GOLD COAST DEPARTMENT OF SOIL AND LAND-USE SURVEY

TECHNICAL REPORT No. 8

R E S T R I C T E D

EXPANDED LEGEND TO THE PROVISIONAL SOIL ASSOCIATION AND SOIL COMPLEX MAP OF THE AYENSU AND DENSU BASINS

By

C.F. Charter
Late Director,
Soil and Land-Use Surveys

KUMASI
April, 1955
Second Impression
June, 1956

EXPANDED LEGEND TO THE PROVISIONAL SOIL ASSOCIATION AND SOIL COMPLEX MAP OF THE AYENSU AND DENSU BASINS

INTRODUCTORY NOTES

The map and its legend

This map and legend is wholely provisional and does not commit the Department of Soil and Land-Use Survey in any way whatsoever. The delay in making information available regarding the surveys of the Upper Densu and Ayensu basins is due to absence of trained staff and laboratory facilities during the first few years after the Gold Coast soil survey was initiated. Soil samples taken in the Upper Densu basin during 1946 and 1947 have had to be discarded due to deterioration during storage and other samples are being obtained and analysed as opportunity permits. Examples of all the major soils in the Ayensu basin have been analysed and particulars of these may be obtained on application to the Department.

Whereas the whole of the Ayensu basin has been formally surveyed only that portion of the Densu basin north of parallel 5° 45' has been methodically traversed. The information given regarding the lower Densu basin has been obtained by random work and special surveys and will need modification, but not drastic modification, in the future.

The cartographic units employed

These are groups of soils geographically associated by reason of the lithology of their parent rocks and relief and drainage. The delineation of individual soil boundaries is impossible in territory such as that concerned except over very small areas capable of being surveyed in detail by means of closely-spaced traverse lines. This is because the individual soil pattern is itself highly complicated by varying lithology, relief and drainage and because the terrain is covered either with dense bush or chaotic cultivation. Over extensive areas the mapping of individual soils is only possible in open country or where a regular system of cultivated fields supplies a grid to which soil boundaries can conveniently be related.

The suitability of soils for cocoa

The principal cartographic and taxonomic soil unit is the soil series. This may be defined as a group of closely similar soils developed over similar parent material under similar conditions of development. It is subdivided into subseries in very detailed surveys based upon variations in its intrinsic characters, chiefly texture

of the fine earth and relative abundance or absence of stones, gravel, etc. Subseries are in turn divided into phases largely dependent upon the vegetation these support and which in turn influences the structure and composition of the humous horizons. Phases, as their name implies, are transitory and rapidly give place to others in territory occupied by man.

Swedru series, forest phase is an excellent cocoa soil but the same is not true of Swedru series, thicket or cultivated phases, unless manuring is practised. It is essential to bear this point in mind when considering the suitability of an area for cocoa production.

In the regions shown on the provisional soil map the areas climatically suited to cocoa lie roughly north of the Swedru-Adaiso-Nsawam-Aburi road. Whilst this is the rough boundary, the possibility of the economically successful establishment of the crop about this line also depends upon soil texture and depth and upon relief and drainage.

Generally speaking soils north of the stated line are suitable for cocoa production by the traditional methods where they are covered by high primary or secondary forest and conform to the physical specifications set out in Cocoa Soils: Good and Bad (1). It will be noted that for all practical purposes no high forest outside forest reserves exists in the regions covered by the provisional soil map.

Where cocoa has been recently destroyed and a good amount of tall shade remains soil conditions are probably suitable for re-establishment, the success of which would in these cases depend upon efficient disease and pest control.

The opportunity is taken here to deprecate in the strongest manner possible any attempts to perpetuate the worst characteristic of colonialism, namely the practice of removing nutrients in crops for export without replenishing the depleted soils. This condemnation includes the use of especially vigorous strains capable of extracting the last remnants of fertility from already exploited soils where such strains are grown without due regard to the maintenance of soil productivity.

Other uses of soils at one time supporting cocoa but now considered unsuitable for the economic production of this crop

Robusta coffee might be considered for some of these soils with better intrinsic qualities but no other tree crop can be recommended. The areas involved are close to developing commercial and industrial centres and are eminently suited to the production of annual and semiperennial food crops of which one is led to believe shortages exist or are likely to exist in the near future. Additional notes on this subject are given, where appropriate, in the expanded legend that follows.

