Seismic constraints on slab dehydration and sub-arc melting beneath the Alaska Peninsula

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The Alaska Peninsula has a long history of plate subduction and diverse arc volcanism along the strike. Despite the diverse arc volcanism on the surface, the slab dehydration and sub-arc melting processes that feed these volcanoes are unclear. Here we utilize the newly available seismic data to build 3-D high-resolution V_P, V_P/V_S, and Q_P models to image the Alaska Peninsula section of the Alaska-Aleutian subduction zone. We find strong along-strike changes in slab dehydration, indicated by low V_P, high V_P/V_S, and the distribution of intermediate-depth seismicity in the slab. In the mantle wedge, low V_P, high V_P/V_S, and high Q_P anomalies show variations in sub-arc melting along the arc. Slab dehydration and sub-arc melting are most extensive below the Pavlof and Shumagin segments in the southwest, weakening below the Chignik and Chirikof segments in the northeast, and strengthening again beneath the Kodiak segment further to the northeast. We propose that the variations of slab hydration at the outer rise significantly influence slab dehydration at greater depths and further control sub-arc melting beneath the Alaska Peninsula.

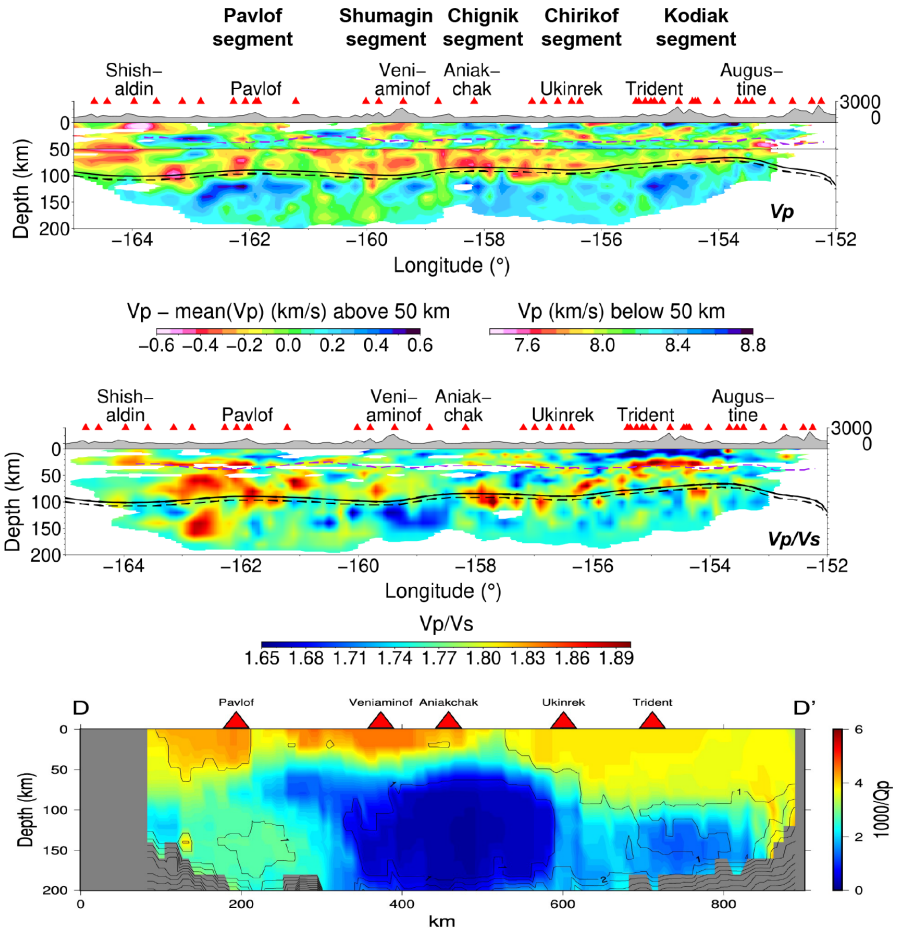

Figure caption: Along-strike variations of the V_P, V_P/V_S, and Q_P structures beneath the volcanic arc. In the V_P and V_P/V_S panels, the black dashed, black solid, and dashed purple curves represent the location of the slab Moho, slab surface, and overriding Moho, respectively. The locations of volcanoes are shown as red inverted triangles at the top with their names written above. In the Q_P panel, black contours show the standard deviations of $1000/Q_P$ estimated from MCMC inversions.