LOESS 黄土

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LETTER

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on behalf of the Western Pacific
Working Group of the INQUA Loess Commission

Loess Letter

Loess Letter is the informal newsletter of the Western Pacific Working Group of the INQUA Loess Commission. Please send news or short reports of work in progress to Ian Smalley, DSIR, Soil Bureau, Lower Hutt, New Zealand. Two issues a year are planned; if you would like to be on the circulation list, send you name and address to Ian Smalley at address above.

WPWG Programme 1980-1982

The major item on the programme is a conference and field trip which is planned to take place in Australia in the latter part of 1980. Participation in the field trip will be essentially by invitation but no restrictions will be placed on the subsequent conference. The field trip will leave Canberra and sites will be examined at Wagga/Junee, Echua area, Kerang/Nyah West, and Willandra. The trip will last about 6 days and will end in Broken Hill.

The conference will be held in the Robinson College of the University of New South Wales in Broken Hill and will be open to anybody who wishes to attend. The conference will concentrate on the following themes:

- Physical, mineralogical and chemical aspects;
- Stratigraphic and chronologic correlations;
- Environments, provenance, source and depositional systems;
- Processes: dynamics of dust production + landscape stability;
- Applied aspects: engineering properties, erodibility, irrigation and fertility.

It is proposed that the conference title include the words 'Dust Mantle' rather than the more restrictive term 'Loess'. Two full days will be devoted to papers, one to a flight over the Strzelecki Desert and one to a ground trip into the Barrier Ranges to look at dust mantles on the stony tabelands. A second meeting should be held in 1981 or 1982, possibly in China and probably before the INQUA Congress; this idea was explored by Jim Bowler on his visit to Peking (Beijing) - see this issue of LL for report.

The WPWG will produce a report on the first field trip and conference for distribution to INQUA and other interested bodies. It is an aim of the WPWG to produce a monograph on dust mantles in the region. The document will concentrate on themes which have been chosen for the 1980 meeting. It is hoped that it will also include information from Japan and India and WPWG members are pursuing contacts in these countries. A list of workers, sites and publications on Australian dust mantles will be compiled; a complementary compilation of bibliographic data on the New Zealand loess is nearing completion. More information on the Dust Mantle field trip and conference can be obtained from Dr J. Bowler, Research School of Pacific Studies, Australian National University, Canberra ACT 2600, Australia.

Bowler in Beijing

Record of discussions
Western Pacific Working Group
INQUA LOESS COMMISSION
Discussions in Beijing 10 and 11 June 1979

Present: Prof. Liu Tung-sheng, Wen Chi-chung, Yi San Fong, J.M. Bowler, Miss Chou Wei Chien (Interpreter).

Bowler outlined the aims and objectives of the Working Group as discussed with New Zealand and Australia Committees. It has been suggested that the WG should seek to organize exchange of information based on field study tours and field conference discussions. The WG might aim to hold two such meetings before the 1982 INQUA Congress.

The WG should aim to publish a summary of data on loessic materials in the three countries, China, Australia and New Zealand for submission to the 1982 Congress.

These proposals were discussed and agreed to in principle with details to be worked out in negotiations.

Bowler then presented an account of the proposal made by the Australian Committee. This involves a Field Study Tour through south eastern Australia concentrating mainly on windblown materials. The tour would end at Broken Hill with a conference on specific themes related to the field trip - such themes have been outlined in the minutes of the Australian Committee meeting of May 29th.

The field tour would be limited to a small invited group - 6 from China, 6 from New Zealand. Field notes and site descriptions should be prepared in advance and distributed to participants in time for them to be translated where necessary.

The Study Tour would be held in late 1980 in September or October.

Financial arrangements

Australia would seek to cover the expenses of delegates from China. New Zealand delegates would be expected to make their own arrangements.

Finance would be sought through the Australian-China Academy exchange scheme supplemented by the possibility of a small amount of money from INQUA Central Committee. In order to facilitate approval from the Australian Academy two approaches are important.

1. The proposal will be forwarded through the Australian National Committee of Quaternary Research. As chairman of that committee, Bowler assured the meeting that it is likely to strongly support the proposition.
2. Since many proposals have already been forwarded to the Australian Academy, it is important that this one be given high priority by China if it is to be accepted into the 1980-81 programme. Bowler therefore requested that notice of this priority be forwarded through Academia Sinica to the Australian Academy.

If strong support for the proposal is presented to the Australian Academy from both sides as soon as possible there is a good chance of obtaining Academy funding for the proposition.

