NATURAL RESOURCES

Sulfur—Industrial Helper

The brimstone of the Bible plays an important part in modern agriculture and industry. Millions of tons used each year to produce essentials for war and peace.

By A. C. MONAHAN

See Front Cover

➤ SULFUR TO grandfather in his early boyhood days was a spring tonic taken with molasses to "thin the blood" after a long-winter diet without table greens. Or perhaps oldsters remember it best from the vile smell of old fashioned kitchen matches. Few then thought of it as an essential in industry.

Sulfur today plays a big part in the production of many important materials ranging from synthetic rubber to fertilizers for the farm.

Some is used as sulfur itself but far more in sulfur chemicals such as sulfuric acid. In fact so high is the demand that it is on the list of short supplies. Considerably over 4,000,000 tons are consumed each year by American industries and the total would be higher if more sulphur were available.

The United States has become the world's principal source of sulfur. America produces enough to meet all domestic needs if it was all used at home. But this nation has a clear duty to the nations of western Europe and other countries to help make them industrially efficient to meet any emergencies that may arise. For that reason it is shipping annually over a million tons to nations that have long relied upon the United States for this product.

Agriculture Biggest Consumer

Sulfur is used in many industries, but agriculture is the greatest consumer. Its most widespread application is in converting phosphate rocks to superphosphate fertilizer.

Other large consumers are the chemical industry, petroleum producers and refiners, paint and pigment makers, steel mills, paper makers, the textile industries and explosives manufacturers. In these industries some sulfur is consumed as sulfur itself but the greater part is used as sulfuric acid or some other sulfur compound.

America's principal supply of sulfur is in natural domes of the element itself discovered from 300 to 2,000 feet under the earth along the coast of the Gulf of Mexico. The discoveries were made in certain cases in drilling for petroleum. After the first dome of natural sulfur was found, years passed before a commercial method was developed to get it out of the low, wet land.

About 88% of the over 5,000,000 tons of sulfur now produced in the United States comes from the domes of native sulfur of the Louisiana-Texas coastal region. More than half the rest is obtained from sulfur-bearing minerals, which are plentiful and widespread but which require expensive chemical treatment before the sulfur is separated. Other sources of sulfur are smelter gases, refinery gases and sour natural gases.

How much sulfur there may be in natural deposits in the Gulf Coast area or elsewhere nobody knows. A new deposit found recently in southern Louisiana in the delta of the Mississippi will produce over 500,000 tons annually when equipment is installed. This will probably be late in 1953. Other new domes recently discovered are now in production or will be shortly.

The location of these natural sulfur deposits under marshes and swamps along the Gulf Coast makes mining by ordinary methods impossible. A relatively inexpensive and efficient method, the invention of an American chemist named Herman Frasch, is used. It requires no underground miners. Hot water, forced down through a drill hole to the deposit, melts the sulfur and brings it to the surface.

The process is not quite as simple as that, however. Sulfur is twice as heavy as water and means must be provided to bring it to the surface. Air under pressure is used to do this.

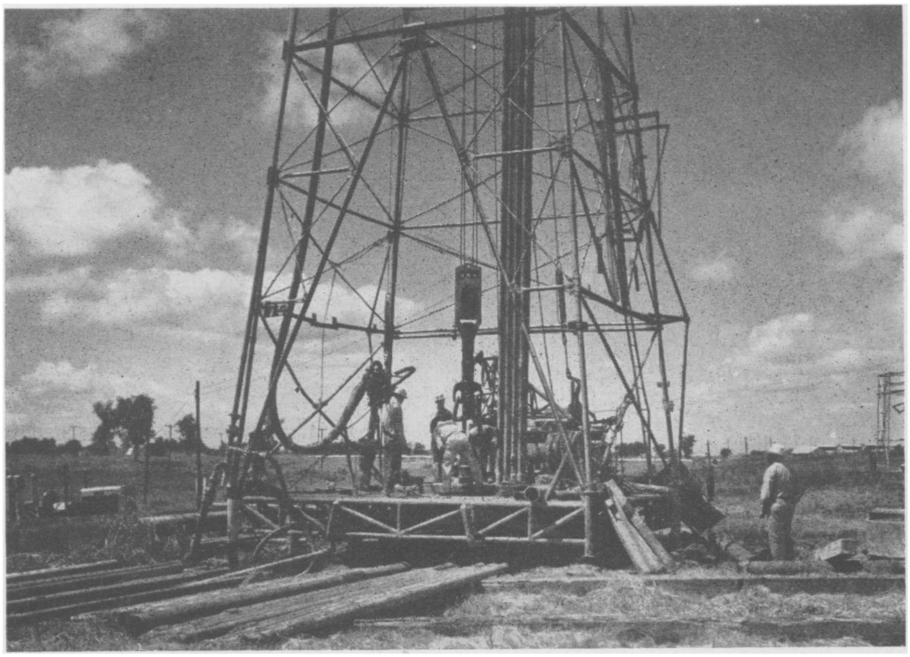
Piped to Surface

The eight- or ten-inch hole drilled down through the surface soil, underlying sand and layers of rock into the sulfur deposit, is fitted with a large pipe within which is a smaller pipe and within this still another of smaller diameter. In other words, the hole is fitted with three concentric pipes.

