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Uranium–Thorium isochron dating results of penultimate (Late Mid–Pleistocene) Interglacial in Lithuania from Mardasavas site

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The Snaigupėlė Interglacial gyttja was dated first by the uranium–thorium isochron method in the Mardasavas parastratotype section, Southeastern Lithuania. The isochron-corrected ^{230}Th / U ages are 202.4 + 38.6/ – 22.9 ka (TSD method) and 220.6 + 35.3 / – 20.5 ka (L / L method). Theses dates correspond to the second part of the Interglacial. The range of the obtained ages is close to the age limit of the MOIS 7 stage of deep sea sediments (186–242 ka).

The ^{230}Th / U dates obtained on gyttja from the Mardasavas section are in fact the corresponding deposits of the penultimate (Snaigupėlė) Interglacial within MOIS 7 present in Lithuania. One more Interglacial warming (Snaigupėlė = Drenthe-Wartha = Cherepet) is recognized between the Butėnai = Holsteinian = Likhvinian Interglacial of the Middle Pleistocene and the Merkinė = Eemian = Mikulino = Kazantsovian Interglacial of the Late Pleistocene. The warm climate event of MOIS 7 is of broad transcontinental or even hemispheral significance rather than a local phenomenon in the East European Plain.

Key words: uranium–thorium dates, gyttja, Snaigupėlė Interglacial, Mardasavas, Lithuania

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INTRODUCTION

Organic-rich sediments of Pleistocene interglacials of the Late Cenozoic (gyttja, peat) contain plant and animal macro- and microfossils that are necessary for the study of vegetation, palaeoenvironment and climate of the geological past. They are appropriate for uranium–thorium (^{230}Th / U) and radiocarbon (^{14}C) dating. Apparently, the only real possibility to solve the problem of climatic changes (Glaciation and Interglaciation transitions) in the Pleistocene is the timing of deposits formations in different interglacials, which serve as key horizons for the purpose of intercontinental regional correlations.

Though many radiocarbon dates were obtained for the interstadials of the last glaciation within the limit of 50–10 ka, the chronostratigraphy and palaeoclimatic conditions of the interglacials remain under discussion. It is obvious from the above that using only the stratigraphical and palynological methods for a reliable reconstruction of the whole sequence of the environmental and palaeoclimate changes is not enough. The uranium–thorium method is an alternative radioisotope method for dating ancient Pleistocene organic-rich sediments, which allows dating at least up to 350 ka.

From the Middle and Upper Pleistocene, sediments of two interglacials are singled out on the East European Plain, conventionally correlated to the Eemian and Holsteinian Interglacials in Western Europe. However, a number of researchers single out one more interglacial between the Eemian and Holsteinian Interglacials in Lithuania, Belarus, Siberia and on the Russian Plain. This interglacial, consistent with MOIS 7 (Marine Oxygen Isotope Stage), is dated between 242–186 ka (Bassinet et al., 1994). It corresponds with sediments of the Snaigupėlė Interglacial in Lithuania, the Shklov Interglacial in Belarus, the Rodionovskoye Interglacial on the Russian Plain and the Shirtinskoye Interglacial in Siberia.

However, a number of researchers assigned the Shklov sediments as the Early Pleistocene ones. The rank and duration of the Kargino Interglacial (Interstadial) in Siberia, correlated with the Middle Weichselian in West Europe, is also under discussion, though many radiocarbon dates were obtained for this Interglacial (Interstadial) within the limit 50–23 ka.

In many sections of southern and eastern Lithuania, between the Butėnai (Holsteinian = Likhvin) and Merkinė (Eemian = Mikulino) Interglacials, one more palaeoclimatic event of interglacial rank, the problematic Snaigupėlė (Drenthe–Wartha = Cherepet) Interglacial, is recognized. They are occasionally met in exposures, thus being easily observed. The stratotypical sediments of the Snaigupėlė palaeobasin have been studied in South Lithuania near the Druskininkai town. The Mardasavas, Valakupiai (Valakampiai) sites and the Buivydžiai outcrops are parastratotypical sections of the Snaigupėlė Interglacial. These sections are located in the area of the Last Glaciation (Nemunas = Vistulian = Valdaian). In the periglacial zone, sites with sections of pre-Last (Drenthe–Wartha) interglacial sediments are located in Germany, Poland, Belarus, Russia. The stratotypical sediments of the Snaigupėlė palaeobasin have been thoroughly studied palaeobotanically (Kondratienė, 1996).

