The interactions of nucleic acid components with rutile surfaces

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The interaction of nucleic acid components with mineral surfaces is of fundamental interest in various fields [1], and may have been important for the origin of life [2, 3]. The adsorption of nucleic acid components on synthetic rutile (TiO_2) surfaces at pH 6.7 and 0.1 M NaCl was studied as a function of surface loading. Adsorption affinity varied greatly with molecular structure, with ribonucleotides > deoxyribonucleotides > ribonucleosides > deoxy-ribonucleosides > free nitrogenous bases, suggesting a role for both sugar and phosphate groups in adsorption.

The base substituent also plays a role with pyrimidines > purines, and guanine derivatives > adenine derivatives. This suggests an interaction between the 2-position substituent of the heterocyclic rings and the mineral surface, in addition to interactions between the sugar and phosphate moieties.

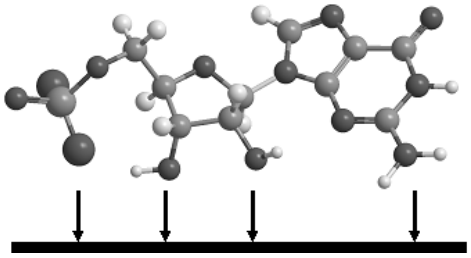

Figure 1: Possible interactions of guanosine-5'-monophosphate with a rutile surface.

We are continuing to study these phenomena as a function of pH as well as by FT-IR spectroscopy to integrate these studies with surface complexation models to establish the surface speciation of nucleic acid components as a function of environmental conditions.

[1] Trevors (1996) *Curr. Opin. Biotechnol.* **7**, 331-6. [2] Franchi *et al.* (1999) *Orig. Life Evol. Biosph.* **29**, 297-315. [3] Ferris *et al.* (1996) *Nature* **381**, 59-61.

Pb, Sr and Nd isotopic constraints on the evolving provenance of the Red River

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Rivers in East Asia have been recognized as having unusual geometries, suggestive of drainage reorganization linked to Tibetan Plateau surface uplift [1]. In this study we analyzed a series of sands from the Red River for bulk Sr and Nd isotopes using TIMS methods. We further collected Pb isotopes from single K-feldspar grains using SIMS, to understand the sediment budget of the modern Red River. We also investigate how this may have evolved during the Cenozoic. We show that while most of the modern sediment is generated by physical erosion in the upper reaches in Yunnan there is significant additional flux from the Song Lo, draining Cathaysia and the SW Yangtze Block [2]. Nd isotope data suggest that 40% of the modern delta sediment comes from the Song Lo. Carbonates in the Song Lo basin make this a major control on the Red River Sr budget. Single grain Pb data show a connection in the Eocene between the middle Yangtze and the Red River, and probably with rivers draining the Songpan Garze terrane in SE Tibet. However, the isotope data do not support a former connection with the upper Yangtze, Mekong or Salween Rivers. Drainage capture appears to have occurred throughout the Cenozoic, consistent with surface uplift propagating gradually to the southeast. The middle Yangtze was lost from the Red River prior to 24 Ma [3], while the connection to the Songpan Garze was cut prior to 12 Ma. The Song Lo joined the Red River after 9 Ma. Erosion is not a simple function of monsoon precipitation. Active rock uplift is also required to drive strong erosion.

[1] Clark *et al.* (2004) *Tectonics* **23,** TC1006. [2] Clift *et al.* (2008) *G-Cubed*, doi,10.1029/2007GC001867. [3] Clift *et al.* (2006) *Geophys. Res. Lett.* **33**, doi,10.1029/2006GL027772.