THE PEAT ACCUMULATION RATE OF THE TWO BOGS OF THE UKRAINIAN CARPATHIANS

Olga Andrieieva

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The information about peat accumulation rate of the two bogs of the Ukrainian Carpathians is presented. There are the oligotrophic bog "Mishok" (Lviv district, Turka region, regional landscape park "Nadsianskyi") and the bog near Chornohora geographical station by Ivan Franko Lviv National University (Ivano-Frankivsk district, Nadvirna region, national nature park "Karpatskyi"). Both of them are not subjected to the direct effects of human impact. The bog "Mishok" started forming in the Late Holocene (SA-1), 2312±80 years ago and the average rate of the peat accumulation of the deposit is 3,5 mm/per year. The bog near Chornohora geographical station started forming in the Early Holocene (BO-2), 8860±150 years ago and the average rate of the peat accumulation of the deposit is 0,8 mm/per year. The average rate of the peat accumulation during Holocene is 0,8 mm/per year, in SA it is noticeably high to 1,3-1,6 mm/per year. The tendency to increase in peat accumulation rate over the Holocene is shown. The tendency for peat accumulation rates to increase over the Holocene is common with that in the southern parts of Siberia and Europe. Thus both of these bogs are very perspective object to complex palaeoecology investigations.

Key words: peat accumulation rate, radiocarbon dating (^{14}C), Holocene, the Ukrainian Carpathians

A bog is a unique database with information about the origin and stages of generating wetland ecosystems, and also climate change during this time and the evolution of surrounding vegetation. For getting all of this information, it is necessary to use an integrated approach to the study of each its components (water, peat, plants) involving a number of different methods: geobotanical, hydrological, peat study etc. Unfortunately, such integrated investigations of wetland ecosystems in Ukraine are not carried out. Thus, today an important task is the accumulation of facts suitable for further palaeoecological interpretations.

One of the important indicators of climate change is a peat accumulation rate. A peat accumulation is a result of annual increases of organic stuff in plant cover and decay, the part of plants which is dying. Intensive growths of the peat mass takes place at the conditions of predominance of the annual increase of new organic stuff over an annual decay of dying parts of plants. Thus, the optimal conditions for genesis of bogs and accumulation of peat are a surplus of water and a temperate climate.

With the genesis of bog and peat accumulation, there is also accordingly an increase of soil carbon pool. By some estimates the world supply of carbon accumulated in peat bogs (6 410 000 km^2) ranges from 329 to 528 Gt (Inisheva, Golovatskaya, 2002). The area of peat bogs in the Ukrainian Carpathians is 0,1 thousand hectares,

the total number of peat bogs is 31, the average area is of 3 ha, the average depth of peat is 1,98 m (Torfovo-bolotnyi fond…, 1973). Thus, studies of peat accumulation rates in the Ukrainian Carpathians have a good perspective and practical importance.

To make a calculation of a peat accumulation rate succession, the radiocarbon dating (^{14}C) of peat samples is necessary. For the territory of Ukraine the calculation of a peat accumulation rate is absent.

Materials and methods

The peat accumulation rate of two bogs in the Ukrainian Carpathians was analyzed. There are the oligotrophic bog "Mishok" (Lviv district, Turka region, regional landscape park (RLP) "Nadsianskyi"; 600 m a.s.l.) and the bog near Chornohora geographical station by Ivan Franko Lviv National University (Ivano-Frankivsk district, Nadvirna region, national nature park (NNP) "Karpatskyi"; 1025 m a.s.l.). Both of them are not subjected to the direct effects of human impact.

Radiocarbon dating was made by Kyiv Radiocarbon Laboratory (National Academy of Sciences of Ukraine State Scientific Centre of Environmental Radiogeochemistry), the results are presented in the table.

Table.

The results of the radiocarbon dating of the sediments of two bogs of the Ukrainian Carpathians

The name of the bog	Depth, cm	Age	Laboratory number	Holocene stage**
"Mishok" (Lviv district, Turka region, RLP "Nadsianskyi")	345	2312±80	[Ki-13544]	SA-1
	200	1097±80	[Ki-13543]	SA-2
	100	1005±80	[Ki-13542]	SA-2
	*70	470±50	[Ki-15390]	SA-3
	*40	280±50	[Ki-15389]	SA-3
The bog near Chornohora geographical station by Ivan Franko Lviv National University (Ivano-Frankivsk district, Nadvirna region, NNP "Karpatskyi")	535	8860±150	[Ki-16900]	BO-2
	430	4980±120	[Ki-16901]	AT-3
	330	3420±80	[Ki-16902]	SB-2
	225	1970±70	[Ki-16903]	SA-1
	135	1290±90	[Ki-16904]	SA-2
	80	860±80	[Ki-16905]	SA-2 (SA-2/ SA-1)

* by (Bezusko et al., 2009).

** Holocene stage: SA – Subatlantic, SB – Subboreal, AT – Atlantic, BO – Boreal.

The rate of the peat accumulation during Holocene was made based on the results of radiocarbon dating.

