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COSMIC RAY RECORDS IN ANTARCTIC METEORITES
- A DATA COMPILATION OF THE COLOGNE-ZÜRICH-COLLABORATION -

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The cosmogenic radionuclides ^{10}Be, ^{26}Al and ^{53}Mn and noble gases were determined in more than 28 meteorites from Antarctica by nuclear analytical techniques and static mass-spectrometry, respectively. The results are summarized in table 1 and table 2. (Some of the data were published previously (6-9)). The concentrations of ^{26}Al and ^{53}Mn (table 1) are normalized to the respective main target elements and given in dpm/kg Si_{eq} and dpm/kg Fe. The errors stated include statistical as well as systematical errors. For noble gas concentrations (table 2) estimated errors are 5% and for isotopic ratios 1.5%. Cosmic ray exposure ages T_{21} were calculated by the noble gas concentrations and the terrestrial residence times (T) on the basis of the spallogenic nuclide ^{26}Al. The suggested pairing (1o) of the LL6 chondrites RKPA 8o238 and RKPA 8o248 and the eucrites ALHA 76oo5 and ALHA 79o17 is confirmed not only by the noble gas data but also by the concentrations of the spallation produced radionuclides. Furthermore, ALHA 8o122, classified as H6 chondrite (1o), has a noble gas pattern which suggests that this meteorite also belongs to the ALHA 8o111 shower.

References:

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Meteorite	Class	Sample	^{10}Be + [dpm/kg]	^{53}Mn + [dpm/kg Fe]	Sample	^{26}Al + [dpm/kg Si_{eq}]	T [10^5 y]
ALHA 76005	Euc	.56	22.8 ± .8	512. ± 74.		266. ± 26. 2)	
ALHA 77009	H4	.11	13.9 ± 1.0	302. ± 28.		167. ± 11. 2)	2.7 ± 1.8
ALHA 77015	L3	.31	14.4 ± 1.2	145. ± 13.		172. ± 20. 1)	5.3 ± 2.2
ALHA 77216	L3	.45	21.1 ± .8	379. ± 34.		191. ± 15. 2)	3.1 ± 1.8
ALHA 77257	Ure	.69	21.2 ± .8	271. ± 56.	.14	165. ± 7.	
ALHA 77258	H6	.25	20.2 ± 1.0	478. ± 52.		151. ± 11. 2)	8.0 ± 2.0
ALHA 77261	L6	.21	22.7 ± 1.4	271. ± 21.		172. ± 20. 2)	3.4 ± 2.1
ALHA 77272	L6	.37	15.9 ± .6	245. ± 32.		168. ± 19. 2)	3.7 ± 2.5
ALHA 77285	H6	.14	16.8 ± .8	410. ± 38.		198. ± 21. 2)	3.5 ± 2.1
ALHA 77297	L6	.25	25.0 ± .9	419. ± 37.		335. ± 33. 2)	≤ .2
ALHA 78043	L6	.20	19.4 ± .7	442. ± 35.		158. ± 15. 2)	6.6 ± 1.9
ALHA 78084	H4	.26	16.9 ± .7	330. ± 34.	.19	246. ± 7.	≤ 1.7
		.34	18.4 ± 1.2	314. ± 32.	.45	224. ± 7.	
		.43	18.3 ± .7	299. ± 30.	.84	239. ± 7.	
		.62	17.5 ± .7	340. ± 34.			
		.66	18.2 ± .6	356. ± 35.			
		.68	18.2 ± 1.0	323. ± 31			
		.70	17.6 ± 1.0	326. ± 33.			
		.76	18.6 ± .7	304. ± 32.			
		.80	18.2 ± .8	359. ± 36.			
		.83	19.0 ± .9	322. ± 34.			
ALHA 78102	H5	.15	19.6 ± .7	327. ± 37.		182. ± 16. 2)	2.9 ± 2.1
ALHA 78113	Aub	.47	19.0 ± 1.0		.32	327. ± 23.	
ALHA 78114	L6	.19	16.8 ± .6	380. ± 34.		182. ± 16. 2)	3.6 ± 1.8
ALHA 79017	Euc	.52	23.8 ± .8	530. ± 75.	.51	288. ± 14.	
ALHA 80111	H5	. 6	19.1 ± .6	285. ± 28.	. 0	237. ± 9.	4.7 ± 1.4
ALHA 80122	H6	. 6	20.7 ± 1.0	364. ± 34.	. 0	315. ± 14.	≤ 1.4
ALHA 80124	H5	. 3	17.3 ± .7	288. ± 28.	.2/3	377. ± 30.	≤ 1.9
EETA 79001	Sher	(A)	5.3 ± .4	62. ± 42.	(A)	119. ± 6.	3.2 ± 1.7
EETA 79002	Dio	.42	23.0 ± .8	357. ± 73.	.16	287. ± 11.	
EETA 79004	Euc	.67	22.2 ± .8	344. ± 67.	.58	266. ± 13.	
EETA 79005	Euc	.65	23.0 ± .8	419. ± 70.	.13	286. ± 10.	
EETA 79006	How	.31	23.8 ± .8	436. ± 72.	. 2	273. ± 16.	
RKPA 78002	H4	.38	17.9 ± 1.2	335. ± 29.	.35	305. ± 13.	≤ 1.6
		.41	17.3 ± .8	340. ± 31.	.40	273. ± 12.	2.0 ± 1.4
		.48	17.5 ± .9	348. ± 32.	.46	303. ± 9.	2.1 ± 1.2
RKPA 80201	H6	.11	18.1 ± .6	286. ± 26.	.10	203. ± 8.	2.9 ± 1.3
		.14	20.5 ± 1.0	327. ± 30.	.13	206. ± 9.	3.8 ± 1.4
		.16	19.0 ± 1.0	300. ± 27.	.15	245. ± 10.	1.8 ± 1.3
RKPA 80213	H6	. 0	14.5 ± 1.0	240. ± 24.	. 0	284. ± 30.	≤ 1.7
RKPA 80238	LL6	. 0	19.7 ± 1.0	357. ± 34.	. 0	267. ± 14.	≤ .4
RKPA 80248	LL6	. 7	19.2 ± .9	338. ± 33.	.0/7	203. ± 18.	≤ 3.3

