Enikő Magyari, Krisztina Buczkó,
Erzsébet Szurdoki & Gábor Újvári (eds.)

CELL-50K

Calibrating Environmental Leads and Lags over the last 50 kyr

an IFG as part of the INTIMATE group

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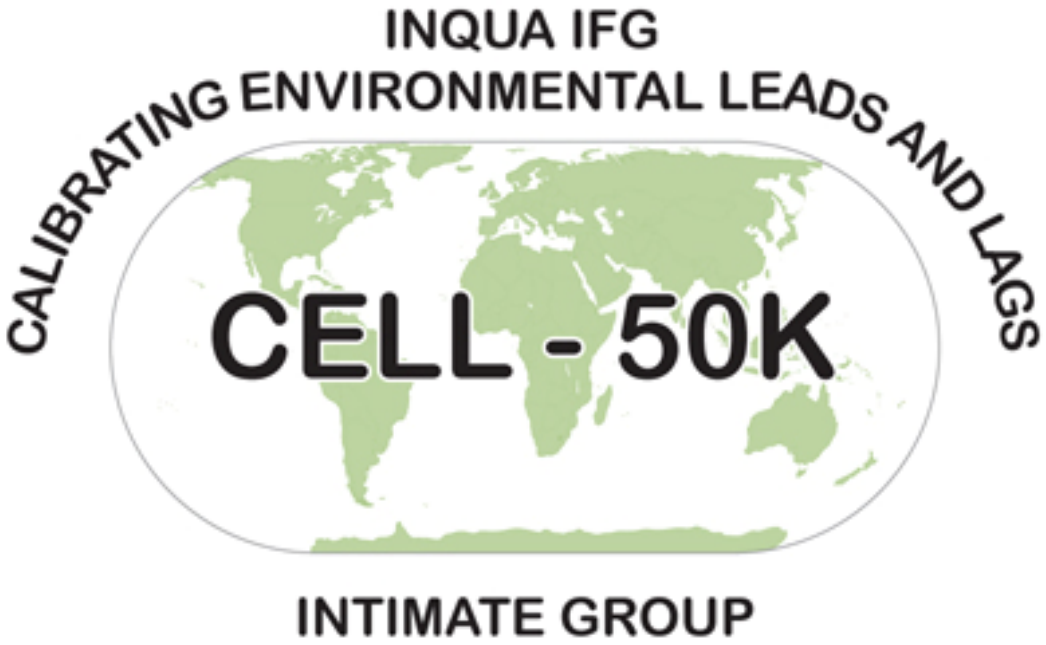

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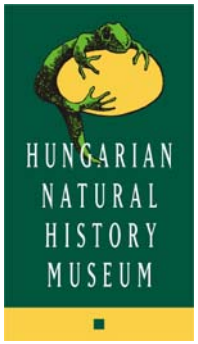
CELL-50K is an IFG (International Focus Group) that will co-ordinate efforts to provide a strong chronological framework for the investigation of how climate forcing is translated into regional climate events and the degree to which different regions show lagged responses to the initial forcing. We will do this by developing robust chronostratigraphic frameworks for testing the scale of leads and lags in response to climate forcing between and within different regions. The aim of this first meeting is to establish future operations of the group and to develop individual regional groups that were proposed during the initial application. We also need to agree protocols for the inclusion and integration of records and a set of scientific targets for a year on year basis, heading towards the overall goal of having regional integrations of palaeodata and some key outcomes during the inter congress period.

Simon Blockley
Principal Investigator of CELL-50K
Department of Geography, Royal Holloway, University of London

Cell-50K is sponsored by:



Front page design by Beáta Briss, Gábor Újvári and Áron Nemes

Welcome to Cell-50K

On behalf of the local organizing committee, we would like to welcome you in Budapest, the capital of Hungary and the city of spas. We are proud that Hungary received the right to organize the first Cell-50K workshop under the auspices of INQUA and INTIMATE.

The Pannonian basin hosts famous loess profiles, several of which cover the last 12-200 (900) ky years (e.g. Paks, Dunaföldvár, Basaharc, Süttő, Tokaj). As part of our workshop, during the fieldtrip, you will have possibility to visit one of them, the attractive profile at Süttő. The basin occupies an area of about 100000 km^2, and forms one of the largest alluvial plains in Europe. Late Neogene subsidence facilitated the accumulation of fluvial sequences in considerable thicknesses in many parts of the basin. Therefore, the area is a key locality in understanding fluvial processes in a continental intramontane setting in response to climatic and tectonic forcing. The study of these famous deposits together with our remarkable loess sequences advanced very much between ca. 1950-1985 thanks to the deep-drilling program of the Hungarian Geological Institute that recovered several long glacial fluvial and alluvial cores (e.g Vésztő & Dévaványa reaching back to ~5 million years). Paleomagnetic, sedimentological, pollen and malacological studies on these sediments provided the first quasi-continuous insights into our Quaternary climate, vegetation and fauna. In addition several loess profiles were studied in these years and together with the fluvial deposits have been revisited more recently to improve their chronologies and use new climatic proxies, such as carbon and oxygen isotopes, various biomarkers, phytolits and many more. Lake sediments in the basin have also been studied widely using multi-proxy paleoecological/paleolimnological methods, but most of them cover only the lateglacial and Holocene period. The longest continuous records date back only to ca. 25-30 ky BP. The search for last glacial continuous records is ongoing and some promising new seismic and geoelectric surveys suggest that continuous lake sediments covering at least the last glacial/interglacial cycle do exist in the Carpathian Mountains in relatively young volcanic basins, so the chance is there that East-Central European scientists will soon fill the gap in the European map of long, continuous, well studied lake sediment archives. The preliminary results will be presented here for the first time.

We hope that this meeting will give opportunity for scientists from less developed regions to close up in the most up to date research technology and not at least make contacts with the representatives of leading schools and laboratories. We believe that for understanding global processes in the past and future, it is necessary to join our efforts and concentrate on the study of less explored regions.

Finally, we would like to take this opportunity to thank all of our sponsors (incl. OTKA K83999, NF101362), and the workshop participants to be present and share new ideas that will in our hope lead to a worldwide network. Our special thanks go to Erzsébet Szurdoki for web-page management and Miklós Rajczy for IT support. We hope you will have a stimulating time in Budapest.

Local Organizing Committee

Enikő Magyari, Krisztina Buczkó and Gábor Újvári

Workshop program

Monday 12th November 2012	
	arrival, hotel check-in
19.00 – 22.00	Welcome and Networking Party (Conference room, Hotel City Inn)

Tuesday 13th November 2012	
9.00 – 10.00	Registration
10.00 – 10.15	Opening ceremony **István Matskási:** Opening speech Director of the museum **Enikő Magyari:** Opening speech local committee
10.15 – 10.45	**Blockley, S**. on behalf of the INTIMATE group CELL-50K (Calibrating Environmental Leads and Lags over the last 50 kyr) – an IFG and project as part of the INTIMATE group.
10.45 – 11.05	**Staff, R.A.,** Ramsey, C.B., Nakagawa, T., Suigetsu 2006 Project Members Long Distance Identification of Leads and Lags in Climatic Change by way of Direct Terrestrial Radiocarbon Comparison
11.05 – 11.25	**Újvári, G.** Loess records in CELL-50k: potential issues of dating, age-depth modeling, proxies and environmental leads and lags
11.25 – 12.00	Coffee break
12.00 – 12.20	**Matthews, I.P.** How useful are tephra layers in calibrating the spatial and temporal phasing of environmental changes?
12.20 – 12.40	**Veres, D.,** Bazin, L., Landais, A., Lemieux-Dudon, B., Parrenin, F., Martinerie, P., Toyé Mahamadou Kele, H., Capron, E., Chappellaz, J., Rasmussen, S.O., Severi, M., Svensson, A., Vinther, B., Wolff, E. A new Antarctic ice core chronology (AICC2012): 0-120 ka
12.40 – 13.00	**Bourne, A.J.,** Davies, S.M., Abbott, P.M. Tephra Constraints on Rapid Climate Events (TRACE) – new results from the Greenland Ice Cores between 25 and 45 ka BP
13.00 –13.20	**Gulyás, S.,** Sümegi, P. Tracking multilevel mosaic-patterning of the environment of the Great Hungarian Plains for the past 80 kys based on regional integration of high resolution (20-40 y) terrestrial records from the database of the University of Szeged, Hungary and correlation with global marine, ice core, terrestrial archives
13.20 – 13.40	**Hardiman, M.** Synchronising terrestrial palaeo-records in the eastern Mediterranean during the Last Glacial using the INTIMATE model
13.40 –14.40	Lunch break (sandwiches plus drinks served in the museum building)

14.40 – 16.00	Afternoon discussion session: key problems and formation of breakout groups
16.00 – 16.30	Coffee break
16.30 – 18.00	Breakout group meeting
18.00 – 19.00	Poster session
19.00 – 21.00	Welcome Party (Hungarian Natural History Museum)

Wednesday 14th November 2012	
9.00 – 9.20	**Almond, P.,** Lorrey, A., Reeves, J., AUS-INTIMATE Members Southern Hemisphere Assessment of Paleoenvironments (SHAPE): Outline of a Proposal to the Palaeoclimate Commission of INQUA
9.20 – 9.40	**Reeves, J.M.,** Cohen, T. & OZ-INTIMATE members Toward a Climate Event Stratigraphy for the Australian region, 0-35 ka
9.40 – 10.00	**Siani, G.,** Michel E. Radiocarbon reservoir age changes in the Southern Ocean since the last deglaciation
10.00 – 10.20	**Chawchai, S.,** Chabangborn, A., Wohlfarth, B., Kylander, M. Löwemark, L. Mörth, C-M. Blaauw, M. Klubseang, W. Reimer, P.J. Fritz, S.C. The Holocene climate history of Lake Kumphawapi, northeast Thailand
10.20 – 10.40	**Magyari, E.K.,** Veres, D., Braun, M., Schäbitz, F., Ferenczy, G. Detecting Dansgaard-Oeschger cycles in the high-resolution last glacial pollen record of Lake St. Ana, Eastern Carpathian Mts, Romania
10.40 – 11.10	Coffee break
11.10 – 11.30	**Gaudenyi, T.,** Jovanovic, M. Molluscan record and taphonomy of loess series – case study of the Late Pleistocene loess series of Titel Loess Plateau
11.30 – 11.50	**Pearce, C**., Massé, G., Kuijpers, A., Seidenkrantz, M-S. A succession of events at the Younger Dryas termination offshore Newfoundland
11.50 – 12.10	**Lane, C.S.,** Johnson, T.C., Chorn, B.T., Scholz C.A. Toward a Late Quaternary tephrostratigraphy for East Africa.
12.10 – 12:30	**Osayi, E.E.,** Njokuocha, R.C. The Atmospheric Bio-Particles of Awka, Nigeria.
12:30 –12:50	**Novothny, Á.,** Horváth, E., Barta, G., Koeniger, P., Rolf, C., Thiel, C., Frechen, M. Complex investigation of the last glacial cycle at the Süttő loess section (Hungary)
12.50 – 14.00	Lunch break (sandwiches plus drinks served in the museum building)
14.00 – 14.30	Breakout groups meet to summarise

14.30 – 15.00	Breakout reports
15.00 – 15.30	Management meeting
15.30 – 15:45	Closing ceremony
16.00 – 17.00	Facultative exhibition visit

Both day poster sessions go parallel in the lecture hall.

