increases, the water level rises, providing increased head pushing discharge through the lake's outlet, increased pressure-driven infiltration into the lake bed, and increased water surface area, thus greater evaporation. When inflow decreases, the lake surface falls for like reason.

Thus observing a lake over a number of years, we can algebraically compute unknown components.

Direct Precipitation	+	Stream Inflow	+	Groundwater Inflow	=	Evaporation	+	Stream Outflow	+	Groundwater Outflow

Rearranging,

Direct Precipitation	+	Stream Inflow	-	Stream Outflow	-	Evaporation	=	Groundwater Outflow	-	Groundwater Inflow

Substituting known values in millions of cubic meters/year,

1,109	+	2,361	-	0	-	3,577	=	Groundwater Outflow	-	Groundwater Inflow

The zero identifies the waterbody as a terminal lake.

Again rearranging,

Groundwater Outflow		Groundwater Inflow	=	-107

Seepage into the Great Salt Lake from the mountains above it exceeds whatever seeps out of the lake by 107,000,000 cubic meters/year. This is not to say that nothing exits through the bed, but rather to indicate that at best, the magnitude is comparatively small.

But as we are by now well aware, science has played a role in such discussion in only recent history. The Great Salt Lake, according to Native American legend, was once connected to the Pacific by a subterranean river which caused treacherous whirlpools in the lake's center.

And as we are also aware, lore can build upon lore.

The River Sidon, the only river mentioned by name in the Book of Mormon (Alma 22:27-34) in some aspects resembles the Rio San Ignacio of Baja California. The Lamanite and Nephite armies were said to have crossed the Sidon multiple times with seemingly ease. The modern San Ignacio can be waded with little effort, as much of its headwater seeps into the alluvium and reaches the sea underground. Brigham Young would have thus have been attuned to the subterrain when in 1847 he declared, "This is the place."

The City of the Saints, and Across the Rocky Mountains to California (1862) by Richard F. Burton,

> *The watershed of the Basin is toward the north, south, east, and west; the affluents of the Columbia and the Colorado Rivers carry off the greatest amount of drainage. One of the geographical peculiarities of the Territory is the "sinking," as it is technically called, of the rivers. The phenomenon is occasioned by the porous nature of the soil. The larger streams, like the Humboldt and the Carson Rivers, form terminating lakes. The smaller are either absorbed by sand, or sink, like the South African fountains, in ponds and puddles of black mire, beneath which is peaty earth that burns as if by spontaneous combustion, and smolders for a long time in dry weather; the waters either reappear, or, escaping under the surface -- a notable instance of the "subterranean river" -- feed the greater drains and the lakes. The potamology is more curious than useful; the streams, being unnavigable, play no important part in the scheme of economy.*

"Potamology," is the scientific study of rivers, not the family doctrine peculiar to the settlement through which Burton had recently passed. The concluding sentence would prove to be one of the greater misstatements of American exploration.

The drama of the hydrology was to grow, soon to include whirlpools.

> *Reported Discovery of a Subterranean Outlet -- Force of the Whirlpool. A subterranean outlet to the Great Salt Lake has been found opposite Corinne, and between Fremont and Kimball Islands. The schooner Pioneer, Capt. Hannah, while sailing in that vicinity last Sunday, was drawn into an opening, which is an immense maelstrom, or stupendous whirlpool, and the descent and circular motion of the water were so rapid and violent that the vessel was made to spin around in it with frightful velocity, and it was only by a high wind prevailing at the time that she was enables to sail beyond the influence of the awful chasm. Capt. Hannah reports that he has no doubt whatever that this opening (never before discovered) is the grand outlet of the lake.* -- New York Times; June 10, 1870

Great Salt Lake schooner

And soon would follow, in the spirit of the Great Kircher (Chapter 8) the inevitable supposition of a subterranean river.

The British publication Anglo American Times, July 9, 1870, provides the lucid details.

> *In a former number we alluded to the underground outlet supposed to have been discovered for the surplus waters of the Great Salt Lake. The subject is of much geographical interest, for the wide basins of the country between the Rocky Mountains and the Sierra Nevada without an outlet for the waters pouring down the vast mountains support the supposition that a great subterranean river flows thence to the sea, as a distinguished geographer alleges. The following details are taken from a paper of Corinne, Utah:*
>
> *One night last week the schooner Pioneer, Capt. Hannah, on our voyage from Corinne to Stockton, when at a point in the lake between Freemont and Kimball Islands, nearly opposite this city, came suddenly in contact with something which the captain thought more solid than water, believing his vessel to have stranded upon rocks. Instead of this, however, the men on the Pioneer discovered that she was in the whirl of a maelstrom, for the vessel immediately revolved as if in a circular current; and the motion was so rapid in the revolutions made that the men could scarce stand to their duties. Capt. Hannah being an old sailor, and understanding the danger he was in, at once added sail, and, a brisk wind blowing at the time, the craft was, after about half-an-hour's detention, borne beyond the vortex of the eddy. He informs Gen. Connor, the owner of the schooner, and from whom we get these interesting facts, that while in the trough of the ugly hole the deck was far lower than the water outside the whirlpool, and that he owes the safety of vessel and men to the stiff breeze which fortunately sprung up at the time. The noise of the waters as they descended denoted that some mighty airless cavity below gave strength to the suction, and the surging, frothy foam above was like the boiling of a mammoth cauldron. That this is the safety valve of Great Salt Lake there seems to be no doubt, and we can reasonably assume that similar openings are numerous on the bottom.*

"Utah Notables, Captain John Hannan," Salt Lake Daily Tribune, April 5, 1873, provides a bit of follow-up.

> *On one of his succeeding voyages upon this stormy sea* [the Great Salt Lake]*, he discovered what will ever embalm his name in the living luster of fame, to-wit, the great whirlpool or maelstrom of Utah, the outlet and subterranean passage of the water from Salt Lake.*
>
> *This discovery was made just at the vesper hour, as the sun was going to set. The sloop Polly Ann was being imperceptibly drawn into the abyss. Captain Jack and Jim McGosling had been "laying toward leeward" of a keg of Canadian whiskey, supplied them by General Conner, and hence did not watch closely for calamities. Hearing a roaring noise like holding a conch shell to one's ear, Cap looked over the gunwale and saw a fearful maelstrom. He got sober quicker than he could say "Jester Clinton," and so did Jim... Just then Cap saw a rippling of the smooth*

surface of the sea and he knew that a gust of wind was passing over the whirl of the maelstrom towards his craft. "Let loose the jib-boom and spread the main sail," shouted Capt. Jack in a voice so familiar to all frequenters of Main Street. "Hoist the top gallant -- unreel the halyards -- cut loose the caboose and hold taut the capstan," again shouted our hero, in that melodious strain so much resembling the song of the animal upon whose back our Savior received his first lesson in equestrianship.

His orders were obeyed -- the "gust" aforesaid caught the sails and carried the Polly Anne safely out of the whirl is had been revolving in, into the smooth open sea, from where he soon after sailed up Barr Creek to Careen and gave the intelligence of his astounding discovery for Dr. Cass and Judge Toohy, who sent it widely over the wires to the utmost ends of the earth, to enlighten and make happy the scientists of every clime and country. This truthful history of the discovery of the outlet of the waters of Salt Lake proves it to be a more reliable institution than the great serpent that Bishop Johnson discovered in Utah Lake a year earlier, both of which were discovered through agency of spiritual manifestations, and a queer kind of planchette called a jug.

Not unlike the controversy regarding the direction of the hydrologic cycle (Chapter 7) the Salt Lake Herald of June 25, 1903, speculated the opposite, that the lake was fed by subterranean springs from a another underground river.

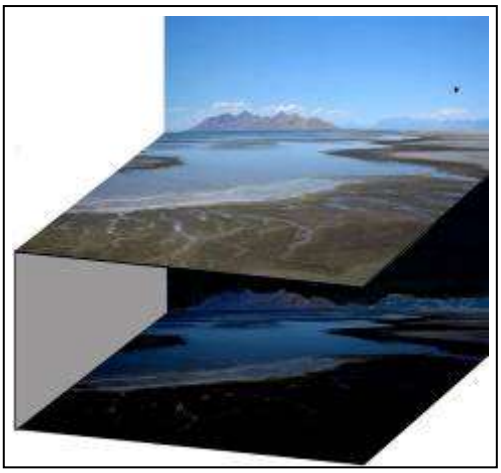
According to the theory, there are places in the bottom where holes may be found that are from six to ten feet wide. These, it is claimed, form the mouths of springs that emit volumes of fresh water into the lake the year around... Adherents to this theory claim that in seasons of heavy precipitation the earth swallows up quantities of water that percolates through the spongy soil to subterranean rivers and then finds its way into the lake through these springs.

Absent the allusion to the underground river, this isn't far from the truth, as indeed the Great Salt Lake receives inflow from numerous seeps.

After a quantitatively-amiss case that lake evaporation is less than tributary inflow, the July 18, 1904, Pittsburgh Press revived the underground-outlet hypothesis.

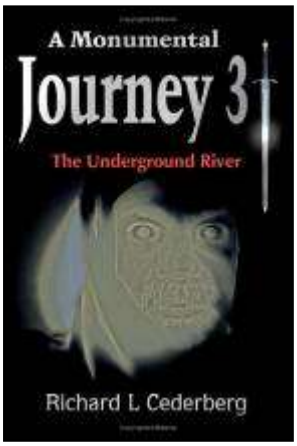
The curious nature of the bottom is indicated by the attempt to build a railroad across the lake... In places near the center the engineers have discovered what appear to be enormous beds of quicksand... There are some spots in these portions where material has been thrown almost daily of over a year without thus far finding bottom. Several of the railroad engineers have a theory that the depressions which it seems impossible to fill are the entrance to an underground river so that as fast as the rock is thrown in, the current of the river carries it away.

Near what is called Antelope Island is another indication that a subterranean opening exists. Frequently the waters near the island are so violently disturbed that people in the vicinity call this place the "maelstrom.'"



Bringing us up to date -- perhaps proving that human intelligence doesn't improve with successive generations -- Branton (1995) notes,

Certain geologists state that the Great Salt Lake has an underground counterpart deep below it, and that a certain type of earthquake could "conceivably" empty the entire contents of the lake into its subterranean counterpart. There are vague rumors of underground streams or rivers which allegedly flow from HUGE caverns in the heart of the Wasatch Mts./Western Rockies (caverns which can supposedly be entered by following the right path through the underground maze), and westward below the valley floor, possibly to the underground "counterpart" of the Great Salt Lake.



And consider The Underground River (2006) by Richard L. Cederberg. The situation in a nutshell: Forced to put their schooner into dry-dock for repairs, the crew of the Heimdall chooses to holiday in southern Utah so they can rendezvous with the Professor, a brilliant confidant from Rabat. What he shares stuns the crew and changes their plans. Now, instead of sailing north to Montague Island, four of them will travel to a hidden base in Taroudant Morocco for secret training on state-of-the-art vessels. The others will climb Ghost Mountain to verify a recently-discovered entrance into a vast underground river system. Tearfully, both groups part company to prepare for the greatest challenge of their collective lives, an extraordinary mission into a numinous subterranean realm in search of century's old Viking civilizations.

And a bit later in the adventure,

> *"Testing, testing, can everybody hear me? Alrighty then, it's me, the big mouth comin' at ya' from downtown Oski, the mineral capital of the bloody universe on the beautiful Underground River. The stone city is about two and a half miles to the south-east of a big island in the middle of Lake Powell at about twenty- three hundred feet."*
>
> *"An island?" The Captains forehead tightened as he glanced over at Jonah, "We're under Utah then!"*

Lake Tahoe

As the underground route might pass near Lake Tahoe, we can consult "Mysteries of the Deep at Lake Tahoe," July 25, 2004, by Tom Stienstra of SFGate.com.

> *Legend is that there is a hole somewhere on the bottom of the lake that is linked to an underground river system that feeds into Pyramid Lake north of Reno. This would explain how drowning victims at Tahoe have floated up at Pyramid. Or would it? Others say it just means that bodies floated over the spillway at north Tahoe could be carried via the Truckee River to Nevada and Pyramid Lake.*

The pioneers couldn't locate the channel, of course, but that's exactly what would be expected if the San Buenaventura were underground.

Unlike Lake Tahoe which feeds it, Pyramid Lake is terminal. It rarely hurts a tale to tie it to something that appears mysterious.

"Trout from the Underground," Daily Picayunne, August 7, 1892,

> *C.D. Brooks, who lives near Oak Park, Cal., recently pumped several trout several inches long from a well on his premises. There seems to be little doubt that an underground river of considerable volume runs through that gravel section, for a few years ago W.L. Willis, who lived in the same neighborhood that Mr. Brooks does, pumped up a number of mountain trout. This stream seems to run down toward the Cosumnes, as trout of good size have been taken from*

pumps as Sheldon many miles south of here. This stream probably comes from Lake Tahoe, that being the nearest mountain lake of sufficient capacity to keep up the supply that is known to exist in this vicinity.

Scientists have long been of the belief that there is a subterranean outlet to Lake Tahoe, and as none other has been discovered, it is fashionable to suppose that this may be it.

The Oak Park cannot be the modern Oak Park in southern California, but Shelton is near Sacramento and the Cosumnes River rises on the western slope of the Sierra Nevada, emptying in the Sacramento-San Joaquin Delta.

In terms of subsequent findings, this trout seem a doubtful a catch, but in the lore of the San Buenaventura, the route fits right in.

A Southern Branch?

We should, of course, allow that some hydrographic details remain unresolved. Perhaps, for example, a southward branch of the San Buenaventura.

"Government Scientists Find Trace of Underground River," Los Angeles Herald, February 20, 1909, suggests such an underground river.

Government experts have made a discovery which leads them to believe that there is an underground river which passes through a valley in the vicinity of Goldfield, Nevada, down through the desert country and passes near Banning, in this state. How much beyond Goldfield is may extend is a mystery on which they are now working.

The first discovery of the existence of this great subterranean stream was an analysis of water taken from both places which were exactly similar. This was followed up with other investigations that are not yet complete, but which have progressed far enough to convince the experts that the stream exists unbroken through all those hundreds of miles.

The map indicates the Goldfield-to-Banning flow route. The Herald continues,

The first discovery of the existence of this great subterranean stream was an analysis of water taken from both places which were exactly similar. This was followed up with other investigations that are not yet complete, but which have progressed far enough to convince the experts that the stream exists unbroken through all those hundreds of miles.

The southern route, in fact, may explain the case of the purloined Colorado River

From the September 6, 1911, edition of the Urbana Daily Courier,

. That the Colorado River has buried itself in an underground channel, two miles south of Yuma, was the statement of William Cranston, a mining man, who arrived here from that point. Cranston said that the mouth of the channel had not been discovered, and it was feared by the residents of that section that the river was finding its way to the Salton Sea.

The September 5, 1911, San Francisco Call added the following,

An engineer of a gasoline launch on the river plying south of Yuma is authority for the statement. The immense lake at Volcano made by the river is practically dry and thousands of dead fish are stranded there, filling the air with stench. It is believed the water is flowing through an underground passage either into the Gulf of California or into Sultan Sea. In the latter event much agricultural la d in the Imperial Valley will be menaced.

The reports may relate to the 1852 Volcano Lake earthquake which formed cracks in the clay desert near the Colorado River and caused mud volcanoes and geysers to become active southwest of Fort Yuma, where the epicenter presumably was located. Volcano Lake is the central waterbody in the map to the right.

While by all accounts the event disrupted the flow of the Colorado, there is scant geological evidence for an "immense lake" before the quake.

For the sake of space, we've condensed Jack Innis' "The Legendary Subterranean Cavern Hoax," San Diego Legends: The Events, People, and Places That Made History (2004), but have retained that dealing with the fantastic underground river.

On the last day of 1887, San Diego Union reporter Charles Degelman interviewed the eminent geology Professor Robert Stearns, Paleontologist of the United States Geological Survey and Curator of Molloseo, United States National Museum.

After extracting the reporter's pledge not to divulge particulars of location, Prof. Stearns related his exploration of a vast cavern extending from beneath the bed of San Diego Bay to the Salton Sea. As the latter lies 30 meters below sea level and the water is saline, the Pacific must have once fed the basin via this conduit until the Laguna Mountains uplifted to close its entrance.

Equipped with coal-oil torches, ropes and balls of twine to mark the way, the professor and his assistant passed through tight spots before reaching an area of total blackness where the torches revealed faint points of light.

> *"My first thought was that we had again reached the outer air with its starry sky. But soon, I realized we were in the mouth of an immense cavern, whose tops and sides were hung with sparkling crystals."*

The walls were thickly studded with colored and shaped crystals and veined of gold-bearing quartz. The floor was strewn with valuable minerals

Stearns then describes the finding of 5000-year-old human remains, evidence of a civilization more advanced than anywhere "in the Near or Far East."

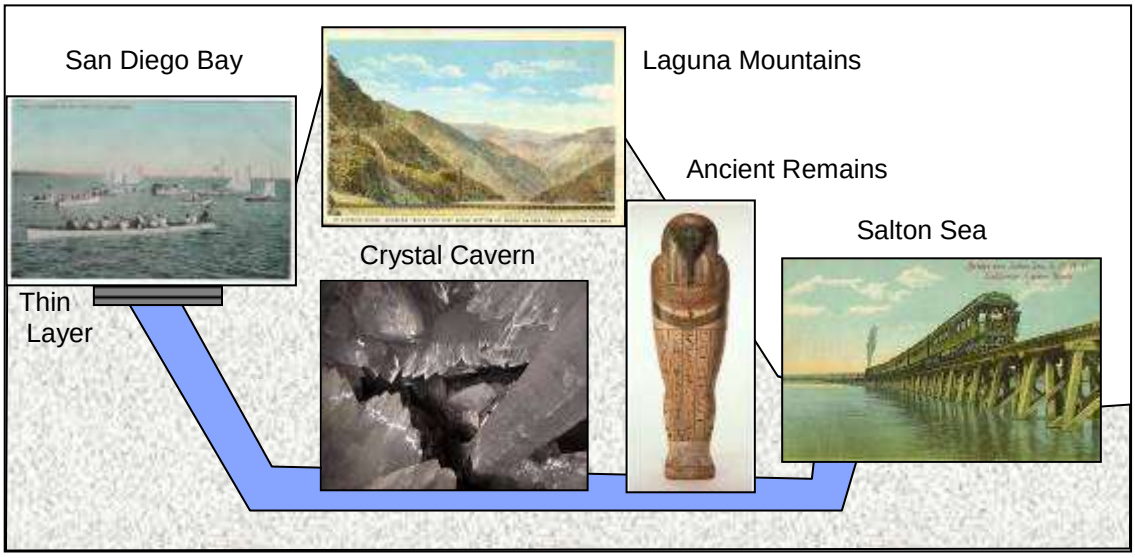
Dripping salt water indicated that only a thin layer of rock keeps San Diego Bay from crushing the cave's ceiling.

The location of the cavern's entrance mustn't be revealed to the general public, insisted the professor, as a ne're-do-well with a few sticks of dynamite could blow open the roof and the river would reclaim its underground channel, flooding the interior desert to a depth of 200 feet. San Diego Bay would become a perpetual vortex; any vessel venturing too close would be sucked in and engulfed in the subterranean current.

Dueglman duly reported the extraordinary discovery next day's edition,

"The Bowels of the Earth: Discovery of an Immense Subterranean Cavern in San Diego. A Prehistoric Race Found Entombed in Coffins Chiseled Out or Solid Stone -- A Cave of Crystals Under the Bed of San Diego Bay."

Our summary,



Questions have since arisen.

Did a phony scientist dupe a gullible reporter?
Did a savvy reporter fool his editor?
Did the editor and reporter trick the Union 's publisher?
Did the entire staff pull off an elaborate New Year's Day hoax?

Decades later, the San Diego Union Tribune endeavored to find the truth. Employment records failed to show any record of reporter Charles Degelman. Federal archives failed to yield any credentials for Professor Robert Stearns.

As we're reminded by conspiritists, the government doesn't want us aware of such things. Thus we must abandon our underground river somewhere under the desert.

A Northern Tributary?

In his harbinger of American expansionism, Report of the Exploring Expedition to the Rocky Mountains in the Year 1842 (1845), the same John Fremont whose report brought end to the pseudo-historic Rio San Buenaventura observed a very-real "subterranean river" exiting the bluffs above Idaho's Snake River.

September 30. Immediately opposite to us, a subterranean river bursts out directly from the face of the escarpment, and falls in white foam to the river below. In the views annexed, you will find, with a sketch of this remarkable fall, a representation of the mural precipices which enclose the main river, and which form its characteristic feature along a great portion of its course. A melancholy and strange looking country -- one of fracture, and violence, and fire.

No less an authority than John Muir left us his observation Steep Trails (1918), a reflection on the western states.

The Lewis, or Snake, River is nearly a thousand miles long and drains nearly the whole of Idaho, a territory rich in scenery, gold mines, flowery, grassy valleys, and deserts, while some of the highest tributaries reach into Wyoming, Utah, and Nevada. Throughout a great part of its course it is countersunk in a black lava plain and shut in by mural precipices a thousand feet high, gloomy, forbidding, and unapproachable, although the gloominess of its canyon is relieved in some manner by its many falls and springs, some of the springs being large enough

> *to appear as the outlets of subterranean rivers. They gush out from the faces of the sheer black walls and descend foaming with brave roar and beauty to swell the flood below.*

We tipped our hat to lava tubes in Chapter 42, but nearly all subsequent examples have been those of karst hydrology. This case, however, is indeed one of lava tubes. As the Snake crosses the southern boundary of the lava plain, no tributaries enter from the north, for this is a region of streams simply disappearing into the porous volcanic rock. Idaho's appropriately-named Big Lost River seeps through the basalt, mingling with other waters for more than 150 kilometers before reemerging at Thousand Springs.

The lithograph and modern photo below illustrate the busting-out.

Outlet of Subterranean River, Fremont (1845),

Modern Riverside, Thousand Springs Reach, Snake River

Pioneers on the Oregon Trail thus had a published picture of the wonders before them, a landscape with rivers underground!

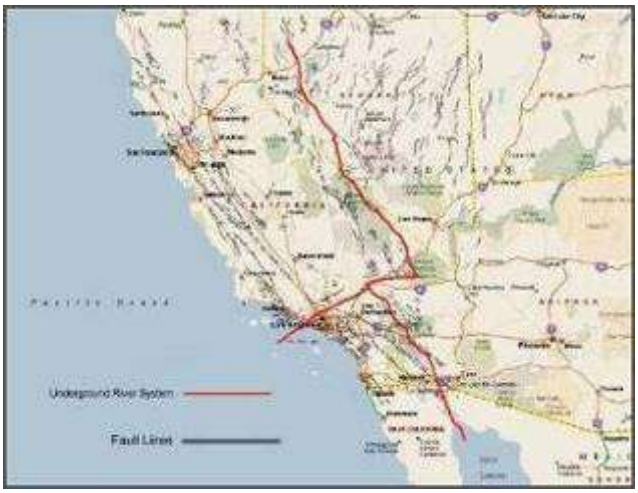
Thousand Springs was likewise wondrous to the Federal Writers' Project. From Oregon Trail: The Missouri River to the Pacific Ocean (1939),

> *The whole of central Idaho seems to be an area of subterranean rivers and possibly cavernous lake beds; at various points in this valley a person can put his ear to the ground and hear deep and troubled rumblings as of a mighty ocean rolling far beneath the surface of the earth.*

The July 1951, Popular Mechanics had the attention-drawing headline "Lost Rivers Return." The notable aspect of the article isn't about Idaho, however, it's the racism.

> *The red men referred to four major streams that tumble out of Idaho's mountains with much promise, then gradually vanish among the sands. But disappearing Big Lost River, Little Lost River, Beaver Creek and Birch Creek -- collectively known as the Lost Rivers -- are now being released from their underground prisons through the ingenuity of the white man.*

In-the-Desert.com suggests a subterranean layout based on fault lines that catches both the North and the South underground tributaries.



Nevada

Though thought by most to be starkly arid, Nevada may have secreted abundant water resource, at least according to some. We'll mention four locations, all in the east-central part of the state.

Monarch

"Underground River, Where Nevada's Sunken Streams Empty Their Waters," Los Angeles Times, September 3, 1893, reports the personal reconnoitering of John Obendorff, "a prospector and miner well known in that State."

> *While working in the bottom of a shaft of the Monarch mine I put in a shot, and descending to see what execution had been done. I found I had broken through into what looked like a cave, with a strong current of air coming up from it. On investigation I found that the opening continued down on an incline. Determined to see what there was below, I put in a cross timber and attached a rope to it. I went down a considerable distance. In some places the opening was very narrow, and in other places four feet wide. In some places it was nearly perpendicular, but it was generally about half pitch. I proceeded down to the end of my rope, put in another cross timber and so I continued.*
>
> *When I got to the bottom I saw a wonderful thing -- a large cavern and a river flowing through it. At first I thought it was a lake, but on reaching the edge of the water I found that it was a flowing stream, and by throwing a piece of lighted paper I found that it had a current of about three miles an hour.*
>
> *I was on the southeast shore, and the bank sloped down to the water's edge gradually, like the sea beach. The roof was thirty or forty feet high, the temperature was mild and a slight current of air was perceptible, blowing in the same direction as the water. Being without facilities for further exploration, I returned to the surface.*
>
> *The next morning I lowered three four-foot planks to the bottom of the shaft, and supplying myself with lunch, rope, candles and matches, I descended to the bottom, which I thin k is about 600 feet below the surface. I lashed my planks together and made a raft, placed two lighted candles on it and let it go on the end of a rope. In this way I learned there were no falls in that distance. I continued in this manner for two miles. In this distance I met no obstacle, only here and there where the tunnel cut through a hard formation there would be rocks projecting to the water's edge, but not preventing me from walking over them.*
>
> *The average width of the stream is about 100 feet, and from bank to bank is over 200 feet.*
>
> *The next morning I explored the tunnel up stream. After going a short distance I found a small stream running into the main stream. In it I saw some fine looking fish, and succeeded in*

landing one with my pole pick. It was a trout eight inches long. I continued until the current of wind got so strong I could not keep my candle burning, so I was compelled to return.

"The place where the discovery was made is Gabb's Valley, Nye County, about twenty-five miles northeast of Luning.

Jake's Valley

Another water-under-the-desert story, this one "The Great Pacific Slope: Jake's Valley Splits Open" from the Los Angeles Times of April 28, 1910,

Great Crevasses Appear on Nevada Plain. Ranchers are Scared, but Only Cattle Perish. Water in Chasms Indicates a Subterranean Stream

Crevasses from two to six feet in width and twenty feet in depth, and of great length, and appeared during the past twenty-four hours in the smooth plains of Jake's Valley, twenty five miles west of Ely. The crevasses have filled rapidly with water and cattle have perished.

Much apprehension is felt among the residents of Jake's Valley, not so much for their personal safety, as for that of the hundreds of head of cattle grazing in that section.

One of the unexplainable mysteries of the strange action of nature is the appearance of water in the crevasses. It is believed here the crevasses are of greater depth than reported by Forrester Burke, and that investigations will show this and that probably the water is from a subterranean stream.

The Spencer River

But one might argue that such tales are old news; we now know better.

