



Tonian oceanic crust processes decoded with multi-techniques from metamorphosed, hydrothermal, coetaneous zircon-tourmaline, southern Brasiliano Orogen

Mariana Werle (1), Léo Hartmann (1), Cassiana Michelin (1), Cristiano Lana (2), Gláucia Queiroga (2), and Karine Arena (1)

(1) Universidade Federal do Rio Grande do Sul, Brazil, (2) Universidade Federal de Ouro Preto, Brazil

Metamorphosed, hydrothermal, coetaneous zircon-tourmaline assemblages document the dynamic evolution of Tonian oceanic crust, southern Brasiliano Orogen. Multi-technique, grain internal structure and composition (BSE imaging, EPMA analyses, characteristic X-ray maps, LA-ICP-MS trace element and U-Pb-Hf-B isotopes) relates the minerals to evolution of Rodinia and Gondwana Supercontinents. Tourmaline is a resilient, much-informative accessory mineral, and thus a proxy for identification of diversified geotectonic environments. We describe massive tourmalinites from Ibaré and Bossoroca ophiolites which obducted onto an oceanic island arc along low amphibolite facies thrusts. The long-lived process (950-660 Ma) also formed the Cambaí Complex of juvenile granitic rocks. This work aims to characterize tourmaline and zircon inclusions. In the field, massive tourmalinites with 1 to 30 m in size (and chloritites) are enclosed in metaserpentinite (olivine + talc + chromite, jackstraw texture, low amphibolite facies) and close (1-50 m) to amphibolite and listvenite. Tourmaline crystals are fibrous up to 20 cm in length. Under the optical microscope, tourmaline only displays zoning in a narrow light rim. Intense cataclasis fractured and broke the crystals, generating vugs. Chlorite is present in two generations. Chl 1 is in apparent equilibrium with homogeneous, core tourmaline, whereas Chl 2 is in equilibrium with tourmaline rim. Zircon occurs in tourmaline mostly in strings of small (5-10 μm) crystals but reaching 50 μm . EPMA analyses display dravite. Composition is dominated by Si, Al, Fe, Mg, with low contents of Na and Ca. Fe⁺³, Ti, Cr, Mn, K, F, Cl and Li contents are negligible. Ibaré tourmaline is homogeneous, but three zones of different gray tones are observed in Bossoroca tourmaline in backscattered electron images (BSE) – Tur 1, Tur 2, Tur 3. These zones were also displayed in EPMA compositions, because elemental variations in Tur 1, Tur 2 and Tur 3 zones observed in BSE images and compositional X-ray maps find correspondence in $\delta^{11}\text{B}$ distribution. Based on isotopic determinations, Ibaré tourmaline has $\delta^{11}\text{B} = +5$, whereas Bossoroca tourmaline Tur 1 has $\delta^{11}\text{B} = +1$ to $+2.2$ (peak at $+1.8$), Tur 2 has $\delta^{11}\text{B} = -1$ to $+0.4$ (peak at 0), Tur 3 has $\delta^{11}\text{B} = -8.2$ to -9.2 , peak at -8.5). U-Pb zircon ages from tourmalinite indicate hydrothermal crystallization near 900 Ma and partial recrystallization near 700 Ma. We interpret the results as indicating that the tourmalinites formed in oceanic crust ($\epsilon_{\text{Hf}} = +12$) environment at 900 Ma, mid-ocean ridge environment (initial fragmentation of Rodinia), later accreted to Gondwana near 700 Ma. Most significant is the oceanic crystallization of Ibaré tur and Tur 1 and Tur 2 from Bossoroca, contrasting with partial recrystallization (Tur 3) in shear zone in the continent. Comparative resilience of zrn-tur indicates that cores of both minerals formed at 900 Ma from oceanic water, dated rims of zircon and tur 3 at 700 Ma, but zrn shows no evidence of recrystallization during tur 3. Intra-grain characteristics of zrn-tur from massive tourmalinite help elucidate processes at the grain to plate-scale.