LOVINA: IS THIS A METEORITE?

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Introduction: Lovina (8.2 kg) was found on Lovina beach in Bali, Indonesia, on January 1981. It is a strikingly oblong, weathered iron with cm-scale pyramids projecting from its upper surface (orientation as found on beach) and cm-sized vugs in the lower surface [1]. Based on petrographic, mineralogical, and geochemical analysis [2], Lovina is classified as an ungrouped iron meteorite (ataxite). The bulk chemical composition, including trace elements, suggests Lovina is a high Ni iron meteorite, although its unusual appearance casts some doubt on this assertion. Since all recovered extraterrestrial materials contain cosmogenic nuclides produced in space we have measured the concentrations of cosmogenic nuclides ^{10}Be, ^{26}Al, and ^{36}Cl to verify its extraterrestrial origin.

Results and Discussion: A piece of Lovina was cleaned by etching with 5% HNO_3/ethanol solution using an ultrasonic bath for ~30 min. 249 mg of the cleaned sample was then dissolved in 4N HNO_3 along with the carrier solutions. The chemical composition of our sample is 57.8% Fe, 0.94% Co, and 36.4% Ni. After chemical separation and purification the cosmogenic radionuclides were measured by AMS at Purdue University. Lovina contains 0.0055±0.0005 dpm ^{10}Be/kg, 0.0029±0.0021 dpm ^{26}Al/kg, and 0.0025±0.0008 dpm ^{36}Cl/kg. These activities are 3 to 4 orders of magnitude lower than those of typical iron meteorites, and the lowest among all iron meteorites except interior pieces from the Nantan or Gibeon meteorites. If the cosmogenic nuclides in Lovina were produced in space, the recovered sample of Lovina was near the center of an object more than ~3 m in diameter, or it resided at ~1.5 m depth in a large object in space. In addition, the ^{10}Be and ^{36}Cl concentrations require a ~1.4 Myr terrestrial age. Alternatively, this concentration of ^{36}Cl can be produced on the Earth if Lovina were exposed at the surface in Indonesia for ~0.1 Myr. Although the observed ^{10}Be is slightly higher than would be expected with a 0.1 Myr terrestrial exposure, the ^{10}Be could be elevated from exposure of Lovina to terrestrial contamination. Although we etched the sample, the concentration of ^{10}Be, ~5×10^5 atom/g, could be absorbed from rain or seawater. It is perhaps noteworthy that Lovina has many pits in its surface. Tektites from Southeast Asia contain more than 2 orders of magnitude higher ^{10}Be than found in Lovina. Based on cosmogenic radionuclide concentrations, it is our opinion that Lovina is unlikely to be of extraterrestrial origin. We will remeasure the cosmogenic radionuclides, as well as noble gases in a larger piece to verify these conclusions.

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References: [1] Meteoritical Bulletin, No. 93, 2008 March. [2] Flemming R. L. et al. 2008. Abstract #2412. 39th Lunar & Planetary Science Conference.