COSMOGENIC RADIONUCLIDES IN H-CHONDRITIC METEORITE FINDS

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The majority of ordinary meteorite finds, including those from Antarctica, do not promise exciting new insights into the formation of their parent bodies or the beginning of the solar system. This is especially expected, if the finds are from mid-latitudes and already significantly altered by weathering. Chances are that weathering has also affected the cosmogenic nuclide content of such meteorites. Herzog and Cressy (1976) [1] describe the possible loss of ^{26}Al and noble gases from four weathered stony meteorites, a result which could not be confirmed for ^{53}Mn in samples of the same objects [2].

If weathering affects cosmogenic radionuclides differently, then those with the best retention can be used to reconstruct the cosmic ray exposure history and possibly also the terrestrial residence time of meteorite finds. If anything at all, the relatively high abundance of ordinary H- and L-chondrite finds provides at least chances to find meteorites with unusual exposure histories so much sought after among them, provided that also weathering effects do not disturb the data interpretation.

The meteorites analyzed in this study have all in common to be finds; they are almost exclusively H-chondrites, and most of them were extremely weathered as derived from their color and texture. The cosmogenic radionuclide ^{53}Mn ($T_{1/2}$= 3.7 x 10^6 years) was determined in these finds and the results are presented in Table 1.

TABLE 1

Meteorite	Type	Recovered Mass [kg]	Year of Find	53Mn [dpm/kg Fe]
Channing	H5	15.3	1936	159 ± 10
Gilgoin	H5	147.5	1889	429 ± 35
Gladstone	H6	57.3	1936	168 ± 11
Hobbs	H4	2.3	1933	146 ± 9
Hugoton	H5	350	1927/35	384 ± 27
Nashville	L6	25	<1939	179 ± 15
Salaices	H4	3.9	1971	183 ± 11
Summerfield	chond			388 ± 31
Tokio	chond	6.6	1974	298 ± 21
Wynella	H4	40	1945/66	296 ± 24

Despite the ^{53}Mn contents of Table 1 very little is known of the H-chondritic meteorite finds. Light noble gases were determined only for Channing, Gilgoin, and Hugoton.

The light noble gas ratios of Channing: $^{22}Ne/^{21}Ne = 1.05$ and $^{3}He/^{21}Ne = 3.02$ [3], are both significantly lower than those of very well shielded samples of Jilin [4]. This may indicate noble gas losses by weathering [1] and consequently make the interpretation of the formally derived exposure age of $T_{exp} = 5 \times 10^6$ y difficult [Nishiizumi et al. (1980),5]. The very low ^{53}Mn concentration of 159 dpm/kg Fe suggests a much shorter exposure age unless shielding effects can be quoted.

Of Gilgoin several fragments were found. Light noble gas measurements suggest a wide range of shielding depths, indicated by the $^{22}Ne/^{21}Ne$-ratios of 1.16 [6] and 1.07 [7], respectively. Again, ^{3}He-losses cannot be excluded for the least shielded sample. The preatmospheric mass of about 290 kg, determined via cosmic ray tracks [8], is in agreement with the noble gas data spread. However, the ^{21}Ne-exposure age of about seven million years can explain the ^{53}Mn-activity of 429 dpm/kg Fe only if the sample analyzed came from the location of maximum ^{53}Mn production within the 20 cm radius object.

Of the two light noble gas measurements available to date for Hugoton, one can be excluded from further consideration, because the low $^{22}Ne/^{21}Ne$-ratio of 1.01 is probably caused by weathering losses from the fragment analyzed [7,1]. The noble gas data of Stauffer et al. (1961) [9] indicate considerable selfshielding: $^{22}Ne/^{21}Ne = 1.08$; the preatmospheric mass of Hugoton was determined to be about 810 kg [8]. The ^{21}Ne-exposure age of about 8×10^6 years agrees well with the ^{53}Mn-activity of 384 dpm/kg Fe.

While noble gas weathering losses are possible for Channing and Hugoton, ^{53}Mn losses are not very probable. Including the meteorites considered by Herzog and Cressy (1976) [1] noble gas weathering losses are possible for six meteorites which do not show any sign of ^{53}Mn loss. Though shielding depth corrections cannot be applied on the ^{53}Mn-results in Table 1, formal ^{53}Mn exposure ages assuming average shielding and a ^{53}Mn-production rate of 434 dpm/kg Fe can be calculated. Formal ^{53}Mn ages in millions of years are: Hobbs 2.2, Channing 2.4, Gladstone 2.6, Nashville 2.8, Salaices 2.9, Wynella 6.1, Tokio 6.8, Hugoton and Summerfield $\geq$ 10.

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