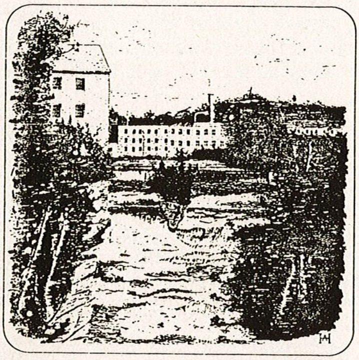
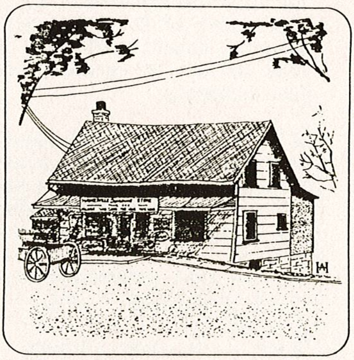
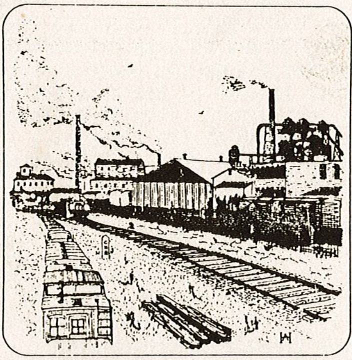
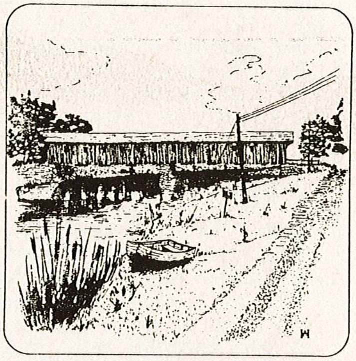
LLIO October 1983 ISSN 0110-7658

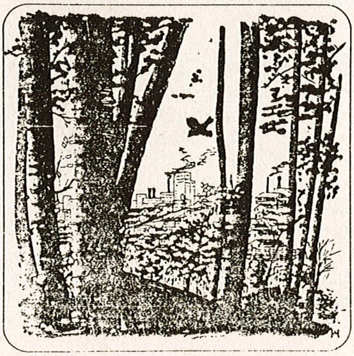
La LETTRE du LOESS
LOESS LETTER 10











LL10: October 1983

Loess Letter is published by the Quaternary Research Group of the University of Waterloo; it is the informal newsletter of the INQUA Loess Commission. LL appears twice a year, usually around April and October. Requests for copies, and material for publication should be sent to Prof. Ian Smalley, Department of Earth Sciences, University of Waterloo, Waterloo, Ontario, Canada N2L 3G1. Brief research papers are published, also reviews of recently published material, and news items and announcements.

LL10 features SEM and loess, some newly discovered loess in Washington State (very close to the Canadian border, there must be related deposits up in British Columbia), loess in Siberia, and a type-sequence at Achenheim; loess in Britain in its periglacial context, redeposited loess with Israel and dust-rain in China. LL11 (eleleleven) is due to be a special issue for the 1984 International Geological Congress in Moscow (IGC 27, 4-14 August).

Cover: our cover picture is borrowed from the cover of 'The Waterloo County Area - Selected Geographical Essays' edited by A.G. McLellan, published by the University of Waterloo in 1971. The sketches of the Waterloo Region are by Alan Hildebrand - they illustrate activities carried out on the loess containing soils of Southern Ontario. This is some of the best agricultural soil in Canada, and the agricultural bias is deliberate. With LL10 we celebrate the publication of the first LL Supplement - Loess and Agriculture 1975-1980: A Bibliography' (copies obtainable from LL at above address).

NALB: The major bibliographic efforts of the Waterloo Loess Group over the next few years will be directed towards the production of the 'North American Loess Bibliography' (NALB for short). This is to be a comprehensive study of loess in all parts of North America. If you know of some relatively obscure material which might be overlooked please send relevant references to Ian Smalley at UW.

The Loess at Jiuzhoutai, Lanzhou, People's Republic of China: a footnote to p. 10-11 of LL9 - from Edward Derbyshire: Since this paper was written, an important analysis of the Lochuan section using the palaeomagnetic method (Heller and Liu 1982)* has resolved this apparent anomaly. New palaeomagnetic measurements indicate a clearly defined magnetic polarity zonation extending below the Olduvai subchron and a late Pliocene age of 2.4 Myr has been assigned to the oldest loess-like sediments measured. The Brunhes-Matuyama boundary at Lochuan occurs at a depth of 53.05 m which is much higher in the profile than previously believed: this does not coincide with the Wucheng-Lishih transition which now has a revised date of 1.1 Myr B.P., as it lies below the Jaramillo subchron.

Initiation of loess accumulation in Central Asia thus appears to have occurred at approximately the same time and to match the first accumulation events in Europe.

* Heller, F. and Liu Tung-sheng, 1982. Magnetostratigraphical dating of loess deposits in China. Nature, 300, 431-433.

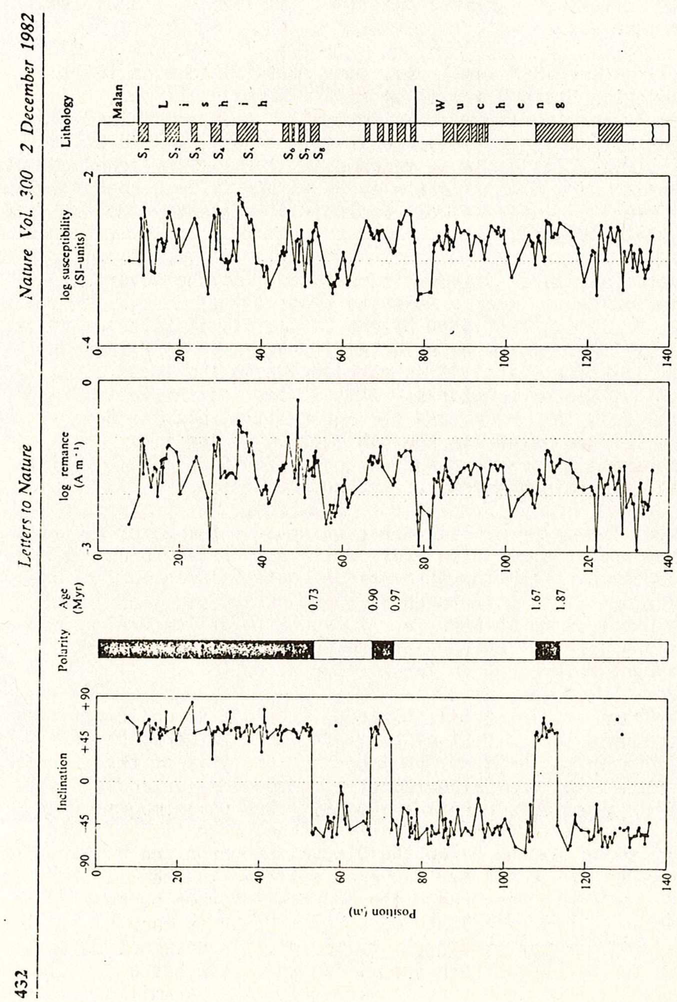
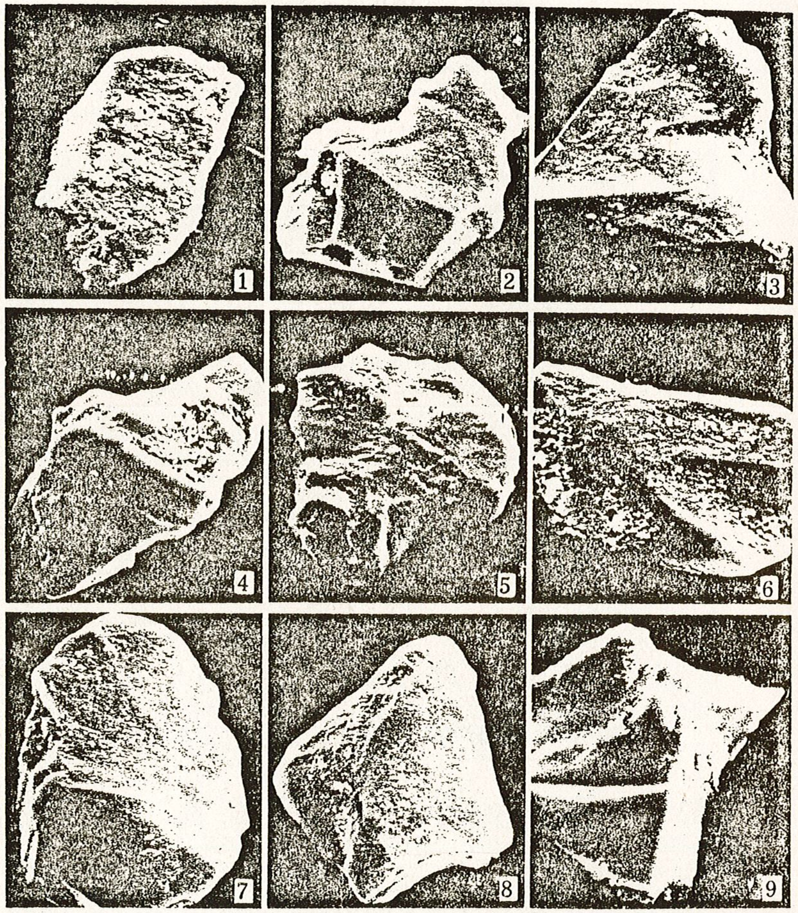


Fig. 1 Magnetic properties of the Lochuan bore hole versus core depth. Inclination data were mostly cleaned at 350 °C. The ages of polarity chron boundaries are according to Mankinen and Dalrymple[13]. Remanence intensities and susceptibilities are plotted before thermal cleaning. Lithological sequence of loess (white) and numbered soil layers (hatched) is according to Liu et al.[2]

Loess and Quaternary Geology 1976-1980. Wang Yong-yan and the Loess Research Section, Department of Geology, Northwest University, Xian, China, pp. 137 plus 39 plates.

