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USING ELASTIC GEOBAROMETRY TO UNVEIL CONTINENTAL COLLISION AND RAPID EXHUMATION IN THE WEST GONDWANA OROGEN: APPLICATION TO HIGH-T/HP ROCKS IN THE NW PART OF THE BORBOREMA PROVINCE, NE BRAZIL

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Elastic geothermobarometry is a method used to estimate pressure and temperature (P-T) conditions based on the residual pressure exhibited by mineral inclusions entrapped in a host. In this study, we present micro-Raman spectroscopic data for quartz inclusions in host garnet from a retrograde mafic granulite and a retrograded eclogite from the Cariré Granulite Zone and Forquilha Eclogite Zone, Ceará Central Domain, northwestern Borborema Province, northeastern Brazil. Elastic modeling using the Quartz-in-Garnet geobarometer suggests residual pressure (Pinc) values between $-0.14(6)$ and $-0.01(6)$ GPa for the mafic granulite, and a range of $0.06(6)$ to $0.54(4)$ GPa for the eclogite, indicating that some inclusions are under tensile stresses (i.e., negative Pinc) while other experienced compressive stresses (i.e., positive Pinc). Isomekes built using Equations of State (EoS) for almandine garnet yield an entrapment pressure (Ptrap) value of $1.35(2)$ GPa at 910 °C for the retrograde mafic granulite, whereas retrograded eclogite isomekes indicate a Ptrap value of $1.68(6)$ GPa at 770 °C. These findings suggest that the volumetric response of quartz inclusions to pressure and temperature changes during exhumation to Earth's surface resulted in compressive and tensile stresses, consistent with the pressure conditions for the Forquilha and Cariré zones, as determined by conventional geothermobarometry. Compressive and tensile stresses result from decompression within the stability field of alpha-quartz. Retrograded eclogite entrapment pressure (Ptrap) of $1.68(6)$ GPa at 770 °C suggests metamorphism at the base of a thickened continental crust (ca. 61 km). In contrast, the retrograde mafic granulite pressure of $1.35(2)$ GPa at 910 °C indicates peak metamorphic conditions during the collisional stage at a burial depth of ca. 49 km. The observed variability in residual pressures suggests a relatively fast exhumation for this segment of the West Gondwana Orogen. In addition, no relict coesite has been identified through μ -Raman spectroscopy, given the absence of diagnostic peaks of coesite, such as 152, 177, 270, 328, 427, 521, and 1145 cm^{-1} . Typical textural features, such as radial fractures and palisade quartz, are also absent. We suggest that the 521 cm^{-1} peak of reported Raman spectra in the literature as coesite corresponds to anatase (TiO_2 , a rutile polymorph). This interpretation is supported by three characteristic vibrational modes of anatase (398, 521, and 640 cm^{-1}) observed near a rutile crystal. Therefore, our appraisal emphasizes that the identification of coesite must be strongly supported by Raman spectroscopy with the presence of main and secondary bands, thus challenging the previously reported occurrence of coesite in the NW Borborema Province.

PALAVRAS-CHAVE: RAMAN SPECTROSCOPY; ELASTIC GEOBAROMETRY; ECLOGITES; HP GRANULITE



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