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Significance on microstructures and morphochemistry of schreibersite from Agoudal iron meteorite (IIAB), one of the latest find of Morocco

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IIAB is the third largest magmatic iron meteorites group with schreibersite ($FeNi_3P$) as one of the most predominant accessory phases. In this group, IIA irons are hexahedrite with low Ni and IIB irons are coarsest octahedrite with high Ni. However, a complete chemical continuity between IIA-IIB exists without any compositional hiatus (Wasson et al. 2007[1]). Textural diversity coupled with schreibersite chemistry is very useful for deciphering the paragenetic sequences of the exsolved phases and estimation of metallographic cooling rate based on phosphide growth kinematics.

Agoudal is one of most recent approved iron meteorites in Morocco [2]. In this communication, we present detailed descriptions of microstructures, new set of mineral chemical data of various schreibersites and finally discuss the metallographic cooling rate. The studied sample was collected by one of co-authors during a field trip (Feb. 2013). Electron Microprobe analyses were carried out on a polished and etched section to demonstrate various microtextures and mineral compositions.

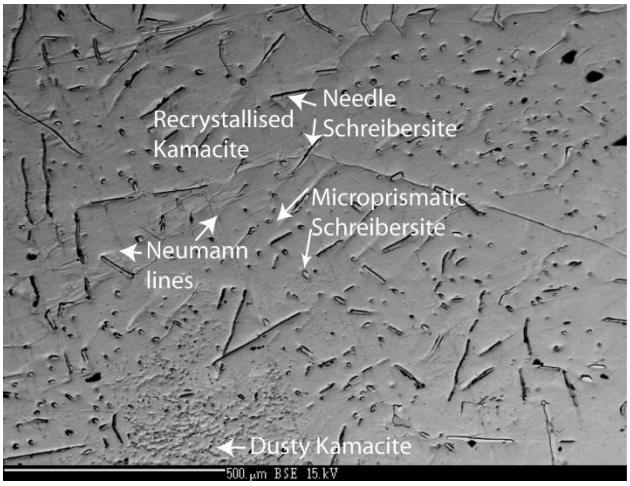

Figure 1: BSE image of various types of schreibersite in Agoudal iron meteorite.

The dominant types of schreibersites include mainly needles and microprismatic schreibersite (often with typical euhedral rhomb-shaped). The other type includes numerous small (even less than micron size) subhedral, beads like grains often produces a dusty/ pitted appearance on Kamacite matrix. Lamellar types are generally rare. We found one large (~ 200 micron across) subhedral grain of schreibersite that could be a part of skeletal schreibersite. Kamacite grains often show evidences of recrystallisation. Schreibersite often found to occur at junction of grain boundaries.

EPMA results show that the large subhedral schreibersite has relatively low Ni content (avg. 26.56 wt%) as compared to other types. Needle-types show the highest Ni content (40.83 wt%) while in microprismatic schreibersites yield moderate Ni content (34.40 wt%). Ni content of lamellar schreibersite is almost uniform (~30 wt%). Different sets of Neumann lines (often decorated Neumann bands) are present in Kamacite matrix (5.5-6.36 wt%).

Finally, the shock-thermal history of Agoudal is discussed. Presence of Neumann lines suggests a shock pressure excursion in the order of 10-12 GPa. Thermal alteration might be also less due to low shock intensity. Low Ni in large schreibersite crystal suggests its early crystallised origin. The sequence of exsolved schreibersite are as follows: lamellar>Microprismatic schreibersite>neddle schreibersite>tiny bead. Subsolidus cooling rate of Agoudal is close to 7°C/Ma (after Randich and Goldstein [3]).

References:

[1] Wasson J.T. (2007) GCA 71: 760-781

[2] Chennaoui Aoudjehane H. et al., MAPS 48 :5025.

[3] Randich E. Goldstein J.I. (1978) GCA 42: 22-33