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Palaeoenvironmental reconstruction of the last period of the Upper Würm in Hungary, based on malacological and radiocarbon data - A magyarországi Felső-Würm utolsó periódusának öskörnyezeti rekonstrukciója malakológiai és radiokarbon adatok alapján

ABSTRACT: The authors performed malacological and radiocarbon analyses on formations which could be synchronised with the 'Upper Weichselian' period. At several localities on the Great Hungarian Plain, a definite level characterized by species preferring cold weather (Columella columella, Pupilla sterri, Vallonia tenuilabris) was found between the years 14.000-16.000 B.P. The authors suggest this period be used as an indicator biostratigraphical horizon, a 'zonula' in Hungary, within the biozone Bithynia leachi-Trichia hispida and the Semilimax kotulai subzone, respectively.

Between the years 1986-1990, the Hungarian Academy of Sciences provided funds (in form of the National Scientific Research Grant (OTKA)) for our complex analyses in the cooperation of the Debrecen Nuclear Research Institute and the Mineralogical and Geological Department of the Debrecen University. Development of the radiocarbon measurement system (CSONGOR, E., - SZABÓ, I., - HERTELENDI, E. 1982; HERTELENDI, E. & al. 1987, 1989) provided a solid basis for C-14 analyses on Molluscan shells (Table I.).

The necessary quantity of net Molluscan shells (cca 20-30 g) was obtained from about 100 kgs of sediments.

collected at 20-25 cm intervals (SÜMEGI, P. 1989). Mainly sections with considerable malaco-faunistical changes determined by previous analyses were selected (SÜMEGI, P. 1986, 1988; SÜMEGI, P. - LÓKI J. 1988; NYILAS, I. - SÜMEGI, P. 1989; KROLOPP, E. - SÜMEGI, P. 1990). The aim of these series of analyses was to detect the malaco-successional changes of the past 30.000 years, the chronological role of the individual species as well as the temporal sequence of the different palaeo-ecological changes.

In the course of these analyses, a special malaco-fauna with characteristic species composition was detected at the boundary of the Upper Würm and the Late Glacial periods, occurring at several topographical spots in Hungary (Danube-Tisza Interfluvial Region: Lakitelek, Tiszaalpár, Hortobágy, Kócsújfalu, Hajdúság, Debrecen, Hajdúböszörmény etc.).

Species preferring a cold climate are typical of this period, like Columella columella, Pupilla sterri and Vallonia tenuilabris, and are present in considerable individual numbers for the last time in Hungary. Due to their known recent distribution and ecological demands, these species have considerable importance as bio-indicators for a palaeo-ecological reconstruction (EVANS, J.G. 1972; KERNEY, M.P. 1971; KERNEY, M.P. & al. 1983; KLEMM, W. 1974; KROLOPP, E. 1973, 1983; LIHAREV, I.M. - RAMMEL'MEIER, E.S. 1962; LOŽEK, V. 1964).

The species Columella columella /MARTENS, 1830/ lives on the Scandinavian Penninsula between the latitudes 61-71°, while in Northern Asia, it occurs between 61-69°. In the Alpes, the species lives up to an of 2.900 m a.s.l. The species is known to prefer a cold climate, hygrophilous steppean element. According to our investigations, the last maximum dominance of this

faunal element can be dated to 14.000-15.000 B.P. on the Great Hungarian Plain, and it became extinct in this area by 12.000 B.P.

Pupilla sterri /VOITH, 1838/ is an inhabitant of the higher mountains in Central and Southern Europe and Central Asia (e.g. Kopet-Dag, Tien San). Its range extends up to an altitude of 2.800 m in the Alpes. According to LOZEK, V. (1964), it is a xerophilous steppean element; however, Hungarian experts have found a strict correlation between the individual number changes of the species P. sterri and Vallonia tenuilabris (FUKOH L. 1987; KROLOPP, E. 1973; SÜMEGI, P., LÓKI, J. 1989). In our opinion, therefore, it can be used in a palaeoclimatic reconstruction as a species preferring cold climate, a steppean element resistant to dry weather. This species was present on the Great Hungarian Plain between the years 14.500-16.000 B.P. for the last time.

