THE TWO TYPES OF IMPACT MELT ROCK AT THE ARAGUAINHA IMPACT STRUTURE, BRAZIL: NEW CONSTRAINT ON THE CRATERING FORMATION PROCESSES.

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Introduction: The Araguainha Dome, in south-central Brazil, is a 40 km impact structure, formed at ca. 254 Ma close to the time of the Permian-Triassic boundary. It offers a stratigraphic window into the sedimentary sequences and to the basement of the Paraná Basin. The basement crops out in the central part of the structure and is surrounded by a belt of polymict impact breccias (PIB), and strata from the lowermost part of the Paraná Basin: the Rio Ivaí Group (Ordovician-Silurian) and Furnas and Ponta Grossa formations (Devonian). The PIB at the Araguainha impact structure, well exposed in the northern and southern sectors of the central uplift, has been shown to be composed of a particulate matrix containing a heterogeneous population of lithic and mineral clasts, and cogenetic melt parti-cles; it, thus, represents suevite. Field study has indicated that the breccia contains large mega-clasts from the metasedimentary basement, mainly phyllite – some with evidence of contact metamorphism against the alkali granite, as well as metasandstone and metapelite. Quartz pebbles, conglomerates, and sandstones and pelites prob-ably derived from the lower part of the basin are also abundant as clasts. Until now, two types of impact melt rock, the so-called type-I and type-II, of different composition and emplacement styles, were identified. Type-I is the more abundant and the first one that was recognized; it is of granitic composition and always occurs in the granite core. The so-called type-II, subdivided into low silica content (LS <68%wt. SiO2) and high silica content (HS >80%wt. of SiO2), is always present as melted clasts in the suevite. In order to characterize the two types of IMR and to understand the relationship between them and the potential target rocks, geochemical and isotopic (Sr-Nd and U-Pb in zircon) data from the two types of impact melt rocks, target rocks, sedimentary units from the lower part of the Paraná basin and samples from the suevites (melted clasts plus matrix) were obtained.

Results and conclusions: In the SiO_2 vs. MgO diagram: the IMR type-I have a restricted geochemical composition, similar with the porphyritic granite, whereas the LS and HS IMR type-II have more heterogeneous geochemical composition but always similar with Cuiabá Group. The suevite matrix has a similar composition with the lower part of the Paraná basin, specifically the Furnas Formation. In the $^{87}Sr/^{86}Sr(251.5)$ vs. $\varepsilon Nd(251.5)$ diagram, the granite has high $^{87}Sr/^{86}Sr$ and less negative εNd of ~9. The lower part of the Paraná basin has lowest 87Sr/86Sr ratios and more negative εNd of ~13. The samples from the Cuiabá Group and the two types of IMR show compositions between these two extremes. Eighty-eight concordant U-Pb isotope data were. The results, together with published data for the basement (Cuiabá Group) and the lower stratigraphic units of the Paraná Basin, were analyzed by multidimensional scaling (MDS) and with the kernel density estimation (KDE). Both suevite samples show a bimodal age population with the main peak at ~640 Ma and a second peak at 2000-2500 Ma. The MDS and KDE plots indicate that the provenance for the two suevite samples is similar to the zircon age populations for the formation in the lower part of the Paraná Basin sequence, very similar to the age population for the Furnas Formation. Based on these geochemical, isotopic and first U-Pb provenance results, we can conclude that: 1) the composition of the melted clast (IMR type-II) looks similar to the Cuiabá Group but the matrix shows a composition and provenance data similar with the lower part of the basin, it means that our field observations that initially favored a strong contribution of clastic material from the Cuiabá Group to the suevite need to be considered with caution and 2), possibly the two IMR do not have the same origin and they are not coming from the same type of target rocks, whereas the IMR type-I is clearly similar to the granite. 3) The IMR type-II is similar in composition to the Cuiaba Group samples or alternatively it represents a mixture between the Furnas and Rio Ivai formations. Finally, our geochemical, isotopic and provenance studies need to be extended statistically. These results will be very useful in determining how deep the transient cavity at Araguainha was excavated, and how deep the projectile may have penetrated into the target. Moreover, the results will contribute to modeling of the cratering processes related to the formation of the Araguainha impact structure.