LOSE LÖSS-BRIEFE

LOESS LETTER 31

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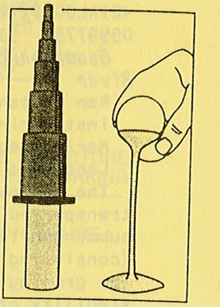

NATO ADVANCED RESEARCH WORKSHOP
Loughborough University of Technology
11-14 April 1994

GENESIS AND PROPERTIES OF COLLAPSIBLE SOILS

Loess Letter LL31 : April 1994

LL welcomes to Loughborough all participants in the NATO Advanced Research Workshop on 'The Genesis and Properties of Collapsible Soils'. Loess is, of course, the chief and most important collapsible soil and has long been investigated by members of the INQUA Loess Commission. We hope that the fruitful discussions will reveal many new aspects of the collapse problem. The Loess Commission has been involved in two conferences in the UK in the early part of 1994 which largely span the current large range of topics being investigated in the loess-rich parts of the world. In January 1994 at Royal Holloway, University of London, there was the joint QRA/INQUA meeting on 'Wind Blown Sediments in the Quaternary Record' which was mostly concerned with loess stratigraphy and dating. Read a full account in the QRA Newsletter for February 1994. In April 1994 at Loughborough University of Technology we have a complementary meeting which involves geotechnical loess problems, the most important of which is collapse. This issue of LL looks, as always, at all aspects of loess, and we reprint some abstracts from the Royal Holloway meeting.

Loess Letter LL is the newsletter of the Loess Commission of the International Union for Quaternary Research INQUA. It is published twice a year (usually in April and October) by Ian Smalley and Tom Dijkstra, Civil Engineering Department, Loughborough University of Technology, Loughborough, LE11 3TU, UK: Fax 0509-610231. Major decisions relating to the Loess Commission are made at the main INQUA Congresses; the next Congress - the 14th - will be held in Berlin in August 1995: details from your national Quaternary Committee or from Prof Dr M Böse, INQUA Büro, Grunewald str 35, D-12165 Berlin: Fax (49) 30 838 6532. The Loess Commission Aim, briefly stated, is to encourage interest in, and research on, loess, and to facilitate links and communication between loess investigators. To celebrate the Berlin Congress, LLs 31, 32 and 33 carry an additional title: 'Lose Löss-Briefe' - which means 'unofficial loess letters'. The main Berlin loess event should be a symposium on 'Löss in Europa' to celebrate the (more or less) 60th Anniversary of Rudolf Grahmann's map of the distribution of loess in Europe. We hope to discuss all aspects of European loess, but an emphasis on distribution might be contrived. Contributions on loess from any part of the world will be welcome for the Congress in general.

LL31 contains some samplings from papers in the new book on 'Engineering Characteristics of Arid Soils' edited by P Fookes and R Parry (Balkema 1994) and a few abstracts from the QRA/INQUA meeting in January. The cover comes from a paper by Alena Klukanova and shows an idealised loess soil structure.

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Geomorphic features and evolution of the submerged delta of the modern Yellow River

Ren Yucan,
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Marine Geology & Quaternary Geology 1992. v 12(4) pp 59-68
Language: CHINESE

The Yellow River Delta is formed as a result of the accumulation of sediment transported by Yellow River from the Loess Plateau. Morphological features of the submerged Yellow River Delta are divided into the following types: delta front (consisting of mouth bar and distal bar), prodelta and mud bay. The mouth bar is the growing point of the Yellow River Delta. Its stability has a direct effect on stability of the river mouth and life-time of the channel. River mouth can push aside sea water, flow 8-10km into the sea from river mouth and form scour structure on the sea bottom during the flood period. Data of geomorphological evolution indicate that the lateral distance of transported silt is 16-20km in width. -from English summary

PROCEEDINGS OF THE 1ST INTERNATIONAL SYMPOSIUM ON ENGINEERING CHARACTERISTICS OF ARID SOILS LONDON / UK / 6-7 JULY 1993

Engineering Characteristics of Arid Soils

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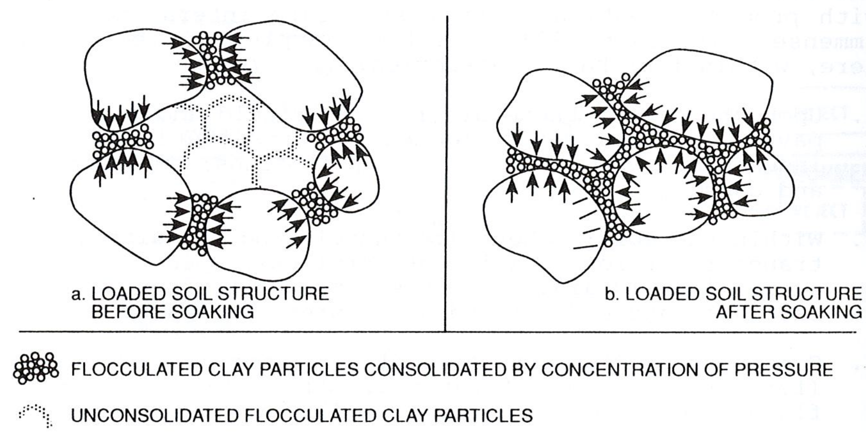

Engineering Characteristics of Arid Soils, Fookes & Parry (eds)
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Classification of arid soils for specific purposes

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ABSTRACT

Engineering structures can be classified according to their purpose, and the requirements of the soil on which, in which, adjacent to which or from which the structure is constructed can be specified. This would form the basis of an application - orientated approach to classification. A second approach is a material-orientated approach to classification, according to which both the physical properties and the local environment should be considered before the material can be classified as suitable for a particular purpose. Examples of the two approaches are given. It is clear that the material approach is most complex, and yet it follows the paths of thought that an engineer would need to follow and it thus provides the basis of a knowledge-based system for design.

INTRODUCTION

The range of engineering structures to be designed, each with proper attention to soil structure interaction, is immense (Aitchison 1983). A few examples can be given here, within four basic categories:

1. Upon the soil: there are road, airfield and railroad pavements; buildings (domestic, institutional and industrial) with shallow or deep footings; embankments and dams.

2. Within the soil: there are tunnels and conduits (for transport or for location of services); open excavations (drainage ditches, open cast mines, etc); basements and underground structures (car parks, etc).

3. Construction with (or of) soil: relates to earth dams (for the retention of water or other fluids or semi-fluids); embankments (terrain modification for road or rail systems, etc); fills (reclaimed areas, etc).

