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Loess Letter 68

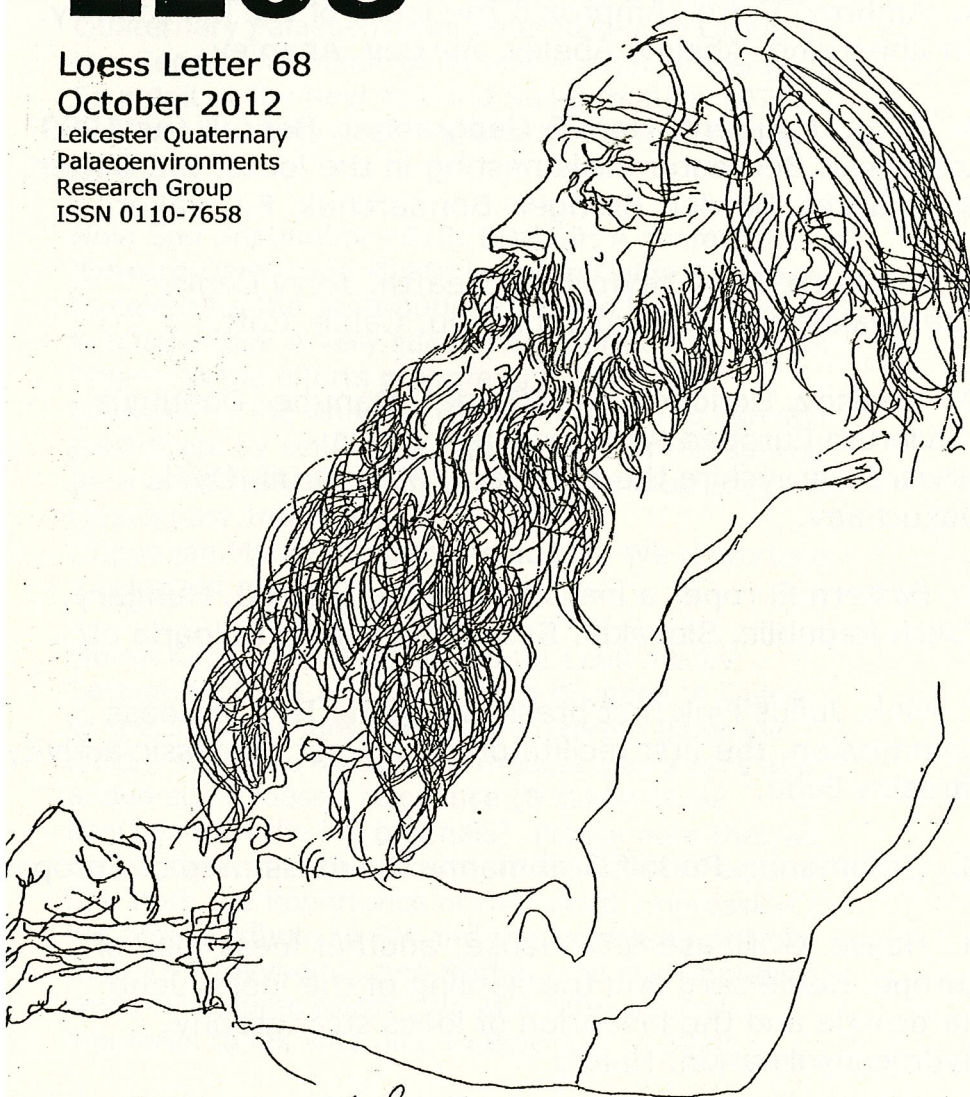
October 2012

Leicester Quaternary

Palaeoenvironments

Research Group

ISSN 0110-7658



*Činčpy a tybuka
slobodan markovic: impression
2012*

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1993.
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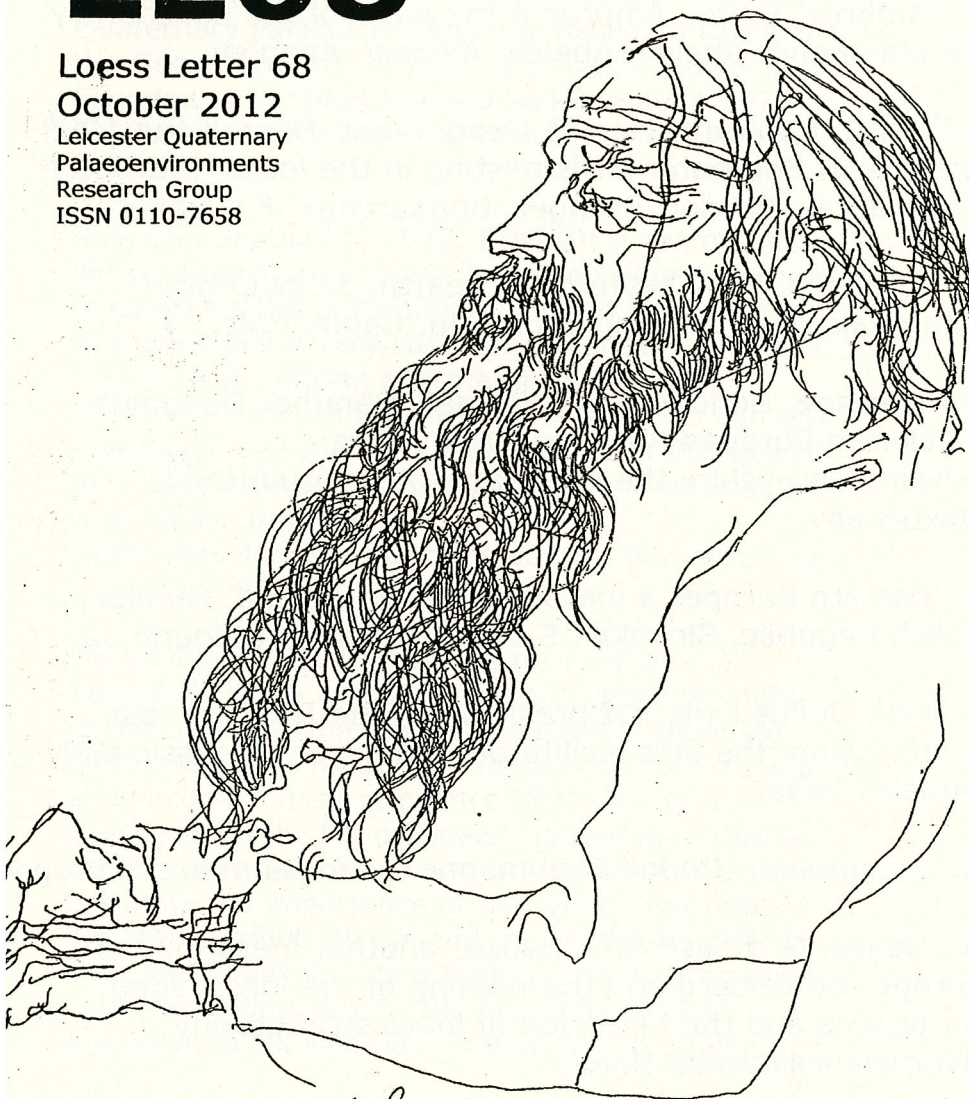
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A Loessic Alphabet [subjective and incomplete;
additions are required; send to Loess Appreciation Group page on
FaceBook]

- A. Ambroz. Wojtek Ambroz & the loess of the hill country.
An Zhi-sheng. Abelev. Abelev. Alexiev. Anan'ev.
- B. Berg. L.S.Berg: Hero & Geographer. Bonn & the 1999
LoessFest. Bee-eater birds nesting in the loess. B.E.Butler.
Brunnacker. Bowler. Bronger. Bondarchuk. F.C.Baker.
- C. Crayford. The Crayford brickearth. Jerzy Cegla.
Chernyakhovskii. Chang Tsung-hu. Cable. Catt.
- D. Denisov, Dodonov, Dust(large), Danube- Danubius
Fluviorum Europae Princeps, Derbyshire:
Edward Derbyshire the third facilitator. Druif. Dylik.
Dokuchaev.
- E. Eastern Europe- a loessic paradise: Poland, Hungary,
Czech Republic, Slovakia, Serbia, Romania, Bulgaria etc.
- F. Fink. Julius Fink first president of the INQUA Loess
Commission, the first facilitator- organiser of loessic activity.
Jaroslav Feda.
- G. Grahmann. Rudolf Grahmann- the loess map of Europe.
- H. Haase. G. Haase & D. Haase; another loess map of
Europe. Heidelberg and the naming of the loess. John
Hardcastle and the invention of loess stratigraphy.
Hydroconsolidation: Handy
- I. Il'in- amazing loess theories & a difficult career. Iowa.
Illinois. INQUA. INQUA Loess Commission. INQUA Loess
Focus Group.

