TERRESTRIAL AGES AND PETROLOGIC DESCRIPTION OF ROOSEVELT COUNTY METEORITES; A. J. T. Jull[1], F. Wlotzka[2] and D. J. Donahue[1]. [1] NSF Accelerator Facility for Radioisotope Analysis, University of Arizona, Tucson, Arizona 85721, USA. [2] Abteilung Kosmochemie, Max-Planck-Institut für Chemie, 6500 Mainz, Germany.

Huss and Wilson (1) first reported on the discovery of a large concentration of meteorites in Roosevelt County, New Mexico in 1973. Since that time, over 150 meteorites have been recovered, of which 65 have been characterized (2,3). The meteorites are found in Roosevelt County and adjoining counties. A large concentration has been found in blowouts near Delphos, NM. About 30 of the 55 meteorites studied by Sipiera et al (2) and Scott et al (3) came from this location. We report in this paper on studies of the ^{14}C content the meteorites to determine terrestrial age (4). The ^{14}C measurements were done by accelerator mass spectrometry. The petrology of the meteorites was assessed to determining the degree of weathering, and pairing, as was previously reported for Libyan meteorites (5).

Weathering effects are strong in the Roosevelt County finds. Metal and troilite are progressively oxidized (grades A, B, C: minor, medium, heavy oxidation), and after that the silicates are also altered. At first phyllosilicates form locally in olivine (grade D), then more massively in all mafic silicates (grade E).

Weathering grades and ^{14}C terrestrial age determinations of the meteorites studied are shown in table 1. Sample sizes were 0.17 to 0.77g. The terrestrial ages of the meteorites ranges from 7,000 years to over 46,000 years. Estimates of ^{14}C age over 40,000 years are dominated by in-situ production of ^{14}C by cosmic rays at the collection site (6), and should be considered limits. The most striking feature of the distribution of ages is the lack of any young meteorites $<7,000$ years old. There is also little structure to the age distribution, and the number of meteorites at 25 to 30 thousand years is probably due to pairing of the four H-5 breccias. A correlation between age and weathering grade is apparent (fig. 1), but there is no decrease in number of meteorites with increasing weathering grade. The meteorites are gradually oxidized, but do not necessarily disintegrate as a result of this oxidation. The age of many of the meteorites appears to be consistent with the age of the cover-sands in Roosevelt County which are expected to be 30,000 to 40,000 years in age (7). We propose that the reason for this age distribution of the meteorites is that the blow-out events which exposed the older Pleistocene cover-sands removed the younger overlying material, including the younger meteorites which would have been contained in it. As most of the Roosevelt County meteorites are $<100g$, this is a reasonable hypothesis. The "residence half-life" of the meteorites may be greater than the age range studied. The observed age distribution does not show a simple dependence which would be expected for a constant infall rate of meteorites (8) on a stable surface, and a simple exponential (weathering-like) process which removes older meteorites. This should result in an age distribution where there are more younger meteorites than older ones (9). Some areas where large numbers of meteorites have been found do seem to show this distribution, a good example may be Yamato (10). However, other Antarctic sites such as Allan Hills (11) and the Libyan meteorites (5) show that other processes must also be affecting the age distribution of meteorites.

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Zolensky et al (12) have discussed the meteorite distribution at Roosevelt County with a view to assessing the infall rate of meteorites. These authors used the ages measured by Boeckl (13) to estimate the time-scale. In order to assess infall rate, it is important firstly to know the terrestrial ages of the meteorites, as well as the efficiency of recovery per unit area. If the age range of the meteorites from 7 to 50 thousand years can be used as an estimate of the age range of all Roosevelt County meteorites, one can estimate an infall rate for this time of about 100 meteorites per 10^6 years per km^2. This is very close to the estimate of Halliday et al (8) of 83, given the assumptions involved.

References: (1.) G. Huss and I. Wilson, Meteoritics, 8, 287 (1973). (2.) P. Sipiera et al, Meteoritics, 22, 504 (1987). (3.) E. Scott et al, Meteoritics, 21, 303. (4.) A. J. T. Jull et al, Geochim. Cosmochim. Acta, 53, 2095. (5.) A. J. T. Jull et al, Geochim. Cosmochim. Acta, 54, 2895. (6.) A. J. T. Jull et al, Nucl. Instrum. Methods, in press. (7.) V. T. Holliday, Geol. Soc. Amer. Bull., 101, 1598 (1989). (8.) I. Halliday et al, Meteoritics, 24, 173 (9.) M. Freundel et al, Geochim. Cosmochim. Acta, 50, 2663. (10.) A. J.T. Jull et al, unpublished results (11.) K. Nishiizumi et al, EPSL, 93, 289. (12.) Zolensky et al, Meteoritics, 25, 11. (13) R. S. Boeckl, Nature, 236, 25.

Table 1: ^{14}C terrestrial age of Roosevelt County meteorites

Sample	Type	Weathering grade	^{14}C,dpm/kg	Terr age[1] (yr.)
RC-032	H-5 Breccia	C	1.85±0.22	26,200±1600
RC-034	H-5 Breccia	C	2.05±0.05	25,400±1300
RC-035	L-6	D	0.59±0.04	36,500±1400
RC-037	H4-5	E	0.07±0.05	>46,000[3]
RC-040	H-5	C	1.47±0.05	28,100±1300
RC-041	L-5	B-C	3.12±0.08	22,600±1300
RC-043	H-5 Breccia[2]	C	0.88±0.03	32,300±1350
RC-044	L-6	D	1.10±0.20	31,000±2000
RC-045	L-6	B	6.49±0.09	16,500±1300
RC-046	H-5 Breccia[2]	B-C	1.91±0.05	25,900±1300
RC-048	L-6[2]	D	0.20±0.04	>44,000[3]
RC-049	LL-4	E	0.35±0.19	>37,500[3]
RC-056	H-5	E	0.26±0.19	>38,000[3]
RC-058	LL-4	B	22.2±0.2	7,000±1300
RC-059	L-6	D	1.97±0.08	26,400±1200
RC-063	L-4	B	17.6±0.07	8,300±1300
RC-064	H-5	C	2.80±0.08	22,800±1300
RC-065	H-5[2]	B-C	7.80±0.20	14,300±1300

[1] The quoted errors in age include analytical precision,and ±15% uncertainty in chemistry and shielding of the samples.
[2] Reclassification, different from previous work (2,3).
[3] 2σ error limits. The ^{14}C observed is from in-situ production.

Fig 1: Correlation of weathering grade and terrestrial age.