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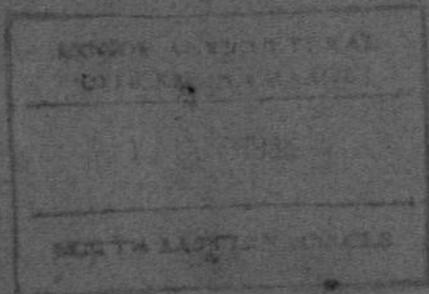
SOME SUGGESTED  
UNITS OF CLASSIFICATION AND MAPPING,  
PARTICULARLY FOR EAST AFRICAN SOILS

BY

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J. D. Anderson.

**Some suggested units of classification and mapping,  
particularly for East African soils**

(Vorschläge zur Klassifikation und Kartierung, insbesondere für ostafrikanische Böden. — Propositions pour la classification et cartographie surtout des sols de l'Afrique de l'Est)

by

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The efforts of pedologists to establish units and a nomenclature in soil classification have met with somewhat unequal success in different parts of the scale of categories of decreasing inclusiveness that must be set up before we have at our service a taxonomic system parallel to those of the biological sciences.

The preliminary sorting tests that are applied in classification are represented by a few well established adjectival terms such as leached, of impeded drainage, mature, skeletal, organic, calcareous, saline, pedocalic; words that in their application to soil description have not been greatly specialised beyond the meanings that (except the last-named) they would bear in ordinary lay language. Well established also, if without formal definition, is the conception of "the great soil groups of the world" in the sense in which the phrase forms the English title of Glinka's book; and though we cannot forego the use of the word "group" in ordinary speech, and attempts to specialise it for any other purpose should be resisted, great soil group, so written, may be regarded as an accepted technical term.

At the other end of the scale, soil surveyors working out the detail of particular areas have developed their own conceptions of what should

be the ultimate, or at least the penultimate specialised unit of scientific soil description, and these tend to coincide more or less with the American series, and to be known under that name in English-speaking countries. Historically understandable though it is, the employment of an indispensable collective noun like "series" as a label for a highly-differentiated kind of natural body is a disaster in our nomenclature, for no one can now introduce the word in its ordinary sense into discussions on soil topics without being harried by a necessity for explanations. The word "type" has a still narrower meaning in American usage, and on the other hand in some Russian papers written in English it seems to be regarded as the equivalent of "great soil group"; but these technical senses have not been so generally accepted, and in English soil literature "type" continues to fulfil its ordinary function in the English language, the onus of explanation falling this time upon the technical user.

Between the great soil group, which the geographer may employ on a continental or world scale, and the essentially parochial series, there is almost a void.

To say this is not to overlook the various names of local origin that have been given to soils of characteristic morphology and which reflect groupings of an intermediate degree of inclusiveness. Examples of names of this kind that have attained some general currency are fen soils, Hochmoorböden, kwelder soils, rendzina, solonetz, szik soils, regur. Others not so generally familiar are warp soils, Molkenböden, mbuga soils, murrum or mocarrero soils. The great soil group names themselves had a similar origin, and have since become more inclusive. (It is curious to note, in passing, that such names seem to become attached most readily to soils of less than optimum drainage, — there is a dearth of handy nicknames for leached soils.) These terms enrich our vocabulary, and one hopes that, with discretion, they will be multiplied as new groups of soils come to be studied, local or dialect words being enlisted for the purpose and drilled to an exact meaning. They do not, however, fill the void to which attention has been drawn above. We have no generally accepted category-names to denote with precision the principles of grouping that are in the minds of users of these terms, and so to indicate the relative standing of such groups of soils in a system of classification.

