A GEOGRAPHIC INFORMATION SYSTEM-BASED CHARACTERIZATION OF THE SÖDERFJÄRDEN IMPACT STRUCTURE, W. FINLAND. Andreas Abels[1], Lauri J. Pesonen[2], Alexander Deutsch[1], Lutz Bischoff[3], Martti Lehtinen[4]; [1]Inst. for Planetology, Univ. Münster, D-48149 Münster, Germany <abels@uni-muenster.de>; [2]Lab. for Paleomagnetism,. Geol. Surv. Finland, FIN-02150 Espoo, Finland; [3]Geol. Inst., Univ. Münster, D-48149 Münster; [4]Finnish Museum of Nat. History, Univ. Helsinki, FIN-00014 Helsinki, Finland.

In order to reevaluate properties and formation of the Söderfjärden impact structure [1], W. Finland, we have applied the Geographic Information System (GIS) software ILWIS 2.1©. The database contains airborne electromagnetic (AEM) and magnetic (AM) data, Landsat-5-TM data, a Digital Elevation Model (DEM) as well as published results of gravity and seismic surveys [2].

The surface expression of Söderfjärden consists of a forested hilly rim that surrounds a lower agriculturally utilised plain. The structure, which has an average rim-crest-diameter of ~6.6 km [3], is situated in Paleoproterozoic granitoids. Drillings revealed a central uplift (max. 287 m high, diameter: ~1.2 km) ~30–50 m below the surface [2,4]. The uplift is surrounded by a downfaulted moat, which is filled with Cambrian sediments [4] and the whole basin is covered by ~30–75 m thick glaciogenic material [2,4]. The impact event occured probably in the Lower Cambrian [4]. The structure is associated with a negative gravity anomaly of up to –6 mGal [2].

A combined interpretation of the DEM and AM data shows, that morphological gaps in the rim are due to prominent faults, some of which are traceable for several kilometers. Selective erosion of a previously continuously elevated rim and possibly post-impact tectonic activity are reponsible for these ruptures. The fault trends are clearly coincident with the dominant fault directions in the region. The same faults, extrapolated to the interior of the crater, are also responsible for the polygonal shape of the inner crater walls, especially indicated by the outline of the AEM anomaly and the morphologically plain. An explanation is a slumping process, in which first uplifted parts of the rim slided back into the excavated crater preferently along pre-exsisting faults which acted as separation planes. This leads to rather straight bounderies of the final crater basin.

The increased electromagnetic response within the crater is mainly caused by the thick water-bearing sediment filling. In addition, several drainage channels are present at the surface. The polygonal shape of the anomaly and the relatively uniform intensity over the whole basin suggest a only minor contribution of impact-induced fracturing and brecciation. The eastern periphery of the topographic plain, covered with Quaternary material, lies beyond the outline of the AEM anomaly. There basement rocks occur probably at relatively shallow depths (<30 m). Furthermore, the crater is characterized by an overall magnetic low which is roughly congruent with the AEM anomaly. A sharply increased magnetic response with an amplitude of ~50 nT at the crater center is probably due to impact lithologies with a newly aquired magnetisation [3]. This anomaly is most distinct in the eastern part of the central uplift.

The seimic and gravity data indicate a certain asymmetry of the crater basin [2]. The eastern moat-rim-transition is considerably shallower than the western slope. A similar, but less distinct difference is visible in the magnetic data, i.e., the SW slope is relatively sharp, whereas the NE transition appears more gradual. Non-uniform slumping might be the reason. The western rim has preserved a steep slope, because no material slided back into the excavated basin, whereas in other rim sections slumping partly filled the moat up. This may explain also the missing allochthonous breccia unit in a drill core which penetrated the whole sedimentary pile in the western moat [4], although the absence of even extensive autochthonous brecciation remains a puzzling phenomenon [3].

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