Mr Yi raised the question of long term planning of the WG beyond 1982 suggesting that it might be appropriate to have a meeting of representatives of all 3 countries involved to consider such plans. After discussion, it was agreed that this important problem could be considered when delegates from all 3 nations met in Australia next year.

Meeting in 1981

The meeting accepted in principle the notion that a second WG meeting would be held before the 1982 Congress. This would be held in China subject to arrangements being made at a future date.

Involvement of New Zealand

Bowler reported on discussions with New Zealand colleagues. Whilst not being in a position to commit New Zealand to any programme he believes they may wish Chinese visitors participating in the proposed 1980 Australian tour to continue on to New Zealand. He has undertaken to report to New Zealand immediately on return to Australia to give them time to clarify any plans they may wish to include in the proposed 1980 Field Study tour.

Copies of these notes to be made available to all members of the Chinese, Australian and New Zealand members of the Western Pacific Working Group.

'Loess Workshop' at Victoria University

Report from 'New Zealand Soil News' 27, no. 3 June 1979

An all-day loess workshop was held in the Geology Department at Victoria University, Wellington on Wednesday 23 May: it was organised by Colin Vucetich and many aspects of loess study in New Zealand were considered - with a few overseas experiences for leavening.

South Island Studies

John Bruce (Soil Bureau, Gore) discussed the relationship between geomorphic surfaces and loess deposits in South Island catchments in the first part of his talk and went on to consider, in comparative terms, soils developed in areas of loess deposition and soils developed in loess source areas in the southern South Island. Soils developed on deep loess in areas of loess deposition are inceptisols - mainly fragiochrepts or fragiaquepts but soils developed on loess in source areas, which may also be on overall deep loess, may be either alfisols or ultisols. Phillip Tonkin (Lincoln College) presented the second paper which dealt with the problem of identification of loess on the West Coast. Several basic questions were considered such as the definition

of loess and the stage approach to the whole loess formation process, and how New Zealand loess columns got their characteristic features. If identification is made by size grading it appears that the West Coast loesses are much more sandy than a typical Timaru loess. Tonkin proposed that some surficial silty deposits occurring on high level terraces are residual products formed as a result of weathering processes in the soil environment and consequently their original sedimentological characteristics and related clues to their provenance are no longer recognisable.

Stratigraphy and Aerosols. Denis Eden (VUW) presented a report on his studies on loess in the Marlborough area. These stratigraphic studies of loess at the northern end of the South Island promise to provide an essential link between North and South Island deposits. Seven layers of relatively unweathered loess have been detected; 18 m of aeolian material spans two glacials and two interglacials - and includes some invaluable tephra layers and paleosols. Bob Stewart (Massey University) discussed the determination of the origin of aeolian components in soil parent material using the oxygen isotope abundance of the marker mineral quartz. Three grain size populations can be distinguished for the purposes of parent material identification, based on their mode of transport in an aeolian system:

(1) a 'sand' population with a grain size greater than 80 μm,
(2) a 'loess' population with a grain size range of 80 μm-10 μm,
(3) an 'aerosolic dust' population with a grain size of 10 μm-1 μm.

The sand grains are transported by saltation and have a source in the local environment. The loess grains are transported as suspended load and may be derived from more distant sources. Aerosolic dust grains travel as part of the tropospheric aerosol and may have sources in different continents from the point of deposition.

Interjections. An extra item was inserted into the programme at this point and Iain Campbell (Soil Bureau,

Nelson) spoke briefly on the loess in Awatere Valley. Recent detailed soil mapping at 1:10 000 on the terraces of the valley has shown that many of the parent materials were either of loess or of an indirect loessial origin. The distribution of the loessial materials however is complicated and in order to produce a reliable soil map in as short a time as possible an understanding of the nature and significance of the loess is essential so that accurate predictions about the soils, and the soil patterns and soil variability can be made. Another extra item was offered by Geoff Mew (Soil Bureau, Nelson) - some further observations on the West Coast loess; recent soil surveys have proved the distribution from the Inangahua Depression to the Hokitika River. Studies co-ordinated by Soil Bureau on the nature and origin of the gley podzols are leading to increased knowledge about parent materials. The last paper before lunch was by Neill Kennedy (Soil Bureau, Rotorua) on field recognition of tephric loess in Central North Island c.42 000-c.15 000 BP. Twelve criteria will aid in the identification of tephric loess: colour, texture, structure, bulk density, sensitivity and dilatancy, root channels, lack of paleosol development, lack of weathering, reaction to allophane, presence of concretions, lack of pumice grains, loess balls. Five specific questions were raised in the paper, no. 4 of which was "Should we try to track down sources of the loess? If so, what is the best way to go about doing this?"

