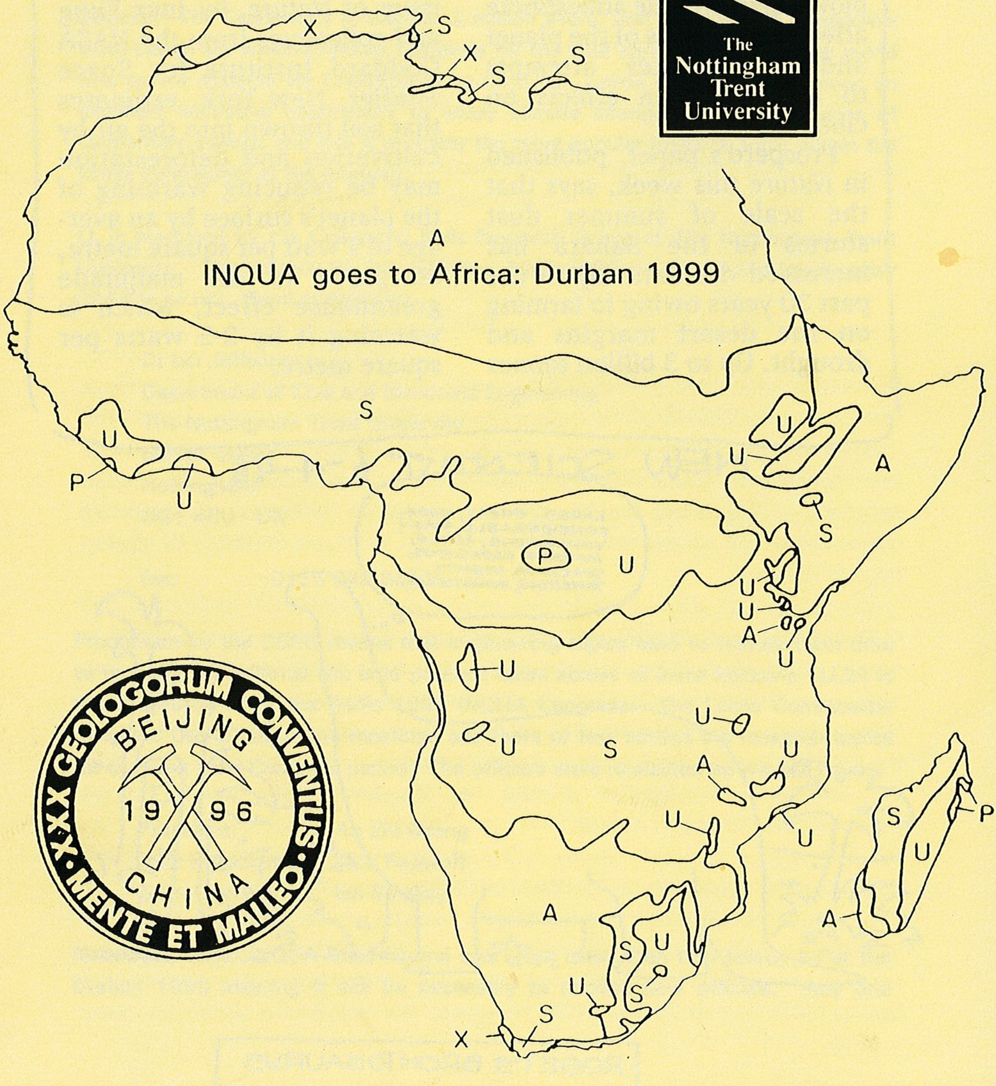
LOESS LETTER 35

APRIL 1996 ISSN 0110-7658

The Nottingham Trent University



INQUA goes to Africa: Durban 1999

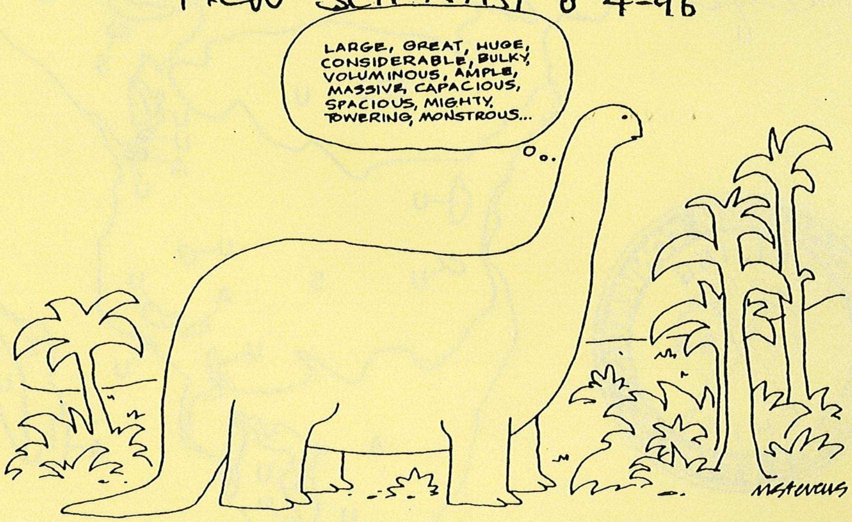
XXX GEOLOGORUM CONVENTUS · MENTE ET MALLEO ·
BEIJING 1996 CHINA

DUST blowing west from the Sahara is shielding parts of North and Central America from global warming. Joseph Prospero and colleagues from the University of Miami says the cooling effect from dust blown high into the atmosphere affects other parts of the planet and "complicates attempts to assess human effects on climate".

Prospero's paper, published in *Nature* this week, says that the scale of summer dust storms in the Sahara has increased dramatically in the past 30 years owing to farming on the desert margins and drought. Up to 3 billion tonnes of mineral dust is blown into the air worldwide from deserts and soils each year. This adds to the cooling effect of sulphate pollution from power plants, which scatters sunlight and slows warming in some industrialised regions of the world.

Another paper in the same issue of *Nature*, by Inez Fung and colleagues from the NASA Goddard Institute for Space Studies, New York, estimates that soil thrown into the air by cultivation and deforestation may be reducing warming of the planet's surface by an average of 1 watt per square metre, compared to the manmade greenhouse effect, which is warming it by 2·5 watts per square metre.

NEW SCIENTIST 6-4-96



ROGET'S BRONTOSAURUS

Contemplates the Loess Literature

Loess Letter 35 : April 1996

Loess Letter (LL) is the newsletter of the INQUA Loess Commission. INQUA is the International Union of Quaternary Research, which encourages and correlates research and investigation on Quaternary topics, within the ICSU framework. ICSU is the International Council of Scientific Unions which looks after world-wide science. The Quaternary is the last 2 million years, and loess is that remarkable wind-blown silt which provides the basis for the best agricultural soil in the world (the parent material for Chernozems to form in). Loess stratigraphy provides an excellent terrestrial opportunity to study climate change and the sequence of Quaternary events, and this is probably the most popular research topic within the Loess community at the moment.

LL is produced by the Collapsing Soils Research Group at The Nottingham Trent University. The editors are Ian Jefferson (civ3jeffei@ntu.ac.uk) and Ian Smalley (ijs4@le.ac.uk). Send material to:

Dr Ian Jefferson
Department of Civil and Structural Engineering
The Nottingham Trent University
Burton Street
Nottingham
NG1 4BU UK

fax: 0115 948 6450

Production by the CSRG means that engineering topics tend to feature from time to time but the editorial aim is to produce news across all loess horizons. LL35 is the first issue since the Berlin 1995 INQUA Congress. The Loess Commission held two useful discussion meetings and more or less settled the research topics for the next Inter-Congress period. The officers were re-elected so we still have:

President:	An Zhi-Sheng
Vice President:	Nick Fedoroff
Secretary:	Ian Smalley

Note that, under INQUA rules no-one can serve more than two terms, so at the Durban 1999 meeting it will be necessary to choose new officers. Any one interested should contact the President. In fact for all matters of Loess Commission policy the President should be consulted:

Professor Dr An Zhi-Sheng
Xian Lab of Loess and Quaternary Geology
3 Xiao Zhai East Road
Xian 710061 Shaanxi, China

Fax: 86-29-526 2566

Any general queries related to INQUA should be directed to the INQUA Secretary:

Professor Dr Sylvi Haldorsen (Sylvi.haldorsen@ijvf.nlh.no)
Department of Soil and Water Sciences
Agricultural University of Norway
PO Box 5028, N-1432 Aas, Norway

Fax: +47 64 94 82 11

Dr Haldorsen has been gathering in proposals for research projects to be pursued by the various INQUA Commissions in the 1995-1999 period. The Loess Commission sees a two track approach developing in loess research. The major topic (organised by An Zhi-Sheng) will concern climate change and climate dynamics; the other theme will be engineering problems, in particular hydrocollapse and subsidence (correlated by CSRG in UK and Professor Dr Marton Pecsi in Hungary).

