Images of magnetite crystals from the Orgueil carbonaceous meteorite

Jacques Jedwab-Université Libre de Bruxelles
jjedwab@ulb.ac.be

This set of images has already been published thirty four years ago, when one expected (wrongly) the abundant presence of platelet magnetites in the lunar soils (1). Although the original paper in which these weird pictures of magnetite crystals appeared has been repeatedly quoted and referred, very few pictures have been reproduced elsewhere in print or on the Web (2, 3, 4). However, the barrel shaped stacks of magnetite platelets have been described as "intriguing, unexplained and beautiful forms of nature" by Hua and Buseck (5).

The purpose of this late release is to help to understand the discussions which will probably be triggered when the first cometary dust captured by STARDUST will be returned to earth in January 2006 (5). Indeed, the odds are that microscopic iron oxide particles will be found in the collected sample, and perhaps among them, well formed magnetite crystals, morphologically similar to those depicted here. This could represent a major scientific advance, in particular in understanding possible relations between comets, asteroids and meteorites (6, 7).

The interesting thing with the magnetite platelets and framboids is that they are recognizable "at first sight", so peculiar are their forms among the other meteoritic mineral species. It can be said that the finding and identifying just one platelet of a few microns, even amidst thousands of others, would be decisive. For all that, they should be compared to some catalogue of shapes, such as the ones displayed here. However, the identification of the critical details demands access to a scanning electron microscope (SEM), which is of course available to the principal investigators of the STARDUST samples.

The morphologies of the magnetite individuals and stacks in Orgueil are quite varied, but some regularities stand out. The layout of the following pictures, which reproduces that of the 1971 paper, has attempted to convey such broad regularities, by putting in each plate grossly or tightly related forms. Detailed descriptive captions are provided in the paper (1), but they were not considered as essential here.

(1) Jedwab, J. (1971) : La magnétite de la météorite d'Orgueil vue au microscope électronique à balayage (Magnetite of the Orgueil meteorite as seen under the scanning electron microscope). ICARUS, 15(2), 319-340 [Abstract accessible at : http//www.sciencedirect.com]

(2) Nagy, B.: Carbonaceous meteorites. Elsevier, 1975, 747 pp., (p.199, Figs. 29-E,F,G,H.)

(3) Brearley, A.J. and Jones, R.H. (1998): Chondritic meteorites. In: Planetary materials, J.J. Papike, ed. (Rev. Miner., v.36, Chap. 3, p. 3-196, Fig. 128).

(4) Buseck, P. R. (2004): Scanning electron microscope images of crystals in the Orgueil C1 meteorite [Fine picture of a stack of magnetite platelets at: http://7starm.asu.edu/orgueil.html]

(5) Hua, X. and Buseck, P.R. (1998): Unusual forms of magnetite in Orgueil carbonaceous chondrite. Meteoritics and Planetary Science, 33 (supplem.), A215-A220. [Full paper (with poorly reproduced pictures) accessible at: http://adsabs.harvard.edu/].

(5) [Presentation of the scientific program of the STARDUST Project : http://stardust.jpl.nasa.gov/science/sci2.html]

(6) Lodders, K. and Osborne, R. (1999): Perspectives on the comet-asteroid-meteorite link. Space Sc. Rev. , 90(1-2), 289-297. [Abstract accessible at: http://www.ingentaconnect.com/]

(7) Rietmeijer, F.J.M. (1998): Interplanetary dust particles. In: Planetary materials, J.J. Papike, ed. (Rev. Miner., v.36, Chap. 2).