A number of terms for this purpose have indeed been proposed, by writers who have felt the need for them in their own work (Shaw, 1927; Robinson, 1929 and 1932; Bennett and Allison, 1928; Russian workers as summarised by Vilensky 1930), but they have been slow in receiving more than a local acceptance. Mainly, one must suppose,

this is because the principles of grouping of soils are not yet ripe for standardisation. Nevertheless some of the proposed group-designations might have been more freely used, and so have helped forward the elucidation of principles, if they had not, as words, been too valuable in their ordinary unspecialised senses for us willingly to assist in bringing them to the fate that has befallen "series". This objection certainly applies to the words family, order, stage, class, division. It does not apply, or hardly at all, to suite, and it is interesting to note that this term has at least attracted general attention and discussion, if not a general acceptance. It seems that a direction in which progress may lie is in a bolder coining of distinctive new words, abandoning the attempts to ascribe highly-specialised meanings to old ones.

In East Africa, by which in this paper is to be understood Uganda, Kenya, Tanganyika, Zanzibar, Nyasaland and Northern Rhodesia, soil survey has, by force of circumstances, taken a form in which it has acutely felt the lack of classifying and mapping units larger than the series but smaller than the great soil group. In a quantitative sense survey has hardly begun. There are no field parties systematically covering the ground with soil-pit and auger, nor is the possibility in sight of our organising such work. The boundaries and (except very roughly) the extent of particular soils are therefore not known; but in parts of East Africa in the past few years much has been done in the study of the soil profile at scattered single points, supplemented by qualitative notes made along the routes of journeys and by accounts of general soil conditions contributed by observers familiar with their own districts. In putting the results of this reconnaissance work into forms suitable for publication, and especially in drafting a map, the series is too specialised a unit, for there must be many series that have not yet been disentangled and many more that have not yet been met with at all. Clearly also the use of the great soil group without further differentiation would often conceal our information by over-generalising it.

#### The Limits of Definition of the Series

The problem of framing bigger units is best approached from a position of clear understanding of how the series itself is used. Some published definitions of the series are of uncompromising narrowness, a typical statement being that the profile within a series must be "quite uniform in all respects except texture of the surface soil." It seems however that even where this is the formal definition, its rigour is relaxed a good deal in practice, the surveyor's discretion (in organised surveys) being guided by his traditions and by the control exercised

from his headquarters. Without departing seriously from standard practice in other countries, therefore, a fairly large variation can be tolerated within a series in such matters as total depth and relative thickness of horizons, minor differences in parent rock, colour differences if mainly due to these and not to anything more fundamental, and slight acidity differences; provided always that this tolerance is not carried into different conditions of drainage or made to accommodate effects due to a change in any other important factor influencing soil development. The individuality or homogeneity of any series as determined in the field is held subject to revision in the light of evidence obtained in the laboratory; and where questions arise of two series being identical when their occurrences are distant geographically, it is judged better to allot different series names, at any rate provisionally, than to be hasty in accepting doubtful correlations.

An example is given below to illustrate, perhaps in an extreme case, the degree of profile variation that it may be necessary to admit locally within a single series.

Three exposures in a well-defined zone of shortgrass plain carrying scattered acacia thorn-trees, bordering the lower south slopes of Mount Meru in Tanganyika (latitude 3 degrees South), at an altitude of 4,000 ft. above sea-level and under a badly-distributed rainfall of about 900 mm., showed the following profiles:

- I. 0-25 cm., grey-black stiff clay-loam, very sticky when wet, cracking into angular grains when dry.  
25-100 cm., hard soapy blue-black clay, cracking when dry with the formation of fissures, whitish in colour in the lowermost 15 cm.  
100-140 cm., whitish-grey calcareous clay and decayed lava, with large  $\text{CaCO}_3$  concretions.  
140 cm. and below, weathered lava fragments, some of them coated with  $\text{CaCO}_3$  externally, passing irregularly into massive lava.  
Calcium carbonate occurs throughout the profile, with occasional nodules; maximum at 100-140 cm.
- II. As above, but the colour of the upper horizons is brownish black, and the total depth of soil above the weathered lava is only 75 cm., with a more abrupt transition. The structure is similar. Calcium carbonate is absent from the top 60 cm., occurs very locally at 60-75 cm., and becomes general only at the junction of clay and lava and in crevices of the lava to 125 cm.
- III. As profile I above, but the blue-black clay extends to 60 cm. only, and between it and the calcareous grey clay is an irregular rusty-brown horizon carrying both  $\text{CaCO}_3$  nodules and hard ferru-

ginous pebbles which may be concretionary or may be residual mineral aggregates from the decayed lava.

