

GEOLOGICAL AND PETROGRAPHICAL CHARACTERIZATION OF THE POLYMICT IMPACT BRECCIA OF THE NORTHERN ARAGUAINHA DOME, BRAZIL

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Introduction

Araguinha Dome in Central Brazil is the largest impact structure in South America, with a diameter of 40 km [1, 2] and age of 254.7 ± 2.5 Ma according to the most recent geochronological data [3]. It is a complex impact structure at a relatively advanced stage of erosion formed in a target of mainly Phanerozoic sedimentary rocks of the Paraná Basin, as well as metasedimentary (Neoproterozoic Cuiabá Group) and crystalline (Cambrian São Vicente Granite) rocks of its basement. The central uplift is 7 km in diameter and comprises a granitic core and a metasedimentary succession, surrounded by impact breccias and deformed sedimentary rocks. Among the impact breccias, three major components have been recognized: monomict breccia in sandstones, polymict breccia, and breccia with melt matrix [2]. A geological and petrographical study of the polymict impact breccias of the NW sector of the central uplift was conducted in order to characterize its components 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 and shock features. Figure 1 shows a schematic geological map of the central uplift, with the location of the studied section.

Local stratigraphy

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. Surrounding the central Cambrian alkali granite, metamorphic rocks of Neoproterozoic age are exposed [4].

Results

General aspects of the breccias are shown in Fig. 3. Comparing the characteristics of the clasts and the litho-stratigraphic units affected by the impact, the following relations can be established: (i) gray metapelite shows characteristics similar to the phyllites of the Neoproterozoic Cuiabá Group; (ii) 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; (iii) fine- to medium-grained, white sandstone very likely comes from the Furnas Formation; (iv) conglomeratic red sandstone and brown pelite show resemblance to strata of the Aquidauana Formation; (v) black pelite can be correlated with the black shales of the Irati Formation; and (vi) gray/purple conglomeratic sandstone might be related to the Corumbataí Formation.

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). Quartz grains in all these lithologies exhibit shock deformation features (Fig. 4).

In thin sections, abundant melt clasts up to cm size were identified (Fig 5); they are generally strongly altered but still recognizable by their characteristic flow textures. Figure 6 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.

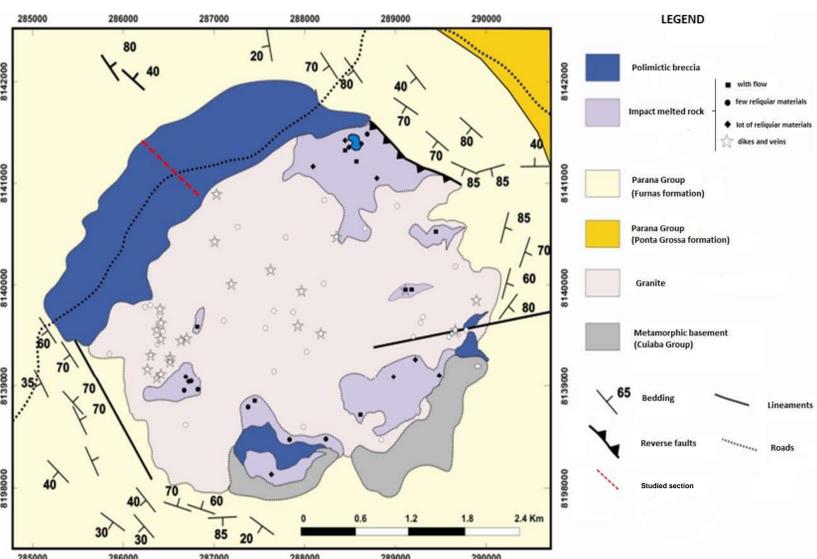


Figure 1. Schematic lithological map of the inner portion of the central uplift of Araguinha Dome (after [4]). The dashed red line in the NW portion of the map shows the location of the studied section across the main body of polymict breccia.

Data collection and processing

Field observations were collected over a > 500 m traverse that represents a de facto vertical section of 75 m length. They included breccia type, as well as clast lithology, size, distribution and shapes, and proportion of matrix. Then I suggest to use the profile giving all sampling sites. Clasts were typified at the macroscopic, mesoscopic (cm-dm) and microscopic (< 1 cm) scales.

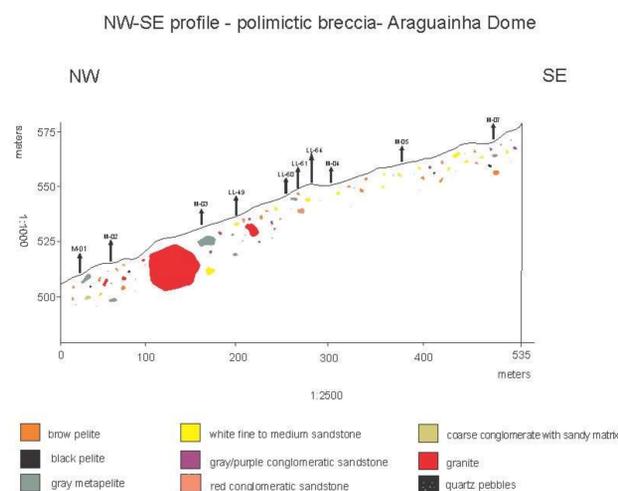


Figure 2. Cross section through the main body of polymict breccia with the location of most representative samples used for detailed analysis. Lithologic variation and relative size in the clast populations along the profile is represented in the legend by different colors.

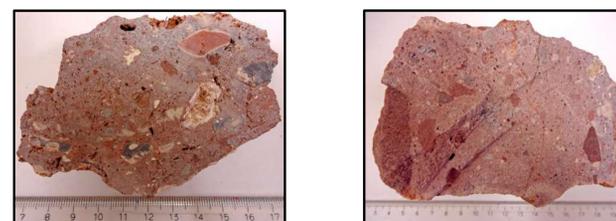


Figure 3. General aspect of the polymictic breccias.

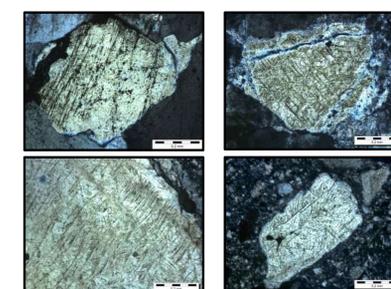


Figure 4. Shock features (PDF, PF, FF, kink bands) in quartz grains in the polymict breccia.

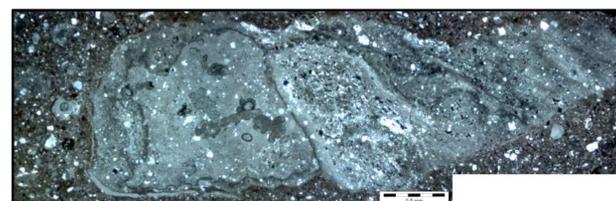


Figure 5. Large melt clast in the polymict breccia.

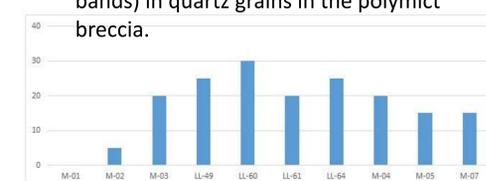


Figure 6. Amount of melt material (vol%) identified through thin section analysis.

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 1-5 and 30 vol% melt clasts.

The various types of clasts were satisfactorily correlated to the target litho-stratigraphic units. The largest clasts (meter size 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.

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

References