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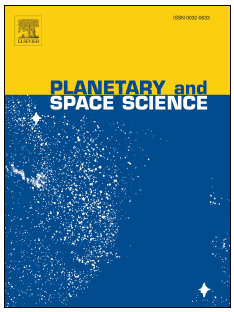

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PII: S0032-0633(17)30148-4

DOI: 10.1016/j.pss.2017.12.018

Reference: PSS 4452

To appear in: *Planetary and Space Science*

Received Date: 3 May 2017

Revised Date: 28 December 2017

Accepted Date: 31 December 2017

Please cite this article as: Mahajan, R.R., Nejia, L.O., Ray, D., Naik, S., Noble gases, nitrogen, cosmic ray exposure history and mineralogy of Beni M'hira (L6) chondrite, *Planetary and Space Science* (2018), doi: 10.1016/j.pss.2017.12.018.

Noble gases, nitrogen, cosmic ray exposure history and mineralogy of Beni M'hira (L6) chondrite

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Abstract

The concentrations and isotopic composition of noble gases helium (He), neon (Ne), argon (Ar), krypton (Kr), xenon(Xe) and nitrogen were measured in the Beni M'hira L6 chondrite. The cosmic ray exposure age of Beni M'hira is estimated of 15.6 ± 3.7 (Ma). The radiogenic age, of around 485 ± 64 Ma, derived from ^{4}He, and of around 504 ± 51 Ma from ^{40}Ar, suggests an age resetting indicating the event impact. The heavy noble gases (Ar, Kr and Xe) concentrations imply that the gas is a mixture of trapped component Q and solar wind. The measured nitrogen abundance of 0.74 ppm and the isotopic signature of δ^{15}N = 14.6 ‰ are within the range of ordinary chondrites. The homogeneous chemical composition of olivine (Fa:26±0.25) and low-Ca pyroxene (Fs:22.4±0.29) suggest that the Beni M'hira meteorite is an equilibrated chondrite. This is further corroborated by strong chondrule-matrix textural integration (lack of chondrules, except a few relict clast). Shock metamorphism generally corresponds to S5 (>45 GPa), however, locally disequilibrium melting (shock-melt veins) suggests, that the peak shock metamorphism was at ~75 GPa, 950°C.

Keywords : Noble gases, ordinary chondrite, cosmic ray exposure age, mineralogy

Introduction

Meteorites are objects predominantly derived from asteroids or comets, which are most likely remnants of the condensates formed during the formation of the solar system. Meteorites