Thursday 15th November 2012

Fieldtrip to Süttő, a famous Hungarian loess profiles covering the last glacial cycle.

We meet at 9.a.m.

Meeting point: in front of the Exhibition Hall of the Hungarian Natural History Museum (conference venue), 1083 Budapest, Ludovika tér 2-6.

Poster presentations:

Bourne, A.J., Matthews, I.P. , Trincardi, F., Lowe, J.J., Blockley, S.P.E.
The use of distal tephra layers to synchronise marine and terrestrial records in the Mediterranean region and beyond.

Buczkó, K., Magyari, E.K., Bitusik, P., Wacnik, A.
Review of dated Late Quaternary palaeolimnological records in the Carpathian region

Da-Cheng, L., Chen, M-T., Yamamoto, M., Yokoyama, Y.
Precisely dated AMS C marine cores reveal the complexity of millennial-scale Asian monsoon variability in the northern South China Sea (MD, MD)

Ferk, M., Ortar, J., Zorn, M.
Recent chronological investigations of palaeoenvironment in Slovenian Dinaric Karst

Magyari, E.K., Peyron, O., Tóth, M., Heiri, O., Lotter, A.F., Buczkó, K.
Pollen- and chironomid-based reconstruction of late glacial summer temperatures in the southern Carpathians (Romania): conflicting results and supporting independent proxies

McClymont, E.L., Ganeshram, R., Pichevin, L.E. , Haywood, A.M. , Blockley, S.
Abrupt climate changes in the tropical Pacific during Termination 1: multi-proxy records from the Gulf of California

Michel E., Siani G., Paterne M., Van der Putten N. , Björck S., Mazaud A., De Pol-Holz R., Muscheler R.
The Southern Ocean's role in the bipolar seesaw: a tephra-chronology strategy to reconstruct high resolution well-dated climate records

Montoya, E., Gosling, W.D.
Evaluation of tropical forests sensitivity to past climate changes: the FORSENS project

Sümegi, P., Gulyás, S., Persaits, G., Sümegi-Törõcsik, T., Jakab, G., Molnár, M., Schöll-Barna, G., Demény, A., Bodor, E.
Paleohydrology of the largest freshwater lake in Central Europe: Results of a multiproxy paleoecological study from Lake Balaton, Western Hungary

Whitney, B.S., Fitzpatrick, K., Metcalfe, S.E., Loader, N.J., Burn, M.J., Surangi W Punyasena, W., Mayle, F.E.
The Pleistocene-Holocene transition in continental South America: Summary of multiproxy data from Laguna La Gaiba

Abstracts

Southern Hemisphere Assessment of Paleoenvironments (SHAPE): Outline of a Proposal to the Palaeoclimate Commission of INQUA

Almond, P. [1], Lorrey, A. [2], Reeves, J. [3], AUS-INTIMATE Members

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oral

The Australasian-INTIMATE project operated within the INQUA inter-congress periods from 2003-2007 and 2007-2011. Its main objective was to develop climate event stratigraphies (CESs) for Australia and New Zealand. Although development of a CES for New Zealand has been possible by using a composite stratotype approach, the climatic variability over the large Australian landmass, and disparate orographic-induced climate patterns for New Zealand has stymied a full integration for Australasia. The highlights of the second phase of AUS-INTIMATE are soon to be published in a special issue of Quaternary Science Reviews. A new proposed project (Southern Hemisphere Assessment of Palaeoenvironments, or SHAPE) intends to build on the successes of AUS-INTIMATE, widening its geographical reach by involving researchers throughout the Southern Hemisphere, and extending the time window to 0-60 ka. The project aims to investigate past environmental characteristics, variability and change through the development and integration of proxy archives and model simulations. A principal research thrust will be interpretation and integration of proxies from a synoptic regime standpoint. Key elements of reconstructing synoptic types will be to exploit reconstructions of climatic gradients to implicate past circulation patterns and drivers at regional and hemispheric-scale. We expect the multifaceted approach offered by SHAPE will assist in linking field-based studies to model simulations, improve understanding of palaeoclimate dynamics, and provide a southern counterpart to efforts underway through the CELL-50 k international focus group aimed at examining interhemispheric linkages.

Tephra Constraints on Rapid Climate Events (TRACE) – new results from the Greenland Ice Cores between 25 and 45 ka BP.

Bourne, A.J.[1*], Davies, S.M. [1], Abbott, P.M. [1]

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oral

The TRACE project (Tephra constraints on Rapid Climate Events) aims to assess the phasing relationships between the atmosphere and the ocean during rapid climate events through the identification of volcanic ash layers in Greenland ice-cores and North Atlantic marine records during the last glacial period. Volcanic ash layers will provide time-parallel marker layers in each record which will be used as constraints to assess the lead/lag responses between the atmospheric and oceanic systems.

Here we present a new sampling strategy for NEEM and NGRIP ice spanning 25-45 ka BP. Preliminary results indicate that more volcanic ash layers are present in these sequences than previously thought. 20 tephra layers have been identified in the NEEM ice, including a suite of 7 layers that fall between Greenland Interstadial 8 and 9. Within the NGRIP ice 39 tephra layers have been identified between 25 and 45 ka BP, also including a suite of 13 layers that fall between Greenland Interstadial 8 and 9. The new sampling strategy will allow the relationship between the 59 tephra layers and sulphate peaks to be assessed. The grain size of some of these layers is very small (~15μm) which may indicate a volcanic source other than Iceland. Differences in the grain size of layers may have implications for the dispersal mechanisms of volcanic ash.

These results provide new ash layers that can potentially be found in marine and terrestrial environments and may also be able assess links between volcanism and the influence of climatic forcing.

The use of distal tephra layers to synchronise marine and terrestrial records in the Mediterranean region and beyond

Bourne, A.J.[1+*], Matthews, I.P. [1], Trincardi, F.[2], Lowe, J.J.[1], Blockley, S.P.E.[1]

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[2] Istituto di Scienze Marine (C.N.R.), Sezione di Geologia Marina, via Gobetti 101, 40129 Bologna, Italy
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poster

Records of environmental change from the Adriatic Sea show shifts in Oxygen isotope values that appear consistent with Dansgaard-Oeschger cycles observed in Greenland ice-core records while Lago Grande di Monticchio (LGdM) pollen data reveals a similar pattern. Synchronising the records from the Adriatic Sea, LGdM, and Greenland requires precise and robust chronological control, which is frequently unavailable using traditional chronological techniques, especially in the case of marine sequences. In the central Mediterranean, tephrochronology offers the potential of isochronous marker horizons and independent age estimates that can help to resolve this problem.

Existing tephrostratigraphical schemes for the region are largely based on bulk analysis of visible tephra layers. The isolation of non-visible distal ash shards from host sediments using density separation techniques has demonstrated tephra layers are more numerous in marine sequences than previously realised, greatly enhancing the potential of tephrostratigraphy as a correlation tool. Indeed, in some records the number of discrete non-visible distal ash layers significantly exceeds that of visible ones.
Here we present tephrostratigraphical results from a number of Adriatic sequences covering the last 50 ka BP. The results highlight the key tephra that can be used to correlate marine and terrestrial records in this region, while the stratigraphic, isotopic and palaeoecological association of each layer defines the marine and terrestrial settings. Bayesian-based age models incorporating tephrochronological data are used to correlate the studied marine records to terrestrial Mediterranean sequences and to assess whether or not the observed isotopic changes are synchronous with those recorded in Greenland.

CELL-50k (Calibrating Environmental Leads and Lags over the last 50 kyr) – an IFG and project as part of the INTIMATE group

Blockley, S.[1*] on behalf of the INTIMATE group

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oral

CELL-50k is an IFG that will co-ordinate efforts to provide a strong chronological framework for the investigation of how climate forcing is translated into regional climate events during the last ~50,000 years. This kick of presentation will outline the main overall goals of CELL-50k over the life of the project. This IFG comes from the INTIMATE (INTegrating Ice core, MArine and TErrestrial records) international collective; an established international collaboration between scientists committed to the attainment of more secure, highly resolved synchronisation of global environmental records spanning the last glacial stage and the transition into the Holocene. Current INTIMATE groups studying the North Atlantic and Austrlasian regions will feed into the global initiative but the key aim of this IFG is to develop a broader geographic framework. I will look at how the North Atlantic INTIMATE group have moved forward to develop robust chronostratigraphic frameworks for testing the scale of leads and lags in response to climate forcing. I will then discuss some ideas for how we move to testing these issues in different regions and also between and within different regions. I will finally raise some key challenges for the new group in order to frame our discussions for the rest of the meeting.

Review of dated Late Quaternary palaeolimnological records in the Carpathian region

Buczkó, K. [1*], Magyari, E.K.[2], Bitusik, P.[3] & Wacnik, A.[4]

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poster

In 2009 we presented a compilation of dated palaeolimnological records in the Carpathian Basin (Buczkó et al 2009). Altogether, 110 localities including 123 sequences were collected from the region. Six sequences can be found in the Czech Republic, 15 in Slovakia, 38 in Poland, 37 in Hungary and 24 in Romania. The longest continuous sequence comes from the Romanian Carpathians (Lezerul Caliman); here pollen and lithological analyses extend back to ca. 17,700 cal yr BP. However, several discontinuous lake sediment records extend back to ca. 30,000 cal yr BP in the Pannonian Basin, that are under study, the results mainly unpublished. Late Quaternary records with at least two proxies (of which at least one is biological), and multiple ^{14}C or ^{237}Cs isotope dates were included. Our aim was to summarize the available proxy records from this region in order to make them available for regional and European-scale Late Quaternary hydrological and palaeoclimate reconstructions. An assessment of the dataset led us to conclude that despite the density of examined sites (1) very few provide firm hydrological-limnological interpretation, such as lake level and mire water-depth fluctuation, lake productivity changes and pH changes; (2) only 47 of them are real multi-proxy studies (have at least two proxies employed on the same sediment core); (3) glacial lakes in Slovakia and Romania as well as in Ukraine are seriously under-investigated although they would be ideal objects of palaeolimnological works with the many proxies applicable on them; (4) the Hungarian lowland areas are dominated by shallow tectonic lakes or palaeochannels, often with unsatisfactory preservation of certain biological proxies (e.g. diatoms, chironomids, cladocerans). Consequently, palaeolimnological studies from this region have to apply a different combination of proxies and approach than mountain lake studies.

