Artifact-in-impactite: a new kind of impact rock. Evidence from the Chiemgau meteorite impact in southeast Germany

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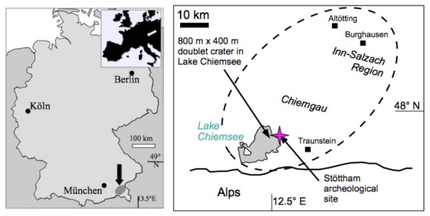
Introduction: The Chiemgau impact as a meanwhile established Holocene impact event has featured quite a few exceptional observations in the last 15 years, which are summarized in [1, 2 and references therein]. From the beginning of research it was clear that a huge catastrophe in the Bronze Age or Celtic era must have already affected densely populated regions, and in a routine archeological excavation at Lake Chiemsee the worldwide unique constellation was encountered that an impact catastrophe layer was excavated sandwiched between settlement layers of the Stone Age/Bronze Age and the Roman Period [3]. The ample occurrence of extreme destruction, extreme temperatures and highest pressures including impact shock effects proved incompatible with an undisturbed colluvial depositional sequence as postulated by archeologists and pedologists-geomorphologists [4]. Following their argumentation the Bavarian Office for Geology (LfU) and the Bavarian Monuments Preservation Office (BLfD) declared the unparalleled Stöttham exposure as a normal colluvium which continously developed since the end of the last Ice Age and let it fill up and overbuild. A recent inspection of the depot of archieved samples from the excavation revealed a key to an unexpected scenario, and **we report highlighting results of both archeological and meteorite impact relevance.**



Elliptically shaped Chiemgau impact strewn field.

Among the finds of ceramics, stone tools, bones and metal artefacts also featured externally rather unsightly lumps, which were found by use of metal detectors and were addressed as "slag" by the excavator. Here we report on specifically conducted mineralogical-geochemical investigations on 16 "slag" samples which have led to very remarkable results.

Part of the Stöttham excavation with the sandwiched impact layer. The geologic/ archeological stratigraphy. a: moraine, b: lower colluvium/lower occupation layer, c: diamictite/catastrophic layer, d: upper colluvium/upper occupation layer with indication of a paving, e: soil.

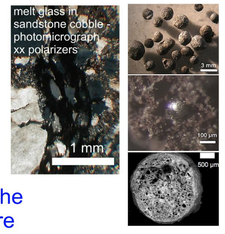
Details of the diamictic texture of the impact layer.

Strongly corroded (heat, acid) and fractured cobbles (gneiss, quartzite) from the catastrophe layer.

Archeological objects (bronze burins, quartzite hammerstone) and fragments of bones, a tooth and pottery from the Stöttham exposure.

Early research in the Stöttham exposure

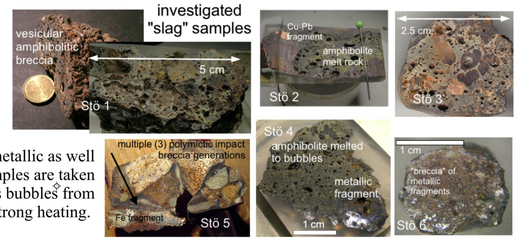
Silica limestone melt rock



Carbonaceous, metallic and glass spherules

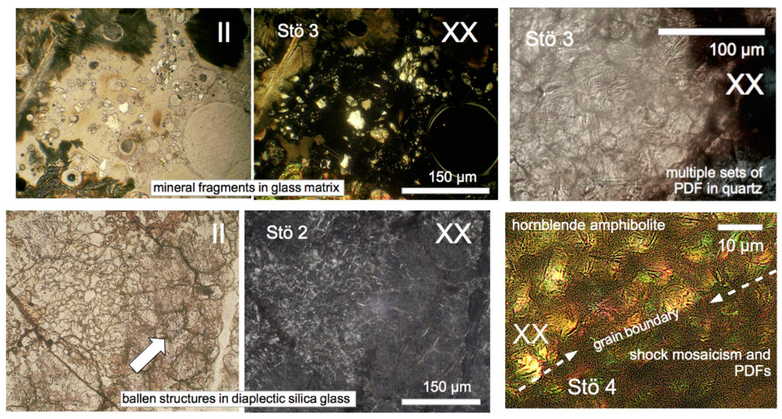
The "slag" breccias from the Stöttham excavation

Multiple breccia generations (here three) are a characteristic geologic impact feature and rarely known from "normal" geological processes



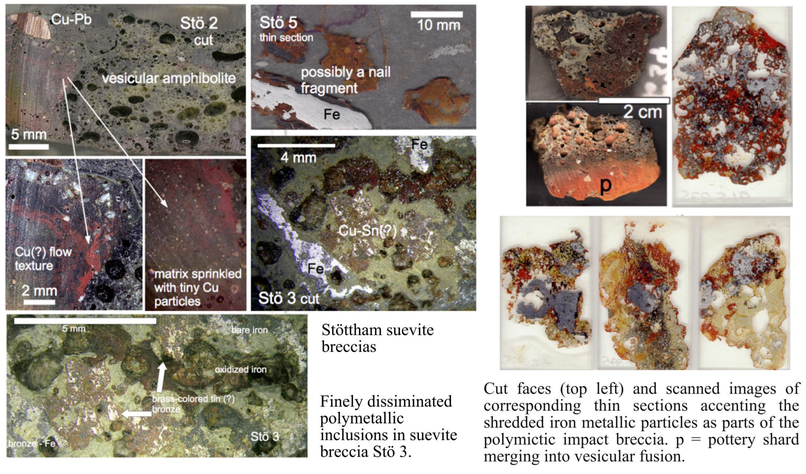
The breccia samples are composed of metallic as well as stony components. Most of the samples are taken by vesicular amphibolite with gas bubbles from strong heating.

