REPUBLIC of the CONGO

DEVELOPMENT OF A SOIL AND TERRAIN MAP/DATABASE

Technical Report No.

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for

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TABLE OF CONTENTS

TEXT APPENDICES

MAP APPENDICES

List of figures

List of tables

ABBREVIATIONS and CONVERSIONS

a.s.l.	altitude in metres above sea level
AWC	available water holding capacity
CEC	cation exchange capacity
EC	electrical conductivity
Ex. Ac.	Exchangeable acidity
FAO	Food and Agriculture Organization
IRD	Research Institute for Development, France (former ORSTOM)
ORSTOM	Office for overseas technical and scientific research (France)
SOTER	World SOils and TERrain Digital Data Base
WCG	Western Congo Group (rocks)

SUMMARY

The "development of a soil, terrain unit map and database for the Republic of the Congo" presents a revised soil map and a terrain unit map (to a scale of 1/2,500,000). The report contains a description of terrain units, according to the principles of the SOTER manual (version 2.5). Soil mapping units are classified in the FAO soil classification (1990). Available information on vegetation has been collected.

Major constraint is that this study has been based only on existing (old) literature and reports.

The appendix includes an adaptation and translation of typical, geo-referenced, soil profile descriptions.

The report provides FAO with basic data on the Congo's natural resources, fundamental data needed for multi-layered GIS-supported information systems and essential for land use planning decisions.

RECOMMENDATIONS

1. Recommendations for the Republic of the Congo

There is no up-to-date soil map of the Congo (1969). Appropriate information on many soils and soil properties is lacking and makes it difficult to assess the land use potentials for specific areas.

The fragile nature of soils and vegetation increases the risks of environmental degradation, due to population pressure and/or mismanagement of natural resources, such as overgrazing, deforestation for fuelwood production and land clearing.

Land resources inventarisation, as initiated by this project, is urgently needed. It should be based on systematic collection of all physical data, which influence land use.

The information presented in this report is fragmental. More fundamental and especially recent information is needed on major land regions, land units, soil types, climatic data (risk factors), land suitability potentials, farming systems, importance of soil erosion and soil conservation measures.

It is important to identify (map/describe) and stop land degradation: soil, soil water and soil fertility losses. Effective measures are needed, such as management of soil and water conservation and soil fertility restoration, crucial to reduce land degradation and increase productivity.

Climatic data need incorporation into agro-ecological zones. Studies of socio-economic factors should also be included.

The matching of all collected data should lead to formulation of sound advises for National Land Use Planning, on a scientific basis.

Databases need to be supplied with reliable, recent, field observations and laboratory analyses. Land use planning is needed to formulate recommendations of appropriate types of land use and soil conservation.

- It is recommended to refine the national terrain unit and soil map. There is an urgent demand for recent field observations, especially for the north of the country.

- The first objective would be to prepare an updated soil map to a scale of 1:1 Million, for incorporation in a digital soil map, as has been done for the east African IGADD countries. At that level, terrain units could be subdivided into clearly defined terrain components. Fieldwork, satellite image and aerial photograph interpretation would be essential at that stage. During reconnaissance soil surveys, combined with training courses, representative soils could be mapped and sampled for each terrain unit.

- In a second phase, more detailed soil and land unit mapping could be foreseen for critical agriculture, pasture or conservation areas.

2. Recommendations for digitalization and database construction

The SOTER programme is a useful tool to handle terrain and soil data. The user of the programme should, however, be advised that the stored information is highly simplified and restricted. It could give a false impression, that enough field data are available for any kind of land use planning decision.

- At the terrain unit level, the programme permits ONE entry only for each topic; e.g. lithology of an area is often complex and composed of contrasting rocks, such as layers of schists and sandstone. The SOTER programme will accept one entry only. This over-simplification may lead to erratic decisions. The same problem exists at the terrain component level.

- SOTER permits a description of quantity of gravels, but not of gravel composition; e.g. a soil with soft weathered schist gravels will store water and provide nutrients to the plants, which is not the case for ironstone or inert quartz gravels.

- There is no entry available for ironstone pans or crusts, which cause important temporary water stagnation problems and damage to coffee and other crops.

- SOTER permits to describe soil structure, but there is no entry to describe the fine to large and deep cracks, as in case of Vertisols.

- There is no entry for mottling, important to define drainage problems.

It must be repeated that, no matter how impressive GIS and computerized systems might be, outputs will be of inferior quality, as long as basic data (field observations) supplied to these system are of poor quality.

INTRODUCTION

1. ACKNOWLEDGEMENTS

First of all, I am grateful to Dr. F. Nachtergaele and Dr. P. Koohafkan at FAO HQ/Rome for their support and for the opportunity to undertake this study.

In Belgium, I would like to thank Prof. Dr. Jan Feyen and Prof. Dr. J. Deckers of the University of Leuven (B) for their confidence.

Special thanks for the friendly and efficient staff at the IRD (former ORSTOM) in Paris, for looking up all the needed documents on micro-film.

2. TERMS OF REFERENCE

Preparation of a technical report, containing a brief description of the major terrain and soil units in both the Republic of the Congo and the Democratic Republic of the Congo (separate report).

The database will contain the following:

1. A physiographic layer with terrain information at an equivalent scale of 1:5 Million or 1:2.5 Million, according to the principles used in the SOTER manual.

2. A soil map at the same scale giving information on the soil unit composition in each unit, surface conditions and the soil phase if required.

3. A selection of geo-referenced typical soil profiles characterizing the major SOTER units in the country, classified in the FAO revised Legend (1990).

Language: English

3. BACKGROUND

In June 1995, FAO, UNEP and ISRIC launched the idea of a significant update of the soil map of the world, using the SOTER methodology. Two volumes (South America and north-eastern Africa) have been released by FAO in digital format. It is the intention to complete the southern and central African region next. For this purpose, AGL has collected in cooperation with the national soil institutes concerned, the soil and terrain information for both the Republic of the Congo and the Democratic Republic of the Congo. However, much material and soil information is dispersed in other libraries and universities. Systematic terrain information has only recently become available. It is the intention that this material be compiled and put in a

relational database system compatible with earlier material collected using the SOTER methodology.

All information can be build into an easily accessible, multi-layered GIS-supported information base, suitable for national and sub-national level agro-ecological zoning, improving irrigation capability interpretation and environmental impact studies, with a view to support the land use planning facilities of the countries concerned.

Agriculture plays a large role in the economy of both countries. It is by far the greatest source of employment for the majority of the population. There is a need to increase the productivity of agriculture, to improve the livehood, of the rural poor.

Development planning depends heavily on sufficient data inputs. Land use planning in both Congo's, is up to now, rarely based on natural resources information. There is a growing awareness that a sound perspective of the agricultural potential is needed. Essential is the preparation of a systematic inventory of natural factors determining the agricultural potential, e.g. landforms and soils.

The objectives of this study are to collect basic data of the natural resources, for procession of those data by computer and to release conclusions on the optimal use of land to decision makers

The ultimate goal is to provide essential information for land use planning to decision makers, in order to improve the living conditions of rural communities and to establish systems for sustainable management and protection of both the renewable natural resources and the physical environment.

4. IMPLEMENTATION AND WORKING METHOD

4.1. Literature study

The consultant started to gather information in the libraries of the University of Gent (Belgium). Valuable data were collected on geology and soils. Detailed information on soils, vegetation, land use and landscapes could be extracted. More research, especially for the

central and northern parts of the country, was done at the IRD (former ORSTOM) in Paris.

4.2. Soil map

Very fragmental soil studies have been done in the Republic of the Congo, concentrated mainly in the southern part (soil maps to a scale of 1/200,000). An important source for this work has been the national soil map of the Congo, to a scale of 1/2,000,000 (1969), made by ORSTOM. This map had been used already to prepare the soil map of the world in 1974. During this study, the original map has been reviewed and adapted to the revised FAO soil classification of 1990.

4.3. Terrain unit map

The terrain unit map has been based on the basin and plateau-like nature of the country, accompanied by changes of climate, vegetation and soils.

Terrain units were subdivided according to geology of the substratum, geomorphology and vegetation. A comparison with the available soil information was useful to understand the physiography of the country.

4.4. Database for the Republic of the Congo

The reader is referred to part II: “Database for the Republic of the Congo”. According to the terms of reference, each terrain unit has been coded and described, taking into account the objective of informatisation.

MAIN FINDINGS AND CONCLUSIONS

PART I NATURAL RESOURCES OF THE REPUBLIC OF THE CONGO

1. Area and population

The Republic of the Congo is a relatively scarcely populated country, located in central Africa, between the parallels of 4° N and 5° S, and the meridians of 11 and 19°E. The country has a very irregular elongated shape and a surface of 342,000 km^2. The Republic of the Congo is bordered (clockwise) by Gabon, Cameroon, the Central African Republic, the Democratic Republic of the Congo (RDC), Cabinda (Angola) and by the Atlantic Ocean.

Relief is dominated by the western Congo basin and its surrounding plateaux. The Mayombe highlands, the Niari-Nyanga depression, the Cataracts and Batéké plateaux separate the coastal zone from the extensive Congo Basin.

Population is about 2.5 Million inhabitants (1992), or 7 per square kilometre. Population growth is 3.0 % and the number of inhabitants is doubling every 23 years. Settlements are mainly concentrated in the south, between Brazzaville and the coast.

Main towns are Brazzaville (596,000 inh.) and Pointe Noire (298,000 inh.) (PC Globe, 1992).

2. Climate

The main characteristic of the equatorial climate is the absence of any seasonal winds, the lack of a well-defined dry season and the consistly high humidity and temperatures.

North of the equator, there is a tendency to higher maximum temperatures and greater diurnal variation during the drier season, but thermal conditions are not so important as are the seasons of the wetter periods. The air humidity remains consistently high (70-80 %).

The year may be divided in four seasons, with the rains coming just after the sun has been overhead. The heaviest rain falls when the sun is on its apparent southward course. At the Ubangi river, the greater dry season occurs from December to February, followed by a lesser-wet season from March to June. The lesser dry season covers July and August and the greater wet season come from September to November.

South of the equator, temperatures rise when the sun is overhead and decrease when the following rains occur. The range of the mean monthly temperatures is only 2°C and the average diurnal range of temperature is only 16°C. At Brazzaville, the lesser dry season occurs in January and February, followed by a lesser-wet season, from March to May. The greater dry season covers June to September and the greater wet season comes from October to December. Again, it is the seasonal distribution of rain, which is the most important factor and the changes of humidity that go with it. Seasonal winds are non-existent, except in coastal Congo, where SW winds blow.

During the drier times of the year, the sky may remain grey and overcast all day and night, and in the wetter seasons rain can fall at any moment.

2.1. Congo Basin

Most of the country belongs to this region. The surrounding plateaux are somewhat cooler.

North of latitude 3°30’S, the climate is “subequatorial”, with an annual rainfall of more than 1,600 mm, reaching 2,100 mm near the Gabon border. There is a dry season of 1-3 months.

South of this parallel, the climate is of the “Lower Congo type”, characterized by a marked dry season of 4-5 months (June-September), high relative humidity even in the dry season, and annual rainfall of less than 1,600 mm.

3. Land use

Congo coffee is indigenous to the Republic of the Congo and it is cultivated, with Arabica coffee, in the Kouilou valley and on the Mayombe highlands.

Groundnuts are grown on the sandy Batéké plateaux and hills.

In the rainforest zone, cassava (manioc) is the main staple crop. Cattle cannot pasture there, because of the tsetse fly. Shifting cultivation is common. Cassava is staple food of a large part of the population, but it quickly exhausts soils.

Bananas and plantains are common. Rubber can be grown in the Central Congo Basin (rainforest). Oil palm (*Elaies guineensis*) grows south of 3°N.

Table 1. Agricultural production of the Republic of the Congo in 1989 (PC Globe, 1992)

crop	metric tons
coffee	2,000
maize	9,000
rubber	2,000
rice	3,000
sugar	31,000

Crops trials of oil palm, coffee, cocoa, groundnuts on the poor sandy Ferralic Arenosols of the coastal belt gave low yields. The long dry season (> 4 months) and the low water holding capacity are limiting factors. Forest soils are initially more fertile than savannah soils.

Cocos palms are abundant on the coastal plain and on the coastal plateau borders (S. of Pointe Noire). Eucalyptus reforestations are successful.

In the Mayombe highlands, topography is the main limitation for agriculture. Erosion control is needed. Soil depth is often a limiting factor. The main crops are: bananas (‘Gros-Michel’), best on clayey soils derived from schists, coffee, cassava, sugar cane, taro, yams, tomatoes, peppers, beans, egg plants, oranges, lemon trees, mangoes and Cocoa.

4. Physiography

The Republic of the Congo belongs to the "African Interior Plateau". Its central part is depressed and forms the Congo Basin. It is bordered on all sides by uplands.

Incision of valleys started during the Cretaceous and further deepening took place following the Miocene tectonical upheaval.

One of the most characterizing elements of African geomorphology are different planation surfaces. These pediplains, nowadays plateaux, represent the final stage of individual cycles of erosion and are separated from each other by escarpments.

4.1. The Congo Basin Plain

The Congo Basin is a depression in the meteorological, as well as the topographical sense. This broad, flat basin constitutes a slight depression of the African continental platform. The Basin is almost completely sealed and the only outlet to the sea is the narrow Congo valley through the Cataracts plateau and the Mayombe or Crystal Mountains. The basin floor has an average altitude of 350 m and rises to the surrounding uplands, or stepped plateaux.

The Congo Basin plain traces out a rough ellipse, the major axis that runs SW-NE. Precambrian rocks are covered by continental deposits, comprising Karroo (mainly Cretaceous), Tertiary and Quaternary sediments, which cover a 150,000 km^2 alluvial plain in the central parts.

The basin is filled up with alluvial deposits from the Congo and its larger tributaries such as the Ubangi, Sangha and Likouala rivers. All rivers flow wide and slow between banks. They are entrenched in thick beds of alluvium. There are many swamps (confluents of the Ubangi, Likouala and Congo rivers) and lakes.

Upstream the Congo River from Mossaka, a monotonous plain is covered by dense rainforest.

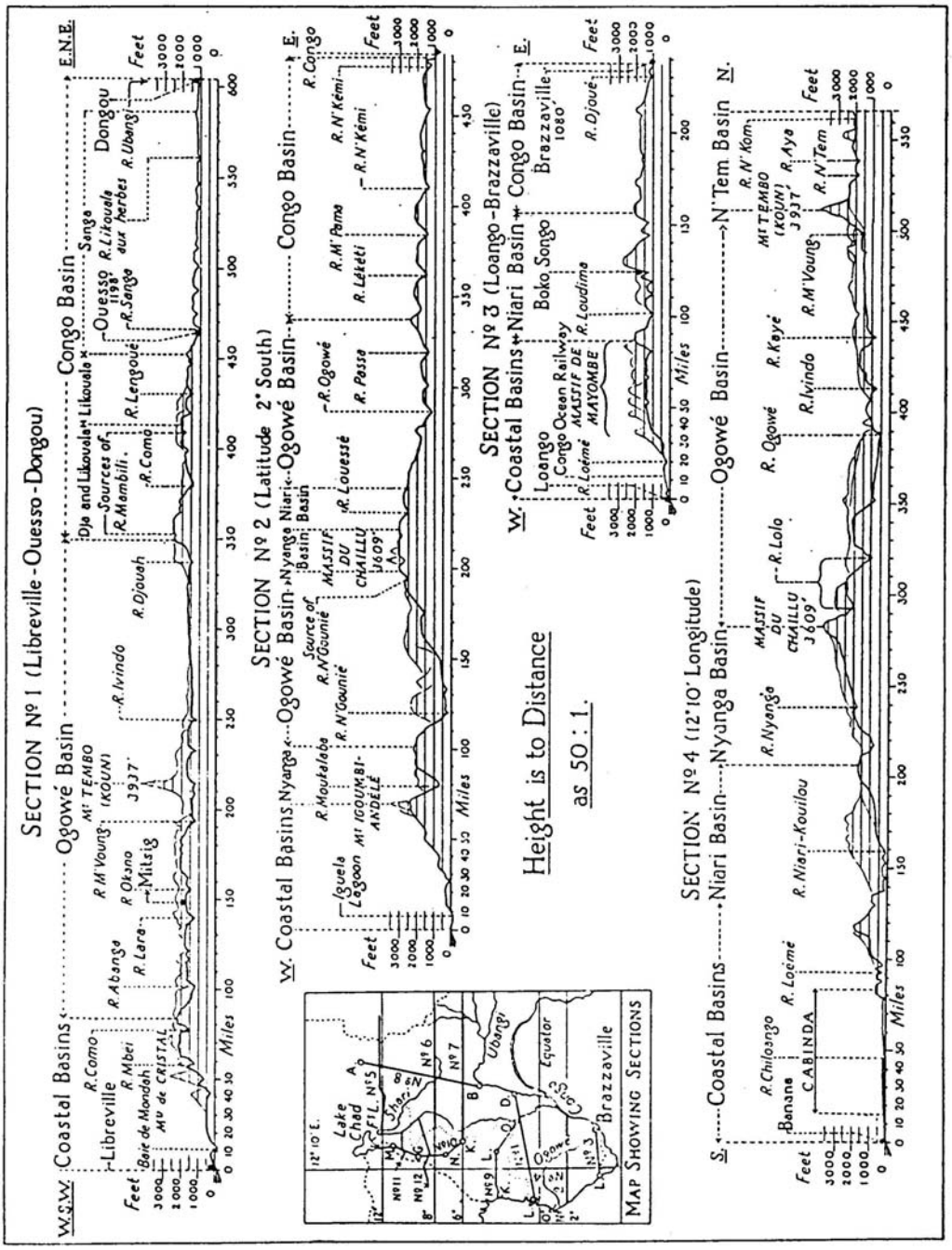


Fig. 1. Cross-sections through the relief of the Congo (NID, 1942)

4.1.1. Congo-Ubangi-Sanga confluent swamps

In between the 16° E meridian and the Ubangi river, the Congo basin is one vast swamp, with the Sangha and two Likouala rivers winding in great loops, sluggishly south to the Congo. The intervening country is a maze of streams joining the three rivers and extending their deltas, at flood seasons, north almost to the equator.

4.2. Low plateaux of the Central Congo Basin

These low plateaux border the Central Congo Basin in the west, at the foot of the higher schist-sandstone plateaux and are overlain by thick Pleistocene layers (Salonga and Yangambi deposits of the DRC), They are called the 'higher old alluvium' in the Republic of the Congo and are of fluviatile and fluvio-lacustrine origin. Soils are Xanthic Ferralsols developed in pre-weathered and transported materials.

Following succession of deposits exists (younger to older):

1. recent alluvial plain deposits (terrain units 210, 211, 212…)
2. river terraces
3. low plateaux of unconsolidated deposits (terrain unit 410)
5. Stanley Pool Series (Mesozoicum)

The Xanthic Ferralsols of the low plateaux are overgrown by rainforest. The plateau is undulating. The more than 40 m thick deposits rest on an older Late-Tertiary surface. These are yellowish brown sandy (clay) loam layers. A basal gravel layer may be present. Quartz is the main sand grain.

4.3. Surrounding stepped plateaux

Nearly the whole region drains to the Congo Basin, except for the protruding western strip of Souanké and the region of Zanaga, belonging to the Ogowé basin.

In the N and the W, the low plateaux of the Congo Basin are bordered by stepped higher plateaux, mainly built of sandstones and schists (terrain units 800 and 900).

There are two major steps:

- The highest dissected plateaux are topped by a tilted old pediplain of the Middle Tertiary at about 650 m a.s.l. (range 500-1,000 m a.s.l.).

- At their foot, occurs a sandy footslope plateaux (Bambio plateau, terrain units 840 and 850), topped by the Late Tertiary planation.

4.3.1. Northern plateaux

The northern plateaux are dominated by the Ibenga plateau, composed of Mesozoic Carnot sandstone (terrain unit 860). The Precambrian M'baiki quartzites and sandstones form a narrow strip on the northern border with the Central African Republic (terrain unit 940) and the Precambrian schists and quartzites of the Nola Series occur along the Cameroon border (terrain units 930 and 980).

The sandy Bambio footslope plateau has been dissected into several blocks by alluvial plains (terrain unit 840).

4.3.2. Sembé-Ouésso plateau
(terrain unit 960)

This dissected plateau has forested slopes, descending to the flat swampy valleys of the Congo tributaries. It reaches altitudes of > 650 m a.s.l.

In the west, it is bordered by Precambrian gneiss plateaux (terrain units 1010 and 1020). The Sembé-Ouésso plateau is built of sandstones, schists and quartzites. The eastern parts belong to the Lualaba-Kwango groups of Karroo and Cretaceous age. The extensive sandstone zone, starts south of the equator and is limited in the north by the 3°30'N parallel (over 400 km). It occurs in between the meridians of Souanké and Ouésso (over 200 km), where it is buried under the Congo Basin deposits.

The plateau top is a remnant of the Mid-Tertiary planation, with an abrupt, 100-200 m high, descend to the Bambio footslope plateau (terrain unit 840), which belong to the Late-Tertiary Pediplain.

Altitude is about 500-700 m (Mount Nabela, 950 m). The incised rivers, e.g. the Mambili and Lekoli, have wide, flat and swampy alluvial valley floors, with sandy-gravelly to clayey deposits.

The basement gneiss is overlain by folded rocks, formerly called the "Schisto-Quartzitique" (B1, lower level), now called Sembé-Ouésso Series: schists, sandstones; quartzites and quartzitic sandstones; overlain by (B2, upper level): coal-bearing schists; dolomites and sandstones, in the NE. There are some granite and dolerite intrusions.

Soils are thick: clayey sands on sandstones, red clayey soils on intrusive rocks, very deep, bright red, clayey soils on dolerite and red clays on schists. There are only rare rock outcrops.

4.3.3. Ivindo (Souanké) and Lekona (Kéllé) gneiss plateaux (terrain units 1020 and 1010)

In the NW of the country, a strip extends far west in between Gabon and Cameroon. This Souanké strip drains to the Ogowé river. The upper courses of the Ivindo and its tributary the Djoua form part of the border with Gabon.

The area is composed of Precambrian gneiss, with some amphibolite inclusions.

The upper valleys of the Ivindo, such as the Djoua, are remarkable for their marshiness. Soils are thick and rock outcrops rare.

The second gneiss plateau is located on the equator, along the Gabon border (Lekona plateau).

4.3.4. Bambio and Lango footslope plateaux
(terrain units 840 and 850)

The Late-Tertiary pediplain tops the 30-50 km wide footslopes with cover sediments, in between the Sembé-Ouésso Plateau and the Congo Basin.

Horizontal polymorphic sandstones are usually buried under an unconsolidated layer, called the “Sandy Clay Series”, also called the “Bambio Plateaux Series”. Rivers and streams have dissected valleys into these sediments, before entering the swampy basin.

The sandy clay deposits are red-coloured, 20-50 m thick, and overlie rounded, ferruginous, quartz gravels (2-3 m), on top of a white clay with red mottles (weathering zone).

The Bambio Plateaux Series could be the equivalent of the Batéké deposits and the horizontal sandstone could be correlated to the polymorphic sandstone.

Alluvial plains are characterized by white sandy clays in the lower areas and by sands in the plateau area.

4.3.6. Batéké hills and plateau remnants
(terrain unit 830 and 820)

East of the line Kinkala-Zanaga occur the Batéké hills and plateaux remnants, covering 80,000 km^2 in the Republic of the Congo, and extending further south into the Democratic Republic of the Congo.

The region is bordered by escarpments along the Congo river. The plateau remnants have an altitude of 700-860 m a.s.l. They are built of Lower-Cainozoic polymorphic sandstone, overlain by Neogene 'sandy loam'.

There are two distinct terrain units, the:

- Batéké plateau remnants, are flat- topped, with a thick sandy loam mantle (Ba2, terrain unit 820),
- Batéké hills, a dissected landscape, cut into the underlying polymorphic sandstone (Ba1, terrain unit 830).

a. Batéké plateau remnants (Ba2, terrain unit 820)
(Mbé, Ngo, Nsa, Djambala, Koukouya plateaux)

The plateau is a remnant of a Pleistocene surface. Slopes are generally < 3 %. The plateaux are inclined from the SW to the NE. Following blocks are considered (from NW to SE):

- Koukouya plateau, 410 km^2, at 800-886 m a.s.l.
- Djambala plateau, 1,000 km^2, at 720-830 m a.s.l.
- Nsa and connected Ngo plateaux, occupying 4,000 km^2 at 600-750 m a.s.l.
- Mbé plateau, or Batéké plateau sensu stricto, covering 7,000 km^2 at 600-760 m a.s.l.

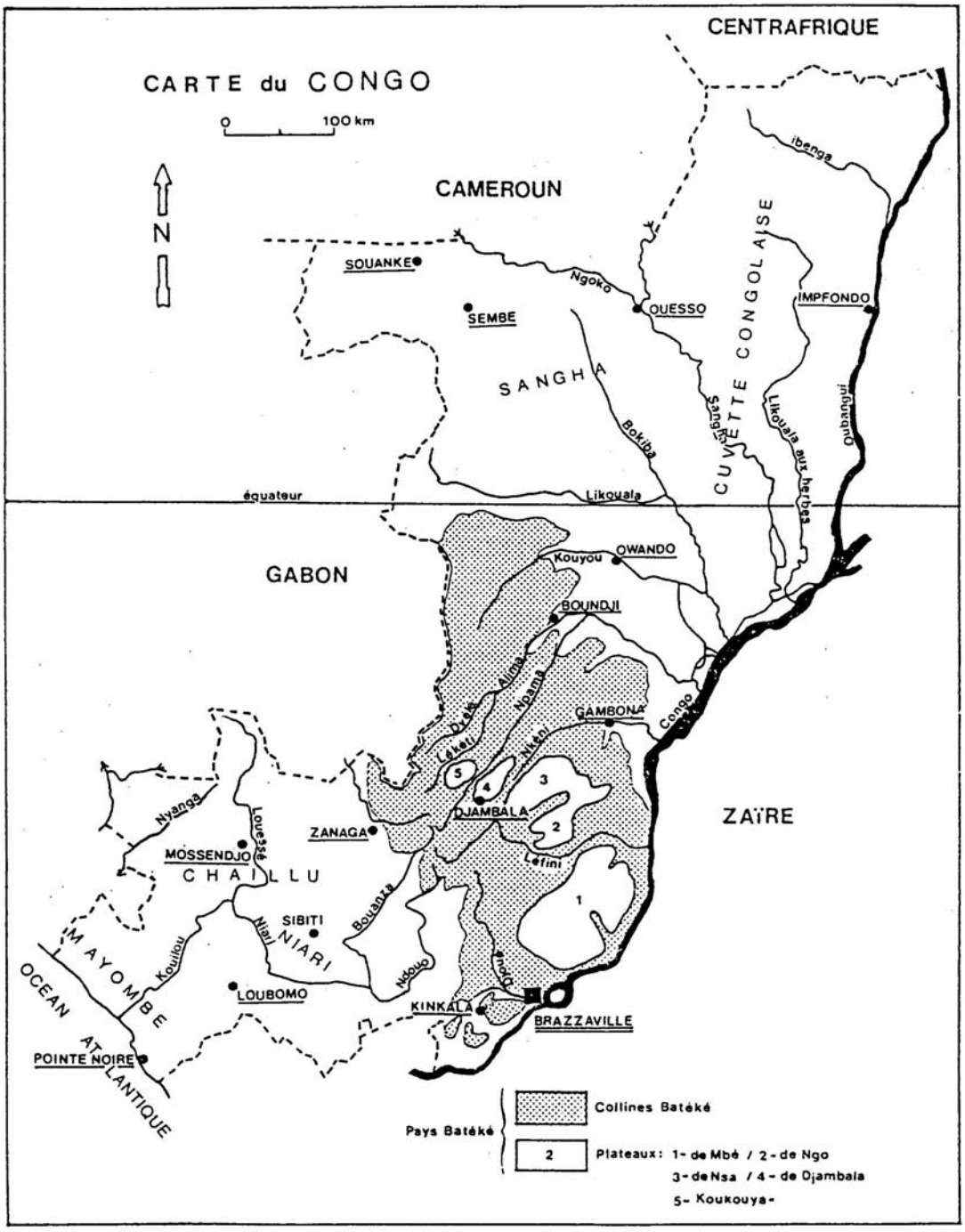


Fig. 2. Location of the Batéké hills (dotted) and the Batéké plateau remnants (1-5) in the Republic of the Congo (Schwartz, 1988).

The plateaux are separated by, hundreds of metres deep, stream valleys. Escarpments of polymorphic sandstone make up part of the valley slopes (terrain component 830/2).

Relief of the plateaux is flat to slightly undulating. The highest parts occur 300 m above the Congo River. Most of the region slopes gradually to the river. Only in the SE there is an abrupt drop, as the Congo has carved a trough from Bolobo downwards to the sea and the plateau drops abruptly into this gorge, called ‘Le Couloir’, and into Stanley Pool. Along the river, white sandstone cliffs rise, called Dover cliffs by Stanley.

However, the Batéké region is markedly different from the surrounding country, for the 60 m thick sandy loam cover overlying the Paleogene Polymorphic sandstone has neither the necessary fertility, nor the needed water holding capacity, to support a dense forest vegetation and the region is an area of orchard bush country, with open sweeping lowlands, and villages nestling in woods on the valley sides (NID, 1942). There are only rare trees and in some places the region looks like a semi-desert. Valley bottoms, however, are swampy and occupied by gallery forests with dense vegetation.

The sandy loams (Limon-sableux) or ‘Ocre Sands’ (brownish yellowi) are clayey fine sands, becoming darker-coloured in depth. Colour is uniform (10 YR 5/6-8). Often sands have been reworked by erosion, and slope and valley deposits have been mixed with the weathering products of the underlying Polymorphic Sandstone (terrain unit 810, Kinkala hills).

The Ocre Sands of the plateaux have a thickness of 60-100 m. Sheet erosion resulted in closed basins (200-500 m wide) of bleached white sands on valley bottoms (‘lességués’), without vegetation or with a swampy zone in the middle.

There are many dry valleys. Closed depressions exist mainly close to the plateau borders:

- Some are 2-3 m deep, with a diameter of 100-600 m, with water stagnation at least in the rainy season. Podzols occur on the lower slopes.

- Other depressions are mostly dry pseudo-dolines, with diameters larger than 800 m and 15 m deep.

b. Batéké hills (on polymorphic sandstone, Ba1, terrain unit 830)

In most of the Batéké region, the sandy loam top layer has been eroded. Rounded dome hills with often very long, moderate to steep slopes, and altitude differences of 100-300 m, have been carved. The hills are separated by usually dry valleys, with flat wide valley bottoms, sometimes suspended. The few larger river valleys have been deeply incised in between the hills. The valleys are characterized by steep (60-70 %) erosion amphitheatres, flat bottoms, without streambed.

A subdivision can be made, the:

- higher hills occur close to the plateaux remnants. They have almost the same altitude as the latter (600-860 m a.s.l.) and are dissected remnants of the plateaux;

- lower hills occur at < 600 m a.s.l. Towards the N they become less important and disappear at the Congo basin. In the south they form the hilly areas W of Brazzaville (terrain unit 810, Kinkala hills).

All hills are affected by erosion amphitheatres, usually stabilized by vegetation.

The Batéké hills extend far to the N. The border is abrupt, about 20 km NE of Brazzaville, and characterized by a step of 350 m high. West of Brazzaville succeeds a region of sandy hills (Kinkala hills, terrain unit 810). Near Franceville in Gabon, the hills end with a 100 m high cliff along the M'Passa river. The Ogowé river has its source on the Batéké hills and flows in a gallery forest in an arid, sandy valley. Near Zanaga, the river enters the Chaillu Massif, but in the east it is bordered by the sandy escarpment of the Batéké, overlooking the granitic valley.

The higher hills are overgrown by slightly shrubby savannah with *Loudetia demeusii*. Semi-deciduous forests occur as extensions of gallery forests on the steeper slopes.

The northern hills, south of the equator ,rise to 600-650 m a.s.l. These dome- or cone-shaped hills (Andélé and M'Bili mountains) are interrupted by a dense drainage system. The landscape is more humid, with small forests and swampy valley bottoms.

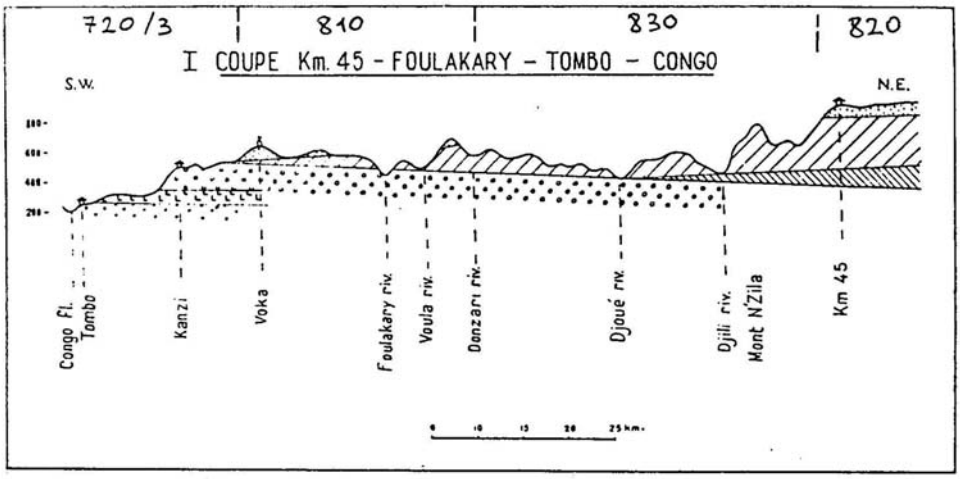
The polymorphic sandstone weathers to very white fine sands, looking like washed sands of valley floors. The hard and compact, yellowish or whitish rock has outcrops in the valley of the Alima, at Kebouya, Ewo, Tchère and near Obougou (terrain component 830/2).

c. Kinkala and Boko sandy hills
(terrain unit 810 and terrain component 720/3)

- West of Brazzaville succeeds the Kinkala sandy hill region (810). Hills are separated by large, slightly sloping valleys. The superposition of the soft Batéké sandy loams on harder polymorphic sandstone is responsible for the relief of the area. After rapid incision in the soft layers, rivers slow down on the harder layers, while the valleys are laterally enlarged and sands redeposited on the flat and often swampy valley floors. The maximum altitude of the sandy massifs is 600-700 m a.s.l.

- West of Kinkala, the Polymorphic Sandstone disappears and the Batéké sandy loam rests directly on Schisto-Greseux or Schisto-Calcaire rocks (720/3). Sandy massifs or hills are less important and strongly dissected. Streams have cut steep, V-shaped valleys in the underlying rocks, lacking the swamps described above.

  Sandy soils still occupy the hills, while on slopes parent materials are mixed, with cherts of the Schisto-Calcaire, rounded quartz (basal conglomerate) and ferruginous-cemented sandstone from the Batéké layers.



....	Sandy loams of the Batéké plateaux
////	Polymorphic sandstone of the Batéké hills
\\\\	Cretaceous sandstone, Stanley Pool Series
°°°°	sandstone of the Inkisi Series, Schisto-Greseux
LLLL	argilites of the Mpioka Series, Schisto-Greseux
....	sandstone of the Mpioka Series

Fig 3. SW-NE transect from the Congo river to the Batéké plateau (Koechlin, 1961)

4.4. Plateaux and depressions of SW Congo

Relief of the SW Congo is built by series of parallel chains, which contain dissected plateau remnants of older planation periods. The Mayombe highlands and the Chaillu massif are prominent relief units. In between them lies the syncline of the Niari-Nyanga Depression on Schisto-Calcaire rocks. Parallel chains of hills rise from the Depression. In the south, the Cataract Plateau (Schisto-Greseux) is located in between the Niari and the Congo basins. North of Brazzaville occurs the monotonous Batéké region, E of the granitic Chaillu massif. Average altitudes are 500-800 m; the Congo river flows at 280 m a.s.l. near Brazzaville.

4.4.1. **Chaillu Massif**
(terrain unit 520)

The Republic of Congo occupies the southern part of this granitic massif, in between the Bouenza river, in the SE, and the N'Gounié, a tributary of the Ogowé river, in the west. In the east, the Chaillu massif joins up with the Batéké region.

Oriented in a NW direction, the massif is about 500 km long and 150 km wide. It is almost completely covered by rainforest.

It is a giant granite batholith, with minor metamorphic inclusions and some basic and ultrabasic intrusions.

Relief is composed of SE-NW running ridges, with rivers following the same direction, in between. In the Niari-Nyanga Depression, the Niari and the Loudima follow the same SE-NW direction.

The highest tops reach 903 m in the Boungou mountains. They keep this height on the watershed chain between the Louessé and the Nyanga (Mayoko region).

Towards the south, altitudes drop to 700-600 m on the Lilahi plateau and to 500 m on the bordering sandstone plateaux of Bandakoumou and Manganza.

The relatively low tops, plateaux and high plains of this stepped massif have been steeply dissected by streams.

- In the SW and N, relief corresponds to an old pediplain surface, with flattened hilltops and true plateaux at similar altitude, dissected by V-shaped valleys.
- The central part has higher tops (N'Doumou mountain chain).

- In the S occur half-orange-shaped hills (inselbergs).

In all cases, usually convex slopes become steeper downslope and valley bottoms are generally narrow. Only the main rivers (Lékoumou, Loyo, Louengo and Lélali) have an important alluvial plain.

4.4.2. Bouenza hills and plateau
(terrain unit 910)

a. Sandstone plateau

The undulating hills (S) and plateau (N) near the Bouenza river on Bouenza Series sandstone, have rounded or flattened tops at 450-600 m a.s.l., with a steeper convex upper and concave lower slopes.

Valleys are frequently dissymmetrical, with steeper slopes under forest, rivers in gallery forests, and concave slopes under herb savannah. The quartzitic sandstone plateau attains 650 m a.s.l. and descends to the Bouenza valley with a steep escarpment.

b. Limestone-schist plateau border and hills

Near the Bouenza falls, the plateau border and hills are covered by Ferralsols on marly limestones and schists of the Bouenza Series. Erosion has truncated the soils on forested steep slopes, in contrast to the savannah-covered sandstone plateaux in the north.

4.4.3. Upper or Niari tillite belt
(terrain unit 920)

These conglomeratic rocks of glacial origin are found as a narrow fringe, in between the Niari-Nyanga Depression and the Bouenza plateau and on the slopes of the Mouyondzi plateau. Near the Bouenza and Niari rivers, erosion has attacked soils on steep slopes.

The landscape is hilly, with steep slopes (30-50 %), forested on the lower slopes and with savannah on tops and upper slopes. The grass cover is less dense than on the clayey soils of the Schisto-Calcaire depression. Small landslides are common (soils sliding over gravel layers).

4.4.4. Niari-Nyanga Depression
(terrain unit 710)

This major depression, at 200-450 m a.s.l. has formed on Schisto-Calcaire rocks (SC) of the WCG. There are three distinct landscapes, the:

- plain on soft, marly calcareous formations, SCII (terrain component 710/1)
- aureoles of hills and “fingers” of harder dolomitic limestone, SCIII, around sandstone plateaux (terrain component 710/2, only partly represented at the scale of the map)
- northern foothills of the sandstone plateaux, cut out of harder limestones, SCI (terrain component 710/3)

a. The plain (terrain component 710/1)

This term designs in broad lines the savannah zone located on Schisto-Calcaire rocks.

