Crustal evolution in the Lavras do Sul region, Southern Brazil and the amalgamation of West Gondwana

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Several models have been discussed in order to provide support to the amalgamation of Supercontinent Gondwana. The Southern Brazil is a key area where an orogenic belt records a history of a plate collision between the Rio de La Plata and Kalahary Cratons. The Lavras do Sul region is a key area to understanding this evolution, and still is a matter of debate. Neopretorozoic magmatic arc (750-720 Ma) is proposed by these geotectonic models, while an older magmatic arc is roughly registered (Passinho event, 870 Ma, Leite 1997). New U-Pb isotopic ages provide a review of these arc evolution, and also new constraint on the West Gondwana amalgamation. Rocks recording the Rio de La Plata Craton are absent in the area, however, older continental crust, with ages $\geq$ 908 Ma and geochemistry similar to the paleoproterozoic blocks are registered in the area. These rocks were intruded by a continental magmatic arc (848-828 Ma), with adakitic magma generation, registered by a tonalitic-trondhjemitic association, with rocks geochemistry suggest a low calk-alkaline affinity, characterized by rocks with age 845 ± 3 Ma, while age 828 ± 8 Ma rocks have typical adakitic traces elements compositions. An earlier continental magmatic arc is registered in the Lavras do Sul region composed by gabro-dioritic-tonalitic-trondhjemitic association (Imbicui Orthometamorphic Suite), with crystallization ages suggesting an evolution around ages 752-723 Ma. Titanites from dioritic rocks suggest a metamorphic event around 679 ± 11 Ma. Using these new data, an older event in the region, Rodinia paleocrust represented by the dioritic-tonalitic gneiss (Encantadas Gneiss) is proposed, in which two earlier distinct magmatic arcs are suggested, the Passinho Orogeny with adakitic magmas associated and the SOI Orogeny, both representing subduction related rocks in a continental arc type, and a metamorphic event at 600 Ma. Thus, the west Gondwana in the Lavras do Sul region register not only the broke up of large continent crust, but also, a probable connection with orogenic belts in central Brazil.

Fate of manufactured mineral nanoparticles in freshwater

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The growing use of engineered nanoparticles (NPs) for industrial applications implies their possible release in variable amounts into the environment. A better understanding of their behaviour and fate in natural systems is therefore required [1, 2]. Particularly, their dissolution rates, potentially faster than the corresponding microsized particles, may directly influence their fate and bioavailability in the biogeosphere.

In this study, we quantify in the laboratory the industrially manufactured NPs ZnO and TiO_2 dissolution rates in natural freshwater (i.e. Seine River water samples). Native NPs size and shape were investigated using FEG-SEM, and appeared as 20-50 nm spheroids, with an associated specific surface area of 37.5 and 57.6 m^2/g for ZnO and TiO_2, respectivelly. The particle size distribution performed by Dynamic Light Scattering revealed three distincts size populations (20-50 nm; 150-200 nm and 400-500 nm) and demonstrate the formation of aggregates.

NPs dissolution rates were determined using both ultrafiltration (UF) and Donnan Membrane Techniques (DMT, [3]). The latter method allows a direct measure of the free metal ion concentration (here Zn^{2+}), while the UF membrane small nominal pore size ($\approx$ 2 nm) results in the separation of small inorganic complexes in addition to free metal ions. After 72 h of solid-solution interaction, Zn^{2+} and $Zn_{dissolved}$ account for 1.9% and 2.6% of the total ZnO NPs added, respectively. The calculated solubility constants are in excellent agreement with the *solubility vs size* and *solubility vs specific surface area* relationships proposed by P. W. Schindler [4], and calibrated for bigger particle sizes.

This study constitutes an important step for the understanding of the manufactured NPs fate in natural systems.

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