4. Construction problems from adjacent soils: relates to

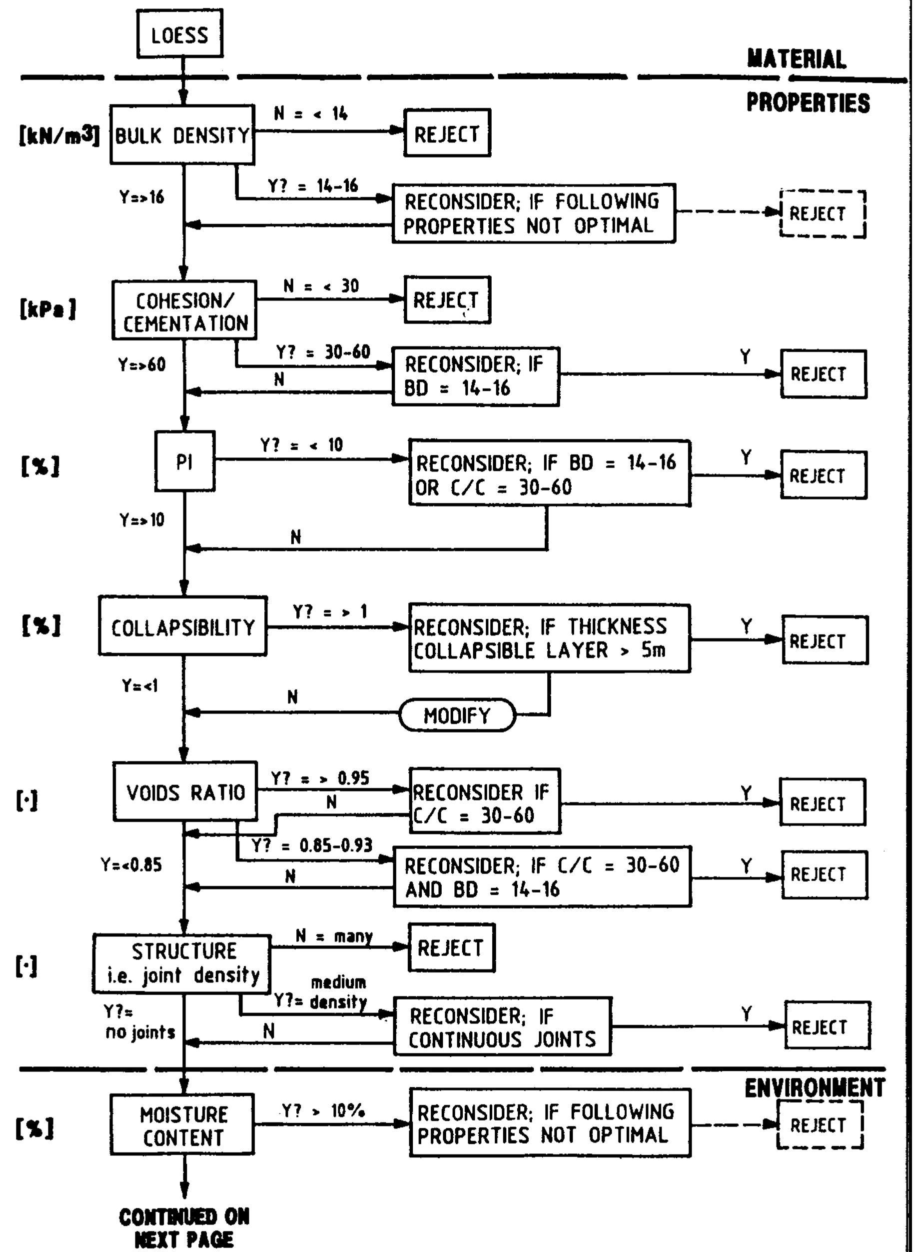

Figure 3. Loess classification

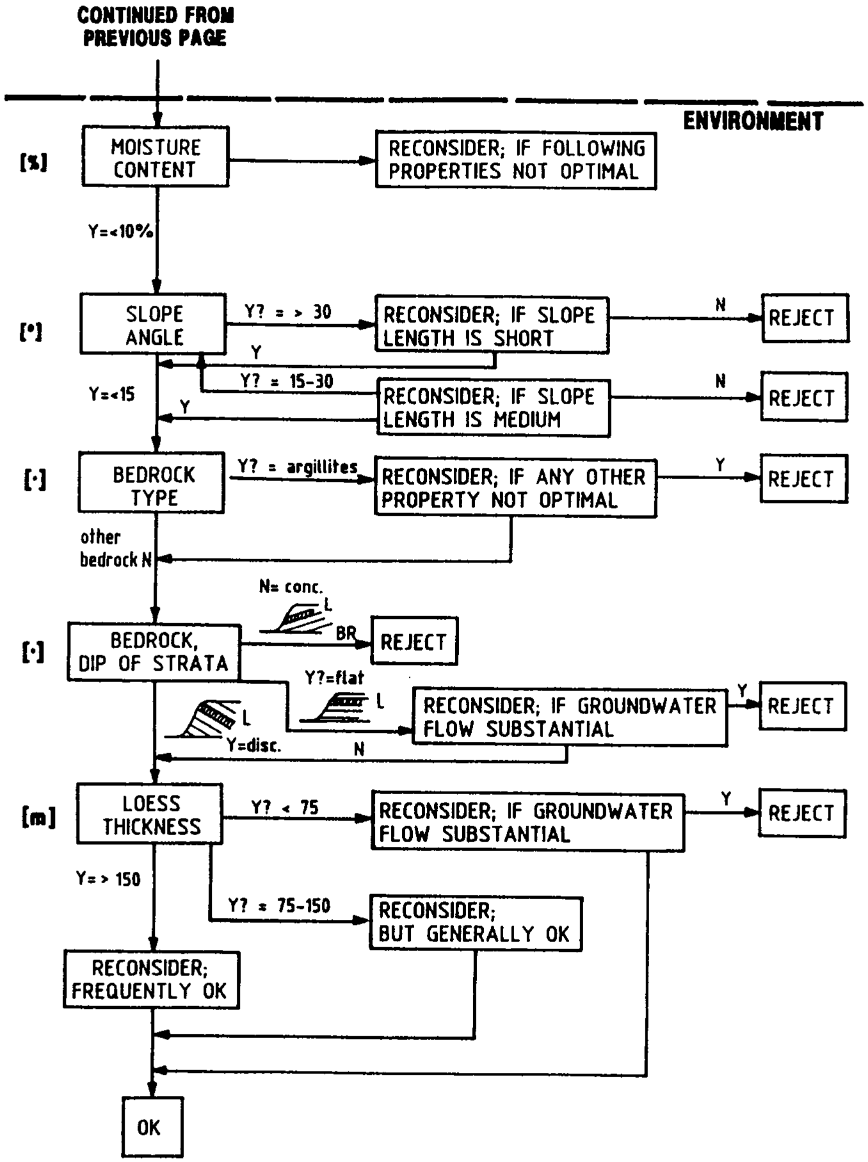

Figure 3 (continued). Loess classification

REFERENCES

Aitchison, G.D. (1983). Soil engineering in Australia. In Soils: an Australian viewpoint. CSIRO/Academic Press 857-871.

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Collapse of soil structure

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INTRODUCTION

The origin of arid soils is bounded with three principal factors: climate, parent material and local conditions (geography, morphology, etc.). Since climate and local conditions are time-variable, paleoarid soils may be encountered produced under favourable conditions in the past which do not persist. An example of such a soil is represented by loess, soil of eolian origin coming from the arid interglacials of Quaternary period.

Though arid soils form a special group of soils, their behaviour should follow the same pattern like any other soil but with some specific features. One of the most prominent one is the bonding of arid soils with cementation bonds as accentuated with evaporites. Casagrande (1932) already attracted the attention to bonding and its importance has been emphasized recently (Leroueil and Vaughan, 1990).

By analyzing the bonding of arid soils - the writer chose loess as a fitting example - one can better understand the process of debonding of common soils (bonded soils are often called "structured" and debonded "destructured"). As far as the soil structure is concerned, one may differentiate bonding within the aggregates or particle clusters (intra-granular bonding) and mutual bonding between aggregates (intergranular bonding - Feda, 1982), the latter being, as a rule, weaker.

COLLAPSE ON WETTING

The writer's starting point is the collapse of loess structure on wetting. It is well known that such a collapse is not confined to loess (Feda, 1966) but loess represents a suitable model material for dealing with it. There are two critical conditions for a loess to be collapsible: high porosity (>40%) and low degree of saturation (<60%).

The ratio of the additional compression due to wetting

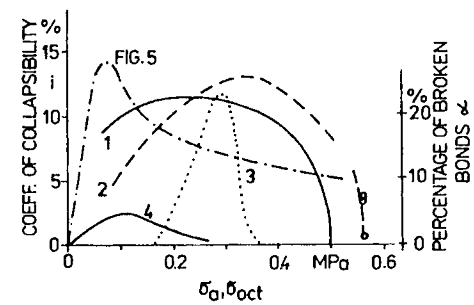

***Figure 1** Dependence of the coefficient of collapsibility on the stress (1 - Kolasa, 1963; 2 - Priklonskiy, 1952; 3 - Feda, 1967 - α vs σ_{oct}; 4 - Feda, 1966).*

to the specimen's height $\Delta e/(1+e)$ (*e* means void ratio) is called the coefficient of collapsibility *i* (in %). Fig. 1 shows two typical test series (1, 2) demonstrating the dependence of *i* on the axial (oedometric) pressure σ_a. The local variability of *i* may be considerable. Curve 1 and open circles denote the same material (loess from Praha-Dejvice) and in the same locality some loess strata are even uncollapsible having lost their structural metastability through transport by solifluction. According to Fig. 1 the metastable (collapsible) structure transforms into the stable one either by the virulent collapse on wetting or - retaining its original water content - by the elevated pressure (for loess in Fig. 1 at σ_a > 0.6 MPa).

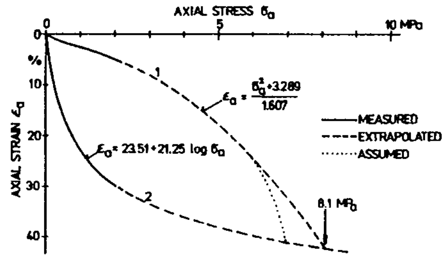

Figure 2 *Compression curves of undisturbed (1) and collapsed (2) Sedlec loess (after Feda, 1992).*

Fig. 2 depicts two oedometric compression curves (loess from Praha-Sedlec), that of the very dry undisturbed loess (water content of about 10% - 1 on Fig. 2) and another after the water inundation of the same loess (curve 2). Both curves are extrapolated beyond σ_a = 2 MPa which was the maximum experimental pressure available. The value of *i* (Fig. 3) confirms 1 and 2 in Fig. 1 in a broader diapason. At higher pressures (σ_a > 5 MPa), the dotted lines in Figs. 2 and 3 seem to be more probable.