On the grounds of luminescence (TL, OSL) dating of Middle and Late Pleistocene sediments from some sections, fine-grained sands of aquatic origin in Lithuania are attributed to the Snaigupėlė (Drenth–Wartha) Interglacial (Gaigalas, 2004). TL dating of Pleistocene sediments from Vilkiškės and Tartokai sections (Eastern Lithuania) allowed to conclude that the lake sediments of warm climate conditions (192.0 + / – 28.0 ka – 182.3 + / – 28.0 ka) can be attributed most likely to the ice-free interval of the Marine Oxygen Isotope Stage 7 (Gaigalas, Fedorowicz, 2002; Gaigalas et al., 2005). A similar thermoluminscence age (175 + / – 18 ka) of Snaigupėlė Interglacial lake sands at the Antaviliai outcrop near the Vilnius city was determined (Satkūnas, Hütt, 1999). The thermoluminescence age also was determined in some samples of fine-grained lacustrine sand in the Gvildžiai outcrop near Klaipėda in West Lithuania (Gaigalas et al., 2001). The dates obtained by St. Fedorowicz (2005) by the TL method (179.5 ± 27, 229.7 ± 36 and 239.3 ± 36 ka) confirm Snaigupėlė Interglacial age of lacustrine sands in the Valakupiai (Valakampiai) outcrop in Vilnius city too.

The Snaigupėlė Interglacial was highly problematic for the Baltic countries till the present time. The age of gyttja from the Valakupiai (Valakampiai) site in Vilnius has been determined (116.0 + / – 10.8 ka and 110.0 + / – 12.1 ka) with two samples of mollusk shell material composed of calcite displaying typical multicomponent Electron Spin Resonance (ESR) spectra (Gaigalas, Molodkov, 2001). The presence of Snaigupėlė (Drethe–Wartha) Interglacial in Eurasia is open to debate.

The absolute dating (by the uranium–thorium method) of gyttja of the Snaigupėlė Interglacial from the parastratotypical Mardasavas section, South Lithuania, will be the aim of our future investigations.

METHODS

In summer 2002, CR2 team members of the INTAS project Kh. A. Arslanov, V. Yu. Kuznecov and F. E. Maksimov participated in field works in Lithuania together with the leader of the CR1 team Prof. A. Gaigalas and his colleagues and collected samples for $^{230}Th / U$ dating from stratotypical Late and Middle Pleistocene sections. Now we give $^{230}Th / U$ ages of the Mardasavas outcrop – one section of a problematic interglacial in Lithuania, named Snaigupėlė (Drenth–Wartha in West Europe, or Chekalino in the Russian Plane). Samples for research were collected from the gyttja layer. For dating we used the same analytic method as had been used for the dating of interglacial peat bog sections in Russia, Belarus and Lithuania (Kuznetsov et. al., 2003; Arslanov et al., 2004; 2005; Gaigalas, Arslanov et al., 2005; Maksimov et al., 2006).

For $^{230}Th / U$ dating, the gyttja samples were dried at 110 °C to constant weight. The ground samples (10–20 g) were burned in a muffle oven at 700 °C. We used both the leachate alone (L / L) (Schwarcz, Latham, 1989; Heijnis, 1992) and the total sample dissolution (TSD) (Luo, Ku, 1991) models for extraction of U and Th isotopes from the samples. In the former case (L / L model), calcined samples were leached with 7 n HNO_3 for 6 h. After centrifuging (the residue was discarded), spikes of ^{232}U and ^{234}Th were added to the solutions. In the second case (TSD model), the calcined samples were dissolved in concentrated HNO_3, HF and HCl solutions. Then F^- was removed by treatment with concentrated $HClO_4$, and U and Th isotopes were co-precipitated on iron hydroxide by carbonate-free ammonia after introduction of ^{232}U and ^{234}Th spikes. To separate uranium and thorium, we used anion exchange resin AB-17. Then U and Th isotopes were deposited on platinum disks, and the alpha-activity of ^{234}U, ^{238}U, ^{232}U, ^{230}Th and ^{232}Th was measured with a silicon detector and a pulse analyzer. The chemical yield of U and Th isotopes was calculated from the activity of ^{232}U and ^{234}Th spikes. The counting efficiency for uranium and thorium isotopes was checked with a

