THE PROPOSED METEORITE IMPACT EVENT IN THE CZECH REPUBLIC: EVIDENCE STRENGTHENED BY INVESTIGATIONS WITH THE DIGITAL TERRAIN MODEL J. Poßekel[1], M. Molnár[2], and K. Ernstson[3], [1]Geophysik Mülheim (Germany) jens.possekel@cityweb.de [2]Resselovo nám. 76, Chrudim 537 01, Czech Republic (molnar@ego93.com) [3]University of Würzburg, 97074 Würzburg, Germany (kernstson@ernstson.de).

Introduction: Three contributions were presented at the past LPSCs [1-3], that reported on a Holocene meteorite impact strewn field in the Czech Republic, first proposed by geologist Z. Štaffen. Resumption of field work and extensive mineralogical-petrographical analyses revealed widespread occurrences of various impactites and abundant and typical strong shock metamorphism [1-3]. Remarkably, no associated clear impact craters could be established so far, what is resumed in this paper as an important observation. Inspired by new investigations with the Digital Terrain Model (DTM) on impact strewn fields in Germany [4-7] we report here on new field work and DTM analyses, which shed more light on the unusual impact event in the Czech Republic (Fig. 1).

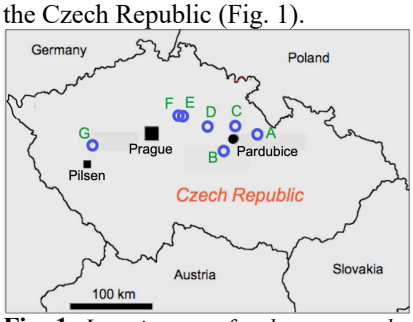


Fig. 1. *Location map for the suspected crater strewn fields, from which examples A and E are shown in this paper.*

The Digital Terrain Model and the new possibilities of impact research: Since some time, the possibilities of the Digital Terrain Model (DTM) have become an important tool for many purposes in the geosciences. Based on LiDAR data, topographic maps and profiles in a regular grid down to spacing of 1 m and with highest altitude resolution down to 20 cm (and even smaller scales by interpolation) may be produced for many countries.

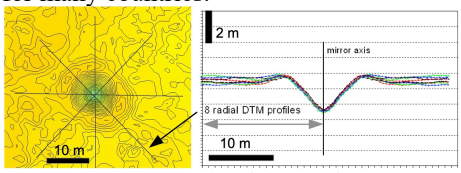


Fig. 2. *DTM Example of the perfectly circular Schatzgrube crater in the Chiemgau impact crater strewn field, map and profiles. See text.*

Thereby the DTM represents the bare ground surface without any objects like plants and buildings and may even be processed in thick forest. The excellent new possibilities of impact research, especially for young craters and in previously unexplored areas, for example in forests and swamps, are shown by the examples of Fig. 2 and 3. The nearly perfectly matching profiles in Fig. 2 prove absolute circularity of the crater over a 40 m area, excluding anthropogenic or ice age origin as impact opponents claim until today.

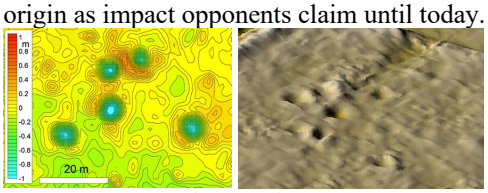
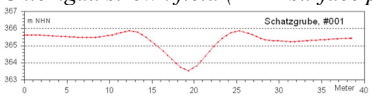


Fig. 3. *Clusters of crateriform structures in the Saarlouis strewn field (mardelles), contour interval 5 cm, and in the Chiemgau strewn field (DTM surface plot).*



taken from Fig. 2.

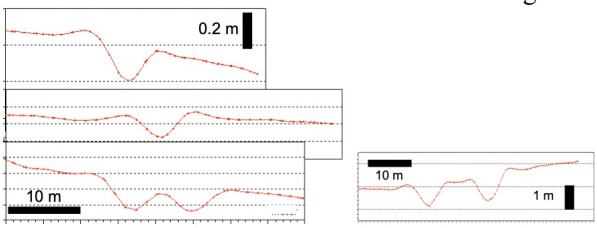
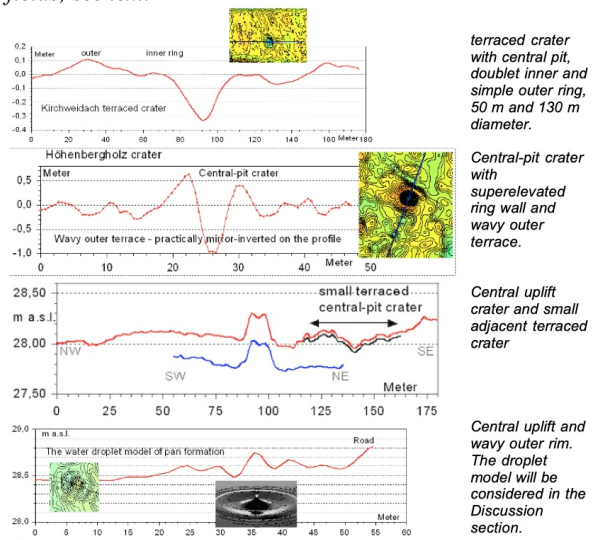


Fig. 4. *Prototype of most craters in the here discussed strewn fields; see text.*



terraced crater with central pit, doublet inner and simple outer ring, 50 m and 130 m diameter.