Buczkó K, Magyari E K, Bitušík P, Wacnik A (2009) Review of dated Late Quaternary palaeolimnological records in the Carpathian Region, east-central Europe HYDROBIOLOGIA 631: pp. 3-28.

The Holocene climate history of Lake Kumphawapi, northeast Thailand

Chawchai, S. [1*], Chabangborn, A. [1], Wohlfarth, B. [1], Kylander, M[1]. Löwemark, L[2]. Mörth, C-M[1]. Blaauw, M[3]. Klubseang, W[4]. Reimer, P.J[3]. Fritz, S.C.[5]

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oral

Recent devastating flooding in Southeast Asia has drawn attention to the importance of understanding the long-term climate dynamics of the region, yet high-resolution paleoenvironmental records are still scarce. Here I present new radiocarbon dates, multi-proxy sediment records (LOI, TOC, C/N, CNS isotopes, Itrax elemental data, magnetic susceptibility, biogenic silica and diatom stratigraphy) for Lake Kumphawapi, the second largest natural lake in northeast Thailand. The data set is used to reconstruct regional climatic and environmental history during the Holocene. The comparison of multiple sediment sequences and their proxies suggests that the summer monsoon was stronger between c. 9800 and 7000 cal yr BP. Lake status and water level changes after 7000 cal yr BP signify a shift to lower effective moisture. By c. 6500 cal yr BP parts of the lake had been transformed into a peatland, while areas of shallow water still occupied the deeper part of the basin until c. 5400-5200 cal yr BP. The driest interval in Kumphawapi's history occurred between c. 5200 and 3200 cal yr BP, when peat extended over large parts of the basin. After 3200 cal yr BP, the deepest part of the lake again turned into a wetland. However, the sediments deposited between c. 3200 and 1600 cal yr BP provide evidence for at least two hiatuses at c. 2700-2500 cal yr BP, and at c. 1900-1600 cal yr BP, which would suggest surface dryness and consequently periods of low effective moisture. The observed lake-level rise after 1600 cal yr BP could have been caused by higher moisture availability, although increased human influence in the catchment cannot be ruled out.

This study shows that multiple sediment sequences and a variety of proxies need to be studied in large lakes, such as Lake Kumphawapi to assess the time transgressive response to past changes in hydroclimate conditions. Kumphawapi is a sensitive archive for recording past shifts in effective moisture, and as such in the intensity of the Asian summer monsoon. The Holocene record of Lake Kumphawapi adds important paleoclimatic information for a region in Southeast Asia and allows discussing past monsoon variability and ITCZ movement in greater detail.

Precisely dated AMS ^{14}C marine cores reveal the complexity of millennial-scale Asian monsoon variability in the northern South China Sea (MD972146, MD972148)

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poster

High sedimentation rate (SR) cores retrieved from the South China Sea (SCS) form the basis for studying the marine components of millennial-scale Asian monsoon (AM) variability and for comparison with the AM reconstructions from cave records on land (e.g. Dongge and Hulu). However, carefully correlating the SCS sedimentary records to the cave records that are precisely dated by U/Th methods with resolution of decadal-scale, has not been completed. Such a correlation is essential when comparing AM influences expressed over land and sea, but requires a construction of marine AMS ^{14}C age models that are precise enough to be compared to the cave U/Th age models. For the purpose of establishing such a correlation, this study presents new data from intensive AMS 14C dated marine cores retrieved from the northern SCS(MD972146, MD972148). The discrepancy of marine and cave δ^{18}O record for the interval of ~18–30 kamight be due to the change of marine 14C reservoir age in SCS surface water during the glacial period, andto the change in interhemispheric dominance of the AM systems. With the new AMS ^{14}C dating on MD972146 and MD972148, we examined the millennial-scale records of planktonic foraminifer δ^{18}O and carbonate contents of MD972146, MD97248, and SONNE 17940-2 and compared those records with Dongge–Hulu δ^{18}O record of the past 30 ka. Our results show that in the intervals corresponding to the high-latitude Northern Hemisphere (NH) Younger Dryas (YD) and Heinrich I event (H1), the AMS ^{14}C dated millennial-scale oscillations show relatively heavy δ^{18}O and low carbonate contents, but H2 and H3 are in the opposite direction. Our results indicate the complexity for the marine cores which were used in interpreting the millennial-scale AM variability.

Recent chronological investigations of palaeoenvironment in Slovenian Dinaric Karst

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poster

The Classical Karst region in western Slovenia was studied from several aspects since many centuries, however the knowledge and understanding of the complex karst system is still lacking in chronological data from the Pleistocene. Modern investigations are therefore focused on analysing of different sediment sequences in order to acquire a more complete interpretation of palaeoenvironmental conditions in the area influenced by both, the Alpine and Mediterranean glaciation types.

Caves turned out to be the most valuable source of informations about the hydrological and consequently, climatological processes, and the palaeoenvironment in the past. Extensive palaeomagnetic dating analyses were carried out in Slovenian caves; recently flowstone from caves is being dated with radiocarbon ^{14}C and U-Th dating methods as well. The preliminary results indicate much different hydrological characteristics in some areas in the past. E.g., the highest piesometric levels, connected with palaeofloods in late Pleistocene and early Holocene, were reached at higher elevations than in present times. Extreme hydrological processes, confirmed by morphological and stratigraphical evidences as well as by dating, could be related to different climate conditions.

In the future it will be necessary to compare and combine the results with similar data in the region with the purpose to improve the understanding of palaeoclimatic signals in the north-western Balkan.

Molluscan record and taphonomy of loess series – case study of the Late Pleistocene loess series of Titel Loess Plateau

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oral

Molluscan shells are one of the most abundant fossils in loess series. In the Quaternary quantitative analysis they should serve as useful fossil in the reconstruction of the past environmental dynamics. However to fully understanding the molluscan record we should evaulate the local geological/lithological conditions. Especially the higher clay or sand content which could reflects as a poorer vegetation character and according this features the molluscan record should be poor in species and individuals.

The rate of the clayey-silty-sandy material accumulation should also reflects as a factor of sensivity in the molluscan record.

The postdepositional condition needs to be fully understandable because in many cases the weathering and ground water influence caused by decalcification(s) at some part of the full analysed profile. The decalcification should be reflects as partly of fully leached the shells preserved in loess series. In some cases the molluscan samples cannot be representative or the sampling sediment volume should be bigger.

In many cases the paleosols are without molluscan record because the geochemical processes (pedogenetic processes or processes of humicifaction) resulted that it damaged or destroyed the molluscan record.

In the interpretation of the past environmental dynamics sometimes the timeline changes are not following the other changes which can be connected to the adaptation functions of molluscs and their sensitivity to the characters of the environmental changes.

Tracking multilevel mosaic-patterning of the environment of the Great Hungarian Plains for the past 80 kys based on regional integration of high resolution (20-40 y) terrestrial records from the database of the University of Szeged, Hungary and correlation with global marine, ice core, terrestrial archives

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oral

The area of the Carpathian Basin is characterized by multilevel mosaic-patterning of the environment fostered by the overlap of four prevailing climatic influences and variation in geomorphology, hydrology and soils. This fractal-like complexity has been present in the area for ca. 200 kys fundamentally influencing the evolution of the Quaternary landscape, biota as well as the former inhabitants. The wealth of information preserved in various terrestrial archives enabled us model paleoenvironmental, paleovegetational changes for the past 80 kys in the heart of the basin at the local, regional and basin-scale level using uniform methodological approaches and high-resolution data (40-20 y). For the sake of accurate modelling, only those results and profiles were included in our work where certain common prerequisites of methodological congruence were present. Among these criteria were undisturbed sampling and reliable chronology based on radiocarbon and/or OSL, IRSL or uranium-series dating. In order to better highlight the climatic background of the local ecosystem, which is present in the heart of the Carpathian Basin, the vegetation classification system of Holdridge was adopted. Models presented are based on multiproxy results from 20 selected loess/paleosol sequences, radiocarbon-dated, undisturbed core sequences of 20 catchment basins and records of environmental historical analyses implemented on nearby archaeological sites. A combination of data enabled us to track not only temporal but also spatial differences in the trajectory of landscape and vegetation evolution. In this presentation we would like to highlight responses of the terrestrial ecosystems to major global climatic perturbations observed at the site, regional and basin-wide level. Finally, causes for the emergence of this mosaic-patterning will be shown on a new high-resolution continuous record extending back to ca. 1 Mys.

Synchronising terrestrial palaeo-records in the eastern Mediterranean during the Last Glacial using the INTIMATE model

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oral

Thus far the INTIMATE approach has predominantly been focused on the North Atlantic and Australasian regions; here this is extended to the eastern Mediterranean where three high resolution pollen records have been placed on independent timescales during the late Last Glacial (48-20 ka BP). This has been achieved utilising radiocarbon data anchored by tephrochronological information which has been combined via the use of Bayesian age-modelling techniques. This has allowed robust, comparable age models to be produced with realistic error ranges and revealed sometimes significant chronological off-sets (~10^3 years) between pre-existing alignment or *'wiggle'* matched chronological schemes and the independent chronological models developed here. These differences are explored and the palaeoenvironmental implications outlined. Tephra layers found within several sites also enables the degree of synchronicity of proxy response to rapid climatic shifts (which dominate the Last Glacial) to be assessed as well as allowing a more precise ordering of palaeoenvironmental events.

Particular emphasis will be given to the regional timing and synchroneity of pollen signals relating to expansion of tree species (relating to warming/wetter conditions) that are followed by harsh climatic deteriorations (linked to Heinrich Events 3 and 4). Finally the Eastern Mediterranean proxy records presented here are compared to the North Atlantic Event Stratigraphy where similarities and differences, potentially related to regional climatic events, are highlighted. Although no direct stratigraphical correlation can be made between the Greenland stratotype and the Mediterranean pollen records under discussion here, a partial relationship may be determined via the stratigraphic relationship of the Laschamp geomagnetic excursion and the Campanian Ignimbrite tephra. This takes advantage of a recently extended INTIMATE Event Stratigraphy that covers the last 48,000 b2k.