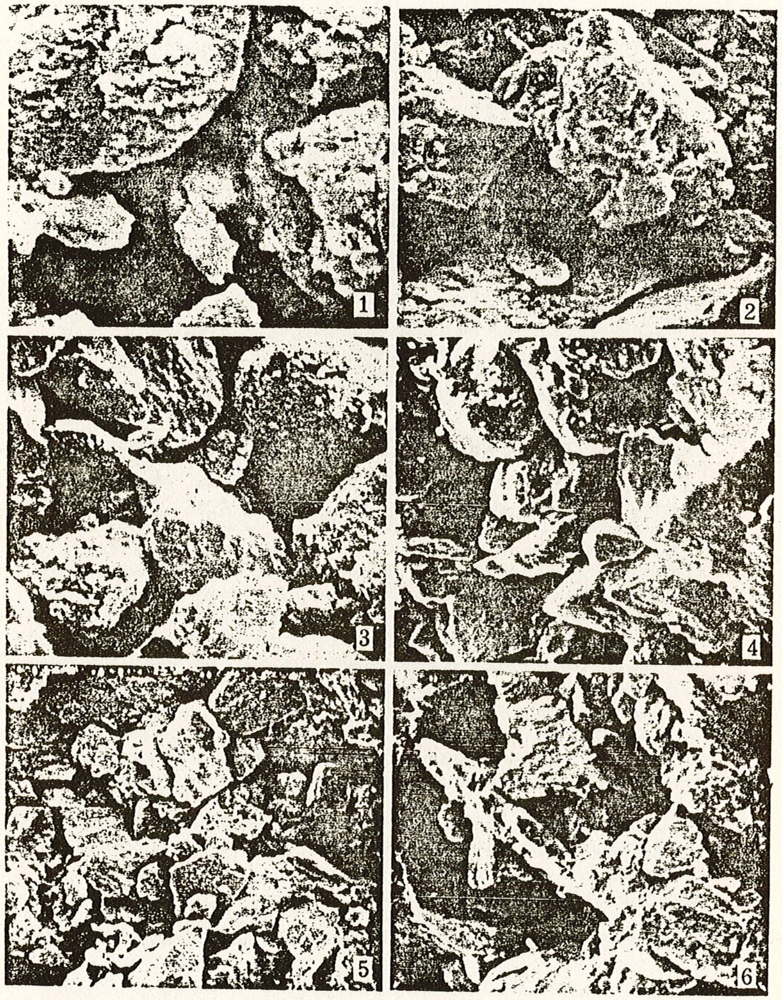
图版III



1. 板状颗粒。 Q_1黄土　兰州九洲台　×498； 2. 不规则状颗粒。 Q_1黄土　兰州九洲台　×540； 3. 三角状颗粒，上有直形槽沟（中右）。 Q_3黄土　陕西洛川　×990； 4. 棒状颗粒，上有直形槽沟（中下），凹坑中有氧化硅沉淀。 Q_3黄土　兰州九洲台　×510； 5. 半圆状颗粒。 Q_2红褐色古土壤　陕西吴旗　×480； 6. 枕状颗粒，上有长三角状槽沟（右下），氧化硅沉淀物表面圆化（中左）。 Q_1黄土　甘肃兰州　×525； 7. 略圆状颗粒，上有碟形坑（右下），表面低洼处有氧化硅沉淀。 Q_2黄土　兰州九洲台　×636； 8. 立方状颗粒，低洼处有氧化硅沉淀。 Q_1黄土　兰州九洲台　×636； 9. 尖状颗粒，上部有略具长方形凹坑。 Q_2红褐色古土壤　甘肃平凉　×510

The extract from this report published in LL9 (p. 31-35) concentrated on vertebrate palaeontology. In LL10 we consider SEM pictures of loess particles and particle features.

图版XI



1. 支架接触。 Q_2^1黄土　陕西长武　×2,000
2. 棱边支架接触。 Q_3黄土　甘肃永登　×900
3. 支架接触。 Q_3黄土　甘肃靖远　×850
4. 穿插镶嵌接触。 Q_3黄土　新疆奇台　×1,025
5. 镶嵌接触。 Q_3黄土　甘肃靖远　×420
6. 穿插镶嵌接触，大颗粒棱边及解理清楚。 Q_1黄土　兰州九洲台　×900

Periglacial environment. Peter Worsley of Reading University has taken over the periglacial review section of 'Progress in Physical Geography' from Hugh French. He has started his new duties in a most excellent and commendable fashion with a long and perceptive look at loess (PPG 7(2), 240-248, 1983). This deals mainly with loess in Britain and we reproduce part of it.

For the INQUA congress at Birmingham, Catt (1977) undertook a review of loess in Britain and concluded that almost all of the loess could be assigned to early late Devensian age, i.e. a few thousand years before 18 500 BP. This statement was based upon a comparison of the coarse silt-sized mineralogy of the loess and that of glacial deposits in eastern England. The latter could be shown stratigraphically to be the products of the late Devensian glaciation. Independent support for this conclusion has been forthcoming from Wintle (1981). In a pioneer application of thermoluminescence dating (TL) to loess, she investigated the TL age of six loess samples from an east-west transect along the south coast of England. All yielded ages consistent with a late Devensian age. Three separate determinations on material from the classic (Type ? see Dalrymple, 196?) locality at Pegwell Bay in east Kent produced the same result, an age band of 12–18 ka taking the error estimates into account. Catt suggested that the glacial outwash spreads occupying what is now the bed of the North Sea were the source from which the loess was derived by aeolian processes. The following year Catt (1978) widened the source area to include what must have been supraglacial sediment. An apparent east-west decrease in modal size of the loess and a corresponding increase in flakey minerals was seen as support for a dominant pattern of easterly winds. However, he did recognize that in locations near to the late Devensian ice limit in western Britain the potential existed for an alternative source for the loess and thus for a different pattern of derivation. Such a circumstance has now been identified in the Morecombe Bay area of northwest England by Vincent and Lee (1981). They have analysed silts on the adjacent limestone outcrops and related them to the local Irish Sea and Lake District glaciers of the late Devensian, well inside their maximum limit. Nevertheless, the basic concept remains the same – a glacigenic origin for the silt. The contrast in the amount of loess surviving in Britain and the European mainland was not attributed to the usual factors, i.e. increased oceanicity and/or unfavourable wind directions. Rather Catt postulated that there was formerly a widespread loess cover beyond the glacial limit with a thickness in the 1–4 m range and that postdepositional erosion was responsible for its partial or complete removal by a combination of natural erosional processes in the late Devensian and pioneer agriculture. This radial suggestion does not appear to have been widely understood or indeed noticed. We may summarize Catt's conception as:

i) a loess blanket derived from then contemporary glacigenic sources, and
ii) extensive postdepositional erosion to produce the fragmentary outcrops which occur at the present time.

Support for an extensive phase of loess erosion was claimed by Burrin (1981) who had investigated the size characteristics of the alluvium which forms the floodplain and valley fills of the rivers Ouse and Cuckmere in the southern Weald of southeast England. He found that the alluvium consisted predominantly of silt-sized material and this homogeneity of texture with little sand and clay led him to postulate a loessic source for the bulk of the alluvium and a corresponding former widespread cover in the Weald. Gallois (1982) who had considerable experience of mapping the Wealden rocks for the Institute of Geological Sciences questioned Burrin's assertion that it was unlikely that the alluvium was mainly derived from the bedrock within the catchments. He drew the attention to the nature of the local sequence as revealed by a borehole in the Ouse basin. The

borehole log demonstrated that the dominant lithologies were silty mudstones and siltstones and this led Gallois to suggest that fluvial erosion would have yielded a silt-rich alluvium and accordingly a more distant origin was unproven. Predictably perhaps, Burrin (1982) rejected this alternative proposal stressing the significant amount of sand contained within the Wealden succession yet an apparent deficiency of this size range in the alluvium which he had extensively analysed. Hence the uniformity of the alluvium texture, despite variations in the catchment bedrock, still indicated to him a source beyond the confines of the basin itself. This example illustrates the possibility of two sources for the loessic material in general – glacigenic and local.

