Iron silicides have been playing a major role in the discovery and discussion of the Holocene large Chiemgau impact event [1-15]. They were detected by local history researchers in the Alpine Foreland (Southeast Germany, Fig. 1) in the subsoil down to the substratum. The iron silicides proved to be FeSii, mineral gupeiite, and FeSii, mineral xifengite. The iron silicides regularly occurred near rimmed craters. Early conclusion: Both the strange matter and the craters could perhaps be related with a meteorite impact in historical time, especially with regard to strongly restricted terrestrial formation of gupeiite and xifengite, and their occurrences in cosmogenic globular particles from the Yanshan area in China [16].

An industrial origin was considered because the iron silicides had been produced in the local industry as a completely unknown byproduct.

An industrial production could largely be excluded because of many field situations absolutely incompatible with anthropogenic support.

Here, we report on completely new analyses of these iron silicide particles from different locations, their in part enigmatic internal and external structures and their obviously complex formation history, using various SEM and TEM techniques. They show the industrial hypothesis can be ruled out with a high degree of probability, and they suggest a cosmic, extraterrestrial origin.

The material

The mass of iron silicides so far sampled in the region totals about 2 kg. The size of the particles ranges between the order of a millimeter to few centimeters. The largest piece is 6 cm long and has a mass of 162 g. Some of the particles exhibit a spherical or ellipsoidal shape, but often a smooth, front combines with a flat, irregularly shaped rear side (Fig. 2 F, F).

The surfaces show metallic luster and practically any corrosion. In many cases, a regmaglyptic surface resembling ablation features of meteorites is striking (Fig. 2 E, F).

Frequently, sparkling crystals can be seen with the naked eye to stick out from the metallic matrix (Fig. 2 G, H).

Iron silicide particles are interspersing highly porous carbonate accretionary lapilli from the Chiemgau strewn field (Fig. 17). Tiny iron silicide particles are frequently incorporated in the local industry as a completely unknown byproduct. In the Chiemgau area, only much more sophisticated procedures using SEM, TEM and EBSD were able to establish largest crater of the strewn field with a rim-to-rim diameter of about 600 m and an extensive ejecta blanket. Geologically, the craters occur in Pleistocene moraine and fluvioglacial sediments.

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Uranium

Among the more than 30 chemical elements (including, e.g., the REE cerium, neodymium and yttrium, but few nickel) so far established in the iron silicide samples, uranium has attracted special attention. It is in general found associated with zirconium (Fig. 12, Fig. 6) or without zirconium (Fig. 13), and frequently together with cerium/neodymium. Interestingly, only in one case uranium has been shown to coexist with thorium, however in traces only (Fig. 13). Except for a faint signal of polonium no other decay products were analyzed. Not any lead was seen in the uranium spectra, and the measured data suggest a uranium age of about 8.8 and 7.7 m.

There is strong evidence that the iron silicides are linked to the Chiemgau meteorite impact event:

- Many field situations in the area are practically excluding any anthropogenic deposition.
- There is an obvious extraterrestrial relation of most other gupeiite and xifengite iron silicide occurrences.
- There is a problematic formation of gupeiite and xifengite in a geologic oxygen-free environment.
- Tiny iron silicide particles are frequently incorporated in accretionary lapilli from the Chiemgau strewn field (Fig. 17).
- Iron silicide particles are interlayering highly porous carbonate recrystallization relics of probably carbonate impact melt (Fig. 17).
- Planar features in a moissanite matrix of the iron silicide (Fig. 2) point to aerodynamic processes.

CAls

Recent analyses [17] show that the iron silicides from the Chiemgau impact strewn field contain peculiar CAls in the form of the monoclinic high-temperature/low-pressure phase CaAl2O4. While the common TiC had already been microprobe-analyzed in the very beginning of the investigation of the iron silicides from the Chiemgau area, only much more sophisticated procedures using SEM, TEM and EBSD were able to reveal the incredibly complex nature of the peculiar matrix. From these investigations the existence of the iron silicide FeSii, mineral haxinite became evident. In Fig. 14 haxinite intergrows with gupeiite and xifengite to form the iron silicide matrix that is hosting a titanium carbide (TiC) crystal. In Fig. 15 the FeSii phase is also clearly documented and in part appears like the yolk of fried eggs within so a fully identified calcium silicate phase, possibly a wollastonite polymorph. In the literature two haxinite polymorphs, a cubic and a trigonal modification, have been reported, and here the trigonal polymorph (S.G. Pm3n, No. 164 [18,19]) has been established.

Haxinite

Haxinite with the iron silicides gupeiite and xifengite as well as the common TiC had already been microprobe-analyzed in the very beginning of the investigation of the iron silicides from the Chiemgau area, only much more sophisticated procedures using SEM, TEM and EBSD were able to reveal the incredibly complex nature of the peculiar matrix. From these investigations the existence of the iron silicide FeSii, mineral haxinite became evident. In Fig. 14 haxinite intergrows with gupeiite and xifengite to form the iron silicide matrix that is hosting a titanium carbide (TiC) crystal. In Fig. 15 the FeSii phase is also clearly documented and in part appears like the yolk of fried eggs within so a fully identified calcium silicate phase, possibly a wollastonite polymorph. In the literature two haxinite polymorphs, a cubic and a trigonal modification, have been reported, and here the trigonal polymorph (S.G. Pm3n, No. 164 [18,19]) has been established.