GENESIS OF PSEUDOTACHYLITE VEINS IN THE BASEMENT OF THE ROCHECHOUART IMPACT CRATER, FRANCE. I. GEOLOGICAL AND PETROGRAPHICAL EVIDENCE. W.U.Reimold[+], L.Bischoff[*], W.Oskierski[*], and H.Schäfer[+], [+]Institute for Mineralogy, [*]Geological Institute, University of Münster, D-4400 Münster, FRG.

We have already reported the existence of pseudotachylite-containing veins (1 dm to < 20 μm in width) found in granitic host rock in a quarry close to the village of Champagnac located less than 5 km from the probable point of impact of the Rochechouart meteorite (1).

Two types of veins can be distinguished according to their fillings, which consist either of quartz ± sulfides (Type I - pyrite can form the matrix of type I veins) or of pseudotachylite (PT) melt in form of pockets (Figs. 2,3) of 50 to 5000 μm in diameter, or of < .5 cm long schlieren embedded into quartz or pyrite layers (Type II). Calcite and dolomite are abundant as parts of the vein fillings (mostly forming fine-grained layers parallel to quartz or PT melt) or in the form of 2nd generation veinlets cutting diagonally through quartz bands and PT melt (Fig. 4). Both, type I and II veins, display the same distribution of spatial field orientations in the Schmidt net (Fig. 1). From these observations we conclude that they form a fracture system distinct from any other structural phenomenon observed in the Haut-Limousin.

Typical for these veins are sericitization fronts extending to 1 cm into the neighbouring granites, where Ca is completely removed from plagioclase, and sericite contains only K (much) and Na (little). The host rock/vein filling contact walls generally are very straight, and clastic debris (in quartz/pyrite or PT melt) can not be traced back to its original position. However, the fractures have been produced by lateral slip, as lithic clasts with symmetrical bending of mica were found (Fig. 5). Maximum deformation stress can be estimated to be ≤ 1 GPa, as only formation of kink bands -in muscovite and plagioclase (Fig. 6)- and of planar fractures (few) (2) in plagioclase serve as pressure indicators. Clasts within PT melt or quartz/sulfide regions consist mostly of quartz (est.: > 95 %). Rarely, some alkalifeldspar was detected (Fig. 9). Plagioclase clasts were not observed at all, despite the fact that up to 30 vol% of the granites consist of Na,Ca-feldspar!

Four melt types are distinguished: a) pockets with glassy - in part chloritized - matrix (Fig. 3 -(1)), b) with fragmental matrix (Fig. 7), c) with recrystallized fragmental matrix and at least partially recrystallized clasts (Figs. 3,8), and d) altered interstitial glass between idiomorphic quartz crystals. Chemically the matrices of types a - d are very K-feldspathic, but contain varying amounts of excess SiO_2 and minor amounts of MgO and FeO. The fact that type d (interstitial glass) is of aluminous composition clearly rules out the possibility that the melt fillings could be residuals of some highly silicious/sulfidic melt. New crystallization of K-feldspar and ferrosilite was detected in the matrix of melt pockets.

Clasts usually are marginally corroded (Fig. 4 -(1), Fig. 9) and internally unaltered, i.e. they are virtuall unseritized, in melt of type b), or they are more or less recrystallized (Fig. 3) in type c) melts. Yet muscovite appears totally unaltered even in totally recrystallized fragments! Assuming that the system was saturated with H_2O (cf. (3)) we can conclude from the stability diagram of muscovite that the tempe-

