Trace element geochemistry in the upper Amazon drainage basin (Bolivia)

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Elemental mass-balance of material carried by rivers to the oceans can be better constrained by knowing the factors which determine the composition of the dissolved and particulate phases. According to Zhang and Huang (1993), weathering and erosion exert a major control on dissolved trace metal concentrations in the Huanghe river. Dupre *et al*, (1996) conclude that U, Rb, Ba and Sr in the Congo river are controlled by the dissolution of the main rock types while the abundance of Rare Earth Elements or transition elements are controlled by the presence of colloids. The partitioning of elements between the dissolved and solid phases may also influence trace element concentrations in large river systems, but few recent studies (e.g. Huang *et al*, 1992; Dupre *et al*, 1996) have focused on this aspect. Further trace element budgets and oceanic residence time (Martin and Meybeck, 1979) rely on few possibly unrepresentative data while the widespread use of clean techniques has in many cases substantially decreased estimates of trace element concentrations , especially those of the transition elements, in rivers (e.g. Shiller and Boyle, 1985; Benoit, 1994).

In order to improve the knowledge of processes which govern trace element distribution in rivers and to better constrain budgets, it would be necessary to produce large sets of data on relatively small drainage basin encompassing the diversity range of lithology, climate, relief.

This paper focuses on concentrations of V, Mn, Co, Ni, Cu, Zn, Cd, Mo, U, Rb, Sr and Ba in both dissolved and suspended matter for the Mamore and Beni watersheds in the Bolivian part of the Amazon basin.

The distribution of trace elements (Sr, Mo, Ba, Rb, U, V, Mn, Ni, Cu, Zn, and Cd) was investigated in surface waters and suspended particulate matter (SPM). Dissolved Sr, Ba and Rb appear to be predominantly derived from soluble rocks (carbonates and evaporites) and to be conservative in waters excepted in highly alkaline or sulphate-rich waters where calcite and baryte can precipitate. Mo and to a lesser extend U correlate well with Ca reflecting their solubility in carbonate rich water. Although transition element behaviour is largely controlled by equilibrium reactions in solution and solid-liquide exchanges, their distribution reflects also the lithological differences between the Mamore and Beni bassins. The mining activity in the Beni basin contributes to increase the concentration of Cd and Zn in the rivers. Inversely the higher content of Mn in the Mamore basin reflects the predominance of carbonate rocks.

The distribution of trace elements in SPM has been attributed mainly to the sorting of feldspars during transport in water, while the corresponding fractionation reflects a binary mixing between muscovite+illite and quartz. These minerals, refractory to weathering and introduced in water rivers by physical erosion, have not contributed to the solubilisation of the elements and the contribution of silicate phases to the dissolved load remains on overall small.

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