Not so, it seems, given the continuing claims regarding the Spencer River/

Might this be the Rio San Buenaventura? Indeed it might, if in fact the Spencer River actually does exist. "Ghost Towns, Mining Camps & Haunted Sites of the Old West," an internet posting by Dustin Dudley, tells us,

A retired rocket scientist living in Nevada claims he has found a currently undiscovered underground river in the Nevada desert. This river, he says, has one and a half times the flow of the Colorado River. If this is true, this water could help supply the whole southwest US. Before you laugh, listen to the story.

Wally Spencer left his position as a rocket designer to pursue oil exploration. He used several images from space shuttle flights. Wally discovered what he believed to be an ancient riverbed in the southern Nevada desert... He guesses that the start of the river is probably in British Columbia. He figures this due to the fact that British Columbia is littered with underground rivers and lakes. He figures that two or more of these underground rivers merge together as they approach Nevada. He thinks that this river meanders its way into the Pacific Ocean.

Spencer applied in 1994 to the Nevada Department of Water Resources (NDWR) to appropriate 782 cubic meters/second of water from a source described as the "Spencer River, an underground river flowing in distinct channels."

Employing satellite photos, space shuttle imaging radar which can detect limestone, sand and calcium deposits, and a radiation detector mounted on the back of a pickup, Spencer claimed to have traced the river for ten kilometers.

Spencer speculated that the underground river is probably 500 million years old, flows to the Pacific, and is 1200 meters below the surface, except a reach in Nevada where it's only 114 meters down.

The underground river's location is supposedly a secret -- "90 to 100 miles from Las Vegas," according to business partner Beverly Jacob -- but the drilling locations are NDWR public record.

Spencer asked for a drilling moratorium by others within 32 kilometers of his location and a finder's fee of what amounts to somewhat less than one percent of the water's market value, but only if 2 cubic meters/second were exceeded. The water from the Spencer should be shared with the public without additional cost.

So let's look at the numbers.

	Spencer River	Colorado River
Discharge, cubic meters/second	782, permit	421, annual average at Lees Ferry
Power	900,000 kW, constant pumping, assuming water table at 114 meters	466,000 kW, Hoover Dam average production

The Spencer River would become the American Southwest's greatest water resource. Phoenix, Las Vegas and Los Angeles and turn on their lawn sprinklers!

Spencer applied for 15 drilling permits, but, assuming that two more Hover Dams could be tapped for the pumping power, in the order of 2,000 more would be required to lift the flow to the land surface.

"Pay Dirt, Underground River to Quench the West" in Equinox, October 1994, was somewhat skeptical, however.

> *You won't find Spencer River on any map of North America -- at least not yet. But it is already flowing for Wally Spencer, a retired chemical engineer who claims to have discovered the major waterways hundreds of meters beneath the Nevada desert. What's more, he says the source could be subsurface caverns in British Columbia.*
>
> *Underground rivers are formed when groundwater enters lava tubes or caverns carved in ancient limestone. But according to Terry Katzer, director for research for the Las Vegas Valley Water District, extensive channels would probably have been disrupted my millions of years of earthquakes and other geological processes. Experts in British Columbia, meanwhile, are equally doubtful. "We are blessed with an abundance of groundwater," says Al Kohut, a specialist with B.C.'s Water Management Program. "But whether there's a connection is more than unlikely."*

And back to "Ghost Towns, Mining Camps & Haunted Sites of the Old West,"

> *The government is trying to sort everything out right now. They are trying to decide who gets what, if an agreement can be reached. The government now knows that they will not find out where the subterranean river lies unless an agreement is made. They have tried everything to find out. Wally has had bugs (listening devices) planted in his house numerous times by unknown government agencies. He knows better than to ever talk about the location of his find. He is just waiting for the day when everything is settled and he can drill for his water. He is now in his seventies and who knows, if an agreement is not made sometime in the near future, he may take this information to the grave with him.*

"To the grave" seems to be the outcome, as Spencer died in 2003 at age 73.

But maybe not. Failing to submit evidence of sufficient water to support the application, NDWR rejected the application in 1999, but Spencer's widow is protesting the ruling.

Western underground river stories are not unrelated, of course, as revealed on TV's "Unsolved Mysteries," October 13, 1993, the story of Dorr and Spencer. The latter feared for his life from the unknown parties who bugged his residence to maintain their water monopolies.

Prospecting in the 1920s

Dorr going underground

Discovering the underground river

Destroying the entrance

Clues from satellite

Spencer locating the river

Discovering the surveillance bug

Don't let on that we're aware

Most Americans don't regularly receive the news from a fact-checking source; they garner bits and pieces of information from whatever media they happen to come upon for whatever reason. Political campaigns are based on this model.

The problem is compounded when lower-echelon media entities themselves uncritically propagate such information. "The Proposed Yucca Mountain Repository: Who Could be at Risk?" Pahrump Valley Gazette of August 12, 1999, serves as a case in point.

The most read newspaper in Nye County
Pahrump Valley Gazette

Two events document the existence of a large underground river in the vicinity of the proposed repository. One possible source of the water for this underground river was discovered when the Navy was unable to explain the discrepancy between the surface water entering Walker Lake and the volume of water retained in the basin. The deficit at first appeared to be a loss to an unknown aquifer.

Using massive amounts of dye, the water was traced to its destination which was in the Sea of Cortez east of Baja California. This of course does not establish the route, only its point of origin and its eventual destination.

The second event places the possible route near to the area in question and involves a gruesome event, which occurred at Devil's Hole near Ash Mountain and 30 some miles south of Yucca Mountain.

A solo scuba diver in Devil's Hole apparently became entangled in some underwater passageway. He apparently undid the straps holding his air source and became separated from the lifeline. The result was disastrous. His body was never recovered. His air bottle (traced by serial number) was found sometime later when it surfaced in the Sea of Cortez.

These two events tend to prove that an underground river does exist and passes near the Nevada Test Site and the proposed Yucca Mountain repository...

Forty years ago Shell Oil exploration in the vicinity of Arden, Nevada (as related by a person living in Las Vegas at the time) intersected an underground source of water with a massive force causing the deflection of the well casing preventing installation. This stopped further exploration and penetration of the earth's crust. Could they have intersected the route of the underground river which connects Walker Lake and Devil's Hole?

Another legend which may point to the route is that of the Indian cave on Kokoweef Mountain near Mountain Pass. The legend tells of an underground river larger than the Colorado which is below sea level and is found in a massive cavern with an underground bluff some 1,500 feet above and overlooking the river channel. (An earth tide is also noted affecting the water level. The rate of water flow from Cima Springs also appears to be associates with ocean tides. It is related to the pulsing of the earth's mantle above the caldron of gasses and molten lava.)

Is the Kokoweef legend true? A 1960 participant in a group which included the owner of Culligan Water related that seismic exploratory tests indicated a gigantic cavern deep within the bowels of this formation.

The piece spews nonsense, 5000 copies in newsprint, to give it a number. We've a missing body, an air tank bobbing up off Mexico, the Navy, Shell Oil and Culligan Water, dimensions of a cavern cliff, a subterranean current sufficient to bend heavy pipe.

Is it any wonder that not a small group of Nevadans envision a mysterious, perhaps monstrous, river beneath their feet?

Lehman Cave, Great Basin National Park

From Buchanan's Journal of Man, June 1888,

A wonderful cave has been discovered in Nevada..., which, if correctly described, could be the greatest cave in the world... The Large Room is said to be 500 feet long, 200 wide and 150 high. "Cyprus Swamp" is an apartment 200 feet square, with pools of clear water over the bottom, mingled with snowy white formations resembling twigs grasses, seeds, etc.

And from "Place of Beauty," Lodi Sentinel, February 1, 1923.

A unique feature is an ordinary sized bathtub -- of ice -- always filled with clear cold water... Almost midway through the maze of "ingrowing icicles" is Lake Como, a placid pool of crystal water filtered through 300 feet of lime formation, so pure as to be tasteless.

Given journalism's propensity to exaggerate cave discoveries, we might have reason to doubt reports of a true underground lake under Nevada. We believe it, though, when the National Park Service says it's so.

Lehman Cave doesn't contain much of a waterbody, but a little is a lot in Nevada.

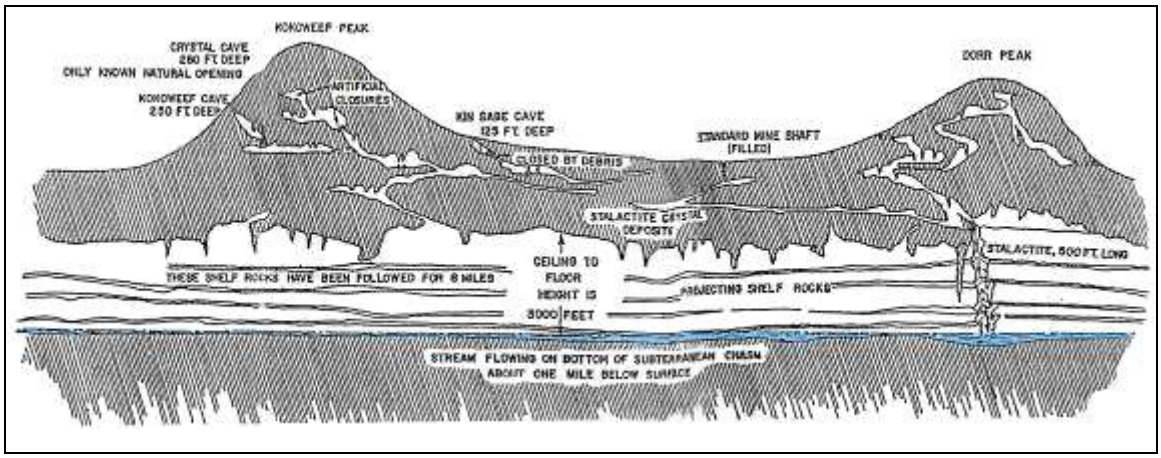
Lehman Cave
$8.00

Kokoweef Peak, California

An oft-recounted tale a western underground river stems from Mr. Earl P. Dorr, whose sworn affidavit describes vast caverns near Kokoweef Peak in California's San Bernardino County. Portions of Dorr's testimony stemming from 1927 follow.

> *These caverns are about 250 miles from Los Angeles, California. Traveling over state highways by automobile, the caverns can be reached in a few hours.*
>
> *Accompanied by a mining engineer, I visited the caverns in the month of May 1927. We entered them and spent 4 days exploring them for a distance of between 8 and 9 miles. We carried with us altimeters and pedometers, to measure the distance we traveled, and had an instrument to take measurements of distance by triangulation, together with such instruments convenient and necessary to make observations and estimations.*
>
> *Our examinations revealed the following facts, viz:*
>
> 1. *From the mouth of the cavern we descended about 2000 feet. There, we found a canyon which, on our altimeter, measured about 3000 to 3500 feet deep. We found the caverns to be divided into many chambers, filled and embellished with the usual stalactites and stalagmites, besides many grotesque and fantastic wonders that make the caverns one of the marvels of the world.*
> 2. *On the floor of the canyon there is a flowing river which by careful examination and measurement (by triangulation) we estimated to be about 300 feet wide, and with considerable depth. The river rises and falls with the tides of the sea -- at high tide, being approximately 300 feet wide, and at low tide, approximately 10 feet wide and 4 feet deep.*
>
> *Sworn by E.P. Dorr, 309 Adena St., Pasadena, Calif., November 16, 1934.*

The cross-section by Herman Wallace Jr. provided some geologic particulars. Dorr claimed to have dynamited the cavern entrance to protect the secret in 1927. He died in 1957 as a result of a mining accident and his cave's never been rediscovered.



There's even a “fact based poem” by Ralph E. Lewis, "Underground River of Gold Legend -- Kokoweef Peak or 'Coco-wee-pah?'" We excerpt the lines dealing with the river.

Earl’s signed Affidavit described the caves,
2,000 feet down, down, down they went
They only planned on two days,
In all, four were spent.
They walked along black-sand ledges,
Surveying the vast golden extent.
This was an underground slot-canyon!
Along it 8 miles they went.
There’s a stalactite at the canyon pit,
Earl swears it’s “1,500 feet long,”
A 3,000-ft waterfall washes over it,
Playing his lovely “stream-of-dreams” song.
There’s the ‘river-of-gold’ at the bottom
And it rises and falls each day,
Unknown tons of gold really got ‘em!
Made by John Herman’s single assay.

Today, five acres of private property just northwestern of the peak is camp for volunteers and investors yet searching for Dorr's entrance.

China Lake, California

Classified activity at the Naval Air Weapons Station China Lake, roughly half way between Los Angeles and Las Vegas, may be of interest to (if not under the direction of) extraterrestrial beings, the protagonists of the chapter to follow, but the location itself might be part of the Rio San Buenaventura, if the www.abovetopsecret.com can be believed.

I was stationed at Naval Air Facility, China Lake 1971, 1972. This is the aviation facility responsible for supporting Naval Weapons Center China Lake. While there, I became friends

with an old desert rat named Pappy Walker. (Charles Walker to the Navy). Pappy owned China Lake Auto Salvage, one of two local wrecking yards. I eventually worked in the yard for Pappy on a part-time basis. During our numerous hours together, Pappy had an eager ear for his stories about his experiences in the desert.

He had been in the area since the 20s, and was one of the local people contracted by the Navy to help build the base in 1942 or 43. After the war, he maintained his good standing with the Navy, winning the contract to remove junk vehicles, as well as the occasional "odd job" that he was called on to perform.

One of these "odd jobs" was eliminating the problem of standing water on the base golf course. This was in the very early 50s, after the base had matured and become the center for Naval weapons development. Naturally, there were quite a few egg-heads and VIPS constantly in residence, so the Navy installed a golf course for them. When the lawns and greens were watered, there were a couple of areas where the water would collect, and it inconvenienced the golfers to a large degree. The base contracted Pappy to fix the problem, which he set out to do by drilling drainage sumps in the low areas, covered by metal grates of mesh fine enough not to swallow golf balls. On one of the holes, at a depth of about 12 to 15 feet, his auger suddenly broke through into an underground cavern and started to free-wheel wildly. Pulling the drill out of the hole and investigating, Pappy realized that he was staring down into an underground river! He immediately reported same to the people he was working for, and it caused quite a stir.

Over the ensuing months, the river was surveyed and found to flow generally from north to south/southwest. It came out from the mountains to the north, crossed the valley, and then ran under the mountains to the south and on to parts unknown. The water was tested and found to be sparkling and pure. The Navy immediately built facilities to draw the water for the base from this river. It eventually supplied all of the water used by the base, and as far as I know, still does.

Pappy was awarded a healthy bonus by the Navy for his discovery.

As the source is www.topsecret.com, of course, we can't reveal the author's identity, but we can disclose a bit about the hydrology.

The groundwater basin encompasses a surface area of 1500 square kilometers of arid land over two aquifers:

Playa formations locally perched on lenses of low permeability near China Lake.

A deep, mostly-unconfined aquifer underlying most of the valley.

The Air Weapons Station is located in a transition zone between the two. Recharge is from the Sierra Nevadas, but due to such improvements as the golf course, groundwater storage is falling.

VX-5 Prowler over China Lake golf course, 1991

It is geologically improbable and historically inconsistent with the region's drilling record that a free-flowing stream courses just a few meters beneath the surface. The naval base draws from a collection of wells monitored for water-rights.

If Pappy made off with a healthy bonus for his discovery, he was a sly old codger.

And Again, the Rio San Buenaventura

Earlier in this chapter, we took the explorer John Fremont at his word, relegating the Rio San Buenaventura to a fabrication that hooked many a mapmaker. A southward-flowing stream

toward the San Buenaventura Mission was given the name, but no one pretended it to be the fabled waterway.

As for the San Buenaventura Mission, however, we have an item of interest from the Ladies' Repository, April 1874.

> *Subterranean Fishes. At San Buenaventura, in California, not long ago, an artesian well was sunk on the sea-beach, about five feet from high-water mark. At the depth of one-hundred and forty-three feet, a strong flow of water was obtained, which spouted to the height of thirty feet. One day, fish were observed in the waste water around the well. On examination, the well was found to be filled with young trout, a large number being thrown out at every jet. They were perfectly developed, and about two inches long. The first examination was to see if they had any eyes; these were found to be perfect. Now, there was no stream within a distance of several miles; and that one, Santa Clara River, had no trout in the lower portion of it. The fish, therefore, must have come from the headwaters of this stream, through some subterranean outlet.*

Consider the facts:

> A legendary river lost in the Great Basin.
> A fish-laden fountain emergent at the California mission of the same name.

Can we not but wonder if the trout were Utah cutthroat? Pursuit of underground rivers is all about possibilities, is it not?

2011

Engaging folklore is many times retold, of course, so it's of little surprise that reaches of the Rio Buenaventura again and again resurge in popular literature. Golden Arrows (2011) by John Chelson does its best to cash in. In exploring the remote areas of the eastern Sierra Nevadas, the protagonist's friendship with a local Shoshone Native American leads him to discover a geological phenomenon that changes his life forever. The gist:

Hypotheses,

> *Indian Mac sat on a table with Bill as the two of them had lunch. He leaned the chrome lagged chair back and started in on another one of his stories. "Bill, I tell you the truth. A long time ago, at the north end of Railroad Valley, my ancestors discovered a river at the back of a deep cave. What I was told by my father was that it was a huge tunnel of water but filled with 'bad spirits'."*

Fieldwork,

> *He climbed a small knoll and could see what appeared to be a broken line of white and green stretching as far back as he could see. This is indeed what he hoped to find.*
>
> *He imagined that it was an underground river bobbing up to the surface from time to time as it made its way down the valley. It never broke through the surface, but it came very close.*

Cartography,

> *"You know, Bill, something about this water has really caught my interest. Looking at all the maps and data we have here, I'm going out on a limb and say this tunnel comes directly from the Great Salt Lake in Utah. That lake has no known outlet and many have wondered how it maintains its level. This underground river could start anyplace under the lake."*
>
> *"It's about two hundred and fifty miles from here to Salt Lake City as the crow flies. No telling how far it might be by way of a meandering underground river. I'm also thinking this river might some to the surface again at Salton Sea, near Indio in California. That's about another five hundred and fifty miles! If so, from there it probably empties into the Gulf of California.*

Lab work,

> *"I'm running some tests now and in a few minutes we'll see what it says about the makeup of the water in your well. While we're waiting, I'm going to check one of my books for the chemical makeup of the Great Salt Lake so we can see how it compares."*
>
> *In a few minutes the test of the of the water sample was complete. "Oh my gosh, Bill, the chemical makeup of the water at the two sites is the same!... I would really like to publish a scientific paper on this revelation"*

The business world,

> *"Okay, here's what I have in mind, Eric. I'm going to buy up a patchwork of a thousand acres or so in the valley following the possible flow of the underground river as much as I can. I've had some preliminary discussions with a large US company regarding special underground turbines for producing electricity. The company and I will be named on the patent and I will get a royalty on every subterranean generator they sell.*

Native American lore, the Great Salt Lake, the Salton Sea, the Gulf of California, Subterranean Hydropower. Has the author missed anything?

Indeed he has -- Alien beings, but that's in Chapter 97.

Conclusion

The Rio San Buenaventura was elaborated by a generation of mapmakers, but in the end was discarded by frustrated explorers and topographic reality. To preserve itself, even the best of legend requires at least a hint of physical corroboration.

Clues to the river's subterranean existence are more difficult to jettison, however. If what we've unearthed -- somewhat literally -- about such an underground river fails to satisfy our scientific skepticism, we've Chapter 97 yet to come, Extraterrestrials and Lost Races of the American West, where evidence for the hidden river will be furthered. Astonishingly furthered.

CHAPTER 95
MESSAGE IN A BOTTLE

Sealed in a bottle, cast into the water, borne by the waves and serendipitously found -- such a message engages our imagination. Who wrote it? What's become of that person? Did fate direct the bottle? What is the finder to do?

The bottle being delivered by an underground river makes the intrigue yet more compelling.

This chapter explores several such tales. Admittedly, most deviate in some degree with the pure scenario, but together they meld the lores of messages in bottles and rivers beneath the ground.

Lost River, Virginia

We'll begin with an account that precisely matches our interest. "A Bottle's Long Journey," Milwaukee Sentinel, September 23, 1890, relates an experience of "a young man prominent in social and business circles of Lynchburg, Virginia."

> *A few years ago -- to be accurate, on June 7, 1884 -- I visited Natural Bridge, and was particularly interested in what is known as the "Lost River," but a more suitable name for it would be the "Never Found River," for though one can hear the drops of its waters as they fall over some subterranean precipice, and even feel the ice-cold spray from them, if standing close to a small cavity in the earth, on one has ever caught a glimpse of the stream.*
>
> *As sort of an experiment and more from idleness than any real belief that I could accomplish anything, I wrote out on the leaf of my memorandum-book my full address and a statement of when and how I committed it to the underground river, together with a request that whosoever should find it would return it to me, stating when and where the finding took place. This I sealed up in a small pocket flack of thick glass, which I carried in my pocket and cropped into the hole where the spray from Lost River raises.*
>
> *I had nearly forgotten all about this affair, when one day last May, I received from the city of Lyons, France, the leaf I had enclosed in the flask and a note from one John Pennington, an English resident of that city, who said that while out sailing in the Gulf of Lyons, he had found my flask and contents on Feb. 21, 1890.*
>
> *Call around my office and I'll take great pleasure in showing you my document and his letter. But I say, wouldn't you like to take the trip to France that bottle did if, as it did, you could come out all right?*

As noted in Chapter 43, America has many "Lost Rivers," this one being the Lost River familiar to Washington and Jefferson, Chapter 40. Most Lost Rivers are of the lost-and-found variety, disappearing and then reappearing; this one simply tumbles from a cave mouth into the stream making Natural Bridge, Virginia a bridge. Its upstream pathway within the limestone isn't known.

The young man prominent in social and business circles most likely tossed his pocket flask into the rock jumble at the river's emergence, not into the inaccessible upper conduit. The bottle slipped through the rock pile, washed a few kilometers to the James River, then nearly 500 kilometers to the Atlantic and then across the sea to France. Documented histories of other transitory Atlantic glassware suggest that the five-year travel time is about right.

While the era of the story is rife with newsprint fabrications, this one seems plausible.

Madagascal Lake, Maine

This account involves a message in a matchbox, a waterproof one. The story's from Maine, however, the state where the salty local of Chapter 49 didn't see much sense in underground

rivers. "A Real Fish Story. What a Bay State Man Can Do When He Really Tries," Bangor Daily Whig & Courier, March 20, 1893, is likewise skeptical.

> *A remarkable discovery was made Thursday by a man in the employ of Joel F. Foster, a fish dealer, which, though in the nature of a fish story, bears some evidence of credibility. He was assorting a lot of fish when he came across a large pickerel which had an unusual protuberance... which proved to be caused by a match safe... a small tin receptacle about three inches in length and a half in width. It contained a communication closely written in lead pencil on two pages.*
>
> *The statement was the story of a hunter who had been lost in a cave* [and] *had found an underground river into which he had cast this matchbox, hoping by it that his death would become known.*

"I was crossing the Devil's Peak on November 5, 1892, a mountain on the east shore of Madagascal Lake. I followed a bear to his den in an unknown cave. After killing him I started to go out, but I could not find the way. I am lost, and as near as I can tell, I have been here about twenty days, and in that time I have lived on turtles.

There is an underground river which runs through this cave and must find its outlet in the lake. I shall seal this in my match box and throw it into the river. Should this ever be found, let then world know the horrible fate of Dave Vernon.

Madagascal Lake, however, is not in terrain known for subterranean streamflow. Cave turtles -- were there such a reptile -- would dwell near cave mouths, where the exit would be obvious. If the matchbox floated to daylight, a Bay State Yankee might ask, why didn't Mr. Vernon simply follow it?

All in all, indeed a fishy story.

Madagascal Lake

Northern California

The headline "Probably a Hoax," Sacramento Record-Union, September 7, 1896, indicates the paper's opinion.

> *A Letter Alleged to Have Been Found in the River.*
>
> *The Sheriff of Colusa County recently received from W.F. Hennessy, Captain of the Yolo Belle, the following letter found in a bottle by a river fisherman near Fremont. It was on a piece of old paper, badly worn, and written in pencil:*

July 13, 1806.

This is to certify that at this date five men are suffering the torture of hell. We are prisoners confined in a cave close to the Sacramento River, about three miles north of Colusa. We are brutally treated and at the present time have almost given up hope. We believe that the fiend who holds us is the murderer Dunham and he fears to liberate us as he knows that we have recognized him. If you would save us it must be done at once; we cannot live much longer.

WILLIAM CLARK.
FRANK WILSON,
JAMES O'NEIL.

In God's name, come at once.

What gives the thing the appearance of a. hoax is the fact that if the men were being so closely imprisoned they would not be able to mall their letter in the river.

As the Sacramento was once said to be part of the elusive Rio San Buenaventura (Chapter 94), this wouldn't be the first mysterious tale regarding the waterway. The captives could have tossed the bottle when the guard wasn't alert. The give-away is the "I'm being held captive" sham.

The hunt for the murderer Dunham seems to have been a Record-Union regular, as a matter of fact. "The Chase After Murdered Dunham" in its entirety from the edition of June 25.

A Strange Man Resembling the Fugitive Seen in Napa County. He Rode a Bicycle and Carried a Double Barreled Shotgun.

"Probably a Hoax" seems generous.

"Suicide Message Thought to be a Joke," San Francisco Call, September 18, 1910, alleges a suicide in the Truckee River.

Letter Found in Bottle in the Truckee River Discredited

According to dispatch from Reno, the following note, signed by "Francis Drake" of Oakland, was found in a bottle lodged among some driftwood on the south bank of the Truckee River.

To whom it may concern:
I have jumped into the Truckee River.
Good-by to my friends; my love to mother.

Nothing is known by the Oakland police of the Francis Drake. An Englishman going by that name recently registered with his wife at the Hotel Metropole, afterwards leaving for Switzerland, but the authorities do not associate him with the suicide note. The opinion is that someone attempted a gruesome joke.

Lake Tahoe has likewise been proposed as a possibility for the elusive Rio San Buenaventura. Letters of the "Goodbye cruel world" variety, however, tend to be another old-hat hoax.

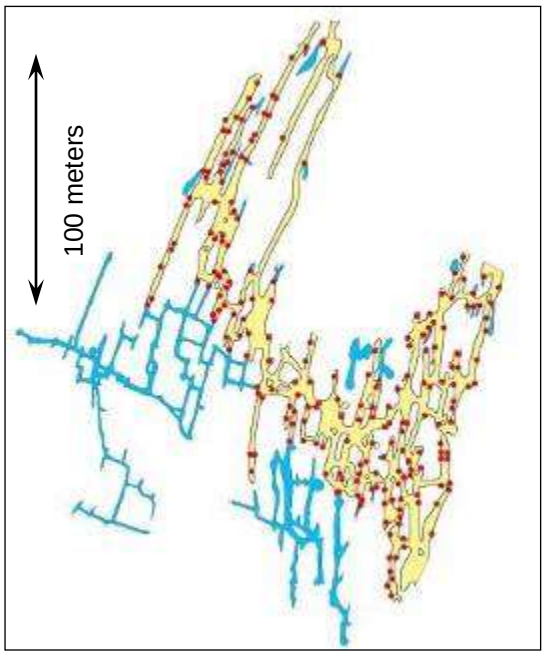
Priest's Cave, Ukraine

We've a true message-in-a-bottle story from the Ukraine, though this one about a bottled message to a cave, as apart from a bottled message from the cave. If there'd been no cave lake, however, there'd be no story.

