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From the Rheic Ocean to the Proto-Caribbean Sea in Venezuela: 300 Million Years of Magmatism in the Northern Andes

Roelant van der Lelij (1), Richard Spikings (1), Alexey Ulianov (2), and Massimo Chiaradia (1)

(1) Section of Earth and Environmental Sciences, University of Geneva, Switzerland (roelant.vanderlelij@unige.ch), (2) Institute of Mineralogy and Geochemistry, University of Lausanne, Switzerland

The pre-Cretaceous igneous and metamorphic basements of the Northern Andes are thought to represent the northwestern corner of Gondwana, and may have witnessed several Wilson cycles. The ages, settings and thermal histories of these rocks provide crucial clues to understand the processes and timing of events, which lead to the amalgamation and subsequent break-up of Pangaea. However, all existing geochronological data from the basement rocks in the Venezuelan Andes were obtained by the Rb/Sr, K/Ar and bulk, multigrain U/Pb methods. These data exhibit evidence for partial daughter isotope loss and large amounts of inheritance, leading to contradictory interpretations. Furthermore, none of the previously dated rocks have been geochemically characterised. We present new, precise in situ Laser Ablation ICP-MS (Zircon) U/Pb ages from geochemically characterised igneous and metamorphic rocks of the Venezuelan Andes.

The oldest granitoids in the Venezuelan Andes are found in the Caparo Block, in the south-eastern Venezuelan Andes. The Cerro Azul, El Cambur and El Tapo granites crystallised along a convergent margin at 499.4 $\pm$ 2.7 Ma, 492.1 $\pm$ 7.4 Ma and 491.6 $\pm$ 4.9 Ma respectively. Subsequently, the Las Islitas granite intruded at 473.1 $\pm$ 3.5 Ma.

Magmatism may have occurred later in the Sierra Nevada Block, with ages from 7 spatially dispersed intrusions indicating extensive magmatism between at least 465.3 $\pm$ 2.0 and 414.5 $\pm$ 3.9 Ma, during the closure of the Rheic Ocean. The subsequent $\sim$200 Ma magmatic hiatus in the Venezuelan Andes may have been a result of tectonic quiescence following the amalgamation of Pangaea.

Late Palaeozoic granitic magmatism appears to have been absent from the Venezuelan Andes. The basement rocks exposed on Paraguana Peninsula (El Amparo pluton: 272.2 $\pm$ 2.6 Ma), Toas Island (248.9 $\pm$ 1.7 Ma) and in the Perijá Andes (El Palmar Granite: 225.1 $\pm$ 1.5 Ma) are situated in the South Caribbean Plate Boundary Zone and may have undergone displacement by several hundreds of km. Ongoing geochemical, geochronological and thermochronological studies of the basement rocks found in the Northern Andes of Colombia may provide further insight into the affinity of these rocks.

Late Triassic, partial anatexis of the metasedimentary rocks of the Iglesias complex led to extensive formation of S-Type granites, such as the La Culata Adamellite (213.2 $\pm$ 1.7 Ma) and the El Carmen Granodiorite (211.6 $\pm$ 1.0 Ma). Similar anatectites appear to have formed diachronously from south to north from Ecuador to Colombia to Venezuela, and may be a prelude to the disassembly of Pangaea.

The basal volcanics of the syn-rift, La Quinta Fm. were formed at 202.0 $\pm$ 1.6 Ma, and are the final Mesozoic magmatic event recorded in the autochthonous basement rocks of Venezuela, and mark the beginning of the separation of North and South America to form the Proto-Caribbean Sea.