LOWER PLATE GEOLOGY AND EARTHQUAKE RUPTURE: 2010 CHILE AND 1964 ALASKA

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Zwei-Weg Laufzeit [s]

Entfernung [km]

Tiefseegraben

Akkretionsfront

Alte Akkretierte Sedimente

Nazca Platte

Turbidite

Mumps

Meeresboden
Rupture stopped at 1-3km high lower plate ridge in the north; in the south it ended at a 20 km wide subducted fracture zone with 1km high relief before subduction. Lower plate relief forms an asperity during one earthquake and a barrier during another.

An upper plate transition from the frontal to middle prism probably arrested shear 10-20 km landward of the trench axis at a seismic velocity boundary. It limited the up-dip width of the rupture and the down-dip boundary is not constrained.

UPPER AND LOWER PLATE FEATURES FIT RUPTURE EXTENT
Figure 15. The 1964 seismic slip and geophysical characteristics map of the PWS subduction zone. Slip appears to occur outside of gravity anomalies and limited updip from the creeping zone. Creeping and locked zones estimated were from the inversion of GPS data [Zweck et al., 2002]. The free-air gravity anomalies were derived from satellite data and calculated by Song and Simons [2003].
The Kodiak margin fault that ruptured in 1964 has subducted relief like the 2010 Chilean interplate fault rupture.

The 1938 earthquake rupture appears to have been constrained to Zodiak Fan. This may indicate a fault mechanics different from that on either side.
CONSIDERATIONS IN FUTURE HAZARDS STUDIES

The traditionally independent fields of fault geology/geophysics and seismology can be integrated better to understand earthquake rupture and interplate fault mechanics.

Modern Geophysical systems can now image subducted km scale lower plate relief to help assess seismic risk. Seismic data can yield physical properties across faults.

Lower plate relief can be a dominant asperity or barrier in the organization of great earthquake rupture. It indicates the spatial variability of plate interface friction.