Loess Letter: the newsletter of the INQUA Loess
Focus Group(<http://inqua-loess.com>) edited by Ian
Smalley(ijs4@le.ac.uk), produced by the Leicester
Quaternary Palaeoenvironments Research Group in
the Geography Department at Leicester University.
Founded at the New Zealand Soil Bureau in 1979.
Published twice a year- for everyone interested in
loess.

Novi Sad September 2012: ED@80: A conference
'Edward Derbyshire @ 80: Loess in China & Europe'
to celebrate the contribution of ED to loess research
& scholarship. A very successful conference, thanks
largely to the efforts of Professor Slobodan
Markovic of the University of Novi Sad. You can still
participate by sending a paper to one of the special
journal issues- of Catena (Lewis.Owen@uc.edu) and
Quaternary International
(Slpbdan.Markovic@dgt.uns.ac.rs) . We reproduce
a selection of abstracts.

Momo Kapor: the illustrations for LL68 are by
Serbian writer & artist MK- from his book 'A Guide
to the Serbian Mentality (6th ed. Dereta Belgrade
2011). We have made very modest alterations and
added some loessic relevance (& taken some
liberties with the MK originals). Please note that we
do not think that the picture on the cover is actually
SM- note the importance of that word 'impression').
We offer a tribute to SM and the University of Novi
Sad, and Voyvodina, and Serbia, and the Danubian
lands- via Momo Kapor. We also offer a small
memorial to MK who died in Belgrade in 2010.

J. Jahn. Jersak.

K. Keilhack. Konrad Keilhack and the first worldwide map of Loess. George Kukla and the linking of the loess record to the deep sea record. Nicolai Ivanovich Kriger. V.I.Krokos. Endre Krolopp.

L. Loess & Leonhard & Lyell- beginnings. Loess Letter. Liu Tung-sheng the fourth facilitator. Lozek for snails. Li Po.

M. Mammoth. Mammuthus primigenius in the Loess. Mahler Das Lied von der Loess. Malan loess. Mississippi. Markovic-Marjanovic, Markovic: Slobodan Markovic the fifth facilitator. Marsigli- Luigi Ferdinando Marsigli who saw the loess in the Danube valley.

N. Novi Sad & the 2009 LoessFest. New Zealand. Northey. Neustruev. Northmore.

O. Obruchev. Vladimir Afanas'evich Obruchev. O'Hara-Dhand. Owen.

P. Pecs. Marton Pecs second president of the INQUA Loess Commission: the second facilitator. Palaeosol. Particle packing. Pyaskovskii and the deep soil formation. Pewe.

Q. Quaternary International, place of publication of Loess papers. Quaternaria. Quartar. Quaternary Science Reviews.

R. Richthofen. F.von Richthofen- the aeolian world of Loess. R.J.Russell- the not-aeolian world of Loess. River Rhine. Ruhe. Rozycki

S. Smalley. Ian Smalley bibliographer- recorder of events, people, places, books, papers, publications. To paraphrase Gilbert White 'Every subject needs its own bibliographer'.

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Sand Martins. Scheidig. Soergel. Subsidence. The Shire. Snails. Bohumil Shimek.

T. Tutkovskii. Timaru. Tisza. Titel plateau. Tokarski. Terzaghi.

U. Uferschwalben- in der Loess. Uzbekistan. Ukraine

V. Vojvodina. Venus of Willendorf- found in the Loess near Krems, kept in a museum in Vienna. Virlet d'Aoust. Velichko Vita-Finzi.

W. Wucheng. Ann Wintle. Wroclaw. Whalley

X. Xian- lots of people made of loess. Tang capital- lots of dusty poetry written here

Y. Yellow Earth. Yellow River. Yaalon. Veliseyev.

Z. Zwierzyniec- in the Polish loess belt, near Lublin. Ludwig Zoeller. Zdzislaw Jary. Zorica Svircev.



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**CONTRIBUTION TO CHINESE LOESS RESEARCH
BY EDWARD DERBYSHIRE**

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Edward first came to China 35 years ago, as a member of a Royal Society delegation of 5 geomorphologists. His work on glacial geomorphology and sedimentology interested Professors Shi Yafeng and Li Jijun, who invited Edward to return to China in 1980 to collaborate with Chinese Quaternary scientists. Having set foot on the fascinating Tibetan and Loess plateaus and seen, in particular, some of the thickest loess in the world with its environmental sensitivity to changes in global climate, Edward re-shaped his research career and actively promoted international scientific collaboration between Chinese and European loess researchers.

His persistent passion about loess and his admirable personality have not only made him successful in his "loessic" career, but have also led him to become a good and faithful friend of many leading Chinese Quaternary scientists, including Professors Liu Tungsheng, Shi Yafeng, Wang Jingtai, Li Jijun, An Zhisheng, Wen Qizhong and Ding Zhongli among others from universities and institutions across China. It was primarily due to his relentless enthusiasm and proactive endeavour that many research projects, jointly led by him and these senior Chinese researchers, have been funded, thus enabling 30 young Chinese and European scientists to establish their careers on a loess foundation.

His personal contribution to loess research is not only remarkable, but spans a broad range from loess geomorphology, stratigraphy, chronology, geochemistry, geohazards, geomagnetism and atmospheric mineral dust and related human health, forming the basis of many internationally influential papers and books. His contribution to international loess research is widely recognised not only by the loess community but also by other scientific and governmental organisations. He has served on many international committees and is the recipient of awards such as the Exemplary Foreign Expert title by the Chinese Government, as well as the Antarctic Service Medal of the United States, the Varnes Medal of the International

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Consortium on Landslides (UNESCO & IUGS) and the 2012 James Harrison Award of the International Union of Geological Sciences.

**EDWARD DERBYSHIRE AND LOESS: A PROPER,
PRODUCTIVE, FRUITFUL, SIGNIFICANT, LUCKY,
FORTUITOUS, CREATIVE AND INSPIRING RELATIONSHIP**

Ian Smalley¹

¹ Loess Letter@ Tin Drum Books, 68 Narborough Road, Leicester LE3 0BR, UK

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Li Po, the poet, sitting with his back to the Loess Plateau, wrote of 'the same old dust of 10,000 ages.' A nice phrase; if we take an 'age' to be a 'generation' we could talk of the same old dust of 100,000 ages. This is our dust; this is loess; this is where Edward Derbyshire belongs.

And it all happened by accident; it was a lucky accident, a stroke of good fortune, a fortuitous occurrence. After the chaos of the Cultural Revolution in China there was a large scale effort to get science going again and rebuild the scientific connections that had been lost. One consequence of this was visits by parties of geographers from various parts of the world to re-connect with their Chinese colleagues. Notably Jim Bowler went from ANU and was amazed and staggered by the Loess Plateau 'the grand Canyon of loess stratigraphy'; and even more notably ED went with a party from the Royal Geographical Society and travelling past Xian (and towards Damascus) had his moment. ED, like Bowler, was seized by the majesty and wonder of the loess. But he arrived as a mature and capable geographer; he could be inspired and do things about it.

