Possible pseudotackylyte of crushing origin from the ISTL along River Hayakawa in Yamanashi Prefecture, central Japan

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A black vein, possible pseudotacylyte was found from the Itoigawa-Shizuoka Tectonic Line along River Hayakawa near Nishiyama hotspring, Yamanashi, central Japan. The black vein develops the range of 10 cm width and 1.1 m long in cataclastic quartz porphyry near the boundary between the white or grayish green quartz porphyry of the Momonoki Group and the black slate of the Amahata Group at this outcrop. The black vein strikes N10E and dips 86W which is subparallel to the boundary of both rocks, and has injection veins. Optical microscope observation under plane-polarized light showed that the black vein is characterized by roundish to angular fragments of the size of several mm to 10 µm and dark-brown cryptocrystalline matrix without the melted texture such as spherulite, flow structure. The fragments consist of many kind of minerals, especially quartz and plagioclase, and resemble to phenocrysts in quartz porphyry, host rock. Analyses of X-ray diffraction (XRD) using elutriated powder and scanning electron microscopy with energy-dispersive spectrometer (SEM-EDS) indicated that matrix composed illite and chlorite. The black vein also includes submicron to 10 µm in size of sphene, apatite, rutile, pyrite, sphalerite, barite, calcite, and so on. Using high resolusion scanning electron microscopy (HRSEM), the matrix cemented with foliated clay minerals was observed on the cross section of freeze-dried sample, but few fragments were altered. At higher magnification, the outline of roundish fragments under optical microscope is serrated, and marginal parts of fragment deformed by plastic flow or stringy textures are not observed. In the matrix, weak layerd polycrystalline aggregates, crystals having high dislocation density, dynamic recrystallized polygonal aggregates and regions having few dislocations are observed in the bright field image using transmission electron microscopy (TEM). The regions having few dislocations show the diffuse amorphous rings and single crystal pattern obtained by electron diffraction pattern. In the fragments of black vein, the absence of fragments which have slaty cleavage and resemblance of phenocrysts in the quartz porphyry indicate that the black vein derived from the quartz porphyry. The presence of euhedral to subhedral pyrite, sphalerite, barite, calcite, illite and chlorite in the black vein suggests the hydrothermal alteration, however, the white host rocks are also altered by geothermal fluid. Amorphous silica is occurred by the hydrothermal alteration at temperatures below about 180C, while, illite and chlorite observed in the black vein are appeared at about 230C (Henley and Ellis, 1983), so the amorphous solids in the black vein were not formed by the hydrothermal alteration. Consequently, the black vein has the injection veins and amorphous solids which are not relevant to hydrothermal alteration, and not observed the melted texture; therefore, the black vein is the possible pseudotachylyte of crushing origin. In the black vein, coexistence of calcite twin of type2 and type3 appeared at temperature above about 200C (e.g. Burkhard, 1983) and presence of illite and chlorite occurred at about 230C, high dislocation density crystals and dynamic recrystallized aggregates showed plastic deformation suggest that pseudotachylyte as well as the other fault rocks occurred near Nisiyama hotspring was likely to form under the deformational condition of brittle-plastic transition.