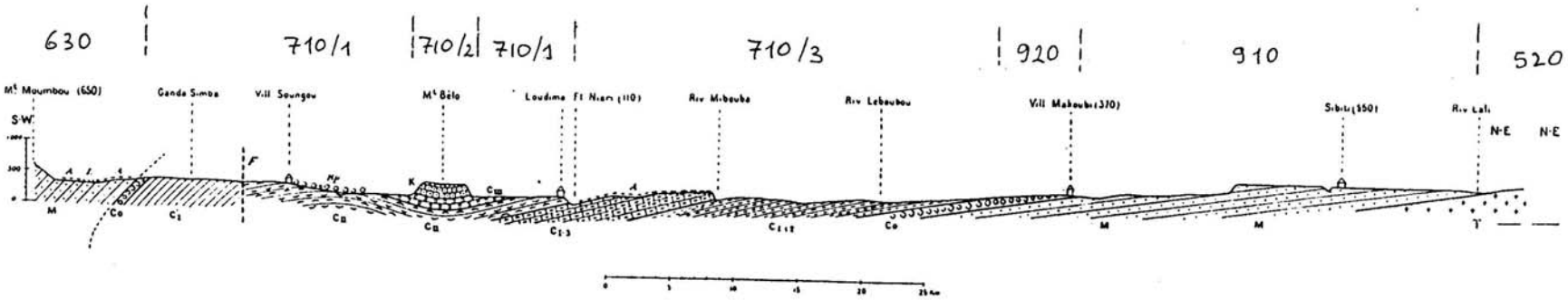
The Depression continues to the Nyanga river in the NW. Relative altitude differences are 30 m, to > 200 m in the east. There is no clear distinction between the watersheds of the Niari and Nyanga rivers.

Vegetation is grass-herb savannah with some shrubs and gallery forest along rivers. Forest is found on some steep crest-lines.

The large flat plain developed on marly limestones of the Schisto-Calcaire System (SCII). Soils are thick, yellow, clayey Ferralsols.

There are numerous swampy depressions: sink holes or dolines, sometimes occupied by lakes. There are many dry valleys. In the middle of this Karst plain occur isolated limestone sugar-leaf hills, e.g. between Dolisie and Kibangou (tropical Karst). Dolomite outcrops build typical domes.

In its western parts, W of Loutété, the direction of the synclinal is parallel to the Mayombe highlands.



y	granite and gneiss of the Chaillu massif (520)
M	quartzitic sandstones and schistoid argilites of the Bouenza (910) and Louila Series (630)
Co	Upper or Niari tillite (920)
CI	Schistoid limestones)
CI 1-2	dolomites and blue limestones) SCI, Schisto-
CI 1-3	oolithic and crystalline limestones) calcaire (710/3)
CII	siliceous limestones, SCII (710/1)
CIII	magnesian limestones, SCIII (710/2)
K	Schisto-Greseux cap of isolated hills (720)

Superficial layers

A	clays and ironstone pans
Rp	siliceous polymorphic rocks

Fig. 4. SW-NE transect from the Pre-Mayombe hills (630) on the Cabinda border (Mount Boumbou), over the Niari-Nyanga Depression (710), the Niari tillite belt (920), Bouenza hills and plateau (910) to the granitic Chaillu massif (520) (Babet, 1932)

35

Extensive flat areas exist, but in the east, folds take a N 60^{o} E direction (‘direction Combienne’).

The actual Niari valley is narrow and dissected in the old (pedi-) plain of the Depression. The river has a narrow alluvial plain, with terraces and temporary hydromorphism.

To the left of the river, relief is subdued. The river terraces are followed, on higher ground, by an extensive clayey “plain” or “low plateau of the Niari”, on an ironstone pan (petroferric phase). This old pediplain, extends to the foot of the Cataracts Plateau. Relief is slightly undulating, with an abrupt descend to the present-day Niari valley. Some residual, gravelly, limestone hills (600 m a.s.l.) built of SCII and rarely SCIII rocks, emerge from the plain. The drainage pattern is scarce. Water circulation occurs below the surface.

The Depression reaches its maximal extension between Loudima and Madingou. Relief is complicated, due to the presence of terraces at different altitudes. Numerous calcareous hills, commonly inselberg-shaped, testify of intense erosion. The river flows at an altitude of 200-100 m a.s.l.. The outside plateaux reach altitudes of 500-700 m, with some higher points (Mont N’Gouédi, 720 m. Mont Kinoumbou 784 m and summits of 820 m SE of Boko-Songho).

Karst phenomena on limestone resulted in small basins (dolines) filled up by clays.

The geomorphology of the Niari-Nyanga Depression is characteristic for many region in the Republic. Erosion surfaces occur at different levels and their cover sediments and derived, both from weathering and transportation.

The higher parts of the plain are covered with rejuvenated Ferralsols, while the lower parts are occupied by temporary hydromorphic soils.

b. The hills of the calcareous borders of the sandstone plateaux

(terrain component 710/2)

Some hills have preserved a top layer of the Schisto-Greseux System: Monts de Comba, Mont Kinoumbo, Mont Bélo... There are calcareous-dolomitic outcrops, in concentric layers around them. The low hills have inselberg-finger shapes and are built of more resistant dolomitic limestones (SCIII). All hill slopes are steep (20-40%); summits are flattened, sometimes forming plateaux.

Mount Bélo, SW of Loudima (Schisto-Greseux overlying Schisto-Calcaire, SCIII) and the little Bamba chain (500 m a.s.l.) are examples. More to the south, similar hills border the valleys of the Louvakou, the Mafoubou and the Loudima.

The Mount Bélo plateau is marked by a sandstone top layer overlying limestone. The plateau rises 50-100 m above the plain and looks like a cuesta. Surrounding dolomitic limestone hills sometimes also have conserved a sandstone top. With this sandstone cap they are flat-topped, without cap they are conical, 20-60 m high. They are aligned in between river basins. The same morphology appears around the Cataracts plateau.

W of the Niari-Kouilou, near the Gabon border, the clayey sandstone plateaux and ridges of Banda (SCIV) rise 150-200 m above the calcareous plains.

Soils on the plateaux are deep (> 2.5 m), even down to 6 m. On the plateau slopes and hills soils are still thick, except on active erosion surfaces.

c. The northern foothills and plateaux (Mouyondzi-Sibiti Plateaux)
(terrain component 710/3)

To the right (N) of the Niari river, there is a succession of hillocks and hills, separated by a dense drainage system. The hills form parallel chains. The terrain rises gradually to the Mouyondzi Plateau (SCI over SCII), which forms the northernmost limit of the depression.

The Bambembé plateau occurs in the east, near Mouyondzi, and the Bayakas plateau W of Sibiti (both at 500 m a.s.l.). They are rising wide and gradually through a stream-dissected hilly country.

Three subunits can be distinguished (N-S):

- a dissected tableland (pediplain) plateau, with deep, yellow to yellowish brown, clayey soils, with a gravel layer at > 2.5 m;
- a plateau border and a steep hill chain, with a southernmost hill range, near to the Niari river, with thick sandy clay or silty clay soils.

c.1. Babembés (Mouyondzi) and the Bayakas (Sibiti) Plateau

These plateaux are tablelands, divided by steep valleys with eroded soils.

The Mouyondzi Plateau (SCIab) is characterized by a sub-horizontal ironstone pan at shallow depth. Outcrops of this pan occur on valley slopes and on the plateau rim. The same pan can be traced across the Niari-Nyanga Depression on the Cataracts Plateau and on the foothills of the Mayombe highlands, above Kimongo.

The surface of these plateaux is an old pediplain. There are gravel layers with ironstone pan pieces, overlain by gravel-free, very clayey Ferralsols of about 2.5 m thick. There is no permanent drainage system and little relief. Dolines are found locally, on Schisto-Calcaire rocks of the SCIc.

This is a densely populated area, with Robusta coffee, oil palm, citrus, bananas, mango, maize, yams, groundnuts and cassava.

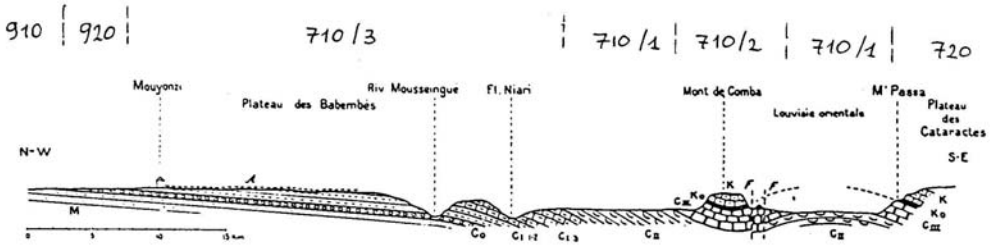
c.2. Foothills of the plateaux

Hill slopes are steep (25-40 %) and valleys are also steep and narrow. The rounded hills form a dense pattern. They have steep convex slopes, sometimes covered with ironstone pan blocks. They developed in Schisto-Calcaire SCIc and SCIb rocks.

Vegetation is either a dense semi-deciduous forest, with *Terminalia superba*, or a shrub savannah. Soils are yellow clayey Ferralsols.

d. Niari river alluvial plain

The soils of the present-day flood plain of the river have a variable texture and are somewhat humiferous. They are temporarily inundated.



Coupe du plateau des Cataractes au plateau des Babembés, à travers la vallée du Niari par l'anticlinal de la Louvisie et le synclinal de la chaîne de Comba.
Section 10.

M grès quartziteux et grès feldspathiques calcareux du Complexe de Leboulou-Sibiti.
Co conglomérat de base du Système schisto-calcaire ;
C I 1-2 dolomies et calcaires bleus et lie de vin en plaquettes ;
C I 3 calcaires oolithiques et cristallins ;
C II calcaires siliceux et calcaires à cherts de la Kinguembo et de la vallée de la Louvisie ;
C III calcaires magnésiens fétides de Comba
K grès du plateau des Cataractes et de Comba.
A latérites et argiles superficielles.

M	quartzitic sandstone and schistoid argilite of the Bouenza (910) and Louila Series (630)
Co	Upper or Niari tillite (920)
CI 1-2	dolomites and blue limestones) SCI, Schisto-
CI 1-3	oolithic and crystalline limestones) calcaire (710/3)
CII	siliceous limestones, SCII (710/1)
CIII	magnesian limestones, SCIII (710/2)
K	Schisto-Greseux sandstone (720)
A	Superficial layers: clays and ironstone pans

Fig. 5. NW-SE transect from the Mouyondzi, or Babembés plateau (710/3), over the Niari plain (710/1) with isolated hills (710/3), to the Cataracts plateau (720/2) (Babet, 1932)

4.4.5. Schisto-Greseux and Cataracts plateaux

(terrain unit 720)

The Cataracts plateau divides the Congo and Niari basins. Its average altitude is 500 m a.s.l., reaching almost 800 m in the west near Boko-Songho (300-400 m above the Niari-Nyanga Depression). Vegetation is wooded savannah and forest.

Between Mindouli and Loudima, the Cataracts plateau dominates the Niari valley with an abrupt cuesta, often preceded, as S of Madingou, by isolated plateau remnants. Seen from the plain, the plateau escarpment looks like a mountain chain. The undulating plateau, on rocks of the Schisto-Greseux System, extends towards the D.R. Congo and towards Boko and Kinkala.

A sub-horizontal ironstone pan occurs at shallow depth. Outcrops of the pan are found on valley slopes and on the plateau border. The same pan can be traced on the foothills of the Mayombe, above Kimongo, and across the Niari-Nyanga Depression, on the Mouyondzi Plateau.

In its western parts, the Plateau has been cut into several isolated blocks, separated by valleys with outcrops of older Schisto-Calcaire rocks: Mont N'Gouédi (720 m), Mont Kinoumbou (784 m), Kissenga Plateau...

The plateau is an old erosion surface, somewhat remodelled during later cycles. Rivers on the plateau surface flow slowly and meander in often swampy valleys. They descend in falls and rapids to the Congo and the Niari.

In the east, between Djoué and Boko, the Schisto-Calcaire and Schisto-Greseux rocks disappear below the sandy loams of the Batéké region (terrain unit 810 and terrain component 720/3).

Near Mindouli, deep ravines have been cut in the plateau rim. The somewhat impermeable soils are continuously eroded. Also along the Congo valley, the plateau rim is a zone of intense erosion. Hilltops and steep slopes are devoid of vegetation and ravines of tens of metres deep are common. In the south of Boko district, streams have completely eroded the upper layers of the Schisto-Greseux (Inkisi Series). The rivers, e.g. the Louenga, flow on rocks of the M'Pioka Series. The break of slope at the contact is marked by erosion ravine activity.

Downstream the Stanley Pool starts a canyon, with hanging valleys of affluents. The Congo river flows max. 480 m below the plateau surface (Kendelo). Further away the plateau is less dissected.

Soils are yellowish-brown to red, fine sandy clay Ferralsols. There is sheet erosion (érosion en nappe), rill erosion (rigoles) and gully erosion (ravines).

4.4.6. The Mayombe highlands

(terrain units 610, 620, 630)

The border with the coastal belt is formed by the 60 km wide, NW-oriented, Mayombe chain. It is a succession of sharp ridges, with elevations of 400-800 m a.s.l. It is a real barrier between the coast and the interior. 200-300 m high steep slopes rise above the rivers. It is an area of active erosion.

Since recent uplift, streams are rejuvenating the landscape. Rapids and waterfalls are common. Vegetation is dense equatorial rainforest.

The Mayombe highlands are composed of the Precambrian Mayombe System and are strongly metamorphic. The folded layers have a general S-SE to N-NW orientation.

A distinction can be made between, the:

- Coastal Mayombe (300-400 m a.s.l.), with crystalline and metamorphic rocks of the Mayombe System: quartzites, graphytic schists, quartz mica-schists, martite-chlorito-schists, epidotes, calcic green-schists (terrain unit 610);

- Interior Mayombe, composed of the 'Quartzo-schisteux': less metamorphic rocks: quartzites, sandstones and limestones (M'Vouti Series, Mounts Bamba System, 600-800 m a.s.l.), N of M'Vouti (terrain unit 620);

- Parallel Chains, or pre-Mayombe hills (400-800 m a.s.l.), in the NE; sandstones and clayey rocks of the Moussouva Series and Bamba Mountains System (terrain unit 630).

The whole forms an anticlinorium, where due to folding and faulting, Bamba System rocks occur in areas of crystalline rocks; the reverse is also true.

The Mayombe highlands form a succession of valleys and ridges, oriented parallel to the coast. Towards the coastal plain slopes are gentle, but the eastern Mayombe ridges rise 200-300 m above the Niari-Nyanga Depression. The Mayombe highlands were once an old pediplain, now dissected to an Appalachian relief.

The region is overgrown by dense rainforest. The Congo, Chiloango (Louango, Xiloango) and Niari-Kouillou have cut transverse valleys through the ridges, but the Upper-Loango flows in a swampy valley, parallel to the Mayombe chains.

a. Coastal Mayombe highlands
(terrain unit 610)

Towards the coastal plain slopes are gentle. The coastal Mayombe rises about 400 m a.s.l..

Rocks belong to the Mayombe System, composed of the Loémé, Bikossi and Loukoula Series. A crystalline zone extends from Bilinga to S of M'Vouti. In the S, gneiss is common. The northern parts are more dissected, with mica-schists, chlorito-schists and epidotes.

Relief is composed of a succession of chains, built of more resistant rocks (mainly quartzites) and elongated depressions, formed by softer rocks (mainly schists). The folded Mayombe highlands have therefore at present an Appalachian relief.

Most valleys are either deep and V-shaped, or wide with an almost flat bottom and meandering rivers.

Granite and quartzo-diorite intrusions are common (terrain unit 510). These areas are strongly dissected, with slopes of up to 60 %, covered by yellowish brown to yellowish red soils, with 35-50 % clay in the B horizon. Rounded hills or domes exist, with steep lower slopes towards narrow, often hydromorphic valleys. Erosion is exposing rock outcrops on steep slopes.

b. Interior Mayombe highlands
(terrain unit 620)

The Interior Mayombe rises 200-300 m above the Niari-Nyanga Depression, or up to 800 m a.s.l. Rocks belong to the 'Quartzo-schisteux': less metamorphic quartzites, sandstones and limestones (of the M'Vouti Series, Bamba Mountains System, 600-800 m a.s.l.), N of M'Vouti. Many Ferralsols overlie a basal gravel layer.

c. The parallel chains or Pré-Mayombe hills
(terrain unit 630)

N of the Loboumo river, a hilly landscape occurs, parallel to the Mayombe chains. Its sedimentary rocks belong to the Mossouva Series of the Bamba Mountains System, Louila Series (argilites) and the Lower Tillite of the WCG, which have been strongly folded during the Western Congo orogenesis (synclines and anticlines). Relief consists of a series of chains, separated by elongated depressions. Often lowlands have a flat bottoms, with clayey alluvium, sometimes swampy (Yambi swamp, Kimongo region).

The parallel chains have straight slopes and are 2-3 km wide. Their altitude decreases from 700-800 m a.s.l. on the NE border with Cabinda to 400-500 m on the hills, which dominate the Niari depression in the east. Part of the dense drainage system has an opposed SW-NE direction, cutting the parallel chains in:

- domes, with deep dry ravines and
- rocky crest lines.

Slopes are often steeper than 50 %. The main drainage system follows the Mayombe direction. Hills and domes are generally composed of clayey rocks, while rocky crestlines are built of sandstone, sometimes forming escarpments. Landslide niches and an erosion staircase micro-relief occurs. Deep gullies are common, usually fixed by forest.

Vegetation is slightly shrubby savannah with forest islands, becoming a dense forest in Cabinda and on the D.R. Congo border areas.

Soils are very deep and clayey Ferralsols or Nitisols. Some soils are shallow. Stone layers are common. The deepest soils are found on the tops and on the upper slopes.

4.5. Coastal belt

The coastal belt, at an altitude of < 200 m a.s.l., is bordered in the east by the Mayombe highlands. It extends over Meso-Cenozoic sedimentary rocks (marl, limestone, sandstone...).

Where the Kouilou river enters the ocean, the coastal belt is 50 km wide, up to Ngotou (50 m a.s.l.). Flooding of the lower river is possible from November to May.

Vegetation is well-developed savannah; forest appears on the NE limits and in the main river valleys.

There are three terrain units, the:

- coastal plain and dunes (100),
- coastal plateaux, covered by the Cirques Series (300),
- alluvial plains and swamps (230).

4.5.1. Coastal plain and dunes
(terrain unit 100)

a. North of Pointe Indienne

North of Pointe Indienne, the coastal plain is discontinuous and narrow (not mapped). Up to Pointe Ste Catherine (in Gabon), the coastline has been smoothed by the Benguela current, and a succession of sandy beaches is backed by forests, or bush-covered dunes. It is a featureless region, with landmarks formed by low hills, as at Tchibobo (Gabon-Congo border). The narrow northern coastal plain is only a sandy string near the ocean, followed by swamps or humid depressions, and succeeded by the first hills of the coastal plateau (300). In some places those hills reach the coast.

Small streams have their mouths blocked with sediments, swept north by the current, so that mainly in Gabon, lagoons occur behind the dunes, and rivers turn north parallel to the shore before entering the sea.

b. South of Pointe Indienne

The coastline S of Pointe Indienne becomes a real coastal plain (3-6 km wide). It is low and sandy, except at Djéno, Pointe M'Vassa, Pointe Noire and Pointe Indienne itself, where low cliffs formed in Upper Cretaceous rocks of the coastal plateau (terrain unit 300).

Low sand dunes (2-5 m high) separate the ocean from a lagoon belt (Malanda, Loubi, M'Vassa, Nombo, Tchikapa) and swampy depressions, with mangrove (locally), papyrus, gallery forests and swamp grasslands. Behind the lagoons occur some old dune belts, flattened (10-12 m high), with intermediate swampy depressions.

Fairly rapidly a gradual and regular rise takes place up to the coastal plateau, through rather open bush country, with denser forest higher up.

S of the Kouilou river, the sandy coast rises towards Loango and behind the coast a chain of hills decreases. Loango is situated on bluffs, succeeded by a wooded plain in the bay of Pointe Noire. At Pointe Noire, the coastal plain is sandy and slightly undulating, with numerous lagoons.

A narrow beach of 9 km long, topped by a 12 m high cliff leads from Pointe Noire to Fausse Pointe Noire. 11 km S is the mouth of the Malonda lagoon.

The most southern part of the coastline consists of low river divides and swampy flat valleys and sandy beaches.

Podzols occur on the top of the coastal sand belts.

4.5.2. Coastal plateau
(terrain unit 300)

From the coastal plain the land rises to a plateau, which extends to the broken country of the Mayombe. It is an area of hills and plateaux, dissected by the drainage system. The maximal altitude is 180 m.

- A hilly zone occurs at the foot of the Mayombe, with soft, rounded shapes: widely rounded tops and straight slopes, descending in sometimes swampy valleys.

- Three plateau subsections may be distinguished, from NW to SE the:

  - Tinkoussou plateau, in between the Conkouati and Noumbi rivers;
  - Kayes plateau, in between the Noumbi and the Kouilou;
  - Hinda plateau in between the Kouilou and the Loémé.

These slightly undulating plateaux contain steeply dissected valleys. Numerous minor dry valleys, with herb or shrub vegetation occur as extensions of the stream valleys.

On all slopes gully erosion occurs. Those places are covered by tree or shrub vegetation, due to the more humid conditions, out of reach of bush fires.

Closed depressions on the plateaux have also a dense vegetation, due to the more humid bottoms. Large theatre-like excavations, with steep slopes (down to 80-100 m) on valley slopes, gave the name to the Cirques Series.

Parts of the retreating steep slopes slide down, but vegetation colonizes these depressions and stops erosion.

4.5.3. Alluvial valleys of the coastal belt
(terrain unit 230)

The Kouilou river flows in a wide and swampy alluvial plain, in between low hills. Included is the N'Tombo swamp (400-500 km^2).

The Noumbi river is meandering in a 1-3 km wide alluvial valley, with a swampy gallery forest.

5. Vegetation

The numbers below (..) refer to the vegetation regions of FAO (1974).

Most of the Central Congo Basin, including all lower grounds, are covered by tropical, evergreen **rainforest**, while some of the surrounding plateaux are occupied by **savannah**, grassland with a varying number of trees or shrubs or both.

The distribution of the two types is more determined by soil conditions and human activity than by rainfall distribution.

5.1. (1) Tropical wet evergreen forest

The northern limit of this forest coincides approximately with latitude 4°N, where the proportion of large deciduous trees increases fairly rapidly.

The rain forest of the southern and central parts of the Republic of the Congo is more broken by grass-woodlands.

The very sandy soils of the Batéké plateaux do not retain enough water to enable the forest to compensate for the short dry season.

5.1.1. (1.a) Tropical lowland rainforest

a. Central Congo Basin

Essentially this is a zone of lower dry ground. On the whole, the forest is developed in regions with a total annual rainfall of at least 1,500 mm, fairly evenly distributed throughout the year. In general the forest is evergreen, but some deciduous trees occur and these increase near the outskirts where the climate approaches that of the surrounding savannahs.

The tropical forest is never leafless. It consists of several strata, including an upper layer of large trees, which may be 40-60 m high. In certain areas there are three fairly defined tree-top stories ranging from 35 to more than 45 m, from 15 to 35 m and up to 15 m. Beneath the tree canopy there may be ill-defined shrub and herb strata. There is a great diversity of woody plants. Mixture of kinds is the rule. The forest is very heterogeneous and among its numerous species are:

- *Chlorophora excelsa*, African or bush oak, iroko
- *Ceiba pentandra*, silk-cotton tree or faux-cottonier, buma
- *Piptadenia africana*, erundu
- *Picnanthus*, kombo, wild or false nutmeg, bokonda
- *Lophira alata*, meni oil tree, bongosi
- *Alstonia congoensis*, pattern-wood tree, bokuka
- *Musanga smithii*, umbrella tree, asseng
- *Irvingia gabonensis*, wild or african mango, dika
- *Pterocarpus soyauxii*, barwood or redwood, muenge
- *Ricinodendron africanum*, african wood-oil-nut tree, njangsang
- *Coula edulis*, african walnut or Gabon nut, wula
- *Entandophragma*, Khaya, african mahogany
- *Dialium*
- *Erythroxylon*
- *Sideroxylon*
- *Croton*
- *Drypetes*
- *Pachylobus*
- *Mymusops,* djave, moabi
- *Erythrophleum guineense*, ordeal tree, elun or elong
- *Macrolobium dewevrei*, limbali or mbalu
- *Terminalia superba*, Congo walnut, djombe

- *Uapaca staudtii*, bosambi
- *Elaeis guineensis*, oil palm or palmier à huile, elen
- *Spathodea campanulata*, African tulip, flame tree, tulipier, etutu
- *Klainedoxa gabonensis*, ngondo
- *Bombax buonopozense*, red-flowering silk-cotton tree, johi
- *Pentaclethra macrophylla*, oil-bean tree, kombolo
- *Aucoumea klaineana*, Gabon mahogany, okoumé
- *Khaya klainei*, Gabon acajou

The underwood also includes:

- *Alchornea floribunda*
- *Geophila obvallata*
- *Scaphopetalum thonneri*

Where ironstone pans occur near the surface, the forest is replaced by short grassy turf, with shrubs growing in small pockets in the pan.

The rainforest keeps the soil almost permanently moist, shelters an intense biological life, maintains a rather constant temperature and suffers practically no erosion. Nevertheless, it is a virtually closed life cycle, in which decomposing dead matter nourishes the living matter. This equilibrium is precarious and is upset by deforestation and cultivation.

Extensive forests of limbali (*Macrolobium dewevrei*) grow on the outer parts of the main forest, particularly towards the N. It prefers light, deep, sandy soils.

Secondary forest

The rainforest has in many places been degraded. Secondary forests are composed of fast growing softwood species, such as:

- *Pycnanthus* kombo, wild nutmeg
- *Ricinodendron africanum* or *R. heudelotii*, African wood-oil-nut tree
- *Albizzia ealaensis*
- *Irvingia grandifolia*
- *Musanga cecropoides* or *M. smithii*, umbrella tree or parasolier
- *Anthocleista nobilis*
- *Vernoninia conferta*
- *Trema guineensis*
- *Harungana madagascariensis*
- *Sterculia tragacantha*

On abandoned fields, there is an abundance of *Acanthus*, ginger and grass families (*Acanthaceae*, *Scitamineae* and *Graminae*) and remnants of plantations, such as bananas and papaya (*Carica papaya*). Some deserted areas are quickly overgrown by bracken ferns (*Pteridium aquilinum*) or tall grasses (*Imperata cylindrica* and *Andropogon spp*.).

Oil palm (*Elaeis guineensis*) is an almost certain indicator of secondary forest, as it cannot grow in the deep shade of virgin forests.

Gradually seedlings of the harder, slower-growing, species appear.

b. Mayombe highlands
(terrain units 510, 610, 620, 630)

The important rainforest of the Mayombe agrees in general with the dry ground forest of the central Congo basin. Many species, which are common on the Mayombe are comparatively rare in the rest of the Congo.

Forest grows on the ridges, but in an irregular way, sometimes only on slopes, with empty tops, but sometimes only on tops. In the Kimongo region (630), forest colonizes erosion gullies on slopes. Inundated forests exist in the Yambi swamp. The vegetation of swampy depressions is composed of herbs. Permanent swamps are occupied by papyrus.

High trees reach 35-50 m, the most important are:

- *Chlorophora excelsa*, kamba, iroko
- *Terminalia superba*, limba
- *Combretodendron africanum*, minzu
- *Sarcocephalus diderrichii*, ngulu maza
- *Entandrophragma cylindrica*
- *Entandrophragma angolensis*, acajou
- *Oxistigma oxyphyllum*, tchibala
- *Thiegheniellea africana*, douka
- *Baïonella toxisperma*, moabi
- *Gossweilerodendron balsamiferum*, agba
- *Khaya*,
- *Guibourtia arnoldiana*

A lower level of trees occurs at 15-25 m, with:

- *Balanites mayumbensis*
- *Ongokea gori*
- *Pentaclethra eetveldeana*
- *Funtumia africana*

A third level of trees reaches 10 m.

There is the usual mixture of species characteristic of the Congo Basin forest. Ferns of over 3 m high are a striking feature.

In the Mayombe, only a quarter of the forest is thought to be primary.

Generally, secondary forest is much denser, with numerous small trees and considerable undergrowth, especially of tall herbs and shrubs, with:

- *Musanga*, umbrella tree, or parasolier
- *Trema guineensis*
- *Harungana madagascariensis*
- *Caloncoba welwitschii*

c. Chaillu Massif
(terrain unit 520)

Dense evergreen humid forest, with leguminoses, covers the massif and part of the sedimentary Bouenza hills and plateau.

Trees are *Chrophyllum lacourtianum*, *Oxystigma*, *Oxyphyllum*, *Dalium pachyphyllum*, *Erythrophleum guineensis*, *Klainedoxe gabonensis*, *Petersia africana*...

Due to human action, some minor shrub savannahs with *Hyparrhenia diplandra*, H. *lecontei* and *Hymenocardia acida*, *Fimbristylis complanata*, *Aframomum stipulatum*, *Pteridium aquilinum* are included in the north. Shrubs are *Anona arenaria*, *Psorospermum febrifugum*, *Bridelia ferruginea*.

5.1.2. (1.b) Regularly flooded tropical forest

This vegetation unit occurs in the east of the country, along the middle course of the Congo and its affluents. In the lower parts of the valleys, there are widespread floods during the period of heaviest rainfall. The riverain or flooded forest follows the lower courses of most rivers, forming a strip of varying width depending on the nature of the banks and the width of the valley. Some flooded areas are very extensive. After the water subsides the soil dries and is relatively firm.

The forest vegetation of the islands or river valleys begins with *Mimosa pigra*. It is often invaded by:

- *Alchornea cordifolia*
- *Bridelia ripicola*
- *Ficus mucuso*
- *Lannea welwitschii*
- *Oxystigma buchholzii*
- *Elaeis guineensis*, wild oil palm

There is no marked lower tree- or shrub layer. Lianas are large and abundant. The tree canopy is composed of:

- *Lannea welwitschii*
- *Oxystigma buchholzii*
- *Spondianthus preussii*
- *Copaifera demeusei*, copal gum
- *Cynometra gilletii*
- *Uapaca guineensis*, bossenghe

Many other trees are characteristic of this type of forest, most with buttresses or stilt roots. Climbing spiny rattan palms (*Calamus* and *Eremospatha*) may combine with other lianas and with stilt roots to form an impenetrable mass. Along the riverbanks there is often a fringe of raphia palms (*Raphia sese* and *R. laurentii*).

5.1.3. (1.c) Tropical swamp forest

This type is especially common along the lower courses of the Ubangi and the Congo. Soils are always soft and spongy.

Despite an asphyxiating soil, the immense swampy area of the confluence of the Congo and the Ubangi rivers carries a tree cover in which the trees have prop or stilt roots. The main tree canopy is dense, but there are also well-developed lower layers and a matted undergrowth. Large lianas are abundant. Many of the tree species are the same as in the temporary flooded forest, especially copal trees and *Uapaca*. Some of the trees are of rather spare appearance (raffia palm), while others are more exuberant and composed of specialized genera of fresh water swamp forest. Characteristic species are:

- *Uapaca heudelotii*
- *Albizzia laurentii*
- *Coffea congensis*
- *Entandrophragma palustre*
- *Sersalia palustre*
- *Symphonia globulifera*
- *Myrianthus scandens*
- *Elaeis guineensis*
- *Mitragyna stipulosa,* vuku

Uapaca and *Mitragyna* sometimes form almost pure stands.

Eichhornia crassipes and fragments of *Ultricularieto nymphacetum* and *Lemneto pistretum* often invade the open water.

The occurrence of grasslands with *Echinochloa stagnina, E. pyramidalis, Leersia hexandra, Phragmites mauritianus* and *Cyperus papyrus* is determined by thickness of the peat and depth of the water.

5.2. (2) Tropical deciduous and semi-deciduous forest

5.2.1. (2.a) Tropical semi-deciduous rainforest,‘equatorial savannah’

This vegetation unit is also called ‘equatorial savannah’ in the Republic of the Congo. It occurs in the:

- central part of the Republic of the Congo,
- Lower Congo (Niari-Nyanga Depression)

Rainforest species are intermixed with deciduous species. Semi-deciduous rainforests grow especially along rivers and in groves on hills and plateaux. Climate differs little from that of other rainforests.

The presence of ‘savannah’ is due to degradation, or to various ecological conditions, especially the insufficient water-holding capacity of sandy soils. These tall grass savannahs are composed of:

- *Pennisetum purpureum*
- *Loudetia arundinacea*
- *Imperata cylindrica*

combined with fire-tolerant shrubs, such as *Hymenocardia acida*. Farmers and hunters frequently burn off the grass steppes.

a. Grass-woodland

Areas of greater or lesser extend, with mainly grasses and scattered trees, are particularly common in the central and southern part of the country. The grasses are mainly tall *Andropogon spp.*, but other herbs, including orchids and ferns, are mixed with them. The trees are different from those in the rainforest and many belong, or are related, to Sudanese species. The grass-woodlands are burned at frequent intervals, generally at least once a year.

Rivers and streams crossing the grass-woodlands are always fringed by rather open forest of minor height and size. Along perennial rivers the trees often close canopies and form gallery forests on either riverbank.

b. Short-grass savannah or steppe

This is a common vegetation type on the plateaux, in between the rivers of the Lower-Congo: on rather poor sandy, stony, or gravelly soils. The short-grass savannah or steppe reaches a height of 0.9-1.2 m at most. The grass cover is never continuous. Visibility is good over long distances. The main grasses are:

- *Aristida dewildemanii*
- *Rhynchelytrum roseum* and *R. amethysteum*, red top grass
- *Heteropogon contortus*, spear grass
- *Sporobolus*
- *Eragrostis*

The short-grass savannah may be almost entirely devoid of trees over large areas, but frequently more or less wooded, with small trees and shrubs, of which *Hymenocardia acida* is the most common. Other species of trees are *Anona senegalensis* and *Sarcocephalus sambucinus* or negro peach.

Short grass savannahs frequently occur on ironstone pan soils with rooting problems for larger grasses. The bracken fern (*Pteridium aquilinum*) sometimes forms dense brakes on dry sandy soils of areas, which have gone out of cultivation.

c. Medium-grass savannah

This type covers large areas, both N and S of the African rainforests. The mature grasses are 1.5 to 2.0 m high and the tussocks, though separate, interlace completely and make walking difficult. This type grows usually on soils of medium fertility and moisture, which often possess enough organic matter. Grasses are:

- *Andropogon spp*.
- *Hyparrhenia* (especially *H. diplandra*)
- *Cymbopogon*, lemon grass
- *Sorghum*, wild millets
- *Heteropogon*, spear grass

Other plants are herbs, as well as rubber-yielding climbers (*Landolphia humilis* and *L. Thollonii*). The woody plants vary in numbers and in kinds from west to east.

A special form of medium-grass savannah is dominated by lalang or alang-alang (*Imperata cylindrica*). This is a perennial grass, 1.2 to 2 m in height, which spreads rapidly from underground runners. It is characteristic of abandoned fields.

d. Tall-grass savannah or Madiadia

This vegetation type is found on rich soils: alluvial plains or highly organic soils at the forest margins. The main constituent is elephant grass (*Pennisetum purpureum*), a giant grass reaching a height of 3.5 to 5 m when fully grown. Very few other herbs occur.

5.2.2. Vegetation of the Niari-Nyanga Depression (terrain unit 710)

Except for gallery forests, this region is covered by shrub savannah. The main shrubs are *Anona arenaria*, *Bridelia ferruginea* and *Sarcocephalus esculentus*.

The gallery forests also spread on steep slopes and forms minor forests (Bangou, Massagé), with *Terminalia superba* and *Ceiba pentandra*.

a. Savannahs with *Hymenocardia acida*

This shrub is abundant around the Niari-Nyanga Depression, but it is absent in most of the Depression. It can however be found on the sandy contact zone near the Schisto-Greseux plateaux, or on sandy alluvium. Other herbs are *Hyparrhenia*, *Andropogon* and *Pennisetum*. Other shrubs are *Albizzia*, *Cassia* and *Combretum.*

b. Savannahs without *Hymenocardia acida*

- Dense savannah, with high *Beckeropsis uniseta* and *Pennisetum purpureum* (elephant grass) occur in humid zones;
- On deep clayey or sandy clay soils grows dense savannah, with *Hyparrhenia diplandra*;
- On shallow soils grows low savannah with *Hyparrhenia lecomtei* and *Andropogon pseudapricus*;
- On eroded soils grows savannah with *Andropogon pseudapricus* and *Trichopteryx*.

5.2.3. Vegetation of the Mouyondzi plateau
(terrain component 710/3)

Vegetation is savannah with *Hyparrhenia diplandra* and *Hymenocardia acida*. Semi-deciduous forest with *Terminalia superba* grows in valleys and on some bordering slopes of the plateau. In the east, part of the Messagé Forest occupies the plateau.

5.2.4. Vegetation of the Bouenza hills and plateau
(terrain unit 910)

Valleys are frequently dissymmetric, with steep slopes under forest, rivers in gallery forests and concave slopes under herb savannah, on slightly sloping sandy terraces. Most of the hills are covered by shrub savannah, with *Loudetia arundinacea* and *Hymenocardia acida*.

5.2.5. Vegetation of the Cataracts plateau
(terrain unit 720)

Forest occupies summits on sandstone, while drier, calcareous slopes are occupied by savannah.

5.2.6. Batéké hills
(terrain unit 830)

Due to the very permeable sandy soils, there is no rainforest cover. Only on steep slopes occur some islands of dense semi-deciduous forest, with evergreen undergrowth. Gallery forests grow on swampy valley bottoms. These forests have been strongly degraded.

Savannah dominates. The proportion of shrubs is variable and sometimes shrubs are absent.

- On sandy loam soils on lower hill summits grows savannah with *Loudetia arundinacea* (*Graminae*);
- Most of the sandy area is covered by a slightly shrubby (*Hymenocardia acida*) savannah, with *Loudetia demeusii*, *Eragrostis brizoïdes*, *Ctenium newtonii*....
- The most sandy areas and the higher hills are covered by savannah, with *Trachypogon thollonii*.

Low herb steppes of *Loudetia simplex* (lousséké) characterize podzolic soils (colluvial lower slopes), alluvial plains and river terraces.

Semi-deciduous forests occur as minor extensions of gallery forests on the steeper slopes (*Hymenocardia ulmoïdes*, *Sapium cornutum*, *Pentaclethra eetveldeana*...), with evergreen undergrowth (*Marantaceae*...).

In the Djoué valley grows savannah with *Aristida*.

5.2.8. Batéké plateaux remnants
(terrain unit 820)

Vegetation on the sandy loam plateaux is savannah with *Trachypogon thollonii* (*Graminae*) and *Annona areneria*.

