Micro/nanostructural characterization of dickite pods formed during the seismic cycle of the Alhama de Murcia fault

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Rounded to lens-shaped micropods of dickite can be found in rocks collected in the Lorca-Totana segment of the Alhama de Murcia Fault, a NE-SW strike-slip 100 km long fault located in the eastern Betic Cordillera. Fault-core rocks are made of foliated bands more than 100 μm thick rich in well crystallized muscovite, paragonite and quartz including dolomite, calcite and hematite crystals frequently > 20 μm size. In some cases, carbonate grains exhibit intact cores but rims with localized disaggregation, holes and Fe-oxide crystallization. Kaolinite can be observed in this foliated bands intergrown with K- and Na-micas. Alternating with these bands that define the main foliation of the rock, thin ultrafine-grained bands (around 20 μm thick) can be observed. These microbands are made of an apparently poorly crystalline material characterized by the presence of numerous holes and vesicles. Compositionally, this material is made of mica bulk composition patches, areas having calcite and dolomite composition, a network of dolomite and calcite skeletal crystals and dispersed crystals of Fe-oxide, which absent or ring-shaped SAED patterns suggest poorly crystalline or amorphous nature. Dickite occurs as isolated micropods, formed by almost euhedral crystals (40 to <2 μm). In some cases, dickite crystals are randomly oriented as testified by ring-shaped SAED patterns. The two layers nature of dickite has been also characterized by SAED patterns. Micro/nanostructures observed in the studied gouges suggest at least two stages of mineral crystallization formed during the seismic cycle of the fault. Frictional heating processes activated coseismic high temperature reactions that produced poorly crystalline materials from the ultrafine-grained bands. Micropods of dickite, probably created by deformation, represents later preferential sites for episodic fluid overpressure followed by fluid discharge and precipitacitation under relatively high temperature.