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Geochronological, petrological and tectonic implications of the Proterozoic massif-type anorthosite intrusions and related rocks from the northern Oaxacan Complex, southern Mexico

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Massif-type anorthosite intrusions are enigmatic and significant crustal components widespread worldwide. They occur either as individual massifs or accompanied by mangerite, charnockite, and granite (AMCG suite). This Proterozoic phenomenon has been studied in numerous complexes, generating long-lasting discussions regarding the magmatic source and the tectonic setting where these rocks form. This controversy is still a matter of debate after decades of scientific research. In this sense, Mexico represents a unique and new opportunity to explore such petrological issues because its exposures of massive anorthosite and associated lithologies are mainly unstudied. These rocks are better exposed in the Oaxacan Complex, the most extensive Mexican inlier of Grenvillian rocks. This work is focused on its northern portion. This area is characterized by 1.4-1.1 Ga metamorphic rocks from the El Catrín and El Marquez units that were later intruded by anorthosite, gabbro, leucogabbro, oxide-apatite gabbronorites (OAGN), and granite bodies from the Huitzo suite. New LA-ICP-MS U-Pb zircon data revealed similar crystallization age ranges in the gabbro-anorthositic (1013-960 Ma) and granitic (1012-964 Ma) rocks. Their zircon Hf-O isotopic composition was compared with previous and new data from the older units of the area to assess the possible interaction between mantle- and crustal-derived melts during their generation. The intrusions of massive anorthosite and gabbro exhibit $\varepsilon_{Hf}(t)$ values of -2.54-4.79 and $\delta^{18}O$ = 6.84-8.03‰. The granitic rocks have $\varepsilon_{Hf}(t)$ values of -0.79-2.87 and $\delta^{18}O$ = 7.80-8.42‰. The lack of mantle-like $\varepsilon_{Hf}(t)$ and $\delta^{18}O$ values suggests the participation of high-$\delta^{18}O$ supracrustal material with more radiogenic Hf signatures during their generation. Simple binary mixing modeling indicates that the gabbro-anorthositic intrusions incorporated ~20-30% of metasedimentary country rocks, supporting a mantle-dominated origin. A slightly higher crustal component is recognized in the studied granitic intrusion. We also propose that these rocks permit an alternative model where Oaxaquia is paleogeographical relocated close to the eastern margin of Laurentia during the final stages of Rodinia amalgamation due to the resemblance in age to the late- to post-Grenvillian AMCG rocks (1016-956 Ma) outcropping there (e.g., Roseland, Mattawa, Labrieville, and Vieux Fort). This new tectonic view challenges the classical Amazonia-Oaxaquia-Baltica connection.