

Beghoul, Mohammed Nouredine, *Lithospheric Structure of the Western United States and the Tibetan Plateau: Implications on their Mechanism of Uplift*, Ph. D. Dissertation, Cornell University, 1991.

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Abstract:

This dissertation seeks to determine the upper mantle structure and the mechanisms responsible for the Cenozoic uplift of the high terranes located near plate boundaries: the Tibetan Plateau and western North America. The upper mantle structure is determined using the first P arrivals obtained from the International Seismological Centre (ISC) at regional distances ($2^\circ - 22^\circ$).

In the first chapter a methodology is presented for computing mantle lid Pn velocities using ISC data together with a detailed error analysis. Application of this algorithm to Colorado Plateau yields an average Pn velocity of 8.12 ± 0.09 km/s. This value is higher than the one reported in the literature but similar to that beneath stable midcontinent regions. We use this Pn value and the Cenozoic history of the plateau to constrain the mode of uplift.

In chapter two, using the same techniques, we confirm the lower Pn velocity beneath the Basin and Range Province and show the presence of about 4% intrinsic azimuthal Pn velocity anisotropy in the mantle lid beneath the Basin and Range. The direction of high velocity coincides with the direction of present-day extension in the Basin and Range Province (i.e., NW - SE). We show that this anisotropy is the result of Cenozoic extension rather than a cumulative signature of older tectonic events.

In chapter three, a modified version of the algorithm and detailed mapping of Sn attenuation allow the determination of mantle lid thickness beneath the western United States and Tibet. We show that the mantle lid thickness beneath the southern 2/3 of Tibet ranges from 135-165 km thick. This value is similar to the one we find for the Great Plains.

The deep structure, Cenozoic uplift, and various other geophysical and geological data of these two high terranes are consistent with the subduction of flat slabs beneath them. The continental Indian Plate is still beneath the southern 2/3 of Tibet, but the oceanic Farallon Plate has already been delaminated from the overriding North American Plate.