Note regarding additional data available for inspection at the headquarters of the Department of Soil and Land-Use Survey

Besides analytical data, specimen soil profiles, soil diagrams and detailed maps of sample strips, showing the soil, vegetation and present land use representative of most of the soil associations and complexes briefly described below, may be inspected upon appointment at the Compilation Office and Musuem of the Department of Soil and Land-Use Survey, Kumasi.

SOILS OCCURRING OVER GRANITIC ROCKS

Soils occurring over granitic rocks of the Cape Coast granite complex

These rocks include granites, or rather granodiorites, unfoliated or foliated to various degrees, in which the main minerals are quartz, potash feldspar, soda-lime feldspar, biotite, muscovite and hornblende. With them occur biotite schists, muscovite-pegmatite, aplite and quartz veins. In numerous places dykes of epidiorite, diorite and amphibolite occur.

1. Adawso// Opimo Complex

This is the most extensive geographical group of soils found in the combined Ayensu and Densu basins and is made up in the main of two Compound Associations: the Adawso/Ofin Compound Association and the Nyanao/Opimo Compound Association.

(a) Adawso/Ofin Compound Association.- This includes the Bawjiasi-Adawso Association of sedentary soils developed directly over little-weathered biotite granite and the Nta-Ofin Association developed over transported materials derived from the erosion of Bawjiasi and Adawso soils.

(i) Bawjiasi-Adawso Association.- Comprises Bawjiasi and Adawso series. Generally speaking Adawso series is by far the most extensive; Bawjiasi series, however, may be locally important, particularly in the south-west.

Bawjiasi series has grey-brown loamy sand humous horizons overlying a reddish sandy clay subsoil containing much quartz gravel and sometimes ironstone gravel as well which grades at a few feet into little decomposed biotite granite not as a rule very well foliated. Where it occurs it occupies the summits and upper slopes of undula tions and its distribution probably depends upon local variations in the amount of biotite contained in the parent rock. These soils are approximately neutral in the humous layers but may become somewhat acid in the subsoil though reaction will be higher again in the decomposing rock. Usually Bawjiasi soils are too shallow under the climatic conditions obtaining for successful growth of perennial tree crops such as cocoa. They are relatively well supplied with potash, lime and magnesia but are likely to be very low in readily-available phosphorus.

Adawso series has grey-brown loamy humous horizons which overlie pale yellow-brown subsoils consisting of sandy clay containing abundant quartz gravel; ironstone gravel, however, is characteristically absent or insignificant. At a few feet little decomposed rock is encountered and this consists of pale granite with sparse biotite, often with veins of pegmatite and quartz.

These soils are found as middle and lower slope associates of Bawjiasi series but over a great deal of the area in which they occur they occupy the upper slopes and summits of undulations to the exclusion of the Bawjiasi soils, the later only occurring where the parent rock is relatively rich in biotite. Adawso soils are approximately neutral throughout the profile and are relatively well supplied with potash and lime; their available phosphate status is low. These soils are in general too shallow and droughty for cocoa or other perennial tree crops and are most economically utilized for the production of annual and semiperennial foodcrops.

(ii) Nta-Ofin Association. - This comprises Nta, Ofin, Oda, Densu, Kakum and Chichiwere series.

Nta series. - These soils are developed in the transported medium to coarse sands occurring in the upper and middle parts of drainage grooves and on the lower slopes of small valleys. The parent material varies in thickness from a couple of feet to as much as seven feet and overlies partially-weathered granite from which it is frequently separated by a well-defined or sparse stone-line. This material is mostly well-drained and pale yellow-brown in colour though impedance and ironstone formation may occur just above and in the upper part of the rotten bedrock. Nta soils have grey-brown sandy humous horizons but no distinctively-developed subsoil. They are more or less neutral throughout the profile and characteristically low in all plant nutrients except under high forest; when this is cleared they rapidly become impoverished. As would be expected Nta series comprises droughty soils unsuitable for perennial tree crops except where the rainfall is abundant and more or less evenly distributed throughout the year. Nta soils are only to be considered as second- or third-rate soils for the production of annual and semiperennial food crops. Unfortunately they are both widespread and extensive. (On the soil map of the West African Cacao Research Institute (2) Nta series was mapped as Asafo and Suhien series, the latter with ironstone in the lower part of the parent material).

