Magmatic record of subduction initiation along the Caribbean Oceanic Plateau

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Subduction initiation is one of the most significant but least understood processes of plate tectonics. The study of early arc magmas produced during subduction initiation has been limited by a lack of exposure of primitive volcanic arc sequences and/or a loss of original geological context during the obduction of ophiolites (1). A unique record of subduction initiation along an oceanic plateau is exposed in uplifted forearc igneous complexes in Central America. These complexes include Upper Cretaceous sequences of the Caribbean Plateau, which are crosscut and overlain by uppermost Cretaceous 'proto-arc' dykes and lava flows that mark a temporal and geochemical transition to more a mature volcanic arc system (2). New field observations and sampling of these sequences in Panama and Colombia (including previously uncharted areas) provide significant constraints on subduction initiation along an oceanic plateau.

Our results confirm the occurrence of an oceanic plateau at the base of the Panama volcanic arc. However, two distinct units have be recognised in proto-arc sequences, which provide a novel insight into the early magmatic evolution of the convergent margin. An early proto-arc magmatic phase includes sequences of pillow basalts, basaltic dykes and gabbroic intrusions that are geochemically transitional between plateau and mature arc sequences. The second proto-arc phase is represented by basaltic dykes, locally crosscuting plateau and early proto-arc sequences, which have more depleted geochemical signature with variable slab input. Studies in the Izu-Bonin-Mariana (IBM) arc system show that subduction initiation can result in a distinct stratigraphic and magmatic evolution associated with successive emplacement of depleted forearc basalt, boninites and mature volcanic arc rocks during a ~8 m.yr. period (1, 3). However, igneous complexes of Panama-Colombia are lithostratigrpahically and geochemically distinct from the IBM forearc, therefore suggesting that the IBM model is not characteristic of subduction initiation magmatism along an oceanic plateau.

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