Ozerna (Ukrainian for "lake"), a.k.a. Popowa Yama or Priest's Cave, is part of the extensive gypsum cave system in western Ukraine, with over 124 kilometers of passageways.

As might be inferred from the mapping, the formation provides a maze of hiding places

- Conduits at lowest level
- Points of connection
- Conduits at the upper level



A portion of Ozerna

In May 1943, 38 Jews fleeing Nazi capture retreated to a karst sinkhole where, after sliding down a 20-meter slope into knee-deep mud, they discovered a narrow opening into the underground. Exploring further, they discovered a cavern hall some 60 meters long and the width of a room.

Unrolling a ball of rope to avoid becoming lost, one kicked a stone that tumbled down a shaft and splashed. They'd found a refuge with a water source.

Ozerna's Lake Nemo.
A second cave pond was dubbed Black Lake.

With great effort, they made their hidden abode habitable. To conserve energy and food, the refugees slept up to 22 hours a day, side by side for warmth. The cave had enough airflow to disperse smoke from a cooking fire. The men emerged in search of food and fuel when the moon was on the wane. Some Ukrainians assisted the refugees, while others collaborated with the occupiers.

After 344 day -- the longest recorded instance of uninterrupted cave habitation -- the Jews found a bottle dropped to the cave entrance by a friendly farmer. Inside was a message,

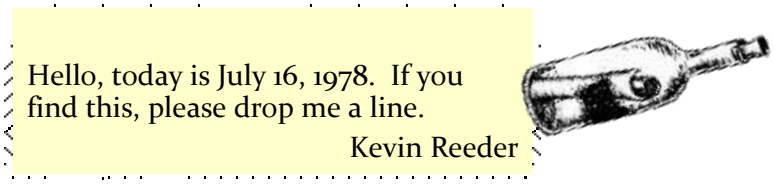
> The Germans have already gone.

The Jews returned to daylight and eventually immigrated to Canada.

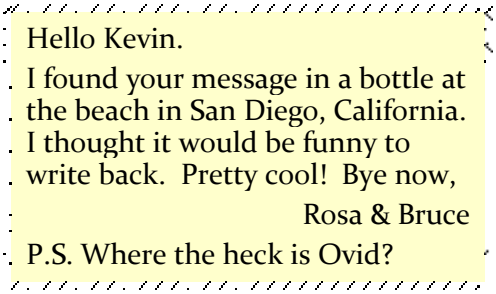
Finger Lakes, New York

From "Note in Bottle Uncorks a Mystery for Finger Lakes," Buffalo News, June 14, 1996,

> *At age 9, on a humdrum summer's day at his grandparents' cottage, Kevin Reeder thought it might be neat to have a pen pal. He put his wish in a bottle and tossed it into Cayuga Lake. His note, brittle and slightly faded, was mailed back recently from San Diego -- 18 years later. Reeder figures the bottle floated down the canals, picked up the ocean current and journeyed 25,000-plus miles around the world.*
>
> *She wrote the note.*



> *The note came back in a letter in February via his childhood home in Geneva, 38 miles southeast of Rochester.*



> *The bottle could have exited Cayuga Lake through a canal at its northern tip and floated either down the Erie Canal toward New York City or into Lake Ontario and the St. Lawrence Seaway to the Atlantic Ocean.*

As indicated in Chapter 85, the Finger Lakes have been asserted to link to an underground river system beneath the Great Lakes. Were that the case, the bottle may have taken a more-direct route.

Potomac River, Maryland

In Chapter 62, The Taste Test, we noted the item from the Frederick, Maryland Daily News, March 9, 1894, by virtue of the moonshine reference.

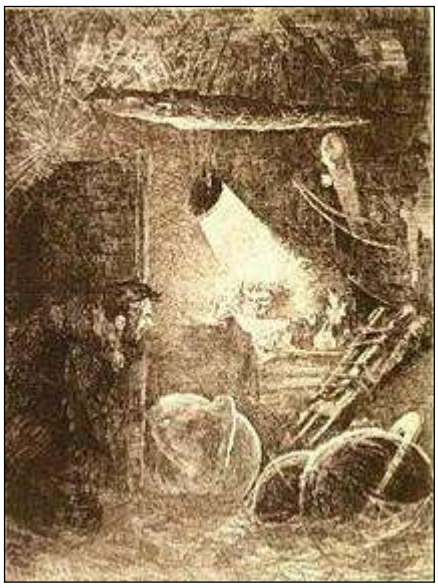
> *A message in a bottle was picked up the Potomac, near Cumberland, stating that the writer was penned up in the mountains by moonshiners.*

Here we'll flag it again, by virtue of how the message was transmitted.

Fiction

Not that we've avoided fabrications to this point, but here we'll shift to publications admittedly fictional.

The most-known message-in-a-bottle tale is **Edgar Alan Poe**'s (Chapter 17) MS. Found in a Bottle (1833), framed as a manuscript penned by a helpless seafarer gazing at approaching fate. What could be more to Poe's taste than a howling maelstrom?



The adieu is lengthy enough to constitute a short story, but small enough to fit into the neck of a bottle. A sampling,

> *But little time will be left me to ponder upon my destiny -- the circles rapidly grow small -- we are plunging madly within the grasp of the whirlpool -- and amid a roaring, and bellowing, and thundering of ocean and of tempest, the ship is quivering, oh God! and -- going down.*

We well know about poetic maelstroms, but if not, we've Chapter 16.

Boys Clubs (Chapters 20-23) have long been a lucrative target for mediocre fiction. Mystery of the Pacific (1899), by **Oliphant Smeaton**, is Boys Club tour de force. While the plot's not worth summarizing, we'll cut to the message in a bottle.

Our explorers find

> *A bottle, evidently a message from the sea, the contents of which were such as to cause them the utmost surprise. The bottle itself had apparently been a considerable time in the water, as the glass was encrusted with minute shell-fish and withered sea-weed.*
>
> *Inside they discovered a paper on which was inscribed in faded, rusty-red characters, the following words, a considerable portion of them being quite undecipherable through damp.*

Guesses regarding indecipherable portions are italicized.

Lat. 27° 13' S., L*ong*. 111° 17' W., Is*le of* Spirits, Tuesday, 12th Fe*bru*ary 18 *year impossible to decipher*. The fourth year *of our* residence *in this* dreary island *far from* home *and* kindred. *For the* love *of* God *and of his Son Jesus* Christ, come *to the* help *of* five castaway Englishm*en*. *If* gold *together with* treasures *and* precious *stones can* tempt *any one to come* here *there is* abundance to make *any one* wealthy *beyond the* dreams of *avarice*. Men *we entreat you,* come *to our help, make* no delay. *S*end *w*ord *to* Mary Web*s*ter Comm*e*rcial Roa*d*, Lei*th*, whoever fi*nds* this, and *G*od will re*w*ard y*ou*.

John Webster, la*te* mas*te*r, *wr*eck*e*d *b*rig Emily Hope

Gibs*o*n, ma*te*

After the explorers find this mysterious island, there's the formulaic underground river.

> *The Consul thereupon began to explain the nature of the "Cave of Gems," which, it turned out, was only the entrance to a perfect network of caverns which ran throughout the entire length of the mighty range of mountains behind the town.*

Entering the aforementioned cave,

Deeper and deeper we pierced into the heart of the mountain gorge, the scene at every step becoming more awe-inspiring and terrific. The defile also began to narrow rapidly, until we saw it ended at the mouth of a huge cavern which yawned in front of us. Never in my life had I beheld a spot that seemed to realize more vividly the awful descriptions in Dante's Inferno.

As soon as we reached the entrance the driver pulled up and we descended from the vehicle, Quintus being told to wait beside an ancient spring just outside the cavern, the inscription on the masonry round which gave evidence of great age.

The vast cliffs towering around on all sides, the aspect of utter desolation stamped on every detail of the scenery, the dreary forest of pines, through which a melancholy wind moaned sadly like the wail of a lost spirit, and the yawning blackness of the great cavern, all impressed me so vividly that I involuntarily shuddered.

"And where do you think the passage leading to the entrance of the Ariutas is likely to lie?

"My idea is," said Marcus, "that it lies away to the west of the molten lake, and that it is in some way connected with the River of Death."

"What is that?"

"It is a mysterious underground river, dark and deep, which seems to flow underneath the entire range of mountains. I believe it enters the ranges away to the west, in the heart of a mountainous, impenetrable tract of country covered with dense forests. But for miles and miles this river flows underground. It must go somewhere."

The River of Death!

At last, on turning a huge projecting cliff, we saw before us -- dark, sullen, and silent -- the almost motionless waters of the River of Death. What a dreary spectacle it presented, yet how glad we were to see it! The track for a time seemed to run alongside the bank of the river, but stopped on reaching what appeared to be a primitive landing-place, -- for an old stone quay stood there, evidently long disused. The width of the river at this place might be from twenty to thirty yards, but its depth was well-nigh fathomless.

The river seemed to flow through subterranean valleys and plains, through narrow gorges and beneath the frowning face of sheer impending cliffs. A dull semi-twilight prevailed, amidst which we could discern objects at a great distance both before and behind us. Gems of a value almost incalculable sparkled here and there, and by their sheen, even in the dull light, lent their quota to the illumination of the gloom.

The water was black as ink, and as oily smooth as the wells of Baku; while a dead silence brooded over all, like the quiet of a desert solitude.

Onward we passed. At last a hasty exclamation from one of our companions induced us to raise our eyes. Immediately ahead of us, with its towers and pillars, its columns and obelisks, imperfectly discernible in the dim light of the cavern, was a subterranean city, evidently of vast extent. We were as yet a considerable distance from it, but every yard we travelled made the wonder seem more mysterious.

And awaiting our adventurers,

The banks of the River of Death were crowded with these strange, white-robed figures, ghost- like in the gloom, which flitted hither and thither, uttering peculiar cries, and beckoning us to draw in nearer to the shore. The towering and massive battlements of the great subterranean city, the domes and minarets and obelisks rising on all sides of us, the stupendous architecture, and the evidences of splendor present on every side, all seemed to imply that we were on the threshold of some remarkable discovery, perhaps the remains of a dead or a dying civilization.

Saluting the Underground City

One might suppose that the message-in-a-bottle-in-an-underground-river genre could get no worse, but that hope is dispelled by **Thomas Jefferson Jerome**'s Ku-Klux Klan No. 40, A Novel (1895). Again we'll not bother with the plot, but begin where a group of hunters seek shelter in a cave.

"What is that?" said Albert Seaton as, in attempting to follow Sam, he stepped on something, which rolled from under his feet and threw him to the ground. "I stepped on something which I am sure was not a stone."

"Here it is," said John, who was immediately behind Albert, "and it is a bottle. What a queer place for a bottle. And there is something in it, too," he said, as he picked it up and held it in a little streak of light that penetrated through a crevice between two large rocks near the mouth of the cave. "I believe it is a paper though," he jocularly remarked, "instead of whisky."

Albert Seaton took the bottle and broke it over a stone, and began to read form the paper. With the first sentence he faltered and failed, and dropping the paper on the ground, he buried his face in his hands in a paroxysm of excitement and grief.

My Dear Wife: I have been shot by the Yankees, and I am bleeding to death in this cave, in which I have taken refuge from their brutal attacks.

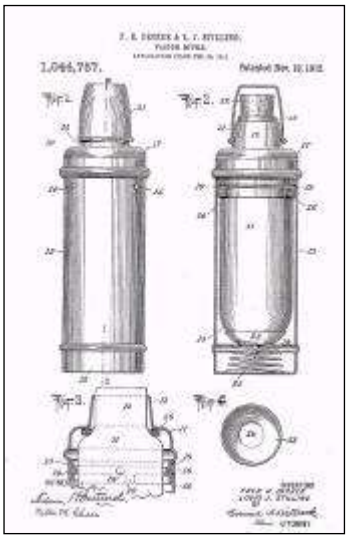
I have with me a note signed by the board of county commissioners of West County, and I deposit it with this letter in a bottle which I happen to have in my pocket, having carried a sick laborer a drunk of brandy in it today. The note is for six thousand dollars, and was given for the salt furnished the poor people of the county by me during the war and the request of the county authorities. I want you to collect it as soon as our country becomes able to pay it, and use the money in defraying the expense of education of our two dear children. Alas, I shall never see the dear children nor you again, and it may be that you will never even hear how I die, but I trust to a kind Providence to the direct the step of some kind person to this cave. I am dying, I know, and my strength is gone, and I lay down my pencil with a prayer for all. God bless you all.

Your loving husband, Albert Seaton, Sr.

It's fortuitous that Albert Sr. bore a bottle destined for a sick laborer. Being morally noble, he couldn't have been toting moonshine, a libation mentioned earlier in this chapter.

Submarines

Were maritime fiction to be believed, messages cast from sinking sailing ships would clog the seas. Bottles floated from stranded submarines of the fictional variety, however, are less common. While, as discussed in Chapter 76, a submarine river isn't quite a subterranean river, we'll relax our criteria sufficiently to cite a pair of sailor's farewells floated from submarine valleys.



A thermos of the period

We included **Edgar Rice Burroughs**' The Land That Time Forgot (1918) in Chapter 21 for its subterranean waterway, but we didn't explain why the writer was writing from the Antarctic. He was an unfortunate American who, through a protracted set of turnabouts on a captured German submarine, found himself castaway on an island reported by the fictitious Italian explorer Caproni in 1721, but never verified until his arrival. The book is the castaway's journal, sealed in a thermos bottle and thrown as last resort into the sea. The flask was discovered in Greenland.

A bit of the manuscript,

> My clothes are worn to shreds. No other living creature ventures to the chill summit of the barrier cliffs. I am safe, and I am alone with my sorrows and my remembered joys -- but without hope. It is said that hope springs eternal in the human breast; but there is none in mine.
>
> Presently I shall fold these pages and push them into my thermos bottle. I shall cork it and screw the cap tight, and then I shall hurl it as far out into the sea as my strength will permit. The wind is off-shore; the tide is running out; perhaps it will be carried into one of those numerous ocean-currents which sweep perpetually from pole to pole and from continent to continent, to be deposited at last upon some inhabited shore. If fate is kind and this does happen, then, for God's sake, come and get me!

That the bottle was found in Greenland speaks to the Arctic-Antarctic maelstrom sub-oceanic pipeline. Caproni's island has yet to be again encountered.

H.P. Lovecraft's The Temple (1925) is a bottled manuscript washed ashore on the coast of the Yucatan. As it's a Lovecraft tale (Chapter 22), it's highly Poesque, but we'll not chronicle the mounting madness.

Lovecraft begins,

> On August 20, 1917, I, Karl Heinrich Graf von Altberg-Ehrenstein, Lieutenant-Commander in the Imperial German Navy and in charge of the submarine U-29, deposit this bottle and record in the Atlantic Ocean at a point to me unknown but probably about N. Latitude 20 degrees, W. Longitude 35 degrees, where my ship lies disabled on the ocean floor.

The officer relates the events leading to the sinking of his U-boat by a mysterious explosion, leaving him stranded in an air-depleting vessel perched upon the ruins of ancient Atlantis.

> The general plan was of a large city at the bottom of a narrow valley, with numerous isolated temples and villas on the steep slopes above. Roofs were fallen and columns were broken, but there still remained an air of immemorially ancient splendor which nothing could efface.
>
> At the bottom of that valley a river once had flowed; for as I examined the scene more closely I beheld the remains of stone and marble bridges and sea-walls, and terraces and embankments once verdant and beautiful.
>
> On one side I could view the entire city as it sloped from the plaza down to the old river-bank; on the other side, in startling proximity, I was confronted by the richly ornate and perfectly preserved facade of a great building, evidently a temple, hollowed from the solid rock.

While there is no shortage of popular literature about the lost continent of Atlantis -- we've references to a half-dozen of such in other chapters -- little is known of Atlantilian hydrology. We are thus indebted to Lt.-Commander Karl Heinrich Graf von Altberg-Ehrenstein for his fieldwork.

Cartoons

Cartoon characters can stumble into adventure (Chapter 25) by acting upon a message in a bottle. In the August 25, 1997 Detective Conan, the Detective Boys are at the beach and find such a note.

> SOS by Shinobu

The boys find Shinobu in a tidal cave, but not before the rising water blocks their exit! But why bother with words when we have the TV?



Edification

We cited Uncle Sam's Secrets: A Story of National Affairs for the Youth of the Nation (1918) in Chapter 22, but Jimmy's still asking questions.

> *"Couldn't we write a letter and send it down the stream in a bottle, so that the people who find it would come and help us out?" said Jimmy. "I have heard of such things happening."*
>
> *The professor smiled. Even in the presence of the immediate danger the smile somehow reassured the others.*
>
> *"We could send the bottle," he said, "but I don't think we could depend on its bringing a party of rescuers. It might be days or weeks before the bottle would attract anybody's attention, and meantime we should starve, for we have not even a day's provisions with us. Even our light would last but a few hours, and in darkness and hunger we should surely perish."*

Jimmy, of course, has additional questions, but we can't dally.

We'll add a personal reflection on one additional bottled message in the Postscript.

CHAPTER 96
THE PARANORMAL

Paranormal: Phenomena outside the range of normal experience.

Phenomena inconsistent with the world as conventionally understood through empirical observation and scientific methodology.

To the degree that observation of underground rivers is consistent with a well-established Newtonian framework, they are not paranormal.

Should such waterways, however, manifest characteristics -- energy fields, in our particular case -- inconsistent with what we consider to be normal science, the subject becomes that of the paranormal.

The conceptualization of underground waters before the Scientific Revolution -- and sometimes well past it -- included divine will, alchemism and odd geophysics, but such ideas weren't in opposition to the prevailing world view. It is not content, per se, that makes a particular belief paranormal, but rather it is the adherence to the belief in the face of convention that makes it so.

Chapter 49, Finding the Underground Rivers, drew upon perceptual senses outside of the tent of standard science to describe groundwater dowsing. We might thus have postponed that topic until the present chapter, but we thought it better to include it in a chapter related to objective.

In Chapter 97, we'll touch on alleged extraterrestrial beings beneath the American West, beings with abilities perhaps scientific to them, but paranormal to us.

In this chapter we'll look at the paranormal in three other settings.

We'll briefly touch upon a few underground river stories of the paranormal that most everyone would agree are just tall tales.

We'll spend a bit on time in London where reports of the supernatural have been grouped by location, and yes, proximity to underground rivers does appear to be a factor.

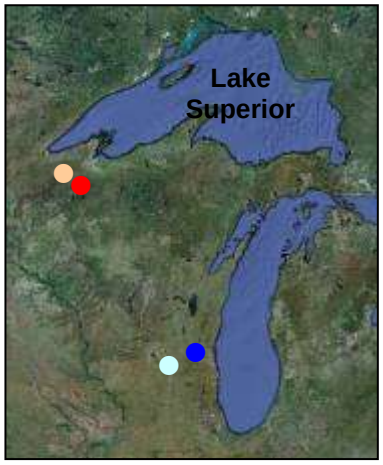
And lastly we'll look at alleged paranormal energies of subterranean waters and its pseudoscientific justification.

Wisconsin, though it could be most anywhere

Anecdotal tales abound regarding underground rivers and the paranormal. They're just stories because they pretend to be nothing else.

To exemplify, we'll summarize three from Wisconsin.

- Bottomless Lakes
- Lake Geneva
- Red Cedar Lake
- Lake Ripley



1. The "Bottomless Lakes" near Honey Creek are said to be to be similar to Lake Superior, having these aspects in common.

   Lacustrine monsters
   Unique fish
   Big Foot sightings
   Strange lights
   Aboriginal mounds

   We've a meld of campfire-yarns and fanciful interpretations of local attributes. We recognize the fish claim as the subterranean river hypothesis in Chapter 85, Beneath the Great Lakes. Ancient mounds predictably point to lost civilizations (Chapter 97) which, given the region's other inexplicabilities, perhaps yet ominously dwell below us. It's underground river territory in more than a geographic sense.

2. A young man dumped his car into Lake Geneva while trying to evade police. The car and could not be recovered. The boy's parents contacted the crew of Jacques Cousteau who brought a small submarine with which they discovered an underground river flowing from the lake. They were almost sucked in. This river comes from Greenland, under Lake Superior to Wisconsin, then west to Nevada, out under the Pacific to Malaysia, up under Europe and back to Greenland. How many such lakes are in the area is unknown, but there are at least three.

   We've the enticing detail of "while trying to evade police," the unreferenced authority of Jacques Cousteau and the mysterious global underground river that paranormally circles back to its source. People may believe portions of the account, but packaged together, it becomes just another spooky tale.

3. In 1890, a farmer claimed to have seen a 12-meter serpent carrying one of his hogs into Red Cedar Lake. In 1891, a fisherman tying up his boat saw an undulating serpent, its body like that of a snake. The head he could not see. Farmers and other fishermen claimed to have also observed the creature; one stated that it had a large head with "protuberances like saw teeth" on its 15-meter back. The serpent was blamed in 1892 for partially devouring five sheep belonging to William Ward. Fears were so severe that residents of nearby Lake Ripley, joined to Red Cedar Lake by an underground stream, closed their summer cottages and returned to the city.

   Such a monster is paranormal by simple definition; 12-meter livestock-eating serpents are not normal. As noted in Chapter 87, To Lie Like a Mulhatton, 19th century journalists enjoyed a good hoax.

   The allusion to the underground stream, however, doesn't, per se, read as part of the fabrication. Them Lake Ripley city-folk -- har, har, har! -- bit on the serpent story. Everybody knows that Willie Ward enjoys his bottle, right? But, you know, if there is such a creature down there, it might have a way to get places.

London Hauntings

In looking for ghosts, it's to our advantage that others have already done so, and unlike most writings regarding to the supernatural, some of their efforts can be reviewed.

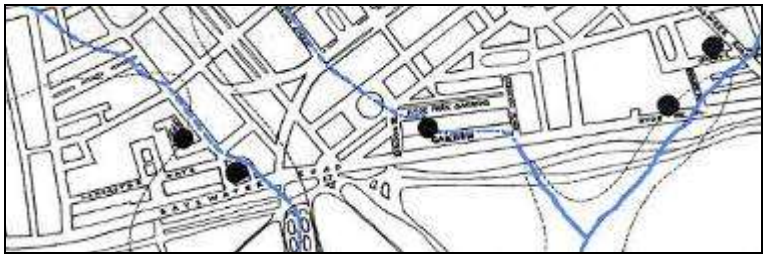
According to G.W. Lambert in "The Geography of London Ghosts," Journal of the Society for Psychical Research 40:7, December 1960, approximately three quarters of the city's paranormal activity takes place near buried waters.

But does the 75 percent signify a primary relationship? We'll quote a few portions of the work.

> *The Society's records of cases of haunting and poltergeists number several hundreds. For London alone, they amount to just over one hundred... To deal in detail with the whole of that area would draw out this study to tedious length, and tire the reader. I will therefore take first a sample district, furnishing enough cases to suggest a working hypothesis, and then apply that hypothesis to two other districts, to see if it works there also.*

The study identifies the underground river courses and ten haunted dwellings in postal district W.1. Locations are to the right

The study then sites three underground river courses and eight haunted houses in postal district W.2



> *To sum up, five (i.e. over 50%) of the cases in W.2 fall in a narrow rectangle bounded on the south by one mile of the Bayswater Road, from Marble Arch to the middle of Lancaster Gate, and about 220 yards wide from south to north. This is rather less than one eighth of the area of W.2. That grouping can hardly be a chance effect.*

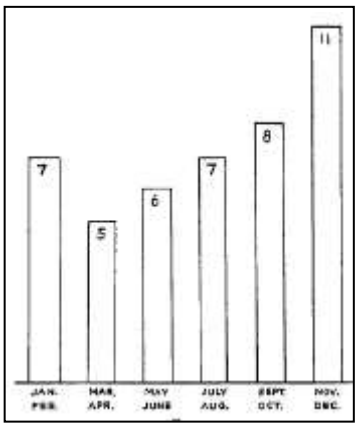
The study then describes the underground rivers courses and locations of 100 haunted houses in postal district S.W.2

> *Of the total of 100 cases, 85 are north of the Thames and 15 south of it. Of the latter group as many as six are in Battersea, the remainder being very scattered. The Battersea cases seem to follow the course of an old creek, now in a brick culvert underground, reaching from near Nine Elms, round by the foot of Lavender Hill, to near the outfall of the Falcon Brook.*

While we might suggest a better statistical design, we'll grant the correlation; where there are buried rivers, there's a disproportionate number poltergeists.

The study then considers the incidence of rainfall.

It is noticeable that some seasons of the year are more prolific of cases than others. In order to illustrate this, I have taken 44 cases from the whole collection, which can be sorted by month as well as year, and have shown their incidence by two-monthly periods in the following diagram.



The preference for the autumn and winter months (September to February, inclusive) is obvious. There is also a summer peak in July-August, the season of thunderstorms. It can, of course, be argued that in the winter people are longer indoors and have more opportunities to observe unaccountable incidents, but that would not explain the summer peak in July-August, months during which people generally are more out of doors than at any other time ' of year.

The two kinds of evidence advanced above relate to the distant ends of the chains of events which, on the working hypothesis, lead to the events to be explained. In each case the chains go underground, in the literal sense of that expression.

The circumstantial evidence in more than one case suggests that underground rivers in flood sometimes discharge water under pressure into old disused house drains, the branches of which to each house were sealed off (inside the perimeter) when a new system was introduced.

It is not too much to claim that the time has now come to look for further detailed observations in the most likely quarter, namely underground, and no longer to jump to the conclusion that all is lying, trickery or "psychic" agency.

In a nutshell: Ghostly apparitions do indeed appear to concentrate in the vicinity of buried rivers, Lambert goes a step further by introducing seasonality as an independent variable. Hauntings seem to happen when it's raining and flooded storm sewers would be prone to disturb the foundations of buildings above.

Thus what the London tourism industry advertises as haunted houses might likewise be described as urban buildings on wet foundations.

Not all paranormal allegations, however, can be as objectively evaluated.

Earth Energies

Throughout our subterranean river journey, we've endeavored to quote directly from sources. If we've clipped some excerpts too severely, at least we've provided a reference.

Dealing with the paranormal, however, studies such as Lambert's are excruciatingly rare. Publications are many, but tend to be of the supermarket-checkout-stand variety and cut-and-pasted web pages. References to original sources are nil, and sadly to say, the few claims sporting an authoritative ring too often turn out to be unverifiable.

The remainder of chapter thus has a bibliographic problem. We'll dutifully pass along what's said, but rarely can we trace the genesis of the claim with any degree of confidence.

An example, a claim asserted in nearly-word-for-word manner without elaboration on numerous web postings:

> *This type of energy line* [one that emanates from a subterranean stream] *is easily detected by a skilled dowser. It can also be detected by a German analytical instrument developed by Dr. Ernst Hartmann and Dr. Dieter Ashcroft in Essen. This equipment known as the Genitron Felix-3 detects ultra-short and radio microwave frequencies with the ability to print them out on a UKW- Spektrometer und Linienschreiber. This equipment is used in German universities and research institutes*

As a machine such as the Felix-3 would seem applicable to a variety of underground river studies, we've done a bit of internet shopping.

Genitron, now part of the Saphymo Group, is indeed a European corporation that produces high-tech detection equipment, but the firm markets no Felix-3 or similarly-named or purposed apparatus.

The only Felix-3s (alternative spellings checked as well) returned by internet search are those of the same story.

No university or institute, German or otherwise, indicates a device by that name in their laboratory capacities.

