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Nature and distribution of recent sediments in the trench of the subduction margin of Ecuador

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Recent deep marine sedimentation in subduction trenches is characterized by the inter-stratification of hemipelagic and turbidite sediments locally interbedded with debris flows, which can result from continental slope shaking by large earthquakes. The objective of this study is to describe the morphologic complexity on the Ecuadorian border of the Nazca tectonic plate where a set of deep marine asperities is subducting at different scales, and its consequences on the lateral distribution of the sediments in the different sub-basins.

The Ecuadorian active margin comprises three geomorphological segments: The northern segment characterized by a wide (5-10 km) and deep trench (3800 – 4000 m), a rough gullied continental slope and a shelf (10-40 km wide) with active subsidence. The central segment strongly influenced by the subduction of the Carnegie ridge which induced a narrow (0–5 km wide) and relatively shallow trench (3100 – 3700 m depth), a smooth and gullied slope with no canyons and a 15–40 km wide shelf characterized by areas with active subsidence and uplift. Finally the southern segment presents a wide (5–10 km) and deep (4000–4700 m) trench, an irregular and starved continental slope with canyon systems and a wide subsiding shelf (20–50 km).

Bathymetry, high-resolution seismic profiles and sedimentary cores collected during the scientific campaign “ATACAMES” along the active margin of Ecuador show that since the last glacial maximum, the trench has been filled by turbidites, hemipelagites, volcaniclastic deposits, homogenites as well as slumps, debris flow and other mass transport deposits. Hemipelagites, turbidites and homogenites are found in all segments. Hemipelagite beds range in thickness from 5cm to 1m reaching over 3m in the north. Turbidites are coarser and sandier showing a higher frequency in the central segment. Mass transport deposits are mainly found in the northern and southern segments, contrasting with volcaniclastic deposits which are mainly present in the central segment.

The distribution of sedimentary facies along the trench could be related to the subduction of the Carnegie Ridge. The ridge exerts a strong influence and control over the individualization of the three segments as well as on the nature and the lateral distribution of the sediments in the trench. Due to shallower deposition conditions, the central segment facing the Carnegie Ridge is full of sandy and silty turbidites in a proportion of 2:1 with respect to the other segments and their location on the main ash pathways might explain the concentration of the volcaniclastic deposits. The southern and northern segments, which are fed by large canyons and affected by isolated seamounts, show more slump, debris flows and mass-transport deposits.