

NOTES AND NEWS

OCCURRENCE OF BASSANITE IN TWO DESERT BASINS IN SOUTHEASTERN CALIFORNIA*

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INTRODUCTION

Bassanite, calcium sulfate hemihydrate, has been identified in drill cores from two desert lake basins, about 175 miles apart, in southeastern California. This finding is significant because the only other reported natural occurrences of bassanite known to the writers are at Mt. Vesuvius, Italy, and in the central Asiatic desert. Palache, Berman and Frondel (1951) describe the Mt. Vesuvius occurrence as follows: "Found in cavities of leucite-tephrite blocks thrown out during the April, 1906, eruption of Vesuvius. Also found with gibbsite in fumaroles of the eruption of 1911." Middle Asiatic bassanite deposits (Popov and Vorob'ev, 1947) are found in the desert soils of eastern Turkmenia and northern and western Fergana. The mineral occurs as a white powder, a weathering product sometimes pseudomorphic after gypsum. In southern Fergana the hemihydrate occurs as thin layers in oil-bearing sands.

The California localities are (1) Danby Lake (dry) (lat. $34^{\circ} 24' N.$, long. $115^{\circ} 17' W.$) at depths of 365 feet and 510 feet; (2) dry lake near Ballarat, Panamint Valley (lat. $36^{\circ} 02' N.$, long. $117^{\circ} 14' W.$) at a depth of 360 feet.

In both localities the mineral is found in unconsolidated sediments as layers, none more than a few millimeters thick, intercalated with layers of silty clay. Gypsum is associated with the bassanite (1) as crystals included in the clay layers, (2) as light brownish granular layers adjacent to the bassanite, and (3) as a fine crystalline constituent within bassanite laminae. The bassanite is snow white and long fibrous in habit; the fibers, which are distinguishable under a hand lens, are arranged in parallel or slightly divergent bundles. Bassanite fiber axes are nearly parallel to the bedding in Danby samples, but they are oriented at a large angle to the bedding in the Panamint Valley specimen.

The Danby sample from a depth of 510 feet ($2\frac{1}{2}$ -inch core, Drill Hole No. 1) was pure enough for chemical and spectrographic studies although the quantity available was insufficient for exhaustive analysis. The optical properties tabulated apply to all three samples.

OPTICAL DATA

Indices of refraction, determined with sodium light, were as follows; α

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(perpendicular to fiber direction)— 1.550 ± 0.002 ; γ (parallel to fiber direction)— 1.577 ± 0.002 . The acicular crystals have parallel extinction, positive elongation, and positive optical character. The mineral is uniaxial or biaxial with small optic axial angle. Winchell (1931) states that $2\text{CaSO}_4 \cdot \text{H}_2\text{O}$ is probably hexagonal; he gives the following optical data: uniaxial positive with $\omega = 1.55$ or slightly less, $\epsilon = 1.57$. Büssem and Galitelli (1937) conclude that the substance is pseudohexagonal and monoclinic; optical properties are as follows: biaxial positive, $2E = 22^\circ$, $\beta = 1.558 - 1.560$, $\gamma = 1.582 - 1.584$. Popov and Vorob'ev (1947) found indices of refraction 1.556 and 1.583, respectively.

ANALYTICAL DATA

CHEMICAL ANALYSIS OF BASSANITE ($2\text{CaSO}_4 \cdot \text{H}_2\text{O}$), IN PER CENT

	Bassanite from Danby Lake (dry) California	Theoretical
CaO	37.75	38.63
SO ₃	54.19	55.16
H ₂ O	6.37	6.21
Total	98.31	100.00

Spectrographic analysis of the bassanite from Danby Lake (dry) gave the following data, in per cent:

0.X	Sr Mg Na Si
0.0X	Al Fe
0.00X	Mn B Ag
0.000X	Cu

CALCULATED MINERALOGIC ANALYSIS

Petrographic examination shows that the bassanite is contaminated with gypsum, celestite, and clay. The proportions of minerals in the sample have been calculated on the basis of the following assumptions: (1) bassanite is $2\text{CaSO}_4 \cdot \text{H}_2\text{O}$; (2) excess water (in the above analysis) is derived from gypsum; (3) excess SO₃ is derived from celestite. The calculated weight percentages of minerals are: bassanite 97.3 per cent, celestite 1.5 per cent, gypsum 0.8 per cent, clay undetermined, total 99.6 per cent.

NATURAL ORIGIN OF THE BASSANITE

Association of bassanite with gypsiferous beds suggests that the hemihydrate was derived from the dihydrate,* either naturally or artificially.

* It is not considered likely that bassanite arises from partial hydration of anhydrite, $\beta\text{-CaSO}_4$. The hemihydrate is structurally more like $\gamma\text{-CaSO}_4$, "soluble anhydrite".

It was at first thought that the material had been produced from gypsum by heat or pressure accompanying core drilling. This is improbable because:

(1) Bassanite is not found in a peripheral zone about the outside of the core, where frictional heat would be greatest. It occurs as horizontal laminae in both internal and external portions of core.

(2) The hemihydrate is not found in core segments from other gypsiferous beds.

(3) The transformation of gypsum to bassanite occurs at 98° C. (Ramsdell and Partridge, 1929; Posnjak, 1938). A liquid-lubricated drill in unconsolidated material probably would not generate a temperature of this magnitude.

(4) The aqueous drill fluid would tend to convert bassanite to gypsum rather than promote the reverse reaction (Milton, 1942).

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