GEOLOGICAL CHARACTERIZATION OF THE SÃO MIGUEL DO TAPUIO IMPACT STRUCTURE, PIAUÍ - BRAZIL. N. Zeitoum, A. P. Crósta and A. M. Góes, 1Institute of Geosciences, University of Campinas, Brazil (nah zeitoum@gmail.com), 2Institute of Geosciences, University of São Paulo, Brazil.

Introduction: São Miguel do Tapuio (SMT) impact structure is located in the eastern portion of the Parnaíba Basin, in the State of Piauí, Brazil. It is a circular structure of about 20 km in diameter exhibiting a raised rim, concentric inner rings and a central elevation core, formed in sedimentary rocks of the Serra Grande and Canindé groups. Several studies have been made since the 1970s trying to interpret the potential origin of this structure. Only recently a field survey led to the confirmation of the impact origin of SMT by finding diagnostic shock features in quartz [1]. These features comprise abundant occurrences of planar features (PFs), ample detection of feather features (FFs) and some rare findings of planar deformation features (PDFs). With these data, SMT structure has become the eighth confirmed impact structure in Brazil and the second largest impact crater known of South America. However, such evidence results from a preliminary investigation of few rock samples collected by the authors in 2017, which still require further detailed analysis. In this context, the purpose of this project is to describe petrographically the samples collected by [1], in order to identify, in addition to the diagnostic features, other deformations indicative of the impact. Although not diagnostic, such characteristics are important because they may reveal transformations that sedimentary rocks have experienced as a result of the impact.

Results and discussion: The analyzes of the samples were based on the petrography sedimentary classification of [2] and [3], and the deformation features were investigated according to the criteria proposed by [4]. Thirteen thin sections of samples collected near the central core of the structure were analyzed using optical microscopy. In general, intensely to moderately fractured breccias, and moderately to slightly fractured sandstones were identified. The breccias have strongly fragmented quartz grains, sometimes with powdery texture filling in the framework of the rock, suggesting origin by comminution processes. Healed fractures were also identified in quartz grains. The sandstones exhibit little grain fracturing, which could result either from very low impact pressure regimes, or by common diagenetic processes (Fig. 1).

Three thin sections from a sample of breccia showed shock features (PFs, FFs and PDFs; Fig. 2). These features represent pressures between 2 and 25GPa that can only be produced in crustal rocks as a result of large impacts [4].

Conclusions: According to the results, shock deformed rocks consist of quartz breccias and present shock features (PF, FF and PDF). Besides shock deformation, these rocks exhibit intense fracturing, grain comminution and healed fractures. The sandstones samples analyzed appear to be less affected by impact deformation, although clearly showing unusual fracturing when compared to similar rocks from outside SMT.

It is interesting to note the heterogeneity between rocks that are little and very deformed, and that occur spatially close to each other. These characteristics, together with the relatively rare occurrences of high-pressure shock deformation features (e.g., PDFs) in general, demonstrate the geological complexity of SMT, suggesting an advanced stage of erosion of this structure.


Acknowledgements: N. Zeitoum acknowledges Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP) for a grant.

Figure 1. a) Poorly sorted quartz breccia; b) Fragmented quartz in poorly sorted quartz breccia; c) Healed fractures in quartz of breccia; d) Fractured quartz in sandstone.

Figure 2. Shock features. a) PFs and FFs; b) PFs; c) and d) PDFs.