Paper Number: 4851

Soft-sediment deformation structures interpreted as seismites in Ediacaran carbonates (Bambuí Group, Brazil)

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Soft-sediment deformation structures have been documented in some Proterozoic platforms [1]. The Sete Lagoas Formation (Ediacaran) is exposed in the northern portion of Minas Gerais State, Brazil and consists of carbonates (mainly) and dolomites. At the base of this unit, dolomitized domal stromatolites occur directly on top of the Paleoproterozoic basement, on an irregular regional discordance. The basal stromatolites are overlaid by a 30m-thick succession of microbial facies (thrombolites and thin laminated microbialites) interbedded with fine-grained wave rippled grainstones. Low angle and swaley/hummocky cross-stratification are also present in this facies. The sequence is followed by a 20m-thick breccia layer that is overlaid by a 12m-thick succession of trough cross stratification dolomitized grainstones and domical stromatolites. In general terms, this succession is interpreted as deposited in very shallow waters in the interior portion of a rimmed carbonate platform.

The present study aims to define the origin and mechanism formation of the breccia layer, taking into account not only erosion, transport and in situ brecciation, but also seismic processes. The 20m-thick breccia layer presents karstic features, forming scarps that can be laterally tracked for tens of kilometers. Thus, it is an excellent regional stratigraphic marker. This breccia layer shows a repetition of minor, decimetric to metric, deformed and undeformed beds (Fig. 1). The undeformed beds consist of decimetric laminated microbialites. The deformed beds are made up of disrupted clasts of microbialites that are mainly platy and oblate in shape. Usually, the clasts allow the reconstitution of the original layer. There is no evidence of rounding or other indicative feature of significant sedimentary transport. Several overturned and convoluted beds are also present. Therefore, it suggests ascendant expulsion of liquefied sediment and interstitial fluids.

Figure 1: Deformed bed between two undeformed beds. The breccia layer is made up of platy and oblate fitted clasts of microbialites.

Based on the criteria defined by Owen and Moretti [2] and Jones and Omoto [3], we support the idea that this breccia are, in fact, seismites. Our interpretation is supported by the following evidences: a) wide stratigraphic (lateral and regional) distribution; b) the deformation structures are restricted to a single stratigraphic interval. The entire breccia layer is confined between an alternation of grainstones

and microbialites beds (below) and dolomitized grainstones; c) breccia beds occur repeatedly through the vertical succession. Each one of these decametric to metric beds suggests a different event; d) rock layers are subhorizontal. Therefore, the influence of slope and/or faults can be ruled out; e) evidences of expulsion of liquefied sediment.

References:

[1] Pratt BR (1994) Geology 22: 1091– 1094.

[2] Owen G and Moretti M (2011) Sedimentary Geology 235: 141-147

[3] Jones AP and Omoto K (2000) Sedimentology 47(6): 1211-1226