Thin-section photomicrographs - shock metamorphism



Shock effects in thin section photomicrographs - II = plane light, XX = crossed polarizers. The diaplectic glass from shocked quartz is in proof of high pressures >5 GPa. According to common impactite nomenclature the occurrence of cogenetic melt glass and shock metamorphism attributes a **suevite** designation to the Stöttham "slag" breccias.

Polymictic suevite breccias - metallic inclusions

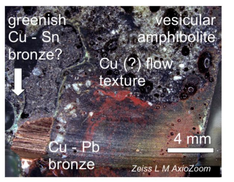


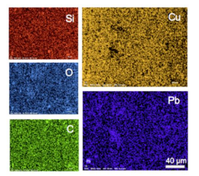
Stöttham suevite breccias

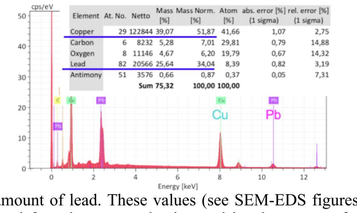
Finely dissiminated polymetallic inclusions in suevite breccia Stö 3.

Cut faces (top left) and scanned images of corresponding thin sections accenting the shredded iron metallic particles as parts of the polymictic impact breccia. p = pottery shard merging into vesicular fusion.

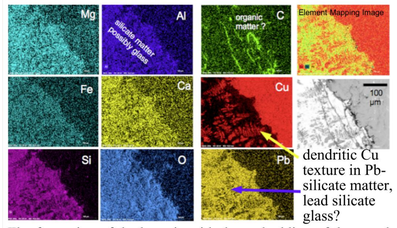
Stö 2 and the copper/lead bronze - SEM-EDS





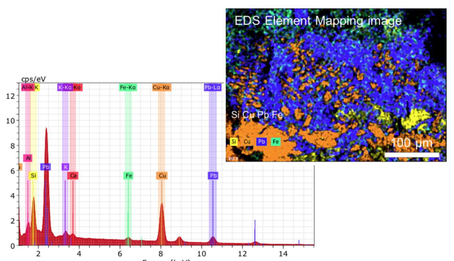


Remarkable: copper - lead bronze fragment with strikingly high amount of lead. These values (see SEM-EDS figures and spectrum to the right) show that the specimen must have originated from human production and has been part of some artefact.



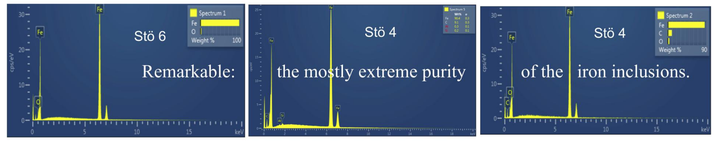
dendritic Cu texture in Pb-silicate matter, lead silicate glass?

The formation of the breccia with the embedding of the metal particles must have been a very complex process, which must have led to the partial separation of the metal components and their mobilization within the silicate rock com-ponents and possibly enabled the formation of a kind of lead glass.



Intimate mixture of tiny metallic and stony components in the suevitic "slag" breccia.

SEM-EDS: Iron particles in the Stöttham suevite breccias



Conclusions: A worldwide novelty and the age of the Chiemgau meteorite impact event

The new investigations demonstrate once more impressively that the Stöttham archeological site had been involved in a meteorite impact invent, the Chiemgau impact. The original finding of a meteorite impact layer between two archeological horizons was to be classified as unique worldwide. From the point of view of both archeology and impact research, the new analyses have put the crown on it by revealing human objects and impact shock intimately intertwined in the same samples — a worldwide novelty defining an artifact-in-impactite as a new kind of impact rock. A more exact dating of the Chiemgau impact, based on the metallic components, is a significant side effect of these unusual samples and their investigation, scheduling the impact event between 900 and 600 BC [5].

References

[1] Rappenglück, M. A., Rappenglück, B., Ernstson. K. (2017) Cosmic collision in prehistory - The Chiemgau Impact: research in a Bavarian meteor- ite crater strewn field (in German). - Zeitschrift für Anomalistik, 17, 235-260. [2] Ernstson, K., Mayer, W., Neumair, A., Rappenglück, B., Rappenglück, M.A., Sudhaus, D., Zeller, K.W. (2010) The Chiemgau Crater Strewn Field: Evidence of a Holocene large impact event in Southeast Bavaria, Germany. Journal of Siberian Federal University. Engineering & Technologies, 1, 72-103. [3]. Ernstson, K., Sideris, C., Liritzis, I., Neumair, A. (2012) The Chiemgau meteorite impact signature of the Stöttham archaeological site (Southeast Germany). Mediterranean Archaeology and Archaeometry, 12, 249-259. [4] Völkel, J., Murray, A., Leopold, M., Hürkamp, K. (2012). Colluvial filling of a glacial bypass channel near the Chiemsee (Stöttham) and its function as geoarchive. Zeitschrift für Geomorphologie (Annals of Geomorphology), 56(3), 371-386, [5] Rappenglück, B., Hiltl, M., Rappenglück, M., Ernstson, K. The Chiemgau Impact - a meteorite impact in the Bronze/Iron Age and its extraordinary appearance in the archaeological record. In: Wolfschmidt, G. (ed.) Himmelswelten und Kosmovisionen - Imaginationen, Modelle, Weltanschauungen. Nuncius Hamburgensis. Beiträge zur Geschichte der Naturwissenschaften 51, Hamburg: tredition. 2020 (in print). P. xx-xx.