

IRON-SILICIDES IN COMET WILD 2 AND COMET CG: F.J.M. Rietmeijer¹ and T. Mannel² Department of Earth and Planetary Sciences, 1-University of New Mexico, MSC3-2040, Albuquerque, NM 87131-0001 USA, ²Space Research Institute of the Austrian Academy of Sciences, Schmiedlstrasse 6, 8042 Graz, Austria.

Introduction: Iron-silicides (Fe-Ni phases) and associated nanophase-metallic Fe⁰ are common natural phases in highly reduced environments such as the Lunar surface and airless planetary bodies by a process known as space weathering [1]. The STARDUST mission captured Fe-silicides from comet Wild 2 embedded in under-dense, density-graded, aerogel [2]. These Fe-silicides are shown in (Fig. 1) along with other silicides. These Wild 2 particles also included “Si-bearing metallic Fe material” [3] of uncertain origin(s).

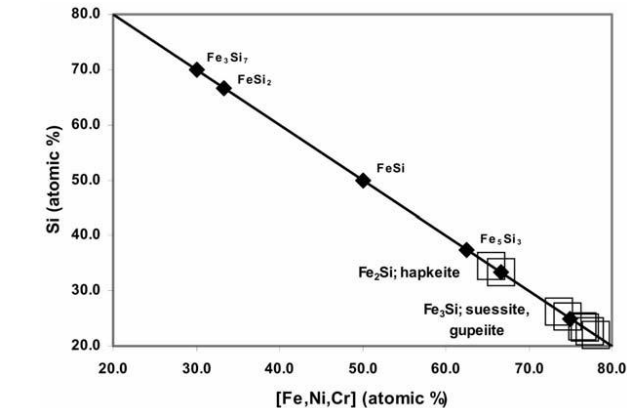


Fig. 1: Iron silicides (black diamonds) including these Wild 2 silicide compositions (open squares) [2].

The fluence of Wild 2 dust particles <10 μm in diameter was recorded by impacts on aluminum foil of the NASA Stardust spacecraft during a close flyby of comet 81P/Wild 2 [4].

Small crater Dust

Sub-10 μm Wild 2 particles that impacted the aluminum foils caused impact craters many of which lined by comet material [4]. A summary of small craters from foil C2008,1 included impact crater sizes and crater *Dp* (inferred diameter) as well as chemical signatures [4]. From these data it emerged that collectively these impacted particles “constituted ” a Wild 2 like composition for silicates and sulfides (Table 1).These data are complementary to the particles captured in under-dense silica aerogel.

The small crater foil data include a small amount of ‘FeSi’ and ‘Fe’ particles (Table 2). Their presence among these comet Wild 2 data support the notion that Fe-silicides might be found in other J-F comets such as comet 67P Churyumov-Gerasimenko.

Table 1	Inferred projectile diameters (nm)	Av.size (nm)]
Mg,Fe mafic silicates	100 - 5413	900
Sulfide (probably iron)	81 - 2019	690
probably both silicate and sulfide	113 - 5413	912
Si,Fe ‘inclusions’; Silicides	506 - 2615	1227

Table 2: Small crater data foil C2008N; Inferred projectile diameter (*Dp*) C2008N1; C2020W; C2054N1

FeSi <i>Dp</i>	Fe <i>Dp</i>
688	1375
750	381
1125	456
1438	556
1000	875
506	156
875	

Comet 67P Churyumov-Gerasimenko

As comets CG and Wild 2 are both J-F comets they may similarities in texture, mineralogy and chemistry. Both have small agglomerates and clusters of micron-sized grains. The smallest detected grains in CG follow log-normal size distributions with an average around 100 nm (Fig. 2).At this time, the possibility that C-G particles contain Wild-like Fe-silicides cannot be dismissed.

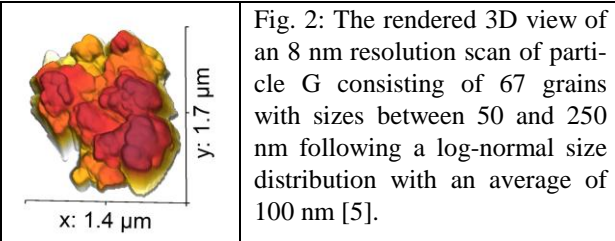


Fig. 2: The rendered 3D view of an 8 nm resolution scan of particle G consisting of 67 grains with sizes between 50 and 250 nm following a log-normal size distribution with an average of 100 nm [5].

[1] Anand M. et al. (2004) *PNAS* 101, 6847-6851.
[2] Rietmeijer F. J. M. (2008) *Meteoritics & Planet. Sci.*, 43, 121-134. [3] Nakamura T. et al. (2008) *Meteoritics & Planet. Sci.*, 43, 247-250. [4] Price M. C. et al. (2010) *Meteoritics & Planet. Sci.*, 45, 1409-1428. [5] Mannel et al. (2019) *A&A*, 630 A26.

Acknowledgments: This work was supported by grant NNNH16ZDA001N-APRA (FJMR) and the Austrian Science Fund FWF P 28100-N36 (TM)