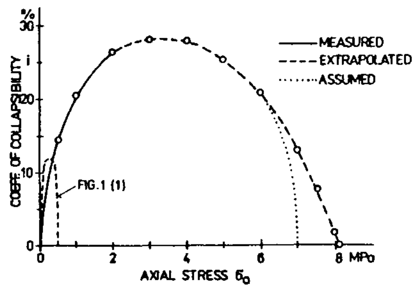

Figure 3 *Coefficient of collapsibility vs stress as deduced from Fig. 2.*

PROGRESSIVE COLLAPSE BY STRAINING

As with loess, two compression curves (undisturbed and debonded) are needed to define the extent of debonding of other soils, analogous to *i*. They may be found already with Casagrande (1932 - Leda clay). Fig. 4 presents a more recent example (Bothkennar clay - Burland, 1990). Many similar curves can be found in the literature. They show that the value of *i* rises to some maximum (structural resistance or strength, marked eg by the preconsolidation load) and then gradually *i* → 0 as the undisturbed compression curve approaches the reconstituted one. The

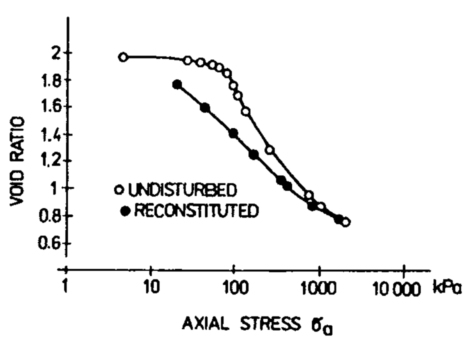

Figure 4 *Compression curves (oedometer) of Bothkennar clay (Burland, 1990).*

process may be interpreted as progressive debonding of the structure and it is accompanied by typical signs of local structural instabilities (see eg Clayton et al., 1992; Feda, 1992 - creep perturbations, etc.). The characteristics of gradual debonding $\Delta e/\Delta e_{max}$ (Δe = the distance between two compression curves) is markedly asymmetrical (Fig. 5).

Similar characteristics of debonding may be found indirectly when interpreting the shear box tests of loess (Feda, 1967 - Fig. 1, curve 3 - % of debonding vs octahedral normal stress σ_{oct}). A transitory loess specimen showing debonding both by water and compression is shown by curve 4 in Fig. 1, compared in Fig. 5 with Bothkennar clay.

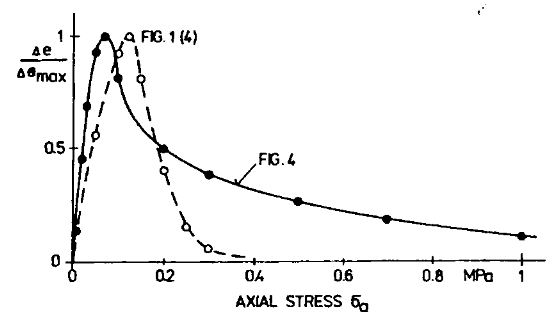

Figure 5 *Characteristics of progressive debonding of Bothkennar clay (Fig. 4) and Dejvice loess (Fig. 1, curve 4).*

CONCLUSION

Generalizing the above phenomena, one may classify the various processes of debonding into:

- Total collapse of structural bonds by external factors (water, quake) - Fig. 6a. All bonds are broken down more or less simultaneously. Typical representatives are collapsible arid soils.
- Progressive debonding (by straining, time, gradual loading), effected by series of local collapses - Fig. 6b. It is the result of nonhomogeneous stress- and strain fields and/or varying resistances of individual bonds.
- Mixed process where an initial intensive collapse is followed by progressive debonding - Fig. 6c. The gradual attenuation of debonding with rising load is typical, on contrary to the total collapse.

Since debonding of the soil structure means the decrease of the soil rigidity and strength, the practical significance of those studies is apparent.

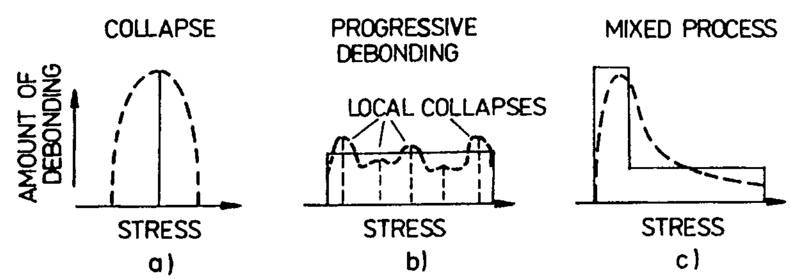

Figure 6 *Classification of various forms of structural debonding.*

REFERENCES

Burland, J. B. (1990). On the compressibility and shear strength of natural clays. Géotechnique, Vol 40, No 3, 329-378.

Casagrande, A. (1932). The structure of clay and its importance in foundation engineering. J. Boston Soc. Civ. Eng., Vol 10, No 4, 168-208.

Clayton, C. R., Hight, D. W. and Hopper, R. J. (1992). Progressive destructuring of Bothkennar clay: implications for sampling and reconsolidation procedures. Géotechnique, Vol 42, No 2, 219-239.

Feda, J. (1966). Structural stability of subsident loess soil from Praha-Dejvice. Eng. Geol., Vol 1, No 3, 201-219.

Feda, J. (1967). Stress-strain properties of loess tested in direct shear box. Proc. Geot. Conf. Oslo, Vol 1, 187-192.

Feda, J. (1982). Mechanics of particulate materials - the principles. Elsevier-Academia, 448 pp.

Feda, J. (1992). Creep of soils and related phenomena. Elsevier-Academia, 424 pp.

Kolasa, M. (1963). Zkoušky prosedavosti spraše z Dejvic (Collapse of loess from Dejvice - in Czech). Inž. stavby, Vol 11, No 8, 289-291.

Leroueil, S. and Vaughan, P. R. (1990). The general and congruent effects of structure in natural soils and weak rocks. Géotechnique, Vol 40, No 3, 467-488.

Priklonskiy, V. A. (1952). Gruntovedenie II. (Soil science II - in Russian). Gosgeolizdat Moscow, 371 pp.

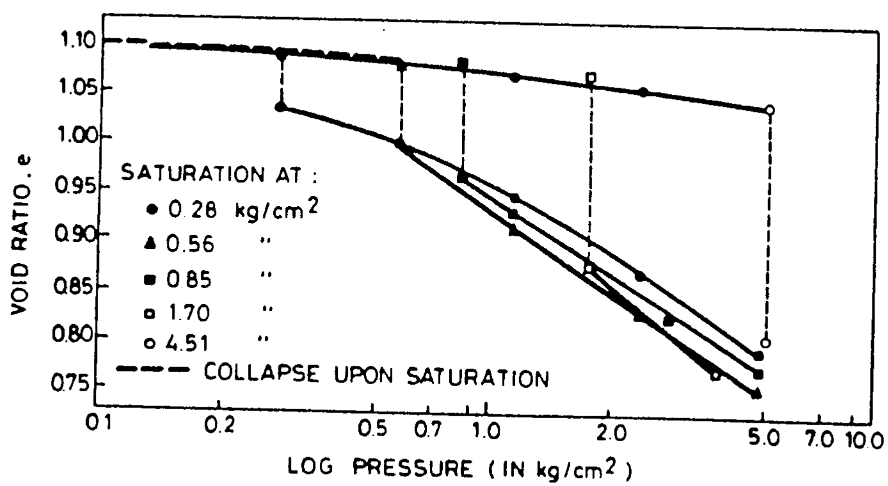

Fig.8. Collapse test results on loess samples reported by Erol and El-Ruwaih (1982)

Erol, O.A. and El-Ruwaih, I.A. (1982). Collapse behaviour of desert loess. Proc. 3rd. Int. Conf. Expansive Soils, Haifa. 196-200.

Engineering Characteristics of Arid Soils, Fookes & Parry (eds)

The Teton Dam failure (Idaho, USA, 1976)

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ABSTRACT

The Teton Dam project is briefly described and the events at failure reported. The failure results from the use of the (arid) Idaho loess for the core, the properties of the loess being described. It is suggested that the failure lies in the original design, during which the loess was incorrectly classified, since it had a plasticity index of 3 and thus was unsuitable as a material for a dam core.

INTRODUCTION TO THE FAILURE

The Teton Dam failure looms large in discussions of arid soil engineering because it is possible that something as basic as mis-identification and incorrect classification of the soil material used for the core was the primary cause of this multi-million dollar failure. The failure, according to Sherard (1987), was one of the most important single events in the history of dam engineering, and it continues to be discussed. There is a considerable literature devoted to the analysis of the failure, and to the search for causes. For reviews see Leps (1988), Penman (1987), and Smalley and Dijkstra (1992).