Ernst Hartmann (1915-1992), the co-inventor, was a medical doctor and dowser who made known in Krankheit als Standortproblem (Illness as a Location Problem, 1960) that illness depends on one's location on the earth's "Global-Net Grid," now known as the "Hartmann Grid." There's no mention in his biographies of an engineering invention, but if, in fact, he carried around an impressive black box with wires and lights, there's every reason to challenge its impartiality.

Dieter Ashcroft, inferentially also a notable inventor, is absent from German scientific records.

Absence of internet corroboration does not prove the Felix-3 to be fictional, of course, but the device's absence challenges the credibility of the rest of the citation.

Genitron markets many instruments, but no Felix-3.

But then again -- the bane of this type of fact check -- nefarious government and multinational corporations may have colluded to confiscate all Felix-3s.

Which is to say that, alas, that we can do little more than pass along what has been repeated by those who've seen the Felix-3 mentioned. The rest of this chapter suffers the same problem.

Ireland

A stream which burrows for about a kilometer in the Parttry Mountains of Ireland is the subject of "Notes on Irish Folklore, A Magic Cave," Folklore -- A Quarterly Review (28) 1917 by W.F. de Vismes Kane

> *In heavy rains the entrance to the caves in the cliff becomes a raging whirlpool, which rises 15 or 20 feet up the face of the cliff, the subterranean passage being unable to give vent to the flood. But in ordinary weather one can penetrate some distance into the caverns which receive the stream.*

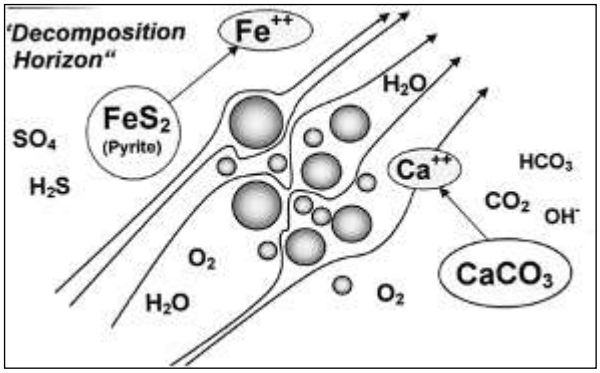
I visited it, desiring to explore the cavern as far as it seemed safe, and took a guide from the nearest part of the main road. When we approached the hollow my guide refused to come further, and tried to dissuade me. He sat down on a height afar off, and would not even go near the entrance. I offered him half a crown, then five shillings, but he said that not for a pound note would he go near the foot of the cliff, and showed such terror that I induced him to give me his reason. He then explained that though persons had penetrated more than once by one of the side openings, he knew a man who having got in suddenly saw the vault lit up by the lights of some large building illuminated with numerous windows, and what he saw and heard was too dreadful to be described, and then he crossed himself and made for his home, leaving me alone on the slope of the hill.

The Pseudoscience

We established in Chapter 8, Subterranean Engines, that water has electromagnetic properties, but not enough for geomagnetic force to propel it to mountain springs. But here we ask another question. Does subterranean water have "subtle energies" that might influence those of us who live above it, energies too subtle to be recognized by scientists paid by the government?

A subtle field is said to be a vortex composed of two spiraling bands, one positive and the other negative, the former carrying the charge and the latter being neutral. (We must quit trying to make sense of this in terms of electrons and such. This is newer.)

Water flowing through anisotropic ground takes up solutes such (e.g. calcium carbonate and pyrite) and metallic ions which induce dynamic broadband resonance. Being a dialectic medium, water favors the formation of potential vortices which contract swiftly after formation. Rotating the dipolar water molecule changes the field composition and the hydronamic flow vortex is produces an electromagnetic vortex and eddy current.



We're at a loss regarding of the meaning of "hydronamic," but does it matter?

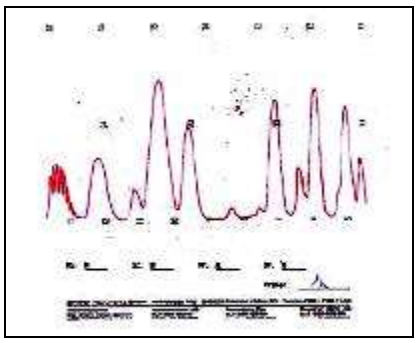
Subterranean water flow generates the following, depending on speed and solutes:

A positive vertical direct-current electromagnetic field
Radio frequencies ranging from 87 to 101 MHz
Microwaves in the 6-centimeter band at the edges of the stream

Additional power is gained where decrystallization occurs. Where streams cross, one above the other, the field becomes more complex.

Below is evidence of the microwaves.

Photographic print of microwaves radiating in the space above an underground watercourse taken in total darkness.



Frequency of the energy emanating from an underground stream recorded by Genitron Felix-F3 frequency analyzer, an apparatus discussed earlier.

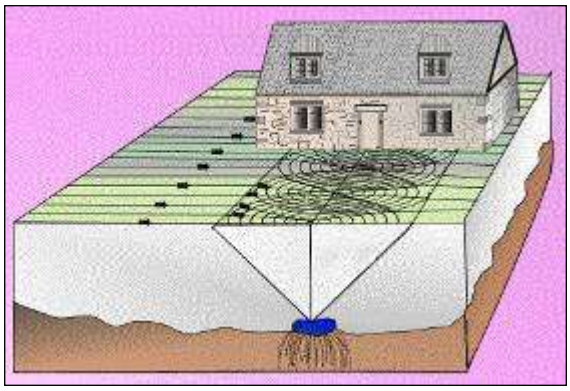
We're unsure of what's being shown, but it indeed looks scientific.

Geophysical Manifestations

"Black streams," underground water veins that emit radiation, are evidenced as earth meridians whose flow has become stagnant or polluted, emanating "Sha Qi" to the surface above. The black stream may be from 0.3 to 1000 meters deep and 0.3 to 100 meters wide. When dowsed, the edges and the centerline are the sharpest. Where the underground channel rises, the edge lines are the more active; on the descent, it's the centerline.

Black streams may have tributaries, convergences, and dowsable echoes parallel to the main stream. They may change course, especially after earthquakes and droughts. They are known to be stronger at midday, mid-summer, full moon, and during periods of sunspot activity. They are also known to be associated with higher levels of ionizing radiation and lightning strikes.

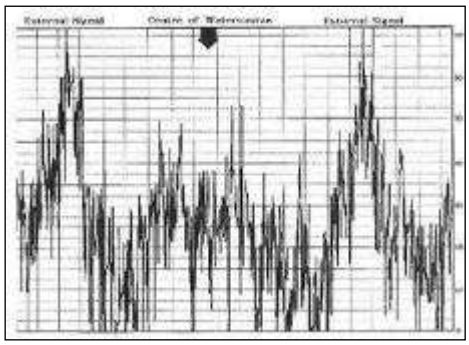
The figure shows how earth energies radiate at 45^{o} from an underground stream, forming vortices on the surface.



As David R. Cowan's internet posting, "Divining and Dowsing, How to use Divining Rods to Find Earth Energies," explains,

> *Concentrate on finding an underground stream and you should find the central wave first, directly above the flowing water. Place a marker over this. The rods will also tell you the direction of flow. Then walk on at a right angle to the stream until the rods react again at one of the outer parallels. Here place another marker. The distance between the markers is the same as the depth of the underground water.*
>
> *This is a simplification of the procedure, since there are said to be other wavebands inside and outside of the parallels, also produced by the running water. It is by finding these that experienced water diviners can judge how much water there might be in an underground course.*

To the right is the earth energy field at the "External Signal," the "Center of Watercourse" and again at the opposite "External Signal." If there is sufficient energy to drive the pens, however, we question if such energy could be classified as "subtle."



But such earth energies are not solely the product of watercourses.

The "Hartmann Grid" consists of naturally-occurring charged lines running North-South every 2 meters and East-West every 2.5 meters. Alternate lines are positively and negatively charged, so where the lines intersect it is possible to have double positive charges and double negative charges. A subterranean stream intersection with a Hartmann grid can cause a severe "Hartman knot."

The Mystery of the White Lions: Children of the Sun God, (2010) is author Linda Tucker's account of her journey into the guarded knowledge and ceremonies of Old Africa. According to the spirit guide Amarava, the last of the first people, water is not native to earth. Rather, the Milky Way is the "spinal fluid" of the universe. "A lot of water is carried between the stars, and is distributed across space this way."

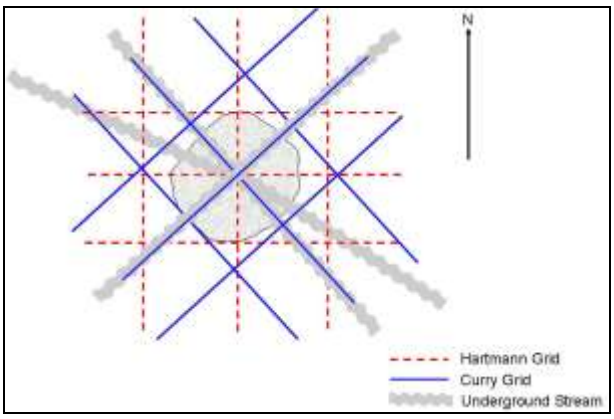
In the chapter entitled, "Underground River of Gold" we're told of the Lulungwa Mangakatsi, "river of the stars" and "the river that never runs dry," a parallel between the Egyptian "duat" linking "river in the sky" and "subterranean river." The Lulungwa Mangakatsi holds Africa together by the power of Ley Lines. "The next time you find a flowing river in the veld (bush), go at night, with leather soles to that river. The nearer you get to the river, the more you will feel this thing, this vibration."

Freshwater rivers are living things containing memory which shaman can read. Where such rives intersect with underground rivers, great pipes of invisible power result.

Is there a "power line" underground river of energy linking the Timbavati with Giza? According to Amarava, yes.

There is also the "Curry Grid," but we've already ventured too far on this tangent.

According to Earth Energy, The Impact of Earth Energies on Life, An Overview of the Origin of Earth Energies, The Hartmann & Curry Grids, undated, by Jiro Olcott, the Menhir de Champ-Dolent -- more than 10 meters high, one of the largest standing menhirs in Brittany -- is precisely at the intersection of Hartmann and Curry Grids as well as no less than three underground streams.



Le Menhir de Champ-Dolent showing crossing points of earth energy currents and underwater streams

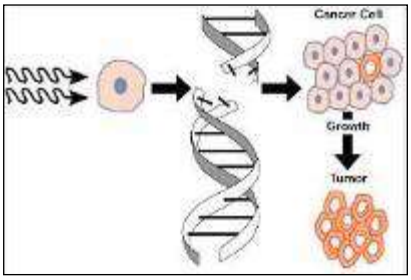
Having unconvincingly explained how hydro-electrochemistry excites geo-energies, we now move to biology. If there's one thing to be learned from the literature of the paranormal, it's to look for linkages.

Human Health Effects

We turn to WhiteMagicWay.com.

> *The geobiology elements are earth meridians, underground water veins or lakes and underground geological cracks or cavities and earth-sky chimneys. These elements emit frequencies above the earth surface that influence living organisms.*
>
> *The human being is an antenna between earth and sky. Its feet are connected to the negative pole, the earth; its head is connected to the positive pole, the sky. Permanently submitted to energy exchange between these two poles, the earth sky flow nourishes its body energetically, for its survival.*
>
> *When two bodies have similar wave length and frequencies, they have instant communication through resonance no matter what the distance is between them.*

Earth is a living being with elements similar to our body; it has 70% of water, it has chakras, meridians, veins and articulations and subtle bodies. That is why our body communicates with earth through resonance.



The living-earth analogy of course goes back to Aristotle.

The carcinogens consequence of underground stream energy is illustrated to the right.

Reported effects of sleeping on the outside edge of an underground watercourse include

Hypersensitivity to light
Insomnia
Fatigue and loss of vitality
Premature aging
Degenerative diseases and rheumatism
Depression headaches
Short term memory loss
Loss of balance
Panic attacks
Optimistic abnormal cell growth leading to cancer

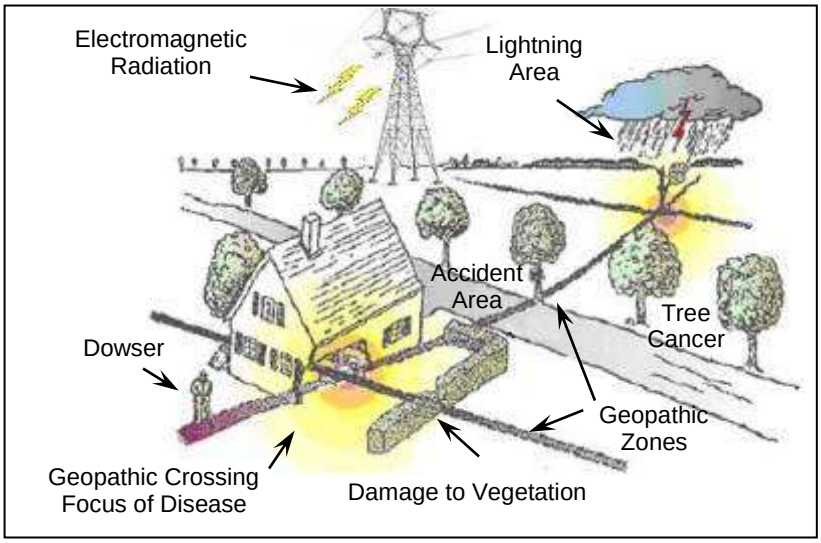
The edge lines are found to be more associated with physical diseases, while the center lines have more correspondence to mental and psycho-spiritual disturbances.

There may also be enhanced production of microbes encouraging mold and rot.

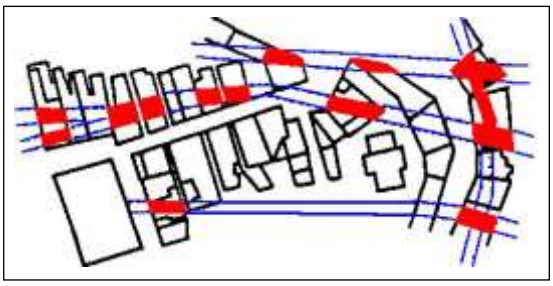
According to Effects of Harmful Radiation and Noxious Rays (1974) by the American Society of Dowsers,

In addition to disease in humans, animals and plants, it has been observed that auto accidents repeatedly occur at points where veins of underground veins run under roads and highways.

The sketch is said to be of a German location.



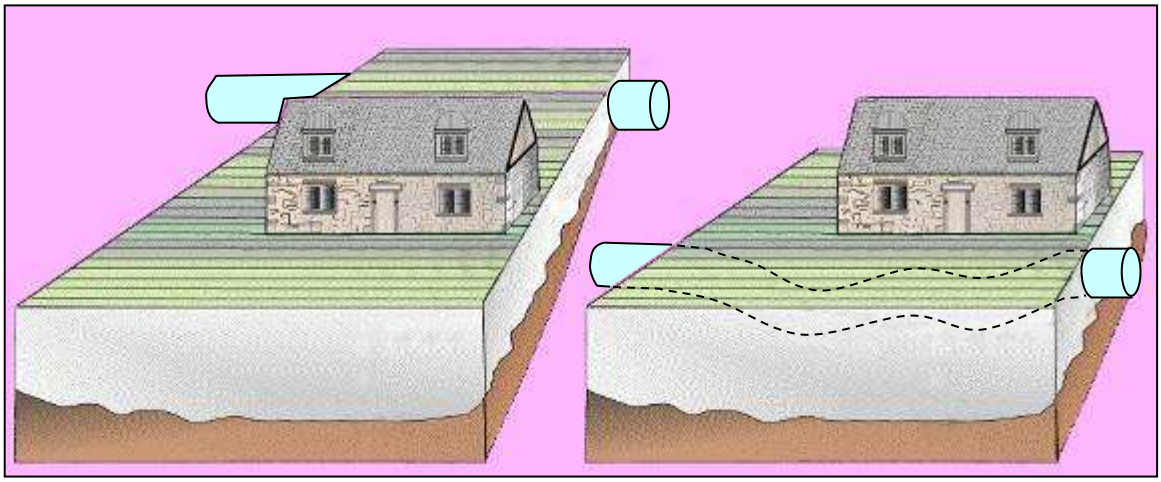
The map to the right is said to be of a German town. Blue lines indicate underground water. Buildings marked red experienced at least one case of cancer in a period of 20 years, according to a German doctor.



Those who seek correlation between underground rivers and deleterious health effects will indeed find one significant relationship: the reports tend to come from Germany.

Feng Shui rules regarding subterranean waters:

Avoid a building site with subterranean streamflow behind the house.
Avoid a building site situated near a straight subterranean watercourse.



Bad Good

Which isn't to imply that all underground river health effects are detrimental. According to Alen MacWeeney and Caro Ness, whose A Space for Silence (2008) promotes sacred spaces for relaxation, meditation and reflection,

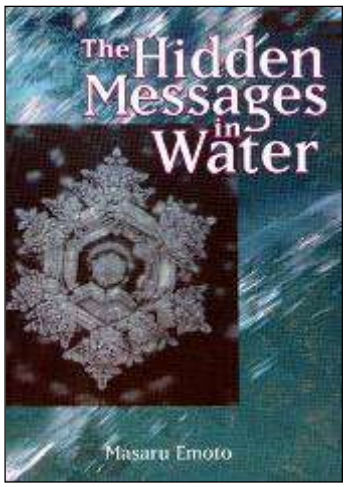
Water lines: Underground streams undulating beneath the earth surface and creating a vertical electromagnetic field several feet wide which is yin in energy and thought to be enervating.

Older evidence from "A Folklore Survey of County Clare," Folklore 23:1, March 1912, by Thomas Westropp,

I have heard at Newhall of a cave "between Ennis and Lisdoonvarna" in which runs an underground river that makes old people young. The exact locality is unknown, as the people who have gone to use it and never been seen again.

Red line: Ennis to Lisdoonvarna

We've consider paranormal radiations derived from the geosystem, but who's to say we ourselves don't energize what's beneath our feet?



Masuro Emoto's Hidden Messages of Water (2005) argues that human consciousness has an effect on the molecular structure of water, causing it to carry emotions and thoughts.

When we have deep, emotive thoughts -- and its human nature that we do -- we thus may be energizing subterranean streamflow?

CHAPTER 97

EXTRATERRESTRIALS AND LOST RACES OF THE AMERICAN WEST

Chapters 17-26 brought us a menagerie of imagined subterranean monsters, the remnants of Atlantilian civilizations and evidence of extraterrestrials. Admiral Byrd's diary (Chapter 15, Hollow Earth Geophysics) was engaging, but fictional.

This chapter isn't about fiction, at least literature marketed as such. We will draw together reports of aliens and vanished civilizations encountered along subterranean waters in the western United States. As the literature of alien visitations and subterranean races tends to intermingle, so will our chapter. Alien visitation from outer space and alien inhabitation beneath our feet have similar likelihood.

As we've done before, we'll begin with a map. Being part of this story, locations from Chapter 94, The Rio San Buenaventura, are indicated by squares.

We'll start at the top.

Rocky Mountains

A great underground river in the American West made the news as far away as New Zealand, as evidenced by "The Writing in the Geode," by C.H. Shinn, Argonaut, February 10, 1890.

Heart of the Rockies, about September 17, 1886.

The entrance to this sub-montane river is in the Assinniboine Mountains, north of the United States line. I was a prospector there for several years, and I heard stories among the older Indiana that a river greater than the Columbia had once flowed where the Rocky Mountains now are; that the Great Spirit had piled the mountains over it and buried it deep underground. At last a medicine man, whose life I had once saved, told me that he knew how to get to the river, and he took me into a cave in a deep gorge. Here we lived for a week, exploring by means of pine torches, and at last found a passage which ran steadily downward. This, the Indian told me, was the path by which his ancestors, who once lived in the middle of the earth, had found their way to the light of day.

I think we were about three thousand feet below the entrance of the cave, when we began to hear the sound of roaring waters. The sound increased, until we stood by an underground river, of whose width and depth we could form no idea. The light of our torches did not even reveal the height of the roof overhead. My guide told me that this was the mother of all the rivers of the world. No other person except himself knew of its existence. It flowed from the end of the north to the extreme south. It grew ever warmer and warmer. There was a time when people lived along its channel, and there were houses and cities of the dead there, and many strange things. It was full of fish without eyes, and they were good to eat. If I would help him build a raft, he would float with me down this river. The old stories said that one could go upon it for many miles. It ran down a hollow under the mountains.

We built and equipped our raft and launched it on the most foolhardy adventure, I do believe, that ever occupied the attention of men. We lit torches, and set them in sockets on the raft, and we were well armed. For two weeks we moved down the high archway, al a steady rate of only about three miles an hour. The average width of the stream was about five hundred feet, but at times it widened out to almost twice that. It swarmed with many kinds of fish, and they were very easy to secure. The rook walls and root seemed to be of solid granite. We were below the later formations.

As nearly as I can calculate, we were about a thousand miles from where our voyage began, and nothing had yet happened to disturb its monotony, when we began to find traces of ancient work...

Suddenly we found that the river was flowing much faster, and we failed to check our raft. We went over a water-fall, perhaps seventy feet high, and were thrown on a shelf of rock at the side of the river below. I was unhurt, but my companion was so badly injured that he died in a few hours. I repaired the raft after a fashion, and continued the voyage, finding it impossible to contrive any way to scale the sides of the water-fall and attempt a return. All our torches were lost and the attempt to proceed further seemed but a last act of despair. A few hours later, I saw a light gleaming over the river in a very remarkable way, shining clear across, as if from the head-light of a locomotive high up on the wall. This aroused me somewhat from my stupor and misery. I sat up on the raft, and steered it close to the edge of the river to see what wonderful thing had happened...

I have lived hero for months, and I have explored all the chambers of the place. There is no escape, so far as I can see. The river, twenty miles below, plunges down vaster descents, and the water gets so hot that I should be boiled alive if I tried the voyage... I am convinced that the river which brought me here flows on into the Gulf of Mexico, and that, sooner or later, my log will be picked up. Perhaps this river is really the source of the Gulf Stream.

The doomed scribe continues about the artifacts a lost race, but we've not time for the anthropology.

Montezuma's Treasure

A more-recent tale comes to us courtesy of the Southern Utah News, June 27, 1990. Based on a circle with downward arrow carved in a rock, supposedly the Aztec treasure hiding sign for the "water trap," Grant Child deduced that the hiding place of Montezuma's treasure was in the lower of the three ponds six miles north of Kanab. A colleague made a dive and discovered a 1x2-meter tunnel, handmade in appearance. Approaching the entrance, he was caught in a heavy draft and feared being swept into an underground river. Child wished to drain the lake, but the site unfortunately happens to be habitat to the endangered Kanab Amber Snail, or so the government insists.

The Mojave Desert

Branton is the pseudonym of an American UFO investigator with a background unsurprisingly in paranormal research. Branton's works include the likes of,

The Secrets of the Mojave, 7th Edition (1995),
The Dulce Wars: Underground Alien Bases and the Battle for Planet Earth (1999),
The Omega Files, Secret Nazi UFO Bases Revealed (2000), and
Reality of the Serpent Race and the Subterranean Origin of UFOs (2003)

As we're more concerned with underground water than underground Nazis, here's an excerpt from The Secrets of the Mojave.

> *The Paihute Indians as we have also related, tell of a race of Grecian or Egyptian-like people with white robes, sandals, and long dark hair held back with a band, who thousands of years ago arrived in North America in large rowing-sailing vessels. The Paiutes say that when Death Valley was still part of an inland sea connected to the Pacific Ocean through the Gulf of California, these "Havmusuvs" discovered an underground cavern system within the Panamint Mountains adjacent to the west edge of Death Valley, and within these vast caverns they built their civilization. To briefly review the Paihute account:*
>
> *The legend says that these ancient people landed their ships near or just below large "quays"' or "doors" high up the eastern slope of the Panamints. However after centuries the lake eventually dried up and disappeared, and as a result of this they developed new methods of reaching the world beyond. This, the Paihutes say, was when they began to experiment with the construction of silvery "flying canoes."*

Bob Fryer, in "Thinking of Water" in The American Dowser, Winter 1990, adds a stratum of geological obfuscation.

> *In the early 50s, a geo-chemist, metallurgist, mining engineer and dowser named Stephan Riess theorized that a vast supply of water ran under the Mojave Desert large enough to supply the needs of all the people in southern California. Riess's conclusions were corroborated by a study done by civil engineers. Their findings revealed that there was as Riess called it, primary water travelling in the deep rock fault system under the desert that had nothing in common with the water in the alluvium sedimentary aquifers. This rock fissure water was also so pure that chlorination was unnecessary, and it ran like deep, life-giving veins in the earth. In fact,* Riess *contended that most underground water did not originate via precipitation that had gradually percolated through the soil as previously thought. Water is incompressible, so once it has reached a depth where the density of the soil becomes equal to its own, it simply cannot "seep" downward any further. He felt instead that the largest quantities of water underground were formed from the elements within the earth, and constituted primary water that had never seen the surface of the earth before. Freshwater springs that spew forth large volumes of water off the coast of islands are good examples.*

As we paddled through similar aqua-genesis in Chapter 8, we won't go there.

Deep Springs, California

Deep Springs, California lies due east of San Jose. The following account is related by Val Valerian in his December 1989 Leading Edge Newsletter.

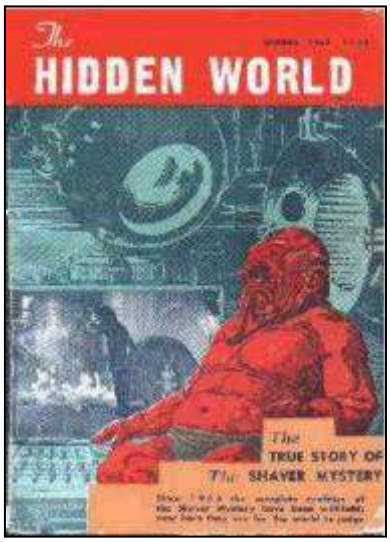
> *Deep Springs, California is an area that is becoming known as the site for very strange events. According to the information released both on the air on KVEG-AM and from other sources, the area is full of strange people wandering around in black suits. There have also been rumors that there is an underground facility in the area. Checking with gravity anomaly maps proved that there are large cavities under the ground in that area. The wildest claims relative to the area have stated that alien life forms are being released there... Deep Springs Lake has been probed and it appears bottomless. Divers have traveled along an underground river 27 miles toward the Las Vegas area before having to turn around.*

Strange men in black suits may not be extraterrestrials, but rather their agents. We're not informed regarding the divers, but as noted later in this chapter, the Navy has frogmen accustomed to such ventures.

