THE KARA CRATER SIZE: SUEVITE LAYER OUTSIDE THE CRATER DEPRESSION. D.D. Badjukov[1], J. Raitala[2], T. Ohmann[2], and C. A. Lorenz[1], [1] V.I. Vernadsky Institute of Geochemistry and Analytical Chemistry RAS, Kosigin str., 19, Moscow, 119991, Russia, badyukov@geokhi.ru, [2]University of Oulu, FIN-90401 Oulu, jraitala@sun3.oulu.fi.

Introduction: The Kara impact structure is located on shore of the Baydarata gulf of Kara sea, 200 km northern from the Vorkuta city, Russia. There are two controversial opinions of the scale of the impact event. It has been suggested that the structure consists of two adjacent craters, the Kara and Ust'- Kara craters. The Kara crater proposed to have a 65 km diameter and the Ust-Kara crater would be 25 km [1] in diameter. If they formed in a single impact event, the combined energy of the event resulted in 65 and 25 km craters was 7.0×10^{21} J [2]. However, indirect evidences lead to an assumption that the Ust-Kara crater does not exist and there is only one crater of 120 km in the original size [3] that corresponds to a 6.8×10^{22} J impact event. This huge scale of the event makes the Kara crater one of the largest craters on the Earth. The evidences for the large Kara event include 1) gravity data which clearly indicate the Kara crater but not the Ust-Kara crater, 2) geology and lithology of the Ust-Kara suevite sheet, and 3) morphometric analyses of topographic and geologic maps of the area [3,4]. The most significant point, which can either prove or disprove the large Kara diameter, is a geological position of the impact breccia outcrop at the Syadmayakha river located 55 km northeast from the Kara crater center. If the breccia is a distal ejecta, the Kara crater has to be less than100 km in its original diameter and the double Kara structure is probable. However, if the breccia is presented by fallback impactites, the single Kara crater which is at least 110 km in diameter is proven and suevites exposed at Ust-Kara belong to the complex crater. In this case the complex crater should have a central uplift and two concentric ring depressions filled by impactites. The crater was heavily eroded and impactites of the outer depression are exposed now at Ust-Kara and the Syadmayakha river only.

Results: To check the idea of the large Kara crater the Syadmayakha river area was visited in 2001. Here we give the first data on the Syadmayakha breccia. The main rocks of the area are Permian terrigenic sediments of the Lekvorkuta Formation present by sandstones and shists. The Permian rocks are exposed along river valleys and show intensive tectonic block deformations and layers which are often in sub-vertical positions (Fig 1). The >1.5 m thick suevite layer is exposed at the Syadmayakha river valley and is overlaid by aquatic sediments which consist of re-washed suevite material (Fig 2, the top of the suevite layer is marked by a dotted line). The suevite seems to be deposited in a depression of underlying Permian rocks and close to the suevite outcrop the Permian sediments are exposed at the same level. The suevite consists of a matrix, rock fragments <5 cm in size, and irregular shaped white or colored inclusions of former glass totally substituted by clay and zeolites. The content of the glass inclusions is estimated to be 10 - 15 vol%. Fragments of rocks are angular or sub-angular and are presented by Permian sediments (> 95%) and pre-Permian (Ordovician to Carboniferous) jasper, sandstone and limestone (<2%). No Cretaceous coal and opoka fragments were recognized in the field and in thin sections. The fragments are embedded in a matrix (60 vol%) consisting of mafic silicates (illite, montmorillonite - ?) and albite and quartz grains with corroded margins. Compositions of a matrix and Permian clasts determined in thin sections of suevite by a broad beam microprobe technique are close each other and resemble thus chemically the impactites of Ust-Kara but differ from pre-Permian rocks (Fig.3), which generally have higher CaO and/or SiO_2 and lower Al_2O_3 [5-7]. Zeolites and clayish material have substituted totally for glasses. However, structures of the mineral aggregates inherited often the structures of glasses, which originally displayed schlieren and flow structures (Fig. 4). Some glasses contained numerous vesicles (Fig. 5). The differences in structures of glass fragments can reflect differences in their chemical compositions like those found in the Kara suevites. Thin-grained matrix of suevite fill out vesicles in the pumice-like glass fragments (Fig. 5) what indicates a relative high pressure during the suevite layer formation. No sphere-like or aerodinamically-shaped glass inclusions were found. Quartz grains with PDF are extremely rare.

