Permo-Triassic metamorphism in the Mérida Andes, Venezuela: New insights from geochronology, O-isotopes, and geothermobarometry

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Although there is a consensus about Pangea assemblage spanning from the Late Carboniferous to the Early Permian in northwestern Gondwana, the tectonics of the Late Permian-Early Triassic period, including the onset of Pangea breakup, is still controversial. In this context, two regional tectonic features need to be considered: the Ouachita-Marathon-Sonora suture to the north, and the east-dipping subduction of the Panthalassa oceanic crust beneath Gondwana to the west. A chemical, isotopic, and geochronological dataset is presented in this contribution to constrain the effects of these tectonic processes in the metamorphic basement of the Mérida Andes in western Venezuela. U-Pb secondary ion mass spectrometry analyses on unpolished surfaces of zircon grains from gneissic rocks yielded an average age of 251.1±4.0 Ma. The corresponding $\delta^{18}O$ values suggest metamorphic recrystallization in zircon instead of high-T fluid interaction. Furthermore, Rb-Sr and Sm-Nd thermochronology in white mica and garnet yielded ages of 243.6±9.3 Ma and 249.3±1.8 Ma, respectively. Thus, the combination of three geochronometers involving different mineral phases allows constraining, for the first time, the Latest Permian-Earliest Triassic metamorphism in the Mérida Andes at 250±3.0 Ma. Amphibolite-facies peak metamorphic conditions at ~680 °C and ~8.0 kbar are estimated via pseudosection modeling and geothermobarometry in distinct mineral assemblages of pelitic paragneiss and hornblende orthogneiss. Metamorphism was possibly triggered by post-orogenic gravitational collapse after the collision of Gondwana and Laurentia to form Pangea. Retrogression between ~240 Ma and ~200 Ma was probably driven by thermal relaxation of tectonically overthickened crust.