

IRON SILICIDES IN POLYMICT UREILITES — RECORDING THE COMPLEX HISTORY OF THE UREILITE PARENT BODY?

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Introduction: The ureilite meteorites are C-rich, ultramafic rocks and are the second most abundant group of achondrite meteorites. Approximately 10-15% of known ureilites are polymict breccias composed of clasts of ureilitic material and other more exotic lithologies and minerals e.g. the recent fall ureilite, Almahata Sitta, has been classified as a polymict ureilite [1,2,3]. During our ongoing studies of different polymict ureilites we have previously reported the occurrence of iron silicide minerals with varying compositions [4,5]. Here we report on our investigations of the polymict ureilites North Haig and Nilpena. North Haig is particularly important as it is the type specimen of the Fe-silicide mineral suessite ($[\text{Fe,Ni}]_3\text{Si}$) [6].

Results and Discussion: Fe-silicide minerals from two polished sections of North Haig (WAM12809 'A' and 'B') and a section of Nilpena (BM.1984,M14; P9497) have been analysed using the Cameca SX100 electron microprobe at the NHM, representative results are tabulated below. The most striking result is the difference in Fe-silicide compositions between the two North Haig sections. In the 'A' section, no grains of suessite were observed, instead all the grains have a nominal composition of $(\text{Fe,Ni})_4\text{Si}$, a potential new mineral, which we have previously recognised in samples from Frontier Mountain [4]. In contrast the vast majority of grains in the 'B' section have suessite composition, however one grain shows a composition very similar to xifengite (Fe_5Si_3), although with appreciable Cr and Ni. The Nilpena section has a lower abundance of Fe-silicide grains and shows more diversity in compositions; suessite and phases with compositions intermediate to known Fe-silicides occur.

Phase	Nominal Formula	Fe wt% (at%)	Si	P	Cr	Ni
Suessite	$(\text{Fe,Ni})_3\text{Si}$	83.91 (73.14)	14.23 (24.67)	~ det lim.	0.64 (0.6)	1.64 (1.36)
Unnamed	$(\text{Fe,Ni})_4\text{Si}$	86.56 (78.45)	10.64 (19.7)	0.23 (0.37)	0.1 (0.9)	2.01 (1.74)
Xifengite	Fe_5Si_3	71.28 (58.43)	22.02 (35.89)	0.43 (0.63)	1.26 (1.11)	4.25 (3.31)

The mode of origin of Fe-silicides within ureilites is controversial. Could these minerals be derived through impacts, local reduction events or even be remnants of the ureilite parent body (UPB) core? The mineralogical and petrological diversity recorded in the polymict ureilites attests to the dynamic history of the UPB. Perhaps the Fe-silicides record a number of different events and processes occurring during various stages of the UPB's lifetime.

References: [1] Goodrich C. A. et al. 2004. *Chem. Der Erde* 64:238-327. [2] Bischoff A. et al. 2006. In *MESS II*, 679-712. [3] Jenniskens P. et al. 2009 *Nature* 458:485-488 [4] Smith C. L. et al. 2008. Abstract #2404. 38th Lunar & Planetary Science Conference. [5] Ross A. J. et al. 2009. Abstract #5269. 72nd Annual Meteoritical Society Meeting. 28th Lunar and Planetary Science Conference. pp. 609-610. [6] Keil K. et al. 1982. *American Mineralogist* 67:126-131