+ Average saturation activity : ^{10}Be = 19.0 ± 0.7 dpm/kg meteorite ,
^{26}Al calculated according to (11), ^{53}Mn calculated according to (12) and (3)

Table 1 : ^{10}Be-, ^{53}Mn- and ^{26}Al-concentrations and terrestrial residence times of Antarctic meteorites

sample	class	3-He	4/3	20-Ne	21-Ne	22/21	20/22	38-Ar	36/38	40-Ar	T_{21}	T_{38}
		(Concentrations in 10^{-8} cm^3STP/g)									(Ma)	
ALHA76005	Euc	12.3	85.7	2.09	2.16	1.15	.84	1.79	.69	930	11.5	13
ALHA77009	H6	20.5	82.7	3.96	4.16	1.14	.84	.64	1.92	3530	16	
ALHA77015	L3	3.60	283.	2.56	.82	1.34	2.33	15.5	5.29	2600	2.3	
ALHA77216	L3	74.2	>1620	926	12.0	7.78	9.91	6.38	4.22	3750	~29	
ALHA77257	Ure	14.9	47.1	14.3	2.87	1.52	3.28	358	5.29	600	~6.5	
ALHA77258	H6	61.6	35.1	11.4	12.5	1.09	.84	2.10	1.69	2340	40	
ALHA77261	L6	12.1	58.6	3.63	2.12	1.23	1.39	.34	1.58	990	8.0	
ALHA77272	L6	8.32	29.9	1.65	1.31	1.25	1.00	.27	2.03	1520	6.5	
ALHA77285	H6	53.1	24.2	11.5	12.6	1.08	.85	1.50	.89	2490	37	
ALHA77297	L6	74.4	10.1	15.0	16.4	1.09	.84	2.17	1.23	3640	48	
ALHA78043	L6	30.9	13.2	7.32	6.56	1.13	.99	.90	.93	1910	21	
ALHA78102	H5	19.5	86.1	2.90	2.98	1.18	.82	.51	1.29	3410	13.5	
ALHA78113	Aub	35.6	12.0	10.6	11.5	1.09	.84	.53	1.46	1220	~23	
ALHA78114	L6	32.0	11.6	7.51	5.98	1.16	1.08	.87	.93	1790	20	
ALHA79017	Euc	12.4	167.	2.03	2.07	1.15	.86	2.12	.71	2110	11	15
ALHA80111	H5	6.35	407.	5.60	1.24	1.38	3.24	.39	3.32	5580	~4.0	
ALHA80122	H6	6.53	682.	9.37	1.29	1.58	4.57	.39	3.11	5450	~4.0	
ALHA80124	H5	5.34	377.	5.15	1.22	1.35	3.11	.47	3.51	4740	~4.0	
EETA79001(A)	Sher	1.00	39.3	.168	.138	1.27	.96	.076	2.21	105	.5	
EETA79002	Dio	39.8	4.9	5.96	6.09	1.18	.83	.47	.73	10	~17	
EETA79004	Euc	20.2	235.	4.33	4.65	1.17	.79	2.96	.75	1290	25	21
EETA79005	Euc	31.1	109.	4.61	4.67	1.18	.84	3.60	.77	1330	25	25
EETA79006	How	15.9	103.	4.08	4.12	1.18	.84	3.11	.77	1000	~15	
RKPA78002,38	H4	9.73	148.	2.54	2.38	1.09	.98	.46	2.67	5550	7.0	
RKPA78002,41		9.41	137.	2.31	2.00	1.12	1.03	.43	2.44	5140	6.5	
RKPA78002,48		9.27	118.	2.60	1.89	1.12	1.21	.46	2.24	4600	5.5	
RKPA80201,11	H6	11.6	106.	2.03	1.86	1.14	.96	.45	1.88	5460	7.0	
RKPA80201,14		12.0	101.	2.13	2.05	1.13	.92	.42	1.80	5740	7.5	
RKPA80201,16		11.5	117.	2.06	1.82	1.13	1.00	.44	1.75	5210	6.5	
RKPA80213	H6	55.4	3092	1076	4.19	21.5	12.0	31.8	5.35	3650	~5	
RKPA80238	LL6	35.7	44.9	7.07	5.76	1.20	1.02	.96	1.30	5360	24	
RKPA80248	LL6	38.7	41.5	6.02	5.83	1.20	.86	.93	1.07	5600	25	

Table 2: Concentrations and isotopic ratios of noble gases and noble gas exposure ages of Antarctic meteorites.

Sample weights ranged between 130 - 250 mg. Shielding corrected 21-Ne exposure ages for chondrites are calculated, after correction for trapped gas contributions, according (3), except for the values marked by "~", where trapped gas concentrations were too high. For these samples, $(22\text{-Ne}/21\text{-Ne})_{cos}=1.1$ and $(22\text{-Ne}/21\text{-Ne})_{tr}=32$ were assumed. 21-Ne exposure ages for achondrites were estimated with the elemental production rates given in (4), assuming mean chemical composition for the respective meteorite classes (5). The 38-Ar exposure ages of the eucrites are calculated with the production rates given in (4).