A dozen different exposures within a short distance from each other in this area might show half-a-dozen such variants on the common theme, but the general effect is of a single soil type, to which series rank is allotted under the name Malala series. In the series description its liability to considerable local variation is made clear.

The variability of the profile in the above instance is chiefly due to heterogeneity in the parent material, which is a lava sheet covered with miscellaneous pyroclastics (ash and tuff) and also with colluvium from the neighbouring slopes of the mountain. There are also slight differences in level, but these are not sufficient to remove any part of the area from being "of impeded drainage." Similar irregularities of profile are found in flood-plain alluvia, on which in East Africa well-defined dark-coloured soils are often developed, as in the Rufiji valley or on the Mkata plains in Tanganyika. Variability is also found in sedentary soils developed on banded rocks such as gneiss, where the banding is irregular and the soil surface is not parallel to the plane of foliation.

There is no great difficulty in admitting such variations as these within the limits of a single series when they occur side by side and there is no evidence that any of them merit a more particular characterisation. If however the Malala plain should ever come under intensive cultivation and be surveyed in detail, such evidence might be forthcoming. In that case how should one speak collectively of the group of parallel series into which the Malala soil might be split?

#### The fasc

The problem has in fact already arisen in regard to this soil in another way. Gethin Jones (1934) has described in Kenya the Athi series, a black clay developed on a lava sheet under grass and acacia-thorns, and having a horizon of calcium carbonate concretions between the clay and the underlying rock. Similar soils are known to occur also in the Rift Valley in both Kenya and Tanganyika, and again in Usangu (south Tanganyika). The local differences between these soils are probably great enough to make it extremely risky to correlate them as a single series, yet they have a similar origin, under the influence of chemical factors and of seasonal impeded drainage, on basic volcanic rocks, under a rainfall of 800 to 900 mm. with long periods of dry weather; and they carry similar vegetation. They are thus entirely parallel in the trend of their development. They belong to the great

soil group of tropical black clays, but if they are merged directly into it, important information is suppressed, for they differ markedly from other members of the same great group such as those found on soft clayey limestones under more humid conditions, or those formed under coastal delta conditions, or on swampy non-calcareous alluvia, or in semi-arid closed-drainage basins (mbuga clays).

The intermediate form of grouping that is needed perhaps resembles the family as used by Bennett and Allison for soils in Cuba (1928, p. 12), and is near the division or possibly the family of C. F. Shaw (1927, p. 36). My reluctance to restrict either of these words to the desired technical meaning has been stated above. W. W. Weir (1927, p. 120) has described a form of "family relationship" between soils, which appears to be the same conception that lies behind G. W. Robinson's suite; and the suite could undoubtedly contain the group of slightly-differing series that I have described. The suite, however, may also bring together soils which, though formed on fundamentally the same parent material, are by no means parallel in their development, a point to which I refer again later on in this paper. The suite is, in fact, not homogeneous enough to take its place as a unit in a true taxonomic system, and it will not satisfactorily serve our present purpose.

For the kind of grouping in question I propose the new term FASC, plural Fascs. This word, cut down from the Latin fascis = a bundle, indicates by its allusion the parity of standing of the grouped series, and the parallel trend of their development; also it avoids any connotation of a following-on relationship between them, a relationship that is quite absent from the idea that is to be expressed. The word has no existing usage in any modern language and can therefore introduce no confusion, yet it could readily be adopted into languages other than English, either unchanged or with simple transliteration.