- On more loamy soils grows *Hyparrhenia diplandra* (*Graminae*) and *Bridelia ferruginea* (*Euphorbiacae*);
- On more sandy soils grows *Loudetia demeusii* (*Graminae*) and *Hymenocardia acida* (*Euphorbiacae*).

There are some semi-deciduous forest islands, with evergreen undergrowth (*Parinarium glabrum*, *Blighia wildemaniana*...). Forests on the plateaux are very reduced and often of human origin. Degraded semi-deciduous and secondary forest occupies about 5 % of the plateaux.

Low herb steppes of *Loudetia simplex* (lousséké) characterize the podzolic soils, found on lower slopes of closed depressions. They form the transition between the plateau and the water-saturated depressions.

On the southeastern plateaux grows savannah, with few small shrubs, including *Hymenocardia acida* and a herb strata with *Loudetia demeussi*, *Trachypogon tholonii* and *Ctenium newtonii*.

On the northwestern plateaux (Koukouya) grows savannah with *Trachypogon thollonii* and *Hymenocardia acida*, with *Hyparrhenia diplandra* on less cultivated soils. Shrubs are *Anona arenaria*, *Albizzia adianthifolia*...

5.3. (3) Tropical inundated coastal formations

5.3.1. (3.a) Mangroves

Mangroves are found on saline loamy soils, exposed directly to the tides along the coast. The stands are dominated by *Rhizophora racemosa, R. harrisonni* and *R. mangle. Avicennia nitida* sometimes occurs behind the areas of *Rhizophora*.

It consists of woodland communities, below the high tide mark, sometimes forest-like, or scrub or bushwood in appearance and limited to deep estuarine muds, which are rich in organic matter and flooded with saline or brackish water, at least at high tide. Most, but not all river estuaries and creeks have mangrove-woodland lining both shores up-stream to near the tidal limits. The threes are 7 to 22 m high and the canopy is dense.

Higher up the creeks, salinity becomes less pronounced and other plants mix with the mangrove-woodland. Screw pines (*Pandanus*) gradually gain the upper hand. The rather monotonous mangrove-woodland gives place, on marshy grounds, to a thick scrub of screw pines, raphia palms (*Raphia vinifera*) and wild spiny date (*Phoenix reclinata*). Climbing and clambering plants appear. Other associated plants are *Hibiscus tiaceus*, rikio (*Uapaca staudtii*), bossipi (*Oxystigma mannii*), bahia (*Mitragyna stipulosa*), ovala (*Pentaclethra macrophylla*) and rouin palms (*Calamus spp*.). The riverain belt of raphia palms often extends some distance into the forest area.

5.4. (4.e.) Dry savannah of the coastal belt

5.4.1. Savannah of the coastal plateau

The Mayombe rainforest extends partly over the coastal plateau, first continuously, but further as a forest-savannah mosaic and still further away as forest islands. Near to the coast, savannahs become more important. They are composed of low herbs, not covering the soil completely (pseudo-steppes).

Anona arenaria is present everywhere on the coastal plateau. *Hymenocardia acida* appears in the hilly zone at the foot of the Mayombe. N of Bas-Kouilou, herbs are dominated by *Rhynchelytrum nerveglume* (after fires) and *Hyparrhenia diplandra*. In the Pointe Noire region, *Loudetia simplex* dominates.

Secondary forests are composed of:

- *Aucumea klaineana*
- *Hymenocardia ulmoïdes*
- *Chysobalanus ellipticus*
- *Monates pruinosa*
- *Gaertnera paniculata*
- *Thomandersia laurifolia*
- *Chaetocarpus africanus*
- *Barteria*

Young forest or secondary regrowth contains:

- *Thomandersia laurifolia,*
- *Pycnanthus kombo,*
- *Caloncoba welwitschii,*
- *Xylopia aethiopica,*
- *Hymenocardia ulmoïdes,*
- *Carapa procera,*
- *Voscanga puberula,*
- *Barteria fistulosa,*
- *Symphonia globulifera,*
- *Macaranga,*
- *Alchornea cardifolia,*
- *Chaerocarpus africanus.*

5.4.2. Swamp forests of the coastal plateaux

These forests grow on inundated flat valley bottoms, around lakes...

- *Oncocalamus*
- *Eremospatha hookeri*
- *Baphia laurifolia*
- *Xylopia rubescens*
- *Allophylus africanus*
- *Aframomum*

5.4.3. Coastal plain Swamp forests

These forests grow on the lowlands of the coastal plain, either behind dunes or beaches, or behind mangroves. They are characterized by the presence of:

- *Anthostema aubriyanum*
- *Euphorbiaceae*
- *Symphonia globulifera*
- *Elaeis guineensis*
- *Anthocleista vogelli*
- *Hypolytrum heterophyllum*
- *Fegimanra africana*
- *Xylopia rubescens*
- *Klainedoxa gabonensis*
- *Saccoglottis gabonensis*

5.4.4. Low coastal dunes

A dense low tree vegetation is present, with:

- *Barteria mauritiana*
- *Dalbergia*
- *Eugenia*
- *Microgramma lycopodioides*
- *Ochna multiflora*
- *Manilkera lacera*
- *Baphia letestui*
- *Landolpha*
- *Phoenix reclinata*
- *Fegimum africana*
- *Syzigium littorale*
- *Landolphia*
- *Polysphaeria*
- *Rutidea*
- *Cassytha filiformis*
- *Sanseviera guineensis*

5.4.5. Coastal plain savannah

On the drier parts of the coastal plain grows grass savannah, with rare *Anona arenaria*. In the Pointe Noire region, *Loudetia simplex* dominates. In humid depressions, near to the *Rhynchelytrum* savannah the main herbs are *Hyparrhenia diplandra*, *Anadephia anecta* and A. *hamata*. In swampy areas occur *Jardinea congoensis*, *Cyrtosperma senegalensis*, *Lycopodium cernuum*, *Rhyncospora corymbosa*.

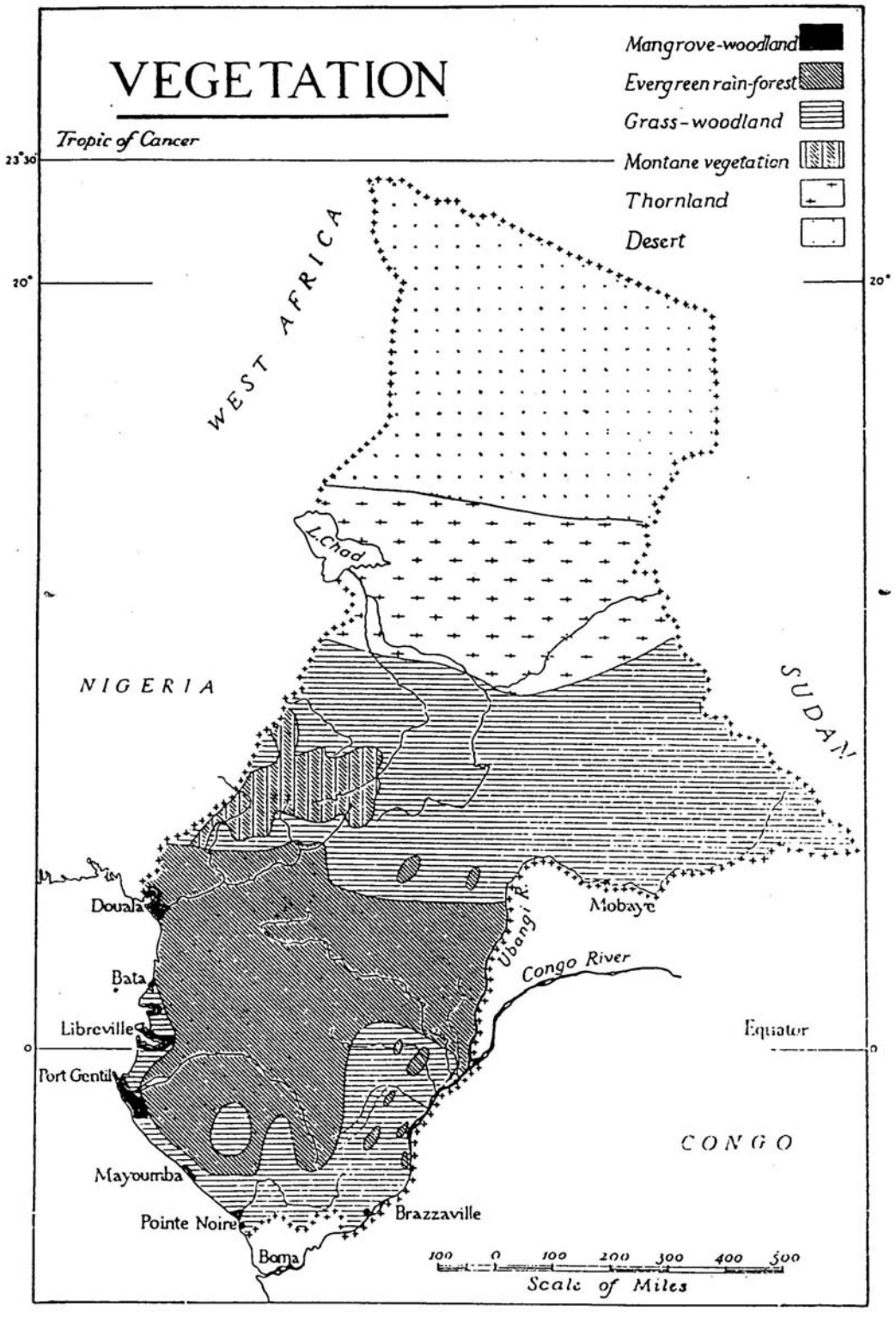


Fig. 6. General vegetation belts of west-central Africa (NID, 1942)

6. Geology

6.1. Precambrian rocks

The oldest group of rocks is the Basement complex of folded, highly metamorphic gneisses and mica-schists, intruded by granites, pegmatites and basic igneous rocks, varied and involving Archaean rocks, which constitute everywhere in Africa the platform on which lie younger rocks. The complex forms the broad rim of the Congo Basin, from the Ubangi-Shari watershed in the N to the Lower Congo. Relief is subdued through profound denudation, except where it has been freshened by tectonic movements or fairly recent erosion.

6.1.1. Chaillu granites

The Chaillu massif is a giant granite batholith, with minor metamorphic inclusions and some basic and ultrabasic intrusions. Metamorphic inclusions are composed of quartzites, amphibolites, pyroxenites, mica-schists and gneisses.

On this soccle were deposited, in the Middle Precambrium, the sedimentary rocks of the Franceville basin and Late Precambrian sediments of the Bouenzian and the Schisto-Calcaire System (WCG).

6.1.2. Francevillian (F)

A narrow strip on the central border with Gabon belongs to these rocks.

- The Upper Francevillian comprises siliceous sandstones.
- The Middle Francevillian (Fm) is composed of jaspis and sandstones (Fm2), on schists and clays (Fm1).
- The Lower Francevillian (Fi) consists of siliceous, arkosic and conglomeratic sandstones.

There are numerous dolerite intrusions.

6.1.3. Mayombe System

The Mayombe System is strongly metamorphic. The folded layers have a general S-SE to N-NW orientation. Rocks are crystalline schists, quartzites, greenstones and intrusives such as granites and diorites.

Three Series are distinguished: from top to bottom:

- *Loukoula Series* (Lg): graphitic schists and quartzites,
  (L1): mica-schists, quartzites, arkosic and rhyolithic schists,
- *Bikossi Series* (BiE): calcic green schists, epidotes
  (BiQm): mica-quartzites, conglomerates,
- *Loémé Series* (Lé): mica-schists, gneisses.

Precambrian igneous intrusions occur in the Mayombe highlands:

- doleritic labradorites
- dolerite lavas
- granites (common)

6.1.4. Bamba Mountains System

This is the oldest part of the former “Quartzo-Schisteux”, called the Sansikwa System in the Democratic Republic of the Congo. These are intensely folded rocks (top to bottom):

(on top of it lies the younger Louila Series of the WCG)

Bamba Mountains System:

- *Mossouva Series (Mo):*	+	quartzitic sandstones, sandy dolomites
	+	shales and schists
	+	quartzitic sandstones, arkoses, conglomerates
- *M’Vouti Series (Mv):*		slates, (calcic) schists, quartzitic sandstones, arkoses, basal conglomerate

(on top of the older Mayombe System)

Following correlation can be made:

Republic of the Congo		*DRC*
Bamba Mountains System	=	Sansikwa System (S)
- Moussouva Series	=	(S2) upper assise
- M’Vouti Series	=	(S1) lower assise
		(S0) basal conglomerate

Both Series are well represented in the Kimongo region, south of Loudima. They form the basement of a hilly region, with swampy valleys and of the pre-Mayombe hills (terrain unit 630).

6.1.5. Bolé Series

The Bolé Series occurs in northern Congo, south of the Sangha river. It starts with quartzites, with layers of schists, and it ends with schists. There are granite and dolerite intrusions.

6.1.6. Sembé-Ouésso Series

The Sembé-Ouésso plateau is an extensive sandstone zone, starting south of the equator, limited in the N by the 3°30'N parallel (over 400 km). In the west it occurs from the meridian of Souanké to the meridian of Ouésso (over 200 km), where it is buried under the Congo Basin. It is composed of very folded layers.

The Sembé-Ouésso Series was formerly called the "Sandstone Mountains Series". It corresponds to the Liki-Bembe Group of the DRC. It is overlain in the east by continental horizontal deposits of the Congo Basin.

Following subdivision can be made:

B2 - *Schisto-Calcaro-Greseux:*

schists, calc-schists, dolomites, quartzitic sandstones, coal-schists

B1 - *Schisto-Quartzitique:*

schists, quartzitic sandstones, quartzites

A - Sporadic conglomerates, overlain by arkoses, sandstones, quartzites

There are dolerite intrusions.

6.1.7. Dja tillite complex

This formation has outcrops N of the Ouésso-Souanké road, 50 km E of the latter. It forms a 40-50 km wide and 100 km long area.

Rocks are black schists and yellowish conglomeratic clayey schists of glacial origin.

6.1.8. Nola Series

On the border with the Central African Republic and Cameroon occur very folded layers with gabbro, pigeonite and dolerite intrusions.

(on top lies the younger Bandja tillite complex, Upper Precambrian)

Nola Series: schists, quartzitic sandstones, arkosic sandstones, conglomerates.

(on top of the older Bolé Series, Lower Precambrium)

6.1.9. Mbaiki Series

Located in the northernmost part of the country, it is composed of quartzitic sandstones, quartzites, schists and local conglomeratic lenses. There are intrusions of gabbros and dolerites.

6.2. Western Congo Group (WCG)
(Upper Precambrian-Devonian)

A mega-cycle of sedimentation started in the Upper Precambrian. The Group consists of sedimentary rocks, also called Oendolongo and Bembe (Angola) or Kundelungu (Katanga).

The former “Quartzo-Schisteux” of the WCG is characterized by a lower tillite and an upper tillite (or Niari tillite), with quartzitic and other rocks of the Louila Series in between.

The WCG consists of 6 stratigraphic units (top to bottom):

- Schisto-Greseux System (e.g. Cataracts plateau)
    - Inkisi Series,
    - M’Pioka Series
- Schisto-Calcaire System (Niari-Nyanga Depression)
- Upper or Niari tillite
- Louila and Bouenza Series
- Lower Tillite of the Lower Congo Series

6.2.1. Schisto-Greseux System
(Cambrian-Devonian)

These are the youngest, more continental, and folded WCG sediments, which rest on the older Schisto-Calcaire System rocks.

a. Inkisi Series (I)

The younger Inkisi Series occurs W of Brazaville. Together with the older M'Pioka Series, it forms the Cataracts Plateau (terrain unit 720).

The Inkisi Series is represented by 600-700 m of sandstones. Outcrops occur in the Boko and Kinkala districts, up to a SW-NE line somewhat to the east of Mindouli. The facies of this Series has an old red sandstone character or "vieux grès rouge". They rest with a slight discordance on the M'Pioka Series.

- The upper stage (I2) is 300 m thick and consists of micaceous and feldspathic, siliceous sandstone, sometimes with quartz pebbles and shale intercalations. It is a fine- to medium-grained, purplish-red rock. It becomes coarser towards the base, with a quartzitic arkose facies. This stage occupies the sandy hill area between the Djoué river (Brazzaville) and Boko (terrain units 810 and 720/3).

- The lower stage (I1) is composed of coarse, cross-bedded conglomeratic, quartzitic arkoses and sandstones.

- The basal metres are a conglomerate (Io) with quartz, quartzites, schists and shale gravels of 3-15 cm.

b. M’Pioka Series (P)

The underlying and older M’Pioka Series is finer and more clayey than the Inkisi Series. It forms sandstone plateaux in the Niari-Nyanga syncline (Mount Bélo plateau).

- The upper stage (PII) has outcrops south of Boko and in the Mindouli-M’Passa region. Thickness of the PII is 450 m at Mindouli, but it disappears W of M’Passa, where only the lower stage PI exists. From top to bottom:

  - PIIc consists of 260 m red, psammitic shales and medium-grained, feldspathic or quartzitic sandstones (at Boko);
  - PIIb is a rapid succession of bluish-grey to greenish-grey, fine grained, feldspathic sandstones and green, yellow, red and purple argilites;
  - PIIa consists of fine-grained, quartzitic sandstones, often cross-bedded and micaceous, without argilites.

- The lower stage (PI) consists of a sandstone layer, in between two clayey layers.

  - The upper PIc level forms the plateaux surface in the Boko-Songho region. It consists of red, sometimes micaceous, somewhat sandy shales or clays.
  - The middle PIb level often forms an escarpment in between the two shale levels. It is a grey to brown, feldspathic quartzite-sandstone.
  - The lower PIa level is composed of banded, micaceous shales. It rests concordantly on the Niari breccia.

- The Niari breccia, or basal conglomerate (Po)

  The Niari breccia (Brèche du Niari) is the equivalent of the Bangou breccia of the DRC. It is a conglomerate, with limestone or quartz gravels, often in a calcareous cement, overlying the Schisto-Calcaire System. Occurrence and thickness are very irregular. Sometimes an intermediate sandstone, quartzite or schist layer (equivalent of the M’Fidi Series in the DRC) occurs in between a lower breccia and the Niari breccia (Mindouli region).

6.2.2. Schisto-Calcaire System
(Upper Precambrian-Cambrian)

These probably marine sediments have at their base a glacial 'conglomerate' or Upper tillite. The stratigraphy of the Niari-Nyanga Depression is as follows:

- Uppermost zone SCIV, 20 m

  - clayey limestones,
  - shales and cherts

- Upper Zone SCIII, 75-300 m, forming steep slopes (e.g. Mount Bélo)

  - grey and massive dolomites (Renéville and S of Kimbédi), sometimes overlain by very coarse, concentric, oolithic, dolomitic limestones;

  - coal-bearing, crystalline, dolomitic limestones (in between Marchand and Mindouli)

  - marly limestones, with layers of silicified oolithic, or chloritic pisolithes, with fossil micro-organisms (pseudo-oolithes).

- The Middle Zone SCII (300 m): soft marly rocks, without dolomites

  - reddish, sandy limestones,
  - limestone with rounded silex to agate zones,
  - grey, black or red, breccia-like limestones,
  - clayey limestones, with calcite needles, oolithes and algae filaments.

- The Lower Zone SCI, N of the Niari river

  - SCIc: pink or grey, crystalline limestone layers, with concentric oolithes, sometimes recrystallized,

  - SCIb: + reddish brown, marly limestone sheets
    + blue or purple, somewhat crystalline, slightly clayey limestone sheets

  - SCIa: grey, blue, or pink layers of massive dolomites.

The whole set is about 1,000 m thick. A limestone or dolomite character dominates, but composition and structure of the rocks is very diverse.

- The Upper Zone (SCIII) is mainly dolomitic, or magnesium-rich. Outcrops occur in the Mindouli region and as a general rule, on steep slopes of Schisto-Greseux-topped plateaux.

- The Middle Zone (SCII) is more clayey and siliceous. Large blocks of ‘polymorphic silicified rocks’ sometimes occur at the surface. This is the case for a set of NW-SE-aligned hills, corresponding to the upper layers of the SCII. This alignment can be followed from the road Dolisie-Loudima to south of the Hidi. The Middle Zone rocks build most of the Niari-Nyanga ‘plain’, on the left shores of the river.

- Mainly clayey limestones characterize the Lower Zone (SCI). Outcrops occur in a large strip, N of the Niari, separated from the river by crystalline and oolithic limestones of the Upper Zone, often ruin or finger-shaped. The Lower Zone rests directly on the Upper or Niari tillite.

Ferruginous pans are common in the Niari region. Apart from the ironstone pan of the Mouyondzi plateau, ironstone blocs and gravels are not rare at the surface.

6.2.3. Upper or Niari tillite (TN)

During a long time considered as a basal conglomerate of the Schisto-Calcaire System, the Niari tillite is a separate continental Series of glacial origin (0-150 m).

It is composed of grey, green, red and yellow mottled clays, compact or shale-like, without clear stratification, with angular or rounded gravels of various sizes. It is well conserved on the NE border of the Schisto-Calcaire System, where it has a thickness of 150 m. In the south it is less important and missing locally.

6.2.4. Louila and Bouenza Series

a. Louila Series
(High Shiloango System of the DRC)

In the south, the Niari tillites rest on the Louila Series (600-650 m thick), subdivided in two layers (top to bottom):

- **Sékélolo upper layers (LoS)**

  - dark, banded, marly limestones, with thin clay layers
  - banded, often marly, shales
  - coarse, arkosic sandstones

- **Diambala lower layers (LoDi)**

  - quartzite-sandstones and shales,
  - marls, shales, sandy limestones, calcareous sandstones, feldspathic sandstones, arkoses.

b. Bouenza Series

N of the Niari-Nyanga Depression, the Upper or Niari tillite overlies the Bouenza Series (top to bottom):

- grey or white, quartzitic sandstones
- green or grey, hard, quartzitic schists,
- purple or greenish-grey, somewhat psammitic schists,
- white or yellow, feldspathic, quartzitic sandstones, called ‘waterfall sandstone’
- hard to soft, grey, kaolinitic, fine-grained, schistoid sandstones

(on top of the granitic soccle)

6.2.5. Lower tillite of the Lower Congo (TB or Ti)

These are conglomeratic, clayey schists of glacial origin, with dolerite intrusions.

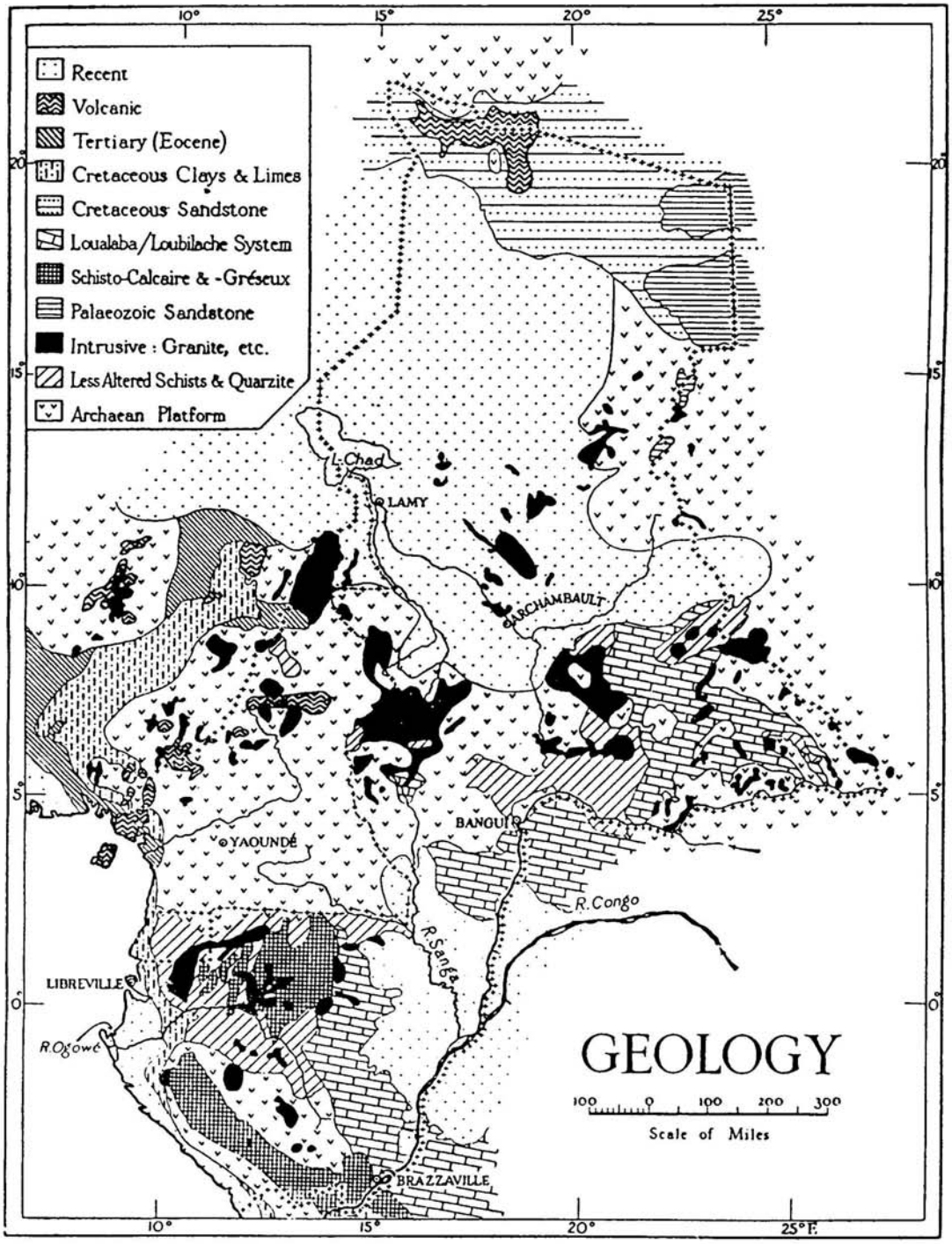


Fig. 7. General geology of west-central Africa (NID, 1942)

6.3. Continental cover formations (Carboniferous to Cretaceous)

Cover formations overlie the old basement. They are composed of shales, sandstones (sometimes with calcareous intercalations), conglomerates and eolian sands.

A subdivision can be made:

- Karroo rocks of the Lualaba Series
- Cretaceous continental rocks of the Kwango Group

For a greater part they are lacustrine beds with highly coloured cross-bedded sandstones.

All rocks are slightly consolidated (sandstones and shales). Formerly the name Lualaba-Lubilash System was used for all beds of the Lualaba and Kwango.

A peneplain has been cut across these rocks. On top of it lie loose sediments: 40-50 m for the Pleistocene cover of the Congo Basin, 120 m for the Mio-Pliocene Kalahari sands (Batéké deposits).

All these rocks form the rim of the Lower Congo basin, from Brazzaville to the eastern part of Gabon, on the lower Ubangi, and thence eastward into the DRC.

Both stages are continental, slightly deformed, but faulted and differentially warped, lying in basins and depressions.

6.3.1. Karroo or Lualaba Series
(Upper Carboniferous-Triassic)

The Karroo deposition begun with an ice age and ended with a volcanic episode. These rocks are mainly shallow fresh water and terrestrial deposits. Basal glaciogene rocks of the Dwyka Formation are overlain by shales, sandstones, mudstones and coal-bearing shales of the Ecca Group.

In the Congo basin, Precambrian rocks are covered by continental sediments from Karroo to recent age; about 3,500 m thick. They comprise Karroo beds, Cretaceous; Tertiary and Quaternary sediments.

- The base of the basin is formed by a Carboniferous tillite, or glacial conglomerate, which may be correlated to the Dwyka Series. These tillites should not be confused with the lower and upper tillites of the older Western Congo Group.

- In the DRC, the Triassic and Jurassic Lukuga Series, overlying Carboniferous rocks, may be correlated with the Lower Stormberg. These are mainly sandstones.

In Angola these rocks correspond to the Lutôe and Cassange Groups.

6.3.2. Cretaceous Kwango Group

a. Stanley Pool Series
(Jurassic-Cretaceous)

The Stanley Pool Series of the Upper-Cretaceous occurs in the Brazzaville region as minor outcrops in the valleys of the Djoué, Djili, Congo and on M'Bamou island. Thick sands overlie them. These are soft, cross-bedded sandstones, white compact sandstones and fossiliferous shales. Fossils and the Late-Cretaceous pediplain on top indicate an Upper-Cretaceous age. Composition:

- Upper level: yellow, cross-bedded, soft, kaolinitic sandstones (Dover cliffs, Stanley Pool)

- Middle level: white, compact sandstones (Makélékélé, Brazzaville)

- Lower level: fossiliferous, red shales, with sandstone intercalations

The upper and middle level belong to the Cretaceous Kwango Series of the DRC. The lower level could be the equivalent of the Lualaba Series.

The Kwango beds form the floor of the central parts of the Congo Basin, being extensively exposed in the drainage system of the Kasai in the DRC. Farther N they are covered by alluvial deposits. No younger beds (other than alluvium and cover sands) are seen in the Congo Basin.

The Calonda Group of Angola is the equivalent of the Kwango Series.

b. Carnot sandstone

The Carnot sandstone, of Mesozoic age, has been deposited in a wide depression on the northern border of the Congo basin (Ibenga plateau, terrain unit 860).

The upper part is a sandstone group, with two series; below exists a fluvio-glacial series.

(1) The sandstone group

- The Upper Series (100 m) consists of white to yellowish brown, cross-bedded, fine to medium grained, clayey-cemented sandstones, with quartz pebble layers and rare red clay layers (equivalent of the Upper Kwango?)

- The Lower Series (5-80 m) is composed of white, grey or pink, cross-bedded arkoses, conglomerates and argilites (equivalent of Lower Kwango?).

(2) The Fluvio-glacial Series

- This series comprises argilites, tillites, calcareous nodules and intercalations (equivalent of Lukuga Series in the DRC?).

6.4. Tertiary to Quaternary continental formations

6.4.1. Batéké Plateaux Series (Ba)

The Batéké deposits are the equivalent o the Kalahari sands.
An upper and a lower level can be distinguished (top to bottom):

- sandy loams of the Batéké plateaux, or Ocre Sand Series (Ba2)
- polymorphic sandstone of the Batéké hills (Ba1)

a. Sandy loams of the Batéké plateaux
(Mio-Pliocene)

These sandy loams, or ‘ocre sands’ (brownish yellow), are loose, slightly clayey, fine sands, becoming darker with depth. Colour is homogeneous (10 YR 5/6-8). They occupy the flat plateaux remnants.

Often erosion has reworked the deposits, as slope and valley deposits are mixed up with the weathering products of the underlying polymorphic sandstone. The deposit has a thickness of > 100 m.

Towards the W, they have been partly eroded and only isolated massifs subsist (Kinkala hills, terrain unit 810). Still further to the west, the polymorphic sandstone disappears and the sandy loams rest directly on rocks of the WCG (terrain component 720/3), at:

- Voka on the Inkisi Series,
- Louango on the M’Pioka Series,
- Mindouli on the Schisto-Calcaire.

b. Polymorphic sandstone (Ba1)
(Eocene)

The sandy loams rest concordantly on the polymorphic sandstone. The latter overlies a Late-Cretaceous pediplain surface, cut across the underlying rocks. On top of the polymorphic sandstones occurs the mid-Tertiary pediplain, below the sandy loams, often with a ferruginous and sandstone gravel layer at the transition.

The subhorizontal, cross-bedded, fine sandstone layers are more or less indurated; colour is yellow to pink. Some upper parts are silicified (duricrust), as discontinuous lenses.

The rocks have an eolian origin and a thickness of 50-300 m. They weather to quartz sands, with < 5 % clay and almost no weatherable mineral reserve.

6.4.2. Bambio Plateaux Series
(Tertiary)

The Bambio Plateaux Series is found in central and northern Congo on the footslope plateaux. These are yellowish sands and sandy loams, probably of eolian origin, also called the ‘Sandy Clay Series’. They overlie polymorphic sandstones. Maybe they are the equivalent of the Batéké deposits.

Probably the upper level of the Mesozoic Carnot sandstone may be correlated to this Series. It consists of ferruginous sandstone, locally overlain by shallow ferruginous clays.

6.4.3. Quaternary deposits of the Central Congo Basin

These are mostly Quaternary alluvial and lacustral-alluvial sediments, covered by Pleistocene ironstone pans, below loose soils.

6.5. Sedimentary rocks of the coastal belt
(Cretaceous to Quaternary)

In the coastal belt, the Precambrian basement is buried below Cretaceous sediments and in the W below Tertiary deposits. There are two groups:

- early Cretaceous (Aptian) to Miocene rocks, intensively folded and faulted during the middle Tertiary uplift;
- after erosion, the truncated folds were covered by a series of Pliocene beds, which were also uplifted.

Three sedimentary groups can be distinguished (top to bottom):

- Plio-Pleistocene Cirques Series, covering most of the coastal plateau (terrain unit 300),
- Upper-Cretaceous Upper Series, mainly along the coast
- Cretaceous Contact Series, mainly along the Mayombe footslopes.

6.5.1. Cretaceous Contact Series
(Aptian to Albian)

Outcrops occur in a narrow strip at the foot of the Mayombe. The lower part consists of black marls, dominated by a series of conglomerates, sandstones, limestones and marls.

- Arkose-psammite Series (Aptian?): conglomerates, arkoses, sandstones, psammites (140 m), of fluvio-lagonal or lacustrine origin.
- Calcaric-dolomitic Series (Aptian-Albian?): oolithic limestones, dolomitic limestones, dolomites, of marine origin.
- Sandstone and blue clay Series (Aptian-Cenomanian?): plastic clays and marl layers, sands, conglomeratic sandstones, of fluvio-lagonal or lacustrine-marine origin.

6.5.2. Upper Cretaceous Upper Series
(Turonian-Campanian)

On the coastline, fossiliferous sandstones, marly sandstones, marls, calcareous sandstones and limestones are found at Banda-Tchibobo, Pointe Kounda, Tchitembo, Pointe Indienne, Pointe Noire, Loya, Fausse Pointe Noire, M'Vassa, Djeno, Kotebiteva and Malonda lagoon.

Near the Mayombe highlands, at Kola, fossiliferous marly sandstones are found (Kola Series, Santonian)

6.5.3. Plio-Pleistocene Cirques Series

This id the most extensive formation of the coastal plateau. It is composed of gravels, red, yellow, white or purple sands, extending from the coast to the Mayombe, with thickness of < 100 m. These alluvial formations have been partly eolian-reworked. Erosion has formed circular theatre-like depressions on steep slopes, or 'cirques'.

The yellowish clayey-sand top layer (70-90 % sand) is 5-15 m thick. A gravel layer with rounded and subangular quartz and ironstone fragments forms the transition to the underlying layer succession.

6.5.4. Holocene alluvium

Holocene alluvium has been deposited, mainly in the coastal sections of the main river valleys.

6.6. Pediplanations

The history of the Congo in the Tertiary and Quaternary has been a continuous succession of denudation, slight deposition and vertical movement. Only on the Atlantic slopes marine Jurassic, Cretaceous and Eocene deposits are found (see above).

The contrasts of featureless plateaux and escarpments can be summarised as follows.

Long intervals of peneplanation occurred during the mid-Cretaceous.

Aridity became marked, interrupted by limestone-producing lakes. Oligocene and older deposits, then at the surface, became silicified (down to 90 m deep). Sands became chalcedonic quartzites...

Pronounced planation in the mid-Tertiary produced the Miocene peneplain.

A further stage of planation produced the Pliocene pediplain (end-Tertiary).

7. Soils

7.1. Introduction

The thick weathering mantles on old pediplain surfaces are at the origin of many present-day soils. Although parent materials are derived from underlying rocks, considerable reworking and slope movements have occurred, with the formation of stonelines and ironstone gravels. Recent soils only occur in alluvial valleys and on incised valley slopes and around rock outcrops.

This explains the thick, extremely weathered and homogeneous soil mantles (e.g. in the Niari-Nyanga Depression), although lithology is very distinct, soils are rather homogeneous. Some subdivision is possible:

- yellow Xanthic Ferralsols have been derived from limestone (terrain unit 710)
- reddish Haplic Ferralsols occur on schists and other rocks of the Schisto-Greseux System (terrain unit 720).
- The most poor and most permeable soils are those of the Batéké region (terrain units 810, 820, 830).

In the south of the Congo Republic following major soil texture groups can be distinguished:

a. Sandy soils

On the Batéké hills (830), and more rarely on the Schisto-Greseux plateaux (720). The sand fraction exceeds 80 %. A low CEC and a low base saturation make them of poor agricultural value.

b. Clayey-sand (sandy clay loam) soils

These occupy the Cataracts plateau (Schisto-Greseux System):

- red, usually strongly eroded, soils on rocks of the Inkisi Series
- colluvial or slope deposit soils on the M'Pioka Series.

In the Niari-Nyanga Depression, soils have a better fertility, because of their alluvial and colluvial origin.

c. Sandy clay soils

Most soils on the rocks of the Lower Schisto-Greseux System belong to this group. Fine sands are more abundant than coarse sands.

d. Clayey soils

Soils on the argilites of the M'Pioka Series (Schisto-Greseux System) and the majority of the soils of the Niari-Nyanga Depression belong to this group. The latter are more fertile, compared to the extremely poor soils of the Schisto-Greseux.

7.2. Soil correlation

This chapter presents a soil correlation between the French ORSTOM Soil Classification and the revised FAO system (tables 5 and 6). Table 7 shows the composition of the soil mapping units.

Several FAO soil phases were distinguished (table 2). These were NOT drawn on the soil map, as it could be interpreted that ALL soils of a mapping unit are characterized by that phase.

In many cases, a particular soil phase (e.g. petroferric phase) only affects part of the soils of that unit.

