**CLAST SELECTION AND METALLOGRAPHIC COOLING RATES: INITIAL RESULTS ON TYPE 1A AND 2A MESOSIDERITES.**  
1B. Baecker, 1B. A. Cohen, 1A. E. Rubin, 1B. Frasl and 2C. M. Corrigan.  
1NASA MSFC, Huntsville, AL 35812. (bastian.baecker@nasa.gov).  
2UAH, Huntsville, AL 35805 ; 3EPSS Department, UCLA, Los Angeles, CA 90095, USA; 4Smithsonian Institution, NMNH, Washington DC, 20560, USA.

**Introduction:** We initiated a comprehensive study [1] on selected clasts and metal of mesosiderites using SEM, electron microprobe and the complete suite of noble gases. Here we report initial results on the petrography of selected clasts and metallographic cooling rates using the central Ni method used in several publications (e.g. [2]). We focus on the approach of selecting grains in least recrystallized mesosiderites. Hence, especially (lithic) clasts in type 1A, 1B, 2A and 2B are the first choice. They provide highest primitive-ness and least annealing/metamorphism. All grains selected should be in close proximity to each other. Lithic clasts in mesosiderites are of high interest because of their igneous texture and similarity to eucrites and howardite petrography (e.g. [3]).

*Clover Springs (2A) (ASU 646.1).* Melt-clasts: L5d is a large low Ca-px grain (1.7x1.5 mm) and is closely surrounded by Fe-Ni metal, merrillite (M5c) and plag (L5w). All grains show multiple fractures and speckles, many filled with Fe-Ni metal, sulfides and oxides. A reaction rim around L5d is observable. Average px and plag compositions are; Fs = 28.6±3.5, Wo2-3, An93. Lithic-clasts: E18m is a plag grain located in a large lithic clast of ~6 x 3 mm. The borders between patches in this clast are irregular and intergrown. Adjacent to E18m is E18r, a low Ca-px to Ca-px grain. Average px and plag compositions are; Fs = 20.4-34.1, Wo3-28, An95.  

*Mount Padbury (2A) (ASU 927).* Melt-clasts: E8m is a very large low Ca-px grain (4200 x 2100 μm) and is closely surrounded by Fe-Ni metal and adjacent to a plag-grain (G9m). All grains show multiple cracks and speckles, many filled with Fe-Ni metal and oxides. As observed for clover springs, the px grain exhibits a reaction rim. Average px and plag compositions are; Fs = 22.7±0.3, Wo2-3, An90. Lithic-clast: Observable in Q17 are plag, silica, and low Ca-px grains located within a large lithic clast of ~7 x 6 mm (Fig. 1A). Average px and plag compositions are; Fs = 35.4-39.7, Wo4-40, An91.

*Patwar (1A) (ASU 634-1-4).* Melt-Clasts: K2b is a low Ca-px grain rimmed by Fe-Ni metal. The size is ~2.5x1.5 mm. The grain exhibit its multiple cracks and is appreciably porous. M4g is an anhedral plag grain with a px-chromite corona/reaction rim. The corona seems to consist of multiple mineral aggregates. Part of the grain seems to be resorbed at the top. Multiple small μ sized inclusions visible all over the grain. It exhibits multiple cracks. The grain is not in close contact to Fe-Ni metal. Size is ~1.8x1.4 mm. Average px, olv and plag compositions are; Fa = 32.0-36.6, Fs = 28.4±0.2, Wo3, An90. Lithic-clasts: A large clast with a size of ~3.2x2.5 mm seems to be igneous and lithic (Fig. 1B). It is composed of 2 anhedral grains which are in close contact and rimmed by Fe-Ni metal. B4m is a large plag grain; whereas D4a is a low Ca-px grain with elevated Mg content. D4a shows abundant lamellae which are probably due to exsolution and therefore characteristic for px. Both grains show multiple cracks and speckles, many filled with Fe-Ni metal and oxides. Average px and plag compositions are; Fs = 26.8-36.3, Wo5-21, An95.

*Northwest Africa 1242 (1A).* Melt-Clasts: P14r is a large low Ca-px grain (1.2x1.0 mm) and is closely surrounded by Fe-Ni metal, merrillite (P14g) and plag – An90Ab10 (Q15g). The subangular px grain is characterized by multiple cracks, speckles, many filled with Fe-Ni metal and oxides and a reaction rim. Average px and plag compositions are; Fs = 26.5±2.5, Wo2, An91. Lithic-clasts: J5h is a plag grain (550x350 μm) - An90. J5l is a silica grain (400x150 μm).

**Toufassour.** Melt-Clasts: Toufassour overall shows a high weathering grade. Many limonite veins are observable. However, two grains (merrillite-C3h and low Ca-px-C3v) with sizes of 220x200 μm and 500x350 μm, survived. Both grains are in proximity to the for Toufassour typ-ical large Fe-Ni grains. C3h is Ca-rich, P-rich and sup-posedly contains larger abundances of RIE. This sin-gle grain is in close contact to the metal and not in an assemblage with other grains; i.e. px, olv or plag. [3] and references therein state that the low number of phosphorous phases in Ca-rich achondrites (i.e. HED’s) is an important issue among all the simi-
larities they exhibit with MES. It seems reasonable that these phases derived from metal and not silicate phases, since the phosphate is in close contact to the metal. If we infer that most P derives from the metal rather than the silicate, we can conclude that in this case HED magmatism is similar to the mesosiderites silicate magmatism and that the metal is of different origin. Average px and plag compositions are; Fs = 23.9±2.3, Wo3, An91. Lithic clasts: F2l is a low Ca-px grain (150x150 µm). F2h is a plag grain (350x250 µm). Metamorphism and annealing is indicated by angular shaped grains. Average px and plag compositions are; Fs = 29.9±1.1, Wo5, An93.

**Metallographic cooling rates:** Many studies infer slow cooling rates for MES metal, i.e. ~0.05-0.2 K/Ma (e.g. [4-7]). We used central Ni measurements [2,6] in taenite to assess cooling rates for well known MES (Mount Padbury, Patwar) as well as rather unknown specimens (NWA 1242, Toufassour). In Fig. 2 we compared the results to cooling rates measured for other MES and Udei Station, an ungrouped iron meteorite from the IAB complex, which for some time was interpreted as a MES [2]. We found that for Mount Padbury and Patwar the cooling rates are in agreement with most studies and plot in the region of ~0.1 K/Ma. However, for especially Toufassour we found cooling rates of ~10K/Ma - similar to results for Udei Station [2]. More measurements have to show that the results are correct, since we performed fast Ni-measurements without complete traverses through the M-shape of taenite. Here, a geometric effect is possible. Since we took multiple spots and found that most MES agree with the literature but not Toufassour gives a hint that this MES is different. However, we emphasize, measuring metallographic cooling rates the same way in metal for MES like for irons could be misleading despite the metamorphism, brecciation and annealing history of MES.

**Acknowledgement:** We thank the ASU Center for Meteorite Studies and NASA JSC for MES specimens. We thank Rosario Esposito for technical assistance with the UCLA e-probe. This work was supported by the NASA/USRA postdoctoral program.