NEW U-Pb ZIRCON AGE DATA FOR BASEMENT AND IMPACT MELT ROCKS FROM THE ROCHECHOUART IMPACT STRUCTURE, NW MASSIF CENTRAL, FRANCE. D. Guerrero[1], W.U. Reimold[1], N. Hauser[1], C. Lana[2], and P. Lambert[3]. [1]Instituto de Geociências, Universidade de Brasília, 70910 900, Brasília, DF, Brasil, daaguerrerogu@unal.edu.co, [2]Departamento de Geologia-Escola de Minas, Universidade Federal de Ouro Preto, 35400-000 Ouro Preto, MG, Brazil, [3]CIRIR - Centre International de Recherche et de Restitution sur les Impacts et sur Rochechouart, 87600 Rochechouart, France.

Résumé: Échantillons de roche fondue d'impacte et de roche cible da structure d'impacte de Rochechouart ont été étudiés par analyse isotopique U-Pb sur zircon. Les résultats primeires pour échantillons de gneiss et amphibolite et deux roches fondues d'impacte de Montoume et Recourdert montrent une bonne corrélation avec les événements attribués à l'évolution crustale du Massif Central. Cependant, les roches fondues d'impacte présentent une grande diversité d'âges, probablement liée à d'autres lithologies de la cible, à ce-jour non analysées. L'âge de l'impacte (~204 Ma) et un événement postérieur (~194 Ma) sont également enregistrés.

Introduction: The Rochechouart impact structure was formed in the crystalline basement of the NW French Massif Central (FMC). Despite deep erosion, a diverse suite of impact facies is still accessible in the structure. In the last decade, the study of this structure has been greatly strengthened due to the efforts made to preserve and promote this impact structure for research and education purposes by the CIRIR. These efforts include a drilling campaign in 2017-2018 that made ~540 m of core of crater fill deposits and shocked target rocks available for the scientific community [1].

We report the first results of a project focused on U-Pb isotope analysis on zircon from representative samples of impactites and basement rocks from the crater area. Our analyses of zircon from both surface and core samples of impact melt rock from different locations within the impact structure will further help to constrain the age of the impact event. The comparison of these results with U-Pb zircon chronology for target rock lithologies will provide information about the dynamics of impactite formation (e.g., source materials for formation of the impact melts) and improve the knowledge on the main target rocks that were affected by the impact. Furthermore, the data obtained from basement rocks will constitute new information to complement and improve the current understanding of the multiple tectono-metamorphic and igneous events that affected the FMC in the region around the impact structure.

Methodology: We present U-Pb on zircon isotope data from two impact melt rocks (IMR) and two basement rock samples. Sampling sites are shown in Fig. 1. The IMR samples are a reddish impact melt rock from Montoume and a yellow impact melt rock from Recoudert. An amphibolite from Exideuil, and a gray foliated gneiss from Moulin de Laurière represent the basement. The rocks were analyzed with a Neptune Plus Thermo Finnigan LA-MC-ICP-MS coupled with a Photon-Machines 193 nm laser system at the Laboratory of Isotope Geochemistry at the University of Ouro Preto, Brazil.

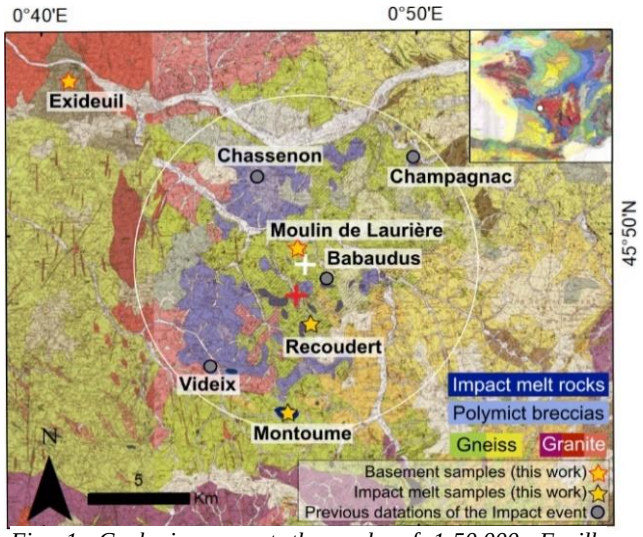

Fig. 1. Geologic map at the scale of 1:50,000, Feuille Rochechouart [2]. The circle indicates the extent of the crater fill deposits (centered on the white cross), and the red cross is the probable center of the intial Rochechouart impact structure. Inset: Geologic map of France at the scale of 1:1,000,000 (BRGM) with the location of the impact structure (white point).