Discussion: The lithology of the Syadmayakha suevite layer is very dose to the lithology of lapilli-agglomerate suevites from upper "layer" of the Kara crater coptoclastic sheet [1] and the uppermost suevite layer [8]. On the other hand, the Syadmayakha breccia differs from K/T boundary ejecta and distal ejecta of the Acraman crater [9] and the Boltysh crater [10]. Hence, the origin of the Syadmayakha suevite has to be the same as that of suevites in other impact craters and this suevite can be either fallback or fallout. The lack of spherical glass particles and aerodinamically shaped bombs in the Syadmayakha suevite indicate their similarity with the Ries fallback suevite [11]. The suevite layer was reworked hydrotermally after the deposition. Further, an abscence of the Cretaceous

sediments in the area suggests that they have been removed before deposition of suevite. This leads to an assumption that the Syadmayakha area belongs to the crater floor but not is located outside the crater rim. Hence, the Kara crater diameter has to be equal to or larger than 110 km. On the other hand, we can not rule out a possibility that the Syadmayakha suevites are material ejected outside the crater which was retained due to specific conditions.

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Fig. 1. Sub-vertical position of Permian sediments, the Pekotsayakha river

Fig.2. The suevite outcrop at the Syadmayakha river

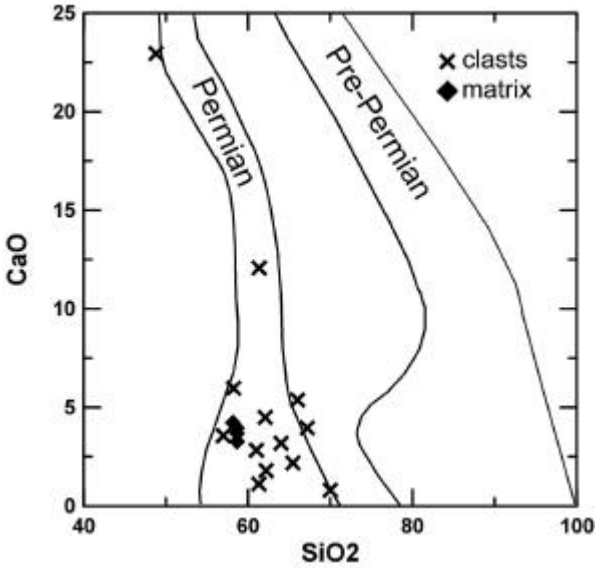

Fig. 3. Compositions of clasts and a matrix in the Syadmayakha suevite. Permian and pre-Permian target rock compositions are shown after [5]

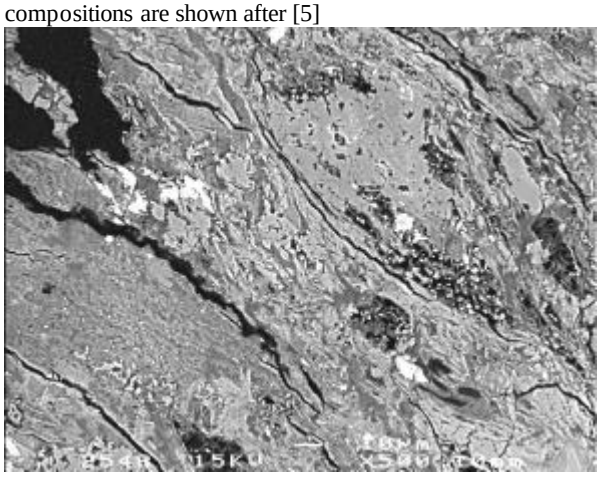

Fig. 4. Inclusion of former glass replaced totally by zeolites in the Syadmayakha suevite (SEM image)

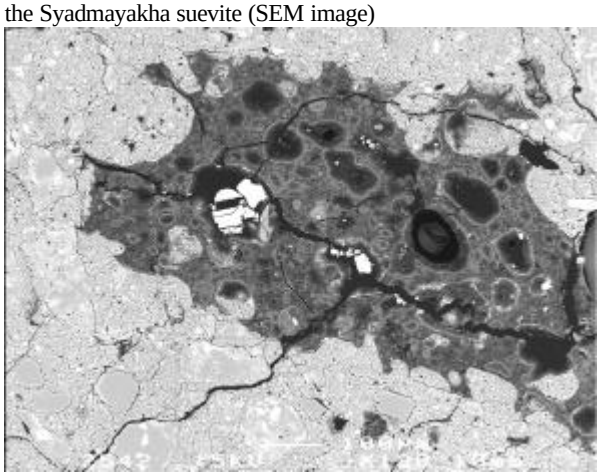

Fig. 5. Inclusion of pumice-like former glass replaced by clayish matter (very dark gray) and zeolites (dark gray). Note filling vesicles at margins by a suevite matrix (SEM image)