#### Other examples of the fasc

In order to define further the kind of grouping that the fasc represents, I add the following illustrations.

##### Example 1

An outcrop of marble near Igawa, Iringa Province, Tanganyika, gives rise to secondary concretionary limestone ("kunkar") on the slope below it. In association with this a heavy black clay has developed, which is an impeded-drainage soil although it lies on a slope. The

climatic conditions are a little more arid than those of the Malala and Athi plains, and the vegetation differs correspondingly; but the Igawa black clay falls conveniently into the Malala-Athi fasc. Similarly it may include certain dark-coloured sandy-clays occurring near Mpwapwa, Central Province, Tanganyika, also in semi-arid country. Their origin may be connected with the occurrence of an amphibolite rock as a calcium-rich variety of the local gneiss. As the Malala and Athi soils are on phonolite or similar lavas, and pyroclastics, it will be seen that I do not regard identity or even lithologic similarity of parent rock as necessary within a fasc, provided that chemical factors deriving from the parent rock have brought about conspicuous similarities in soil development.

#### Example 2

In Zanzibar and Pemba occur yellow-brown sandy clays, acid in reaction and poor in organic matter, not laterised (silica/sesquioxide ratio in the clay fraction near 2.0), and pervious to a depth varying from 30 to 120 cm. from the surface. Below that depth they have a coarse-cloddy structure with percolation taking place mainly between the clods, the colour being mottled and streaked with orange, red and grey. Their parent materials are judged to have been slightly-calcareous sandy-clay marine beds of Pliocene and Miocene age, but they are now devoid of calcium carbonate. They occur indifferently on steep, moderate, or gentle slopes, their character as soils of partly-impeded drainage depending rather on the nature and history of the parent material than on factors of topography. They vary a good deal in the detail of the profile, and as they are amongst the important clove soils of the islands they will probably come to be sub-classified in several series. Soils of generally similar origin and nature have been recognised also in the coast belt of the Tanganyika mainland. In the present state of knowledge of this group of soils an attempt to separate them into series would be futile, but they fall very conveniently together as a fasc, which might appropriately be known as the Chake-Chake fasc, from a typical locality of the occurrence of these soils in Pemba.

#### Example 3

It is notorious that in those parts of Africa where the native population practises shifting cultivation, strictly virgin soils are difficult to find with certainty. Man, in virtue of his habit of changing the vegetation and with it the soil climate, and his hastening of erosion, must be taken just as seriously as an agent in soil formation (and destruction) as are the physical and biological factors ordinarily considered.

It may be noted that I should not include in the Usambara fasc the laterised red loams that are formed under rain-forest on lavas, as for example those of Kilimanjaro and of Rungwe, in Tanganyika, or on tuffs, as those of Kikuyu in Kenya; nor those on granites, as those of parts of the southern highlands (Iringa Province) of Tanganyika; nor those on sandstones, as in the Bukoba district west of Lake Victoria. All these show well-marked differences from each other and from the Usambara soils, in spite of the intensity of climatic action in this great soil group.

When the laterised red loams come to be better known as a world group, it seems probable that a need will be felt for a category of classification that can include all these mountain rain-forest soils on whatever parent material they are formed, together with the parallel formations from the non-African tropics, but which will still contain only a part of the great soil group. The beginnings of a further grouping of this kind can already be perceived in East Africa, but it would be premature to attempt here a discussion of its principles, still more so to suggest an appropriate name for such a category.

The above examples illustrate the functions of the proposed term *fasc* better than would a formal definition. A statement that may be regarded as a definition is however included in the summary at the end of this paper.

