IMPACT DEPOSITS AT ROCHECHOUART-CHASSENON- P. Lambert - Sciences et Applications., Le Lafayette, avenue Kennedy, 33700 Bordeaux-Mérignac, France (lambertbdx@numericable.fr)

Introduction: A fundamental aspect of formation of large meteorite impact is the generation of ejecta deposits. A large effort has recently been expanded towards breccia studies at terrestrial impacts structures (Ries, Bosumtwi, Chixculub, Chesapeake Bay, e.g. [1-4]). They are the only source of ground truth data for proximal impact ejecta studies. Field geology on the Moon, Mars and other planetary bodies of the solar system as well as large-scale experimentation on Earth (explosions) are not realistic. Compared to other terrestrial impact structures, still little is done at Rochechouart-Chassenon. The aim of this paper is to review and update knowledge on its breccia deposits.

Target: The target is constituted of granitic intrusive and metamorphic rocks of Hercynian age, with more mafic formations outcropping locally near the NE corner of the structure (Figure 1).

Impact deposits: Impact melts, suevite and polymict lithic breccias overlie more or less brecciated bedrock of the target. In between, the crater floor is exposed over a ca 12 km central zone (Figure 1). It is flat, gently dipping 6°N, although one can distinguish a faint 4km wide central “rise” up to 70 m above a 4 km wide “annular depression”. The breccia deposit is discontinuous. The largest continuous sheet forms a ca 3 km wide circular patch at Chassenon and a 6 km elongated zone in the SW. Suevite always lays above polymict lithic breccias which are only found directly above the target bedrock. The contact is sharp. Its geometry is irregular at the meter scale. The original top of the suevite deposit is displayed in Chassenon, forming a fine stratified layer very similar to ignimbrite. Components, mostly mineral debris, match the lithological composition of the target. The bulk chemical composition matches that of the “average” target, and not that of the underlying suevite (Figure 1). Underlying suevite is stratified. Impact melts form intermittent patches from the “central high” (Babaudus) to the periphery of the deposits (Montoume and Bel Air, see Figure 1). The largest bleb spreads over ca 1 km2 (Valette) but others can be as small as a few meters (Bel Air). The thickness is about 1 meter at Babaudus and Bel Air, a few meters at Valette and about 10 meters at Mountoume where the melt rock displays large vertical joints very similar to cooling joints found in rhyolite lava flows. There is no obvious link between damage in the target and the setting of impact melt. For instance, relatively undisturbed material (shocked < 10 GPa) occurs below the Babaudus melt rock. Unlike Ries deposits, which are fairly homogeneous at the macroscopic scale over the whole structure, those at Rochechouart-Chassenon are highly variable in color and texture, explaining why they are usually referred by locality. Yet the target was more “homogeneous” than at the Ries: petrographic studies show that only fragments of exposed target are found in the various deposits. Despite the granitic composition of the target, macroscopic differences also characterize target rocks (reddish granite and leptynite / dark grey gneiss). These correlate with minor yet significant variations in the Fe-Mg content of the rocks (Figure 1). A similar explanation accounts for the differences between deposits at the various localities. They all plot separately on the Fe-Mg diagram (Fgure 1). The differences correlate with the local setting. Mountoume melt matches the composition of nearby granite and leptynite but not that of the local gneiss. Chassenon suevite matches the composition of local gneiss. Babaudus melt falls in between, suggesting a mixing of nearby leptynite with locally occurring gneiss. The mafic Bel Air melt rock is chemically consistent with the exposures of the mafic rocks in the NW of the target. Scattering of the plots of Rochechouart polymict lithic breccias correlates with the border between two contrasting target formations, gneiss and leptynites (Figure 1).

Discussion: Excavation and readjustment did not mix nor homogenise ejecta at the scale of the crater. This applies to impact melts (already inferred at Ries [1]), but also to suevite and probably to melt free deposits. Melts are unlikely to have ever formed a continuous sheet (no homogenisation of liquids). The integrity of the Chassenon deposit strikingly contrasts with the age (214 +/- 8 MA [9]) and morphology of the structure. It is much less eroded than previously thought, implying a long period of protection from erosion. This places new constraints on the interpretation of the geological evolution of the western part of the Hercynian continent. This also implies that the actual deposits, despite apparent erosion, are representative of the initial crater fill. The full section consists then of about 30 m polymict breccia overlain by up to about 20 m of suevite topped by several meters (?) of ash. Where stratification, bedding and fine debris have already been reported at the top of suevite (exemple at Ries [8]), they always show evidence of reworking associated to water flooding. Here there is no interference with water. The deposit was entirely airborne thus offering a quite unique analogue for KT studies and for plume modelling. The lack of water invasion combined to the proximity with the Mesozoic shore places constraints on the size of the crater and on extension of major faulting in the target. Any readjustment was terminated when the top of the suevite was deposited horizontally. Positioned in the "annular" depression, the Chassenon section places an upper limit on the thickness of the deposits over the whole structure. Melts are then unlikely to have been much thicker than today. Estimates for the total amount of melt in the proximal deposits fall between 0.1<<0.5 km3, including the contribution from suevite.

