The Lu-Hf systematics of meteorites: Consistent or not?

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The discrepancy between the λ^{176}Lu value determined from terrestrial minerals (1.867 ± 0.011 $\times 10^{-11}$yr^{-1}; [1-3]) and those derived from meteorite WR isochrons (1.93-1.98 $\times 10^{-11}$yr^{-1}; [2,4-8]) remains unsolved. Meteorites that violate isochron assumptions are not ideally suited for λ^{176}Lu measurements [9]. Nevertheless, some *internal* (mineral) isochrons may yield valuable insights about the early solar system. Amelin [9] compared the Lu-Hf and U-Pb systematics of phosphates in the primitive achondrite Acapulco and the ordinary chondrite Richardton (H5), resulting in a λ^{176}Lu that is consistent with terrestrial mineral data, but yielding imprecise initial ^{176}Hf/^{177}Hf values (i). Constraining the Richardton intercept further using the WR of [8] yields i = 0.279849 ±32, which is higher than expected for basaltic eucrite- and chondrite WR isochrons (i ≈ 0.27964 ±4, wtd. mean of [5-7] & this work]), but would make sense if a positive correlation between ^{176}Hf/^{177}Hf and ^{176}Lu/^{177}Hf already existed in the earliest solar system materials. Photoexcitation by gamma irradiation could have temporarily increased the effective decay rate of ^{176}Lu [10], creating anomalously steep Lu-Hf isochron slopes and high apparent λ^{176}Lu values for meteorites. Albarède *et al*. [10] argued that *internal* gamma sources such as ^{26}Al$\rightarrow^{26}$Mg and ^{60}Fe$\rightarrow^{60}$Co$\rightarrow^{60}$Ni were not abundant enough to do this. For an *external* gamma source, such as the young Sun or a gamma ray burst from a supernova, significant photoexcitation would have been restricted to objects less than a few cm in radius, i.e., before the material coalesced into planetary bodies [10]. Igneous rocks crystallized in planetary interiors would not be expected to show anomalously high λ^{176}Lu. However, internal isochrons of the eucrite Juvinas (present study, [6 & 7], i = 0.27969 ±4, $\lambda^{176}Lu_{apparent}$ = 1.93 ±0.02 $\times 10^{-11}$yr^{-1}), and the angrite SAH99555 ([11], i = 0.279682 ±30, $\lambda^{176}Lu_{apparent}$ = 1.99 ±0.02 $\times 10^{-11}$yr^{-1}) show exactly that, suggesting that perhaps an internal source of gamma radiation did indeed exist [11] or that there is a different reason for the apparent ^{176}Hf excesses.

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Lipid biomarkers as indicators for environmental stress in cyanobacterial mats of Abu Dhabi, United Arab Emirates

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Intertidal cyanobacterial mats in the coastal flats of the Arabian Gulf in Abu Dhabi (United Arab Emirates) grow under locally different conditions. Salinity ranges from 60 to 200 due to the high evaporation rates of the tidal waters caused by shadowless sunshine exposure for nearly 12 hours a day.

We compared the phospholipid fatty acid profiles of six mats from lower, middle and upper tidal zones. The analysed mats show differences in their texture and horizontal layering. As the colours of the layers are attributed to the activity of physiologically different bacterial populations we sliced the mats accordingly and compared the results of single-layer analyses with the data for the whole mats. Phospholipids are main constituents of cell membranes and are easy to extract and identify. Differences in concentrations and distributions will reflect changes in microbial populations and reactions on environmental stress, e.g. desiccation.

Former studies had shown that lipids may be involved in the protection against environmental stress as they maintain the membrane fluidity. In our mats, increased ratios of saturated to unsaturated fatty acids, cyclopropyl to monounsaturated fatty acids and *trans*- to *cis*-monounsaturated fatty acids are interpreted as response to environmental stress in the region. The *trans*- to *cis*-monounsaturated fatty acid ratios reached up to 1.6, e.g. for elaidic acid in our mats.

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