Toward a Late Quaternary tephrostratigraphy for East Africa

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Volcanic ash (tephra) from explosive eruptions can be preserved as discrete layers within lake sediments. Tephra layers can be characterised using the chemical composition of the glass shards and correlated either to proximal tephra outcrops (which can be radiometrically dated) and/or to other distal occurrences of the same layer. Many studies have now shown that tephra can be detected in records 1000 km's from their source, often as microscopic or "cryptic" layers. These layers are isochrons, deposited instantaneously and rapidly buried within accumulating lake sediments. During the Late Quaternary there have been many explosive eruptions from volcanoes along the East African Rift and these have produced many widespread tephra layers. The East African Rift is also home to some of the longest continental lake sediment records in the world, which are providing important insight into past environmental and climatic conditions. Work is under way to detect (crypto-) tephra layers within Late Quaternary sediments from a number of lake records in East Africa, with the aim of building a regional tephrostratigraphic framework which will: (i) Enable more robust correlation of palaeoclimate archives from across tropical Africa, by providing stratigraphic tie-lines between archives; (ii) provide age constraints for individual core chronologies, in particular beyond the limits of radiocarbon dating; and (iii) increase our knowledge of Late Quaternary explosive volcanism in East Africa.

Detecting Dansgaard-Oeschger cycles in the high-resolution last glacial pollen record of Lake St. Ana, Eastern Carpathian Mts, Romania

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oral

We intend to present in this paper the first long pollen record from the Eastern Carpathian Mountains, namely the volcanic lake sediment record of St. Ana. The record extends back to ca. 35,000 years. We provide high-resolution (~50-100 yr) pollen percentage and accumulation rate, magnetic susceptibility and LOI records and correlate the detected changes with DO cycles and Heinrich events. We test the prevalence and spread of temperate broad leave and boreal forest elements during DO interstadials and discuss LGM and lateglacial vegetation succession of the Eastern Carpathians.

According to the first results, DO interstadials in the Eastern Carpathians were characterised by the advance (5-10% increase) of temperate deciduous tree taxa (*Fagus*, *Carpinus betulus*, *Corylus*, *Fraxinus excelsior* type, *Ulmus*) and *Picea* and both DO1 and DO2 stadials/interstadial showed marked pollen compositional change during MIS2. The full glacial part of the pollen record suggests a regionally semi-open boreal parkland landscape below 900 m a.s.l. with stone pine (*Pinus cembra*) and Scotch pine (*P. sylvestris*) dominated forest steppes, likely in the mid-altitude zone and Juniper scrubland above it. High relative frequencies of grass (Poaceae) and low sagebrush (*Artemisia*) and Chenopods (Chenopodiaceae) pollen suggests that the steppes were productive grass steppes in this period. The absence of conifer stomata and woody plant macrofossils suggest that the crater slopes were not forested during the fullglacial. A notable feature of the pollen record is the absence of large amplitude arboreal pollen frequency fluctuations in MIS 2. Also notable is the high microcharcoal influx until ca. 19,500 cal yr BP suggesting regular wildfires. This is followed by decreased microcharcoal influxes accompanied by a shift in the herb vegetation from grass to sagebrush dominance. It is likely that this shift was assisted by the decreasing fire frequencies; however, it did not lead to increasing forest cover during the terminal phase of MIS2.

Pollen- and chironomid-based reconstruction of late glacial summer temperatures in the southern Carpathians (Romania): conflicting results and supporting independent proxies

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poster

We reconstructed Lateglacial (LG) and Early Holocene (EH) summer temperatures at Lake Brazi and Lake Gales (Retezat Mountains, S Carpathians) based on fossil pollen and chironomid assemblages in order to study the amplitude of LG warmest month mean temperature (T_w) change in SE Europe. The climate reconstructions were based on the Modern Analogue Technique (pollen) and weighted averaging partial least-squares regression model (chironomids).This area lies far from the North Atlantic centre of meridional overturning circulation changes that exerted high amplitude temperature fluctuation in NW Europe. Climate models indicate low amplitude summer temperature change in this area that might have been beneficial for the survival of freshly emerging LG ecosystems during these climatic oscillations, but proxy-based reconstructions are scarce in this area, making such inference difficult at present. Our reconstructions come from the subalpine zone of the southern Carpathians, characterised today by high precipitation and relatively mild winter temperatures (1600 mm and -6.6 ºCat 1740 m a.s.l.). Pollen-inferred T_w showed rapid increase in our reconstruction between 14,800 and 14,500 cal yr BP, from 7.5 to 11.6 ºC and a further increase to 14 ºC by 14,200 cal yr BP. This overall 6.5 ºC increase in 600 years contrasts with the chironomid-inferred T_w increase of only 2.8 ºC in the same period. Absolute values are also much lower and more realistic in the chironomid-based reconstruction, reach 8.1-8.7 ºC during the late glacial interstadial. The onset of the Younger Dryas (GS-1) was characterized by sharp pollen-based decrease in T_w, from 14 to 8 ºC (6 ºC decrease), while the chironomid-based reconstruction showed a weak (non-significant), <1 ºC, decrease. This is the largest discrepancy between the two reconstructions, the general trends of which are otherwise similar.
In this presentation we will examine the possible reasons of the differing results (regarding both amplitude and absolute values), show similarity indices (Chord distances) between fossil and modern pollen assemblages to evaluate the quality of the modern analogues. We will also invoke other proxies (LOI, geochemistry derived soil development, diatom-inferred pH and total P, plant macrofossil and Cladocera community changes) to show the most likely amplitude of T_w fluctuation during the LG in the Retezat Mts. Overall our results imply that T_w decrease at the Allerød/Younger Dryas transition was likely less than inferred by the pollen-based reconstruction, other proxies point to seasonality change (longer winters) and small scale decrease in aquatic and terrestrial productivity that would rather support T_w decrease between 0-2 ºC, in line with the climate model hindcast.

How useful are tephra layers in calibrating the spatial and temporal phasing of environmental changes?

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oral

The detection and analysis of tephra layers is now widely employed in Late Quaternary studies, where individual ash layers provide both stratigraphic and chronological markers within sediment sequences. However, the ability of individual tephra layers to address the specific questions surrounding the identification of leads and lags in climatic transitions has not been fully explored. Here, the well-established Lateglacial tephrostratigraphy of Northwest Europe is outlined with specific reference to tephra layers within this stratigraphy which have the potential to constrain environmental leads and lags. Where tephra layers cannot be utilised to their fullest potential, the limiting factors preventing their use are examined and key areas for future research and for establishing tephrochronologies in other regions are highlighted. In addition, new data demonstrating how developing robust tephrostratigraphies can impact on our understanding of the phasing and sequencing of environmental events will be discussed. This will include a discussion of the use of tephras to assess the links between palaeotemperature reconstructions and oxygen-isotopic variations in Scottish lake sequences during the Lateglacial period.

Lakes in previously glaciated regions have the potential to constrain the timing of deglaciation of a landscape via the direct-dating of material associated with the onset of sedimentation. This usually necessitates the dating of organic matter via radiocarbon, which then provides a minimum age for lake formation. By dating several sites within a region, a series of chronostratigraphic ‘pinning points’ can be developed which allow the maximum glacial extent to be reconstructed. This exercise has been attempted numerous times across Scotland over the last c. 50 years and the published results are inconsistent. This most likely reflects the sampling of bulk organic material in the majority of these cases, hence it is possible these dates are affected by mineral carbon, and/or sample selection errors.

In recent years an alternative approach has been applied to address the timing and pattern of deglaciation, namely, cosmogenic nuclide dating of rocks associated with glacial landforms. These studies have frequently suggested a different temporal pattern of deglaciation and subsequent glacial re-advance. However, the chronological uncertainties associated with this technique make direct comparisons between the lake and landform chronologies difficult to achieve. Here we present new chronological data from several sites in Scotland, discuss the application of tephra layers as isochronous marker layers to resolve this problem, and the use of tephras in generating high-precision lake chronologies.

Abrupt climate changes in the tropical Pacific during Termination 1: multi-proxy records from the Gulf of California

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poster

Termination 1 (T1, c. 19-10 ka) was punctuated by a series of abrupt climate events that raise questions about the climate forcing mechanisms that operate at millennial timescales and that drive rapid climate changes. Evidence for dynamic tropical Pacific climate across T1 drives debate over whether modern analogues of seasonal Intertropical Convergence Zone (ITCZ) migration and/or El Niño-Southern Oscillation (ENSO)-like variability are appropriate. It also questions whether tropical Pacific climate is sensitive to the dramatic events observed in the north Atlantic region. We show results from high-resolution (average ~66 yr) analyses of marine sediments from the Gulf of California (IMAGES site MD02-2515). We employ geochemical proxies to reconstruct sea-surface temperatures, biological production, wind strength and runoff in order to investigate changes to ocean and atmospheric circulation. We find evidence for southern-hemisphere forcing of sea-surface temperatures but a biological response to northern hemisphere events during T1. The two temperature proxy records (the U^{K}_{37}' and TEX^{H}_{86} indices) reveal different expressions of the deglacial sea-surface warming, which we attribute to changes in wind-driven upwelling intensity. Enhanced precipitation and runoff into the Gulf of California coincide with the Heinrich 1 and Younger Dryas stadials, reflecting an atmospheric response to the events originating in the North Atlantic. Fully-coupled climate model simulations for the glacial maximum and Heinrich events confirm the proxy data results: that neither the modern seasonal or inter-annual cycles are valid analogues for glacial or deglacial climates in the tropical Pacific.

The Southern Ocean's role in the bipolar seesaw: a tephra-chronology strategy to reconstruct high resolution well-dated climate records

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poster

The rapid climate changes of the last deglaciation and the Holocene display asynchronous climatic behaviour between the two hemispheres. To increase our understanding of the dynamics behind inter-hemispheric climate linkages, high resolution and well-dated records from both hemispheres are needed. In the Southern Ocean (SO) the changing ^{14}C reservoir ages of surface waters along SO oceanic fronts result in large uncertainties in the chronology of marine records. Furthermore, there are restricted possibilities in this vast oceanic region to collect terrestrial records. We intend to establish a tephro-chronology to improve the ^{14}C dating of SO marine continuous records. The occurrences of the same tephra layers, independently dated on land and in marine sediments, allow the determination of local surface water ^{14}C reservoir ages (R_{surf}). In marine sediment core MD07-3088, retrieved off Chile, 5 tephra levels were chemically correlated to tephra fall-outs from the Hudson volcano making estimations of R_{surf} changes feasible (See Siani et al.). We intend to reconstruct the volcanic event sequence for the Kerguelen Archipelago since the Last Glacial Maximum from peat cores and a marine core retrieved downwind of "îles Kerguelen". By combining land and ocean records, the knowledge of R_{surf} changes in the sub-Antarctic area of the Indian Ocean will also allow us to study the influence of deep-water ^{14}C age changes. This will lead to well-dated climate reconstructions and increased insights in the role of SO circulation during rapid climate events.

