Can clay minerals be used as a tool in environmental assessment?

CHANGLING HE

[1]Department of Geosciences and Natural Resource Management, University of Copenhagen
ch@geo.ku.dk

It has been well documented that clay minerals have strong capacity to adsorb heavy metals. Naturally, a close correlation can be expected between them. However the author's previous work showed that there was no correlation between heavy metals and kaolinite, illite or chlorite in the samples taken from salt marsh at the east coast of Wadden Sea. One explanation was that there were not many heavy metals to be adsorbed in that environment. If this explanation was valid and could be generalized, correlation between clay minerals and heavy metals might be used, in some way, as an indicator of environmental situation. It was true that the sampling site at Danish west coast was not polluted. However much more samples, especially samples from different environmental conditions must be investigated.

In present investigation, totally 21 samples were collected from soils around the mining area in Jiangxi, Southeastern China. The predominant clay minerals are illite, kaolinite and chlorite. The average concentration of the heavy metals investigated, Cu, Pb, Zn, Ag and As are 2 to 6 folds of that of the local reference. However, the correlations between them and the clay minerals are generally poor: illite is negatively correlated to all these metals except for As to which r (correlation coefficient) is 0.642; kaolinite has also negative correlation with three of the five heavy metals, Ag, Cu and Zn, while positive but low (r 0,31) with Pb and some correlation (r 0,59) with As

To focus on the fraction of heavy metals that presumably associate only to clay minerals, sequential chemical extraction was used to extract the "exchangeable" fraction of the metals. For this fraction, the correlations are even lower. The poor correlations may suggest that at least some of the adsorbing sites of the clay surfaces are not saturated. It may be due to a significant amount of the heavy metals were accommodated in the crystal structures of mineral phases, or were adsorbed by the stronger adsorbents, such as organic matters and Fe (hydr)oxides than clay minerals. Further investigation is needed.