THE NYROKI CRATER: HIGHLY–POSSIBLE IMPACT STRUCTURE IN TRANSBAIKALIAN SIBERIA (RUSSIA).

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Location: The Nyroki crater (center coordinates are 54º26'30"N, 112º51'34"E) is localized to the East of the Baikal Lake within the Vitim channeled upland which exhibits a moderate mountain relief with the altitudes ranged from 1200 to 1800 m above sea level. This zone was formed during the Mesozoic-Cenozoic times and has a smoothed topography of the watersheds at deep downcutting of the river valleys. These wide valleys contain a number of terraces and are characterized by a developed steady-state profile.

General morphology: The crater is present on the watershed ridge of NW strike, which separates the Alakan + Agenda Rs systems on the south and China + Nyroki Rs on the north. Due to its exclusively right rounded morphology, the crater is clearly expressed on the spurry local topography **(Fig. 1).** The flat bottom of the crater is surrounded by the step slopes and the fragmented chain of the delineating hills. These hills are elevated up to 30 – 170 m above the adjacent areas of watershed ridge and can be considered as the remnants of the eroded crater's outer rim. The diameter of the crater across the rim axis is 5.5 km. In contrast to the spurry relief of the adjacent watersheds the topography of SW and NE borders off the crater is more rigged.

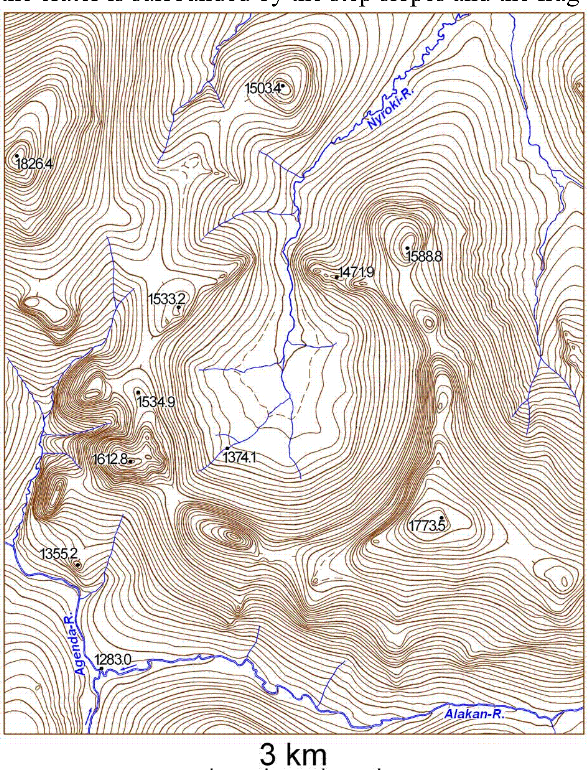

Fig. 1. Topography of the crater and its vicinity. The bold contour lines of the topography are shown at every 50 m; the thin ones – are at 10 m; the dashed ones – at 5 m. Numerals show the elevation of the topographic points in m, above sea level.

General geological setting: The target rocks of the crater are represented by the sedimentary (Cambrian), metamorphic (Upper Proterozoic) and igneous (a number of intrusions ranging from Upper Proterozoic to Paleozoic-Mesozoic ones) rocks **(Fig. 2).** Post-crater lithologies are made up of Q IV and Q III deposits; of a special interest in the sequence are the Nyroki intercrater lake (N?) deposits: silts and sandy-gravel sediments of up to several hundred m in thickness. In general, the target complex of the crater is made up of hard granitic, crystalline and igneous rocks.

On the impact origin of the crater: Based upon its exclusively right rounded morphology, the Nyroki crater can be confidently interpreted as a highly possible impact structure. No other model can be applied to explain its origin by a non-impact way. On the other hand, the morphologic criterion is for today the only one evidence of the impact origin of the structure. As for the other evidences of the impact, the Nyroki crater is still not investigated in this aspect. In the meantime, the relatively young age of the structure and the specificity of its target rock complex are highly favorable for the quest of a number of the impact proofs here.

Quest of the shock metamorphism traces: Good field criteria of impact may be found in the Cambrian and Proterozoic limestones, shales and sandstones (shatter cones) and in various hard sedimentary and igneous target rocks ("gries" breccia). Petrographic evidences of impact such as various planar micro-structure systems (cracks, lamellae of mechanical twinning, PDF's of definite crystallographic orientation in a host mineral) are often common for the shocked quartz, feldspar and some other rock-forming minerals. To this we can add the diaplectic and melting vitrification of quartz and feldspar, origin of pseudotachylites and impact melt glasses. In case of the sampling the diaplectic and impact melt products in the crater, high-pressure minerals (coesite, stishovite, impact diamonds, etc.) are also possible here. All these features both diagnostic and accompanying for the impact are well described in [1–4 and other papers] and many times were studied