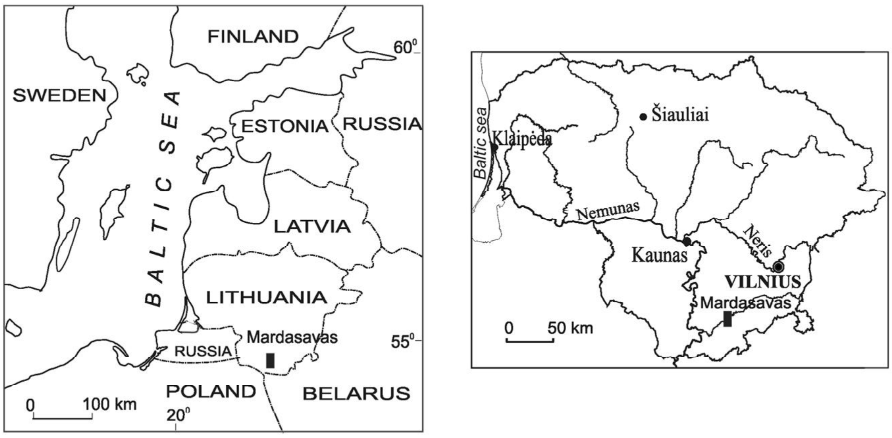

Fig. 1. Location of Mardasavas section
1 pav. Mardasavo pjūvis žemėlapyje

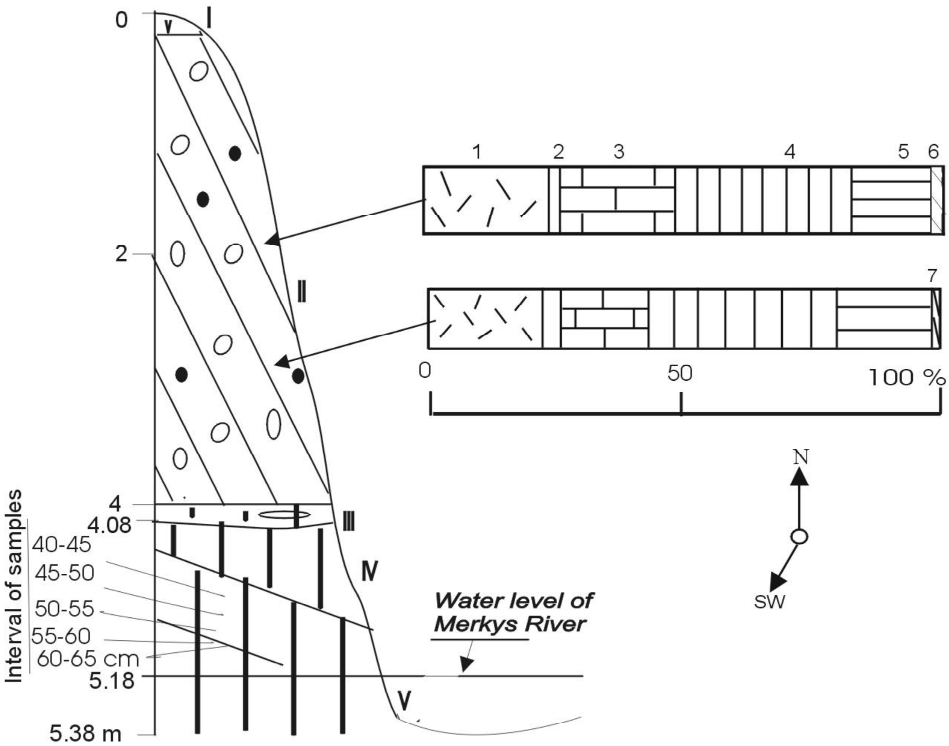

Fig. 2. Section of Mardasavas outcrop at the Merkys River with petrographical composition and orientation of pebbles in the till Coordinates (longitude, latitude): 54°08’39’’; 24°19’25’’.

Samples *1–4* for U /Th from the gyttja layer. ^{230}Th / U age ranges from 202.4 + 38.6 / – 22.9 ka (TSD method) to 220.6 + 35.3 / – 20.5 ka (L / L method).

Layers of sediments: I – soil, II – till grey colour, III – gyttja of dark brown colour with lens of sand, IV – gyttja of dark brown colour, diagonal fissure (25° incline), V – gyttja of dark brown colour, under water level in the Merkys River.

Integral diagrams of petrographical composition of gravel in till:

1 – crystalline rocks, *2* – sandstones and silstones, *3* – dolostones, *4* – Ordovician and Silurian limestones, *5* – other limestones, *6* – Mesozoic marls, *7* – other rocks

2 pav. Mardasavo atodangos pjūvis kairiajame Merkio upės krante ir morenos gargždo petrografinės sudėties integralinės diagramos bei orientacija.

1–4 mėginiai iš gitijos sluoksnio U / Th nustatymui. ^{230}Th / U amžius kinta nuo 202,4 + 38,6 / – 22,9 tūkst. metų (TSD metodas) iki 220,6 + 35,3 / – 20,5 tūkst. metų (L / L metodas).

Nuogulų sluoksniai: I – dirvožemis, II – pilka morena, III – tamsiai ruda gitija su smėlio lizdais, IV – tamsiai ruda, įstrižai skalūnuota (25°) gitija, V – tamsiai ruda gitija, panirusi po Merkio upės vandens lygiu.

Morenos gargždo petrografinės sudėties integralinės diagramos: *1* – kristalinės uolienos, *2* – smiltainiai ir aleurolitai, *3* – dolomitai, *4* – ordoviko ir silūro klintys, *5* – kitos klintys, *6* – mezozojaus mergeliai, *7* – kitos uolienos