Doing things about it is his forte. A great loess scholar (that's a given) but also a fixer, an arranger, an organiser. It is no accident that he appears in the Loess Bibliographical list of 100 loess people as an organiser. Impossible to discuss all the events; I shall focus on two, which I judge to be (but I may be biased) the best of the organisational triumphs. 1994 was an important year. At a meeting at Royal Holloway Ludwig Zoeller suggested that a meeting be held to celebrate 175 years since Karl Caesar von Leonhard named loess in Heidelberg. ED absorbed this idea; but he was concerned in 1994 with the NATO ASI conference at Loughborough University 'Genesis and Properties of Collapsible Soils' -here was loess as a problem engineering soil. A topic which NATO thought important enough to support. With NATO funding important people could be brought to Middle England; George Kukla addressed the meeting and was very nervous about being exposed to an audience of engineers. Richard Handy came from Iowa, and Jaroslav Feda from Prague. It was an amazing gathering of loess scholars and it was a pioneering effort- the idea of

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bringing together so many various opinions on soil collapse was totally novel. And the bringing people from around the world set the scene for the greatest triumph.

In 1999, at Heidelberg and Bonn: the great LoessFest- Ludwig Zoeller's idea made manifest- and largely organised and driven by ED. Once again attended by people from many nations, many of whom were rather surprised to be there, but a great international gathering and celebration of loess. Much can be said about LoessFest (and should be said- and recorded) but a simple summary would be that it was a great celebration of loess, and that it was carried forward by the efforts of Edward Derbyshire.

COULD THE CHINESE LOESS PLATEAU RECEIVE SIGNIFICANT DUST INPUT FROM THE YELLOW RIVER?

Thomas Stevens^{1,2}, Anna Bird¹, Andrew Carter³, Pieter Vermeesch³, Timothy Watson¹, Huayu Lu⁴, Sergio Andò⁵, Eduardo Garzanti⁵, Michael Cottam⁶, Inga Sevastjanova⁶, Martin Rittner³

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The origin of loess deposits on the Chinese Loess Plateau, one of the most valuable Cenozoic climate archives on land, has recently become the subject of considerable debate. Hypotheses range from sources in proximal or distal deserts, alluvial fans, mountain regions and the Tibetan plateau. Many of these previous hypotheses have been derived from the analysis of bulk sediment samples from loess and potential dust source regions. While river systems have been evoked as possible dust sources for other loess areas in China and beyond, the question of the relationship of dust and sand sediment sources to the major river systems in the Chinese Loess Plateau region has not previously been substantively addressed.

Here we apply a single-grain based technique in an attempt to discriminate between potential multiple sources. Single-grains have the advantage over bulk techniques in that they will not average out signatures from multiple sources. We use U-Pb and fission-track dating of single grains of zircon, alongside heavy mineral

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analyses, to test the role of proximal deserts and the potential influence of major rivers on providing Chinese Loess Plateau dust. Initial results suggest that the samples from the eastern Mu Us desert and the Tengger desert can be explained by local sources and recycling of the underlying Cretaceous rock. However, the western Mu Us desert samples as well as Quaternary loess samples show different zircon U-Pb age spectra and heavy mineral distributions, indicative of a strong influence from northeastern Tibet. Further, samples from the Yellow River are close to identical to these western Mu Us samples and, crucially, also to Quaternary samples from the Loess Plateau. This and the differences between samples from the Tengger desert, the Loess Plateau, the western Mu Us and the eastern Mu Us suggests that the Tibetan sediments are unlikely to have been transported directly by wind, but rather may have been delivered by the Yellow River. This provides the first evidence of a possible genetic link between the Yellow River and the Loess Plateau.

LOESS IN VOJVODINA REGION (NORTHERN SERBIA): AN ESSENTIAL LINK BETWEEN EUROPEAN AND ASIAN PLEISTOCENE ENVIRONMENTS

Slobodan B. Marković¹, Ulrich Hambach², Thomas Stevens^{3,1}, Mladjen Jovanović¹, Ken O'Hara-Dhand⁴, Tin Lukić¹, Biljana Basarin¹, Huayu Lu⁵, Ian Smalley⁴, Björn Buggle², Michael Zech^{2, 6}, Zorica Svirčev⁷, Pál Sümegei⁸, Nebojša Milojković¹, Ludwig Zöller²

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⁴ Giotto Loess Research Group, Department of Geology, Leicester University, LE1 7RH, UK

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Loess deposits in the Vojvodina region, northern Serbia, are among the oldest and most complete loess-paleosol sequences in Europe to recent time. These thick sequences contain a detailed paleoclimatic record from the late Early Pleistocene. Based on the correlation of detailed magnetic susceptibility (MS) records from Vojvodina with the Chinese loess record and deep-sea isotope stratigraphy we here reconfirm and expand on a stratigraphic model of the Vojvodinian loess-paleosol chronostratigraphic sequence following the Chinese loess stratigraphic system.

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Variations in MS, dust accumulation rates, and the intensity of pedogenesis demonstrate evidence for a Middle Pleistocene climatic and environmental transition. The onset of loess deposition in Vojvodina also indicates a direct link between dust generation in Europe and that in the interior of Eurasia since the Early Pleistocene. The youngest part of the Early Pleistocene and oldest part of the Middle Pleistocene is characterized by relatively uniform dust accumulation and soil formation rates as well as relatively high magnetic susceptibility values. In contrast, the last five interglacial-glacial cycles are characterized by sharp environmental differences between high dust accumulation rates during the glacials and low rates observed during soil development. The data presented in this study demonstrate the great potential of Vojvodina's loess archives for the reconstruction of the continental Eurasian Pleistocene climatic and environmental evolution.

ASIA IN EUROPE? – A DIRECT STRATIGRAPHIC COMPARISON BETWEEN THE CHINESE LOESS PLATEAU AND THE MIDDLE DANUBE BASIN LOESS

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Loess deposits are considered to be some of the most detailed and long-term records of Pleistocene climate change. In Eurasia, a unique mid-latitude loess-belt ranging from China to South-Eastern Europe provides insights into climate evolution since the Pliocene, at least. Whereas loess deposits in Western and Central Europe are temporarily and spatially discontinuous, in the Lower and Middle Danube Basin, at the western edge of the Eurasian loess belt, one can find true loess plateaus providing almost continuous archives of Pleistocene palaeoclimate. These plateaus were presumably formed under similar environmental conditions like in the Chinese Loess Plateau (CLP) and in other Central Asian loess areas.

In the region called Vojvodina (North Serbia), we find loess deposits dating back at least to the younger Early Pleistocene and reaching thicknesses of more than 50 m (Marković et al., 2009, 2011). A most remarkable morphological feature is the Titel Loess Plateau (TLP), situated in the interfluvium of the Danube and Tisza rivers. 5 palaeosol complexes can be distinguished separated by several metres thick loess layers. The lower 2 palaeosol units are developed as strongly rubified forest soils with decreasing degree of pedogenesis from old to young. In contrast, the younger palaeosol units including the recent soil are developed as steppe soils.

A detailed magnetic susceptibility (MS) record in combination with palaeopedological observations forms the backbone of the relative stratigraphy.

The pattern of MS variation and absence of any erosion sign in the profiles suggest a correlation of paleosol complexes V-S₅, V-S₄, V-S₃, V-S₂ and V-S₁ with the MIS 15-13, 11, 9, 7 and 5, respectively. The distinct and characteristic MS record of the TLP loess-paleosol sequences provides important and significant similarities to the environmental magnetic records observed in other Eurasian loess sections. This opens the possibility to extend the temporal and spatial correlation across the Eurasian loess belt from China via Central Asia to the Middle Danube Basin. Due to high accumulation rates, the Middle and Late Pleistocene loess-paleosol sequences of the TLP preserve a unique aeolian continental record of climate and environmental changes for the last c. 600 kyr.

