

Davisonite and lehiite discredited

PETE J. DUNN

Department of Mineral Sciences, Smithsonian Institution, Washington, D.C. 20560, U.S.A.

CARL A. FRANCIS

Harvard Mineralogical Museum, 24 Oxford Street, Cambridge, Massachusetts 02138, U.S.A.

ABSTRACT

Lehiite and davisonite, formerly considered valid species from near Fairfield, Utah, are discredited as crandallite and a mixture of apatite and crandallite, respectively. The discreditations have been approved by the IMA Commission on New Minerals and Mineral Names.

INTRODUCTION

The gem variscite nodules from Clay Canyon, near Fairfield, Utah, are noted for several rare phosphates that occur within their alteration rinds. These minerals were studied principally by E. S. Larsen, Jr., of Harvard University and E. V. Shannon of the Smithsonian Institution, who described davisonite, dehrnite, deltaite, englishite, lehiite, and lewistonite, among others (Larsen and Shannon, 1930a, 1930b). Reexamination has shown that dehrnite and lewistonite are carbonate-fluorapatite (Dunn, 1978); deltaite is crandallite (Elberty and Greenberg, 1960; Blount, 1974), but that englishite (Dunn et al., 1984) is a distinct and well-characterized species. Our investigation of the validity of davisonite and lehiite as species is reported here.

The deliberate designation of types by describers of new minerals using, for example, the definitions proposed by Embrey and Hey (1970) is a fairly recent practice. In the case of the Fairfield phosphates there are no specimens specifically designated as type by the original investigators. However, there is in the Harvard University collection a series of specimens deposited by E. S. Larsen, Jr. (H95485–H95497), including vials of powders that are labeled by species name and “anal.” in Larsen’s handwriting, as confirmed by Dr. Clifford Frondel. These specimens, which have the best claim to type status, are the ones examined in both the present and previous studies (Dunn, 1978; Dunn et al., 1984).

On the basis of the results of our work presented below, davisonite and lehiite have been formally discredited as species by unanimous votes of the IMA Commission on New Minerals and Mineral Names.

DAVISONITE

Davisonite was originally named dennisonite by Larsen and Shannon (1930b), but the naming was in error and was later corrected to davisonite (Palache et al., 1951). The label accompanying H95490, a vial containing a minute amount of white powder, has the following annotations: “E.S.L. type” appears on the front in Dr. Frondel’s

bold hand; “Studied by Moore (1974) = apatite + minor crandallite” appears on the back in the fine hand of Dr. Paul B. Moore. New X-ray powder films made from Moore’s powder mount and from the contents of the vial are identical and corroborate Moore’s identification.

The physical properties of davisonite reported by Larsen and Shannon (hardness of 4½, specific gravity of 2.85, negative elongation, hexagonal cross section with perfect (0001) cleavage, negative optic sign, and indices of refraction $\omega = 1.601$ and $\epsilon = 1.591$) correspond well to those of an apatite (Palache et al., 1951). The indices of refraction are distinctly lower than those of the other carbonate-fluorapatites (“dehrnite” and “lewistonite”) from Fairfield but are similar to those of carbonate-hydroxyl apatite (“dahllite”) from St. Paul’s Rocks (Washington, 1929).

An attempt to explain Shannon’s analysis of davisonite as simply a mixture of apatite and crandallite is not satisfactory. Calculation of all Al as crandallite, and subtraction of appropriate proportions of Ca, P, and H, does not yield a composition close to that of apatite. Additionally, Mg and excess H are reported, suggesting additional contaminants. Although we cannot definitively correlate the analysis with the present contents of the vial, the lack of such confirmation is not troublesome inasmuch as the integrity of these samples has been compromised, in part, by some erroneous switching of the vials (Dunn, 1978).

In his re-examination of the Fairfield phosphates, E. S. Larsen III (1942) did not find this mineral; he speculated that it might be related to a member of the pseudowavellite-deltaite (i.e., crandallite) series. All studied samples of material that fit the description of this mineral, even generally, have been found, by X-ray diffraction methods and microchemical tests, to be carbonate-fluorapatite.

A purported davisonite from Brazil was reported by Guimarães (1934), but its chemical composition is only slightly similar to that of davisonite (after deduction of 28.56% insoluble residues). Because the indices of refraction for this material ($\omega = 1.633$, $\epsilon = 1.628$) are not similar to those reported for davisonite and because the descrip-

tion of davisonite does not permit its facile differentiation from carbonate-fluorapatite, this Brazilian "occurrence" can reasonably be dismissed as a false report.

Thus it is evident that davisonite was distinguished from apatite only by its lower indices of refraction and density and by the Al, Mg, and excess H in the formula, which resulted from contamination of the analytical concentrate by crandallite and possibly other unidentified compounds.

LEHIITE

The Harvard sample (H95493) of lehiite, a purported Na-K-Ca-Al phosphate, cannot be located. Providentially, a specimen in the Smithsonian Institution collection (NMNH no. 114987) consists of a vial of powder, the vial and label being identical in form to those that hold the Harvard University types of the Fairfield species. Additionally, the label is written in Larsen's hand, as confirmed by Dr. Frondel, and the handwriting is the same as on the other vials at Harvard. Nothing more is known of the sample; it is the only "authentic" lehiite known.

The powder yields the X-ray powder diffraction pattern of crandallite; no other diffractions are present. In oil immersion, it is obvious that there are two different textures of crandallite present: one in anhedral fragments, and one of fibrous habit. Their indices of refraction lie within the reported ranges for crandallite. Microprobe analyses of such fragments, of both habits, indicate that they are crandallite, with Ca:Al:P very near 1:3:2. Most important, there are no alkalis, the presence of which had given lehiite, together with the now-discredited lewistonite and dehrnite, species status.

The Utah phosphates were re-examined by E. S. Larsen III (1942), and the matter of lehiite was addressed by him, without reference to the original vial of material described herein. (Its existence might not have been known to him.) He indicated that the "lehiite" he had found occurred as "dense, light gray layers on the outer shells of the nodules, and is made up of fine to moderately coarse fibers generally in subparallel bands." We have not found material that matches the fibrous aspect of that described. However, all such gray outer layers of nodules examined have been mixtures, mostly of crandallite and quartz or carbonate-fluorapatite and quartz. Some millisite also fits this description. Additionally, both crandallite and carbonate-fluorapatite at Fairfield commonly occur in fibrous and radial habits. Larsen (1942) stated that the optical properties of this material did not match those of the original description, but that the "X-ray powder photograph of

this material shows it to be unrelated to any of the other minerals found in the nodules." No diffraction data were given nor could his powder films be found at Harvard. Because all such gray layers examined by us were mixtures, we propose that Larsen (in 1942) also obtained powder photographs of mixtures, but did not recognize them as such.

It is therefore recommended that lehiite be discredited as being a mixture of crandallite and unknown K-Na-bearing phases. Given the descriptions in the literature, millisite-wardite might have been the contaminant, but this is wholly conjectural.

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