Interaction of prion protein, pentapeptide and lysine with soil clays

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Pathogenic prion protein-scrapie (PrP^{sc}) may contaminate soils for decades, providing infection pathways for animals through inhalation or ingestion.

Sorption of Lysine and PrP(92-96)

NMR and XRD investigations of simple amino-acid (lysine) on synthetic montmorillonite show that lysine adsorption at most leads to a 6 nm expansion of the interlayer, compared to 12 nm expansion observed by [1] These results indicate the importance of surface charge density, which is lower in the present synthetic montmorillonite and the importance of organic molecule geometry sorbed onto smectites. ESR investigation of the pentapeptide (PrP(92-96) complex formed with -Cu^{2+} demonstrates a change of Cu^{2+} coordination in the complex upon adsorption to the synthetic clay from, at neutral pH, a N_4 type coordination in bulk water [2] to a NO_3 one in the interlayer).

MD Simulations of the PrP-clay System

MD simulations were performed for the PrP(92-138) peptide [3] adsorption on clay. The peptide anchored to the clay surface via up to 10 hydrogen bonds from lysine and histidine residues to oxygen atoms of the siloxane cavities, and a total adsorption energy of 3465 $KJ.mol^{-1}$ was obtained. Our results provide insight to the mechanism for strong association of prion protein on clay surfaces.

[1] Parbhakar *et al.* (2005) *J. Coll. And Surface* A **307**, 142. [2] Hureau *et al.* (2004) *JBIC*, 735-744. [3] Govaerts *et al.* (2007) *PNAS* **101**, 8343-8347.

The Lesser Antilles subduction factory

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In subduction zones, crustal material consisting of oceanic basalts overlaid by sediments is recycled into to mantle but part of the subducted material is immediately recycled into new crust during the formation of island arc volcanics. The proportion of subducted material involved in the genesis of this crust varies depending on factors such as the amount and type of subducted sediments or the speed and angle of the subducting plate.

Here we concentrate on the chemical budget of the Lesser Antilles Arc, which is famous for having the most “continental crust-like” geochemical signature. Its location perpendicular to the South American continent and the vast amount of sedimentary material present on the subducting oceanic plate in front of the southern part of the arc certainly play a major role in this signature.

We establish the average chemical and isotopic compositions of sediments located at three different latitudes in front of the arc and show that major differences exist along the north-south axis. The presence in the south of high proportions of continental detrital material leads to very continental-like Nd, Hf and Pb isotopic compositions, but more interestingly, to a decoupling of the Nd and Hf isotopic systems with very low Hf relative to Nd isotopic ratios. In addition, because the oceanic crust subducted in the south is older than in the north, thick layers of black shales created during two major oceanic anoxic events are present only in the south. They are characterized by extremely radiogenic Pb isotopes and their occurrence in the southern sedimentary pile contributes to large diversity of Pb isotopic compositions in the subducted material.

The north-south chemical and isotopic variation defined by the sediments is mirrored in the arc lavas and the clear correlation suggests that most of the arc characteristics are inherited from subducted sediments rather than acquired through the melting processes producing the arc magmas.

Chemical compositions of the arc magmas also change through time at the same location. Detailed chemical and isotopic analyses of 25 Ma of magma genesis in Martinique shows that the subducted sediments always contributed to the source of magmas but that their proportion varied through time, most probably in relationship with the thickness and geometry of the subducted sedimentary pile.