Late Pleistocene Paleosol-Sedimentary Sequence Near Kursk, Russia: Refining Chronostratigraphy And Paleoecological Reconstructions For The East European Loess Area

Svetlana Sycheva[1], Sergey Sedov[2], Manfred Frechen[3], Birgit Terhorst[4]

[1] Institute of Geography RAS, Moscow, Russia
[2] Instituto de Geología, UNAM, Mexico City, Mexico, serg_sedov@yahoo.com
[3] Leibnitz Institute for Applied Geophysics, Hannover, Germany
[4] Institute of Geography and Geology, University of Würzburg, Germany

Aleksandrov quarry is located 10 km south of the Kursk city on the leveled watershed of Seim and Mlodat rivers in the west-center of European Russia. In its exposures one of the most detailed and complete paleosol-sedimentary record for the Late Pleistocene on the East European loess area is exposed. At present it is provided with a chronological scale based on a set of instrumental datings (C14 and OSL) and vast variety of research results (physical, chemical and mineralogical characteristics of paleosols and sediments, micromorphological observations, phytolith and pollen assemblages)

Paleosols of Aleksandrov quarry are under monitoring since the early 1990 s. The paleobalka with interglacial Ryshkov paleosol on its slopes and in the bottom was discovered This soil is correlated with Salyn soil of Mikulino interglacial of the upland positions according to Velichko et al. (1997). New OSL dates of the sediments below and above paleosol profile confirm that development period of Ryshkov paleosol is restricted to MIS5e and its Paleobalka is filled by Valdai colluvial-solifluction and loessic sediments and paleosols. According to the ^{14}C- dating and OSL dates, the two lower interstadial Kukuev and Streletsk soils belong to the early Valdai – MIS 5c and MIS5a respectively, while the two upper paleosols (Aleksandrov and Bryansk) belong to the Middle Valdai – MIS3. Pedogenetic features are specific for each paleosol. In particular Ryshkov paleosol is presented by Albeluvisol with typical morphological and analytical indicators of leaching, stagnic processes, clay illuviation typical for humid forest pedogenesis. It presents a sharp differences to the Holocene Chernozem typical for steppe ecosystems. These differences point to more humid climate during the Last Interglacial. Kukuev paleosol still presents signs of clay illuviation whereas overlying streletsk and Alexandrov paleosols have chernozem-type profiles and Bryansk soil is a Cambisol partly deformed by posterior cryogenic processes. Late Valday loess deposition was rather modest, so the top of Bryansk paleosol often corresponds to the base of the Holocene Chernozem profile.

The sequence of Alexandrovsky quarry provides more complete record of Late Pleistocene geological events, than standard Russian loess stratigraphy (Velichko 2005) and better possibilities for correlation with the global climate proxies.

Lessons from the AMS ^{14}C and OSL/IRSL-dating of the Dunaszekcső loess record, Hungary

Gábor Újvári[1], Mihály Molnár[2], Ágnes Novothny[3], János Kovács[4,5]

[1] Geodetic and Geophysical Institute, Research Centre for Astronomy and Earth Sciences, Hungarian Academy of Sciences, H-9400 Sopron, Csatkai E. u. 6-8., Hungary
[2] Hertelendi Laboratory of Environmental Studies, Institute of Nuclear Research, Hungarian Academy of Sciences, H-4026 Debrecen, Bem tér 18/C, Hungary
[3] Department of Physical Geography, Eötvös Loránd University, H-1117 Budapest, Pázmány Péter sétány 1/C, Hungary
[4] Department of Geology and Meteorology, H-7624 Pécs, Ifjúság u. 6., Hungary
[5] Szentágothai Research Centre, Environmental Analytical and Geoanalytical Research Group, H-7624 Pécs, Ifjúság u. 20., Hungary

Reliable chronologies are prerequisites of appropriate proxy interpretations from terrestrial archives of Quaternary climate and environmental change. Loess records may provide a wealth of paleoenvironmental information, yet they are usually poorly dated. This mostly means low resolution dating of loess profiles and also imprecise chronologies, i.e. age-depth models that have uncertainties of millennial magnitude. This prevents us from addressing issues like synchroneity of abrupt climatic/environmental events on millennial time scales. Two different means of dating are commonly applied for loess sequences: luminescence and radiocarbon dating. Major problems are low precision of luminescence ages and the general lack of organic macrofossils (e.g. charcoal) in loess that can reliably be dated using ^{14}C. Other datable phases in loess are mollusc shells, rhizoliths and organic matter. Evidences are growing that rhizoliths are unreliable phases for ^{14}C-dating and organic matter ^{14}C ages are

often seriously compromised by rejuvenation in loess sequences. Also mollusc shells are often regarded as unreliable material for ^{14}C-dating, as they may incorporate ^{14}C-deficient (or dead) carbon from the local carbonate-rich substrate during shell formation, thereby producing anomalously old ages by up to 3000 years.