Ofin series. - These soils are developed over grey alluvial sand a few feet in thickness which overlies a varying amount of stream gravel and this the decomposing bedrock. Under natural conditions these soils are waterlogged and often flooded during the wet seasons but may dry out almost completely during periods of drought or little rain, particularly after they have been cleared of their forest cover. This characteristic is enhanced when the stream gravels underlying these soils form a thick layer devoid of perennial groundwater. The surface humous horizons are dark grey-brown in colour and the soils are more or less neutral throughout the profile. As with Nta series these soils are themselves very low in plant foods but these may be supplied by the moving groundwater. Ofin soils are uncertain cocoa soils and have mostly been used by farmers for dry season vegetables, sweet potatoes, sugarcane and, latterly, rice. Ofin series is both widespread and locally extensive. (On the WACRI soil map (2) these soils were marked as Akodum series).

Oda series. - These are soils developed in grey, pale grey or almost white clayey stream alluvium which grade into Ofin series. The clayey alluvium which is of the non-plastic type, may be underlain by a layer of stream gravel or may directly overlie the rotten bed-rock. Usually, the clayey alluvium is not thicker than six feet. Oda soils are waterlogged during the wet seasons and frequently flooded. Except where the clayey alluvium is very thin, they retain moisture fairly well during the dry periods. They have a dark grey-brown humous horizon, are more or less neutral throughout the profile and may be well supplied with plant nutrients. These soils only occur in relatively inextensive patches, for Gold Coast rivers appear to transport most of their fine sediment to the sea. Cocoa frequently does well on these soils, though farmers use them widely for the same crops as are grown on Ofin series.

Densu series. - These soils closely resemble those of Oda series but have a more or less plastic clay parent material to which the weathering products of basic rocks and basic dykes have contributed. This parent material is darker in colour than that of Oda series, being some shade of grey and never whitish.

Kakum series. - This comprises soils developed over grey and brown mottled silty or fine sandy clay of river and stream levees and their margins. Such clay may also occur on first terraces along the Densu and its larger affluents. It is only of local importance.

Chichiwere series. - This series contains soils developed over fine, medium and coarse levee sands occurring on stream and river banks. Such soils are liable to be droughty and to contain little in the way of plant nutrients. They are widely distributed but nowhere extensive. In some areas they are planted to coconuts. (The medium to coarse subseries was called Beira series on the WACRI soil map (2)).

Associated with the above soils, especially along the Densu and its major affluents, occur patches of brown loamy or gravelly soils, the remnants of old river terraces. On some summits rocky skeletal soils may occur; these will be described below as Nyanao series. Elsewhere patches of shallow to deep red-brown drifts occur and these, too, will be described later as Koransang and Kukua series.

(b) Nyanao/Opimo Compound Association. - This Association is characterized by steep rocky hills, or inselbergs; it forms a large part of the divide between the Densu and Ayensu basins and stretches in a broad belt through the central part of the Densu basin itself. Elsewhere the Association occurs with more subdued relief scattered in a manner that is difficult to map except on a large scale amongst the whole expanse of the Adawso-Nta Association. Outliers of this Association also occur in the Swedru/Ofin Compound Association and amongst the Osibi// Adzintam Complex. This Compound Association contains the Nyanao-Adiembra Association and the Opimo-Ofin Association.

(i) Nyanao-Adiembra Association.- This Association comprises Nyanao, Tinkong and Adiembra series, all sedentary soils developed on the summits and slopes of rocky inselbergs and the small rocky hillocks to which many of the former have been reduced by erosion.

Nyanao series. - This is a skeletal soil developed over various types of granitic rock in which a humous horizon directly overlies solid rock, rock brash or little-weathered bedrock. These soils are more or less neutral throughout the profile and well supplied with plant nutrients except perhaps phosphorus. Nyanao soils are shallow and provide little root room. In consequence they are droughty except where they occur at the summit of high hills kept moist by cloud and mist. Only in such exceptional circumstances can they support good cocoa.

