THE KARA IMPACT STRUCTURE: HYDROGEN ISOTOPIC COMPOSITION IN THE IMPACT MELTS AND CONSTRAINTS ON THE IMPACT AGE. M.A.Nazarov (1), A.L.Devirts (1), E.P.Lagutina (1), A.S.Alekseev (2), D.D.Badjukov (1), and Yu.A.Shukolyukov (1,2) (1) Vernadsky Institute of Geochemistry and Analytical Chemistry, Moscow, 117975; (2) Moscow State University, Geological Faculty, Moscow, 119899, USSR

Introduction. K-Ar isochrone age of the Kara impact structure was determined to be 65+/-0.4 Ma [1] that is consistent with the K/T boundary age. However 39Ar-40Ar measurements [2] showed that the structure is older than 70 Ma and is probably related to the Campanian/Maastrichtian boundary (73 - 74 Ma). The discrepancy is significant and demands further dating of the structure by different methods.

It has been suggested [3] that the Kara structure may be formed in a shallow sea. If the suggestion is correct, the Kara impact melts should be contaminated with sea-water that can be identified through hydrogen isotopic composition. The reconstuction of the Kara impact environment can give additional constraints on the impact age because the history of transgressions and regressions at the impact site during the time of our interest can be reconstructed from general paleogeography and from paleontological studies of the crater rocks. For this reason we studied hydrogen isotopic composition in the Kara impact melts.

Results. Impact glasses KA2-306,1, KA2-099,0, SA1-306,1, and cryptocrystalline impact melts PL2-148,0 and 701e collected in different sites and in different geological positions in the Kara structure were analyzed for hydrogen isotopic composition. The samples are slightly altered and contain secondary phases formed by hydrothermal processes during post-impact cooling. The δD values were determined in gas fractions released in the temperature intervals of 20° - 200°C and 200°- 1100°C. The δD and H2O release spectra from 100° to 1100°C was measured for impact melt PL2-148,0 (Fig.) The obtained data show that deuterium concentrations in the 20°-200°C fractions are higher and more variable than those in the 200° -1100°C fractions. The δD values of between -61 to -73 °/oo in the 20° - 200°C fractions (Table) are close to those in recent atmospheric precipitation at the latitude. Therefore hydrogen released between 20° and 200° could be of atmospheric origin, but in the case of samples SA1-306,1 and 701e, δD values reveal fractionation or mixing with other meteoric water. Hydrogen of the 200° - 1100°C fractions is certainly from fluid inclusions or secondary clay minerals. It has the isotopic composition in the range of from -100 to -141 °/oo which is not dependet on texture, chemistry and geological positions of the studied samples. The composition is very far from the SMOW value and indicates only one component of meteoric origin.

Discussion. Reconstructions of Upper Cretaceous paleogeography for the Western Siberia and the Yamal Peninsula [4] are available for the Kara impact site. The reconstructions suggest a maximum phase of a transgression from Santonian to Lower Campanian. A deep sea was spread over the territories and penetrated through the Ural to the Pechora region. Sedimentary rocks of the age are represented by opokas , siliceous clays and sandstones. During Upper Campanian and Maastrichtian the Western Siberia sea began to reduce and to shallow. Deposits of the age are mainly clays and sands. However a main regression started in Upper Maastrichtian. At the Yamal Peninsula Upper Maastrichtian deposits comprise regressive facies and Danian is represented by continental sediments. In the central part of the Western Siberia Maastrichtian and Lower Danian deposits are of marine type. It means that the Maastrichtian sea retreated to the south. Thus we can suggest that there was a sea at the Kara impact site up to Upper Maastrichtian or Lower Danian.

Paleontological studies of the Kara crater rocks [5] support the conclusion inferred from general paleogeography. Marine fossils and Cretaceous rocks of the Kara crater are similar to those of the Western Siberia region. Santionian and Lower Campanian fossils found in the crater are associated with siliceous rocks, whereas Upper Campanian - Maastrichtian fossils are connected with clay and sand materials. However Upper Maastrichtian marine fossils described in the Western Siberia deposits were not recognized in the Kara crater rocks. Therefore we can conclude that a land could exist at the Kara impact site from the beginning of Upper Maastrichtian.

The results of the measurements of hydrogen isotopic composition do not show any contamination of the Kara impact melts with sea-water. It means that the Kara structure was formed on a land area, and, hence, the structure must be of Upper Maastrichtian or younger age, i.e. younger than 69 - 70 Ma. Thus the age constraints are better compatible with the K-Ar date of 65.7 Ma [1] and support strongly the possible connection between the Kara structure and the K/T boundary event.

KARA STRUCTURE: Nazarov, M.A. et al.

REFERENCES. [1] Kolesnikov E.M. et al., (1990) LPS XXI, p.649; [2] Koeberl C. et al., (1990) Geology, v.18, p.50; [3] Masaitis V.L. et al., (1980) Geology of astroblems, 231p.; [4] Galerkina S.G. et al., (1982) Sov. Geology, n.12, p.77(in Russian); [5] Alekseev A.S. et al., (1989) LPS XX, p.5.

Table.

Sample	T°C	δD, °/oo	H_2O wt%
KA2-306,1	20-200	-72	.93
	200-1100	-109	2.7
KA2-099,0	20-200	-61	1.02
	200-1100	-100	2.72
SA1-306,1	20-200	-111	.08
	200-1100	-141	1.75
PL2-148,0	20-200	-73	.27
	200-1100	-124	1.43
701e	20-200	-132	.07
	200-1100	-107	.48