CORRELATING CHINA LOESS AND ANTARCTICA ICE RECORDS

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We correlate the China loess and Antarctica ice records to address the inter-hemispheric climate link over the past 800 ka. The results show a broad coupling between Asian and Antarctic climates at the glacial-interglacial scale. However, a number of decoupled aspects are revealed, among which marine isotope stage (MIS) 13 exhibits a strong anomaly compared with the other interglacials. It is characterized by unusually positive benthic oxygen ($\delta^{18}\text{O}$) and carbon isotope ($\delta^{13}\text{C}$) values in the world oceans, cooler Antarctic temperature, lower summer sea surface temperature in the South Atlantic, lower CO_2 and CH_4 concentrations, but by extremely strong Asian, Indian and African summer monsoons, weakest Asian winter monsoon, and lowest Asian dust and iron fluxes. Pervasive warm conditions were also evidenced by the records from northern high-latitude regions. These consistently indicate a warmer Northern Hemisphere and a cooler Southern Hemisphere, and hence a strong asymmetry of hemispheric climates during MIS-13. Similar anomalies of lesser extents also occurred during MIS-11 and MIS-5e. Thus, MIS-13 provides a case that the Northern Hemisphere experienced a substantial warming under relatively low concentrations of greenhouse gases. It suggests that the global climate's sys-

tem possesses a natural variability that is not predictable from the simple response of northern summer insolation and atmospheric CO₂ changes. During MIS-13, both hemispheres responded in different ways leading to anomalous continental, marine and atmospheric conditions at the global scale. The correlations also suggest that the marine δ¹⁸O record is not always a reliable indicator of the northern ice-volume changes, and that the asymmetry of hemispheric climates is one of the prominent factors controlling the strength of Asian, Indian and African monsoon circulations, most likely through modulating the position of the inter-tropical convergence zone (ITCZ) and land-sea thermal contrasts.

CLIMATE CHANGE, GLACIATION, SEDIMENT TRANSFER, LANDSCAPE DEVELOPMENT AND LOESS IN AND AROUND THE TIBETAN-HIMALAYAN OROGEN: A TRIBUTE TO PROFESSOR EDWARD DERBYSHIRE

Lewis A. Owen¹

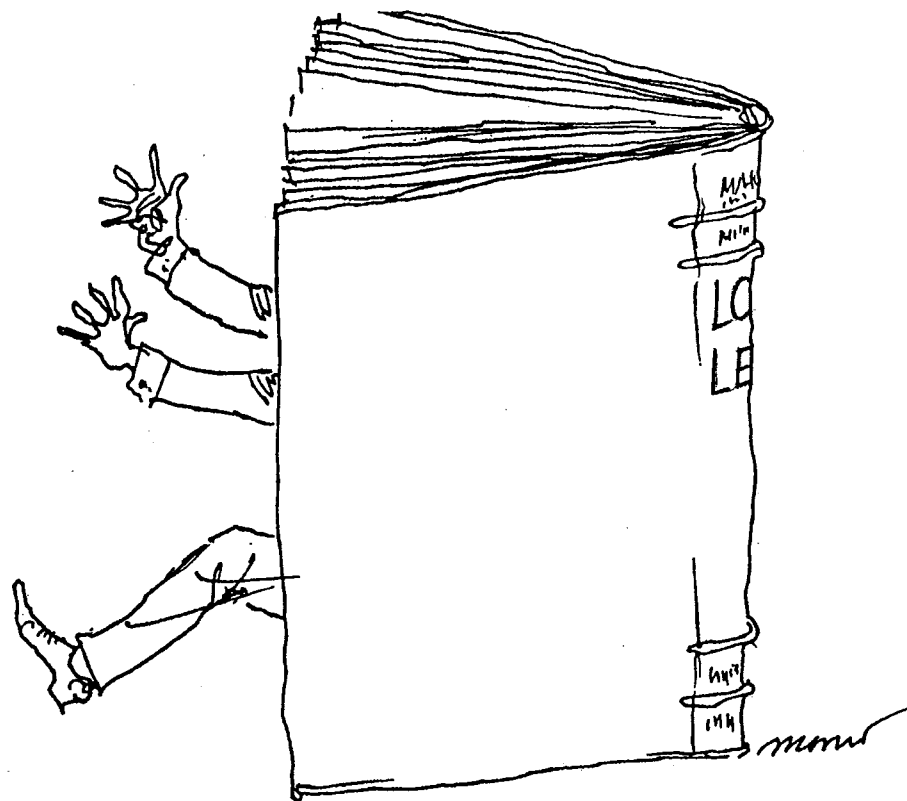
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The Tibetan-Himalayan orogen is the most glaciated realm outside of the polar regions. As such, thick successions of Quaternary glacial and associated deposits are present within the orogen. The orogen is surrounded by some of the world's most impressive loess deposits, including those of the Loess Plateau, Xingjiang and the Potwar Plateau. Loess and loessic deposits also exist within the orogen, albeit thin. Glacial and associated processes may provide important sources of silt for mountain loess and for some of the thick loess deposits that surround the orogen. Understanding the nature of, and the relationships between, climate change, glaciation, sediment transfer and deposition, and landscape development in and around the Tibetan-Himalaya orogen using these deposits allows them to be utilized as important archives for reconstructing past environmental change and to help predict the dynamics of future change. Edward Derbyshire was amongst the first modern scientists to begin to examine the nature of these sedimentary systems, and to begin to understand the controls on sediment transfer and deposition in and around the Himalayan-Tibetan orogen. His early work clearly pioneered research on Quaternary glacial and associated sedimentary systems in Central Asia and forms the foundation for today's studies. In particular, Edward Derbyshire established key glacial chronologies in the Tibetan-Himalayan orogen, providing a modern framework for the study of the Quaternary glacial history of Central Asia. Edward Derbyshire was also amongst the first to examine the loess and loessic deposits within the orogen and at critical sites in China using modern techniques. In particular, his research

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emphasized the significance of these sedimentary archives for understanding environmental change and was fundamental in providing key insights into the nature of climate change, glaciation, sediment transfer and deposition within and around the orogen. Over the years, Edward Derbyshire, has continued to tirelessly and generously inspire, encourage and mentor numerous students and colleagues to investigate the nature of Quaternary sedimentary systems, landscape development and environmental change in Central Asia (as well as in many other regions). So many are extremely grateful for his collaborative leadership and look forward to seeing his future contributions.



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ISOTOPIC AND ELEMENTAL COMPOSITIONS OF CARBONATE NODULES FROM CHINESE LOESS AND THE IMPLICATIONS FOR THE EAST-ASIAN SUMMER MONSOON VARIATIONS

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In the past two decades, various elemental ratios have been employed to quantify the chemical weathering intensity of loess deposits and are regarded as proxies for the East-Asian monsoon variations. However, chemical weathering intensity reflected by most of these proxies is a combined result of chemical weathering in source regions, post-depositional weathering, and transport-induced grain-size changes. Only the post-depositional weathering can be confidently ascribed to the summer monsoon variations.

Pedogenic carbonate nodules are soil new growth formed under wet-dry cycle and thus have great potential to document the summer monsoon variations. Here we present the spatial isotopic and elemental compositions of carbonate nodules from a north-south loess transect of northern China for the last and penultimate interglacials (MIS 5 and 7). The nodules have carbonate contents ranging from 50% to 80%, and demonstrate a distinct negative $\delta^{18}\text{O}$ - $\delta^{13}\text{C}$ relationship (the lower $\delta^{18}\text{O}$ values the higher C_4 component). Meteorological observations have shown a summertime dip in $\delta^{18}\text{O}$ values of monsoon precipitation ($\delta^{18}\text{O}_p$). According to our previous study, the high $\delta^{18}\text{O}$ values of carbonate nodules may result from increased precipitation in spring and fall characterized by relatively high $\delta^{18}\text{O}_p$ values, and reflect relatively strong summer monsoon. Therefore, strong summer monsoons (seasonally broad monsoons) produce high $\delta^{18}\text{O}_p$ values and favor C_3 over C_4 plants and vice versa, thus leading to the negative $\delta^{18}\text{O}$ - $\delta^{13}\text{C}$ relationship.

