THE PROPOSED NALBACH (SAARLAND, GERMANY) IMPACT SITE: IS IT A COMPANION TO THE CHIEMGAU (SOUTHEAST BAVARIA, GERMANY) IMPACT STREWN FIELD?

76th Annual Meteoritical Society Meeting (2013)
5058.pdf

Kord Ernstson
Faculty of Philosophy I, University of Würzburg, Würzburg, Germany,
kernstson@ernstson.de

Werner Müller
66809 Nalbach, Germany
edumueller@t-online.de

Andreas Neumair
Institute for Interdisciplinary Studies, Gilching, Germany,
andreas.neumair@arcor.de

Abstract

Widespread occurrence of peculiar samples in the Nalbach area (Saarland, West of Germany) covering many square kilometers makes a meteorite impact event in the Holocene very probable. Most convincing are indications of high temperatures and high pressures and the evidence of probable shock. Absolutely identical findings in the Chiemgau meteorite impact crater strewn field suggest that obviously most similar processes at a related time took place. A coincidence provided, an extended impact event that affected a distance of at least 500 km must be considered.

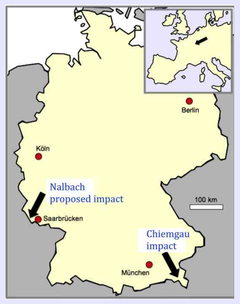

Fig. 1

The Nalbach proposed meteorite impact

Introduction

In 2009 during honorary archeological field work by W.M., abundant finds of a greenish, bluish and bluish-black glass-like material so far unknown in the region under consideration (Fig. 1) attracted some attention. Originally ascribed to Celtic - Roman glassworks, the in part significant magnetization of the samples however puzzled with regard to simple glass from early history. Nevertheless, researchers from a few universities who had been asked by W.M. about the origin of the strange material instantly insisted on an anthropogenic formation. This estimation initiated more detailed field work in the course of which far more strange material and peculiarly deformed rocks partly featuring influence of strongly enhanced temperatures were discovered obviously not compatible with the common and well-known archeological and geologic scenario of the region.

When a preliminary investigation of a specimen showed evidence of shock metamorphism [1, 2], and other samples in a first approach were speaking in favor of meteoritic components, the idea of an impact in young geological times, probably in the Holocene, got contours.

Observations (Figs. 2 - 9)

The host of peculiar finds is done on an area a few hundred meters wide without exhibiting a morphologically clear crater structure. This may be explained by post-impact alluvial overprint on low ground or by special conditions (airburst impact) in the course of the proposed impact event. The peculiar material under consideration may roughly be divided into several groups:

- strongly magnetic metallic chunks reminding of iron shale of heavily weathered iron meteorites (Fig. 2)
- various glasses and glass-like matter
- polymictic breccias
- pebbles and cobbles showing mechanical load and high-temperature signature.

Fig. 2. Strongly magnetic iron-metallic chunks reminding of iron shale. Coin diameter 21 mm.

Fig. 3. Vesicular slag-like glass (to the left) similar to the Chapadmalal, Argentina, impact glass (so-called "scoria", to the right).

Fig. 4. Aerodynamic-ally shaped tektite-like glasses. Field width is 7 cm.

Fig. 5. Dense, slightly magnetic glass fragments with lots of vesicles. Millimeter scale. The greenish, bluish and bluish black colors probably originate from iron oxide. A very similar glass has been reported from the Pleistocene Zhamanshin impact crater in Kazakhstan. Koeberl [3] describes the impact glass as of distinct blue color showing a layered structure with numerous small vesicles, and the blue color is said to range between the layers from opaque turquoise to very dark blue.

Fig. 6. Reddish and grayish pumice.

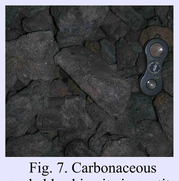

Fig. 7. Carbonaceous probable chiemite impactite (see Fig. 20)

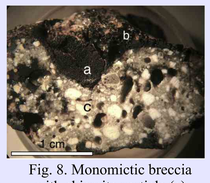

Fig. 8. Monomictic breccia with chiemite particle (a) and black glass (b) in a glass matrix (c).

Fig. 9. Chiemite fragment fused in gray fine-grained, non-recrystallized glass.

Observations, cont. (Figs. 10 - 18)

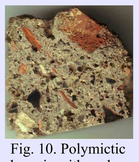

Fig. 10. Polymictic breccia with rock and glass particles in a dominantly sandy matrix. The aligned reddish glass fragments may point to flow texture.

Fig. 11. Melt rock with monogenetic rock particles (quartzite) in a glass matrix. Cut surface.

Fig. 12. Melt rock with polygenetic rock particles in a glass matrix.

Fig. 13. Splinters of bones in vesicular glass matrix. Width of image 3 cm; cut surface.

