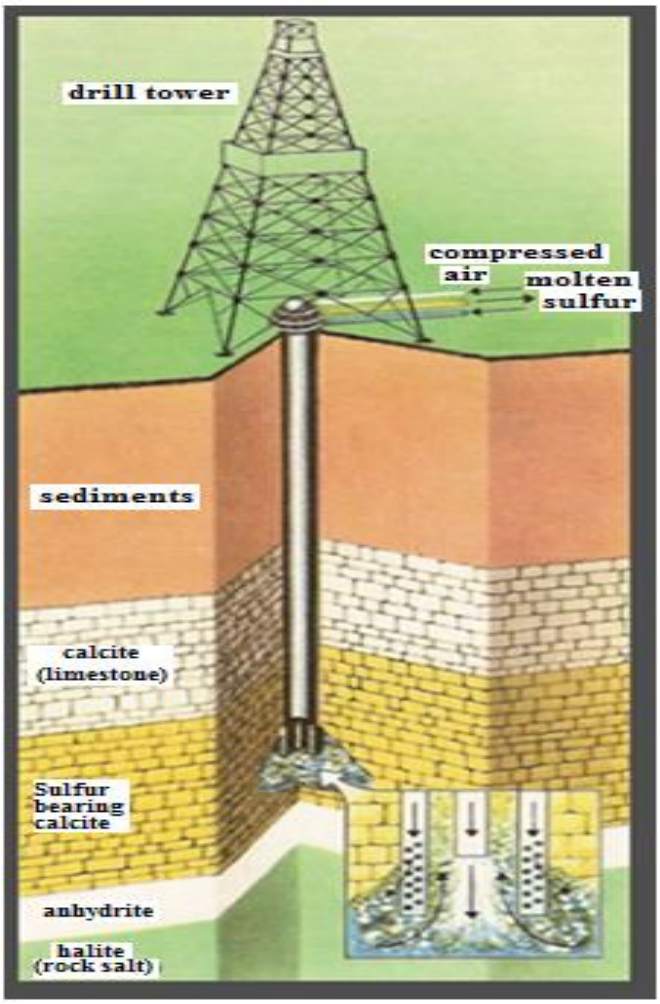
Frasch mines processing method

At bedded evaporate deposits were developed in a few other countries and on Mexican salt domes, Iraq began producing Frasch sulfur in 1972 at its Mishraq Mine with an initial capacity of 250,000 metric tons per year (t/yr.) that expanded to 1 Mt/yr in 1974 (Merwin, 1974, Merwin and Keyes, 1976, p. 1249). The Mishraq deposit possibly is the largest native sulfur deposit in the world, with an estimated 100 to 250 Mt of sulfur resulting from bacterial activity (Barker and others, 1979).



{Little is known about events in the Iraqi sulfur industry since 1990. Iraq's invasion of Kuwait in August 1990 precipitated the gulf war in 1991 during which United Nations (UN) forces bombed many of Iraq's industrial complexes. Although the sulfur operation was not damaged, sanctions imposed after the war curtailed exports of sulfur. The level of operation at Mishraq since then is not known, but an agreement that began in 2000 for Iraq to supply Jordan Phosphates Mines Co. with sulfur was believed to include sulfur produced at Mishraq. Jordan invoked an article of the UN charter that allows a UN member to not implement a sanction if it is against that country's domestic interests. The price of the Iraqi sulfur was discounted by about 30 percent from material available elsewhere in the region}.

Frasch process

The Frasch sulfur process only works under very specific geologic conditions. It can be used for deposits 50–800 meters deep. the process has proven to be either salt domes or bedded evaporate deposits in which permeable native sulfur deposits are enclosed in impermeable formations. The elemental sulfur obtained by this process can be very pure (99.7 - 99.8%). In this form, it is light yellow in color. If contaminated by organic compounds, it can be dark-colored.

The description and characteristics of the Frasch process are as follows:

1- It can be used for deposits 50–800 meters deep.

2- The process was applied either on the salt domes or bedded evaporate deposits.

