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Early development of the south Central American margin: mechanisms and tectonic implications

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The south Central American margin forms the SW border of the Caribbean Plate on top of the subducting Cocos and Nazca Plates between Nicaragua and Colombia. New and previous tectonostratigraphic, age and geochemical results show that the forearc basement between south Costa Rica and east Panama is composed of autochthonous and accreted sequences that provide important constraints on the development of the south Central American margin, the evolution of the Caribbean Plate and the formation of an inter-American land bridge.

Autochtonous sequences in the forearc include three tectonostratigraphic units that occur at a regional scale: (1) a Late Cretaceous oceanic plateau considered to represent an extension of the Caribbean Large Igneous Province (CLIP) at the base of the arc; (2) Late Campanian to Maastrichtian protoarc sequences that cover or intrude the oceanic plateau; and (3) Maastrichtian to Eocene sequences of a more mature volcanic arc that overlies or intrude preceding units. These units clearly indicate that subduction initiation along the margin and, thus, the birth of the Caribbean Plate occurred in the Campanian. Incipient subduction was possibly triggered or facilitated by contrasted lithospheric strength across the edge of the CLIP and collision between the CLIP and South America during westward migration of South America. Accreted sequences in the forearc include mostly Late Cretaceous to Eocene seamount fragments between south Costa Rica and west Panama, with additional Eocene to Miocene olistostromal and hemipelagic sediments in south Costa Rica. The age and tectonostratigraphic relationships of accreted sequences, autochtonous sequences, and overlying forearc slope sediment suggest that subduction erosion, punctuated by local seamount or sediment accretion was the dominant process controlling the evolution of the outer margin at least until the Miocene.

A major tectonic event affected the margin in the Middle Eocene, which is indicated by a regional unconformity in the forearc, migration of the Panamanian volcanic front and increased (apparent) rates of seamount accretion. This event may relate to large-scale plate reorganisation in the Pacific. New tectonostratigraphic, paleomagnetic, geochemical and geochronologic data from east Panama indicate that the easternmost margin was subsequently segmented and bended by a combination of strike-slip faulting, block rotation and orocline tightening. The segmentation suggests incipient collision of the south Central American arc with South America in the Late Eocene. This is much prior to Middle Miocene age indicated by an unconformity in the Chucunaque-Tuira basin at the eastern border of the margin, or Pliocene age associated to inter-American exchanges of terrestrial fauna and changes in the global ocean circulation.