#### The Generalised Mapping of Complex Soil Associations

The units of grouping discussed up to this point are based on fundamental similarities in the soil profile. They therefore take their places in a strict taxonomic system. The problems of scientific classification and of convenient exposition are not, however, always the same, and it is sometimes necessary to group soils together in other ways. Thus we speak of the clove soils of Zanzibar, or of a soil province of the Union of South Africa, and thereby employ a grouping in which soil morphology is subordinated to some other attribute possessed in common by these soils. Devices of this kind are a frequent necessity in the practical applications of soil science, but they may also have to be called into service in soil mapping, even when the basis of the map is a purely morphological classification. Suppose that the soils of a large piece of country are to be mapped on a small piece of paper, and there is known to be a complex entanglement of soil types, how are the facts to be represented, or at least indicated?

An example will illustrate one of the ways in which this difficulty has arisen in mapping East African soils, and also the solution of it that

is proposed. I owe the material for this example to Dr. W. S. Martin, of Kampala.

In Buganda and parts of Busoga (Uganda), the surface topography over considerable areas consists of little else but a repetition of crests and hollows. The crests and slopes carry well-drained red loams; the hollows are swampy and carry black clays; towards the foot of the slopes are "murram"<sup>1)</sup> soils. If we suppose a point P on a crest and a point Q in a hollow, a traverse from P to Q takes us over a range of differences in the soil profile that cannot possibly be included in any grouping that depends on morphological similarity. To contain them, a unit of grouping would have to accommodate extremes of drainage-conditions, colour, texture, structure, reaction, clay-constitution, presence of concretionary horizons, in fact of every classifying property. Yet unless a survey were undertaken in minute detail, it would be impossible to map these different soils individually. They are not, properly speaking, individual soils at all, but are a compound soil unit of another kind in which a chain of profile-differences occurs in a regular manner.

The difficulty is encountered in this or some similar form by all soil surveyors. It has sometimes been evaded by regarding the bottomlands as carrying temporarily immature soils, or soils of suspended development. Thus G. F. Marbut (1927) considered that

"Excessive moisture is not a permanent condition of soil development on a given spot. The normal development of the geographic cycle in any region finally, and in relatively short time reduces the level of ground water below the level of ordinary soil-making forces.

Fundamentally the features of soils developed under the influence of a high water-table or of excessive moisture (which is equivalent to the lack of aeration) is a phase of incomplete development of the soil profile. It is a kind of soil youthfulness . . . ."

On this basis the well-drained soils of a region are singled out as its characteristic zonal type and are given representation on the map, the ill-drained soils being relegated to intrazonal standing and suppressed. I suggest, however, that to accept this principle is to sacrifice another that is being increasingly recognised as affording the truly philosophical standpoint in pedology, namely that soils should be classified by the evidence that they themselves yield, rather than by the soil-forming agencies that are presumed to be operating on them. This is not to

<sup>1)</sup> See G. W. Robinson, *Soils*, 1932, p. 59, for a reference to the term "murram".

say that we should not also study geology, climate, and the geographic cycle, in order the better to understand the story the soil tells. But unless the soil profile itself affords evidence of gradually improving drainage (and most ill-drained soils do not), we are not entitled to classify a black clay as a youthful red loam, nor to represent it as red loam on the map when in its own very different character it occupies an important proportion of the land surface. The soils of the bottom-lands constitute just as much of the truth about soil conditions in these parts of Uganda as do the red loams of the ridges, or the murrum soils met with in between when going uphill from Q to P.

#### The Catena

The P—Q range is really continuous, but in studying a sample area in detail it is possible to pick out three or four distinctive types of profile and give series rank to each of them, making it clear in the descriptions of these series that they vary about their means so as to join up continuously. The different series so distinguished have agricultural characters corresponding to their differing profile characters, and the identification and naming of them has a definite practical usefulness in guiding local soil-utilisation. But for distinguishing entire districts that possess a composite distribution of soil types of the kind described, from other districts that have more uniform soils, we need a composite unit of mapping.