Central-pit crater with superelevated ring wall and wavy outer terrace.

Central uplift crater and small adjacent terraced crater

Central uplift and wavy outer rim. The droplet model will be considered in the Discussion section.

Fig. 5. *Complex craters with modified center and periphery structures seen in the DTM.*

Fig. 4 shows diametrical DTM elevation profiles through the Schatzgrube crater and craters from the Premnitz and Saarlouis strewn fields, which can be considered prototypes: a central pit crater with a pronounced ring wall surrounded by a broader flat

depression enlarging the complete structure to a diameter of several decameters.

Types of more complex craters: The described prototype of the crateriform structures does not hide the fact that in all of the strewn fields presented and studied here there are very complex variations, for which it is somewhat generalized that a central-pit crater is surrounded by a more or less broad ring zone of terraced or undulating formation, which enlarges the whole structure up to three times or more the morphologically conspicuous inner crater. A counterpart are structures that instead of the central pit have a central hump, which in turn may be surrounded with complex ring structures. Characteristic examples are shown in Fig. 5.

The Czech crater strewn fields: After the widespread strewn fields with extensive and unambiguous impact findings (see Introduction) but without significantly large associated impact structures, the idea grew that, as with the strewn fields in neighboring Germany, there could be a highly modified impact signature in the form of widespread strewn fields of predominantly small craters and that this finding could only be obtained with the help of the DTM. The result was, not completely surprisingly, clear, what Fig. 6 - 8 prove impressively.

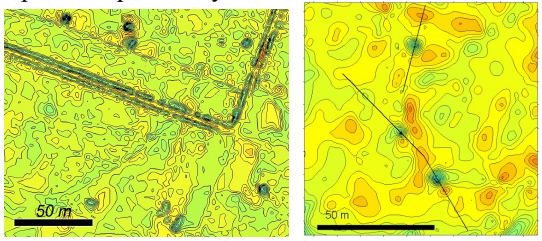


Fig. 6. *DTM of clusters of crateriform structures, location A and E.*

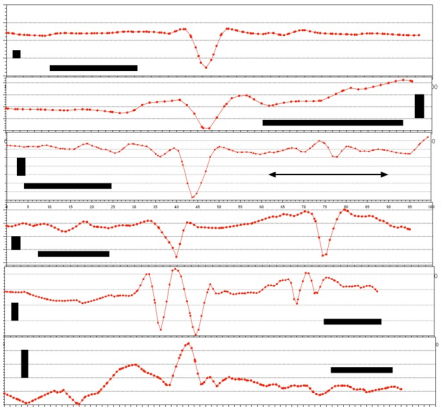


Fig. 7. *DTM diametral profiles over crateriform structures; location E in Fig. 1; 20 m horizontal, 0.2 vertical scale bars.*

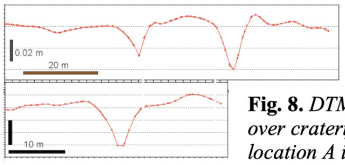


Fig. 8. *DTM diametral profiles over crateriform structures; location A in Fig. 1.*

Discussion and conclusion: Results presented here on new important impact findings in the Czech Republic:

-- The crateriform structures speak for a formation in an impact event.

-- They exclude an anthropogenic or geogenic formation. However, we specifically note that for some of these crateriform structures, there may be discussion of other origins without further investigation on the ground, e.g., if impact structures were later used by humans for different purposes and are interpreted by archeologists as fundamentally anthropogenic.

-- As discussed for the neighboring German strewn fields with increasing certainty so far, an airburst impact event is to be assumed, which started from a very loosely bound asteroid or a comet.

-- The complex crateriform structures presented here can be explained according to the water droplet model (Fig. 5) or be equated to the shapes produced by severe earthquakes, e.g., with the known earthquake sand blows.

-- The similarity of the strewn fields occurring over the whole of Central Europe in almost identical formation (Fig. 9), and the simultaneously observable association with unambiguous strong impact shock is highlighting.

-- Two model are considered. There have been much more frequent airburst impact events in the Holocene without major morphological imprinting of the Earth's surface (bigger craters), or the strewn fields belong to a single giant event by a projectile already strongly dissected in its approach to the Earth. A dating of the events so far is available only for the Chiemgau impact with a relatively well secured age of 900 - 600 BC.

Fig. 9. *Strewn fields with clusters of crateriform structures in Central Europe. The open symbol denotes the location of a newly discovered strewn field of smaller and larger virtually identical crateriform structures currently under investigation.*

References:[1] Molnár, M. et a. (2017) 48th Lunar and Planetary Science, Abstract #1920.pdf. [2] Molnár, M. et a. (2018). *49th Lunar and Planetary Science*, Abstract #1423.pdf. [3] Molnár, M. et a. (2020) *51st Lunar and Planetary Science*, Abstract #1229.pdf. [4] Poßekel, J. and Ernstson, K. (2021) *12th Planetary Crater Consortium Mtg 2021*, Abstract #2024.pdf. [5] Rappenglück, M.A. et al. (2021) *12th Planetary Crater Consortium Mtg 2021*, Abstract #2021.pdf. [6] Poßekel, J. and Ernstson, K. (2020) 11th Planetary Crater Consortium Mtg 2021, Abstract #2040.pdf. [7] Ernstson, K. and Poßekel, J. (2020) *12th Planetary Crater Consortium Mtg 2020,* Abstract #2019.pdf.