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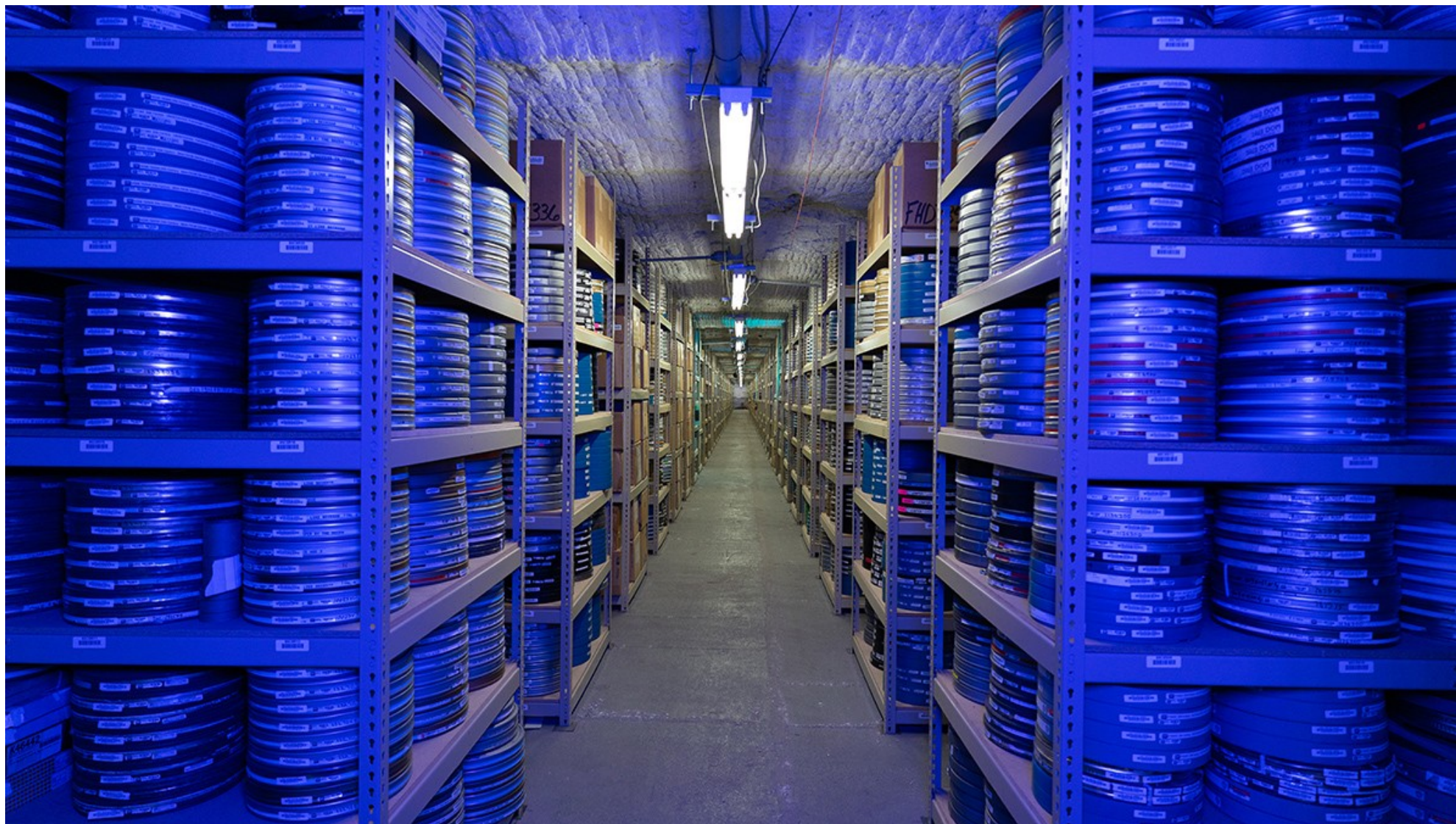
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Salt of the Earth: Vast Underground Salt Caverns Are Preserving Our History—and Just Might Power Our Future

From health spas to film storage, salt mine caverns have been put to use in surprising ways—and they're now poised to contribute to the generation and storage of clean energy.

