Physical-chemical characterization and ecotoxicity of residues from alteration of engineered nanomaterials

C. BOTTA[1], J. LABILLE[1]*, J. FENG[1], J. ROSE[1], P. CHAURAND[1], M. AUFFAN[2], J. GARRIC[3], B. VOLLAT[3], K. ABBACI[3], P. NOURY[3], A. MASION[1] AND J.-Y. BOTTERO[1]

[1]CEREGE, UMR 6635 CNRS/Aix-Marseille Université, Europôle de l'Arbois, 13545, Aix-en-Provence, France (*correspondence: labille@cerege.fr)
[2]Duke University, Civil and Environmental Engineering Department, 121 Hudson Hall, 27707, Durham, North Carolina, USA
[3]CEMAGREF, Ecotoxicology laboratory, 69336 LYON, France

Little is known at present concerning impact of nanotechnologies on our environment, and especially the fate after degradation of nanocomposites included in nanomaterials, like sunscreen formulations released in water after use. This study focuses on the aging and behaviour of a mineral nanometric UV filter, TiO_2 nanoparticle core coated with AlOOH and embedded in polydimethylsiloxane (PDMS). This nanocomposite was submitted to UV alteration in water, and the byproducts formed were characterized in terms of size, chemistry and physical-chemical properties. Finally, we also studied the potential toxic effects of this byproducts on fish (Danio rerio) and crustaceous (Daphnia magna).

Our results revealed a progressive dispersion of the nanocomposite in water, suggesting the alteration of the PDMS coating. This was confirmed by ICP-AES and FTIR experiment, showing a release of silicon and aluminum from the initial product. As a consequence, the degradation of the external layer could induce a direct contact of titanium with water, favouring photocatalytic processes.

The toxicological results reveal a penetration of byproducts into aquatic organisms and significant effects on reproduction, hatching and death rate at high concentration.

Similar experiments concerning several sunscreens formulations containing embedded nano-TiO_2 are at present in progress.

Grain sorting in large rivers and continental recycling

J. BOUCHEZ[1], J. GAILLARDET[1], C. FRANCE-LANORD[2] AND L. MAURICE-BOURGOIN[3]

[1]IPGP-Université Paris Diderot, 4 place Jussieu, 75252 Paris cedex 05, France
[2]CRPG-CNRS, BP 20, 54501 Vandoeuvre-lès-Nancy, France
[3]LMTG-IRD, 14 avenue Edouard Belin, 31400 Toulouse, France

Rivers participate in the destruction and construction of continents. They transport the products of erosion and weathering, and supply material to sedimentary basins that are surrected during orogenesis, and undergo later erosion-transport-sedimentation cycles.

Erosion and weathering create a wide range of solid products in terms of grain size, mineralogy, chemical and isotopic compositions. In river channels, these products are hydrodynamically sorted. Sampling large rivers sediments along depth-profiles allow to study the whole range of transported sediments.

The Amazon rivers have been sampled along depth-profiles. Large chemical and isotopic (Sr and Nd) variations are observed. Mineralogical fractionations can be deduced from elemental and isotopic ratios. Relationships between the enrichment of a mobile element in the fine phase compared to the coarse phase, and the overall enrichment of this element compared to Upper Continental Crust (UCC, [1]) suggests that the fine phase is preferentially recycled during erosion cycles.

The Solimões and the Madeira rivers, the two main tributaries of the Amazon, drain contrasted types of crust. The Madeira crust is almost exclusively formed of highly weathered meta-sediments, whereas the Solimões crust is also influenced by a significant younger magmatic arc component ([2]). These rivers allow to study two distinct stages of continental recycling. Madeira River sediments are significantly more homogenous and finer that the Solimões River sediments, in terms of chemistry and Sr and Nd isotopic compositions. The Madeira crust is shown to be the result of preferential recycling of fine sediments.

Our findings emphasize the role played by hydrodynamic sorting of sediments, in crustal differenciation over erosion cycles.

[1] Taylor & McLennan (1985) *The continental crust: its evolution and composition* (Oxford). [2] Allègre *et al*. (1996) *Chem. Geol*. **131**, 96-112.