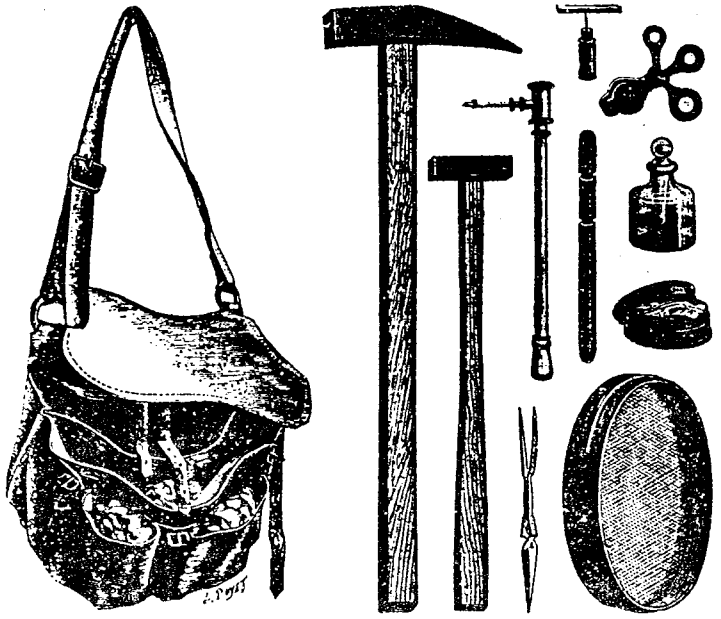
Slope failures and Quaternary events. After lunch David Bell (University of Canterbury) spoke on loessial erosion and geotechnical characterisation of loess. It appears that loess can be usefully divided into three types for geotechnical consideration and that this simple classification is quite effective. Tunnel gullying is a continuing problem and mechanisms have been noted which operate either above or below the fragipan in the slope loess. Simple input of rain does not seem to be a direct control on slope failure: the Wahine storm produced no mass movement and neither did Cyclone Alison which had a 600 yr return period - but modest storms caused severe slope movements. Derek Milne (Soil Bureau,

Taita) gave an account of his stratigraphic endeavours in the southern part of the North Island. Essentially he considered the problem of whether five or six loess layers were detectable above the level of the Mount Curl tephra (i.e. later than 230 000 BP). After considerable investigations in the Rangitikei river valley and in some later developments in the Wellington region, it appeared that there were five loess layers. The total element analysis method has proved useful in the search for paleosols and Cyril Childs at the Soil Bureau has found that potassium is a very useful indicator element. Some Pacific Ocean cores obtained by Watkins and Huang appear to contain the Mount Curl tephra so some correlation with the oceanic record may be possible.