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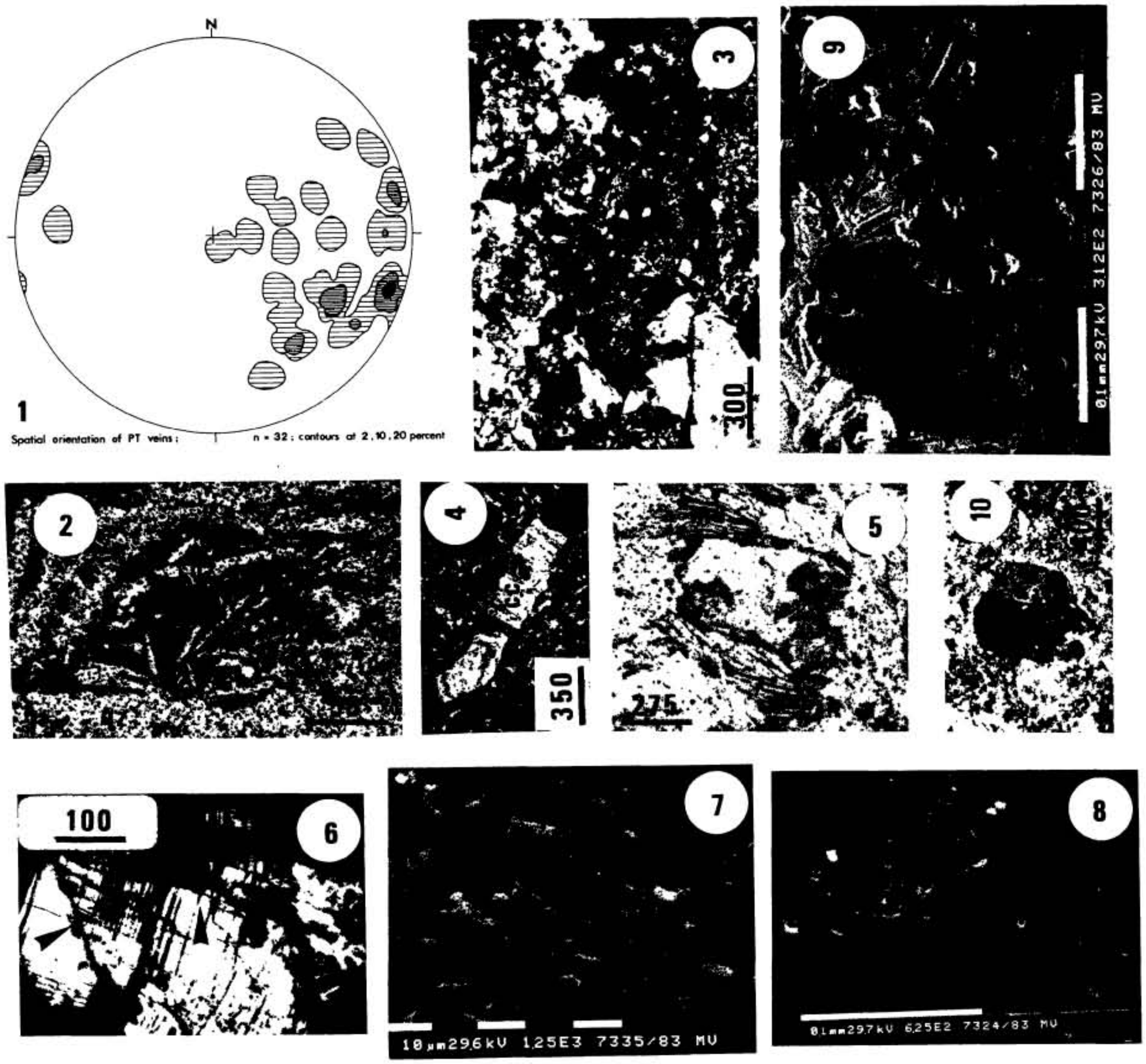
rature in the vein system never exceeded ± 720 °C. Sulfide mineralogy adds to this assumption: pyrrhotite is absent, but pyrite often crystallized prior to quartz, alkalifeldspar, and pyroxene, and in addition, arsenopyrite was detected as primary crystallization as well. Both phases, arsenopyrite and pyrite, are unstable above 740 °C. Detection of considerable amounts of incompatible elements such as Pb or Ba in sulfide aggregates supports the conclusion that silicon and sulfides are of hydrothermal-pneumatolytic origin. Not much can be said about the probable cooling period, but it had to be sufficiently long to complete recrystallization, e.g. of coarse-grained clasts such as the K-feldspar clast of Fig. 10, and to completely change the chemistry of the vein system, as will be discussed in the companion paper (3).

Unequivocally, formation of these vein fillings involved more than a simple one--stage process (3)!

References: (1) Reimold, W.U. et al. (1983) LPS XIV, 636-637; (2) Stöffler, D. (1971) Fortschr. Miner. 49, 50-113; (3) Reimold, W.U. et al. (1984) Genesis of pseudotachylite veins...., II. Geochemistry and genetic model (this volume).



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