NOTES AND NEWS

PSEUDOTACHYLITE OF THE ANTIETAM QUARTZITE

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Introduction

The material which forms the basis of this paper was first encountered by Ernst Cloos during the course of field studies in Frederick County, Maryland. The quarry from which the specimens were collected is located in the Antietam quartzite approximately 8 miles south of the town of Frederick and 3 miles west of Sugar Loaf Mountain on the west side of the Monocacy River. The author later accompanied Ernst Cloos to the locality at which time further studies were made and additional material secured.

General Description

The Antietam quartzite of lower Cambrian age is lead gray to brownish gray in color. In the vicinity of the Monocacy River, the rock shows evidence of faulting and is cut by numerous veins which have a preferred orientation (Fig. 1). These veins, which represent tension cracks, have been filled with chlorite, chlorite and quartz, and occasionally with only quartz. The majority of them contain chlorite and their dark greenish black appearance suggested tachylite veins in the field. The veins vary in width from 1 to 1/16 inch (Fig. 2). The small veins are usually elliptical

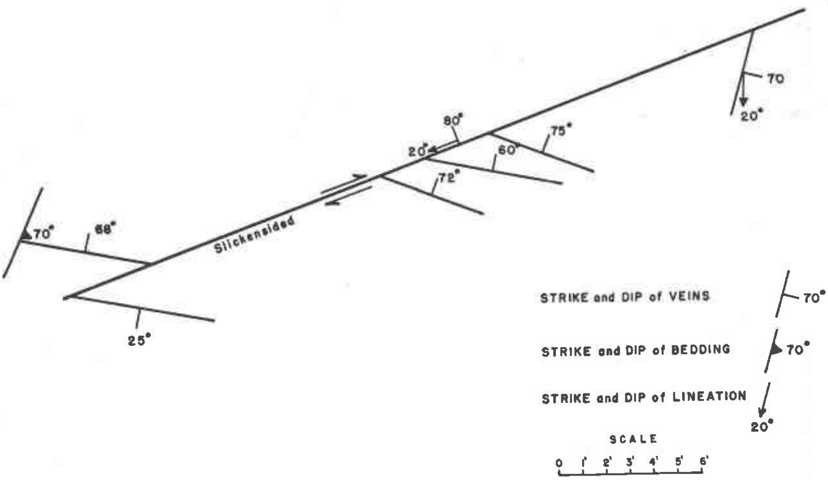

Fig. 1. Relationship of veins and faulting in Antietam quartzite near Monocacy River, 8 miles south of Frederick, Md.

and are usually less than 1 foot in length. Drusy structures have been encountered in several instances, with well formed quartz crystals growing perpendicular to the vein wall. In the abandoned quarry, on the south side of the road near the river, a small fault is present. Bedding dips 70 degrees to the southeast and is obliquely cut by tension cracks on both sides of the fault plane (Fig. 1).

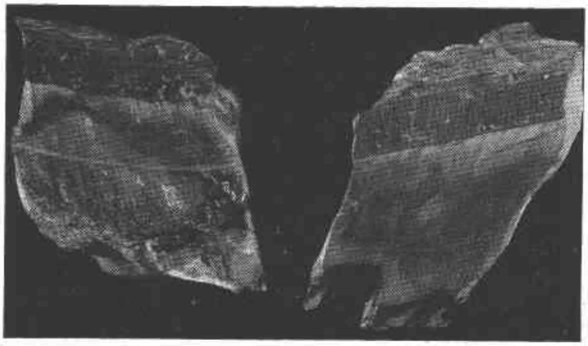

FIG. 2. Chlorite veins (upper dark area) in Antietam quartzite.

MICROSCOPIC CHARACTERISTICS

The Antietam quartzite possesses a granoblastic structure and is composed of subangular grains of quartz with subordinate albite-twinned plagioclase and microcline. Blue-green tourmaline, zircon, and biotite are accessory minerals. In thin section the rock has a dirty appearance and the mineral grains are surrounded by slivers of sericite and chlorite, yellow iron oxide, and argillaceous matter.

