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An ^{57}Fe 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 $31^{\circ} 1' \text{ S} / 127^{\circ} 13' \text{ E}$ [1]. Here, we report the characterization of the Fe-bearing phases in this chondrite using ^{57}Fe 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 $\text{Fa}_{30(5)}$ [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 Fe^{3+} 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 Fe^{3+} allows us to estimate the terrestrial age of Lynch-001 to be around 6,000 yr, consistent with the value of $6,700 \pm 1,300$ yr determined by ^{14}C dating [3].

References

- [1] M. M. Grady, Catalogue of Meteorites, 5th ed (Cambridge University Press, 2000) p 689.
- [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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