By Korena Di Roma Howley

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Thousands of film reels are stacked in an Underground Vaults & Storage (UV&S) storage bay in the Hutchinson, Kan., salt mine. Credit: Courtesy of UV&S

In spring 2025, torrential rains fell on central Romania's Harghita County in Transylvania, causing the waters of the Corund River to flood its banks. Speaking to reporters at a press conference in early May, county prefect Petres Sandor [estimated](#) that the river,

Ionic Compounds: Worth Their Salt?

[Salt of the Earth: Vast Underground Salt Caverns Are Preserving Our History—and Just Might Power Our Future](#)

which winds through towns nestled in the foothills of the Carpathian Mountains, had swelled to more than a hundred times its normal flow.

The river had also begun to seep into the [Praid salt mine](#), home to one of the largest salt reserves in Europe and the economic lifeblood of surrounding communities.

In the weeks that followed, [access to the Praid mine was suspended, staff and nearby households were evacuated](#), and the underground dams built in haste to stave off flooding [collapsed](#). Officials made efforts to redirect the river and save the mine, but the damage had been done: By July, the flooded mine was forced to close indefinitely.

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Transylvania’s Praid salt mine was one of the region’s most popular tourist destinations, attracting half a million visitors annually.

—a medical center; an Orthodox church; a movie theater; a museum; and an adventure park featuring arcades, zip lines, and a planetarium.

[How the Rise of a Salty Blob Led to the Fall of the Last Ice Age](#)

[Insights for Making Quick Clay Landslides Less Quick](#)

[Snowball Earth’s Liquid Seas Dipped Way Below Freezing](#)

[Episodic Tales of Salt](#)

[What Salty Water Means for Wild Horses](#)



Romans were the first to mine for salt at Praid beginning around the 2nd century CE. When the area was under Hapsburg rule in the mid-1700s, larger-scale extraction began, and it continued until the mine’s recent closure, producing up to [100,000 metric tons of salt](#) per year at its peak.

But in the modern era, Praid was not only an operational salt mine. It was also one of the region’s most popular tourist destinations, attracting half a million visitors a year to repurposed caverns that housed—nearly 122 meters (400 feet) belowground



Before it flooded in spring 2025, Romania's Praid salt mine was a hugely popular tourist destination that housed amenities including a planetarium, a movie theater, a medical center, and an Orthodox church. Credit: [Thomas Hackl/Flickr](#), [CC BY-NC 2.0](#)

There are two main categories of caverns formed via salt extraction, and both possess unique properties. These include pure, dry air, very

low permeability, and—given the right conditions—structural stability. Some caverns, like Praid, are by-products of rock salt mining that began millennia ago and continues today. Others have been intentionally created for storage purposes, with the by-product being the salt.

Around the world, these properties have made salt caverns ideal for storing anything from archival film footage to the United States' [Strategic Petroleum Reserve](#).

Other uses are on the horizon. As the global community grapples with the need to alter its energy habits in the face of climate change, it may be that at least one clean energy solution lies right beneath our feet.

Old Salt

Between 10,000 and 12,000 years ago, humans began cultivating crops and domesticating animals. As diets changed for both humans and their livestock, the need for large quantities of salt grew.

“Previously, with hunter-fisher-gatherers, salt came into the diet mostly through meat, nuts, and small fruits,” said [E. Cory Sills](#), associate professor of geography at the University of Texas at Tyler. “But with a move to more carbohydrate-based diets, salt needed to be found and manufactured.”

And once the use of salt as a food preservative became widespread, an industry was born, with efforts to find and mine the mineral cropping up across Asia, Central America, and Europe.

The world's oldest salt mine is said to be Hallstatt, near the Austrian village of the same name (meaning “salt town”). In fact, Neolithic peoples likely settled at Hallstatt, located in a high Alpine valley, thanks to the presence of salt, as most communities at that time opted for the fertile plains.

[Artifacts uncovered at Hallstatt](#) include a deer antler pickaxe that dates to what were perhaps the earliest salt extraction efforts, around 5000 BCE, as well as textiles, human remains, and the oldest known wooden staircase in Europe. Researchers [date the start](#) of

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Artifacts uncovered at Hallstatt include a deer antler pickaxe that dates to 5000 BCE.