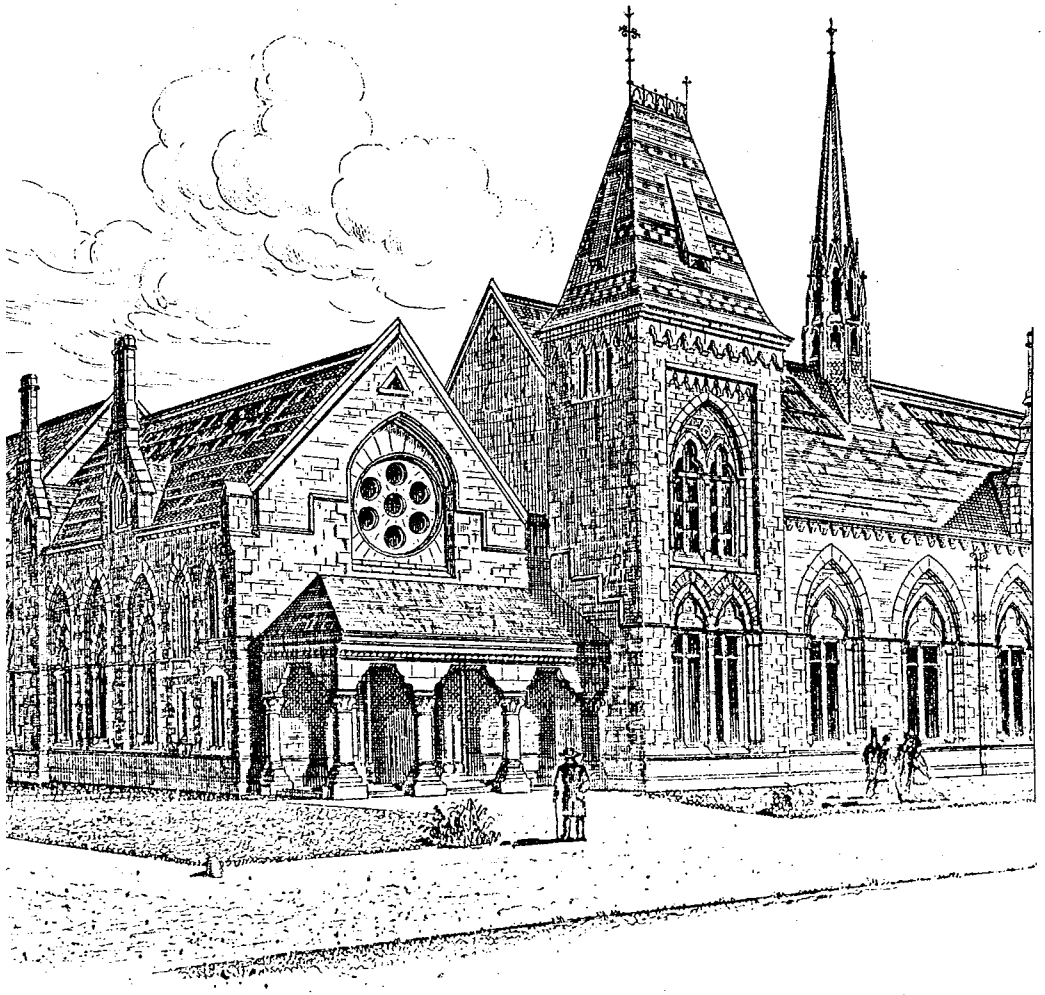
Wairarapa and Wanganui. Alan Palmer (VUW) discussed the genesis of loess in the Wairarapa and made some comparisons with loess formation in Illinois. High rates of uplift in the Wairarapa have meant hard work for the local rivers and powerful river flows have had the effect of forming plentiful silt; the comminution effect is powerful and efficient. In Illinois the rivers flow much more slowly (very slowly in some cases) but there has been widespread Quaternary glaciation which has provided abundant silt material for widespread loess deposits. The last paper was by Hugh Wilde (Soil Bureau, Palmerston North) who looked at the stratigraphy of the Wanganui loess. He has attempted to develop a c.220 000 year cover bed stratigraphy for the Wanganui and south Taranaki districts and in particular for the extensive raised coastal terraces that dominate the area. The study was begun soon after Des Cowie had definitely identified loess for the first time in the North Island and has now reached a stage where a complex stratigraphy has been worked out - which should be correlateable with the Rangitikei valley system without too much straining. It is an interesting possibility that there may be an offshore source for the Wanganui loess material. Sea levels may have fallen by as much as 100 m during Quaternary cold phases and this would have exposed a likely source area. It is apparent from the Wanganui

and Rangitikei studies that North Island loess stratigraphy is in a promising and exciting phase; more investigations are required (particularly based on some drill cores in the Wanganui region) but the current results give an elegant picture of Quaternary events and suggest that New Zealand loess investigators are well placed to make fundamental contributions to world wide Quaternary correlation studies - and to participate in what D.Q. Bowen has called the critical task of Quaternary science: the correlation of the continental with the oceanic record.

Postscript (Observations). The workshop closed soon after 5 pm and with seven concentrated hours of useful discussion achieved there was a general movement to the Staff Club. There had been a slight interruption for a power cut but Bob Stewart lectured steadily on in the semi-darkness, and luckily the lights came back on after about half-an-hour. It was a productive meeting and demonstrated very clearly the healthy state of loess research in New Zealand, and the growing appreciation of loess as a valuable resource and an unsurpassed subject for interdisciplinary investigations.



Haast's headquarters one hundred years ago: from Haast, J. van 1879. Geology of the Provinces of Canterbury and Westland, New Zealand.



CANTERBURY MUSEUM, CHRISTCHURCH
NEW ZEALAND.

Publications

Scanning Electron Microscopy in the Study of Sediments: A Symposium. edited by W.B. Whalley, Geo Abstracts Norwich 1978.

Whalley organised a symposium on SEM in the study of sediments at the 1977 meeting of British Geological Societies held in Swansea. This volume, elegantly produced by Geo Abstracts at Norwich, contains 29 of the papers. Several papers touch on loess, and one deserves particular notice. Pant, Agrawal and Krishnamurthy report on the Karewa Beds of Kashmir and suggest that loess deposition started with the deglaciation of the Kashmir valley in c.15000 BP and continued up to 10000 BP and that this accounts for the 4 m thick accumulation of loess. The loess in India has not been widely discussed, which makes this paper especially valuable and important.

