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LETTER

Graphite in the martian meteorite Allan Hills 84001

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ABSTRACT

We use confocal Raman imaging spectroscopy and transmission electron microscopy to study the martian meteorite Allan Hills (ALH) 84001, reported to contain mineral assemblages within carbonate globules (carbonate + magnetite), interpreted as potential relict signatures of ancient martian biota. Models for an abiologic origin for these assemblages required the presence of graphite, and this study is the first report of graphite within ALH 84001. The graphite occurs as hollow spheres (nano-onions), filaments, and highly crystalline particles in intimate association with magnetite in the carbonate globules. In addition to supporting an abiologic origin for the carbonate globule assemblages in ALH 84001, this work proves that there is an inventory of reduced-carbon phases on Mars that has not yet been thoroughly investigated.

Keywords: Martian life, SNC, organic carbon, Mars Science Lab, Raman spectroscopy, magnetite, volatiles