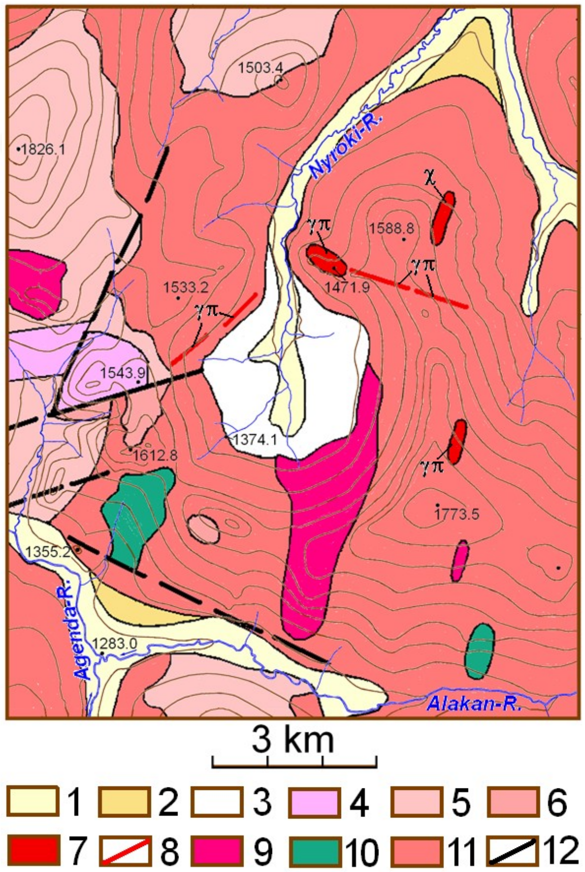

Fig. 2. Geological target of the Nyroki crater.
Legend: *A. Stratigraphic sequence.* 1 – Holocenian alluvial deposits (Q IV); 1 – Upper Pleistocenian deposits (Q III); 3 – Neogene (N?) Nyroki intercrater lake deposits: silts and sandy-gravel sediments; 4 – Low Cambrian conglomerates, sandstones and shales of the Burunda siute (Cm_1br); 7 – Upper Proterozoic shists, gravelites, conglomerates and limestones of the Ikat suite (PR_2ik); 8 – Upper Proterozoic limestones of the Tilim suite (PR_2tl). *B. Igneous sequence.* 5 – post-Cambrian igneous rocks of indefinite age: granites and granit-porphyres of the Nyroki complex (γπPZ–MZ?n); syenite dykes (χPZ–MZ?); 11 – dykes of granites and granit-porphyres of the Nyroki complex (γπPZ–MZ?n); 6 – Early Paleozoic granites of the Vitim igneous complex ($\gamma\pi PZ_1v$); 9 – Later Proterozoic diorites of the Barguzin igneous complex (δPR_2b); 10 – Later Proterozoic granites of the Barguzin igneous complex (γPR_2b). 12 – faults. The local topography is expressed by the contour lines shown at every 50 m; altitudes of some topographic points are the same as on the **Fig. 1**.

by us in the Popigai, Kara, Loganchia, Zhamanshin, Ries and some other astroblemes [5 and other papers]. Hard target rocks of the Nyroki crater, and especially granites among them, are highly perspective for the quest and study of the shock-originated mineralogical and petrographic diagnostic features, mentioned above.

Possible crater structure due to impact model: Theory of impact cratering allows predicting the internal structure of the Nyroki crater. The crater has to be of a complex type with a central uplift (following to [4] the terrestrial craters of more than ~4 km in diameter originated on a hard target are of a complex type). After the dependence [6] the diameter of the uplift should be ~600–700 m, and ~400–700 m after [5]. The axial rise of the uplift has to be ~400 m after [7]. The Nyroki central uplift can be present in the crater bottom profile in a buried variant. As there are no mapped suevites (vitro-clastic deposits of the explosion cloud) on the crater rim, so the rim is made up of the para-authochtonous products of the plastic flow zone. Complicated topography of SW and NE borders off the crater can be explained by the centrifugal displacement of para-authochtonous masses during cratering. Deep pre-impact river valleys could stimulate the process.

Some estimates within the impact model: The energy of the Nyroki impact is estimated to be ~10^{18} J after [8]. In case of the vertical impact at 24.6 km/s (an average impact velocity after [9]) for the spherical meteorite (L–H group chondrite with a specific density of ~3.5 g/cm^3) the diameter of the meteorite is estimated to be ~130 m.

Summary: The data presented show the Nyroki crater is highly-possible impact structure originated in Cenozoic (pre-Pleistocenian) time. It needs the detailed study. Unfortunately, the study is possible in case of the financial support for the future field expedition.

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