Paper Number: 2868

Whole-rock geochemistry and mineral chemistry of Late Triassic granitoids from Merida Andes, Venezuela: tectonic implications for NW Gondwana

Tazzo-Rangel, M. D.[1], Sifontes, R.[2], Hoeger, T.[3], Vlach, S. R. F.[3], Weber, B.[1], Andara, A.[4]

[1]Centro de Investigación Científica y de Educación Superior de Ensenada. Baja California, México.
mtazzo@cicese.edu.mx

[2]Universidad Central de Venezuela. Facultad de Ciencias. Instituto de Ciencias de la Tierra. Caracas, Venezuela.

[3]Universidade de São Paulo, Instituto de Geociências, Departamento de Mineralogia y Geotectônica. São Paulo, Brasil.

[4]Universidad de Los Andes. Escuela de Ingeniería Geológica. Grupo de Investigaciones en Ciencias de La Tierra-TERRA. Mérida, Venezuela.

The El Carmen Granodiorite (ECG) and the La Culata Granite (CG) are the most voluminous Late Triassic batholiths within Venezuelan Central Andes. The U-Pb zircon ages of these rocks place them approximately at 211 and 207 Ma, respectively [1] [2]. These granitoids intruded Neoproterozoic(?)-Early Paleozoic gneisses and schists from Iglesias Complex, with a well exposed contact aureole among the ECG and fine-grained carboniferous metasediments.

Both batholiths consist of acid and peraluminous rocks. Tonalitic dykes and microgranular enclaves are common within the ECG, but in general the mineralogical and chemical composition of this granitoid is relatively homogeneous, with abundant biotite, epidote, and allanite-(Ce), the latter two with a magmatic connotation according to their textural and chemical characteristics; rare earth elements (REE) patterns are fractionated (La_N/Yb_N 14-29) with little or absent Eu anomaly. Other chemical signatures include low Rb/Sr (0.14-0.42), moderate Nb/Ta (2.5-13.5), very high and variable Ba/Nb (48-251) and negative anomalies in Nb and Ti in spider diagrams. In contrast, the CG is more peraluminous with garnet and andalusite as accessory phases, large variations in the REE fractionation patterns, negative Eu anomalies, and higher Rb/Sr ratios (1.5-3.6).

Field investigations along with petrographic, whole-rock geochemistry, as well as feldspar and mica chemical analysis are consistent with a volcanic arc setting for the ECG and a syncollisional regime for the CG. Compositional characteristics of the sources are also distinctive, suggesting generation of granodioritic-tonalitic magma from metagreywackes with andesite clasts for the ECG, and mixing of pelitic sources for the CG. Thus, chemical and mineralogical differences between these almost contemporaneous batholiths suggest that they have formed at slightly different stages within the same geotectonic setting at the northwestern edge of Gondwana. Besides that, a Permian intracratonic foreland basin existed in the Merida Andes, the Guatemalan-Mexican terrains to the north, and Colombia-Peru-Bolivia to the west and southwest, where siliciclastic and carbonatic sediments were deposited [3]. To the northeast of this basin, evidence for an active convergent margin is well constrained from rhyolitic and granitic rocks of El Baul Massif [4]. It is possible that ECG magmatism was generated during the final stages of this volcanic arc, but if this suggestion is true, then terrain accretion and final assemblage of Pangea was responsible for the CG magmatism. On the other hand, it is also possible that both granitoids formed at distance from the trench [1], but the more primitive source of the ECG is probably from the lower crust. The Permo-Triassic arc is well documented in adjacent terrains to Merida Andes at the NW edge of Gondwana, such us Santander Massif [1] and Sierra Nevada de Santa Marta [5] in Colombia, and Maya Block in Mexico and Central America [6].

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