Table 2. Soil phases (FAO).

phase	Description
inundic	an area is flooded during more than 10 days, during the growing period
petro-ferric	a continuous ironstone crust occurs at < 1 m from the surface
phreatic	a groundwater table occurs at depth of < 5 m
rudic	stones and gravels in the topsoil and at the surface restrict mechanized agriculture
salic	the soils have an electrical conductivity of > 4 dS/m at a depth of < 1 m
skeletic	a layer of > 25 cm thick, with > 40 % ironstone concretions, or fragmented ironstone crust, occurs at a depth of < 50 cm
sodic	the soils have an exchangeable sodium percentage (ESP) of > 6, in some horizon, within 1 m of the surface
lithic	hard rock occurs at a depth of < 50 cm

Table 3. Subdivision of Ferralsols in the ORSTOM classification, based on the characteristics of the B horizon (Jamet and Rieffel, 1976)

Ferralsols subdivision	exchangeable bases cmol(+)/kg	base saturation %	pH water
weakly desaturated	2-8	40-80	5.5-6.5
moderately desaturated	1-3	20-40	4.5-6.0
strongly desaturated	< 1	< 20	< 5.5

Table 4. Criteria for group subdivision in the ORSTOM System

group	characteristics
typic (typique)	ABC-profile, of relatively similar texture throughout
clay eluviated (appauvri)	higher clay content in the B than in the A horizon
sandy (psammitique)	sandy and loamy sand soils
rejuvenated (rajeuni) • by erosion or modal • rejuvenated penevolved (rajeuni pénévolué) • penevolved (pénévolué) with a structural B horizon	 • parent rock at shallow depth • same and a strong structure • deep soils, strongly structured B horizon (Nitisols)

Table 5. Tentative soil correlation: FAO soil classifications of 1990 and 1974, USDA (1975), French ORSTOM classification (modified from Euroconsult, 1989)

FAO classification 1990 and (1974)	USDA 1975 classification	ORSTOM classification
Fluvisols	Fluvents	Sols minéraux bruts, et sols d'apport alluvial et colluvial
Gleysols		
Eutric and Dystric Gleysols	Aquents, Aquepts,	Sols hydromorphiques humifères à gley
Mollic Gleysols	Aquolls	Sols humiques à gley
Umbric Gleysols (Humic Gleysols)	Humaquepts	
Plinthosols (Plinthic Gleysols)	Plinthaquepts	Sols hydromorphes à accumulation de fer en carapace ou cuirasse
Regosols	Orthents	Sols minéraux bruts
Leptosols (Lithosols)	Entisols, Inceptisols	Lithosols et sols lithiques
Umbric Leptosols (Rankers)	Haplumbrepts	
Rendzic Leptosols (Rendzinas)	Rendolls	
Arenosols	Psamments	Sols peu évolués d'apport eolian
Ferralic Arenosols	Oxic Quartzipsamments	Sols ferrallitiques, moyennement ou fortement désaturés, à texture sableuse
Andosols	Andepts	Andosols
Vertisols	Vertisols	Vertisols
Solonchaks		
Haplic Solonchaks (Orthic Solonchaks)	Aquepts, Orthids, Salorthids	Sols halomorphes
Mollic Solonchaks	Salorthidic Calciustolls and Haplustolls	
Gleyic Solonchaks	Halaquepts	
Solonetz		
Haplic Solonetz (Orthic Solonetz)	Natrustalfs	Sols alcalins
Mollic Solonetz	Natrustolls	
Gleyic Solonetz	Natraqualfs	

FAO classification 1990 and (1974)	USDA 1975 classification	ORSTOM classification
Cambisols		
Eutric Cambisols	Eutrochrepts, Ustochrepts, Eutropepts	Sols ferrugineux tropicaux (non lessivés)
Dystric Cambisols	Dystrochrept, Dystropepts	Sols ferrallitiques, fortement et moyennement désaturés, rajeunis (part of)
	Haplumbrepts, Humitropepts	Sols ferrallitiques désaturés, rajeunis
Humic Cambisols	Aquic Dystrochrept or Eutrochrept	Sols ferrallitiques, fortement et moyennement désaturés, humifères, rajeunis
Calcaric Cambisols (Calcic Cambisols)	Eutrochrepts, Ustochrepts	
Vertic Cambisols	Vertic Tropepts	
Ferralic Cambisols	Oxic Tropepts	
Lixisols (part of Luvisols)	Alfisols	Sols ferrugineux tropicaux lessivés
Haplic Lixisols (Orthic Luvisols)	Hapludalfs, Haplustalfs	
Haplic Lixisols (Chromic Luvisols)	Rhodustalfs	
Ferric Lixisols (Ferric Luvisols)	-	
Gleyic Lixisols (Gleyic Luvisols)	Aqualfs	
Podzols	Spodosols	Sols Podzolisés
Haplic Podzols (Orthic Podzols)	Orthods	
Ferric Podzols	Ferrods	
Carbic Podzols (Humic Podzols)	Humods	
Gleyic Podzols	Aquods	
Planosols		Sols ferrigineux tropicaux lessivés (part of)
Eutric Planosols	Albaqualfs, Paleustalfs	
Dystric Planosols	Albaquults	
Mollic Planosols	Mollic Albaqualfs	
Acrisols	Ultisols	Sols ferrallitiques fortement désaturés (part of)
Haplic Acrisols (Orthic Acrisols)	Hapludults, Haplustults	

FAO classification 1990 and (1974)	USDA 1975 classification	ORSTOM classification
Ferric Acrisols	Paleustults	Sols ferrallitiques fortement désaturés (part of)
Humic Acrisols	Humults	
Plinthic Acrisols	Plinthaquults, Plinthudults, Plinthustults	
Gleyic Acrisols	Aquults	
Nitisols (Nitosols)		
Humic Nitisols	Tropohumults, Palehumults	Sols ferrallitiques moyennement désaturés, pénévolués
Haplic Nitisols (Dystric Nitosols)	Tropudults	
Haplic Nitisols (Eutric Nitosols)	Paleudalfs, Tropudalfs	Sols ferrugineux tropicaux lessivés
Rhodic Nitisols (Eutric Nitosols)	Rhodustalfs	
Rhodic Nitisols (Dystric Nitosols)	Rhodustults, Rhodudults	Sols ferrallitiques moyennement désaturés éluviés
Ferralsols	Oxisols	Sols ferrallitiques, fortement désaturés (FFD)
Haplic Ferralsols (Orthic Ferralsols)	Orthox, Ustox	FFD typiques
Xanthic Ferralsols		FFD jaunes
Rhodic Ferralsols	Eutrustox, Eutrorthox	FFD typiques
Humic Ferralsols	Humox	FFD humifères
Geric Ferralsols (Acric Ferralsols)	Acrox	
Plinthic Ferralsols	Plinthaquox	

Table 6. Tentative soil correlation: ORSTOM classification, FAO classification of 1990 and 1974, USDA (1975), (modified from Landon, 1984)

ORSTOM classification	USDA (1975) classification	FAO (1990) classification
Sols minéraux bruts (young mineral soils): C profile, rock outcrops	Orthents Psamments Fluvents	Leptosols Arenosols Fluvisols
Sols peu évolués (slightly evolved soils): A-C profile 1. d'érosion (eroded) 2. d'apport alluvial/colluvial		 1. Regosols, Leptosols 2. Fluvisols
• humifères (humiferous)	Orthents humitropepts	Regosols Humic Cambisols
• à allophanes (with allophanes)	Andepts	Andosols
• non-climatiques (non-climatic)	Orthents Fluvents Psamments Tropepts	Regosols, Fluvisols, Arenosols, Cambisols Calcaric Regosols Rendzic Leptosols
Andosols		
• saturés (saturated)	Eutrandepts	Mollic Andosols
• désaturés (desaturated)	hydrandepts dystrandepts	Humic Andosols Ochric Andosols
Vertisols	Vertisols	Vertisols
Sols hydromorphes (hydromorphic soils)	Aquents	Gleysols
Sols brunifiés tropicaux (tropical brown soils)	Eutropepts Tropudalfs	Cambisols Lixisols
Podzols + sols podzoliques (podzols + podzolic soils)	Spodosols	Podzols
Sols ferrugineux tropicaux (tropical ferruginous soils)		
• peu lessivés (slightly leached)	Ustropepts	Cambisols
• lessivés (leached)	Haplustalfs Paleustalfs Plinthustalfs	Lixisols Nitisols Plinthic Lixisols
• apauvris à pseudo-gley (leached with pseudo-gley)	Tropaqualfs	Gleyic Lixisols

ORSTOM classification	USDA (1975) classification	FAO (1990) classification
Sols ferrallitiques (ferralitic soils): A-Bo-C profile		
a. faiblement désaturés (slightly desaturated)		
• typiques (typic) thick red or yellow soils	Eutrorthox Eutrustox	Ferralsols
• appauvris (leached) leaching of Fe or clay from A horizon, out of the soil profile	Alfic Eutrustox	Haplic Ferralsols Xanthic Ferralsols
• remaniés (reworked), e.g. with stone or gravel layers		
• rajeunis (rejuvenated) erosion of a thick soil, down to the original material	Ustropept Eutropepts	Ferralic Cambisols Eutric Cambisols
• pénévolués (penevolved) B horizon with a strong structure		Haplic Nitisols
b. moyennement désaturés (moderately desaturated)		
• typiques (typic) thick, red or yellow	Haplorthox Haplustox	Haplic, Xanthic, Rhodic Ferralsols
• humifères (humiferous)	Haplohumox sombrihumox	Humic Ferralsols
• appauvris (leached)	Ultic + Alfic Haplorthox	Haplic Ferralsols
• remaniés (reworked)	Oxic Udults Haplorthox Haplustox	Acrisols Ferralsols
• rajeunis (rejuvenated) • rajeunis pénévolués (rejuvenated penevolved)	Typic and Oxic Dystropepts	Ferralic Cambisols
c. fortement désaturés (strongly desaturated)		
• typiques (typic)	Haplorthox Acrorthox Oxic Psammentic Dystropepts	Haplic Ferralsols Ferralic Cambisols
• humifères (humiferous)	Haplohumox Acrohumox Sombrihumox	Humic Ferralsols
• appauvris (leached)	Ultic subgroups of Haplorthox	Haplic Ferralsols Geric Ferralsols

ORSTOM classification	USDA (1975) classification	FAO (1990) classification
• remaniés (reworked)	Haplorthox Acrorthox	Haplic Ferralsols Geric Ferralsols
• rajeunis (rejuvenated) rajeunis pénévolués	Oxic Dystropepts	Ferralic Cambisols
• psammitiques (sandy)	Quartzipsamments	Ferralic Arenosols Luvic Arenosols
• lessivés (leached)	Paleudults Oxic Tropudults Oxic Rhodudults	Haplic Nitisols Haplic Acrisols
Sols hydromorphes (hydromorphic soils)		
Minéraux ou peu humifères (Mineral or slightly humiferous)		
• à gley (with gley)	Tropaquents Tropaquepts	Eutric and Dystric Gleysols
• lessivés (leached)	Tropaqualfs Tropaquults	Gleyic Lixisols Gleyic Acrisols
• à pseudogley (with pseudo-gley)	Aquic subgroups of Tropudalfs and Tropudults	
• à accumulation de fer en carapace ou cuirasse (with iron accumulation in ironstone pans)	Petroferric subgroups of Aquox, Aquult, Aquepts	petroferric phase of Gleyic Ferralsols Gleyic Acrisols Gleyic Cambisols
Sols hydromorphiques organiques et moyennement organiques (organic and moderately organic hydromorphic soils)	Histosols	Histosols

Table 7. Soil mapping units of the Republic of the Congo (FAO classification, 1990)

Associated soils cover > 20 %, inclusions < 20 % of the soil mapping unit.

region	mapping unit	assoc. soils	inclusions and phases (partly)	terrain units
peaty valleys of N Congo	HS - 2a	GLd, GLu	-	211
alluvial plains of the coastal belt	GL 1 - 2a	FLd	SC; inundic, phreatic phase	230
Congo river alluvium	GLd 1 - 2a	PT, FLd	HS	210
swampy valleys of the Congo Basin plain	GLu 1 - 1a	FRx, PZg	PZc, ARa	212
Central Congo Basin plain, Ivindo swamps	GLu 2 - 2a	FRx, HS	-	210, 240
incised valleys of central Congo	GLu 3 – 1/2a	ARo, FLu	-	220, 830/2
Sangha alluvial plain	FLd 1 - 2a	PT, NTh	phreatic, inundic phase	221
coastal plain	ARh1 – 1ab	GL, PZc	SC; inundic, phreatic, salic, sodic phase	100
Batéké hills	ARl 1 – 1/2b	ARo	-	830/1, 830/3
coastal plateau	ARo 1 - 1a	FRx, ARl	CMo, FLd, GLd	300
coastal plateau	ARo 2 - 1a	-	LXh, FRh, ACh	300
Batéké hills	ARo 3 - 1ab	FRh, FRg	-	830/1
Ibenga plateau	ARo 4 – 1a	ACf, RGd	-	860
Mayombe highlands	CMo 1 - 2bc	FRh, NTh	LP, GLd, PT, FRx; lithic, rudic, skeletic phase	610, 620, 510
NW Schisto-Greseux and Franceville plateaux	CMo 2 - 2/3b	FRh, ARo	ACg; lithic, rudic phase	720/1, 970
Cataracts plateau	FRh 1 - 3ab	FRx	FRr, GL, NT; petroferric, lithic, rudic phase	720/2
Kinkala hills	FRh 2 – 2b	FRx, ARo	-	810
Chaillu massif	FRh 3- 2b	FRu, FRx	FLd, GLd; skeletic phase	520

region	mapping unit	assoc. soils	inclusions and phases (partly)	terrain units
Ivindo and Lekona gneiss plateaux	FRh 4 - 2/3b	CMo	FLd, GLd; skeletic, petroferric phase	1010, 1020
Sembé-Ouésso and Dja tillite plateau	FRh 5 - 2b	NTh	FRr, CMo	960/1, 950
Sembé-Ouésso plateau	FRh 6 - 2b	FRr, NTh	-	960/1, 960/2
Mbaiki plateau (N Congo)	FRh 7 - 2ab	ARo	skeletic phase	940
Bambio plateaux Lango plateau	FRh 8 - 1/2a	ARo		840, 850
Upper Nouabalé plateau	FRh 9 - 2/3a	ACh	skeletic phase	930
Bomassa plateau	FRh 10	HS		980
Batéké plateaux remnants	FRg 1 – 1/2a	NTh, ARo	RGd, ARa, PZc, PZg	820
E Bouenza hills	FRg 2 - 2a	FRu, ARo	-	910
Niari-Nyanga hills	FRx 1 -2/3ab	GL, LXf	CMd, CMu; petroferric, skeletic phase	710/2, 630
- Pre-Mayombe + Niari-Nyanga plain - N-N northern foothills	FRx 2 – 3a FRx 2 – 3ab	ACp, NTh	FLd, GL, CMu; skeletic, petroferric phase	630 710/1 710/3
Bouenza hills, Niari tillite belt	FRx 3 – 2ab	ACh, NTh	ACP, FLd, CMu, GLd, skeletic, rudic phase	910, 920
Low plateaux of Congo Basin	FRx 4 - 1a	GLd, GLu	HS	410
Ivindo gneiss plateau and Low plateaux of the Congo	FRx 5 - 1/2a	GL, FRg	-	1020, 410
northern Batéké hills	FRx 6 - 1/2a	FRg, GL	ARa, PZg	830/1, 830/3
Mayombe highlands	NTh 1 -3c	FRh	ACu; lithic, rudic phase	620
Sembé-Ouésso plateau	NTh 2 - 2b	FRp, FRx	skeletic phase	960/1, 960/2

PART II

DATA BASE for the Republic of the CONGO

1. Introduction

This chapter gives a description of each terrain unit and component. They were coded according to the SOTER programme (version 2.5).

As the SOTER programme does only allow one entry, even in complex regions, a more accurate description of the terrain units can be found in following chapter.

Information has been structured as follows:

- SOTER database codes (numbered)
- geological and geomorphological information
- soil information: units, textural and slope classes (FAO, 1990), typical soil profiles
- vegetation (FAO, 1974 and other sources)

1.1. SOTER terrain characterization

In the following descriptions, codings (see SOTER manual) are presented for:

Terrain unit (0000)

4	major landform
5	regional slope
6	hypsometry
7	general lithology

Terrain components (0000/0)

10	proportion of the SOTER unit (%)
11	dominant slope
12	local surface form
13	depth to bedrock
14	parent material
15	surface drainage
16	depth of groundwater
17	frequency of flooding

1.2. Main terrain regions

Terrain units have not been numbered at random, but according to the major land regions to which they belong.

0100	Coastal plain
0200	Alluvial plains
0300	Coastal plateau
0400	Low plateaux of the Congo Basin (higher old alluvium)
0500	Granitic massifs/major intrusions/plateaux
0600	Mayombe highlands
0700	Western Congo Group landscapes
0800	Sandy plateaux
0900	Higher plateaux surrounding the Congo Basin (mainly schists, sandstones and quartzites)
1000	Gneiss plateaux
1100	Volcanic intrusions

1.3. List of terrain units/components of the Republic of the Congo

100	*Coastal plain*
200	*Alluvial plains*
210	Congo Basin plain
211	Peaty valleys of the northern Congo
212	Swampy valleys of the Congo Basin plain
220	Incised valleys in the plateaux
221	Sangha alluvial plain
230	Coastal belt alluvial plains
240	Ivindo or Souanké swamps
300	*Coastal plateau*
400	*Low plateaux of the Congo Basin*
410	Low plateaux of the Central Congo Basin (higher old alluvium)
500	*Granitic massifs/intrusions/plateaux*
510	Granite intrusions in the Mayombe highlands
520	Chaillu granite massif
600	*Mayombe highlands*
610	Coastal Mayombe
620	Interior Mayombe
630	Parallel chains or Pre-Mayombe hills
700	*Western Congo Group landscapes*
710	Niari-Nyanga Depression
720	Schisto-Greseux plateaux
720/1	NW plateaux
720/2	Cataracts plateau
720/3	dissected, partly sand-covered plateaux of Boko
800	*Sandy plateaux*
810	Kinkala sandy hills
820-830	Batéké region
820	Batéké plateau remnants
830/1	Batéké hills on polymorphic sandstone
830/2	dissected valleys in the Batéké region
830/3	Batéké hills with a dense drainage pattern (forested)
840	Bambio footslope plateau sections

850 Lango footslope plateau on Mesozoic rocks
860 Ibenga plateau

900 Higher plateaux surrounding the Congo Basin
910 Bouenza hills and plateau
920 Niari tillite belt
930 Upper Nouabalé plateau
940 Mbaiki plateau
950 Dja tillite plateau
960 Sembé-Ouésso plateau
960/1 main plateau
960/2 plateau on coarser rocks
970 Franceville plateau
980 Bomassa plateau

1000 Gneiss plateaux
1010 Lekona or Kéllé gneiss plateau
1020 Ivindo or Souanké gneiss plateau

1100 volcanic intrusions
1110 dolerite intrusions of the Sembé-Ouésso plateau

2. Description of the terrain units of the Republic of the Congo

100 Coastal plain

- SOTER (4) LP, (5) WE, (6) 1, (7) UM, (10) 100, (11) 0, (12) D, (13) > 100, (14) UM

- The coastal plain is low, swampy and thickly wooded, with sandy beaches and dunes. North of Pointe Indienne, the plain is discontinuous and narrow; south of it, it is a true coastal plain (3-6 km wide).

  - North of Pointe Indienne occurs a succession of sandy beaches, backed by forests or bush-covered dunes. A sandy string along the ocean is followed by swampy depressions, succeeded by the hills of the coastal plateau (terrain unit 300). In certain places those hills reach the coast. Small streams have their mouths blocked with sediments, swept north by the Benguela current.

  - S of Pointe Indienne, the coast is low and sandy, except for some capes (e.g. Pointe M'Vassa, Pointe Noire and Pointe Indienne), with low cliffs of Upper Cretaceous rocks. Low dunes (2-5 m high) separate the ocean from a lagoon belt (Malanda, Loubi, M'Vassa, Nombo, Tchikapa) and swamps with locally mangroves, papyrus, gallery forests and swamp grasslands. Behind the lagoons occur old, flattened dune belts (10-12 m high), with intermediate swamp zones. The most southern part consists of low divides, swampy valleys and sandy beaches.

- ARh 1 – 1ab, partly inundic, phreatic, or salic phase; profile CG006 (PZc)

  The dune soils are: *Sols ferrallitiques fortement désaturés, psammitiques, appauvris modaux ou hydromorphes* = hydromorphic or leached, strongly desaturated, sandy ferralitic soils. Podzols occur on top of the sandy belts (profile CG006).

- Vegetation is dry savannah (FAO vegetation unit 4e). Swampy coastal forest occupies the lowlands, behind the dunes or beaches, or behind mangroves. On the low dunes grow dense low trees. Grass savannah covers the coastal plain, with rare *Anona arenaria* (see chapter on vegetation for species).

200 Alluvial plains

210 Congo Basin plain

- SOTER (4) LP, (5) F, (6) 2, (7) UF, (10) 100, (11) 0, (12) D, (13) > 100, (14) UF

- The Congo Basin traces out a rough ellipse, the major axis which runs SW-NE. In this plain, the Congo is joined by its affluents: Ubangi, Sangha… All rivers flow wide and slowly between banks. They are entrenched in thick beds of alluvium. There are many swamps and lakes. The alluvial deposits have a gravelly base, passing gradually into sandy to coarse sandy layers. Clayey layers are rare.

- GLu 2 – 2a, GLd 1 – 2a;
  profile CG024 (GLd), profile CG032 (FLd)

- Regularly flooded tropical forest (FAO vegetation unit 1b). In the lower parts of the valleys there are widespread floods during heavy rainfall. The riverain flooded forest follows the lower courses of most rivers, forming a strip of varying width, depending on the nature of the banks and the width of the valley. Some flooded areas are very extensive. After the water subsides, the soil dries and it becomes relatively firm (for species, see chapter on vegetation). Tropical swamp forest (1c) is also abundant (see terrain unit 212 below).

211 Peaty valleys of the northern Congo

- SOTER (4) LV, (5) WE, (6) 2, (7) UO, (10) 100, (11) 0, (12) G, (13) 20, (14) UO

- These are poorly drained, flat valley bottoms with thick peat layers, in incised valleys in old alluvium (terrain unit 410).

- HS – 2a

- Vegetation (see 212).

212 Swampy valleys in the Congo basin plain

- SOTER (4) LV, (5) WE, (6) 2, (7) UF, (10) 100, (11) 0, (12) G (13) 2, (14) UF

- Many of the affluents of the Congo flow in wide, swampy, flat bottom valleys, surrounded by the extensive plain of the Congo Basin.

- GLu 1 – 1a, profile CG036 (GLu)

- Tropical swamp forest (FAO vegetation unit 1c). Despite an asphyxiating soil, the immense swampy area carries a tree cover in which the tree roots have prop or stilt roots. The main tree canopy is dense, but there are also well-developed lower layers and matted undergrowth. Large lianas are abundant. Many of the trees are the same as in the temporary flooded forest (see chapter on vegetation for species).

220 Incised valleys in the plateaux

- SOTER (4) LV, (5) WE, (6) 2, (7) UF, (10) 100, (11) 0, (12) G, (13) 10, (14) UF

- These valleys (300-400 m a.s.l.) have been incised in the central and northern plateaux, surrounding the Congo basin. They have flat bottoms, with humiferous, poorly drained, sometimes sandy soils.

- GLu 3 – 1/2a; profile CG034 (ARg)

- Vegetation, see 212.

221 Sangha alluvial valley

- SOTER (4) LV, (5) F, (6) 2, (7) UF, (10) 100, (11) 1, (12) T, (13) 50, (14) UF

- The wide Sangha alluvial valley has been distinguished as a separate terrain unit.

- FLd 1 – 2a, profile CG023 (FLd)

230 Coastal alluvial plains

- SOTER (4) LV, (5) WE, (6) 1, (7) UF (10) 100, (11) 0, (12) T, (13) 60, (14) UF

- Rivers flows in wide alluvial plains near to the ocean (terrain unit 100). The estuarine parts are saline. Valleys are deeply incised further inland, in the coastal plateau (terrain unit 300).

- GL 1 – 2a; partly inundic, phreatic, salic phase; profiles CG005 (FLd) and CG028 (ARg)

- Tropical inundated coastal formations, with mangroves (FAO vegetation unit 3a) grow on estuarine soils. There are networks of creeks, lined by mangroves and other coastal forests (see chapter on vegetation for species).

  As water becomes less saline, mangroves are gradually replaced up-river and on higher grounds, by a mixture of wild date palms (*Phoenix reclinata*), raphia palms (*Raphia laurentii* and R. *Sese*), screw-pines (*Pandanus*) and other trees. Many of these plants also have stilt roots and this forest is very similar to that of the mangroves, although much more varied in appearance. Large woody climbers (lianas) occur in places.

240 Ivindo or Souanké swamps

- SOTER (4) LV, (5) WE, (6) 2, (7) UF, (10) 100, (11) 0, (12) T, (13) 10, (14) UF

- Extensive swamps occur along the upper affluents of the Ogowé (Ivindo, Djoua…). The underlying basement is composed of Precambrian gneiss. Extensive areas of yellow Ferralsols border the swamps.

- GLu 2 – 2a; profile CG035: swamp borders (FRx, phreatic phase)

  Hydromorphic, yellow, sandy clay and bright yellow, sandy to clayey sand soils occur. Gley starts at a depth of 30-80 cm. The lowest positions are occupied by permanently saturated, humiferous, grey coarse sandy soils.

- Periodically or permanently inundated swamp vegetation.

300 Coastal plateau

- SOTER (4) LL, (5) G, (6) 1, (7) UE (10) 100, (11) 3, (12) D, (13) 20, (14) UE

- From the coastal plain, the land rises to the coastal plateau, at < 200 m a.s.l. It is covered by the sandy “Cirques Series” and extends to the foot of the Mayombe in the east. The coastal plateau conserves a pediplain remnant (Miocene or Pliocene), over Mesozoic-Cenozoic sedimentary rocks (marls, limestones, sandstones...). Relief is slightly undulating, at 100-120 m a.s.l. Deep valleys, with flat bottoms, dissect the plateau (often slopes of > 50 %). Those slopes are affected by theatre-like erosion, called ‘cirques’ (Cirques series). Many circular closed depressions are probably the result of subsoil dissolution. Following succession exists (top to bottom)

  - Plio-Pleistocene sandy Cirques Series
  - Marine and continental Tertiary Ocre clayey sands
  - Marine Cretaceous rocks
  - Sub-littoral sandstone

- ARo 1 – 1a and ARo 2 – 1a; profile CG012 (ARl)

- Vegetation is dry savannah (FAO vegetation unit 4e): a grassy plateau, with scattered stunted shrubs, intersected by shallow, more or less wooded depressions. To the east, vegetation becomes more luxuriant, forming a transition to the grasslands of the next region.

  Low herbs do not cover the soil completely and form pseudo-steppes. *Anona arenaria* is present everywhere. *Hymenocardia acida* appears in the hilly zone, at the foot of the Mayombe.

400 Low plateaux of the Congo Basin

410 Low plateaux of the Central Congo Basin (higher old alluvium)

- SOTER (4) LL, (5) U, (6) 2, (7) UL (10) 100, (11) 1, (12) D, (13) 60, (14) UL

- The low plateaux border the Central Congo Basin in the west. They are overlain by thick Pleistocene layers (Salonga and Yangambi deposits of the DRC), called the “higher or terraced old alluvium” in the Republic of the Congo, of fluviatile and fluvio-lacustrine origin. Relief is undulating. The > 40 m thick deposits rest on a Late-Tertiary surface. There is a basal gravel layer. Quartz is the main sand grain.

- FRx 4 – 1a, profiles CG022 (FRx) and CG032 (FRx)

  Soils are Xanthic Ferralsols, developed in pre-weathered and transported materials.

- Vegetation is tropical lowland rainforest (FAO vegetation unit 1a). This is a zone of lower dry ground with typical rain forest. In general the forest is evergreen, but some deciduous trees occur and these increase near the outskirts, where the climate approaches that of the surrounding savannahs. The tropical forest is never leafless and consists of several strata, including an upper strata of large trees, which may be 40-60 m high. The forest has in many places been degraded to secondary forest (see chapter on vegetation for species).

500 Granitic massifs

510 Granitic intrusions in the Mayombe

- SOTER (4) SU, (5) DO, (6) 7, (7) IA1, (10) 100, (11) 25, (12) D, (13) 1.5, (14) IA1

- Granite and quartzo-diorite intrusions are common. Only larger intrusions could be mapped. These areas are strongly dissected, with slopes up to 60 %. Rounded hills or domes have steep lower slopes descending to narrow, often hydromorphic valleys. Erosion has exposed rock outcrops on steep slopes.

- CMo 1 – 2bc, partly lithic, skeletic or rudic phase; profile CG009 (FRx)

  Yellowish brown to yellowish red soils, with usually 35-50 % clay in the B horizon.

  Sols ferrallitiques fortement désaturés, (faiblement) appauvris, à Bgr à profondeur variable, sur matériau argilo-sableux à argileux, issus de l'alteration des granites et diorites quartzitiques = strongly desaturated, (slightly) leached, Ferralsols on granite and quartzo-diorite, overlying a gravel layer, sometimes with ironstone fragments.

- Vegetation: see terrain unit 600.

520 Chaillu granite massif

- SOTER (4) LL, (5) RI, (6) 3, (7) IA1, (10) 100, (11) 15, (12) D, (13) 4, (14) IA1

- The massif is oriented in a NW direction, 500 km long and 150 km wide. It is a giant granite batholith, with minor metamorphic inclusions and (ultra)basic intrusions. Relief is composed of SE-NW ridges. Rivers follow the same direction. The highest tops reach 903 m (Boungou mountains). They keep this height on the watershed between the Louessé and the Nyanga. Towards the S, altitude drops to 700-500 m. The relatively low tops and high plains of this stepped massif have been deeply dissected by streams. Usually, convex slopes become steeper downslope and valley bottoms are generally narrow.

  - In the SW and N, relief is dominated by a pediplain surface, with flattened hill tops or flat plateaux, dissected by some V-shaped valleys;

  - the central part contains higher tops (N'Doumou mountains), with in the S, high half-orange-shaped hills.

  - Only the main rivers (Lékoumou, Loyo, Louengo and Lélali) have an important alluvial plain.

- FRh 6 - 3ab, partly skeletic phase; profile CG030 (FRu)

  Soils are usually 4 m thick, reworked, homogeneous, coarse sandy clay Haplic and Humic Ferralsols, without gravels, overlying gravel layers and weathered rock.

  Under forest, the topsoil (0-10 cm) contains an average clay content of 40-52 %, 5-7 % organic matter, a C/N ratio of 12-14.5; a pH of 3.6-4.0; the sum of exchangeable bases is 0.3-0.8 cmol(+)/kg and base saturation is < 10 %.

  Under savannah it contains an average clay content of 45-52 %, 4.5-6.5 % organic matter, a C/N ratio of 14-18; a pH of 4.5-4.7; the sum of exchangeable bases is 0.3-0.6 cmol(+)/kg and base saturation is < 15 %.

  Sols ferrallitiques remaniés, jaunes, argilo-sableux, issus de roche granitique, à recouvrement épais = thick, reworked, yellow, sandy clay ferralitic soils, derived from granitic rocks).

- Vegetation is dense evergreen rainforest (FAO vegetation unit 1a), with leguminoses (see chapter on vegetation for species). Important crops are Robusta coffee, oil palm and rubber.

600 Mayombe highlands

- SOTER (4) SU, (5) RI, (6) 7, (7) MA1

- The Mayombe, or Crystal Mountains, are a 60 km wide succession of sharp ridges, with elevations of 500-800 m a.s.l. Folded layers have generally a SSE to NNW orientation, parallel to the coast. The highlands have been deeply dissected. They are a real barrier between the coast and the interior. 200-300 m high and steep slopes rise above the rivers. Since recent uplift, streams are rejuvenating the landscape. The Niari-Kouilou breaks through the mountains at the 'Portes de N'Gotou'. Gravel terraces occur several metres above the present day rivers.

  The Mayombe are composed of the strongly metamorphic Precambrian Mayombe System. Rocks are schists, quartzites, greenstones and intrusives such as granite (terrain unit 510) (see chapter on geology for more details).

- Soils derived from quartzites and quartzitic sandstones have a more sandy texture and a poorly developed soil structure. Soils on schists are clayey and better structured. All soils are acid and strongly desaturated. On schists, topsoil pH values of 3.5 are common. Potassium levels are high.

- The Mayombe dense rainforest agrees in general with the dry ground forest of the central Congo basin. Many species common in the Mayombe, being comparatively rare in the rest of the Congo (see chapter on vegetation for species). Ferns over 3 m high are a striking feature.

  Generally, secondary forest is much denser, with numerous small trees and considerable undergrowth, especially of tall herbs and shrubs.

610 Coastal Mayombe

- SOTER (4) SU, (5) RI, (6) 7, (7) MB2, (10) 100, (11) 25, (12) D, (13) 1.5, (14) MB2

- The Coastal Mayombe (300-400 m a.s.l.) is built of crystalline and metamorphic rocks of the Mayombe System (Loémé, Bikossi, Loukoula Series): quartzites, graphytic schists, quartz mica-schists, martite-chlorito-schists, epidotes, calcareous green schists. Towards the coastal plain, slopes are gentle. The crystalline zone extends from Bilinga to S of M'Vouti. In the S, gneiss is also common. The northern part is more dissected, with mica-schists, chlorito-schists and epidotes.

  There is a succession of chains of resistant rocks (mainly quartzites) and elongated depressions, formed by softer rocks (schists). The folded Mayombe has an Appalachian relief. Most valleys are either deep and V-shaped, or large with an almost flat bottom, with meandering rivers.

- CMo 1 – 2bc; partly skeletic, rudic or lithic phase; profile CG007 (CMo)

  Sols ferrallitiques fortement désaturés, faiblement appauvris, à Bgr à profondeur variable, sur matériau argilo-sableux à argileux, issus de l'alteration de roches schisteuses = slightly leached, strongly desaturated ferralitic soils on schists. These soils contain 40-50 % of clay; 5-10 % silt; fine sands; a strong medium blocky structure; they overlie gravel layers.

  Sols ferrallitiques fortement désaturés, appauvris modaux, à Bgr à profondeur variable, sur matériau argilo-sableux à argileux, issus de l'alteration des roches métamorphiques schisteuses = leached, strongly desaturated ferralitic soils on schists or gneiss, overlying a gravel layer.

  Sols ferrallitiques fortement désaturés, appauvris en argile, à Bgr à profondeur variable, sur matériau argilo-sableux, issus de l'alteration des grès ou grès quartzites = clay eluviated, strongly desaturated,ferralitic soils on sandstones or quartzites; on slightly sloping or flat surfaces; deep soils overlying a gravel layer.

  Sols ferrallitiques fortement désaturés, rajeunis par érosion, sur matériau argilo-sableux issu de l'altération des grès = rejuvenated eroded, strongly desaturated ferralitic soils; with a steep relief, on sandstone, quartzite, metamorphic rocks.

620 Interior Mayombe

- SOTER (4) SU, (5) RI, (6) 7, (7) MA1, (10) 100, (11) 25, (12) D, (13) 1.5, (14) MA1

- The Interior Mayombe is composed of the 'Quartzo-schisteux': less metamorphic rocks: quartzites, sandstones and limestones (M'Vouti Series, Mount Bamba System), at 600-800 m a.s.l. The ridges rise 200-300 m above the Niari-Nyanga Depression.

- CMo 1 - 2bc, NTh 1 – 3c; partly rudic or lithic phase; profiles CG005 (LPu) and CG011 (CMo)

  Sols ferrallitiques fortement désaturés, faiblement appauvris, à Bgr à profondeur variable, sur matériau argilo-sableux à argileux, issus de l'alteration de roches schisteuses = slightly leached, strongly desaturated, ferralitic soils on schists. They contain 40-50 % clay; 5-10 % silt; fine sands; a strong medium blocky structure and overlie gravel layers.

  Sols ferrallitiques fortement désaturés, appauvris en argile, à Bgr à profondeur variable, sur matériau argilo-sableux, issus de l'alteration des grès ou grès quartzites = clay eluviated, strongly desaturated ferralitic soils, overlying gravel layers, on sandstones or quartzites. These deep soils occur on slight slopes or on flat surfaces.

630 Parallel chains or Pre-Mayombe hills

- SOTER (4) SR, (5) DO, (6) 7, (7), SC2, (10) 100, (11) 25, (12) D, (13) 1.5, (14) SC2

- The parallel chains (400-800 m a.s.l.) are built of sandstones and argilites. The hills run parallel to the Mayombe. Rocks belong to the Mossouva Series (Bamba Mountains System), Louila Series and Lower tillite (WCG), all strongly folded. The chains are separated by elongated lowlands, often with a flat bottom and silty clay to clayey alluvium, sometimes swampy (Yambi swamp, Kimongo region).

  The hills are 2-3 km wide and altitude decreases from 700-800 m a.s.l. on the Cabinda border, to 400-500 m a.s.l. on the hills dominating the Niari-Nyanga Depression, in the east. Part of the dense drainage system has an opposed NE-SW direction, cutting the parallel chains in domes, with deep, dry ravines and rocky crests. Slopes often exceed 50 %. Hills and domes are generally built of clayey rocks, while rocky crestlines are made of sandstone, sometimes forming escarpments.

- FRx 1 – 2/3ab, FRx 2 – 3a; partly rudic or lithic phase; profile CG014 (FRx)

  Soils are very deep, with little textural differentiation, clay content is high, there is a structured A horizon and a strong desaturation. Some soils are shallow (lithic phase and Leptosols). Stone layers are common. The deepest soils occur on tops and upper slopes. Landslide niches and erosion staircase micro-relief is common. Deep gullies have been fixed by forest.

  Sols ferrallitiques typiques, jaunes, fortement désaturés, sur argilites de la Louila, sur pentes fortes = strongly desaturated, yellow, typic ferralitic soils, on argilites of the Louila series, on steep slopes.

  Sols ferrallitiques fortement désaturés, à Bgr issu des argilites de la Louila, de pentes fortes = shallow, strongly desaturated ferralitic soils, on a gravel layer, on argilites of the Louila series, on steep slopes.

  Sols ferrallitiques fortement désaturés, pénévolués et rajeunis par érosion, sur matériau argileux de l'altération des argilites de la Louila = shallow or on gravel layers, rejuvenated, eroded, penevolved, strongly desaturated ferralitic soils, on argilites of the Louila Series.

- Vegetation is slightly shrubby savannah with forest islands, becoming a dense forest in Cabinda and on the border with the DRC.

700 Western Congo Group landscapes

- The Western Congo Group is divided into (bottom to top):

    - *Lower tillite of Lower Congo Series*: tillite, schists, quartzites, doloritic lavas;
    - *Louila* (terrain unit 630) *and Bouenza Series* (terrain unit 910): breccia, limestones, calc-schists, clayey limestones, schists, quartzites, basal conglomerate;
    - *Upper tillite or Niari tillite* (terrain unit 920)
    - Schisto-Calcaire System (important area, terrain unit 710)
    - Schisto-Greseux System (important area, terrain unit 720)

- Vegetation is tropical semi-deciduous rainforest, or equatorial savannah (FAO vegetation unit 2a). Rainforest species are intermixed with deciduous species. Semi-deciduous rainforests grow especially along rivers and in groves on hills and plateaux. Savannah vegetation is due to degradation, or to various ecological conditions. These are tall grass savannahs, frequently burned off by farmers and hunters.

  On rather poor, dry, sandy, stony or gravelly soils, usually on plateaux between streams, occur short-grass savannahs or steppes. The grass cover is never continuous. The short-grass savannah may be almost entirely devoid of trees over large areas, but also frequently more or less wooded with small trees and shrubs, with *Hymenocardia acida*. Short grass savannah frequently occurs on ironstone pan soils with rooting problems for taller grasses (see chapter on vegetation for species).

710 Niari-Nyanga Depression

- SOTER (4) CD, (5) KA, (6) 2, (7) SO1

- The Schisto-Calcaire depression, at 200-450 m a.s.l., is built of Precambrian-Cambrian dolomitic limestones, dolomites, limestones, cherts, schists, calc-schists, breccia, conglomerates, clayey dolomites, calcareous psammites and calcareous sandstones (see chapter on geology for more details). The Depression is a large synclinal. It touches the Mayombe (terrain unit 630) in the SW and the granitic Chaillu massif (terrain unit 520) in the NE. The depression reaches its maximal extension between Loudima and Madingou. Relief is complicated, due to the presence of terraces at different altitudes. Numerous calcareous hills, commonly inselberg-shaped, testify of intense erosion. The Niari river flows at an altitude of 200-100 m. The surrounding plateaux (720, 910…) have altitudes of 500-700 m, with some higher points (Mont N'Gouédi, 720 m. Mont Kinoumbou 784 m and summits of 820 m SE of Boko-Songho).