The Teton Dam was a large embankment dam (see Fig 1) that failed during the morning of 5 June 1976 while the first filling was under way. At the time of the failure, the height of water above the original stream bed was approximately 84m (274 ft), within 7m (23 ft) of maximum normal reservoir level. The average filling rate was approximately 0.34m/day (1.1 ft /day). Between 07-00h on 5 June, when initial damaging leaks were first seen in the right groin of the dam, and noon of that day, total breaching and failure occurred, beginning with the appearance of muddy springs in the right groin, followed quickly by piping through the embankment, and ending with collapse of the crest into the rapidly enlarged pipe.

LOESS PROPERTIES

The reasons for the failure are complex and involve shortcomings in concept, design, materials and construction. The authors suggest that a major factor (possibly the major factor) was the use of a particular arid soil (the local Idaho loess) as the construction material for a large part of the dam. Penman (1987) provides some useful data relating to the large loess core. The volume of the core fill was 3,965,466m^3, which was more than half the volume of the dam. Average placement water content was 18.6%, that is 1.3% on the dry side of optimum, and the average dry density was 15.6 kN/m^3. Average specific gravity of the silt was 2.62, so that the average void ratio would be 0.646 (water void 0.487 and air void 0.158) with a degree of saturation of 75%. The average

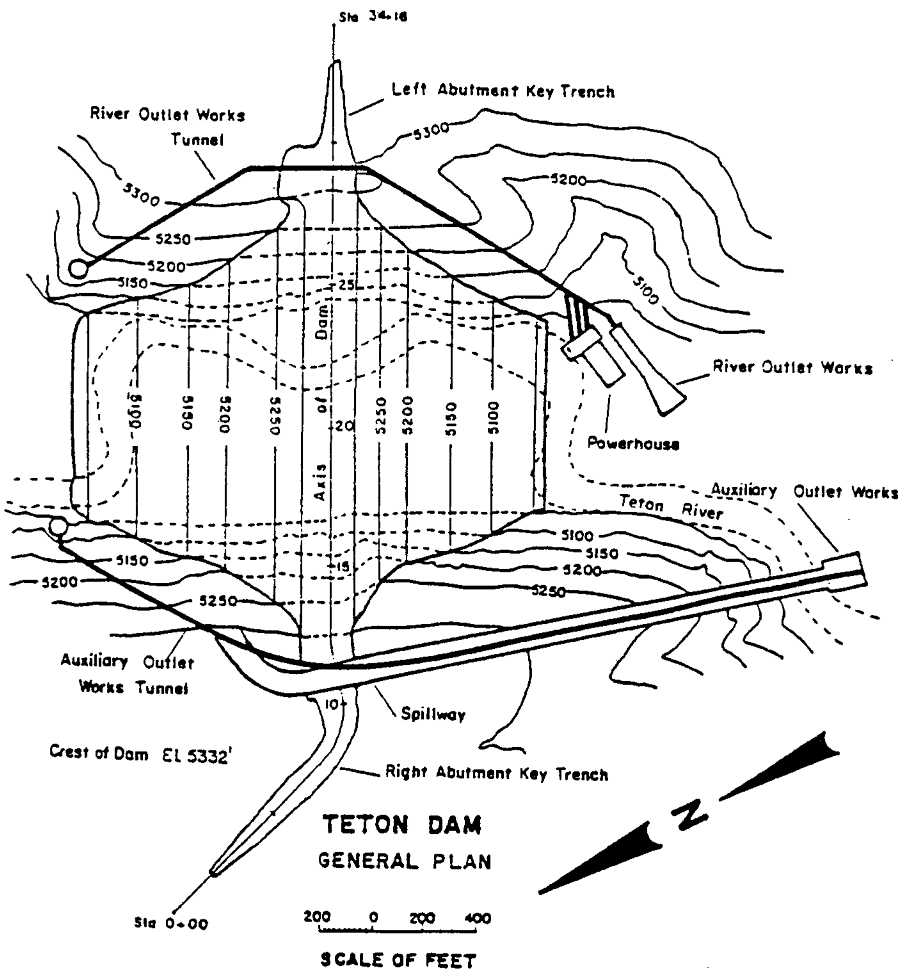

Fig 1. General plan of the Teton Dam, based on the original design drawings of the US. Bureau of Reclamation, with dimensions in feet (2 ft = 0.305m). The failure initially occurred in the right abutment, where the dam meets the canyon wall. On 5 June 1976 the water level reached 5309 ft, more or less at spillway level - then the failure happened.

bulk density (18.5 kN/m^3) was not particularly high considering that compaction was by 12 passes of a 6t/m sheepsfoot roller on every 150mm thick layer (remoulded loess is difficult to compact). This heavy compaction of the loess material at a water content drier than optimum produced a strong but brittle fill that must have had a very low initial pore pressure.

A PI value of 3 for the loess core was subsequently determined (i.e. post-collapse). This would indicate that, if the fill was being placed at an undrained shear strength as low as 80 kN/m^2, a reduction in the placement water content of only 0.5% could nearly double the strength (to 157 kN/m^2) but an increase of 0.5% would reduce the strength almost to zero (i.e. 3 kN/m^2: Penman 1987, p. 231). This sensitivity to small changes in moisture content is a major reason why loess is not a suitable material for large earth dam cores.

CONCLUDING DISCUSSION

Why was this unsuitable arid soil material used for the core of this large dam? Where does the responsibility lie for the major engineering failure? Sowers (1993) has discussed this problem in an attempt to determine where shortcomings lay, but in the current authors' opinion, he has not given sufficient status to the peculiar nature of the soil fill for the core. The implication of Sowers' discussion is that relatively minor changes in design and construction procedures would have prevented the problem. It is difficult to see how a successful dam core could ever be achieved with loess, however laid or treated, and it is apparent that more emphasis needs to be put on the special nature of the loess prior to its use in construction. Unusual arid soils do not fit easily into current construction practices.

REFERENCES

Leps, T.M. 1988. Failure of Teton Dam. In R.B. Jansen (ed). Advanced Dam Engineering for Design, Construction and Rehabilitation. Van Nostrand Rheinhold New York pp. 34-41.

Penman, A.D.M. 1987. Teton investigation - a review of existing findings. Eng. Geol. 24, 221-237.

Sherard, J.L. 1987. Lessons from the Teton Dam failure. Eng. Geol. 24, 239-256.

Smalley, I.J. and Dijkstra, T.A. 1991. The Teton Dam (Idaho USA) failure: problems with the use of loess material in earth dam structures. Eng. Geol. 31, 197-203.

Sowers, G.F. 1993. Human factors in civil and geotechnical engineering failures. J. Geotech. Eng. ASCE 119, 238-252.

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An alternative approach to the understanding of the collapse mechanism in desert sands, loess and other collapsing soils

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ABSTRACT Natural collapsing soils show the phenomenon of hydrocompaction or hydroconsolidation, and are often thought of as a special class of soil. However, their behaviour is analogous to the characteristics shown firstly by compacted soils placed dry of optimum and, secondly, by soils undergoing aging, or mild diagenesis. An alternative approach is thus to place collapsing soils into the context of engineering soils in general.

INTRODUCTION

Collapsing soils comprise a large group of diverse geological origins, which are characterised by a predominantly granular soil structure, a small proportion of fines and the phenomenon of collapse of the microstructure upon inundation, with or without a previous surcharge. The traditional understanding of these soils is that the fine matrix, perhaps allied to tension from moisture films, acts as a binding agent to the coarser granular skeleton. The collapse is traditionally envisioned as being the result of strength loss in the binding agent, allowing grain re-arrangement in the coarse fraction (Jennings and Knight 1957). The "collapse potential" for collapse upon inundation is determined for either a given value of normal stress using a single oedometer test (Jennings and Knight 1975, Lutenegger and Saber 1988) or for any value of normal stress using the double oedometer test (Jennings and Knight 1957) as shown in Fig. 1.

NATURAL COLLAPSING SOILS

Three main categories are usually considered (Dudley 1970, Clemence and Finbarr 1981) as follows.

(i) Aeolian deposits including dunes, cover sands, loess, loessial soils and pyroclastic dusts.

(ii) Water laid deposits including alluvial fans, flood deposits and debris slide material.

(iii) Residual soils.

The first two of these categories (Quaternary age deposits) are the subject of this paper but the third is not (residual soils being examples of retro-grading soils where bonding is being destroyed by weathering). Soil in category (ii) raises a problem in that it could be expected that the water present at the time of deposition could have led to collapse but a mechanism whereby this could have been circumvented has been suggested by Roberts and Melickian 1970 (in Jones 1986).