LL35 is the last issue before the International Geological Conference in Beijing in August 1996. LL will be circulated at IGC and there will be a session on loess within the Engineering Geology programme. Loess will be discussed at the "Windy Day" meeting at Nene College, Northampton, UK on 8 May 1996 and at the GeoComputation Conference at Leeds University, UK in September 1996. An Inter-Congress discussion is planned for the International Geomorphology Conference at Bologna in August 1997.

LL35 is full of good things. The flood of loess publication continues. These are good times for loess investigators (largely because of the major efforts of the indefatigable Ed Derbyshire - who managed to be INQUA Secretary <u>and</u> drive loess research along at an unprecedented rate). LL congratulates Vojen Lozek and George Kukla on their 70th and 65th birthdays. We reproduce a valedictory essay by Vaclav Cilek from Geolines 1995, No 2. Contents and extracts from three loess volumes are included. These three loess volumes illustrate very effectively the range of currently active regions of loess investigation: The NATO volume on loess engineering, Quaternary Proceedings 4 and Quaternary Science Reviews 14 (7/8) on wind blown sediments in the Quaternary record.

At the Berlin 1995 INQUA meeting all the Commissions were considered and assessed, and a new scheme was devised whereby the Commissions would promote and pursue actual research projects, rather than just providing general support for an area of Quaternary interest. The Loess Commission did quite well in the assessment, and we would like to perform well in the Inter-Congress period. So publish your papers, circulate your reprints, have ideas and insights - above all communicate and disseminate. Loess research is a world-wide activity - make sure that as many people as possible know what you are doing.

That list of names that you encounter is the list of loess specialists in North America, reprinted from Quaternary Research. Everyone on this list received a copy of LL34. What we need is a similar list of loess specialists for Europe, Asia, Africa, Australasia and South America.

IGCP news. the new chair of the Science Board of the International Geological Correlation Programme IGCP is Prof. E. Derbyshire (already mentioned); for the period 1996 - 1998. He is currently involved with the direction of IGCP 349 - the Desert Margins project. This will now be carried on by Drs Singhvi and An Zhi-Sheng.

Call for papers. A special issue of the journal Engineering Geology is being prepared. the current title is "Collapsing Soils: Problems of Hydroconsolidation and Shallow Subsidence" - and it will obviously be largely about loess. Send proposed titles and abstracts to Dr Ian Jefferson at Nottingham Trent University. We hope to build on the success of the NATO book. Further ahead, a symposium on 'Collapsing Soils' is planned for the Durban 1999 INQUA meeting, as part of the Loess Commission 's contribution.

INQUA goes to Africa: Durban 1999 (see front cover). The map is from 'Soils of the Tropics: Properties and Appraisal' by Armand van Wambeke (McGraw-Hill 1992) and shows moisture regimes in African soils: A Aridic, S Ustic, X Xeric, U Udic and P Perudic. Where is the loess? still a matter of dispute for this continent.

ETERNAL UNDERTAKING
永恒的事业

—Dedicated to the 30th International Geological Congress
—献给第三十届国际地质大会

Words by: Wang Milly 王弭力词
Music by: Lei Lei 雷蕾曲
English translation by: Wang Fengxin 王逢鑫译
First sung by: Guan Mucun 关牧村首唱

GEOLINES (Praha), 2 (1995)

On the restless maturity of the Great Story Teller[1] and also on the adventurous life of the Lover of the loess profiles

Václav CÍLEK

Geological Institute AS CR, Rozvojová 135, 165 00 Praha 6, Czech Republic

Quaternary Geology as a systematically studied scientific field has been brought to us in the Second World War by the German geologists. They knew the subject well, because in the northern half of Germany hardly any geologic formation exists other than the Quaternary, and also because it is a discipline particularly useful in the projecting of highways or of large agronomic constructions.

V. Ložek at that time, although still a high school student, was a dedicated malacozoologist. He gathered snails from much of central Bohemia. Against the warning of Prof. Julius Komárek: "Don't get involved with those 'Boulder men'", he began studying fossil malacofaunas. He quickly realized that a small snail can not run away too far, and that therefore it can be affected by even minor changes of environment. Gradually he laid a foundation to an important field of paleoenvironmental analysis (he has been nominated a honorary member of the Philosophical Society in Cambridge and got the medal of A. Penck).

The archeologist F. Prošek initiated him[1] in the knowledge of prehistoric cultures and stratigraphy, and because at that time they frequently visited the Czech Karst, they used to meet regularly Jiří Kukla. In those days Kukla was an enthusiastic speleologist, who codiscovered a good part of the Koněprusy caverns, almost drowned in the underground lake in the Bozkov cave and led several adventurous expeditions into the badlands of southeastern Slovakia. Together[2] they got particularly interested in the loess sections with embedded soils and paleolithic artifacts. They documented tens of sections which do not exist any more, described their main features and realized that there had been a large number of ice advances, each of them a bit different than the others, and that the whole Quaternary system[3] was incomplete. V. Ložek meantime spent ten years busily traveling through Czechoslovakia, charting deposits of natural fertilizers. In every sheet of the 1:100,000 map he visited the most important Quaternary localities and so became familiar with most hills, valleys and settlements of Czechoslovakia. Furthermore he memorized the geographic settings so well, that a Hungarian from Hrušov would frequently mistake him for his compatriot, same as a guy born in Zábrdka valley. When my wife told him that she was born in Sopreč, postal district Vápno[4], she expected the usual amused reaction, but certainly not a brief information on the neighboring villages Vlčí Habřina, Žáravice and Strášov, accompanied by a brief evaluation of the neighboring important localities of Quaternary sediments.

With the demise of small brickyards V. Ložek dedicated more and more of his time to the karst sediments. Kukla's whereabouts were more adventurous. He worked as a geologist in Cuba and nearly got shot dead at night at sea, mistaken for an American intruder. For several years his boss was Che Guevara ("quite a fine chap, but it was impossible to talk politics with him"). After the Soviet occupation in 1968 he tried to get to the West. Kukla's history at that time was revealed to me by the legendary classic of the world of Quaternary geology, Rhodes Fairbridge, an Australian, known for his past as a military intelligence officer. Just in passing, let me mention his trip on the 19th of August, 1968, from Berlin to Prague, at which he was passing convoys of military vehicles. He told me: "In Prague I immediately visited the CIA representatives and told them that the occupation was starting. They answered that they did not know anything about it and that I saw probably the regular autumn maneuvers. Later they published a communiqué that the action of the five armies took them by surprise, because they didn't get any advance information."

But back to our story: Fairbridge explained to me: "We were exceptionally interested in Kukla. We drilled extensively in the ocean but didn't know the situation on the land. In the ocean it looked like 17 interglacials. Seventeen calcareous dunes were also found in Australia, and Kukla reported 17 fossil soils in the loess at Red Hill in Brno[5]. The number 17 was more or less a coincidence, but then it all fitted nicely together. Kukla, however, declined to depart to USA without his wife Helena. Complicated dealings with the Ministry of Exterior lasted almost a year. Finally we made a deal. We exchanged Kukla for one excellent American surgeon, who helped stabilize the health of the then president Ludvík Svoboda." Kukla himself doesn't know about this action. However, the fact is that among the group of the 50 foreign scientists whom the Americans tried to get for permanent residence through an NSF project[6], there were Brits, Mexicans, a few Russians, one Bulgarian, and also Kukla.

