

Segmentation and Physical Characteristics of the Nazca-South American Plates Subduction Interface

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The Nazca and South American plates subduction interface, as disclosed by the Wadati-Benioff zone geometry, is sectioned into a sequence of normal and abnormal subducting segments with well-defined physical, morphological and structural characteristics, from about latitude 8° N to about 45°S, along the South American western continental margin. Segment's boundaries are marked by contortion zones in the upper 300-km seismogenic slab, and with no obvious relationship to the 600-km depth seismicity zone. The main morphological difference between abnormal and normal subducting segments is a nearly horizontal or slightly dipping seismicity plateau under the continent. Both subducting segments have similar geometry in the upper 100-km thick slab: They start at or near the Perú-Chile trench at small dipping angle (about 10°-16°), gradually increasing to 25°-30° to around 100-km depth. Normal subducted segments continue landward, with this dipping angle, into the upper mantle to variable depths. But, the abnormal subducting segments become nearly horizontal or dip slightly inland for several hundred kilometers, and then reassume the 25°-30° dipping angle.

Normal subducting segments are characterized by: active volcanoes, a negative-heat-flow anomaly along the trench axis, a broad-high-positive-heat-flow anomaly with extreme values near or east of the active volcanic axis; subducting-locked zones from near surface to 40-70 km depth. On the other hand, abnormal subducting segments have: no active volcanoes, a negative-heat-flow anomaly along the trench axis, a minor-positive-heat-flow anomaly between the Andes and the Perú-Chile Trench, a broad-negative-heat-flow-anomaly under the Andes, and the subducting-locked zones extend from near surface to about 40-km depth.