THE NATURE OF "MASKELYNITE" IN SHOCKED METEORITES: NOT DIAPLECTIC GLASS BUT A GLASS QUENCHED FROM SHOCK-INDUCED DENSE MELT AT HIGH-PRESSURES;

M. Chen [1,2] and A. El Goresy [2]; [1] Guangzhou Institute of Geochemistry, Academia Sinica, Guangzhou 510640, China, E-Mail: Chen@mpch-mainz.mpg.de, [2] Max-Planck-Institut für Chemie, P. O. Box 3060, D-55128 Mainz, Germany; E-Mail: Goresy@mpch-mainz.mpg.de

The acronym Maskelynite was first coined to describe an isotropic glass of an unknown origin with near labradorite composition in the Shergotty meteorite by G. Tschermack [1] . Since 1967 the term was redefined and used for shock-induced isotropic glass in meteorites thought to be diaplectic plagioclase glass [2-5] . However, since 1997 several reports presented ample petrologic evidence that the "maskelynite" in several shocked chondritic and SNC meteorites is a dense glass quenched from shock-induced dense melts at high-pressures [6, 7] . We have extended our scrutiny to shocked Saharan L-chondrites and SNC meteorites, the Antarctic SNC meteorite-793605, and ALH 84001 in the search for genuin diaplectic glass [8,9] .

The following critical criteria allow recognition of dense glasses quenched from shock-induced dense mineral melts from diaplectic plagioclase glasses: (a) Absence of cleavage, intragranular cracks and shock-induced fractures in "maskelynite", because these features can only be erased during a melting event but not during solid-state transformation from crystalline to glass. Should melting be incomplete, then the "maskelynite" would contain fractured fragments of diaplectic plagioclase. (b) Offshoots of dense "maskelynite" from the "maskelynite" grain surfaces filling fractures in the neighbouring silicates. (c) Evidence for melting of pyroxene and mesostasis appearing as flowed and meandering schlieren in unfractured "maskelynite" [6,7] . The absence of vesiculation in "maskelynite" [3,4,10] is not an a priori evidence against melting. Vesiculation can occur only if melting takes place after pressure release at very high post-shock temperatures, while silicate melts formed and quenched at high-pressures do not vesiculate. Vesiculation of silicate melts is inhibited at high-pressures because the melt volume is controlled by the confining pressure, a fact well known from melting experiments of silicates at high-pressures.

We here report our results of our detailed survey of the shocked L-chondrites Sixiangkou, Tenham, Peace River, Dar al Gani 350, Dar al Gani 355, and the SNC meteorites Dar al Gani 476, Zagami, Chassigny, ALH 84001, in comparison to the classical "maskelynite"-bearing Shergotty.

Results: (1) L-chondrites: In Sixiangkou "maskelynite" is barren of any kind of fracturing listed in (a). The material displays radiating cracks thus pervasively fracturing the neighbouring orthopyroxens and olivine. "Maskelynite" near the shock melt veins are exceedingly enriched in K (up to 2.0 % K_2O) and their structural formulae do not satisfy plagioclase stoichiometry, a feature that cannot be explained by solid-state transformation. "Maskelynite" in Tenham and Peace River display complex features depending on the spatial relationship to the shock melt veins. While glass grains next to the melt veins are enriched in K, nonstoichiometric and are barren of any fractures, grains some 200 μm away from the veins contain fractured fragments of diaplectic stoichiometric plagioclase ($Ab_{82}An_{12}Or_6$) in nonstoichiometric K-rich (3.6% K_2O) smooth dense glass. Far from the veins, no "maskelynite" is encountered and heavily fractured plagioclase is present instead. Dar al Gani 350 and Dar al Gani 355 display the same features and contain no diaplectic plagioclase glass.

(2)SNC meteorites: In Zagami "maskelynite" ($An_{52}Ab_{47}Or_1$) displays no evidence of solid-state transformation to diaplectic glass. The grains are clear, smooth with no shock-induced fractures. "Maskelynites" in Zagami and Shergotty do not posses the typical zoning of igneous feldspars. The An- and Ab- zoning profiles do not display the systematic complementary behavior, and the compositional range is extremely narrow (Shergotty: $An_{57.6}$ $Ab_{42.3}$ $Or_{0.7}$ to An_{55} Ab_{45} $Or_{0.9}$; Zagami: An_{45} Ab_{51} Or_1 to An_{43} Ab_{54} Or_1) indicating homogenization [7]. Offshoots in fractures in pyroxenes (CPX) are quite abundant thus indicating injection of dense plagioclase liquid in these fractures. Shlieren of molten CPX and mesostasis in unfractured "maskelynite"are visible in both meteorites. In addition, Zagami displays shock-melt veins with no evidence of vesiculation, thus emphasizing the behavior of silicate melts under high-pressures as discussed above. Dar al Gani 476 must have experienced a higher degree of shock than Zagami and Shergotty. CPX in this meteorite is pervasivly impregnated by numerous offshoots from "maskelynite". In comparison to other SNCs, smooth glasses in Chassigny contain fragments of fractured diaplectic plagioclase within the dense smooth regions thus indicating parial melting.

The present investigations present unequivocal evidence that the studied meteorites do not contain any diaplectic plagioclase glasses and hence the previously estimated peak-shock pressures are low and need critical revision. A detailed survey of shocked meteorites in view of the criteria presented here is needed.

References:

[1] M. G. Tschermak, *Sitzungsberichte der Matematisch-Naturwissenschaftlichen Classe der*

kaiserlichen Akademie der Wissenschaften **LXV. Band**, 122-146 (1872). [2] R. A. Binns, *NATURE* **18**, 1111-1112 (1967). [3] D. Stöffler, et al., *Geochimica et Cosmochimica Acta* **50**, 889-904 (1986). [4] D. Stöffler, A. Bischoff, V. Buchwald, A. E. Rubin, *Shock effects in meteorites*. J. F. K. a. M. S. Mathews, Ed., Meteorites and the Early Solar System. (The University of Arizona Press, Tuscon, Tuscon, 1988). [5] S. Greshacke, D. Stöffler, metamorphism in the shergotite Dar Elgani 476, ***LPSC XXX***, Houston, TX (LPI, 1999). [6] A. El Goresy, B. Wopenka, M. Chen, S. Weinbruch, T. Sharp, *LPS* **XXVIII**, 329-330 (1997). [7] A. El Goresy, B. Wopencka, M. Chen, G. Kurat, *METEORITICS* **32**, A38-A39 (1997). [8] D. Stöffler, *Fortschr. Miner.* **49**, 50-113 (1972). [9] D. Stöffler, U. Hornemann, *Meteoritics* **7**, 371-394 (1972). [10] D. Stöffler, K. Keil, E. R. D. Scott, *Geochimica et Cosmochimica Acta* **55**, 3845-3867 (1991).