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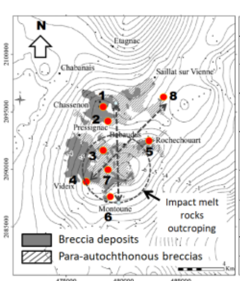
We report on the first comprehensive scientific drilling campaign to be completed in the Rochechouart impact structure, France (Fig. 1), describing the various holes and the first visual inspection of the major lithologies encountered (Fig. 2), in reference to the IUGS nomenclature [1].

Results: 18 holes have been drilled vertically, ranging from 1 to 120 m in depth. The holes are located at 8 sites spread along two 10 km-long radial traverses across the center of the structure (Fig. 1).



DRILLING PROGRAM				
SITES	LITHOLOGY and shock (after [3])		Drilling	
	Crater fill	Underlying target (impact damages)	Hole n°	Depth (m)
n°1: Chassenon	"Top" suevite with impactoclastites Polymict lithic breccia	Gneiss (weak)	1 2 3	4.5 120,6 1
n°2 : Champonger	Polymict lithic breccia	Gneiss (weak), Microgranite (weak, includes shatter cones)	4 5 6	10,5 3,1 3,1
n°3: Valette	Clast rich "basal" impact melt rock locally vesicular (non digested vesicular melt clasts in melt)	Gneiss and granitic gneiss (strong, up to partial melting)	7 8 9 10	60,7 1,1 1,1 1
n°4: Puy Chiraud (Videix)	Suevite or clast rich massive "basal" impact melt rock (similar in color and texture to Montoume)	Granite and granitic gneiss (strong)	11 12 13	60,6 1 1
n°5: Rochechouart castle	Polymict lithic breccia	Granitic gneiss (weak)	14 15	60,8 1
n°6 : Montoume	Clast rich massive "basal" impact melt rock	Granite and granitic gneiss (strong)	16	60,5
n°7: Recoudert	Massive, locally vesicular "basal" impact melt rock	Gneiss and granitic gneiss (unknown)	17	60,1
n°8: Champagnac quarry	Polymict lithic breccia	Mafic gneiss, granodiorite (weak)	18	61

Fig.1. Drill sites and drillholes characteristics. Regional map after [2], and geological data after [3].

The cumulative depth drilled is 515 m, with 99.7% recovery. The final numbers may slightly change following forthcoming geophysical logging, to be performed early 2018 by the CNRS (Geosciences Montpellier) with the same rationale, objectives and down-hole sensors they used for the IODP Chicxulub Expedition 364 [4].

In the allochthonous units, maximum clast size is < 0.5 m and rarely exceeds the core diameter (86 mm). The two shallow holes at site 1 mainly sample vertical flow banded, fine grained impactoclastite dikes similar to those described in [3]. The 120 m SC2 hole located near the top of the Chassenon breccia deposits (site 1, Fig. 1) intersects i) "suevite" (impact melt-bearing breccia) down to 88 m, ii) monomict breccia down to 113 m with clasts comprising fine grained and strongly fractured gneiss, and iii) "massive" locally cataclased gneiss cut by thin monomict breccia dykes. The contact at the bottom of the suevite is transitional. Below the contact, the matrix of the breccia and fractures in the clasts are more or less systematically healed, mainly by hydrothermal carbonates, whereas above the contact, hydrothermal effects appear to be restricted to the melt clasts. The suevite clearly displays two different units. The upper unit fits the classical description of "suevite" according to [1]; comparatively melt clasts in the lower unit are rare. The transition occurs at a depth of ~40 m. Above, clasts are randomly oriented and melt fragments are usually equant. However, clast size distribution and clast/matrix proportion are not random. Unlike the upper suevite, the lower melt-bearing unit locally shows oriented textures and evidence of flow. Dilatancy effects are suspected from the occurence of "cloudy" monomict breccia lenses interpreted as "popped out" clasts in the lower suevite. The underlying monomict breccia unit is cut by multiple horizontal pseudotachylitic breccia dikes. Several cm- to sub-meter-wide impactoclastite dikes cut the upper suevite. They are not observed below 30 m.

Holes SC4, 5 and 6 (site 2, Fig.1) intersecting the bottom of the Chassenon deposits resemble the bottom of the SC3 hole located 1 km from site 2.