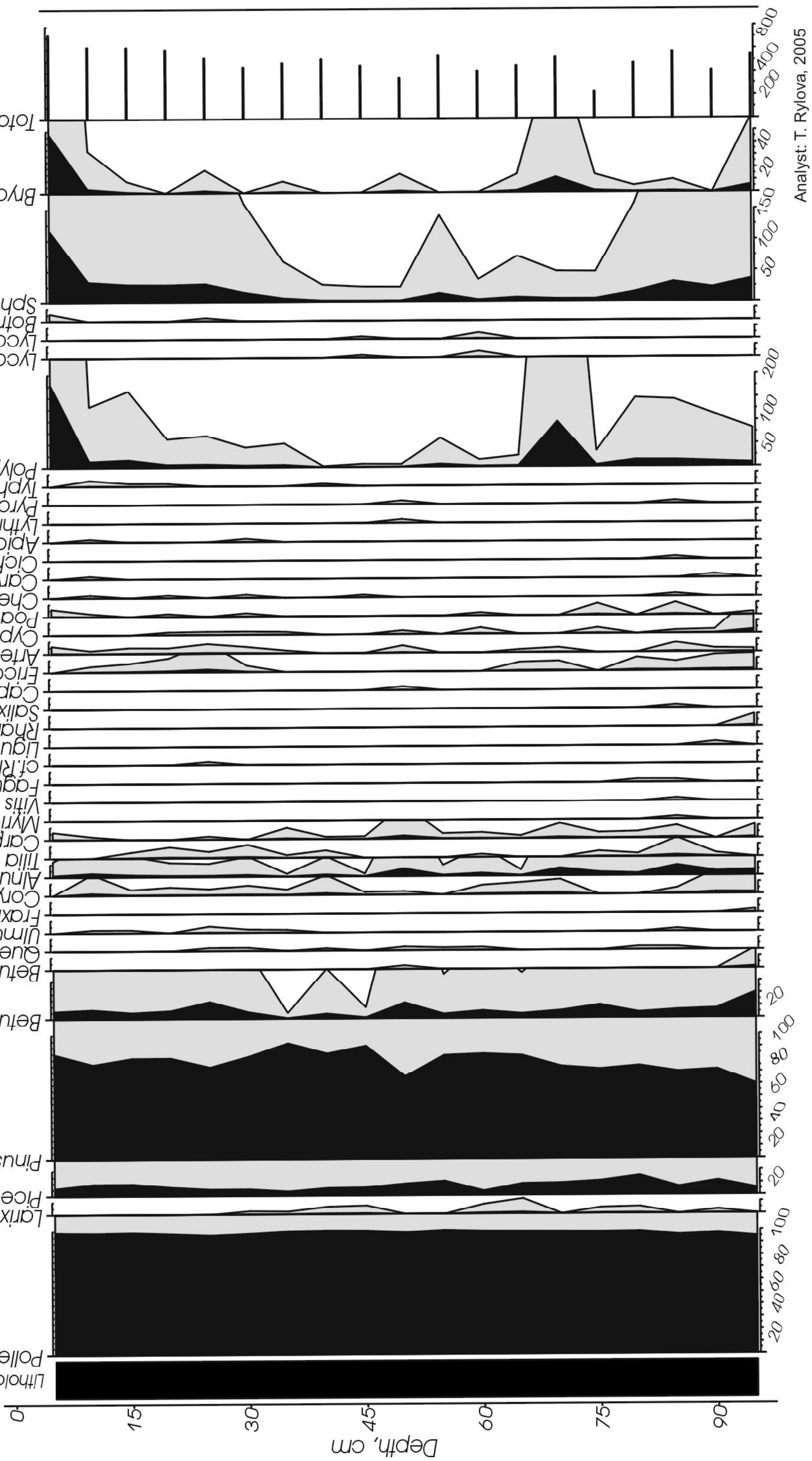

Fig. 3. Palynological diagram of dating gytija layer in Mardasavas section
3 pav. Datuoto gitijos sluoksnio Mardasavo atodangoje palinologinė diagrama

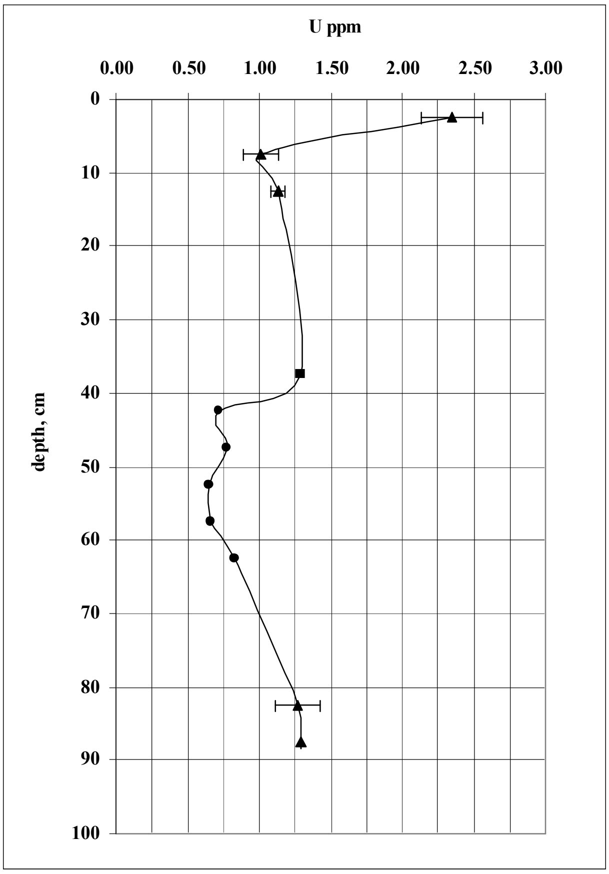

Fig. 4. Distribution of ^{238}U contents of gyttja samples in vertical profile of Mardasavas section: ▲ – laser-luminescence; ● – alpha-spectrometric; ■ – alpha-spectrometric and laser-luminescence

