IMPACT MELT ROCKS FROM THE L3-6 CHONDRITIC REGOLITH BRECCIA NORTHWEST AFRICA (NWA) 869

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Introduction: NWA 869 is a L3-6 regolith breccia consisting of lithic clasts, embedded in a partly clastic matrix [1]. Besides chondritic lithic clasts of various petrologic types this meteorite contains a variety of impact melt rocks (IMRs), i.e whole-rock melts formed by shock pressures between 80 to 100 Gpa. The corresponding velocity of impacting bodies is > 8 km/sec, leading to post-shock temperatures of at least 1.500 °C [2-4].

Petrology: The abundance of IMRs in NWA 869 is about 1 vol% with clast sizes up to 4.5 cm [1]. Six IMR clasts have been analyzed, three of which are clast-free. The others contain various amounts of admixed mineral and lithic clasts, embedded within a glassy or crystallized mesostasis. The mean compositions of olivines crystallized from the mesostasis vary between Fa_{12} and $Fa_{25.}$ Fe,Ni metal and FeS are strongly depleted and show very characteristic intergrowth, known as "fizzed troilite" [5].

Chemistry: The ratios for Mg/Si, Ca/Si, Al/Si and Ca/Al of the investigated IMR´s are within the range for bulk NWA 869, for chondrite clasts of various petrologic types and for the clastic matrix of this meteorite. This demonstrates that IMR´s in NWA 869 represent crystallized chondritic whole rock melts. Additionally, mineral and lithic clasts enclosed in the clast-poor IMR´s belong to typical lithologies found in NWA 869, i.e. L chondritic rocks of type 4 to 6 [1]

Discussion: The mean depletion of sulfides in IMR clasts relative to the bulk meteorite is about 70 %, and the depletion of Fe,Ni metal in one IMR clast is about 95 % [1]. We assume that these depletions are the result of gravitational separation of heavy Fe,Ni-FeS melts from silicate melts within superheated impact melt sheets with their very low viscosities. We speculate that so-called sulfide-rich iron meteorites [6] could be the counterpart of Fe,Ni-FeS-depleted impact melt rocks and possibly represent the crystallized heavy liquids segregated from their parent melts. Some mm to cm-sized IMRs show amoeboidal outer shapes and gradients in grain size, which verifies that they cooled rapidly as small entities. Hence, we believe that some IMRs are excavated droplets formed either by impacts into pre-existing crystallized impact melt units or by impacts into still molten melt sheets. Should they have formed by simple impacts into regular L chondritic rocks it would be difficult to explain their strong depletion in Fe,Ni metal and sulfide.

References: [1] Metzler K. et al. 2010. *Meteoritics & Planetary Science* 45, submitted. [2] Stöffler D. et al. 1988. In: *Meteorites and the early solar system*:165-202. [3] Stöffler D. et al. 1991. *Geochimica et Cosmochimica Acta* 55:3845-3867. [4] Hörz F. et al. 2005. *Meteoritics & Planetary Science* 40: 1329-1346. [5] Scott E.R.D. 1982. *Geochimica et Cosmochimica Acta*, 46:813-823. [6] D'Oratio M. et al 2009. *Meteoritics & Planetary Science* 44:221-231.