Kokoweef Peak, California

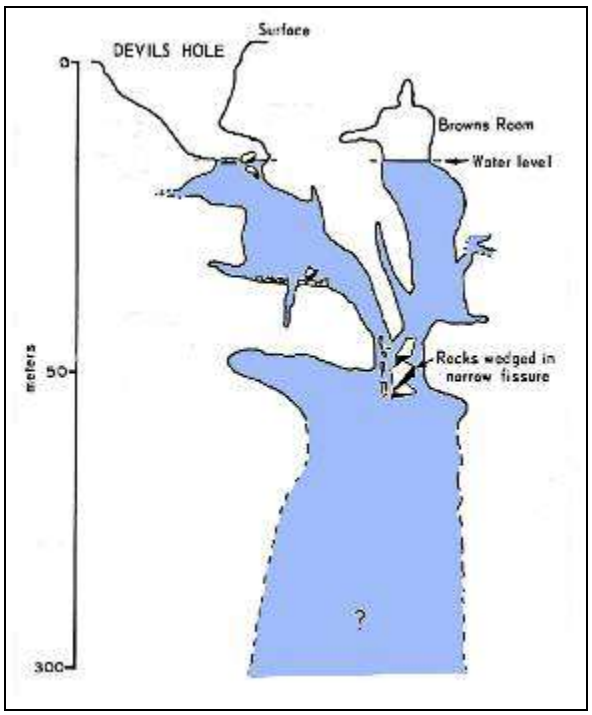
In a 1962 issue of The Hidden World, UFO researcher -- the title that's given --Chuck Edwards linked the Kokoweef subterranean drainage network (Chapter 97) to the inventers of flying saucers.

> *Our foundation has located a vast system of underground passages in the Mother Lode country of California. They were first discovered in 1936* [sic. 1936 was the year that Dorr went public with a Los Angeles Times interview.]*, ignored by all even with our best efforts to reveal them. Recently a road crew blasted out an opening verifying our claims. One of the chambers is 200 feet long, 70 feet wide and 50 feet high. We have disclosed what we believe to be a vast subterranean drainage system (probably traversing the Great American Desert country for a distance of more than 600 miles). We believe this system extends out like five fingers of your hand to such landmarks as Zion Canyon in Utah, the Grand Canyon, another runs south from the Carson Sink in Nevada and yet another follows the western slope of the same range, joining its counterpart and ending somewhere in the Mojave Desert.*



Devils Hole, California

Devils Hole -- no apostrophe, according to the National Park Service -- is a 10 by 20 meter limestone sinkhole in Death Valley National Park flooded to 15 meters from the land surface. The depth to the well's bottom is roughly 120 meters.



Halliday's description of Devil's Hole as rising and falling with the tides, like Dorr's at Kokoweef Peak, suggests a water course connected to an underground ocean.

One might wonder about oceanic tides, however, as a subterranean connection to the Pacific would flood Death Valley. Most, if not all, of the water is derived from the northwest, where it flows at considerable depth under the Nevada Test Site.

As explained by Branton, however, there may be other forces at play. We can refer to Chapter 45, The Hydraulics of Underground Waters, for possibilities.

Legend regarding two divers lost in Devils Hole holds that a SCUBA tank bearing the serial number of one of the divers was found months later in the Bay of Cortez.

Quoting from Branton (1995),

> *According to Sasquatch Researcher* [as with previously cited "UFO researcher Chuck Edwards," we cite titles as given] *Virginia Louis Swanson, Devil's Hole... has been the scene of at least one disappearance. According to Swanson, two boys entered the cave several years ago and were never seen again. Navy scuba divers were lowered on cables and reported seeing a large river which roared up from below, flowing across a wide expanse. They could not estimate its depth because of a myriad of colonnades of black rock through which the river flowed before plunging once again down an abyss. The cave is somewhere near Devil's Hole (which is still open to public view, although "fenced in"), and was allegedly sealed shortly after the disappearance.*

Entry is indeed now restricted, but it's to protect the Devils Hole Pupfish, an endangered species and resident since the Ice Age.

Submarines

A submarine would be required to confirm Devils Hole's connection to the Pacific. And according to Branton (1995), this may have indeed occurred.

> *This might confirm the allegations made by one anonymous retired Navy officer that the Navy has knowledge of a vast system or labyrinth of aqua-caverns which meander beneath the surface of California and even into other western states, and that these watery labyrinths exit*

out into the oceans via huge entrances in the lower walls of the Continental Slope. One of the more extravagant claims is that some of these aqua-caverns are so large that they can be navigated by submarine, and that one nuclear submarine on a secret mapping mission in fact became lost within the maze and was never heard from again.

The USS Thresher disappeared on April 10, 1963, with a crew of 129 under the command of John W. Harvey, USN. As revelation of nearby alien presence would panic the entirety of Southern California, it comes as no surprise that the official reporting stops at this point.

That's not to say that there's been a lack of unofficial reporting regarding subterranean sub missions, however. We'll quote just one Internet item, from a certain "johnlear."

Many years ago a Navy friend of mine told me about a hidden Navy base in Lake Tahoe. He also told me about the "tubes," the Navy underground transportation system. He told me that the techs that worked in the tubes were called "tubemoles."

In the March 1980 edition of his Rebel Magazine, John J. Williams revealed that many subterranean cavities below the western US have been explored via nuclear submarines to several hundred miles inland, particularly in the region of southern California and the Oregon-California border. According to Williams,

Some time ago, I heard a man on a TV interview-show briefly mention that parts of California and neighboring states are floating on the Pacific Ocean! He was a high ranking Naval officer on a top- secret nuclear submarine that has been (and is) exploring and mapping these enormous caverns and passage-ways underneath the West for over 10 years now.

A friend of mine finally tracked the man down. He is now living quietly in retirement and asked that no details pointing to him be revealed as he does not want publicity and government attention. After writing this article, I destroyed my files on him.

He makes the following statements from his observations:

1. *The passageways are labyrinthine with widths from a few to thousands of feet (caverns), averaging roughly about a 100 feet.*
2. *Much like dry caverns do, heights and depths vary a great deal and in some cases, two or more caverns or passageways pass over or under each other at different depths.*
3. *Most of the entrances lie just off the Continental Shelf*
4. *Most of the entrances are too small for submarine investigation; and many that are large enough lie in waters that are too deep.*
5. *Some of the caverns (in S. California) are topped with oil while some others are filled with gases believed to approximate our atmosphere (in very ancient times).*
6. *The San Joaquin Valley is essentially a portion of the original cavernous area that collapsed eons ago due to its sheer weight.*

7. *What is being passed off as the "San Andreas Fault" are large, unsupported chambers that are in the process of collapsing. When the big one finally hits, many scientists in the know believe that most of California will break off like a cold Hershey bar and slide into the ocean!*
8. *(Deleted due to the possibility of undue stress and fear which may result from its disclosure.)*
9. *A well-known US nuclear submarine lost its way in these passages and disappeared forever.*

Camp Irwin

Leon Davidson, in an early issue of Flying Saucers Magazine, spoke of a network of "underground tunnels in the California desert, at Camp Irwin, near Barstow."

Richard Toronto reprinted an article in his Shaverton newsletter describing a Los Angeles Municipal Water Director who talked with a man who said that he was hired by the government to look for underground water sources for Camp Irwin. The man came across an abandoned mine and near the bottom discovered an earth fault wide enough to traverse until emerging into a river-cavern in which he saw a crystal pure underground river 500 meters wide which flowed out of sight.

The Municipal Water Director claimed to have since discovered at least five similar underground rivers, some die-traced to the Gulf of California and at least one to the Pacific through openings in the continental slope.

While the tale about a fellow who talked with someone who saw something makes no mention of lost civilizations or extraterrestrial, its publication in a UFO newsletter suggests what else may be involved.

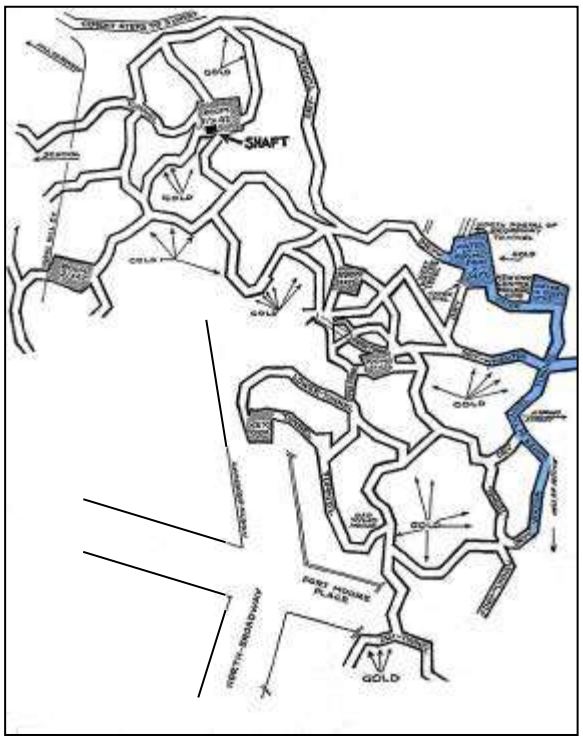
A Municipal Water Director, after all, is a respectable official.

Los Angeles

"Lizard People's Catacomb City Hunted," Los Angeles Times, January 29, 1934, published a scoop by Jean Bosquet on "Lizard City," a labyrinth deep below Los Angeles chemically excavated by the Lizard People in times long ago. Discovery was achieved by geological mining engineer Warren Shufelt and his radio X-ray apparatus. At time of publication, Shufelt was digging a shaft for verification.

We will concede that the legend of an ancient race of "a much higher type intellectually than modern human beings" seems indeed very likely. Our interest, however, is in the portion of the article pertaining to underground rivers.

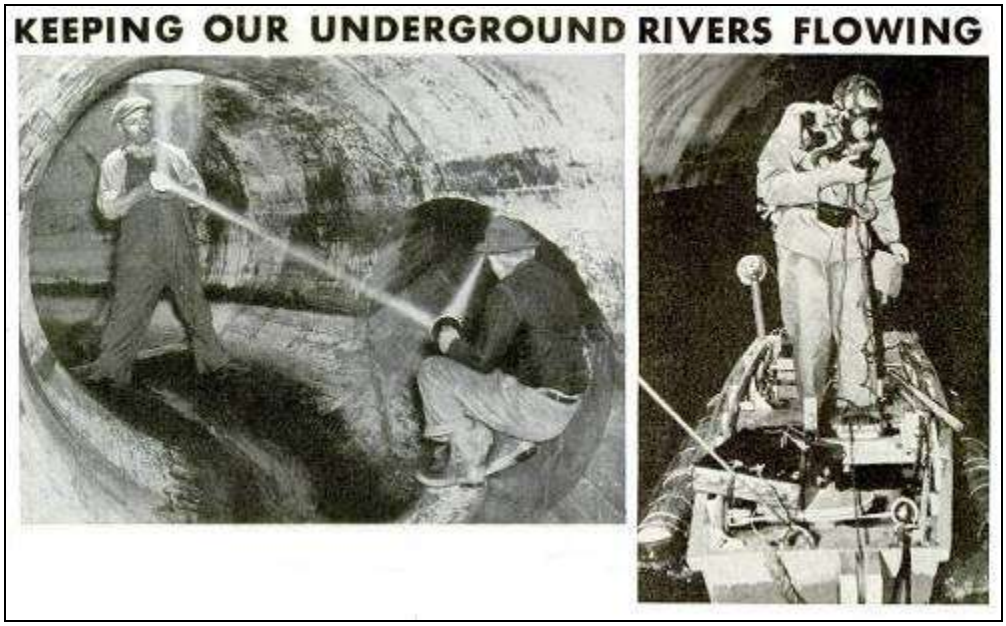
> *Engineer Sinks Shaft Under Fort Moore Hill to Find Maze of Tunnels and Priceless Treasures of Legendary Inhabitants.*
>
> *The tide passing daily in and out of the lower tunnel portals and forcing air into the upper tunnels, provided ventilation.*
>
> *Shufelt's radio device consists chiefly of a cylindrical glass case inside which a plummet attached to a copper wire sways continually, pointing, he asserts, towards minerals or tunnels below the surface of the ground.*



Lizard City layout is shown to the left with tidal tunnels indicated in blue. The site's location in modern Los Angeles is shown below. Santa Monica Freeway construction may have obliterated the entrances to the subterranean site.

The Los Angeles Times article included a photo of Shufelt baling water out of a 70-meter vertical shaft, not an unexpected necessity, as such depth would have taken him to sea level. As he anticipated his objective to be another 250 meters below, however, his tidal air-pump theory would seem to suggest that in Lizard City times, the Pacific itself was itself that much lower than it is today.

And let's look closely at the January 1943 edition of Popular Mechanics.



The caption for the left photo:

> *Sunlight is made to turn corners with mirrors and safely illuminate hundreds of feet of sewer conduit.*

As we can see the beam, this seems true, laser-like in a pre-laser era. The caption for the right photo, however, seems less likely.

> *Dressed like a man from Mars, an engineer sets forth on a dangerous expedition through 55 miles of Los Angeles sewers.*

A boatman dressed like a man from Mars in the Los Angeles underground! We suspect otherwise, a Martian photographed in transit to points inland.

Or might it be our Chapter 34 Stygian boatman, in gasmask and sans oar?

The flying saucers, occasional submarine and paddling aliens enter the underworld waterway of the American West under Los Angeles, perhaps near the Santa Monica Pier.

Connecting the Dots

The clues indeed seem to verify the existence of Chapter 94's Rio San Buenaventura!

We're not the first to see connections, of course, as evidenced by the unattributed map published by In-the-Desert.com.

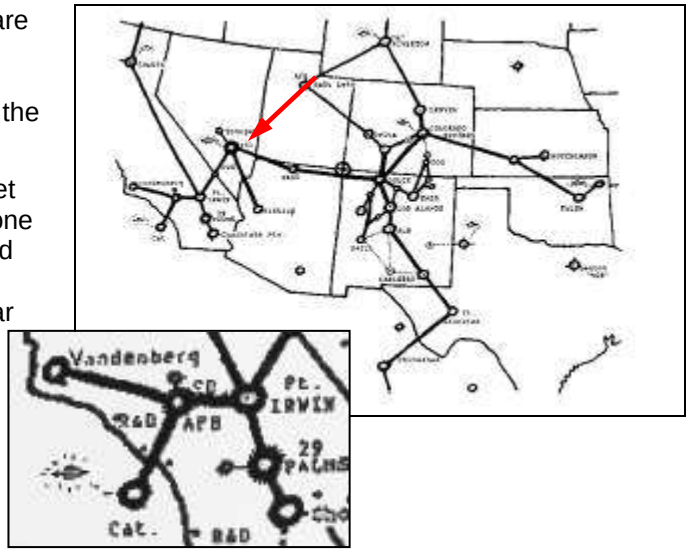
> *This is the approximate location of the underground river. Many accounts of places where the river would start and it's course to the south following earthquake fault lines has led us to this map. Other accounts have the river starting as far north as British Columbia.*

We've noted evidence extending yet further inland, however.

No one claims that all the connections are fluvial, of course, as evidenced by the tunnel map linking secret underground military bases, Nevada's Area 51 being the central command.

It would appear, however, that the secret tunnel map is missing an obvious link, one from Salt Lake to Area 51. Underground rivers meander, but there would be little reason for the main branch to loop as far east as New Mexico.

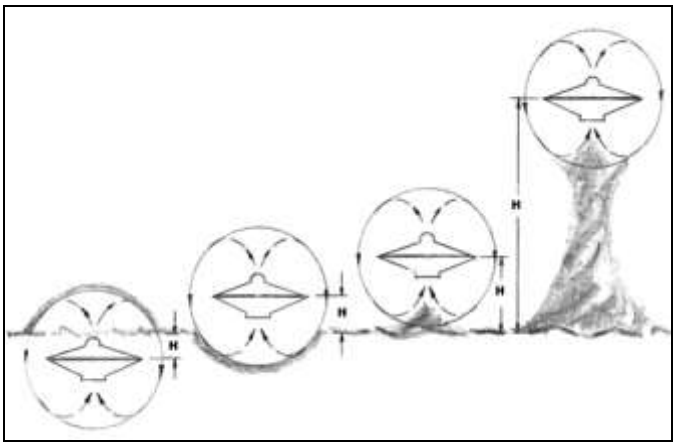
We've added it in red.



Note the offshore UFO launching facility near Catalina Island. The illustration to the right suggests that the visitors enter the labyrinth on the surface, but secrecy requires that they do it yet submerged.

The photo below appears to be a takeoff, not a launch. As analyzed by Feindt, a takeoff creates an upward vortex.

Underwater Flying Saucers,
The Walkford Files internet posting



Carl Feindt, "Physical Influences of a UFO on Water," internet posting, 2005

A Warning from Below

Raymond Bernard's Hollow Earth (1964) discusses reports from those who've visited the inner world. They speak of a harmonious civilization, people 2.75 meters tall, having no diseases and living hundreds, if not thousands, of years. The Inner Earthers were driven underground by a past thermonuclear war, perhaps the one that sunk Atlantis. Since these beings share our planet, they are understandable concerned about a second nuclear destruction. The atomic bombing

Japan led to the increased sightings of UFOs in the 1950s, as the Inner Earth's people were watching. They will not interfere with our lives unless we threaten theirs.

To us, underground rivers are dangerous waterways. To those below, it's the upper world that causes concern.

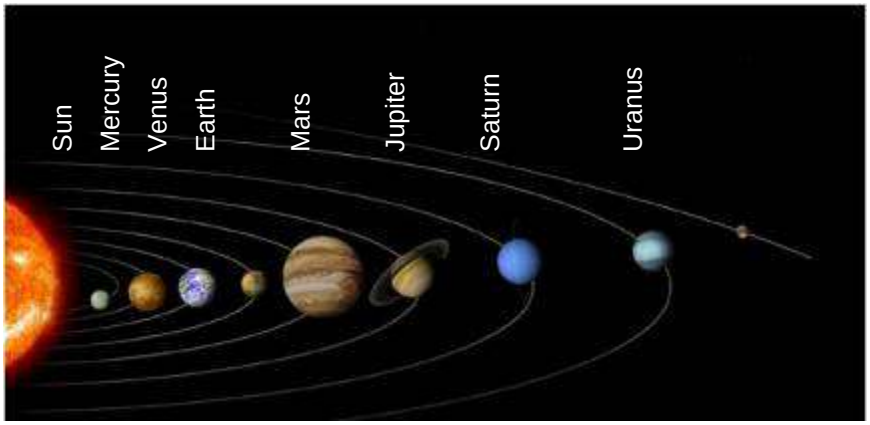
Conclusion

Could an underground network of UFO bases be the fabled Rio San Buenaventura?

We can only speculate, of course, but we can't ignore the general geographical correspondence.

CHAPTER 98
UNDERGROUND RIVERS IN OUTER SPACE

The chapter just completed, Extraterrestrials and Lost Rivers of the American West, looked at alien beings navigating our own underground waterways. Here, we'll look for underground rivers where those visitors perhaps embarked. This chapter should perhaps be called "Underground Rivers Elsewhere in Our Solar System," but we'll use the more-encompassing title in anticipation of more distant discoveries.



We seek planets or their moons where there seems a possibility of a past or present underground river, the last terms loosely interpreted. The "ground" may not be dirt, but an icy crust; the "river" may not flow as do ours.

Given the uniformity tenant of science that fundamental rules don't vary with time or location, if the landscape of a distant planet or moon resembles to some degree a terrain with which we are familiar, what transpires beneath the two may also have similarity.

Thus we seek extraterrestrial likenesses to terrestrial geology associated with subterranean streamflow.

As we look, we'll keep in mind three conditions that must be met for an underground river to exist.

There must be a fluid that can also exist in gaseous phase to regain elevation in its cycle. We won't insist it be water, however; it might be a hydrocarbon or something else.

There must be an energy source. We sketch the sun in the corner of our own hydrologic cycle diagrams. On objects elsewhere in space, however, power could come from the body's thermal core or from planetary tides, a mechanism we'll describe for the Jovian moon Europa.

There must be a mechanism for conduit development. On the earth, we've two possibilities: karstification and lava tubing. The chemistry on another body in space may not be right for carbonate karst, per se, but there might be a like-acting process involving dissolution or corrosion. Absent the dispersal of solutes or dissociated particulates from the solid-liquid boundary, a stagnant pool will insulate itself and at we'll have but a motionless subsurface sea.

A planet or moon may have once had an environment different from that of the present. Atmospheres can alter or even disappear. Cores can cool. Volcanoes have their season. We need to look at each planet or moon both as it now and how it might have once been.

In our underground rivers odyssey, we'll look for bodies in space having signs of any sort of hydrologic activity. Liquid on the surface might point to flows below.

B The Moon

We'll begin with the celestial body about which we know most, our moon. There, we'll prospect for sublunarian rivers -- the adjective coined, but it has to be correct -- from three perspectives: fiction, pseudoscience and actual science.

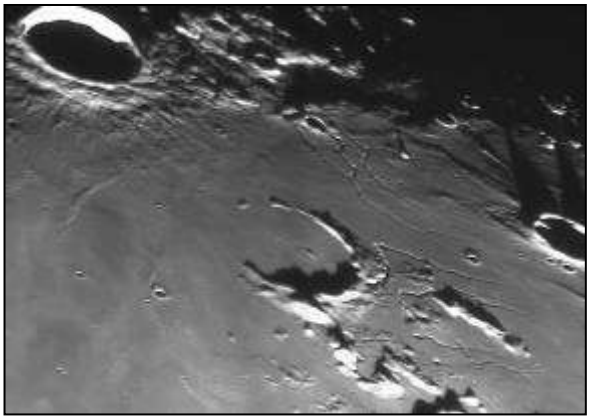
Lunar maria are formations on the moon's surface that when viewed by eye from the earth, seem to resemble seas. Galileo, however, was skeptical regarding the interpretation. From his Dialogue Concerning the Two Chief World Systems (1632),

> *What is clearly seen in the moon is that the darker parts are all plains, with few rocks and ridges in them, though there are some. The brighter remainder is all fill of rocks, mountains, round ridges, and other shapes, and in particular there are great ranges of mountains around the spots.*
>
> *I think that the material of the lunar globe is not land and water, and this alone is enough to prevent generations and alterations similar to ours.*

Galileo was correct. Lunar mares are not ocean beds, but basaltic plains.

That's not to say, however, that liquid once flowing on lunar rock hasn't left its mark.

The photograph to the right taken from Ludiver Observatory shows meandering and branching channel beds, the agent haven been not water, but lava.



But who's to say there couldn't be a very different sort of geological history within? This sort of question is precisely why we have fiction, both of the literary variety and of the esoteric scientific sort.

If the fiction and pseudoscience of extraterrestrial underground waters seem closely akin treatments afforded by the same writers to their terrestrial equivalents, it's because writers of fiction and conceivers of alternative science have unabashedly rehashed tales and theories they've constructed for the earth.

Akin to the hollow earth in Chapter 15, how about a hollow moon?

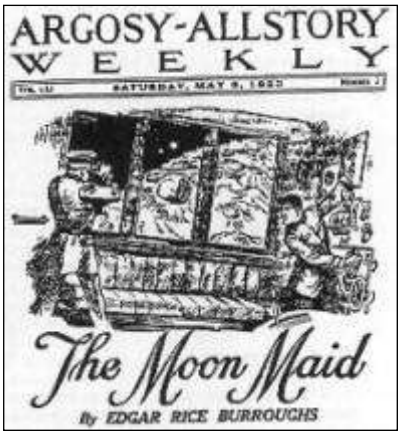
In The First Men in the Moon (1901), H.G. Wells describes the insectide "Selenites" dwelling inside such a satellite.

A hollow moon "Sulva" is background for That Hideous Strength (1945) by C.S. Lewis.

The Lomokome Papers (1947), Herman Wouk's venture into science fiction, employs a like setting.

We'll only delve into one such volume, however, as one's enough -- The Moon Maid (1922) by Edgar Rice Burroughs whom we met in Chapter 21, More Boys Club Series.

Arriving at the moon,



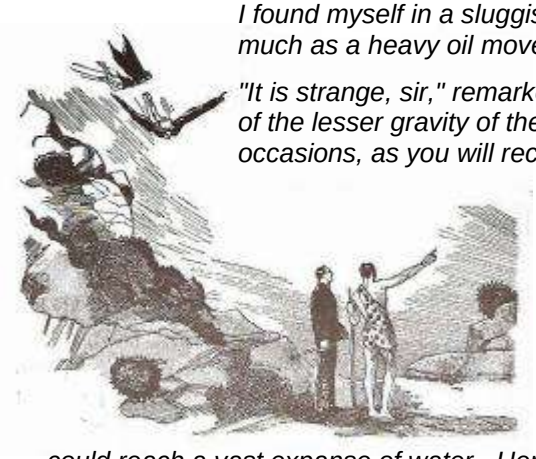
During the next ten miles our speed diminished ran idly, until we suddenly realized that we were no longer falling, but that our motion had been reversed and we were rising. Up we went for approximately eight miles when suddenly we began to fall again. Again we fell, but this time for only six miles, when our motion was reversed and we rose again a distance of about four miles. This see-sawing was continued until we finally came to rest at about what we estimated was a distance of some one hundred and thirty miles below the summit of the crater. It was quite dark, and we had only our instruments to tell us of what was happening to the ship, the interior of which was, of course, brilliantly illuminated and comfortably warm.

Now below us, and now above us, for the ship had rolled completely over each time we had passed the point at which we came finally to rest, we had noted the luminosity that Norton had first observed from above the mouth of the crater. Each of us had been doing considerable thinking, and at last young Norton could contain himself no longer.

"I beg your pardon, sir," he said deferentially, "but won't you tell us what you think of it; what your theory is as to where we are and why we hang here in mid-air, and why the ship rolled over every time we passed this point?"

"I can only account for it," I replied, "upon a single, rather preposterous hypothesis, which is that the Union is a hollow sphere, with a solid crust some two hundred and fifty miles in thickness. Gravity is preventing us from rising above the point where we now are, while centrifugal force keeps us from falling."

The hollow-moon geophysics is the hollow- earth geophysics of Chapter 15. Regarding the inner waters,



I found myself in a sluggish, yet powerful current, the water seeming to move much as a heavy oil moves to the gravity of Earth.

"It is strange, sir," remarked Jay, "that none of us thought of the natural effects of the lesser gravity of the Moon. We have discussed the matter upon many occasions, as you will recall, yet when we faced the actual condition we gave it no consideration whatsoever."

The only important entry upon the log since I had turned in was West's report of the results of his analysis of the water, which showed that it was not only perfectly safe for drinking purposes but usually pure, with an extremely low saline content.

I stepped into the river, and as I did so I glanced to my left to see stretching before me as far as my eye could reach a vast expanse of water. Here then I had stumbled upon the mouth of the river and, beyond, a lunar sea.

We crossed many rivers, for the lunar world is well watered. We skirted several lakes, and at one point of high ground, I saw, far at our left, the waters of what appeared to be a great ocean.

Rushing down from the hillside, the water poured in torrents into the ravine, and presently, though it must have been twenty or thirty feet deep, it was filled almost to overflowing. Whoever had sought refuge there would have been drowned and washed away to the big ocean far below.

Moh-goh was already up and in the bath, a marble affair fed by a continuous supply of icy water which originated among the ice-clad peaks of the higher mountains behind Laythe.

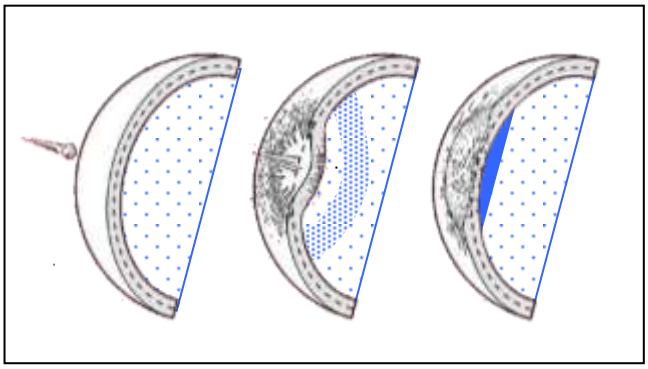
Again, it's very much the same type of prose devoted to imaginary explorers discovering the waters of a hollow earth.