Elemental compositions of the carbonate nodules, obtained by treatment with acetic acid, show a southward increase in Sr/Ba (from ~4.5 to over 5.1) and U/Th ratios (from ~0.7 to over 1.2) for both MIS 5 and 7. Sr and U are mobile elements compared to Ba and Th, thus high ratios of Sr/Ba and U/Th in carbonate nodules (soil-forming product) indicate increased weathering intensity of their overlying soil units. In addition, both Sr/Ba and U/Th ratios increase southward with $\delta^{18}\text{O}$ val-

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ues of carbonate nodules, indicating a southward increase in monsoon precipitation during interglacial periods. In this context, carbonate nodules are valuable for the reconstruction of summer monsoon history and well worth further studies.

EVOLUTION OF EAST ASIAN SUMMER MONSOON DURING THE PLIOCENE BASED ON PALAEOPRECIPITATION RECONSTRUCTION ON THE LOESS PLATEAU

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East Asia climate experienced significant changes during the Pliocene period. One hypothesis suggested that a significant uplift of Tibetan Plateau led to dramatic changes in the strengths of the Asian winter and summer monsoons, while the other related the environment changes in this period to rapid growth of the Arctic ice-sheet. The key issue needs to be further explored is which factor(s) caused the major changes of East Asia monsoon during this period. The Neogene aeolian deposits in northern China are of unique values for this issue. Previous reconstructions of the evolution of East Asia summer monsoons were mostly based on magnetic susceptibility and geochemical proxies (e.g. FeD/FeT, Rb/Sr). However, the intensity of summer monsoon has only been qualitatively addressed because the value of these proxies are recorded not only the intensity of pedogenesis in aeolian deposited region, but also the changes with the composition of chemical and mineralogy from aeolian source region.

In this study, an improved inverse vegetation modelling approach coupled physiological responses of C_3 and C_4 plants, is used to quantitatively reconstruct palaeoclimate, based on pollen and carbon isotope data that have accurate relationship between vegetation composition and climate in Xifeng red clay profile, the eastern Loess Plateau. We show that the changes in the annual precipitation generally higher 100-300mm than the present before 5.0 Ma, then significantly decreased from 5.0 to 4.0 Ma, and touched the minimum values of 100-200mm lower than modern during 4.0 to 2.4 Ma. The seasonal analysis revealed that this annual precipitation shift mainly attributed to the summer rainfall decrease. Results indicate the intensity of summer monsoon was decline, in contrast to previous interpretation of intensifying trend during the Pliocene period. Numerical modeling studies have demonstrated that uplift of the Tibetan Plateau would have enhanced East Asian

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summer monsoon strength. This Pliocene climate changes in East Asia are therefore unlikely to be a response to Plateau uplift. On the contrary, our results give support to the view that ongoing global cooling could have weakened the summer monsoon in East Asia.

LATE QUATERNARY LOESS RECORDS IN EASTERN KAZAKHSTAN

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The Kazakhstan loess represents a significant, although still little known source of terrestrial palaeoclimate proxies in the continental Eurasia linking the East European, Chinese and Central Asian loess provinces. Aeolian (silty and sandy) deposits in the lowland areas along the Southern Altai and the Rudno Altai Foot-hills of East Kazakhstan (the Bukhtarma Basin) document major Pleistocene (interglacial / glacial and interstadial / stadial) climatic shifts with stages of massive sediment accumulations interspersed by stages of former surface stabilization with formation of variably developed palaeosols. The regional diversity of the Quaternary atmospheric circulation dynamics and the related near-surface clastic sediment flows is significantly pre-disposed by the local topography, with spectacular, up to 300 m-high sand dune fields in the adjacent Zaisan Basin contrasting the relatively minor silty blanket over the NW part of the study area. Thickness of the regional loess cover reaches 5-20 m what is significantly less than on the northern side of the (Russian) Altai with up to 150 m of loess deposits. A spatial discontinuity and local loess preservation in East Kazakhstan illustrates a complex Quaternary geological history with intensive past and present erosional processes.

The presently most continuous reference loess section Izkutty on the northern slopes of the Kalbinskiy Range (1380 m) shows the cyclic and well-sorted aeolian sediment deposition with several horizons of buried chernozemic and brunisolic palaeosols (the MIS 5 and 3 PKs) corresponding to open parkland-steppe and mixed taiga forest, respectively. The fossil soils bear signs of some cryogenic distortions, which are less prominent than those observed in the northern Altai loess formations, suggesting reduced Pleistocene permafrost activities than in southern Siberia. A progressive sediment accumulation indicates a pronounced aridization and an increased areal aeolian activity along the SW margin of the Altai during the Last Glacial. Contextual magnetic and non-magnetic proxy data correlate well with the northern Altai Late Pleistocene loess stratigraphic sequences and the enclosed pedocomplexes matched by the global climate records encompassing MIS 5-1 (i.e.,

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the time interval of the last 130 ka). In spite of the close geographic distance from the principal loess area of SW Siberia (centred on the North Altai Plains and the Ob River Plateau), the East Kazakhstan loess deposits evidently represent a separate geological entity governed by the regional climate regime and wind-direction patterns within the transitional zone affected by the Siberian, Central Asian and NW Chinese atmospheric circulation. The local loess records illustrate a diversity of formation and pedogenic modification of air-borne silty deposits also documented by the "Chinese" magnetic susceptibility trends with enhanced MS in soils in contrast to the Siberian loess-palaeosol sequences on the northern side of the Altai Mountains with uniform peaks of LF MS in loess units. Partly "mixed" MS signals found in accretional pedogenic horizons make the situation more complex. Differences in the specific parent material mineralogy in conjunction with the regional Quaternary climate regimes and specific sediment weathering processes are assumed to be the principal factors beyond the MS variations. Further investigations are in progress.

HUMIDITY CHANGE IN QUATERNARY OF NORTHERN ASIA

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climate variations were investigated in sedimentary sections of closed lakes and in sediments of Late Glacial and Late Holocene eolian landforms in West Siberia. The Late Holocene dunes are composed of eolian sands with buried soils and are overlain by an immature modern soil. They are localized along the eastern sides of lakes and reach 10 m high. The dry and cold intervals were associated with eolian processes, fall of lake levels, deflation, and accumulation of dunes, while the relatively wet and warm stages were the times of soil formation. Radiocarbon ages and correlation with tree-ring data indicate that the subaerial deposition represents a 200-300 year quasi-periodicity of dry and cold cycles alternating with periods of wet climate at air temperatures about those at present.

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CHINA: MATERIALS FOR A LOESS LANDSCAPE

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For various reasons it was thought that material for the great Chinese loess deposits originated in the deserts of the north- and the idea of a 'desert' origin was widely accepted.

But Butler, in Australia in 1956, cast doubt on the actual existence of desert loess and this led to considerable discussion. One facet of the argument (advocated by Smalley & Vita-Finzi in 1968) proposed that there were no desert specific mechanisms which could produce the large amounts of loess material observed. Applying this idea to Chinese loess was particularly appropriate because of the huge extent and thickness of the deposits. How was this vast amount of loess material produced?

Smalley & Krinsley in 1978 proposed a sequence of events that led to the formation of the Chinese loess. This required that the loess be mountain loess (eventually defined by Smalley & Derbyshire 1990) - the material was made in the mountains to the west; and the Yellow River had a role to play in bringing it to the loess deposit region; and that loess material in desert regions was in a state of transit.