Results and discussions

The oligotrophic bog "Mishok". The depth of peat deposit is 3,45 m. It started forming in the Late Holocene (SA-1), 2312±80 years ago (table). The average rate of the peat accumulation of the deposit is 3,5 mm/per year. But it was not a stable rate during Late Holocene (Fig. 1). The peat accumulation rate was the highest nearly 1000 years ago (10,8 mm/per year), then considerably slowed down to 0,6 mm/per year, and in the last 300 years it was 1,6 mm/per year.

This indicates that during bog evolution it was under stable high humidification, and organic matter decomposition processes were slowed; vegetation had a long growing season and peat deposits were not subjected to compression. These processes and peat accumulation rate correlate well with changes in temperatures in late Holocene – "Medieval Warm Period", which was about 1000 years ago, changed during the Little Ice Age Period, and then again began warming to date – a new climatic optimum.

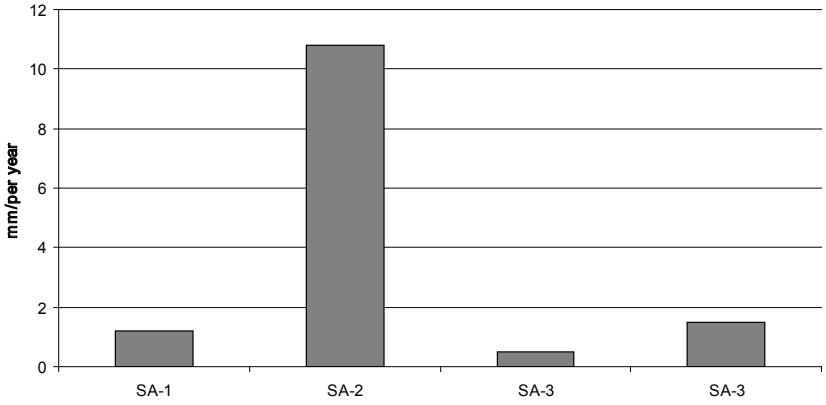

Fig. 1. The peat accumulation rate of the oligotrophic bog "Mishok" (Lviv district, Turka region, RLP "Nadsianskyi").

A. Bezusko et al. (2009) suggests palynological characteristics for the upper 70 cm of sediments of the bog "Mishok", reflecting the dynamics of vegetation in the region over the past 500 years (SA-3). Forest vegetation dominated during that time. Changes in the main tree species in the region occurred through a gradual increase in participation of conifer (spruce, fir) and deciduous reduction (beech, hornbeam, oak). The beginning of these changes is recorded by radiocarbon date of 280±50 years ago (table). The impact of human activities (pollen of cereals and weeds) is constant in palaeopalinology materials that slightly decreased about 300 years ago for a short period of time. Palynological study should be carried out throughout the peat deposit of bog "Mishok" to ascertain data about the dynamics of plant cover during the late Holocene (SA).

The bog near Chornohora geographical station by Ivan Franko Lviv National University. The depth of peat deposit is 5,35 m. It started forming in the Early Holocene (BO-2), 8860±150 years ago (table). Thus it is a very valuable object for

integrated palaeoecology investigations in the Ukrainian Carpathians, because it conserved information during complete Holocene. Palynological investigation has not been carried out and are in the plan on the near future.

The average rate of the peat accumulation of this deposit is 0,8 mm/per year. But it was very much modified during Holocene (Fig. 2). The highest rate of the peat accumulation was in SA – 1,3 mm/per year and the least it was in BO – 0,35 mm/per year.

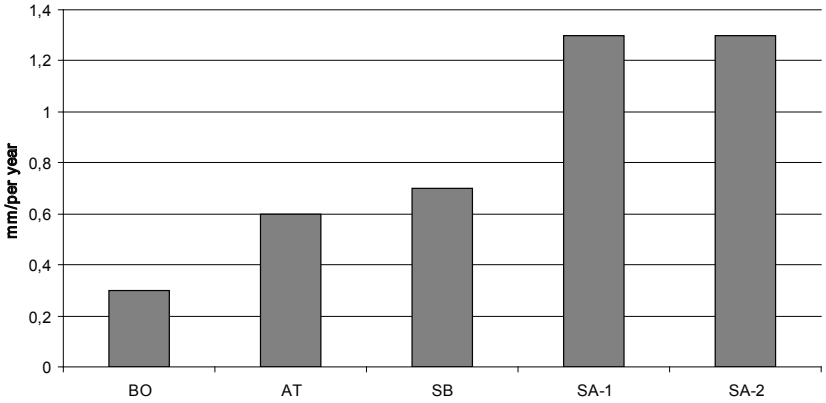

Fig. 2. The peat accumulation rate of the bog near Chornohora geographical station by Ivan Franko Lviv National University (Ivano-Frankivsk district, Nadvirna region, NNP "Karpatskyi").

On the example of the bog near Chornohora geographical station, it is a clearly visible trend that the peat accumulation rate increases over Holocene from ancient time to the present. From 0,35 mm/per year in Boreal it was gradually increasing at the Atlantic and Subboreal, and it was almost doubled at Subatlantic – up to 1,3 mm/per year. This may indicate a change in the conditions of peat forming during Holocene, for example, an increase of some moistening and warming. Increase in the peat accumulation rate in the Subatlantic may additionally be associated with less compaction of this layer.

