



Seismic constraints on a large dyking event in Western Gulf of Aden

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In November 2010, a large number of events were recorded by the world seismic networks showing important activity occurring along the western part of the Aden Ridge. West of the Shulka El Sheik transform zone, events in this large seismic swarm (magnitudes above 5) occurred in a complex area, where the change of both the ridge direction and the bathymetry suggest the propagation of the ridge into a continental lithosphere and the influence of the thermal anomaly of the Afar Hot Spot. We combine several sets of data from permanent networks and temporary 3C broad stations installed after the beginning of the event along the southern and eastern coasts of Yemen and Djibouti respectively, we located more than 600 earthquakes with magnitudes ranging from 2.5 to 5.6 that occurred during the first months following the first event. The spatial distribution of the main seismicity reveals a very clear N115°-trending alignment, parallel to the mean direction of the en-echelon spreading segments that form the ridge at this longitude. Half of the events, which represent half of the total seismic energy released during the first months, are located in the central third section of the segment. Here several volcanic cones and recent lava flows observed from bathymetric and acoustic reflectivity data during the Tadjouraden cruise (Audin, 1999, Dauteuil et al., 2001) constitute the sea floor. In addition to this main activity, two small groups of events suggest the activation of landslides into a large fan and the activity in a volcanic area 50 km due east from the main active zone. The time evolution of the seismicity shows several bursts of activity. Some of them are clearly related to sudden activities within the volcanic areas, when others exhibit horizontal migration of the events, with velocity around ~ 1 km/h. The time-space evolution of the seismicity clearly reveals the intrusion of dykes associated with magma propagation from the crustal magmatic centres into the rift zone. We use knowledge from spatial geodetic observations of rifting episodes in the regions: the Harrat Al-Shaqah event in 2009 (Arabia Saudia), the Tanzanian one in 2007, and the major Dabahu Manda Harraro rifting episode in Afar. Taking into account that the geodetic moment is one order of magnitude higher than the seismic moment during such events, the seismic activity of this event of the Aden ridge represents a major rifting episode certainly associated with the opening of the segment by dyking estimated to be higher than 10 m.