

Accepted Manuscript

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PII: S0895-9811(17)30050-0

DOI: [10.1016/j.jsames.2017.09.030](https://doi.org/10.1016/j.jsames.2017.09.030)

Reference: SAMES 1795

To appear in: *Journal of South American Earth Sciences*

Received Date: 9 February 2017

Accepted Date: 24 September 2017

Please cite this article as: Lira, Raúl., Poklepovic, Marí.F., Tourmaline orbicules in peraluminous monzogranites of Argentina: A study case of fluid-rock interaction between leucogranite and country-rock metasediments, *Journal of South American Earth Sciences* (2017), doi: 10.1016/j.jsames.2017.09.030.

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Tourmaline orbicules in peraluminous monzogranites of Argentina: a study case of fluid-rock interaction between leucogranite and country-rock metasediments

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Abstract

Tourmaline orbicules hosted in peraluminous granites are documented worldwide. Seven occurrences were identified in Argentina. Petrography, mineral chemistry, whole-rock geochemistry mass balance and microthermometric studies were performed in orbicules formed at the cupola of a peraluminous A-type leucogranite (Los Riojanos pluton), as well as complementary investigation was achieved in other orbicules of similar geological setting. Mass balance computations in zoned orbicules consistently confirmed immobility of Si both in core and halo, immobility of K and little loss of Al during halo reactions. Elements gained and lost in the schorl-rich core are Fe, Al, Mg, Ti, Ba, Sr, Y and Zr, and Na, K, Rb and Nb, respectively; in the halo, K, Ba, Sr, Y, Zr and locally CaO, were gained, and Fe, Mg, Na, Al, Rb and Nb were lost. The schorl-rich core is enriched in LREE relative to the leucogranite host. A temperature-salinity plot from fluid inclusion data delineates a magmatic-meteoric mixing trend of diluting salinity with descending temperature. Computed δD_{H_2O} values from Los Riojanos orbicule schorl suggest magmatic and magmatic-meteoric mixed origins. In Los Riojanos, mass balance constraints suggest that Fe, Mg, Ba, Sr and metallic traces like Zn and V ($\pm$ Pb) were most likely derived from country-rock schists and gneisses through fluid-rock exchange reactions. A late magmatic-, volatile-rich- fluid exsolution scenario for the formation of orbicules is envisaged. Schorl crystallization was likely delayed to the latest stages of leucogranite consolidation, not only favored by the high diffusivity of B_2O_3 preferentially partitioned into the exsolved aqueous-rich fluid, but also likely limited to the low availability of Fe and Mg from the scarce granitic biotite, and to the high F^- content of the melt. The spatial confinement of orbicules to the contact zone granite-metasediments suggests that orbicules were not formed until

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