History of salt mining and usage

Our Daily Salt

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Salt is the only rock mineral consumed by people directly, since sodium chloride is an essential part of our diet

Salt is the common name of a sedimentary rock whose main component is halite (sodium chloride, NaCl). This compound is one of the key components of seawater; following evaporation, it quickly reaches the saturation point and precipitates, forming a sediment of cubical crystals on the bottom. Salt can contain also admixtures of other minerals, such as sulfates and chlorides of calcium, magnesium, and potassium. Rock salt is relatively common in geological formations of various age. In the past, the formation of salt deposits was favored by prolonged periods of dry climate, and the transformation – as a result of lowering sea levels – of shallow shelf seas into groups of lagoons, in which halite was accumulated. The great thickness of rock salt deposits – frequently reaching several kilometers – is explained by the continuing influx of seawater into coastline lagoons (supplementing the evaporated brine) and the gradual lowering of their bottom. Currently, salt precipitates in lakes with no tributaries, in salt evaporation ponds, tidal flats, located in regions with low rainfall and high evaporation level. Salt is essential for maintaining the body's fluid balance, as well as playing an important role in the physiology of nerve and muscle cells. The average adult body contains approximately 250 g of salt, which is constantly being lost and should be replenished. Our bodily requirement for salt varies depending on various factors such as climate and type of work performed; it is estimated at a few grams per day.

How to get salt

Since the dawn of time, humans have been aware that salt is essential for their and their livestock's wellbeing; however, they had no idea about the existence of underground deposits of rock salt, and instead they collected it from salt lakes and seashores. While today salt is widely available and cheap, it once used to be a highly valuable and desirable product. People with access to salt were also likely to have money and power, bestowing great fortunes on owners and leaseholders of salt mines and desalination plants. Monarchs generally controlled the production and trade of salt; the guild of salt mine supervisors in Mediaeval Poland filled the king's coffers and brought good financial and political reward to its members. Salt was one of the first traded products, while its production was one of the earliest human industries. It was also of great practical importance as a food preservative.

On different continents, and quite independently, people came up with a wide range of ways of obtaining salt. The cheapest and simplest method was evaporation of sea water. Inhabitants of dry and hot regions had a real advantage: salt could be collected from the bottoms of dried up lakes, salt tidal flats known as sabkhas, natural salinas, and from artificial ponds constructed in the seashore zone. Another popular method was boiling seawater or brine from natural saline

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Rock salt is relatively common in various geological formations of different eras

springs in clay pots which were broken once sufficient salt formed inside. Ancient Romans burned swamp plants to extract salt from the ashes. In the Middle Ages, inhabitants of Denmark and the Netherlands obtained salt by burning peat saturated with seawater. Salt deposits located close to the surface also came to be mined. In time, certain techniques of obtaining salt became an inspiration for other industries. In ancient China, the important region for salt industry was Sichuan, where salt was produced from natural saline springs by boiling as far back as 3000 B.C. In 252 B.C., the locals discovered that rather than being formed in the pools, the brine effused from the ground. The first saline wells were soon being drilled; by the mid-11th century, salt producers from Sichuan developed a new percussive drilling technique which remained the most advanced over the following seven or eight centuries.

Salt mining was a common occupation of the Celts (the 5th-1st centuries B.C.), whose tribes occupied the lands of today's Hungary, Austria, and Bavaria, later scattering across Europe. The Romans called them Gauls, deriving the name from "hal," an ancient Greek word for salt. The best known Celtic salt mines, settlements, and burial sites are found in the Salzburg Alps in Austria, near Hallstatt and Dürrnberg. Names of many towns in Germany (e.g. Halle) and Austria (Hallein, Swabisch Hall, Hallstatt) and European regions (Galicia in northern Spain and southern Poland) are also derived from Celtic salt mines. The Medieval Church re-opened ancient salt mines in the Alps region, damaged or closed during the wars that followed the Roman Empire's collapse. A new production technique was developed in 1268. Until then, miners had climbed up and down steep shafts, with baskets filled with salt debris on their backs; the new method involved pumping water into the salt mine and pumping out the resulting brine. In Ancient Rome, most cities were established near locations where salt was produced. The Roman conquests allowed them to take control over Celtic mines and saline pools in North Africa, Sicily, Spain, and Portugal. They also took over saline plants in Greece, by the Black Sea, and in the Middle East. Soldiers were frequently paid with salt, providing the root for our contemporary word "salary." The Latin word "sal" (salt) is also the basis for the French "solde" (pay), and from it comes "soldier."

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The cheapest method of obtaining salt involved the natural evaporation of seawater

Preserving freshness

Ancient Egyptians were likely to have been the first to use salt to preserve meat and fish. Storing food was essential in the event of a dry summer when the Nile did not flood. Salt was also used for embalming (mummifying) bodies. Celts also salted meat and meat products such as ham. Romans put salt on vegetables, giving us the word "salad," as well as on fish, ham and sausage; they also used it to preserve olives and vegetables. In the Mediterranean Sea region during the days of the Roman Empire, it was most practical to produce salt near fishing areas. Trade in salted fish – mainly Atlantic cod and herring – boomed during the Middle Ages. At the time, the main centers producing valuable sea salt were located in France and Portugal. Salt was used for far more than preserving food: it was also used in tanning, cleaning chimneys, welding pipes, glazing ceramics, and as a treatment for many ailments. In Britain and France, salt was a strategic product; until the 14th century, a standard procedure when preparing for war was to store large quantities of salt and salted fish and meat.