The term suite as used by G. W. Robinson (*loc. cit.*) can include a range of differing soils related to each other in this way if, as in this case, they are formed on the same or essentially the same parent material. In endeavouring to make use of this term, however, two difficulties arise. The suite had its original application in Wales, and it may be doubted whether the soils it was designed to accommodate differ quite so far between extremes as do the well- and ill-drained extremes of the P—Q range under tropical conditions, to say nothing of the murrum soil with its ferruginous concretionary horizon. A more fundamental difficulty theoretically is the inclusion in Robinson's suite of two different kinds of relationship between soils that have a common parent material (common parent material being the test for inclusion in a suite). There may be a linking in sequence across the morphological groups as in the Uganda soils, or there may be a grouping of soils that differ merely in being formed on different facies of the parent material, or in degree of maturity, or in having been modified by cultivation, or in other ways that leave them still essentially parallel in development and therefore classifiable within a true morphological group, the fasc of

the earlier part of this paper. The suite is thus partly a unit of mapping convenience based on the geological map, and partly a true taxonomic division. Having a compound function, it can fulfil neither duty at any one time without ambiguity, and its usefulness is confined to discussions of the influence of parent rock, as such, on soil formation. In the case under discussion in Uganda the feature to which it is desired to draw attention in mapping is the regular repetition of a certain sequence of soil profiles in association with a certain topography. The uniformity of the parent material is of subsidiary interest.

This feature is found so frequently in various forms in East Africa (see the additional examples below) that in East Africa at least, and the problem may be more general, a distinctive word is needed in referring to it. We cannot appropriate for this specialised technical use such words as *sequence*, *range*, *succession*, if we desire to retain freedom of usage for these words in ordinary speech. I propose the word *CATENA* (Latin, = a chain). This term will help to indicate that the soils so grouped are linked by their topographic relationship, and will also perhaps serve to recall the nature of the topography in which they occur by evoking a mental picture of the catenary curve, the P—Q—P traverse. In certain forms of the catena, however, only one half of the curve is found (see the first example below).

The Uganda soils might be spoken of as the Bukalasa catena, from the locality of Martin's detailed studies of them as a group.

On a generalised map they would be coloured together as a unit. A convenient practical means of representation of a catena would be the use of stripes of the two or more colours that were employed, as separate solid colourings, to represent the different constituent soil types of the catena when found by themselves. The significance of the composite colouring would lie in its announcement that two or more soil profiles occur in a defined relationship to each other throughout the area so depicted. The nature of this relationship would be conveyed briefly to the reader by use of the term *catena* in the legend, and more fully in the accompanying memoir.

#### Other Examples of the Catena

Further examples of catenary associations of soils are the following:

##### Example 1

The Usambara Mountains, also the Uluguru Mountains and other mountain masses of the crystalline complex in Tanganyika, descend to the neighbouring plains sometimes through low-foothill districts in

which the Bukalasa type of catena occurs, but with a less pronounced development of the murram profile, or even an absence of it; and sometimes by abrupt escarpments many miles in length. Along the foot of the scarps occur narrow strips of country where soil conditions change very rapidly in a direction at right-angles to the line of the scarp. In some parts the strip is so narrow that on a generalised map it can hardly receive representation at all. The broader parts of the scarp-foot strips will require to be represented as catenas.

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type

#### Example 2

Certain areas of granite in central Tanganyika are overlaid by a deposit of partly-consolidated granitic detritus which is dated by geologists as of an age earlier than the earth movements that accompanied the formation of the Rift Valleys (see Teale, 1932). This deposit is nicknamed by them "the grey cement". On it a soil has developed. The topography is that of a wide peneplain, which is now being dissected by the cutting-back of the present drainage lines so as to expose the granite. On the exposures of granite a soil develops. In the depressions ("mbugas", for it is a semi-arid country), occur inky-black calcareous clays. This succession of soils, — on "grey cement", on granite, and on mbuga alluvium, with intermediate members including murram soils, is conveniently spoken of and mapped as a catena. It may be called the Kazi-Kazi catena, after the place so-named from which Mr. B. D. Burt, Survey Botanist to the Tsetse Research Department, Tanganyika, has furnished me with material for the study of it.

