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An ⁵⁷Fe Mössbauer Study of the Ordinary Chondrite meteorite Lynch-001

The Lynch-001 meteorite is classified as an ordinary chondrite of the petrologic group L5-6 that has undergone 'minor to moderate' terrestrial weathering (A/B class). It was found in the Nullarbor desert in Western Australia in 1977 at the coordinates 31° 1′ S / 127° 13′ E [1]. Here, we report the characterization of the Febearing phases in this chondrite using ⁵⁷Fe Mössbauer spectroscopy carried out over the temperature range 13 to 295 K. The paramagnetic doublets of olivine and pyroxene dominate the spectra, accounting for 62(3)% of the spectral area at room temperature. On the basis of the room temperature quadrupole splitting of 2.93(1) mm/s we estimate the olivine composition to be Fa₃₀₍₅₎[2]. Besides the olivine and pyroxene, there is a paramagnetic ferric component that amounts to 15(2)% of the spectral area at room temperature. The presence of this Fe³⁺ component attests to the weathering of this meteorite. The spectrum also includes troilite (FeS) with a relative spectral area of 12(2)%, Fe-Ni metal (4(2)%) and magnetite/maghemite (7(2)%). The total relative proportion of Fe³⁺ allows us to estimate the terrestrial age of Lynch-001 to be around 6,000 yr, consistent with the value of 6,700 ± 1,300 yr determined by ¹⁴C dating [3].

References

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- [2] O. N. Menzies, P. A. Bland and F. J. Berry, Lunar Planet. Sci. XXXII, pp. 1967-1968, (2001)
- [3] A.J.T. Jull et al., Meteoritics & Planetary Sci. 45, 1271-1283 (2010).

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