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Reflection of Contrasting Crustal Structures of the Western Usa in Gravity Field

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The modeled profile (length is about 3000 km) crosses the contrasting morphological structures of western USA. It starts in the Pacific ocean (˜35N; -125W), then cross the Central Califronia, Great Valey, Sierra-Nevada Mountaints, Basin and Range Province, Plateau Colorado, Rocky Mountaints, and finishes in the Great Plains (˜42N; -100W). Beneath the surface, the profile crosses interesting uppermost-mantle features, including a high- velocity body beneath the Sierra-Nevada reaching a depth of 200 km, undulations of lithosphere/asthenosphere boundary, edge of Precambrian cratonic lithosphere, etc...

The gravity field of the ocean-continent transition is characterized by a steady decrease from about -22 mGal free air anomalies over the Pacific plate, to negative Bouguer anomalies down to -350 mGal over the Rocky Mountaints, and then inctease to near zero values over the Great Plains. The gravity anomaly crossing by the profile is a global minimum. Western USA is also characterized by negative geoid anomaly down to -30m.

Most of the profile follows the seismic experiments lines. Seismic-geological structure of the crust is compiled in accordance to [1-11]. Sesmic-geological crustal structure changes dramatically along the profile. Oceanic part of the profile is presented by thin (5-6) km high velocity (basalt/gabbro) oceanic crust. Shelf and coastal ranges are characterized by (10-15) km thickness crust composed mostly of metasediments. Great Valey is a deep sedimentary basin. In axial part beneath sediments the complexes with mantle geophysical signatures are located. Batholith of Sierra-Nevada is characterized by low seismic velocities (˜6.0 km/c) and thick (45-50) km crust. Basin and Range Province is characterized by strongly deformed upper crust and flat Moho at the depth ˜30 km. Plateau Colorado, Rocky Mountains and Great Plains are less studied by seismic investigations. Nevertheless, variations of crustall thickness and structure were also revealed there.

There was executed a preliminary density modeling.

Model 1. Densities in water were fixed as 1.03 g/ccm, in sediments as 2.0-2.4, and in the blocks of the crust as 2.85 g/ccm, in the blocks of the mantle as 3.30 g/ccm. This model shows roughly the gravity effects of the water layer, the sedimentary basins, and the undulations of the Moho boundary at fixed density contrast of 0.45 g/ccm. Residual anomaly were up to 200 mGal. Besause density variations in the crust can not compensate so great anomalies, it proves existence of mantle density anomalies.

Model 2. Densities in the mantle are allowed to vary within (3.15-3.50) g/ccm. This model allow to define conventional mantle densities anomaly. A trend of density increase toward inner parts of North American continent was revealed. The trend correlates with increasing of seimic Pn velocities.

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