  The region coincides in broad lines with a savannah zone. An old pediplain extends to the foot of the Cataracts Plateau (terrain unit 720).

  Three distinct landscapes exists, the:

  - 'plain' on soft, marly calcareous formations (SCII),
  - aureoles of hills and "fingers" of harder dolomitic limestone (SCIII), around sandstone plateaux,
  - northern foothills of the sandstone plateaux, cut out of harder SCI limestones,

- Except for river gallery forests, this region is covered by shrub savannah (see chapter on vegetation for species). In steep areas, gallery forests also spread on slopes and form some minor forests (Bangou, Massagé), with *Terminalia superba* and *Ceiba pentandra*. There are two types of savannahs:

  - Savannah with *Hymenocardia acida* is common around the Niari-Nyanga Depression, but absent in most of the depression itself. It can however be found on the sandy contact zone, near the Schisto-Greseux sandstones (terrain unit 720), or on sandy alluvium.

- Savannah without *Hymenocardia acida*:

  - dense savannahs with high *Beckeropsis uniseta* and *Pennisetum purpureum* (elephant grass) in humid zones;

  - dense savannah with *Hyparrhenia diplandra* on deep clay or sandy clay soils;

  - low savannah with *Hyparrhenia lecomtei* and *Andropogon pseudapricus* on shallow soils;

  - savannah with *Andropogon pseudapricus* and *Trichopteryx* on eroded soils.

710/1 Niari 'plain'

- SOTER (10) 55, (11) 5, (12) K, (13) 3, (14) SO1

- This term designs in broad lines the savannah zone located on Schisto-Calcaire rocks. Altitude differences are 30 m to > 200 m in the east. There is no clear distinction between the watersheds of the Niari and Nyanga rivers. Rocks are marly limestones of the Schisto-Calcaire (SCII).

  There are numerous swampy depressions: sink holes or dolines, sometimes occupied by a lake. There are dry valleys. Dolines are filled up by clays.

  In the middle of this Karst plain occur isolated limestone sugar-leaf hills, e.g. in between Dolisie and Kibangou (tropical karst). Dolomite outcrops build typical domes.

  To the left of the river (S), relief is subdued. There are terraces, with on higher ground, an extensive clayey plain or low "plateau of the Niari river", with an ironstone pan (petroferric phase). This is an old pediplain, extending to the foot of the Cataracts Plateau. The plain is widely undulating and descends abruptly to the actual Niari valley. A series of residual and gravelly limestone hills (600 m a.s.l.) of SCII and rarely SCIII rocks emerge in the plain. The drainage pattern is scarce. Water circulation occurs below the surface.

The actual Niari valley is narrow and dissected in the old pediplain. The river has a narrow alluvial plain. Temporary hydromorphism characterizes the soils of the Niari terraces.

- FRx 2 – 3a, partly skeletic, or petroferric phase; profile CG008 (FRx)

  Soils are thick, yellow, clayey Ferralsols. Ferruginous pans are common. Ironstone blocks and gravels are common at the surface. A typical profile is composed of (top to bottom):

  - a yellow sandy clay Ferralsol, abruptly overlying
  - ironstone concretions, in a hard red clay, with some rounded, larger fragments
  - a clayey decalcification zone
  - limestone

  The yellow clays of the plain are completely decalcified. On rejuvenated hills and slopes, calcareous soils also occur.

  - Reworked yellow silty clay Ferralsols, on marly limestones or shales, under savannah, have (0-10 cm) an average clay content of 55-70 %, 6-7 % organic matter, a C/N ratio of 16-19; pH is 3.8-4.8; the sum of exchangeable bases is 1-3 cmol(+)/kg and base saturation is < 20 %.

  - Reworked, moderately desaturated, rejuvenated, silty clay Ferralsols, derived from the Schisto-Calcaire, have (0-10 cm), under savannah, an average clay content of 38-50 %, 4-7 % organic matter, a C/N ratio of 14-15; pH is 4.8-5.8; the sum of exchangeable bases is 3-30 cmol(+)/kg and base saturation is 15-70 %.

  The higher parts of the widely undulating Niari plain are covered with the rejuvenated Ferralsols, while the lower parts are occupied by temporary hydromorphic soils.

  The best soils occur on flat to slightly depressed areas, on silty clay colluvial soils. They have a moderate to good soil structure and a good to very good organic matter content, sum of bases and mineral reserves. Clayey soils on the same substratum are well structured. However, soil structure is easily destroyed by wrong management. These soils are chemically poor, but contain enough organic matter.

- *Sols ferrallitiques fortement désaturés, remaniés, faiblement appauvris, argilo-sableux, dérivés de marnes greseuses (SCII)* = slightly leached, reworked, strongly desaturated, sandy clay soils, derived from sandy marls (SCII).

- *Sols ferrallitiques remaniés, jaunes, argileux, issus du Schisto-Calcaire* = reworked, yellow, clayey, ferrallitic soils, derived from the Schisto-Calcaire

- *Sols ferrallitiques remaniés, rajeunis, argilo-limoneux à argileux, dérivés du Schisto-Calcaire* = rejuvenated, reworked, silty clay to clay, ferralitic soils, derived from the Schisto-Calcaire (gravels at < 60 cm, overlying weathered limestone: N of the Niari river, on the hills succeeding the clayey low plateau).

- *Sols ferrallitiques, typiques, jaunes, sur colluvions argilo-limoneuses issus du Schisto-Calcaire moyen de zone plane* = yellow, typic Ferralic soils, on silty clay alluvium of the Middle Schisto-Calcaire plain (SCII). These soils cover important parts of the lower non-hydromorphic plain, near limestone hills.

- *Sols ferrallitiques, appauvris, jaunes, sur matériau argilo-limoneux à argileux de zone plane* = yellow, leached, ferralitic soils, on silty clay to clay deposits of the plain. These soils cover important parts of the plain, near limestone hills.

- *Sols ferrallitiques typiques, jaunes, fortement désaturés, issus du Schisto-Calcaire, de zone plane* = strongly desaturated, yellow, typic ferralitic soils, on the Schisto-Calcaire plain. These soils form, S of the river, the old plain or “plateau of the Niari valley”. Soils are, 3 m deep, yellow, decalcified clays (SCII), overlying a ferruginous gravel layer (ironstone pan pieces, quartz...)

- *Sols ferrallitiques fortements désaturés, hydromorphes, sur matériau argilo-sableux à argileux, issu du Schisto-Calcaire* = hydromorphic, strongly desaturated, ferralitic soils, on silty clay to clay of the Schisto-Calcaire (temporary hydromorphism).

The soils of the present-day river floodplain have a variable texture and are somewhat humiferous. They are temporarily inundated.

- *sols peu évolués d’apport alluvial, hydromorphes* = hydromorphic, slightly evolved soils of alluvial origin.

On river terraces occur:

- *sols ferrallitiques appauvris hydromorphes sur matérau argilo-limoneux* = hydromorphic, leached, ferralitic soils, on silty clay deposits, with ironstone concretions; suitable for potato, fruit trees, bananas.

- Vegetation is grass-herb savannah with some shrubs; and gallery forests along the rivers. Forest is found on some crest-lines.

710/2 Calcareous borders (SCIII) of sandstone plateaux

- SOTER (10) 15, (11) 30, (12) M, (13) 3, (14) SC2

- Some hills in the Depression have preserved a top of Schisto-Greseux rocks: Comba Mts, Mount Kinoumbo, Mount Bélo... Calcareous and dolomitic outcrops occur in concentric layers around them. These are low hills with inselberg-finger shapes, built from more resistant dolomitic limestones (SCIII). Hill slopes are steep (20-40%) and summits are flat, sometimes forming plateaux. Mount Bélo, SW of Loudima (Schisto-Greseux overlying Schisto-Calcaire, SCIII) and the Little Bamba chain (500 m a.s.l.) are typical examples. More to the south, similar hills border the valleys of the Louvakou, the Mafoubou and the Loudima.

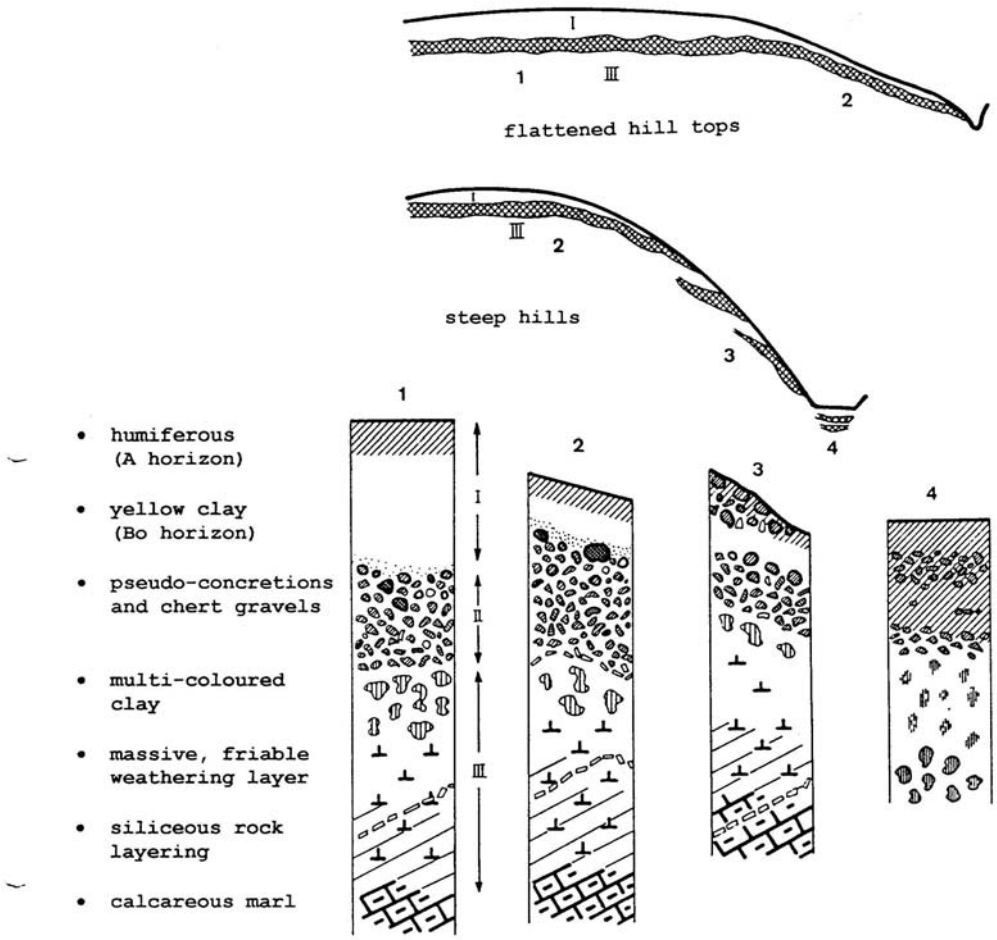
  The Mount Bélo plateau has an irregular topography, marked by a sandstone top overlying limestone. The plateau rises 50-100 m above the plain and looks like a cuesta. Surrounding dolomitic limestone hills sometimes also have conserved a sandstone top and are flat-topped. Without sandstone cap, they are conical, 20-60 m high. They are aligned in between river basins. The same morphology appears around the Cataracts plateau (720).

  W of the Niari-Kouilou, near the Gabon border, the clayey sandstone plateaux and ridges of Banda (SCIV) sharply rise 150-200 m above the calcareous plains.

- FRx 1 – 2/3ab, partly skeletic or petroferric phase; profile CG013 (LXf)

  Ferralsols on the plateaux are deep (> 2.5 m), even down to 6 m. On slopes and hills, soils are (Ferric) Lixisols, only shallow on active erosion surfaces.

- Savannah, see chapter on vegetation for species.



Sols ferrallitiques fortement désaturés remaniés jaunes =
Yellow, reworked, strongly desaturated Xanthic Ferralsols (FRx)

1. with a thick soil mantle
2. truncated by erosion
3. –do-
4. hydromorphic with pseudo-gley

Fig. 8. Soil topo-sequence on Schisto-Calcaire rocks of the Niari-Nyanga Depression, terrain unit 710 (de Boissezon and Gras, 1970)

710/3 Northern foothills and plateaux (SCI) (Mouyondzi-Sibiti Plateaux)

- SOTER (10) 30, (11) 5, (12) D, (13) 3, (14) S01

- To the right (N) of the Niari river, occurs a succession of hillocks and hills, separated by a dense drainage pattern. The hills form parallel chains. The terrain rises gradually to the Mouyondzi Plateau (SCI over SCII), which forms the northern limit of the Niari-Nyanga Depression. The Bambembé plateau occurs in the east, near Mouyondzi, and the Bayakas plateau W of Sibiti (both at 500 m a.s.l.). They are rising gradually in a dissected hilly country.

  Two subunits can be distinguished (from N to S):

  - **Tableland plateaux** (remnants of an old pediplain), on clayey limestones and dolomites; with deep, yellow to yellowish brown, clayey soils, with a gravel layer at > 2.5 m..

    The Mouyondzi Plateau (SCIab) is covered by a sub-horizontal ironstone pan at shallow depth. Outcrops of the pan occur on valley slopes and on the plateau rim. The same pan can be traced across the Niari-Nyanga Depression on the Cataracts Plateau (terrain unit 720) and on the foothills of the Mayombe (terrain unit 630).

    There is no permanent drainage system and there is little relief on the plateaux. Only where the plateau occurs on SCIc rocks, there are some dolines.

    - FRx 2 – 3ab; partly skeletic or petroferric phase; profile CG002 (FRx)

      There are gravel layers, with ironstone pieces, covered by gravel-free, very clayey soils of about 2.5 m thick.

      Reworked, yellow, clayey Ferralsols, with ironstone pieces have (0-10 cm), under savannah, an average clay content of 60-75 %, 4-8 % organic matter, a C/N ratio of 15-20; pH is 4-5; the sum of exchangeable bases is 1-2 cmol(+)/kg and base saturation is < 30%.

Sols ferrallitiques remaniés, jaunes, argileux (à anciennes cuirasses), issus essentiellement de calcaire marneux (SC et Bz3) ou argilite (Bz1), à recouvrement épais = thick, yellow, clayey, ferralitic soils (overlying a gravel layer with ironstone fragments), derived from marly limestones (SC and Bz3) or shales (Bz1).

- This is a densely populated area. Crops are oil palm, banana, mango, pineapple, robusta coffee, oranges, mandarines, lemon, maize, yams, groundnuts, cassava…

- **Plateau borders and steep hill chains**, without gravels, or with a gravel layer near to the surface.

  Hill slopes are convex and steep, 25-40 %. Valleys are narrow. The hill pattern is dense. Slopes are sometimes covered by ironstone blocks. Soils developed in Schisto-Calcaire rocks of the SCIc and SCIb.

  - FRx 2 – 3ab

    Soils are yellow, clayey Ferralsols, but as the upper layers have been eroded, a gravel layer is found at < 1 m depth. Eroded and deep soils are intensely mixed.

    Sols ferrallitiques rajeunis, à B(u,gr) à faible profondeur, sur matériau argilo-limoneux à argileux, issu du Schisto-Calcaire inférieur et moyen, en pente = shallow, rejuvenated, ferralitic soils, on silty clay to clay deposits, derived from the lower and middle Schisto-Calcaire (SCI and II), on slopes.

- Vegetation of the Mouyondzi plateau is savannah, with *Hyparrhenia diplandra* and *Hymenocardia acida*. Semi-deciduous forest with *Terminalia superba* exists in valleys and on some border slopes of the plateau. In the east, part of the Messagé Forest occurs on the plateau.

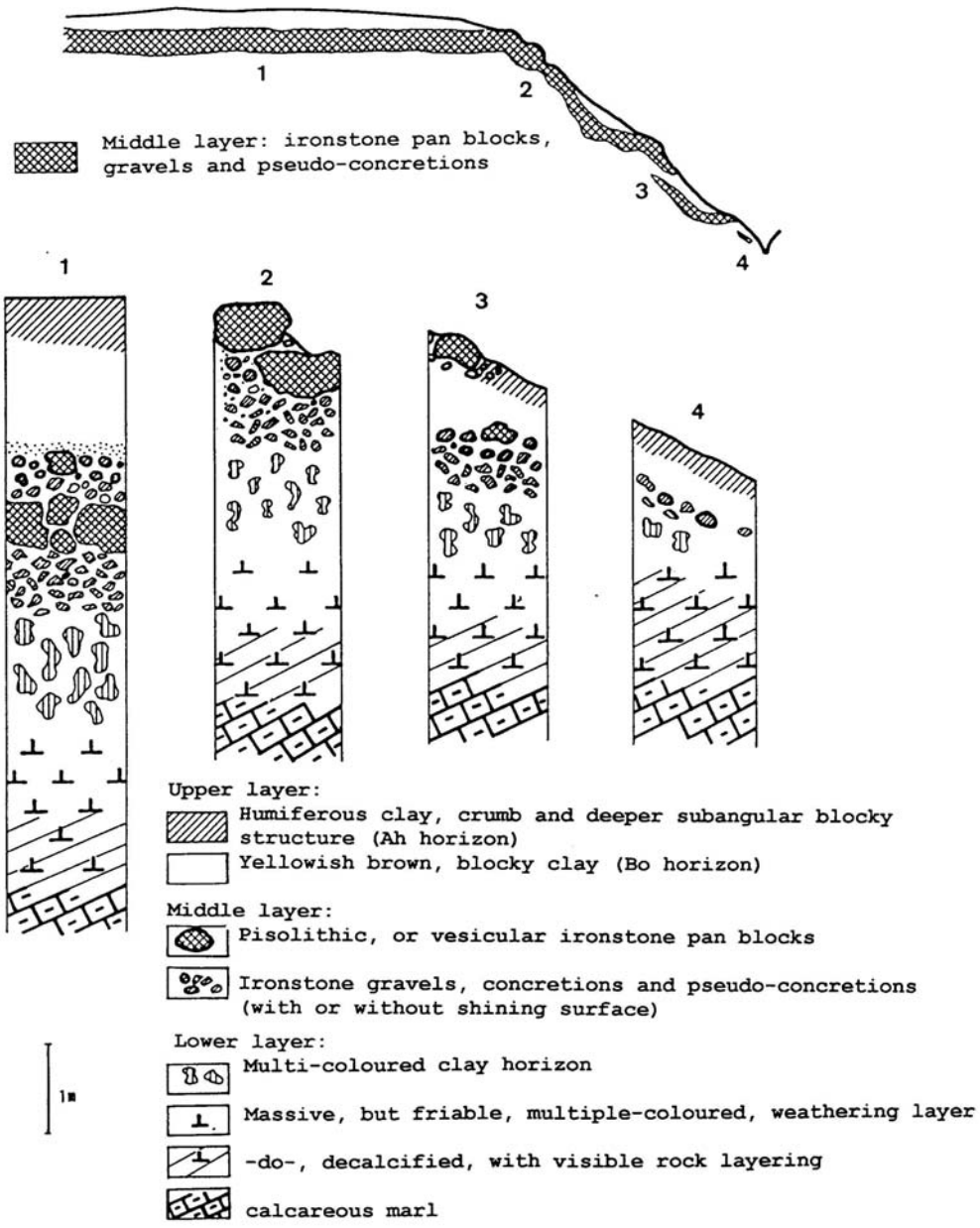


Fig. 9. Soils of the Mouyondzi plateau (710/3) (de Boissezon and Gras, 1970)

720 Schisto-Greseux plateaux

- SOTER (4) LL, (5) R, (6) 3, (7) SC2

- The Schisto-Greseux System, of Cambrian-Devonian age, is composed of two series, from top to bottom:

    - Inkisi Series: an important quartzite-arkose series, with schists, quartzites, arkoses, and a basal conglomerate.

    - M'Pioka Series: covering extensive surfaces on the Cataracts plateau, composed of quartzites, schists, breccia, calcareous sandstones and conglomerate.

720/1 NW Schisto-Greseux plateaux

- SOTER (10) 20, (11) 5, (12) D, (13) 4, (14) SC2

- CMo 2 – 2/3b; partly rudic, or lithic phase

720/2 Cataracts plateau

- SOTER (10) 65, (11) 5, (12) D, (13) 4, (14) SC2

- The undulating Cataracts plateau divides the Congo and Niari basins. Average altitude varies from 500 m a.s.l. to 800 m in the west, near Boko-Songho (about 300-400 m above the Niari-Nyanga depression.

  The plateau top is an old planation surface, remodelled during later cycles. Rivers on the plateau flow slow and meander in often swampy valleys. They descend in falls or rapids to the Congo or Niari. The western plateau has been cut into blocks, separated by valleys cut into older Schisto-Calcaire rocks (of terrain unit 710): Mont N'Gouédi (720 m), Mont Kinoumbou (784 m), Kissenga Plateau...

  Between Mindouli and Loudima, the Cataracts plateau dominates the Niari valley with an abrupt cuesta, often preceded, as south of Madingou, by isolated plateau remnants.

  The N step to the Cataracts Plateaux is abrupt. At Mindouli, the plateau escarpment is continuous and oriented along the 'direction combienne'.

  In the east, between Djoué and Boko, Schisto-Calcaire and Schisto-Greseux rocks disappear below the sands of the Batéké. Relief then consists of low and rounded hills (see Kinkala hills, terrain component 810).

  Near Marchand, eroded slopes are wider and deep ravines are cut in the plateau border; the less permeable soil is continuously eroded.

  Along the Congo valley, the plateau rim is a zone of intense erosion. Hilltops and steep slopes are devoid of vegetation and ravines of tens of metres deep are common. Immediately below the Stanley Pool starts a canyon, with hanging affluent valleys. The Congo flows max. 480 m below the plateau (Kendelo). Further away from the river the plateau is less dissected.

- FRh 1 – 3ab, partly petroferric, lithic or rudic phase; profile CG003 (FRh)

  Soils are yellowish-brown to red, fine sandy clays, strongly desaturated.

The plateau is overlain by a sub-horizontal ironstone pan at shallow depth. Outcrops of the pan occur on valley slopes and on the plateau rim. The same pan can be traced on the foothills of the Mayombe, above Kimongo, and across the Niari-Nyanga Depression on the Mouyondzi Plateau.

- *Sols ferrallitiques typiques, modaux, fortement désaturés* = strongly desaturated, typical ferralitic soils, on sandstone of the M'Pioka Series, on plateaux and hill tops.

- *Sols ferrallitiques pénévolués modal* = normal, penevolved ferralitic soil on rocks of the M'Pioka Series, on hill tops of the western plateau and other isolated blocks.

- *Sols ferrallitiques, rajeunis par erosion, sur matériau argilo-sableux, issu de l'altération d'argilites et grès de la M'Pioka* = rejuvenated, eroded, ferralitic soils, on sandy clay deposits, derived from weathered shales and sandstones of the M'Pioka Series (slopes of sandstone plateaux near the Schisto-Calcaire Depression).

There is sheet erosion (érosion en nappe), rill erosion (rigoles) and gully erosion (ravines).

- Vegetation is tropical semi-deciduous rainforest (FAO vegetation unit 2.a). Forest grows on sandstone summits, while drier slopes are occupied by savannah.

720/3 Dissected, partly sand-covered plateaux N of Boko

- SOTER (10) 15, (11) 15, (12) D, (13) 2, (14) SC2

- Batéké sandy loams only cover plateau remnants, as river incision has exposed rocks of the Schisto-Greseux. See also terrain unit 810, where sandy hills overlie polymorphic sandstone. In the south of Boko district, streams have completely eroded the upper layers of the Schisto-Greseux (Inkisi Series). The rivers, especially the Louenga, flow on rocks of the M'Pioka Series. The break of slope at the contact is marked by strong erosion ravine activity. Further away from the river the plateau is less dissected.

- FRh 2 – 2b

800 Sandy plateaux

This region is belongs to the stepped, dissected plateaux, surrounding the Congo Basin. There are middle to late Tertiary planation levels. The plateaux are covered by thick sand(y clay loam) sheets. Most rivers have cut valleys through the sandsheet into the underlying rocks.

810 Kinkala hills

- SOTER (4) LL, (5) S, (6) 2, (7) UE (10) 15, (11) 15, (12) M, (13) 2, (14) UE

- The Batéké sandy loam plateau cover has been strongly dissected and eroded. The underlying polymorphic sandstone has been exposed and only sandy hills remain.

- FRh 2 – 2b; profile CG037 on a sandy hill (ARo)

- Vegetation is tropical semi-deciduous rain forest (FAO vegetation unit 2.a). Rainforest species are intermixed with deciduous species (see chapter on vegetation for species).

820-830 Batéké region

The Batéké region is located east of the line Kinkala-Zanaga, over 80,000 km^2 in the Republic of the Congo and extending further south into the D.R. of the Congo.

Along the Congo Basin it is bordered by cuestas. The dissected plateau has an altitude of 700-860 m a.s.l., but it is lower in the south. It is built of Lower-Cainozoic polymorphic sandstone, overlain by Neogene sandy loam.

Distinction is made between the almost flat sandy loam plateau remnants, and the sandy hills, formed after dissection into the polymorphic sandstone.

- the Batéké plateaux, have flat top and a thick sandy loam mantle (Ba2, terrain unit 820),
- the Batéké hills, are a dissected landscape, cut into the underlying polymorphic sandstone (Ba1, terrain unit 830).

820 Batéké plateau remnants

- SOTER (4) LL, (5) G, (6) 3, (7) UE (10) 100, (11) 3, (12) L, (13) 60, (14) UE
- The plateau has been cut into separate blocks. It is a Pleistocene surface. Slopes are generally < 3 %. Following plateaux sections are considered (from NW to SE):
  - Koukouya plateau, 410 km^2, at 800-886 m a.s.l.
  - Djambala plateau, 1,000 km^2, at 720-830 m a.s.l.
  - Nsa and connected Ngo plateau, 4,000 km^2 at 600-750 m a.s.l.
  - Mbé plateau, or the Batéké plateau sensu stricto, 7,000 km^2 at 600-760 m a.s.l.

The plateaux are separated by hundreds of metres deep valleys. Escarpments of polymorphic sandstone make up part of the valley slopes (see 830/2).

Relief is flat to slightly undulating. The highest parts lie 300 m above the Congo River and most of the plateau slopes gradually to the river.

There are many dry valleys. Closed depressions exist mainly near the plateau borders.

The Batéké plateau is composed of the “Ocre sand series”, (Ba2), which overlie polymorphic sandstones (Eocene) or “Lower Kalahari”. The latter is topped by a very flat Mid-Tertiary pediplain. The Ocre sand series (Pliocene) or “Upper Kalahari” are yellowish-brown sandy loams, becoming more reddish with depth (see chapter on geology for more details).

The plateau is monotonous and flat over huge areas. There are many hydromorphic, closed depressions (blowouts or dissolution hollows). Some are 2-3 m deep, with a diameter of 100-600 m, with water stagnation, at least in the rainy season. Podzols occur on the lower slopes. Other depressions are mostly dry pseudo-dolines, with diameters larger than 800 m and 15 m deep. There are no valleys with permanent rivers. Poor drainage conditions are only found in bottoms of closed depressions and dry valleys. The closed basins, with white bleached sands and podzols are called ‘lességués’. Their lowest parts are swampy.

The sandy loams (Limons-sableux) or ‘Ocre Sands’ (yellowish-brown) are loose, becoming darker with dept (10 YR 5/6-5/8). Often the sands have been reworked by erosion, as slope and valley deposits are mixed with the similar weathering products of the underlying Polymorphic Sandstone. The ‘Ocre sands’ on the plateaux have a thickness of 60-100 m.

- FRg 1 – 1/2a;

  - profile CG025 (FRg), under savannah
  - profile CG031 (FRg), under forest

  Soils are deep, homogenous, Geric Ferralsols and Ferralic Arenosols. Clay content decreases downslope and varies between 4 and 25 %. These poor soils have a favourable porosity. The soils of the Koukouya and Djamba plateaux have a higher clay content (35 %), more organic matter and a better mineral fertility.

  Leached humiferous Geric Ferralsols (0-10 cm) under savannah have an average clay content of 10-30 %, 8 % organic matter, a C/N ratio of 19; pH is 4.5-5.5; the sum of exchangeable bases is 0.2-1.5 cmol(+)/kg and base saturation is < 20 %.

Leached humiferous Geric Ferralsols (0-10 cm) under forest have an average clay content of 15-35 %, 10 % organic matter, a C/N ratio of 15; pH is 3.3-4.3; the sum of exchangeable bases is 0.2-0.5 cmol(+)/kg and base saturation is < 10 %.

- *Sols ferrallitiques appauvris (en argile et fer), humiques ou jaunes, sur matériaux sablo-argileux issus des limons sableux (Ba2)* = yellow or humic, clay- and iron-leached, ferralitic soils, on clayey sand deposits derived from Ba2 sandy loams.

- *Sols ferrallitiques fortement désaturés, psammitiques, sur limons-sableux* = deep, strongly desaturated sandy soils (90 % quartz) on sandy loams of plateaux and hill tops.

- *Podzols hydromorphes* = hydromorphic podzols of lower slopes of valley bottoms (lousséké) in Batéké hills and depressions on the Batéké plateau

Topographic position and drainage are important. On the sandy loam plateaux, water infiltrates easily and soils on slopes and in depressions receive lateral drainage water. Plateau soils are Ferralic Arenosols and Geric Ferralsols; the mid-slope soils are Humic Cambisols. Carbic Podzols occur on lower slopes. Hydromorphic soils are located in swampy closed depressions.

- Vegetation is moist savannah (FAO vegetation unit 4.c), with *Loudetia demeusii*, *Trachypogon thollonii* and *Annona arenaria*. The soils have neither the necessary fertility nor the needed water holding capacity to support a dense forest vegetation and the plateau is an area of orchard bush country, with open sweeping lowlands, and villages nestling in woods on the valley sides. Only rare trees grow on the plateau, which in some places looks like a semi-desert. The valley bottoms, however, are swampy and occupied by gallery forests with dense vegetation.

  - On more clayey soils grows *Hyparrhenia diplandra* (Graminae) and *Bridelia ferruginea* (*Euphorbiacae*);

  - On more sandy soils grows *Loudetia demeusii* (*Graminae*) and *Hymenocardia acida* (*Euphorbiacae*).

  Locally there are some semi-deciduous forest islands with evergreen undergrowth. Forests on the plateaux are very reduced and often of human origin. Degraded semi-deciduous and secondary forest occupies about 5 % of the plateaux.

  Low herb steppes of Loudetia simplex (lousséké) characterize the podzols of the closed depressions.

830 Batéké hills on polymorphic sandstone

- SOTER (4) SH, (5) DO, (6) 3, (7) SC2 (10) 70, (11) 15, (12) D, (13) 2, (14) SC2

- This is a dissected plateau, where the Batéké sandy loam top layer (of terrain unit 820) has been eroded. The residual hills are rounded and dome-shaped, often with very long, moderate to steep slopes. Altitude differences are 100-300 m. The polymorphic sandstone weathers to very white, fine sands. The sandstone is very hard, compact and yellowish or whitish (middle-Kalahari). Rock outcrops occur in the valleys of the Alima, at Kebouya, Ewo, Tchère and near Obougou (terrain component 830/2).

  The hills are separated by dry valleys, with wide, flat valley bottoms, sometimes suspended. There are a few larger deeply incised valleys. There are steep (60-70 %) erosion amphitheatres, stabilized by vegetation.

  - The higher hills occur near the plateau remnants (820). They reach almost the same altitude (600-860 m a.s.l.).

  - Lower hills occur further away, at < 600 m a.s.l. Towards the N they disappear at the limit with the Congo basin. In the south, they form the hilly area W of Brazzaville (terrain unit 810).

  The hills end abruptly, about 20 km NE of Brazzaville, with a step of 350 m high. Near Franceville (Gabon), they end with a 100 m high cliff along the M'Passa river. The Ogowé river has its source on the Batéké hills and flows in a gallery forest in an arid, sandy valley. Near Zanaga, the river enters the Chaillu Massif, bordered in the E by the sandy escarpment of the Batéké hills, overlooking a granitic valley. The entrenched valley of the Congo cuts through the Batéké region for 200 km down to Stanley Pool. Steep hills rise 100-250 m above the river, upstream receding from the water's edge. The canyon is called 'the Corridor (Le Couloir)'. White sandstone cliffs rise along the Congo.

- ARo 3 – 1ab, RGd 1 – 1/2b; profile CG001 (ARo)

  Leached yellow Ferralic Arenosols (0-10 cm), under forest, have an average clay content of 2-4 %, 2.5-5 % organic matter, a C/N ratio of 10-15; pH is 4.0; the sum of exchangeable bases is 0.3-0.5 cmol(+)/kg and base saturation is < 10 %.

Leached yellow Ferralic Arenosols (0-10 cm), under savannah, have an average clay content of 1-5 %, 1.6 % organic matter, a C/N ratio of 14; pH is 5.0-6.0; the sum of exchangeable bases is 0.4 cmol(+)/kg and base saturation is 5-30 %.

- *Sols ferrallitiques appauvris (en fer), jaunes, sur matériaux sableux, issus des grès polymorphes (Ba1)* = (iron-)leached, yellow ferralitic soils in sandy materials, derived from polymorphic sandstone (Ba1).

Hydromorphic soils are located in swampy, closed depressions on the plateaux (820) and in alluvial valleys between the hills (830/2).

- *Podzols hydromorphes* = hydromorphic podzols of valley bottoms (lousséké) in Batéké hills and depressions on the Batéké plateau.

- Higher hills are covered by slightly shrubby savannah, with *Loudetia demeusii*. Semi-deciduous forests occur, as extensions of gallery forests, on the steeper slopes.
  Vegetation is a short herb savannah, with small shrubs and with narrow gallery forests along the rivers.

  Only on steep slopes occurs dense semi-deciduous forest, with evergreen undergrowth. Gallery forest occurs on the swampy valley bottoms. These forests have been strongly degraded. Savannah dominates. The proportion of shrubs is variable and sometimes there are no shrubs.

  - On more clayey soils of lower hill tops grows savannah with *Loudetia arundinacea* (*Graminae*).

  - Most of the area is covered with slightly shrubby (*Hymenocardia acida*) savannah, with *Loudetia demeusii*, *Eragrostis brizoïdes*, *Ctenium newtonii*...

  - The most sandy areas and higher hills are covered by savannah with *Trachypogon thollonii*.

  Low herb steppes of *Loudetia simplex* (lousséké) characterize podzols, colluvial lower slopes, alluvial plains, or river terraces.

  In the valley of the Djoué occurs savannah with *Aristida*.

830/2 Dissected valleys of the Batéké region

- SOTER (10) 15, (11) 20, (12) D, (13) 2, (14) SC2

- The Batéké hills (830/1) are separated by wide, flat valley bottoms, sometimes suspended. The larger river valleys are deeply incised. There are steep (60-70 %) erosion amphitheatres and flat bottoms, without stream bed. Rivers flow about 75 m lower, also on polymorphic sandstone.

- GLu 3 – 1/2a, profile CG015 (PZc)

  Valley bottoms are occupied by Gleysols, lower slopes often by Carbic Podzols (profile CG015).

- Vegetation along the rivers is gallery forest.

830/3 Northern Batéké hills

- (10) 15, (11) 15, (12) S, (13) 2, (14) SC2, (15) V

- The northern Batéké hills reach an altitude of 600-650 m a.s.l. They are mainly forested or herb-overgrown, dome-shaped, or somewhat cone-shaped hills (Andélé and M'Bili mountains). They have a denser drainage pattern.

- ARl 1 – 1/2b, profile CG020 (ARl)

  Soils are differentiated from the other Batéké soils by a more compact B horizon, with a slight clay increase.

- The landscape is more humid than the other Batéké hills, with small forests around more or less swampy valley bottoms.

840 Bambio footslope plateau sections

- SOTER (4) LF, (5) G, (6) 2, (7) U (10) 100, (11) 2, (12) L, (13) 20, (14) U

- Separate Bambio plateau sections occurs at the foot of the higher plateaux, at the transition to the Congo basin. Rocks belong to the Bambio Series: siliceous polymorphic sandstones, overlain by sandy loam of the “Sandy Clay Series”. A Late-Tertiary pediplain overlies the 30-50 km wide footslopes. Rivers and streams flow in dissected valleys, before entering the swampy Congo basin. The upper sandy clays are red, 20-50 m thick, and overlie a rounded, ferruginous, quartz gravel layer of 2-3 m thick, on top of white clays, with red mottles (weathering zone). They could be the equivalents of the Batéké deposits. The underlying horizontal sandstone could be correlated to the polymorphic sandstone. The alluvial plains in this region are filled up with white sandy clays, in the lower areas, and by sands in plateau valleys.

- FRh 8 – 1/2a, profile CG019 (FRh)

  Plateau summits are occupied by sandy loam soils (up to 20 % of clay). On slopes occur sandy clay loam soils (30-35 % in the subsoil), reddish in depth.

- Vegetation is tropical rainforest (1.a)

850 Lango footslope plateaux on Mesozoic rocks

- SOTER (4) LF, (5) G, (6) 2, (7) SO2 (10) 100, (11) 2, (12) D, (13) 5, (14) SO2

- This is a minor terrain unit, associated to the Bambio plateau, but in this case sandy loams lie directly on Mesozoic rocks (sandstones, argilites, marls), instead of polymorphic sandstone.

- FRh 8 – 1/2a

- Vegetation is tropical rainforest (1.a).

860 Ibenga plateau

- SOTER (4) LL, (5) U, (6) 2, (7) SC2 (10) 100, (11) 5, (12) L, (13) 5, (14) SC2

- This sandy plateau, at 500-600 m a.s.l., is located in northern Congo, on the Mesozoic Carnot sandstone (argilites, fluvio-glacial deposits, conglomerates, kaolinitic and siliceous sandstones). The plateau is dissected by the main rivers (e.g. the Ibenga).

- ARo 4 – 1a

- Vegetation is tropical rainforest (FAO vegetation unit 1.a).

900 Higher plateaux surrounding the Congo Basin

This region includes dissected plateaux of medium altitude (500-1,000 m a.s.l.), surrounding the Congo Basin. Nearly the whole region drains to the Congo Basin, except for the most western regions. Rocks are sedimentary (mainly sandstones) and metamorphic (mainly quartzites and schists). Granite and gneiss plateaux have been described separately, respectively terrain units 510, 520 and 1010, 1020).

910 Bouenza hills (S) and plateau (N)

- SOTER (4) LL, (5) R, (6) 2, (7) SC2/SO1, (10) 100, (11) 15, (12) S, (13) 2, (14) SC2/SO1

- These hills become a plateau in the N, on rocks of the Bouenza Series. There are rounded or flattened tops at 450-650 m a.s.l. There are alternating zones of sandstones, marly limestones and schists. The plateau border and the hills are mainly built of marly limestones and schists.

