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# Triassic to Early Cretaceous tectonic evolution of Ecuador: insights from U-Pb LA-ICP-MS geochronology, geochemistry and provenance studies

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The initiation of Triassic Pangaean disassembly and the subsequent evolution of the Tethys-Pacific active margin have given rise to a series of tectono-stratigraphic terranes within Ecuador. Despite the general paucity of radiometric and geochemical data, two models have been proposed for the Early-Late Mesozoic evolution of Ecuador. An allochthonous model for the Eastern Cordillera describes a collage of four narrow Mesozoic terranes (Guamote/Chaucha - continental sliver, Alao - island arc, Loja - para-autochthonous sliver and Salado - marginal basin), which accreted to the palaeo-continental margin in the Early Cretaceous. Alternatively, an autochthonous model describes a common structural and sedimentological history for both the western and eastern flanks of the Eastern Cordillera, and interprets 'terrane bounding sutures' as intrusive contacts.

New U-Pb LA-ICP-MS dates of 245.7±5.6, 239.2±2.2, 234.2±1.1 and 234.66±0.95 Ma, from magmatic rims of zircons extracted from acidic intrusive rocks the Loja Terrane and Amotape Complex of Ecuador confirm the presence of a belt of Triassic migmatites and S-Type granites spanning the latitudinal extent of Ecuador. These dates are interpreted as crystallization ages related to a HT metamorphic event that occurred prior to the disassembly of Pangaea, although may be ultimately responsible for its fragmentation via rifting. Xenocrystic zircon cores are common suggesting that the protoliths were sedimentary rocks, which received detritus from provinces such as: a) the Ventuari-Tabajos (2.0 – 1.8 Ga), b) the Sunsas-Grenvillian (1.3 – 1.0 Ga), and (c) the Braziliano-Pan African Orogen (450 – 650 Ma).

New major and trace element, REE and Sr-Nd-Pb isotopic data from volcanic rocks of the Alao Terrane confirm the presence of an arc sequence. Relatively low LREE to HREE enrichment and juvenile Sr-Nd-Pb isotopic signatures suggest that this arc formed on extended 'transitional' crust in a marginal basin setting. U-Pb LA-ICP-MS ages of detrital zircons from arc related, meta-sedimentary rocks range from ∼2.6 Ga to 163.7±1.6 Ma, showing scattered age peaks from ∼2.7 Ga – 1.4 Ga and prominent peaks characteristic of the Sunsas-Grenvillian province (1.3 – 1.0 Ma) and the Braziliano-Pan African orogen (450 – 650 Ma). Collectively, these data argue against the previously proposed intra-oceanic arc setting, and for the formation of the Jurassic Alao arc in a marginal basin setting that received continental detritus.

Meta-sedimentary rocks from the Guamote/Chaucha Terrane yield U-Pb LA-ICP-MS ages of detrital zircons that span from ∼3.0 Ga to 155±6.1 Ma. A large Braziliano-Pan African age peak suggests that the Guamote Terrane remained autochthonous to the South American – Gondwana margin, and argues against its previously proposed exotic nature (ruling out a Laurentian origin). Heavy mineral analyses show prominent zircon-tourmaline-rutile (ZTR) assemblages, suggesting that these mature meta-sedimentary rocks were sourced from granitic continental crust and reworked sedimentary sources. To explain the present day structural position of the Guamote Terrane (west of the Peltetec suture), we envisage the Guamote Terrane as a para-autochthonous sliver of the relict Jurassic, northwest South American margin that was emplaced dextrally along and to the west of the Peltetec suture during the accretion of the Caribbean Plateau at 75-73 Ma.

Continued complementary studies such as geochronology, geochemistry and provenance studies of selected Triassic – Jurassic granitic and meta-sedimentary rocks will be used to place more robust constraints on the Triassic – Early Cretaceous tectonic evolution of Ecuador. High temperature (Tc ∼ 380 – 650°C) thermochronology (U/Pb apatite, titanite, rutile and 40Ar/39Ar muscovite and hornblende) of Palaeozoic – Triassic crystalline rocks will be used to investigate the pre-Caribbean cooling and exhumation history of the South American margin with relation to the previously proposed Early Cretaceous terrane accretion events.