The role of salt as a food preservative changed dramatically due to the industrial revolution. The early 19th century saw the invention of a new way of preserving food in glass jars, sealed tightly and heated up. The first British company producing canned food was founded in 1809, and the invention of food freezing further limited the usage of the salt for food preservation. The role of salt in cooking has reduced significantly although people will never stop salting food. Some former saline ponds are still producing salt; it is still being obtained in the Camargue marshlands near the mouth of the Rhône, where the desalination ponds were first founded in the Roman days. Traditions of salt production are being revived near the mouth of the Loire, in Guerande, on the island of Noirmoutier, and further south on Île de Ré. The first pools were built there by the Vikings. In Sicily, sea salt is still produced in artificial desalination pools near Trapani, first established by the Phoenicians, and saltmaking traditions date back to the 8th century B.C. For many centuries, salt has also been produced from desert lakes (salars) in the Sahara Desert in Africa, in the Atacama Desert in South America, and the Great Salt Lake in North America.

By the late 20th century, the chemical industry had largely shifted from using rock salt to salt extracted from saturated brine. Traditional underground salt mining in countries using the highest amounts of salt became no longer profitable, and many mines were closed. At the same time, storage and disposal in salt caverns

has been developed. Countries such as the US, Germany and France now store a significant proportion of their annual demand for natural gas and oil in salt caverns. The popularity of this storage method is due to the low construction and usage costs, high safety, and favorable environmental and social considerations.

What about Poland?

Poland has major underground rock salt deposits. Occuring in northern, western and central Poland are the Upper Permian salt deposits, being the product of the declining shallow Zechstein Sea, which extended from the British Isles, through present day Germany, as far as Poland, Lithuania and southern Latvia over 200 million years ago. In southern Poland, there are much younger salt deposits of the Miocene age (formed 13 million years ago), extending parallel to the Carpathian belt. The earliest traces of salt production near Wieliczka are the oldest in Europe (dating back to approx. 4,000 years B.C. - mid-Neolithic period). Six thousand years ago, people living around Wieliczka evaporated brine extracted from brine springs. Traditions of salt mining in Poland reach back as far as the 13th century. In the 14th century, over 30% of state income came from the salt trade. The ancient salt mines in Wieliczka and Bochnia are no longer active, instead acting as tourist attractions and sanatoria. In both mines there are underground rehabilitation facilities, as well as shops and restaurants. The Wieliczka mine - listed as a UNESCO World Heritage Site in 1978 - receives over a million visitors each year. For many years the Polish Geological Institute continued studies on the geology of salt deposits in Poland and evidenced their resources.

Currently, only the Zechstein rock salt is being exploited in two mines in Poland. At the Kłodawa salt mine, located in the largest salt dome in the Polish Lowlands (26 km long, max. width 2 km), salt is exploited with a chamber system, using explosives. In the Polkowice-Sieroszowice mine, owned by the major Polish mining company KGHM, a combine is used to mechanically crush the rock. The largest Polish salt producer is the company Inowrocław Salt Mines "Solino," which obtains brine exclusively from two leaching mines (the brine is obtained by dissolving rock salt with water pumped through drill holes directly into the salt body) located in Góra and Mogilno. The saturated brine is used to produce salt at the Sodium Plant "Janikosoda" and Nitrogen Plant "Anwil." Both the crushed and evaporated salt are used in the chemical industry, food processing industry (in particular meat and fish), thermal energy, pharmacy, metallurgy, livestock farming, road infrastructure, and direct consumption. In recent years, the main "consumer" of rock salt has been the road infrastructure industry.

The national energy security requires storage of energy fuels, e.g. natural gas and oil. The salt domes of central Poland and the salt beds in the Fore-Sudetic region and Pomerania provide suitable geological conditions for the construction of salt caverns functioning as safe underground storage and disposal facilities. In Poland, such storage is performed at the Underground Oil and Fuel Storage site located in the exploited brine chambers of the Góra salt mine. This facility was opened in 2002, and it has combined storage capacity of approx. five million cubic meters. The part of the Mogilno salt dome not used for brine production has also been used to construct a modern underground cavern storage for gas, in operation since 1997. A similar storage facility is currently being leached in the stratifom rock salt deposit at Puck Bay near Kosakowo. Salt deposits may also be used to store the radioactive wastes generated by the nuclear plants, for example in Asse, Morsleben, and Gorleben in Germany.

The human adventure with salt has been going on for millennia. It is only recently that our view of salt has changed: from an essential dietary ingredient and food preservative to a safe facility for storing fuels essential for the economy. Humans will always need salt, and we are lucky that we are unlikely to ever run out of it. ■

Further reading:

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