Evaluation of tropical forests sensitivity to past climate changes: the FORSENS project

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poster

The "Evaluation of tropical forests sensitivity to past climate changes" (FORSENS) project is aimed to improve the understanding of Neotropical forest dynamics, based on a comparison of forests dynamics through time (Last Glacial Maximum [21,500 years ago] to the present) across an elevation and latitudinal gradient. Here we introduce our research plans. Two entirely new records of past environmental change will be developed within the equatorial tropics: Lake Baños (Ecuador, 3816 m asl); and one from lower elevation on the eastern Andean flank (to be collected in 2013). Moreover, two published records of past environmental change from the southern hemisphere tropics will be enhanced to create a network of four comparable sites across which past environmental changes can be assessed: 1) Lake Khomer Kotcha (Bolivia, 4153 m asl)[1,2]; and 2) Lake Consuelo (Peru, 1360 m asl)[3].

Upon completion we aim to have all records robustly dated and detailed records from fossil pollen, charcoal, chironomids, non-pollen palynomorphs and organic geochemistry ($\delta^{15}N$, $\delta^{13}C$). By standardising across the four sites we will be better able to determine the impact of specific past climate change events on vegetation. In particular we will target: 1) the last deglaciation (21,500-11,700 years ago) and, 2) the Holocene Dry event (8,000-4,000 years ago). The knowledge of past interactions between climate-vegetation-human will provide new insights into how future global climatic change could affect to tropical forests. Therefore, it is hoped that FORSENS will provide valuable data for the scientific community and will be of interest to CELL-50k/INTIMATE framework.

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Complex investigation of the last glacial cycle at the Süttő loess section (Hungary)

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oral

The loess-palaeosol record in the Süttő travertine quarry, Hungary (47°44.26' N, 18°26.87' E, 256 m a.s.l.) provides an excellent high-resolution archive for palaeoenvironmental changes in the Northern part of the Carpathian Basin. Loess deposits up to 20 m thickness cover the Süttő travertine complex, located next to the right bank of the Danube River. The loess is intercalated by two greyish stratified sandy loess horizons, three brownish steppe-like soils and a well developed pedocomplex, including a reddish-brown palaeosol covered by a chernozem-like palaeosol in paleovalley infilling. Detailed luminescence dating was carried out using IRSL (infrared stimulated luminescence) OSL (optically stimulated luminescence) and IRRF (Infrared-radiofluorescence) methods revealing more or less continuous sedimentation from MIS 6 to MIS 2. Independent age control is provided by radiocarbon dating for the upper part of the profile, by amino acid racemization (AAR) from the main loess units and by uranium-series ($^{230}Th/^{234}U$) ages correlating the travertine with MIS 7-8 beneath the loess.
The multi-dating approach provided an excellent chronological framework for the sediment succession at Süttő. In order to reconstruct the palaeoclimate and environmental changes during the last glacial cycle, high resolution grain size, malacological, geochemical (bulk carbonate stable isotope composition and n-alkanes) as well as palaeomagnetic analyses have been performed.

The Atmospheric Bio-Particles of Awka, Nigeria.

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Studies on the airborne particles of Awka municipality, Nigeria was carried out from March, 2002 to February, 2003 using Tauber's pollen trap. A total of 12312 bioparticles consisting of 65.19% pollen grains, 23.81% fungal spores, 0.21% Pteridophyte spores, 8.85% charred plant epidermis and 1.29% algal cyst/spores. Of the pollen grains, 115 pollen types belonging to 61 families (54 Dicotyledons and 7 Monocotyledons) were identified. There was a significant difference ($P<0.05$) in the mean monthly pollen and fungal spore counts. The dominant pollen grains in the atmosphere of the area were those of Poaceae, *Elaeis guineensis* Jaqc., *Nauclea latifolia* Sm*., Alchornea cordifolia* Chum and Thon., *Eugenea nodiflora* Benth., *Hymenocardia acida* Tul., Syzygium *guineensis* Engl., *Albizia adiantifolia* Schumach, *Irvingia wombolu* Vermoesern, Asteraceae and Amaranthaceae/Chenopodiaceae, while fungal spores included those of *Nigrospora, Helminthosporium, Alternaria, Pithomyces,Puccinia* and *Cladosporium.* The quantity of the palynomorphs counted was affected by meteorological variables such as mean rainfall, mean wind velocity and direction and relative humidity. Plants of the Lowland Rainforest and Secondary Grassland produced over ninety five percent of the total pollen trapped.

A succession of events at the Younger Dryas termination offshore Newfoundland

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oral

Marine sediment core AI07-14G was taken from 239 m water depth in Placentia Bay off the south coast of Newfoundland. Based on 6 radiocarbon dates, the 510 cm core spans the age interval from 12.9 to 9.9 cal. kyrs. BP. With an average accumulation rate of 5.7 years/cm, the core provides a high resolution record of the Younger Dryas – Holocene transition. After X-ray fluorescence (XRF) core scanning, the core was subsampled and analyzed for diatoms, benthic foraminifera, grain size distribution, calcium carbonate content, total organic carbon content, and the geochemical diatom sea ice proxy IP_{25}.
The Younger Dryas termination is clearly reflected in the record as a stepwise succession of events, with changes in ocean circulation preceding the atmospheric signal. In our record, the transition is first characterized by a gradual decrease of the Labrador Current intensity, followed by an intensification of Gulf Stream – North Atlantic Current water transport which resulted in a rapid decline of sea-ice cover. The northward migration of both the atmospheric and oceanic fronts subsequently led to an abrupt rise in productivity and further advection of warm Atlantic waters to the surface. The rate of the atmospheric change is comparable to those reported from Greenland ice cores and the Cariaco Basin, indicating a very fast, Atlantic basin-scale shift in oceanic and atmospheric circulation patterns in which a strengthening of the AMOC preceded the atmospheric response.

Toward a Climate Event Stratigraphy for the Australian region, 0-35 ka

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In 2003, an Australasian INTIMATE project (AUS-INTIMATE) commenced, with formal recognition from INQUA (Project Number 0806), and comprising two centres of activity, one in Australia (OZ-INTIMATE) and one in New Zealand (NZ-INTIMATE). After an initial successful workshop in 2004, the Australian chapter became somewhat dormant, and was reinvigorated in 2009, with a commitment made to the development of an Australian Climate Event Statigraphy (CES) covering the last thirty thousand years.

To approach the >60 degrees latitude, the Australia region was initially divided into four broad climatic zones: tropical, temperate, arid interior, Southern Ocean. From this, a minimum dataset to describe the major climatic events across the continent has been determined. A key time period of the Australian CES is 14.5 – 12.5 ka, which includes both the Antarctic Cold Reversal in the south and the onset/strengthening of the Australian monsoon in the north. Also, the Australian CES has been extended to at least 35 ka, to include the full decline into the LGM and the possible bimodal character of cooling/drying present in several records. The Antarctic EDML record is used to link with NZ and the North Atlantic groups. One of the key findings is the spatial variability in responses to major global climatic drivers along with key time intervals where Australia has little to no data. This will form the basis for suggested future research priorities in the Australasian region.

Radiocarbon reservoir age changes in the Southern Ocean since the last deglaciation

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Accuracy of timing of millennian-scale climatic events recorded in marine and continental archives are crucial for a better understanding of the mechanisms, temporal frequency and the geographical repercussion that govern ocean-climate interactions. A robust benchmark to solve this issue bears on the knowledge of present and past quantitative estimates of marine radiocarbon reservoir ages (sea surface - atmosphere ^{14}C differences) that still remain poorly constrained. Knowledge of marine radiocarbon surface reservoir ages allows the accurate correlation of continental, cryospheric and marine paleoclimate records.

Here we present, for the first time, independent measures of deglacial reservoir age changes in the Eastern Pacific sector of the Southern Ocean obtained by ^{14}C dating of tephra contemporaneously deposited over the Patagonian marine and terrestrial region. For this study, we have selected a long CALYPSO high sedimentation piston core MD07-3088 collected off the south Chilean margin between the northern Chonos archipelago and southern Taitao peninsula at about 46°S during the IMAGES R/V Marion Dufresne cruise Pachiderme (February 2007).
We show that deglacial reservoir age increased to 1300 years, compared to 800 years during the Holocene. Using these reservoir age changes we show that climatic and carbon cycle records from the Southern Ocean are synchronous with the Antarctic ice core records during the last deglaciation.

Long Distance Identification of Leads and Lags in Climatic Change by way of Direct Terrestrial Radiocarbon Comparison

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oral

We have recently published the first 'wholly terrestrial' (non-reservoir-corrected) radiocarbon (^{14}C) calibration dataset that spans the entire range of the ^{14}C dating method (Bronk Ramsey *et al*. 2012). This dataset comprises 808 ^{14}C measurements of terrestrial plant macrofossils picked from the varved sediment sequence of Lake Suigetsu, central Japan, across the last 52,800 cal. years. Furthermore, the sediment record provides a rich archive of palaeoenvironmental proxy data (including pollen, diatom, biomarker and isotopic data) from the East Asian monsoon region across the entirety of the last glacial cycle (Nakagawa *et al*. 2012).
If radiocarbon data from a similar, terrestrial site (that also provides its own palaeoenvironmental data) are calibrated against this Suigetsu ^{14}C dataset, (instead of to the IntCal calibration curve), then important information can be gleaned about any leads/lags in the climate system between the respective sites directly – across potentially very large geographical distances. In this way, the absolute age of the respective records is not paramount, but the relative timing of respective climatic trends can be disentangled much more robustly.
Here, we present an example of this long distance comparison by modelling the ^{14}C dataset from Soppensee, Swiss Plateau, on to the Lake Suigetsu ^{14}C curve, demonstrating the relative timing of climatic events between the two sites across the Last Glacial/Interglacial Transition (LGIT).

Bronk Ramsey C. et al. 2012: *Science* **338**, 370-374.
Nakagawa T. *et al*. 2012: *Quaternary Science Reviews* **36**, 164-176.

Paleohydrology of the largest freshwater lake in Central Europe: Results of a multiproxy paleoecological study from Lake Balaton, Western Hungary

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poster

The largest freshwater lake in Central Europe is located in Western Transdanubia ca.100 kms SW of the capital city Budapest. The lacustrine basin covering an area of 594 km^2 is composed of a series of adjacent neotectonic basin, which emerged during the Late Glacial. The lake is fed by the Zala River on the west and is drained artificially since Roman times. As an important freshwater reservoir the fate of the lake is crucial in the light of expected global warming events. Climatically speaking it lies at the interface of two major climatic influences (Atlantic, Submediterranean). Extensive multiproxy analysis of a radiocarbon-dated core sequences taken along the northern shoreline enabled us to capture past fluctuations of the water level from ca 16 kys up to the Late Holocene. Results were compared with other global and European as well as North Atlantic paleoenvironmental proxies in order to highlight how lake levels fluctuated under climatic perturbations of the Late Glacial and the Holocene. Signals of Atlantic and/or Submediterranean climatic influences could have been attested in the paleorecord from the Holocene onwards.

