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Noble gases in two shergottites and one nakhlite from Antarctica: Y000027, Y000097, and Y000593

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We have investigated secondary influences on the noble gas budget in rim and interior pairs of three Martian meteorites from Antarctica: the lherzolitic shergottites Y000027 and Y000097, and the nakhlite Y000593. Three factors have been found to influence the original Martian noble gas budget: shock metamorphic overprint, cosmic irradiation, and terrestrial weathering. The 3He/4He ratio of the shergottites is between 0.189 and 0.217, which indicates almost complete loss of radiogenic 4He. This is expected from the high shock pressure observed in the shergottite samples. The concentration of 4He in these shergottite samples ranges from 33.8 to 39.4x10−8 ccSTP/g. 22Ne in the shergottites is on the order of 14x10−9 ccSTP/g. The nakhlite has ~800x10−8 ccSTP/g 4He and ~26x10−9 ccSTP/g 22Ne. An indication for solar cosmic ray contribution to the neon budget can be found in the shergottites. As Y000027 and Y000097 are reported to be paired we conclude the cosmic ray exposure (CRE) age T(3+21) of this shergottite to be 4.41±0.54 Ma. For the nakhlite Y000593 T(3+21) is 11.8±0.3 Ma. Heavy noble gas concentrations show large differences between rim and interior samples with the rim samples having 1.3–2.9, 1.7–38, and 1.4–20 times as much 36Ar, 84Kr, and 132Xe, respectively. The enrichment of heavy noble gases in the rim samples indicates severe terrestrial contamination. The relation between 129Xe/132Xe and 84Kr/132Xe in the rim samples shows that the incorporation mechanism caused elemental fractionation of Kr and Xe to the extent that in the Y000027 shergottite samples any Martian signature is completely masked by terrestrial contamination, if the total is taken. Only the 1400 ° C steps show clear evidence for Martian atmosphere. The Y000593 nakhlite interior sample, on the other hand, shows low 84Kr/132Xe in relation to 129Xe/132Xe, which is characteristic for fractionated Martian atmosphere observed in nakhlites.

Statistical properties of the Transantarctic Mountains (TAM) micrometeorite collection

Clément Suavet; Pierre Rochette, Professor; Myriam Kars; Jérôme Gattacceca; Luigi Folco; Ralph P Harvey, Associate Professor

Micrometeorites have been recovered from traps located at the summit of nunataks in the Transantarctic Mountains (TAM), Antarctica. They constitute the TAM micrometeorite collection. Micrometeorites accumulated by direct infall for hundreds of thousands of years. This long collection duration is confirmed by the wide range of weathering by dissolution of olivine in the stony micrometeorites from the TAM collection. A statistical study of the size distribution and frequency by type of this collection, and comparison with other Antarctic micrometeorite collections (the South Pole Water Well collection and the Walcott Névé collection), suggest that the TAM collection is essentially unbiased. Thanks to the very long exposure of the traps, large diameter (>1000 μm) micrometeorites are present in sufficiently large numbers to allow a statistically meaningful estimate of their size distribution in this size range for the first time. We found that the slope of the size distribution remains constant in the 100–1600 μm size range. Therefore, the size distribution of micrometeorites in this size range is controlled by a single process.

Evaluation of a curve-f 1 itting method for diffuse reflectance spectra in the UV-Visible-NIR wavelength region

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The Modified Gaussian Method (MGM) proposed by Sunshine et al. (1990) is generally used to decompose spectra in the UV–Visible–NIR wavelength region into the characteristic absorption bands of minerals. Here, we compare the optimized results obtained using different curve–fitting methods for this spectrum. The result obtained using the Gaussian function for the absorption band shows a better fit than that obtained using the Lorentzian function. The background continuum of a quadratic polynomial for the wavenumber provides a better result than does the linear function for the wavenumber. We successfully decomposed the spectra of ordinary chondrites and eucrites into the absorption bands of olivine and pyroxene. The wavelength positions of these absorption bands are broadly consistent with the Fe contents of olivine and pyroxene. Although the present results are derived from a limited number of spectra, they are of use in terms of the decomposition of diffuse reflectance spectra.

Chemical characteristics of the lherzolitic shergottite Yamato 000097: 1 magmatism on Mars inferred from the chemical compositions of shergottites

Naoki Shirai; Mitsuru Ebihara, Professor

As a part of a consortium study, we analyzed the Martian meteorite Yamato (Y) 000097 by prompt gamma–ray analysis, instrumental neutron activation analysis, and instrumental photon activation analysis. For comparison, we also analyzed Allan Hills (ALH) 77005 using the same methods. The data confirm that Y000097 belongs to

lherzolitic shergottites in terms of chemical composition. Although there exist slight differences in elemental abundances among lherzolitic shergottites due to differences in the modal abundances of constituent minerals, they have essentially the same chemical compositions, suggesting they are genetically related and experienced similar formation histories. Zr/Hf ratios obtained for Y000097 and ALH 77005 are subchondritic, consistent with values reported for other lherzolitic shergottites and olivine-phyric shergottites. Such fractionation can be explained by invoking clinopyroxene, ilmenite, or majorite in the petrogenesis of the shergottites' source material. CI-normalized Hf/Sm ratios obtained for Y000097 and ALH 77005 are 1.52 and 1.37, respectively, consistent with superchondritic Hf/Sm ratios reported for shergottites. Based on experimentally derived partition coefficients, majorite is the best candidate mineral for the fractionation of Hf and Sm in shergottites.

Inter- and intraspecific variations of the chemical properties of high-Arctic mosses along water regime gradients

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We examined and compared the contents of organic chemical components (lignin-like compounds, total carbohydrates, extractives, and carbon) and nutrients (nitrogen, phosphorus, potassium, calcium, and magnesium) among the mosses *Calliergon giganteum*, *Hylocomium splendens*, and *Racomitrium lanuginosum*, and among three populations of *H. splendens* collected from habitats in contrasting water regimes in the Canadian high-Arctic tundra. C:N:P ratios were analyzed among and within moss species. Mosses from hydric habitats had lower total carbohydrate contents and higher nutrients contents than did mosses from drier habitats; however, we found no intraspecific variations in nitrogen and calcium contents in different populations of *H. splendens* along water-regime gradients. The contents of lignin-like compounds, extractives, and carbon showed no clear trends along water-regime gradients. Mosses from hydric habitats had lower C:N, C:P, and N:P ratios than did mosses from drier habitats, although we found no intraspecific variations in C:N ratios in *H. splendens* along water-regime gradients. These results suggest that the chemical properties of mosses, especially nutrient content, are strongly correlated with water availability in high Arctic tundra.