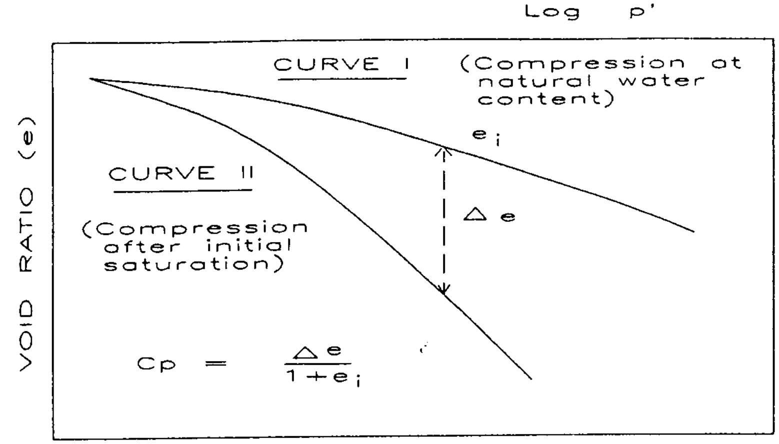

Fig. 1 Double oedometer test for the determination of the collapse potential (C_p) of collapsible soils (after Jennings and Knight, 1957).

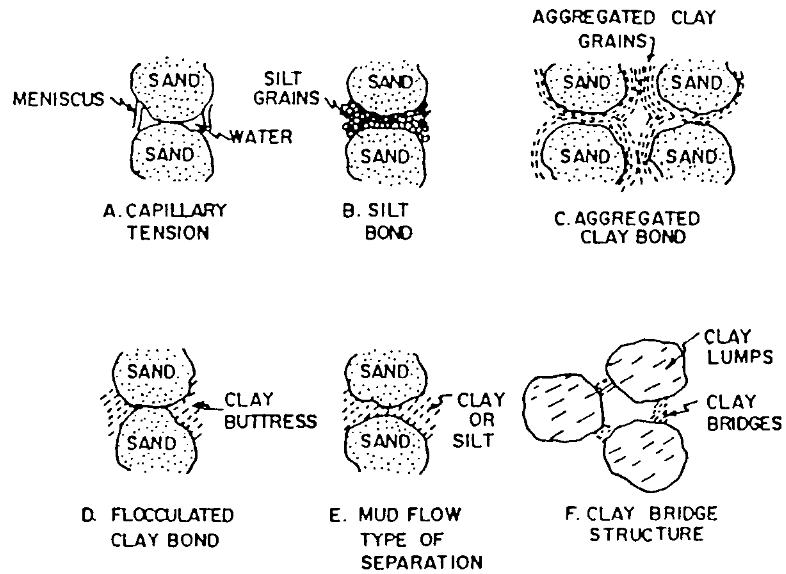

Fig. 2 Varieties of bonding agents in collapsing soils and their microfabric characteristics (from Clemence and Finbarr 1981).

MECHANISM OF COLLAPSE

The microstructures believed to be responsible for collapsible sands have been well illustrated by Barden et al 1973 and Clemence and Finbarr 1981, among others, and are shown in Fig. 2. S.F.M. photographs of collapsing sands can show textures similar to the simple idealisations as in Fig. 3 but can also take more complex forms (Fig.

THE INTERNATIONAL UNION FOR QUATERNARY RESEARCH and the Quaternary Research Association

QRA

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Guest of Honour
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STRUCTURAL ASPECTS OF LOESS GEOTECHNICAL PROPERTIES

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The characteristic morphometric and geometric features of the structure of loess soils are as follows: a) existence at the surface of sandy and coarse-dusty fractions of a multilayer and complex composition, the upper layer of this "jacket" being mainly of clay minerals and the inner one consisting of carbonates, amorphous silica and iron hydroxides; b) abundant aggregates of clayey and fine-dusty material, forming aggregates of globular type 0.01-0.25 mm in diameter; c) the presence of three types of pores:micropores 50-500 μm in size, inter-aggregate and inter granular pores 8-50 μm in size and intra-aggregate pores less than 8 μm; d) the existence of one-level, consisting (in the non-saturated state) of a highly porous structure of particle-grains, aggregate-grains,grainy-aggregate and aggregate types.

Among the qualities of loess structure bearing upon its energetics there are the following: a) prevalence of water non-resistant contacts of transition (point) type, embracing contacts formed by iono-electrostatic forces between the clayey minerals, and contacts generated in salts and 3/2 oxides formation, where singular connections of chemical nature are developed; b) presence of phase (cementational) contacts, arising from isolation of the volumetric phase of carbonates, other salts and 3/2 oxides, non-mobile or slowly mobile under water action; c) presence in the humidity associated with capillarity conditions, but disappearing as water saturation conditions are approached (close to 0.9-0.95 index), provoking rapid decrease in structural cohesion.

On the basis of the mechanism of loess subsidence there are two interconnected phenomena, developing during increase in soil moisture and resulting in the collapse of structural stability, soil consolidation and subsidence: a) decrease of interaction energy between structural elements and contacts due to transformation of transitional contacts into coagulational ones and b) structural transformation, consisting of transformation of loess structure from completed form into non-completed, as a result of destruction of water non-resistant clay and clayey-silty aggregates.

THE LOESS SEDIMENT TYPES OF SLOVAKIA, THEIR FABRIC AND PROPERTIES

Alena Klukanova

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Based on studies of the Slovak Carpathian loess soils it appears that the loess mass is composed of various primary rock fragments and minerals, products of their secondary changes and different organic substances. These components are found in loess soils under various conditions. They are diversely distributed vertically depending on the terrain relief, the climate, the degree of dissection, the water table level and other factors. The fabric of loess reflects not only the sediment genesis, but affects also its engineering geological properties. Four basic groups characterise the loess sediments. They are: typical loess, sandy loess, clayey loess and loess-like sediments. They differ from each other in their fabric, microstructure, genesis, physical and mechanical properties, tendency to collapse and other properties. Collapse is one of the most significant properties of loess deposits and consists of sudden volume change under the influence of humidity, stress or loading. To explain the mechanism of loess collapse or "sagging" the process has been reproduced in a triaxial cell and the associated microstructural changes monitored.

HYDROCONSOLIDATION AND SUBSIDENCE OF LOESS: STUDIES FROM CHINA, RUSSIA, NORTH AMERICA AND EUROPE

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[2]*Department of Geography, Royal Holloway, University of London, Egham, TW2O OEX, UK*

Various approaches to the widespread problem of the hydroconsolidation and subsidence of loess have been suggested. These include considerations of rheology, thermodynamics, phase movements, particle packing, interparticle bonding, pore structure and distribution, catastrophe theory, topology, and simple structural frameworks. Chinese, North American and most European investigators tend to concentrate on mechanisms of loess collapse. The Russian literature, however, contains an extra dimension. Two approaches, the 'syngenetic' and the 'epigenetic' approach, to the formation of subsiding loess have been defined in the literature. Most investigators follow a syngenetic approach which appears to be a consequence of the aeolian idea of loess deposition. Some Russian writiers, in contrast, promote an epigenetic approach in which collapsibility can develop in an originally non-collapsible material, which can then suffer from hydroconsolidation and subsidence. The basis of the phenomenon is a change in the packing structure of the major loess particles, and this can be modelled using simple Monte Carlo methods to develop appropriate structures. This paper aims to review the work done on this important subject. Serious investigation of hydroconsolidation and subsidence of loess began in the early nineteen-forties (fifty years ago) and this has been reported in a piecemeal manner. A detailed, critical review of this diverse work is now overdue and this is presented here in the light of recent work in the United Kingdom. An attempt is made to describe the process in a phenomenological and a structural sense. The role of N. Ya Denisov in this development, as 'subsidence pioneer' is considered.

