Neutron capture-induced ^{150}Sm anomalies in IAB Iron meteorites and Winonaites

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Isotope anomalies produced by neutron capture in nuclides with large neutron capture cross sections can be used to constrain the irradiation history of extra-terrestrial matter [e.g. 1]. This study investigates the exposure history of IAB irons and Winonaites, which are presumed to come from the same body [2], using the increase in ^{150}Sm as a result of neutron capture by ^{149}Sm. For this purpose, Samarium was separated from 200-500 mg samples using standard dissolution and ion exchange techniques. The isotope ratios were measured on a Triton TIMS in static mode. Analytical uncertainties on the reported ratios are <12 ppm (2 sd; n=8) for the standard and <35 ppm for the samples (2 se).

Figure 1 shows the neutron capture-induced isotopic shifts in ^{150}Sm/^{152}Sm measured on three IAB silicates (1.1-1.8 ε-units) and two Winonaites (1.0-5.5 ε-units). The corresponding neutron fluences for the IABs (1.5-2.5 x 10^{15} n/cm^2) and the Winonaites (1.4-7.4 x 10^{15} n/cm^2) are similar to those of chondrites [1]. The similar fluences calculated for the IABs are difficult to reconcile with their different cosmic ray exposure ages [e.g. 3], unless one invokes a common regolith history on the parent body followed by high shielding depths within their meteoroids (so that they were only insignificantly affected by exposure to cosmic rays after ejection from the parent body).

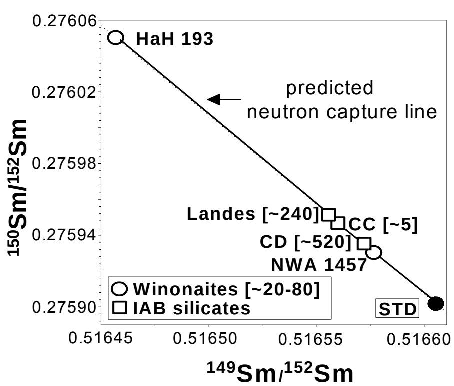

Fig. 1: HaH = Hammadah al Hamra; CC = Caddo County; CD = Canyon Diablo; NWA = North West Africa; STD = terrestrial standard; Cosmic ray exposure age [Myr].

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An HRTEM and XRD investigation of 2:1 clay mineral diagenesis in the Jeanne d'Arc Basin, offshore eastern Canada

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We have undertaken an HRTEM and XRD study of 2:1 clay mineral assemblages from argillaceous rocks of the Adolphus D-50 (AD-D50) and the Northern Ben Nevis P-93 (NBN-P93) wells, Jeanne d'Arc Basin, offshore eastern Canada. X-ray diffraction patterns of the <0.1µm size fractions after air drying and ethylene glycol solvation show that the 2:1 clay mineral assemblages span the major steps in the evolution of smectite to illite, consistent with the results of Abid *et al.* (2004). Clay mineral assemblages at shallow (1565 m) to intermediate well depths (3135 m) consist of smectite, randomly interstratified I-S (R0), weakly ordered I/S (WR1), and short-range ordered I-S (R1) phases. HRTEM images of the same samples after *n*-alkylammonium exchange show the presence of multiple phases of low- and high-charge expandable 2:1 clay minerals, an R1-ordered phase and illite. The low- and high-charge expandable 2:1 clay minerals decrease with burial depth, whereas the R1 ordered I-S and illite become the predominant 2:1 clay minerals. Microanalysis of individual 2:1 clay mineral particles as well as TEM images of freeze-etch replicas will be presented and will contribute to our overall understanding of the structural changes that occur in I/S during burial diagenesis, especially in the structure of weakly-ordered I/S. This clay mineral study is part of a broader research project attempting to link fluid flow events within the Jeanne d'Arc Basin to a number of anomalous patterns of illitization in strongly faulted areas of the basin. There is evidence that points to a fluid-flow driven increase in the percentage of illite in I/S (involving K-bearing fluids) rather than a simple temperature-dependence of the illitization of I/S clays.

References

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