SEDIMENT OF A CENTRAL EUROPEAN MOUNTAIN LAKE IMPLIES AN EXTRATERRESTRIAL IMPACT AT THE YOUNGER DRYAS ONSET.

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Introduction: The Younger Dryas (YD) is well-documented cold period recorded over the Northern Hemisphere. Reasons for this sudden climate change are widely discussed by the scientific community [e.g. 1, 2]. Climate cooling began ~12,900 years ago and lasted ~1,200 years [3]. Recent discoveries [e.g. 4, 1] have revealed new evidence of impact proxies (incl. glassy microspherules), supporting a possibility of a major cosmic impact/airburst event caused by a fragmented comet or asteroid. Such event could be responsible for the Younger Dryas onset, including the disappearance of pre-historic paleoindian Clovis culture and large North American mammals such as mastodon, mammoth, and many others [5]. We analyzed sediments of a former mountain lake to test a possible presence of the impact proxies in Central Europe.

Methods and results: The research was carried out on a sediment profile from Stara Jimka paleolake (Fig. 1A; 49°4'7.4"N, 13°24'10.7"E, 1,110 m a.s.l.). We used a ^{14}C-dated ~5-m-long core to find a 0.5-m-long sequence covering the YD onset. This sequence was analyzed in 2-mm-step using XRF scanning, loss-on-ignition (LOI), magnetic separation and manual picking of glassy microspherules using a dissecting microscope, and ^{14}C-dating (4 AMS dates). In 1.2-cm-thick depth interval (447.8 – 449.0 cm), we identified abundant (>17,000 per kilogram) glassy Fe-rich microspherules (Fig.1B, C, and D) in a sediment containing framboidal microspherules and increased proportion of organic matter (LOI ~13 %). Scanning electron microscope (SEM) analysis of a thin section slice revealed a simultaneous occurrence of a volcanic ash shard accumulation. Concentration of the glassy Fe-rich microspherules was lower at deeper levels of the mentioned depth interval and continuously increased upwards, peaking at 448.1 cm. These microspherules range from 10 to 40 μm in diameter and often display tear-like droplets on their surfaces (Fig. 1B), aerodynamic teardrop shapes (Fig. 1C) and/or dendritic surface patterns (Fig. 1D) characteristic of high-temperature melting followed by abrupt quenching.

Discussion and conclusions: We identified an accumulation of tephra-like glass material in the Stara Jimka sediment. Its origin is probably linked to the Laacher See volcano eruption (East Eifel Volcanic Field; ~12,900 cal. yr. BP) [6]. The occurrence of this volcanic material and ^{14}C-dating indicate that the age of the glassy Fe-rich microspherules found in the same depth interval is ~12.9 kiloyear BP, similar to the age of the impact-related microspherules from the North American sites [1]. This is the first evidence of these unusual tracers in Central Europe (Fig. 1A).

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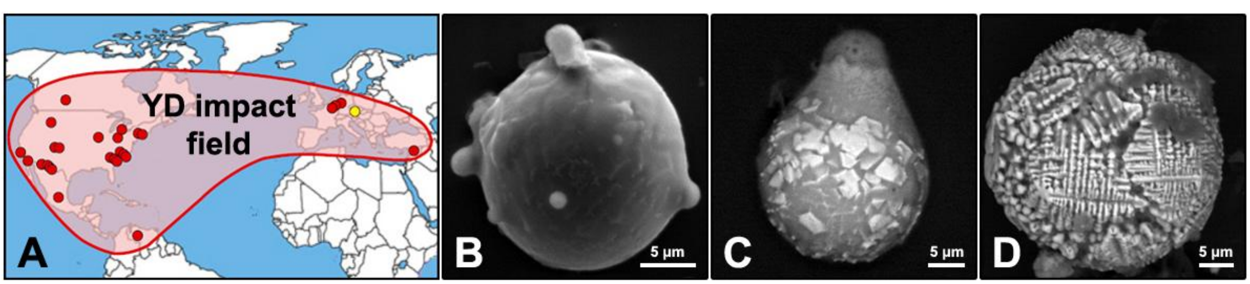

Fig. 1: A. Hypothetical YD impact field presented by Wittke et al. [1; modified]. Red dots represent localities with evidence of YD-impact-related proxies. Stara Jimka site is shown as a yellow dot. B, C, and D. Examples of glassy microspherules from Stara Jimka site.