Loess records in CELL-50k: potential issues of dating, age-depth modeling, proxies and environmental leads and lags

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oral

Loess sequences are valuable terrestrial archives of regional climate and environmental conditions of the late Quaternary. As such, their incorporation into the CELL-50k project is a crucial task. However, numerous potential issues arise concerning dating, age modeling, and the use of different proxies in calibrating environmental leads and lags. Calibrated radiocarbon ages are in many cases not reconcilable with OSL/IRSL ages and luminescence chronologies often include age reversals and considerable scatter leading to controversial age-depth models and highlighting the need for a Bayesian approach. Furthermore, the interpretation of some proxies like e.g. grain size, magnetic susceptibility and $\delta^{13}C_{org}$ are not always straightforward, at least they variability can be explained in different ways. In this study these potential problems are discussed by using examples from European loess sequences and some criteria are given for choosing the most appropriate loess records for calibrating environmental leads and lags. Additionally, some thoughts to estimate the dominant flow direction of information between the climate/environmental variables using transfer entropy and the quantification of time lags (τ) between the driving signal and responses are given, which can be used for the analyses of relations between any proxies from different archives in CELL-50k.

A new Antarctic ice core chronology (AICC2012): 0-120 ka

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poster

Advancing the understanding of past rapid climate variability and improving chronological relationships between records are scientific topics of outmost reference in palaeoenvironmental research. The deep polar ice cores provide reference chronological records commonly employed in global correlation of past climate events. However, temporal divergences reaching up to several millennia still exist between ice cores over the last climatic cycle and beyond.
In this context we present new model simulations performed in the frame of Antarctic Ice Core Chronology (AICC2012), a comprehensive follow up of the approach initiated by Lemieux-Dudon et al. (QSR, 2010) through the multi-site dating of ice core records using an inverse Bayesian assimilation approach, the Datice tool. We focus on the integration and analysis of glaciological inputs and data constraints, including a wide range of relative and absolute gas and ice stratigraphic markers over the period 0-120 ka. We produced well-constrained chronological scenarios for five ice core records, Dome C, EDML, Vostok, Talos Dome and NorthGRIP. Compared to previous timescales, the new AICC2012 chronology provides improved temporal constraints in order to asses the timing of past climate events. We discuss two such examples in selected time intervals over the last 120 ka.

The Pleistocene-Holocene transition in continental South America: Summary of multiproxy data from Laguna La Gaiba

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poster

Published[1,2] and ongoing analyses from a sediment core extracted from a large lake in the Pantanal, the headwaters of the Paraguay River, continental South America, elucidate patterns of precipitation and temperature change, as well as biogeographic perspectives, from ca. 45,000 yrs BP until present. This multiproxy dataset includes completed analyses of pollen, diatoms, XRF core scanner data, charcoal, carbon isotopes, *Pediastrum*, and ongoing work includes hydrogen isotope analyses of leaf waxes and *Sporomiella* spores. Environmental changes inferred from these data are constrained with an age-model based on 18 radiocarbon dates, 16 of which were derived using well-preserved terrestrial macrofossils. Initial investigations using fossil pollen data demonstrate that deglacial warming occurred at 19,500 yrs BP, rising precipitation marked the end of the late Pleistocene at 12,200 yrs BP[1], and drought occurred in the early to mid-Holocene (10,000 – 3,000 yrs BP)[2]. Emphasized here are high-resolution analyses of geochemical (XRF) and fossil diatom data across the LGIT, from which we infer limnological and catchment changes, which we link to abrupt changes in climate.

[1]Whitney BS et al. (2011) Palaeogeogr Palaeoclimat Palaeoecol 307: 177-192
[2]Whitney BS and FE Mayle (2012) J. Paleolim 47: 601-615

Field trip guide

Late Quaternary paleoenvironments as recorded in loess-paleosol archives located northwest of Budapest: a field trip along the Danube bend to the Süttő section

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This field trip guide is based on two papers by Novothny et al. ([Novothny, Á., Frechen, M., Horváth, E., Bradák, B., Oches, E.A., McCoy, W., Stevens, T., 2009. Luminescence and amino acid racemization chronology and magnetic susceptibility record of the loess - paleosol sequence at Süttő, Hungary. Quaternary International 198, 62-76.], and [Novothny, Á., Frechen, M., Horváth, E., Wacha, L., Rolf, C., 2011. Investigating the penultimate and last glacial cycles of the Sütto loess section (Hungary) using luminescence dating, high-resolution grain size, and magnetic susceptibility data. Quaternary International 234, 75-85.]) and a paper by Königer et al, (Koeniger, P., Barta, G., Thiel, C., Bajnóczi, B., Novothny, Á., Horváth, E., Techmer, A., Frechen, M. Stable isotope composition of bulk and secondary carbonates from the Quaternary loess- paleosoil sequence in Süttő, Hungary). The reader is referred to these works for further details on the Süttő loess-paleosol section.

Hungarian loess stratigraphy

Loess is composed predominantly of silt-size particles and formed essentially by the accumulation of wind-blown dust (Pye, 1995). Deposition and formation of loess from wind-blown dust occurred mostly in periglacial environments during the Quaternary. Loess and loess-like sediments cover more than 30% of the surface of Hungary, in the largest thickness in the Transdanubian Hills, Gödöllő Hills and on terraces along the right bank of the River Danube. The thickest loess exposures are located in this area containing both the old and the young loess series (Paks, Dunakömlőd, Dunaszekcső, etc.). The thickness of the old loess series is almost 25 m along the Danube-valley. The young loess series can be found along the Danube-valley, and its most important key sections are located in the Gödöllő Hills (e.g. Mende section) and next to the Northern part of the Danube-valley (e.g. Basaharc section). The lower part of the young loess has a thickness of 15-20 m intercalated by several thick, brown, well-developed forest steppe-like soils. They are termed in order from the bottom to the top: Mende Base pedocomplex (MB), Basaharc Lower paleosoil (BA), Basaharc Double paleosoil (BD_1, BD_2), and the Mende Upper double paleosoil (MF_1, MF_2) (Pécsi 1985; Pécsi and Richter 1996). The upper part of the young loess has a thickness of 10 m and consists of sandy loess, intercalated by at least two very poorly

developed soils (humic horizons: h_1, h_2). Two tephra layers are described from the young loess series. The lower one is termed Bag Tephra (BT), locates above the lowermost pedocomplex (MB) (Horváth 2001). The high K-content suggests the correlation with the Villa Senni Tuff in Italy (around 351 ka BP) (Horváth 2001). The other tephra layer is known as Paks Tephra (PT) and has similar composition like the Bag Tephra, therefore the same source area can be assumed. It was deposited during the Oxygen Isotope Stage 3 (OIS 3 or MIS 3), as estimated from luminescence ages of the bracketing loess.

However, the loess record of the past 130,000 years is not preserved in its entirety. Recent independent chronological studies indicate large discontinuities in the Upper Pleistocene loess (from the Last Interglacial to Early Glacial record) in the key sections at Basaharc, Mende and Paks (Wintle and Packman, 1988; Zöller et al., 1994; Frechen et al., 1997).

The loess-paleosoil sequence at Süttő

The Upper Pleistocene loess series are well-exposed in the Carpathian Basin at Süttő (*Fig. 1*),

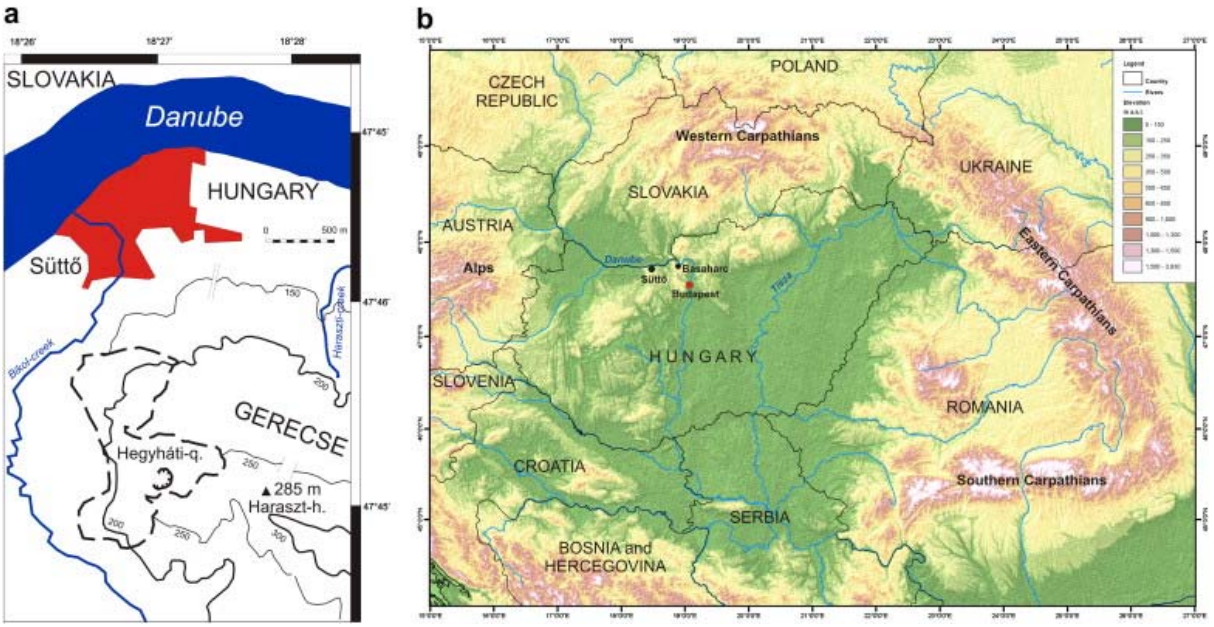

Fig. 1. a) Map showing the location of the Süttő section in northern Hungary. b) Map showing the location of the Carpathian Basin.

providing an ideal opportunity to investigate last glacial-interglacial loess chronostratigraphy in Hungary. The Süttő section is situated at an altitude of 256 m asl, at 47°44.26' N and 18°26.87' E close to the settlement of Süttő – about 35 km western from the Basaharc key-section. The loess-paleosoil sequence covers a travertine complex. The freshwater limestone body of the Süttő Travertine Formation is situated on a Danube terrace, near the Haraszti Hill (Scheuer and Schweitzer, 1988) (*Fig. 1. b*).

This 25-m thick travertine sequence was formed by springs discharging from a karstic substrate. The travertine at Süttő was investigated by uranium-series dating ($^{230}Th/^{234}U$) and yielded Mid-Pleistocene ages ranging from 235 ± 21 ka to 314 ± 45 ka (MIS 7-8) (Sierralta et al., 2010).