In the USA he quickly realized that with his Czech style he wouldn't survive. He organizes symposia, writes, lectures. He warned President Nixon on climate changes. He was at the birth of the Greenhouse Effect action, originally planned more as a way to get money for continuing research. It later got out of hand because of the media. In the Antarctic, near the South Pole, he fell into an ice crevasse and almost froze to death; in Argentina he nearly killed a certain minister by the Czech Francovka[7]. He dives in the Cayman Islands, studies corals at Barbados, he cores in Chinese loesses and in Ukrainian lakes. He takes part in every important climate action, knows everybody, testifies in Congress, exchanges opinions with Al Gore[8].

Ložek meantime studies at home, and he is at home everywhere, where Czech or Slovak is spoken. And he publishes, writes more than Jaroslav Vrchlický but less than Jirásek[9] – almost 800 papers, including three principal monographs, and takes part in several tens of other works. His citation record compares to half of an average institute. He is curious and still roams through Bohemia digging dirt. He doesn't organize, doesn't attend meetings, doesn't like to answer letters. Several directorates of nature parks tried to get him into permanent inventory under the motto: "Ložek as a regional phenomenon", but he keeps escaping. His mobility even led to a hypothesis that there are several Ložeks, and each one works hard on a different profile.

Also, Jiří, today George Kukla, continues his restless life between New York, Dolní Věstonice and Tibet. His first love, Miss Kmentová[10], was an innkeeper's daughter in a restaurant of the 4th price-group[11], and it is in similar establishments where Jiří is still today recharging his legendary criticism and insight.

Ložek and Kukla are characterized by their great field experience and knowledge of nature, capability of making startling syntheses, busy publishing activity, and selfless sharing of personal findings with the community at large. Apart of that they display a certain wisdom. Thank God for such people!

Notes:

(1) – meaning Ložek; (2) – meaning Prošek, Ložek, and Kukla; (3) – as understood at that time; (4) – small unknown, middle of nowhere hamlets; (5) – this is a mistaken information. The reference should be to 8 glacial – interglacial cycles within the Brunhes chron of normal polarity; (6) – the Senior Foreign Scientist Award of the US National Science Foundation; (7) – the alcoholic lotion for massaging; (8) – current USA vicepresident; (9) – prolific early Czech belletrists; (10) a first grade school classmate; (11) – the cheapest and usually dirtiest bars and restaurants.

Loess: ANDERSON, Robert S., BEGÉT, James E., BETTIS, Arthur E., BURNS, Scott F., BURRAS, Lee, DARMOODY, Robert G., DECHERT, Thomas V., DIFFENDAL Jr., DORT, Wakefield, Jr., Robert F., FALEN, Anita, FOLLMER, Leon R., FOSBERG, Maynard A., GASTON, Wilbert P., HAJIC, Edwin R., HALL, George F., HALL, Robert D., HAYNES, C. Vance Jr., HOBBS, Howard C., HOLLIDAY, Vance T., HUDNALL, Wayne H., HUMMELL, Richard L., JACOBS, Peter M., JOHNSON, W. Hilton, JONES, Robert C., KUKLA, George J., LEIGH, David S., LOHSE, John S., MARTIN, Charles W., MARTIN, Larry D., McCOY, William D., McKAY, Donald E., MILES, Randall J., MIRECKI, June E., MORRISON, Roger B., MUHS, Daniel R., MURPHEY, Joseph B., OCHES, Eric A., PÉWÉ, Troy L., PIERCE, Kenneth L., PORTER, Stephen C., REYNOLDS, Richard L., RICHMOND, Gerald M., RIGGS, Karl A., RODBELL, Donald T., RUTTER, Nathaniel W., STEWART, J. D., TANDARICH, John P., THOMAS, Jerry A., TOUCHET, B. Arville, WADE, Steven L., WYSOCKI, Douglas A., ZELLER, Edward J.

Vol. 14 Nos 7–8 1995 ISSN 0277-3791

QUATERNARY SCIENCE REVIEWS

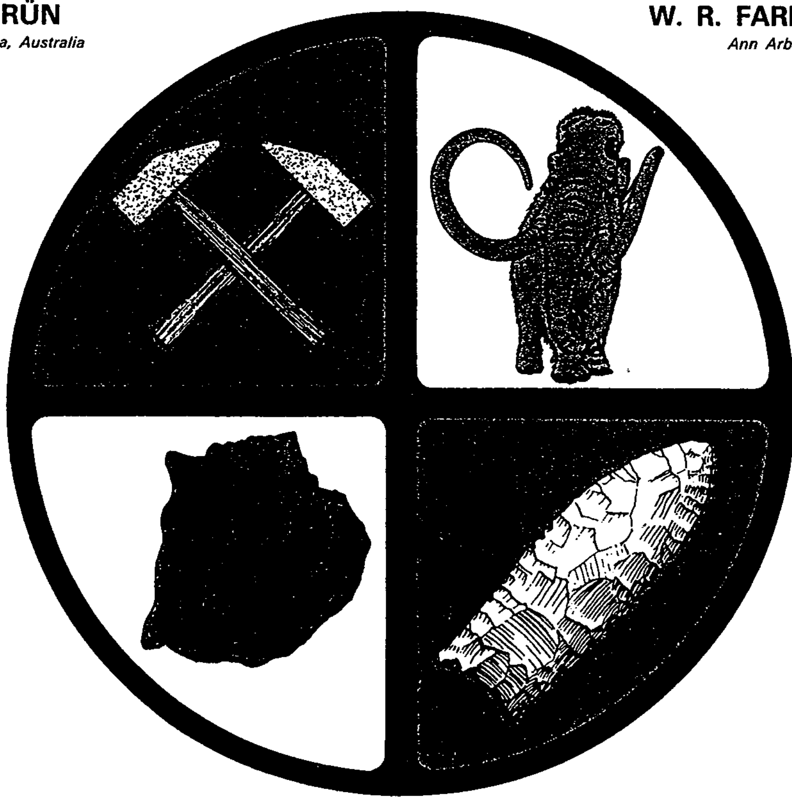
The International Multidisciplinary Research and Review Journal

ICP-349

AEOLIAN SEDIMENTS IN THE QUATERNARY RECORD

Guest Editor

EDWARD DERBYSHIRE



QUATERNARY SCIENCE REVIEWS
The International Multidisciplinary Research and Review Journal
Volume 14 Numbers 7–8 1995

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Pergamon

Quaternary Science Reviews, Vol. 14, pp. 653–667, 1995.

0277–3791/95 $29.00

0277–3791(95)00047–X

THE NATURE, ORIGIN AND ACCUMULATION OF LOESS

K. PYE

Postgraduate Research Institute for Sedimentology, University of Reading, Whiteknights, Reading RG6 2AB, U.K.

Abstract — Loess can be defined simply as a terrestrial clastic sediment, composed predominantly of silt-size particles, which is formed essentially by the accumulation of wind-blown dust. There are three fundamental requirements for its formation: (1) a sustained source of dust, (2) adequate wind energy to transport the dust, and (3) a suitable accumulation site. Most loess has been modified to some degree by local reworking, bioturbation and syn-depositional weathering, but a process of 'loessification' is not necessary for a dust deposit to qualify as loess. The terms 'primary loess' and 'secondary loess' have previously been used to describe wind-deposited loess and redeposited loess, respectively, but it is more accurate to describe material reworked and redeposited by non-aeolian processes as 'loess-derived colluvium' or 'loess-derived alluvium'. During the Quaternary, loess formed in three main situations: (1) mid-continental shield areas beyond the limits of ice sheets (periglacial loess), (2) on the margins of high mountain ranges (perimontane loess), and (3) on the semi-arid margins of some lowland deserts (peridesert loess). Peridesert loess is relatively poorly developed partly due to the limited efficiency of silt-generating mechanisms in lowland deserts compared with glaciation, but also important is the tendency in arid areas for dust to be dispersed over a wide area and to be rapidly reworked after deposition, particularly in areas which experience frequent climatic changes. The remarkably thick loess of China and Central Asia results from an unusual combination of conditions which has persisted for much of the last 2–3 million years, namely rapid uplift of the Tibetan Plateau and surrounding mountain ranges, high rates of sediment production and supply to adjacent basins, a strong northwesterly and westerly wind regime, and the existence of effective dust traps downwind of the source regions.