Tinkong series. - These are well-drained soils developed in biotite granite as a rule and have red subsoils devoid of a quartz and ironstone gravel zone. Where sufficiently deep they support good cocoa. Inadequate analytical data are available for these soils in the regions under review to comment on their nutrient status though this may be expected to be inherently good.

Adiembra series. - This series comprises the less well-drained brown associate of Tinkong series. At present little can be stated regarding it other than what has already been noted with respect to its red associate.

(ii) Opimo-Ofin Association. - The soils of this Association have been developed in piedmont drift more or less surrounding the bases of inselbergs and their eroded remnants. It comprises Opimo, Nsawam, Nta, Ofin and other 'alluvial' soils.

Opimo series. - The soils of this series are developed over a uniform red drift of granite origin found at the base of granite inselbergs. This drift may be six or more feet deep but is often little over a foot in thickness. It may be separated from the little-weathered bedrock by a stoneline consisting of more or less rounded quartz and granite stones and small boulders. Incipient buchananite may occur at the base of the drift or in the upper part of the weathered bedrock provided weathering has proceeded far enough. (Buchananite is partially-indurated more or less mottled clay and the initial stage in the development of ironstone). Few analytical data are as yet available regarding Opimo soils but it is known that the deeper patches provide good cocoa soils.

Nsawam series. - This is the less well-drained brown associate of Tinkong series and much that has been stated about that group of soils applies to this.

Ofin series. - This and other transported alluvial soils have already been described.

Associated with Adawso/Ofin Compound Association are Koransang and Kukua series; these are soils developed in red and brown peneplain drifts respectively. Such soils closely resemble Opimo and Nsawam series but occur

on the flattish summits of undulations and are unassociated with inselbergs - at least as far as the present cycle of weathering is concerned. Many of such soils are quite shallow, overlying bedrock at a depth of a few feet or less; hence they tend to be droughty. Analyses of such soils in other parts of the Gold Coast suggest that they are less well-stocked with plant nutrients than either soils of sedentary weathering or those of piedmonts. Ancient drifts in the Gold Coast were first recognized in the Densu basin. It is now known that soils whose parent materials have this origin are of major importance in tropical Africa.

2. Koforidua/Ofin Compound Association

This Compound Association occurs in the extreme north of the Densu basin. It is compounded of the Koforidua-Nankesi Association and the Nta-Ofin Association. The former is developed over well-foliated biotite granite and the latter over the transported weathering products of these soils. Included in the Compound Association are areas of soil developed over hornblende granite, Wacri-Kukurantumi Association, and over coarse-grained diorite, Tafo series. Some areas occur where the soils are pale orange in the subsoil and developed over deeply-weathered biotite gneiss or schist. (On the WACRI soil map (2) these have been delineated as Jumapo series).

Koforidua series. - This comprises soils with a medium sandy loam humous topsoil that overlies a reddish sandy clay subsoil containing abundant quartz and ironstone gravel. Usually at about six feet or so partially-weathered parent rock is encountered. These soils are about neutral at the surface, becoming acid with depth; the reaction rises, however, as the parent rock is reached. Koforidua soils are well supplied with bases but available phosphorus is low. They are excellent media for the growth of cocoa as they are sufficiently deep to be retentive of moisture during dry periods but not so deep that the rotten parent rock is below the reach of plant roots.

Nankesi series. - These soils are the brown subsoiled associates of Koforidua series with less perfect internal drainage due to their topographical position.

Wacri series. - These soils resemble Koforidua series except that they have developed over hornblende granite and tend to be shallower.

Kukurantumi series. - The soils in this series are the brown subsoiled associates of Wacri series which they resemble except in their internal drainage.

Tafo series. - These soils have the same general profile structure as the others so far described in the Koforidua-Nankesi Association and are developed over a very coarse-grained diorite. On the whole these are more clayey and plastic than others in the Association

and the subsoil colour is brown or reddish brown rather than red, even in the most elevated of the examples. No analytical data are yet available for these soils, but they are presumed to be inherently well supplied with bases and to be neutral at the surface and to show increasing acidity with depth until the rotten parent rock is reached.

