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Reconstruction of the Jurassic to Early Cretaceous tectono-magmatic evolution of the Northern Andean Arc from their Crustal Thickness and Thermobarometry

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Igneous rocks in magmatic arcs record variations in composition, thermal flux, and subduction dynamics through time. In the Northern Andes, arc magmatism of the Jurassic age registers a complicated history, including the fragmentation of Pangea at the end of the Triassic and the beginning of a new subduction zone in the Jurassic located at the western margin of South America.

We characterized the crustal thickness variations of the Early Jurassic to Early Cretaceous (194-130 Ma) in plutonic and volcanic rocks of the Northern Andes of Colombia and Ecuador, using trace elements signatures and analyzed the implications of the emplacement conditions during the last stage of the magmatism using Al-in-hornblende thermobarometry and mineral chemistry. Moderate rare earth elements (REE) slopes and depleted heavy REE patterns show that the primary residual magma source was amphibole, but plagioclase and pyroxene were also significant residual phases indicating that the magma source was formed in a crust that varied in thickness from 35-50 km. The La/Yb and Sr/Y crustal quantifications variations indicate that the arc underwent two thickening episodes. The first episode (190 to 180 Ma) is associated with a magmatic event. The second episode (165 to 154 Ma) is related to the shift to an oblique subduction setting and a subsequent collisional event that produced medium P-T metamorphic rocks. In the Late Jurassic to Early Cretaceous (154-130 Ma), the crust became thinner and, in this scenario, was emplaced the last stage of plutonism with depths that varied from shallow to deep level (until 25.5 km) in the crust.