An alternative overview of British loess distribution was put forward by Lill and Smalley (1978) in which they argued for the discrimination of three different kinds of loess on the basis of age and sedimentary character. The divisions were: a) interglacial deposits, b) 'postglacial' silty drift deposits, and c) brickearth. Here it should first be noted that 'brickearth' is a traditional term used to describe silt sequences in southeast England without implying any genetic connotation. The three kinds of loess were related to the INQUA commission's proposed definitions of the various variants and derivatives. The former type may be disregarded since it was essentially based on a single locality which is no longer exposed. The second corresponds with the thin loess of Catt who considered it to be derived from the North Sea basin. A different viewpoint was adopted by Lill and Smalley for the brickearths of Kent and Essex on either side of the Thames estuary, since these were regarded as the westernmost outcrops of the main loess belt of the north European plain and thereby derived from continental ice debris rather than from British glacigenic sources. A Last Glaciation age was assumed. The relatively localized deposition of 'continental loess' around the Thames estuary was thought to be a function of easterly loess bearing winds along the southern margins of a blocking glacial anticyclone over Fennoscandia encountering cyclonic airflows from the west inducing deposition of the suspended sediment load within the interface zone. This framework brought forth strong criticism from Catt (1979) on a number of grounds not all of which need concern the present discussion. First, he noted the difficulties of applying the INQUA classification scheme in fringe areas. Second, the range of techniques used in the study of the British loess were stressed and that considerable data lay behind the 'North Sea source model'. Although particle size and mineralogical analyses of the coarse silt fraction where the most useful they were supplemented by other approaches. The sum total of evidence enabled a correlation to be made between the widespread thin loess and with some of the thicker sequences in the lower Thames. This was taken to imply a unified source area and depositional environment. Third, the assignment of all 'brickearths' in the Thames to a loessic origin overrides evidence to the contrary, particularly where there is abundant faunal evidence for accumulation in an interglacial environment. It is clear that brickearth is produced under differing climatic regimes and it cannot be simply lumped as a single facies. A detailed study of the distal Thames loess in northeast Essex by Eden (1980) demonstrated a North Sea source consistent with Catt's overall thesis. Likewise Chartres (1981) reporting on mineralogical studies of soils developed on the terraces in the lower Kennet valley in south central England noted the presence of an exotic heavy mineral suite in the silt-sized range. Comparison with the catchment mineralogy revealed the likelihood of an exotic source outside the local area. No doubt influenced by Catt's work, he concluded that a North Sea source and late Devensian age was probable.

A timely warning that it is unwise to assume that all surface silt materials are necessarily of late Devensian age can be derived from Lee's (1979) account of a loess bed between tills in the Merseyside area of northwest England. Although Lee assumes a Devensian age for both of the tills and hence a Devensian age for the loess, there is no evidence to refute the suggestion that the lower till antedates the late Devensian and that the loess is also of an earlier age. Hence we have a similar dilemma as that posed by surface ice wedge casts south of the late Devensian limit for although the simplest interpretation might correlate ice-wedge growth with the maximum glacial extension, there is no reason why the ice wedge casts could not antedate the glacial event and likewise with surface accumulations of silt. Further support for this contention is contained within the recent Institute of Geological Sciences memoir which describes the Faversham area (Holmes, 1981).

However, reference to Holmes (1981) is made primarily since the Faversham area is part of the Thames estuary 'brickearth' belt and has a long history of scientific study. It should be noted that geological memoirs in Britain describe the results of approximately 1:10 000 scale field mapping and accordingly the field relationships can be taken with some confidence. In this instance most of the fieldwork was completed in the late 1930s (possibly a record for delayed publication). Unfortunately the nomenclature used to describe the surficial sediments is rather antiquated and all the materials of loessic affinities are classified as 'head brickearths'. These can be subdivided chronologically into three types. The oldest is regarded as largely wind-borne since it apparently lacks the interdigitated gravels which are prevalent in the younger units. Somewhat strangely it is tentatively assigned to the Hoxnian stage which is a late middle Pleistocene interglacial. The depositional environment for the sediment is, to say the least, original, for it is postulated that shallow depressions on Tertiary clays supported boggy soils and wind action winnowed (fine) sands from nearby gravel outcrops. The mobile sand carpet then became 'anchored to and admixed with muddy clay to form a heavy type of brickearth' (Holmes, 1981, 67). The intermediate aged unit is described as being more or less intimately associated with gravels and the fines are seen as being derived by a mechanism similar to that just noted for the oldest brickearth. Again an interglacial age is inferred, this time the Ipswichian or Last Interglacial stage. It is asserted that a primarily aeolian or fluvial origin must be rejected. The youngest unit constitutes the most widespread surface outcrop on the map sheet and unconformably mantles the relief. It is difficult to derive a clear picture of the precise nature of the depositional environment which is proposed since two processes are considered: a) solifluction and b) intense weathering of landslipped Tertiary clay. Again, aeolian and fluvial mechanisms are viewed with disfavour. It is clear that the faunal content is a major influence in the interpretation of the sediment, particularly the land mollusca which are regarded as indicators of moist temperate or colder damp environments 'far less severe than under periglacial conditions'. We finally emerge with a rather confused picture of a terrestrial environment with a higher rainfall total than present promoting downwash-sludging processes, somehow interconnected with periglacial agencies. To add to the mystery, it is then claimed that northeasterly prevailing winds both intensified disintegration and erosion of the Tertiary bedrock, but also raised dust. This contributed to the slow downslope sludging of the weathered bedrock particularly on slopes with northerly or easterly aspects. Sediment sources outside the area are given little consideration. It is here suggested that the interpretation is completely shackled by tradition mixed with vague notions of periglacial environmental processes. Significantly, perhaps, none of the papers cited in this progress report on recent work concerning loess are cited in the memoir. Despite this drawback, it seems reasonable to suggest that it is highly probable that much of the brickearth (loess) which is present in the Faversham area is of local derivation. For the moment we must await the results of future research but the likelihood is that we shall have to eventually accept both indigenous and foreign sources for the British loess.

Burrin, P.J. 1981: Loess in the Weald. *Proceedings of the Geologists' Association, London* 92, 87–92.

1982: Reply by the author to R.W. Gallois. *Proceedings of the Geologists' Association, London* 93, 317.

Catt, J.A. 1977: Loess and coversands. In Shotton, F.W., editor, *British Quaternary studies – recent advances*, Oxford: Oxford University Press, 221–29.

1978: The contribution of loess to soils in lowland Britain. In Limbrey, S. and Evans, J.G., editors, *The effect of man on the landscape: the lowland zone*, British Archaeology Council Research Report 21, 12–20.

1979: Distribution of loess in Britain. *Proceedings of the Geologists' Association, London* 90, 93–95.

Chartres, C.J. 1981: The mineralogy of Quaternary deposits in the Kennet Valley, Berkshire. *Proceedings of the Geologists' Association, London* 92, 93–103.

Dalrymple, J.B. 1969: Une région typique d'Angleterre, l'île de Thanet. *Bulletin de l'Association francaise pour l'etude du Quaternaire, Supplement*, 13–16.

Eden, D.N. 1980: The loess of northeast Essex, England. *Boreas* 9, 165–77.

Gallois, R.W. 1982: Loess in the Weald. *Proceedings of the Geologists' Association London* 93, 316.

Holmes, S.C.A. 1981: Geology of the country around Faversham. *Memoirs Geological Survey of Great Britain*, Sheet 273. (117 pp.)

Lee, M.P. 1979: Loess from the Pleistocene of the Wirral Peninsula, Merseyside. *Proceedings of the Geologists' Association, London* 90, 21–26.

Lill, G.O. and **Smalley, I.J.** 1978: Distribution of loess in Britain. *Proceedings of the Geologists' Association, London* 89, 57–65.

Vincent, P.J. and **Lee, M.P.** 1981: Some observations on the loess around Morecombe Bay, northwest England. *Proceedings of the Yorkshire Geological Society* 43, 281–94.

Wintle, A.G. 1981: Thermoluminescence, dating of late Devensian loesses in southern England. *Nature* 289, 478–80.

International Center for Soil Conservation Information

The following is a press release from N. W. **Hudson** of the Cranfield Institute of Technology, England:

It is planned to set up an International Center for Soil Conservation Information as an independent, non-profit-making, educational organization based at the National College of Agricultural Engineering, (NCAE), at Silsoe, Bedford, England.

The activities of the Center will be to:

1. Collect and collate information on soil conservation using bibliographic sources and a world network of correspondents. There will be a machine-readable database, as well as hard copy and micro storage.
2. Disseminate information through:
   - —a regular newsletter or bulletin
   - —state-of-the-art reviews on particular soil conservation topics
   - —subject bibliographies, with and without abstracts
   - —supplying, so far as copyright allows, copies of published literature.

The Center will work closely with NCAE in offering training facilities, research opportunity, and consultancy services.

Anyone interested is invited to write to: ICSCI, NCAE, Silsoe, Bedford, MK45 4DT, UK.

Redeposited Loess from the Quaternary Besor Basin, Israel.
A. Sneh. Israel Journal of Earth-Sciences 32, 63-69, 1983.

