GEOLOGICAL AND PETROGRAPHICAL CHARACTERIZATION OF THE POLYMICT IMPACT BRECCIA OF THE ARAGUAINHA DOME, BRAZIL. L. De Marchi[1], N. Hauser[2], W. U. Reimold[3], A. P. Crósta[1], and L. Braz[2]; [1]Institute of Geosciences, University of Campinas, Campinas, Brazil, [2]University of Brasilia, Brasília, Brazil, [3]Museum für Naturkunde and Humboldt Universität Berlin, Germany (alvaro@ige.unicamp.br).

Introduction: Araguainha Dome in Central Brazil is the largest impact structure in South America, with a diameter of 40 km [1, 2]. The most recent geochronological data assign an age of 254.7 ± 2.5 Ma to the impact [3]. Araguainha Dome is a complex impact structure at a relatively advanced stage of erosion, which was formed in a target of mainly Phanerozoic sedimentary rocks of the northern portion of the Paraná Basin and into the metasedimentary rocks (Neoproterozoic Cuiabá Group) and crystalline rocks (Cambrian São Vicente Granite) of its basement. The central uplift measures about 7 km in diameter and comprises a granitic core and metasedymentary succession surrounded by impact breccias and deformed sedimentary rocks. Among the impact breccias three major components have been recognized: monomict breccias of sandstones, polymict breccias, and breccia with melt matrix [2].

A geological and petrographical study of the polymict impact breccias of the NW sector of the central uplift of Araguainha was conducted in order to characterize the components of this breccia, in terms of their lithological composition and stratigraphic provenance, sizes and shapes of the clasts, as well as the relative proportions of different clast types and matrix, and the possible occurrence of melt clasts. Figure 1 shows a schematic geological map of the central uplift, with the location of the studied section accros the largest of the known polymict breccia bodies.

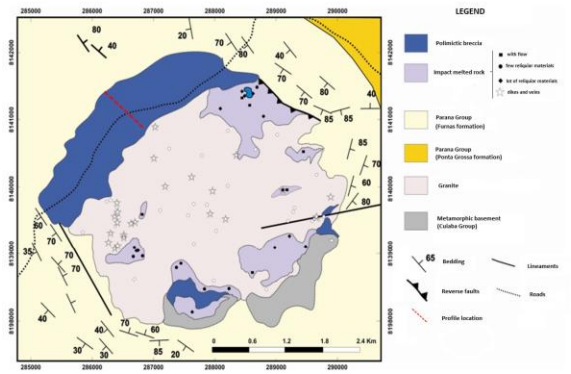

Figure 1. Schematic lithological map of the inner portion of the central uplift of Araguainha Dome (after [4]). The red dashed line in the NW portion of the map shows the location of the studied section across the main body of polymict breccia.

Local stratigraphy: The Araguainha impact structure was excavated on sedimentary strata of the northern portion of the Paraná Basin, an intracratonic sedimentary basin that covers large portions of Southern Brazil and parts of Uruguay, Paraguay, and Argentina. The sedimentary strata affected by the impact include the Paraná Group (Devonian), represented by the Furnas and Ponta Grossa formations, the Tubarão Group (Carboniferous-Permian), represented by the Aquidauana Formation, and the Passa Dois Group (Permian-Triassic), represented by the Irati and Corumbataí formations. Around the edge of the central Cambrian alkali granite complex, metamorphic rocks of Neoproterozoic age are exposed [4].

Data collection and processing: For characterizing the polymict breccia, a 535 m long NW-SE trending section was investigated across the main body of polymict breccia (Fig. 1). Samples were collected at 5 m spacings whenever possible. The samples were described in terms of their type, size, clast distribution and shapes (rounding), as well as proportion of matrix. Ten of these samples were selected for a more detailed analysis, including microscopic description of polished thin sections. The locations of the M-01, M-02, M-03, LL-49, LL-60, LL-61, LL-64, M-04, M-05 and M-07 samples are shown in Fig. 2. Microscopically melt clasts were identified and melt abundance was quantified by pointcounting.

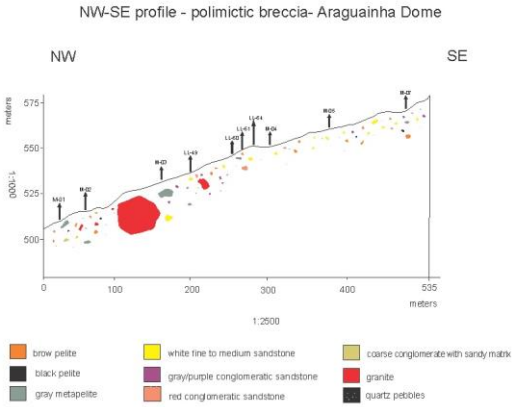

Figure 2. Cross section through the main body of polymict breccia with the location of samples used for detailed analysis. The lithologic variation and relative size in the clast populations along the profile is represented ~~by the colors of~~ in the legend.