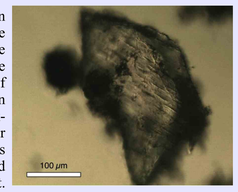

Fig. 14. Quartz grain from a breccia sandstone particle on grain slide under the microscope exhibiting two sets of planar deformation which may be shock-produced planar deformation features (PDFs). Plane polarized light.

Fig. 15. Glass-coated sandstone pebbles. The glass film has in each case a thickness of no more than a fraction of a millimeter pointing to very short exposure to extreme heat.

Fig. 16. Cut surface of a glass-coated sandstone pebble pervaded by a set of subparallel fissures that are more or less completely filled with a dark glass.

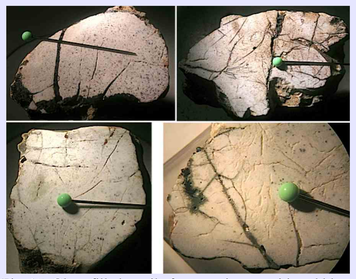

Fig. 17. Glass-filled tensile fractures in quartzitic cobbles; sawed surfaces. Note also here the fissures often narrowing from the surface which document the direction of fracture propagation and the injection of the melt or the rock vapor.

Fig. 18. Layered glass and rock probably initiated by the formation of widely open spallation fissures. Cut surface, maximum width is 41 mm.

The Chiemgau impact and meteorite crater strewn field

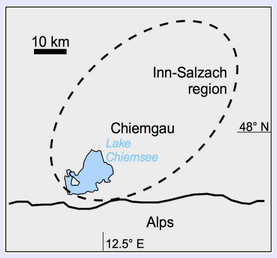

Fig. 19. Location map of the Chiemgau impact roughly elliptically shaped strewn field (see Fig. 1).

-- The Chiemgau strewn fi eld [4, and references therein] dated to the Bronze Age/Celtic era comprises more than 80 mostly rimmed craters scattered in a region of about 60 km length and ca. 30 km width in the very South-East of Germany (Fig. 19, Fig. 1).

-- The crater diameters range between a few meters and a few hundred meters, among them Lake Tüttensee, the hitherto established 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 fl uvio-glacial sediments.

-- The impact is substantiated by [4, and references therein]

- heavy deformations of the Quaternary cobbles and boulders in and around the craters
- abundant fused rock material (impact melt rocks and various glasses)
- shock-metamorphic effects (planar deformation features, PDFs, diaplectic glass)
- geophysical (gravity and geomagnetic) anomalies
- abundant occurrence of metallic, glass and carbon spherules; accretionary lapilli
- high-pressure/high-temperature carbon allotropes [5, 6]
- iron silicide particles composed of xifengite, gupeiite, hapkeite, fersilicite and ferdisilicite with crystals of cubic moissanite and khamrabaevite and containing CAIs [7, 8]

-- The impactor is suggested to have been a roughly 1,000 m sized low-density disintegrated, loosely bound asteroid or a disintegrated comet in order to account for the extensive strewn field [4].

Nalbach and Chiemgau parallels

Here, the remarkable parallelism of many of the Nalbach evidences with those of the Chiemgau impact is spotlighted. In the following images characteristic samples from both locations are posted side by side. If not otherwise indicated the Nalbach examples are set to the left.

Fig. 20. Peculiar pumice-like carbon matter that widely occurs in the Chiemgau crater strewn field where it has been given the name chiemite to be a new kind of a carbonaceous impactite [9]. The material mostly composed of glassy amorphous carbon contains specific carbon allotropes (carbynes, diamond-like carbon [DLC]/carbyne-like carbon) that require high temperatures and high pressures for formation [5, 6]. Practically identical matter is abundantly found in the Nalbach area.

Nalbach and Chiemgau parallels, cont.

Fig. 21. Very dense and hard glassy carbon. In the Chiemgau impact event this glass-like carbon is suggested to be an end product in an impact shock-produced short-term coalification process the target vegetation (wood, peat) having been the source material. Millimeter scales.

Fig. 22. Pumice from the Nalbach area and from Lake Chiemsee.

Fig. 23. Nalbach and Chiemgau pumice in close-up. Both samples show quite similar texture.

Fig. 24. Tektite-like, aerodynamically shaped glasses from the Nalbach and Chiemgau areas. Field widths are 7 cm.

Fig. 25. To the left: Individual pieces from Fig. 24 showing quite similar sculpture for the Nalbach glass (upper) and the Chiemgau glass (lower). Suchlike forms exhibiting flow structures possibly from contortion in a plastic condition are known also from Zhamanshin irgizites and from real tektites. Image to the right: The end fractures of both glasses shown on the left reveal identical internal texture.