The 60 m deep holes SC7, 11, 16 and 17 (circled zone on Fig. 1), start with massive, heterogeneous and textured clast-rich impact melt rocks. Melt-in-melt textures are abundant. The units become more homogeneous with depth without homogenizing completely. All impact melts display evidence of flow. The units extend respectively 15, 12, 10 and 20 m below surface. SC7 (site 3, Fig. 1) is distinguished by vesicular clasts at the top of the unit. SC17 (site 7, Fig.1) displays a 2 m thick, massive, yellow impact melt rock intercalated within a purple-red impact melt rock unit. The latter bears small (mm) vesicles and wormlike vesicles. It lies directly on highly deformed crystalline basement rocks. In SC7, SC11 and SC16, the impact melt rock units merge into suevites and "melt-poor suevites", with sharp variations in texture, clast size and clast shape, down to 20, 40 and 17 m, respectively, where basement rocks are intersected. The latter consist of granitoid and granitoid gneiss displaying cataclastic texture and anastomosed veining. They are locally intersected by a variety of breccia dikes (monomict, polymict lithic, impact melt and pseudotachylitic breccias, and pseudotachylite). Hydrothermal healing is less developed than in the external cores.

SC14 (site 5, Fig.1) is located at the foot of the 40 m thick historical Rochechouart cliff exposing polymict lithic breccia. The hole starts with 1.5 m of altered polymict breccia bearing some rounded clasts and flow-like features in the matrix. It merges into a matrix-rich flow-foliated monomict breccia with rounded clasts. At 4 m depth it is cut by a 1 m thick pseudotachylitic breccia, below which occurs a highly cataclased granitic gneiss that is locally brecciated and cut by a series of breccia dikes (polymict lithic, pseudotachylitic and banded melt-rock). Fractures filled by hydrothermal minerals cross-cut all the units and become more abundant at ~30 m depth and below.

SC15 (site 5, Fig.1) samples 1 m of yellow clast-rich impact melt rock.

SC18 (site 8, Fig. 1), located at the top of the Champagnac quarry, starts with 12 m of monomict gneissic breccia with rounded clasts and varied proportion of matrix. From 10 to 12 m, the proportion of matrix increases and, the size and angularity of clasts decreases. At 12 m, it merges into a complex 2 m thick unit of pseudotachylitic breccia alternating with white and black altered mylonite or pseudotachylite, underlain by 2 m of brecciated gneiss. An ~40 cm thick mafic dike with black veins marks the boundary with migmatitic rocks, gneiss, granitoid and granodiorite, that are all highly cataclased, sheared and veined to 60 m depth. This unit is cut by monomict, polymict lithic, and pseudotachylitic, breccia dikes. All units display multiple stages of veining, fracturing and hydrothermal healing.

Conclusions and Perspectives: The quantity and quality of materials recovered by the drilling campaign has exceeded expectations [5] enabling CIRIR and PIs to fully develop their projects (list on cirir-edu.org). Core samples will be assigned following the first sample EOI party scheduled for late Spring 2018. CIRIR's second call for PI projects is now open until late 2018 (see website for details).

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References: [1] Stöffler, D., and R. A. F. Grieve (2007) *Cambridge University Press*, 82-92. [2] Bobée C. et al. (2010) *Near Surface Geophysics 8*, 259-270. [3] Lambert P. (2010) *GSA Spec Pap. 465*, 505–541. . [4] Morgan J. V. et al. (2017) *Science, 354*, 878–882. [5] Lambert P. et al. (2016) MAPS, Abstract, #6471.pdf.

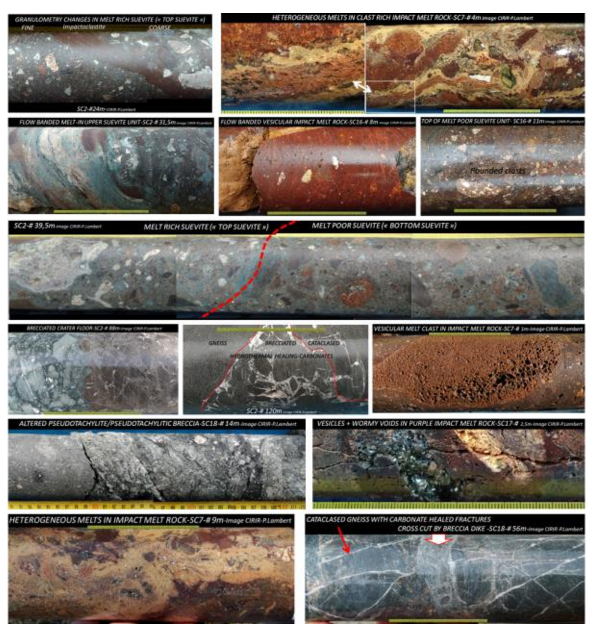

Fig.2. Representative impactite lithologies and features of the CRIR cores (see each core image for provisional description and location).