

IMPACT FEATURES FROM VARGEÃO DOME, SOUTHERN BRAZIL

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Introduction: Vargeão Dome is a 12.4 km diameter circular depression located in southern Brazil. It was formed on Cretaceous basalts and Jurassic/Triassic sandstones. Since it was first reported in 1978, several hypotheses have been proposed to explain its origin: alkaline intrusion [1], volcanic crater [2] and impact by an extraterrestrial body [3][4]. Although the impact hypothesis has been widely accepted, little evidence has been given. In this paper, we describe a wide set of impact features recently found at Vargeão.

Geological Setting and Impact Features: The Vargeão circular structure was formed on basaltic rocks of Serra Geral Formation and sandstones of the Pirambóia (Triassic) and Botucatu (Jurassic) formations, all units of the Paraná basin. Outside the structure, there are no occurrences of Jurassic/Triassic sandstones at the surface. Boreholes drilled for oil in the region found these sandstones at depths from 700 to 1,000m, below several layers of basaltic flows. However, in the central portion of the structure, highly deformed blocks of sandstones crop out, bounded by faults.

The analysis of aerial photographs, Landsat-7/ETM+ imagery and digital elevation model led to the recognition of two types of structures. The first type, on a regional scale, is characterized by a sub-rectangular system, controlled by two patterns of fractures/faults, with directions N70-60E and NW. The second occurs only within the structure, characterized by an annular-radial system, formed as a result of collapse faulting and the development of the central uplift, during the modification stage of crater formation.

Impact breccias found in Vargeão include two major types: monomict breccias comprising diabase and basalt; polymict breccias with fragments of sandstone, basalt, diabase and mudstone. Most of the breccias occur in concentric plateaus in the inner portion of the structure, within and around the central uplift.

Uplift in the center of the structure seems to have reached some hundreds of meters, as indicated by the current position of the sandstones. Erosion may also have played a role in exposing the sandstones at the present surface. However, the topographic gradient of 150m between the crater rim the adjacent inner portions of the crater floor, together with gradients of 70m between the central uplift and its surroundings, indicate that the original crater morphology is partially preserved.

Shatter cones were found in sandstones and basalts in several locations within and around the central uplift, with individual cones reaching up to 50cm in sandstones and 12cm in basalts.

Petrographic analysis of brecciated sandstones and basalts revealed abundant planar deformation features (shock lamellae) in quartz and plagioclase, with up to 4 crystallographic directions.

Conclusion: The recognition of a wide set of impact features indicates that Vargeão Dome was formed by the impact of an extraterrestrial body at a still undetermined time, but after the formation of basaltic lava flows of the Serra Geral Fm. (post 120 Ma.)

References: [1] Paiva Filho et al. 1978. *XXX Cong. Bras. Geol.*, Brazilian Geol. Soc., 408-412. [2] Barbour Jr. E. et al. 1981. *Paulipetro – relatório Técnico, Consórcio CESP-IPT*. [3] Crósta A. P. 1982. *XXXII Cong. Bras. Geol.*, Brazilian Geol. Soc., 1372-1377. [4] Hachiro J. et al. 1993. 3^o Simp. Geol. Sudeste, Brazilian Geol. Soc., 276-283.