Fig. 26. Vitrified cobbles; images to the left: Nalbach; to the right: Chiemgau impact. The cobble in Fig. 27 demonstrates how thin the glass coating is which holds true for the Nalbach as well as for the Chiemgau vitrified cobbles.This has to be interpreted as the result of extremely strong and extremely short-term heat build-up or of thermal evaporation of the cobble with the glass material.

Fig. 27. Glass-filled fissures in quartzitic cobbles; to the left Nalbach, to the right Chiemgau. The edges of the open fissures fitting perfectly prove the tensile character of the fracturing. Note that in both cases larger fissures are narrowing.Therefore the glass filling the open fissure must have been injected from the outside as melt or vapor also in a very short time. The increasing narrowing of the fissures indicates the direction of the fracture propagation providing the path for the melt or the rock vapor, respectively.

Fig. 28. The vitrified Nalbach cobble from Fig. 27 and one more comparison with a vitrified cobble from the Chiemgau impact area - front and rear each. The succession of mechanical load by shock and unloading with fracturing and subsequent vitrification is indicated by the fact that also the freshly fractured surfaces are completely vitrified.

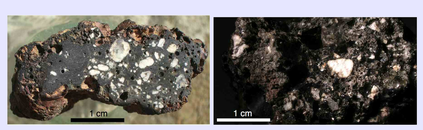

Fig. 29. Monomictic melt breccia composed of quartzitic fragments in a glass matrix. To the left Nalbach (sawed surface); to the right Chiemgau (freshly fractured surface).

Nalbach and Chiemgau parallels, cont.

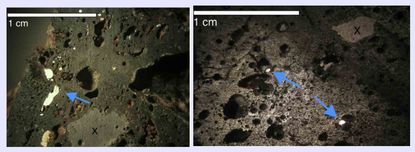

Fig. 30. Rock particles (x) and metallic inclusions (arrows) in a glass matrix. Left: Nalbach; right: Chiemgau impact.

Discussion

The widespread occurrence of peculiar samples in the Nalbach area covering many square kilometers makes a meteorite impact event in the Holocene very probable. Most convincing are indications of high temperatures and high pressures, particularly the mineralogical evidence of probable shock [1]. Likewise convincing are the abundant finds of cobbles exhibiting open fissures that are filled with glass having obviously been injected as melt or rock vapor into the propagating fractures (Fig. 17, Fig. 27). Impact shock spallation [10] can easily explain these peculiar features. In addition the paper-thin glass coating these pebbles and cobbles all around is practically incompatible with any furnace processes but gives evidence of an extremely short exposure of the cobbles to enormous heat which can be attributed to an impact air burst. Without having been aware of these peculiar vitrified cobbles an air burst was already considered in [1] with reference to lacking craters in the Nalbach area.

Moreover, the many extraordinary finds exemplified in this contribution like the various polymictic breccias, the tektite-like glass pieces and other glass varieties including pumice particles are in their entirety hardly to be explained by processes other than meteorite impact.

All the Nalbach findings as described have practically identical counterparts in the Chiemgau impact strewn field. What is different? So far no iron silicides being a prominent feature in the Chiemgau complex [4, 7, 8, 11] have been found, however no special efforts have been spent for their detection in the deep soil. The ample occurrence of in part strong shock effects (planar deformation features, PDFs, diaplectic glass) in Chiemgau samples could so far not be established simply because respective microscopic thin section inspections have been initiated only now.

Conclusions

The absolutely identical findings in the Nalbach area and in the Chiemgau impact strewn field suggest that obviously most similar processes at a related time took place. Once finally and independently the impact for the Nalbach area should prove well-founded, then it could be interesting and important to consider a coincidence in a much extended impact event that affected a distance of at least 500 km (see Fig. 1).

References

[1] Buchner, E. et al. 2011. Abstract #5048. 74th Annual Meteoritical Society Meeting. [2] Schmieder, M. et al. 2011. Abstract #5059. 74th Annual Meteoritical Society Meeting. [3] Koeberl, C. 1988. Geochimica Cosmochimica Acta 52: 779-784. [4] Ernstson, K. et al. 2010. *Journal of Siberian Federal University, Engineering & Technologies* 3: 72-103 [5] Shumilova, T. G. et al. 2012. Abstract #1430. 43rd Lunar & Planetary Science Conference. [6] Isaenko, S. et al. 2012. Abstract, European Mineralogical Conference, Vol. 1, EMC2012-217. [7] Bauer, F. et al. 2013, Abstract #5056. 76th Annual Meteoritical Society Meeting. [8] Rappenglück, M.A. et al., 2013, Abstract #5055. 76th Annual Meteoritical Society Meeting. [9] Ernstson, K. et al. (2013), Yushkin Memorial Seminar 2013), Proceedings, Syktyvkar: IG Komi SC UB RAS, 546 p. [10] Ernstson, K. et al. 2001, Geology, 29, 11-14.[11] Hiltl, M. et al. 2011. Abstract #1391. 42nd Lunar & Planetary Science Conference.