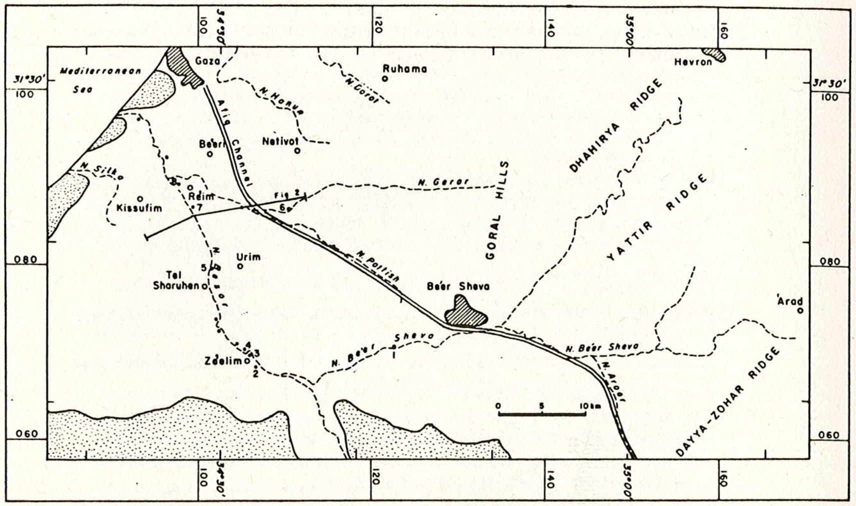


Fig. 1. Map of Besor—Be'er Sheva drainage basin showing the course of the Neogene Afiq Channel. Stations studied are marked by heavy black dots. Numbered stations refer to sections presented in Fig. 10. 1 — Hazerim. 2 — Ze'elim South. 3 — Ze'elim. 4 — Ze'elim North. 5 — 'En Besor. 6 — Nahal Gerar. 7 — Tel Ur. 8 — Re'im.

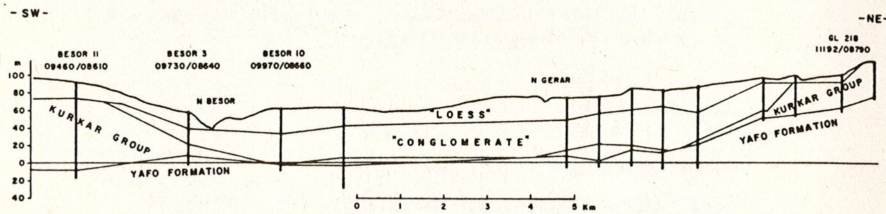


Fig. 2. Section across the Besor Basin showing the main rock units (modified after Shachnai, 1967). For location see Fig. 1.

Experimental investigation of silt formation by static breakage processes: the effect of temperature, moisture and salt on quartz dune sand and granitic regolith. K. Pye & C.H.B. Sperling. Sedimentology 30, 49-62, 1983.

(6) The shapes and surface textures of grains affected by salt weathering are dominated by angular breakage surfaces which are indistinguishable from those produced by frost action and crushing. It is therefore unlikely that surface features seen under the SEM can be used to identify a salt-weathering origin for fossil sediments. Such features clearly are not, as some earlier workers maintained (e.g. Smalley & Cabrera, 1970), diagnostic of a glacial grinding origin.

(7) The importance of salt weathering in forming silt for loess sheet deposition is likely to depend on: (a) the mineralogical and grain size composition of desert sediments: (b) the pre-emergent stress and thermal history of the rocks from which they derive (which is a major control on degree of microfracturing): (c) the previous weathering and transport history of the sediments: and (d) the availability of suitable salts. These factors must all be considered in assessing whether a particular desert region could have provided a significant source of salt-weathered silt during the Pleistocene and Holocene. Dune areas which consist of mature quartzose sands are unlikely to supply as much silt as areas of compositionally immature sediment. A particularly favourable environment for silt formation might be expected where alluvial fans extend down from actively rising mountain fronts towards extensive saline basins.

Achenheim: une séquence-type des Loess du Pléistocène Moyen et Supérieur. J. Heim, J.P. Lautridou, J. Maucorps, J. Puisségur, J. Sommé et A. Thévenin. Bulletin de l'Association française pour l'étude du Quaternaire 1982 (2-3), 147-159.

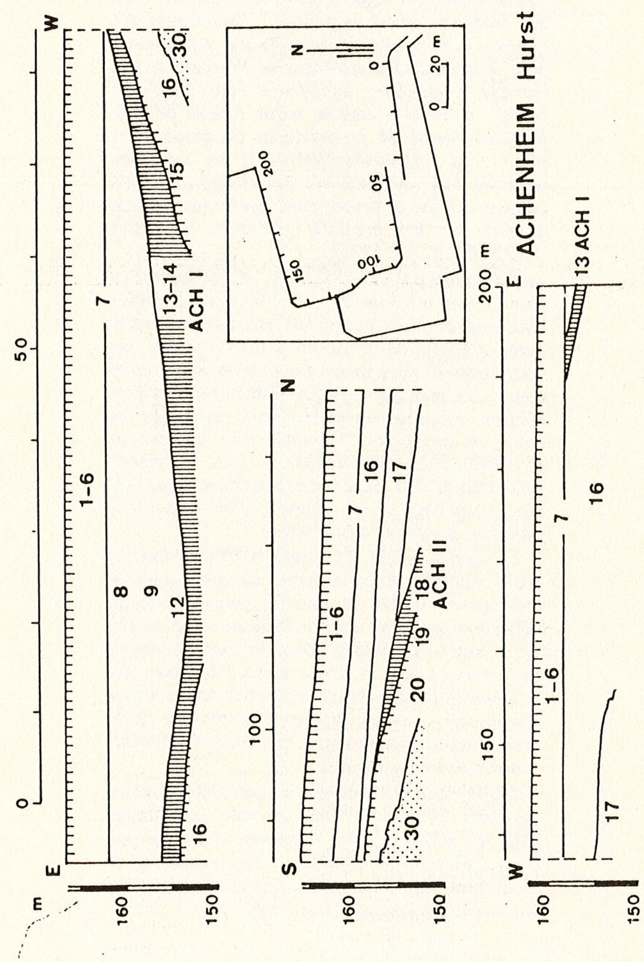


Fig. 3. - Profils des parois de la Loessière Hurst à Achenheim.
Fig. 3. - Profiles of the walls of Hurst Brickyard at Achenheim.

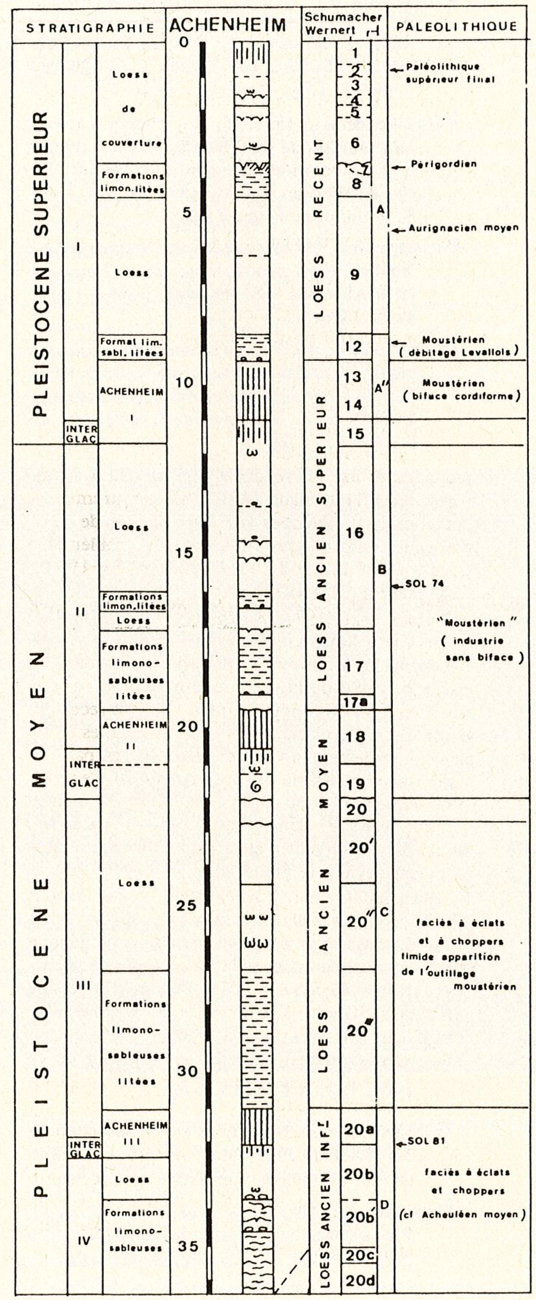
Rassai (1971), en se fondant surtout sur l'étude de la coupe voisine d'Hangenbieten, comparée à celles d'Achenheim, établit une corrélation avec la stratigraphie des loess du Kaisersthuhl (sols de Riegel) et date du Würm l'essentiel de la série loessique. Selon cette interprétation qui est appuyée par la révision faunistique de Guenther (1971), l'Interglaciaire Riss-Würm se placerait au niveau de la couche 20 de Wernert (fig. 5) mais la position stratigraphique du « limon rouge des plateaux » et des loess anciens dans la carrière Hurst n'est pas clairement établie.

Thévenin (1973, 1976, 1978) en proposant un bloc diagramme schématique des carrières d'Achenheim qui restitue les anciens profils, indique un âge Mindel-Riss pour le « limon rouge des plateaux » et retient l'interprétation würmienne pour le loess ancien supérieur de Wernert, ce qui l'amène à attribuer au Würm l'ensemble des dépôts observables dans la partie récente de l'exploitation Hurst où se développe un grand lehm placé dans l'interstade WII-WIII, les premières datations 14 C obtenues sur des charbons de bois contenues dans ce grand lehm restant problématiques (36 000 B.P. ± 2 200/1 700 B.P., Ly 1961 ; ⩾43 500 B.P., Ly 1976).

