SPHERULES AND MICROCRYSTITES IN ROCHECHOUART IMPACTOCLASTITE DIKES.

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Introduction: Impactoclastite, an ash-like material mainly composed of mineral debris with macroscopic layering, occurs exclusively in a ~2 km^2 region ca. 4 km NW of the presumed center of the Rochechouart impact structure near the community of Chassenon [1]. A horizontally layered impactoclastite deposit devoid of impact melt with a particle size of 10–150 µm occurred in a quarry capping suevite [1]. In contrast, variably oriented, mm to dm-thick impactoclastite dikes that contain impact melt particles cut the Chassenon suevite to a depth >30 m [2]. Notably, both impactoclastite lithologies contain impactor components [3]. We report additional observations to a study of Chassenon impactoclastite dike-hosted spherules [4] to unravel the petrogenesis of these impact vapor plume-related deposits.

Samples and Methods: We analyzed three additional petrographic thin sections of three samples of a sub-vertical impactoclastite dike from Chassenon drillcore SC1 [2] with an optical microscope and a JEOL-JXA 8530F field-emission electron microprobe equipped with an energy-dispersive spectrometer (EDS) at Arizona State University.

Results: The sample at 2.52 m depth contains one 110 µm microcrystite (Fig. 1) with an amorphous core surrounded by 20 µm skeletal pyroxene laths and a 3 µm rim that contains sub-µm crystals enriched in Fe, Cr and Ni.

We did not find spherules in our sample thin section at 3.09 m depth.

The sample at 3.46 m depth contains five spherules; three are oval, 50 to 240 µm, and one is 400 × 120 µm and has a tear-drop shape; one of the oval spherules contains clusters of up to 2 µm MgAlFeCrNi spinel crystal near its rim; also, one dumbbell-microcrystite is present with sub-µm clusters of MgAlFeCrNi spinel near its rim.

All spherules and microcrystites are pervasively altered and hydrated.

Discussion: Spherules and microcrystites, some associated with MgAlFeNiCr spinel, are evidence for impact fireball components [5] in the Chassenon impactoclastite dikes [1], similar to deposits overlying suevite in the Bosumtwi and El'gygytgyn craters [6,7]. Contrary to these fireball deposits, spherules appear absent in the horizontally layered impactoclastite deposit that caps the Chassenon suevite; instead, sub-vertical impactoclastite dikes host spherules. Impactoclastite dike formation is constrained by their wallrock-parallel layering [1] that suggests rapid and forceful emplacement, likely precluding settling through water, while fallback of ~100 µm particles from an impact plume should occur within 1 day after impact [8].

Hypothesis: The Chassenon suevite/impactoclastite deposit was likely situated in a depression that allowed its preservation and present-day topographic prominence. Melt-free surficial impactoclastite could have settled early from the impact plume because it had separated from higher energetic, melt-rich ejecta; later fallback material in the horizontal impactoclastite was likely lost to erosion. Sub-vertical fissures in the suevite may have opened due to gravitational adjustment following central peak collapse. These block movements may have caused a mass deficiency in the crater floor during the fallback phase hours to a few days after the impact, ramping down the ~2 km^2 region and triggering sudden decompression in the crater floor [9], which sucked spherule-bearing fallback material into these fissures.

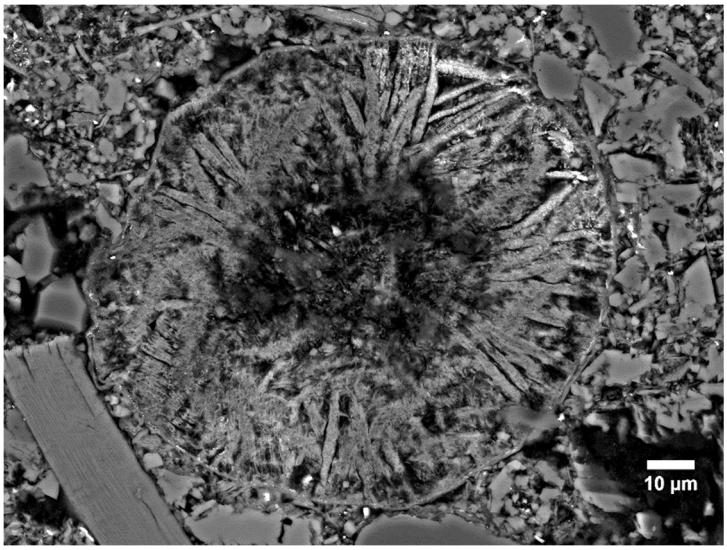

Fig. 1. Microcrystite with <1 µm MgAlFeCrNi spinel (?) in rim, impactoclastite dike at 2.52 m depth in Chassenon drillcore C1; backscattered electron image.

Acknowledgements: CIRIR for supplying samples of Rochechouart impact rocks.

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