Results: The clast populations were analyzed both at outcrop, hand specimen and microscopical scales, with the results showing good correlation between these datasets. The main types of clasts identified are (i) brown pelite; (ii) black pelite; (iii) gray metapelite; (iv) fine- to medium-grained, white sandstone; (v) red conglomeratic sandstone; (vi) gray/purple conglomeratic sandstone; and (vii) quartz pebbles. Comparing the characteristics of the clasts and the litho-stratigraphic units affected by the impact, the following relations can be established: the gray metapelite shows characteristics similar to the phyllites of the Neoproterozoic Cuiabá Group; the quartz pebbles are either derived from the basal portion of the Furnas Formation or from the Alto Garças Formation (Rio Ivaí Group), a sedimentary unit located below the base of the stratigraphic column of the Paraná Basin, underneath the Furnas Formation, and that comprises predominantly basal conglomerates; the fine- to medium-grained, white sandstone very likely comes from the Furnas Formation; the conglomeratic red sandstone and the brown pelite show resemblence to strata of the Aquidauana Formation; the black pelite can be correlated with the black shales of the Irati Formation; and the gray/purple conglomeratic sandstone might be related to the Corumbataí Formation.

Very large clast (several meters to >50 m blocks – Fig. 2) of an alkali granite might be correlated with the São Vicente Granite of Cambrian age that forms part of the basement of the Paraná Basin in the region. In outcrop no melt clasts could be identified, albeit a parallel section some 200 meters further northeast showed up to meter size melt blobs during previous visits to the structure.

The most common clasts in the polymict breccia are the brown pelite/conglomeratic red sandstone (Aquidauana Fm.) and the quartz pebbles (Furnas and/or Alto Garças formations). As for size variation, only three types of clasts show a weak increase in size along the NW to SE profile: gray metapelite, brown pelite and conglomeratic red sandstone. There was no detectable pattern in terms of the rounding of the clasts. As for the amount of matrix, the average abundance is around 70% with variation between 65 and 75%, for all scales of observation (outcrop, sample and thin section).

In thin sections abundant up to cm sized melt clasts could be identified; they are generally strongly altered but still recognizable by their flow textures. Figure 3 shows the variation in the amount of melt material in the samples from along-section, with seemingly larger amounts occurring in samples from the center of the breccia body.

Conclusions: Regarding the nature of the polymict breccia, originally considered by [2] to be a lithic breccia, the results of the microscopic analysis provide enough evidence to classify it as a suevite, containing between 5 and 30 vol% of melt. The various types of clasts were satisfactorily correlated to the target litho-stratigraphic units. Interestingly, no lithological nor physical attribute changes can be reported from the clast population across section, with the exception that some lithologies occur more abundantly than others along the entire section. The largest clasts (meter sized and larger), especially occurring in the lowermost section of the profile, seemingly are derived from the basement (Cuiabá phyllites and São Vicente granite) and could either represent crater floor or megablocks directly above it.

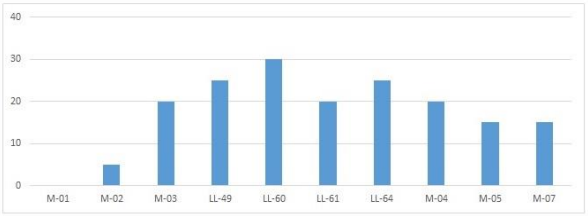

Figure 3. Amount of melt material (vol%) identified through thin section analysis.

The most common clasts are likely from the Aquidauana Formation, which may be due to the fact that it is the thickest unit of the stratigraphic column in this portion of the Paraná Basin. However, clasts related to all units affected by the impact, ranging in age from Neoproterozoic to Permian, were identified in the polymict impact breccia. In terms of clast size, a weak increase was observed for three clast types towards the upper part of the breccia section.

References: [1] Crósta, A.P. et al. (1981) *Revista Brasileira de Geociências*, 11, 139-146. [2] Engelhardt, W. et al. (1992) *Meteoritics*, 27, 442-457. [3] Tohver, E. et al. (2012) *GCA*, 86, 214-227. [4] Yokoyama, E. 2008. MSc thesis. University of São Paulo (unpublished), 122 pp.