Buraczynski (1977-78, 1978, 1979) au terme d'une étude lithologique détaillée de deux profils d'Achengeim (dont l'un se place justement dans la partie nouvelle de la carrière Hurst), propose une interprétation où le même grand lehm est reconnu comme sol interglaciaire Riss-Würm et où les loess anciens seulement divisés en deux parties par un autre sol comparable (« complexe de sol de type d'Achenheim ») sont attribués au Riss. De même, Fouquoire (1978), dans la carrière Hurst, place l'Interglaciaire Riss-Würm au niveau d'un sol qui latéralement devient le grand lehm.

Indépendamment, Puisségur (1978), se fondant sur les données malacologiques de profils levés en 1965 avec Wernert, retrouve l'évolution climatique détaillée würmienne dans le loess récent de la carrière Hurst. Cependant, dans la carrière voisine Sundhauser-Ouest, il estime logique de situer l'Interglaciaire Riss-Wurm à la jonction Loess ancien moyen-Loess ancien supérieur, le contenu de ce dernier restant indéterminé, en raison de la localisation des profils étudiés.

L'historique des conceptions sur la stratigraphie des loess d'Achenheim montre donc que, comme dans les autres régions loessiques, l'un des problèmes majeurs est celui de la reconnaissance du Pléistocène récent, condition préalable pour l'interprétation des séries antérieures.



Stratigraphie, industries paléolithiques des loess d'Achenheim.

Buraczynski J., 1977-78. – Caractéristiques lithologiques des loess d'Achenheim (France). *Annales Universitatis Mariae-Curie-Sklodowska, Lublin*, vol. 32/33, 5, p. 125-149, 2 photos, 9 fig., 4 tabl.

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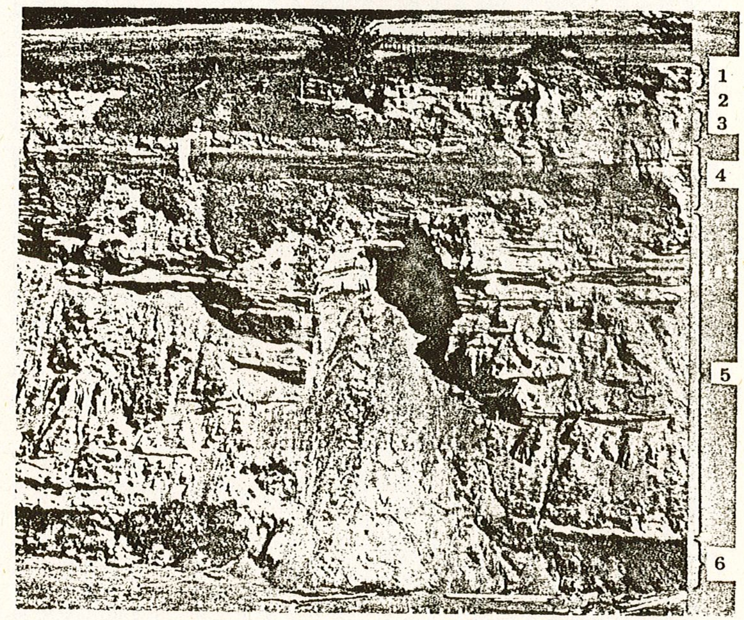
West beach silt - A late Pleistocene loess, Central Puget Lowland, Washington. G.W. Thorsen, Washington Geologic Newsletter 11 (2), 1-4, April 1983.

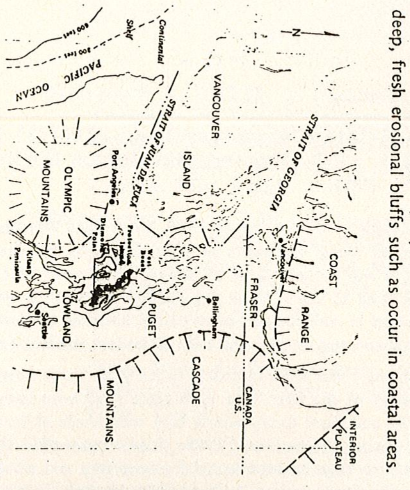
Origin – In the fall of 1979, when loess was first recognized along the bluffs of West Beach on Whidbey Island, it was thought to be an isolated occurrence. Later, in returning to other perplexing geologic sections, it was recognized in numerous areas. In places, however, the loess drapes down and intermingles with water-laid material and thus is not a true loess according to the strict North American usage of the term. One such place is between Ebeys Landing and Fort Casey where tiny snail shells of fresh water species can be found in the silts. In other areas the silt section may be interrupted by very thin and planar sandy "partings" and(or) isolated ripple marked horizons, indicating at least temporary inundation.



West Beach on Whidbey Island. Bluff is about 200 feet high on the right.

1. Sand dunes (post glacial)
2. Till (Vashon Drift)
3. Gravelly sand (Vashon advance outwash)
4. Massive silt (loess)
5. Stratified pebbly sand
6. Stratified silt with some sand and peat (Whidbey Formation)

Distribution – So far the West Beach silt has been recognized as far west as Protection Island and possibly Port Williams on the Olympic Peninsula. The northernmost exposures have been found at West Beach and Blowers Bluff on Whidbey Island. The unit may be exposed as far south as northern Kitsap Peninsula but verification will await further study and the dating of an apparent paleosol here. No exposures have so far been found on the mainland to the east. This may, in part, be due to the relative lack of deep, fresh erosional bluffs such as occur in coastal areas.



General location of West Beach silt occurrences (shaded area)

Soil forming processes would make an exposure of the loess on upland surfaces difficult to differentiate from other silt-rich units.

One might expect wind-deposited dust to blanket extensive areas. Why is the extent of the West Beach silt so localized? Among the possibilities are that it is not really localized, but simply hasn't been recognized elsewhere or that it was deposited in and reworked by water and thus is indistinguishable from any other water-laid silt. Another possibility is that it was eroded from much of its original area of deposition. Such material would erode very easily in today's relatively rainy environment. Undoubtedly, the climate was different from that of the present. Maybe it is just a coincidence that the area where remnants are now found roughly coincides with the "rain shadow" of the Olympic Mountains.

Age – The scarcity of organic material in the basal paleosol of the loess at West Beach has made it difficult to use radiocarbon dating techniques there. However, the unit is well exposed on the north-facing bluffs of Protection Island. Here, a continuous blanket of uniform elevation abruptly drapes down and interfingers with stream and floodplain deposits. Wood from within the base of the loess has been dated at 33,490 ± 550 and 31,500 ± 890 years before present by two different labs. Wood from sediments nearing the end of the period of loess deposition has been dated at 28,200 ± 860 years before present.

Stratigraphic relationships – Puget Sound Quaternary geology is far from a simple "layer cake" of superimposed sediments, and the central Lowland is no exception. Complicating recognition and tracing of the West Beach silt is the variety of its overlying and underlying sediments. Commonly underlying the unit is a glacial drift made up of a rather "poor quality" till, nonsorted sandy gravels, and(or) glaciomarine sediments. This drift unit, where present, is commonly blanketlike rather than exhibiting the abrupt thickening and thinning of the till from the last ice sheet. In other places, including at West Beach, the loess overlies gray, locally pebbly sand that is as much as 120 feet thick. Features such as the great thickness, vertical and lateral consistency, and lack of wood or peat suggest that these sands were deposited from glacial melt-water streams. . . .

From the foregoing it is obvious that recognition of the West Beach silt, like most scientific discoveries, may raise as many questions as it solves. Nevertheless, such a "marker bed" can help solve some knotty stratigraphic problems. Geologic mapping has been likened to solving a 3-D puzzle with most of the pieces missing, so we can use any tools we can get. In spite of unresolved scientific questions, the more we know about Quaternary stratigraphy the better it can contribute to applied practical problems such as gravel exploration, ground water and waste disposal questions, landslide distribution, and even regional tectonics.

Since recognition of the West Beach silt as a loess, another, older loess has been recognized in the area. This unit, essentially identical to the West Beach silt, is beyond the range of conventional radiocarbon dating (40,000 years). Thus, stratigraphy and other geologic tools will be needed to recognize it and trace its extent. Together these interesting formations may help solve some perplexing problems in Quaternary geology. They should also be useful in tying together southwest British Columbia, Olympic Peninsula, and southern Puget Sound Pleistocene stratigraphy.

Kawakawa Tephra in Wairarapa, New Zealand, and its use for correlating Ohakea loess. A.S. Palmer. N.Z. J. Geology & Geophysics 25, 305-315, 1982.

