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TWO UNUSUAL OCCURRENCES OF MICROSTYLOLITES

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ABSTRACT

Microstylolites are here reported in both quartzite and in welded tuff. Descriptions of these unusual occurrences and accompanying photomicrographs suggest difficulties in applying the widely held theory of pressure—solution for the origin of these features.

INTRODUCTION

The purpose of this paper is to place on record two unusual occurrences of microstylolites. One example concerns microstylolites in quartzite, discovered by Burma; the other in what is apparently a welded tuff, discovered by Riley.

There are few records of stylolites in quartzite in the literature. Conybeare described microstylolites from an early Proterozoic quartzite (Conybeare, 1949) and casually mentioned another such occurrence (Conybeare, 1950). Tarr (1916) described macrostylolites from Dakota quartzite in Colorado. Price described problematical macrostylolites in Medina quartzite (Price, 1934).

Stylolites in quartzitic sandstone have a slightly more extensive record in the literature. Andrews (1947), Price (1934) and Stockdale (1936, 1945) have described macrostylolites in quartzitic Pennsylvanian (Pottsville) sandstone along the Appalachian area from Maryland to Alabama. Sloss and Feray (1948) similarly described microstylolites in a Cretaceous quartzitic sandstone in Montana.

All the above authors attribute the stylolites in sandstones and quartzites to pressure-solution. Shaub (1947, 1950) has disputed this origin, but his alternative theory seems even less capable of accounting for the phenomena described.

MICROSTYLOLITES IN THE SIOUX QUARTZITE

The microstylolites in quartzite observed by us were found in a glacial cobble found in the vicinity of Lincoln, Nebraska. It rather obviously came from the outcrop area in eastern South Dakota—southwestern Minnesota. The Sioux quartzite of this area is virtually undisturbed, and apparently has never been subjected to an orogeny, in contradistinction to the quartzites and sandstones mentioned above. This is substantiated by the unstrained, uncrushed, unsheared nature of the quartzite specimen in hand.

The quartzite itself is composed of a poorly sorted mixture of coarse sand to silt. The subangular nature of the grains and the low degree of sorting suggest that the original sandstone would have had a low porosity. The small amount of original pore space has in the main been filled with mosaic quartz. (figs. 1, 2)

The quartzite shows a rude graded bedding, and the microstylolites are apparently concentrated at the lamella boundaries, although not entirely restricted to them. They usually make their way between the grains, many of which show beautifully sutured boundaries, but occasionally cut across a grain or across an area of quartz cement. For these reasons, there seems to be no doubt that the stylolites formed after the quartzite

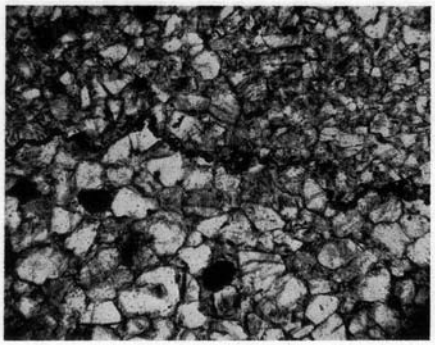

FIG. 1.—Microstylolites in Sioux quartzite. ×30.

was cemented into a rock which was virtually free of voids.

The situation is peculiar. Here are well developed microstylolites in a highly insoluble rock which could have had little or no circulating water in it. The petrographic study yields little evidence of particularly deep burial, or metamorphism of consequence, and no evidence of orogeny is reported for this area of the Sioux outcrops. In these circumstances, the pressure-solution theory seems difficult to apply, but we can suggest nothing better.

MICROSTYLOLITES IN WELDED TUFF

No references have been found in the literature to stylolites in tuffs. It thus is doubly unfortunate that no locality data can be given for our specimen. It was part of a collection purchased many years ago and on which no data remain. The character of the material suggests that it is of middle or late Tertiary age and is from the western United States. The rock itself is a tuff and almost certainly a welded tuff. Pore space is approximately nil. The rock is a dark-red aphanite, of procelainous luster, containing numerous light colored small "phenocrysts." In thin-section, (fig. 3) shard-phantoms are quite evident as is a strongly developed layering displaying minute compaction structures. Mineralogically, the rock carries albite, orthoclase, quartz, and biotite and abundant devitrified glass, with secondary sericite, chlorite, hematite, and leucoxene.

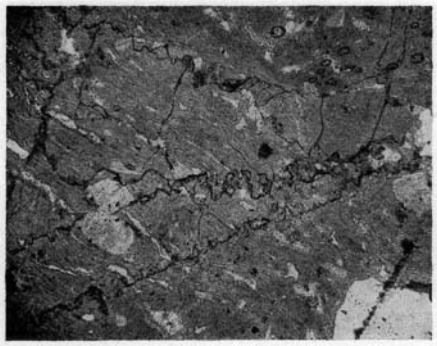

FIG. 3.—Microstylolites in welded tuff. ×30.

A most striking feature is the extremely well developed microstylolites which cut indifferently across all the minerals. They appear to occur in three inclined sets, one approximately parallel to the layered structure. The suture is characteristically lined with chlorite, or less commonly sericite. Here again there is the difficulty of accounting for a supposed solution feature in a well-nigh impervious rock. The occurrence of the stylolites in three sets is also a complication and suggests that static load is not re-

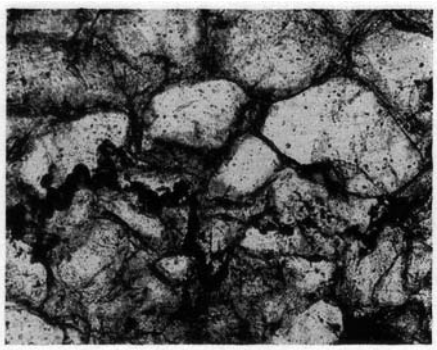

FIG. 2.—Microstylolites in Sioux sandstone. ×80.

sponsible. The chlorite in the sutures suggests some hydrothermal action, but although all the feldspars are somewhat sericitized, the extent of it is hardly more than one would expect as a result of the self alteration by hot gases in a cooling ash-bed. No satisfactory explanation presents itself.

REFERENCES

ANDREWS, D. A., 1947, Significance of stylolites in sandstone (Abst.): Washington Acad. Sci. Jour., v. 37, pp. 372–373.

CONYBEARE, C. E. B., 1949, Stylolites in pre-Cambrian quartzite: Jour. Geology, v. 57, pp. 83–85.

———, 1950, Stylolites in pre-Cambrian quartzite: a reply: Jour. Geology, v. 58, pp. 652–654.

PRICE, P. H., 1934, Stylolites in sandstone: Jour. Geology, v. 42, pp. 188–192.

SHAUB, B. M., 1947, Coal partings in stylolite seams: Jour. Sedimentary Petrology, v. 17, pp. 114–118.

———, 1950, Stylolites in pre-Cambrian quartzite: Discussion: Jour. Geology, v. 58, pp. 650–652.

SLOSS, D. D. and FERAY, D. E., 1948, Microstylolites in sandstone: Jour. Sedimentary Petrology, v. 18, pp. 3–13.

STOCKDALE, P. B., 1936, Rare stylolites: Am. Jour. Sci., 5th ser., v. 32, pp. 129–133.

———, 1945, Stylolites with films of coal: Jour. Geology, v. 53, pp. 133–136.

TARR, W. A., 1916, Stylolites in quartzite: Science, new ser., v. 43, pp. 819–820.