Sampling positions in the Hegyháti quarry

Two quasi-continuous vertical trenches were prepared for sampling. The lower part of the loess sequence was opened up on the N-NW wall of the quarry, while the upper part was explored on the freshly excavated SW wall, as it was found to have a more detailed record for the upper part of the sequence. The vertical trenches were overlapping each-other for more than two meters for the better comparison and correlation of the sediment units between the two walls.

Geochronology

Detailed chronological investigations have been accomplished on the loess sequence, comprising infrared stimulated luminescence (IRSL), infrared radiofluorescence (IRRF) measurements from loess samples, amino acid racemization (AAR) from molluscs and radiocarbon dating obtained from molluscs and charcoal samples (Novothny et al., 2009, 2010, 2011). Fading corrected IRSL ages are in agreement with AAR and radiocarbon dating, although fading corrected IRSL ages from the penultimate glacial loess tend to underestimate the real deposition age (*Fig. 2*). Therefore, the IRSL data calculated for this period, has to be interpreted carefully and considered as minimum ages. Based on the presented chronological data, the loess-paleosoil succession at Süttő represents a quasi continuous sediment record for the time period ranging from MIS 6 to MIS 2 and the most detailed loess/paleosoil sequence in Hungary covering an age span of at least the past 150 ka:

- four paleosoil horizons formed during MIS 5.
- sandy loess and sand about 2 m thickness deposited during MIS 4
- this is covered by a paleosoil and two laminated horizons formed during MIS 3
- it is covered by loess more than 5 m thick, which accumulated during MIS 2

Based on the established chronological framework high-resolution investigations have been carried out, including granulometry, environmental magnetism, pedology, malacology, geochemistry by means of organic carbon, stable carbon and oxygen isotopes in order to reconstruct paleoclimate and paleoenvironmental changes.

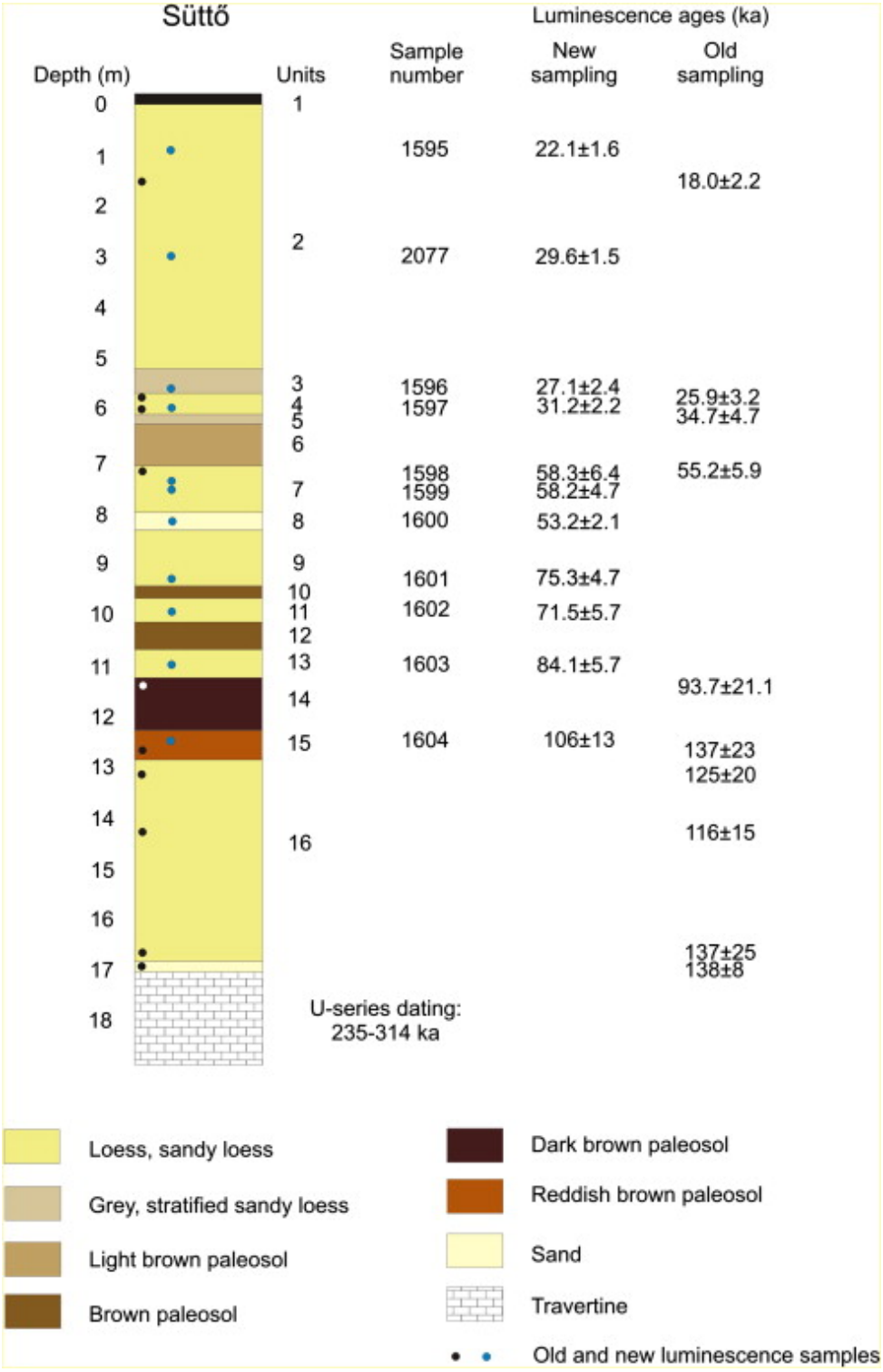

Fig. 2. Stratigraphic logs of the loess profile at Süttő, showing major sedimentological units, luminescence sample positions and (old and new) luminescence ages.

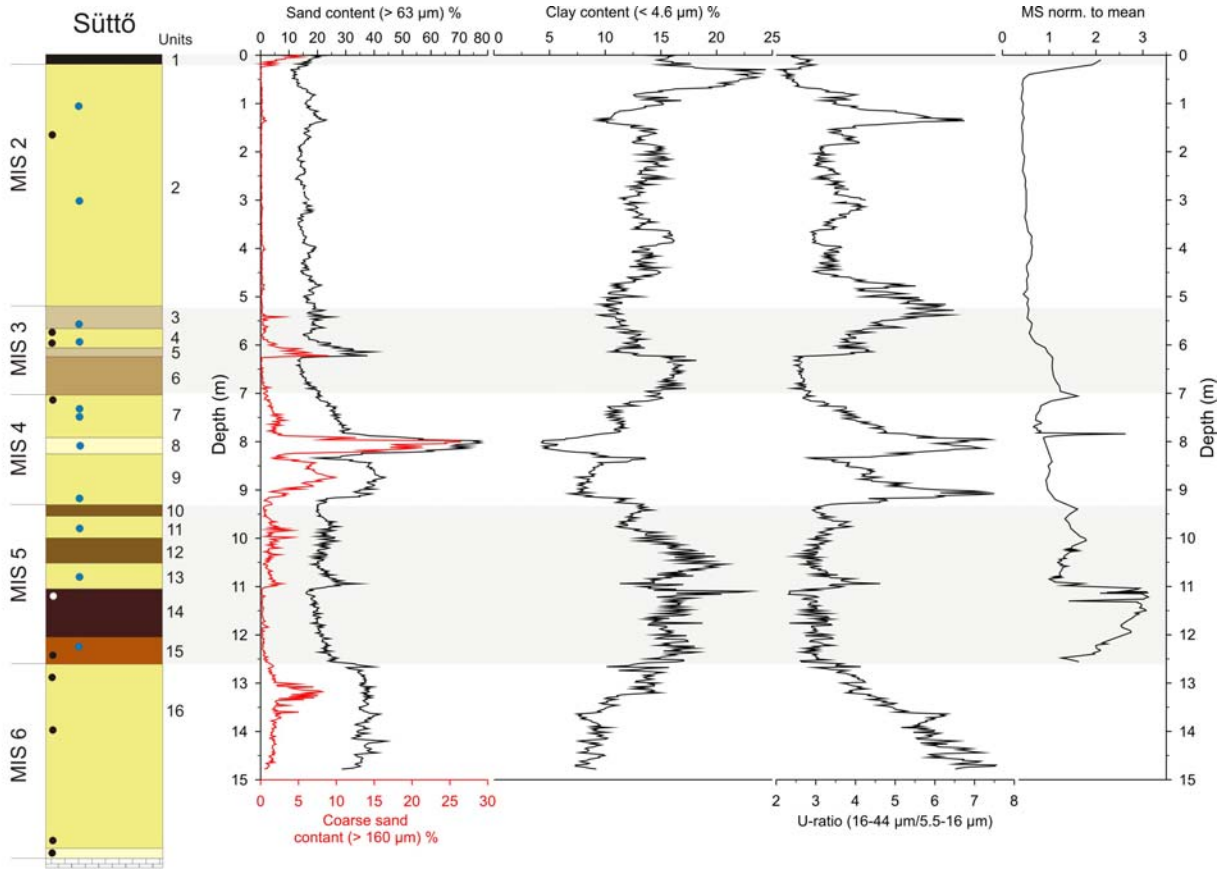

Fig. 3. Stratigraphic logs of the loess profile at Sütt}o, showing major sedimentological units and luminescence sample positions. Variation of grain-size parameters clay-, total sand and coarse sand contents, U ratio and magnetic susceptibility curves are shown along the log of the profile.

Granulometry

Clay-, sand-, coarse sand content and U ratio were calculated from the results of high-resolution grain size measurements (*Fig. 3)*. Grain-size distribution of loess is mainly a function of wind intensity (speed, strength) and distance from the main sediment source. In general, coarser grains accumulate during colder periods, when wind intensity was stronger, and finer grains deposited in warmer periods, when climatic conditions were not in favour for stronger winds. Dominance of finer aeolian dust deposition during warmer periods and coarser dust in cold periods is confirmed by the determination of the U ratio (16-44 m m/ 5.5-16 µm) (Vandenberghe et al., 1985). Higher U ratios imply colder periods and lower U ratios indicate warmer climate. The advantage of the U ratio is that it ignores the secondary formed clay minerals and sand size grains, which deposited by saltation (Vandenberghe et al., 1997). However, the sand content also provides important information about predominating wind regime and short events triggered by

abrupt increases of aeolian dynamics. Clay content of the samples is a result of pedogenetic processes, therefore it is considered as a good marker for warmer and more humid periods with soil formation. The total sand and coarse sand content showed a similar pattern like those of the loess-paleosoil sequences in Serbia (Surduk, Titel) with enhanced deposition of coarser material during MIS 6 to 4 compared to MIS 2 (Marković et al., 2008; Antoine et al., 2009). This similarity implies regional significance of the wind dynamics and might denote changes in general wind circulation owing to alteration of wind direction during MIS 2 (Bokhorst et al., 2009) or changes in wind intensity and/or material availability upwind, which might be more relevant at Süttő. In contrast to other investigated loess sections in the southern Carpathian Basin, higher contribution of coarser material is detected indicating the vicinity of the source material from the floodplain of the Danube and its tributaries.The presence of some greyish, laminated horizons in the sequence deposited during MIS 3 provide evidence for the intermediate character of the Süttő profile (or generally the loess in the northern Carpathian Basin) between the wetter climate induced diverse Western European loess sequences and the drier loess successions in the southern Carpathian Basin with total absence of tundra gleys and laminated loess layers.