4 pav. ^{238}U kiekio pasiskirstymas gitijos mėginiuose vertikaliame Mardasavo atodangos profilyje: ▲ – lazerio-liuminescencijos; ● – alfa-spektrometrijos ir ■ – alfa-spektrometrijos ir lazerio-liuminescencijos duomenimis

trans-uranium (^{239}Pu and ^{241}Am) standard of known activity.

LOCATION AND DESCRIPTION OF MARDASAVAS SECTION

The Mardasavas section is located on the right bank of the Merkys River between Mardasavas and Puvočiai villages in Varėna district, Southeastern Lithuania (Fig. 1). The basement of the 1st terrace above the flood plain is open in the Mardasavas outcrop (Fig. 2). The Merkys River flows in the outwash plane of Southeastern Lithuania, often named the Merkys sandur plane. The following layers are exposed in the Mardasavas outcrop (from bottom to top): dark gyttja (layer V) – interval 5.38–5.18 m; dark brown gyttja (layer IV) – interval 5.18–4.08 m; dark brown gyttja with lens of sand (layer III) – interval 4.08–4.0 m; grey till (loamly boulder clay) (layer II) – interval 4.0–0.30 m; recent soil (layer I) – interval 0.30–0.0 m.

On the top of the Mardasavas gyttja lies the Medininkai (Wartha) till of the Middle Pleistocene. It is characterized by a specific composition of clasts. The petrographical composition of coarse gravel in Medininkai glaciation till is shown in integral diagrams (Fig. 2). The Ordovician and Silurian grey organogenic limestones with other limestones transported from the northern part of the Baltic countries and the northern part of the Central Baltic Sea bottom prevail. Pebbles and gravel of crystalline rocks were transported from the Fennoscandian crystalline Precambrian shield. Dolostones were exarated by the glacier of the Medininkai glaciation in Latvia and northern Lithuania. Their sources existed in the Devonian dolomite field.

PALYNOLOGY OF THE GYTTJA

Palynological analyses of gyttja samples from the Mardasavas outcrop were carried out by T. Rylova (2005) (Fig. 3). *Pinus* prevails in all section. Gyttja from the research section corresponds to the end of the interglacial.

The development of flora of the Snaigupėlė Interglaciation according to the stratotype section of the Snaigupėlė-705 borhole generally is most similar to that of the Merkinė (Eemian) Interglaciation (Kondratienė, 1996). The former (Snaigupėlė) differs from the latter (Merkinė) in some features (Kondratienė, 1996). The alk-tree appeared and spread simultaneously with broad-leaved trees (except hornbeam), much earlier than the nut-tree, during the Snaigupėlė Interglaciation. The maximum spread of lime-trees occurred before that of nut-trees and was much poorer. The oak was widely spread twice: at the beginning of optimal climate of the Snaigupėlė Interglaciation and at the beginning of the hornbeam expansion. Quite a few exotic and extinct species of the Butėnai (Holsteinian) Interglacial have been found in the composition of the Snaigupėlė flora. The number of these is less than in the Butėnai (Holsteinian) Interglacial.

RESULTS OF ^{230}TH / U ISOCHRON DATING AND DISCUSSION ON INTERPRETATION

In order to assess the distribution of uranium in the vertical profile of the peat bog and to assess the validity of the peat bog section for ^{230}Th / U dating, we determined uranium content in gyttja layers from top to bottom (Fig. 4). Figure 4 shows the distribution of uranium across the section. Data of Fig. 4 illustrate that uranium content in the upper and lower layers of gyttja is more considerable than U content in layers at depth of 35–60 cm. This means that dissolved U with groundwater penetrated into the gyttja, but was absorbed in the upper and lower gyttja layers which act as a geochemical barrier. For this reason, layers from the depth 35–65 cm are favourable for ^{230}Th / U dating.

