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Structural framework of a Northandean Cretaceous subduction cycle

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The Northandean plate margin acquired its structural configuration during wholesale crustal deformations and coeval magmatic pulses, among which a Late Triassic crustal attenuation gave rise to a crustal remobilization of the Proterozoic basement and a Jurassic subduction event resulted in the telescoping of the continental margin and the formation of a voluminous magmatic arc under the regime of a flattening slab. The ensuing Cretaceous convergent period is separated from the Jurassic event by a passive margin evolution and correlates, combining all available age data, with the formation of the Caribbean-Northandean plateau province. Accretion of this latter province to the continental margin ends the lifespan of the Cretaceous subduction cycle and initiates, after a period of a large-scale shortening by a lithospheric buckling, the present subduction cycle at the Ecuador-Colombia trench.
In this contribution we aim to characterize a three-fold evolution of the Cretaceous subduction cycle, deciphering the significance of widely distributed structures and the response of the upper plate to the loading of the converging slabs. A failed onset of subduction first occurred inboard of the inherited Triassic-Jurassic suture by the reactivation of normal faults formed during the preceding passive-margin stage. During subduction initiation a broad forearc realm underwent subsidence, defining thereby a depocenter under platform conditions. In the backarc region this initial subduction stage is recorded by the formation of a broad forebulge, typically delimited by inward dipping, marginal normal faults. A second highly contractional stage involved the erosion of the frontal continental margin, an incipient underplating of the continental slivers, and their return within a time span of about 20 Ma. Within the forearc domain, exhumation of the continental slivers can be correlated by uplift and the formation of a subaerial swell, which separated subsequently fore- and back-arc basins. Contemporaneously, rim basins bordering the forebulge of the inner backarc realm maintained a high subsidence. A third Late Cretaceous subduction stage evolved under the conditions of an oblique SW-NE oriented plate convergence and experienced extensional pulses, to conclude from the structural setting of a voluminous arc magmatism. It finished in the Campanian, when the subduction became locked, as evidenced by the onset of a regional buckling of the lower oceanic and a rebound of the upper continental plate, which is well evidenced by thermochronological signals and the shallowing or “continentalization” of the backarc basins. Both onset and shutoff of this subduction cycle may be documented by a wealth of structural data which will be presented in order to discuss possible mechanisms, which underlie this threefold evolution.