3- A hole is drilled down to the sulfur deposit and in it is inserted a piece of apparatus consisting of three concentric tubes, see down schematic diagram.

4- Superheated water is injected directly into the sulfur-containing mineral strata (sulfur formation), during the outermost tube, melting the sulfur all around it.

5- The temperature of pumped water at about 165°C and under sufficient pressure (2.5-3 MPa) to keep the water from boiling.

(Because sulfur has a relatively low melting point at 115°C, it is possible to melt it with superheated water which is water that has attained a temperature above its boiling point because it is under pressure).

6- 3-38 cubic meters of superheated water are required to produce every tone of sulfur depending on the depth and sulfur size.

7- The elemental Sulfur melts (m.p. 115 °C) and tries to flow into the middle tube.

8- Water pressure alone is unable to force the sulfur into the surface due to the molten sulfur (greater density). Since molten sulfur is heavier than water, the sulfur passes halfway to the surface by the effect of the pressure applied by the hot water.

9- Hot compressed air is pumped down through the innermost tube (center) to froth the sulfur, making it less dense, and pushing it to the surface.

10- Early in the century, at the point in the process when the sulfur reached the surface, it was pumped into wooden forms or molds where it cooled and solidified.

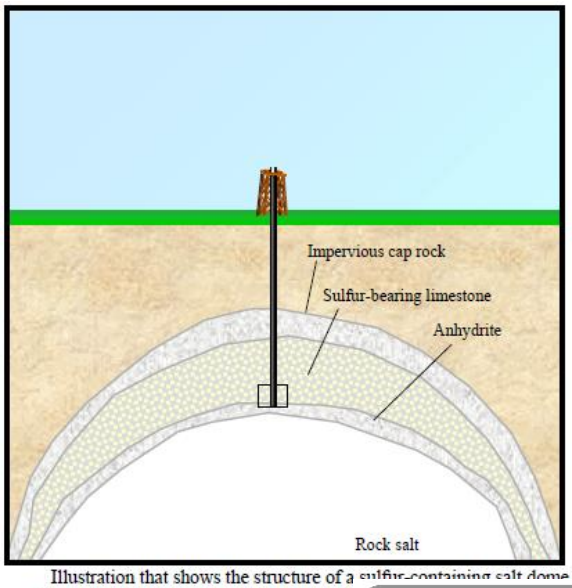
11- Modern facilities use insulated pipes to move the sulfur to heated storage tanks where it is held.

12- At last the heated storage sulfur is transferred to a terminal from which it is shipped to customers.

13- When large quantities of excess sulfur are stockpiled, the molten sulfur is cooled and solidified, creating huge blocks of solid sulfur from which the term “poured to block” is derived.

14- The elemental sulfur obtained by this process can be very pure (99.7 - 99.8%).

Models of the Frasch process



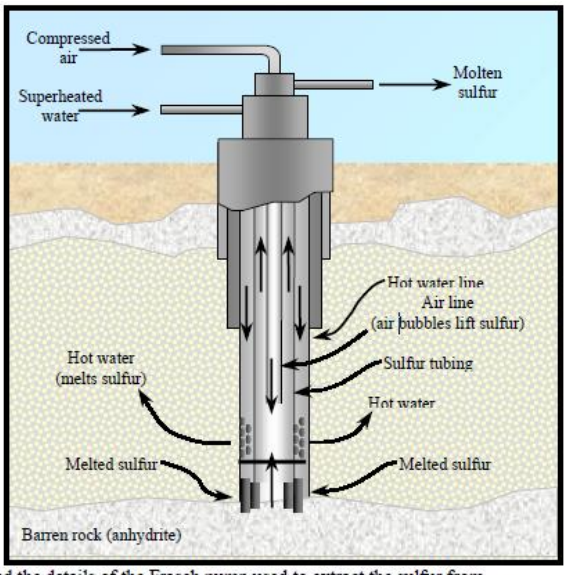


Illustration that shows the structure of a sulfur-containing salt dome and the details of the Frasch pump used to extract the sulfur from underground formations. Superheated w r is lifted to the surface with compressed air.