Quaternary Soils. edited by W.C. Mahoney, Geo Abstracts Norwich 1978.

These are papers presented at the third conference on Quaternary Research which was held in May 1976 at York University in Toronto. R.B. Morrison of the University of Arizona at Tucson discussed Quaternary soil stratigraphy-concepts, methods and problems. He offered a detailed consideration of the loess record of Central Europe and included, as appendix 1, a geologists viewpoint on the U.S. System of Soil Taxonomy - of which he is, by and large, very critical. Olson, Brunson & Ruhe reported on clay mineral weathering and quaternary soil morphologies in Indiana. L.R. Follmer reviewed the Sangamon Soil in its type area - and a long, detailed and useful review it is. Allen and Ward offered a stratigraphic reappraisal of the Brussels Formation in Illinois and Missouri. Rutter, Foscolos & Hughes considered the climatic trends during the Quaternary in Central Yukon based upon pedological and geomorphological evidence - their paper includes a discussion on loess in the Central Yukon region.

Ice Ages - Solving the Mystery. J. Imbrie & K.P. Imbrie, Macmillan 1979.

In his review of this book in 'Science' H.E. Wright Jr reproduced fig. 4 of the Zermatt glacier in the Swiss Alps. We reproduce part of fig. 37 which represents climatic history recorded in the loess of a Czechoslovakian brickyard. Chapter 14 called 'Pulsebeat of Climate' is largely about loess and the work of George Kukla and Vojen Lozek and coworkers showing the clarity and precision of the stratigraphic record in the material at Brno. Loess gets a passing mention in the early part of the book and is defined on p.54; there is also a pronounciation guide (pronounced to rhyme with "bus") - which seems disputable. The newly published Heinemann Dictionary of New Zealand English suggests a pronounciation as 'lerss' which seems much more suitable.

Wright's review in 'Science' (204, 751-753, 1979) is moderately enthusiastic and he points out some weaknesses with respect to terrestrial affairs; he states that "Although the book is not 'The Double Helix', its personalised approach holds attention and makes complicated relations seem simple and important." On the other hand W.S. Broecker in his 'Nature' review (278, 819-820, 1979) specifically states that "Their book does for climate what J.D. Watson's 'The Double Helix' did for molecular biology." His review is also well illustrated but he prefers people to places so we get portraits of Croll, Agassiz and Milankovitch. LL's review of reviews comes out just on the side of 'Science'; of course we assume that all LL readers will read the book.

1961 George Kukla and Vojen Ložek of the Czechoslovakian Academy of Sciences demonstrate that the sequence of soils and loesses in the nonglaciated regions of central Europe contain detailed records of Pleistocene climate.

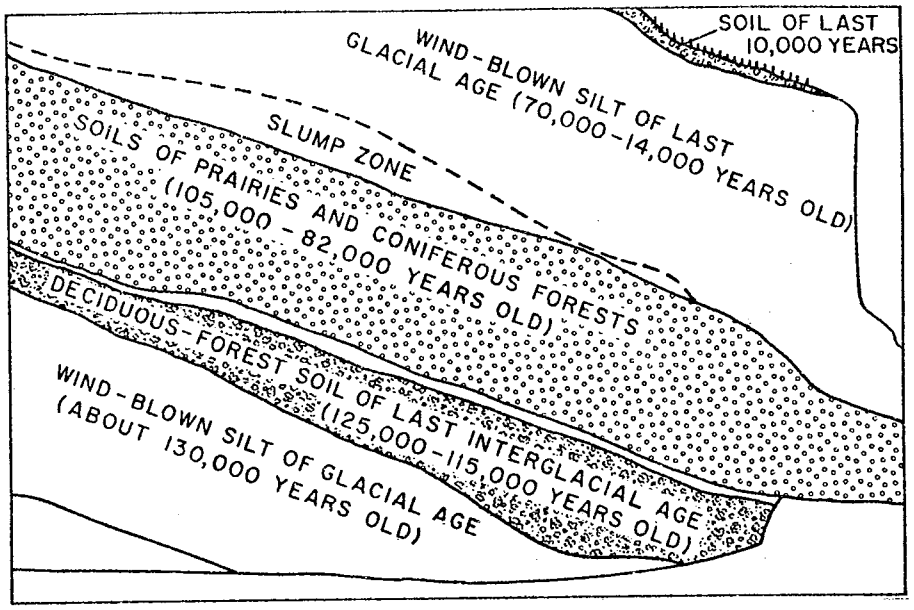


Figure 37. Climatic history recorded in a Czechoslovakian brickyard. Events of the past 130,000 years are recorded as a sequence of soils and wind-blown silts (loesses) in a quarry at Nové Město. (Courtesy of G.J. Kukla.)

