

ABSTRACT

The seismic refraction-wide-angle of reflection experiments carried out between 1985 and 1994 in the Kenya Rift (KRISP '85, KRISP '90 and KRISP '84) show major crustal thickness variations both along and across the rift. Along the rift axis crustal thickness varies from 35 km in the south beneath the Kenya dome to 20 km in the north beneath the Turkana region. Due to the distribution of crustal thickness beneath the rift flanks, it can be stated that the major amount of variation in crustal thickness along the rift axis is due to the Tertiary rifting episode. The profile completed in 1990 across the rift of the Kenya dome at the latitude of Lake Baringo and the profile completed in 1994 across the rift south of the Kenya dome at the latitude of Lake Magadi both show that the low uppermost mantle P (tief)n velocity of 7.5-7.7 km/s and crustal thinning of 5-10 km is confined to below the surface expression of the rift. An abrupt change in Moho depths and P (tief)n velocities of 8.0-8.2 km/s occur. East of the rift, the profile completed in 1994 through the Chyulu Hills Quaternary volcanic field reveals some of the thickest crust (38-44 km) encountered so far beneath Kenya over a distance of volcanic field are of a reverberatory nature from immediately behind the first arrivals to beyond the Moho reflection P(tief)M P. This reverberatory nature could possibly be caused by equivalents of the volcanic outpourings in the Chyulu Hills. Beneath the Chyulu Hills uppermost mantle P(tief)n velocity is 7.9-8.0 km/s. Below the 600 km long axial rift profile, P(tief)n velocities are low being 7.5-7.7 km/s. However, under the northern part of the rift two layers with velocities of 8.1 km/s and 8.3 km/s are embedded in the low velocity mantle material at 40-45 km and 60-65 km depth respectively. In contrast, the wide-angle data show that beneath the Kenya dome in the southern part of the rift low mantle velocities occur down to at least 60 km depth. This mantle velocity structure is indicative of the depth to the onset of melting being at least 65 km beneath the northern part of the rift and thus not being shallower than the depth (45-50 km) to the onset of melting under the Kenya dome to the south. The above results taken together with results from teleseismic studies, petrology and surface geology indicate anomalously hot mantle material appearing below the present site of the Kenya Rift about 20-30 Ma ago. The active uprising of this anomalously hot mantle material since this time has given rise to widespread volcanism along the whole length of the rift and has modified the crust beneath the rift by mafic igneous underplating and intrusion especially into the basal layer. Accompanying the uprising of the anomalously hot mantle material minor crustal extension (5-10 km) has occurred beneath the Kenya dome in the southern part of the rift where crustal thickness is large (35 km). Under the Turkana region in the northern part of the rift a greater amount of extension (35-40 km) has taken place and the crustal thickness is small (20 km) although the depth to the onset of melting under the northern part of the rift is, if anything, greater than under the southern part of the rift.