LOESS LETTER

ISSN 0110 7658

October 1993

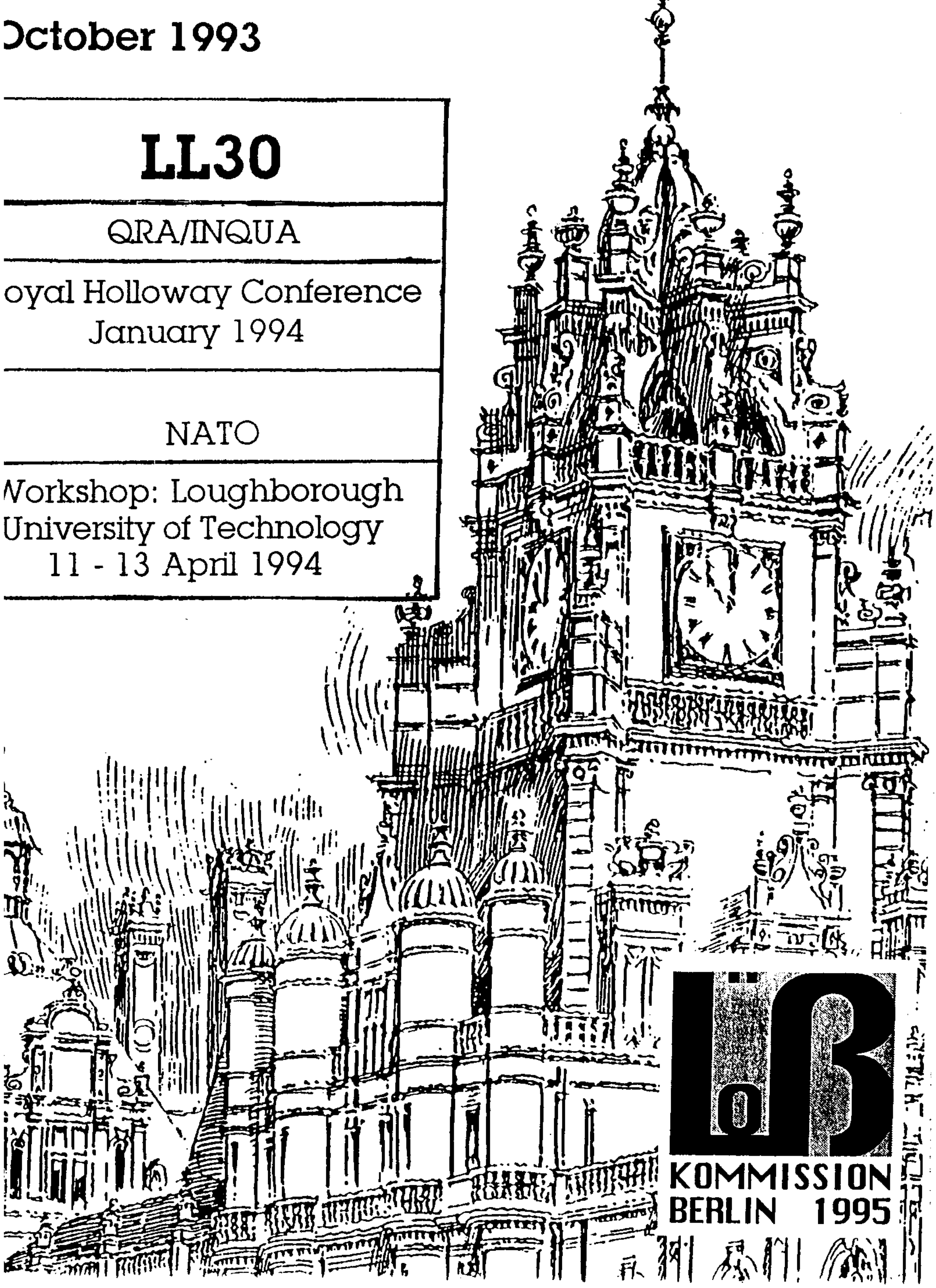
LL30

QRA/INQUA

Royal Holloway Conference
January 1994

NATO

Workshop: Loughborough
University of Technology
11 - 13 April 1994



黄土通讯

LOESS LETTER 30: October 1993

Loess Letter LL is the newsletter of the Loess Commission of the International Union for Quaternary Research INQUA. It is published twice a year, normally in April and October, by Ian Smalley, Civil Engineering Department, Loughborough University of Technology, Loughborough LE11 3TU, England. For more details of the Loess Commission contact the President, Prof. Dr. An Zhi-Sheng, Xian Laboratory for Loess and Quaternary Geology, P O Box 17, Xian, China.

LL30 is a special issue to commemorate the Wind-blown Sediments Meeting of the Quaternary Research Association QRA and INQUA at Royal Holloway, University of London, 5-8 January 1994.. LL30 is also a special issue because it represents 15 years of continuous publication for LL - another landmark in our quest for 50 appearances. Also we celebrate, more or less exactly, the 30th anniversary of the Liu and Chang paper which initiated modern loess stratigraphy, presented at Lodz in 1961, but not published until 1964.

1994 is a very important year for the Loess Commission; several major meetings in the year before Berlin 1995. In addition to the QRA/INQUA Wind-blown Sediments Meeting in January there are the NZ joint meeting of the Tephrochronology, Palaeopedology and Loess Commissions in Hamilton in February; the NATO Collapsing Soils Workshop in Loughborough in April and the IGCP 349/Loess Commission meeting in Xian in August.

LL30 contains 10 abstracts from the 3rd International Geomorphology Conference (Hamilton, Ontario, August 1993). There was a brief Loess Commission meeting at Hamilton and future developments were discussed. Sixteen loess papers were presented but we only have room for 10 (and some of these have been shortened). As the financial situation eases we hope to enlarge LL and return to a more useful length. LL31 and LL32 will of course be aimed directly at Berlin 1995 INQUA.

