

A new geological map of the El'gygytyn impact structure, NE Russia. U. Raschke¹, P. Zaag¹, W. U. Reimold^{1,2}, and R. T. Schmitt¹, ¹Museum für Naturkunde, Leibniz-Institut für Evolutions- und Biodiversitätsforschung, Invalidenstraße 43, 10115 Berlin, Germany (e-mail: ulli.raschke@mfn-berlin.de), ²Humboldt-Universität zu Berlin, Unter den Linden 6, 10099 Berlin, Germany (e-mail: uwe.reimold@mfn-berlin.de)

Introduction: El'gygytyn is a 3.6 Ma [1], 18-km-diameter complex impact structure [2], located in the Ochotsk-Chukotsky Volcanic Belt of Chukotka Peninsula (Northeast Russia) [3,4]. The mainly silicious volcanic rocks of the crater area were described as the Late Cretaceous Pykarvaam and Milguveem series [5-7]. ⁴⁰Ar-³⁹Ar dating of volcanic rocks from the crater area gave ages of 86-89 Ma [8]. In summer 2011 an expedition of the Alfred-Wegener-Institut (Potsdam), the Arctic and Antarctic Research Institute (St. Petersburg), the University of Cologne, and the Museum für Naturkunde Berlin to the impact structure allowed us to investigate the geology of the eastern half of the crater. Samples from 58 outcrops were collected and analyzed. The petrographic and geochemical results, together with previous mapping, allowed us to create a new geological map of this impact structure (Fig. 1).

Samples and Methods: All samples are from volcanic country rock and were taken from fresh outcrops from the NE to the S along the crater rim. We prepared 48 thin sections and 43 XRF analyses. Additionally, we obtained 76 samples (bedrock and colluvium) from a 2003 expedition (collected by O. Juschus [9]). Overall, ~80 new samples were studied and provided information for the new geological map. The map was compiled incorporating information from the following sources: 1) Russian geological map [10, 11], 2) Russian topographic map [12], 3) stratigraphic map [8], 4) simplified map [13], 5) Digital Elevation Model [14], and 6) ASTER data [15]. The map (Fig. 1) was produced with the ArcGis 10 software.

Expedition and Results: Our team is still working on the impactites from the 2009 ICDP drill core from Lake El'gygytyn. We note the relevance of comparing the core material with the target rocks from the crater region. An established data set is available in the literature [16] and was used for the petrographic and geochemical characterisation of the drilled impactites [17]. One of the objectives of the summer 2011 German-Russian expedition was geological reconnaissance of the relatively unknown eastern crater rim. The chemical results of our samples from there indicate a wide range of basaltic to (trachy)-rhyolitic volcanics. Petrographic studies revealed that all types of volcanics observed in the drill core occur in the wider crater region and some of them constitute the current eastern rim: basaltic and andesitic lava flows, pyroclastic flows (including rhyodacitic and rhyolitic ignimbrites), and a variety of tuffs. Phreatomagmatic tuffs with

andesitic composition occur mainly in the southern sector of the morphological crater rim. Ash tuffs occur as thin layers in patchy, only a few meter wide outcrops on top of the lava flows or are intercalated with different units of ignimbrites. Besides the newly discovered tuffs, we identified a large basalt sheet in the SE part of the crater rim, of ~4 km² extent. The mafic rocks overlying the rhyolitic ignimbrites form the prominent hills in the eastern parts of the crater structure. A few meter-sized boulders of impact melt breccia of dacitic bulk composition occur in the 3 m thick terrace at the SE shoreline. Besides this material that contains shocked clasts covering the range from ~10 to ~50 GPa, we did not detect any evidence of impact-induced shock deformation in the rocks of the eastern crater rim, such as shatter cones that were, however, found in the drill core.

Discussion: We identified some previously unknown lithologies, e.g. andesitic tuffs and rhyolitic ignimbrites, at the southeastern crater rim. The large basalt sheet in the SE and the hills of rhyolitic ignimbrite along the NE rim also represent new regional geological information. Besides this, we could confirm large parts of the previous Russian maps. All country rocks are strongly degraded by the Arctic weather conditions; therefore it was difficult to obtain structural information. Generally, it was not possible to identify faults or contact relationships. It was only possible to estimate roughly the transitions between different lithologies within a few meters. Accordingly, all tectonic attributes of the new map are based on the older Russian map and other authors [10-12].

