Chert breccia

I read with interest the paper by Siva Siddaiah[1] on petrography and geochemistry of chert breccia occurring between Precambrain Sirban Limestone and Paleogene Subathu Formation. Chert breccia is an autoclastic breccia, in which both fragments and matrix are composed of microcrystalline quartz[2,3]. Furthermore, chert breccia of Kalakot area consists of angular to subangular, lensoid, elongate, centimetre to decimetre long fragments of quartz in a cherty matrix[1]. Surprisingly, Siva Siddaiah ignored the fragments and studied only the matrix of chert breccia and based on its geochemistry concluded it to be of typical volcanic character. Drawing an analogy between the agglomerate of the Kanthan area, of igneous origin and the chert breccia, of sedimentary origin seems unjustified. Chemistry of many sedimentary rocks is similar to that of igneous and metamorphic rocks, but this does not mean that sedimentary rocks are of igneous or metamorphic origin.

The close and frequent associations of chert and breccia structures indicate that cracking and fragmentation are inherent to the maturation of siliceous sediments. These rocks become sufficiently brittle during the early stage of their formation, tend to break into fragments and ultimately become lithified along with the matrix during diagenesis. In such cases chemical (and isotopic) analysis of both fragments and matrix in a chert breccia should yield information on the evolution of early diagenetic conditions in the rock's history[3].

There is also strong evidence that many cherts are the result of replacement of pre-existing carbonate where replacement textures are abundant[3]. In another mechanism analogous to sedimentary boudinage, a second silicification stage is supposedly responsible for the chertification of the matrix and conversion of the entire sediment package into a chert[4]. None of these mechanisms suggests that chert breccia forms by volcanic processes. Chert is always rich in silica and this has been reported in the chemical analysis (90–91%) conducted by Siva Siddaiah[1]. However, the occurrence of relict textures of sanidine and biotite may be related to their occurrence in the precursor matrix, which was later silicified. Thus, the assumption of Singh[5] appears the most reasonable. He has hypothesized that the chert breccia of the Jammu area formed as a result of silicification of the underlying Sirban limestone. The quartz identified in the Sirban Limestone in this study may be dolomite, as it shows similar interference colour to quartz.

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Response:

Whole-rock samples of breccia were used in petrography and geochemical studies[1] and not samples of matrix/groundmass alone, as wrongly pointed out by B. P. Singh. In fact, the samples studied consist predominantly of phenocrysts (quartz) compared to matrix and thus the inferences drawn pertain to this. Breccia units observed at Kalakot and Kanthan are ~40 km apart occurring at the same stratigraphic position/level having upper contact with the same basal Subathu Shale. In addition, field and petrographic features of the Kalakot breccia are similar to those of Kanthan for which an igneous origin was suggested[2] and their comparison is justified.

Geochemistry, particularly immobile element concentrations and their ratios in the breccia, are typical of volcanic rather than sedimentary origin. Earlier descriptions of the breccia were solely based on field observations without petrological and geochemical data[3]. Indeed, field studies alone are not sufficient to establish the origin of any rocks in general, and breccia, in particular. Therefore, detailed and systematic field and laboratory studies of this breccia were desired and awaited since long[1]. In the field, the Kalakot breccia shows phenocrysts of quartz and feldspar of different shapes and sizes, randomly distributed in a fine-grained glassy matrix. Mineralogical and textural characteristics (quartz with hexagonal bipyramidal, triangular, dagger, sickle and splintery-shaped morphologies) were ascribed to a volcanic origin. In addition, neither replacement of carbonates nor relicts of the replacement textures was observed in the studied samples. A high content of silica (~90 wt%) in the breccia is partly due to predominance of quartz phenocrysts in the Kalakot breccia, and silicic tuffs with 90 wt% of silica content are not uncommon[4]. Thus, the breccia at Kalakot displays field, mineralogical, textural and geochemical characteristics typical of a rhyolitic tuff breccia. Systematic geochemical, isotopic and chronological studies are planned not only for Kalakot and Kanthan but also for breccias found elsewhere in the Jammu region, to understand their origin.

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