NOTES AND NEWS

LUDWIGITE FROM COLORADO GULCH, NEAR HELENA, MONTANA

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The relatively rare magnesium-iron borate ludwigite was found during the past summer to occur abundantly 10 miles west of Helena, at Colorado Gulch, Lewis and Clark County, Montana. It occurs at two prospect pits on the summit of the high hill northwest of the junction of the forks of Colorado Creek. The prospect openings are in the marbleized dolomites and limestones of the Devonian Jefferson formation a few yards from the contact of the Boulder batholith, which here consists of subporphyritic quartz monzonite. The prospect pits had been opened up in search for iron ore, which consists of magnetite having a notably perfect octahedral parting, apparently as a result of incipient alteration.

Large quantities of black rock are exposed, consisting almost wholly of a radially fibrous mineral, which because of the prevalence of tourmaline in this part of the batholith might at first sight be considered to be tourmaline. The silky luster of the mineral and its tendency toward ocherous weathering, however, suggest that the mineral is ludwigite. The identity of the mineral was proved by its boron flame reaction, solubility in HCl, and copious precipitates of iron and magnesium. When crushed and examined in oils, a large number of straight slender fibers are seen, but only the very thinnest of them are translucent. The fibers give sharp, straight extinction, and are pleochroic, from deep olive-green in the transverse position to brown parallel to the length. They have positive elongation, and fibers showing the maximum difference in absorption give flash figures, which show that $Z=c$. By Mallard's method 2E was found to be 40°; the dispersion is powerful, $r>v$. The index $\alpha=1.85$.

The specific gravity, kindly determined by Dr. George Switzer, is 3.70 ± 0.02. As this seemed somewhat low, determinations on ludwigite from the type locality, Banat, Hungary, were made; one specimen (Brush Coll. no. 1082) gave 3.97 ± 0.02, and another (Brush coll. no. 1080) gave 3.70 ± 0.02. Magnesioludwigite (Brush Coll. no. 4172) from the type locality, Big Cottonwood, Utah, was also measured, giving the value 3.62 ± 0.02. The ludwigite from Colorado Gulch is therefore near the magnesian end of the ludwigite series. Like the type material, it is fairly magnetic.

To those familiar with the northern portion of the Boulder batholith and the extraordinary abundance of tourmaline in its marginal zones and in its ore deposits,[1] it has long seemed anomalous that other boron minerals have not developed. Before this ludwigite was found, axinite occur-

[1] Knopf, Adolph, The tourmalinic silver-lead type of ore deposit: *Econ. Geology*, **8**, 105–119 (1913); Ore deposits of the Helena mining region: *U. S. Geol. Survey, Bull.* **527**, (1913).

ring in small amount at Elkhorn was the only boron mineral other than tourmaline known to be present in the contact zones of the Boulder batholith. Ludwigite, intimately mingled with magnetite and a minor amount of forsterite, was found by Donald F. MacDonald[2] to occur at the Redemption iron mine in the contact zone of the Philipsburg batholith, about 50 miles southwest of the Colorado Gulch locality.

[2] Schaller, W. T., Ludwigite from Montana: *U. S. Geol. Survey, Bull.* **490,** 28–32 (1911); cf. also Emmons, W. H., and Calkins, F. C., Geology and ore deposits of the Philipsburg quadrangle, Montana: *U. S. Geol. Survey, Prof. Paper* **78,** 129, 162, 220 (1913).

BOOK REVIEW

ELEMENTS OF MINERALOGY by ALEXANDER N. WINCHELL. xiii+535 pages, 468 figures. Prentice-Hall, Inc., New York, **1942.** Price $5.00.

This text attempts to do for the beginning student of crystallography and physical mineralogy what Dr. Winchell's *Elements of Optical Mineralogy* has done for the student beginning in that field, namely: to present minerals as members of broad groups which vary continuously in composition and properties. Most texts permit the student to infer that minerals are fixed in their chemical and mineralogical properties. In this respect, the new text succeeds admirably, since in all discussions the idea of continuous variation and serial relations between properties in isomorphous groups dominates descriptive, illustrative, and interpretive material.

The chapter headings follow a customary pattern: I, Introduction; II, Crystallography; III, Physical Mineralogy; IV, Chemical Mineralogy; V, Descriptive Mineralogy; VI, Economic Mineralogy; VII, Determinative Mineralogy; followed by a glossary and index.

In the chapter on Crystallography, Winchell has succeeded in the reviewer's opinion in making the basic concepts of the x-ray study of crystals understandable to the beginner as the basis for the subdivisions of physical crystallography. This is a distinct innovation since texts have clung to the traditional presentation of physical crystallography, followed by a discussion of modern x-ray methods. Excellent figures showing the relations between crystal habits and mineral structures in the six crystal systems are particularly useful (pp. 112–113). The discussion of crystal systems follows the conventional Dana order. Illustrations are numerous and well placed.

The chapter on Determinative Mineralogy combines physical and crystallographic properties in a series of four identification tables, each based on a different property or combination of properties. These should prove exceedingly useful since the student has an opportunity to check his identifications by a series of parallel keys, based on different grouping of properties. Table I is based on streak and specific gravity; table II on hardness and streak; table III on cleavage and luster; and table IV on refractive index.

The book is well composed. Errors are few, although some, especially in the section on Chemical Mineralogy, are annoying. For example, selenium (p. 218) is said to have a valence of +2 or +6, and an example, SeO_2, is cited which has the valence +4; sulfur (p. 220) is given as +2 or +6 when in the commonest sulfide minerals and in an example given (H_2S) the valence is −2. Similarly, tellurium is stated incompletely. A few diagrams are mislabelled, especially the line drawings of crystals: figs. 70, 145, 150, and 152, where Miller indices of faces are incorrectly designated. Professor Winchell, however, is to be complimented on a book which should be well received by teachers of mineralogy.

The price of the book ($5.00) may limit its adoptions, since in future use to the geology student as a reference work, it is of somewhat less completeness than other texts in the field, selling at essentially the same price.

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