NATO Workshop on Collapsing Soils: 11, 12, and 13 April 1994 at Loughborough University of Technology. For details contact Professor E. Derbyshire, Geography Department, Royal Holloway & Bedford New College, Egham, Surrey. TW20 OEX, UK.

IGCP 349/Loess Commission Workshop on the Palaeoenvironmental Record of Desert Margins and Palaeomonsoon Variation during the last 20 Ka: in Xian 14-23 August 1994. For details contact Professor An Zhi-sheng, Xian Laboratory for Loess & Quaternary Geology, P O Box 17, Xian, China.

14th INQUA Berlin 1995. First circular issued. Contact address: Congress Partner GmbH, Emmastr. 220, 28 213 Bremen, Germany.

L'ORIGINE DES LIMONS SABLEUX EOLIENS DES MONTS DE MATMATA (TUNISIE)

Ballais, Jean-Louis, Institut de Géographie, Université de Provence, 13621 Aix-en-Provence Cedex, France.

Les limons sableux éoliens de Matmata (Tunisie) sont réputés être des "loess péridésertiques" provenant du Grand Erg Oriental, à l'Ouest.

Je me propose de montrer que, au contraire, ces limons sableux proviennent, non pas du Sahara, mais des steppes et sebkhas du Noprd. Ceci à partir d' *arguments minéralogiques:*

- le cortège de minéraux lourds des limons sableux de Matmata ressemble beaucoup à celui des Grands Chotts (= sebkhas) situés plus au Nord,
- les limons sableux contiennent du gypse et de l'attapulgite, comme le remplissage des Grands Chotts,
- les limons sableux continnent de la glauconie qui ne peut provenir que du Nord.

arguments géomorphologiques:

- les limons sableux n'existent que sur les versants tournés au Nord, voire à l'Est, ou sont plus épais sur ces versants,
- la déflation a atteint 10 à 20 m sur les Grands chotts depuis la dernière phase lacustre,
- enfin, toutes les études indiquent que, comme aujourd'hui, les vents dominants efficaces sont restés de secteur Nord au cours du Pléistocéne moyen à supérieur.