QSR

INTRODUCTION

The past two decades have seen an unprecedented growth of interest in the palaeoenvironmental significance of aeolian dust deposits preserved in deep sea sediments, ice caps and terrestrial loess–palaeosol sequences. Such deposits potentially provide an important source of information about changes in the extent and intensity of continental aridity, the extent and timing of glaciations, and variations in global atmospheric circulation. Aeolian sediment records also provide evidence which can be used to test palaeoclimatic reconstructions produced using global climate models. In the case of deep sea dust records, two main sedimentological properties have been used in this connection, namely the lithogenic mass accumulation rate (MAR), which provides a proxy measure of continental aridity, and lithogenic median grain size (MGS), which has been used as a proxy measure of mean wind strength (e.g. Rea and Leinen, 1988). In studies of terrestrial loess–palaeosol sequences, a range of other sedimentological, pedological and geochemical properties have been used as proxies for regional atmospheric circulation and climatic conditions, including the silt/clay ratio, calcium carbonate content, total organic carbon content and various elemental ratios. However, reliable interpretation of the palaeoenvironmental significance of these data requires an adequate understanding of the factors which govern the availability, transport, deposition and post-depositional modification of dust. This paper presents a brief review of these aspects with particular reference to loess deposits.

THE NATURE OF LOESS

The term *loess* is derived from the German word *löss* (meaning loose) which is reported to have been first used by von Leonhard (1823–4) to describe friable, silty deposits along the Rhine Valley near Heidelberg (Kirchenheimer, 1969). Lyell (1834) brought the term into widespread usage and was responsible for stimulating interest in similar deposits. While visiting North America in 1845–6, Lyell observed the loess along the Mississippi Valley and noted its similarity with that along the Rhine, concluding that the deposits in both areas were probably of fluvial origin (Lyell, 1847). The importance of wind in transporting dust from Africa over the Atlantic Ocean and Europe had been recorded by at least the late eighteenth century (Dobson, 1781; Darwin, 1846; Ehrenberg, 1847), and in China the relationship between wind-blown dust and loess, known locally as *huangtu*, was understood more than 2000 years ago (Liu Tung-sheng, 1985). However, the aeolian origin of loess did not become widely accepted in the west until the publications of von Richthofen (Richthofen, 1877–85, 1882). In Russia, the importance of wind in loess genesis was

Pergamon

Quaternary Science Reviews, Vol. 14, pp. 669–680, 1995.

0277–3791/95 $29.00

0277–3791(95)00048–8

GLACIAL COMMINUTION OF QUARTZ SAND GRAINS AND THE PRODUCTION OF LOESSIC SILT: A SIMULATION STUDY

JANET S. WRIGHT

Department of Geography and Topographic Science, University of Glasgow, Glasgow G12 8QQ, U.K.

Abstract — Traditional views have attributed the formation of loess-sized quartz silt particles to glacial processes. Glacial grinding was considered to be the only mechanism capable of producing loessic silt in the quantities necessary for the formation of loess deposits. This idea has been strengthened by the apparent close association between present or former glacierised regions and major global loess deposits. However, some doubts exist as to whether or not glacial grinding is capable of producing sufficient quantities of quartz silt. Because of the difficulties entailed in the observations and direct measurement of subglacial abrasion and crushing, this paper describes and discusses the results of a simulation study designed to examine abrasion and size reduction of quartz grains under "grinding" conditions analogous to those experienced in a subglacial environment. The findings from these experimental runs suggest that, although particle breakage and comminution does occur, little silt-sized material is actually produced. The amount of silt produced ranges from approximately 9% of the original sample in one experimental run to less than 1% for the other seven runs. It is suggested that the results obtained may show considerably less abrasion and loessic silt production than may be expected to occur within a natural subglacial environment because: (1) subglacial grains experience much greater overburden pressures for much longer periods of time; (2) the use of sand-sized grains may represent a stable component resistant to further size reduction through crushing or abrasion; and (3) the use of a monomineralic sample of relatively sound quartz grains. Although care must be taken when relating results obtained from these experimental runs to silt production within a glacial environment, findings from this work do question whether large amounts of quartz silts are produced within subglacial environments. The importance of glacial processes in the formation of loess deposits may lie in the reworking of pre-existing sediments by ice rather than the actual production of vast quantities of silt. This in turn suggests that care should be taken in the interpretation of the provenance of particles comprising loess deposits.

QSR

INTRODUCTION

As with all sedimentary deposits, three basic stages are involved in the formation of a loess deposit:

(1) Particle formation.
(2) Particle transportation.
(3) Particle deposition.

It is now almost universally accepted that the great majority of loess deposits are formed from material which has been transported by the wind. However, the provenance stage of loess deposits has been somewhat neglected, and the mechanisms of actual loess-sized particle formation remain less clear.

Since the nineteenth century it has been recognised that glaciers may play a key role in producing material necessary for some loess deposits. For example Lyell (1863, quoted by Smalley, 1975) believed that "during the glacial period the Alps were a great centre of dispersion, not only of erratics.......but also of very fine mud", and Tutkovskii (1900, quoted by Smalley, 1978) felt that "the normal löss......is as truly a product of the old inland ice as are moraines, osars, erratics, striae etc." Smith and Norton (1935) considered the action of glaciers to be crucial to the formation of loess-sized particles, and they defined loess as "the sediment which is deposited in the bottom lands from streams carrying water from the melting glaciers and then picked up and redeposited in the uplands by the wind". This idea was followed up by Smalley (1966), who felt that loessic silt particles could be produced by the direct action of glaciers on the underlying bedrock. Essentially, bedrock is pulverised by glaciers producing predominantly sand-sized debris which is then further crushed subglacially to give a wide range of particle sizes with some falling into the loess-size range.

As most of the major loess deposits of the world tend to be associated with the Pleistocene glaciations, Smalley and Vita-Finzi (1968) concluded that glacial grinding was the only mechanism capable of producing loess-sized quartz silt. Boulton (1979, p. 19) added support to this argument by stating that "considerable comminution is produced at the interface between large clasts and the bed, which results in production of fine sand and silt rock flour, and may be the single most important source of silt".

In this paper the results of experiments designed to simulate the subglacial abrasion of quartz sand grains will be presented and discussed. Debris transported by glaciers is derived from two principal sources:

(1) Supraglacially from nunataks and valley sides.
(2) Subglacially from the glacier bed.

Genesis and Properties of Collapsible Soils

Edited by

Edward Derbyshire (Editor-in-Chief),
Tom Dijkstra and Ian J. Smalley

NATO ASI Series

Series C: Mathematical and Physical Sciences – Vol. 468

Genesis and Properties of Collapsible Soils

edited by

Edward Derbyshire (Editor-in-Chief)
Department of Geography,
Royal Holloway, University of London,
Egham, Surrey, U.K.

Tom Dijkstra
and
Ian J. Smalley
Centre for Loess Research,
Department of Civil Engineering,
Loughborough University of Technology,
Loughborough, U.K.

Kluwer Academic Publishers

Dordrecht / Boston / London

Published in cooperation with NATO Scientific Affairs Division

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TYPES AND DISTRIBUTION OF COLLAPSIBLE SOILS

C.D.F. ROGERS
Senior Lecturer in Geotechnics
Department of Civil and Building Engineering
Loughborough University of Technology
Leicestershire, United Kingdom

ABSTRACT. Collapsible soils are metastable and must have an open structure, that is the soil particles must be in an open packing which is capable of becoming a (significantly) closer packing. A granular material with angular particles compacted on the dry side of optimum can form a structure which is capable of significant further densification, but the classic collapsible soils are natural materials where the combination of particle type and sedimentation mechanism combine to give collapsibility. There is a fierce debate about what soils should be considered as collapsible and this has spawned several definitions of a collapsible soil, all of which are in some way limiting. The debate is advanced hereafter by consideration, from a geotechnical viewpoint, of what is *not* a collapsible soil. Thereafter a simple hierarchical, systematic classification can be produced which allows both compacted and natural materials to be included. A geographical classification which places all types of natural collapsible systems on a convenient base map is also required. This paper aims to address both of these issues by considering collapsible soils in their widest possible sense.

