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RADIOCARBON DATINGS OF YAMATO METEORITES : K.Kigoshi and E.Matsuda , Department of chemistry, Gakushuin University, Mejiro,Toshima-ku, Tokyo

The terrestrial ages of five Yamato Meteorites have been measured by their contents of cosmic-ray-produced carbon-14. Among them three Yamato Meteorites Y-74013,Y-74097, and Y-74136 which are all diogenites, were found at sites apart from one to two kilometers each other on the bare ice sheet. They are considered [1] to be a single meteorite from their apparent shapes and unique texture.

This paper presents an evidence for these three meteorites being a single meteorite. And also presents a method adopted in our experimental procedure which includes a check for modern carbon contamination in the meteorites.

The meteorite sample was pulverized in an airtight alumina crusher for 10 hours. The powdered sample in a platinum boat was put into a quartz tube and was evacuated for a few hours at 100°C. The sample was then heated at 600°C for 5 hours under vacuum (10^{-5}-10^{-6}Torr) to remove terrestrial contaminants. The evolved gases were passed through a liquid nitrogen trap, where CO_2 and other condensable gases were recovered. Noncondensable gases mainly CH_4 and CO, were then passed through the CuO furnace heated at 450°C-550°C, where CO was converted to CO_2, and were recovered in a molecular sieve 4A cooled in liquid nitrogen. The CO_2 condensed in a liquid nitrogen trap was purified from SO_2 and H_2O by distillation at -150°C. The temperature of the molecular sieve 3A was raised to dryice-methanol temperature. The gas recovered from the molecular sieve 4A was circulated through the CuO furnace at 800° for 40 minutes to oxidize CH_4 to CO_2 and added to the previously recovered CO_2.

The sample in the quartz tube was then heated at 1200°C for 5 hours under vacuum. Evolved CO_2 gas was recovered with the same procedure as in the case of 600°C. The residual sample was heated again at 1200°C for 3 hours in oxygen atmosphere. The CO_2 evolved in this step was collected as 1200°C fraction togather with the previous one. The amounts of carbon

recovered at 600°C and 1200°C were measured volumetrically as CO_2 gases.

The CO_2 gases of both fractions were converted to acetylene through lithium carbide which was prepared by the reaction between metalic lithium and CO_2. The reaction of lithium carbide with tritium free water gave acetylene. The acetylene was purified by the adsorption in the molecular sieve 4A at 0°C and the desorption at 100°C. The molecular sieve 4A used here was prepared from radium free sodium aluminate and sodium silicate, and it gave no measurable amount of radon in the desorpted gases. The carbon-14 in the acetylene was counted in a proportional counter of 53.0 cm^3 which has a background of 0.373 $\pm$ 0.016 cpm.

As shown in Table 1, all 600°C fractions of recovered carbon have specific radiocarbon concentrations of nearly the same level to that of atmospheric carbon dioxide. This indicates that the 600°C fractions are mainly composed of the carbon of recent contamination on the earth. The terrestrial ages listed in Table 1 are calculated from the C-14 activities in the 1200°C fractions and that of of modern standard which is a mean value of measured C-14 activities of Allende and Bruderheim.

The terrestrial ages of Y-75102,Y-74459, and Y74013 are consistent with the measured values by Fireman[2] The agreement of the terrestrial ages of Y-74013,Y-74097, and Y-74136 supports the view that these are a single meteorite.

References

(1) Takeda,H.,Mori,H., and Yanai,K. (1981) Mem. Natl Inst. Polar Res., Spec. Issue, 20, p.81-99.

(2) Fireman,E.L. (1983) Mem. Natl Inst. Polar Res., Spec. Issue, 30, p.246-250.

Table 1. Terrestrial ages and vacuum extraction of carbon and C-14.

Meteorite (Wgt)	Type	Temp. (°C)	Recovered carbon (mg)	^{14}C (dpm/kg)	^{14}C Specific activity (dpm/g C)	Terrestrial age (10^3 yr)
Y-75102 (21.53 g)	L6	600	2.40	3.7 ± 1.5	19 ± 8	
		1000	0.82	20.2 ± 1.7	305 ± 25	2.0 ± 0.6
		1200*		18.2 ± 1.8		
Y-74459 (13.17 g)	H6	600	6.70	3.9 ± 1.8	8 ± 2	
		1000	0.68	< 1.4		19 ± 2
		1200*		3.6 ± 1.4		
Y-74013 (16.9 g)	DIO	600	1.31	1.9 ± 0.8	24 ± 11	
		1200	0.54	7.1 ± 1.0	222 ± 31	16 ± 1
Y-74097 (15.8 g)	DIO	600	1.41	3.3 ± 1.1	37 ± 12	
		1200	0.67	5.3 ± 1.1	120 ± 30	19 ± 2
Y-74136 (14.9 g)	DIO	600	1.44	2.1 ± 1.1	22 ± 12	
		1200	0.81	6.7 ± 1.5	123 ± 28	17 ± 1
Allende	C3	600	13.5	14.0 ± 1.5	20 ± 3	
		1200	35.4	49.1 ± 1.8	25 ± 1	Modern
Bruderheim	L6	1200		52.9 ± 2.3		Modern

* In this case ,sample was recrushed and small amount of graphite was added.