The 1978 model has been proved to be true by a whole sequence of ingenious and intricate experiments. In particular the analysis of zircons has produced data allowing particle sources to be identified. The zircon particle proves to be a key component of the loess landscape; but the mode particle remains the silt-sized quartz particle.

The problem running in parallel with the 'how did the material form?' question is the puzzle of why loess material has such a restricted size range. What controls operate on the formation of loess material? In the quartz particles it appears that

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TIME SCALE AND ASTRONOMICAL IMPRINT OF SERBIAN LOESS DEPOSITS

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Long continuous terrestrial sequences have been used to construct time scales in order to study paleoclimate trends and evolution. In order to construct reliable time scale it is necessary to have undisturbed and continuous record. Time scales of loess paleosol sequences were constructed for deposits on Chinese Loess Plateau using different approaches and were mainly used to study the evolution of East Asian Monsoon. Sequences that are as complete and as continuous as the ones on Chinese Loess Plateau are rare in Europe. On the other hand, loess in Vojvodina region (Northern Serbia) is regarded as one of the thickest and most complete in Europe. Recent study (Marković et al., 2011) showed that loess in Vojvodina spans the last million years.

Based on the interprofile correlation between two most important loess paleosol sequences, Stari Slankamen and Titel Loess Plateau synthetic profile was formed. Newly developed time scale was obtained by tuning the magnetic susceptibility record to insolation values (Berger and Loutre, 1991). The resulting magnetic susceptibility time scale shows a close similarity to the sequences on Chinese Loess Plateau and to the orbital tuned δO^{18} .

The time scale indicates much older age for the Bruhnes Matuyama boundary, recorded in loess unit V-L9, which is in good agreement with the recent results obtained during paleomagnetic measurements (Marković et al., 2011). The lock in effect is much greater than in Chinese loess sequences, which is probably due to the strong root channels, which penetrate several meters down through V-S8 into V-L9 and probably influence the magnetic properties of the sediments.

Spectral and wavelet analysis of tuned magnetic susceptibility record reveal the presence of typical orbital frequencies, corresponding to eccentricity, obliquity and precession. Eccentricity frequencies of solar irradiance are dominant, while relatively short time orbital cycles of obliquity and precession are weak. This can be attributed to the time frame of the investigated profile, since the lower part of the sequence can be assigned to the so called 41 ky world. Wavelet analysis reveals the presence of Mid Pleistocene Transition, indicating that the eccentricity parameter becomes dominant from 650 ky.

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Due to the completeness and the time frame of studied loess paleosol sequence, the site provides an opportunity for investigating the evolution and climate dynamics in this part of Europe. The synthetic profile can be seen as rare paleoclimate archive that enables the reconstruction of orbital influences over Pannonian Basin and can be seen as link between west European sequences and Asian loess.



PHASES OF LOESS DOLL DEVELOPMENT – DESCRIPTIVE AND ANALYTICAL METHODS

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Carbonate concretions in loess-paleosol sequences are often called as 'loess dolls' based on their various morphologies. These features can be dispersed in loess, but are commonly found under paleosols. Their existence draws attention to the connection with leaching processes or groundwater level fluctuations. Loess dolls are formed in cavity systems, which are well exposed to air and where the partial CO₂ pressure is lower. Carbonate may also accumulate around precipitation nuclei within these cavities, and can cement hypocoatings together. In many cases loess dolls are characterized by a multiphase development history. Our aim was to discover the secret of these processes.

Research with different investigations was performed on 5 loess doll samples from the Paks loess profile (Hungary) in order to determine their developmental phases.

1. Loess dolls were cut into two parts to represent their inner structure. For the further visualization of the structure and pore networks high resolution micro-CT analysis was carried out.
2. High resolution sampling by a gimlet was achieved along the longitudinal axis and several transversal axes of each loess doll. Stable oxygen isotope composition ($\delta^{18}\text{O}$) was measured against VPDB in order to distinguish between the presumed carbonate precipitation phases.
3. Experiments were performed on the remaining samples by using 20% hydrochloric acid. During gradual dissolution the certain phases were checked.

From the preliminary results two main observations arose. Loess dolls with prominent cavities (usually forming star-like cracks), do allow to distinguish between different phases during development. It shows connection with the variation of the oxygen isotopic composition, because the $\delta^{18}\text{O}$ values range in separate clusters concerning the structural units. However loess dolls with pores showing disperse scattering or quite homogeneous inner structure are characterized with

more compensated oxygen isotopic compositions. The $\delta^{18}\text{O}$ values refer to a quite continuous carbonate precipitation process.

NEW FRONTIERS IN MOLECULAR LOESS RESEARCH

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Macrofossils such as charcoal remains are rarely preserved in loess paleosol sequences, hence they give only a discontinuous picture on the paleovegetation. Valuable information on paleofloristic changes is delivered by microfossils such as pollen. However, the palynological approach is limited by far distance transport and selective preservation of palynomorphs in the loess paleosol environment. Fossil organic soil material, however, is present in paleosols as well as in loess units, though the concentration can be very low. Marker molecules of certain plant taxa (= molecular fossils, biomarkers) preserved in the fossil organic material of a loess paleosol sequence provide a continuous record of the on-site vegetation. In recent years, the n-alkane approach has been established for paleoenvironmental reconstruction in loess research. Long chain n-alkanes mainly derive from cuticular plant waxes and the relative abundance of n-alkane homologues allow to detect past changes in the grass and tree abundance. So far, this approach represents the state of the art in molecular based paleovegetation studies in loess.

Nevertheless, certain biomarkers especially of the terpenoid class potentially provide a more detailed picture on the paleoflora composition. This group of biomarkers is an important constituent of tree resins and individual compounds represent chemosystematic markers. Hence, already the identification of these compounds in a sample gives information on the presence of certain plant taxa. This approach has been successfully applied to studies of lacustrine and marine sediments as well as lignites but never to loess and paleosol archives.

Here, the authors present micro-, and molecular fossil based results from the Tumara section (Siberia), showing for the first time the potential of terpenoid derived biomarkers for paleovegetation reconstruction also in loess paleosol sites. Using biomarkers, conifer pollen in glacial units of the Tumara profile could be attributed to the local paleovegetation, disproving a significant far distance origin of the pollen signal. Moreover, it was possible to gather paleovegetation information also from stratigraphic units where pollen were poorly preserved.

Finally, the authors give an outlook on how this new approach in molecular loess research issued here may significantly contribute to essential paleoenvironmental questions in the Carpathian Basin realm (e.g. „trees or no trees?“).

LOESS AS GEOHERITAGE – GEOCONSERVATION & GEOTOURISM

IMAGE AND IMAGINATION: LOESS GEOHERITAGE AND GEOTOURISM IN EUROPE

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The loess of the Eurasian belt is seen, especially by non-specialists, as a blanketing deposit with few spectacular aesthetically stimulating landforms. Much of its interest lies in the hidden stories its palaeosols reveal of past climates and environments, some inhabited by early humans. In historical times, loess has influenced patterns of agriculture and settlement. These elements are particularly well, if not always obviously, seen in the Danube basin. Its topography, loess, wildlife, political and socio-economic histories have been examined and recorded over some four-hundred years by a succession of travellers and scientists from across Europe. Their geoheritage legacy is found in libraries, museums and art galleries within the Danube basin and especially southern Europe.

When funding and resources for Earth science research are constrained both loess research and geoconservation necessarily compete with other research agendas as well as agricultural and commercial uses and developments. A major challenge for the loess community is to engage with non-specialist stakeholders to meaningfully present the scientific and applied relevance of their research outputs. Geotourism as: “*The provision of interpretative and service facilities for geosites and geomorphosites and their encompassing topography, together with their associated in situ and ex situ artefacts, to constituency-build for their conservation by generating appreciation, learning and research by and for current and future generations*” provides the necessary underpinning framework.

