CRUSTAL STRUCTURE BENEATH ETHIOPIA AND KENYA: IMPLICATIONS FOR RIFT DEVELOPMENT IN EASTERN AFRICA

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The East African Rift System (EARS) is one of the largest continental rift systems on Earth, extending from the Afar region of Ethiopia southward to beyond the Zambezi River (Figure 1). Crustal structure was investigated within and surrounding the Eastern Branch of the EARS in Ethiopia and Kenya to determine the extent to which the Precambrian crustal structure has been modified by the Cenozoic tectonism found there. Two methods of receiver function analysis, the H-k method (Figure 2), and direct stacks of the waveforms, were used to analyze broadband seismic data that came from two IRIS/PASSCAL broadband seismic experiments conducted in Ethiopia between 2000 and 2002 and in Kenya between 2001 and 2002 (Figure 1). Crustal thickness to the east of the Kenya rift varies between 39 to 42 km and Poisson’s ratios for the crust vary between 0.24 and 0.27 (Figure 3). To the west of the Kenya rift, Moho depths vary between 37 and 38 km and Poisson’s ratios vary between 0.24 and 0.27. These findings support previous studies showing that crust away from the Kenya rift has not been modified extensively by the Cenozoic rifting and magmatism. Beneath the Ethiopian Plateau on either side of the Main Ethiopian Rift, crustal thickness ranges from 33 to 44 km, and Poisson’s ratios vary from 0.23 to 0.28. Within the Main Ethiopian Rift, Moho depths vary from 27 to 38 km, and Poisson’s ratios range from 0.27 to 0.35 (Figure 3). A crustal thickness of 25 km and a Poisson’s ratio of 0.36 were obtained for a single station in the Afar Depression. When compared to the Mozambique Belt crust in Tanzania and Kenya, as well as global averages, these results indicate that the crust beneath the Ethiopian Plateau has not been modified significantly by the Cenozoic rifting and magmatism.