Crystal chemistry and magnetism of Fe-serpentines based on XMCD

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Fe-rich layer silicates are rare on Earth, but are a major component of CM2 carbonaceous chondrites. They formed during early aqueous alteration events that affected CM2s' asteroidal or cometary parent body [1]. Bulk magnetometry (300-2 K) has proven useful for characterizing Fe-serpentines' mineralogy, close to the pole cronstedtite in CM2s [2]. Comparison with results from single crystals supports the hypothesis of a variable Fe content of serpentines along the alteration sequence of CM2s [2], similarly to terrestrial serpentinization. Site distribution and valence of iron in serpentines would directly be linked to their growth conditions (T, water-rock ratio or duration [3]). Understanding the conditions in which the reactions occurred on the parent body of CM2s thus relies on a thorough characterization of their crystal chemistry.

Here we present the results of a X-ray Magnetic Circular Dichroism study at the Fe K-edge of oriented single crystals of cronstedtite, showing a strong planar anisotropy. We measured XMCD at various angles between the **c** axis and the applied field. We will show how ligand field multiplet calculations [4] allow one to separate various contributions to the pre-edge. This would yield an estimate of the crystal chemistry of Fe in this multisite (octahedral, Oh, and tetrahedral) and multivalent ($Fe^{2+,3+}$) mineral, allowing for a fine characterization of this alteration mineral in meteorites. Also, XMCD suggests that the anisotropy of cronstedtite originates from the strong single ion anisotropy of Fe^{2+} in distorted Oh sites. Finally, exploring the variations of XMCD with substitutions (mostly Fe-Si) would clarify which parameters control the disruption of a long-range magnetic order in Fe-serpentines, from AF, when only Fe^{2+} is present, in Oh sites [5], to spin-glass like, in cronstedtite [2].

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Estimating the Potential Evapotranspiration by using Landsat imagery

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Freshwater resources are becoming increasingly limited in many parts of the world, and decision makers are demanding new tools for monitoring water availability and rates of consumption. Remotely sensed data and especially Landsat imagery provides an estimate of land-surface temperature that allow mapping of evapotranspiration (ET) at the spatial scales. This work presents the utility of satellite imagery in water resource management. General modeling techniques for using land-surface temperature in mapping the surface energy balance are described, including methods developed to safeguard ET estimate. Examples are provided of how remotely sensed maps of ET derived from Landsat thermal imagery are being used operationally by water managers today: in monitoring water rights, negotiating, estimating water-use by invasive species, and in determining allocations for agriculture, urban use, and endangered species protection. To better address user requirements for high-resolution, time-continuous ET data, novel techniques have been developed to improve the spatial resolution of Landsat thermal-band imagery and temporal resolution between Landsat overpasses by fusing information from other wavebands and satellites.

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