GEOMORPHOLOGICAL ASPECT OF LANDUSE OF LOESS-PADING LANDSCAPE

Yatsukhno, Valentin, Department of Geography, Byelorussian State University, Minsk, 220080, Belarus

Loess plains within Belarus occupy nearly 10% of the territory and belong to the typical periglacial geomorphological types of relief. The structure-functional peculiarities and morphological aspect of the landscapes are determined by the presence of thin rock mass (1-10m) of cover deposits in the form of loess rocks and loesses. Their levelling role is revealed in considerable smoothing of an initial knob-and-kettle moraine relief to a slightly rolling or occasionally flat landscape. Valley-side slopes of rivers are noticeably complicated by deeply cutting-in gully-balka systems for which a slightly denudation profile of balance is characteristic. On the watershed territories suffosing padings are widely spread. They are not deep (0.1-1.0 m), nearly circular, locked subsidences with an area of 0.1 to 1.5×10^3 m^2. The quantity of padings is determined by a degree of the micro- and mezorelief formation, drainage of elementary catchment basins, thickness of loess deposits and is equal on average to nearly 500 padings per km^2.

The pading microrelief of loess plains is a decisive factor of sharp spatial differentiation of soil-ecological conditions. Each pading, with its catchment basin areas, divides loess territories into relatively isolated locations, giving them a cellular character. The morphology of this landscape excludes the formation of large agricultural fields within the loess-pading landscapes and does not allow for hydroreclamation. Proper management of these natural loess areas will alow for the development of ecologically stable agrolandscapes, excluding the development of erosion, suffosion and land subsidence processes.

FIELD EXPERIMENTS ON THE ROUTING OF RUNOFF AND SEDIMENT ON A COMPLEX SLOPE IN THE HILLY LOESS REGION, CHINA.

S.H. Luk, University of Toronto, Erindale Campus, 3359 Mississauga Road, Mississauga, Ontario, Canada L5L 1C6; Q.G.Cai, Department of Geomorphology, Institute of Geography, Chinese Academy of Sciences, Building 917, Datun Road, Beijing, China 100101; G.P. Wang, Shanxi Institute of Soil and Water Conservation, Lishi, Shanxi Province, China.

The hilly loess region in North China is one of the most severely eroded areas of the world. To gain detailed knowledge of the range of erosion processes, and the spatial interaction of slope processes, large scale field experiments covering an entire hillslope were conducted on a complex slope in the hilly loess region, Lishi, Shanxi Province during 1990 and 1991. In the large plot with dimensions of 30 m long and 8 m wide, the slope units commonly observed in the hilly loess region -- a gentle upper slope (0-3°), a steep middle slope (15°), and a very steep lower slope (42-50°) -- are represented. Thirty SPRACO full cone jets arranged in 6 rows spaced 4 m apart were used to deliver simulated rainfall at a controlled intensity of 60 mm/h.

Two porous galvanized steel bridges spanning the entire width of the plot and positioned to measure runoff and sediment transport at the lower end of the upper slope and the middle slope at 5 m and 15 m respectively from the upper end of the plot were installed. Runoff and sediment concentration of rill flow and interrill flow were sampled every two minutes. Hydraulic parameters of flow width, depth, and velocity were monitored as well. At the outlet of the plot, a manually controlled tipping bucket with a capacity of 87 L per tip was installed to monitor total plot runoff continuously. In total, five experiments in 1990 and five in 1991, each lasting 60 minutes, were conducted. A range of antecedent soil moisture and surface conditions were represented.