The Nta-Ofin Association and its component soils occurring in valleys between the soils of Koforidua and other upland soils have already been described.

3. Swedru/Ofin Compound Association

This Compound Association covers towards the north more than half of the Ayensu basin and extends into the north-western part of the Densu basin. It consists of two Simple Associations: Swedru-Nsaba and Akroso-Ofin, the latter being developed from the transported products of the erosion of the former.

Swedru series. - This is an excellent cocoa soil and is developed over biotite schist, weathered fragments of the latter usually being met with towards the base of a six-foot pit. The surface humous horizons consist of grey-brown clay loam and overlie a red clay subsoil containing moderate amounts of quartz ironstone gravel. The subsoil grades into highly-weathered parent rock of which patches only are discernible in most six-foot pits. The surface layer is usually neutral or even slightly alkaline and may even be somewhat calcareous; with depth, however, reactions fall. Very full analytical data are available for this series which show that it is high in lime, magnesia and potash although readily-available phosphorus is low.

Nsaba series. - This comprises the brown, less completely-drained associates of Swedru series occurring at lower elevations on the slopes of hills and undulations.

Akroso series. - This is a loamy transported soil found in drainage gooves and on the middle to lower slopes of small valleys in a superior position to Nta series which it resembles in profile form. These soils are neutral at the surface but become more acid with depth. Their inherent nutrient status is much lower than that of either Swedru or Nsaba series.

The remaining members of the Akroso-Ofin Association: Nta, Ofin, Oda (Densu), Kakum and Chichiwere series: have already been described above.

Awaham series. - This series occurs as scattered, inextensive components of the Akroso-Ofin Association and is developed over terrace gravels and red-brown loamy clays occurring on remnants of old river terraces.

4. Swedru/Kumasi Complex

This is a facies of the Swedru/Ofin Compound Association occurring in the west centre of the Ayensu

basin. It comprises, besides the soils already described above, sizeable patches of Kumasi-Asuansi Association. These soils are developed over coarsely-quartzose, biotite granodiorite and have a coarse sandy to fine gravelly topsoil whilst the subsoil is either red (Kumasi series) or orange (Asuansi series) coarse sandy clay. The unweathered parent rock is never met with in pits. Asuansi series which is the less well-drained associate of the red subsoiled Kumasi series appears most common here. Both series are known from other parts of the forest region of the Gold Coast and are less fertile than Swedru or Nsaba series largely on account of their coarser texture and the great depths to which the underlying rock is weathered. Elsewhere cocoa has not survived on the average for more than 25-30 years on these soils.

5. Asamankese/Adawso Complex

This is a somewhat anomalous Complex of grey and greyish yellow clayey and sandy soils occurring at the extreme south of the Atewa range north of Asamankese. They have probably been developed over pegmatites. Analytical data are available for Asamankese series which show it to be more or less neutral in reaction and to have a high base status. Cocoa is at present doing well on this complex.

Soils occurring over rocks of the Dixcove granite suite

6. Abomosu/Ofin Compound Association

This comprises Abomosu Consociation on the uplands and Nta-Ofin Association in the valleys. The latter has already been described. This Compound Association occurs in an internal valley in the Atewa range and is developed over feldspar porphyry and its associated weathering products.

Abomosu series is a soil with an orange coloured subsoil occurring on the summits and slopes of undulations. In this region it receives a high rainfall and is thoroughly leached and very to highly acid at the surface as well as in the lower parts of the profile. Analytical data are available for these soils both from this and other areas but not much is known as yet about their cropping characteristics.

SOILS OCCURRING OVER BASIC METAMORPHIC ROCKS

These basic metamorphic rocks comprise altered lavas, etc., of the Upper Birrimian formation and include hornblende schists and calc-chlorite schists. One area of these rocks, under heavy rainfall (> 70 ins.), is found in the Atewa range which forms the north-western divide of both the Ayensu and Densu basins whilst another is found in the extreme south-west of the Ayensu basin under relatively low rainfall and much lower relief.