two  
type

#### Example 3

P. Vageler (1911 and 1912) has described the southern part of Ugogo, in central Tanganyika, as consisting essentially of a series of troughs or basins having level floors, evidently old lake-basins. The centre of each basin is occupied by dark-coloured calcium-rich clays. In successive zones going outwards towards the margins, are grey sandy clays and slightly clayey sands. The banks of the former lakes are represented by a greater or less development of red earths, the product of the weathering action of an earlier climate upon the low hill-ranges that intervene between the basins. Each soil zone carries its characteristic type of vegetation, from open grass-steppe in the middle, through various formations of grass and acacia thorn, to a mixed deciduous "Urbusch" and baobabs on the red earths.

I have no personal acquaintance with these soils of southern Ugogo except for a journey made across the region by motor car, but this

glimpse suggested to me that Vageler's description may receive fair interpretation on a generalised map as a catenary association of soils, the profile varying in each basin between red-earth and mbuga clay. The governing conditions are those of topography, but the topography is in part that of the present day, in part an old one now concealed, which in time past brought about the observed lie of the reassorted parent materials and which, no doubt, still influences the drainage.

I may add that in the course of correspondence following my first suggestion of the need for a term such as *catena* in the above sense (1933), Mr. V. A. Beckley, of Nairobi, has pointed out that the term could find a wider application than in expressing merely a sequence of different soils conditioned by topography. He would include also sequences conditioned by the climatic zones that encircle a great mountain in the tropics like Mount Kenya, thus visualising the *catena* on a grand scale. Another magnificent example would be that on Kilimanjaro, where conditions range from alpine to semi-arid tropical within a score of miles. Again he adduces replicated sequences of profile differences due to lithological factors, and of these Mr. Gethin Jones has described to me well-marked examples from the formations adjoining the eastern coast of Lake Victoria.

Such extensions as these to the conception of the *catena* open up interesting and, I think, enlightening possibilities in the expression of the relationships of soils in directions that run across the main phyla of genetic and morphological classification.

### Summary

There is no generally accepted usage, in soil classification, in regard to the definitions and names of categories falling between the great soil group at one extreme and the series at the other. In East Africa, where conditions allow only of a reconnaissance of soils and not of a systematic survey, a need for intermediate units is felt. The disadvantages of restricting existing words to specialised senses for this purpose are pointed out, and a bolder coining of new terms is advocated.

After a discussion of the allowable latitude in defining a soil series, a form of grouping of allied series is described, with examples from East Africa, under the new name FASC.

The series included in a *fasc* are parallel in their development. They have undergone the same kind and intensity of climatic weathering, have

similar conditions of drainage, and the genetic factors due to parent material have similar effect. They differ in degree of maturity, in the effects of man's intervention in soil development, in the effects of changes of vegetation, or in the sum total of small effects due to their being geographically distant in occurrence. These differences, while preventing their inclusion within a single series, leave their affinities closer than would be expressed by merely including them in the same great soil group. It is emphasised that the fasc is not a purely geological grouping.

The need for another category intermediate between the fasc and the great soil group is foreshadowed.

A unit of mapping convenience is described, to be termed the CATENA. Examples are given showing how the need for it arises in East Africa.

The catena is a grouping of soils which, while they fall wide apart in a natural system of classification on account of fundamental genetic and morphological differences, are yet linked in their occurrence by conditions of topography and are repeated in the same relationship to each other wherever the same conditions are met with. The use of a composite mapping-unit of this kind is advocated in preference to the suppression of all but one of the associated soil types on grounds of their being of arrested development, or intrazonal.

A means of representing catenary distributions on a map is suggested.

Extensions of the sense and use of the catena are mentioned, which have been proposed by other workers.

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