TERRESTRIAL AGE AND PETROLOGIC TYPE OF METEORITES FROM THE LIBYAN DESERT; A. J. T. Jull[1], F. Wlotzka[2], H. Palme[2] and D. J. Donahue[1]. [1]NSF Accelerator Facility for Radioisotope Analysis, University of Arizona, Tucson, AZ 85721, USA [2]Max-Planck-Institut fÜr Chemie, 6500 Mainz, West Germany.

Sixty-one meteorites were collected near Daraj, in the Hammadah (stony desert) al Hamra, western Libya (29°37'N, 11°45'E), from an area of about 80 by 80 km. All the meteorites are ordinary chondrites, but of various classes and petrologic types. The meteorites collected have been grouped into different falls on the basis of chemical-petrologic data and geographic information. A high concentration of H5 chondrites was found in a "strewn-field" of about 10X5 km, apparently belonging to the same event (fall event 1). Two other H5 chondrites were assigned to fall events 2 and 3. Fall event 4 is less well defined. Ten H4 chondrites were lumped together, most of which were found in a 30X16 km area, 40km SE of fall event 1. H6 chondrites define at least two falls, events 5 and 6. The meteorites from fall event 6 were found rather close together, and show shock veins and undulose extinction of olivine, whereas members of fall event 5 are less crystalline and are not shocked. Fall event 10 is rather well characterized, all six L6 chondrites show multiple shock veins and maskelynite (shock facies d [1]). Four of these were found in a linear array of 45 km in length, the position of the other two is unknown. Two LL4 chondrites were classed as fall event 12. A minimum of 13 fall events is required to explain the chemical and petrographic differences among the meteorites collected in the Hammadah al Hamra.

Meteorites from 9 different fall events were selected for ^{14}C analyses. Samples of about 0.5g were melted with an iron combustion accelerator in a flow of oxygen. Evolved CO_2 is purified and reduced to graphite for accelerator analysis (2). The ^{14}C results are shown in the table. With two exceptions, the results fall into the range of 3,500 to 7,600 years. The ages for the 3 different samples of fall event 1 agree quite well, the same is true for the samples of fall event 10. The reproducibility of terrestrial age measurements appears to be better than the ±1300 yr assigned on the basis of earlier measurements (2). The L4 group (fall event 8) contains at least two falls, one of them, sample DA 119, has the highest age found, of 35,000+3000 years. This difference increases the minimum number of fall events to 14. Considering that 31 of the samples belong to six well-defined fall events (1,2,3,6,10 and 12), it is possible to define an upper limit of 36 fall events.

The number of falls observed in the collection area of 6,400 km2 can be compared with estimated meteorite fall rates, such as those derived from the fireball observations of the Canadian Meteor Network (3). Excluding the two oldest falls, we obtain 12 to 34 falls per 6,400 km2 in about 10,000 years, which can be compared with the calculated estimates of 560 with masses >1kg. Uncertainties in these estimates and incomplete recovery may be responsible for this discrepancy. In any case, a concentration mechanism is not needed to explain the apparently high number of meteorite finds in the Hammadah al Hamra.

The cut-off at the high end of the age distribution may be connected to climatic change in this region. Several authors have found geologic evidence that the Sahara climate was much more humid up to about 8,000 years BP. This time coincides with the upper limit of the meteorite-age cluster. Weathering and disintegration of meteorite falls before 8,000 BP could have been much more intensive, allowing only a few meteorites to survive. All the meteorites show signs of weathering. Thin sections show the replacement of metal and later troilite by iron oxides, and the filling of cracks with oxide veins. Accordingly, they were classified into three weathering categories from A (minor) to C (heavy). Meteorites <7,000 years old showed only categories A and B. The results can be compared to the terrestrial age distribution of U. S. meteorites, and Antarctic sites. The "median" age appears to be longer than estimated by Boeckl (4). In any case, these data indicate that the processes for accumulation and disappearance of meteorites are controlled by the same processes as at other sites, though the rates of weathering and distribution of ages are different.

References: (1) Dodd, R. T, and Jarosewich, E. (1979) Earth Planet. Sci. Lett., 44, 335 (2) Jull, A. J. T., et al. (1989) Geochim. Cosmochim. Acta, 53, 2095 (3) Halliday, I., et al. (1989) Meteoritics, 24, 173 (4) Boeckl, R. (1972) Nature, 236, 25.

^{14}C terrestrial ages for different fall events defined by chemical and petrologic criteria.

Event	Sample	Class.	Weath.	^{14}C, dpm/kg	^{14}C age ($\pm$1300)
1	DA 008	H5	A	28.9±0.3	3,500
	DA 013	H5	B	25.5±0.3	4,500
	DA 102	H5	A	27.4±0.3	3,900
2	DA 009	H5	A	22.9±0.2	5,400
4	DA 114	H4	C	6.1±0.3	16,300
5	DA 016	H6	B	25.8±0.4	4,400
6	DA 115	H6	A	27.6±0.3	3,900
7	DA 011	H3	A	25.7±0.2	4,400
8A	DA 002	L4	A	23.4±0.2	5,800
8B	DA 119	L4	C	0.68±0.22	35,000 $\pm$3000
10	DA 014	L6	B	21.2±0.3	6,600
	DA 107	L6	A	20.1±0.3	7,000
12	DA 108	LL4	C	20.3±0.3	7,600