Romania. Centuries later, as nations industrialized, technology helped miners dig deeper and identify where to drill. “Due to modern technology since World War II, geophysical equipment like ground-penetrating radar can look into the Earth and detect salt domes,” said Sills.

Some mines, like Hallstatt, have continued to produce salt. In both active and discontinued mines, the process of hewing away at walls of the mineral over the course of millennia, centuries, or mere decades has resulted in enormous underground caverns that, as it turns out, have some savory benefits.

We’re Not on the Surface of Kansas Anymore

Nearly 200 meters (650 feet) below the grassland near Hutchinson, Kan., 20 hectares (50 acres) of hollowed-out salt caverns store government records, private assets, beloved film reels and movie props, and much more.

“We will store anything that’s not illegal, flammable, or explosive,” said [Jeff Ollenburger](#), president of [Underground Vaults & Storage](#) (UV&S), which has operated a storage facility in the Hutchinson salt mine since 1959. At the company’s inception, the space was primarily used to store oil and gas records. Today its storage possibilities are limited only by the dimensions of its elevator—approximately 2.5 × 1.3 meters (8 × 4 feet).

organized salt mining in the region to around 1500 BCE, and the activity contributed to the wealth of the community for more than a thousand years. Findings at Hallstatt reveal the progression of early mining activity, which by 400 BCE included tunnels more than 198 meters (650 feet) deep.

Salt mining operations in Europe developed further during the Middle Ages, particularly in western Poland and what is now

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UV&S has operated a storage facility in the Hutchinson salt mine since 1959. The company transports items including film reels, movie props, and government records down into its storage bays via its elevator, which measures about 2.5×1.3 meters (8×4 feet). Credit: Courtesy of UV&S

The Hutchinson mine, along with its companion museum, [Strataca](#)—which exhibits movie paraphernalia such as a shirt worn by James Dean in *Giant*, costumes from *The Matrix*, and props from *Men in Black*—is perhaps the United States' most well known example of a rock salt mine living a second life.

But salt mines in Europe and other parts of the world have also carved out alternate existences.

Like Praid, the Wieliczka salt mine in Poland is a major tourist destination, though traditional mining operations there have largely ceased. Among the attractions for its more than 1 million visitors each year are a saline lake, elaborate salt sculptures and friezes, [banquet halls](#), and entire chapels carved into the rock—much of it lit by multitiered salt-crystal chandeliers.

Other tourist destinations include Colombia's [Salt Cathedral of Zipaquirá](#) and Romania's [Turda salt mine](#), once used as an air raid shelter and for cheese storage and now a theme park complete with a Ferris wheel and an amphitheater.

Among its many materials, [DeepStore](#), in England's Winsford salt mine, holds the fashion archive of Laura Ashley, including hand-painted wallpaper, clothing, and other items spanning the company's 70-year history. With his [Memory of Mankind](#) project, Austrian artist Martin Kunze aims to save modern human heritage from potential oblivion by transferring the accumulated digital record onto ceramic tablets to be stashed for safekeeping at Hallstatt.

Salt mines have been used as both [storage sites for radioactive waste](#) and—as with Praid—medical centers and health spas that tout the underground environment's alleged therapeutic properties, including [air that helps to absorb bodily toxins](#). In Belarus, the [National Speleotherapy Clinic](#) makes use of underground salt caverns, claiming to provide relief for patients with respiratory ailments and allergic diseases.

During World War II, Nazis stashed looted valuables in salt mines like Austria's Altaussee, as the mines were protected from allied bombs and inclement weather. Thousands of paintings and artifacts were eventually recovered from these sites by an international group of curators and historians known as the [Monuments Men](#).

A decade later and an ocean away, an American veteran of the same war was one of several local business leaders seeking a safe place to store physical records in Hutchinson, according to Ollenburger of UV&S. The veteran recalled the recovery of artifacts from salt mines in Europe and suggested using caverns from the local mine, which had been operating since the 1920s, for storage.

