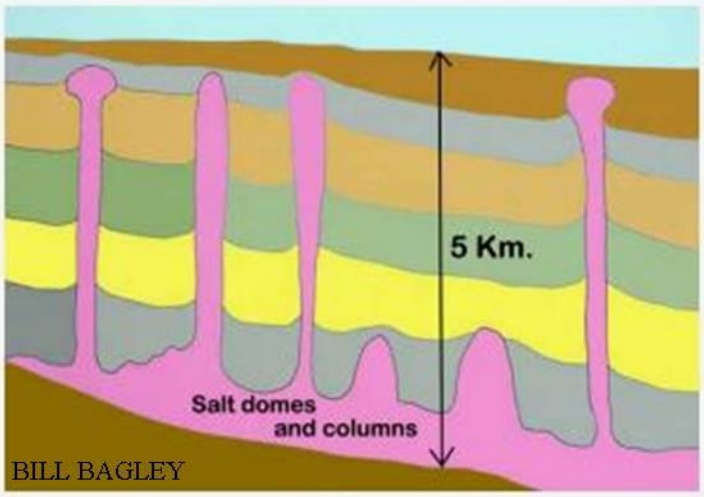
Bill's Rocks and Minerals
Halite (Common salt).

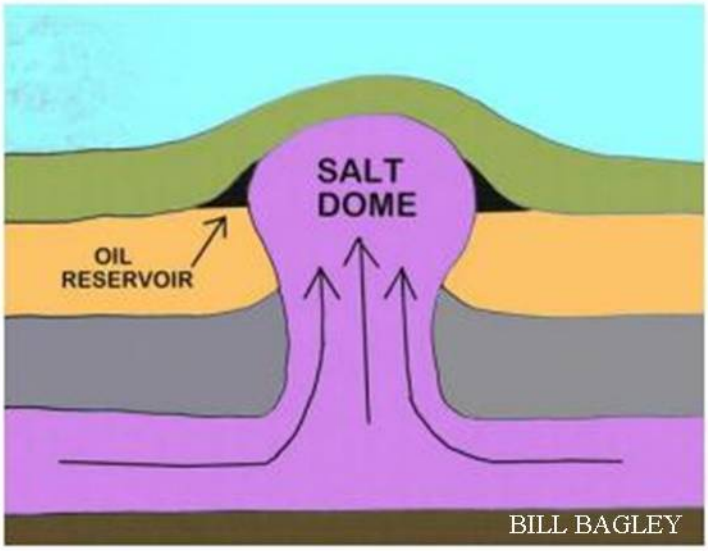
Halite, or common salt is only one of a number of evaporite minerals, some of which are well known to us, for instance, calcite, gypsum, dolomite, borax, anhydrite and magnesite. Perhaps not so well known are, sylvite, kainite, langbeinite, and several more.

Evaporite minerals		
Mineral class	Mineral name	Chemical composition
Chlorides	Halite	$NaCl$
	Sylvite	KCl
	Carnalite	$KMgCl_3 * 6H_2O$
	Kainite	$KMg(SO_4)Cl * 3H_2O$
Sulphates	Anhydrite	$CaSO_4$
	Gypsum	$CaSO_4 * 2H_2O$
	Kieserite	$MgSO_4 * H_2O$
	Langbeinite	$K_2Mg_2(SO_4)_3$
	Polyhalite	$K_2Ca_2Mg(SO_4)_6 * H_2O$
Carbonates	Dolomite	$CaMg(CO_3)_2$
	Calcite	$CaCO_3$
	Magnesite	$MgCO_3$

The first thing to establish is the occurrence of evaporite mineral deposits, in other words, how and where they are formed. They are formed as the result of the evaporation of salt rich bodies of water, and there are two types of depositional environments, marine and non-marine.

Dealing first with marine environments. Typically sea water carries about 3.5% by weight of salts, but the salts won't start precipitating until the water has evaporated to about half it's original volume. For this to happen the sea must be closed off, either by tectonic activity or by lowering sea levels due to glaciation. As the body of water evaporates, the salts or minerals in suspension become more and more concentrated until they are forced to precipitate and form crystalline structures. The first and better known minerals to precipitate from the shrinking body of water are the carbonates calcite and dolomite, followed by the sulphates gypsum and anhydrite, then the chlorides sylvite and halite. Once the sea has completely dried and the sedimentary layers of salts are deposited the lowered sea basin creates conditions which allows coverage by other sediments such as mudstone and sandstone.





Much of the salt mined from the completed sedimentary layers is from salt domes which may be as large as five miles in diameter. The mechanism that creates salt domes is quite simple. Pressure exerted by overlying sediments on the comparatively fluid salt layer forces it to migrate upwards through those mud and sandstone sedimentary layers, deforming them as it does so, creating salt domes and salt columns, and also creating conditions for oil reservoirs. Most salt domes and columns do not reach the surface, but when they do salt glaciers can be formed. A recommended site to learn more about salt domes is to be found at http://geology.com/stories/13/salt-domes/

Salt pans at Gozo. Creative Commons by Paul Stephenson.

Today about 25% of salt production is from the forced evaporation of sea water in very large salt pans. The other 75% of production is from historic deposits, both marine and non marine.

Many non marine deposits of salts are in the form of playas or salt flats, and they are the result of falling water levels in shallow inland basins which periodically fall by evaporation, resulting in the precipitation of their salt content. Usually found in desert areas, and often in close proximity to coastal regions, these basins or playas derive their salt content from ground water, and can cover vast areas. Although the basins are very shallow, often only a

few metres deep, they hold vast amounts of salt simply because they are so large. The largest salt flats in the world are at Salar de Uyuni in Bolivia, covering an area of 4000 square miles. Not so large, but still quite substantial are the probably better known salt flats at Bonneville, Death Valley, and Salt Lake in the U.S.A.

Death Valley salt flats. Creative Commons by Vadim Kurland.

There are three main types of salt extraction, deep shaft mining, solution mining, and solar evaporation.

In deep shaft mining, the salt from ancient buried deposits and salt domes is found in a compact form as rock salt, with crystals rarely observed, and usually quite discoloured as the result of mineral impurities. Untreated, it is mixed with sand and used as a road treatment in winter conditions. It can also be refined and used as a food additive.

In solution mining, halite is extracted from salt beds by erecting wells which inject water to dissolve the salt, making a brine solution which is then pumped away to the refinery plant for evaporation. This type of salt production is the main source of salt for food additives and industrial processes.

Solar evaporation is a natural process which creates seasonal opportunities for salt harvesting. Salt gathering usually happens once a year when the evaporated salt beds reach a specific thickness. This type of salt production can only occur in areas with low rainfall and a lot of sun, for instance, Australia and some Mediterranean countries.

Halite crystals, although rare in deep mined deposits, are plentiful in playas and salt beds because they are open to air, allowing unrestricted growth. Although halite is typically colourless or clear it is not uncommon for it to have a light pink colour because of the presence of the organism Halobacterium ssp. which live in the brine. On the Mohs scale halite has a hardness of 2.5 which is about the same as your finger nail, and the crystals are cubic with perfect cleavage, and a conchoidal fracture.

Halite crystals have an interesting habit of sometimes displaying " hopper growth", a habit which is also known in several other minerals. Hopper is a descriptive term of the appearance of dished faces in the crystal which happen because of a combination of fast growth, and preferential growth on the corners and edges of the crystal.

Hopper crystals. Creative Commons R. Weller/Cochise College.

For an informative site on salt production and salt evaporates a visit to the website below is recommended.
www.slideshare.net/hzharraz/topic-6-evaporite-salt-deposits

Bill Bagley