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Seismic Images of the Crust Beneath the Epicentral Region of Bhuj (2001) Earthquake and its implications

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Seismic images obtained by pre-stack depth migration of seismic refraction data acquired before the 2001 Mw = 7.7 Bhuj (western India) earthquake along three short (~35 km) profiles are presented. The results show that the crust is highly reflective with strong, near-horizontal reflections at all depths. The crust (~35-45 km) thickens by 10 km over a distance of about 50 km from the northern margin of the Gulf of Kutch to the epicentral region of the earthquake. The Moho, clearly imaged at the base, appears to be flat with a smooth dip from the coast to the interior of the continent. Aftershocks of the Bhuj earthquake extending to the maximum depth of 37 km are contained within the crust. The existence of a thick and highly-reflective crust (~45 km) at the epicentral zone probably indicate crustal thickening due to the compressive regime of the past 40 Ma, whereas the Kutch tectonic framework dates to Mesozoic rifting associated with the break-up of Gondwanaland. There is no evidence for offsets in the crust-mantle boundary. The crustal reflectivity pattern along with the laterally varying signal strength of reflectors may indicate that this zone was tectonically disturbed prior to the 2001 event.

Keywords: Bhuj earthquake; seismic image; pre-stack depth migration.