Paper Number: 1486

Osbornite (TiN): Implications for an extraterrestrial origin of carbonado-diamonds

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Carbonado-diamond is the most enigmatic of all the known high pressure carbon polymorphs and is found only in Brazil (3.2-3.9 Ga) and the Central African Republic (2.6-3.8 Ga) in non-kimberlitic/lamproitic, metaconglomerates. Proposals for the origin of carbonado-diamond range from crystallization in Earth's crust to the mantle, none of which are viable given the high porosities and melt-like patinas that characterize these unusual, polycrystalline and robustly aggregated diamond masses [<1 to >3,000 ct]. An innovative alternative is cosmic in origin; this model invokes white dwarf stars, and C-rich exoplanets, both of which are spectroscopically diamond-bearing [1]. We present new observations on TiN in carbonado- diamonds that supports an extraterrestrial origin.

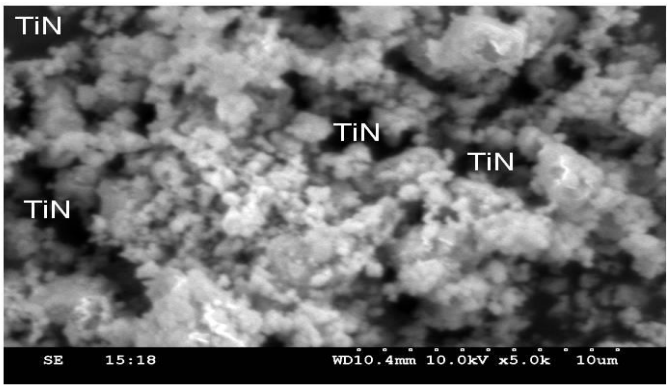

Figure 1: Figure 1: SEM images of osbornite in carbonado-diamond.

The presence of osbornite in carbonado has been reported by [2] as Ti-Cu-N, and by [3] in our earlier investigation by X-ray diffraction and nuclear magnetic resonance. In the present study we confirmed the presence of interstitial TiN by Laser-Raman spectroscopic and X-ray photoelectron spectroscopic (XPS). The XPS peak at 396.8 eV is representative of N in stoichiometric TiN. The other observed binding energy peaks at 455.6 and 461.0 eV correspond to Ti 2p3/2 and Ti 2p1/2 and the TiN phase. Laser Raman spectroscopic studies showed three strong and broad peaks at 276 cm^{-1} and 402 cm^{-1} and 602 cm^{-1} at room temperature. All three Raman peaks are assigned to TiN, comparable to trace amounts of osbornite known to occur in iron and in some enstatite chondrites and achondrites [4]. Terrestrial osbornite is known at only one locality, in the continental collision zone of Tibet [5], a setting that is again totally incompatible with the textural characteristics of carbonado [1]. With the recent discovery of TiN in the Wild comet, and the extraordinarily low redox [IW-4], and high T= 2500-3000K required, for its formation, we conclude that carbonado-diamond is most reasonably of extraterrestrial origin. GP thanks CSIR, ISRO, PLANEX , Physical Research Laboratory for the financial support.

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