

DISCOVERY AND EVOLUTION OF THE TONIAN TRÊS VENDAS ECLOGITE, SÃO GABRIEL TERRANE, RIO GRANDE DO SUL

Pinto, V.M.¹; Debruyne D.¹; Queiroga, G.N.²; Lana, C.²; Castro, M.P.²; Fragoso, B.¹; Porcher, C.C.³; Laux, J.⁴; Hartmann, L.A.³
¹Universidade Federal de Pelotas; ²Universidade Federal de Ouro Preto; ³Universidade Federal do Rio Grande do Sul; ⁴CPRM, SUREG-PA

RESUMO: The Três Vendas eclogite was discovered in southernmost Brazil at 5 km from the Cerro Mantiqueiras ophiolite, and is here reported. The São Gabriel Terrane in the Dom Feliciano Belt comprises tonalitic to trondhjemitic gneisses and metadiorites of the Cambaí Complex, which are part of the Tonian Passinho arc generated during subduction of the Proto-Adamastor Ocean. The pressure-temperature-time trajectory of these rocks during the evolution of the arc and subsequent incorporation in the São Gabriel Terrane remains poorly constrained. Therefore, this study integrated field work with petrography, scanning electron microscopy at UFRGS, electron microprobe analyses of minerals and U-Pb-Hf isotopes of zircon at UFOP to determine geological evolution. These garnet-omphacite-bearing amphibolites crop out in lenses that are in sharp contact with the surrounding mica schists and gneisses. The preserved high-grade metamorphic assemblage in these rocks has garnet, rutile and fine-grained symplectites of tchermakitic hornblende, oligoclase, and diopside or augite with minor quartz and omphacite, indicating that these rocks are eclogites. The low-grade assemblages include tremolite, zoisite, biotite, titanite, and chlorite. The main opaque minerals are ilmenite and magnetite, along with accessory pyrite and chalcopyrite that reflect locally reducing conditions. Zircon and apatite are ubiquitous accessory minerals. Whole rock geochemical data were obtained using XRF. Chemical composition and Zr-Y characteristics are consistent with tholeiitic island arc basalts. Garnet compositions indicate alpine type eclogites. Geothermobarometry combined with thermodynamic modeling (Perple_X 6.8.6) indicates pressures above 15–17 kbar based on the omphacite composition, while zoned garnet has increasing pyrope content towards the rims. This indicates equilibrium at 720–750°C from core to rim at decreasing pressures from ~10 to ~8 kbar. The presence of rutile points to pressures above ~9 kbar at these conditions. Rutile is bordered by titanite reflecting retrograde metamorphism at higher water activity. Plagioclase-tchermackite geothermobarometry indicates (re)equilibration at 570–630 °C and pressures of ~8 kbar, while tremolite-plagioclase pairs indicate (re)equilibration around 500–550 °C and ~4.5 kbar. Zircon from the Três Vendas eclogite was dated with U-Pb LA-ICP-MS, complemented by *in situ* Hf isotope analyses. Zircon crystals are subhedral, with stubby prismatic shapes, and cores generally display oscillatory zoning in cathodoluminescence, surrounded by mantles with uniform bright cathodoluminescence. Zircon cores yielded 909.5 ± 5 Ma, interpreted as the magmatic age, which is close to the age of the surrounding Cambaí Complex. Metamorphic rims were dated at 892 ± 8 Ma, interpreted as the age of peak temperature shortly after maximum burial. Zircon age-corrected ϵ_{Hf} isotope compositions range between +4 and +10, indicating derivation from depleted mantle. The combined data position the Três Vendas eclogite in the Passinho arc and burial >45 km, most likely in a subduction channel. Burial was followed by rapid exhumation, during which these rocks experienced peak temperature around 750 °C. The data from the first eclogite in southern Brazil have significant consequences for the interpretation of the evolution of the Brasiliano Orogen in the Tonian.

PALAVRAS-CHAVE: ECLOGITE, TONIAN, PASSINHO ARC