NON-TRADITIONAL STABLE ISOTOPE VARIATIONS IN THE IMPACTITES OF THE ROCHECHOUART IMPACT STRUCTURE: TRACING IMPACT VOLATILIZATION, MELTING, MIXING, AND HYDROTHERMAL OVERPRINTING.

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Introduction: The Rochechouart structure is a deeply eroded impact crater formed ~ 207 Myr ago that no longer displays any impact-related topography [1]. Its surface is currently at the level of the crater floor, with a diameter of about 20-25 km, based on morphological, geophysical, and structural reconstructions [2,3]. Despite the high degree of erosion, the Rochechouart impact structure preserves a wide suite of impactites (impactoclastites, suevites, impact melt rocks, breccias, granite and gneiss from basement), with a large proportion of melted material. These lithologies were sampled during the 2017 drilling campaign, held by the CIRIR in 2017 [4] (funded by the Réserve Naturelle Nationale de Rochechouart-Chassenon). This campaign resulted in 18 drill holes (with a cumulative length of ~ 540 m) located at 8 sites along two 10-km radial transects across the center of the structure [5].

Samples and methods: Nineteen samples from 6 drilling sites from across the Rochechouart impact structure have been selected for this study. The samples are selected from cores SC1, SC2, SC3, SC7, SC11, SC15, SC16, and SC17. Three of them are from the basement (1 granite and 2 gneiss), 8 from impact melt rocks, 3 from suevites, 3 from impact breccias, and 2 from impactoclastites intervals. The nineteen studied samples have been selected based on prior petrographic and geochemical studies. The aim here is to trace volatilization as well as the addition of a meteoritic component to the different lithologies by applying the germanium [Ge] isotope system (CRPG-CRNS Nancy) in combination with highly/moderately siderophile elements concentrations. Iron, zinc, and copper isotope systematics (G-Time, ULB) are applied to complement the Ge isotope data to study other syn- and post-impact processes, such as melting, mixing of target rocks, and hydrothermal alteration.

Results: The Ge isotope results for the 19 selected impactites and target lithologies are the first obtained within any impact structure. They display large variations in $\delta^{74/70}$Ge values (from ~ 0.1 to 1‰). The observed Ge isotope compositions, in combination with their Ge concentrations, put forward the existence of two groups among the impactite samples, which are distinct from the basement samples (*Fig. 1*). One group (mostly impactoclastites, suevites and one breccia) exhibits similar Ge concentrations as the basement samples but at higher $\delta^{74/70}$Ge isotopic signatures, while the other group (impact melt rocks and one breccia) displays comparable or lower Ge isotopic signatures relative to the basement samples, but at higher Ge elemental concentrations.

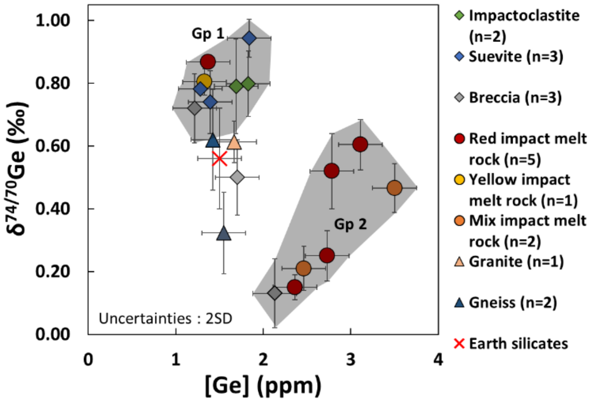

Fig. 1: $\delta^{74/70}$Ge versus Ge concentration. Distinction between two major groups and the basement samples. (Silicate Earth mean composition [6])

Discussion and conclusions: The Ge isotope results imply at least two distinct processes affecting these drill core samples: (1) the heavy $\delta^{74/70}$Ge isotopic signatures in Group 1 possibly reflect impact induced volatilization, (2) while the Group 2 signatures likely reflect secondary alteration. Moreover, Fe, Cu, Zn isotope data and HSE concentrations are currently being collected for the same nineteen samples, in order to constrain the geochemical and isotopic signatures of the various lithologies of the Rochechouart impact structure. Along with geochemical and petrographic characteristics, the nature of these syn- and post-impact processes, including melting and mixing of target rocks, volatilization, meteoritic contribution, and hydrothermal alteration, may be traced and refined.

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