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MINERALS OF THE SALINE DOMES OF THE TEXAS-LOUISIANA COASTAL PLAIN

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The greater number of our most interesting mineral occurrences would remain unknown to us were it not for their close connection with ore deposits or other materials of economic importance. Even the oil fields in the topographically almost featureless plain bordering the Gulf of Mexico are found to be by no means wholly lacking in things of interest to the mineralogist.

Years ago the drilling of deep wells near the Texas-Louisiana coast, at places where there were gas seeps, sulfurous springs, or salt licks, led to the discovery of petroleum in that region. The gradual extension of these oil fields and the discovery of others has greatly broadened our knowledge concerning the geology and mineralogy of the rocks associated with them. It has been found that the oil deposits seem to be invariably associated in this coastal plain region with what are known as saline domes.

The saline domes are usually wholly subterranean and buried from sight under the nearly horizontally bedded sands and clays of the plain. Rarely they are marked by low mounds, whose summits in some cases are 60 or 80 feet above the surrounding country and have a diameter of a mile or more. At other times their location is marked by a depression filled by a lake. Usually they are invisible to the eye and some of them are beneath the waters of the Gulf of Mexico. Some 63 such domes have been mapped to date in Texas and Louisiana alone, and others yet undiscovered doubtless exist there. Further south, in the Yucatan Peninsula of Mexico, other similar domes are also yielding large quantities of oil.

Saline domes are well known in other parts of the world.

Their general characteristic is the presence within them of large deposits of mineral salts of various kinds, principally sulfates and chlorides of sodium and potassium. The domes of Germany have supplied vast quantities of potassium salts, as well as of sodium salts, particularly halite. The deposits in the Texas-Louisiana region do not contain potassium salts, but are made up primarily of halite containing impurities in the form of other minerals in very minor amount.

The bottom of the salt deposits in Texas and Louisiana has never been found, tho borings have pierced rock salt for depths of 5,000 feet. The total thickness of the salt may be several times that figure. The upper part of the "salt core" is often conical and is usually mixed with layers or masses of gypsum and anhydrite, known to the drillers simply as "gypsum," and sometimes as "salt." Above this, usually not many hundreds of feet below ground, there is often a so-called "cap-rock" layer of hard but porous limestone or dolomite. In the numerous cavities of the atter rock large quantities of native sulfur are sometimes present, and petroleum is found in it or among the upturned sedimentary strata along the sides of the salt core.

The "gypsum" found in the Gulf Coast saline domes appears to be usually a very interesting combination of calcium sulfate in its anhydrous and hydrous forms. Abundant microscopic anhydrite crystals, without definite orientation or arrangement, are enclosed in a matrix of gypsum (selenite), whose crystals have cleavage directions in parallel position thruout the specimen. In other samples the material is massive, like fine-grained marble or alabaster, filled with bright anhydrite. This arrangement of the above minerals has been observed to be general in samples obtained from borings at Damon Mound, Hoskins Mound, and Pierce Junction, Texas. The anhydrite crystals are simple combinations of the three orthorhombic pinacoids, except for a few which have the form of steep pyramids. Two specimens of the "gypsum" from Damon Mound gave specific gravities of 2.37 and 2.88, respectively; the first is a specimen with pronounced cleavage in three directions; the second is very fine-grained granular, with massive structure. From this determination it is seen that the first specimen contains about 8.6 per cent. of anhydrite and 91.4 per cent. of gypsum, while the second has 97.2 per cent. of anhydrite and 2.8 per cent. of gypsum. Thus the cleavage of the first type is accounted for by the predominance

of crystallized gypsum, which is present only in small quantity in the second, or massive, type of material.

The principal cleavage has, in some cases at least, been observed in a vertical position, indicating forces of crystallization operating in that direction.

Great numbers of small anhydrite crystals also occur embedded in the rock salt. They can be freed from the matrix of salt or of gypsum by treating the material with water in the former case or with a weak solution of hydrochloric acid in the latter. In either case the anhydrite crystals will be slightly etched and roughened by this treatment and some of their edges and corners will be rounded. From the gypsum of Damon Mound small doubly terminated quartz crystals were obtained. These are well developed, brilliant, and colorless to smoky. There are also some very clean-cut little dolomite rhombohedrons.

The sulfur that is present is often well crystallized, tho most of the crystals are small. Attractive box mounts are available. The two principal sulfur deposits now being worked commercially are at Sulphur station, Louisiana, west of New Orleans, and at Bryan Heights (Freeport), Texas, at the mouth of the Brazos River. The sulfur is obtained by forcing very hot water down the well casing into the heart of the deposit; the sulfur is melted and flows to the surface along a smaller pipe within the casing.

Sulfides in crystallized form have been reported from the salt mines of Louisiana; these are galenite, sphalerite, and pyrite. Some microscopic black crystals from the rock salt at Hockley, Texas, have been determined for the writer by Dr. Edgar T. Wherry as pseudomorphs of limonite after pyrite, the following forms having been identified:

Dominant form, 120, the usual pyritohedron; present in good-sized faces, 210, the negative pyritohedron; also 100, the cube. Other forms are represented by small and curved faces, but the form 340 was certainly identified, and forms 014, 016, and 067 doubtfully. No faces of the octahedron, 111, nor any diploids, were observed.

The surface clays above some of the salt domes, as at Damon Mound, are filled locally with tiny gypsum crystals and plates. There are also developments of sulfates of iron (partly melanterite) which in water solution have been extensively sold for medicinal purposes. In the borings from within the domes,

pseudomorphs of calcite after selenite crystals have been reported, as well as some very nice little free selenites, some of which are twinned. One or two twinned calcite crystals 0.5 cm. long were also obtained, rhombohedrons completely filled with white sand after the manner of those from Fontainebleau. Much of the gypsum from the borings has a dark smoky color and upon breaking emits a strong fetid odor.

The rock salt is extensively mined in Louisiana at Weeks Island and elsewhere by means of large underground chambers. The most of the salt is of the familiar granular crystalline sort with but little impurity.

Specimens of old borings, consisting of gypsum and anhydrite, are available at some places (Damon Mound, Texas, being one of them). Under the present war conditions it is often difficult to obtain access to the sulfur properties or the mines.

LAZULITE IN AN UNUSUAL FORM

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Some months ago there was received at the National Museum for identification a peculiar rock, evidently a somewhat altered volcanic breccia, so injected with a blue coloring matter as to suggest lapis-lazuli. The manner in which the coloring matter was distributed, a portion of it in the cementing material and a portion actually replacing the original rock fragments, suggested its secondary origin and invited careful tests to ascertain its true nature. Thin sections under the microscope showed the coloring matter to occur as minute scales without crystal form and very irregularly distributed. These had the refractive indices and gave the chemical reactions of *lazulite*, which is a hydrous phosphate of aluminium, iron and magnesium. It is an interesting occurrence since it closely simulates, as above noted, lapis-lazuli (lazurite), which has, however, a quite different composition.

The specimen was received from Mr. Frederick L. Whitehead, of Hassel, Montana, who reports that he has found the material, thus far, only as float.