In this study an attempt has been made to address some of the dating issues and problems mentioned above by triple-dating (AMS ^{14}C and OSL/IRSL) of the Dunaszekcső loess-paleosol sequence (South-Hungary). While the OSL/IRSL techniques directly date the sediment (quartz and K-feldspar grains) and provide burial ages, radiocarbon yield ages from phases like organic matter, mollusc shells and rhizoliths and determines the time elapsed since the living system was last in equilibrium with atmospheric ^{14}C and became closed after burial.

As revealed in this study all loess rhizoliths sampled at three different depths (4.00 m: 9744-10156 2σ age range in cal yr BP, 5.00 m: 8013-8167 cal yr BP and 6.00 m: 9534-9686 cal yr BP) yield Holocene ages, so absolute ages cannot be gained this way for loess deposition.

As charcoals are widely accepted as phases yielding very reliable ^{14}C ages, mollusc shell ^{14}C ages were tested against charcoal ages. Here we focused on molluscs with smaller (< 10 mm) shells as some evidence exists that some species do not incorporate dead carbon into their shells or at least in low amounts. Our results demonstrate that *Succinella oblonga and Vitrea crystallina* yield statistically indistinguishable ages (2σ age ranges: 29990-30830 and 29600-30530 cal yr BP) when compared with the charcoal ^{14}C age (29960-30780 cal yr BP, depth 8.20 m), and others like Clausilia sp. and *Chondrula tridens* give slightly older ages than the charcoals and show larger age anomalies (500-900 14C yr).

Compared to the charcoal ages at 8.20-8.25 m depth, the post-IR IRSL225 age of 28520±1120 yr (2σ age range: 26280-30760 yr) from a depth of 7.75 m match quite well the charcoal ages (Dsz-Ch1, 2σ: 29960-30780 cal yr BP and Dsz-Ch2, 2σ: 29350-30150 cal yr BP). At the same time, the post-IR OSL approach seems to slightly underestimate (2σ: 20640-26960 yr), while the post-IR IRSL290 overestimate (2σ: 30260-37100 yr) the expected/true age of deposition at the respective depth (7.75 m). At a depth of 4.00 m, slight underestimation of mollusc AMS ^{14}C ages (*Trochulus hispidus*, 2σ: 22370-22740 cal yr BP, *Arianta arbustorum*, 2σ: 24470-25120 cal yr BP) by post-IR OSL (2σ: 17140-21980 yr) and a moderate to significant overestimation by OSL (2σ: 26760-33800 yr) and post-IR IRSL290 (2σ: 27660-35740 yr) has been recognized. Again, the post-IR IRSL225 age (2σ: 23180-26900 yr) lies the closest to the AMS ^{14}C ages.

To decide which technique, AMS ^{14}C or OSL/IRSL yields more accurate ages is not possible without independent absolute chronological data based on another method. Yet, we think that the consistent ^{14}C ages of charcoals and small molluscs (two phases having very different origin and genesis) suggest that these ages are reliable and may reflect the real age of sedimentation. Clearly, the precision of ^{14}C ages are an order of magnitude better (calibrated 2σ age ranges 500-800 yr) than the luminescence ages (2σ age ranges: 3700-7900 yr) and this may be another reason for creating age-depth models based purely on ^{14}C ages, if high precision is needed. The use of a mixture of ages (i.e. ^{14}C and OSL/IRSL) seems to counterproductive in this respect and we suggest to separate the results of the two techniques in modeling. OSL/IRSL-based age models are useful in checking the accuracy of ^{14}C-based chronologies for the last 50 ka and vice versa and proxy interpretations should be tested against both ^{14}C and OSL/IRSL age models independently.

Abrupt climate changes during the last two glacial-interglacial cycles as recorded in Chinese loess

Shiling Yang, Zhongli Ding

Key Laboratory of Cenozoic Geology and Environment, Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing 100029, China, yangsl@mail.iggcas.ac.cn

Thick loess deposits in the northern Loess Plateau are valuable archives of millennial-scale climate variability. In order to construct a comprehensive climatic record of millennial-scale variability for northern China, grain size was measured for 12,330 samples from eight thick loess sections. Between-section correlation of these grain size records shows that, although small depositional hiatuses may be present in places within a single section, most parts of the sections display continuous dust deposition throughout the past two glacial cycles. By correlating the eight records with the precisely dated Chinese stalagmite δ^{18}O record, a stacked 249-kyr-long grain size time series was constructed, termed the "CHILOMOS" (Chinese Loess Millennial-Scale Oscillation Stack) record, which is the first high-resolution stack documenting millennial-scale variability in northern China.

The CHILOMOS record shows millennial-scale climatic events superimposed on a prominent cooling trend during the last and penultimate glaciations, consistent with the pattern of increasing global ice volume. However, this cooling trend is dampened in the stalagmite record and totally suppressed in the low-latitude ocean record. It follows that the Loess Plateau, far from the low-latitude ocean, is largely influenced by the northern high-latitude ice sheets, while the proximal stalagmites of southern China primarily document signals from the low-latitude ocean. In contrast to the Greenland ice core and stalagmite δ^{18}O records, the CHILOMOS record exhibits relatively small-amplitude oscillations for the two interglacials, probably as a result of