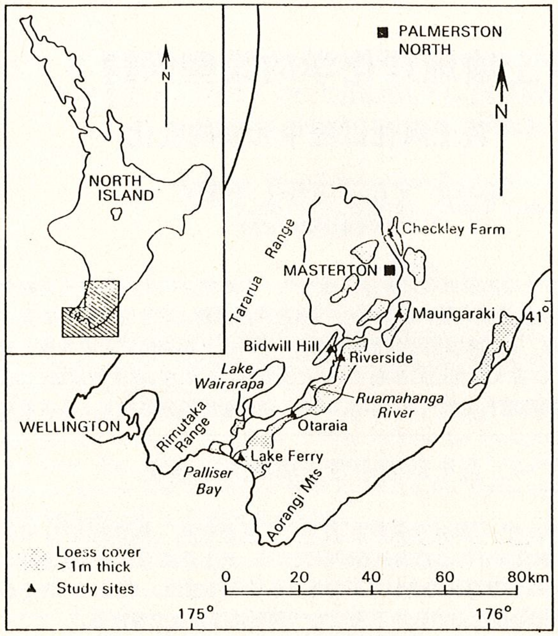


Fig. 1 The main loess areas in eastern Wairarapa showing localities mentioned in the text.

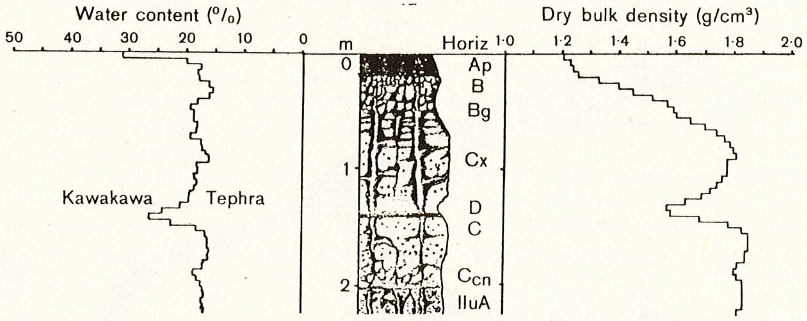


Fig. 4A Bidwill Hill core.

In the eastern part of Wairarapa, the 20 000-year-old Kawakawa Tephra occurs as a 0.06–0.10 m band of coarse silt to fine sand with medium and fine ash size glass and pumice fragments within the uppermost extensive loess unit. Loess enclosing Kawakawa Tephra occurs mainly on alluvial fan and terrace deposits older than the Waiohine Surface. The stratigraphic position of Kawakawa Tephra within the loess enables confident correlation with the Ohakea loess of Rangitikei and Manawatu. Kawakawa Tephra and enclosing loess have contrasting particle shape, particle packing, grain-size distribution, and mineralogy. Consequently, the dry bulk density and natural water content of the tephra, where thick and coarse, differ markedly from that of the loess. The dry bulk density/natural water content method can usually be used to locate the position of the tephra within the loess column at sites where the tephra is not macroscopically visible. Identification of Kawakawa Tephra is confirmed by ferromagnesian mineralogy.

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古土壤地球化学的某些问题

——黄土风化过程中元素的变化

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（中国科学院地球化学研究所）

对黄土中埋藏古土壤的研究有过许多报道[2,5,8]。但对黄土风化过程中元素的变化讨论则不多。笔者是在近年来对陕西洛川黄土剖面工作的基础上，讨论了不同类型古土壤中元素的含量与分布，古土壤剖面中元素的变化。并将古土壤的化学组成与黄土母质进行比较，进而论述了在古气候变迁的影响下，黄土剖面中元素迁移、积聚的地球化学特征。这对探讨黄土的堆积环境和生物气候条件的演变，以及地层划分等均有十分重要意义。

一、黄土剖面中古土壤的分布概况

黄河中游地区黄土中，广泛分布着若干"红层"或"红色条带"，据研究认为，它们属于古土壤层[9]。黄土物质成分和动植物化石的研究表明，黄土是在干旱草原生态环境下堆积的[7]，而古土壤是在温暖湿润的森林草原的生物条件下形成的。黄土——古土壤的多次叠复，反映了第四纪地质历史过程中不同生物气候环境的多次交替演变。

本文所研究的陕西洛川黄土剖面，黄土总厚约 130 米。在该剖面中，不同时期的黄土

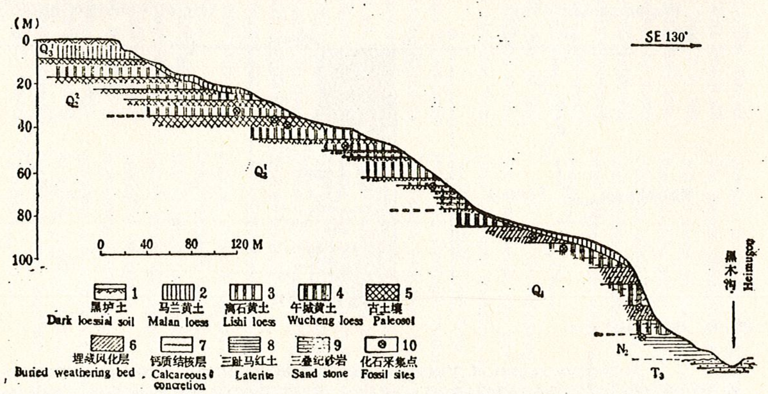

图 1　陕西洛川坡头村黄土剖面图

Fig. 1 Loess section of Potou village, Luochuan, Shaanxi Province

ON THE GEOCHEMICAL CHARACTERISTICS OF PALEOSOL ——THE CHANGE OF CHEMICAL ELEMENTS IN LOESS DURING WEATHERING PROCESS

Sun Fuqing, Wen Qizhong, Diao Guiyi and Yu Suhua
(Institute of Geochemistry, Academia Sinica)

Summary

This paper deals mainly with the content and distribution of chemical elements in different types of paleosol in loessial section of Luochuan, and the geochemical characteristics of elements in their translocation or accumulation process during process of soil formation from loess to paleosol.

Comparing with parent material (loess), the average contents of Al, Fe^{3+} and K of the paleosol are higher than those of loess; whereas the average contents of Ca, Fe^{2+} and Na are lower than those of loess. The contents of Al, Fe^{3+}, K in paleosol profile increase from bottom upward, and the highest value appears in the argillic layer, but the $CaCO_3$ content is lowest and caliche horizon is evident.

It is found by t test that the contents of Ca, Al, Fe^{3+}, K, Si, Ti, Mn, Zn, etc. were changed markedly, but the contents of Pb, Co, Ba were not changed evidently after the genetic process from loess to paleosol. In addition, it can be found from the analysis of relative values of eluviation and illuviation of oxides that the Fe_2O_3, Al_2O_3, K_2O, etc. were accumulating, but CaO, Na_2O were leaching relatively in pedogenetic process. The accumulation of Fe_2O_3 and leaching of CaO are most obvious. At the same time, the contents of Zn, Cu, Mn, Ti, Ni, etc. in paleosol are higher than those in loessial parent material, and the content of Co in paleosol is lower than loessial parent material. The distribution of these elements in the profiles are also different. It is considered that with strengthening of the intensity of pedogenesis progressively the Sr/Ba value was decreasing, whereas the F/Cl value and leaching coefficient ($SiO_2/RO+R_2O$) and aluminization coefficient (Al_2O_3/Al_2O_3 (Malan loess)) etc. were increasing.

The different types of paleosol reflect their difference in the intensity of weathering process in pedogenesis, which they had undergone and the difference of leaching and accumulation degree of elements also reflects the marks of paleoclimatic fluctuation for each warm-humid pedogenetic stages during loess deposition and evolution.

Origin of desert loess from some experimental observations.
W.B. Whalley, J.R. Marshall & B.J. Smith. Nature 300 No. 5891, 433-435, 2 December 1982.

A longstanding problem of Quaternary geology has been the origin of the silty deposit known as loess. Of the many explanations for its formation and distribution[1,2], the most commonly accepted is that the silt is produced by subglacial grinding processes[1,3,4], followed by redistribution and deposition by the wind. The large expanses of loess in central Europe are therefore considered to be the consequence of Quaternary glaciation[5]. There is, however, a view[6,7] that loessic silt may also originate as the product of processes in hot deserts. Some proponents of the desert loess hypothesis consider that silt-size material is the product of weathering processes[7] which may include salt weathering[8] or weathering down incipient cracks[9]. An alternative mechanism is aeolian attrition of sand grains, although, probably as a result of the experimental work of Kuenen[10], Smalley and Krinsley[11] consider that only fine silt (2–6 μm) is produced in large quantities by the abrasion of quartz grains. We have simulated aeolian attrition of angular quartz grains previously produced by weathering in deserts. The products of abrasion show that both coarse and fine silt sizes are produced. These findings suggest that desert aeolian processes can produce loess. We also suggest that much of this material from many deserts has been deposited in the sea but that the Chinese loess could have been produced in the Gobi desert. The finest particles produced by such attrition may be a source of silica for silcrete formation.

Analysis of dust rain in the historic times of China.
Zhang De'er. Kexue Tongbao 28(3), 361-366, March 1983.

Chronological Table of Dust Rains in the Historic Times of China.