1. Introduction

This paper was written primarily to form a good starting point for discussions on the genesis and properties of collapsible soils, the paper constituting the first keynote talk to a NATO workshop on this topic [1]. The aim of the paper was to produce a critique, from a geotechnical engineering viewpoint, of the various attempts to classify collapsible soils in order that the types of collapsible soil encountered in practice could be defined. In considering the various types of collapsible soil that occur it is necessary to consider the genesis of these soils, which results in turn in a consideration of the distribution of the major deposits of collapsible soils worldwide.

In order to meet these primary aims, it was important that collapsible soils should be considered in their widest sense. It rapidly became clear that the subject is one which is addressed by researchers from numerous academic disciplines ranging from geotechnical engineers through engineering geologists, geologists, geomorphologists and sedimentologists to soil scientists. It is necessarily the case that the boundaries of study of these disciplines will limit the subject definition and that each will form a subset of the whole. It equally became apparent that geotechnical engineering provided the best vantage point from which to view these various subsets since it must become involved, at some point, in all natural and man-made soils. Nevertheless full

E. Derbyshire et al. (eds.), Genesis and Properties of Collapsible Soils, 1–17.

SIX DEFINABLE PARTICLE TYPES IN ENGINEERING SOILS AND THEIR PARTICIPATION IN COLLAPSE EVENTS: PROPOSALS AND DISCUSSIONS.

IAN JEFFERSON and IAN SMALLEY
Lecturers in Geotechnics and Engineering Geology, respectively,
Civil And Building Engineering Department,
Loughborough University of Technology,
Leicestershire, United Kingdom.

ABSTRACT. Six definable particle types need to be recognised in engineering soils. Failure to appreciate the true nature of soil and to treat soils crudely as a 'black box' has led to many different types of failures. The basic five types that need to be recognised are (related to the R-size diagram, see Figure 1) AA' active clay minerals, BB' inactive clay minerals, C fine cohesive primary minerals, D silt (at R approximately equals 1), E sand. We estimate that at about 200 microns and above the cohesive forces can be neglected, so that truly granular soils start at 200 microns and extend to 60 mm. We propose 60 mm as the upper limit of truly granular behaviour, which has been arbitrary chosen for the discussion purposes. From 50 to 200 microns we propose that a sixth definable sub-region type occurs, where R<1 but cohesive forces are still significant.

Many misconceptions have occurred because of oversimplification in soil type recognition. For example, a soil from region D was used as the core material of the Teton Dam and as such made a significant contribution to its collapse and failure. Quickclays have only recently been recognised as region C materials, having previously been considered as type A or B materials. This significantly delayed the understanding of their formation and failure modes. Collapsing soils occur in regions C, D and E; the basic requirements are inactive particles (usually primary mineral particles), an open structure (often by slow-fall sedimentation) and short range bonds. We have tentatively defined three ideal collapsing soils: Soar Sand (at point E), Loughborough Loess (at D) and Quebec Quickclay (at C). These are defined in structural and mineralogical terms only, for the purposes of discussion.

1. Introduction

The aim of this paper is to define six distinctive particle types in engineering soils, and to indicate which of them are involved in collapsing soil problems. There is a need to redefine the engineering descriptions of soils; simple divisions into sand, silt and clay, or cohesive and cohesionless normally used are no longer adequate. Not only are they inadequate in a purely descriptive sense, but they actually contribute to misunderstandings and bad practice, and hence can lead to geotechnical failures. We briefly discuss the St Jean Vianney landslide (1971) and the Teton Dam failure (1976)

E. Derbyshire et al. (eds.), Genesis and Properties of Collapsible Soils, 19–31.

A STRESS PATH MODEL FOR COLLAPSIBLE LOESS

RICHARD L. HANDY
Distinguished Professor Emeritus and Consultant
Department of Civil and Construction Engineering
Iowa State University
Ames, Iowa, U.S.A.

ABSTRACT. Stress paths were determined for loess *in situ* at two sites, from overburden pressures and from lateral stresses measured with the K_o Stepped Blade. K_o is as low as 0.1 to 0.3, compared with 0.4 to 0.5 for a normally consolidated silt soil. The K_o values are consistent with compression of a laterally confined solid having a low Poisson's ratio.

At the site farther from the loess source, the stress path inclines upward at 45°, indicating that lateral stress remained constant as vertical stress increased during loess accumulation. At a depth of 4 m, the stress path intersects the K_f failure line and abruptly turns downward, evidence for partial collapse of the loess under its own weight. Partial collapse increased the lateral stress and caused K_o to become much higher than would result from normal consolidation, becoming transitional to a value of 1.0 in the basal zone where the soil is fully collapsed and its moisture content is at the liquid limit. The potential settlement from saturation collapse may be estimated from the calculated decrease in soil volume as the moisture content decreases from a saturated field condition to the liquid limit.

At the site adjacent to the Missouri River floodplain source, the stress path is between the K_o line and K_f lines, indicating retention of a low lateral stress and high collapsibility throughout the depths tested.

1. Introduction and Review

The lateral stresses that exist *in situ* in soils can be of considerable value for interpreting soil stress history, that in turn affects engineering uses ranging from the determination of expansive or collapsible nature of the soil to predicting skin friction on pile. Lateral stresses nevertheless have received scant attention except as they have been simulated and measured in the laboratory. A reason is that until recently there has been no reliable way to measure them in the field, particularly in a hydrocollapsible soils that preclude the use of self-boring pressuremeters such as the CamKometer developed at Cambridge University and the PAF developed in France.

E. Derbyshire et al. (eds.), Genesis and Properties of Collapsible Soils, 33–47.

ON THE DEVELOPMENT OF MICROSTRUCTURE IN COLLAPSIBLE SOILS

Lessons from the Study of Recent Sediments and Artificial Cementation

Jacques LOCAT
Engineering Geology Research Group (GREGI)
Department of Geology and Geological Engineering,
Laval University,
Sainte-Foy, Qc, CANADA, G1K 7P4

Abstract

Sensitive clays are part of the collapsible soils. The origin of sensitivity has been investigated for many years. Some new facets of the development of microstructure in fine-grained soils are presented in the light of work on recent sediments and from projects looking at lime stabilisation of muds and sensitive clays. Particular attention is given to the response of to the microstructure to stress changes with the introduction of the porosity index (I_n) and to the development of cementation as a major source of bonding strength. Finally, cementation and leaching are presented as the processes leading to greater collapsibility in sensitive clays.

1. Introduction

Following the last Wisconsinan glaciation, drapes of fine-grained soils were deposited from lakes or marine bodies in many parts of Eastern Canada partly filling depressions (Figure 1). Most of these deposits have now emerged and, except for their weathered surfaces, can be considered as very compressible soils, and in the case of raised marine deposits, very to extremely sensitive soils. Although fine-grained soils deposited prior to the last glaciation can be found, the overconsolidation due to glacial loading has strongly modified their microstructure (and void ratio) to the extent that they are neither very compressible nor collapsible. This is an indication that collapsible soils in glaciated areas must be young.