The mine is located within a salt deposit known as the [Hutchinson Salt Member](#), which covers more than 95,000 square kilometers (37,000 square miles) at depths of between 152 and 305 meters (500–1,000 feet). It was once believed that the salt in this region was found in isolated pockets, said Ollenburger. But drilling and modern technology revealed the true extent of the deposit, which was formed [around 275 million years ago](#), when shallow seas evaporated under the extremely dry, hot conditions of the Permian (~298.9–252 million years ago).

The Hutchinson Salt Company, owner of the mine in which UV&S operates, extracts rock salt that is primarily used for deicing roads in winter. This form of mining leaves behind large cavities that are ideal for storage, with natural temperatures of around 20°C (68°F) and 45% humidity. UV&S currently occupies 50 of approximately 900 available acres, with individual storage bays that are each about the size of a football field.

And the Hutchinson Salt Company is still mining, Ollenburger said. “We will never run out of space.”



Salt caverns around the world have been repurposed in a variety of ways. Colombia's Salt Cathedral exists in a former salt mine in Zipaquirá about 180 meters (600 feet) underground. Credit: [Bernard Gagnon/Wikimedia Commons, CC BY-SA 4.0](#)

Because Hutchinson was developed as a rock salt mine only within the past century, its planners selected the location in part to avoid a fate like Praid's.

Elsewhere in the United States, salt mines may contend with differing levels of humidity, moisture, and temperature, Ollenburger said. “We just do not” face such issues, Ollenburger said, “because of the geology above us.”

The Hutchinson mine, Ollenburger said, is incredibly stable. “It’s a very inert, safe environment to be in,” he said. “And it’s very elastic. We’ve had small earthquakes from time to time in the region, and the whole salt cavity kind of moves together.”

The same properties that make salt caverns ideal for preserving archival documents and film reels also lend themselves to storing an entirely different kind of treasure: the resources that fuel the world.

A Subterranean Solution

In 1888, the modern practice of solution mining began in New York, and several years later it was put into use in China. Canada took up the practice in the mid-20th century, and it’s now [a widespread method of salt production](#). Solution mining involves drilling a well into a deposit, pumping freshwater through it to dissolve the salt, and then removing the resulting brine. Salt’s [low permeability and porosity](#), combined with a natural plasticity that enables self-healing of fractures, means the resulting cavern is airtight and watertight.

Solution mining is still practiced in parts of the Hutchinson deposit today. The brine might be used in chemical processes or mineral production. Or it might be disposed of.

That’s because a number of the caverns created by solution mining—and their storage possibilities—have themselves become the purpose of the practice.

When it comes to energy storage, salt caverns are fairly agnostic. In the United States, caverns along the Texas and Louisiana coastlines are used to store the nation’s Strategic Petroleum Reserve in the form of [402 million barrels](#) of crude oil. Elsewhere in the United States,

as well as in Europe and China, salt caverns are reservoirs for natural gas. Because hydrocarbons like oil [can accumulate around salt domes](#), caverns are also manufactured [to store waste](#) from nearby oil fields.

But applications for salt caverns that target more sustainable energy sources are also being put into practice.

Near the city of Changzhou in China's Yangtze River Delta, development of what will be the world's largest [compressed air energy storage](#) (CAES) facility has been underway since 2022. CAES optimizes existing sustainable energy sources, such as solar and wind power, by using the energy captured during higher production phases (i.e., periods of high sunlight or strong wind) to compress air. That air is then injected into a storage facility. When demand for energy peaks or when solar and wind production is low, energy generated by releasing the compressed air through turbines can fill the gaps.



Compressed air energy storage (CAES) facilities, such as this Hydrostor facility, store energy generated by wind and solar power in the form of compressed air, sometimes storing it in underground caverns. Credit: Hydrostor

CAES is a cleaner energy alternative that can contribute to power grid stability in part because of its [capacity](#) for longer-term energy storage relative to battery-based systems. And one key to the technology's success lies in resilient, leakproof salt caverns.

The CAES facility in Changzhou, known as the [Jintan Salt Cave CAES Project](#), entered its second phase in early 2025. The salt cavern facility, created using solution mining, is expected to have an annual output of approximately 924 gigawatt-hours of energy per year. In the United States, this would power around 84,000 homes per day.

