C1XS data calibration: X-rays to elements

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C1XS (Chandrayaan-1 X-ray Spectrometer) is a compact X-ray fluorescence (XRF) spectrometer, currently orbiting the Moon as a payload on the Indian Chandrayaan-1 mission [1]. C1XS is designed to provide high quality mapping of the major rock-forming elements (e.g. Mg, Al, Si, Ca, Ti & Fe) in the lunar surface. Some initial results will be described at this meeting by [2].

An ‘in-house’ IDL XRF modelling code is used to convert the C1XS raw X-ray flux data into elemental ratios and abundances. This method will be outlined and results from accompanying laboratory experiments discussed.

In these experiments we aim to replicate the “real-life” C1XS measuring state in order to understand the role of grain size variations in the lunar regolith and changes in the solar aspect angle (angle between the Sun, lunar surface and C1XS detectors) on XRF intensity [3-5].

These experiments are being carried out in the RESIK X-ray beam facility at the Rutherford Appleton Laboratory, UK, where pre-flight ground calibration of the instrument took place. This facility can provide a controlled X-ray beam from a variety of anode targets. We are able to place two Si-PIN diode detectors within a vacuum chamber, along with the sample of interest. The X-ray beam’s angles of incidence and emergence can be varied by rotating the sample and the fluorescence detector in order to simulate changes in the phase angle experienced during the mission.

Samples have been chosen to represent lunar regolith constituents. We measure pure elemental oxides (MgO, Al_2O_3, SiO_2, and FeO), as fine-grained powder samples at two different grain size fractions, (and as flat surfaces for reference), as well as a more complex lunar regolith simulant powder, JSC-1A [6].

[1] Grande *et al*. (in press) *Planet. Space Sci*. [2] Crawford *et al.* (2009) *GCA,* this volume. [3] Maruyama *et al*. (2008) *Earth Planets Space* **60,** 293-297. [4] Näränen *et al*. (2008) *Icarus* **198,** 408-419. [5] Owens *et al*. (in press) *Anal. Chem.* [6] Carpenter (2006) www.lunarmarssimulant.com**.**

Estimating soil organic carbon input to marine sediments

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Estimating (past) input of terrestrial organic carbon (OC) in marine sediments is complicated due to the heterogeneity of the OC. Two end member mixing models based on different parameters often give different results. This is in part due to the fact that terrestrial OC is only represented by one end member (often representing plant OC) where it in fact consists of two OC pools, i.e., plant and soil OC.

The branched vs. isoprenoid tetraether (BIT) index is a new proxy for soil OC input, with the branched tetraether membrane lipids being derived from bacteria living in soils and peat bogs [1]. We have now applied this molecular proxy in a three end member mixing model, in conjunction with $\delta^{13}C$ and C/N values of total organic matter, in a marine sediment core from the Congo deep sea fan to estimate inputs of marine, soil and plant OC to this location over the last deglaciation. Results indicate an average of 45% of the OC being of soil origin, pointing to the importance of soil OC and the need for proper characterization of this fraction.

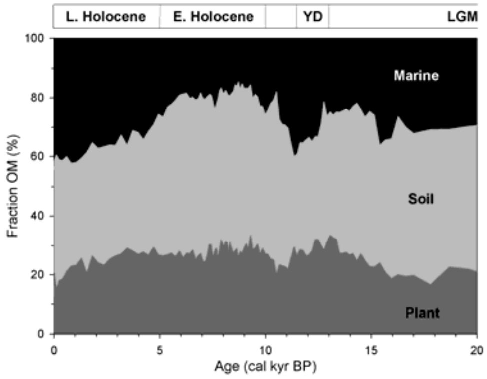

Figure 1: Composition of the organic carbon input to the Congo deep sea fan over the last 20 thousand years. YD = Younger Dryas; LGM = Last Glacial Maximum.

[1] Hopmans *et al.* (2004) *EPSL* **224**, 107-116.