

SEISMITES AS INDICATORS OF REACTIVATION OF BASEMENT STRUCTURES IN THE PARNAÍBA BASIN, NORTHEASTERN BRAZIL

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RESUMO: Soft-sediment deformation structures characterized as seismites were identified in at least seven lithostratigraphic units in the Parnaíba Basin.

In the eastern border of the Parnaíba Basin, a swarm of subparallel clastic dikes occurs in sandstones and conglomerates of the Ipu Formation (Serra Grande Group, Late Ordovician – Early Silurian). The dikes show evidence of forced injection from below, and are filled with coarse-grained material (coarse sand to pebbles). The studied outcrops are situated in close proximity to faults of the Transbrasiliano Lineament. Other soft-sediment deformation structures, such as load casts, were observed in very coarse sandstones in other outcrops in the same area. The mechanisms of deformation, coarse-grained nature of the sediments affected and the existence of more than one deformed level implies the occurrence of recurrent seismic events of high magnitude ($M_w > 7$), and the relationship with Transbrasiliano Lineament faults suggests that the seismicity is associated with a reactivation of this structure. Clastic dike orientation indicates a maximum horizontal stress (Sh_{max}) with direction N50-60E. This tectonic reactivation is probably related to the processes responsible for the origin of Parnaíba Basin, and seems to be restricted to the Ipu Formation, not affecting the upper units of the Serra Grande Group (Tinguá and Jaicós formations).

On the southwestern border of the basin, a great variety of soft-sediment deformation structures (sinsedimentary folds and faults, clastic dikes, convolute lamination, recumbently-folded cross stratification) occurs in two distinct stratigraphic horizons, one at the top of Pimenteiras formation (Early Devonian) and the other in the basal portion of the Cabeças Formation (Early-Middle Devonian). The deformation structures are interpreted as seismites, associated with large-scale seismic-induced slumps. The great lateral extension of the deformed horizons (~90-100km) indicates recurrence of seismic events of minimum magnitude $M_w \sim 6.3-6.5$. The seismites are situated close by faults of the Transbrasiliano Lineament, suggesting that the seismicity is associated with a reactivation of this structure, although a relationship with the Tocantins-Araguaia Lineament is also possible. Data from sinsedimentary normal faults indicate a subvertical maximum principal stress (σ_1) and a minimum principal stress (σ_3) oriented between N-S and NE-SW.

Clastic dikes, sinsedimentary faults and load casts interpreted as seismites were also described in lacustrine shales of the Pastos Bons Formation (Early Cretaceous) in the central portion of the Parnaíba Basin. The studied outcrops are located on the Transbrasiliano Lineament, and clastic dike and fault orientation indicates a maximum horizontal stress (Sh_{max}) with direction N40E, parallel to the regional orientation of the lineament.

Seismites were also identified in the Piauí (Pennsylvanian) and Pedra de Fogo (Early Permian) formations. At least six distinct levels of deformation structures were described, indicating the occurrence of recurrent seismic episodes during the deposition. Studies in these units are at a preliminary stage, and the relationship of the seismicity with reactivation of basement structures is still not clear.

The palaeoseismicity data obtained corroborate the important role that large structures of the Precambrian basement had in the origin and evolution of the Parnaíba Basin, as indicated by other geological and geophysical data.

KEYWORDS: SEISMITES; PARNAÍBA BASIN; TRANSBRASILIANO LINEAMENT.