Loess geotourism encompasses the recognition and assessment of its geosites/geomorphosites, interpretative media, and promotion, as well as the lives, work, collections, publications, artworks, field-notes, personal papers, workplaces, residences and even final resting places of researchers. Employing such a geotourism approach, the loess community could best present its case for research and geoconservation resources. An approach to loess geotourism based upon the interpretation and presentation of historical materials and artistic/literary outputs is most likely to achieve the desired outcome. Consequently, the Danube basin is presented as a theoretical

case study of how the suggested approach might be implemented at some exemplar sites. It is suggested that a similar approach could be adopted more widely in the Eurasian loess belt. The case study's approach is contextualised within an interpretative geo-historical framework and model.

INITIAL RESEARCH ON HUMAN PERCEPTION OF LOESS LANDSCAPES IN BARANYA, EASTERN CROATIA

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Landscape has an objective nature, which is of material structure and measurable, and, at the same time, it has a subjective nature within a value structure, both qualitative and aesthetic. Significant visual phenomena of the Slavonia and Baranya planes in Eastern Croatia are the vertical surfaces of loess deposits. Physical characteristics of loess have enabled men to perforate it and create spatial structures in it, called *gators* that have served for residential and economic purposes throughout the history of this area. The continued decay and disappearance of the *gator's* residential function has pointed to a problem of today's perception and evaluation of these structures, now mostly empty and abandoned. The main dilemma lies in the interpretation of *gator's* potential as spatial and phenomenological resources in the context of local natural values and problems arising from limited structural features of loess. The article presents physical characteristics of *gators* from and around the village of Batina in Croatian Baranya as well as their role in a holistic review of the Baranya loess landscape. At this stage, authors are proposing and defining a methodology of researching loess structures from different theoretical and methodological perspectives. We discuss various issues that are highlighted in a comparative framework, relating to distinctions between experts' and local population's attitudes on loess and its natural and human features. The proposed methodology is based on risk perception related to place-identity and landscape values. The article investigates the use of visual instruments (photographs) in quantitative and qualitative research methods. Quantitative methods include evaluation of loess deposits in comparison to other natural phenomena of the region, recognition of *gators* as a part of its architectural and economic heritage and ranking of *gators*' (via visual presentation-photographs) as suitable for different functions (habitation, storage, wine cellars, museums, tourism). Qualitative methods follow, again via visual presentation, emotional associations and suggestions on the same subject of *gators*' past and present use and possible re-use. Described methods will be realized through a survey of a sample of local experts and region's population.

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Loessification (on the 130th anniversary of the birth of L.S.Berg)

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We can define loess- at least we can attempt to define loess (Smalley & Jary 2004); we can discuss the factors that affect its distribution (Smalley & Jary 2005a) and examine attempts to describe that distribution (Smalley & Jary 2005b), but can we grasp the slippery concept of 'loessification' – the idea that 'not-loess' ground can, by various transformative processes, become loess ground ?

Here is a word of some historical power but apparently very little contemporary relevance. It is a word that has never been deployed to any large effect in New Zealand, but there is a certain NZSN relevance because it is via the medium of soil science that it has had some impact. Also from our point of view the NZ Soil Bureau played a small, but important part, in the wider study.

We propose, in this discussion, that the idea of loessification can be considered at two levels; we shall deal with 'grand' loessification and 'petit' loessification (gL and pL for short). At the centre of the discussions is the work of two individuals: L.S.Berg (for gL: Berg 1916, 1932, 1964) and M.Pecsi (for pL: Pecsi 1990, 1995, Pecsi et al 2000).

Berg was involved in the great 20th Century debates about the nature and origin of loess. He was the main protagonist for the idea that loess came about by processes of weathering and soil formation; he offered the 'eluvial' or soil theory of loess formation, sometimes called the 'in-situ' theory; he was the guru of

loessification. According to Pyaskovskii (1946) Berg arrived at the conclusion that loess is to be regarded as a normal mineral zonal soil formation. So much of the discussion of loess in the 20th Century swirled about Berg that we feel justified in examining him and his ideas at some length.

Lev Semenovich Berg 1876-1950; more famous as an ichthyologist than a soil scientist, for most of his life associated with Leningrad University. In 1916 (when he was 40 years old) he published a long paper/monograph on loess, based on his studies in western Russia and Ukraine. In the words of the Great Soviet Encyclopedia "he proposed a soil theory of the formation of loess". This monograph was republished in 1925 in his book 'Climate and Life'. According to the Great Soviet Encyclopedia "Berg elaborated the study of landscapes and developed the teaching of V.V.Dokuchaev on natural zones.. " He was much influenced by Dokuchaev and the development of soil science, and the basic Dokuchaev ideas can be discerned in the Berg loess hypothesis. A second edition of Climate and Life was prepared and was ready for publication in 1940, but the publication was delayed by the Great Patriotic War. It came out eventually in 1947, and a translation into English of the important loess portions was published by the Israel Programme of Scientific Translations in 1964. Berg (1964) is very like Berg (1916); we do not think that the Berg loess ideas changed significantly during his life; they were certainly very influential in the Soviet Union. To quote Pyaskovskii again "There can be no doubt that the most important factor in the development of our knowledge concerning loess was the fruitful idea of L.S.Berg as presented in a series of articles and collected under the title of 'the pedological theory of loess formation' (Pyaskovskii 1946).

The basic Berg ideas (gL) were discussed some years ago in Soil News (Smalley 1980). In the New Zealand setting they were never applicable because they basically required a definition of loess which had no application in New Zealand. Loess definitions are still being discussed at some length (Smalley & Jary 2004) but we can say that if collapsibility and carbonate content are key defining factors, as Berg would require, then the NZ loess is excluded. But, if aeolian deposition and the mantling of the landscape are the key factors then NZ loess fits in nicely. Berg would never accept aeolian deposition.

Pecsi (our chosen champion of pL) was able to accept aeolian deposition as an important stage in the formation of a loess

deposit. He was essentially happy with all the sedimentological preliminaries, he required loessification to operate between the aeolian deposition event and our contemporary observation of loess ground. After the sedimentological processes have finished, then the pedological processes can begin, and a discussion in Soil News takes on some relevance. Pecsí was a great enthusiast for loess, he was president of the INQUA Loess Commission for many years and wrote many papers, and edited many volumes, on his chosen material. He was Director of the Geographical Institute of the Hungarian Academy of Sciences, and made Budapest a great centre for loess research. As a member of the Central European scholarly establishment during Soviet times he was bound to be influenced by the Russian loess ideas, and supported the idea of loessification to the end of his life (in 2003). A special commemorative volume of Quaternary International has been edited by A. Dodonov and A. Velichko, which contains (inevitably) further discussion of the in-situ approach to loess formation (Smalley et al 2006). We can see the attraction of loessification in a philosophical context; it confers on loess a special status- it makes it a special, unique ground material, a marvellous and wonderful thing. A Hungarian scholar might well be drawn to loess because it is a major deposit in that country and there is, in that land-locked sedimentary basin, a relative shortage of things to investigate. And in Soviet times there was no way that you could be an oceanographer in the Pacific, or even look at the Munich loess.

Pecsí (1990): a key paper with an intriguing title 'Loess is not just the accumulation of dust'. Pecsí states that "Dust only becomes loess after the passage of a certain amount of time in a given geographical zone". That small word zone has interesting echoes of a Dokuchaevian past; the idea of a zonal control of loess formation was very strong in the Russian approach to the problem. In fact in one of the most recent maps of loess distribution (Trofimov 2001, reproduced in Smalley & Jary 2005b) global climatic zones are emphasized. A similar statement from Pecsí (1995) "In the process of loessification, the development of loess fabric, the role of zonal, regional and partly of local environmental factors is regarded [as] decisive".

