American Mineralogist, Volume 87, pages 1250–1256, 2002

Cristobalite inclusions in the Tatahouine achondrite: Implications for shock conditions

KARIM BENZERARA,[1,*] FRANÇOIS GUYOT,[1] JEAN ALIX BARRAT,[2] PHILIPPE GILLET,[3] AND MAURICE LESOURD[4]

[1]Laboratoire de Minéralogie-Cristallographie, UMR 7590 and Institut de Physique du Globe de Paris, 4 place Jussieu, 75252 Paris Cedex, France
[2]Laboratoire de Géodynamique et Planétologie, UMR 6112 and Université d'Angers, Faculté des Sciences, 2 Bd Lavoisier, 49045 Angers Cedex, France
[3]Laboratoire de Sciences de la Terre, CNRS UMR 5570, Ecole Normale Supérieure de Lyon, 46 allée d'Italie, 69364 Lyon Cedex 07, France
[4]CNRS et Service Commun de Microscopie Electronique, Faculté de Médecine, Rue Haute de Reculée, 49045 Angers Cedex, France

ABSTRACT

The mineralogy of the Tatahouine diogenite was investigated by optical microscopy, Raman micro-spectrometry, and scanning and transmission electron microscopies. Inclusions of α-cristobalite in orthopyroxenes, locally in symplectic association with chromites, or associated with metal, have been characterized for the first time in a diogenite. Mosaicism of the orthopyroxenes indicates shock effects in the meteorite. The shock history of the meteorite must be consistent with the presence of vein-like structures containing inclusions of well-crystallized cristobalite, a low-pressure, high-temperature phase. Several possible mechanisms to account for these observations are discussed. The simplest one, consistent with all observations, is that a shock event would have occurred in a hot orthopyroxenite, either before extensive cooling of the asteroid, or in materials heated by previous impacts and maintained hot under an ejecta blanket.