Microscopically, the quartzite appears to be relatively undeformed. The quartz grains possess a faint undulatory extinction but no suggestion of crushing and annealing of the grains was noted. The presence of chlorite and sericite and the relatively undeformed character of the grains suggests that regionally the rock belongs to a low stage of metamorphism.

In most instances the vein material consists of chlorite with subordinate quartz. The quartz grains occur as small individuals distributed throughout the chlorite but occasionally large masses are present. At the boundaries of large masses of chlorite and quartz, chlorite seems to filter into the quartz. A rhythmic development of these two minerals was also noted, with small worm-like chlorite masses arranged in hexagonal outlines within large quartz grains. Large quartz masses are usually highly deformed (Anderson, 1945), the deformation being more pronounced when chlorite is subordinate in amount (Fig. 3).

The beta index of refraction of the vein chlorite is 1.641. The optic angle, 2V, is very small and the mineral is negative. The pleochroism is:

Z = deep yellowish green
Y = pale yellowish green

The retardation, measured by means of a Berek compensator, was 206 mμ, corresponding to a birefringence of approximately 0.006. Re-

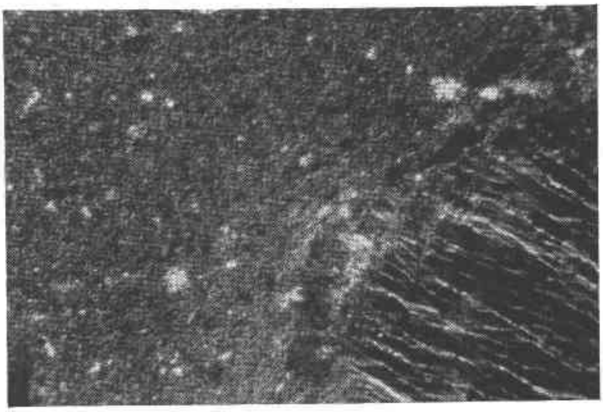

FIG. 3. Thin section of vein chlorite showing deformed character of large quartz and distribution of small quartz. Crossed nicols.

ferring these data to Winchell's curves (Winchell, 1933, p. 278) the composition of the vein chlorite is:

Ferroantigorite ($H_4Fe_3Si_2O_9$) = 34%
Daphinite ($H_4Fe_2Al_2SiO_9$) = 33%
Antigorite ($H_4Mg_3Si_2O_9$) = 17%
Amesite ($H_4Mg_2Al_2SiO_9$) = 16%

This information indicates that the vein chlorite is of the iron-rich variety.

Chlorite of the Antietam quartzite was isolated and studied. The beta index and birefringence was found to be the same as that of the vein chlorite, hence the composition of both is identical.

CONCLUSIONS

The composition of the dark colored veins, which represent the filling of tension cracks caused by faulting, is essentially chlorite and quartz. The term pseudotachylite has been applied in this instance to emphasize the resemblance of the vein-filling to that of basaltic glass. Diabase dikes are present approximately two miles east of the locality under discussion but no evidence of igneous activity was observed in the immediate vicinity. The mineral character of the vein-filling and the absence of evidence of igneous activity does not favor an igneous origin of these veins.

Shand (1916) has discussed the origin of pseudotachylite of Parijs, Orange Free State. Here, granite gneiss is cut by numerous veins of black rock which resembles tachylite. It was Shand's opinion that the pseudotachylite originates from the granite gneiss through melting "caused not by shearing but by shock, or, alternatively, by gas-fluxing" (Shand 1916, p. 219).

Pseudotachylites have been reported from Madras, Scotland, and Argentina (Shand, p. 209). In every instance, faulting seems to have been associated with the development of these rocks and no direct evidence of igneous activity was present.

The pseudotachylite of the Antietam quartzite is thought to have originated through faulting. The boundaries between the country rock and the vein are sharp and microscopically chlorite is usually well developed along the contact. The similarity in composition between chlorite of the quartzite and that of the vein-filling suggests that the chlorite was derived from the quartzite. The rise in temperature due to faulting is thought to have caused the migration of ions of chlorite and quartz from the quartzite into the tension cracks thus producing small veins resembling tachylite. Adjustment along these veins after they were filled resulted in the deformation of the quartz.

References

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