Shock-metamorphic effects in chert: Evidence from the Jebel Waqf as Suwwan impact structure, Jordan

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The petrographic study of a chert nodule recovered from the central uplift of the recently discovered ~6 km Jebel Waqf as Suwwan impact structure, Jordan [1;2], revealed - in addition to some well-established shock-metamorphic effects in quartz [3;4] - new potential shock features in crypto- to microcrystalline varieties of silica. The microcrystalline chert groundmass exhibits a dendritic and a superimposed orthogonal fracture pattern at the cm- to mm-scale, commonly associated with microscopic quartz 'recrystallization bands' that intersect the primary diagenetic chert fabric. Aggregates of spherulitic microfibrous silica (first-generation chalcedony *sensu stricto* and second-generation quartzine [5]) in veins are locally of shattered appearance. Quartzine shows conspicuous sets of 'curved fractures' (Fig. 1A) that run perpendicular to the fiber direction (c-axis) and commonly trend subparallel to planar fractures (PF) in neighbouring coarser-crystalline shocked quartz. Quartz exhibits PF, sometimes combined with feather features (FF) [6] (Fig. 1B), and mainly single sets of planar deformation features (PDF) parallel to the basal plane (0001) (Brazil twins) with rare additional PDF in the {10-13} direction.

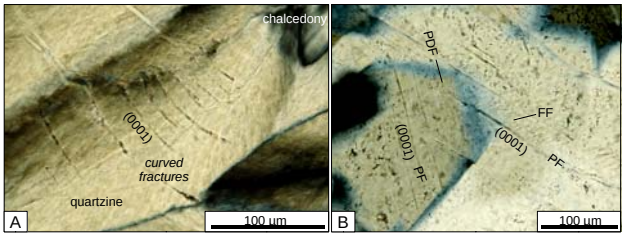

Fig. 1: Microdeformation features in chert from Jebel Waqf as Suwwan, Jordan; **A**: 'curved fractures' in microfibrous spherulitic quartzine; **B**: shocked quartz exhibiting planar deformation features (PDF), planar fractures (PF), and feather features (FF) (A and B cross-polarized light).

Shock petrography indicates shock pressures of ≥10 GPa and high shock-induced differential stresses [4;7] that affected the chert nodule as a whole. The internal crosscutting relationships between primary diagenetic and deformational features suggest that the dendritic-orthogonal fractures in the chert groundmass are post-diagenetic and most likely related to impact-induced shear deformation. Curved fractures in spherulitic quartzine (as possible microstructural equivalents to planar fractures parallel to the basal plane in quartz) might represent particular low- to medium-pressure shock effects in cryptocrystalline fibrous silica, unless noted in rocks not affected by shock metamorphism. Recrystallization bands probably represent healed fractures and cannot be linked with either shock or shear deformation. A systematic comparative study of deformation features in cherts from various terrestrial impact structures and cherts deformed by diagenesis and tectonism is planned.

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