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Local seismicity surrounding the Atobá Ridge in the slow-slipping St. Paul transform system, equatorial Atlantic

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The equatorial Atlantic transform faults are among the largest and most complex in the world's oceans. Among them, the St. Paul Transform System (SPTS) is a large multi-faulted system formed by four slow-slipping transform faults (Transforms A, B, C, and D), accumulating □630 km of axial offset (Maia et al., 2016). Transform A is the northernmost fault which contains the Atoba Ridge Zone (ARZ), a large transpressive ridge formed at a large stepover (Maia et al., 2016). St. Peter and St. Paul (SPSP) islets sit at the ARZ summit, where is installed a single broadband seismograph (ASPSP) recording local seismicity since 2011 (de Melo and do Nascimento., 2018). Here, we produce a new catalog of the local seismicity recorded around the ARZ between 2011 and 2016. For the epicenter location, we process an initial picking of the P and S waves referent to 359 earthquakes identified manually using SEISAN package applying a 2-12 Hz band-pass filter. Next, we follow a single station approach to locate the epicenters. We estimate the source-receiver distance based on the differential S-P time and the back azimuth from the polarization of P wave recordings, whenever this shows a high rectilinearity coefficient (Montalbetti and Kanasewich., 1970; Cesca et al., 2022). A total of 245 earthquakes were cataloged again using the new improved location process. 54 earthquakes were also identified also by EquatorialAtlanic hydroacoustic catalog (Parnell-Turner et al., 2022) and 12 by the International Seismological Centre. Our results reveal that a large part (174 earthquakes) of the local seismicity is clustered on the west flank of the ARZ, located from 2.18 to 22.58 km southwest of the SPSP islets. Rocks sampled along the ARZ are peridotite mylonites exhumed during the transpressional push-up tectonism of the ARZ. Other minor events are located on the east flank of the ARZ where sample deformation shows strong control of seawater fluid percolation (Bickert et al., 2023), enabling weakening of the rheology and possibly contributing to maintain an aseismic behavior on the faults.

Bickert, M., Kaczmarek, M. A., Brunelli, D., Maia, M., Campos, T. F., & Sichel, S. E. (2023). Fluid-assisted grain size reduction leads to strain localization in oceanic transform faults. *Nature Communications*, *14*(1), 4087.

Cesca, S., Sugan, M., Rudzinski, Ł., Vajedian, S., Niemz, P., Plank, S., ... & Dahm, T. (2022). Massive earthquake swarm driven by magmatic intrusion at the Bransfield Strait, Antarctica. *Communications Earth & Environment*, *3*(1), 89.

de Melo, G. W., & Do Nascimento, A. F. (2018). Earthquake magnitude relationships for the Saint Peter and Saint Paul archipelago, equatorial atlantic. *Pure and Applied Geophysics*, *175*, 741-756.

Maia, M., Sichel, S., Briais, A., Brunelli, D., Ligi, M., Ferreira, N., ... & Oliveira, P. (2016). Extreme mantle uplift and exhumation along a transpressive transform fault. *Nature Geoscience*, *9*(8), 619-623.

Montalbetti, J. F., & Kanasewich, E. R. (1970). Enhancement of teleseismic body phases with a polarization filter. *Geophysical Journal International*, *21*(2), 119-129.

Parnell□Turner, R., Smith, D. K., & Dziak, R. P. (2022). Hydroacoustic monitoring of seafloor spreading and transform faulting in the equatorial Atlantic Ocean. *Journal of Geophysical Research: Solid Earth*, *127*(7), e2022JB024008.