Here we present ^{230}Th / U dating results of the gyttja strata. The results of alpha-spectrometrical measurements of U and Th isotopes and their activity ratios are given in Tables 1 and 2. We used both "leachate alone" and "total sample dissolution" models for extraction of U and Th isotopes. In order to account for detrital U and Th isotopes and to determine the present-day ^{230}Th / ^{234}U ratios in the organic fraction of coeval samples, we constructed isochron plots of U and Th isotopes for both the L / L and TSD models. For isochron dating of the gyttja samples we used samples from the middle part of gyttja strata (samples 1, 3, 5, 6, depth 35–65 cm, Tables 1 and 2). We used only those data sets of samples from inner sublayers whose isotopic composition yielded an agreement between the isochron-corrected ^{230}Th / U ages for the L / L and TSD models. We estimated the present thorium index with an exaggerated standard deviation ($a = f \pm \sigma f$) using the least-square method of York (1966) (Fig. 5 and 6). From the isochron plots (Fig. 5 and 6) the detrital corrected ages were calculated according to Geyh (2001): 202.4 + 38.6 / –22.9 ka (TSD model) and 220.6 + 35.3 / –20.5 ka (L/L model). The range of the obtained ages is close to the age limit of the MOIS 7 stage of deep sea sediments (186–242 ka, Bassinet et al., 1994) and well correlates with the age range of the Rodionovo peat bog strata (186–240 ka) on the NE Russian Plain. The range of the obtained isochron ^{230}Th / U ages of the Upper Middle Pleistocene Interglacial peat bog section Rodionovo on the Pechora River (186–240 ka) is well

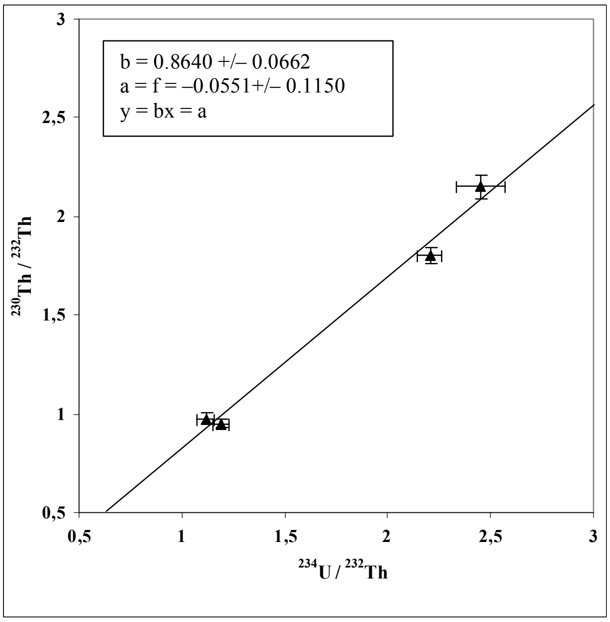

Fig 5. Isochron plots of ^{230}Th / ^{232}Th – ^{234}U / ^{232}Th for total dissolved (TSD) gyttja samples from Mardasavas section
5 pav. Mardasavo atodangos visiškai ištirpintų (TSD) degintos gitijos mėginių ^{230}Th/^{232}Th – ^{234}U/^{232}Th izochroninė diagrama

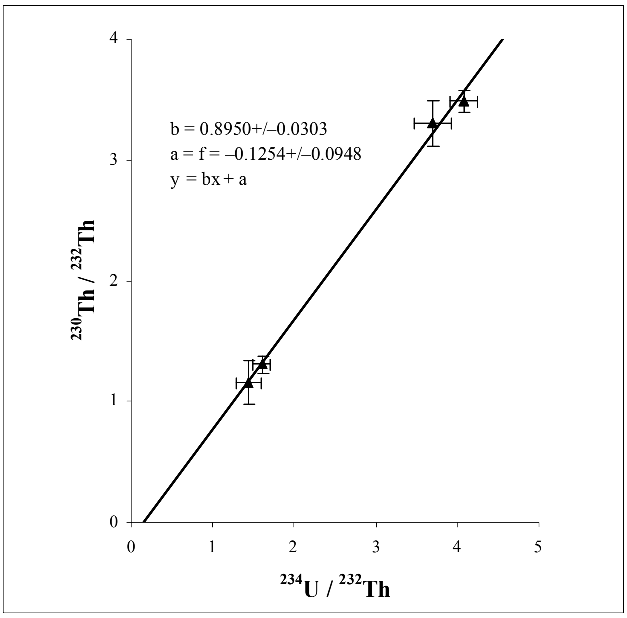

Fig. 6. Isochron plots of ^{230}Th / ^{232}Th – ^{234}U / ^{232}Th for leachates of calcined gyttja samples from Mardasavas section
6 pav. Mardasavo atodangos tirpintų degintos gitijos mėginių ^{230}Th / ^{232}Th – ^{234}U / ^{232}Th izochroninė diagrama

Table 1. **Alpha-activity of U and Th isotopes and their ratios in gyttja samples of Mardasavas section, leaching of calcined samples with 7n HNO_3 during 6h**
1 lentelė. **U ir Th izotopų alfa aktyvumas ir jų santykis Mardasavo atodangos gitijos mėginiuose, kai degti mėginiai tirpinti 6 valandas 7n HNO_3**

