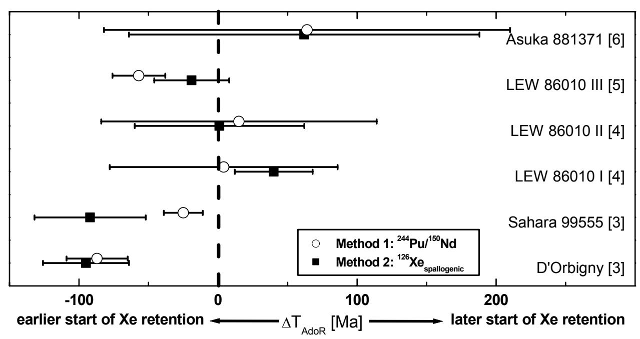
Plutonium-Xenon systematics of Angrites

Conference or Workshop Item

PLUTONIUM-XENON SYSTEMATICS OF ANGRITES H. Busemann and O. Eugster, University of Bern, Physics Institute, Sidlerstr. 5, 3012 Bern, Switzerland, busemann@phim.unibe.ch.

Introduction: Angrites are igneous meteorites that crystallized very early in the solar system, ~10 Ma after CAIs, as also implied by the presence of now extinct short-lived radionuclides such as ^{53}Mn, ^{146}Sm and ^{244}Pu [1]. Fission Xe was used to calculate ^{244}Pu-^{136}Xe-retention ages of eucrites, relative to that of Angra dos Reis (AdoR) [2]. AdoR has an absolute Pb-Pb age of 4557.8 Ma [see 1 for ref.]. Most eucrites, being as old as angrites, experienced various parent body processes leading to ages ranging from ~20 Ma before, to ~100 Ma after AdoR [2]. Angrites, however, remained largely unaltered after differentiation. Here, we examine whether Xe isotopic characteristics allow determining an age sequence for angrites.

Experiment: We measured the Xe isotopic composition for the recent finds Sahara 99555 and D'Orbigny (details in [3]) and re-examined data for other angrites [4-8]. Two methods are used to obtain Pu-Xe-ages: method 1 assumes ^{244}Pu/^{150}Nd to be constant in the early solar system [9]. However, LEW 86010 implied some variations [5]. We thus also applied method 2 using spallogenic ^{126}Xe as a proxy for Nd, thus reducing distribution effects of Nd [2].



Results: Results from both methods are shown in the figure. Within large uncertainties (1σ), both methods yield generally similar retention ages, scattering around the reference age of AdoR. However, Sahara 99555 and D'Orbigny show significantly older ages, apparently ~85 Ma prior to CAI formation. This might indicate problems with the assumed [Ba]/[REE] ratios, variations in the initial ^{244}Pu/^{150}Nd, a varying production of ^{126}Xe from Nd relative to all REE, an unusually high ^{238}U content in the respective sample, or fission Xe contributions from an unknown precursor.

The discovery of 2% excess on ^{235}U in D'Orbigny glass, associated with an apparent Pb-Pb age of 4.7 Ga [10], possibly originating from the decay of ^{247}Cm ($T_{1/2}$ = 15.6 Ma), might indicate that angrites could indeed contain remnants of an unknown radionuclide. The ongoing analysis of fission Xe in the D'Orbigny glass will address this issue.

References: [1] Carlson R. W. and Lugmair G. W. (2000) in *Origin of the Earth and Moon*, University of Arizona Press, Tucson, 25-44. [2] Shukolyukov A. and Begemann F. (1996) *GCA, 60,* 2453-2471. [3] Busemann H. and Eugster O. (2002) *Meteorit. Planet. Sci., 37,* 1865-1891. [4] Eugster O. et al. (1991) *GCA, 55,* 2957-2964. [5] Hohenberg C.M. et al. (1991) *EPSL, 102,* 167-177. [6] Weigel A. et al. (1997) *GCA, 61,* 239-248. [7] Hohenberg C.M. (1970) *GCA, 34,* 185-191. [8] Munk M.N. (1967) *EPSL, 3,* 457-465. [9] Lugmair G. W. and Marti K. (1977) *EPSL, 35,* 273-284. [10] Jagoutz E. et al. (2003) *Geophys. Res. Abstr., 5,* #08802.