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Microstructures, textures and geothermometry of graphitic carbon in low- to high-grade mylonites

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Graphitization differs from most mineral transformations occurring during diagenesis and metamorphism in that is an irreversible process. Graphitic carbon exhibits a large range of structures and chemical compositions, ranging from amorphous-like compounds (e.g. soot, low-grade coal), through a myriad of turbostratic structures (e.g. carbonaceous materials in metamorphic rocks), to rather rare crystalline flaky graphite. Graphitic material has a number of properties and the most significant one is the structural change of the graphitic materials with increase of temperature in the fault zones as well as in very low-grade to high-grade metamorphic terrains. During metamorphic processes, organic matter is progressively transformed into graphite and the degree of maturation or graphitization of graphitic materials is a potential tool, therefore, considered as a reliable indicator of peak conditions of the metamorphic grade in metamorphic petrology. In mylonites and brittle fault zones, graphitic material is rheologically very weak, a phenomenon, which results in shear concentration along zones rich in graphitic material. The characteristics and metamorphic peak conditions of graphitic material-bearing mylonites from fault zones are studied using optical microscopy, SEM, Electron Back-Scattered Diffraction (EBSD) and Raman microspectroscopy and carbon isotopic analysis. The graphite grains are distributed parallel to the mylonitic foliation and present coarse to very fine-grained microstructures. The deformation includes dislocation glide. The deformed graphite lattice-preferred orientation by EBSD measured records presents intracrystalline slip system, which is easy in the direction of the <a>-axes and, in fact, nearly in any direction within the basal planes. The thermometry of graphitic material by Raman spectroscopy was calibrated for the temperature range from 360 to 650 °C. These structural analyses of graphitic material in mylonitic rocks allow unraveling the possible relationship of deformation conditions and geological processes.