NITROGEN, NOBLE GASES AND NUCLEAR TRACKS IN LUNAR METEORITES MAC88104/88105. S.V.S.Murty and J.N.Goswami, Physical Research Laboratory, Navrangpura, Ahmedabad 380009, INDIA.

The Antarctic meteorites MAC88104/88105, recovered in 1988, are recognised to be of lunar origin and are considered as members of the same fall. One sample from 88104 and five samples from 88105 have been received by us for a combined study of nitrogen, noble gases, trace elements, nuclear tracks and thermoluminiscence records to characterise their exposure and irradiation histories as well as their geochemical features. Here we report our preliminary results of N, noble gases and nuclear tracks in these samples. TL and trace element studies are in progress.

Nitrogen and noble gases have been analysed in the matrix samples of 88104/105 by static mass spectrometry using standard procedures [1]. The samples have been combusted at 400°C in 100 milli torr O_2 prior to the pyrolysis steps to get rid of surficial contaminants. Five temparature steps have been carried out to resolve the trapped and cosmogenic components. The results are given in table 1.

Nitrogen : The N content of 16.7 ppm with $\delta^{15}N$=22.29‰ for 88105 as determined by us is higher than the values of 7 ppm N and 5.7‰ $\delta^{15}N$ reported earlier [2]. In addition, there is also no indication for the presence of large terrestrial contamination in the $\leqslant$ 450°C fractions. The temperature release patterns for N are shown in Fig.1. The opposite sign for $\delta^{15}N$ in the 600°C step for the two samples could be due to release of spallogenic component even at such low temperatures. This is corroborated by the release pattern obtained for Ne and Ar isotopes also. The trends at higher temperatures are similar for both the samples. Most of the nitrogen should be of solar wind origin since the indegenous nitrogen of moon is a minor component with $\delta^{15}N$ = 13‰ [3].

Ne and Ar : Both Ne and Ar isotopic data indicate that the amounts of S.W. in these samples are extremely low. As noted earlier the spallation component is clearly visible in the low temperature factions for Ne and Ar in both the samples. Our Ne and Ar data are in good agreement with the data of Eugster [4]. Taking the chemical composition for these samples from Palme et al. [5] and computing the maximum GCR production rates from [6] we derived the minimum exposure ages for these samples. Both the ^{21}Ne and ^{38}Ar exposure ages are concordant and give a value of 180 Ma. In view of the short cosmic ray exposure duration in space [7] this long exposure reflects long residence time for these samples within the nuclear active region of the lunar regolith. The exposure ages and the isotopic data also support the pairing of 88104 and 88105 as a single fall.

Nuclear Tracks : Earlier attempts to reveal nuclear tracks in lunar meteorites were not successful due to the shocked nature of these anorthositic breccias. We report here the first observation of nuclear tracks in lunar meteorites. Out of the five samples analysed, we found nuclear tracks in three sub-samples of MAC 88105. The track densities in two of these samples are $\sim 10^5$ while the third sample has a track density of $\sim 2X10^5$. No signature of solar flare irradiation records has been found in any of the samples. If the observed tracks were produced entirely during the space-exposure (transit-time from moon to earth) of this meteorite, it cannot be $<$0.2 m.y. as this will not leave any allowance for ablation loss. The ^{26}Al data suggests space exposure of $\leq$ 0.1 or 0.6 m.y. depending on zero or 1 m.y. terrestrial residence time for this meteorite [7,4]. The track data rule out the first value and constrains the exposure age to within 0.2 to 0.6 m.y. If on the otherhand we attribute the track production to have taken place entirely on the lunar surface, one can obtain a sub-decimeter age (effective exposure within the top 10 cm of lunar regolith) of less than 2 to 3 m.y. Data from TL studies will allow us to put further constraints on these limits.

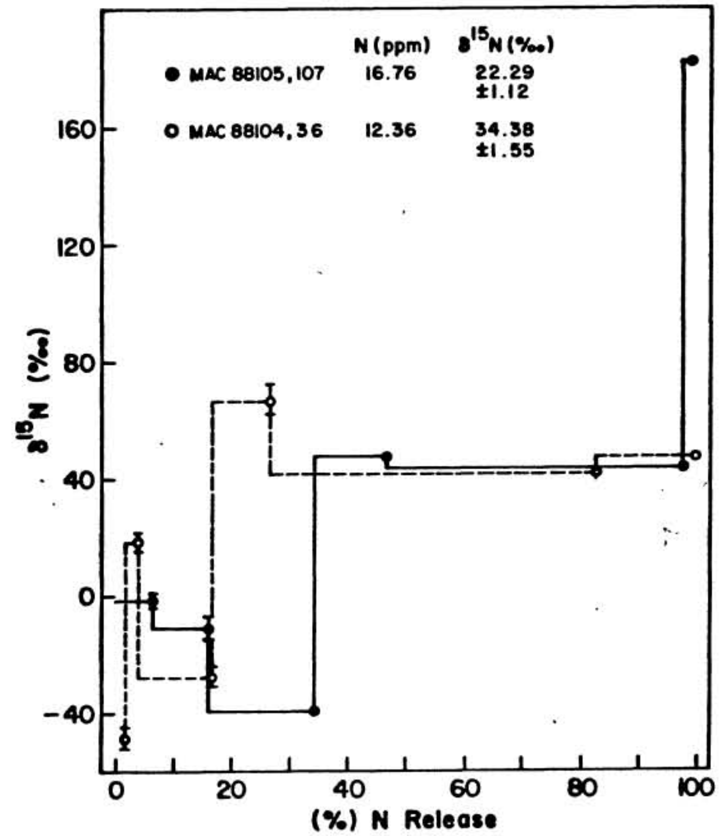

Fig.1 : Stepwise release pattern of N for MAC88104/105

Table 1 : N, Ne and Ar in MAC 88104,36 and MAC 88105,107

Sample	N (ppm)	δ^{15}N (‰)	^{22}Ne (10^{-8}ccSTP/g)	^{36}Ar	^{20}Ne/^{22}Ne	^{21}Ne/^{22}Ne	^{38}Ar/^{36}Ar	^{40}Ar/^{36}Ar
MAC 88104,36 21.88mg	12.3	34.38 ±1.55	39.5	119	5.156 .019	0.4724 .0017	0.3685 .0005	13.57 .10
MAC 88105,107 14.64mg	16.7	22.29 1.12	38.7	128	5.332 0.028	0.4585 0.0022	0.3769 .0001	11.27 .18

Errors on isotopic ratios represent 95% confidence limit. Errors in concentration are ±15%.

References : [1] Murty, S.V.S. (1990), LPSC, 21, 829, [2] Grady, M.M. and Pillinger, C.T. (1990), LPSC 21, 427, [3] Kerridge, J.F., Eugster, O., Kim, J.S. and Marti, K. (1990), LPSC 21, 623, [4] Eugster, O (1990), LPSC 21, 337, [5] Palme, H. et al. (1990), LPSC 21, 930, [6] Hohenberg, C.M. et al. (1978), Proc. Lunar Planet Sci. Conf. 9th 2311, [7] Nishiizumi, K. et al. (1990), LPSC 21, 897.