Vallonia tenuilabris (BRAUN, 1843) is recently living in the mountains of Southern Siberia, Central Asia and Northern China. It was extinct in Europe by the end of the Pleistocene. According to climatic requirements, it prefers cold weather is resistant to dry conditions, and occurs in steppean regions. Its last significant peak of dominance on the Great Hungarian Plain was found between the years 14.500-16.000 B.P. According to C-14 dates, it became extinct in the Carpathian Basin between the years 11.000-12.000 B.P.

On the basis of the appearance and dominance peak of these three very characteristic species, the climate of the period between 14.000-16.000 B.P. could be reconstructed as very cold. On the basis of the composition of the malacofauna, the July mean temperature could be defined as 12-14 °C (SÜMEGI P. 1989), which is 7-9 °C lower than that of our days. This uniformly cold period can be divided into a more

arid (15.000-16.000 B.P.) and a more humid (14.000-15.000 B.P.) phase. An interesting feature of this latter climatic period, is, that the species Cochlicopa nitens appeared for the first time in Hungary (NYILAS, I. - SÜMEGI, P. 1989; SÜMEGI, P. - LÓKI J. - HERTELENDI, E. - SZÖÖR, GY. 1990).

Our statements concerning climate are in good agreement with North-European morena studies indicating transgression of the ice-sheet, a so-called microstadial ('Pomeranian readvance') (CEPEK, A.G. 1967; SEREBRANNYJ, L.R. - RAUKAS, A.V. 1970).

Considering that this malacological horizon was clearly recognised at several places in Hungary, it is proposed here that within the Trichia hispida-Bithynia leachi biozone, Semilimax kotulai subzone, set by KROLOPP, E. (1983) based on malacological biostratigraphy, the period corresponding to the stadial level between 14.000-16.000 B.P. be named Columella columella-Pupilla sterri-Vallonia tenuilabris zonule. As a type section, the outcrop of the Lakitelek brickyards is proposed here.

SUMMARY

By a complex application of malacological and radiocarbon investigations, characteristic dominance level of species preferring cold climate between the years 14.000-16.000 B.P. was demonstrated. On the basis of former data, this period took place by the end of the Upper Weichselian, the end of the Upper Pleniglacial, the beginning of the Last Glacial. This is a microstadial level fixed from biostratigraphical evidence by the last dominance peak of the species Columella columella and Vallonia tenuilabris and the last appearance of the species Pupilla sterri on the Great Hungarian plain. Stratigraphical and

palaeo-ecological results can be equally synchronised with glacial morena studies, because in the same interval a characteristic advance of the ice-sheet was found as well (Pomeranian phase).

ÖSSZEFOGLALÁS

Malakológiai és radiokarbon vizsgálatok együttes alkalmazásával 14.000-16.000 BP. évek között hidegkedvelő fajok jellegzetes dominanciaszintjét lehetett kimutatni. Az eddigi adatok alapján ez a szint az "Upper Weichselian" periódus (felső-pleniglaciális) végén, a "Last Glacial" kezdetén alakult ki. Egy mikrostradiális szint, amelyet a Columella columella, a Vallonia tenuilabris időben utolsó dominanciacsúcsa és a Pupilla sterri alföldi utolsó megjelenése rögzíti biosztratigráfiaiilag. A sztratigráfiai és paleoökológiai eredmények is szinkronizálhatók a glaciális morénavizsgálatokhoz, hiszen ugyanebben az időintervallumban jellegzetes jégtakaró előrenyomulást rögzítettek (Pomerániai fázis).

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Oppel zone	Locality	¹⁴ C data, BP. years	Code
Bithynia leachi-	Hortobágy	15 800 ± 200	DEB-1546
Trichia hispida	(Nyírólapos territory)		
zona	Debreceen	15 740 ± 200	DEB-1565
Semilimax	(brickyard)		
kotulai	Tiszaalpár	15 310 ± 350	DEB-1080
subzona	(riverside of Tisza)		
(KROLOPP, E.1987)			
Proposed:	Lakitelek	14 840 ± 300	DEB-1075
Columella	(brickyard)		
columella-			
Pupilla sterri-	Hortobágy	14 560 ± 300	DEB-1068
Vallonia	(Kócsújfalu village)		
tenuilabris			
zonula			

I. Táblázat: Gastropoda héjajakból meghatározott koradatok
Radiokarbon age of the studied Gastropoda shells