7 and 9. Atukrom/Birim Compound Association

This comprises Atukrom-Asikuma Association of the uplands and Ansum-Birim Association of drainage grooves and valleys. These soils occur in areas of rainfall of 70 inches and over and tend to be considerably leached.

(a) Atukrom-Asikuma Association

Atukrom series is a red clay or clay loam soil, humous-stained at the surface and containing in the subsoil characteristic, somewhat flattened, ironstone gravels.

Asikuma series is its brown associate with less perfect internal drainage. Unweathered calc-chlorite schist which is the parent rock usually occurs only at considerable depths although occasional small patches of skeletal soil, Piki series, occur here and there. Some soils contain large stones and boulders of ferruginous bauxite and the few inextensive flat summits are covered with a brown drift, Atewiridu series, overlying this. This elevated drift soil belongs to the uppermost peneplain in the Gold Coast and is highly leached and extremely acid.

Atukrom and Asikuma series both support good cocoa at the present time where these soils are not under forest reserves.

(b) Ansum-Birim Association.- This Association comprises Ansum series found in drainage grooves and along the lower slopes of narrow valleys and Birim series on the incised floodplains of streams.

Ansum series consists of a grey topsoil overlying uniform brown, gravelless transported loam or clay loam which at a few feet rests on the highly weathered bedrock. The latter is frequently separated from the former by a stone-line of ironstone gravel or ferruginized rock fragments. This series has a profile closely resembling those of Akroso and Nta soils and like the latter is believed to be less productive than the associated

sedentary soils. Analytical data are available for Ansum soils, both from these and other regions.

Birim series.- These soils are developed in brown, well-drained incised stream and river alluvium of a clay or clay loam texture. They support excellent cocoa as a rule. Analyses are available for soils from both these and other regions in the Gold Coast.

8. Atewa/Birim Compound Association

Atewa series appears to be the only member of the upland association (or consociation) described, no brown associate having been recorded so far; the lowland consists of Ansum and Birim soils, particulars of which have already been given. The Compound Association is found on the flanks of the Atewa range both in the Ayensu and Densu basins and occurs under moderately high or high rainfall.

Atewa series consists of a grey-brown humous topsoil overlying red clay or clay loam with scattered quartz gravel but no ironstone gravels. These soils have been recorded from other parts of the Gold Coast forest area but have been little studied up to the present and their mode of formation and parent material have not been determined as yet. Some analytical data are available from several sources. Although Atewa soils support cocoa little is known regarding their value with relation to this crop at present.

9. Atewiridu Consociation

(See section 7, above).

10. Bunuso// Atukrom Complex

This Complex occupies a relatively small area at the extreme south of the Atewa range and compriscs a mixture of soils, Bunuso series developed over hornblende schist, and Atukrom and Asikuma series developed over calc-chlorite schist. Bunuso series is a dark grey-brown, almost black, highly humous skeletal soil.

11. Osibi// Adzintam Complex

This comprises an area of soils in the south of the Ayensu basin developed under conditions of moderate relief and relatively low rainfall from hornblende schist. Osibi series is a neutral to somewhat alkaline shallow, almost black, soil which grades in depressions and valleys into a deeper dark grey to black plastic clay, Bumbi series, which may be calcareous in its lower horizons at 5 to 6 feet. Adzintam series is a dark red soil extending to about 6 feet in depth which is highly manganiferous and contains rounded ironstone gravel and stones of quartz and schist; it may be in part sedentary in origin or developed wholly in drift material. On valley slopes and in valley bottoms it grades into somewhat plastic brown and grey mottled clay containing ironstone concretions; this is Tachem series. Analyses of all four of these

soils are available.

12. Osibi-Bumbi Association

This comprises Osibi and Bumbi series, the former on the upper slopes of undulations and the latter in depressions and stream valleys. Both these soils have been described above. The Osibi-Bumbi Association occurs under savannah in the extreme south-west of the Ayensu basin.

13. Yenku Consociation

This consists of the skeletal soils of Yenku series developed over hornblende schist under dry forest, thicket or savannah and low rainfall. They occur on a few hills in the extreme south-west of the Ayensu basin.