Pecsí et al (2000) " On the issue of explanations for the origin of loess Berg and Pecsí considered it important to emphasize that the sedimented material is not yet loess, i.e. it is not the loess which

accumulates but its mineral weight. The ideal conditions for loessification are provided by soil horizons of semi-arid steppes and open woodlands (in some places warm and dry steppes) and during Pleistocene periglacials in those of cold steppes and open woodlands; they form the megazonas of loess formation. There have been explanations given concerning loess formation emphasizing the predominant role played by the geographical environment, i.e. by the loess megazone, in the soils of which organic and non-organic processes play a more important part than any other transportation or accumulation processes (... Berg 1916, Pyaskovskii 1946, Kriger 1965....)"

Pecsí produces a gloss on Berg's forthright views and adapts them somewhat to his own position. The Pecsí position is more interesting and does actually have some relevance to 21st century loess studies. Berg was too extreme; denying aeolian deposition was a mistake. It is interesting that Pecsí cites Pyaskovskii (1946). This is a remarkably interesting paper and gives real breadth to the gL discussion. This is where Soil Bureau made a critical contribution to the debate; the English translation of Pyaskovskii (1946) was prepared at Soil Bureau and published by Loess Letter in 1986; there is a shortage of windows into the Berg world- this allows a critical glimpse. There are aspects of interpretation which touch on the Pyaskovskii paper- it opens with a paean of praise for Berg (see above) but a careful reading suggests that it might be a carefully coded, and damaging attack on the Berg position. Pyaskovskii picks out a great weakness in the gL approach; how do you deal with deposits that have enormous thickness? Does the process front work its way down through hundreds of metres of ground, or is some alternative required to provide these vast amounts of loess material?

It is better to let the sedimentological processes perform their function before applying the pedological reasoning. Pecsí is taking a correct approach, and this approach can be fitted quite neatly into a study of loess deposit formation which requires all the critical events or stages to be identified and elucidated. Actually many questions remain, and in the interests of context setting a few can be discussed here. Berg (1932) stated that.. " The wind, according to its velocity, can carry either coarser or finer particles, but why it should give a preference to particles of 0.01 to 0.05 mm in diameter, has never yet been explained by any follower of the aeolian theory." This is easy to explain; a simple compromise is

operating. The forces on ground particles are essentially cohesion and weight; the smaller particles are more cohesive and the larger particles are heavier. At around 80 μm the best lift is achieved, so it is no surprise that aeolian loess has particles in the silt size range. There is another factor becoming more established; it appears that quartz in nature is predisposed to fracture and breakage leading to a silt-sized product (Kumar et al 2006); so the silt sized pick-up occurs because it is silt sized particles which are overwhelmingly available. It is interesting to note that Berg may have been the first person to suggest that the size range 10-50 μm is the special 'loessial' size range (see Browzin 1985).

The 'sequence-of-events' approach to loess deposit formation has been brilliantly deployed by Wright (2001) to explain loess deposits in Nigeria, China, Hungary and Tunisia. We can add the pL event on to the main sequence and it will fit quite comfortably. There are other event types which are still being currently discussed. The problem of making the silt particles for loess deposits is still active (see Wright 2001, Kumar et al 2006) and this bears on the difficulties of supplying material for deposits of 'desert' loess. There is increasing awareness of the role played by large rivers in distributing loess material far and wide across the landscape, before the property-producing aeolian transportation event occurs. There is almost certainly much more loess in India than has been appreciated and the great rivers, e.g. the Indus, the Ganges and the Brahmaputra, deliver vast amounts of potentially loess material into convenient positions. And another three rivers, the Dnepr, Don and Volga, have had a greater effect on loess distribution in western Russia and Ukraine than has been hitherto acknowledged. So there are vast transportation events that require further study, and now we have a late event, a post-aeolian event, to add to the list of significant loessial activities that require investigation and explanation.

The aeolian deposition event gives to a loess deposit its open, metastable structure, and contributes to the characteristic (Berg-noted) particle size distribution. This appears to us to be the truly defining event; all the other events are important and significant, but at the heart of loess deposit formation is that remarkable aeolian event. Now, although this provides the metastability, it does not necessarily provide collapsibility. The open metastable system has potential energy, it could collapse into a more stable system- but a mechanism has to be available to allow the collapse

to take place. And this is where the pL process has a role. Recent (on-going) studies on the loess at Ospringe in Kent, UK have indicated that post-aeolian processes modify the inter-particle contacts in the metastable ground and facilitate collapse. Deposition of a network of needle-shaped carbonates at particle contacts allows clay mineral material to be trapped and concentrated at the particle contacts. A clay level content is reached which provides collapsibility. It has been noted that a system with a very low clay mineral content does not collapse, and a system with a relatively high clay mineral content does not collapse. There is a middle range of clay content that allows collapse, and it is this middle range which is achieved in the pL process.

2006 is the 130th anniversary of Berg's birth; and it is the 90th anniversary of his pedological theory- so some celebration is justified. He has produced 90 years of discussion and debate. The gL approach may be fatally flawed- but the pL angle looks worthy of consideration. 2006 is also the anniversary (60th) of the publication of Pyaskovskii's remarkable paper- we should also celebrate this, and the small, but key, contribution by the NZ Soil Bureau to the great loessification debate.

References

Berg, L.S. 1916. The origin of loess. Communications Russian Geographical Foundation 11, 579-646 (in Russian; reprinted in *Climate and Life* 1922).

Berg, L.S. 1932. The origin of loess. *Gerlands Beitr. Geophys.* 35, 130-150 (reprinted in *Loess Lithology and Genesis*, ed. I.J. Smalley 1975).

Berg, L.S. 1964. Loess as a product of weathering and soil formation. *Israel Prog.Sci.Trans.* Jerusalem 207p (translated from *Climate and Life* 2nd.ed).

Browzin, B.S. 1985. Granular loess classification based on loessial fraction. *Bull.Assoc.Eng.Geol.* 22, 217-227.

Kruger, N.I. 1965. Loess, its characteristics and relation to the geographical environment. *Nauka, Moscow* 296p. (in Russian).

Kumar, R., Jefferson, I.F., O'Hara-Dhand, K., Smalley, I.J. 2006. Controls on quartz silt formation by crystalline defects. *Naturwissenschaften*- in press.

Pecsi, M. 1990. Loess is not just the accumulation of dust. *Quaternary International* 7/8. 1-21.

Pecsi, M. 1995. The role of principles and methods in loess-palaeosol investigations. *GeoJournal* 36, 117-131.

Pecsi, M., Nemezc, E., Hartyani, Z., Horvath, T. 2000. Formation of minerals in loess and soils. *Acta.Geol.Hungarica* 43/4, 379-404.

Pyaskovskii, B.V., 1946. Loess as a deep soil formation. *Pochvovedenie*, for 1946, no.11, 686-696. (in Russian; English translation in *Loess Letter Supplement* 3, 1989)

Smalley, I.J. 1980. The loess controversy and Soviet science. *New Zealand Soil News* 28, 27-29.

Smalley, I.J., Jary, Z. 2004. A random walk towards a definition of loess. *New Zealand Soil News* 52, 142-146.

Smalley, I.J., Jary, Z. 2005a. Where is the loess? (and why?) *New Zealand Soil News* 53, 70-74.

Smalley, I.J., Jary, Z. 2005b. Maps of worldwide loess distribution: from Keilhack to Kriger and beyond. *New Zealand Soil News* 53, 45-49.

Smalley, I.J., Jefferson, I.F., O'Hara-Dhand, K., Evans, R.D. 2006. An approach to the problem of loess deposit formation: Some comments on the 'in-situ' or 'soil-eluvial' hypothesis. *Quaternary International*- in press

Trofimov, V.T. (ed). 2001. *Loess mantle of the Earth and its properties*. Moscow University Press, Moscow 464p (in Russian; review in *NZSN* 49, 148-149, 2002).

Wright, J.S. 2001. 'Desert' loess versus 'glacial' loess: quartz silt formation. source areas and sediment pathways in the formation of loess deposits. *Geomorphology* 36, 231-256.