No.	Depth, cm	Ash, %	^{238}U ppm	^{234}U ppm	^{230}Th ppm	^{232}Th ppm	^{230}Th/^{234}U	^{234}U/^{238}U	Age
M-1b	35–40	56.36	0.931 ± 0.037	1.061 ± 0.040	0.907 ± 0.012	0.260 ± 0.006	0.855 ± 0.034	1.140 ± 0.062	193.4 ± 30/22
M-2b	40–45	45.42	0.515 ± 0.015	0.631 ± 0.017	0.653 ± 0.018	0.175 ± 0.009	1.035 ± 0.040	1.225 ± 0.049	≥ 350
M-3b	45–50	55.10	0.551 ± 0.023	0.676 ± 0.026	0.604 ± 0.016	0.183 ± 0.009	0.893 ± 0.042	1.227 ± 0.070	209.4 ± 41/29
M-4b	50–55	57.55	0.466 ± 0.011	0.605 ± 0.013	0.651 ± 0.020	0.224 ± 0.012	1.076 ± 0.040	1.298 ± 0.041	≥ 350
M-5b	55–60	67.71	0476 ± 0.029	0.569 ± 0.033	0.459 ± 0.019	0.398 ± 0.018	0.807 ± 0.058	1.195 ± 0.101	165 ± 38/27
M-6b	60–65	68.36	0.595 ± 0.018	0.707 ± 0.020	0.575 ± 0.015	0.440 ± 0.012	0.813 ± 0.031	1.188 ± 0.049	168.1 ± 19/16

Table 2. **Alpha-activity of U and Th isotopes and their ratios in gyttja samples of Mardasavas section on totally dissolving calcined samples**
2 lentelė. **U ir Th izotopų alfa aktyvumas ir jų santykis Mardasavo atodangos gitijos mėginiuose visiškai ištirpinus degtus mėginius**

No.	Depth, cm	Ash, %	^{238}U ppm	^{234}U ppm	^{230}Th ppm	^{232}Th ppm	$^{230}Th/^{234}U$	$^{234}U/^{238}U$	Age
M-1a	35–40	56.36	1.672 ± 0.036	1.820 ± 0.039	1.485 ± 0.023	0.825 ± 0.014	0.816 ± 0.022	1.089 ± 0.033	175.8 ± 15/13
M-2a	40–45	45.42	1.564 ± 0.038	1.718 ± 0.041	1.562 ± 0.025	0.638 ± 0.014	0.909 ± 0.026	1.098 ± 0.037	237.5 ± 36/26
M-3a	45–50	55.10	1.424 ± 0.060	1.508 ± 0.062	1.322 ± 0.023	0.615 ± 0.014	0.877 ± 0.039	1.059 ± 0.062	217.3 ± 51/32
M-4a	50–55	57.55	1.398 ± 0.028	1.520 ± 0.030	1.272 ± 0.014	0.915 ± 0.011	0.837 ± 0.019	1.087 ± 0.031	187.5 ± 15/13
M-5a	55–60	67.71	1.077 ± 0.037	1.144 ± 0.038	1.000 ± 0.019	1.025 ± 0.019	0.874 ± 0.033	1.062 ± 0.051	214.6 ± 39/27
M-6a	60–65	68.36	1.032 ± 0.023	1.059 ± 0.023	0.847 ± 0.011	0.891 ± 0.012	0.800 ± 0.020	1.026 ± 0.032	172.4 ± 14/12

within the age limits of MOIS 7 of deep sea sediments (186–242 ka) (Arslanov et al., 2006).

Uranium series dating was performed on gyttja from Mardasavas at the laboratories in St. Petersburg and in Hannover (Sierralta et al., 2006). The St. Petersburg laboratory applied radiometric measurements by alpha-spectrometry, the Hannover laboratory used thermal ionization mass spectrometry (TIMS). The results of radiometric and TIMS measurements from the Mardasavas section are comparable (presentation of Dr. M. Sierralta at INTAS Final Workshop; Sierralta et al., 2006).

At the Valakupiai (Valakampiai) and Vilkiškės sections lacustrine mineralogenic sandy sediments are exposed, which correlate also with the Snaigupėlė interglacial (Gaigalas, Fedorowicz, 2004). The thermoluminescence age ranges from 239 ± 36 ka to 180 ± 27 ka.

The range of the obtained ^{230}Th / U ages corresponds to the end of the Snaigupėlė Interglacial in the Mardasavas section. This thesis is confirmed by palynological dating of gyttja from the Mardasavas section. Thus, the obtained ^{230}Th / U dates allow us to attribute the gyttja layer of the Mardasavas outcrop to the end of the Snaigupėlė Interglacial. The layer of gyttja studied in Mardasavas most likely correlates with the end of the Marine Oxygen Isotope Stage 7 deep sea sediments (186–242 ka) and with the age range of the Radionovo peat bog strata (186–240 ka) on the NE Russian Plain situated at the Lower Pechora River (Arslanov et al., 2004).