Results: The zircon ages obtained from the two basement rocks range from the Neoproterozoic to the Carboniferous (Fig. 2). The gneiss sample yielded ages from the Neoproterozoic to the Silurian (433 ± 15 Ma), with principal age peaks in the upper Neoproterozoic (~544 Ma) and lower Cambrian (~523 Ma). The amphibolite provided zircon ages from the Neoproterozoic to the Carboniferous (326 ± 5 Ma), with a dominant age peak at ~362 Ma and two minor peaks at ~327 and ~449 Ma. Both basement samples contribute to the age peak at ~567 Ma. The impact melt rocks show a considerable diversity of ages from Neoproterozoic to Triassic; in the case of the Recoudert impact melt rock, down to 203 ± 2 Ma, and down to the Lower Jurassic in the case of the Montoume impact melt (195 ± 3 Ma). Most of the pre-Permian age peaks were obtained primarily for zircons from the Montoume impact melt, including the most prominent peak for zircon from both IMR samples at

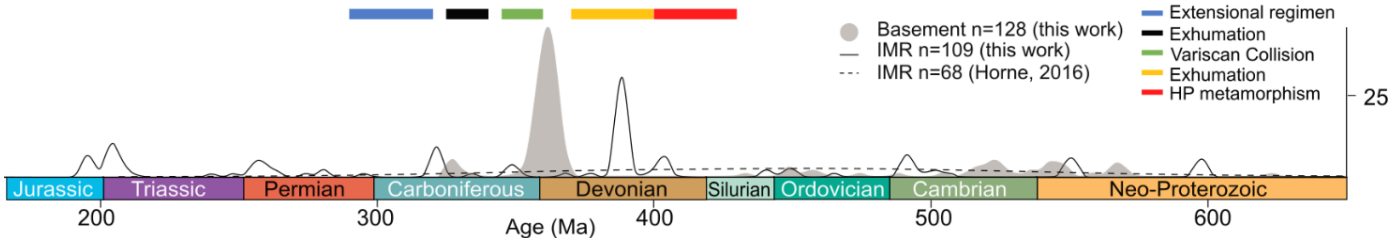

Fig. 2. Kernel density plot for the results of this study. The U-Pb results obtained by [3] for impact melt rock (IMR) from Montoume and Babaudus are also displayed. Only data with 90-110 % concordance are considered. The upper colored bars refer to major events in the geologic evolution of the French Massif Central [4].

~388 Ma. The Recoudert sample contributes mainly to the Permian age peaks.

Discussion: The FMC has been widely studied, with varied results and different interpretations of its geodynamic evolution, principally in tems of the duration of events (e.g., [4] and refered therein). The age peaks obtained for our basement samples can be broadly correlated with major events documented elsewhere in the NW FMC (compare the color bars in Fig. 2). The Neoproterozoic to Ordovician ages could correspond to ages of protoliths from the metamorphic basement. The age peak at ~363 Ma is slightly older than the postulated Variscan Collision period (~345-360 Ma; [4]). However, it agrees with other previously reported Upper Devonian ages (~365 Ma) for the NW FMC, which were attributed to Barrovian metamorphism developed during this orogeny [5]. Finally, the pre-impact age peak at ~327 Ma correlates with the Carboniferous Exhumation stage. The impact melt samples show a great diversity of Paleozoic ages, probably related to a variety of zircons from different protoliths, with age populations that are not recognized in the zircon populations of the two basement rocks analyzed by us to date. This includes a Middle Devonian age peak and younger Permian ages. These ages may be related to protoliths recording the exhumation of high grade rocks [6] and a possible granitization phase in the Haut-Limousin [7].

Some of the youngest ages (compare Fig. 3) recorded on zircon from our impact melt samples relate to ~204 Ma, which is in good agreement with other recent U-Pb on zircon ages for the impact event (204 ± 2.2 and 207 ± 3.6 Ma; [8]). However, there are also some ~195 Ma ages. Similar very young ages have been obtained previously from Babaudus impact melt rock (Fig. 3), and they were related to post-impact thermal activity [8]. Moreover, [9] raised the possibility of a Lower Jurassic impact age based on a presumed marine target environment for the structure. Further textural characterization of the zircons from our study and analysis of other samples will help with the interpretation of these most recent ages.

Conclusions: First isotope results for a gneiss and an amphibolite from the FMC basement in the area of

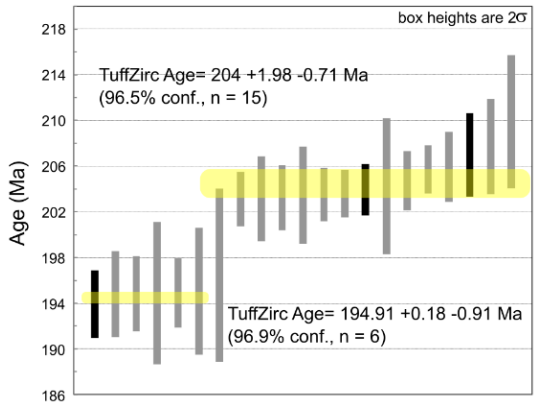

Fig. 3. TuffZirc age plots for the youngest ages of this study (gray bars) and data reported by [8] (black bars). Plot made with Isoplot v. 4.15 [10].

the impact structure show good agreement with ages of known events documented for the NW FMC. U-Pb dating on zircon from two impact melt rock samples resulted in a great diversity of Paleozoic ages, including ages that are not recorded in the data for our first two analyzed basement samples. Some of the most important peaks of basement ages (e.g., ~362 Ma) are not registered in the IMR data. Finally, a Lower Jurassic age was obtained from the Montoume IMR, the significance of which is not yet well understood.

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Acknowledgements: This study is supported in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) – under Finance Code 001, and through a 2021 Barringer Family Fund for Meteorite Impact Research grant to Daniela Guerrero.