THE OCCURRENCE OF MENDOZITE AND TAMARUGITE IN MISSOURI

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INTRODUCTION

During the second week of June, 1934, the writer collected from an outcrop of Joachim dolomite near the town of Eureka, Missouri, a hydrous soda alum efflorescence which was found to be composed largely of mendozite with some tamarugite. A similar substance, later identified as the same minerals, occurred as an efflorescence on the basal Cherokee conglomerate at Fulton, Callaway County, Missouri. Mendozite has been reported at Mendoza and elsewhere in Argentina, in Chile, at the solfatara of Pozzuoli near Naples, and in Box Elder County, Utah, but never before, to the writer's knowledge, from Missouri.

OCCURRENCE AND DESCRIPTION

The mineral of the St. Louis County locality occurred as a white, fluffy to granular powder in varying degrees of compactness on the west-facing side of a recently excavated road cut in the Joachim dolomite on the Woods Road about one mile north of Eureka, Missouri. A section of dolomite about 10 feet in thickness and fifty yards long is exposed in the cut which lies low on a west sloping hillside. Ground water migrating down the slope of the hill and seeping out on this surface would be dried by the mid-day and afternoon sunshine. The evaporating water, fed by seepage and capillarity, would leave behind its soluble load as a residue on the surface. This deposited on the limestone surface as a white powdery coating, thickening to a friable porous encrustation up to about 3/8 inch in thickness, or hanging in fragile little stalactites as much as ½ inch in length below the narrow bedding plane shelves.

No apparent relationship could be established between the efflorescence and slope wash markings, porous beds or impervious layers in the limestone. Apparently the freshest-appearing part of the limestone carried the thicker or more abundant efflorescence. In fact, the margin of the deposit outlined a profile of freshness on the limestone.

A generous sample was scraped from the thicker crusts and stalactites. It had a slightly astringent, stinging taste.

The powdered efflorescence was examined microscopically and the material other than impurities of fine quartz, dolomite, and clay, was found to consist of two different substances, both being anisotropic. One had low birefringence, was extremely fine-grained, occurred in small aggregates, and had a general index of refraction that varied but slightly from 1.490. It was so fine-grained that no other optical properties could be determined. The other anisotropic material was highly birefringent and varied in index of refraction between 1.430 and 1.460. A few grains were found which gave slightly uncentered acute bisectrix figures and the mineral was found to be unquestionably biaxial negative, with an estimated axial angle of about 40°. The beta index was near 1.450 although the exact value was not obtained. Because of the fineness of grain (magnifications up to 1200 *X* were used) and partial contamination of borders by clay, very precise values of the optical properties could not be determined.

However, reference to Larsen and Berman's determinative tables[1] suggested that the mineral was mendozite, $Na_2O \cdot Al_2O_3 \cdot 4SO_3 \cdot 22H_2O$. Accordingly, a distilled water solution of the efflorescence was made and allowed to evaporate to dryness and the crystallized product studied optically. It was comparatively coarsely crystalline and determined to be mendozite with the following optical properties: $\alpha = 1.436$, $\beta = 1.455$, $\gamma = 1.459$, $\pm .003$; biaxial, negative, $2V = 40°–50°$, dispersion, $r > v$, $X = b$. The similarity of these data with those obtained on the original or undissolved material is believed to be confirmatory of the identification of one of the efflorescence minerals as mendozite.

The following chemical tests are likewise in accord. The material was soluble in cold distilled water except for a small amount of buff-colored residue determined microscopically to be dolomite and quartz. The filtered solution gave stong positive qualitative tests for the sulfate ion and aluminum, but negative micro-chemical tests for potassium and chloride. The flame color test for potassium on the solid material was likewise negative. These are the results one would expect for mendozite. A test for iron was negative, eliminating halotrichite as a possibility.

Larsen reports that mendozite alters in air to tamarugite, $Na_2O \cdot Al_2O_3 \cdot 4SO_3 \cdot 12H_2O$, which has indices of refraction as follows:

[1] The Microscopic Determination of the Non-Opaque Minerals, *U. S. Geol. Survey*, Bull. **848**.

$\alpha = 1.484$, $\beta = 1.487$, $\gamma = 1.496$. The writer believes that the very fine-grained mineral having indices of refraction near 1.490 is tamarugite coming from the alteration of mendozite. Positive identification was impossible because of the fineness of grain.

An efflorescence similar in appearance to the one described but not studied closely had been noticed two years before on a large south-facing outcrop of very coarse conglomerate forming the north bank of Stinson Creek in the southeast part of Fulton, Missouri. This locality was revisited in November, 1934, and material collected for study. The denser crusts and coarser particles gave the same chemical and optical results as the St. Louis County material. The finest filaments associated with the efflorescence were too small to be measured optically except that their indices fell within the range of the coarser material. It is believed that this efflorescence is likewise mendozite.

Origin of the Mendozite

In accounting for the probable origin of the constituents of mendozite on the Joachim dolomite it seems most logical that the source of the sulfate was oxidizing pyrite. The insoluble residue in HCl contains fine-grained pyrite, clay which is limonite-stained, and a little fine quartz sand. Sulphuric acid released from the oxidized pyrite might react with the clay to form an aluminum sulfate. Sodium may have come from sodium clay in the dolomite or it may have been present as a remnant of connate waters. The development of the efflorescence on the freshest part of the exposure suggests that at least one of the essential constituents is associated with unweathered rock.