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# Pre-, Syn- and Post Eruptive Seismicity of the 2011 Eruption of Nabro Volcano, Eritrea

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Nabro volcano, located in south-east Eritrea, East Africa, lies at the eastern margin of the Afar Rift and the Danakil Depression. Its tectonic behaviour is controlled by the divergence of the Arabian, Nubian and Somali plates. Nabro volcano was thought to be seismically quiet until it erupted in June 2011 with limited warning. The volcano erupted on June 12, 2011 around 20:32 UTC, following a series of earthquakes on that day that reached a maximum magnitude of 5.8. It is the first recorded eruption of Nabro volcano and only the second in Eritrea, following the Dubbi eruption in 1861. A lava flow emerged from the caldera and travelled about 20 km from the vent and buried settlements in the area. At the time of this eruption there was no seismic network in Eritrea, and hence the volcano was not monitored. In this study we use ten Ethiopian, one Yemeni and one Djibouti stations to investigate the seismicity of the area before, during and after the eruption. Four Eritrean seismic stations deployed in June 2011, four days after the eruption, are also included in the dataset. Travel time picks supplied by colleagues from Djibouti were also incorporated into the dataset. Our analysis covers roughly three months before and after the eruption and shows that Nabro was seismically quiet before the eruption (nine events), with the exception of one major earthquake (4.8 magnitude) that occurred on March 31, 2011. In contrast, the region shows continued seismic activity after the eruption (92 events). During the eruption seismicity levels are high (123 events), with two days particularly active, June 12 and June 17 with 85 and 28 discrete events, respectively. Maximum magnitudes of 5.8 and 5.9 were recorded on these two days. The two days of increased seismicity are consistent with satellite observations of the eruption which show two distinct phases of the eruption. The period between these two phases was dominated by volcanic tremor. The tremor signal lasted for almost one month following the initiation of the eruption. In summary, we have shown that the volcano was relatively quiet before eruption but continued to be seismically active for an extended period of time afterwards.