Anthropogene of East Asia: Stratigraphy & Correlation. M.N. Alekseev. Publishing House 'Nauka' Moscow 1978 (in Russian).

Only 1100 printed so would-be purchasers will need to hurry. Alekseev makes some interesting stratigraphic comparisons between deposits on Soviet territory and the North China loess. He suggests that in the loess sequence of North China the pedocomplex in the Malan Huangtu is the possible equivalent of the Karginsk beds, which he puts in the chronological interval between 45000-25000 BP.

Loess from the Pleistocene of the Wirral Peninsula, Merseyside. MP. Lee. Proc. Geologists Assoc. 90, 21-26, 1979.

Martin Lee has discovered another deposit of loess in England. Now that the terminological barrier has been broken it is gratifying to see loess spreading inexorably across the face of Britain. The Lee deposit is well away from the recognised deposits in the south and east and suggests that the loess cover might have been very extensive.

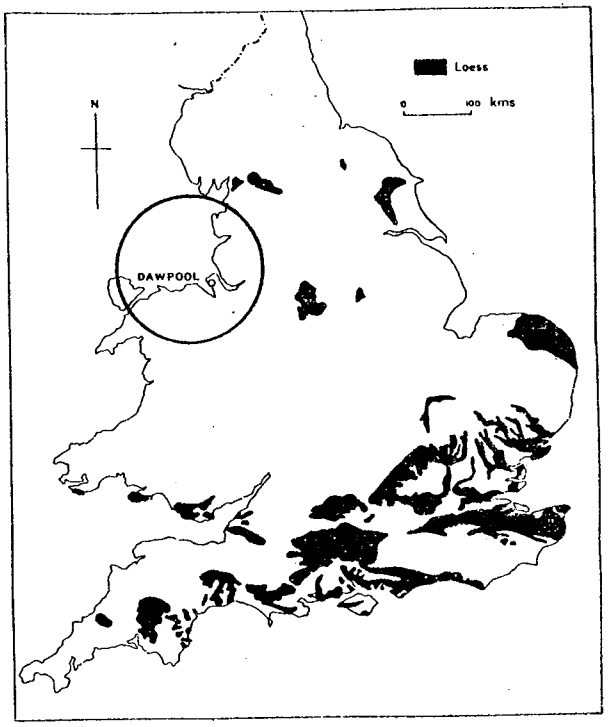


Fig. 1. Distribution of loess in England and Wales with the location of Dawpool (after J. A. Catt, 1977).

Saharan Dust. edited by C. Morales, Wiley & Sons, Chichester. 1979.

This is volume 14 in the SCOPE series; the acronym stands for Scientific Committee on Problems of the Environment (of the International Council of Scientific Unions). A workshop was held in Gothenburg, Sweden in April 1977 to discuss Saharan Dust - Mobilization, Transport & Deposition and this volume contains the papers and recommendations. Three papers in the General Description and Ecology section; one paper on Mobilization - but an excellent one by D.A. Gillette; five papers on Transport and seven on Monitoring and Deposition. For a more detailed review see 'New Zealand Soil News' vol. 27, no. 4, 1979.

Conferences

CLIMANZ 1981. A Climanz conference is being planned for 1981; the tentative title is 'Climatic Change in Australasia; the last 30 K Years' and the tentative time is February 1981. Possible venue - a ski-resort in Australia with conference facilities; duration 5 days including an afternoon excursion. The next meeting of the CLIMANZ working group will probably be in Canberra in late 1979, possibly during the IUGG/IAMAP meeting. The IAMAP meeting contains some interesting symposia, in particular Dec. 7-8, 1979 Sea Level, Ice Sheets and Climatic Change - details from A. Ivan Johnson, USGS, Mail Stop 417, Reston Va.22092, USA.

3RD AUSTRALIA-NEW ZEALAND GEOMECHANICS CONFERENCE: 12-16 May 1980. Victoria University of Wellington, Wellington, New Zealand. This conference includes some discussion sessions on the geotechnical properties of loess and it should be possible to consider in particular failure mechanisms and engineering problems on the Christchurch Port Hills.

INTERNATIONAL CONFERENCE ON ARIDIC SOILS - PROPERTIES, GENESIS AND MANAGEMENT, March 29-April 4, 1981.
This conference is being hosted by the Israel Society of Soil Science and constitutes a meeting of Commissions V and VI of the ISSS.

