If You Wish Upon A Star. Chiemite: An Anthropocene Pseudo-Impactite

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Summary

Since the beginning of the Anthropocene, mankind has produced a variety of **artificial materials** in large quantities which now contribute to the composition of modern sediments. Some of these materials may closely resemble natural rocks or minerals and transported and weathered anthropogenic matter is particularly hard to distinguish from natural materials. **Coal products**, when taken superficially, may be mistakenly identified **as exotic natural materials**. In recent years, samples taken by non-specialists from the **Lake Chiemsee area, Germany**, have been misdiagnosed as **meteorite impact matter** and have caused controversial discussions about their cosmic origin. In our study, we investigate carbonaceous samples from southern Bavaria which have recently been claimed to represent **a new type of impactite, the so-called 'Chiemite'.** 'Chiemite' samples were analysed using a combination of **microanalytical techniques** and compared against a **coking coal reference sample**. The absence of minerals and microfeatures related to meteorite impacts in the Chiemite samples, as well as the high degree of similarity to the coal reference material, indicate that **the site did not experience any cosmogenic activity.**

Meterorite impacts and Chiemite material

Meteorite impacts are identified using a specific combination of minerals and microfeatures including coesite, shock laminations and planar deformation features in relation to the geological setting and anthropogenic history of the area – in short, they must be identified using an **multidisciplinary approach**.

Over the past few years, a group of non-professional geologists, the CIRT (Chiemgau Impact Research Team), discovered an **exotic material (nicknamed 'Chiemite')** near Lake Chiemsee, in the South East of Bavaria, Germany and proposed a **cosmic origin** for this unusual material. The location where the material was found is dominated by Mesozoic carbonates, Quaternary sediments from the last ice age and over **400 years of coal mining and industrial process** history. The group has published articles and reports attesting to the exotic material's extra-terrestrial origin, however, none of their research has been verified by a **comprehensive comparative study.**

Aim

The present study wishes to identify whether the chiemite samples show evidence for the presence of a meteorite impact, and compare features of this "exotic material" with a **reference coking coal sample**. **Two types of chiemite** were investigated – the **pumice-like carbonaceous chiemite** ('Rauschberg Chiemite' and 'Mauerkirchen Chiemite' samples) and the **tough vesicular glass matter chiemite** ('Glassy Carbon'), in addition to the coal reference material. All samples were analysed by XRD, FTIR and SEM analysis.

Figure 1: Samples analysed: Coking Coal reference material, Mauerkirchen Chiemite, Rauschberg Chiemite, Glassy Carbon.

Chiemite Samples and Coal Reference Material

No meteorite related minerals or microfeatures were detected in chiemite samples. However, pumice-lie chiemite demonstrated **a high degree of similarity with the reference coking coal material**, as highlighted by XRD (presence of quartz and graphite), SEM (aluminosilicate clays, pyrite and an organic carbonaceous matrix) and FTIR analyses (spectra indicative of high maturity, i.e. **anthracite stage** (Chen et al., 2012)).

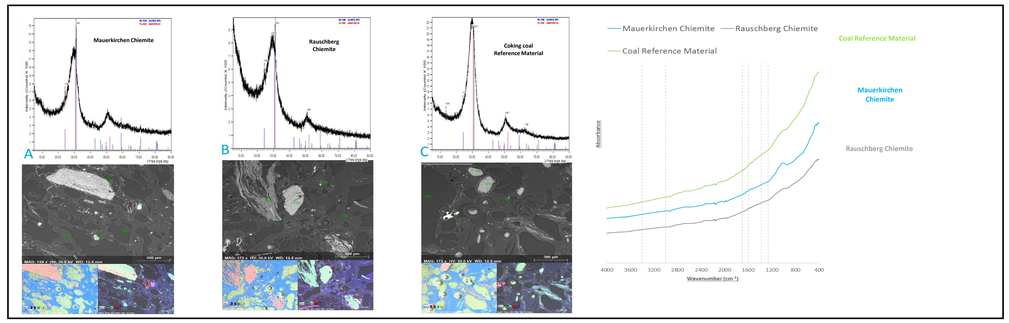

Figure 2: (A) Top: Mauerkirchen Chiemite XRD Spectra. Below: Mauerkirchen Chiemite SEM micrograph and elemental map. (B) Top: Rauschberg Chiemite XRD Spectra. Below: Rauschberg Chiemite SEM micrograph and elemental map. (C) Top: Coal Reference XRD Spectra. Below: Coal Reference SEM micrograph and elemental map. (D) FTIR-ATR spectra for the Mauerkirchen Chiemite, Rauschberg Chiemite and coal reference.

Glassy Carbon

The glassy carbon sample showed no similarities with the coal reference material, however it also showed no indication of being related to a hypervelocity meteorite impact. This sample seems to be either **amorphous industrial oven melt** or **amorphous organic matter.**

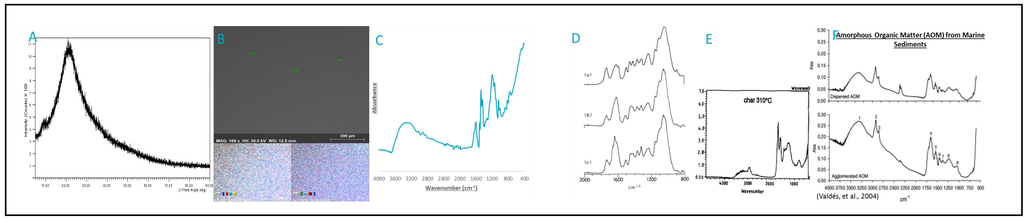

Figure 3: (A) The XRD results for the Glassy Carbon sample. (B) The SEM micrograph and elemental map for the Glassy Carbon sample. (C) The FTIR-ATR spectrum for the Glassy Carbon. (D) Spectra from decayed root matter in peat (Given et al., 1984). (E) The spectrum of a cellulose char heated to 310°C (Pastarova et al., 1994). (F) Spectra from unlithified AOM in marine sediment (Valdes et al., 2004).

Conclusion

The results presented a strong case for the Mauerkirchen and Rauschberg chiemite samples to be **coking coal.** The glassy carbon is an amorphous organic material related to coal processing such as an **amorphous oven melt**. The absence of minerals and microfeatures related to meteorite impacts in the Chiemite samples, as well as the high degree of similarity to the coal reference material, indicate that **the site did not experience any cosmogenic activity**.

FOR FURTHER INFORMATION
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