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# Seismic Monitoring of Mining-Related Events in Jacobina-BA

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## Introduction

This study examines recent seismic activity in the Jacobina region (Bahia), where seven underground gold mines operate within meta-sedimentary rocks, including quartzites, meta-conglomerates, and schists. The mining complex is situated in the southern portion of the Jacobina Ridge. N-S oriented compressional faults, E-W strike-slip faults, and mafic dikes and sills characterise the study area.

Events recorded between 2018 and 2021 by the Brazilian Seismographic Network (RSBR) showed that the epicentres were located around the urban area of Jacobina (accuracy > 5 km), and magnitudes ranged between 1.0 and 3.2 $M_R$. Due to the increased seismicity rate, a temporary network of six short-period seismic stations was deployed from February 2022 to August 2023. Analyses revealed event epicentres clustered near the mining areas, with hypocentral depths shallower than 1 km.

## Method

This work aims to examine the seismicity recorded by regional and local seismic networks, allowing us to investigate the possible correlation between mining operations and observed seismicity, and assess the possibility that natural reactivation of geological discontinuities controls the seismicity. To achieve this, data from the regional and temporary networks are being used to:

- Automatically detect seismic events using an algorithm based on Template Matching;
- Locate the events using algorithms such as Hypocenter and HypoDD;
- Estimate source parameters such as focal mechanism, seismic moment, radiated energy, and stress drop.

## Results and Conclusions

The hypothesis linking seismicity to reactivation of geological structures (e.g., faults and dikes) requires further investigation. However, if reactivation occurs, it is confined to regions near mines. Focal mechanism analysis of 18 events on March 4–5, 2020, predominantly indicates reverse faulting, suggesting that seismicity may arise from vertical stress reduction due to rock removal.

Jacobina has experienced recurrent seismic activity, which has damaged nearby residences and poses risks to mine infrastructure, particularly two tailings dams. Methods based on Gutenberg-Richter parameters roughly estimate a maximum magnitude of 3.0, whereas an alternative approach using observed magnitudes estimates a magnitude of 3.6. Faults and dikes in hard rock may increase seismic hazard if these structures reach critical failure conditions.

This is an ongoing study, and the results discussed here are preliminary. Future steps include expanding the seismic event catalogue via template matching-based automated detection and calculating source parameters for all events. Moreover, a single-station location method based on Coda Wave Interferometry and Distance Geometry Solvers is being developed for periods when the local network data is unavailable.