The conference will comprise sessions of contributed papers, introduced by invited speakers. Poster sessions will also be held. During a five day field excursion we shall be able to examine the most important aridic soils of Judea and the Negev deserts and to see the recent management and land use as practised and developed in these areas. Specific interest groups will also be able to hold meetings during and after the conference. Tours to visit holy sites and places of archaeological and biblical interest will be offered as well.

Further information: Secretariat, P O Box 3054, Tel Aviv, Israel.

SEM Examination of Loess - A Progress Report

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As part of investigations on processes of formation of glacigenic materials work is being undertaken on the examination of loe-sic materials with the scanning electron microscope (SEM). The SEM (Cambridge S180) is fitted with an energy-dispersive X-Ray analyzer (EDX) and a cathodoluminescence detector will be added shortly. The SEM can supply valuable information on overall structure as well as individual particles and this is enhanced by elemental analysis by EDX - although clay mineral identification needs to be backed up by X-Ray diffraction, DTA, DTG etc.

The approach is from two directions, the first synthetic: to investigate the production of the basic materials of loess, e.g. subglacial grinding, fluvio-glacial attrition. The second is to look at the structure and variability of

it in loesses. To date, most of the samples have been from southern England but examples from Scotland, France, Switzerland, Iceland, Yugoslavia and USA have been collected as well as a sample from Central Wairarapa kindly provided by Dr M. Crozier and Mr R. Owen.

Fracture surfaces through loess samples enable the structure and the way in which cohesion is supplied to be looked at quite easily. It is difficult to make quantitative observations however, but coupled with analysis of granulometry by Coulter Counter it appears that much of the silt-size component is frequently composed of agglomerated clay-sized particles. Ultrasonic dispersion can break up aggregates which, under conventional methods, remain as clumps. The clay-size material may be of clay minerals but the amount varies widely from sample to sample, and sometimes within specimens. Inactive (non-clay minerals) fragments appear to grade from very small particles (<1μm) up through to silt-size. Sand size particles do occur and it may be that the sand is part of the sediment as a whole or it may have been added to the finer grains. Interpretation is difficult until the full links with the synthetic experiments can be made. As well as glacial grinding it seems likely that high energy fluvial processes play an important part in the production of silt.

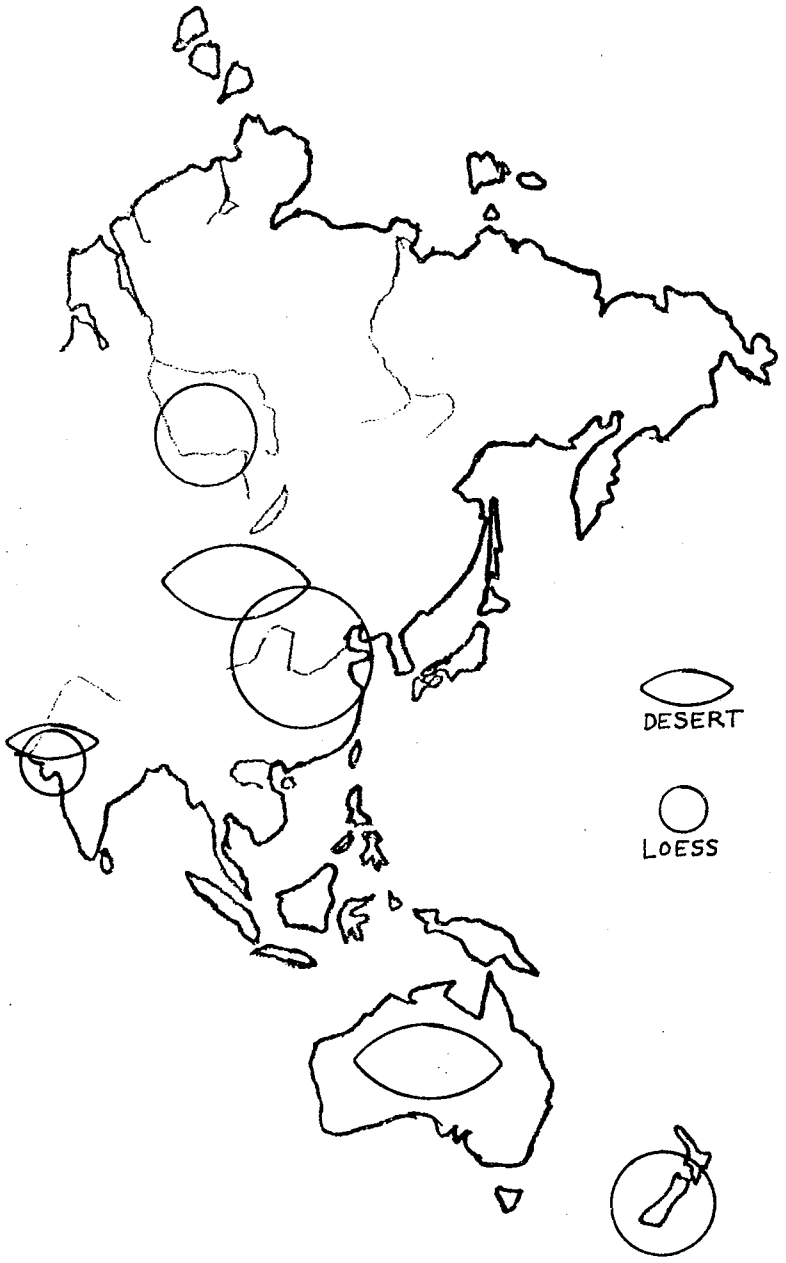
Environmental discrimination procedures have been used to look at component grains in loesses. This is difficult to apply for particles smaller than sand because of the possibilities for subsequent mixing into the original loess. Identification of one component may not hold for the total. In several of the English samples mixing evidently has taken place and it is likely that periglacial solifluction is mainly responsible. Fluvial overbank deposits can also contribute silt to give, in extreme cases, a loess-like deposit. Care must be taken therefore in the interpretation of loess by grain size parameters alone. Some of the discrepancies of the mapping of loess deposits by authors in the UK may be due to some of these interpretational problems.