"The Moon Maid" (2007) by William Cane interprets the interior of the hollow moon based on the novel.

A pseudo-scientific rationale for the hollow moon is the impressively-titled "accretion-disk dynamics." Others subscribe to the Vasin-Shcherbakov Theory that the moon is an alien spacecraft.

According to believers, evidence for hollowness can be seen with a telescope. The craters wouldn't be so large, but for the thin shell's rebound from meteorite impact.

We've also speculated how vapor within the hollow globe could be condensed by shock wave compression, the condensate then forming a sea.



We needn't penetrate a hollow-moon, however, to find water under the lunar surface.

Water was entrapped in Apollo 17 rock samples. From the July 8, 2011 edition of Science, by Erik H. Hauri, Thomas Weinreich, Alberto E. Saal, Malcolm C. Rutherford, and James A. Van Orman,

> *Primitive magmatic melt inclusions from the moon contain as much water as some terrestrial mid-ocean* ridge magmas
>
> *The moon has long been thought to be highly depleted in volatiles such as water, and indeed published direct measurements of water in lunar volcanic glasses have never exceeded 50 parts per million (ppm).*
>
> *Here, we report in situ measurements of water in lunar melt inclusions; these samples of primitive lunar magma, by virtue of being trapped within olivine crystals before volcanic eruption, did not experience post-eruptive degassing. The lunar melt inclusions contain 615 to 1410 ppm water and high correlated amounts of fluorine (50 to 78 ppm), sulfur (612 to 877 ppm), and chlorine (1.5 to 3.0 ppm). These volatile contents are very similar to primitive terrestrial mid-ocean ridge basalts and indicate that some parts of the lunar interior contain as much water as Earth's upper mantle.*

As reported in "Evidence of Water Beneath Moon's Stony Face," New York Times, May 27, 2011,

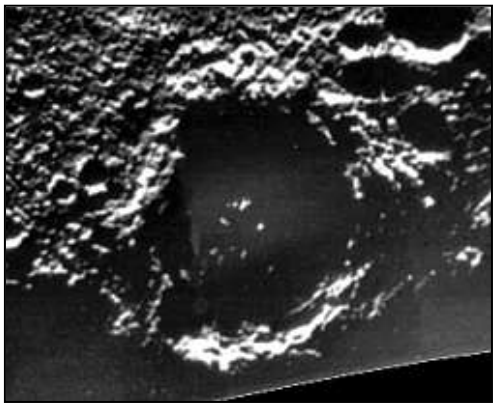
> *Now, scientists analyzing tiny fragments of hardened lava from long-ago lunar eruptions report that the fragments contain about as much water as similar magmas on Earth, meaning there is plenty of water inside the Moon too.*

"There is a reservoir down there in the Moon that has the same concentration of water as some reservoirs in the upper mantle of Earth," Dr. Saal told the Times. "That's for sure."

No one at NASA is proposing that such water has gathered into waterbodies, but what's established is that there's water.

C Mercury

Mercury's silicate surface is similar in appearance to that of our moon, an ancient surface heavily cratered and without evidence of plate tectonics. Mercury has a wispy atmosphere of atoms blasted off its rock by solar wind, but because the planet is so hot, these atoms quickly escape into space. Mercury has features akin to the maria on our own moon, but nobody has thought to call them "seas." Surprisingly, however, NASA Deep Space Network radar observations of Mercury's north pole (shown to the right) seem to reflect water ice in the protected shadows of craters.



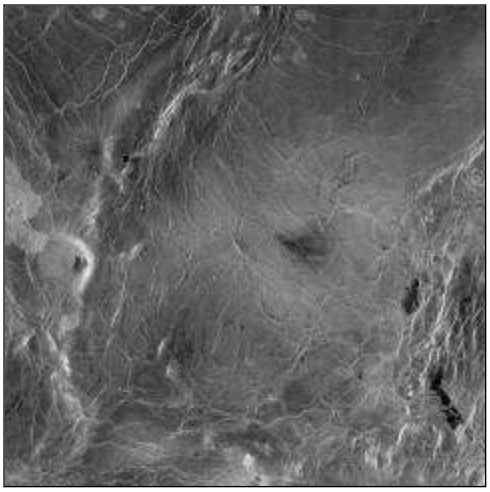
The Roman deity Mercury was known to the Greeks as Hermes, guide to the underworld. Despite the radar observations, there's a snowball's chance in Hermes' territory for underground rivers on Mercury.

D Venus

According to astrobiologist David Grinspoon in Venus Revealed: A New Look Below the Clouds of Our Mysterious Twin Planet (1998),

> *The vast volcanic plains that cover nearly all low-lying areas are the long-sought global "oceans" on the surface of Venus–frozen oceans of basalt. One of the most astounding surface forms discovered by Magellan furthers the analogy: this ocean is fed by rivers! We see numerous thin, meandering channels, typically a mile wide and thousands of miles in length. The longest of these, Baltis Vallis, winds more than forty-two hundred miles over the plains. Baltis is longer than the Nile and thus can safely be called the longest river anywhere within several light-years of here. On Earth or Mars we would interpret such features as evidence of past or present running water. The analogy with structures carved by terrestrial water goes quite deep. We see fanlike river deltas, meanders, and bars, and places where streams have flooded their banks.*

Skeptics find the analogy strained. "Tributaries" that slope the wrong way show little evidence of damage from ground movement causing the reverse in gradient. There's no progressive widening of the main channel. The "channels" are more likely overlapped lava flows intercepted by fractures and folded rises.



A 1996 Magellan photo.

Today's environment is much too hot for liquid water but there does appear to be a small amount of water vapor amidst the carbon dioxide atmosphere acidified by sulfur gases. Lakes of sulfuric acid have been hypothesized, but sulfuric acid raindrops would evaporate in transit.

Infrared spectrometry suggests that Venus might have had water oceans at one time, but given that the surface has been reworked by intensive igneous activity, the hypothesis is hard to test.

With an atmospheric pathway, we're at least step closer to the possibility of a circulatory system than we were on our own moon.

E **Mars**

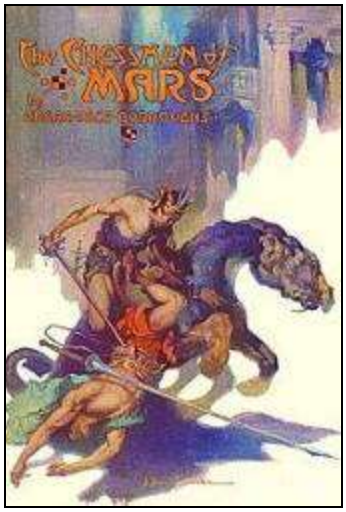
We cited Marshall Gardner's A Journey to the Earth's Interior (1913) in Chapter 15, Hollow Earth Geophysics, but the author also presents a vacant case -- interpret this as you like -- for Mars based on a gleam of light seen emanating from the planet's north polar area. As a hollow earth and hollow moon more than satisfy our curiosity regarding hollow bodies in space, however, we'll not further utilize Gardner in our quest for underground rivers.

For fictional underground rivers on the Red Planet, we turn once again to Edgar Rice Burroughs.

The Warlord of Mars (1914)

At last the truth dawned upon me -- I was following a subterranean river which emptied into the Iss at the very point where I had hidden.

The rowers were now quite close to me. The noise of their own paddles drowned the sound of mine, but in another instant the growing light ahead would reveal me to them.

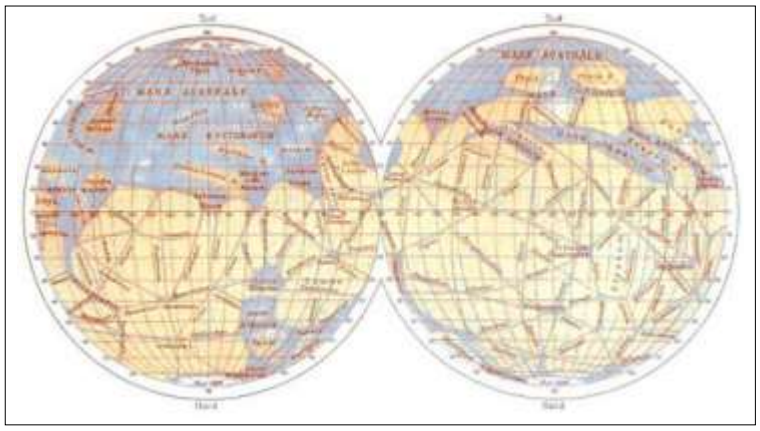


The Chessmen of Mars (1922)

Tons upon tons of dirt must have been removed, and for a long time he wondered where it had been deposited, until in following downward a tunnel of great size and length he sensed before him the thunderous rush of subterranean waters, and presently came to the bank of a great, underground river, tumbling onward, no doubt, the length of a world to the buried sea of Omean.

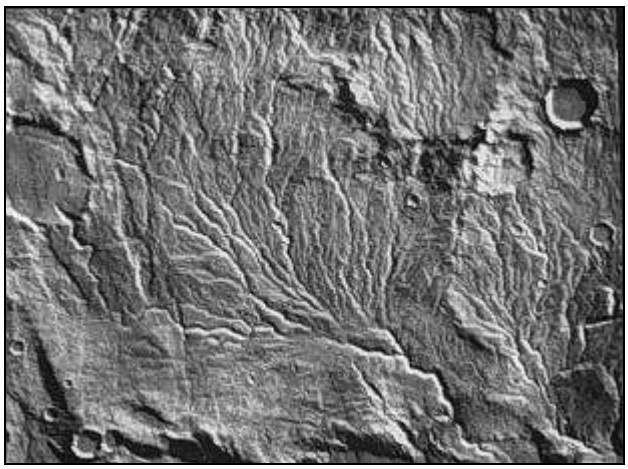
Burroughs rolled out such verbiage for Earth, Moon, Pellucidar or Mars. Boys Clubs like adventure wherever it occurs.

Scientists have likewise hypothesized Martian waters, and telescopic observations from the time of Galileo gave credibility to what appeared to be canals. Giovanni Schiaparelli's 1877 canal map is to the right.



Modern astronomy has revealed the canals to be an optical illusion, but like the seas of our own moon, popular lore lingers.

Like Venus, liquid water may have once covered some of the planet's surface, but Mars retains better evidence in what appears to be ancient shores of a primordial Oceanus Borealis and traces of catastrophic floods.



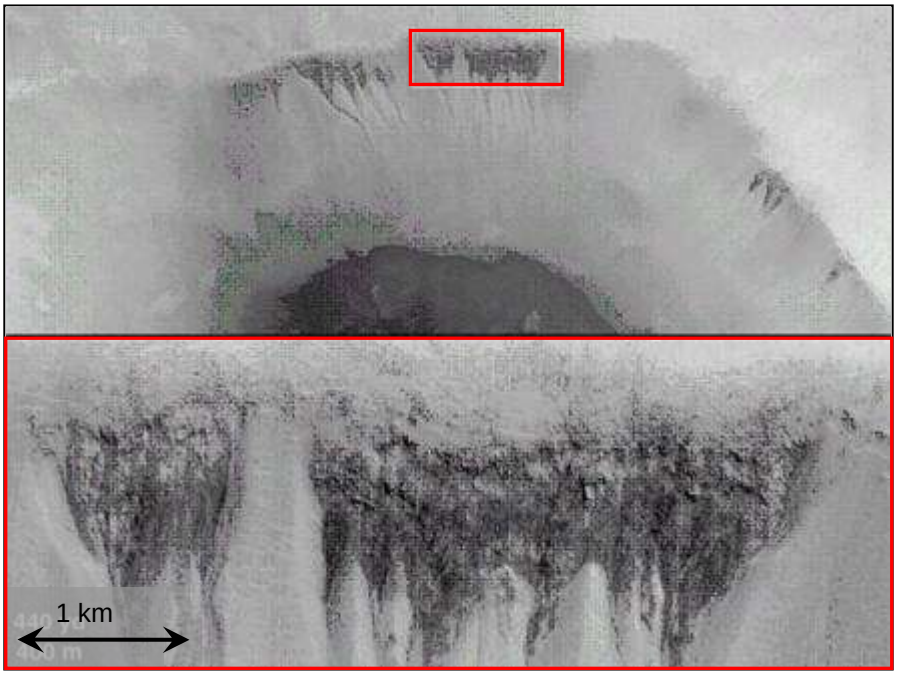
Signs of past drainage.

Artist's conception

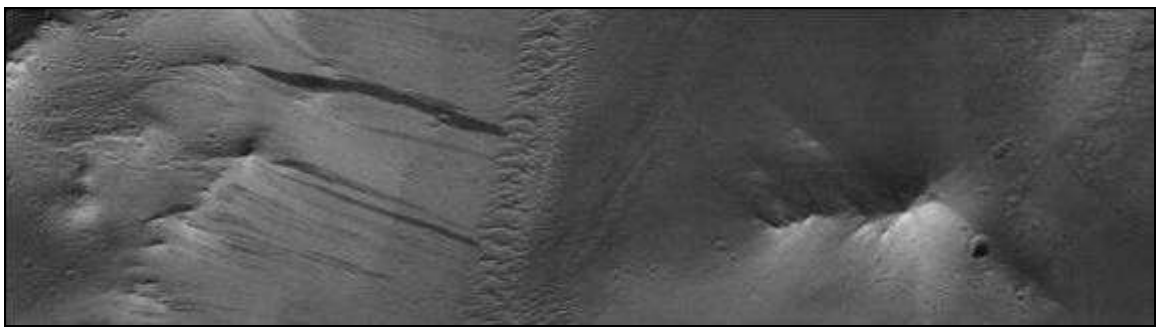
And not all the signs of water are ancient and -- particular to our interests -- are on the surface.

Photographic evidence of subsurface piping beneath a crater rim is shown to the right.

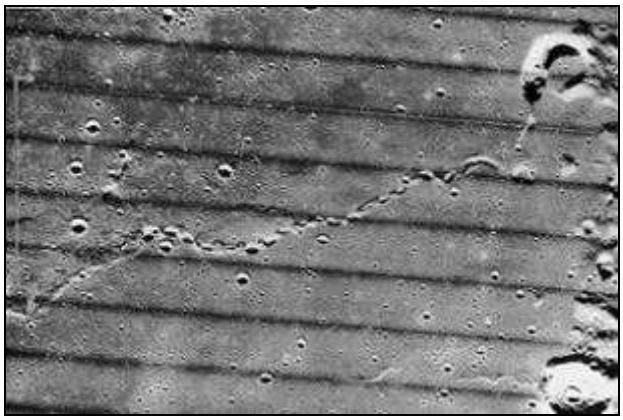
The flow features are meters wide on 25 to 40-degree slopes. Repeat imaging by HiRISE, a University of Arizona project, indicates that the features grow during warm seasons and fade in cold seasons.



The image below shows downstream erosion from what might be geologically-recent subsurface drainage from crater and valley slopes.



Lava tubes are evidenced by chain of collapsed conduits, below, left. On the right is a closer view of uncollapsed tubes on the surface.



Images sent by NASA's Mars Express of the landscape surrounding the giant volcano Ascraeus Mons reveal sinuous channels, 1-2 kilometers wide and 20-50 kilometers in length, which appear to have been caused by expelled boiling fluids. At the low atmospheric pressure, a volatile liquid boils quickly as it erupts from the sides of a volcano, surging with force capable of carving channels down the slope and creating gigantic debris flows.

According to John Murray, et al. in "Late-stage water eruptions from Ascraeus Mons Volcano, Mars: Implications for its Structure and History," Earth and Planetary Science Letters, July 25, 2009, some of the channels may have been carved by water flowing underground, later to be exposed when the roof of the conduit collapsed.

"If we had water flowing below the surface, we have a warm and wet environment, protected from cosmic radiation. This is a great place for life to develop,' suggests the lead author.

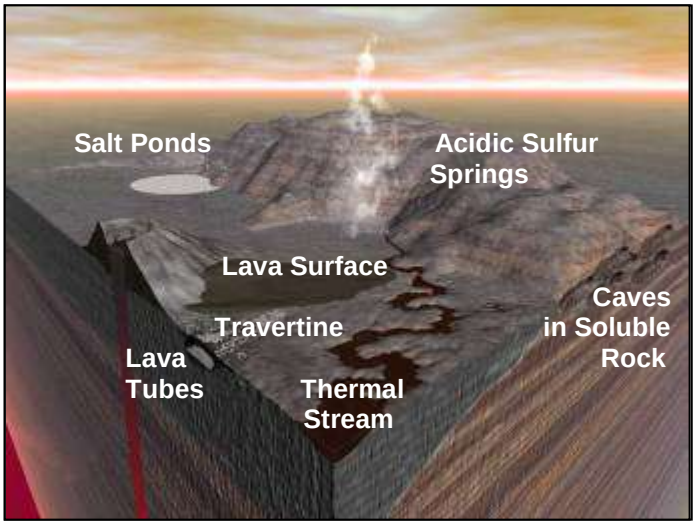
The image to the right is of Mars' Acheron Fossae region taken by Mars Express high-resolution stereographic photography. The region's mythological name, of course, suggests an underground river, but we'll focus on the large crater, 55 kilometers in diameter and 2 kilometers, rim to floor. Eroded material carried from outside the crater has resurfaced its floor, compelling evidence for an epoch of runoff.

Mars might even be a candidate for karstification, as its rock contains calcium carbonate and its atmosphere contains carbon dioxide, but even with the chemistry in order, there's not a sufficient

hydrologic cycle pumping acidified precipitation through the rock. This isn't to say, however, that there couldn't have once been a wetter time when solution might have occurred.

The artistic rendition to the right portrays a fairly earth-like Martian hydrogeology. Groundwater isn't shown, but to complete the cycle, water presumably seeps from the ponds and streams, is reheated below and rises to the vents.

Travertine is a form of limestone deposited by mineral springs, and thus the "Caves in Soluble Rocks" to the right.



We'll cite "Mars Tubes," a 2005 National UFO Center web posting, for its mention of lava tubes, but revelations from the august-sounding National UFO Center should perhaps have been in the chapter before, the one about Extraterrestrials.

> *It is likely the entire planet is crisscrossed with lava tubes. Many seemed to be formed along valleys and natural low lying former river or creek beds. Once the volcanic tube is laid down water eventually flows through the tubes.*

Lava tubes could be of value for space exploration, according to "Identifying Lava Tubes and Their Products on Olympus Mons, Mars and Implications for Planetary Exploration,".42nd Lunar and Planetary Science Conference, The Woodlands, Texas, 2011, by J.E. Bleacher, et al.,

> *Developing a series of criteria for identifying lava tubes on other planets is critical for the planetary community as these features are discussed as possible protected habitation zones for native life and future human explorers.*

The possibility of "protected habitation zones for native life" catches our attention. Life of any sort requires water, and where there's a damp tube, there could just a well be a passage with standing or flowing water.

The Red Planet may lack canals, but we've visual indication of fluvial erosion, subsurface emergence and lava tubes. Underground rivers seem unlikely today, but enough of the hydrologic pieces fit together to make a plausible case that there once might have been such.

F Jupiter

Because of its earthlike temperature and pressure, Jupiter possesses an atmosphere in which water droplets may condense. Water ice seems to be a significant component of the Jovian core, but on the whole, Jupiter consists of trapped helium, hydrogen and water vapor.

We may do a bit better with its moons, however. Of the planet's largest, Io, Europa, Ganymede, and Callisto, all but the first are believed to have iced-over oceans. We'll confine our discussion to Europa, as that the one we've most successfully passed spacecraft by.

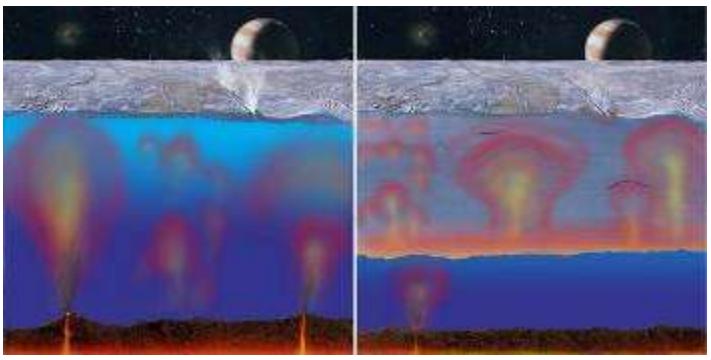
Europa has a core; a rock envelope around it; a thick layer of water or slushy ice and impure water ice on the surface. Europa is thought to have twice as much water as does Earth, a surprise to most of us.

Jupiter's immense gravity causes tides sufficient to fracture the icy crust. Images taken by the Galileo spacecraft show fractured ice and where expressed liquid may have frozen on the surface.

The fragmented chunks of ice are similar in appearance to those in our own polar seas during a springtime thaw. The sparsity of craters suggests that the subsurface ocean wipes the record clean with regularity.

"Galileo Findings Boost Idea of Other-Worldly Ocean," NASA Jet Propulsion Laboratory, NASA, January 10, 2000,

> *When NASA's Galileo spacecraft swooped past Jupiter's moon Europa a week ago, it picked up powerful new evidence that a liquid ocean lies beneath Europa's icy crust.*
>
> *"I think these findings tell us that there is indeed a layer of liquid water beneath Europa's surface," said Dr. Margaret Kivelson, principal investigator... "This new evidence certainly makes the argument for the presence of an ocean far more persuasive."*
>
> *It appears that the ocean lies beneath the surface somewhere in the outer 100 kilometers, the approximate thickness of the ice/water layer.*
>
> *These latest findings are consistent with previous Galileo images and data showing a tortured surface seemingly formed when Europa's surface ice broke and rearranged itself while floating on a sea below.*



Observation of spherical flexure and measurement of magnetic variations help estimate the ice thickness, but ice-penetrating radar will solve the question, just as it's done beneath Antarctica.

A NASA/JPL artists' conception illustrates Europa's thick-ocean/thin-ocean alternatives.

“We’ve learned a lot about Europa in the past few years,” Prof. William McKinnon of Washington University told Science Daily, December 14, 2007. “Now the scientific community has come to a consensus that there most certainly is an ocean. We’re ready to take the next step and explore that ocean and the ice shell that overlays it.”

An underground river? No, more like an under-ice ocean. But as we'll see with Saturn's moon Enceladus, we can't be sure it's all ice on top.

G Saturn

Like Jupiter, Saturn likely has water ice as a significant component of its core, but may not have much else that's solid. Again the moons may be better candidates for geological processes. We'll look at two, Enceladus and Titan.

Along with Earth, Mars and Jupiter's Europa, Saturn's moon Enceladus is one of the places in the Solar System for which there is direct evidence of water. Cyrovolcanic mountains ("ice volcanoes" in which erupting volatiles condense to solid form when vented to the low temperature) indicate that the moon has ample water within, heated geothermally, or like Jupiter's Europa, by tidal action.

Spacecraft flyby revealed cyrogeysers ("ice geysers," less voluminous than cyrovolcanoes) shooting plumes consisting of about equal parts ice and water vapor hundreds of kilometers into the sky. As discussed in Chapter 48, Subterranean Geophysics, where there's a geyser, there's a conduit directing it to the surface. There's evidence for an ocean at a few hundred meters to a few kilometers beneath the moon's icy shell.

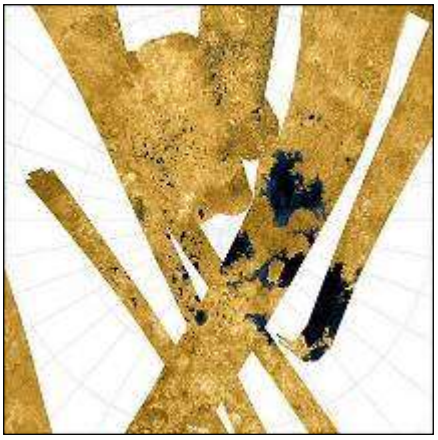
Rather than an explosive emission caused by expanding bubbles rising directly from a hidden ocean, intermediate caverns of vapor may moderate the flow.

The atmospheric composition of Saturn's moon Titan resembles that of an early earth, the major difference being Titan's -178° C temperature.

Scientists believe that methane- and ethane-laden rain on Titan carve meandering channels to lakes and seas trapped in volcanic depressions. As explained by Alex Hayes of California Institute of Technology in Science Daily, October 12, 2007,

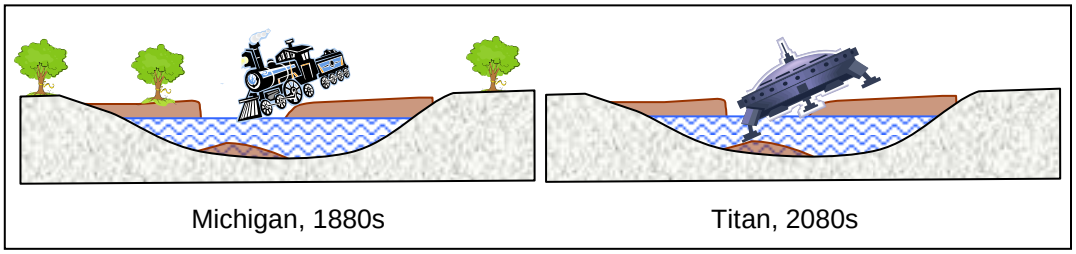
> *The lakes we are observing on Titan appear to be in varying states of fullness, suggesting their involvement in a complex hydrologic system akin to Earth's water cycle.*
>
> *The lakes we have seen so far vary in size from the smallest observable, approximately 1 square kilometers, to greater than 100 000 square kilometers, which is slightly larger than the great lakes in Midwestern USA. Of the roughly 400 observed lakes, 70 percent of their area is taken up by large "seas" greater than 26 000 square kilometers.*

About 14 percent of the false-color mosaic of Titan's north polar region is covered by what seems to be hydrocarbon lakes. Features appearing darkest are thought to be liquid; solid surfaces appear as brown.



Titan's surface was thought to be an icy crust until the flyby, the mostly-solid surface a surprise to investigators. Significant to our interest in underground waterbodies elsewhere in the Solar System is the possibility that oceans we presume to be topped with ice crusts could also lie under visible "ground."

We hesitate to offer advice to rocket scientists, but we'll point out what we discovered in Chapter 80. In the same manner that incrusted lakes can fool railroad men, incrusted seas can fool flyby photographers.



Michigan, 1880s Titan, 2080s

Xanadu, an Australia-sized region on Titan, has meandering channel beds similar those of Chengdu, China, the Xanadu of Kubla Khan, Chapter 31, Down to a Sunless Sea.

Xanadu, Titan

Chengdu, China

The Chinese terrain lies within the South China karst region (Chapter 58), but we can't presume the same geochemistry on Titan where the carving force may have been streams of methane or ethane. Titan's drainage networks might have once flowed onto areas now covered by dunes, what's referred to as Titan's "sand seas," or even to still-visible hydrocarbon lakes at the satellite's poles.

Radio wave reflection suggests a liquid ocean with a 10-or-more percent ammonia content acting as antifreeze some 50 kilometers down.