CONCLUSIONS

The existence of the Snaigupėlė (Drenthe–Wartha) Interglacial in Lithuania was problematic. The only real possibility to solve the problem was the timing of gyttja formation of the Snaigupėlė time by absolute dating methods, in our case by the ^{230}Th / U method. The ^{230}Th / U dates obtained first on gyttja from the Mardasavas parastratotype section show the Snaigupėlė Interglacial age of the Middle Pleistocene. The isochron-derived ^{230}Th / U age of gyttja in the Mardasavas section (Southeastern Lithuania) ranges from 202.4 + 38.6/ – 22.9 ka (TSD method) to 220.6 + 35.3/ – 20.5 ka (L / L method). This range of the ^{230}Th / U ages corresponds to the end of the Snaigupėlė Interglacial in the Mardasavas section. This conclusion was confirmed by the palynological dating of gyttja from the Mardasavas section. The layer of gyttja in Mardasavas most likely is correlated with the end of the marine oxygen isotope stage 7 of deep sea sediments (186–242 ka) and with the range of the Rodionovo peat bog strata (186–240 ka) in NE Europe. One more Interglacial warming (Snaigupėlė = Drathe–Wartha = Cherepet) has been recognized between Butėnai = Holsteinian = Likhvinian Interglacial of the Middle Pleistocene and the Merkinė = Eemian = Mikulino = Kazantsovian Interglacial of the Late Pleistocene. The warm climate event MOIS 7 is of a broad transcontinental or even hemispheral significance rather than being a local phenomenon in the East European Plain.

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PRIEŠPASKUTINIO (VĖLYVOJO VIDURINIO PLEISTOCENO) TARPLEDYNMEČIO URANO-TORIO IZOCHRONINIO DATAVIMO REZULTATAI MARDASAVO PJŪVIO NUOGULOSE LIETUVOJE

S a n t r a u k a

Snaigupėlės tarpledynmečio buvimas Lietuvoje iki šiol buvo problemiškas. Vienas patikimų jo buvimo patvirtinimo būdų buvo absoliutaus amžiaus nustatymas. Snaigupėlės tarpledynmečio gitija pirmą kartą buvo datuota Mardasavo parastratotipiniame pjūvyje urano-torio izochroniniu metodu. Izochroninis koreguotas ^{230}Th / U tirtos gitijos amžius patvirtinamas datomis 202,4 + 38,6 / – 22,9 ka (TSD metodas) ir 220,6 + 35,3 / – 20,5 ka (L / L metodas), kurios atitinka Snaigupėlės tarpledynmečio vėlyvąjį etapą. Tą patvirtina ir palinologiniai duomenys. Gautos datos yra artimos giliųjų jūrinių nuosėdų 7-os izotopinės stadijos pabaigai (186–242 tūkst. metų). Urano-torio metodu gautos Snaigupėlės tarpledynmečio gitijos datos derinasi su tuo pačiu metodu datuotomis durpėmis Rodionovo vietovėje ŠR

Europos dalyje (186–240 tūkst. metų). Taigi galima tvirtinti, kad Skandinavijos apledėjimo srityje tarp Butėnų = Holšteino = Lichvino ir Merkinės-Emio = Mikulino = Kazantsevo tarpledynmečių dar vienas tarpledynmečio tipo (Snaigupėlės = Drentės-Vartos = Čerepeco) atšilimas egzistavo viduriniame pleistocene. Šilto klimato laikotarpis jūrinių nuosėdų pjūvyje (MOIS 7) yra greičiausiai ne vietinis Rytų Europos, bet tarpžemyninis arba globalinės reikšmės reiškinys.

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РЕЗУЛЬТАТЫ ДАТИРОВАНИЯ ИЗОХРОННЫМ МЕТОДОМ УРАНА-ТОРИЯ ПРЕДПОСЛЕДНЕГО (ПОЗДНЕГО СРЕДНЕПЛЕЙСТОЦЕНОВОГО) МЕЖЛЕДНИКОВЬЯ ПО РАЗРЕЗУ МАРДАСАВАС В ЛИТВЕ

Р е з ю м е

Существование снайгупельского межледниковья в Литве до сих пор оставалось под вопросом. Для его подтверждения в позднем среднем плейстоцене надежную аргументацию можно получить определением абсолютного возраста. Впервые изохронным методом урана–тория датирована гиттия снайгупельского межледниковья в парастратотипном разрезе Мардасавас в Литве. Изохрон-корректированные даты исследованных образцов – 202,4 + 38,6 / –22,9 ka (метод TSD) и 220,6 + 35,3 / –20,5 ka (метод L / L). Как подтверждают палинологические данные, они соответствуют позднему этапу снайгупельского межледниковья. Уран-ториевые даты являются близкими по возрасту конечной фазе морской изотопной (MOIS 7) стадии (186–242 тыс. лет). Датировки снайгупельской межледниковой гиттии сопоставляются с датированными уран-ториевым методом торфами в разрезе Родионово в СВ Европе (186–240 тыс. лет). Таким образом, можно утверждать, что существовал еще один теплый интервал (снайгупельского = дренте-варта = черепецкого) межледникового типа в среднем плейстоцене между бутенским = гольштейнским = лихвинс-ким межледниковьем и мяркинским = эемским = микулинс-ким= казанцевским межледниковьем. Потепление климата в разрезе морских осадков (MOIS 7), по всей вероятности, носит межконтинентальный или глобальный характер и не является локальным восточным-европейским явлением.