NOBLE GASES IN TWO SHERGOTTITES AND A NAKHLITE FROM ANTARCTICA: Y000027, Y000097, AND Y000593.

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Introduction: Three Martian meteorites from Antarctica have been investigated for noble gases: the shergottites Y000027 and Y000097, and the nakhlite Y000593. The results are currently prepared for publication [1].

Experimental: For each meteorite a pair of rim and interior samples was obtained. These were measured in four temperature steps: 500, 1000, 1400, and 1800 °C. For experimental details see [2].

Results: The amount of 4He in the four shergottite samples ranges between 33.8 and 39.4 x 10^-8 ccSTP/g. 22Ne is on the order of 14 x 10^-8 ccSTP/g. The nakhlite contains ~800 x 10^-8 ccSTP/g of 3He and 22Ne, respectively. The heavy noble gases show large differences between the rim and interior samples, with the rim having 1.5–38, and 1.4–20 times as much 84Kr and 132Xe compared to the corresponding interior.

Discussion and Conclusions: Helium loss: The 4He/3He ratio of the two shergottites is ~5, which indicates essentially complete loss of radiogenic 4He [3], as can be expected given their high shock pressure [4]. Hints for solar cosmic ray contributions to the neon budget can be seen in three of the four shergottite samples, and also – interestingly – the nakhlite Y000593 (rim).

Cosmic ray exposure ages: For calculating exposure ages we use the average chemical composition for shergottites from [5] and for the nakhlite from [6]. Y000027 and Y000097 are probably paired [4] and T(3+21+38) of this shergottite is 3.68 Ma, in good agreement with cosmic ray exposure ages for other lherzolitic shergottites (e.g., [6]). For Y000593 we obtain an age T (3+21) = 11.86±0.27 Ma, which is in good agreement with the exposure ages of the other nakhlites [7].

Terrestrial contamination and Martian components: The enrichment of heavy noble gases in the rim samples indicates severe contamination by air. From the 129Xe/132Xe and 84Kr/132Xe relationship it is evident that the incorporation mechanism caused elemental fractionation between Kr and Xe and that in the Y000027/97 and Y000593 (rim) samples any Martian signature is – with few exceptions – completely masked. However, the Y000593 interior sample shows the shift to the left that is characteristic for fractionated Martian atmosphere in the nakhlites. In all but one sample a Martian atmospheric component can be seen in the 1400 °C step. No further disentangling of Martian components is possible without measuring mineral separates, however.


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