The breakdown of soil aggregates by ultrasonics coupled with SEM, Coulter Counter and shear tests is also providing some results of interest but this work is still at a preliminary stage.

A World Map of Loess Distribution

In the next three issues of Loess Letter an attempt will be made to present an outline map of the world distribution of loess and related mantle materials. This will have to be very much an outline given the format restrictions under which LL is produced but it is hoped that it will be possible to at least indicate very general areas of loess occurrence. There does not appear to have been a serious attempt to produce a world map of loess since the modest effort of Smalley & Vita-Finzi in 1968 (J. Sed. Pet. 38, 766-774), which was in fact largely based on the much earlier map by Scheidig. The Smalley Vita-Finzi map was reproduced in Morales 'Saharan Dust' (see this issue of LL for brief review) which suggests that it has not yet been superceded. The best map available could be that produced by Kriger in his book 'Loess, its characteristics and relation to the geographical environment' published by Nauka in Moscow in 1965. Perhaps available is not the right word to use about this map; it is certainly published but only 1350 copies were produced so it is elusive in the extreme. LL hopes to publish the Kriger map as a supplement to a future issue.

Part 1 of the LL outline map shows the WPWG region; this contains the great Chinese deposit, the more modest New Zealand deposit and the relatively unappreciated deposit on the western flank of the Indian peninsula. The deposit shown in the Soviet Union is the most easterly of those shown by Kriger but its location is very approximate and little is known about it. Three deserts may contribute mantle materials - they are the Gobi/Ordos desert to the north and west of the inland loess region in China, the Australian desert and the Thar desert in NW India. Other features could (and should) be marked on this outline map and LL would be pleased to receive comments and suggestions



(perhaps a xerox of the map with suggestions drawn on). Part 2 will cover North and South America and Part 3 will cover Europe and Africa and eventually it may be possible to assemble the three parts into a useful complete world map which can be issued as another supplement to complement the Kriger 1965 map.

100 Years Ago

Land snails are occasionally found. Some of the sands are ferruginous, and pipe-stem forms of iron sand are occasionally found, with also hollow root-like forms of calcareous matter. The cohesive strength of the particles tends to preserve the mass in a vertical position for a long time, even at sixty to seventy feet height. When not quite as cohesive, time will wear off the rougher points, and produce a rounded mammillated hills covered with a thin soil, and sloping at about an angle of 50°; for example, the "Mamelles" below St Charles, and the hills at Glasgow and St Joseph. Our richest upland soils near the Missouri river are due to a sub-soil of loess.

Lastly, the aeolian hypothesis is untenable when referred to the loess of the valleys, hillsides, and hills adjacent to the Missouri and Mississippi rivers; for, although often of a depth from twenty to two hundred feet, it cannot be clearly traced far back from these rivers, and I believe in Missouri not farther than fifteen miles from them. It must therefore have been a sediment in the quiet waters when the rivers were blocked up below by ice; when the barrier melted away a channel was worn through the silt, leaving these finely comminuted clays on the neighbouring hills as we now find them.

G.C. Broadhead 1879
Origin of the Loess
Amer. J. Science 169, 427-428.