Revised ages of angrites

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Angrites are a small group of 18 differentiated achondrites and are among the oldest known rocks of our Solar System. These meteorites have low metamorphism and shock effects, are enriched in refractory elements and are well suited as anchors for short-lived nuclide chronology. Therefore it is crucial to accurately measure their ages according to the Pb-Pb chronometer, the only absolute geochronometer with sufficient precision to resolve age differences in the early Solar System processes.

To determine accurate ^{207}Pb-^{206}Pb ages, the isotopic ratio of ^{238}U/^{235}U must be known. This number was assumed to be invariant at 137.88 for several decades but recent studies [1, 2] have shown that variations occur not only in terrestrial rocks but also in meteorites. In this study, we analysed six bulk angrite samples: three quenched angrites and three plutonic angrites, for their uranium isotopic ratios using the double-spike MC-ICPMS procedure after [3]. The ratios are reported relative to the recently published value of 137.837 ± 0.015 (2σ) for the uranium isotopic standard CRM145 [4]. The ^{238}U/^{235}U ratios for the analysed angrites are uniform within error of each other, ranging from 137.763-137.802. Analytical errors are 0.018-0.049 (2σ), depending on the sample size. These data, combined with ^{206}Pb-^{207}Pb analysis by TIMS, are used to revise previously reported Pb-Pb ages to values with a higher accuracy, leading to a more reliable early Solar System chronometer.

The causes of variations in the ^{238}U/^{235}U ratios in meteorites are currently debated, including the possible decay of extant ^{247}Cm to ^{235}U. Th and Nd are used as present day proxies for the extinct Cm. Therefore, the correlation between Th/U or Nd/U and uranium isotopic ratios is used to find evidence for the decay of ^{247}Cm in the early stages of the Solar System [1, 2]. In addition to ^{238}U/^{235}U values, we analysed the rare earth element (REE) pattern and the U and Th concentrations of the samples to determine the environment in which the meteorites formed and the plausibility for Cm being present during angrite formation.

[1] Brennecka *et al*. (2010) *Science* **327**, 449–451. [2] Amelin *et al*. (2010) *EPSL* **300**, 343–350. [3] Stirling *et al*. (2006) *EPSL* **251**, 383–397. [4] Richter *et al*. (2010a) *International Journal of Mass Spectometry* 295(1-2) 94–97.

Mineralogy of atmospheric particles deposited on cypress leaves close to a nuclear plant

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Enhanced activity of actinides and some decay products has been reported for the leaves of cypress trees (*Chamaecyparis nootkatensis*) at the edge of the Malvési uranium-processing facility, SW France. The enhanced activity is due to the release of actinides via the smokestacks and artificial ponds inside the facility. This study was conducted to characterize the particulate matter deposited on the leaf surfaces from the atmosphere and to investigate whether or not radioactive particles may be identified.

Air-dried leaf samples were examined by scanning electron microscopy (SEM), in combination with energy-dispersive X-ray spectrometry (EDX). The samples were scanned systematically in both secondary and backscattered electron modes. EDX spectra were collected from particles and from areas devoid of particles (background spectra). These background spectra as well as the signals resulting from the C or Au coating were taken into account for the interpretation of the qualitative EDX spectra of the individual particles trapped on the leaf surface.

Particles ranging in size from <200 nm to ~40 μm were found on most portions of the adaxial leaf surface, but they are especially abundant at the boundary between facial and lateral leaves. We classified the particles chemically according to the most prominent peaks in the EDX spectra, yielding the following five principal classes: carbonates, silicates, sulfates, oxides/hydroxides, and halides. Approximately 80% of all analyzed particles could be attributed to these five classes. In addition, other types of particles were found, including Fe alloys; scheelite-group phases; phosphates; sulfides; and fly ash spheres.

Of special interest are U-rich particles, which were identified as U oxides, except for one particle, which was an U-oxide-fluoride. Clearly, these particles were released into the atmosphere by the nuclear facility prior to their deposition on the leaf surfaces. As most of the U-rich particles are ≤1 μm across, they are respirable.

Once inhaled, particles containing alpha-emitting isotopes represent a potentially long-term source of ionizing radiation inside the lungs and thus, pose a threat to the health of the people living nearby.