Structural framework and regional significance of the Northandean Cretaceous subduction cycle

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The Northandean plate margin underwent a fundamental change in its structural configuration during a Cretaceous subduction cycle, as evidenced by the formation and accretion of a province of basic igneous arc rocks that gave rise to the basement of an Northandean Western Cordillera. Further north, this igneous terrane links to the Caribbean Large Igneous Province and has been associated, with respect to its origin, to an actively spreading ridge of the Farallon plate, implying a far-travelled origin with respect to Southamerica and calling for the existence of giant strike-slip faults. We challenge this allochthonous scenario by an alternative option of a forearc origin, invoking the possibility of a forearc opening by the forcing of a toroidal mantle flow at the northern end of the Andean trench, which would have introduced mantle material from the Pacific into the Andean realm through a Central American gap. Support for such an opening mode of a forearc basin comes from extensional tectonics, that accompanied the emplacement of the basic arc units and a concomitant subduction of the extrusive basic units at the inner border of this postulated forearc basin. This intraplate subduction comprises a distinct three-partite evolution: (I) Convergence first became manifest by the reactivation of a normal fault located within the supposed forearc basin and inboard of an inherited Triassic-Jurassic suture, but still failed at a crustal level. (II) A succeeding contractional stage involved the reactivation of the inherited Triassic-Jurassic suture and the tectonic erosion of a frontal compartment of the continental margin. After an incipient underplating, slivers of this continental compartment returned within a time span of about 20 Ma. (III) A final Late Cretaceous subduction stage evolved under the conditions of an oblique SW-NE oriented plate convergence and is characterized by extensional pulses, as may be concluded from the structural setting of the giant Antioquia batholith. In the Campanian subduction definitely locked, as evidenced by the regional buckling of the forearc realm and a rebound of the upper continental plate. Both onset and shutoff of this subduction cycle may be linked to deformation phases and are dated by syntectonic, fault-guided intrusions. This scenario of a forearc origin of the basic igneous province calls for the existence of two paired subduction zones: on its outer margin the subducting Farallon slab imposed a trench-parallel mantle flow and constrained an expansion of the forarc basin by slab rollback. On its inner margin, a secondary subduction compensated a surplus expansion of the actively forming forearc basin.