ILUMETSA POTENTIAL IMPACT STRUCTURE AS AN ODESSA-TYPE CRATER Ania Losiak[1], Argo Jõeleht[2], Jüri Plado[2,] Kaidi Sarv[2]: [1]Institute of Geological Sciences PAS, Poland (anna.losiak@twarda.pan.pl), [2]Department of Geology, Uni Tartu, Tartu, Estonia

Introduction: Odessa-type crater was proposed to be one of the principal structural types of small impact craters [1]. These are characterized by having anticlines (sometimes with truncated tops) within the crater inner rim, locally displaced along inward-dipping faults [1, 2]. This study aims to document structures within the inner slope of the Ilumetsa Large (IL) potential impact structure in order to compare them to nearby undeformed sedimentary target and known Odessa-type small impact craters on Earth.

Study site: Ilumetsa in SE Estonia consists of two rimmed structures 80 m and ~50 m in diameter, located 725 m from each other [3] and 7 ka old [4]. The target consisted of a ~0.5-1 m of limno-glacial sands, a couple of meters of glacial till, and Middle Devonian weakly lithified sandstone at 2-4 m depth. Undisturbed sandstone is usually cross-bedded, and often consist of 20-30 cm white sets dividied by 5-10 cm reddish layers that post-depositionally became enriched in silt and clay (Fig. 1D). Ilumetsa is often considered a proven meteorite impact site [5], but neither remnants of the projectile nor shock metamorphic indicators have been found [3]. However, the presence of deformed sedimentary beds (including the rim consisting of sands mixed with numerous clayey till lenses; [6], age of the structure more than 7 ka after deglaciation of this area, a small thickness of glacial sediments and the presence of charcoals within specific locations of ejecta blanket [4,7], favour an impact rather than a glacial (e.g., kettle- or sinkhole) origin for the craters [3].

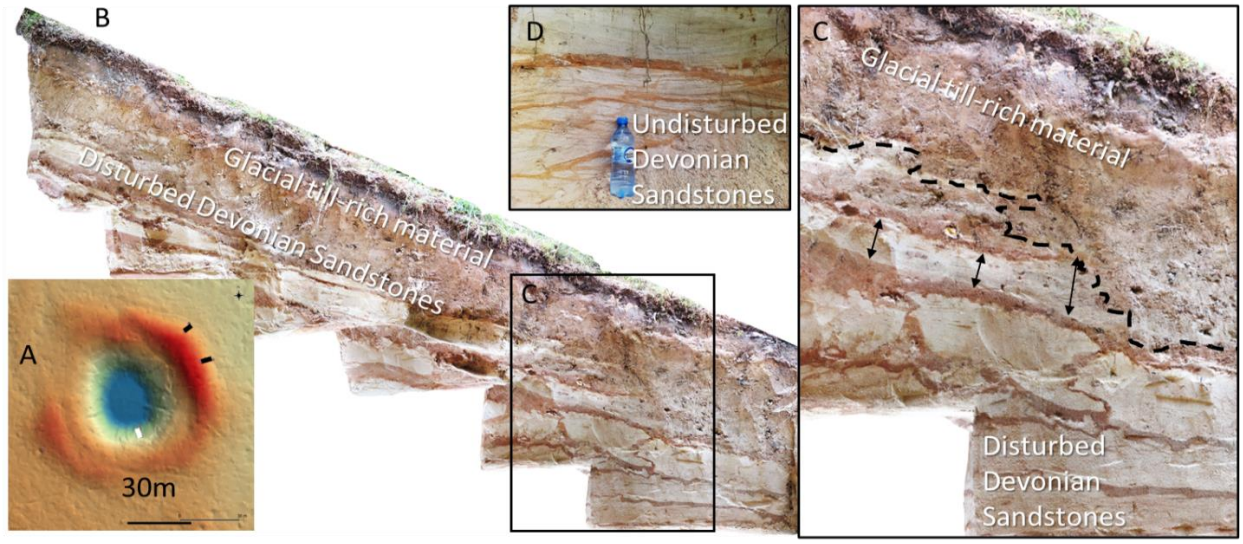

Figure 1. A) DEM of the Ilumetsa Large (IL): white line inside the crater shows the location of the trench shown in B, north-eastern trench (black line) was described in detail in [4]. B) An inner trench showing sandstone layering, initially approximately horizontal, now inclined towards the crater center, suggesting the existence of an anticline characteristic for Odessa-type craters. C) Close up of one of the sections showing disturbed sandstones with truncated, expanded edges and local intrusions of glacial till into Devonian sandstone. D) Undisturbed Devonian Sandstones as seen ~9 km from IL at the river Võhandu cliff.

Results: Five meters long, up to 1.6 m deep trench (white line on Fig. 1A) was dug in the middle part of inner slope of the IL. The trench shows that below 20-50 cm of glacial-till-rich material (either glacial till layer or till-rich ejecta), there are Devonian sandstones inclined towards the crater center with a dip of 15-20° (Fig. 1B). Sandstone is disturbed (no signs of crossbedding are preserved) but not mixed (larger white-red sections are roughly preserved). Interestingly, layers within sandstones are truncated (Fig. 1C). Additionally, the thickness of individual layers within sandstone is extended in some places, sometimes by till-rich intrusions into sandstone. Those findings are consistent with previous work by [6]. **Discussion**: We suggest that our observations are consistent with Ilumetsa being an Odessa-type crater. The properties of disturbed sandstones are consistent with a movement of material outwards from the Ilumetsa center, suggestive of an explosion. Sadly we still have not found meteorites nor shock metamorphic effects, so Ilumetsa remains a potential impact structure.

References: [1] Shoemaker and Eggelton 1961, Lawrence Radiation Laboratory Cratering Symposium, pp. A:1-27. [2] Shoemaker et al. 2005. Australian Journal of Earth Sciences: An International Geoscience Journal of the Geological Society of Australia, 52: 529-544. [3] Plado 2012. MAPS 47:1590-1605. [4] Losiak et al. 2020. MAPS 55: 274-293. [5] Osinski and Grieve 2019. Elements 15:70-71. [6] Aaloe 1963. Eesti NSV Teaduste Akadeemia Geoloogia Instituudi uurimused 11:35-43 [7] Losiak et al. 2022. (in review). **Acknowledgments:** 1) Marie Sklodowska-Curie grant ImpChar, agreement No 749157, 2) 2016 Barringer Family Fund for Meteorite Impact Research, 3) funding from the National Science Centre Poland 2020/39/D/ST10/02675. We do **NOT thank** the Ilumetsa Devils that probably caused the appearance of hordes of mosquitos, a flood, and even a small tornado in an attempt to stop our fieldwork.