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Rb–Sr, Sm–Nd and Ar–Ar isotopic systematics of lherzolitic shergottite Yamato 000097

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Isotopic analysis of the Martian lherzolitic shergottite Yamato 000097 yields a Rb–Sr age of 147±28 Ma with an initial $^{87}Sr/^{86}Sr$ ratio of 0.710490±0.000072, a Sm–Nd age of 152±13 Ma with an initial ε ^{143}Nd-value of +11.7±0.2 and a ^{39}Ar–^{40}Ar age of ～260 Ma. The near concordance of these ages and the Rb–Sr and Sm–Nd initial isotopic signatures suggest that Yamato 000097 crystallized from low Rb/Sr, light rare earth element depleted source materials ～150 Ma ago. Although the ^{39}Ar–^{40}Ar age is significantly higher than the Rb–Sr and Sm–Nd ages, Yamato 000097 shows little to no evidence of trapped Martian atmospheric ^{40}Ar. The trapped 40Ar concentration of Yamato 000097 is similar to that of Zagami, suggesting basaltic and lherzolitic shergottites may have similarly inherited excess ^{40}Ar from their magmas. The Rb–Sr and Sm–Nd ages and initial 87Sr/86Sr and ε ^{143}Nd-values of Yamato 000097 and Yamato 793605 lie on the same isotopic ingrowth curves, suggesting that they came from very similar mantle sources. Allan Hills 77005 probably came from the same source, but Lewis Cliff 88516 appears to be from a distinct but similar source. Yamato 000097 represents the most recent magmatism from its source of which we have record, and is the youngest Martian meteorite for which concordant Rb–Sr and Sm–Nd ages have been determined.

Mineralogy and petrology of paired lherzolitic shergottites Yamato 000027, Yamato 000047, and Yamato 000097: Another fragment from a Martian "lherzolite" block

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Y000027, Y000047, and Y000097 are new lherzolitic shergottites that show a poikilitic texture with interstitial non-poikilitic basaltic areas. They have identical mineral compositions and petrography, confirming their pairing. The Y00 shergottites first crystallized olivine and chromite, which were then partially enclosed by low-Ca pyroxenes. Interstitial areas of melt then formed as a result of oikocryst accumulation. Plagioclase and Fe-rich pyroxene crystallized from the interstitial melt, forming the non-poikilitic basaltic areas. The cooling rate during crystallization of the

basaltic area was fast enough to preserve chemical zoning within olivine and pyroxene in poikilitic areas. The Y00s have similar petrology and mineralogy to other lherzolitic shergottites: all are likely to have originated from the same igneous block on Mars. The subtle mineralogical differences that exist are probably due to spatially variable cooling rates during crystallization of the basaltic area. In terms of mineral composition, the Y00s are most similar to (although distinct from) LEW88516, Y-793605, and NWA1950. Olivine and pyroxene compositions within interstitial areas may be related to the abundance of intercumulus melt, which, as with the nakhlite case, varied spatially in the igneous block. Although the Y00s and other lherzolitic shergottites (ALH77005, LEW88516, Y-793605, GRV99027, GRV020900, and NWA1950) were located within deeper levels of the block, RBT04262, a new shergottite similar in petrology and mineralogy to lherzolitic shergottites, may have been located at a slightly shallower level characterized by abundant, evolved interstitial melts.

Noble gases of the Yamato 000027 and Yamato 000097 lherzolitic shergottites from Mars

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We used total melting and stepwise heating methods to measure noble gases within bulk samples from Yamato 000027 and Yamato 000097 lherzolites as well as a melt-vein sample from Yamato 000027. He and Ne are dominated by cosmogenic noble gases. The obtained cosmic-ray exposure age of 4.6 ± 1.5 Ma, an average age based on cosmogenic ^{3}He, ^{21}Ne, and ^{38}Ar for these samples, is consistent with the ages of other lherzolitic shergottites, indicating a common impact event for the ejection of lherzolites from Mars. Heavy noble gases released from the bulk samples at low temperatures were elementally fractionated terrestrial atmosphere. Martian noble-gas isotopic signatures, ^{40}Ar/^{36}Ar = 1900 and ^{129}Xe/^{132}Xe = 1.3, were observed at high temperatures (>1000° C). The melt-vein sample released greater amounts of atmospheric Ar, Kr, and Xe at low temperatures than the bulk samples. Large amounts of Ar and Kr, as well as excess ^{40}Ar and ^{129}Xe, were evolved from the melt-vein sample at 1400° C, and the gas shows very high ^{36}Ar/^{132}Xe (=3100) and ^{84}Kr/^{132}Xe (=76) values. Maximum ^{40}Ar/^{36}Ar and ^{129}Xe/^{132}Xe values of the melt sample were 1100 and 1.6, respectively, at 1600° C. Cosmogenic Kr shows an absence of ^{80}Kr and ^{82}Kr produced by neutron capture on Br, which suggests a small pre-atmospheric body. Overall noble gas compositions for Y000027 and Y000097 support pairing for the Yamato 00 shergottites.

Seasonal changes in nauplii and adults of Calanus hyperboreus (Copepoda) captured in sediment traps, Amundsen Gulf, Canadian Arctic

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Arctic copepods were collected using time-series sediment traps in the Amundsen

Gulf, Canadian Arctic, as part of the CASES (Canadian Arctic Shelf Exchange Study) program. Four sediment traps were deployed at three stations (200 m depth for CA15, 200 and 400 m depths for CA18, and 200 m depth for CA20) from October 2003 to July 2004. We collected many copepod nauplii ranging in body length from 155 to 811 μm, among which nauplii (mostly N1–2) of Calanus with a size of ～190 μm apparently increased in abundance from February to mid-March. Mature-stage adult females (AF) of Calanus hyperboreus were collected in the traps from February to March, and adult males of C. hyperboreus appeared from November to December at all stations. The likely spawning period of these AF coincided with the occurrence period of ～190 μm-sized nauplii. This finding suggests that these nauplii were derived from C. hyperboreus and that their breeding began at the beginning of November or December at the latest, continuing through April in the Amundsen Gulf.

Unmanned Magnetometer Network Observation in the 44th Japanese Antarctic Research Expedition: Initial Results and an Event Study on Auroral Substorm Evolution

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In the 44th Japanese Antarctic Research Expedition (JARE-44) in 2003–2004, four unmanned magnetometers were deployed at four sites in the Antarctic to perform a network observation of upper atmosphere physics phenomena. Three of them were set about 80 km from Syowa Station, and the other was at Dome Fuji Camp, about 800 km from Syowa. Observations were carried out continuously with a maximum sampling rate of 1 second until they were terminated. The purpose of the close network around Syowa was to observe the two-dimensional distribution of the ionospheric equivalent current in a localized area within the field-of-view of the all-sky auroral imager at Syowa. Dome Fuji is located around the higher latitude edge of the auroral zone, while Syowa is at middle of it. Auroral observation with the all-sky imager was also carried out at Dome Fuji in 2003. Such a simultaneous auroral and magnetic observation both at Dome Fuji and Syowa enables us to study auroral activities in a larger scale. In this paper, the deployment and performance of the unmanned magnetometers in the JARE-44 are reported and one auroral substorm event is analyzed in some detail to show the usefulness of this kind of magnetometer network.