  Valleys are frequently dissymmetric, with steeper slopes under forest, rivers with gallery forests, and concave slopes under herb savannah. The quartzitic sandstone plateau descends to the Bouenza valley with a steep escarpment.

  - FRx 3 – 2ab, FRg 2 – 2a; profile CG026 (FRx)

  1. On sandstone, soils are > 1 m deep, more sandy Ferralsols without gravels, eluviated in the upper horizons, overlying a gravel layer with quartz sands and ferruginized sandstone pieces; on top of weathered sandstone.

     - Under forest, the leached, yellow Ferralsols (0-10 cm) on sandstone, have an average clay content of 7-20 %, 3 % of organic matter, a C/N ratio of 13; pH is 3.7-4.5; the sum of exchangeable bases is 0.3-2 cmol(+)/kg and base saturation is < 10 %.

- Under savannah, the leached, yellow Ferralsols (0-10 cm) on sandstone, have an average clay content of 4-25 %, 1-3 % of organic matter, a C/N ratio of 16; pH is 4.9-5.5; the sum of exchangeable bases is < 0.5 cmol(+)/kg and base saturation is 10-20 %.

- Reworked yellow Ferralsols, derived from sandstone, have (0-10 cm), under savannah, an average clay content of 12-25 %, 2.5-3.5 % of organic matter, a C/N ratio of 13-16; pH is 4.0-5.0; the sum of exchangeable bases is 0.6-0.7 cmol(+)/kg and base saturation is < 15 %.

    - *Sols ferrallitiques remaniés, faiblement appauvris, sablo-argileux, issus de grès bouenzien, à recouvrement épais* = thick, slightly leached, reworked, clayey sand ferralitic soils, derived from Bouenzian sandstone.

2. On marly limestones and schists, e.g. near the Bouenza falls, the plateau border and the hills, erosion has truncated soils on steep forested slopes, in contrast with the savannah-covered sandstone plateaux in the north.

   The < 1 m thick, blocky, silty clay soils overlie rounded, fine gravels and ironstone pieces; on top of weathered rock: colourful-mottled clay.

   The reworked, yellow, silty clay Ferralsols, derived from shales have (0-10 cm), under forest, an average clay content of 45-55 %, 3 % organic matter, a C/N ratio of < 10; pH is 3.7-4.5; the sum of exchangeable bases is 0.6-1.5 cmol(+)/kg and base saturation is 6-16 %.

    - *Sols ferrallitiques remaniés, jaunes, argileux ou argilo-limoneux, issus d'argilite ou de calcaires marneux du Bouenzien (Bz3), généralement tronqués par l'érosion* = reworked, generally erosion-truncated, yellow, silty clay to clay ferralitic soils, derived from Bouenzian (Bz3) marly limestones or argilites.

- The Bouenza region is covered by tropical semi-deciduous rainforest (FAO vegetation unit 2.a), see chapter on vegetation for more details. Most of the hills are covered by shrub savannah with *Loudetia arundinacea* and *Hymenocardia acida*. Forest occupies valley bottoms and lower slopes. Valleys are frequently dissymmetric, with a steeper slope under forest, rivers with gallery forests and concave slopes with herb savannah on slightly sloping sandy terraces.

920 Niari or Upper tillite belt

- SOTER (4) SH, (5) T, (6) 2, (7) UG, (10) 100, (11) 40, (12) S, (13) 2, (14) UG

- The Upper or Niari tillite belt forms a narrow fringe, in between the Niari-Nyanga Depression and the Bouenza hills. Erosion has affected the steep slopes. It is a hilly area, with steep slopes (30-50 %). The tillite is a mottled, compact or shale-like clay, with angular or rounded gravels. It is well conserved along the NE border of the Schisto-Calcaire, where it has a thickness of 150 m. In the south it is less important and missing locally.

- FRx 3 – 2ab, partly rudic phase; profile CG027 (ACh)

  Soils are coarse sandy clays, overlying a rounded gravel layer (of glacial origin). Small landslides are common (soils sliding over gravel layers).

  Sols ferrallitiques remaniés, jaunes, argilo-sableux issus essentiellement de la tillite supérieure du Niari (Ts), à recouvrement épais ou tronqués par l'érosion = thick (Ferralsols) and erosion-truncated (Acrisols), yellow, sandy clay soils, derived from the Upper or Niari tillite (Ts)

- The Niari tillite belt is steeply sloping. It is forested on lower slopes. Savannah of *Hyparrhenia diplandra*, *Hymenocardia acida* and *Anona arenaria* grows on tops and upper slopes. The grass cover is less dense than on the clayey soils of the Schisto-Calcaire depression.

930 Upper Nouabalé plateau

- SOTER (4) LL, (5) R, (6) 2, (7) MB2, (10) 100, (11) 10, (12) D, (13) 4, (14) MB2

- This dissected plateau, on the border with the Central African Republic rises to 510-570 m a.s.l. The Precambrian metamorphic rocks are: mica-, graphitic-, chlorito-schists and amphibolites.

- FRh 9 – 2/3a, partly skeletic phase

- Vegetation is tropical rainforest (FAO vegetation unit 1.a).

940 Mbaiki plateau

- SOTER (4) LL, (5) R, (6) 2, (7) SC2, (10) 100, (11) 8, (12) D, (13) 4, (14) SC2

- The Mbaiki plateau forms a strip on the northernmost border with the Central African Republic. Altitude is 550-600 m a.s.l. Rocks belong to the Precambrian Mbaiki Series: sandstones, quartzites, schists and conglomerates.

- FRh 7 – 2ab; partly skeletic phase

- Vegetation is tropical rainforest (FAO vegetation unit 1.a)

950 Dja tillite plateau

- SOTER (4) LL, (5) R, (6) 2, (7) SC1 (10) 100, (11) 8, (12) D, (13) 4, (14) SC1

- This somewhat dissected plateau rises to about 650 m a.s.l. It is a 40-50 km wide and 100 km long area, built of black schists and yellow conglomeratic clayey schists of glacial origin.

- FRh 5 – 2b

- Vegetation is tropical rainforest (FAO vegetation unit 1.a)

960 Sembé-Ouésso plateau

- The plateau is an extensive sandstone zone, starting south of the equator and limited in the north by the 3° 30'N parallel (over 400 km). It occurs in between the meridians of Souanké and Ouésso (over 200 km), where it is buried under the Congo Basin deposits.

  There are forested slopes, descending towards the flat swampy valleys of the Congo river affluents. In the west, near Gabon, it is bordered by Precambrian gneiss (terrain units 1010 and 1020). The rocks of the Sembé-Ouésso plateau are mainly folded schists, sandstones and quartzites.

  The plateau summit is a remnant of the Mid-Tertiary planation, at 600 m a.s.l., which descends abruptly 100-200 m to the Bambio footslope plateau (terrain unit 840). The latter is topped by the Late-Tertiary Pediplain.

  Altitude is about 500-700 m (Mount Nabela, 950 m). Rivers, such as the Mambili and Lekoli, have wide, swampy alluvial valley floors, with sandy-gravelly to clayey deposits.

  Distinction has been made between the main plateau (960/1) and a plateau sector composed of coarser rocks (960/2).

The lower level A is composed of coarser rocks: conglomerates, arkoses, sandstones and quartzites. The rocks of the “Schisto-Quartzitique”, are now classified as the Sembé-Ouésso Series, level B1: red schists; ferruginous, feldspathic and siliceous sandstones; quartzites and quartzitic sandstones; overlain by the “Schisto-Calcao-Greseux” or level B2: clayey, coal-bearing schists; dolomites and sandstones. There are some granite and large dolerite intrusions (terrain unit 1110).

- Soils are Haplic Ferralsols and Nitisols; rock outcrops are rare:
  - sandy clay loam soils on sandstones,
  - red clayey soils on gneiss and intrusive rocks,
  - very deep, bright red clays on dolerite intrusions,
  - red clays on schists.

960/1 Main plateau (B or SO_B)

- SOTER (4) LL, (5) R, (6) 2, (7) SC2, (10) 80, (11) 8, (12) D, (13) 4, (14) SC2

- Rocks are schists, limestones, sandstones and quartzites.

- FRh 6 – 2b, NTh 2 – 2b partly skeletic phase;
  profile CG018 (FRh)

  Red soils occur on the plateau. On slopes occur (top to bottom): dark brown, light brown and yellow soils. Yellowish grey soils occupy the lower slopes. Brown slope soils are dominating.

  Valley bottom soils are grey, clayey, very humiferous, very poorly drained.

960/2 Plateau on coarser rocks (A or SO_A)

- SOTER (4) LL, (5) R, (6) 2, (7) SC2, (10) 20, (11) 8, (12) D, (13) 4, (14) SC1
- Rocks are sandstones, quartzites, arkoses and conglomerates
- FRh 6 – 2b

970 Franceville or Francevillian plateau

- SOTER (4) LL, (5) R, (6) 2, (7) SC2, (10) 100, (11) 8, (12) D, (13) 4, (14) SC2
- A narrow strip of the Francevillian plateau is located on the Gabon border (Congo-Ogowé watershed), at about 600 m a.s.l. Rocks are siliceous sandstones, jaspis, schists, clays, arkosic and conglomeratic sandstones. There are numerous dolerite intrusions.
- CMo 2 – 2/3b, partly lithic, rudic phase
- Vegetation is tropical rainforest (FAO vegetation unit 1.a).

980 Bomassa plateau

- SOTER (4) LL, (5) R, (6) 2, (7) MB2 (10) 100, (11) 8, (12) D, (13) 4, (14) MB2

- The Bomassa plateau is a minor terrain unit on the border with Cameroon and the Central African Republic. The dissected plateau occurs at 450 m a.s.l. (about 100 m above the Sangha river). Rocks belong to the Precambrian Nola Series: clayey schists, sandstones, quartzites and conglomerates.

- FRh 10

- Vegetation is tropical rainforest (FAO vegetation unit 1.a)

1000 Gneiss plateaux

The central western parts of the country, near Gabon, are built of Precambrian (granito-)gneiss. Two gneiss plateaux are distinguished: the Lekona (Congo basin) and the Ivindo plateau (Ogowé basin).

1010 Lekona or Kéllé plateau

- SOTER (4) LL, (5) R, (6) 2, (7) MA2, (10) 100, (11) 10, (12) D, (13) 4, (14) MA2

- The dissected plateau drains towards the Congo river. It is composed of Precambrian (granito-)gneisses, with some amphibolite inclusions. Altitude is 550-600 m a.s.l. Valleys are incised and many flat bottoms are swampy.

- FRh 4 – 2/3b, partly skeletic phase; profile CG017 (FRh)

  Plateau summits conserved deep soils, slopes are more eroded and colluvial footslopes are common.

  Reddish brown (sandy) clay soils formed on amphibole granito-gneisses, generally on ironstone gravels at 1 m depth. Yellow (sandy) clay soils developed from biotite and pegmatite granito-gneisses. Soils on dolerite inclusions are very deep and very clayey.

- Vegetation is tropical rainforest (FAO vegetation unit 1.a).

1020 Ivindo or Souanké plateau

- SOTER (4) LL, (5) G, (6) 2, (7) SC2 (10) 100, (11) 2, (12) D, (13) 4, (14) SC2 (15) S

- The Ivindo and its tributary Djoua drain to the Ogowé. They flow in a less dissected plateau on Precambrian gneiss, with some amphibolite inclusions. Altitude is 450-700 m a.s.l. The valleys of the Ivindo and the Djoua are remarkable for their marshiness.

- FRh 4 – 2/3b, FRx 5 – 1/2a, partly petroferric phase, profile CG016 (FRh): plateau, profile CG029 (FRx): lower slopes.

  Plateau summit soils are thick and reddish (FRh), with exposed ironstone pans on the plateau edges (slope gravels). They are followed by red (top slopes) to yellow (lower slopes) Ferralsols. The yellow and well drained Xanthic Ferralsols (FRx) of the lower slopes are deficient in Ca and Mg. Gleysols occur in extensive bottomlands. Rock outcrops rare.

  Dark reddish brown, very clayey (> 50 %) soils developed from amphibolite inclusions. Potassium is deficient.

- Vegetation is tropical rainforest (FAO vegetation unit 1.a).

1100 Volcanic intrusions

Only minor intrusions occur. One larger dolerite intrusion is located on the Sembé-Ouésso plateau (terrain unit 960).

1110 Dolerite of the Sembé-Ouésso plateau

- SOTER (4) LL, (5) R, (6) 2, (7) IB3, (10) 100, (11) 8, (12) D, (13) 10, (14) IB3

- These are numerous intrusions on the Sembé-Ouésso plateau. Only the main, very extensive, intrusion could be mapped.

- NTh2 – 2b, profile CG021 (NTh or NTu)

  Soils on dolerite are dark to bright red, very deep, very clayey, with an excellent structure and a high mineral reserve.

- Vegetation is somewhat more developed than on the surrounding plateau.

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APPENDIX I

SOIL PROFILE DESCRIPTIONS

Introduction

The following soil profile descriptions have been selected for - and entered in - the SOTER programme (version 2.5m). A database diskette has been sent, together with the report, to FAO, Land and Water Development Division.

The SOTER programme only considers part of the soil data. Therefore, the soil profile descriptions have been completely reproduced and translated in this volume of the report.

Soil surveys in the Republic of the Congo mainly took place in the south of the country and soils were classified according to the ORSTOM Classification System.

During this study typical soil profiles have been given a tentative FAO soil classification (1990).

An attempt has been made to choose adequate master horizon symbols (A,B,C) and to give symbols to the subordinate properties (concretions, salts, cementations...).

A new numbering was attributed to the soil profiles, starting with the country ISO code (CG…). The former profile numbers are also mentioned.

NOTICE

Attention is drawn to the fact that soil reports at the IRD, in Paris, are kept on micro-film. Photocopies are not always easy to read and it is not excluded certain letters and numbers were wrongly interpreted (a “3” may be confused with an “8”…).

INDEX I

terrain units/components - soil profiles

830/3	CG020	Luvic Arenosols	46
terrain unit	soil profile	soil classification	page
840	CG019	Haplic Ferralsols	44
910	CG026	Xanthic Ferralsols	58
920	CG027	Haplic Acrisols	60
960/1	CG028	Haplic Ferralsols	62
1010	CG017	Haplic Ferralsols	40
1020	CG016	Haplic Ferralsols	38
1020	CG029	Xanthic Ferralsols	64
1110	CG021	Humic or Haplic Nitisols	48

INDEX II

soil profiles - terrain units/components

CG027	920	Haplic Acrisols	60
CG028	230	Gleyic Arenosols	62
soil profile	terrain unit	soil classification	page
CG029	1020	Xanthic Ferralsols	64
CG030	520	Humic Ferralsols	66
CG031	820	Geric Ferralsols (under forest)	68
CG032	210	Dystric Fluvisols, phreatic phase	70
CG033	410	Xanthic Ferralsols	72
CG034	220	Gleyic Arenosols	74
CG035	240	Xanthic Ferralsols, phreatic ph.	76
CG036	212	Umbric Gleysols	78
CG037	810	Ferralic Arenosols	80

Profile CG001 (formerly CB5)

Classification:	Ferralic Arenosols, ARo (FAO, 1990) Sols psammitiques fortement désaturés (ORSTOM)
Source:	Denis (1974)
Location:	Track to Lifoula II, NE of Brazzaville
Coordinates:	04° 05'S; 15° 22'E -04.08°; 15.37°
Terrain unit:	830/1, Batéké hills
Altitude:	500 m a.s.l.
Physiography:	Softly rounded hilly landscape, with a scarse drainage pattern
Slope:	hill top
Drainage:	excessively drained
Parent material:	weathered polymorphic sandstone, 90 % quartz
Vegetation:	slightly shrubby savannah, with *Loudetia demeusii*, and an imperfect grass cover (at the profile site); there are some forest islands around, with more organic matter in the topsoil.

Profile description

Ah 0-45 cm	Yellowish brown (10 YR 5/4, dry); sand to fine sand; weak, subangular, blocky structure; spread, bare, fine sand grains; very porous; coherent; fine roots, penetrating and surrounding aggregates; smooth and gradual boundary.
Bw1 45-150 cm	Yellowish brown (10 YR 6/4, dry); sand to fine sand; weak, angular and subangular, blocky structure; very porous; very friable; some bare, fine sand grains.
Bw2 150-190+ cm	Pale yellow (10 YR 7/4, dry); sand to fine sand; coarse, blocky structure.

Analytical data of profile CG001

horizon	depth (cm)	> 2 mm %	coarse sand 0.2-2 mm	fine sand 0.05-0.2 mm	silt 0.05 - 0.002 mm	clay < 0.002 mm	tex-ture USDA
Ah1	15		38.9	56.2	2.2	0.01	S
Bw1	100		32.8	59.5	3.1	0.8	S
Bw2	180		37.9	54.8	2.0	1.9	S
cmol(+)/kg							
Ca	Mg	K	Na	Acidity	Ex. Al.	Al sat. (m)	Base sat. %
0.08	0.01	0.04	0.03				18.9
0.08	0.01	0.01	0.03				15.7
0.01	0.01	0.01	0.03				6.0
cmol(+)/kg						bar	%
CEC_{soil} sum cat.	CEC_{soil} NH_4OAc	CEC_{soil} bases +Al	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15
	0.08			5.0			
	0.07			5.5			
	0.5			5.4			
C/N	organ. C %	N %	free Fe_2O_3 %	total Fe_2O_3 %	P. total mg/100g	$CaCO_3$%	EC sat. dS/m
13.1	0.55	0.042	0.52	0.5			
17.2	0.67	0.039	0.72	1.0			
11.1	0.31	0.028	0.76	0.8			

Profile CG002 (formerly DZI 8)

Classification:	Xanthic Ferralsols, FRx (FAO, 1990) Sols ferrallitiques typiques, indurés (ORSTOM)
Source:	Denis (1974)
Location:	Mouyondzi plateau
Coordinates:	04° 02'S; 13° 56'E -04.03°, 13.93°
Terrain unit:	710/3, Niari-Nyanga Depression, Mouyondzi plateau
Altitude:	470 m a.s.l.
Physiography:	Small, flat plateau, formerly a part of a large plateau, now dissected by steep valleys
Slope:	< 1 %
Drainage:	Well drained
Parent material:	Marls of the Lower Schisto-Calcaire (SCI)
Vegetation:	Shrubby savannah, with many cultivated fields

Profile description

Ah	0-10 cm	Clay; brown to greyish brown (10 YR 4/3, moist); organic matter not directly detectable; no gravels; moderate, fine and medium, crumb structure; friable; many, fine roots, around aggregates; clear boundary.
AB	10-35 cm	Clay; yellowish brown (10 YR 5/6, moist); organic matter not directly detectable; diffuse humiferous penetration; no gravels; moderate, fine and medium, blocky structure; loose; friable; porous; abundant, healthy, fine roots; distinct boundary.
BA	35-70 cm	Clay with quartz sand; bright yellowish brown (10 YR 6/4, dry); organic matter not directly detectable; abundant, contrasting and coherent, dark brown spots, in vertical stripes and irregular spots of a few mm to 1 cm; no gravels; moderate, fine and medium, blocky structure; loose; porous; friable; healthy, fine roots; gradual boundary.
Bo1	70-170 cm	Clay with quartz sand; yellow (10 YR 7/6, dry); apparently no organic matter; rare, distinct, brown,

vertical spots, limited to the upper part of the horizon; at 160 cm: rare ferruginous elements, black stained and dark red inside; moderate, fine to medium, blocky structure; friable; rare roots; distinct boundary.

Bo2,cs 170-250 Clay; similar fine earth as in the horizon above; abundant ferruginous gravels of a few mm to 2 cm diameter, in a fine earth matrix, with identical characteristics as the horizon above.

Analytical data of profile CG002

horizon	depth (cm)	> 2 mm %	co. sand 0.25-2 mm	fi.sand 0.05-0.25 mm	silt 0.05 - 0.002mm	clay < 0.002	tex-ture USDA
Ah	1		9.1	5.4	16.0	50.8	C
AB	25		8.9	4.2	15.0	65.6	C
BA	50		7.1	4.4	15.0	69.0	C
Bo1	80		6.8	6.7	10.4	70.1	C
Bo1	160		7.2	4.6	11.8	71.9	C
cmol(+)/kg							
Ca	Mg	K	Na	Acidity	Ex. Al.	Al s. (m)	Base s.%
2.4	0.2	0.2	0.05				22
0.3	0.01	0.01	0.01				5
0.1	0.01	0.01	0.01				2
0.01	0.01	0.01	0.01				
0.01	0.01	0.01	0.01				
cmol(+)/kg						bar	%
CEC_{soil} s. cat.	CEC_{soil} NH_4OAc	CEC_{soil} bas.+Al	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15
	12.8			5.0			
	6.9			4.75			
	4.3			5.5			
	3.3			5.0			
	2.9			5.2			
C/N	organ. C %	N %	Free Fe_2O_3 %	Total Fe_2O_3 %	total P mg/100g	$CaCO_3$%	EC sat.
21.2	5.3	0.25	4.4	10.0			
15.3	2.3	0.15	3.7	11.6			
8.5	1.1	0.13	4.0	11.2			
-	-	-	3.7	11.6			
-	-	-	5.0	12.0			

Profile CG003 (formerly S 17)

Classification:	Haplic Ferralsols, FRh (FAO, 1990) Sols ferrallitiques appauvris (ORSTOM)
Source:	Denis (1974), description by V.Carlotti (1965)
Location:	track from Lemba to the Congo river (Boko)
Coordinates:	04° 52'S; 14° 26'E -04.87°; 14.43°
Terrain unit:	720/2, Cataracts plateau
Altitude:	300 m a.s.l.
Physiography:	extensive plateau, with sheet erosion
Slope:	plateau summit
Drainage:	well drained, very deep groundwater
Parent material:	Inkisi Series of the Schisto-Greseux System
Vegetation:	moderately shrubby savannah, with *Hymenocardia acida* shrubs and *Aristida dewildemanii* herbs

Profile description

Ap	0- 25 cm	Fine and coarse quartz sand; brown (10 YR 5/3, dry); organic matter not directly detectable; moderate, medium, subangular, blocky structure, associated to medium crumb; slightly firm; fine roots in and around aggregates; smooth and gradual boundary.
Bo1	25-156 cm	Coarse and fine sandy clay loam; very pale brown (10 YR 7/4, moist); moderate, coarse, subangular, blocky structure; firm; fine roots, in and around aggregates, down to a depth of 60 cm; weak biological activity, with termite galleries; smooth and gradual boundary.
Bo2	156-300 cm	Very pale brown (10YR 7/4, almost dry); similar to the horizon above.

Analytical data of profile CG003

horizon	depth (cm)	> 2 mm %	coarse sand 0.25-2 mm	fine sand 0.05-0.25 mm	silt 0.05 - 0.002 mm	clay < 0.002 mm	tex-ture USDA
Ap	15		47.5	40.0	6.5	4.5	S
Bo1	45		30.5	26.5	8.0	32.5	SCL
Bo1	100		30.5	27.0	8.0	33.0	SCL
cmol(+)/kg							
Ca	Mg	K	Na	Acidity	Ex.Al.	Al sat. (m)	Base sat. %
0.4	0.01	0.05	0.01				
0.4	0.15	0.05	0.01				
0.4	0.15	0.05	0.01				
cmol(+)/kg						bar	%
CEC_{soil} sum cat.	CEC_{soil} NH_4OAc	CEC_{soil} bases + Al	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15
	1.4			5.7			
	3.2			5.1			
	2.6			5.3			
C/N	organ. C %	N %	free Fe_2O_3 %	Total Fe_2O_3 %	P. total mg/100g	$CaCO_3$%	EC sat. DS/m
4.2	0.50	0.12	0.7	2.8			
-	-	-	3.2	5.7			
-	-	-	3.2	5.7			

Profile CG004 (formerly DIM 46)

Classification: Umbric Leptosols, LPu (FAO, 1990)

	Sols peu évolués d'érosion, régosoliques, sur roches gréseuses (ORSTOM)
Source:	Jamet and Rieffel (1976)
Location:	Mount Bamba, Mayombe highlands, SE of Mvouti
Coordinates:	04° 25'S; 12° 40'E (approximate) -04.42°; 12.67°
Terrain unit:	620
Altitude:	800 m
Physiography:	narrow crest line, near the top of the mountain
Drainage:	well drained
Parent material:	Bamba Mountains sandstones and quartzitic sandstones
Vegetation:	Open rainforest

Profile description

O	0-5/10 cm	Thick litter layer, with fine and medium roots, around decaying plant debris, humiferous aggregates and abundant bleached, bare, quartz sand grains.
Ah	5/10-15/20	Brown (10 YR 3/1, dry and 10YR 2/1, moist); organic matter not directly detectable; sand, with dominantly coarse quartz sand; single grain; abundant roots; discontinuous horizon, interrupted by large sandstone-like blocks on the surface.
C	15/20 + cm	Fractured and weathered sandstone, with penetrating tongues of humiferous greyish sand.

Analytical data of profile CG004

horizon	depth (cm)	> 2 mm %	coarse sand	Fine sand	silt 0.05 -	clay <	tex-ture

			0.25-2 mm	0.05-0.25 mm	0.002 mm	0.002 mm	USDA
Ah	5-10	-	55.8	21.0	9.2	2.3	S
cmol(+)/kg							
Ca	Mg	K	Na	Acidity	Ex. Al.	Al sat. (m)	Base sat. %
0.08	0.20	0.18	0.05				4.7
cmol(+)/kg						bar	%
CEC_{soil} sum of cat.	CEC_{soil} NH_4OAc	CEC_{soil} bases + Al	CEC_{soil} (Ca)	PH H_2O	pH KCl	1/3	15
	10.90			3.6			
organic matter %	organ. C %	N %	C/N	avail. P ppm	P. total %	$CaCO_3$%	EC sat. dS/m
1.58	0.91	0.112	18.9				

Profile CG005 (formerly HO 29)

Classification: Dystric Fluvisols, phreatic phase, FLd (FAO, 1990)
Sols peu évolués, d'apport alluvial, hydromorphes à pseudo-gley ou à gley (ORSTOM)

Source:	Jamet and Rieffel (1976)
Location:	Loémé river alluvial plain, 3 km downstream of Guéna (Bilinga).
Coordinates:	04° 35'S; 12° 15'E (approximately) -04.58°; 12.25°
Terrain unit:	230, alluvial plains of the coastal belt
Altitude:	about 50 m
Physiography:	1 km wide alluvial plain, profile 500 m from the river
Slope:	flat
Drainage:	Imperfectly drained
Parent material:	thick, homogeneous, sandy colluvo-alluvium
Vegetation:	recent grass fallow, locally cassava fields

Profile description

Ap	0-05 cm	Very dark brown; slightly moist; organic matter not directly detectable; some charcoal fragments; clayey fine sand to fine quartz sand (abundant bleached quartz grains); moderate, fine and medium, crumb structure; coherent; porous; many roots; distinct boundary.
CA	05-75 cm	Yellowish grey; slightly moist; organic matter not directly detectable, diffuse humiferous penetration, extending in depth as spots; fine sandy loam; weak, fine and medium, subangular, blocky structure; coherent; porous; many roots; gradual transition.
C1	75-150 cm	Yellowish brown; moist; common greyish mottles, down to 1 m, getting more rare below; somewhat more clayey (sandy clay loam); fine and medium, subangular, blocky structure; somewhat more coherent; porous; few roots.
C2g	150 + cm	Yellowish brown; wet; common, distinct, contrasting, fine, ferruginous mottles; sandy clay loam.

Analytical data of profile CG005

horizon	depth (cm)	> 2 mm %	coarse sand 0.25-2 mm	fine sand 0.05-0.25 mm	silt 0.05 - 0.002 mm	clay < 0.002 mm	tex-ture USDA
CA	10-20		24.7	47.4	13.1	11.8	SL
CA	70		24.1	45.0	13.0	16.4	SL
C2g	160		21.7	42.1	14.0	21.2	SCL
cmol(+)/kg							
Ca	Mg	K	Na	H^+	Al^{3+}	Al sat. (m)	Base sat. %
0.26	tr.	0.06	0.04				10.6
0.05	tr.	0.06	0.05				9.2
0.05	tr.	0.06	0.04				6.25
cmol(+)/kg						bar	%
CEC_{soil} sum of cations	CEC_{soil} NH_4OAc	CEC_{soil} bases + Al	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15
	3.4			4.5			
	2.4			4.7			
	2.4			4.8			
organic matter %	organ. C %	N %	C/N	avail. P ppm	P. total %	$CaCO_3$%	EC sat. dS/m
1.58	0.91	0.112	8.1		0.046		
0.69	0.40	0.084	4.7		0.052		
					0.030		

Profile CG006 (formerly Loa 22)

Classification: Carbic Podzols, PZc (FAO, 1990)
Podzols à alios (ORSTOM)

Source: Jamet and Rieffel (1976)

Location: Gnimina forest, 2 km from the coast, near to Pointe Indienne (Loango)

Coordinates: 04° 40’ S; 11° 45’ E (approximately)
-04.67°; 11.75°

Terrain unit: 100, coastal dunes

Altitude: 10 m

Physiography: dune slopes

Drainage: excessively drained

Parent material: coastal sand dunes

Vegetation: coastal forest

Profile description

Ah1 0-10 cm Coarse sand, organic horizon; reddish brown; abundant roots, in a dense network; crumb structure; friable; abundant bare sand grains; abundant, decomposing, ligneous fragments; gradual boundary.

Ah2 10-17 cm Humiferous sand, greyish black; single grain; dry; less dense root system; gradual boundary.

E 17-130 cm White sand, with some diffuse, vertical, greyish, slightly humiferous spots; few, medium and coarse roots; in the lower tens of cm, colour becomes slightly greyish; irregular boundary.

Bh 130-150/180 Humus and (some) iron accumulation; compact, but friable between fingers; irregular lower limit: seen from above: prismatic blocks separated by white sand tongues; the upper 1-2 cm of the horizon is more friable and more brownish, due to a maximum accumulation of organic matter, this colour is not constant, but occurs in concentric zones; deeper, colour becomes reddish yellowish brown and compaction increases over 5-6 cm; the lower horizon is more friable and lighter coloured, passing to the brownish yellow of the C horizon; a few harder ferruginous concretions occur.

C 150/180-270 Slightly brownish yellow sand, more humid.

Analytical data of profile CG006

horizon	depth (cm)	> 2 mm %	coarse sand 0.25-2 mm	fine sand 0.05-0.25 mm	silt 0.05 - 0.002 mm	clay < 0.002 mm	tex-ture USDA
Ah1	0-10		40.5	12.2	-	-	S
Ah2	10-15		75.0	16.5	-	-	S
E	75		66.1	33.9	-	-	S
Bh	130-135		-	-	-	-	S

Bh C	135-145 190		60.4 70.2	31.2 27.3	0.3 0.5	1.2 0.3	S S
cmol(+)/kg							
Ca	Mg	K	Na	H^+	Al^{3+}	Al sat. (m)	Base sat. %
0.39 0.05 - - - -	1.23 0.11 - - - -	0.37 0.05 - - - -	0.21 0.03 - - - -				47.3 3.9 - - - -
Cmol(+)/kg						bar	%
CEC_{soil} sum cat.	CEC_{soil} NH_4OAc	CEC_{soil} bases + Al	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15
	46.40 6.2 - - - -			3.9 4.3 4.5 4.3 4.5 4.7			
organic matter %	organ. C %	N %	C/N	free Fe_2O_3 %	total Fe_2O_3 %	$CaCO_3$%	EC sat. dS/m
	2.67 0.52 0.39 4.18 3.88 0.53	1.242 0.270 0.042 0.199 0.203 -	21 19 9.3 21 19.1 -	0.20 0.24 0.28 0.96 0.60 0.36	0.50 0.60 0.50 1.90 1.40 0.70		

Profile CG007 (formerly RJBO 33)

Classification: Ferralic Cambisols, CMo (FAO, 1990)
Sols ferrallitiques faiblement ou moyennement désaturés (ORSTOM)

Source: Jamet and Rieffel (1976)

Location: forestry track “Guillermot”, at 20 km S of Les Saras (Mboulou)

Coordinates: 04° 30’S; 12°20’E (approximately)
-04.50°; 12.33°

Terrain unit: 610, coastal Mayombe highlands

Altitude: 315 m

Physiography: Strongly dissected region, 130 m relative altitude difference, profile on a hill top

Drainage: well drained

Parent material: greenstones, rock outcrops of several cubic metres nearby

Vegetation: well developed rainforest

Profile description

Ah1 0-03 cm Orange brown (5 YR 4/3, moist); organic matter not directly detectable; fine sandy clay; moderate, fine and medium crumb, associated to a medium subangular blocky structure; porous; friable; many fine roots, penetrating in the aggregates.

Ah2 03-16 cm Brownish orange (5 YR 4/6, moist); sandy clay; moderate, medium, blocky structure; very porous; many roots; cavities and termite galleries.

Bw1 16-80 cm Same colour; slightly more clayey; moderate, medium, blocky structure; porous; termite galleries.

Bw2 80-160 cm Same colour and texture; moderate, finer and medium, blocky structure; more friable.

Bw3 160-220 cm Slightly reddish orange (5 YR 5/6); other characteristics identical as above, but more coherent.

C,gr 220-320 cm 5 YR 4/8; detritical quartz gravels, rare weathered greenstone (epidote), rare ferruginous gravels.

CR 320 + cm 2.5 YR 4/6, weathered rock.

Analytical data of profile CG007

horizon	depth (cm)	> 2 mm %	Coarse sand 0.25-2 mm	fine sand 0.05-0.25 mm	silt 0.05 - 0.002 mm	clay < 0.002 mm	texture USDA
Ah1	0-5		7.3	27.9	13.1	41.9	C
Ah2	10-15		5.3	25.0	16.6	46.9	C
Bw1	30-35		4.1	20.7	18.4	54.2	C

Bw2	65-70		4.9	21.8	13.0	54.2	C
Bw2	100-105		4.4	20.6	15.0	56.2	C
Bw2	155-160		4.6	21.0	17.3	54.3	C
Bw3	190-200		5.4	21.2	17.0	51.1	C
C,gr	240		18.2	19.9	31.8	26.4	L
CR	320		18.7	32.0	35.7	11.5	SL
cmol(+)/kg							
Ca	Mg	K	Na	H^+	Al^{3+}	Al(m)	V %
1.64	0.47	0.25	0.08				20.9
0.33	0.13	0.03	0.04				9.1
0.21	0.11	tr.	0.06				12.7
0.29	0.14	tr.	0.04				26.1
0.25	0.14	tr.	0.04				33.1
0.25	0.11	tr.	0.04				35.0
0.37	0.11	tr.	0.04				27.4
0.33	0.10	tr.	0.04				52.2
0.21	0.10	tr.	0.04				25.0
cmol(+)/kg						bar	%
CEC_{soil} sum ct.	CEC_{soil} NH_4OAc	CEC_{soil} b.+ Al	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15
	11.7			4.80			
	5.8			5.15			
	3.0			5.30			
	1.8			5.60			
	1.3			5.85			
	1.2			5.75			
	1.9			5.80			
	0.9			5.95			
	1.4			5.80			
C/N	org. C%	N %	free Fe_2O_3 %	total Fe_2O_3 %	avail. P %	P. total	EC sat.
13.5	3.40	0.252	6.00	14.40	0.070	2.34	
9.6	1.01	0.105	6.12	16.96	0.018	2.29	
9.3	0.56	0.060	6.24	18.76	0.018	2.34	
8.6	0.36	0.042	6.80	19.12			
7.7	0.30	0.039	6.14	19.20			
			6.16	19.16			
			6.64	19.56			
			8.40	24.40			
			9.72	22.28			

Profile CG008 (formerly JR 3)

Classification:	Xanthic Ferralsols, FRx (FAO, 1990) Sols ferrallitiques typiques, jaunes, sur matériau argileux à argilo-sableux, issu du Schisto-Calcaire moyen, de zones planes (ORSTOM)
Source:	Jamet and Rieffel (1976)
Location:	near Kayes (left banks of the Niari river)
Coordinates:	04° 15'S; 13° 19'E -04.25°; 13.32°
Terrain unit:	710/1, Schisto-Calcaire plain
Altitude:	180 m
Physiography:	widely undulating plateau, dominated by a few gravelly hills

Drainage: well drained

Parent material: Schisto-Calcaire (SCII): marls, sandstones, limestones

Vegetation: shrub savannah

Profile description

Ah 0-15 cm Clay; dry; (10 YR 3/3, moist); organic matter not directly detectable; no mottles; no gravels; moderate, medium to coarse, blocky structure; loose; friable; porous; some fine vertical cracks; abundant roots; distinct and smooth boundary.

AB 15-30 cm Clay; dry; (10 YR 4/4, moist); organic matter not directly detectable; no mottles; no gravels; weak to moderate, coarse, blocky structure; coherent; firm; some vertical cracks; few, fine roots; distinct and smooth transition.

BA 30-80 cm Heavy clay; moist; (10 YR 5/8, moist); apparently non-organic; no mottles; no gravels; weak to moderate, fine to medium, blocky structure; strong biological activity; loose; friable; gradual and smooth transition.

Bo 80-240 cm Heavy clay; moist; (10 YR 5/8, moist); no mottles; very fine black flakes of 1-2 mm, sometimes concentrated in small amounts; massive to somewhat blocky, breaking to crumb; loose; friable; porous; fine roots and rootlets.

Analytical data of profile CG008

horizon	depth (cm)	> 2 mm %	coarse sand 0.25-2 mm	fine sand 0.05-0.25 mm	silt 0.05 - 0.002 mm	clay < 0.002 mm	tex-ture USDA
Ah	0-15		5.6	9.5	28.7	46.7	C
AB	15-30		4.2	10.5	23.6	58.1	C
BA	50-60		2.9	7.4	22.5	65.5	C
Bo	150-160		2.4	4.5	15.6	71.8	C
cmol(+)/kg							
Ca	Mg	K	Na	H^+	Al^{3+}	Al sat. (m)	Base sat. %
4.6	1.65	0.20	0.2				60
1.65	0.55	0.05	0.1				40
1.25	0.25	0.05	0.05				45

1.20	0.15	0.05	0.05				38
cmol(+)/kg						bar	%
CEC_{soil} sum of cat.	CEC_{soil} NH_4OAc	CEC_{soil} bases + Al	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15
	11.1 5.8 3.55 3.8			6.2 6.1 5.9 5.9			
C/N	organ. C %	N %	free Fe_2O_3 %	avail. P %	P. total %	$CaCO_3$%	EC sat. dS/m
16 10 -	3.16 1.29 -	0.195 0.13 -					

Profile CG009 (formerly GUE 9)

Classification: Xanthic Ferralsols, FRx (FAO, 1990)
Sols ferrallitiques typiques, faiblement appauvris, sur matériau argilo-sableux, issu de l'altération des granites et diorites quartzitiques (ORSTOM)

Source: Jamet and Rieffel (1976)

Location: Mfoubou granite massif, SE of Guéna (Bilinga), Mayombe highlands

Coordinates: 04° 40'S; 12° 15'E
-04.67°; 12.25°

Terrain unit: 510, Mayombe granite intrusions

Altitude: about 400 m

Physiography: steeply dissected region, top of a hillock with slopes of about 60 %

Drainage: well drained

Parent material: calco-alkaline granite, blocks of 2-3 m on the slopes

Vegetation: open forest, with a weak developed undergrowth

Profile description

Ah 0-05 cm Coarse quartz sandy clay loam; greyish brown (10 YR 5/2, moist); organic matter not directly detectable; fine, subangular, blocky structure; very porous; very friable; cavities and galleries; many, fine and medium roots.

