ISLA ISABEL, MEXICO: A THIN CRUST UNDER A SHALLOW CONTINENTAL PLATFORM

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The crust at Isabel Island in the Mexican Pacific continental platform is only 17 km thick; this thickness has been determined by seismic studies, and more recently corroborated by a magnetotelluric one. The thin crust is the result of rifting and extensional tectonism induced by the separation of Baja California Peninsula from mainland Mexico. The island shows Plio-Pleistocene volcanic activity, including the formation of maars and the presence of mantle xenoliths. Alkali basalts transported peridotite xenoliths to the island’ s surface. Furthermore, pressure estimates for the Isabel xenoliths indicate that they equilibrated at relatively low pressures (5.9–15.5 kb), supporting the occurrence of shallow crustal processes. Gravity and magnetic models show that the island represents the emerged portion (0.03 km^3) of a larger laccolith (12 x 8 km) where apparently successive magma intrusions have deformed the shallow (100 m) continental platform where it is located. A nearby exploration well distant 8 km from the island reached 3157 mbsl; from 1400 to 3157 m-depth the recovered nuclei consisted of oceanic crust, where the deepest 250 m were of dolerite composition. At the bottom of the well a temperature of 231ºC was reported, yielding a geothermal gradient of 73 ºC/km, one of the largest in the world, indicating an anomalously high heat flux in the area. Since dolerite dikes often occur in swarms it is likely that they are present throughout the area. Nearby gravity and magnetic anomalies of similar characteristics to those of Isabel Island support the probable presence of additional intrusive bodies in this region. A thin crust with high heat-flow, combined with a shallow continental platform represents an opportunity area to carry out hard-rock drilling projects.

Keywords: Isabel Island, Mexico, Thin crust, Laccolith