Development of Flow-Field Flow Fractionation based methods for the characterization of engineered nanoparticles in a complex matrix

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Engineered nanoparticles (ENPs) containing consumer products are already on the market. These may release the containing nanoparticles into the environment during their production, use and disposal/recycling. To assess the risk related to this release accurate methods for nanoparticle quantification in a wide variety of matrices are needed. These standardized methods to detect, quantify and characterize ENPs in consumer products are in fact nonexistent.

Field Flow Fractionation (FFF) coupled to specific detectors is one of the most promising techniques for these tasks. To establish robust methods for analyzing ENPs in products, biological media and the environment a systematic approach to thoroughly optimze and validate FFF for certain combinations of ENP and sample matrix is needed. Many parameters like cross flow, carrier composition, membrane type, channel height and injection procedure determine the performance of FFF. The same is true for the sample preparation and the specific particle detection following separation as e.g. by ICP-MS.

The strategy to be adopted depends strongly on the analytical information requested, the type of the ENPs and the nature of the matrix. The examples of nanoparticles of silica-NPs in a food sample (tomato soup) and silver-NPs in food and the environment will be presented.

The sample preparation was performed by several particle/matrix adapted approaches using colloidal extraction, acidic, alkaline and enzymatic attacs. Flow-FFF coupled to online UV-DAD, multi-angle light scattering, dynamic light scatering and ICP-MS were used to characterize compositions and properties of nanoparticles as a function of size. The optimization schemes aimed at maximum recovery, lowest possible influence on peak shape and position, minimum alteration of the original ENP during analytical procedure and pratical applicability (e.g. analysis time). The results show that ENPs can be analyzed in complex matricees with good recovery. Also it is evident how strong FFF results depend on the interplay of sample characteristics and run conditions.

Thoroughly adapted and optimized analytical methods, as those presented here, are essential to investigate the fate of ENPs during the entire life cycle of the consumer product.

Detrital zircon age populations and provenance of the Cape–Karoo succession in South Africa and correlatives in Argentina

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The similarities in litho- and biostratigraphy between the rock successions in the Paleozoic Cape-Karoo basin in Southern Africa and the Sauce Grande basin in Argentina as well as the structure of the Cape and Sierra de la Ventana folded mountain belts that deformed strata of these basins along their southern margins as part of the Gondwanide tectonic terrane, have long been recognized [1, 2]. In order to better constrain the provenance terrains for the two basins, a comparative U/Pb age study of detrital zircon populations was undertaken using LA-ICP-MS . Arenaceous samples were collected in the southwestern Cape region of South Africa, and at Mar del Plata and the Sierre de la Ventana in Argentina. Samples came from the broadly equivalent Ordovician-Silurian Table Mountain and Curamadal Groups, Devonian Bokkeveld and Ventana Groups, uppermost Carboniferous to lowermost Permian glaciogenic Dwyka and Sauce Grande diamictites and greywackes of the lower Permian Ecca and Bonete successions

Results display remarkable similarities but also important subtle diffences in detrital zircon age populations between the two basins, Most characteristic of both areas is the dominance of two major populations of zircons namely late Mesoproterozoic (1200 – 1000 Ma) and late Neoproterozoic to Cambrian (600 – 500 Ma) with perhaps a subordinate late Paleoproterozoic (1900 – 1700 Ma) population in some samples with absolute scarcity or absence of any older zircons. Apart from the glaciogenic Sauce Grande Formation in the Ventana region, all the other formations sampled in this area essentially hold only a late Neoarchean – early Phanerozoic zircon population. In contrast the samples from the western Cape in south Africa are virtually all characterized by both late Neoproterozoic – early Phanerozoic and late Mesoproterozoic age populations. Interestingly a sample of arenite from Mar del Plata along the west coast of Argentina also displays the two major zircon age populations that are characteristic of the correlative Table Mountain arenites in the western Cape. Results indicate that the successions in the Western Cape and eastern part of the Sauce Grande basin were mainly sourced from late Neoproterozoic Pan African/Brasiliano and late Mesoproterozoic Namaqua-Natal metamorphic belts. Rocks in the Ventana area, however, were essentially sourced from Brasiliano terranes. A prominent early Permian zircon population is present in the Bonete Formation of the Ventana region suggesting transport from a juvenile source to the south in the Gondwanide orogen.

[1 Du Toit (1937) *Our Wandering Continents; An Hypothesis of Continental drifting* ,Oliver & Boyd, London, UK.
[2] Milani et al (2008) *Geological Society, London, Special Publications* **294**, 319-342.