The hot water is forced down the outer space made by the concentric pipes. Hot air is forced down the center pipe. Air, water and the melted sulfur come to the surface in the space between the two inner pipes. The air bubbling through the mixture keeps the sulfur suspended.

The liquid mixture is then sprayed out evenly over vast, open air lots, where it is allowed to dry thoroughly before shipment. Such a sulfur pile is shown on the cover of this week's SCIENCE NEWS LETTER.

The melting point of sulfur is low but it is higher than that of ordinary boiling water—approximately 240 degrees Fahren-



SULFUR WELL—These men are drilling a well for sulfur at the Newgulf, Texas, mine of the Texas Gulf Sulphur Company. If the element is found, superheated water will carry it to the surface where it is then dried out before shipping.

heit. For this reason superheated water with a temperature approaching 300 degrees Fahrenheit and under a pressure of about 100 pounds must be used.

Today's demand for sulfur and the increasing demands foreseen for the future are resulting in extensive activities to develop cheaper and more satisfactory ways of obtaining the important element from its plentiful ores and of recovering the sulfur from smelter gas, from the gases from petroleum refineries and from natural gas. An extended program is under way, sponsored by the U. S. Petroleum Administration for Defense.

Sulfur from Fool's Gold

Other programs are being carried out by the U. S. Bureau of Mines, research laboratories and private industries. One important project is under way by the Bureau of Mines in its laboratories at the University of Minnesota. Its objective is to find more practical means of obtaining both sulfur and iron from the iron sulfide deposits in that state. Minnesota has great deposits of this natural material, which is commonly known as pyrites and was once called fool's gold because of its appearance.

Petroleum refiners are heavy users of sulfur but great quantities can be recovered from the gases discharged into the atmosphere by the same refiners. These gases contain sulfur in vile smelling compounds that are not only obnoxious to smell but are also injurious to eyes and lungs. The recovery of the sulfur is an important step in the prevention of air pollution.

Many processes are used to recover the sulfur in refinery gases but what is called an improved method has recently been developed at the Polytechnic Institute of Brooklyn. It is a method in which the foul smelling waste is burned under specially controlled conditions to give ordinary water and sulfur. The sulfur so obtained, even if it actually comes from the vile smelling hydrogen sulfide gas, is of high purity and suitable for uses where sulfur from other sources requires expensive purification. Refinery gases in America could yield up to 500,000 tons annually to the supply, Institute chemists estimate.

While much sulfur is used in industrial production as sulfur itself or some of its important compounds, about three-fourths of America's total supply is converted into sulfuric acid. By far the largest role for this acid is in manufacturing superphosphate fertilizers, essential in growing crops to feed the American people. Fertilizer industries consume nearly 4,000,000 tons of sulfuric acid each year.

The second largest use of sulfuric acid is in the manufacture of other chemicals, including explosives needed in war, mining and other industrial activities. These purposes take some 2,000,000 tons.

Petroleum refining is the third largest consumer, using over 1,000,000 tons a year. Without this sulfuric acid, essential steels for national defense and civilian applications would be produced with difficulty.

One hope for meeting the shortage of sulfur lies in using acids other than sulfuric to make superphosphate fertilizers. The job is being tackled seriously in both England and the United States, and progress is reported. The British Department of Scientific and Industrial Research has found that a mixture of sulfuric and nitric acids will work. The American Tennessee Valley Authority is exploring possibilities of a mixture of nitric acid with either sulfuric or phosphoric acid.

The British research shows that nitric acid alone can reduce the phosphate rock, giving the soluble calcium phosphate known as superphosphate and calcium nitrate as a by-product. With sulfuric acid, calcium sulfate is the by-product.

Calcium nitrate is a valuable fertilizer but it absorbs moisture readily, causing caking. Calcium sulfate does not. When a mixture of the two acids is used in a ratio approaching half and half, the sulfate formed seems to protect the nitrate from water absorption. The work of the American TVA bears out the British findings.

Nitric acid, unlike sulfuric, does not require a chemical element obtained from the crust of the earth. It can be made from the abundant supply of nitrogen in the atmosphere. By a so-called fixation process this atmospheric nitrogen is captured and converted into an oxide which, when chemically united with water, becomes nitric acid. England can make its own nitric acid and its fertilizer industry need no longer depend so largely on the availability of American sulfur.

U. S. Production Greatest

Of course, the United States is not the only nation mining native sulfur but it produces perhaps ten times as much as the rest of the world combined. Up to 1900, Sicily produced about 90% of the world's supply and America imported many thousands of tons of it each year. Some 45 years ago the production of Louisiana sulfur by the Frasch process made this country independent of imports. With the discovery of Texas sulfur domes a little later, America became a supplier to the rest of the world. Texas ranks first in American production.

Other countries producing sulfur in addition to Italy, which includes Sicily, are Japan, France, Chile, Bolivia and Peru. A dozen other nations produce some. Of course, sulfur is being produced in many parts of the world from pyrites and other sulfur-bearing, minerals such as galena, zincblende and sulfates. But the cost is high. What is needed is the discovery of more natural deposits and cheaper methods of reducing sulfur ores. Substitutes for sulfuric acid would greatly extend the present available supply.

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