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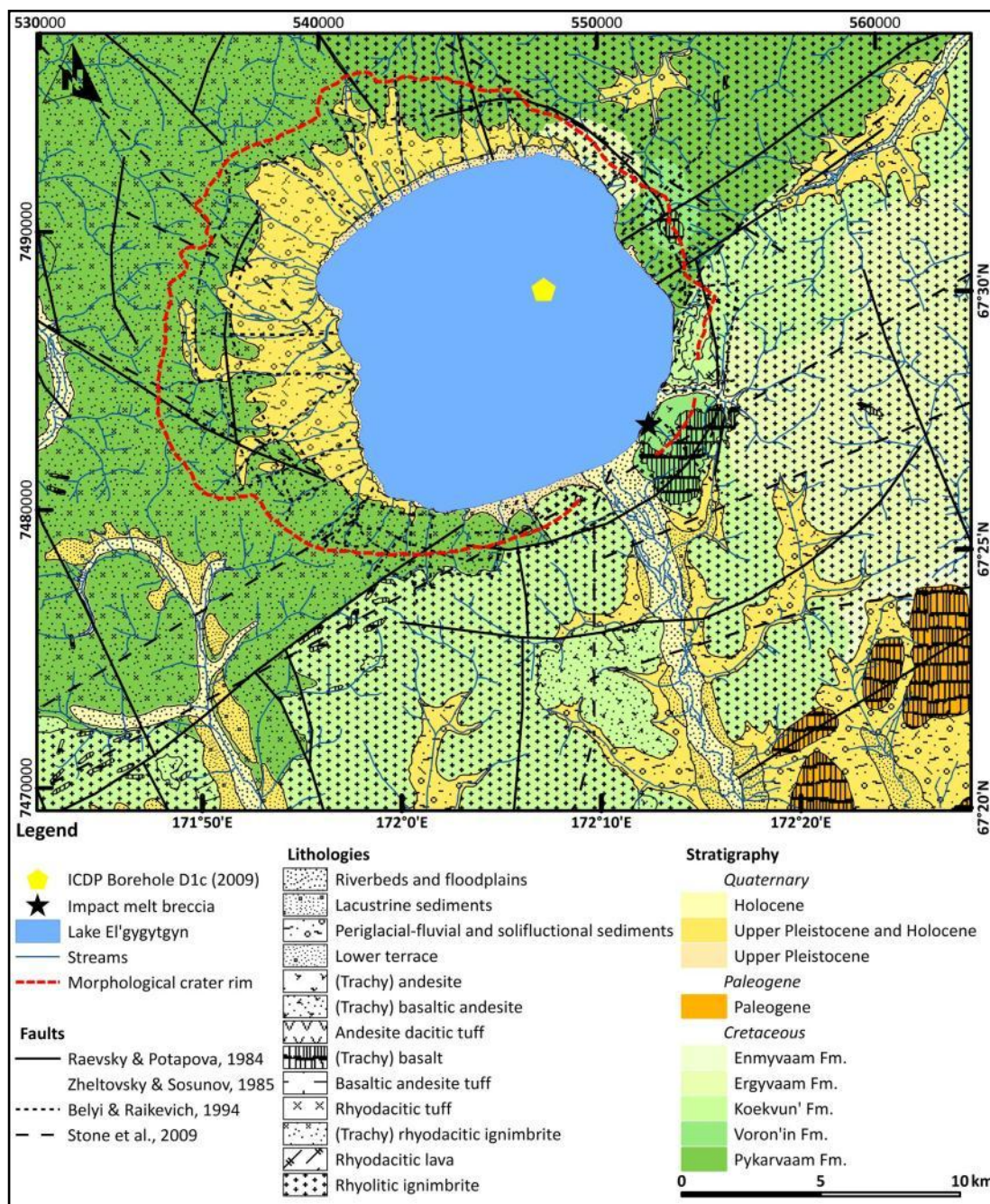


Fig. 1: New geological map of the El'gygytyn impact structure. ©Museum für Naturkunde Berlin