Previous field monitoring shows that where upslope runoff reaches the lower slope, contribution of runoff and sediment by the lower slope is increased by 2.4 and 4.4 times respectively. Results from the field experiments show that for the given slope length and constant rainfall intensity, runoff and sediment load from the upper and middle slopes did not reach the lower slope until 20 to 25 minutes after the beginning of the storm. This coincides in a general way with widespread rill development on the middle slope. When upslope contribution reaches the lower slope, runoff rate and sediment concentration measured at the plot outlet were increased by an average of 2.5 and 5.0 times respectively.

These observations suggest that in the hilly loess region, erosion occurs quite frequently during low to medium magnitude events on the upper and middle slope, but localized deposition at the lower end of the middle slope produced a short concave segment. During high magnitude events, due to runoff contribution from the upper and middle slopes, erosion of the concave segment by deep rilling and shallow gullying on the lower slope occurred. Hence, sediment contribuited by the entire slope in the high magnitude events is sharply increased due to spatial interaction of slope processes.

MODELLING LANDFORM - SOIL RELATIONSHIPS IN LOESS AREAS OF SOUTH-WEST GERMANY USING GIS TOOLS

Guendra, Hartmut; Hoffman, Klaus; Dikau, Richard, Department of Geography, University of Heidelberg, Im Neuenheimer Feld 348, D-6900 Heidelberg, Germany

Landform morphometry and its determining function on soil distribution is one of the prerequisites applied to soil mapping. Pedologists use morphometrical attributes such as position on slope divergence, convergence and slope angle to draw conclusions on the distribution on soils. Soil mapping is time-consuming and expensive. Therefore, it is convenient to investigate the postulated relationships by means of landform attributes deduced from digital elevation models. To this end research is conducted in cooperation with the Geological Survey of Baden-Württemberg in loess areas in south-west Germany to record quantitative relations between morphometry and soil distribution. The compilation of an empirical model which describes micro- to mesoscale soil distribution is of primary interest.

The result of the soil mapping at scale of 1:10,000 in two selected study areas with relatively homogeneous vegetation and subsurface material are combined with the results of the morphometrical landform analyses based on digital elevation models in 10 m resolution by using probability analysis. fifteen morphometrical attributes have been used in the investigation including slope angle, plan and profile curvature, size of catchment areas, and distances to watershed and drainage lines.

To combine model parameters, GIS tools (IDRISI) and a statistical analysis system (SAS) have been used on a PC.

The results can be summarised as follows:

Colluvisols, cambisols and pararendzina are highly affected by runoff divergencies and runoff convergencies, plan and profile curvature, as well as by the size of the catchment area of the slope points. Concerning the pattern of soil distribution, slope angle is less significant. Expectedly, the tendency of colluvisols development raises according to diminishing distances and vertical differences towards the drainage channels.

SLOPE-DEPOSITS AND THEIR INFLUENCE ON THE SOILS

Kleb... Arno, Chair of Geomorphology, University of Bayreuth, Germany

Most textbooks on pedogenesis stress the importance of the relief as a pedogenic factor. However, when it comes to the explanation of soil types and their distribution, information on this relationship is usually restricted to simple morphometry. In fact, the influence of the relief on the soils also includes past geomorphic processes; in particular the accumulation of slope-detritus (cover-beds) may have modified the composition of surficial substrata decisively: such beds consist of allochthonous material – upslope-saprolite, often eolian fines – therefore differing in their composition from local bedrock. They are usually separated from each other and from bedrock by conspicuous disconformities significantly affecting pedogenesis, for instance through water-conductivity.

Evidence for soils largely influenced by their stratified parent-materials can be demonstrated in Germany. Up to three cover-beds are distributed in a relief-dependent, predictable, manner. They affect the soils through disconformities and through their inmixed loess, buffering processes such as podzolization while supporting others such as oxidation or depletion of clay. Cover-beds that are dominated by loess may even decouple pedogenesis from bedrock-influence entirely, leading to Alfisols regardless of the underlying bedrock.