Century	Dust-Rain Year											
20th	1933	1930	1928	1925	1923	1920	1914	1906				
19th	1899	1896	1895	1879	1878	1876	1875	1872	1869	1868	1865	1864
	1863	1862	1861	1860	1859	1858	1857	1856	1855	1853	1852	1851
	1850	1847	1842	1840	1826	1825	1824	1813	1810	1807		
18th	1794	1786	1785	1783	1774	1773	1769	1768	1759	1751	1745	1742
	1739	1732	1727	1721	1720	1712	1709	1706	1705	1701		
	1698	1696	1693	1692	1691	1690	1687	1686	1680	1672	1671	1670
	1668	1667	1662	1660	[illegible]			[illegible]	1644	1643	1642	1641
	1640	1639	1637	[illegible]					[illegible]	1621	1620	1619
	1618	1613	[illegible]									
											[illegible]	1550
	[illegible]	652	633	[illegible]								
6th	582	580	550	537	536	[illegible]	[illegible]	[illegible]	503			
5th	488	486	452	439	402							
4th	383	382	357	323	321							
Before 3rd	300	−32	−35	−78	−86	−125	−284	−1150				

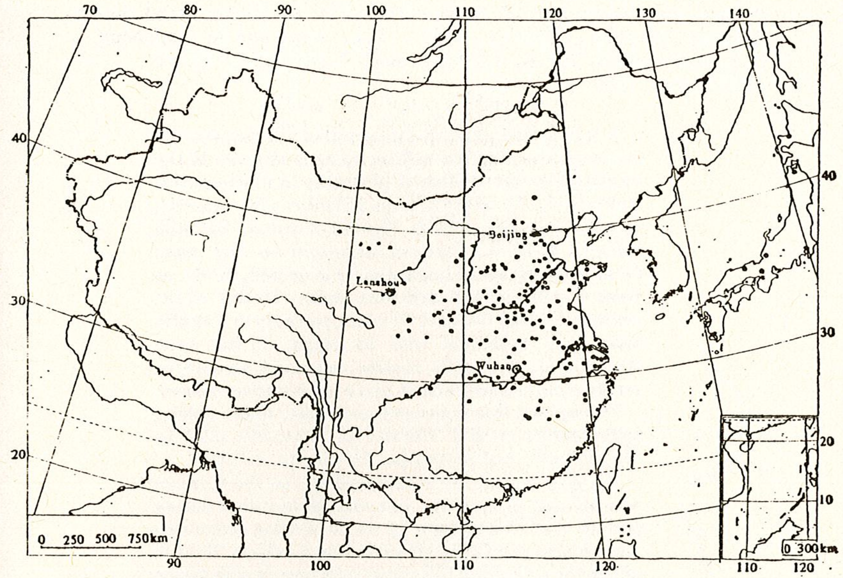

Fig. 1. Distribution of dust rain in historic times.

The dust and sand can be traced back to the Mongolia desert where the gale originated and were reinforced on the way. Dust rain of this type resulted from the passage of a strong cold front, followed by an intensified anticyclone in its rear. It is interesting to note that the path of dust rain in the historic times is quite similar to the anticyclone path in October—May given by meteorological data in modern times. The second type of dust rain was often described as "sand flying up in calm", "dust rain as fog". This type might occur anywhere. But it is noteworthy that all the dust rains in lower latitudinal regions such as Putian (1671), Wuzhou (1768) and Xiangshan (1721) belong to this type. The dust and sand were carried by upper tropospherical westerlies, then settled down under favourable conditions. In China, the vast regions where dust rains occur are situated in the rear of the trough of Eastern Asia, where sinking current prevails, suitable for the dust to settle down. It is interesting to discover that the climate in China is cold when the trough of Eastern Asia is the deepest. This point is consistent with the conclusion of the frequent dust rain spells mentioned above.

In a word, the dust rain is a phenomenon of loess deposition in the atmosphere. The dust and sand are transported by wind force. The areas where dust rain occurred in historic times nearly coincide with those of loess distribution today, and the dust rain frequently occurred in cold period. Their frequency is closely correlated with the thermal background, so that records about dust rain will provide useful evidences for reconstructing historical temperature.

Origin and character of loess-like silt in unglaciated South-Central Yakutia, Siberia, USSR. T.L. Péwé and A. Journaux. U.S. Geological Survey Professional Paper 1262. 46 p. Washington 1983.

A well-sorted uniform tan loesslike silt mantles the river terraces and low rolling uplands of much of the unglaciated part of Siberia, especially in south-central Yakutia (fig. 1), where it forms a blanket a few centimeters to many meters thick. The silt of central Yakutia, referred to in the Russian literature as clay loam, loesslike loam, dusty loam, glacial loam and, rarely, as loess, has been mentioned since before the turn of the century. During the past 75 years, workers in Yakutia have been concerned with its origin. It has been classified as a fluviatile, marine, estuarine, lacustrine, residual, and eolian deposit, and a combination of these.

Throughout this report, we shall refer to the upland sediments of central Yakutia as "loess-like silt," or "upland silt," and sometimes for brevity, as "silt."

We believe that the widespread silt on the terraces and uplands is loess and was mostly deposited during periods of glacial advance by winds blowing across outwash plains and valley trains in broad valleys. The tan silt on the ridges and hill slopes interfingers with layers of gray-to-black perennially frozen silt in drainageways and small valley bottoms. This black, frozen silt has been retransported from the hill slopes by rill wash, creep, solifluction, incorporating much organic debris, including many vertebrate remains. In a few places, two or more stratigraphic units can be recognized in the silt, but as we saw relatively few good stratigraphic exposures, it has not been possible to subdivide the silt stratigraphically; consequently the silt is treated as a single unit in this discussion.

This report is in part the result of a cooperative project proposed by Péwé to the Academy of Sciences of the U.S.S.R. and the National Academy of Sciences of the U.S.A. Péwé and Journaux visited the Lena-Aldan area in 1969 while participating in the excursion of the Periglacial Commission of the International Geographical Union. Because of the striking similarity of the distribution, character, and stratigraphy of the loesslike silt exposed in central Yakutia to the perennially frozen Quaternary silt exposed in unglaciated central Alaska (Péwé 1955, 1975a,b), Péwé returned in 1973 to make further observations and to collect silt, paleontological, and radiocarbon samples. The 1973 visit was in part made in connection with the Second International Conference on Permafrost (Péwé, 1973a,b,c). In order to understand more fully the origin, distribution, and characteristics of the silt, the exposures examined by Péwé and Journaux in 1969 were revisited and more samples collected.

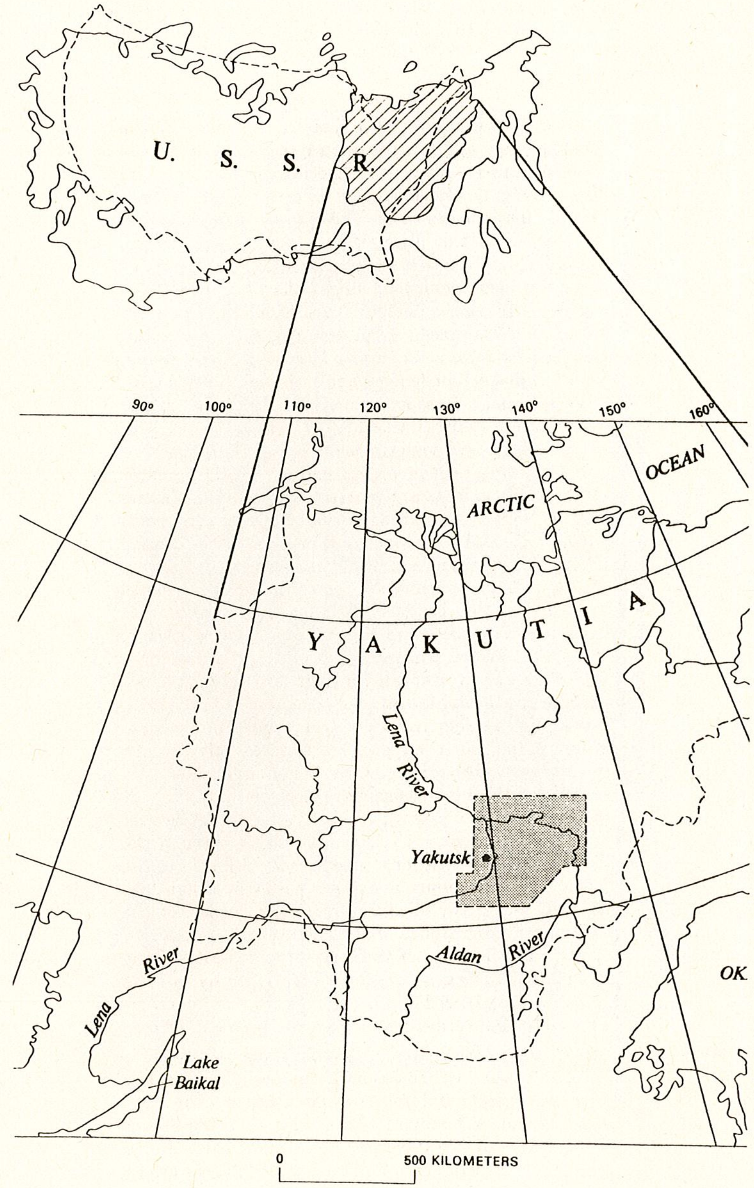

FIGURE 1.—Index map of Yakutia, U.S.S.R. Area of field research near Yakutsk (shaded area)

