

# Hg and expanding 2:1 phyllosilicates: a combined XRD, TG-MS, and EXAFS study

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Running title: Hg montmorillonite, vermiculite and amino acids.

## ABSTRACT

Synchrotron based extended X-ray absorption fine structure spectroscopy (EXAFS), X-ray diffraction at room and high temperature, thermal analyses combined with mass spectrometry of evolved gas, and chemical analyses contributed to assess the influence of Hg on montmorillonite and vermiculite layers.

Selected 2:1 expanding layer minerals are characterized by different value and location of the layer charge. The adsorbed Hg amount is higher for montmorillonite (Hg = 37.7 meq/100g) than for vermiculite (Hg = 28.0 meq/100g). The layer periodicity for Hg treated samples results in *d*-spacing of 15.2 and 14.5 Å for montmorillonite and vermiculite respectively. Thermal and evolved gas spectrometry analyses suggest that Hg is released at  $T \cong 230^\circ\text{C}$  and at  $600^\circ\text{C}$  for montmorillonite, whereas Hg is released from vermiculite at 550, 800 and  $860^\circ\text{C}$ .

The effect of temperature on Hg release is also apparent when  $d_{001}$  value at  $230^\circ\text{C}$  for montmorillonite ( $d_{001} = 10.3 \text{ \AA}$ ) is compared to  $d_{002}$  value for vermiculite ( $d_{001} = 11.8 \text{ \AA}$ ).

EXAFS analyses provide qualitative evidence that oxygen atoms occupy the first coordination shell of Hg in both smectite systems. The best fit between observed and calculated spectra is obtained when montroydite is assumed as reference model compound.

Keywords: montmorillonite, vermiculite, mercury, X-ray, diffraction, adsorption