PALEOMAGNETISM OF THE LAKE JÄNISJÄRVI IMPACT STRUCTURE AND ITS IMPLICATIONS TO BALTICA'S NEOPROTEROZOIC PALEORECONSTRUCTIONS. J. Salminen[1], F. Donadini[1], L. J. Pesonen[1], and V. L. Masaitis (2) [1]Division of Geophysics, P.O.Box 64, 00014 University of Helsinki, Finland; [2]Karpinsky Geological institute, Sredny prospect 74, St.-Petersburg, 199106 Russia
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Introduction: Impact structures often provide useful material for paleomagnetic studies. In particular, when the impactites can be accurately dated and carry a stable thermoremanent magnetization, they may provide keypoles for continents paleoreconstructions [1]. Impactites may provide also good material for paleointensity studies [2].

Because, a successful paleomagnetic approach requires that the remanence is primary, we will present here in addition to paleomagnetic results also petrophysical and rock magnetic results for the rocks of the Lake Jänisjärvi impact structure and surrounding.

Geological setting and sampling: The Lake Jänisjärvi impact structure (latitude: 61°58'N, longitude: 30°58'E) is located in Russian Karelia, about 220 km North of St. Petersburg. The present diameter of the structure as based on the gravity data [3] is about 16 km. Isotopic dating, using both ^{40}Ar-^{39}Ar [4] and K-Ar [5] methods, yields age of ca. 700 Ma for the melt rocks.

The structure is located in the South eastern part of the Fennoscandian shield close to the Archean-Proterozoic boundary. The Archaean crystalline basement, composed of gneissic granite and migmatites, crops out 3 to 4 km North of the lake. The Jänisjärvi is surrounded by Proterozoic crystalline schists [6]. Due to the impact event, the schists around the lake are strongly fractured.

Oriented hand samples were collected from the impactites in the three central islands of the lake and in the western part of the lake. Target material, consisting of Paleoproterozoic-Mesoproterozoic (Svecofennian) rocks, was also sampled. All together, 54 hand samples from 28 sites were collected.

Methods: Petrophysical properties (susceptibility, intensity of natural remanent magnetization (NRM), and density) of the samples were measured mostly at the Petrophysics Laboratory of the Geological Survey of Finland (GSF). Thermomagnetic and hysteresis properties were measured at University of Helsinki (UH). Demagnetization of the samples was carried out partly at GSF and partly at UH mainly using AF treatment, only few thermal treatments were done.

To determine the paleointensity we used Thellier technique [7] with standard pTRM and tail checks [8].

Results: The rocks originated after the Jänisjärvi impact event show different petrophysical properties from the unshocked target rocks. In particular, we observed an increased porosity in the impactites.

The natural remanent magnetization (NRM) of the tagamites is generally weak, but fairly stable during demagnetization. The characteristic remanence component, carried usually by titanomaghemite and magnetite, yields a paleomagnetic pole (latitude 45.0°, longitude 76.9°, dp = 9.9°, dm = 11.0°, 5 sites). The component, which was most common in impactites, has also been isolated in a few target rocks at the rim of the structure as a weak overprint on the Svecofennian 1.9 Ga direction.

Paleointensity determination based on 7 reliable measurements yielded a mean value of 68.71 ±7.60 μT.

Discussion: Paleomagnetic results for tagamites place Baltica to 60ºS paleolatitude at the time when the rocks gained their characteristics magnetization. The paleomagnetic pole derived from tagamite samples differs from the Neoproterozoic poles of Baltica [9]. The pole matches better with the poles corresponding to an age of about 500 Ma in the APWP for Baltica. If the magnetization of the samples is related to impact event, this is in disagreement with the isotopic age of about 700 Ma for the impact melt rock [4; 5], since the cooling of such shallow melt bodies is assumed to occur quite fast and the aquired remanence should match in time with isotopic closing. In addition, paleointensity studies of tagamites show clearly higher paleointensities than other Neoproterozoic - Cambrian rocks.

The question thus arises whether the isotopic ages are in error due to inherent problems of the ^{39}Ar-^{40}Ar dating technique [10]. One method to solve this discrepancy would be the dating of the melt material again, because the ^{39}Ar-^{40}Ar age using the whole rock samples could be biased by older Svecofennian inclusions. The occurrence of metasiltstones clasts of Vendian age in the suevite may indeed indicate that the impact is younger than 700 Ma. Hence, a new dating may provide useful data for solving the dilemma.

Assuming, however that the 700 Ma data indeed represents the age of the Jänisjärvi impact event, we try to explain the significant deviation of the Jänisjärvi pole from Neoproterozoic poles published for Baltica [9]. We studied four possible reasons, which may explain the discrepancy: (1) post-impact remagnetization; (2) post-impact tilting, (3) secular variation of the geomagnetic field or (4) a poorly defined APWP due to to the paucity of well-dated Neoproterozoic paleomagnetic poles.

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