So-called sensitive clays of Eastern Canada fall into the category of collapsible soils because they show a sudden change in their mechanical behaviour upon remoulding and also because once the preconsolidation pressure is exceeded, they exhibit a dramatic increase in the compressibility index (C_c) which can be well above 1 [22, 30, 2, 6, 51, 67]. This behaviour, quite typical of sensitive clays found in other parts of the World, has been found to be related to the particular microstructure of the sediments and the evolution of the porewater chemistry [69, 51, 34]. It is also quite clear that the sediment sources, the sedimentary environments and the postdepositional conditions have to be

E. Derbyshire et al. (eds.), Genesis and Properties of Collapsible Soils, 93–128.

DESIGN AND TREATMENT OF LOESS BASES IN BULGARIA

D. EVSTATIEV,
Professor,
Geological Institute, Geotechnical Laboratory, Bulgarian Academy of Sciences,
"Acad. G. Bonchev", Sofia, Bulgaria

ABSTRACT. Collapsible loess soils occupy 13 % of Bulgarian territory and are a serious problem for construction. For this reason a lot of research work is being carried out concerning their origin, stratigraphy, lithology, engineering geological and soil mechanics properties. Loess thickness reaches up to 50 m and the total collapse under conditions of moistening and overburden pressure may reach up to 170 cm.

The Russian classification of loess bases has been adopted in Bulgaria. This distinguishes two types according to the magnitude of the collapse under conditions of moistening and overburden pressure. It is sufficient to avoid the collapse of structures from the additional load in the case of Type T_1 bases. This is achieved by means of widening of foundations, heavy tamping, soil-cement cushions, short pyramidal piles, micropiles and, more rarely, by tamping of reinforced concrete precast piles.

The Type T_2 bases are thicker and collapse under overburden pressure. Sufficiently reliable and economical solutions for their stabilization are not available yet. Two basic approaches are possible in this case. The first one consists in transforming the Type T_2 into a Type T_1 base by means of preliminary moistening, preliminary moistening and explosion energy and soil piles. The second approach implies complete elimination of the collapse hazard by silica grouting, jet grouting, compaction grouting, deepening of the excavation followed by over heavy compaction and construction of soil or soil-cement cushions. Most of these methods need further development.

1. Introduction

Geological investigation of the Bulgarian loess dates back to 1836 and is associated with the name of Ami Boué. This Frenchman, born in Hamburg in 1794, graduated in Medicine at Edinburgh University, Scotland, before he became a geologist. He laid the foundations of Bulgarian geology. In April 1994 the Bulgarian Academy of Sciences celebrated the two hundredth anniversary of Ami Boué.

The first scientific summary work, "Loess in North Bulgaria", was published 100 years after the pioneer scientific report of Ami Boué [1]. In the next decades Bulgarian loess was thoroughly studied from the point of view of Geology, Engineering Geology and Soil Mechanics, since considerable civil, industrial and ameliorative construction had been undertaken on it. Some 30 % of the Bulgaria's population lives on 13% of

E. Derbyshire et al. (eds.), Genesis and Properties of Collapsible Soils, 375–382.

Number 4 1995

Quaternary Proceedings

Series Editer
John Lowe

Centre for Quaternary Research,
Department of Geography,
Royal Holloway,
University of London,
Egham,
Surrey TW20 0EX, UK.

WILEY
Publishers Since 1807

Wind Blown Sediments in the Quaternary Record

Edited by
Edward Derbyshire

Published on behalf of the
Quaternary Research Association
by John Wiley & Sons

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Accumulation Rate of Loess in Tadjikistan and China: Relationship with Global Ice Volume Cycles.

N.J. Shackleton, Z. An, A.E. Dodonov, J. Gavin, G.J. Kukla, V.A. Ranov and L.P. Zhou.

Shackleton, N.J., An, Z., Dodonov, A.E., Gavin, J., Kukla, G.J., Ranov, V.A. and Zhou, L.P., 1995 Accumulation rate of loess in Tadjikistan and China: relationship with global ice volume cycles. In *Wind Blown Sediments in the Quaternary Record* (Edward Derbyshire). Quaternary Proceedings No. 4, John Wiley & Sons Ltd., Chichester, pp. 1- 6.

Abstract

Thick loess sequences provide valuable long-term records of dust accumulation in northern China and in former Soviet Central Asia. We report a detailed record of magnetic susceptibility for the Karamaidan loess section in Tadjikistan, for the Brunhes magnetochron. We have correlated this record with those obtained from three Chinese loess sections and with the marine oxygen isotope record. The patterns exhibited by these records over the Middle Pleistocene are remarkably similar. Using a modified version of the susceptibility age model of Kukla et al. (1988), we obtained records of varying dust accumulation in China and Tadjikistan for the last 2.6 and 0.8 million years respectively. Cross-spectral analysis shows that the dust accumulation in both China and Tadjikistan is more highly coherent with global ice volume as represented by the marine oxygen isotope record than with orbital insolation or with an orbitally modelled ice volume record. This suggests that the accumulation of dust is causally related to the development of continental ice sheets rather than being directly controlled by insolation variations.

KEYWORDS: magnetic susceptibility; dust records; cross-spectral analysis.

Shackleton, N.J. and Zhou, L.P., Godwin Laboratory for Quaternary Research, University of Cambridge, Free School Lane, Cambridge CB2 3RS, UK.

An, Z., Xi'an Laboratory of Loess & Quaternary Geology, Chinese Academy of Sciences, PO Box 17, Xi'an, China.

Dodonov, A.E., Geological Institute, Russian Academy of Sciences Pyzhevsky per. 7, 109017 Moscow, Russia, CIS.

Gavin, J. and Kukla, G.J., Lamont-Doherty Earth Observatory, Palisades, NY 10964, USA.

Ranov, V.A., Institute of History, Archaeology and Ethnography, 33 Rudaki Ave., Dushanbe, 737025 Republic of Tadjikistan, CIS.

Zhou, L.P., The McDonald Institute for Archaeological Research, University of Cambridge, Downing Street, Cambridge CB2 3ER, UK.

Introduction

While many continuous records of Quaternary climate are available from ocean sediments (CLIMAP project members, 1976, 1981), most of the few long, continuous records of past climate from land sites are from those areas covered by loess. The most extensively studied region is in the Chinese Loess Plateau (Liu 1988, Liu 1991), but thick loess sequences also exist in Tadjikistan where the presence of numerous Palaeolithic stone tools in the interbedded soils provides additional interest (Dodonov 1991). In the loess sequences of both areas, as well as in the less extensive and more discontinuous loess sections of central Europe (Kukla 1977), the most obvious evidence of changing climate is buried soils formed during relatively mild and moist periods separating intervals of dry and cool glacial climate. As magnetic susceptibility is found to be low in the loess and high in the intervening soils, it provides a convenient palaeoclimate proxy (Heller & Liu 1982, Kukla *et al.* 1988).

Magnetic susceptibility data from three thick Chinese loess sections (Xifeng 1, Xifeng II and Luochuan) have already been published (Kukla *et al.* 1990). Here we report the first long and detailed susceptibility record from the Karamaidan section in Tadjikistan (38°38'N, 68°51'E), shown in Figure 1 with the upper part of the Xifeng II section for comparison. Susceptibility is high in the soil horizons and low in the intervening loesses. Most of the visible fossil soils at this locality are polygenetic and hence referred to as pedocomplexes (PC) I, PCII and so on. Note that there has been more than one scheme for numbering the soils. The numbering scheme used here is as used in Karamaidan by Heller (personal comm.) and by Bronger *et al.* (this volume). It is consistent with the scheme of Lazarenko *et al.* (1981), but differs from that used in Dodonov (1991). First

Quaternary Proceedings No. 4, 1995 7-18

Loess-Palaeosol Sequences as Recorders of Palaeoclimatic Variations During the Last Glacial-Interglacial Cycle: Some Problems of Correlation in North-Central China.

Edward Derbyshire, David H. Keen, Rob A. Kemp, Tim A. Rolph, John Shaw and Xingmin Meng.

Derbyshire, E., Keen, D.H., Kemp, R.A., Rolph, T.A., Shaw, J. and Meng, X., 1995 Loess-palaeosol sequences as recorders of palaeoclimatic variations during the last Glacial-Interglacial cycle: some problems of correlation in north-central China. In *Wind Blown Sediments in the Quaternary Record* (Edward Derbyshire). Quaternary Proceedings No. 4, John Wiley & Sons Ltd., Chichester, pp. 7- 18.