THE ORIGIN, TRANSPORT AND PRIMARY DEPOSITION OF LOESSIC MATERIAL

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There are three fundamental requirements for the formation of primary aeolian loess deposits: (1) a source of dust; (2) adequate wind energy to entrain and transport the dust; (3) the existence of a suitable deposition site where dust can accumulate in a relatively unmodified form. Additionally, long-term preservation of loess in the geological record requires favourable tectonic and palaeogeographical conditions which favour burial rather than erosion of the deposits following their formation. Contrary to some published views, there is no shortage of loess-size sediment either in modern surface environments or the sedimentary record, in which mudrocks composed of clay, silt and fine sand comprise approximately two-thirds. Many different types of unvegetated surface, including weathered bedrock, unconsolidated sediments and soils, can provide significant sources of dust, and very large quantities of material are today deflated from arid and semi-arid parts of the earth's land surface. However, evidence from ocean cores and terrestrial loess sequences clearly indicates that rates of dust accumulation have varied substantially during the Quaternary, and in many areas were significantly higher than present during periods of cooler global climate. Conventionally this has been widely attributed to the following factors: (a) the greater extent of glaciation and frost weathering during Pleistocene cold stages, which both formed more primary silt-size material and allowed extensive reworking of pre-existing weathering debris by ice and fluvio-glacial action; (b) the greater extent of aridity in many tropical and sub-tropical desert areas during cold stages of the Pleistocene, and (c) the greater intensity of global wind systems during cold stages due to steeper thermal gradients. In many temperate mid-latitude localities a clear temporal relationship has been demonstrated between glaciation/fluvioglacial activity and neighbouring loess formation. However, in the context of loess formation on the margins of deserts the relationships between aridity, wind intensity and rates of loess accumulation are much less certain. Although global climate modellers have often assumed a simple positive relationship between aridity and dust flux, and between average wind strength and dust mean grain size, detailed consideration of the sedimentological and other evidence indicates that a much more complex situation exists. In some circumstances, decreases in aridity have resulted in increased dust flux, due either to increased surface instability and dust availability or to increased incidence of dust transporting winds. The consequences of such changes for loess accumulation rates depend strongly on the nature of the environmental gradients in areas adjoining the dust source regions, and on the nature of the prevailing wind systems responsible for dust dispersion. Sharp environmental gradients, (reflected) by rapid changes in vegetation density and near-surface status, favour trapping of airborne dust relatively close to the dust source and consequently lead to relatively high rates of loess accumulation. More gradual environmental gradients, on the other hand, favour dispersion of dust over a wide area, leading to a much higher likelihood of surface erosion and reworking, and consequently much lower rates if net dust accumulation per unit area. Proximal dust deposition is also favoured by a dominance of near-surface wind systems, for example those associated with low-level inversions, which inhibit vertical mixing and high level dispersion of dust. Conversely, distal transport and deposition of dust is favoured by meteorological conditions which involve strong vertical mixing and incorporation into upper level wind systems. These points are illustrated by evidence from Israel, the Great Plains area of North America and northern China.

SEDIMENTOLOGICAL CHARACTERISTICS FROM SOIL PARENT MATERIALS OF AEOLIAN ORIGIN: SOUTHEASTERN BUENOS AIRES PROVINCE, AGENTINA

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Centro de Geologia de Costas y Cuaternario, CC 722, 7600 Mar del Plata, Argentina

This study concerns the grain size and mineralogical composition of the parent material of soils in the intermontane area of the Tandilia Range, a tectonic mountain system located in the southeastern sector of Buenos Aires Province, where altitudes reach 270m asl. Cenozoic sediments cover the intermontane areas and sometimes the horizontal summits of the ranges. The intermontane area is characterized by a landscape of hills up to 60m high with a complex morphology. The upper part of the stratigraphic sequence is composed of very fine sandy silts of aeolian origin (loess). The present soil has developed on these sediments which correspond to the last glacial and postglacial stages (Late Pleistocene to Holocene).

Particle size distribution is usually unimodal, with the mean grain size between coarse silt and very fine sand (3-5 phi units), mainly poorly sorted, positive to symmetrically skewed. The sediments can be classified as sandy loess according to sand fraction content.

<DIALOG File 89: (c) 1994 American Geological Institute>
02059522 GEOREF NO.: 93-39023 BIBL. INDEX GEOLOGY NO.: 93-40396
TITLE: *Prachovite sedimenty Horehronskeho podolia a ich vlastnosti*
TRANSLATED TITLE: Aleuritic sediments of the upper Hron River valley and their properties
AUTHOR(S): Sajgalik, J.; Bockorova, B.
CORPORATE SOURCE: STU, Stavebna Fak., Bratislava, Czechoslovakia
SOURCE: Mineralia Slovaca vol. 24 no. 1-2 p. 121-126
DATE: 1992
COUNTRY OF PUBLICATION: Czechoslovakia
CODEN: MSLOBI ISSN: 0369-2086 REFS.: 4
SUBFILE: B
DOCUMENT TYPE: Serial BIBLIOGRAPHIC LEVEL: Analytic
ILLUSTRATIONS: illus.
LANGUAGE: Slovakian SUMMARY LANGUAGE: English

<DIALOG File 89: (c) 1994 American Geological Institute>
02059254 GEOREF NO.: 93-38755 BIBL. INDEX GEOLOGY NO.: 93-40224
TITLE: *Geomorphology and late Quaternary of the Chaco (South America)*
AUTHOR(S): Iriondo, Martin
CORPORATE SOURCE: CADINQUA, Casilla de Correo 487-3100, Parana, Argentina
SOURCE: Geomorphology vol. 7 no. 4 p. 289-303
DATE: 1993
COUNTRY OF PUBLICATION: Netherlands
ISSN: 0169-555X REFS.: 19
SUBFILE: B
DOCUMENT TYPE: Serial BIBLIOGRAPHIC LEVEL: Analytic
ILLUSTRATIONS: illus.; 1 table; geol. sketch maps
LANGUAGE: English
ABSTRACT: The Chaco is a large tropical plain located in the interior of South America, consisting of parts of Argentina, Paraguay and Bolivia. It is 840,000 km SUP 2 in area and is characterized by forests, savannas and extensive swamps, which give it a marked climatic and biogeographic identity. It encompasses five huge alluvial fans built by the major rivers which cross the region: Salado, Bermejo, Pilcomayo, Parapeti and Grande. The fans are composed of several sedimentary units, deposited during different times of the late Quaternary under diverse climates. Two fluvial terraces appear at the apex of each fan; the older one is probably late Pleistocene in age, the second was formed in postglacial times. Humid climates, such as the present one, favoured the generation of soils and stable fluvial belts; drier climates led to widespread sedimentation along small ephemeral channels and large spill-outs. During two intervals, on in the late Quaternary glacial maximum and the late Holocene dry climates occurred in the region, leading to the formation of dune fields and loess mantles.

<DIALOG File 89: (c) 1994 American Geological Institute>
02060074 GEOREF NO.: 93-39575 BIBL. INDEX GEOLOGY NO.: 93-38526
TITLE: *Aspecto del material piroclastico de los loes, Cordoba, Argentina*
TRANSLATED TITLE: Pyroclastic material content of loess, Cordoba, Argentina
AUTHOR(S): Karlsson de Dorato, Alicia
CORPORATE SOURCE: Universidad Nacional de Cordoba, Departamento de Geologia Basica, Cordoba, Argentina
MONOGRAPH TITLE: *Actas del Decimo primer congreso geologico argentino*
TRANSLATED MONOGRAPH TITLE: Proceedings of the Eleventh Argentine geological congress
AUTHOR(S): Anonymous
CONFERENCE TITLE: Decimo primer congreso geologico argentino
CONFERENCE LOCATION: San Juan, Argentina
CONFERENCE DATE: Sept. 17-21, 1990
SOURCE: Actas del Congreso Geologico Argentino vol. 11 Vol. 1 p. 434-438
DATE: 1992
COUNTRY OF PUBLICATION: Argentina
ISSN: 0325-2620 REFS.: 6
SUBFILE: B
DOCUMENT TYPE: Serial; Conference BIBLIOGRAPHIC LEVEL: Analytic
ILLUSTRATIONS: illus.
LANGUAGE: Spanish SUMMARY LANGUAGE: English

<DIALOG File 89: (c) 1994 American Geological Institute>
02071210 GEOREF NO.: 94-02569
TITLE: *Magnetic mineralogy of the Chinese loess*
AUTHOR(S): Eyre, J. K.; Shaw, J.
CORPORATE SOURCE: Liverpool University, Department Earth Sciences, Liverpool, United Kingdom
MONOGRAPH TITLE: *AGU 1992 western Pacific geophysics meeting*
AUTHOR(S): Anonymous
CONFERENCE TITLE: American Geophysical Union, 1992 western Pacific geophysics meeting
CONFERENCE LOCATION: Hong Kong
CONFERENCE DATE: Aug. 17-21, 1992
SOURCE: Eos, Transactions, American Geophysical Union vol. 73 no. 25; Suppl. p. 64
DATE: 1992
COUNTRY OF PUBLICATION: United States
CODEN: EOSTAJ ISSN: 0096-3941
SUBFILE: B
DOCUMENT TYPE: Abstract; Serial; Conference BIBLIOGRAPHIC LEVEL: Analytic
LANGUAGE: English

<DIALOG File 89: (c) 1994 American Geological Institute>
02071004 GEOREF NO.: 94-02363
TITLE: *The legacy of Thomas Macbride and Bohumil Shimek*
AUTHOR(S): Bettis, E. Arthur, III; Baker, Debby Z.
SOURCE: Iowa Geology vol. 17 p. 6-7
DATE: 1992
COUNTRY OF PUBLICATION: United States
ISSN: 0193-4856
SUBFILE: B
DOCUMENT TYPE: Serial BIBLIOGRAPHIC LEVEL: Analytic
ILLUSTRATIONS: illus.; portr.
LANGUAGE: English

<DIALOG File 292: (c) 1994 Elsevier Science Ltd.>
0998955 93K-12286
Matuyama/Brunhes (M/B) transition recorded in Chinese loess
Donghuai Sun, ; Shaw, J. ; Zhisheng An, ; Rolph, T.
Xian Laboratory for Loess and Quaternary Geology, Academia Sinica, Xian, China.
Journal of Geomagnetism & Geoelectricity 1993. v 45(4) pp 319-330
Language: English

