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Seismotectonics and characterization of natural and man-made events at Mpape following the 2024 Abuja earthquakes in Nigeria

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From 10 to 19 September 2024, residents of Mpape, a densely populated settlement in Abuja, Nigeria, with a high concentration of mining firms, witnessed a series of vibrations that they thought were from usual ground shakings resulting from regular quarry blasts. The duration (nine days) of the vibrations motivated this research to determine the seismotectonic nature and characterize artificial and natural events at Mpape. We adopted seismological, geological and geophysical approaches to process and analyse aeromagnetic data using the Oasis Montaj software; and seismic data covering one year retrieved from three short period local stations located within Abuja using Geotool and Seisan software, and the Matlab package. Results show the presence of a tectonic fault within Mpape, which was hitherto unknown. Analysis of the waveform data confirmed the 10-19 September 2024 vibrations resulted from many seismic foreshocks that heralded the main event located (Lat:9.217°N, Lon:7.453°E, Ml=3.5, depth=15km; Intensity=V); followed by a sequence of aftershocks with III-IV intensities. The seismograms also contained suspicious events with high amplitude P-onsets with no clear S waves for different days and were associated with rock blasting events; while some blasts coincided with hitherto two unnoticed seismic events of 1 and 9 November 2023 with magnitudes 2.5 and 2.7 respectively.

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