RADIATIVE HEATING OF NEO C-TYPE ASTEROIDS, A PLAUSIBLE CAUSE OF METAMORPHISM FOR CK CHONDRITES? N. Chaumard[1], B. Devouard[1], B. Zanda[2] and A. Provost[1]. [1]Laboratoire Magmas et Volcans, UMR 6524 Blaise Pascal University – CNRS, 5 rue Kessler, 63038 Clermont-Ferrand, France. E-mail: n.chaumard@opgc.univ-bpclermont.fr; [2]LMCM, MNHN UMR 7202 CNRS, 61 rue Buffon, 75005 Paris, France.

Introduction: CK chondrites are the only group of carbonaceous chondrites with petrographic types ranging from 3 to 6 [1]. There might be a continuous series from oxidized CVs to CKs [2, 3]. One of the peculiarities of CK chondrites from petrological type 3 to 5 is the texture of their matrices, with numerous micron-sized vacuoles and inclusions inside the olivine grains [4, 5]. Porous olivine aggregates have been formed experimentally by heating fine-grained assemblages of San Carlos olivine (Fo_{88}), at temperatures ranging from 1350 to 1550°C [6]. The textures in CK matrices could similarly be the result of a transient HT event having affected a fine-grained matrix. Metamorphosed CKs have been interpreted as the result of shock metamorphism [4, 5]. We propose an alternative numerical model to account for the transient HT event at the origin of CK chondrites: we investigated the effect of radiative heating from the Sun on asteroids with close perihelion and low albedo.

Method: Surface temperatures were obtained with a Lambertian temperature model [7, 8, 9]. Temperatures at depth in the asteroid were obtained by heat diffusion, solved by a Crank-Nicolson finite difference method.

Results: C-type asteroids, with albedos c. 0.07 [10], are plausible parent-bodies for carbonaceous meteorites. Among Near Earth Objects (NEO), a number have perihelial distances < 0.387 AU (Mercury's orbit). Phaethon is an example of such an object (albedo = 0.1066, perihelion ≈ 0.14 AU). With favorable parameters, maximum sub-surface temperatures of C-type meteoroids can reach up to 1050°C at perihelion. However, heat diffusion is limited in depth owing to the spin of the asteroid and the thermal diffusivity coefficient. Heat varies exponentially at depths of 0.5-2 meters before it is completely dampened. Temperature at the core depends on the radius of the object. Core temperatures significant for metamorphic processes (>300°C) could be reached only for small meteoroids, with a diameter lower than 1 meter.

Conclusions: Our results suggest that radiative heating, although limited in depth, might be a source in the metamorphism of infra-meter objects (the case for all CK meteorites). This process should be further considered as a possible cause of the thermal metamorphism visible in CK carbonaceous chondrites of petrological types 3 to 5.

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