

Tectonic uplift of the Costa Rica - Panamá arc in the Paleocene time as a consequence of the collision between the Cuban arc and the Bahamas Bank

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In Costa Rica, two sedimentary basinal cycles record strong tectonic uplift of the Costa Rica – Panamá intra-oceanic arc in the Paleocene time.

The first sedimentary cycle, of middle to late Paleocene age, records (1) the uplift of the mature calc-alkaline arc, (2) uplift of the ophiolitic complexes (Nicoya Complex s.l.) and formation of a continuous, NW-SE oriented outer arc, and (3) destruction of the Upper Cretaceous Barra Honda platform.

This cycle is composed of very coarse-grained slope sediments. The depositional environment evolved from a carbonate slope into a submarine fan. The cycle started with mixed carbonate/volcaniclastic slope-apron sequences (Loma Danta Member type). They are composed of allodapic limestones coming from the destruction of the Barra Honda carbonate platform. The carbonate deposits were rapidly overlain by prograding coarse-grained channel-lobe systems of the Curú Formation. They represent the first occurrence of well-developed submarine fans in the Costa Rica arc. In the fore-arc basins of NW Costa Rica, four small submarine fans (Cerro de Piedra, Curú, Sámara and Bahía de Santa Elena) were generated during the uplift. The main source of these sediments was the volcanic arc, located to the NE.

The second sedimentary cycle, of late Paleocene to early Eocene age, records the marine sedimentation during the time of tectonic quiescence, after the uplift. The cycle consists of transgressive to highstand carbonate deposits mixed with fine-grained pyroclastic sediments coming from explosive volcanism. The units, Espíritu Santo, Arío and Zapotal, represent this cycle. Sediments of the Espíritu Santo Formation are neritic limestones constructed on the uplifted Nicoya Complex. Their distribution shows a continuous, NW-SE oriented outer arc (Pacific facing), from NW Costa Rica to S Panamá. The Arío Formation and their equivalent in the back-arc basin, the Río Lari Formation, consists of deep-sea deposits. They are composed of hemipelagites and non-fan hemipelagic turbidites without cyclic pattern. In the inner fore-arc basins, the cycle corresponds with fine-grained volcaniclastic turbidite (Zapotal Member type) and shelf deposits.

Age of the tectonic phase. Detailed foraminiferal biostratigraphy indicates that the strong uplift began in the middle Paleocene (zone P2) with the destruction of the Barra Honda platform and ended in the late Paleocene (at the end of zone P4), when the development of submarine fan systems of the Curú Formation finished. The explosive volcanic activity, however, continued into the early Eocene time.

Plate-tectonic interpretation. The Paleocene was a time of important plate re-organization in the Caribbean region. The collision between the Cuban arc and the Bahamas Bank stopped the northeastward migration of the Caribbean plate. We believe that one of the most important tectonic consequences of this collision was the rapid uplift of the Costa Rica - Panamá intra-oceanic arc. The collision produced an environment of strong inter-plate stress at the western margin of the Caribbean plate (Central America). Consequently, this high convergence between the Caribbean plate and the Farallón plate along the Middle America Trench uplifted the intra-oceanic arc and increased the volcanic activity at this time.

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