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Celestite and Strontianite

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CELESTITE AND STRONTIANITE

Introduction:

The major part of the strontium salts used in the United States are imported, the production in this country being very small. In fact, no production has been reported since 1910. Deposits of strontium minerals are known to occur in Arizona, and it is thought that a description of strontium salts, the value and uses, may be of some value.

STRONTIUM MINERALS

There are two strontium minerals of commercial importance: celestite, strontium sulphate ($SrSO_4$) and strontianite, strontium carbonate ($SrCO_3$). Of these two, strontianite is the more valuable because it is more readily converted into salts desired for commercial purposes.

Strontium is a metal, but does not, to the writer's knowledge, occur as a metal in nature, nor is it commercially used in metalic form.

STRONTIANITE

Composition:—Strontium carbonate, $SrCO_3$. Carbon dioxide (CO_2), 29.9%; strontia (SrO), 70.1%, equals 100%. A little calcium is sometimes present.

Form:—Crystalline. Crystals in the orthorhombic system. Crystals often acicular (needle-like) or spear shaped. Twins common. Also columnar, fibrous and granular.

Color:—Pale green, also white, gray, yellow and brown. Transparent to translucent.

Streak:—White. Lustre, vitreous (glassy) inclining to resinous.

Hardness:—Rather soft. (H. equals 3.5 to 4.) Brittle, breaks with an uneven fracture.

Weight:—Light. (Sp. Gr. 3.68 to 3.72.)

Occurrence:—Usually associated with gypsum and calcareous rocks, in beds. Also as geods in limestone and sandstone.

Blowpipe Tests:—Borax bead swells up, throws out minute sprouts, fuses only on thin edges, and colors flame strontia-red; assay reacts alkaline after ignition. Moistened with hydrochloric acid and heated by a flame imparts an intense red color to flame. Soluble in hydrochloric acid. Precipitated from this solution (dilute) by sulphuric acid, as white strontium sulphate. ($SrSO_4$).

CELESTITE

Composition:—Strontium sulphate, $SrSO_4$. Sulphur trioxide (SO_3), 43.6%, strontia (SrO), 56.4%, equal 100%. Calcium and barium sometimes present.

Form:—Crystalline, orthorhombic system. Crystals commonly tabular or prismatic; also fibrous and radiated; sometimes globular; occasionally granular.

Color:—White, often faint bluish, sometimes reddish. Transparent to sub-translucent.

Streak:—White.

Lustre:—Vitreous (glassy) inclining to pearly.

Hardness:—Soft. (H. equals 3 to 3.5.)

Weight:—Light. (Sp. Gr. 3.95 to 3.97.) (High for such salts.)

Occurrence:—Usually in limestone or sandstone beds; occasionally with metalliferous ores; also in beds of gypsum and rock salt; also with sulphur in volcanic regions.

Blowpipe Tests:—Characterized by form, cleavage, high specific gravity, red coloration of the flame. Does not effervesce with acids. Specific gravity lower than barite.

USES OF STRONTIUM SALTS

The metal strontium is not used commercially, but its salts find various uses. The hydrate and the nitrate are the most important salts.

"Strontium hydrate is used principally in the recovery of sugar from beet molasses. The process is still employed in Germany and by the Raffinerie Parisienne, but the cost of hydrate is too great for its use to become general. Strontium sucrate (saccharate) is much more easily formed than calcium sucrate, and for this reason the celebrated German chemist, Carl Schiebler, of Berlin, has urged the use of strontium hydrate in sugar factories, especially as Germany has extensive deposits of strontium minerals from which it has been possible heretofore to obtain the hydrate cheaply. The beet molasses is mixed in suitable proportions with the hydrate, and the sucrate is formed. The mother liquors are separated by filter presses. The cakes of strontium sucrate are washed, then mixed with water, and carbonated. The strontium carbonate thus formed is burned to a cuastic condition and used over again."

Strontium nitrate finds its chief use in pyrotechny, due to its property of imparting a red color to the flame.

Strontium in various forms, as the iodide, bromide, acetate, arsenate, phosphate, and other salts is used as medicine, and in the chemical laboratory.

According to the Journal of the Society of Chemical Industry, III, 1884, p. 33, "basic bricks are made from strontianite by mixing the raw or burnt strontianite with clay or argillaceous ironstone, in such proportions that the brick shall have about 10% silicia, and then working it into a plastic mass with tar. After molding the bricks are dusted with fine clay or ironstone, dried and burned."

METHODS OF EXTRACTION AND PURIFICATION

Strontium is mined as the carbonate and sulphate, but, as stated before, is used as the hydrate and nitrate. Strontium hydrate is most simply made by calcination of the carbonate, strontianite. It is made from the sulphate by the reduction of the sulphate to the sulphide with charcoal or coal, the extraction of the sulphide with water and the subsequent precipitation of the hydrate by a metallic oxide or hydrate.

Strontium nitrate is made by dissolving the carbonate in nitric acid, if the native mineral can be procured sufficiently free from other bases that would consume the acid. The carbonate used is sometimes made from the sulphate by fusing with soda ash and leaching out the sodium sulphate formed.

THE STRONTIUM INDUSTRY

No figures are available showing any production of strontium salts in the United States for the past several years. The imports of strontium salts in 1915 were $6,411, as compared with $1,016 in 1914.

DEPOSITS OF STRONTIUM MINERALS

The metal strontium belongs to the same group as calcium and barium. It is found in small amounts in igneous rocks, in the form of the oxide (SrO); also in sea water and sea weeds, and in boiler scale.

Strontium and calcium are so closely related that their common association in rocks is to be expected. The natural sequence of chemically deposited sediments places strontium above a calcareous deposit and below gypsum.

Celestite is found associated with limestone or sandstone. It also occurs in beds of gypsum salt or clay. It is sometimes associated with metalliferous ores, as galena and sphalerite, and in volcanic regions with sulphur. In places it fills the cavities in fossils.

Strontianite occurs usually as granular masses and crytals, forming nests and geods in limestone.

VALUE AND ECONOMIC CONSIDERATIONS

Strontium minerals as mined can hardly be given a value in the

United States, because the production has been so small. The price is very low, however, and probably would not exceed $2.50 to $4.00 a ton.

The demand for strontium minerals is rather small, and fluctuating. Therefore the material must be easily mined and readily accessible for shipment. It must also be very pure.

Strontium occurs in various states of the United States, as New York, Ohio, Texas, West Virginia, Michigan, Pennsylvania, Kansas, Colorado, Tennessee, California and Arizona. Celestite is by far the most common form in this country. In Arizona the strontium mineral is celestite. It occurs 15 miles south of Gila Bend, Maricopa County. Here the mineral occurs in sedimentary series associated with gypsum, sandstones, and conglomerates containing pebbles of coarse grained granite. The series is involved with igneous flows and intrusives.

The celestite occurs in beds overlain and underlain by sandstone beds and by igneous flows. The most promising beds here are 40 to 50 feet thick, and are most productive in the upper ten feet. The mineral is of a very good grade.

THE FUTURE OF THE INDUSTRY

Due to the scant demand and the inaccessibility of deposits, the strontium industry at present has only a potential value. When attention is drawn to important deposits, it is probable that a demand for the material will arise. The uses already discovered and the fact that most of the product used in the United States is imported, indicates that at some future time the more extensive deposits in this country may be worked. It is doubtful, however, if the industry will ever reach any great proportions.