

An improved extraction system to measure carbon-14 terrestrial ages of meteorites and pairing of the Antarctic Yamato-75097 group chondrites

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We examined an improved system for extraction of carbon from meteorites using a vacuum-tight RF melting method. Meteorite samples mixed with an iron combustion accelerator including a specific amount of carbon (0.052%) were combusted in a RF furnace (LECO HF-10). ¹⁴C₂ extracted from the meteorite was diluted with a known amount of nearly ¹⁴C-free CO₂ evolved from the iron accelerator on combustion. The ¹⁴C activities of the recently fallen Holbrook (L6) and Mt. Tazerzait (L5) meteorites were measured by this method. The mean value was 56.5±3.0 dpm/kg, which is similar to the values reported for recently fallen L6 chondrites.

Terrestrial ages were measured for four Antarctic meteorites: 1.8±0.5 kyr for Yamato (Y)-75097 (L6), 1.8±0.5 kyr for Y-75108 (L6), and 0.1±0.1 kyr for Y-74192 (H5). For Y-74190 (L6), an apparent age of 0.8±0.5 kyr, which is younger than the other samples, was calculated. The Y-74190 chondrite appears to have been irradiated at a deeper depth in the meteoroid than the other three samples on the basis of the ²²Ne/²¹Ne and ³He/²¹Ne ratios, and it may have higher ¹⁴C saturated activity. With the ¹⁴C saturated activity corrected for shielding depth, we have the same terrestrial age, about 1.8 kyr, as that for the other Y-75097 group specimens. Hence the Y-74190 is confirmed to be paired with Y-75097, Y-75102, Y-75108, and Y-75271. The five samples Y-74190, Y-75097, and Y-75108, together with Y-75102 (L6) and Y-75271 (L6), have been reported to be paired and fragments of an L-chondrite shower. The result of this work and literature data for latter two samples confirmed that they are paired. On the other hand, the obtained terrestrial age of Y-74192 (H5) suggests that it could be a recently fallen meteorite. It is doubtful, however, that the value of 46.4 dpm/kg is suitable for the saturated ¹⁴C activity used in estimating the terrestrial age of Y-74192. More discussion and experimental work are needed for other recently fallen meteorites, both for L and H chondrites, and a correction for the shielding effect should be done to determine a more reliable terrestrial age.