# NOTES AND NEWS

## AN OCCURRENCE OF DIASPORE IN QUARTZITE

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A study of specimens of the Sioux quartzite from several localities in southwestern Minnesota and southeastern S. Dakota shows that diaspore is an abundant and characteristic mineral of at least large portions of the formation. Since diaspore occurs most commonly in association with corundum and emery[1] or in residual clays[2] and bauxites, its occurrence in a quartzite is believed worthy of note. No similar occurrence of diaspore is known.

The Sioux quartzite (Algonkian) outcrops in portions of southwestern Minnesota and in neighboring parts of Iowa and South Dakota. The formation is of great thickness.[3] Most of it is well cemented but parts of the formation are porous and contain a small amount of cement.[4] There is no evidence that the Sioux quartzite was ever subjected to deep burial or to high temperature metamorphism. The formation was probably submerged during a portion of Cretaceous time because Cretaceous deposits overlie the quartzite in many localities.

Thin sections of all available specimens of the quartzite were examined. They are very similar and show that all the specimens contain diaspore. The specimens from Pipestone, Minnesota, were taken from positions stratigraphically higher than the well known "pipestone" or catlinite layer[5] which forms the basal portion of the outcrop.

The quartzite from Pipestone shows secondary growth, but there is little evidence of dynamic metamorphism. The outlines of the original quartz grains are for the most part distinct, indicating little recrystallization. Under crossed nicols the grains extinguish evenly and very few grains show any evidence of strain. A polished section shows clear rounded quartz grains in a cloudy matrix that, except for the diaspore, which acts partially as a cement, is composed of silica. The rock is thoroughly cemented.

The diaspore (see Fig. 1) forms irregular masses between the original sand grains of the quartzite, and subhedral and euhedral grains up to

[1] Dana, E. S., *Descriptive Mineralogy*, New York, John Wiley and Sons, 1892, p. 247.

[2] Allen, Victor T., Mineral composition and origin of Missouri flint and diaspore clays: *Missouri Geol. Survey and Water Resources, 58th Biennial Report*, Appendix 4, **1935.**

[3] Rothrock, E. P., and Newcomb, R. V., Sand and gravel deposits of Minnehaha County, S. Dakota: *Geol. and Nat. History Survey, Circular* **26,** p. 9, 1926.

[4] Winchell, N. H., *Geology of Minnesota*, Vol. I of the Final Report, **1884,** p. 542.

[5] Winchell, N. H., *op. cit.*, p. 540.

.35 mm. in diameter. It constitutes over 3 per cent by weight of the quartzite, as determined by heavy liquid separation of the crushed quartzite grains. In thin section the diaspore is colorless, but concentrates from the crushed quartzite have a distinct pinkish color. The masses of diaspore are not aggregates but each mass has optical continuity. The mineral liberates water in a closed tube Qualitative chemical tests indicate abundance of aluminum. The refractive indices are: $\alpha=1.700$, $\beta=1.720$, $\gamma=1.752$ (all $\pm.003$). Using these indices the calculated $2V=83°$, approximately. The identification was kindly confirmed by Dr. J. W. Gruner, using an $x$-ray diffraction pattern.

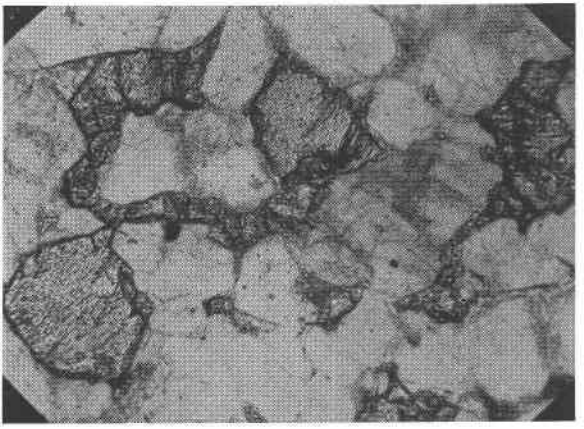

FIG. 1. Photomicrograph of a thin section of the Sioux quartzite from Pipestone, Minn. The mineral with high relief is diaspore. Other material is quartz. Plain light (×60).

Associated with the diaspore in the quartzite are rutile and iron oxides. The rutile occurs as euhedral crystals, some geniculate twins, and as very small irregular specks. Usually the rutile, which is rather abundant, lies between the original quartz grains but an occasional crystal penetrates a quartz grain. The iron oxides are probably largely responsible for the distinct reddish color of the rock. In thin section these oxides appear to be concentrated in the interstitial spaces and on the borders of the quartz grains.

Detailed field and laboratory study might definitely establish the genesis of the diaspore. From the evidence at hand, however, several possibilities may be mentioned. The diaspore could hardly be detrital. It is equally unlikely that it could have been formed at high temperatures, not only because the quartzite formation itself lacks evidence of high temperature metamorphism, but also because at high temperatures

the alumina would probably have reacted with the silica present to form an aluminum silicate.

Perhaps the most likely hypothesis is that the diaspore was formed from differential leaching by meteoric waters. The leached material might have been any aluminous silicate or silicates originally present in the formation or, possibly, silicates which were introduced in colloidal solutions. Supporting the leaching hypothesis is the fact that feldspars, clay minerals and other silicates are almost if not quite lacking in the specimens studied. This evidence, however, is only of negative value as the original mineral composition of the formation is unknown. The considerable amount of rutile also lends support to the idea of leaching. The rutile very likely was derived by alteration of ilmenite or other titanium-bearing minerals. Titanium is recognized as a concentration product and is usually found in residual clays and bauxites.[6]

Whatever may be the genesis of the diaspore it is certain that the agencies of metamorphism have had a very long time in which to effect their alterations. The formation is pre-Cambrian and, as noted above, portions of it are still porous and poorly cemented. The cementation of the quartzitic portions of the rock seems likely to have followed the formation of the diaspore although secondary growth of the quartz and leaching of the silicates might have been contemporaneous. In fact the silica leached from the silicate minerals may have contributed to the cementing material.

The writer has already begun a detailed study of all phases of the Sioux quartzite.

[6] Clarke, F. W., *The Data of Geochemistry, U. S. Geol. Surv., Bull.* **770,** 1924, p. 503.