

Crustal structure of the Khartoum Basin, Sudan

Nada El Tahir ^{a,b,*}, Andrew Nyblade ^{a,b}, Jordi Julià ^c, Raymond Durrheim ^{a,d}

a School of Geosciences, The University of the Witwatersrand, Johannesburg, South Africa

b Department of Geosciences, Penn State University, University Park, PA 16802, USA

c Departamento de Geofísica & Programa de Pós-Graduação em Geodinâmica e Geofísica, Universidade Federal do Rio Grande do Norte, Natal, Brazil

d CSIR Centre for Mining Innovation, Johannesburg, South Africa

*Corresponding author: nada_ahmed99@hotmail.com

Abstract

The crustal structure of the northern part of the Khartoum Basin has been investigated using data from 3 permanent seismic stations within 40 km of Khartoum and two modeling methods, H–k stacking of receiver functions and a joint inversion of receiver functions and Rayleigh wave group velocities. The Khartoum Basin is one of several Mesozoic rift basins in Sudan associated with the Central African Rift System. Results from the H–k-stacking indicate that crustal thickness beneath the Khartoum Basin ranges between 33 and 37 km, with an average of 35 km, and that the crustal V_p/V_s ratio ranges from 1.74 to 1.81, with an average of 1.78. From the joint inversion of receiver functions and Rayleigh wave group velocities, we obtained similar results for Moho depth, as well as an average shear wave velocity of 3.7 km/s for the crust. These results provide the first seismic estimates of Moho depth for a basin in Sudan. When compared to average crustal thickness for unrifted Proterozoic crust in eastern Africa, our results indicate that at most only a few km of crustal thinning may have occurred beneath the Khartoum Basin. This finding is consistent with estimates of effective elastic plate thickness, which indicate little modification of the Proterozoic lithosphere beneath the basin, and suggests that there may be insufficient topography on the lithosphere–asthenosphere boundary beneath the Sudanese basins to channel plume material westward from Ethiopia.