The paper presets a detailed record of the Matuyama/Brunhes (M/B) polarity transition recorded in a loess section at Xifeng, in the central part of the Chinese loess plateau. The remanence of all samples was investigated using thermal demagnetisation from room temperature up to 650 degreesC. The results indicate a duration of 32 000 years for the decay and recovery of the main dipole intensity, and 20 000 years for the period of major directional change. During the transition the field intensity falls to an average of 30% of its value before and after the transition. Calculated VGP paths of most stages are continuous and confined to preferred longitude bands which include America, the Atlantic Ocean or Africa. Field behaviour during the transition period suggests that non-dipolar terms are dominant while the dipole field is weak. -from Authors

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<DIALOG File 292: (c) 1994 Elsevier Science Ltd.>
1002980 94J-00224
Loesses and aeolian sands in Franconia, FRG
Hagedorn, H. ; Rosner, R. ; Kurz, J. ; Busche, D.
Zeitschrift fur Geomorphologie, Supplementband 1991. v 90 pp 61-76
Language: English

Loess, blown sands and sand dunes cover vast areas of Franconia. New studies on loess occurrences have shown their well-proved regional variation related to source areas. Blown sands and sand dunes have recently been surveyed with respect to provenance, origin and stratigraphy. First datings of buried soils in sand dunes have shown their Atlantic age. -Authors

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<DIALOG File 89: (c) 1994 American Geological Institute>
02063280 GEOREF NO.: 93-42784 BIBL. INDEX GEOLOGY NO.: 93-46253
TITLE: *Genesis of calcium carbonate in loess and Paleosols in central China*
AUTHOR(S): Guo, Zheng Tang; Fedoroff, N.
CORPORATE SOURCE: I.N.A. P.G., Thiverval-Grignon, France
MONOGRAPH TITLE: *Soil micromorphology; a basic and applied science; proceedings*
EDITOR(S): Douglas, Lowell A. (editor)
CORPORATE SOURCE: Rutgers Univ., Dep. Soils Crops, New Brunswick, NJ, United States
CONFERENCE TITLE: VIIIth international working meeting of Soil micromorphology
CONFERENCE LOCATION: San Antonio, TX, United States
CONFERENCE DATE: July 1988
SOURCE: Proceedings of the International Working Meeting on Soil Micromorphology vol. 8 p. 355-359
DATE: 1990
COUNTRY OF PUBLICATION: International
ISBN: 0-444-88302-9
REFS.: 11
SUBFILE: B
DOCUMENT TYPE: Serial; Conference BIBLIOGRAPHIC LEVEL: Analytic
ILLUSTRATIONS: illus.; 1 plate
LANGUAGE: English
NOTE: Elsevier Sci. Pub.

<DIALOG File 89: (c) 1994 American Geological Institute>
02061159 GEOREF NO.: 93-40663 BIBL. INDEX GEOLOGY NO.: 93-40113
TITLE: *Genezis prosadochnosti lessovykh porod*
TRANSLATED TITLE: Genesis of loess subsidence
AUTHOR(S): Minervin, A. V.
CORPORATE SOURCE: Moskovskiy Gosudarstvennyy Universitet, Moscow, RUS
SOURCE: Geoekologiya: Inzhenernaya Geologiya. Gidrogeologiya. Geokriologiya vol. 1993 no. 3 p. 18-36
DATE: 1993
COUNTRY OF PUBLICATION: RUS
REFS.: 50
SUBFILE: B
DOCUMENT TYPE: Serial BIBLIOGRAPHIC LEVEL: Analytic
ILLUSTRATIONS: illus.; charts
LANGUAGE: Russian

<DIALOG File 292: (c) 1994 Elsevier Science Ltd.>
1005163 93M-1438
Use of chemical criteria to distinguish soils formed in loess in eastern Southland, New Zealand.
McIntosh, P. D. ; Whitton, J. S.
N. Z. Soil Bureau, DSIR, Private Bag, Dunedin, New Zealand.
New Zealand Journal of Geology & Geophysics 1988. v 31(3) pp 363-373 1 map
Language: English
Four soils (Umbric Dystrochrepts) formed in loess in eastern Southland, at altitudes of 195-365 m and under a rainfall of 1000 to > 1400 mm, were mineralogically and chemically analysed to determine the soil variation in this area, and to establish whether mineralogical or chemical criteria could be used to distinguish series. Trends of pH, total C and N, organic P, P retention, oxalate-soluble Fe, Al and Si, and clay mineralogy were related to climate rather than parent material. The two lower altitude soils have clay fractions dominated by chlorite, mica- vermiculite, and kaolinite. Above 200 m altitude, higher rainfall, and consequently greater leaching and more acid conditions, appear to be responsible for the transformation of mica and chlorite to interlayered mica-chlorite and chlorite-vermiculite. In this environment, formation of proto-imogolite allophane has been favoured. Ni, Cu, Zn, Co and Pb have been leached from upper horizons, while a higher proportion of poorly ordered Fe, Al, and Si compounds in these soils has resulted in their having higher P retention values than lower altitude soils. Phosphate retention values were used to define class limits for two series not readily distinguishable on morphology alone. - A.F.C.

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02060530 GEOREF NO.: 93-40031 BIBL. INDEX GEOLOGY NO.: 93-40325
TRANSLATED TITLE: Eruptive history of the Higashi Izu monogenetic volcano field; 1, 0-32 ka
AUTHOR(S): Hayakawa, Yukio; Koyama, Masato
CORPORATE SOURCE: Gunma University, Faculty of Education, Maebashi, Japan; Shizuoka University, Japan
SOURCE: Kasan = Bulletin of the Volcanological Society of Japan vol. 37 no. 4 p. 167-181
DATE: 1992
COUNTRY OF PUBLICATION: Japan
CODEN: KAZAAX ISSN: 0453-4360 REFS.: 47
SUBFILE: B
DOCUMENT TYPE: Serial BIBLIOGRAPHIC LEVEL: Analytic
ILLUSTRATIONS: illus.; strat. cols.; 2 tables; sketch map
LANGUAGE: Japanese SUMMARY LANGUAGE: English

<DIALOG File 89: (c) 1994 American Geological Institute>
02060527 GEOREF NO.: 93-40028 BIBL. INDEX GEOLOGY NO.: 93-41516
TRANSLATED TITLE: The effect of different seismic loadings on dynamic modulus and damping ratio of loess
AUTHOR(S): Wang Jun; Wang Lanmin; Li Lan
CORPORATE SOURCE: State Seismological Bureau, Lanzhou Seismological Institute, Lanzhou, China
SOURCE: Ziran Zaihai Xuebao = Journal of Natural Disasters vol. 1 no. 4 p. 75-79
DATE: 1992
COUNTRY OF PUBLICATION: China
REFS.: 4
SUBFILE: B
DOCUMENT TYPE: Serial BIBLIOGRAPHIC LEVEL: Analytic
ILLUSTRATIONS: illus.; 1 table
LANGUAGE: Chinese SUMMARY LANGUAGE: English

<DIALOG File 89: (c) 1994 American Geological Institute>
02065439 GEOREF NO.: 93-44954 BIBL. INDEX GEOLOGY NO.: 93-45931
TRANSLATED TITLE: Geological evidence for the presence of the Emperor event in China
AUTHOR(S): Ge Tongming; Fan Limin; Liu Jian
CORPORATE SOURCE: Guangzhou Marine Geological Survey, Ministry of Geology and Mineral Resources, Guangzhou, China
SOURCE: Dizhixue Bao = Acta Geologica Sinica vol. 66 no. 4 p. 381-389
DATE: 1992
COUNTRY OF PUBLICATION: China
CODEN: TCHPAX ISSN: 0001-5717 REFS.: 22
SUBFILE: B
DOCUMENT TYPE: Serial BIBLIOGRAPHIC LEVEL: Analytic
ILLUSTRATIONS: strat. cols.; 2 tables
LANGUAGE: Chinese SUMMARY LANGUAGE: English

<DIALOG File 89: (c) 1994 American Geological Institute>
02065413 GEOREF NO.: 93-44928 BIBL. INDEX GEOLOGY NO.: 93-46148
TITLE: *Le niveau a langues de Kesselt, horizon repere de la stratigraphique du Weichselien superieur europeen; signification paleoenvironnementale et paleoclimatique*
TRANSLATED TITLE: The cryoturbated level of Kesselt, a key horizon of the stratigraphy of the European upper Weichselian; paleoenvironmental and paleoclimatic significance
AUTHOR(S): Van Vliet-Lanoe, B.
CORPORATE SOURCE: CNRS, Cent. Geomorphologie, Caen, France
SOURCE: Memoires de la Societe Geologique de France, Nouvelle Serie vol. 160 p. 35-44
DATE: 1992
COUNTRY OF PUBLICATION: France
ISSN: 0249-7549 REFS.: 42
SUBFILE: B
DOCUMENT TYPE: Serial BIBLIOGRAPHIC LEVEL: Analytic
ILLUSTRATIONS: illus.
LANGUAGE: French SUMMARY LANGUAGE: English

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ESTIMATING THE PROCESSES OF ACCUMULATION OF LOESS IN TADZHIKISTAN

Introduction

Problems of accumulation of loess during the Holocene still remain a discussion subject. This situation is testified to by the results of the last Symposium in FRG (1990) on that subject. In extension of that discussion we suggest, in what is to follow, new original data on estimating the rate of the accumulation of loess in Tadzhikistan.