Abstract

Detailed sampling of several sections in the loess-palaeosol succession of North China has been undertaken along a present-day precipitation and temperature gradient from the humid south-east of the Loess Plateau to its semi-arid western margins. Data on magnetic susceptibility, granulometry, sediment fabric, mineralogy, micromorphology, snails, carbonates and organic carbon were obtained from several sites. The data from these sections show them to be a high resolution record of climatic variation. However, a number of problems affecting the representativeness of the data have been encountered. The advantages provided by high accumulation rates (high resolution record) of the western margins of the Loess Plateau may be offset by 'cut and fill' disparities between adjacent sections. Some lithostratigraphic sequences from which proxy measures of climate have been derived are incomplete, as shown by erosion surfaces, water-laminated zones and truncated palaeosol profiles. In the more humid eastern area of southern Shaanxi Province, a further problem is posed by the clear evidence of superimposition (or "welding") of successive palaeosols, substantial pedogenic modification of the intercalated loessic units, and massive lowering of parts of the plateau surface by human action in historical times. The presence of such features, together with the common stratigraphical practices of 'counting down from the top' and correlating individual loess-palaeosol sections with the marine and the ice core oxygen isotope curves, has implications for stratigraphical correlation across and well beyond the Chinese Loess Plateau.

KEYWORDS: magnetic susceptibility; micromorphology; sedimentary properties; Loess Plateau.

Derbyshire, E., Kemp, R.A., and Meng, X., Centre for Quaternary Research, Department of Geography, Royal Holloway, University of London, Egham, Surrey TW20 0EX, UK.

Keen, D.H., School of Natural and Environmental Science, Coventry University, Priory Street, Coventry CV1 5FB, UK.

Rolph, T.A. and Shaw, J., Quaternary Environmental Research Centre, University of Liverpool, Oliver Lodge Building, Liverpool L69 3BX, UK.

Introduction

The Loess Plateau of northern China lies between the rivers Hwang (Yellow) and Wei, and covers an estimated area of 275,600 km² (Liu *et al.* 1964: see Fig. 1). It consists of wind-blown silts often over 100m thick. Exceptional thicknesses of more than 300m are known near the city of Lanzhou (Derbyshire 1984). The potential value of these loess sequences, with their many intercalated palaeosols, as a record of changing Quaternary climates was first recognised in the late 1950s (Liu 1958). On the basis of fossil assemblages, Liu (1964) demonstrated that deposition of the Chinese loess extended throughout the entire Quaternary. The early work of Liu and Chang (1964) concentrated on the type site at Luochuan in Shaanxi Province to establish the first-order loess-palaeosol lithostratigraphy of the Loess Plateau. This work refined the original succession consisting, from oldest to youngest, of Wucheng, Lishi and Malan loess. Alternating palaeosol and loess units were assigned 'S' and 'L' labels respectively, and each numbered consecutively from the top downwards (S_0, L_1, S_1, L_2, etc.).

Studies of palaeomagnetic variations in the loess at Luochuan established an age for the basal loess contact with the Pliocene red "clay" (the Luochuan Red Loam Formation; Liu & Yuan 1987) of 2.48 Ma (Heller & Liu 1982, 1984). The Olduvai Sub-Chron was fixed at a depth of 100-108m (coincident with WS_1, the sixteenth buried palaeosol below S_0), and the Jaramillo Sub-Chron at 66-70m (between loess

Quaternary Proceedings No. 4, 1995 41-51

Sedimentological Characteristics and Rare Earth Element Fingerprinting of Tibetan Silts and their Relationship with the Sediments of the Western Chinese Loess Plateau.

M.L. Clarke

M.L. Clarke, 1995 Sedimentological characteristics and rare earth element fingerprinting of Tibetan silts and their relationship with the sediments of the western Chinese Loess plateau, In *Wind Blown Sediments in the Quaternary Record* (Edward Derbyshire). Quaternary Proceedings No. 4, John Wiley & Sons Ltd., Chichester, pp. 41- 51.

Abstract

The source of the constituent silt particles of the central Chinese Loess Plateau has long been considered to be the gobi and sand deserts to the north and northwest. However, the western Loess Plateau lies in the foothills of the vast, high level (5000m) Tibetan Plateau and associated mountain chains. Rare Earth Element analysis of silts from the Kunlun Mountains in northern Tibet show strikingly similar signatures to those of loess from Lanzhou, suggesting that the western Loess Plateau deposits have a significant input of sediment derived from Tibet. Aeolian features in the Kunlun Mountains indicate an effective transport system directing fine-grained sediment into the Qaidam Basin where it may deflated by strong frontal winds associated with the Mongolian-Siberian High Pressure System. A sixty metre loess deposit formed within the local mountain environment at Labrang shows further evidence of silt forming processes in northeastern Tibet.

KEYWORDS: rare earth elements, silt, loess, China, Tibet.

M.L. Clarke, Institute of Earth Studies, University of Wales, Aberystwyth, Dyfed SY23 3DB, Wales.

Introduction

The majority of research on Chinese loess has been undertaken within the middle reaches of the Yellow River in the central Loess Plateau at sites such as Luochuan, Baoji and Xifeng, in close proximity to the Ordos and Tengger Deserts. However, the thickest accumulations of loess in China occur near the city of Lanzhou in the westernmost part of the Loess Plateau, surrounded by the mountains of Tibet to the northwest, west and south and the Tengger Desert to the north (Fig. 1). Lanzhou lies in the rainshadow of the Tibetan Plateau, on a steep climatic gradient from the area affected by the Asian Monsoon to the hyper-arid northwest Chinese deserts. This is well illustrated by comparing the mean annual precipitation which varies from 600mm in Xian to 330mm in Lanzhou and 30mm in Golmud (Zhao 1986). The loess deposits at Lanzhou are up to 335 metres thick and rest upon terrace gravels of the Yellow River. The loess-palaeosol sequences are believed to reflect the relative dominance of the Mongolian-Siberian Anticyclone over the southerly monsoon (An Zhisheng *et al.* 1991).

The constituent silts of the central Chinese Loess Plateau are thought to derive from the gobi (gravel) and shamo (sand) desert regions of northern China and Mongolia (Liu *et al.* 1985; Wu & Gao 1991). The western region, around Lanzhou, is believed to have an additional input from the tectonically-active mountain ranges of Tibet which lie to the immediate west (Bowler *et al.* 1987; Zhang *et al.* 1991). An intense periglacial environment exists in these mountains (Fig. 2), which also contain active glaciers. These are the two commonly cited pre-requisites for cold climate silt formation (Smalley 1966; Minervin 1974; Konischev 1987). Aeolian transport of silt particles produced in these mountain and/or desert environments is facilitated by the Mongolian-Siberian Anticyclone, which dominates the climate system of northwestern China during winter, and the southerly summer Asian Monsoon, which dominates the climate of southern and central China in the summer, although its effects are currently weak in Lanzhou. Spring dust storms associated with the Mongolian-Siberian high pressure system currently deflate silt from the Taklimakan and Qaidam Basins, reworking silt in their path as they are accelerated by the high mountains through the Hexi Corridor and across the Yellow River valley and deposit loess up to several centimetres thick in the Lanzhou Basin (Wang Jingtai *et al.*, this proceedings). Silt transport also occurs via the Yellow River which rises on the Tibetan Plateau and flows through the Lanzhou Basin. This paper describes a comparison of the particle size and rare earth geochemistry of silts sampled from two areas of Tibet with the loess taken from the western Loess Plateau around Lanzhou.

Sample Sites

The sample sites were located in three regions of the Tibetan Front: the western Loess Plateau around Lanzhou at Jiuzhoutai, Dawan and Sala Shan; Labrang in northwestern Tibet; and several sites across a transect in northern Tibet stretching from

Quaternary Proceedings No. 5, 1993 69-81

Loess-Palaeosol-Sequences in Tadjikistan as a Palaeoclimatic Record of the Quaternary in Central Asia.

A. Bronger, R. Winter, O. Derevjanko & S. Aldag

A. Bronger, R. Winter, O. Derevjanko & S. Aldag, 1995 Loess-palaeosol-sequences in Tadjikistan as a palaeoclimatic record of the Quaternary in Central Asia, In *Wind Blown Sediments in the Quaternary Record* (Edward Derbyshire). Quaternary Proceedings No. 4, John Wiley & Sons Ltd., Chichester, pp. 69-81.