The (quasi) homogeneous appearance of loess accumulated during MIS 2 is confuted by the clay content and U-ratio. They are more fragmented and allowing a recognition of three distinct (sub)cycles. Two peaks with higher clay content (12-15%) appear on the curve of the clay content centred at around 4 and 2 m depth, beside the pronounced peak caused by the modern soil. At similar positions the curve of the U-ratio shows depressions, indicating (slightly) warmer periods with dominating fine silt deposition during MIS 2.

Magnetic susceptibility

The MS curve of Süttő shows a clear difference between loess and paleosoil horizons, indicating the alterations of arid and more humid environments. The clay content showed excellent agreement with the MS curve, both are providing a good proxy for the local temperature and precipitation regime. Magnetic susceptibility values are ranging between 186 $*10^{-6}$ [SI] and 1350 $*10^{-6}$ [SI] along the profile (*Fig. 3*; values normalised to mean). Lowest values are typical for the loess layers at the uppermost part of the profile. Slightly higher MS values are characteristic for the loess in the middle part of the composite profile. Buried soils often show higher MS values, which are interpreted as the consequence of higher precipitation, due to in-situ formation of magnetizable minerals as a function of precipitation. Highest values are characteristic of the modern soil on the top of the profile and of the pedocomplex. Lower MS values are typical for

the brownish buried soils in the middle of the profile. The MS values of the grey, laminated horizons (Unit 3, 5) are identical to the bracketing loess or paleosoil layers. One of the warmer period during MIS 2 is might be observed on the MS curve as well, as it contains a small, flat "peak" in the same position, at around 4 m depth.

Molluscs

Generally mild climate is presumed for the rest of the MIS stage 3 based on the investigation of the mollusc fauna from the sediments accumulated during MIS 3 and 2 (E. Krolopp unpublished data). The mollusc fauna indicates that climate was almost as warm as today (mean July temperature: 20.9°C) with lesser precipitation during the interstadial period, favouring steppe-forest steppe vegetation (E. Krolopp unpublished data). The malaco-thermometer method verified the younger warmer period during MIS 2 through calculations of the mollusc fauna of the loess unit 2 between 2.5 and 0.9 m depth. Investigations reported cold (mean July temperature of 12.9°C), but moist climate during the younger warmer period, which turned to slightly colder with mean July temperature of 11.8°C and drier conditions for the last colder period (Krolopp, unpublished data).

Secondary carbonates, stable isotopes

Stable carbon and oxygen isotope compositions of bulk carbonate and secondary carbonates were investigated from the Süttő profile (Koeniger et al., 2012). Bulk samples range from +2.6‰ to -13.9‰ and from -2.3‰ to -17.0‰ for $\delta^{13}C$ and $\delta^{18}O$, respectively (expressed on VPDB-scale) (*Fig. 4*). The isotope composition of different secondary carbonates allow clear distinguishing between the organically related and inorganically (directly) precipitated subtypes. In general, secondary carbonates show more depleted values than bulk samples; especially calcified root cells with mean values of -16.0‰ and -11.8‰ for $\delta^{13}C$ and $\delta^{18}O$, respectively. Microscale secondary carbonates show three characteristic clusters reflecting their genetic origin (*Fig. 5*). Calcified root cells (CRC) are connected with biomineralization processes and indicate the most depleted $\delta^{13}C$ and $\delta^{18}O$ values. Earthworm biospheroids (EBS) show a distinct cluster denoting partly the influence of dietary uptake. The third cluster consists of those secondary carbonates whose origin is strictly connected to precipitation from supersaturated bicarbonate solutions (hypocoatings - HC, carbonate coatings - CC, their combination - HC+CC, subtype of carbonate coatings - CC2).

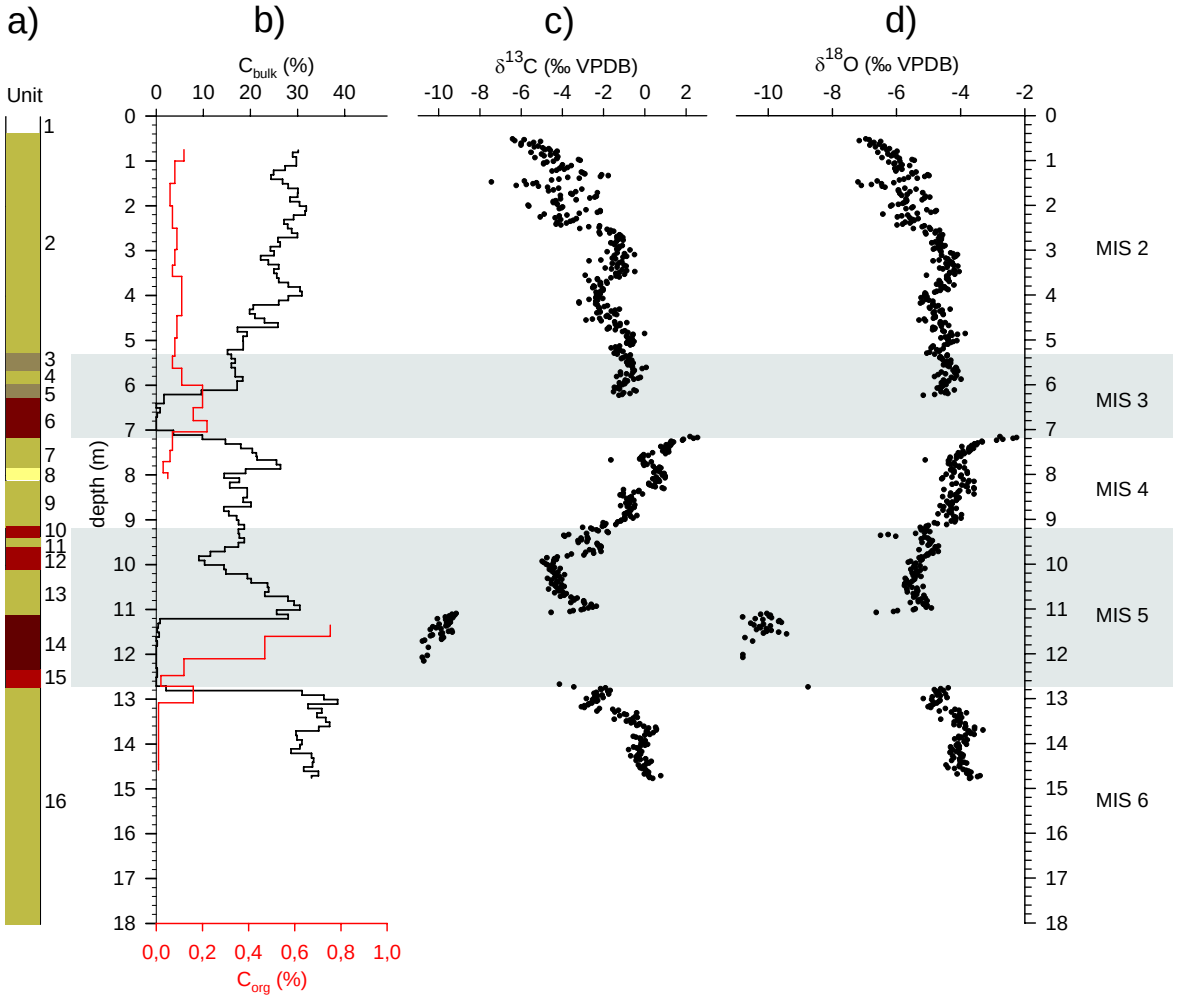

Fig. 4: Süttő loess-paleosoil units (a), bulk carbonate (C_{bulk}) and organic carbon (C_{org}) content (b), $\delta^{13}C$ (c) and $\delta^{18}O$ (d) from bulk loess samples vs. depth of sampling.

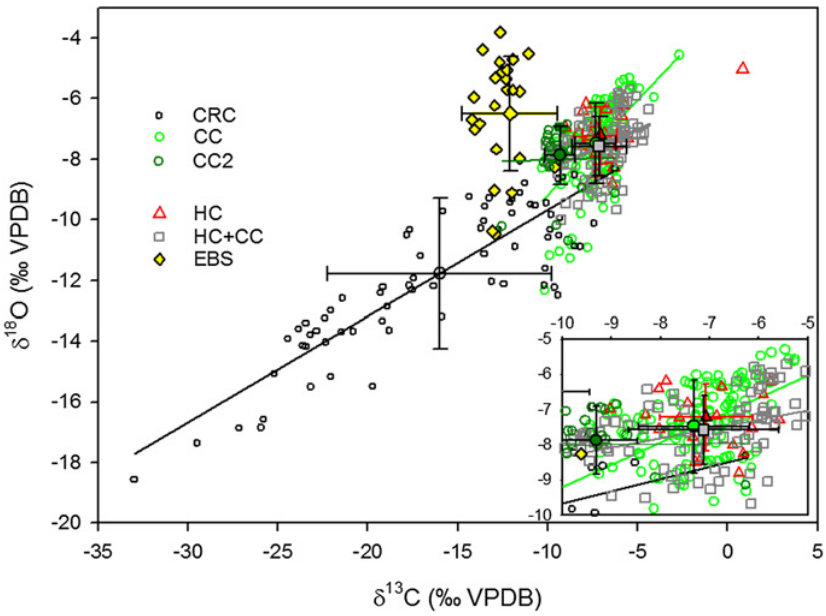

Fig. 5: $\delta^{13}C$ vs. $\delta^{18}O$ plot of microscale secondary carbonates (CRC, CC, HC+CC, HC, CC2, and EBS) with mean values, standard deviation and regression line (where significant) for each subtype.

In general, the isotope values of secondary carbonates show different patterns in the loess and sandy loess horizons compared to the paleosoils. The isotopic composition of secondary carbonates in loess can be more reliable as a proxy than those of bulk samples, because the genetic evolution of the secondary carbonates and their relation to the host strata is known.

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