Physico-Geographical conditions of the accumulation of loess

The highest mountain ranges of Tyang-Syang and of Pamiro-Alai, sitting as specific curtain systems, form voluminous orographic niches open for penetration of air masses into the area from the South-East. Mountain ranges rising to 5000-6000 m above the sea level in the eastern and northern parts of Middle Asia form a strong block preventing air masses from the SE to enter. These conditions work to stagnate air masses in the lower troposphere. Thus the dust storms originating in the deserts of Middle Asia and breaking out into the mountain systems of the Pamiro-Alai tend to build up the dust load in the convective lower tropospheric layer. Aerosol gradually sediments to the surface from that layer, while the meteostations record dust haze during these episodes.

Conditions favorable for generation of dust storms in the deserts of Middle Asia are produced during summer and fall, when lack of precipitation in combination with overdrying of soil surface, featuring only extremely sparse vegetation cover, open way to deflation processes even at otherwise modest wind speeds.

Dust haze, brought into the air by such storms hangs there even after the storm episode is over and is transported by air streams in the lower troposphere to large distances hence. Large particles quickly sediment to ground, testifying, as it were, to deflation processes, while the fine fraction remains suspended in the air for quite a while, forming haze.

The comparative analyses of granulometric composition of loesses and dust sedimented after a dust storm, as well as that of suspended aerosol indicate that mass distributions of all these fractions are identical to each other.

Estimated rate of loess accumulation

The actual data on periodicity of dust haze events and the natural model of their development both served as a basis for calculations of the rate of accumulation of loess in Tadzhikistan. A special technique was developed for that purpose.

The analysis of data thus obtained indicates that the power of accumulated loess deposits depends on the absolute height of site, on the local climatic features at station site, and on its distance from the dust source. The depth of precipitated aerosol layer sedimented annually varies from 0.04 mm/yr to 0.683 mm/yr. The average rate of loess accumulation over the territory of the Republic constitutes 0.2 mm/yr. Approximately the same rates were obtained for the early holocene when calculating the depth of soil horizons, corresponding to that temporal cross-section (Lomov, 1991).

Computational data were used to map the distribution of loess layer increments over Tadzhikistan. Mapped information mainly reflects the dependence of aerosol density on the local absolute height. The maximum increment of loess is found in the valleys featuring the lowest absolute heights above the sea level.

Basing on that map data one may assume that the maximum depth of loess sediments should be found in the southernmost areas of Tadzhikistan. Actually however the available map of loess sediments for Tadzhikistan (Mirzobayev, e.a., 1968) indicates, first, that the loess cover in the Southern Tadzhikistan is far from solid, and, second, that according to the latest data available the maximum depth of such sediments is found in the northern part of the areal of loess accumulation. Finally, patches are found of a paleoareal of loess accumulation, presently raised by tectonic process beyond 2500 m above the sea level.

Conclusions

Two principal conclusions follow from comparing the two maps.

1. Paleogeography of the Southern Tadzhikistan had been somewhat different during the Aeopleistocene, working to displace the paleogeographic niches of loess accumulation to central areas of the Republic; 2. active tectonic processes during the Pleistocene worked to form central mountain ranges in the Southern Tadzhikistan, breaking the homogeneous loess cover and initiating the processes of loess erosion from mountain slopes and down the river valleys. Remainders of loess layers (the so-called "Ourta Boz") found in the valleys of the Vakhsh, Pyandzh and other rivers testify to that. Such remainders usually tower for several tens of meters above the younger alluvial terraces.

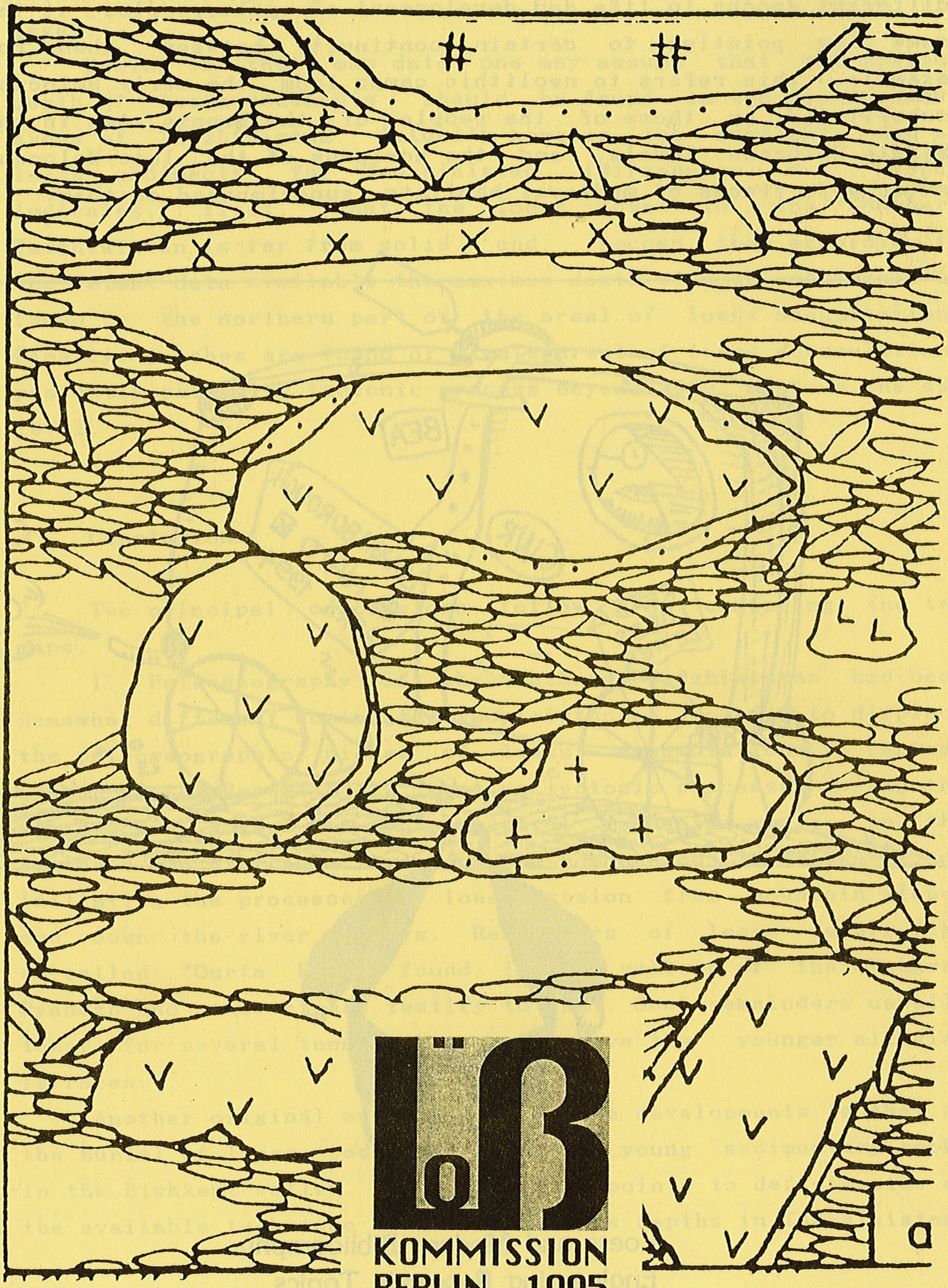
Another original example of the same developments is that of the burial of loess sediments below the young sedimentary rocks in the Bishkent valley. That fact also points to deficiencies of the available technique used to map loess depths in Tadzhikistan.

The data obtained on the rate of loess accumulation during the Holocene explain certain isolation found between the different epochs in life and development of paleopeoples, at the same time pointing to certain continuity between them. For example, this refers to neolithic camps from the early Holocene substituted by those of the people of the Bronze Age in the Middle Holocene levels, and the horizons of the late Holocene soils with traces of medieval habitats, superimposed on them.

LAMBERT
Loess and Modern Bibliography:
Engineering Research Topics.

LOSE LÖSS-BRIEFE

LOESS LETTER 31



LÖSS KOMMISSION

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