Crustal And Lithospheric Thickness Variations For Central Alaska And The Chugach-St. Elias Region From P And S Receiver Functions

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1 Tectonic Setting

The Yakutat Block of southern Alaska is an erosive tectonic setting that becomes accentuated towards the Atlantic Margin. The Yakutat Block is a component of the circumcontinental affinity to the east. The entire block is covered with thick deposits of sedimentary rocks. GPS measurements indicate that the velocity of the Yakutat Block is driven by stresses from both the Pacific Plate and North America, indicating that the block is currently experiencing compression. The subduction zone of the Yakutat Block is further complicated by the asthenospheric glacial erode that dominates the terrestrial portion of the block (map modified from Redfield and Fitzgerald, 1995).

2 STEEP Seismic Experiment

The Joint Elastodynamics and Tectonics Project (STEER) is a multi-disciplinary study to address the evolution of the highest crustal mountain ranges of St. Elias Mountains of southwestern Alaska and northeastern Canada. In order to extend the broadband seismic coverage provided by the Alaska Earthquake Information Center, additional surveys were initiated in western Alaska during the summers of 2001 and 2005 as part of the STEER project. In 2001, 23 broadband seismic stations were installed on and around the Yakutat Block.

3 Telesismic Events

Many studies of the crustal structure, particularly crust thickness, have been published for this region of southern Alaska. However, most have not provided a complete picture of the crustal structure. The 1998 collection of crustal seismic waves from near Yakutat and Cordova that can be approximately 20 km thick. In addition, the Yakutat Ophiolite Zone of the western portion of the block has been the scarcer or quiescent earthquakes that have been observed and also indicate thin thick crust (Jost et al., 1997).

4a 3-D Wavefield Migration of P Receiver Functions

Estimated sections of CCP processed data (a) and integrated data (b) along a single shot line and four North-South lines. The data are shown on crust map. Due to the presence of strong multiples and sub-Moho reflections, the Moho depths on the western portion of the Yakutat block, which represents W-E transects are also shown on crust map. The thickness of the crust decreases and appears to the discontinuous across terrane boundaries.

4b 3-D Wavefield Migration of P Receiver Functions

Estimated sections of CCP processed data (a) and integrated data (b) along a single shot line (P-3) and four North-South lines. The data are shown on crust map. Due to the presence of strong multiples and sub-Moho reflections, the Moho depths on the western portion of the Yakutat block, which represents W-E transects are also shown on crust map. The thickness of the crust decreases and appears to the discontinuous across terrane boundaries.

5 S Receiver Functions - Lithospheric Thickness

Synthetic (red and blue) and actual (black and yellow dashed line) waveforms are shown for all S receiver functions. These functions are calculated in the frequency domain, and depict the velocity structure for the mid-lithospheric region. The thick crust is highlighted by the strong multiple reflections. The Moho is also clearly visible in the frequency domain.

6 Conclusions

- Receiver function signals on Yakutat dominate by multiples.
- Discontinuity of Moho across terrane boundaries.
- Thick crust is on the western portion of the block
- Highly variable Moho and L-M thicknesses.