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Magmatism on rift flanks: insights from Ambient-Noise Phase-velocity in Afar region

Félicie Korostelev (1,2), Cornelis Weemstra (3), Sylvie Leroy (1,2), Lapo Boschi (1), Yong Ren (4), Abdulhakim Ahmed (1,2,5), Derek Keir (6), Graham W. Stuart (4), Frédérique Rolandone (1,2), Khaled Khanbari (7), James O.S. Hammond (8), J. Michael Kendall (9), Cécile Doubre (10), and Ismail Al Ganad (11)

(1) Sorbonne Universités, UPMC Univ Paris 06, UMR 7193, Institut des Sciences de la Terre Paris (iSTeP), F-75005 Paris, France., (2) CNRS, UMR 7193, Institut des Sciences de la Terre Paris (iSTeP), F-75005 Paris, France., (3) Department of Geoscience and Engineering, Delft University of Technology, Stevinweg 1, 2628 CN Delft, The Netherlands., (4) School of Earth and Environment, University of Leeds, Leeds, UK., (5) Seismological and Volcanological Observatory Center, Dhamar, Yemen., (6) National Oceanography Centre Southampton, University of Southampton, Southampton, U.K., SO14 6GG., (7) Sana'a University, Yemen Remote Sensing and GIS Center, Sana'a, Yemen., (8) Imperial College London, London, SW7, U.K., (9) University of Bristol, Bristol, BS8, U.K., (10) EOST, IPGS, Univ. Strasbourg, France., (11) Yemen Geological Survey and mineral Resources Board, Sana'a, Yemen.

During the breakup of continent in the presence of magma, strain is commonly assumed to initially occur by border faulting, and progressively migrate in space and time towards axial magma intrusion. Magmatic processes near the rift flanks are commonly ignored. We present phase-velocity maps of the crust and uppermost mantle of the conjugate margins of the southern Red Sea (Afar and Yemen) using ambient noise tomography to constrain crustal modification during breakup. Our images show that the low seismic velocities characterize not only upper crust beneath the axial volcanic systems, but also both upper and lower crust beneath rift flanks where ongoing volcanism and hydrothermal activity occurs at the surface. The results show that magmatic modification of the crust beneath rift flanks likely occurs for a protracted period of time during the breakup process, and may persist through to early seafloor spreading. Since ongoing flank magmatism during breakup impacts the thermal evolution of the lithosphere, it has implications for the subsidence history of the rift.