14. Winneba-Bumbi Association

This association is found under short grass savannah in the extreme south-west of the Ayensu basin. This association comprises Simpa series on the summits of undulations and Winneba series on the slopes; the depressions and drainage lines are occupied by Tachem and Bumbi series which have already been described. Simpa series consists of pale brown coarse sand overlying compact brown and grey mottled clay containing rounded and subangular quartz stones. Winneba series consists of greyish brown clay overlying brown and grey mottled clay containing quartz stones and ironstone gravel which merges at depth into partially-weathered hornblende schist.

SOILS DERIVED FROM METAMORPHOSED SEDIMENTS AND SEDIMENTARY ROCKS

(Akwapimian, Buem and Voltain formations)

15. Fete Consociation

This Consociation occurs on the steep western flanks of the Akwapim ridge from near Aburi in the north to near Dom in the south. The principal soil present is Fete series, a dark, highly humous, and moderately to very acid skeletal soil developed over hard quartzites of the Akwapimian formation. Mixed with it are lesser amounts of a skeletal soil found over phyllite, Salom series. Analyses of both of these soils are available. Neither are good media for cocoa growth.

16. Korle Consociation

This comprises reddish sandy soils developed from softish Akwapimian quartzites. These soils cover the relatively low hills extending from near Dom south-west to the coast. Analyses are available from similar soils on the Accra plains.

17 Fete-Krabo Association

This Association occurs over the rocks of an Akwapimian outlier found to the west and north of Senya Beraku where the divide between the Ayensu and Densu basins approaches the coast. The soils included in the Association comprise Fete series, already described, occurring on steep slopes, whilst Osonko, Midie and Senya series occupy gentler slopes and flattish summits and Beraku and Krabo series are found in drainage grooves and valleys. Osonko series is a red sandy loam containing ironstone gravel and sandstone brash; Midie series is a deep to moderately deep red sandy soil devoid of ironstone gravel and of brash, except at depth; Senya series is a shallow soil developed over well-rounded marine terrace gravels. Beraku series is developed in pale brown transported sand and Krabo series in brown and grey mottled sandy clay alluvium. Analytical data for these soils are available either from this region or from the Accra plains. This Association occurs under too low a rainfall for cocoa and is devoted to subsistence farming with bush fallows.

18. Midie Complex

The soils of this Complex developed over rocks of the Buem formation have not been completely worked out: the examination of other Buem areas being necessary for this purpose. However, deep red sandy or loamy soils belonging to Midie series occur extensively and also areas of Fete-like, brashy quartzite soils are found. Soils resembling Beraku and Krabo series occur in drainage grooves and valleys. Where piedmont drifts occur soils apparently identical with the Oyarifa series of the Accra plains are found; these are deep, red clay loam or light clay soils with some mottling towards the base where the weathered bedrock occurs. All this Complex was under forest all of which has been felled and cocoa planted. Little or no cocoa now survives, it having disappeared well before the appearance of virus diseases, and the Complex is now devoted to food-crop farming with maize, cassava and cocoyam as the main crops whilst some small areas are under pineapples.

19. Bediesi Consociation

This comprises red sandy or loamy soils, Bediesi series, developed in piedmont drifts occurring at the base of the Voltain scarp from the extreme north of the Densu basin to just south-east of Koforidua. In general profile form these soils resemble Oyarifa series. Over most of this Consociation cocoa has been killed out by swollen shoot. No analytical data for Bediesi soils are available but it is not considered from their origin that they would form good media for cocoa production without liberal manuring.

SOILS DERIVED FROM ALLUVIUM

Stretches of alluvium in the Ayensu and Densu basins are of very small extent, a characteristic in keeping with much of the alluvium to be found in West Africa.

20. Oyibi-Muni Association

This Association comprises the grey clays, Oyibi series, and grey sands, Muni series, of the saline coastal lagoons. These are separated from the sea by sand bars covered by Keta series. Analyses of the soils are available.

21. Ayensu-Chichiwere Association

This Association consists mainly of Ayensu and Chichiwere series, the latter having already been described. Ayensu series is a heavy grey-brown clay crumby-cloddy in the uppermost horizon which overlies a roughly prismatic subsoil which gives place to irregular polyhedric masses of parent alluvial clay below. Beneath this alluvial clay occurs at about six feet, more or less, coarse feldspathic sand which contains brackish groundwater. This Association occurs near the mouth of the Ayensu river and is under savannah, fringing bush or cultivation, mainly cassava. Analyses of the soil series are available.