H Uranus and I Neptune

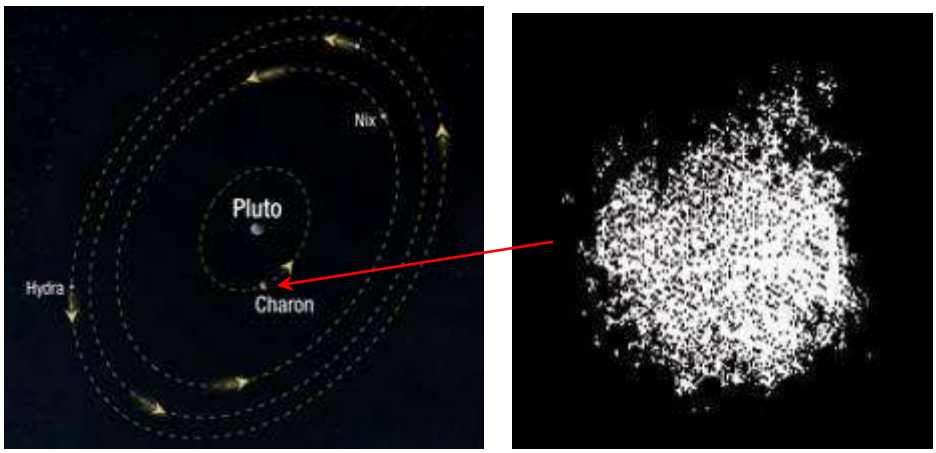
Uranus and Neptune are thought to have cores of iron and silicates surrounded by a mantel of water, methane and ammonia ices, similar to the composition of Saturn's Titan. Unlike the polar seas of the latter, however, the oceans of Uranus and Neptune -- if there are such -- would be compressed by the thick atmospheres. Neptune has an internal heat source; Uranus does not.

We'll not find underground rivers in these places because there's no ground.

J Pluto

Pluto's moon Charon is just over half the size of Pluto. Mutual eclipses of Pluto and Charon allow spectrography of the planet alone and then the pair; the difference reveals the composition of Charon's surface. Whereas Pluto is covered with nitrogen and methane ices, Charon's appears to be plated by less volatile water ice, probably deposited by cyrogeysers active in the geological sense, as solar radiation would have degraded older ice to an amorphous state in only 30,000 years, an astronomical heartbeat.

Charon's very name, of course, demands the presence of an underground river, but the ice is all the evidence currently available.



Looking for Solar System-wide commonalities, the possibility of a Plutonain sea falls within speculation regarding ice-covered seas on the moons of other planets.

Smaller icy bodies where the liquid layer beneath the icy crust may be in direct contact with underlying rock, allowing dissolution of minerals and salts	Larger icy bodies where high-pressure ice may underlie the liquid layer
Pluto Rhea, Saturn Titania, Uranus Oberon, Uranus Triton, Neptune	Ganymede, Jupiter Callisto, Jupiter Titan, Saturn

Conclusions

Lunar and Martian underground rivers in science fiction are much like underground rivers of corresponding terrestrial fiction; they're settings for stories about plot. Actual science, however, tells a richer story.

On our moon we've found water, but nothing that merits being called a river.

On Saturn's moon Xanadu, however, there are signs of what seems to have once been rivers. Landforms on several seemingly-desiccated Solar System bodies suggest past epochs when fluids flowed freely.

Mars seems to have ice springs and lava tubes that might convey subterranean water. The planet may even today have a rudimentary hydrologic cycle.

We've remotely sensed liquid seas buried beneath the frozen surfaces of other extraterrestrial bodies.

We began this chapter by listing three necessary conditions for underground rivers to exist elsewhere in the Solar System. Between planets and moons, we seem to have met them all. Whether the conditions are (or once were) mutually satisfied at any location is yet to be determined, but there is indeed the possibility of underground rivers in outer space.

CHAPTER 99
WHY DO WE BELIEVE WHAT WE BELIEVE?

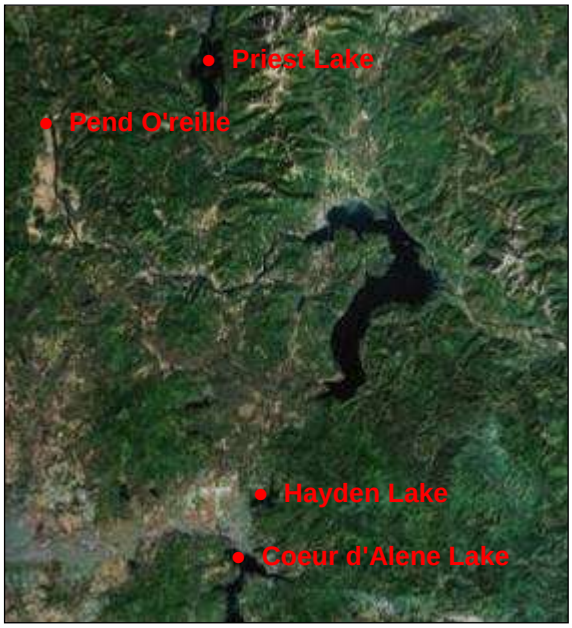
Or, to put the question in terms of underground rivers, why do we think that subterranean streams flow beneath us when we are reasonably well informed that what's flowing down there is mostly through mud and fractured rock?

We will divide the question of belief into two parts, "As Children" and "As Adults," though we may find the psychological bases to be not that different. In each, we will mention a few reasons suggested by experts and add a few examples of how beliefs become reinforced.

As Children

Guide to Northern Idaho, December 11, 2009, catches the flavor.

> *Is there really an underground river between Lake Coeur d'Alene and Hayden Lake? Or is it between Hayden and Pend O'reille? Or is it just a really great old story? Decades ago the story was heard a lot. Perhaps science has quelled the mystery, bummer.*
>
> *If you were a kid growing up in the 50s or 60s you knew the tale. Or at least some version of it. Yes, it was lore and legend of how the body or a man who drown in Lake Coeur d'Alene was discovered in Hayden Lake. Or drown in Harden and found in Pend Oreille? Or any combination of these. Sometimes Priest Lake was even thrown into a version.*



Jean Piaget noted in The Language and Thought of the Child (1959) that,

> *There is in the child a tendency towards justification at all costs, a spontaneous belief that everything is connected with everything else and that everything can be explained by everything else.*

To test Piaget's theory, Robert W. and Cindi Katz interviewed and observed 24 three-to-six-year-old children in regard to their understanding of the hydrologic cycle and reported their findings in "The Hydrologic Cycle and the Wisdom of the Child," Geographical Review, January 1977, the title a twist of Yi-Fu Tuan's "The Hydrologic Cycle and the Wisdom of God" (1979), mentioned in the prologue of our own study. Indeed, the psychologists found that children go to sophisticated (if wildly incorrect) efforts to explain how the source of tap water/

Of the 24, only one volunteered the concept of an underground river.

Child: *Water comes out of the ground.*
Interviewer: *Out of the ground! And how does it get up here [to the faucet] if it comes out of the ground?*
Child: *It's attached to the ground.*
Interviewer: *Ohhh! It's attached to the ground? How is it attached?*
Child: *Under the house it's attached to the ground-in the dirt.*
Interviewer: *And in the dirt is there something for water to come through?*

Child: *And even a river or something.*
Interviewer: *Ohhh.*
Child: *A brook.*
Interviewer: *Is the river or brook near your house?*
Child: *Under it.*
Interviewer: *There's a river under your house?*
Child: *There's a river under every house*.

As only one subject proposed the existence of an actual underground river, we might interpret that such a concept is foreign to most children. But at a more fundamental level, most of the children pictured water in the dirt and water moved by pipes. Linking the ideas would come quite naturally.

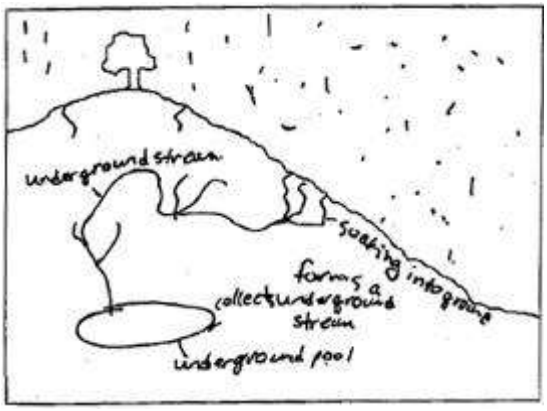
The brain of course doesn't form with an implanted concept of a river underground, and based on the small study above, the explicit idea's often absent through pre-school years. But when the possibility of logical connection presents itself, albeit in a story book of which we've noted many in earlier chapters, the young mind latches on.

After a number of years of schooling, however, children are expected to be better informed. The National Research Council's National Science Education Standards (1996) deemed that eighth graders should possess appropriate understandings regarding groundwater and its role in the hydrologic cycle and textbook publishers have endeavored to incorporate content that adheres to this goal.

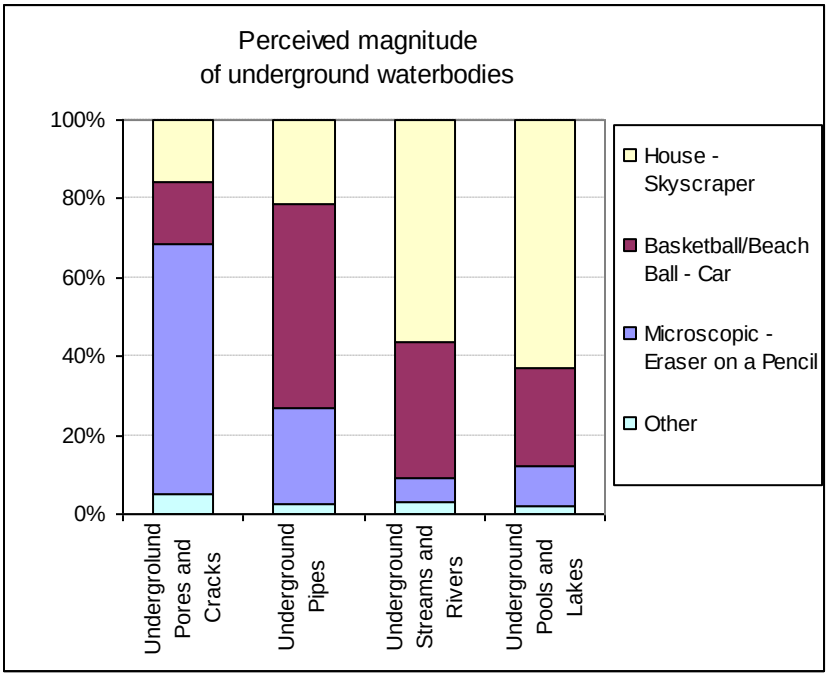
But to how much effect?

The drawing to the right is an illustration from David Dickerson and Karen Dawkins' "Eighth Grade Students' Understanding of Ground Water," Journal of Geoscience Education, 52 (2004) suggests that the National Resource Council goals are yet to be achieved.

In the words of the drawing, "Soaking into ground forms an underground stream," and such streams "collect" to form an "underground pool."



"Students' Conception of Scale Regarding Ground Water," Journal of Geoscience Education, 53 (2005) by David Dickerson, Timothy Callahan, Mary Van Sickel and Genny Hay compared three groups of students but for our purposes we group them into one larger sample. The instrument was a set of multiple choice questions designed to reveal perceptions of magnitude in relation to the four hydrogeologic categories listed on the chart to the tight.



An unsurprising finding is that is that of the first bar. The majority of students perceive "underground pores and cracks" to be in a size range from microscopic to that of a pencil eraser.

Findings disturbing to the National Research Council would be those of bars 3 and 4. A majority of the subjects deem "underground streams and rivers" and "underground pools and lakes" to be between the size of a house and a skyscraper.

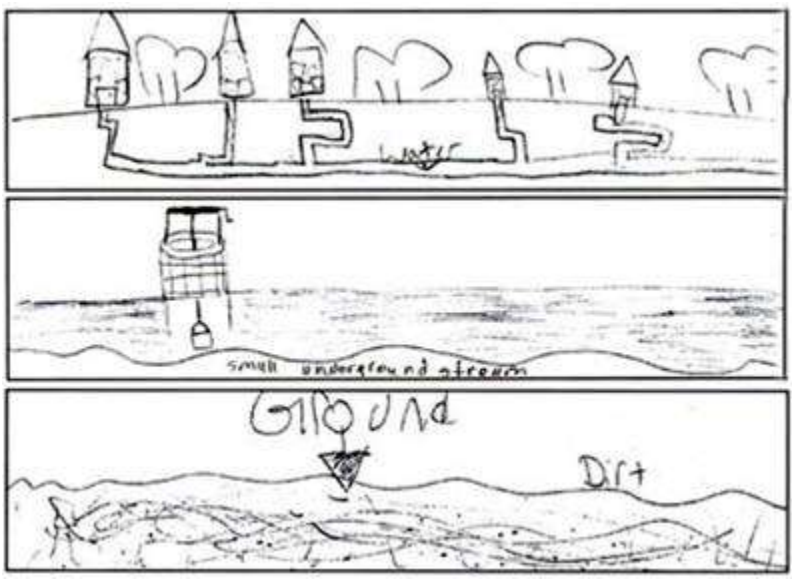
In "Students' Developing Understanding of Water in Environmental Systems," Journal of Environmental Education 40:3, 2009, Beth Covitt, Kristin Gunckel and Charles Anderson asked grade-school children the question, "Draw a picture or explain what it looks like underground where there is water."

Here is a sample of results,

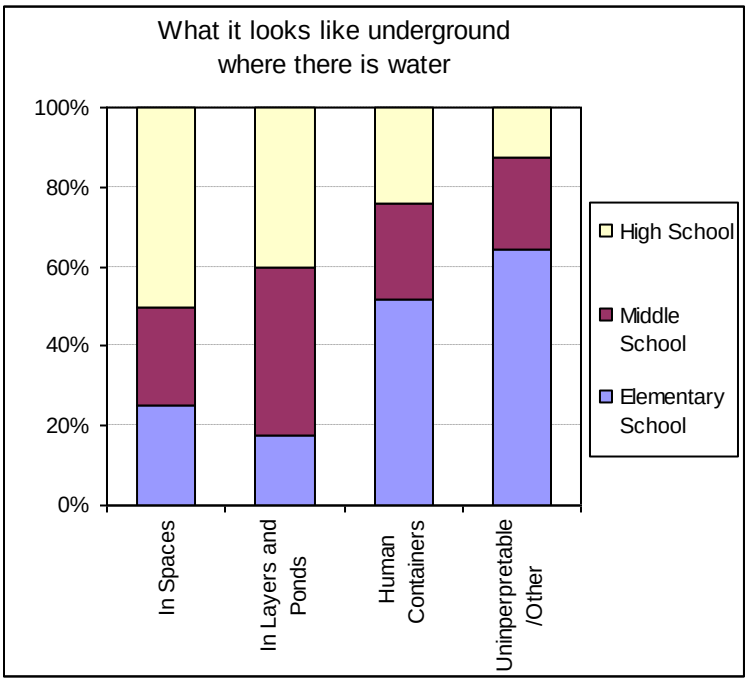
A drawing that that resembles a human-built pipe system,

A labeled reference to an underground stream, and lastly,

The concept of an aquifer -- "Dirt," to the student.



The authors evaluated older students by written survey. The combined results are to the right.



Students at all grade levels more likely envision underground water as lakes and ponds than in small spaces or engineered-appearing tanks or pipes. The positive finding -- slight that it is -- is that by high school, the concept of porous aquifers (i.e., "in spaces") is up to 18 percent. In envisioning what's below our feet, most American schoolchildren still think of flowing streams.

Why don't the children seem to believe what their National Science Education Standardcompliant textbooks tell them?

We looked at numerous underground river games in Chapter 28, but we didn't emphasize how early such game-playing can begin. Here are three aimed at preschoolers.

The Backyardigans, Mission to Mars

Freddi Fish

Pajama Sam

Backyardigans began as a Canadian children's TV series featuring five animal children whose backyard becomes an adventure land. The screenshot shows an underground river on Mars, a geologic possibility discussed in Chapter 42, Underground Rivers in Caverns other than Karst, but the game isn't about planetary science.

Freddi Fish and Pajama Sam are of similar bent. From Freddi's publishers,

> *Kids direct this amazing interactive adventure through a giant tree-house, underground river caverns and even a sunken mine. Teamwork, clever thinking and some creative problem-solving lead our hero, and your kids, to a surprising conclusion -- maybe Darkness isn't as bad as it seems!*

Don't be afraid of the dark, kids, or you'll miss the great underground river and not master creative problem solving. Teamwork is what's important!

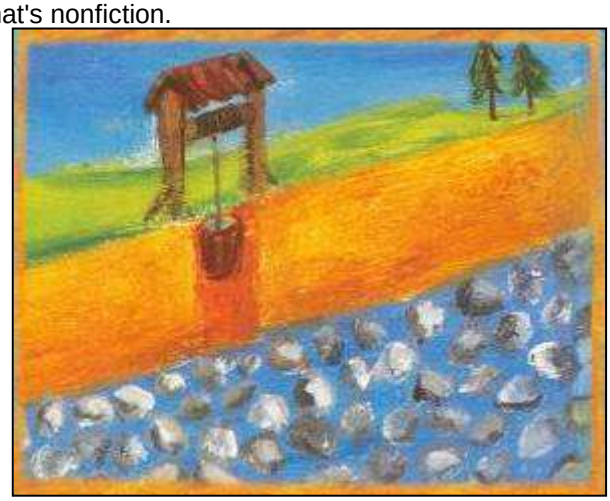
We've thumbed through literature that would be read to a young child in Chapter 19, but here we'll note a picture books for young children that's nonfiction.

One Well, The Story of Water on Earth (2007) by Rochelle Strauss is scientifically accurate and up to date. Aquifers are

> *Layers of gravel, porous (holey) rocks or soil that trap large amounts of water.*

Why then, we wonder, does the introduction perpetuate the old-time riverine conceptualization of groundwater?

> *Earth is the only planet with liquid water -- and therefore the only planet that can support life. All water is connected. Every raindrop, lake, underground river and glacier is part of a single global well.*



Put a picture book or a game for small children about a subterranean boat ride in the ring with the National Research Council's goals for eighth-graders. The illustrations win.

American youth have, in fact, been instructed regarding such "underground rivers" for a rather long period. Take the Boys and Girls Magazine Section published by the Los Angeles Herald, March 3, 1907.

> *It is not an unusual thing in Arizona or New Mexico, or the arid portions of Territories close to the eastern slope of the Rockies, to encounter a stream which, after flowing in the legitimate manner for several miles, will disappear in the panel, sometimes very gradually, at others with startling rapidity.*
>
> *The water simply subsides into the sand, which is very light and porous. Where it goes is another question. Perhaps to feed some vast subterranean lake, or perhaps to emerge again in the form of springs and artesian wells.*

The boys and girls are deceived regarding "some vast subterranean lake," a fairly-common journalistic misrepresentation, but that's minor compared with what's to follow -- an underground river that flows not to, but from, the sea.

> *Sometimes the conditions are reversed, and the river, instead of disappearing before it reaches the sea, comes from the sea and disappears in the land. On the coast of Cephalonia* [an earthquake-prone Ionian island] *the sea runs into the land in a strong stream, turning a water-wheel on its way, and disappears in the earth about one hundred yards from the entrance. These sea-fed rivers are also found in Mexico, where they are known as "zanates."*

"Zanates" are "cenotes," the Mexican sinkholes discussed in Chapter 41.

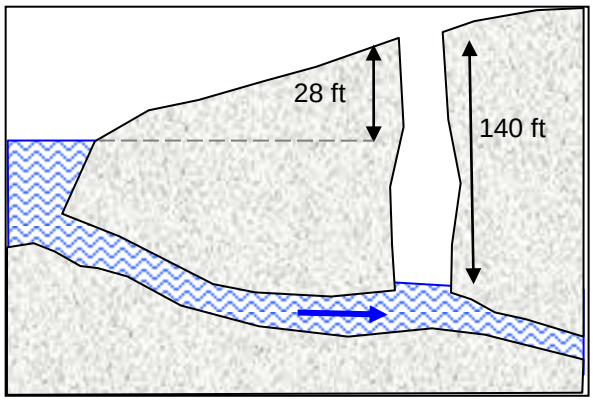
Boys and Girls Monthly Magazine continues onward, blithely plagiarizing a decade-old "Underground Rivers" from the journal Science, April 9, 1886, which we will quote directly.

> *The writer, while passing through Yucatan, Mexico, in 1870, saw a large stream running with torrential speed within a natural tunnel not far from the seashore, and probably over one hundred feet below the surface of the ocean. These underground rivers, which are said to be numerous in the neighborhood of the city of Merida, are called zanates by the inhabitants of Yucatan. I had time to visit only one of these remarkable subterranean rivers. Its shaft-like entrance was adorned by a picturesque old Spanish well-curb of stone, furnished with standards of fancifully forged iron-work. Nothing on the surface indicated the existence of the vast cavern under the monotonous and flat lowlands of the peninsula of Yucatan; and, though not a breath of air stirred, the deafening roar of the torrent under our feet could not be perceived until we were fully inside of the cave.*

The visitor then described his decent into the formation.

> *It had the rounded appearance of a stream flowing horizontally under great pressure, ten or twelve feet in diameter, and looking like a gigantic black icicle lying on its side. This large volume of water plunged with great swiftness into an unexplored and dark chamber with terrific roar, and producing noises which resembled the hollow echoes of heavy explosions heard now and then above the perpetual rumbling of the rushing water.*

The manager of the plantation informed me that the mouth or entrance of this zanate was only twenty-eight feet above the Gulf of Mexico; and since my barometer indicated a descent of a hundred and forty feet, if the information was correct, this stream was delivering, within forty miles from the seashore, a volume of fresh water about a hundred and twelve feet below the level of the sea.



A river flowing downhill from the ocean! The Boys and Girls Magazine Section seems indeed to have something of interest to more than just boys and girls.

Unfortunately for the boys and girls, however, the rewriter seems not to have read the rest of his source. From the original Science article,

This latter circumstance seems to prove that the elevation given by the manager of the plantation may be incorrect; but, besides the fact that the belief in the great depth of these zanates below the ocean is current among the cultivated people of Merida, the manager of the plantation insisted on the correctness of his figures, which were obtained by the instrumental surveys connected with the irrigation of his large estate, the waste water from which runs into the sea.

To the Science author, the elevation reported by the plantation manager had to have been incorrect, but boys and girls are more likely to read Boys and Girls Monthly Magazine than Science.

Or consider "Underground Streams" in The Youth's Companion, April 15, 1915.

Sometimes a farmer stops up the vent hole, in order to make a pond. A man named Johnson once threshed his wheat and stacked the straw in the bottom of a sink hole. Whether he expected this result or not, the drainage hole was stopped up, the water rose until it submerged most of his farm, backed into an adjacent depression, and formed a pond three hundred yards wide, half a mile long, and forty feet deep in places. People came from twenty miles around to fish in Johnson's Pond.

Of course we can call it just a kids' story, but such "A man named Johnson"-type tales shape pliable minds.

What do they mean by an underground river? asks Larry Roberts, age 8, of Spokane, Washington, in "Ask Andy," Gastonia Gazette, August 8, 1968.

Andy explains it as a "tunnel,

We see rivers flowing along on top of the ground outdoors, under the wide open sky. It seems downright impossible for a river to flow under the ground, buried down out of sight. Nevertheless, it is possible. There really are underground rivers. We have found a lot of them and there are many, many more that nobody has discovered. These underground rivers are filled with rainwater that sinks down, down into the spongy rocks below the surface. Some of this water fills the pores and pockets of buried rocks. It collects in vast stores of buried ground water.

> *But whatever it is, water always must flow downhill. If it is on a slope, it must gush or trickle down to lower land. The buried ground water also must flow downward. Sometimes it collects in tilted rocks buried deep in a hill. Then it must flow down a slope. As it flows it chews and washes out a tunnel for itself through the rocks. This flowing, underground water is an underground river. Sometimes it digs its way to the side of a slope and comes gushing outdoors in a stream or a waterfall. Sometimes it flows on and on for miles underground.*

All in all, the concept of a riverine underground river meshes well with a young mind and for a hundred or so years, we've been inferring that the concept is correct.

As Adults

We might grant that children can be easily deceived, but we as, adults, manifest greater power of discernment. The facts, however, seem to speak otherwise.

Ian Maciver, "Urban Water Supply Alternatives, Perception and Choice in the Grand Basin, Ontario," University of Chicago Department of Geography Research Paper No. 126 (1970)

> *Probably groundwater is much more commonly perceived as being stored in underground lakes and flowing in underground rivers, than it is as a resource stored in the pore spaces of rock and unconsolidated sediments.*

As explained by an interviewee in Brantford, Ontario, "Rainfall seeps into the ground and gets into the rocks. Bodies of water are down there -- huge, huge lakes."

Another stated, "There's an underground river flowing northward below Galt that replenishes all the wells in this area. I think it is called the Styx and it empties somewhere into the bottom of Georgian Bay." As noted in Chapter 60, there is indeed a surficial River Styx in the province, but the commentator's mythological perception trumps what's on the modern map.

Of the people willing to express an opinion as to the mode of storage of groundwater, three saw it as occurring in underground rivers, channels, lakes or "veins" for every one who answered correctly.

In "Political Behavior and the Decision Making Process in the Allocation of Water Resources between Recreational and Municipal Use," Natural Resources Journal, 9 (1969), an examination of water management in eastern Massachusetts, Roger Kasperson found that the "giant underground river" was the major myth among Silver Lake residents.

> *The underground river starts in New Hampshire and flows in a curving path through Massachusetts and then empties into the Atlantic Ocean. When it reaches Brockton, it's about 3,000 feet down. The engineers are working on it right now. Where do you think the VA hospital gets its water?*

Five water users and one political official cited of their own volition, this "underground river" as the best possible solution to the problem. Efforts to determine the source of this myth were fruitless, although interpersonal communication was apparently the route of diffusion.

Kasperson's generalizations are straightforward. A "rage for order" impels an individual to put sketchy information into some kind of manageable pattern. A relatively simple, often oversimplified picture is a more efficient way to organize a subject than is a more detailed and confusing picture offered by scientific experts.

For the ordinary citizen not directly concerned with groundwater management, equating underground conditions and the surface rivers and lakes with which he or she is familiar is a simple and efficient way to organize an otherwise-confusing set of phenomena.

Metaphor, the extension of the principles and patterns of a familiar field to a less familiar one, is an efficient way to gain a sense of understanding. An individual's tentative picture of subsurface processes will be reinforced every time he or she encounters a reference to "reservoirs," "basins," or "flow," or sees the collapse of a cavernous Florida limestone sinkhole.

Kasperson's answer is not to promote details of the subsurface environment or the equations of groundwater flow. More realistic and efficacious education might come from metaphors according better with relevant facts and less well with the surface realm. Develop terminology not suggesting a correspondence between the features of subaerial and subterranean "reservoirs," "basins," and "flow."

In "Vernacular American Theories of Earth Science," Journal of Geological Education, 35 (1987), William Meyer notes that as everyman is his own historian, everyman is his own earth scientist. Those who have no instruction in the subject do not dismiss it from their minds, but rather construct pictures of the earth and its processes with the tools available. They then act on the basis of the beliefs, correct or incorrect.

Meyer reflects on notion of wide currency in American thought, past and present, that groundwater occurs in much the same form as does surface water -- in large .basins or lakes and in rapidly flowing streams, rather than in the interstices of sediment and bedrock. Meyer notes the use of such words as "pools," "lakes," "rivers," "streams," and "veins" as descriptors rather than metaphors, usually implying the idea of groundwater as a contiguous body.

