EM characterisation of a potential meteorite sample

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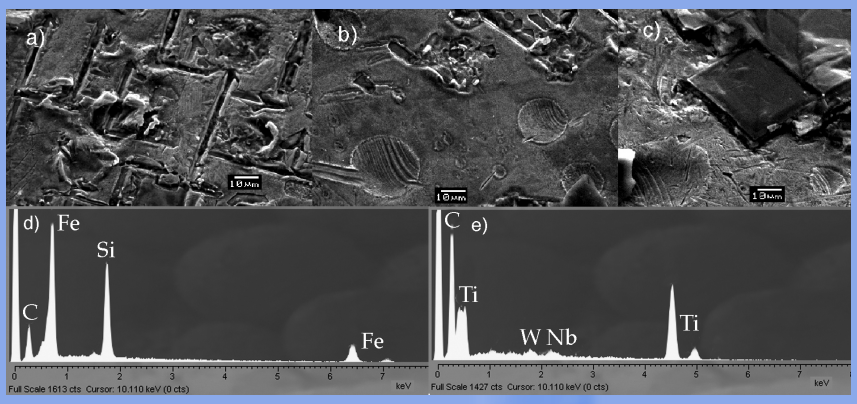
In the district of Altötting (Upper Bavaria, Germany) four particular and apparently correlated spatial configurations were recently discovered:
- craterlike structures
- anomaly of Ni-traces in honey samples, from biomonitoring with honey bees
- severe magnetic anomalies in the stray field of the craterlike structures
- metallic particles (diameter mostly > 1 cm) in the upper 30 cm of the soil

Fig. 1



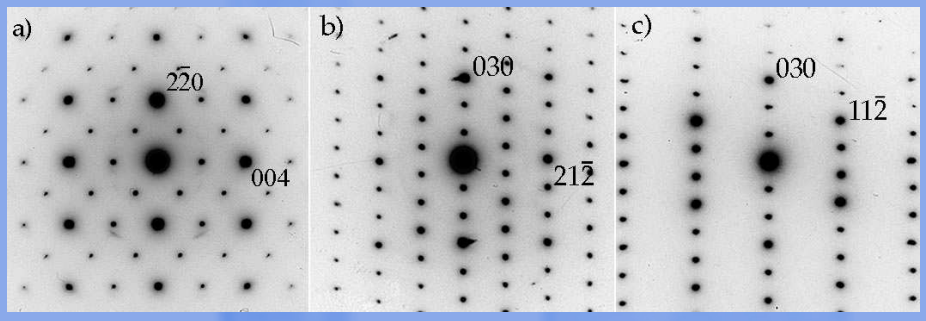


Fig. 2

In Figure 1 SEM images of three distinctly different surface morphologies are shown, together with the respective EDX spectra. These reveal a primarily Fe-Si content with some micron sized cubic Ti rich, C-containing inclusions.

In Figures 2 and 3 SAED patterns from internal grains of these samples are shown from which three different phases can be recognised. Figure 2.a reveals the [110] zone of cubic Fe_3Si, also known as Gupeiite, while Figures 2b and 2c show the [101] and [201] zones of the hexagonal Fe_5Si_3 structure, also known as Xifengite. These SAED patterns originate from micron sized grains, whereas the ring pattern in Figure 3b relates to the nanoparticles shown in Figure 3a and can be explained by the bcc α-Fe structure, the poor quality of the image being due to the magnetic distortions of the beam.

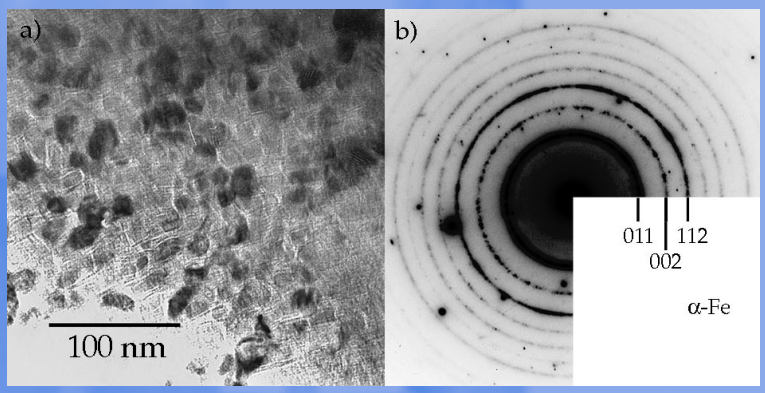


Fig. 3

The presence of Xifengite and Gupeite in Fe_xSi_y-particles over a wide area in undisturbed soil profiles, accompanied by further refractory species, supports the hypotheses of a cosmic origin, in analogy to the results from the Yanshan area.