Another CAES project, Nengchu-1 in the central Chinese province of Hubei, [began operations in January 2025](#) and will [have an output of around 319 gigawatt-hours of energy annually](#). Unlike Jintan, Nengchu-1 repurposes the existing caverns of an abandoned underground salt mine.

Though salt caverns meet the [strict geological requirements](#) of CAES facilities, more widespread use of the technology faces other hurdles. In addition to site limitations and the high cost of development, CAES poses safety risks including combustion and fire.

A Home for Hydrogen

Salt caverns are also ideal for storing hydrogen, another clean energy alternative. Like CAES, [hydrogen energy solutions](#) leverage solar and wind power and the favorable properties of salt caverns. During highly windy or sunny periods, energy generated by wind turbines or solar grids can be used to split water into hydrogen and oxygen. The hydrogen can then be stored in salt caverns and converted back to electricity during peak demand hours.

But not all caverns are created equal.

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Not all caverns are created equal.

Solution mining in a salt dome creates cylindrical caverns ideal for storing and later delivering gaseous hydrogen, [which can be used to supplement energy supplies when demand is high](#).

Unlike a salt dome, which is formed by [salt tectonics](#) and gravity and has a more vertical structure and homogenous composition, a salt bed like Hutchinson is characterized by horizontal layers of varying solubility and strength. Here, solution mining operations can be subject to geological constraints, explained [Tingwei “Lucy” Ko](#),

research assistant professor with the Bureau of Economic Geology at the University of Texas at Austin. Until drilling begins, no one knows how much the composition of a salt bed may vary, or where its weak layers are located. That variability, said Ko, “can cause a cavern to collapse.”

As with caverns used for storing other hydrocarbon reserves—such as those along the Gulf Coast of the United States—these reservoirs targeted for greener energy are created for storage purposes, and [the resulting brine may wind up in leach ponds or saline aquifers](#), a practice that comes with its own environmental cost.

In fact, balancing the costs and benefits of hydrogen storage requires consideration of multiple factors, including safety. Hydrogen is highly flammable and must be stored under very high pressure, bringing the risk of combustion. Frequency of access is also a concern.

“If you use hydrogen as a fuel and you need to withdraw and inject the gas frequently, that could compromise geochemical properties,” Ko said.

Still, the benefits could be significant when it comes to cultivating a decarbonized and stable energy supply.

“With solar and wind, there’s a lot of curtailment, a lot of wasted energy and not enough capacity,” said Ko. “Geologic storage is a pretty great option.”



In some regions, including Utah, seen here, solution mining in salt domes leaves behind caverns that are used to store hydrogen. Credit: [Archaeopoda/Wikimedia Commons](https://commons.wikimedia.org/wiki/File:Archaeopoda/Wikimedia Commons), [CC BY-SA 3.0](https://creativecommons.org/licenses/by-sa/3.0/)

Currently, there are only a handful of locations globally where salt cavern hydrogen storage has been put into practice, including the Gulf Coast, Texas, Utah, and the United Kingdom and Germany. All are areas where extensive salt domes are present. Which brings another issue to the surface: geology itself.

“Salt is not everywhere,” said Ko. “And it’s not always in the same place as wind turbines.”

Mining the Future

Without its economic lifeline, the town of Praid is looking to [lure visitors with new experiences](#) that take advantage of the region’s outdoor, gastronomic, and wellness offerings.

Like other incidents that came before it, the Praid flooding showed that there’s still much to learn about mitigating disaster in salt mines. And while technology is easing the way toward more widely spread energy storage in salt caverns, there remain enormous—and costly—challenges to overcome.

For Ollenburger, the future of salt cavern storage is filled with possibility.

“We’re finding new ways to offer storage to clients who might need different things,” he said. UV&S has built refrigerated storage panels for film industry clients who require their materials to remain at even lower temperature and humidity levels. The company has also discussed using the space for data centers, a need that will only increase with the rapid growth and development of artificial intelligence.

“What we have is an immense amount of space,” Ollenburger said, “and we’re trying to figure out how best to use it.”

—Korena Di Roma Howley ([@korenahowley](#)), Science Writer

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