REFERENCES

1. Charter, C.F. 1948. Cocoa Soils: Good and Bad. An introduction to the soils of the forest regions of West Africa. West African Cacao Research Institure, Tafo. (Cyclostyled).

2. West African Cacao Research Institute, Division of Soil Science and Chemistry. 1946. Map: Detailed Soil Survey, West African Cacao Research Institute: 1:2,500.

FAA.

APPENDIX

AREA OF SOIL ASSOCIATIONS

No.	Association	Area coverage		
		Sq. miles	Acres	% Total
1a.	Adawso/Ofin Compound Association	856.48	548,147.20	47.57
1b.	Nyanao/Opimo Compound Association	85.02	54,412.80	4.72
2.	Koforidua/Ofin Compound Association	102.14	65,369.60	5.67
3.	Swedru/Ofin Compound Association	429.99	275,193.60	23.88
4.	Swedru//Kumasi Complex	24.13	15,443.20	1.34
5.	Asamankese//Adawso Complex	16.89	10,809.60	0.94
6.	Abomosu/Ofin Compound Association	2.10	1,344.00	0.12
7.	Atukrom/Birim Compound Association	49.28	31,539.20	2.74
8.	Atewa/Birim Compound Association	29.74	19,033.60	1.65
9.	Atewiridu Consociation	0.86	550.40	0.05
10.	Bunuso//Atukrom Complex	3.58	2,291.20	0.20
11.	Osibi// Adzintam Complex	43.36	27,750.40	2.41
12.	Osibi-Bumbi Association	7.47	4,780.80	0.41
13.	Yenku Consociation	3.19	2,041.60	0.18
14.	Winneba-Bumbi Association	12.76	8,166.40	0.71
15.	Fete Consociation	11.06	7,078.40	0.61
16.	Korle Consociation	7.55	4,832.00	0.42
17.	Fete-Krabo Association	19.00	12,160.00	1.05
18.	Midle Complex	61.58	39,411.20	3.42
19.	Bediesi Consociation	22.34	14,297.60	1.24
20.	Oyibi-Muni Association	8.41	5,382.40	0.47
21.	Ayensu-Chichiwere Association	3.58	2,291.20	0.20
	TOTAL	1,800.51	1,152,326.40	100.00

sba.

AYENSU AND DENSU BASINS

Provisional map of Soil Associations and Soil Complexes

Scale 1:250,000

Miles 0 1 2 3 4 5 10 Miles

Asamankese
Akroso
Swedru
Winneba (Sumpa)
Senya Beraku
ACCRA

1st Class road
2nd Class road
3rd Class road

SOILS OCCURRING OVER GRANITIC ROCKS

Over Cape Coast Granite Complex

- Adawso/Ofin Compound Association } Adawso//Opimo Complex
- Nyanao/Opimo Compound Association }
- Koforidua/Ofin Compound Association
- Swedru/Ofin Compound Association
- Swedru//Kumasi Complex
- Asamankese//Adawso Complex

Over Dixcove Granite Suite

- Abamosu/Ofin Compound Association

SOILS OCCURRING OVER BASIC METAMORPHIC ROCKS

- Atakrom/Birim Compound Association
- Atewa/Birim Compound Association
- Atewiridu Consociation
- Bunuso//Atukrom Complex
- Osibi//Adzintam Complex
- Osibi–Bumbi Association
- Yenku Consociation
- Winneba–Bumbi Association

SOILS DERIVED FROM METAMORPHOSED SEDIMENTS AND SEDIMENTARY ROCKS (Akwapimian, Buem and Voltaian Formations)

- Fete Consociation
- Korle Consociation
- Fete–Krabe Association
- Midle Complex
- Bediesi Consociation

SOILS DERIVED FROM ALLUVIUM

- Oyibi–Muni Association
- Ayensu–Chichiwere Association

Base map GOLD COAST General Topographical series 1:250,000 Sheets 14 and 18, Accra and Koforidua Accra, Survey Department 1958 and 1961

Kumasi April, 1965