FLUORINE AND CHLORINE IN THE CLAY FRACTION OF FINE GRAINED SANDS FROM THE AMAZON RIVER DELTA. IMPLICATIONS FOR THEIR GEOCHEMICAL BEHAVIOR FROM WEATHERING TO METAMORPHISM

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The F and Cl contents of the clay fraction of fine grained sediments may be representative of the weathered rocks as they can enter the hydroxyl sites of the clay minerals. The Amazon river delta precipitates a detritical charge that can approach the average composition of weathering products of the Andean chain, the Guiana and Brazilian Precambrian shields, and the Amazon basin sediments. We analyzed F and Cl in the clay fraction (< 2 µm) of 15 samples of fine grained sands dredged and grabbed from several river channel bottoms across the Amazon river delta. The XRD mineralogical composition of the samples is 44-53 wt.% illite, 32-56 wt.% kaolinite and 14-22 wt.% smectite. The halogens were analyzed by ISE method with an average of 793 ppm and standard deviation of ±7.1. It fall well in the range of F contents of the < 2 µm fraction of the suspend load of rivers. The Cl content is between 20 ppm to 70 pmm close to the detection limit. The F contents of shales and clays is mainly determined by the clay minerals and the apatite. The average P_2O_5 contents of shales is 0.16 % which correspond to an average apatite content of 0.38 wt. %. The maximal F contribution due to the presence of fluorapatite (F = 3.75 %) is 142 ppm. For an average shale with 59 wt. % of clays minerals the same F content as the Amazon river clay fraction would contribute 468 ppm of F. The total F content of the shale is 610 ppm. Such F level is quite close to the upper continental crust F average of 554 ppm. The Cl contents of the Amazon river clay fraction is significantly lower compared to the average shale. An useful approach to identify geochemical fractionation is the K/F ratio. The mantle peridotites show the highest F/K = 0.59. In contrast the basalt have one order of magnitude lower F/K = 0.046 due to strong fractionation related to the partial melting of mantle. During fractional crystallization F enters more the solide and granites have F/K = 0.02. The weathering reactions produce only minor F enrichment with the partial leaching of K as the shales have K/F = 0.028. It means that phyllosilicates concentrates most of the F of the UCC and that sedimentary sorting concentrated F in the clay fraction of sediments. We compare the F contents of the average shale using Amazon river clay fraction composition to the average amphibolite grade mica schist of the Seridó Belt. Its average composition gives F = 672 ppm, P_2O_5 = 0.22 % and apatite content of 0.52 wt.%. Assuming the clay mineral weight of average shale the F content of the Seridó shale clay fraction would be 808 ppm. This is close to 793 ppm of F obtained for the Amazon river clay fraction. The preservation of ratio F/K in shale and in amphibolite grade shale shows that during prograde metamorphism F is not lost to the fluid phase.