A NEW LOCALITY FOR LUDLAMITE*

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Ludlamite, a hydrous iron phosphate, has been found in the copper-cobalt deposits in the Blackbird district, Lemhi County, Idaho. This discovery of ludlamite establishes a third verified occurrence of this mineral in the United States, the first two from New Hampshire were described by Wolfe (10, 11). Ludlamite was first discovered at the Wheal Jane mine in Cornwall in 1877 (3). Since that time this mineral has been found once in Japan (4), once in Colombia (2), and has been reported from Bavaria (8) under the name "lehnerite," which has been shown by Berman (1) to be ludlamite.

The Blackbird district is in the east-central part of Idaho, about 20 miles southwest of Salmon, the nearest town of any size. The district is accessible by graded dirt and gravel roads from Salmon and Challis. The nearest railroad is at Darby, Montana, 105 miles away.

Ludlamite in the Blackbird district is intimately associated with dark blue vivianite crystals, pyrite, quartz, calcite, and siderite. It occurs in vugs and in veinlets in the sulfide ore consisting of pyrrhotite, chalcopyrite, pyrite, and cobaltite, along with minor minerals including safflorite, tourmaline, apatite, micas, and carbonates. A detailed description of the occurrence of the ludlamite is contained in a Strategic Minerals report on the district by John S. Vhay (9).

The ludlamite crystals are pale sea-green, transparent, and are remarkably free from inclusions. They are monoclinic basal tablets, with prominent *c* (001) faces, and perfect basal cleavage. The crystals are usually about 8 millimeters across, although some of them are 12 millimeters across, and most of them are 4 millimeters thick. When heated the ludlamite crystals exfoliate rapidly into thin basal plates, indicating a definite lamellar structure. The results of three determinations of specific gravity made on the Berman microbalance are G.=3.15, 3.17, and 3.18[a]; and a determination on the same sample made by the Adams-Johnston pycnometer method shows G.=3.152.[b] The specific gravity value (3.72) in Larsen's (5) tables, 1921 edition, and copied in the 1934 edition (6), is a misprint for G.=3.12. (Field's (3) original work on ludlamite shows G.=3.12). Optically ludlamite is biaxial positive.[c] The

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[a] Determinations by Geo. Switzer, U. S. National Museum.

[b] Determination by J. J. Fahey, U. S. Geological Survey.

[c] In the original description of ludlamite by Field (3), Professor Maskelyne of the British Museum contributed the crystallographic and optical data, in which he stated that

optical axial angle for the Blackbird ludlamite is large, $2V = 86°$. $Z \wedge c$ is large. $Y = b$. The indices of refraction measured by the immersion method in white light are: $\alpha = 1.651$, $\beta = 1.669$, $\gamma = 1.690$. Optical data are in agreement with those recorded in the literature, especially for the Palermo (New Hampshire) and the Hagendorf (Bavaria) material.

No quantitative chemical work has been done in the Geological Survey on ludlamite from the Blackbird district, but a qualitative spectrographic examination[d] indicates that the mineral is almost a pure iron phosphate.

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the optical character of ludlamite was negative. However, Maskelyne (7) redetermined the optical character of ludlamite on a better crystal of the same material and found that "The optical character (of ludlamite) is positive."

[d] Examination by K. J. Murata, U. S. Geological Survey.