**MINERALOGY OF VESICULAR OLIVINE IN THREE CK4−6 CHONDRITES: RELATIONSHIP TO SILICATE DARKENING**

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**Introduction:** A unique feature of CK chondrites is that their chondrules and matrices show silicate darkening. Most previous workers suggested that the silicate darkening resulted from shock metamorphism [e.g., 1], but the true cause has long been unknown. Recent studies of CK4 chondrites [2−4] revealed that they contain abundant unusual olivine in their matrices, and this contains numerous micron to submicron-size vesicles and inclusions of magnetite, pentlandite, and a variety of other minerals. The authors suggested that the vesicular olivine resulted from recrystallization of partially melted olivine by shock, and this is the principal cause of the silicate darkening. Here we present the results of our mineralogical and petrological investigation of LEW86258 (CK4), EET87507 (CK5), and EET87860 (CK5/6). Our purpose was to examine whether vesicular olivine is the cause of the silicate darkening in these chondrites and to determine its origin and relationship to the silicate darkening.

**Results:** The three CK4−6 chondrites show a similar degree of strong silicate darkening in their matrices and chondrule mesostases. Backscattered electron images of highly darkened regions in the matrices of the three chondrites show that olivine with numerous vesicles (<0.1−3 μm in diameter) fills interstices of nonvesicular olivine crystals, exhibiting a complex network of veinlets. The vesicular olivine contains numerous spherical grains (<0.1−5μm) of magnetite and pentlandite as well as grains of plagioclase, low-Ca pyroxene and diopside, although the relative abundance of these inclusions differs between the chondrites. There is a tendency that a region having a higher volume proportion of vesicular olivine to exhibit a darker and dustier appearance in transmitted light.

**Discussion:** Vesicular olivine occurs pervasively in the matrices in LEW86258, EET87507, and EET87860. The mineralogical characteristics of the vesicular olivine in all the chondrites closely resemble those in the Kobe and Karoonda CK4 chondrites [2-4]. From these observations, we conclude that microinclusion-rich vesicular olivine is the principal cause of the silicate darkening in the LEW86258, EET87507, and EET87860 chondrites.

The internal texture of the vesicular olivine resembles that of shock-induced local melts in the matrices of carbonaceous chondrites [e.g., 5]. Thus we suggest that the vesicular olivine formed from melts that were produced from fine-grained olivine in the matrix by shock. During melting, numerous small vesicles were produced in the melts, and the melts trapped numerous droplets of melted magnetite and pentlandite as well as fragmented grains of other minerals.

**References:** [1] Rubin A.E. 1992. *Geochimica et Cosmochimica Acta* 56:1705−1714. [2] Tomeoka K. et al. 2001. *Meteoritics & Planetary Science* 36:1535−1545. [3] Tomeoka K. et al. 2005. *Journal of Mineralogical and Petrological Sciences* 100:116−125. [4] Ohnishi I. et al. 2007. *Journal of Mineralogical and Petrological Sciences* 102:346−351. [5] Tomeoka K. et al. 1999. *Geochimica et Cosmochimica Acta* 63:3683−3703.