SANTA MARTA CRATER: MACROSCOPIC AND PETOGRAPHIC EVIDENCES OF A NEW CONFIRMED IMPACT STRUCTURE IN NORTHEASTERN BRAZIL E. B. Uchôa[1], M. A. R. Vasconcelos[1], A. P. Crósta[1]. [1]Institute of Geosciences, University of Campinas, Brazil, (eleniltonuchoa@ige.unicamp.br); (vasconcelos@ige.unicamp.br); (alvaro@ige.unicamp.br).

Introduction: Santa Marta crater, centered at 45°14'W, 10°10'S, is located in the county of Corrente, in Piaui State. This structure had been previously proposed as a possible impact crater by [1], who named it as 'Gilbués'. However, [2] called it Santa Marta as it is part of the homonymous mountain range. The structure has an apparent elongated shape, with a NE-SW major axis ~9.7 km long and NW-SE minor axis ~8.9 km, displaying in the central part an elevated plateau that appears to be part of the central uplift (Fig. 1). Santa Marta crater was formed in sedimentary strata (conglomerates, sandstones, siltstones) of Carboniferous and Cretaceous ages, respectively, that belong to two phanerozoic basins: Parnaiba and São Francisco. Analysis of airborne geophysical data presented by [2] shows that Santa Marta has geophysical characteristics compatible with those of an impact structure in sedimentary target. In September 2012 we carried out a field campaign in order to search for evidence of its origin. We present here the results of this field campaign, that succeed in identifying the first evidence of the impact origin of Santa Marta, allowing to confirm it as the 7th impact structure located in the Brazilian territory.

Geological settings: The study area comprises sedimentary rocks of the Parnaiba and São Francisco basins. The Parnaiba basin has an extension of 600.000 km^2 [3]. The limit of this basin are: to the north with the São Luis Craton, west with the Amazonas Craton, east (E) with the São Francisco Craton and to the south (S) with São Francisco sedimentary basin, where Santa Marta is located. Two units outcrop in the study area: Canindé Group, comprising the Poti Formation (Mississippian) with 320 m thick, and Balsas Group, represented by the Piaui Formation (Pennsilvanian) with 340 m thick [4]. The São Francisco basin is limited to the north by the Parnaiba Basin, west by the Brasília Folded Belt, east by the Araçuaí/Espinhaço Folded Belt and to the south by the Paraná sedimentary basin [5]. The lithostratigraphic units of the São Francisco basin present in the study area are the Urucuia and Areado groups, both Cretaceous.

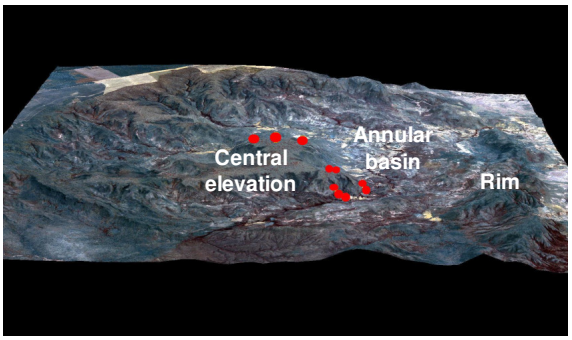

Figure 1- Perspective view of Santa Marta impact crater using high-resolution WorldView-2 imagery draped over digital elevation data. Locations of shatter cone occurrences are shown in red.

Geology of the Santa Marta structure:

A total of 164 sites were visited in the field, located both, inside and outside the structure. There are three topographic regions in Santa Marta: rim, annular basin and central elevation in the form of an irregularly shaped flat inner *plateau* (Fig. 1). The crater rim sits at an altitude of ~700 m and is better exposed at the northwestern part of the structure, where it comprises breccias, sandstones and a thin ferruginous layer. The annular basin, located between the rim and central elevation, is comprised by conglomerates, sandstones, siltstones and shales. At some specific points there are shatter cones formed in sandstone (Fig. 1). The central elevation forms a plateau that is interconected with the southwest rim of the crater. The rocks found near this area were breccias and a thin superficial ferruginous layer.

The lithotypes of Santa Marta can be divided from bottom to top as Balsas Group (Piaui Formation), Urucuia Group, Areado Group and Tertiary-Quaternary sediments. The strata of the Piauí Fm. were found in the NNE portion of the structure and comprise red sandstones often with siltstones intercalations. Strata belonging to the Urucuia and Areado groups are exposed at the elevated regions of Santa Marta, especially at the center of structure and at its NW portion. They comprise conglomerates, sandstones, red and purple siltstones, red and white shales and breccias. Tertiary and Quaternary unconsolidated sediments deposits were observed along the main drainage channels.

Macroscopic and microscopic shock features: We have found polymitic breccias in several locations at the central elevation and also in the region between the rim and the central elevation, covering a large area of the structure. These breccias comprise fragments ranging in size from 3 mm to 3 cm embedded in a red matrix. At the to of the *plateau* of the central elevation large outcrops of sandstones with 2 cm- long shatter cones (Fig. 2) were found. Furthermore, shatter cones were found associated with the polymict breccias at the annular basin, in ten different sites (Fig. 1). Microscopic shock deformation features found in sandstones and polymict breccias include PF (planar fractures) and FF (feather features), especially. Abundant PDF with one and two sets of planes were found in shatter cones (Fig. 3) in red and white sandstones. The occurrence of these shock features suggests that the exposed rocks of Santa Marta were likely submitted to pressures of up to 15-20 GPa.

Conclusion: The first evidence of the impact origin of Santa Marta structure is presented here, comprising shatter cones, polymict impact breccias and microscopic features such as PDF, FF and PF. Santa Marta is, therefore, the 7th impact structure confirmed within the Brazilian territory [6].

References: [1] Master, S. & Heymann, J. (2000) *Meteoritics & Planetary Science 35* Supplement. [2] Vasconcelos, M.A.R. et al. (2010) *GSA Special Paper* #465. [3] Vaz, P. T. et al. (2007). *Boletim de Geociências da Petrobras 15* pp. 253-263. [4] Góes, A. M. & Feijó, F. J. (1994) *Boletim de Geociências da Petrobrasi8* pp. 57-67. [5] Campos, J. E. G. & Dardenne, M. A. (1997) *Revista Brasileira de Geociências 27*.pp. 283-294. [6] Crósta, A.P. et al. (2012) 44th LPSC (this meeting).

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Figure 2- Shatter cones in red sandstone from Santa Marta.

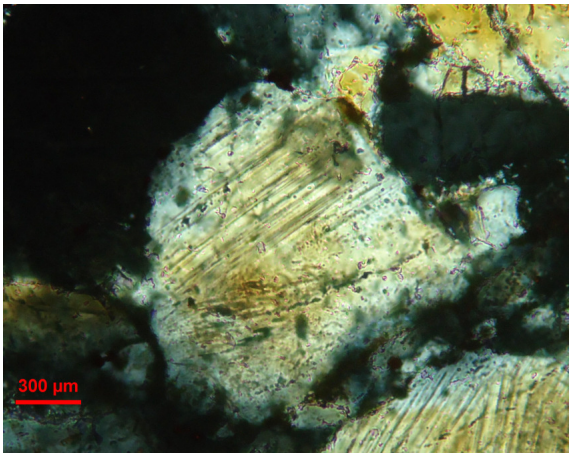

Figure 3- Photomicrograph showing up to two sets of PDF in quartz from Piauí sandstone.