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Noble gases in Baszkówka and Mt. Tazerzait

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Concentration and isotopic composition of noble gases have been measured in bulk samples of the L5 chondrites Baszkówka and Mt. Tazerzait. Compared to other chondrites both meteorites have very large cosmic-ray exposure ages of 74 and 60 million years, respectively. During their history both meteorites were not involved in major thermal events.

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Concentration and isotopic composition of He, Ne and Ar, as well as the concentrations of the main isotopes of Kr and Xe were determined using techniques and methods recently described by Scherer and Schultz (2000).

We have analysed three bulk samples of Baszkówka and for comparison two bulk samples of Mt. Tazerzait. Results are given in Table 1.

Gas retention ages are calculated from the concentrations of the radiogenic isotopes ^{4}He and ^{40}Ar and mean concentrations of U and K in L-chondrites of 15 ppb and 870 ppm, respectively (Mason, 1979). The cosmogenic component of ^{4}He is calculated using $(^{4}He/^{3}He)_c = 6.1$ (Alexeev, 1998), ^{40}Ar is taken as completely of radiogenic origin. Results of calculated gas retention ages are compiled in Table 2. Both meteorites exhibit comparatively large gas retention ages, especially the gas retention age of Mt. Tazerzait is high. Thus, the material of both meteorites was not involved in the major thermal event several 100 Ma ago (Anders, 1964; Alexeev, 1998). Furthermore, also a late solar heating is excluded. The concentrations of trapped 84Kr and 132Xe as well as the 129Xe/132Xe ratios are typical for chondrites of type 5.

Table 1

Noble gas concentrations (in 10^{-8} cm^3 STP/g) in Baszkówka and Mt. Tazerzait; uncertainties of individual measurements for He, Ne and Ar are estimated to be < 5%, for Kr and Xe < 10%; larger variations are due to sample inhomogeneities

Name	Weight [mg]	^{3}He	^{4}He	^{20}Ne	^{21}Ne	^{22}Ne	^{36}Ar	^{38}Ar	^{40}Ar	^{84}Kr	^{132}Xe	^{129}Xe/^{132}Xe
Baszkówka	100.8	122.2	2168	18.61	19.19	22.87	2.63	2.77	5197	0.010	0.020	1.52
	103.3	125.2	2073	16.82	17.32	20.68	3.13	2.95	5668	0.016	0.029	1.30
	103.1	114.0	2197	15.51	15.90	18.96	3.33	2.85	4779	0.015	0.023	1.29
mean	–	120.5	2146	16.98	17.47	20.84	3.03	2.86	5215	0.014	0.024	1.37
	–	±4.7	±53	±1.27	±1.35	±1.60	±0.29	±0.07	±363	±0.003	±0.004	±0.11
Mt. Tazerzait	120.0	100.0	2676	19.80	21.65	23.53	3.56	2.85	6783	0.009	0.018	–
	101.9	96.7	2626	18.96	20.70	22.57	3.52	2.96	7261	0.009	0.013	1.14
mean	–	98.3	2651	19.38	21.18	23.05	3.54	2.91	7022	0.009	0.016	1.14
	–	±1.7	±25	±0.42	±0.47	±0.48	±0.02	±0.06	±239	±0.000	±0.003	–

Table 2

Radiogenic ^{4}He and ^{40}Ar and calculated gas retention ages as well as exposure ages and the shielding parameter $(^{22}Ne/^{21}Ne)_c$ of Baszkówka and Mt. Tazerzait

Name	$^{4}He_r$	$^{40}Ar_r$	Gas retention age [Ga]		$(^{22}Ne/^{21}Ne)_c$	Exposure ages [Ma]			
	[10^{-8} cm^3 STP/g]		U, Th-^{4}He	K-^{40}Ar		^{3}He	^{21}Ne	^{38}Ar	mean
Baszkówka	1411	5215	3.15	4.45	1.193	76.4	72.1	74.6	74.4±2.2
Mt. Tazerzait	2050	7022	3.95	4.83	1.089	60.6	57.6	61.7	60.0±2.1

Cosmic-ray exposure ages are calculated from the cosmogenic nuclides ^{3}He, ^{21}Ne and ^{38}Ar using procedures and production rates of Eugster (1988). Results are given Table 2. The mean exposure ages of 74 and 60 Ma for Baszkówka and Mt. Tazerzait, respectively, are extremely high compared to other L-chondrites, or chondrites in general (Fig. 1). This could imply that the parent body of these meteorites is located in the asteroidal belt far from resonances that bring meteoroids to Earth-crossing orbits.

The shielding sensitive parameter $(^{22}Ne/^{21}Ne)_c$ of Baszkówka is with 1.193 high and indicates that the measured samples comes from a location with low shielding. A lower limit of the pre-atmospheric radius of about 11 cm is given by the recovered mass of 15.5 kg. If a solar cosmic-ray contribution is excluded, the ablation loss during atmospheric entry should not exceed a few centimetres (see Graf *et al.*, 1990). The Mt. Tazerzait sample, however, comes from a shielded position and thus was part of a much larger meteoroid.

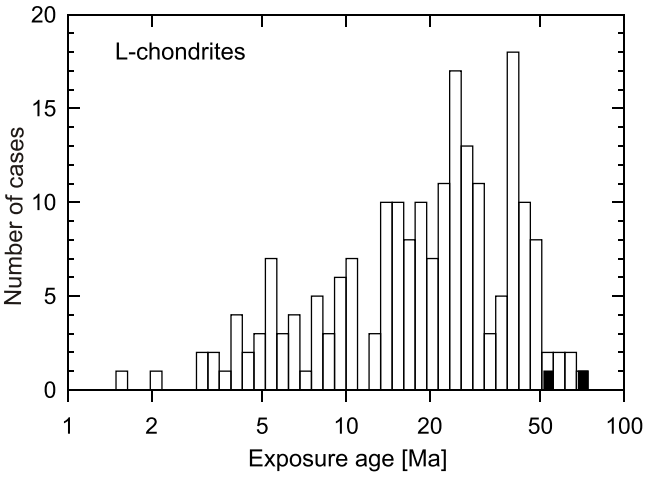

Fig. 1. Comparison of exposure ages of L chondrites (taken from Lipschutz and Schultz, 1998) with those of Baszkówka and Mt. Tazerzait

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