AB 05-17 cm Coarse quartz sandy clay loam; greyish yellow (10 YR 5/8, moist); medium, blocky structure; coherent; porous; less galleries; many, fine and medium roots.

Bo1 17-50 cm Coarse quartz sandy clay; yellowish orange (7.5 YR 6/8, dry and 7.5 YR 5/6, moist); moderate, medium, blocky structure; coherent; porous; some roots.

Bo2 50-150+ cm More clayey, coarse quartz, sandy clay; same colour as above (7.5 YR 5/6, moist); blocky structure; more coherent; less porous; few roots.

Analytical data of profile CG009

horizon	depth (cm)	> 2 mm %	coarse sand 0.25-2 mm	fine sand 0.05-0.25 mm	Silt 0.05 - 0.002 mm	clay < 0.002 mm	tex-ture USDA
Ah	0-05		38.3	9.4	2.2	34.1	SCL
AB	10-15		46.4	10.9	3.3	34.5	SCL
Bo1	50		43.6	9.1	7.6	38.9	SC
Bo2	100		37.4	8.6	3.7	47.4	SC
Bo2	150		36.9	8.6	3.6	46.9	SC
cmol(+)/kg							
Ca	Mg	K	Na	H^+	Al^{3+}	Al sat. (m)	Base sat. %
0.36	0.53	0.51	0.05				12.9
0.06	0.10	0.04	tr				8.6
0.08	0.08	0.04	tr				10.0
tr.	0.05	tr.	tr				2.0
0.14	0.03	0.04	0.7				36.4

cmol(+)/kg						bar	%
CEC_{soil} sum cat.	CEC_{soil} NH_4OAc	CEC_{soil} bases + Al	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15
	11.20			3.8			
	2.53			4.2			
	2.00			4.7			
	2.50			4.9			
	2.50			4.4			
organ. mat. %	organ. carbon %	N %	free Fe_2O_3 %	Total Fe_2O_3 %	P. total %	$CaCO_3$%	EC sat. dS/m
	8.0	0.455	3.7	9.0			
	1.3	0.130	-	-			
	0.7	0.081	3.0	9.0			
	-	-	-	-			
	-	-	2.8	9.2			

Profile CG010 (formerly JR 38)

Classification: Xanthic Ferralsols, FRx (FAO)
Sols ferrallitiques typiques, sur matériau argilo-sableux, issu de l'altération d'argilites et grès de la Mpioka (ORSTOM)

Source: Jamet and Rieffel (1976)

Location: Boko-Songho, Cataracts plateau

Coordinates: 04° 29'S; 13° 24'E
-04.48°; 13.40°

Terrain unit: 720/2, Cataracts plateau

Altitude: 400 m

Physiography: widely undulating plateau, at about 100 m from the plateau escarpment

Drainage: well drained

Parent material: Mpioka series sandstones and argilites, Schisto-Greseux System

Vegetation: shrub savannah

Profile description

O 0-02 cm Thin, discontinuous, litter layer, with greyish black sands

Ah 02-24 cm Fine sandy clay loam; dry; (10 YR 4/2, moist); organic matter not directly detectable; no mottles; no gravels; massive to weak, coarse, blocky structure; coherent; slightly friable; many roots; clear and smooth boundary.

AB 24-55 cm Fine sandy clay; moist; (7.5 YR 5/4, moist); organic matter not directly detectable; many penetrations of irregular, non-oriented, restricted, brown, humiferous spots, forming a clear and contrasting network, decreasing with depth; no gravels; weak, blocky structure to massive; coherent; friable; gradual and smooth transition.

Bo1 55-120 cm Sandy clay; moist; (7.5 YR 6/6, moist); organic matter not directly detectable; some, non-oriented, irregular, clear and contrasting, brown spots, disappearing in depth; moderate, weak, fine, blocky structure; loose; friable; gradual and smooth transition.

Bo2 120-220 cm Fine sandy clay; moist; (7.5 YR 6/6, moist); apparently non-organic; no spots; no gravels; massive to blocky structure, with a floury micro-structure; loose; friable; porous; many fine roots.

Analytical data of profile CG010

horizon	depth (cm)	> 2 mm %	coarse sand 0.25-2 mm	fine sand 0.05-0.25 mm	silt 0.05 - 0.002 mm	clay < 0.002 mm	tex-ture USDA
Ap1	0-20		9.7	45.6	28.3	22.0	SCL
AB	20-40		7.1	40.0	16.3	36.5	SC
Bo2	140-150		7.1	40.0	12.7	36.2	SC
cmol(+)/kg							

Ca	Mg	K	Na	H^+	Al^{3+}	Al sat. (m)	Base sat. %
0.85 0.2 0.1	0.3 0.05 0.01	0.93 0.2 0.05	0.01 0.05 0.05				29 11 6
cmol(+)/kg						bar	%
CEC_{soil} sum cat.	CEC_{soil} NH_4OAc	CEC_{soil} bases + Al	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15
	5.4 4.55 3.5			5.2 5.0 4.9			
C/N	organ. C %	N %	free Fe_2O_3 %	free Fe_2O_3 %	P. total %	$CaCO_3$ %	EC sat. dS/m
15 - -	1.80 - -	0.12 - -	- - 2.85	- - 5.75			

Profile CG011 (formerly DIM 43)

Classification: Ferralic Cambisols, CMo (FAO, 1990)
Sols ferrallitiques faiblement appauvris, sur matériau sablo-argileux à argileux, issu de l'altération des grès (ORSTOM)

Source: Jamet and Rieffel (1976)

Location: Bamba Mountain, SE of Mvouti, Mayombe highlands

Coordinates: 04° 25'S; 12° 40'E (approximately)
-04.42°; 12.67°

Terrain unit: 620, Interior Mayombe highlands

Altitude: 800 m

Physiography: upper slope (20 %) of the mountain

Drainage: well drained

Parent material: Bamba Mountains System quartzitic sandstone

Vegetation: open forest, with open shrub undergrowth

Profile description

O 0-07 cm Litter layer with reddish fine and medium roots and decomposing organic debris in between; strings of humiferous aggregates, along fine roots; many bleached sand grains.

Ah 07-32 cm Sandy clay loam; yellowish brown (10 YR 4/4, moist); organic matter not directly detectable; moderate, fine and medium, blocky structure; coherent; no fissures; porous; friable; many roots.

AB 32-80 cm Sandy clay; yellow (10 YR 5/8, moist), sometimes slightly coloured by organic matter (10 YR 6/8); few greyish humiferous spots; moderate, medium, blocky structure; coherent; porous as above; common roots.

Bw 80-180 cm More clayey sandy clay; yellow (10 YR 6/8, moist); strong, medium, blocky structure; coherent; porous; friable; slightly plastic; near the base, starting at 150 cm: spread sandstone gravels.

C,gr 180-250 cm (10 YR 6/6, moist); abundant, irregular and rounded, and superficially red-coloured and weathered, but inside only slightly weathered, blocks of quartzitic sandstone; plus slightly weathered, very hard, greyish gravels of quartzitic sandstone, quartz and indurated, ferruginous sandstone.

Analytical data of profile CG011

horizon	depth (cm)	> 2 mm %	coarse sand 0.25-2 mm	fine sand 0.05-0.25 mm	silt 0.05 - 0.002 mm	clay < 0.002 mm	tex-ture USDA
Ah	7-15		21.5	19.1	23.9	29.1	SCL
AB	40-45		21.0	17.5	27.1	32.0	CL
Bw	100		20.0	16.4	30.2	33.1	CL
C,gr	200		20.3	14.2	22.1	40.8	C
cmol(+)/kg							
Ca	Mg	K	Na	H^+	Al^{3+}	Al sat. (m)	Base sat. %
tr.	0.03	0.08	0.05				1.3
tr.	tr.	0.04	0.05				1.2
0.05	tr.	0.04	0.03				2.0
0.08	tr.	0.04	0.03				2.2

cmol(+)/kg						bar	%
CEC_{soil} sum of cations	CEC_{soil} NH_4OAc	CEC_{soil} bases + Al	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15
	12.10 7.60 6.10 6.70			4.20 5.10 5.05 4.85			
C/N	organ. C %	N %	free Fe_2O_3 %	avail. P ppm	P. total mg/100g	$CaCO_3$ %	EC sat. dS/m
10.7 1.8 - -	2.87 0.74 - -	0.269 0.412 - -					

Profile CG012 (formerly GUE 11)

Classification: Luvic Arenosols, ARl (FAO, 1990)
Sols psammitiques appauvris, modaux (ORSTOM)

Source: Jamet and Rieffel (1976)

Location: Forestry track at 15 km SE of Guéna (Bilinga), at the foot of the Mayombe highlands

Coordinates: 04° 40'S; 12° 15'E (approximately)
-04.67°; 12.25°

Terrain unit: 300, coastal plateau

Altitude: about 100 m

Physiography: Widely dissected region

Drainage: excessively drained

Parent material: sandy deposits of the Cirques series

Vegetation: open forest, with open shrub undergrowth, many *Maranthaceae*

Profile description

O 0-03 cm Thin litter layer, with a dense network of fine

roots, humiferous aggregates and bleached sand grains.

Ah 03-10 cm Sand to fine quartz sand; brown (7.5 YR 3/2, moist); organic matter not directly detectable; single grain; many shining, washed, sand grains; many, fine and medium roots; clear boundary.

AB 10-18 cm Somewhat more loamy quartz sand; brownish grey (10 YR 5/3, dry and 10YR 4/2, moist); single grain; many, fine and medium roots; distinct transition.

BA 18-70 cm Loamy fine quartz sand; yellowish grey (10 YR 6/3, dry and 10 YR 5/6, moist); with slightly contrasting, greyish, humiferous spots; weak, very fine to fine, blocky structure; friable; many roots; distinct transition.

Bw 70-200 cm Loamy sand, the clay content increases with depth; greyish yellow to yellow in depth (10 YR 7/4, dry and 10 YR 5-6/6, moist); many, small, clear, contrasting, greyish vertical and oblique greyish spots; weak, very fine and fine, blocky structure; coherent; porous; some roots.

Analytical data of profile CG012

horizon	depth (cm)	> 2 mm %	coarse sand 0.25-2 mm	fine sand 0.05-0.25 mm	silt 0.05 - 0.002 mm	clay < 0.002 mm	tex-ture USDA
Ah	3-5		23.9	61.0	8.5	1.7	S
AB	10-15		24.7	56.9	5.1	6.3	S
BA	40		20.2	56.3	10.0	9.7	LS
BA	60		20.2	56.0	14.9	9.1	LS
Bw	180		20.4	53.6	14.2	13.3	SL
cmol(+)/kg							
Ca	Mg	K	Na	H^+	Al^{3+}	Al sat. (m)	Base sat. %
0.49	0.20	0.15	0.05				20.0
0.26	0.10	0.08	0.03				21.3
0.21	0.08	0.04	0.03				17.1
0.21	0.10	0.04	0.03				22.4
0.21	0.08	0.04	tr.				15.0
cmol(+)/kg						bar	%
CEC_{soil} sum cat.	CEC_{soil} NH_4OAc	CEC_{soil} bases + Al	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15
	4.45			3.8			
	2.30			3.7			

	2.10 1.70 2.20			4.3 4.7 4.7			
C/N	organ. carb.%	N %	free Fe_2O_3 (%)	free Fe_2O_3 (%)	P. total %	P av.%	EC sat. dS/m
14.0	2.74	0.196	-	-	-		
8.9	1.25	0.140	-	-	-		
8.1	0.57	0.070	1.2	1.9	1.9		
-	-	-	-	-	-		
-	-	-	1.5	1.7	1.7		

Profile CG013 (formerly JR 83)

Classification: Ferric Lixisols, LXf (FAO, 1990)
Sols ferrallitiques pénévolués, avec erosion et remaniément, sur pente forte (ORSTOM)

Source: Denis and Rieffel (1975)

Location: hills near Kayes

Coordinates: 04° 06'S; 13° 18'E
-04.10°; 13.30°

Terrain unit: 710/2, Niari-Nyanga Depression hills

Altitude: 380 m

Physiography: moderately steep calcareous hills, profile mid-slope on a hill (slope 30 %)

Drainage: well drained

Parent material: Schisto-Calcaire System

Stoniness: slopes covered with many limestone blocks

Erosion: sheet erosion (root system, sedimentation)

Vegetation: shrub savannah

Profile description

Ah 0-10 cm Silty clay; (10 YR 5/4, dry); organic matter not directly detectable; no mottles; no gravels; moderate, fine, crumb structure; coherent; non-friable; many, fine and medium roots.

AB 10-25 cm Fine silty clay (10 YR 6/6, dry); organic matter not directly detectable; moderate, medium, blocky structure; coherent; slightly firm; many, fine cracks, with migration of organic matter; distinct and smooth boundary.

Bt,cs 25-70 cm Clay; (10 YR 6/8, moist); apparently non-organic; rounded, ferruginous nodules, of 1-8 mm diameter; moderate, fine and medium, blocky structure; clear and smooth transition.

BC 70-130 cm Same as above; (10 YR 6/6, moist); with slightly contrasting, faint, irregular, brownish spots; in the lower horizon, limestone bedding becomes visible; gradual transition.

C/R 130-150 cm Yellowish mass as in the BC; no more brownish spots; clay; layers of flattened, strongly weathered, red to pale yellow, gravels of limestone and calcareous marl; gradually passing to hard, slightly weathered limestone.

Analytical data of profile CG013

horizon	depth (cm)	> 2 mm %	coarse sand 0.25-2 mm	fine sand 0.05-0.25 mm	silt 0.05 - 0.002 mm	clay < 0.002 mm	tex-ture USDA
Ah	0-5		9.9	3.3	32.2	40.3	C
Bt	35-45		4.0	2.1	28.1	59.0	C
C/R	130-140		-	-	-	-	C
Cmol(+)/kg							
Ca	Mg	K	Na	H^+	Al^{3+}	Al sat. (m)	Base sat. %
3.1	0.75	0.15	0.2				48.0
3.3	0.70	0.15	0.2				88.5
6.4	2.75	0.20	0.2				-
cmol(+)/kg						bar	%
CEC_{soil} sum of	CEC_{soil} NH_4OAc	CEC_{soil} bases +	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15

cations		Al					
	9.2 9.1 10.9			5.5 5.7 -			
C/N	organ. C %	N %	free Fe_2O_3 (%)	total Fe_2O_3 (%)	P. total mg/100g	$CaCO_3$ %	EC sat. dS/m
11.0 4.5 -	1.60 0.50 -	0.15 0.11 -					

Profile CG014 (formerly KR 16)

Classification: Xanthic Ferralsols, FRh (FAO, 1990)
Sols ferrallitiques typiques, jaunes, sur argilites de la Louila (ORSTOM)

Source: Denis and Rieffel (1975)

Location: Matembo, Louila valley

Coordinates: 04° 32'S; 13° 10'E
-04.53°; 13.17°

Terrain unit: 630, Parallel hill chains, Pre-Mayombe hills

Altitude: 430 m

Physiography: hilly, profile on a hill top, no erosion

Drainage: well drained

Parent material: Argilites of the Louila Series

Vegetation: shrub savannah

Profile description

Ah1 0-15 cm Heavy clay; (10 YR 5/6, dry); organic matter not directly detectable; no mottles; no gravels; moderate, coarse and medium, blocky structure, followed by roots; coherent; slightly friable;

slightly porous; many vertical fissures of about 1 mm; abundant fine roots and rootlets; distinct and smooth transition.

Ah2 15-40 cm Heavy clay; (10 YR 6/6, dry); organic matter not directly detectable; no gravels; at the base of the horizon occur a few, irregular, vertical, slightly contrasting, diffuse, yellowish spots, without relation to other characteristics; moderate, medium, blocky structure; many roots; distinct and smooth boundary.

AB 40-80 cm Heavy clay; (10 YR 7/6, dry); organic matter not directly detectable; no gravels; many, clear, contrasting, brown spots of variable sizes, without relation to other characteristics; weak, fine, blocky structure; loose; friable; moderate biological activity; gradual and smooth transition.

Bo 80-400 cm Heavy clay; more moist in depth; (10 YR 7/6, dry); organic matter not directly detectable in the first 20 cm; no gravels; in the first 20 cm: few, small, irregular, contrasting, vertical, brown spots; weak, fine, blocky structure; very friable; weak biological activity; few roots.

Analytical data of profile CG014

horizon	depth (cm)	> 2 mm %	coarse sand 0.25-2 mm	fine sand 0.05-0.25 mm	silt 0.05 - 0.002 mm	clay < 0.002 mm	tex-ture USDA
Ah1	0-15		3.0	2.9	18.3	69.2	C
AB	50-60		2.0	2.6	16.6	75.4	C
Bo	110-120		2.5	2.6	16.6	76.0	C
Bo	190-200		2.4	2.4	13.0	77.9	C
Bo	390-400		2.1	2.4	18.0	77.2	C
Cmol(+)/kg							
Ca	Mg	K	Na	H^+	Al^{3+}	Al sat. (m)	Base sat. %
0.20	0.01	0.01	0.05				
0.15	0.01	0.01	0.05				
0.15	0.01	0.01	0.01				
0.15	0.01	0.01	0.01				
0.15	0.01	0.01	0.01				
cmol(+)/kg						bar	%
CEC_{soil} sum of cations	CEC_{soil} NH_4OAc	CEC_{soil} bases+Al	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15

				4.7 4.9 5.0 5.05 4.7			
organic mat. %	organ. C %	N %	free Fe_2O_3(%)	total Fe_2O_3(%)	P. total mg/100g	$CaCO_3$ %	EC sat.
	2.49 0.86 0.40 - -	0.150 0.090 0.070 - -	- - 6.6 - 7.6	18.1 18.1 18.1 18.8 18.8			

Profile CG015 (formerly GASC 1)

Classification: Carbic Podzols, PZc (FAO, 1990)
Paléopodzol humique, à nappe perchée secondaire (paleo-podzol; with a secondary perched watertable in the rainy season only) (ORSTOM)

Source: Schwartz (1988)

Location: Nganga-Lingolo (W of the Djoué river, W of Brazzaville)

Coordinates: 04° 20'S; 15°07'E (approximately)
-04.33°; 15.12°

Terrain unit: 830/2, Batéké hills

Altitude: about 350 m

Physiography: lower slopes of a depression in the hilly region

Drainage: imperfectly drained

Parent material: weathering sands of polymorphic sandstone

Vegetation: open savannah, with *Loudetia simplex, Monocymbium ceresiiforme* and *Bulbostylis laniceps.*

Remarks: charcoal on the surface (burning of the vegetation) and algal or lichen crusts

Profile description

Ah1 0-15 cm Fine quartz sand; grey (7.5 YR 4/0, dry); single grain, weakly-developed micro-aggregates; many roots; distinct and smooth transition.

Ah2 15-35 cm Sand; grey (7.5 YR 4/1 down to 25 cm, 10YR 5/1 deeper, dry); single grain, with micro-aggregates; fine roots; distinct and smooth boundary.

A/E 35-55 cm Glossic horizon, sand, many organic matter tongues of variable size, descending in the E horizon.

E 55-105 cm Sand, cream white (10 YR 7/2, moist); single grain; abrupt and smooth boundary.

Bhg1 105-112 cm Clayey sand; grey (7.5 YR 5/1, moist); very compact; massive; temporary water stagnation; abrupt boundary.

Bh2 112-185 cm Sand; brownish black; hardened and locally harder than in other places, but loose from 112 to 117 cm; moist; many, mainly vertical roots, passing through the spodic horizon, sometimes following horizontal layers before descending deeper; faunal activity; gradual boundary.

Bh3 185-260 cm Sand; chocolate brown; hardened; humid, because of the rising groundwater table; tree roots reach a depth of about 205 cm; more yellowish to the base.

BC 260 + cm loose yellowish sands.

Analytical data of profile CG015

horizon	depth (cm)	> 2 mm %	coarse sand 0.25-2 mm	fine sand 0.05-0.25 mm	silt 0.05 - 0.002 mm	clay < 0.002 mm	tex-ture USDA
Ah1	0-15		52.9	42.7	3.0	1.1	S
Ah2	25-35		59.7	37.9	2.1	0.9	S
A/E	35-55		55.6	40.7	2.9	1.1	S
E	80-95		41.2	50.1	7.1	0.9	S
Bhg1	110		46.1	41.2	8.5	3.1	S
Bh2	140		41.9	41.1	4.5	5.3	S
Bh3	260		54.5	35.7	4.3	4.6	S
cmol(+)/kg							

Ca	Mg	K	Na	H^+	Al^{3+}	Al sat. (m)	Base sat. %
0.01	0.04	0.06	tr.				0.6
0.07	0.02	0.03	0.01				0.7
0.04	0.02	0.01	0.01				0.7
0.06	0.02	0.01	0				2.6
0.05	0.01	0.01	0				3.9
0.08	0.01	0.02	0				5.0
0.04	0	0.02	0				0.4
cmol(+)/kg						bar	%
CEC_{soil} sum of cations	CEC_{soil} NH_4OAc	CEC_{soil} bases+Al	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15
	19.11			4.9	3.4		
	18.4			5.4	3.9		
	11.5			5.9	4.1		
	3.5			6.6	4.9		
	1.8			5.6	3.9		
	2.2			4.3	3.3		
	14.3			5.4	4.4		
C/N	organ. C %	N %	total Fe_2O_3 (%)	free Fe_2O_3 (%)	P. total mg/100g	$CaCO_3$ %	EC sat. dS/m
31.3	1.314	0.0420	0.16	0.00			
13.4	0.287	0.0210	0.08	0.08			
11.0	0.138	0.0126	0.40	0.04			
4.5	0.038	0.0084	0.40	0.06			
18.9	0.515	0.0273	0.16	0.22			
43.7	4.714	0.1078	0.48	0.15			
32.3	0.595	0.0182	0.16	0.03			

Profile CG016 (formerly BS21)

Classification:	Haplic Ferralsols, FRh (FAO, 1990) Sols ferrallitiques sur granito-gneiss (ORSTOM)
Source:	Brugiere (1960)
Location:	Elenzo farm (NE of Soanké), crestline of the watershed between the Momakoma and the N'Zoa
Coordinates:	02° 10'N; 14° 10'E (approximately) 02.17°; 14.17°
Terrain unit:	1020, Ivindo gneiss plateau
Altitude:	about 600 m
Topography:	top of a crestline
Drainage:	well drained
Parent material:	weathering products of granito-gneiss
Vegetation:	farmland with Angolo peas, the area will be planted with oil palm

Profile description

Ap	0-5 cm	Sandy clay; reddish brown; humiferous; fine crumb structure; firm; good porosity; some ferruginous, coarse sand at the surface.
AB	5-20 cm	Sandy clay, reddish brown; slight humiferous penetration; medium, subangular blocky structure; few black sand grains in the matrix.

BA 20-55 cm Sandy clay; red; blocky structure; small, yellowish brown spots at 50 cm depth.

Bo 55-280 cm Clay; spotted horizon; red and yellowish brown spots increase in size, and their limits become more distinct with depth; compact but non-coherent; moist; at 250 cm, appear a few white mica flakes and weathered ferro-magnesian minerals in a clayey matrix; good rooting to a depth of 200 cm.

Analytical data of profile CG016

horizon	depth (cm)	> 2 mm %	coarse sand 0.25-2 mm	fine sand 0.05-0.25 mm	silt 0.05 - 0.002 mm	clay < 0.002 mm	tex-ture USDA
Ap-AB	0-10	0	24	28	10	39	SC
BA	25-30	0	16.5	18	10	50	C
Bo	100	0	18	18	3.5	66	C
Bo	250	0	9	12.5	6	68	C
cmol(+)/kg							
Ca	Mg	K	Na	H^+	Al^{3+}	Al sat. (m)	Base sat. %
1.88	0.46	0.17	0.04				
0.69	0.30	0.06	0.03				
0.41	0.10	0.03	0.03				
0.18	0.18	0.04	0.01				
cmol(+)/kg						bar	%
CEC_{soil} sum of cations	CEC_{soil} NH_4OAc	CEC_{soil} bases+Al	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15
				4.5			
				4.3			
				4.3			
				4.3			
C/N	organ. C %	N %	free Fe_2O_3 (%)	avail. P ppm Truogh	P. total mg/100 g	$CaCO_3$%	EC sat. dS/m
9.1	1.7	0.187					
6.9	0.7	0.102					
-	-	-					
-	-	-					

Profile CG017 (formerly KK5)

Classification:	Haplic Ferralsols, FRh (FAO, 1990) Sols ferrallitiques argilo-sableux (ORSTOM)
Source:	Brugiere (1960)
Location:	6.5 km NW of Kékélé, road from Etoumbi to Mékambo (Gabon)
Coordinates:	00° 30’ N; 14° 30’E (approximately) 00.50°; 14.50°
Terrain unit:	1010, Kéllé gneiss plateau
Altitude:	588 m
Topography:	plateau border, near steep slopes
Drainage:	well drained
Parent material:	granito-gneiss weathering products
Vegetation:	fallow with umbrella trees

Profile description

Ap	0-04 cm	Coarse sandy clay; dark reddish brown; humiferous; crumb structure; good porosity; many roots.
Bo1	04-120 cm	More clayey, reddish brown; coarse blocky, breaking into subangular, blocky structure; reduced porosity.
Bo2,cs	120 + cm	Ironstone gravels and blocks in a clay matrix, limiting root penetration.

Analytical data of profile CG017

horizon	depth (cm)	> 2 mm %	coarse sand 0.25-2 mm	fine sand 0.05-0.25 mm	Silt 0.05 - 0.002 mm	Clay < 0.002 mm	tex-ture USDA
Ap Bo1	0-04 60		20 21	19 12.5	7 8.5	41 58	SC C
cmol(+)/kg							
Ca	Mg	K	Na	H^+	Al^{3+}	Al sat. (m)	Base sat. %
0.65 0.03	0.26 0.05	0.25 0.05	0.06 0.02				
cmol(+)/kg						bar	%
CEC_{soil} sum of cations	CEC_{soil} NH_4OAc	CEC_{soil} bases+Al	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15
				4.8 4.2			
C/N	organ. C %	N %	free Fe_2O_3 (%)	avail. P ppm Truogh	P. total mg/100 g	$CaCO_3$%	EC sat. dS/m
11.1 7.4	3.2 0.7	0.278 0.092					

Profile CG018 (formerly 0-3, I2)

Classification:	Haplic Ferralsols, FRh (FAO, 1990) Sols ferrallitiques bruns, issus de la series Sembé-Ouésso, niveau B1 (ORSTOM)
Source:	Brugiere (1960)
Location:	km 15, SW of Ouésso
Coordinates:	01° 40'N; 15°55' E 01.67°; 15.92°
Terrain unit:	960/1 Sembé-Ouésso main plateau sector
Altitude:	400 m
Topography:	slopes (8-9 %) of the plateau
Drainage:	well drained
Parent material:	schisto-quartzite weathering products of the Sembé-Ouésso series, B1 level
Vegetation:	CFHBC plantation

Profile description

O		Shallow litter layer
Ap1	0-05 cm	A thin layer of loose bare sand overlies fine sandy loam; dark brown; slightly humiferous; weak crumb structure to single grain.
Ap2	05-15 cm	Still humiferous, fine sandy loam; dark reddish brown; dry; medium, blocky structure; low porosity; maximum root development.
BA	15-50 cm	Reddish brown; sandy clay loam; moderate, more coarse blocky structure, with a prismatic tendency; more moist; abundant roots.
Bt	50-90 cm	Clay and iron accumulation; red; sandy clay loam; thin, discontinuous cutans on aggregate faces; some

diffuse more red spots; finer structure and less cohesion; most humid horizon; many roots.

Bo 90-230 cm Sandy clay loam; red; more coherent and drier; many roots.

Analytical data of profile CG018

horizon	depth (cm)	> 2 mm %	coarse sand 0.25-2 mm	fine sand 0.05-0.25 mm	silt 0.05 - 0.002 mm	clay < 0.002 mm	tex-ture USDA
Ap1	0-5	0	15	67	3.3	14	SL
Ap2	5-15	0	14	65	3.5	17	SL
BA	30	0	10.5	59	3.5	25	SCL
Bt	75	0	13	54	3.5	28	SCL
Bo	150	0	10	58	5.0	27	SCL
cmol(+)/kg							
Ca	Mg	K	Na	H^+	Al^{3+}	Al sat. (m)	Base sat. %
0.33	0.10	0.09	0.01				15.4
0.25	0.05	0.05	0.01				13.6
0.11	0.03	0.05	0.01				4.5
0.07	0.02	0.05	0.01				3.3
0.05	tr.	0.04	tr.				27
cmol(+)/kg						bar	%
CEC_{soil} sum of cations	CEC_{soil} NH_4OAc	CEC_{soil} bases+Al	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15
	2.5			4.0			
	2.7			4.3			
	4.4			4.3			
	4.5			4.4			
	3.7			4.35			
C/N	organ. C %	N %	free Fe_2O_3 (%)	avail. P ppm	P. total mg/100 g	$CaCO_3$%	EC sat. dS/m
8.8	0.8	0.091					
6.3	0.5	0.079					
6.0	0.4	0.067					
5.9	0.4	0.068					
-	-	-					

Profile CG019 (formerly FR24)

Classification:	Haplic Ferralsols, FRh (FAO, 1990) Sols ferrallitiques, issus de la série Argilo-Sableuse (ORSTOM)
Source:	Brugiere (1960)
Location:	N of Makoua, on the track Mohali, Ikamou, 100 m from the junction with the road to Mambili
Coordinates:	00° 10’N; 15°35’ E 00.17°; 15.58°
Terrain unit:	840, Bambio plateau
Altitude:	370 m
Topography:	top of the extensive footslope plateau, about 40 m above the alluvial plains
Drainage:	well drained
Parent material:	sandy clay loam of the Bambio plateaux series
Vegetation:	palm plantation and recent forest regrowth

Profile description

Ap	0-15 cm	Sandy loam; brownish black; humiferous; single grain, with some humiferous aggregates, many roots.
AB	15-80 cm	Sandy loam; brown to yellowish brown; some diffuse humiferous penetration; single grain, towards the base a weak, blocky structure tendency appears; weak cohesion; many roots.
Bo	80-200 cm	Sandy clay loam; yellowish brown; weak, medium, blocky structure; weak cohesion; good root penetration.

Analytical data of profile CG019

horizon	depth (cm)	> 2 mm %	coarse sand 0.25-2 mm	fine sand 0.05-0.25 mm	silt 0.05 - 0.002 mm	Clay < 0.002 mm	tex-ture USDA
Ap	0-10	0	40	39	1.0	18	SL
AB	50	0	46	35	0.5	19	SL
Bo	120	0	39	35	0.5	20	SCL
Cmol(+)/kg							
Ca	Mg	K	Na	H^+	Al^{3+}	Al sat. (m)	Base sat. %
0.02	0.04	0.04	0.03				38
tr.	0.02	0.02	0.02				3
tr.	tr.	tr.	0.03				25
cmol(+)/kg						bar	%
CEC_{soil} sum of cations	CEC_{soil} NH_4Oac	CEC_{soil} bases+Al	CEC_{soil} (Ca)	PH H_2O	pH KCl	1/3	15
	3.4			3.9			
	3.0			4.0			
	3.8			4.5			
C/N	organ. C %	N %	free Fe_2O_3 (%)	avail. P ppm Truogh	P. total mg/100 g	$CaCO_3$%	EC sat. dS/m
14.2	1.9	0.133					
13.1	0.9	0.074					
7	0.3	0.049					

Profile CG020 (formerly RO-81)

Classification:	Luvic Arenosols, ARl (FAO, 1990) Sols psammitiques des collines Batéké à réseau hydrographique dense (ORSTOM)
Source:	Brugiere (1960)
Location:	3 km NW of Etoro regional farm (N of Gamboma)
Coordinates:	01° 45'S; 16°00'E (approximately) -01.75°; 16.00°
Terrain unit:	830/3, Batéké hills with a dense drainage pattern (inclusion of 830/3 in area of 830/1)
Altitude:	350 m
Topography:	hilly, profile position mid-slope
Drainage:	Excessively drained
Parent material:	weathering products of polymorphic sandstone
Vegetation:	savannah with *Trachypogon thollonii* and *Ctenium*

Profile description

Ah1	0-15 cm	Slightly loamy fine sand; black; humiferous; burned; single grain tendency, with some humiferous aggregates; abundant roots.
Ah2	15-30 cm	Slightly loamy fine sand; black; humiferous; burned; weak, blocky structure.
AB	30-85 cm	Loamy sand; rare humus infiltration, along vertical stripes and abundant small spots; moderate, medium, blocky structure; good cohesion.
Bo1	85-160 cm	Loamy sand; slightly reddish yellowish brown; strong, medium, blocky structure; strong cohesion.
Bo2	160-220 cm	Similar, but les coherent, few roots down to 200 cm.

Analytical data of profile CG020

horizon	depth (cm)	> 2 mm %	coarse sand 0.25-2 mm	fine sand 0.05-0.25 mm	silt 0.05 - 0.002 mm	Clay < 0.002 mm	tex-ture USDA
Ah	0-20	0	13	76	0.2	9	S
AB	50	0	13	74	2.1	11	LS
Bo1	120	0	12.5	71.5	2.1	14	LS
cmol(+)/kg							
Ca	Mg	K	Na	H^+	Al^{3+}	Al sat. (m)	Base sat. %
0.24	0.05	0.09	0.01				
0.02	tr.	0.05	0.01				
0.04	tr.	0.04	tr.				
cmol(+)/kg						bar	%
CEC_{soil} sum of cations	CEC_{soil} NH_4OAc	CEC_{soil} bases+Al	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15
				4.8			
				5.0			
				4.9			
C/N	organ. C %	N %	free Fe_2O_3 (%)	avail. P ppm Truogh	P. total mg/100g	$CaCO_3$%	EC sat. dS/m
14.4	0.8	0.055					
11.3	0.4	0.032					
6.8	0.2	0.035					

Profile CG021 (formerly Z1)

Classification:	Humic or Haplic Nitisols, NTu, NTh (FAO, 1990) Sols ferrallitiques, issus de dolérites (ORSTOM)
Source:	Brugiere (1960)
Location:	Old Reynes coffee plantation, on the slopes of the Lengoué valley (SW of Ouésso)
Coordinates:	01° 20’N; 15°40’E (approximately) 01.33°; 15.67°
Terrain unit:	1110, volcanic intrusions
Altitude:	420 m
Topography:	top of a hill dominating the Lengoué valley
Drainage:	well drained
Parent material:	weathering products of dolerite
Vegetation:	old coffee plantation, recently cut

Profile description

Ap	0-20 cm	Coarse sandy clay loam; dark reddish brown; humiferous; crumb structure; excellent porosity; many coffee tree roots, no gravels.
AB	20-30 cm	Transition layer
Bt	30-140 cm	More clayey: sandy clay; dark red; nutty structure; moist; very good root penetration; few white flakes, no gravels.

Analytical data of profile CG021

horizon	depth (cm)	> 2 mm %	coarse sand 0.25-2 mm	fine sand 0.05-0.25 mm	silt 0.05 - 0.002 mm	Clay < 0.002 mm	tex-ture USDA
Ap	0-10	0	23	38	3	30	SCL
AB	20-30	0	18.5	37	4	38	SC
Bt	80-90	0	16	32	16	33	SCL
cmol(+)/kg							
Ca	Mg	K	Na	H^+	Al^{3+}	Al sat. (m)	Base sat. %
1.05	0.36	0.21	tr.				
0.15	0.07	0.06	tr.				
0.11	0.06	0.04	tr.				
cmol(+)/kg						bar	%
CEC_{soil} sum of cations	CEC_{soil} NH_4OAc	CEC_{soil} bases+Al	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15
				4.1			
				4.05			
				4.35			
C/N	organ. C %	N %	free Fe_2O_3 (%)	avail. P ppm Truogh	P. total mg/100 g	$CaCO_3$%	EC sat. dS/m
13	2.5	0.192					
7.9	0.9	0.114					
-	-	-					

Profile CG022 (formerly FR36)

Classification: Xanthic Ferralsols, FRx (FAO, 1990)

	Sols ferrallitiques jaunes, sur alluvions anciennes élevées (ORSTOM)
Source:	Brugiere (1960)
Location:	Regional farm of Fort-Rousset (Owando)
Coordinates:	00° 25’S; 15°55’E (approximately) -00.42°; 15.92°
Terrain unit:	410, low plateaux of the Congo Basin
Altitude:	370 m
Topography:	upper slopes of the plateau
Drainage:	well drained
Parent material:	‘higher old alluvium’
Vegetation:	cocoa plantation

Profile description

O		Litter layer, with leaves and roots
Ap	0-30 cm	Fine sandy loam; humiferous; brown; single grain, with some humiferous aggregates at the surface, deeper starts a weak, blocky structure; abundant roots.
AB	30-60 cm	Fine sandy loam; yellowish brown to brown; diffuse penetration of organic matter; medium, blocky structure; moderate porosity.
Bo	60-220 cm	Slightly more clayey at a depth of 150 cm (sandy clay loam); yellowish brown; weak, medium, blocky structure; less coherent than the horizon above; good root penetration down to 200 cm.

Analytical data of profile CG022

horizon	depth (cm)	> 2 mm %	coarse sand 0.25-2	fine sand 0.05-	silt 0.05 - 0.002	clay < 0.002	tex-ture USDA

			mm	0.25 mm	mm	mm	
Ap	0-15	0	18	63	1	14	LS
AB	40	0	22	60.5	3	14	SL
Bo	150	0	18	62.5	1	20	SCL
cmol(+)/kg							
Ca	Mg	K	Na	H^+	Al^{3+}	Al sat. (m)	Base sat. %
0.18	0.12	0.04	0.03				
0.06	0.03	0.04	0.02				
0.03	0.02	0.02	0.02				
cmol(+)/kg						bar	%
CEC_{soil} sum of cations	CEC_{soil} NH_4OAc	CEC_{soil} bases+Al	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15
				3.4			
				4.4			
				4.7			
C/N	organ. C %	N %	free Fe_2O_3 (%)	avail. P ppm Truogh	P. total mg/100 g	$CaCO_3$%	EC sat. dS/m
17.1	2.5	0.147					
16.8	1.1	0.066					
8.5	0.3	0.034					

Profile CG023 (formerly Z5)

Classification: Dystric Fluvisols, phreatic phase, FLd (FAO, 1990)
Sols alluviaux de la Sangha (ORSTOM)

Source: Brugiere (1960)

Location: Near to the Sangha river, downstream of Ouésso

Coordinates: 01° 40’N; 16°10’E (approximately)
01.67°; 16.17°

Terrain unit: 221, Sangha river alluvial plain

Altitude: 330 m

Topography: alluvial plain, profile near to the Sangha river

Drainage: imperfectly drained

Parent material: silty-clayey alluvium

Vegetation: old forest

Profile description

Ah 0-30 cm Silty clay; dark grey; slightly humiferous; medium, blocky structure; poor porosity; common roots.