In the area of Moscow, Russia, stratified soils occur as well. Inmixed loess is widespread, so that Alfisols, partly with stagnic properties, dominate throughout. In southern France, loess has less influence on the soils, leading to a lack of Alfisols, while soil-properties are affected by the permeability of the cover-beds, mainly controlled by the content of reworked older, intensely weathered soils. In south-central Turkey, the ubiquitous influence of loess leads to quite uniform soils overlying any type of bedrock. These soils formed from several cover-beds during several phases of clay-translocation, each accompanied by an accumulation of carbonate in the respective subsoils. While doing so, the carbonate enrichment from the upper soils superimposed the properties of the respective lower ones. Thus, the major cover-beds are separated by soil-forming intervals. Similar relationships may be found in the northern Great Basin, USA, and its rim.

In conclusion, stratified soil-parent materials are not random within one area. They are distributed and connected to each other in a predictable manner. They contribute significantly to the understanding of soil-properties.

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A POSSIBLE EOLIAN DEPOSIT IN MICHIGAN'S UPPER PENINSULA

Schaetzl, Randall, J., Department of Geography, Michigan State University, East Lansing, MI 48824-1115, U.S.A.; Liebens, Johan, Department of Geography, Michigan State University.

We present data that document the existence of thin, spatially discontinuous deposits of eolian silts and fine sands in the western portion of Michigan's upper peninsula (UP). Maps of the surficial geology of this region show only glacial drift, with thin deposits of Peoria loess in the extreme SW portion of the region, well south of our study area.

We studied soils and surficial sediments from 25 sites in and near the Peshekee Highlands. This region is dominated by glacially scoured and abraded crystalline rock uplands, with deep, drift-filled valleys. It is bounded by the Yellow Dog Plains (glaciolacustrine plain with a veneer of outwash) on the north, the Mulligan Plains (outwash) to the east, the Baraga Plains (outwash) to the west, and the Keewenaw moraine to the northwest (which lacks the silt cap). The southern limit of this region is more difficult to define, as drift thickness and local relief concomitantly diminish in a southerly direction.

On bedrock uplands in the Peshekee Highlands, 40-60+ cm of silty sediments overlay either hard bedrock or cobbly sandy loam and loamy sand glacial till. The profile mean weighted particle size of the eolian cap ranges from 170-225μ across the region, which places most of the sediments in silt loam or fine sandy loam textural classes (USDA system). Total silt contents range from 40 to)50%. The great majority of the silts are in the coarse and medium subfractions. The silt "cap" contains from 0 to 20% coarse fragments by weight. Most of the fragments are assumed to have been frost heaved from the till below since few are found where the silts immediately overlay bedrock (no till substratum). SEM analysis of silt grains from the presumed eolian materials support the contention that they have been transported by wind, and are not a type of flow till, lacustrine deposit, or diamict, as has been suggested informally by others.

PROBLEMS IN THE STUDY OF EXOGENIC MORPHOGENESIS OF LOESS TERRITORY: AN EXAMPLE FROM THE TRNAVA HILLYLAND, SLOVAKIA

Stankoviansky, Milos, Institute of Geography, Slovak Academy of Science, 81473 Bratislava, Stefanikova 49, Slovak Republic.

In this paper problems concerning the study of exogenic morphogenesis of loess environments is presented using the table-like part of the Trnava Hillyland in the Danube Lowland as a field example.

Six groups of processes have been related to the exomorphogenesis of this region during the Würm and the Holocene. These processes include: gravitational, cryogravitational (particularly during the Würm), pluvial, fluvial, aeolian, subsurface water and anthropologic disturbancess. These processes resulted in creation of numerous depressional and elevational landforms, such as valleys with well developed flood-plains, abandoned valleys, dell-like valleys, dells, dell-like linear lowerings, closed depressions, linear elevations and dunes.

Characteristic features of some of the above mentioned landforms is their polygenetic origin. Wind, gravity, regelation, subsurface water and surficially running water took part in their development. However, determination of the relative importance of individual processes in the development of these landforms is problematic. Related to this is the question of what length of time individual processes operated within these landscapes. This is particularly relevant when considering aeolian processes.