NITROGEN AND NOBLE GASES IN A GLASS SAMPLE FROM LEW88516;

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The Antarctic meteorite LEW88516 has been classified (1) as a member of the SNC group of meteorites, specifically a shergottite. It is reported to be remarkably similar in mineralogy, petrogenesis and chemistry to the previously known ALH77005 shergottite (1-5), with both being compositionally distinct from other shergottites (2). LEW88516 shows pervasive shock features (2,3) and has been found to contain glass veins attributable to a shock origin (2). In an effort to determine whether the glass in LEW88516 contains any of the isotopically-heavy trapped nitrogen component observed in EETA 79001 glass (6,7), as well as the related high-$^{40}Ar/^{36}Ar$ and high-$^{129}Xe/^{132}Xe$ components (8,9), we undertook an analysis of an 11.9 mg glass sample (LEW88516,4) provided to us by H. Y. McSween, Jr. as part of a consortium study of this meteorite.

Nitrogen and noble gases were extracted from LEW88516,4 in a series of combustion steps at increasing temperatures followed by a final pyrolysis, using essentially the same procedures as those reported in (6) for EETA79001. Initial steps at 550°C were intended to remove any surface-sited nitrogen-containing contaminants, while the 700°C step was expected to show the onset of release of a trapped argon component, based on our previous data for EETA 79001 (6). It was hoped that the bulk of any trapped gas release would be concentrated in one of two steps at 1100°C and ~1400°C, maximizing our analytical sensitivity. Results of the analysis are shown in Tables 1 and 2. Except for He and Ne, data obtained for the 550°C steps will be omitted from further consideration on the assumption that they represent terrestrial contamination.

Table 1. Light noble gas and nitrogen yields and isotopic ratios from 11.9 mg of LEW 88516,4.

Step	^{4}He	^{3}He	^{22}Ne	$^{20}Ne/^{22}Ne$	$^{21}Ne/^{22}Ne$	^{36}Ar	^{40}Ar	^{38}Ar	ppm N	$\delta^{15}N$(‰)
550°C	8.	1.62	0.0654	6.8	0.168	0.0842	27.5	0.0144	0.295	5.0
	13.	0.03	0.0055	1.7	0.013	0.0076	2.0	0.0023	0.019	1.3
550°C	< 6.	0.205	0.1642	9.59	0.0421	0.0581	8.4	0.0117	0.001	----
	----	0.005	0.0068	0.72	0.0017	0.0076	1.4	0.0026	0.003	----
700°C	36.	1.80	0.2294	7.97	0.2103	0.0220	11.2	0.0031	0.105	4.7
	13.	0.04	0.0073	0.55	0.0050	0.0092	1.5	0.0025	0.009	3.1
1100°C	20.	2.83	0.671	2.59	0.6427	0.122	530	0.079	0.257	5.8
	15.	0.06	0.018	0.15	0.0079	0.052	30	0.013	0.017	2.0
1400°C	17.9	0.597	0.507	1.23	0.742	0.259	235	0.1007	0.011	42
	9.8	0.012	0.014	0.22	0.012	0.026	13	0.0087	0.003	34

Noble gas amounts given in units of 10^{-8} ccSTP/g. Errors given below the values. There are additional systematic errors of ±10% on He yields, ±15% on Ne yields, and ±10% on Ar yields.

On the face of it, there is nothing that stands out in our data. He and Ne, especially $^{3}He_{sp}$ (~7 x 10^{-8} ccSTP/g) and $^{21}Ne_{sp}$ (~8 x 10^{-9} ccSTP/g), are comparable to the amounts reported for ALH77005 (9). The ^{40}Ar seen could be generated, given the K content of LEW88516 (5), in about

3.5 x 10^9 years. The $\delta^{15}N$ values appear very ordinary, but there is a small enhancement in ^{129}Xe in the last step. On the whole, the trapped component being sought is not obviously present.

Table 2. Kr and Xe data from 11.9 mg of LEW 88516,4.

Step	^{84}Kr	^{132}Xe	$^{129}Xe/^{132}Xe$
550°C	1.534±0.070	0.580±0.055	0.976±0.037
550°C	0.551±0.051	0.343±0.042	1.016±0.033
700°C	0.151±0.092	0.555±0.052	0.972±0.034
1100°C	1.765±0.058	0.311±0.077	0.976±0.070
1400°C	1.16 ± 0.13	0.220±0.062	1.136±0.085

Gas amounts in units of 10^{-10} ccSTP/g. There are additional systematic errors of ±15% on the Kr yields and Xe yields.

If, however, one compares our ^{40}Ar yield to that of ALH77005 (9), whereby one sees a five-fold enhancement in our LEW88516 sample, and considers that the shergottites in general have apparently lost their radiogenic ^{40}Ar in a relatively recent shock event (10), another interpretation becomes possible. One can assume that ^{40}Ar is predominantly trapped, with only a small radiogenic contribution. On that basis, a comparison with ^{40}Ar data for EETA 79001 (6,7) indicates that there is about 20% of the EETA 79001 trapped component in LEW88516 glass. As the trapped component in EETA 79001 contributed about 84 ppb N (7), this would imply ~17 ppb of the heavy component in LEW88516. For a +600‰ to +650‰ N component, we would expect to see a 25‰ to 30‰ effect in $\delta^{15}N$. If one recalls that the shergottites contain "indigenous" nitrogen released at temperatures above 700°-800°C which lies in the range of -15‰ to -25‰ (11,12), the observed $\delta^{15}N$ values are in fact consistent with the presence of this amount of trapped component. The excess of ^{129}Xe seen at 1400°C, taking into account the uncertainties of the measurement, is also consistent with the presence of about 20% of the trapped component seen in EETA 79001. We would thus conclude that in fact there is a shock-implanted trapped component in the LEW88516 glass similar to that seen in EETA 79001, but lower in amount by about a factor of five.

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