Benthic Foraminifera from ODP Sites Verify Model of Subduction Erosion

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Scientists have intensely studied the convergent plate margin off Costa Rica during the last two decades to understand the process of subduction along the Central American margin. Based on high- resolution 3D seismic data and results from ODP drilling, it has recently been recognized that the Costa Rican forearc wedge on the upper plate at this convergent plate boundary is currently undergoing active subduction erosion (Meschede et al., 1999; Ranero and von Huene, 2000) rather than tectonic accretion by underplating. The model of subduction erosion implies that the forearc wedge of the upper plate is progressively reduced at its base and that the offscraped material is transported downward into the subduction zone. Removal of material from the base of the forearc causes extensional deformation of the upper plate, which results in subsidence of the forearc wedge and leads to landward migration of the coastline (Fig. 1).

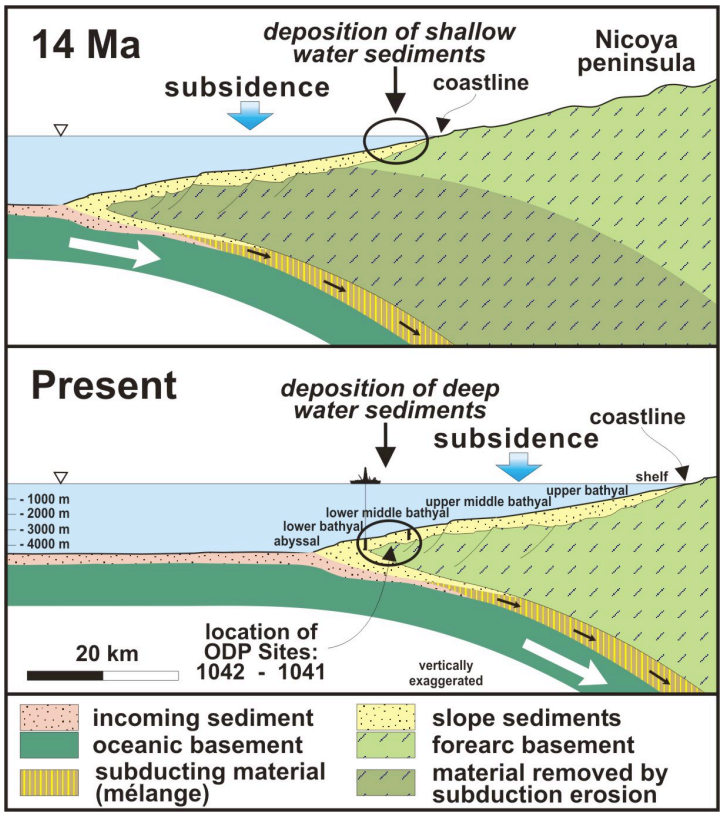

Fig. 1: Model for active subduction erosion causing subsidence of the forearc wedge off Costa Rica.

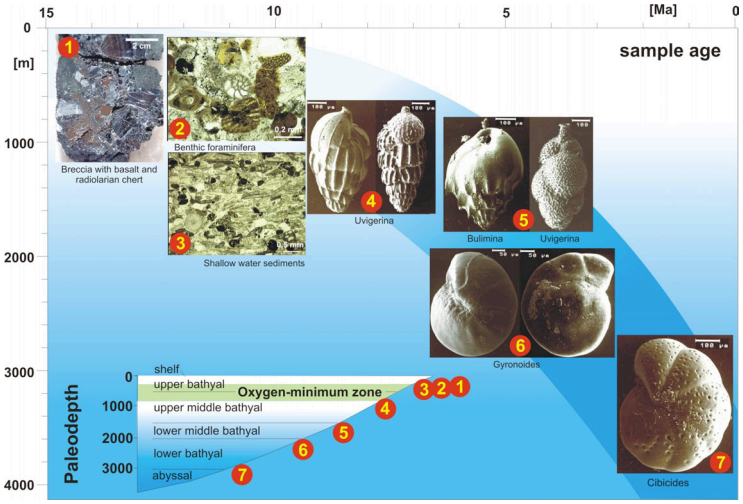

Fig. 2: Bathymetric evolution of the Costa Rican forearc revealed from ODP samples.

The remains of single-celled organisms (benthic foraminiferal faunas) can provide information on the history of changes in the ocean depth and other ocean features. Therefore, faunas from ODP Sites 1041 and 1042 located within sediments on top of the Costa Rican forearc basement have been sampled to test the hypothesis of subsidence of the forearc wedge as a result of subduction erosion. By comparing these organisms with their Recent equivalents from similar environments, scientists demonstrated that the forearc underwent strong subsidence, thus verifying the model of subduction erosion off Costa Rica (Meschede et al., in press). Sites 1041 and 1042 revealed an inverse bathymetric profile in time with species and sedimentary structures indicating shallow water conditions at the base of the holes and subsequently deeper water conditions in lower borehole depths (Fig. 2).

References:
Meschede, M., Zweigel, P. & Kiefer, E. (1999): Subsidence at a convergent plate boundary: evidence for tectonic erosion off Costa Rica. Terra Nova, 11 (2/3), 112-117.

Meschede, M., et al. (in press): Benthic foraminiferal distribution and sedimentary structures suggest tectonic erosion at the Costa Rica convergent plate margin. Accepted for publication at Terra Nova.

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