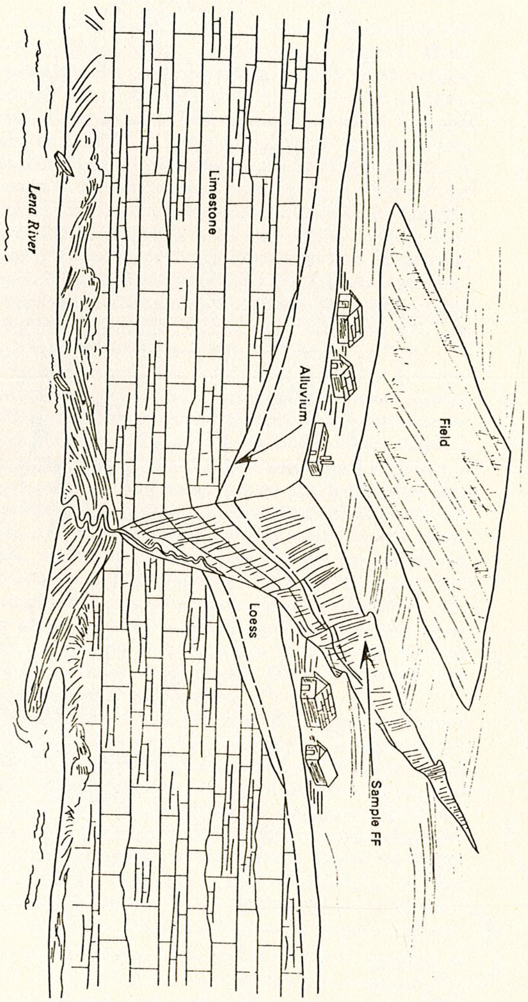

FIGURE 13.—Loess-covered terrace of Ilanskjo Village on Cambrian dolomitic limestone, 70 km upstream from Pokrovsk on left limit of Lena River. See figure 3. Loess is 7 m thick at gulley.

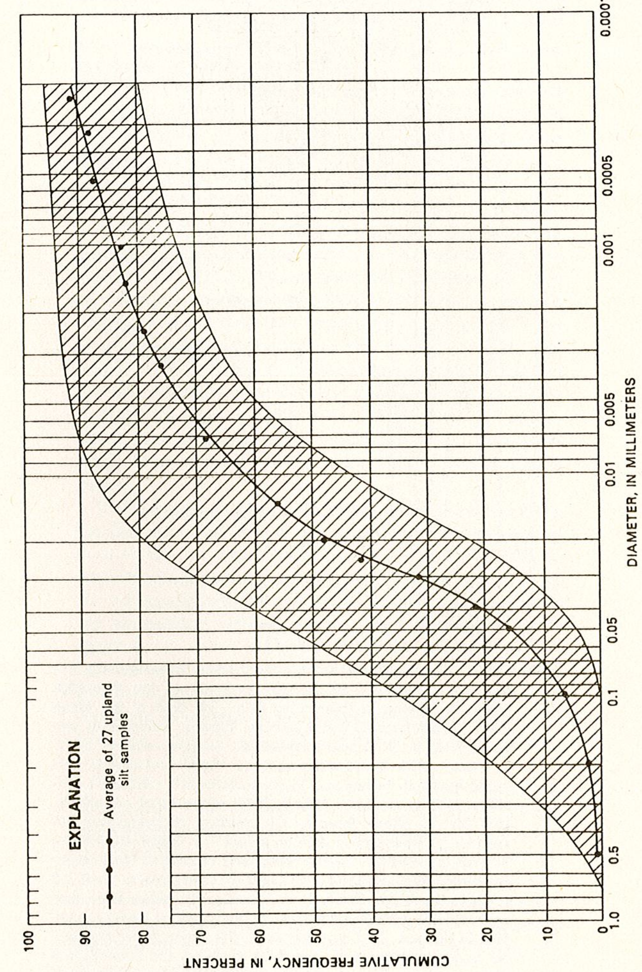

FIGURE 16.—Average cumulative-frequency grain-size curve for 27 samples of upland silt on high terraces in central Yakutia. Range of texture of samples shown by cross-hatched area.

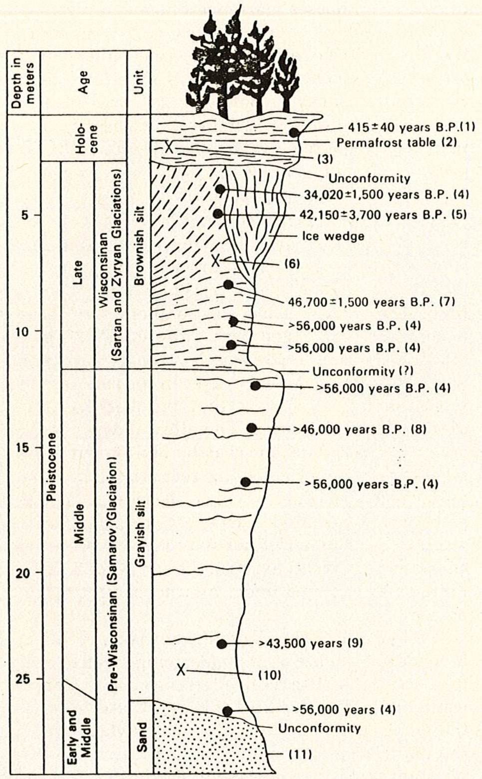

FIGURE 30.—Diagrammatic stratigraphic section of perennially frozen late Quaternary silt in the exposure of the 50-m-high (Abalakh) terrace at Mamontova Gora, left limit of the Aldan River 310 km from its mouth, central Yakutia. Radiocarbon material dated in U. S. and loesslike silt samples collected by T. L. Péwé, 1973. Radiocarbon material dated in U.S.S.R. collected by M. S. Ivanov and V. V. Kastukevick, 1974 (P. I.Melnikov, written commun., June 6, 1975). From Péwé and others, 1977 (fig. 3). (Reproduced by the courtesy of *Quaternary Research*.) (1) Radiocarbon date on a root 1 m below the surface, SI 1968 (SI numbers indicate laboratory number of Smithsonian Institution, United States). (2) Depth to permafrost is about 1-2 m under the forest. Flat-topped ice wedges indicate a lower permafrost table with thawing down to the top of ice wedges sometime in the past. (3) Loess sample G. See figure 21 for mechanical analyses; tables 3, 4, and 6 for chemical and mineralogical analyses of samples G-I. (4) Radiocarbon date from Permafrost Institute, Yakutsk. (5) Radiocarbon date on tree fragments, SI 1965. (6) Loess sample H. (7) Radiocarbon date from two small fragments of unidentified late Quaternary mammal ribs, SI 1972. (8) Radiocarbon date on wood fragments, SI 1967. (9) Radiocarbon date on wood fragments, SI 1966. (10) Loess sample I. (11) Crossbedded brown sand of early and middl Pleistocene age.

Hypotheses advanced to explain the origin of the upland silt proposes marine, estuarine, lacustrine, fluvial, residual, or eolian sources, or a combination of these. A marine or estuarine source is unlikely because of the absence of evidence of deltas, shorelines, beaches, clay, mud cracks, ripple marks, and marine or brackish-water fossils. Moreover, such an origin would require a rise of sea level or a subsidence of the land of many meters in late Pleistocene time, an inundation not borne out by geologic evidence.

The upland silt is not of fluviatile origin because (1) it is unstratified and contains no individual beds or lenses of other sediments, (2) it occurs as a nearly continuous blanket over a surface of irregular topography with relief of 200 or 300 m and is more than 200 m above the major rivers; and (3) no fresh-water fossils are present.

The lacustrine hypothesis is strongly supported by workers studying the ice wedges in the perennially frozen ground. They believe that the loesslike silt is a combination of lacustrine and alluvial deposits formed on great flood plains and marshy plains. But there are several reasons for believing this origin unlikely. No evidence of shorelines, wave-cut beaches, or deltas are present; nor are mud cracks, ripple marks, or fresh-water fossils found. Neither stratification nor an appreciable amount of clay exists in the silt. No definite upper limit, to be expected under a lacustrine hypothesis, is present.

The hypothesis that loesslike silt is a product of the breakdown in place of the underlying rocks, mainly by frost action, has also received strong support from many workers. Evidence against this hypothesis includes: (1) the minerals in the silt are not everywhere similar to the underlying bedrock, (2) no large particles of more resistant minerals are present, (3) the silt does not become progressively coarser toward bedrock, (4) mechanical disintegration by alternate freezing and thawing could not produce untransported silt 60 m thick on flat terraces, and (5) the silt contains undisturbed carbonaceous layers.

Evidence for the eolian origin of the upland silt is abundant: (1) the silt mantles older topography, (2) it is lithologically independent of the underlying material, (3) stratification is indistinct or absent, (4) it is associated with sand dunes, (5) it contains fossils of air-breathing land animals, (6) its sorting and texture are similar to those of loess and windblown dust from many places elsewhere in the world, and (7) the grains are angular and relatively fresh.

Central Yakutia has not been glaciated. However, glaciers from the Verkhoyansk Range on the north and west as well as glaciers in the ranges south and east and the continental glacier on the west almost surrounded the interior of Yakutia during times of glacial maxima (fig. 4). We believe the upland silt to be loess deposited mainly during periods of glacial expansion by winds blowing across the unvegetated outwash plains and flood plains of glacial streams.

LL10: October 1983: Contents

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