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Brittle Structures and Seismicity in Vitória (ES)

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This research aimed primarily to relate brittle structural data to the occurrence of earthquakes in Vitória (ES), Brazil. On March 1st, 1955, the Earth shook in Vitória due to a seismic event of magnitude 6.3 mb, with its epicenter located 300 km off the coast. It is considered the fourth largest earthquake in Brazil's history. Seven other earthquakes have occurred in Vitória and its surroundings. On July 2nd, 2020, another earthquake of magnitude 1.9 mR occurred in Vitória, felt by the local population, with its epicenter located in the Fradinhos neighborhood. Vitória is an island composed predominantly of plutonic igneous rocks in its central portion, typically granites (CPRM, 2015) dated to approximately 500 million years ago, sedimentary rocks from the Barreiras Formation dated between 23.03 and 5.33 million years ago in the northern margin, and Quaternary coastal sedimentary deposits. The methodological approach integrated the analysis of lineament domains at both regional and local scales with the structural analysis of fault/striations pairs affecting the weathered basement and Neogene deposits. In addition, a bibliographic survey was conducted on the geographic occurrence and seismograms of the earthquakes that took place in Vitória and surrounding areas, followed by their spatial representation on thematic maps. The results showed that the brittle structures predominantly trend NW-SE, NNW-SSE, NE-SW, and E-W, aligning with the orientations of neotectonic events in the area: i) sinistral strike-slip E-W; ii) dextral strike-slip E-W; and iii) NW-SE extension (BRICALLI, 2011). The orientations of local lineaments predominantly follow NW-SE, NNW-SSE, NE-SW, ENE-WSW, and E-W trends (PIMENTEL and BRICALLI, 2023), which reflect the regional orientations identified for the state of Espírito Santo, especially the Colatina Shear Zone and the Vitória-Trindade Lineament. Based on the results, it is observed that: i) the brittle structures of the Vitória-Trindade Lineament and the Colatina Shear Zone appear to control the occurrence of earthquakes in the area, as they share the same orientations as the main regional and local lineaments that exhibit strong tectonic control, and the seismic events are located near these structures; ii) there is a strong influence of regional and local brittle structures, as well as neotectonic activity, on the occurrence of earthquakes, since the orientations of the neotectonic events coincide with those of the main regional and local brittle structures.