The over-riding thesis of those in the profession of educational psychology returns us to the discussion of models in the introduction of our own study.

Models are expressions of something we think we'd like to understand in terms of something we think we do understand.

In the words of Mciver,

> *One's conceptions of the unknown tend to pattern themselves after the known and since surface waters congregate into wide bodies such as lakes or confined routes such as rivers; this thought pattern may be transferred to the subterranean world.*

At almost every turn of our journey, we've quoted portions of what readers of a given era would themselves have read. The telling of the story is itself part of the story.

We should acknowledge our propensity attribute notable attributes to lands having revered history. Take, for example, "A New Winter Resort," Living Age, March 17, 1883, a travelogue of 19th-century Palestine.

> *One of the fellahin, seeing my interest in ruins and topographical curiosities, led me to the head of a valley, where he said there was a mysterious rock with a hole in it, where the roaring of a mighty river might be heard. The aperture was a crack in the table-rock of limestone, about three inches, by two; its sides were worn smooth by listeners who had placed their ears upon it from time immemorial. On following the example of the thousands who had probably preceded me, I was saluted by a strong draught of air, which rushed upwards from unknown depths, and heard to my surprise, the mighty roaring-sound that had given the rock its mystical reputation; but I felt at once that no subterranean river large enough to produce the rushing of such a torrent, was likely, for physical reasons, to exist in that locality, for the noise, is that of a distant Niagara. I was puzzled till I ascended a neighboring hill, where the roar of the sea was distinctly audible; and I am therefore disposed to think that the fissure must have led to a cave on the seashore, from which the sound is conducted, as by a whispering gallery, to this point, distant from it about three miles.*

The media subscribes to our need for stories, even the New York Times. Take, for example, an April 15, 1928, feature article.

> *Underground Rivers are Found to Originate in Three Ways*
>
> *One of nature's oddities is the underground river, many of which have been found beneath the United States. Streams under the earth's surface arise in three different ways. One of them is by water seeping through limestone rock and running under the surface, to emerge some distance away. Charles P. Berkey, Professor of Geology and Mineralogy at Columbia University says that "the underground waters move through the fractures and joints of the rock*

and gradually dissolve some of it, making in this way more and more room for the flowing water. This kind of action forms caves, many of which are extensive indeed."

In many limestone regions small streams developed on the surface have disappeared into the ground. Subterranean rivers are also formed in sandy and gravel districts, the river sinking through the sand and gravel to reappear further away.

The third way in which underground rivers take form, according to Julian D. Sears of the United States Geological Survey, is disclosed in districts where large areas have been submerged by lava which is likely to break up on cooling in such a way as to be very permeable. In some of the lava-covered areas the water sinks as rapidly as it does in limestone and tends to follow the pre-existing streamways and eventually to emerge in large springs. Underground streams of this type are found in Idaho, Oregon and California.

These rivers are often traced by following' sinkholes-depressions shaped like saucers with holes in the bottom. Sometimes underground rivers wear away the earth and rock above them and make their subterranean courses visible. They may be traced when invisible by putting coloring matter in them, uranin dye being adapted to the purpose. Last year, in Manchester, England, an underground river traced in this way was found to be more than eight miles long.

What Prof. Berkey states is entirely true -- subterranean waters flow in one of three ways:

As percolating groundwater,
Via karst passageways and
In volcanic tubes.

Geologists of 1928 knew their geology. What misleads us is the professor's order presentation and degree of pursuit. Seeping rivers are "also formed in sandy and gravel districts." Nearly all of us who drink well water, public or domestic, draw from this "also," but here the subject is given the pazazz of grainy dirt.

The New York Times instead plays for the dramatic. "Caves, many of which are extensive," "pre-existing streamways," "uranin dye" (a florescent yellow-green chemical that sounds vaguely radioactive) and "eight miles" are phrases we remember. Arkansas contains at least three Blue Lakes, one in karst uplands and two in abandoned Mississippi meanders, but this blue lake appears to sport hydrogeologic characteristics of both terrains. No matter the confusion, what the reader's mind is wired for is the Mississippi's "ebb and flow."

Why would the reader not come away believing all the more in rivers rushing underground if it's in the New York Times?

Who among us doesn't relish a mystery?

Let us quote from ”Kansas' Underground River, Lies Below a Stratum of Rock Deeper than the Bottom of the Kaw River," Los Angeles Times, November 3, 1913.

The underflow, the underground stream of water running beneath the length of the State of Kansas, and supplying water for many municipalities, and in the western part of the state drawn on by farmers and irrigationists, is lowering. It is getting deeper into the ground every year... The underflow seems to "run on its own hook." Where it starts and where it stops no one knows.

The phrase "no one knows" regarding the alpha and omega of underground streams has appeared some half-dozen times in our journey. "It's a fact that..." dampens our imaginations. "No one knows" opens them.

Who among us doesn't want to believe a good yarn? Take, for example, "Subterranean Streams in South Carolina," Popular Science Monthly, June 1876,

The next spring of which I know the existence is at "The Rocks" plantation, some twelve miles away, and the last of the chain is the famous "Eutaw Springs," where a battle was fought during the Revolution. At the latter place there are two openings, some distance apart, and tradition

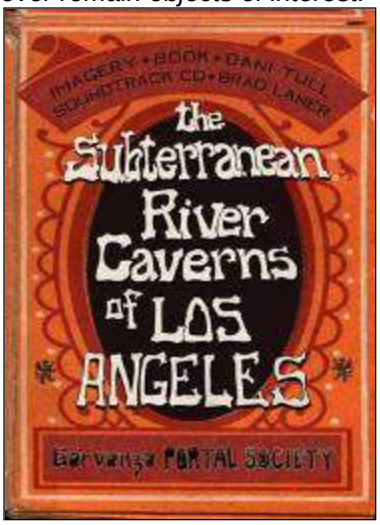
says that an Indian once dived into one and emerged from the other... The indications seem to be that this enormous subterranean cave or water-course is hollowed out through a narrow stratum of limestone-rock which winds its way in a southeasterly direction; but it may be of far greater extent. Near Pineville, some ten miles from the nearest spring, and considerably off the course, there is a certain spot in the public road where the sound of the horse's feet is precisely like the noise made in crossing an earth-covered bridge, and tradition tells of treasure buried there in Revolutionary times.

A Revolutionary battle! The Indian! The horses' hollow hoof beats! Buried treasure! This underground river has it all.

Who among us doesn't want to believe in something wonderful? Take, for example, "The Helderbergs," Harper's New Monthly Magazine, October 1869, a report of a limestone escarpment in New York State.

Cave explorations are interesting to those who love to see the wonder of nature -- things before unseen, new and surprising. Who knows, someone thus exploring may discover a great, subterranean transcontinental river; an underground, round-the-world canal, cheapening freightage between New York and San Francisco. Whether you should find this wondrous stream or not, a visit to the under-world will not be forgotten; the hornstone and the fossils collected, nay, the grimy, shattered lantern that you carried, will ever remain objects of interest.

In The Subterranean River Caverns of Los Angeles (2006), Dani Tull chronicles his invented-reality explorations into the secret network of caverns below the urban surface -- not secret to us however, as we were there in Chapter 97, Extraterrestrials and Lost Rivers of the American West.



An accompanying soundtrack provides a sound track of the imagined sounds, the audio fascination noted in Chapter 37.

Many Angelinos believed Tull's maps to be tangible real and searched for the "portals" marked with an X, a fitting real-world culmination of constructed mythology.

Add to our natural inclination to believe in underground rivers the fact that we, as a literate culture, have been long primed with misinformation.

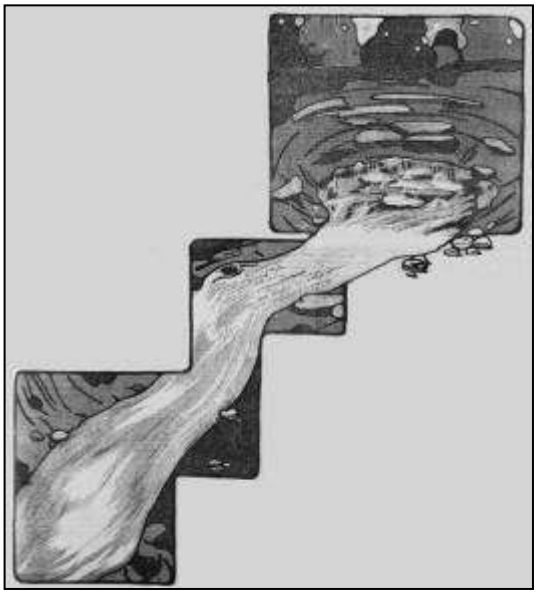
Brooklyn Daily Eagle, June 5, 1872 Miscellaneous Items	New York Herald, February 16, 1877 Personal Intelligence
The mortal remains of 117 steamboats adorn the bottom of the Arkansas River.	*Iberia, La. has a white negro with white hair.*
A natural spring that will intoxicate, situated near Kern River, Cal., is delighting the Indians of that vicinity.	*It is believed that the Jura Mountains of Switzerland are undermined by subterranean streams.*
Those best acquainted with the topography of the Colorado desert are confident that a large subterranean stream runs under it, and that the entire desert may be reclaimed by artesian wells.	*England is getting salmon eggs for her rivers from the Rhine and expects to make even the Thames a fine fishing place.*

Minneapolis Journal, August 24, 1901 The World for a Week *Probably the most valuable street crossing in the country is one at Manhattan, Kan. which consists of flat stone slabs bearing petrified footprints of prehistoric birds. They were collected by a geological student, attached for freight duties and finally taken by the town marshal to repair the crossing.* *A mighty subterranean stream has been found in Ohio in the vicinity of Chardon, a suburb of Cleveland. Wells have been dug which at a certain depth began to roar. In one of these the bottom dropped out, revealing a stream which was so swift it could not be sounded.*	Salt Lake Telegram, January 9, 1925 Interesting Facts *An underground river is believed to pass beneath France.* *Luminous gloves are being worn by Parisian motorists.* *The "military pace" is reckoned at two feet, six inches.* *Ants can swim, using their six legs like a six-oared boat.* *Women are in charge of one of London's largest animal hospitals.*
Salt Lake Telegram, April 9, 1927 Facts of Interest *An old Irish legend of about 944 A.D. gives an account of a vision of a ship or airplane in the sky.* *An underground river has been discovered passing under Mount Blanc, the highest mountain in the world.* *Traffic congestion on highways and streets of the United States is responsible for an annual loss of four billion dollars in time and wasted fuel.*	Science News-Letter, January 9, 1928 *A recent study of college students shows that one of the chief causes of failure in college is inability to read.* *The course of an underground stream in England was traced for eight miles by placing coloring matter in the water where an opening occurred.* *A duck hospital for ailing ducks was established recently by California's fish and game department.*

Impress your dinner-table companions with such bits of knowledge.

Indiana's Lost River provides us an opportunity to note the bane of journalistic misfeasance associated with subterranean watercourses.

The text of "The Mystery of the Far-Famed Indiana River Which Loses Itself," Saint Paul Globe, July 25, 1902, is wrapped around the graphic to the right. We will peruse the article for journalistic assertions common to underground river stories.



For years geologists and other men of science have sought an explanation to the mysteries of Lost River, but today the remarkable stream is almost as great a mystery as ever.

The only explanation that can be accepted as the true cause of the strange pranks of Lost River is the fact that this entire underground section of Indiana is hollow -- literally honeycombed. In fact, with caves and caverns into which Lost River plunges, only to suddenly reappear again in some unexpected place.

The theory had been advanced, in fact, it is now known almost beyond a doubt, that the subterranean passages through which Lost River flows, and that the numerous caves in the vicinity of the stream, are but a part of the system of caverns branching off from the Mammoth cave of Kentucky. In proof of this claim, the same varieties of blind fish have been found in Lost River which swim the gloomy river Styx of the mammoth Kentucky cave.

Near Orleans, Lost River drops from sight into a great dark cavernous hole, which has the appearance of the entrance to Satanic regions -- and from which the river gains its secondary name -- the river Styx.

Lost River boils up from the bowels of the earth like a mammoth spring, and flows away a stream thirty or forty yards in width. The river entirely fills the cave from which it bursts forth, even in the driest seasons. Here the river forms an immense pool, the depth of which is unknown. Boats have been rowed over the boiling surface of the water and lines with lead weights attached have been let out for over 860 feet, but no bottom was torched. The stream has the appearance of a huge spring as the waters boll and swirl up in three great bubbles from unknown depths below.

Half a mile north of Orangeville is a spot known as the gulf. It is a great deep funnel-shaped valley, the bottom of which the waters of Lost River again rise and flow above the surface in a serpentine course for about fifty yards. Then the river rushes into a fissure in the rocks and hides underground again. For many years it was thought these were the same waters that appear at Orangeville, but sawdust and oats cast in the waters at the gulf have always failed to appear at the rise far below.

The Widow Scott, who lives four miles from Orangeville, was in the habit of keeping her milk in the mouth of a cave near the rear of the house, which was cold and well adapted to the purpose. For crock covers she used the large square tops from tobacco boxes.

One morning the widow visited her milk house and was surprised and perplexed to find its floor swept clean. Not a vestige of crocks, covers or milk was to be seen. A heavy rain had come up the night before and, running into the cave, had carried away the widow's milk crock covers. The next day, however, they were found floating peaceably in the river near the old Springer chapel, over three miles from their accustomed place, and none the worse for the subterranean journey.

Standard journalistic misrepresentations:

Reference to a hollow earth, the theme of Chapter 15, Hollow Earth Geophysics. "This entire underground section of Indiana is hollow," paints a picture more dramatic than, say, "This entire underground section of Indiana contains many caves."

A link to Mammoth Cave. Mammoth Cave is 200 kilometers distant and has a karst drainage area of roughly 20 by 20 kilometers. There is no link to this Lost River, though as noted in Chapter 55, Mammoth Cave connects to another Lost River.

Like fish as proof of connection. As noted in Chapter 50, Wrecks of Ancient Life, eyeless fish are indigenous to many cave systems in the region.

The Styx comparison, the familiar literary allusion pursued in Chapter 60, A Superfluity of Surface Stygian Streams.

The pit of "depth unknown." The weight didn't fall vertically; it was likely carried downstream.

The error of a false negative, in this case that not recovering sawdust and oats disproved hydraulic connection to a nearby spring.

The personal tale of an unfortunate, a readership favorite. That Widow Scott's milk crock covers could have been washed downstream by overland streamflow eluded the reporter.

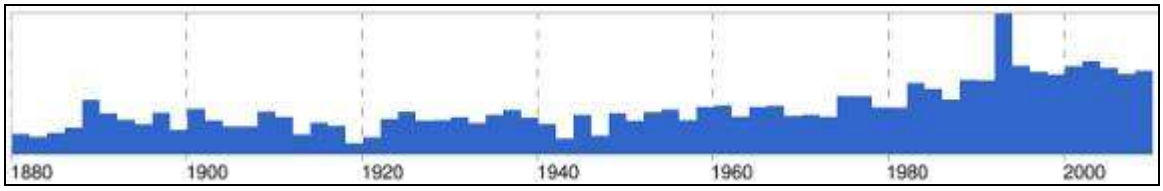
The Globe's account added little to public edification, but it did well in enhancing popular misconceptions.

And it's not just an issue of elementary education. From "New Machine Sparks Rivalries at CERN," Science, June 16, 1989, an update on the 100-GeV Large Electron-Proton Collider; European Laboratory for Particle Physics in Geneva,

> *The construction of the accelerator, too, which is buried underground at depths ranging from 50 to 170 meters, and extends from the plain next to Lake Geneva right up to the edge of the Jura Mountains, has had its headaches. To meet opposition from local residents, all the electric cabling had to be buried in trenches. And digging was halted for several months in late 1986 after construction crews unexpectedly came across an underground river.*

If today's prime scientific publication refers to an "underground river," how can we disagree?

Here's a timeline of news articles with "underground river" in the title. The raw numbers are not particularly meaningful, as they are proportional to the breadth of the database, but the increase over time itself tells a story. The relative rash over the last several decades was spurred by discoveries in karst regions. The spurt in 1992 was driven by the shenanigans of the Texas Water Commission (Chapter 69, The Law of Subterranean Streams).



We've spent more than 50 chapters looking at the topic through a variety of perspectives. Had we input from experts in other fields, say health science, we'd have had even more chapters -- and we invite such input -- but we don't need additional vantage points to recognize the commonality.

We persist in envisioning underground rivers because we're inundated with such references.

Why do we believe what we believe?

As children and as adults -- it seems to make little difference -- we're wired to envision underground rivers and what we're told so often misleadingly reinforces the concept.

Looking at the journey we're now completing, was it not the dramatic portrayals that best caught our fancy?

In Chapter 16, The Maelstrom, we reflected on human fascination with the might of nature.

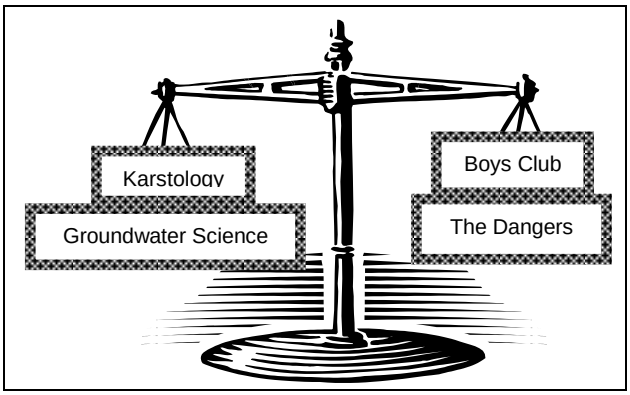
In Chapter 92, Underground Rivers of Gold, we noted how the precious metal commands our attention.

In Chapter 97, Extraterrestrials and Lost Races of the American West, we observed how outlandish tales engage our imagination

Stories of underground waters tend to be more engaging than the facts behind them.

Let us test our own propensity.

Select two or three chapters from out study that presented an array of solid facts and meaty quotes. Choose another two or three that dealt more with stories. A pair of each type of chapter is illustrated at the right. We're going to weigh our reactions.



Which chapters did we find more engaging? Which contained items we yet remember? Which chapters might we want to revisit?

Our journey's made us better informed regarding karstology, but it's the segments dealing with stories, the ones on the right arm, that better registered. We factually know that underground rivers comprise but a minute portion of the world's water resources, but at the same time, such waterways retain a big place in our consciousness.

CONCLUSION

Surely we've yet missed much on our subterranean journey, but we've seen perhaps more than we thought we'd encounter.

We've seen Charon at the oars, reminding us that from days long before Homer, subterranean streams have linked us with the afterlife.

We've seen how Judeo-Christianity, a centerpiece of Western culture for the last 2000 years, appropriated Greek concepts of natural philosophy, and in particular, how unseen underground rivers fit into the earth's scheme.

We've seen how burgeoning science strove to explain the mechanism by which water returned from the sea to the springheads. We've seen how theological preconceptions delayed the process and at one time, how what little knowledge had been garnered was preserved.

We've seen some strange physics and we're seen what we not believe to be the correct understanding.

We've seen the wholesale incorporation of underground river lore into fiction, some of literary merit, some at best suited for adolescent boys.

We've seen what poets and artists have done with underground rivers.

We've seen a good bit of geology and a bit of biology.

We've seen how we've made use of subterranean waters. We've seen the dangers in doing so.

We've seen that the Rio San Bonaventura may be flowing under our feet.

We paddle in Charon's wake

 .

FINAL EXAM
DAY TRIPS FROM MONTICELLO

This final examination isn't for a grade. If we've made it this far, we most certainly have earned the credit/

Rather, let us test the validity of the basic hypothesis suggested at the start of our journey -- that underground rivers are woven into the fabric of our being. In one sense or another, we're never far from one.

In the previous chapters, we've cited "Monticello" locations multiple times. It's an historic name -- the Virginia residence of Thomas Jefferson -- and an atlas reveals no less than 20 American towns, lakes or dams by that name.

We'll engage in a quick exercise -- nothing scientific or rigorous, we admit, but enough to see if our hypothesis is justified.

Is there an underground river within a day trip from each Monticello?

Our constraints:

We'll use only information from the previous chapters.

We'll allow "underground river" any of its meanings.

We'll define "day trip" as within the same state.

Here's where our day trips might lead us.

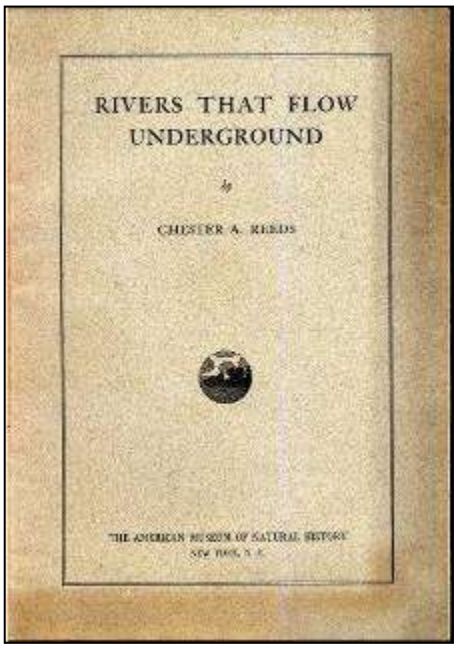
From	To -- km	To Visit	Chapter
Monticello, AR	Harrison, AR -- 370	Hurricane River Cave's artificial waterfall	57
Monticello, Dam CA	Monticello Dam, CA -- 0	The maelstrom	65
Monticello, FL	Wakulla, FL -- 70	Wakulla Springs. Dive with care.	57
Monticello, GA	Cave Spring, GA -- 230	Good water	74

Monticello, IL	Monticello, IL -- 0	"After digging down 65 feet and boring 22 feet he came to a body of water, which burst forth with a rushing current and rose 50 feet in thirty minutes."	80
Monticello, IN	Bedford, IN -- 260	Bluespring Cavern's 4.8 kilometer boat ride	57
Monticello, IA	Monticello, IA -- 0	Hometown of Old Jumbo's diviner	40
Monticello, KY	Mammoth Cavern, KY -- 150	There's nothing like Mammoth.	55
Monticello, LA	Delcambre, LA -- 410	Lake Peigneur. Drill with care.	74
Monticello, ME	Eagle Lake, ME -- 130	Home of the 19th-century Yankee who in response to fanciful theories of lakes fed by underground rivers, judged, "Well, I guess it rains in."	49
Monticello, MN	Harmony, NM -- 270	Is Niagara Cave connected to the other Niagara?	82
Monticello, MS	Natchez, MS -- 130	"Hurrying toward the subterranean stream, were other streams, small and great, but all deep, hurrying to and from that great mother-stream underneath, just as the small and great overground streams hurry to and from the mother Mississippi."	86
Monticello, MO	Hannibal, MO -- 75	Mark Twain Cave	17
Monticello, NY	Monticello, NY -- 0	Where the Monticello and Port Jervis Railroad encountered the incrusted lake	80
Monticello, NC	Whiteville, NC -- 290	"When in the vicinity of the supposed stream it can be plainly heard, but when a person lies flat upon the ground the phenomenon becomes really alarming."	40
Monticello, TX	Austin, TX -- 500 Ft. Worth, TX -- 230	"Render unto Caesar that which is Caesar's" -- Texan law of subterranean streams "and unto God that which is God's" -- God is a Great Underground River	69 30
Monticello, SC	Prineville, NC -- 210	"There is a certain spot in the public road where the sound of the horse's feet is precisely like the noise made in crossing an earth-covered bridge, and tradition tells of treasure buried there in Revolutionary times."	99
Monticello, UT	Cedar City, UT -- 550	Cascade Falls, where lava abuts karst	43
Monticello, VA	Natural Bridge, VA -- 130	Once owned by Thomas Jefferson	40
Monticello, WI	Spring Valley, WI -- 241	Crystal Cave's artificial pools and carpeted walkway	52

Twenty out of 20 Monticellos are each in some way near an underground river. Most city names won't score as well, but the count seems to confirm our hypothesis -- We are never distant from such waters.

POSTSCRIPT

Subsequent to posting an early draft of this document, I came upon a reference to Chester Albert Reeds' Rivers that Flow Underground (1928), published by the American Museum of Natural History. Of the academic libraries having linked catalogs, the item's held by only Johns Hopkins, the American Museum of Natural History, Case Western and the University of Oklahoma.



But given the title, I had no choice but to pursue the document. Reeds turns out to have been the museum's Curator of Geology and Invertebrate Paleontology and his work -- one of many, as he was a tireless publicist for natural science -- is a 16-page booklet inspired by an Explorers Club outing to Virginia's Endless Caverns. Illustrated with 16 photos and a map, Rivers that Flow Underground was written for the curious public.

In researching my book, Endless Caverns hadn't risen to my attention as it offers little unique regarding karstology or hydrology, and in fact, hasn't even a boat ride. It's just another Shenandoah Valley excursion for Washingtonians. The advertised "55 degrees year 'round" sounds inviting on a muggy summer day, but $16.00 seems pricey for just a stroll.

Endless Caverns

As with many American cave attractions, Endless Caverns' better days were in past decades.

Our last postcard

But in 1928, the caverns were very much an adventure for Chester Reeds.

> *By means of a rope, the party wound its way down over slippery walls to the clear stream at the bottom. Here the water was cool and shallow, and the ceilings so close at times that we were obliged to stoop. In some places the ceiling was as low as eighteen inches, and the only way we could precede was to lie flat in the rushing water and squirm along. Then we would come out into fairly large chambers where we could stand up and stretch. It took one and one-half hours to cover two hundred yards in this manner. Progress upstream was stopped by the ceiling descending abruptly into a deep pool of water. It may have been possible to dive under*

> *this obstruction, but it was not deemed wise to attempt it before exploring a side avenue. But this was blocked by a growth of huge stalactites and stalagmites, and, after noting raccoon tracks in the red mud, 'we essayed to return to the point of entry and to proceed downstream in an endeavor to find the outlet. This part of the trip was more interesting, for the chambers were larger and the ceilings were not so low. The red mud, however, was more plentiful and the sloping shelves more treacherous. Twice we reached places where it was impossible to follow the actual stream bed, but in both instances we found passages above which led to the water beyond. After much scrambling we came to a "Fairy Fount," to a perfect likeness of an "Elephant's Head," and to a "Silent 'Waterfall," over which the stream dropped some ten feet. Having left our ropes dangling at the point of entry, we could not proceed farther, so we placed the following label in a bottle and turned back:*
>
> *This bottle is placed at the farthest point penetrated by members of the expedition of the American Museum of Natural History and the Explorers' Club of New York, May 1925. If anyone finds it and can carry it still farther, please report to the American Museum of Natural History.*

To establish the existence of underground rivers, Reeds cites ancient Greece, the karst regions of Europe, Mammoth Cave and even lava tubes. Much like this book, actually.

That all but one of Reeds' examples were known to me is of no matter. Nor are his occasional errors, e.g.,

> *The swiftly moving, acidulated waters have carved many a tortuous tunnel and left behind many a spacious chamber.* -- "Subterranean Streams of the Endless Caverns, Virginia," Bulletin of the Geological Society of America 37:1, 1926

What's of matter is that century before me, someone was on the stream that I'm yet traveling.

While it seems non-sequitur to credit in postscript a source not known to me at the time of my compilation, I'll do so none the less.

As written in the Explorers Club bottle,

> *If anyone finds it and can carry it still farther, please report to the American Museum of Natural History.*

I indeed found the bottle.