Abstract

Loess profiles in Tadjikistan contain numerous palaeosols and have been described from a chronostratigraphical point of view; for example, the B/M boundary was recently confirmed between pedocomplexes PK IX and X. However, no studies regarding the genesis of the palaeosols, essential for palaeoclimatic deductions, have been made so far. A genetic classification is difficult because almost all fossil soils are truncated and recalcified from the overlying loess. Micromorphology allows primary and secondary carbonates to be distinguished and provides unequivocal evidence of the process of clay illuviation. The grain-size distribution and 160 thin sections of loesses and palaeosols were studied from the upper and central part of the Karamaydan and the central and lower part of the Chashmanigar sequences. Typical loess occurs in all parts of the Karamaydan and Chashmanigar profiles down to PK XXVII. All strongly developed B or Bt horizons in both exposures represent interglacials similar to the Holocene. The loess-palaeosol-sequence at Karamaydan (PK I-X) can very well be compared with the $\delta^{18}O$ - record shown in the SPECMAP curve of the Brunhes Chron. From the present knowledge the loess-palaeosol-sequence at Chashmanigar (PK X - PK XXX) provides the most detailed sequence for the Matuyama Chron in Central Asia. It gives even more palaeoclimatic information than the loess profiles in China and even the deep-sea curves known so far.

KEYWORDS: pedocomplexes; micromorphology (soils); grain-size distributions; SPECMAP.

A. Bronger, R. Winter and S. Aldag, Department of Geography, University of Kiel, D-24098 Kiel, Germany.

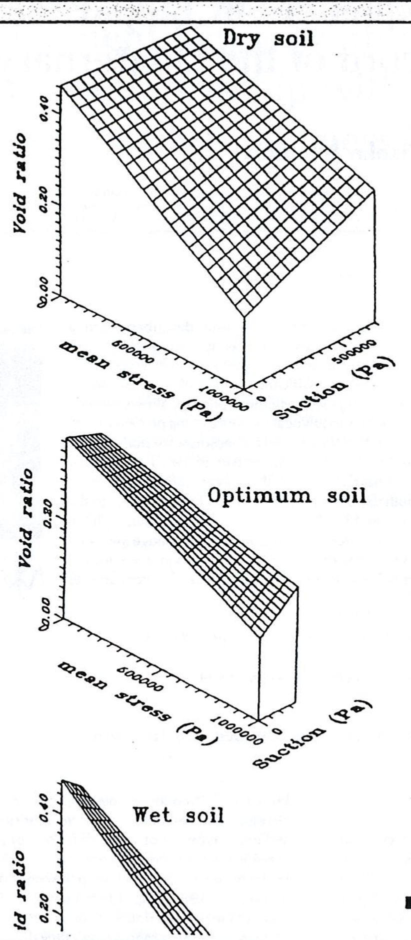
O. Derevjanko, Tadjik Geological Survey, Krasnych Partizan, 27, 734025 Dushanbe, Tadjikistan.

Introduction and Approach

Loess profiles in the former Soviet Central Asia, especially in the Tadjik Depression, contain numerous palaeosols. They are up to 90 m thick in the Tashkent region and up to 150 - 200 m in the Tadjik Depression. They have been described from a geological-stratigraphical point of view, mainly by Dodonov (*e.g.* 1979, 1984, 1991), Dodonov *et al.* (1977, 1982), Lazarenko (1977, 1984) and Lazarenko *et al.* (1981). Penkov and Gamov, (1977, 1988) identified the Brunhes/Matuyama (B/M) boundary in several loess profiles mainly in Tadjikistan between the pedocomplexes IX and X (Fig. 4, see below). The Jaramillo- and Olduvai subchrons could also be found in some profiles (Penkov & Gamov 1977, 1980; Dodonov & Penkov 1977; Lazarenko *et al.* 1991). The palaeomagnetism of the loess profile at Karamaydan (Fig. 3, 4) was recently investigated in greater detail by Förster and Heller (1994, in press). They confirmed the stratigraphic position of the B/M-boundary between PK IX and PK X.

However, very little attention has been paid to the *genesis* of the palaeosols, which is necessary for palaeoclimatic deductions. Dodonov (1991, Figs. 4, 5) differentiated "buried soil", "embryonic soil" and "pedocomplex", and Lazarenko (1984, Fig. 13-1) differentiated "fully developed zonal-type buried soils", "moderately developed buried soils" and "slightly developed and embryonic soils and transitional layers of soil-sediment type". But they did not consider genesis and classification of the palaeosols. Sometimes different soil horizons were identified in palaeosols or pedocomplexes (Lazarenko 1984, Fig. 13-2; Lomov & Ranov 1985), but without further description or evidence of the process of clay illuviation by micromorphology they do not allow inferences about their origin and climatic significance. No Ck horizons were mentioned by these authors and shown in the above mentioned schemes although distinct calcareous nodules ("Lößkindl") are a very characteristic feature of many soils (cf. Figs. 3-5). They are especially common in the loess profile of Chashmanigar, which is considered "the Eopleistocene (= Old Pleistocene) stratotype of Southern Tadjikistan loess formation" by Dodonov and Lomov (1985, 223). Lazarenko (1984, Fig. 13-2) mentioned a "dense epigenetic lime crust" a few centimetres thick in the uppermost part of a BCca horizon of his "fully developed buried soils". - From a few samples of loesses and paleosols grain-size analyses were done (Dodonov 1991, Fig. 6). - The palaeosols were not compared with the Holocene "zonal" or climaphytomorphic soil (Schroeder, 1984) of this loess area. These soils at an altitude of about 1000-1800 m a.s.l. were earlier called "Cinnamonic Brown

Unsaturated soils, Volumes 1 & 2



Edited by EE Alonso & P Delage, published by AA Balkema. ISBN 90 5410 583 6 Proceedings of the first International conference on unsaturated soils held in Paris 6-8 September 1995, organised by ISSMFE TC6 and Ecole Nationale des Ponts et Chaussees, Paris.

Land subsidence

Edited by FBJ Barends, FJJ Brouwer, FH Schroder, published by AA Balkema, Rotterdam. ISBN 90 5410 589 5, 409 pages. Subsidence occurs in many parts of the world, particularly in densely populated deltaic regions.

Practical foundation engineering handbook

Edited by Robert Wade Brown, published by McGraw-Hill. ISBN 0 07 008194 8, £81.95. Comprehensive handbook on foundation theory, design and practice. Based on contributions from 13 American academics and practitioners.

25 Stress-reducing Thoughts
Author Unknown

1. Indecision is the key to flexibility.
2. You cannot tell which way the train went by looking at the tracks.
3. There is absolutely no substitute for a genuine lack of preparation.
4. Happiness is merely the remission of pain.
5. Nostalgia is not what it used to be.
6. Sometimes too much to drink is not enough.
7. The facts, although interesting, are irrelevant.
8. The careful application of terror is also a form of communication.
9. Someone who thinks logically is a nice contrast to the real world.
10. Things are more like they are today than they ever were before.
11. Anything worth fighting for is worth fighting dirty for.
12. Everything should be made as simple as possible, but no simpler.
13. Friends may come and go, but enemies accumulate.
14. I have seen the truth and it makes no sense.
15. Suicide is the most sincere form of self-criticism.
16. If you think that there is good in everybody, you have not met everybody.
17. All things being equal, fat people use more soap.
18. If you can smile when things go wrong, you have someone in mind to blame.
19. One-seventh of your life is spent on Monday.
20. By the time you make ends meet, they move the ends.
21. Not one shred of evidence supports the notion that life is serious.
22. There is always one more imbecile than you counted on.
23. This is as bad as it can get, but do not count on it.
24. Never wrestle with a pig. You both get dirty and the pig likes it.
25. The trouble with life is that you are halfway through it before you realize that it is a "do-it-yourself" thing.

Cribbed from the G'raffiti, newsletter of the Camelopard Society November 1995, Vol. VIII, No. 11, attributed to fax-land.

黄土通訊