Conclusions and final remarks: Rochechouart-Chassenon is unique owing to both completeness and accessibility. The crater floor, impact deposits and the target below are readily and simultaneously available for 3D investigation at all scales. Yet knowledge is still rudimentary. Practical means for remediation will be presented while facilitating access to the world scientific community for ground truth data "mining" at Rochechouart-Chassenon (Test Site Initiative) [10].

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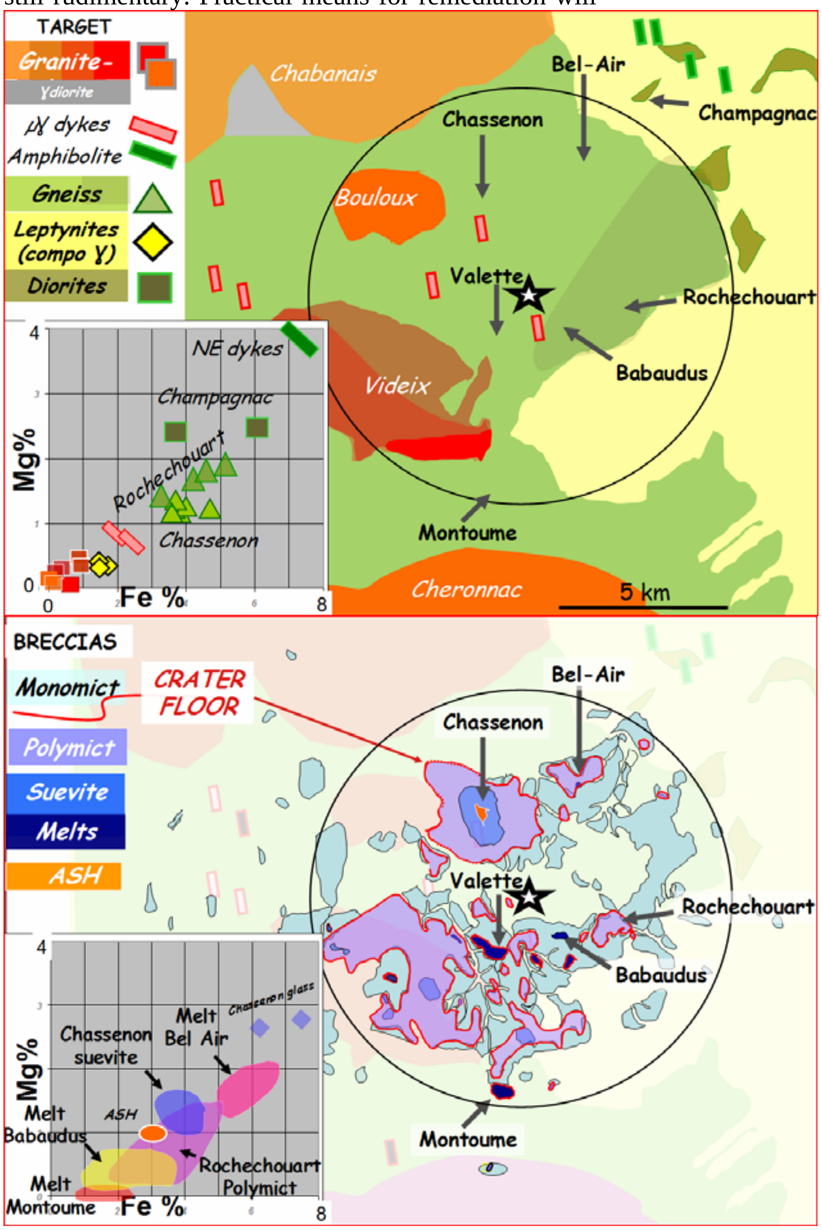

Figure 1: Top- Map of the target formations (impact formations withdrawn); Bottom- Map of the impact formations (target formations withdrawn); Circle: Extent of exposed deposits above the crater floor; Star: Geometric centre of the deposits. Insert on the bottom left of each map: Fe-Mg distribution for the main units (taken from wet analyses/AAS/XRF of samples over ca 250 localities given in [6]. Squares = intrusive bodies, rectangles = dykes, triangles = gneiss, lozenge = leptynite. Color of symbol matches that for each rock type. Compositional variations in gneiss, more mafic near Rochechouart compared to Chassenon, are represented by two nuances of green. Four nuances of red account for variations between the Cheronnac, Bouloux, Chabanais and Videix granites. Videix granite shows compositional gradation with its southern end matching the composition of the Montoume melt rocks. Melt at Montoume stands at one end of a "mafic" trend and Bel air at the other. Chassenon suevite is closer to the mafic pole, whereas Babaudus melt rock is closer to the granite pole.