

MAPPING RUPTILE STRUCTURES RELATED TO REGIONAL TECTONIC EVENTS IN THE PORONGOS METAMORPHIC COMPLEX USING VIRTUAL OUTCROP MODELS

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ABSTRACT: The Porongos Metamorphic Complex is located in the central portion of the South–Riograndense Shield, composed of a metavolcanosedimentary sequence with intercalations of orthogneisses and metaultramafic rocks. These units record a complex deformational history generated at least during five high and low-temperature tectonic events. In this work, the integration of structural data obtained in the field and through a Virtual Outcrop Model have been used to perform a structural analysis of a quarry. The objective is to unravel the processes involved in the generation of the observed ruptile structures, especially the orientation of tension fields respective to observed structure's geometry and kinematic. Field data were obtained using traditional methods of structural geology such as the acquisition of orientation of planes and lines, description of structures and kinematic analysis. An image-based modeling approach through photogrammetric analysis of photos taken in the field was used to construct the Virtual Outcrop Model. Structural analysis was made direct on the Virtual Outcrop Model and in orthorectified images. The structural data were inverted to obtain the paleo-stress orientations. This information revealed the superposition of three deformational events: i) compressional; ii) transtensional and iii) extensional. The compressional regime is related to a pure radial compression with N-S horizontal maximum compression vector. This tension regime corresponds mainly to the development of veins, reverse and contractional faults. The transtensional regime corresponds to an NW-SE sub-horizontal extension and an NE-SW horizontal compression. Structures associated to this paleo tensor are veins and normal, inverse and contractional faults. The extensional regime displays a transcurrent component. This regime has a sub- NE-SW horizontal extension and an NW-SE sub-vertical compressional vector. Structures associated to this tensor consist of normal faults, pairs of conjugated fractures and veins. The cut-off relationships between the structures show that transtension followed compression and subsequently by the extensional event. During the Phanerozoic, the interior of the Gondwana Supercontinent was affected by diverse tectonic events, such as rifting in the early Paleozoic and Mesozoic eras (Triassic) and supercontinent fragmentation in the Cretaceous. The first two deformational events identified in the study area are related to reactivation of old structures during transtensional rifting of Camaquã Basin, whereas the last event is related to the opening of the South Atlantic Ocean. Additional geochronological and thermochronological data can be used to test these hypotheses. The method used proved to be efficient for structural analysis, as well as for the determination of tectonic regimes.

KEYWORDS: Ruptile structures, Virtual Outcrop Model, Regional tectonic events