The research of peat accumulation rates in Ukraine has not been conducted and there are no data for comparison. But the peat accumulation rate of the bog near the Chornohora geographical station in Boreal is very low (0,3 mm/per year) and over Holocene it is not high compared to the peat bogs in the per taiga (1,1 mm/per year), Western Siberia (1,6 mm/year) and the European North (0,8 mm/per year) (Inisheva, Liss, 2006; Inysheva, Kobak, Turchinovich, 2013). The tendency for peat accumulation rates to increase over the Holocene is common with that in the southern parts of Siberia and Europe.

Conclusions

The peat accumulation rate of the two bogs of the Ukrainian Carpathians is presented. The bog "Mishok" conserves the information during last 2312±80 years (SA) and

the bog near Chornohora geographical station – over Holocene from 8860±150 years ago.

The average rate of the peat accumulation during Holocene is 0,8 mm/per year, in SA noticeably high to 1,3-1,6 mm/per year. The tendency for peat accumulation rates to increase over the Holocene is shown.

The bog "Mishok" and the bog near Chornohora geographical station are important objects for complex palaeoecology investigations in the Ukrainian Carpathians.

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ШВИДКІСТЬ ТОРФОНАКОПИЧЕННЯ У ДВОХ БОЛОТАХ УКРАЇНСЬКИХ КАРПАТ

О.О. Андрєєва

Наведено дані щодо швидкості торфонакопичення у двох болотах Українських Карпат: оліготрофне болото "Мішок" (Львівська обл., Турківський р-н, регіональний ландшафтний парк "Надсянський")

та болото поблизу Чорногірського географічного стаціонару Львівського національного університету імені Івана Франка (Івано-Франківська обл., Надвірнянський р-н, Карпатський національний природний парк). Обидва торфовища не зазнали безпосереднього впливу діяльності людини. За даними радіовуглецевого датування встановлено, що болото "Мішок" почало формуватися в пізньому голоцені (SA-1), 2312 ± 80 р.т., а середня швидкість торфонакопичення у ньому становить 3,5 мм/рік. У відкладах болота поблизу Чорногірського географічного стаціонару відображений цілий голоцен – початок його формування 8860 ± 150 р.т. (BO-2). Середня швидкість торфонакопичення тут незначна й становить 0,8 мм/рік, але добре помітна тенденція до збільшення цієї швидкості протягом голоцену, максимального значення вона сягає в SA – 1,3 мм/рік. Показники швидкості торфонакопичення в пізньому голоцені (SA) є близькими у відкладах обох боліт – 1,3-1,6 мм/рік. Такі високі значення, порівняно з іншими відрізками голоцену, деякою мірою можуть бути пояснені меншим ступенем ущільнення верхніх шарів торфу. Обидва досліджені болота є перспективними об'єктами для комплексних палеоекологічних досліджень.

Ключові слова: швидкість торфонакопичення, радіовуглецеве датування, голоцен, Українські Карпати

СКОРОСТЬ НАКОПЛЕНИЯ ТОРФА В ДВУХ БОЛОТАХ УКРАИНСКИХ КАРПАТ

О.О. Андреева

В статье приведена информация про скорость накопления торфа в двух болотах Украинских Карпат: олиготрофного болота "Мешок" (Львовська обл., Турковський р-н, региональный ландшафтный парк "Надсянский") и болота возле Черногорского географического стационара Львовского национального университета имени Ивана Франко (Ивано-Франковская обл., Надвирнянский р-н, Карпатский национальный природный парк) на основании радиоуглеродного анализа их отложений. Оба болота не испытывали непосредственного антропогенного влияния. Болото "Мешок" начало формироваться в позднем голоцене (SA-1), 2312±80 л.н., и средняя скорость накопления торфа в нем составляет 3,5 мм/год. В отложениях болота возле Черногорского географического стационара сохранилась информация обо всем голоцене, начало формирования его отложений 8860±150 л.н. (BO-2). Средняя скорость накопления торфа в этом болоте незначительная и составляет 0,8 мм/год, также тут четко прослеживается тенденция увеличения скорости накопления торфа на протяжении голоцена, и максимальных значений она достигает в SA – 1,3 мм/год. Для SA-периода эти показатели близки для обоих болот – 1,3-1,6 мм/год. Наивысшие показатели скорости накопления торфа в SA можно до некоторой степени объяснить тем, что верхний слой торфа менее уплотнен. Оба исследованных болота – перспективные объекты для комплексных палеоэкологических исследований в Украинских Карпатах.

Ключевые слова: скорость торфонакопления, радиоуглеродное датирование, голоцен, Украинские Карпаты

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Андрєєва О.О. Інститут екології Карпат НАН України, вул. Козельницька, 4, м. Львів, 79026, Україна; e-mail: andrieieva.olga@gmail.com

Andrieieva O.O. Institute of Ecology of the Carpathians NAS of Ukraine, 4, Kozelnytska St, Lviv, 79026, Ukraine; e-mail: andrieieva.olga@gmail.com