Crystal-chemistry of trace metals in the lagoon sediments of New Caledonia

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Major issues remain about the environmental cycle of toxic trace metals in fragile coastal ecosystems. This is especially true in New Caledonia where the erosion of massive lateritic nickel ores [1] leads to metal inputs to mangrove [2,3] and lagoon. The concentration of trace metals in the sediments of these ecosystems is thus more than 1000 times higher (up to 2000 ppm Ni) than in other similar settings worldwide, which might be harmful for their exceptional biodiversity. We have investigated the distribution and synchrotron-derived speciation of Ni, Fe, Cr and Mn in the lagoon sediments from New Caledonia in order to gain further insights on the crystal-chemistry of these trace metals upon marine early digenesis. The results obtained show that Ni occurs as a mixture of Ni-bearing Fe oxides (goethite) and in Fe-rich 2:1 phyllosilicate (nontronite and glauconite), which also trap other trace metals like Cr and Mn. This speciation significantly differs from that we previously observed in mangrove sediments, where a large fraction of Ni and Fe was found in pyrite [2,3]. Our results thus suggest that re-oxidation of sulfide minerals by tide fluctuations leads to progressive redistribution of sulfides-associated trace metals toward more oxidized minerals (especially Fe-oxides). They also suggest that neoformation of Fe-rich clay minerals might not only play a significant role on the coastal/marine biogeochemical cycle of Fe [4], but also on those of Ni and other trace metals like Cr and Mn.

[1] Dublet et al. (2012) *GCA* **95**, 119-133. [2] Noël et al. (2014) *GCA* **136**, 211-228. [3] Noël et al. (2015) *GCA* **169**, 82-98. [4] Baldermann et al. (2015) *Nature Geoscience* **8**, 885-890.