C1 30-120 cm Silty clay; light brownish yellow; very weak, blocky structure; very poor porosity.

C2g 120-150 cm Silty clay; compact; yellowish brown ferruginous mottled; hydromorphic.

C3g,cs 150-200 Silty clay; compact; yellowish brown ferruginous mottled; hydromorphic; with ironstone concretrions of a valley ironstone pan.

Analytical data of profile CG023

horizon	depth (cm)	> 2 mm %	coarse sand 0.25-2 mm	fine sand 0.05-0.25 mm	silt 0.05 - 0.002 mm	clay < 0.002 mm	tex-ture USDA
Ah	0-15	0	2	31	20.5	41	C

C1 C2g	50 100	0 0	1.5 4.5	27.5 24	15.0 14.5	53 53	C C
cmol(+)/kg							
Ca	Mg	K	Na	H^+	Al^{3+}	Al sat. (m)	Base sat. %
0.15 0.07 0.04	0.14 0.9 0.9	0.15 0.04 0.04	tr. tr. tr.				
cmol(+)/kg						bar	%
CEC_{soil} sum of cations	CEC_{soil} NH_4OAc	CEC_{soil} bases+Al	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15
				3.85 4.3 4.75			
C/N	organ. C %	N %	free Fe_2O_3 (%)	avail. P ppm Truogh	P. total mg/100 g	$CaCO_3$%	EC sat. dS/m
11.3 6.2 -	1.7 0.4 -	0.150 0.065 -					

Profile CG024 (formerly LIK 2)

Classification: Dystric Gleysols, GLd (FAO, 1990)
Sols minéraux inondés de la cuvette du Congo (ORSTOM)

Source: Brugiere (1960)

Location: community farm of Ngoundjia (S of Impfondo)

Coordinates: 01° 20’N; 17°55’E (approximately)
01.33°; 17.92°

Terrain unit: 210, Congo Basin alluvial plain

Altitude: 350 m

Topography: flooded alluvial plain

Drainage: very poorly drained

Parent material: alluvial (sandy) clay

Vegetation: no data, farmland?

Profile description

Ahg 0-15 cm Sandy clay loam; light grey; blocky structure; yellowish brown mottled.

Cg,cs 15-200 cm Clay; light brownish yellow to greyish brownish yellow in depth, without defined boundary; the number of yellowish brown mottles increases with depth; becoming very soft, yellowish red ironstone concretions, destroyed between the fingers, but never forming hard concretions, or an ironstone pan; blocky structure; very compact; root penetration is very weak and stops at 50 cm, root channels are surrounded by bluish-grey colours (reduced iron).

Analytical data of profile CG024

horizon	depth (cm)	> 2 mm %	coarse sand 0.25-2 mm	fine sand 0.05-0.25 mm	silt 0.05 - 0.002 mm	clay < 0.002 mm	tex-ture USDA
Ahg	0-10	0	20	28	13	34	SCL
Cg	25-35	0	17.5	20	12	50.5	C
Cg	200	0	26.5	17.5	6	47	SC

cmol(+)/kg							
Ca	Mg	K	Na	H^+	Al^{3+}	Al sat. (m)	Base sat. %
0.22 0.15 0.15	0.25 0.02 tr.	0.15 0.04 0.02	0.02 0.02 0.02				
cmol(+)/kg						bar	%
CEC_{soil} sum of cations	CEC_{soil} NH_4OAc	CEC_{soil} bases+Al	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15
				3.8 4.1 4.5			
C/N	organ. C %	N %	free Fe_2O_3 (%)	avail. P ppm Truogh	P. tot.mg /100g	$CaCO_3$%	EC sat. dS/m
11.1 8.8 7.6	2.1 0.7 0.6	0.187 0.082 0.074					

Profile CG025 (formerly BJK 62)

Classification: Geric Ferralsols, FRg (FAO, 1990)
Sols ferrallitiques, de savane, issus des limons-sableux des plateaux Batéké (ORSTOM)

Source: de Boissezon (1963)

Location: 3.5 km W-NW of Nkoua village, Djambala plateau

Coordinates: 02° 20’S; 14°50’E (approximately)
-02.33°; 14.83°

Terrain unit: 820, Batéké plateau remnants

Altitude: 860 m

Topography: flat plateau

Drainage: somewhat excessively well drained

Parent material: weathering product of the 'Batéké Sandy Loam Series'

Vegetation: moderately dense shrub savannah, with *Hyparrhenia diplandra* and *Anona arenaria* (see also CG031: profile under forest)

Profile description

Ah 0-12 cm Sandy clay loam; black (10 YR 2/1); homogeneous humiferous; presenting a massive structure, due to the dense grass root network; the elementary structure has a fine crumb tendency; weak cohesion; good porosity.

AB 12-50 cm Sandy clay loam; greyish brown (10 YR 2/2); homogeneous humiferous; weak, subangular, blocky structure; good porosity.

Bw 50-70 cm More clayey sandy clay loam; penetration of organic matter in spots and stripes in the brownish yellow matrix; moderate, medium, blocky structure; most compact horizon; few roots, mainly of trees.

Bo1 70-100 cm Same texture as above; brownish reddish yellow to reddish yellow (7.5 YR 4/4, moist); weak, blocky structure, falling apart in micro-blocks; tubular porosity; very low root density; a few, brown, humiferous spots (old root channels or termite galleries).

Bo2 100 + cm Same texture, reddish yellow (7.5YR 5/6); slightly moist, even in the dry season.

Analytical data of profile CG025

horizon	depth (cm)	> 2 mm %	co.sand 0.25-2 mm	fine sand 0.05-0.25mm	Silt 0.05 – 0.002mm	clay < 0.002 mm	tex-ture USDA
Ah	0-10	0	36	25	2	27	SCL
AB	25-30	0	35	27	2.5	30	SCL
Bw	50	0	34	28	2	34	SCL
Bo2	100-110	0	33	27	3	35.5	SCL
cmol(+)/kg							

Ca	Mg	K	Na	H^+	Al^{3+}	Al sat. (m)	Base sat. %
cmol(+)/kg						bar	%
CEC_{soil} sum cat	CEC_{soil} NH_4OAc	CEC_{soil} bases+Al	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15
				5.0 - - -			
C/N	organ. C %	N %	free Fe_2O_3(%)	avail. P ppm	P.tot. mg/100g	$CaCO_3$%	EC dS/m
21.8 21.9 - -	4.8 2.3 - -	0.220 0.105 - -					

Classified as Geric Ferralsols, based on complete soil analyses of Batéké plateau soils of the DRC.

Profile CG026 (formerly RM6)

Classification: Xanthic Ferralsols, FRx (FAO, 1990)
Sols ferrallitiques fortement désaturés, typiques, jaunes, argileux, issus de schistes psammitiques du Bouenzien (Bz1), (ORDTOM)

Source: de Champs and Denis (1974)

Location: CCAF road, km 3, S of Tsimba, SW of Mossendjo

Coordinates: 03° 10’S; 12°35’E (approximately)
-03.17°; 12.58°

Terrain unit: 910, Bouenza plateau

Altitude: 600 m

Topography: pediplain plateau, W of, and near to the Itmibou valley

Drainage: well drained

Parent material: weathering products of psammitic schists.

Vegetation: savannah with very tall *Hymenocardia, Hyparrhenia* and *Aframomum*; clearing in the forest (100 m away)

Profile description

Ah 0-08 cm Sandy clay; brownish black (10 YR 4/2); humiferous; moderate, fine, blocky structure; weak to moderate cohesion; good porosity; many, very fine roots; few termite galleries; clear and smooth transition.

AB 08-35 cm Fine sandy clay; humiferous penetration; lighter brown (10 YR 4/3, moist); moderate, fine, blocky structure; moderate porosity; spread roots; abrupt and undulating transition.

Bo 35-170 cm Sandy clay to clay; brownish yellow (10 YR 6/6, moist); humiferous penetration, in wide pockets (of 1-4 cm) in the upper part; micro-blocky structure; weak cohesion; few, spread roots; moist horizon, without gravels.

Analytical data of profile CG026

horizon	depth (cm)	> 2 mm %	co.sand 0.25-2 mm	fine sand 0.05-0.25 mm	silt 0.05 - 0.002 mm	clay < 0.002 mm	tex-ture USDA
Ah	0-8	0	8.5	6.5	4.9	63.0	C
AB	25-35	0	12.0	7.5	4.7	66.1	C
Bo	90-100	0	12.7	7.3	4.4	69.6	C
cmol(+)/kg							
Ca	Mg	K	Na	H^+	Al^{3+}	Al sat. (m)	Base sat. %

0.06 0.08 0.08	tr. tr. tr.	0.23 0.11 0.08	0.05 0.05 0.05				2.3 2.5 4.9
cmol(+)/kg						bar	%
CEC_{soil} sum cat	CEC_{soil} NH_4OAc	CEC_{soil} bases+Al	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15
	15.85 9.50 4.30			4.55 4.70 5.60			
C/N	organ. C %	N %	free Fe_2O_3(%)	avail. P ppm	P.tot. mg/100 g	$CaCO_3$%	EC sat. dS/m
19.4 18.8 4.9	6.20 3.29 0.48	0.319 0.175 0.098					

Profile CG027 (formerly RM7)

Classification: Haplic Acrisols, ACh (FAO, 1990)
Sols ferrallitiques fortement désaturés, rajeunis, jaunes, argilo-sableux, issus de tillite (ORSTOM)

Source: de Champs and Denis (1974)

Location: Track from Dévinié to Congo Bois Camp, km 12

Coordinates: 02° 45’S; 12°10’E (approximately)
-02.75°; 12.17°

Terrain unit: 920, Niari tillite belt

Altitude: about 500 m

Topography: mid-slope, in a hilly landscape

Drainage: well drained

Parent material: weathering products of the Niari or Upper tillite

Vegetation: secondary forest

Profile description

Ah1 0-0.5 cm Sand; greyish white; single grain, with a crumb tendency; weak cohesion; good porosity; distinct transition.

Ah2 0.5-20 cm Coarse sandy loam; light yellow (10 YR 6/4), but darker along fissures; strong, coarse, blocky structure; very coherent; very compact; moderate porosity; termite galleries; common, medium roots, along fissures; diffuse transition.

Bt 20-180 cm Sandy clay to clay; yellow (10 YR 7/4), becoming brighter in depth (10 YR 6/6); moderate, fine, blocky structure; moderate cohesion, when moist; strong cohesion, when dry; moderate porosity; at 170 cm appear gravels and angular sands; strong compaction; still many, medium and coarse roots.

BC,st.l 180-200 Stone line composed of (1) rounded sandstone gravels, (2) angular quartz gravels, (3) rounded quartz gravels; all in a brownish yellow clay matrix; the stoneline is parallel to the surface and slightly undulating.

C/R 200-350 cm Weathered tillite, yellowish and brownish yellow spotted (10 YR 6/4); many rounded quartz and other gravels.

Analytical data of profile CG027

horizon	depth (cm)	> 2 mm %	co.sand 0.25-2 mm	fine sand 0.05-	silt 0.05 - 0.002	clay < 0.002	tex-ture USDA

				0.25 mm	mm	mm	
Ah	0-10		35.2	18.9	8.2	31.8	SCL
Bt	40-50		25.2	12.8	10.4	43.9	SC
Bt	150-170		23.1	12.5	14.1	44.1	C
C/R	300-330		23.7	24.3	23.5	23.3	SCL
cmol(+)/kg							
Ca	Mg	K	Na	H^+	Al^{3+}	Al sat. (m)	Base sat. %
0.08	-	0.15	0.05				3.1
0.08	-	0.11	0.05				2.4
0.08	0.03	0.11	0.05				2.6
-	-	-	-				-
cmol(+)/kg						bar	%
CEC_{soil} sum of cations	CEC_{soil} NH_4OAc	CEC_{soil} bases+Al	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15
	9.00			4.15			
	9.80			4.50			
	10.30			4.40			
	-			5.05			
C/N	organ. C %	N %	free Fe_2O_3(%)	avail. P ppm	P.tot. mg/100 g	$CaCO_3$%	EC sat. dS/m
10.1	1.79	0.178					
6.4	0.81	0.126					
-	-	-					
-	-	-					

Profile CG028 (formerly LOA 17)

Classification: Gleyic Arenosols, ARg (FAO, 1990)
Sols hydromorphiques minéraux (ORSTOM)

Source: Jamet (1967)

Location: near the village of Timana on the road to Bas - Kouilou

Coordinates: 04° 20’S; 11°50’E
-04.33°; 11.83°

Terrain unit: 230, coastal alluvial plains

Altitude: 5 m

Topography: flat

Drainage: very poorly drained, groundwater table at the surface in small depressions

Parent material: alluvium

Vegetation: E and W limited by gallery forests, old cassava fields, now under grass fallow; some palms and cocos grow on non-inundated spots.

Surface: covered by brown aggregates and burned grasses, with locally a thin layer of yellowish sands, in between the grasses

Profile description

Ah 0-15 cm Fine sand; humiferous; brown (10 YR 5/1); very humid; moderate, medium, crumb structure at the surface, getting nutty deeper; very weak cohesion of the aggregates; abundant, subhorizontal, fine roots; distinct transition.

ACg 15-55 cm Fine sand; slightly humiferous; grey; very humid; single grain; distinct, commonly rounded, small, ferruginous, mottles, more abundant towards the base; dark grey, humiferous spots, in the upper 10 cm.

C1g 55-65 cm More coarse sand; greyish; water saturation gives a fluid consistency; common ferruginous mottles.

C2g 65-100 cm Clayey sand; bluish-grey reduced; with abundant streaks of distinct, ferruginous mottles; massive; more compact and less permeable than the horizon above; water-saturated.

C3r 100 + cm Bluish-grey loamy sand (gley, reduced)

Analytical data of profile CG028

horizon	depth (cm)	> 2 mm %	coarse sand 0.25-2 mm	fine sand 0.05-0.25 mm	silt 0.05 - 0.002 mm	clay < 0.002 mm	tex-ture USDA
Ah	0-10	0	36.6	48.9	11.7	0.8	S
ACg	35	0	36.1	50.3	4.3	0.8	S
C2g	90	0	37.8	51.1	10.4	0.9	S

C3r	130	0	32.4	51.8	14.7	1.8	LS
Cmol(+)/kg							
Ca	Mg	K	Na	H^+	Al^{3+}	Al sat. (m)	Base sat. %
0.06 0.05 - -	0.11 tr. - -	0.07 0.01 - -	0.06 0.03 - -				17.9 5.6 - -
cmol(+)/kg						bar	%
CEC_{soil} sum of cations	CEC_{soil} NH_4OAc	CEC_{soil} bases+Al	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15
	3.00 1.60 - -			4.6 4.5 5.0 5.1			
C/N	organ. C %	N %	free Fe_2O_3 (%)clay	avail. P ppm	P.tot. mg/100 g	$CaCO_3$%	EC sat. dS/m
16.0 16.6 - -	2.01 0.93 - -	0.126 0.056 - -					

Profile CG029 (formerly MT6)

Classification: Xanthic Ferralsols, FRx (FAO, 1990)
Sols ferrallitiques jaunes non-hydromorphiques (ORSTOM)

Source: Bocquier (1957)

Location: Mediao-Touamaka, along the Souanké-Ouésso road, SE of Souanké

Coordinates: 01° 55’N; 14°15’E (approximately)
01.92°; 14.25°

Terrain unit: 1020, Ivindo granito-gneiss plateau

Altitude: 500 m

Topography: Slight slope of the plateau

Drainage: well drained

Parent material: colluvial weathering products of gneiss

Vegetation: secondary forest, with dense undergrowth

Profile description

Ah 0-25 cm Coarse sandy clay; humiferous; yellowish brown; crumb structure; good porosity; abundant roots.

AB 25-40 cm Similar, but with a subangular, blocky structure.

Bo 40-220 cm More clayey; yellowish; subangular blocky tendency; good root penetration down to 150 cm.

Analytical data of profile CG029

horizon	depth (cm)	> 2 mm %	coarse sand 0.25-2 mm	fine sand 0.05-0.25 mm	silt 0.05 - 0.002 mm	clay < 0.002 mm	tex-ture USDA
Ah	0-10	0	28	25	3	40	SC
Bo	50	0	21	24.5	1.5	50	C
cmol(+)/kg							
Ca	Mg	K	Na	H^+	Al^{3+}	Al sat. (m)	Base sat. %
0.38	0.19	0.12	-				
0.08	0.05	0.02	-				
cmol(+)/kg						bar	%
CEC_{soil} sum of cations	CEC_{soil} NH_4OAc	CEC_{soil} bases+Al	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15
				4.0			
				4.4			

C/N	organ. C %	N %	free Fe_2O_3 (%)	avail. P ppm	P.tot. mg/100 g	$CaCO_3$%	EC sat. dS/m
9.9	2.9	0.182					
7.5	0.6	0.077					

Profile CG030 (formerly ZA33)

Classification:	Humic Ferralsols, FRu (FAO, 1990) Sols ferrallitiques fortement désaturés, remaniés, jaunes, modaux, dérivés de granodiorite, profonds, à humus forestier (ORSTOM)
Source:	de Boissezon (1966)
Location:	Ingoumina, S of Zanaga, eastern Chaillu massif
Coordinates:	02° 55’S; 13°50’E (approximately) -02.92°; 13.83°
Terrain unit:	520, Chaillu granitic massif
Altitude:	about 650 m
Topography:	plateau
Drainage:	well drained
Parent material:	weathering products of granodiorite
Vegetation:	rainforest

Profile description

O		Discontinuous and thin litter layer
Ah	0-45 cm	Clayey sand; dark brown (10 YR 2/2, moist); homogeneous humiferous; fine to medium crumb; slightly moist; spread roots; termite presence at about 45 cm; gradual transition.
A/B	45-90 cm	Sandy clay; slightly brownish yellow; somewhat heterogeneous, humiferous penetration, in faint spots; weak, blocky structure; moderate cohesion; few, spread roots; slightly moist; progressive transition.
Bo1	90-260 cm	Sandy clay; yellow (10 YR 5/8, moist); no well-defined structure, a blocky tendency falls apart into micro-crumb; slightly moist; friable; abrupt transition.
Bo2 st.l.	260-300 cm	Stone layer of fine and coarse ferralitic gravels, composed of quartz vein fragments, amorphous siliceous rocks, various concretioned materials, also including angular quartz of variable sizes; the soil matrix is formed by a slightly moist; yellow, sandy clay.
R/B	300 + cm	Sandy clay; brownish yellow (10 YR 6/9, moist); slightly moist; with blocks of ferruginous, yellowish-reddish brown, weathered rock blocks; augering possible down to 330 cm.

Analytical data of profile CG030

horizon	depth (cm)	> 2 mm %	co.sand 0.25-2 mm	fine sand 0.05-0.25 mm	silt 0.05 - 0.002 mm	clay < 0.002 mm	tex-ture USDA
Ah	10		29.5	23.5	1.5	39.0	SC
Bo1	110		26.5	20.0	3.5	49.0	SC
Bo1	190		25.0	17.0	5.0	53.0	C
Bo2	255		24.0	19.0	7.5	49.5	C
Bo2	290		25.0	21.0	10.0	43.5	SC

R/B	330		43.5	15.5	11.0	24.0	SCL
cmol(+)/kg							
Ca	Mg	K	Na	H^+	Al^{3+}	Al sat. (m)	Base sat. %
0.43 -	0.01 -	0.17 -	0.11 -				
cmol(+)/kg						bar	%
CEC_{soil} sum of cations	CEC_{soil} NH_4OAc	CEC_{soil} bases+Al	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15
				3.9 5.0 5.1 4.9 5.0 5.3			
C/N	organ. C %	N %	free Fe_2O_3(%)	avail. P ppm	P.tot.	$CaCO_3$%	EC sat.
14.7 -	3.6 -	0.245 -					

Profile CG031 (formerly KY 101)

Classification: Geric Ferralsols, FRg (FAO, 1990)
Sols ferrallitiques, issus des limons-sableux des Plateaux Batéké, sous forêt (ORSTOM)

Source: Brugiere (1960)

Location: Missa forest, at 1 km W of Ankou, Koukouya plateau

Coordinates: 02° 20’S; 14°30’E (approximately)
-02.33°; 14.50°

Terrain unit: 820, Batéké plateau remnants

Altitude: 860 m

Topography: flat plateau

Drainage: well drained

Parent material: weathering products of Batéké sandy loam

Vegetation: old forest (see also CG025: profile under savannah)

Profile description

O 0-03 cm Litter layer, with leaves and root remnants

Ah 03-08 cm Fine sandy clay loam, with abundant bare sand grains under the litter layer; dark grey; humiferous; single grain, with some crumb aggregates, formed by termites; many roots.

AB 08-35 cm Fine sandy clay loam; still humiferous; light brown; blocky tendency.

Bo1 35-60 cm More clayey; darker brown; medium, blocky structure.

Bo2 60-200 cm Same texture; brownish yellow, slightly more red at 80 cm; moderate, medium, blocky structure; moderate cohesion; good porosity; well supplied with roots.

Analytical data of profile CG031

horizon	depth (cm)	> 2 mm %	coarse sand 0.25-2 mm	fine sand 0.05-0.25 mm	silt 0.05 - 0.002 mm	clay < 0.002 mm	tex-ture USDA
Ah	3-8	0	12	39	2.5	37	SC
AB	20-30	0	18	48.5	5.5	21.5	SCL
Bo1	50	0	15	44	3	32	SCL
Bo2	120	0	18.5	42.5	2	38	SC
cmol(+)/kg							
Ca	Mg	K	Na	H^+	Al^{3+}	Al sat. (m)	Base sat. %
0.09	tr.	0.17	0.05				
tr.	tr.	0.05	0.02				
tr.	tr.	0.01	0.03				
tr.	tr.	0.04	0.03				
cmol(+)/kg						bar	%
CEC_{soil} sum of cations	CEC_{soil} NH_4OAc	CEC_{soil} bases+Al	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15
	14.5			3.3			
	6.4			3.9			

	4.7 2.4			3.9 4.0			
C/N	organ. C %	N %	free Fe_2O_3 (%)	avail. P ppm	P.tot. mg/100 g	$CaCO_3$%	EC sat. dS/m
18.5 15.8 15 10	5.8 2.9 1.8 0.7	0.313 0.184 0.122 0.068					

Profile CG032 (formerly LIK 1)

Classification:	Dystric Fluvisols, phreatic phase, FLd (FAO, 1990) Sols du bourrelet fluvial exondé (ORSTOM)
Source:	Brugiere (1960)
Location:	Community farm of Ngoundjia, S of Impfondo, profile 900 m S of the E block, near to the Congo river
Coordinates:	01° 20’N; 17°55’E (approximately) 01.33°; 17.92°
Terrain unit:	210, Congo Basin plain
Altitude:	350 m
Topography:	non-inundated river levee of a few hundreds metres wide, near to the Congo river; numerous termite hills
Drainage:	moderately well drained
Parent material:	levee alluvium
Vegetation:	Community farm in a forestry belt

Profile description

Ap 0-20 cm Fine sandy clay loam; light grey, but darker in the first 3 cm; blocky structure, with a massive tendency.

C1g 20-75 cm Clay; light greyish yellow matrix, with bluish grey to brownish yellow mottles; angular blocky; compact.

C2g 75-140 cm Clay; brownish yellow mottled; very massive.

C3,cs 140-200 cm Clay, with ironstone pan in formation; many, very soft ironstone concretions; light brownish yellow soil matrix, with dark yellowish brown veins.

Analytical data of profile CG032

horizon	depth (cm)	> 2 mm %	coarse sand 0.25-2 mm	fine sand 0.05-0.25 mm	silt 0.05 - 0.002 mm	clay < 0.002 mm	tex-ture USDA
Ap	0-10		15	48.5	16	20.5	SCL
Cg1	20-40		8.5	34	14	42.5	C
Cg3	140		6	19	18	57.0	C
cmol(+)/kg							
Ca	Mg	K	Na	H^+	Al^{3+}	Al sat. (m)	Base sat. %
1.48	0.28	0.27	0.04				
1.02	0.23	0.18	0.03				
0.18	0.02	0.05	0.03				
cmol(+)/kg						bar	%
CEC_{soil} sum of cations	CEC_{soil} NH_4OAc	CEC_{soil} bases+Al	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15
				4.3			
				4.6			
				4.3			
C/N	organ. C %	N %	free Fe_2O_3 (%)	Avail. P ppm	P.tot. mg/100 g	$CaCO_3$%	EC sat. dS/m

8.8 8.5 6.3	1.3 0.6 0.4	0.144 0.068 0.067					

Profile CG033 (formerly MANI 8)

Classification:	Xanthic Ferralsols, FRx (FAO, 1990) Sols ferrallitiques appauvris, jaunes, sur plateaux d'alluvions anciennes élevées (ORSTOM)
Source:	Denis (1972)
Location:	Makoua, 200 m from the airport, along a perpendicular track, near the border of the extensive plateau
Coordinates:	00° 05'S; 15°35'E (approximately) -00.08°; 15.58°
Terrain unit:	410, Low plateaux of the Congo Basin
Altitude:	350 m
Topography:	flat plateau, with soft bordering slopes
Drainage:	well drained, very deep groundwater table
Parent material:	old alluvium
Vegetation:	Shrub savannah, dominated by *Hymenocardia*

Profile description

Ah 0-15 cm Loamy fine sand; black, with yellowish spots, a sign of leaching; organic matter not directly detectable; moist; no gravels; weak, fine, crumb structure; abundant, fine roots, surrounded by dispersed, bare, coarse, sand grains; loose; friable; porous to very porous; distinct transition.

AB 15-35 cm Loamy fine sand; moist; very dark brown, with clear, contrasting, brownish yellow spots, a sign of leaching; weak, fine, blocky structure; loose; friable; no gravels; porous; roots all over the horizon; distinct transition.

BA 35-65 cm Fine sandy loam; yellowish brown to brownish yellow; humiferous penetration in spots and streaks; moist; no gravels; weak, fine and medium, blocky structure; loose; friable; porous; few, fine roots; gradual transition.

Bo 65-110 cm Fine sandy loam; brownish yellow; apparently non-organic; moist; no gravels; weak, fine and medium, blocky structure; loose; friable; porous; no roots.

Analytical data of profile CG033

horizon	depth (cm)	> 2 mm %	coarse sand 0.25-2 mm	fine sand 0.05-0.25 mm	silt 0.05 - 0.002 mm	clay < 0.002 mm	tex-ture USDA
Ah	0-10	0	37.6	44.8	5.1	8.8	LS
AB	25	0	35.4	48.7	3.5	8.9	LS
BA	50	0	28.8	45.0	7.0	18.8	SL
Bo	110	0	31.2	44.4	5.4	16.5	SL
cmol(+)/kg							
Ca	Mg	K	Na	H^+	Al^{3+}	Al sat. (m)	Base sat. %
0.1	0.2	0.05	0.01				4
0.01	0.1	0.05	0.01				2.5
0.01	0.05	0.01	0.01				1
0.01	0.01	0.01	0.01				-
cmol(+)/kg						bar	%
CEC_{soil} sum of cations	CEC_{soil} NH_4OAc	CEC_{soil} bases+Al	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15
	8.1			5.1			
	4.5			5.0			

	3.2 2.3			5.1 5.1			
C/N	organ. C %	N %	free Fe_2O_3 (%)clay	avail. P ppm	P total %	$CaCO_3$%	EC sat. dS/m
16 15 9 -	1.13 0.60 0.36 -	0.07 0.04 0.04 -			1.0 0.8 0.6 0.65		

Profile CG034 (formerly O-6)

Classification: Gleyic Arenosols, ARg (FAO, 1990)
Sols hydromorphiques psammitiques d'alluvions grises de bas-fonds (ORSTOM)

Source: Bocquier (1956)

Location: Kangatéma, along a Lengoué affluent (SW of Ouésso), palm plantation of 1950

Coordinates: 01° 20'N; 15°40'E (approximately)
01.33°; 15.67°

Terrain unit: 220, incised Congo affluent valleys of the plateau regions

Altitude: 400 m

Topography: slightly higher old terrace in a swampy alluvial valley

Drainage: poorly drained, fluctuating groundwater table affects most of the profile (now deep at 210 cm)

Parent material: old terrace alluvium

Vegetation: parasite-attacked palm plantation of 1950 in bad shape

Profile description

Ah 0-07 cm Fine sand; greyish black; humiferous; single grain; abundant roots.

AC 07-32 cm Fine sand; brownish grey; diffuse humus penetration, becoming vertical streaks deeper; very weak structure, single grain tendency; abundant roots.

C1g 32-150 cm Fine sand; greyish white, with some humiferous, fine, brownish mottles; single grain; few palm roots, down to 120 cm.

C2r 150-165 cm Fine sand; dark grey; humiferous layer, overlying reduced, greyish green mottles.

C3r,gr 165-210 Rounded, coarse, gravel layer of alluvial origin, with in between a ferruginous, brownish yellow and greenish grey matrix.

Analytical data of profile CG034

horizon	depth (cm)	> 2 mm %	coarse sand 0.25-2 mm	fine sand 0.05-0.25 mm	silt 0.05 - 0.002 mm	clay < 0.002 mm	tex-ture USDA
Ah-AC	0-15		32.0	60.0	1.5	5.0	S
C1g	75		28.0	70.0	1.0	3.0	S
C2r	160		33.0	64.0	1.0	4.0	S
cmol(+)/kg							
Ca	Mg	K	Na	H^+	Al^{3+}	Al sat. (m)	Base sat. %
0.26	0.05	0.04	0.01				
tr.	tr.	0.02	tr.				
tr.	tr.	0.02	tr.				
cmol(+)/kg						bar	%
CEC_{soil} sum of cations	CEC_{soil} NH_4OAc	CEC_{soil} bases+Al	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15
				3.85			
				5.6			
				6.0			
C/N	organ. C %	N %	free Fe_2O_3 (%)	avail. P ppm	P.tot. mg/100 g	$CaCO_3$%	EC sat. dS/m
17.9	2.0	0.112					
1.4	0.03	0.021					
2.8	0.07	0.026					

Profile CG035 (formerly MT-10)

Classification:	Xanthic Ferralsols, phreatic phase, FRx (FAO, 1990) Sols hydromorphiques jaunes, issus de granito-gneiss (ORSTOM)
Source:	Brugiere (1960)
Location:	E of Tembé, 3.5 km S of block I.2, junction B2/A6, Touamaka, along the Souanké-Ouésso road, SE of Souanké
Coordinates:	01° 55'N; 14°15'E (approximately) 01.92°; 14.25°
Terrain unit:	240, Ivindo swamps (border)
Altitude:	500 m
Topography:	Lower part of a slight slope, extensive soils on the border of swamps
Drainage:	imperfectly drained, temporary water saturation fluctuating in the profile
Parent material:	weathering products derived from granito-gneiss
Vegetation:	old open forest

Profile description

Ah 0-06 cm Coarse sandy clay loam; very dark brown; crumb structure tendency; good porosity; many roots.

AB 06-50 cm Sandy clay; less dark; humiferous penetration; coarse blocky structure; very coherent; somewhat dry; many roots.

Bog 50-200 cm Sandy clay; yellow; weak, medium, blocky structure; less coherent; reduced porosity; at 90 cm appear reddish mottles and from 150 cm fine red mottles in a lighter matrix; roots penetrate to about 100 cm only.

Analytical data of profile CG035

horizon	depth (cm)	> 2 mm %	coarse sand 0.25-2 mm	fine sand 0.05-0.25 mm	silt 0.05 - 0.002 mm	clay < 0.002 mm	tex-ture USDA
Ah-AB	0-15	0	28	30	2.5	34	SCL
AB-Bog	50	0	27	29.5	2.5	39	SC
Bog	120	0	27	28	1.5	41.5	SC
cmol(+)/kg							
Ca	Mg	K	Na	H^+	Al^{3+}	Al sat. (m)	Base sat. %
0.07	0.12	0.06	tr.				
0.07	0.06	0.02	tr.				
0.07	0.05	0.02	tr.				
cmol(+)/kg						bar	%
CEC_{soil} sum of cations	CEC_{soil} NH_4OAc	CEC_{soil} bases+Al	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15
				3.9			
				4.5			
				4.5			
C/N	organ. C %	N %	free Fe_2O_3 (%)	avail. P ppm	P.tot. mg/100 g	$CaCO_3$%	EC sat. dS/m
15.2	2.3	0.151					
6.9	0.5	0.073					
-	-	-					

Profile CG036 (formerly FR 30)

Classification:	Umbric Gleysols, GLu (FAO, 1990) Sols hydromorphes minéraux humifères de bas-fonds forestiers (ORSTOM)
Source:	Brugiere (1960)
Location:	temporary inundated valley floor, near Ikamou, N of Makoua
Coordinates:	00° 05'N; 15°35'E (approximately) 00.08°; 15.58°
Terrain unit:	212, swampy valley floors of the Congo Basin
Altitude:	320 m
Topography:	flat valley floor
Drainage:	poorly drained, groundwater table at 60 cm
Parent material:	alluvium
Vegetation:	swamp forest

Profile description

O		Few centimetres of litter
Ah	0-30 cm	Sandy loam; black; organo-mineral horizon; very humiferous; sands are not covered by organic matter; single grain tendency.
AC	30-45 cm	Sandy loam; dark grey to light grey; still somewhat humiferous and structured.
Cr	45-60 cm	Loamy sand; greyish white to white; reduced and water-saturated; massive.

Analytical data of profile CG036

horizon	depth (cm)	> 2 mm %	coarse sand 0.25-2 mm	fine sand 0.05-0.25 mm	silt 0.05 - 0.002 mm	clay < 0.002 mm	tex-ture USDA
Ah	0-20	0	32	46	2	18	SL
Cr	50	0	36	50.5	11	6	LS
cmol(+)/kg							
Ca	Mg	K	Na	Exchan. Acidity	Al^{3+}	Al sat. (m)	Base sat. %
tr.	0.05	0.08	0.02				
tr.	0.02	tr.	0.02				
cmol(+)/kg						bar	%
CEC_{soil} sum of bases + acidity	CEC_{soil} NH_4OAc	$ECEC_{soil}$ sum of bases + Al	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15
				3.8			
				5.4			
C/N	organ. C %	N %	free Fe_2O_3 (%)	avail. P mg/kg	P.tot. mg/100 g	$CaCO_3$%	EC sat. dS/m
15.4	4.9	0.319					
10	0.7	0.070					

Profile CG037 (formerly MAB 7)

Classification:	Ferralic Arenosols, ARo (FAO, 1990) Sols ferrallitiques fortement désaturés, sur limon-sableux Batéké, de pente de plateaux et de collines (ORSTOM)
Source:	Denis (1974)
Location:	hill along the road Mindouli-Kinkala
Coordinates:	04° 18'S; 14°38'E -04.30°; 14.63°
Terrain unit:	810, Kinkala hills
Altitude:	500 m
Topography:	mid-slope of a hill, in a hilly undulating landscape
Drainage:	somewhat excessively drained
Parent material:	mixed weathering products of Batéké sandy loam (Ba2) and underlying polymorphic sandstone (Ba1)
Vegetation:	forest

Profile description

O	3-0 cm	Litter layer, with tiny branches and leafs; the lower cm is composed of detectable organic matter; many, individual and bare, quartz sand grains.
Ah	0-15 cm	Quartz sand; greyish brown (10 YR 5/2); dry; not directly detectable organic matter; moderate, fine, crumb structure; loose; very friable; very dense, fine root network; very porous; distinct and smooth transition.

AB 15-100 cm Quartz sand; yellowish brown (10 YR 5/4); dry; not directly detectable organic matter; weak, fine and medium, blocky structure, falling apart into single grain; loose; very friable; few, fine roots; very porous; gradual and irregular transition.

BA 100-150 cm Quartz sand; light yellowish brown (10 YR 6/4); dry; not directly detectable organic matter; many, clear, contrasting, large, coherent; rounded and deeper, vertical, grey spots, without any relation to other characteristics, getting less in depth, in a yellowish soil matrix; weak, medium, subangular, blocky structure; loose to soft; very friable; very porous; few roots; gradual and irregular transition.

Bw 150-300 cm Quartz sand; brownish yellow to brown (10 YR 6.5/6); dry; not directly detectable organic matter; no spots; same structure and consistency as above; no roots.

Analytical data of profile CG037

horizon	depth (cm)	> 2 mm %	coarse sand 0.25-2 mm	fine sand 0.05-0.25 mm	silt 0.05 - 0.002 mm	clay < 0.002 mm	tex-ture USDA
Ah	0-5	0	57.6	35.3	2.2	1.9	S
AB	50	0	60.2	35.2	1.6	2.6	S
BA	140	0	65.5	29.6	2.1	1.2	S
Bw	280	0	54.0	42.3	3.4	0.01	S
cmol(+)/kg							
Ca	Mg	K	Na	Exchan. Acidity	Al^{3+}	Al sat. (m)	Base sat. %
0.04	0.04	0.02	0.01				4.3
0.04	0.01	0.01	0.01				4.4
0.04	0.01	0.01	0.01				8
0.01	0.04	0.01	0.01				10
cmol(+)/kg						bar	%
CEC_{soil} sum of bases + acidity	CEC_{soil} NH_4OAc	$ECEC_{soil}$ sum of bases + Al	CEC_{soil} (Ca)	pH H_2O	pH KCl	1/3	15
	2.3			4.9			
	0.5			5.05			
	0.5			5.3			
	0.4			5.4			
C/N	organ. C %	N %	free Fe_2O_3 (%)	total Fe_2O_3 (%)	P.tot. mg/100 g	$CaCO_3$%	EC sat. dS/m

12.4 16.0 15.3 -	2.35 1.01 0.86 -	0.19 0.06 0.06 -	0.54 0.64 0.78 1.0	1.2 9.8 1.2 1.6			

Appendix 2

Soil map legend
(FAO classification, 1990)

Associated soils cover > 20 %, inclusions < 20 % of the soil mapping unit.

region	mapping unit	assoc. soils	inclusions and phases (partly)	terrain units	Idnr.
peaty valleys of N Congo	HS - 2a	GLd, GLu	-	211	1
alluvial plains of the coastal belt	GL 1 - 2a	FLd	SC; inundic, phreatic phase	230	2
Congo river alluvium	GLd 1 - 2a	PT, FLd	HS	210	3
swampy valleys of the Congo Basin plain	GLu 1 - 1a	FRx, PZg	PZc, ARa	212	4
Central Congo Basin plain, Ivindo swamps	GLu 2 - 2a	FRx, HS	-	210, 240	5
incised valleys of central Congo	GLu 3 – 1/2a	ARo, FLu	-	220, 830/2	6
Sangha alluvial plain	FLd 1 - 2a	PT, NTh	phreatic, inundic phase	221	7
coastal plain	ARh1 – 1ab	GL, PZc	SC; inundic, phreatic, salic, sodic phase	100	8
Batéké hills	ARl 1 – 1/2b	ARo	-	830/1, 830/3	9
coastal plateau	ARo 1 - 1a	FRx, ARl	CMo, FLd, GLd	300	10
coastal plateau	ARo 2 - 1a	-	LXh, FRh, ACh	300	11
Batéké hills	ARo 3 - 1ab	FRh, FRg	-	830/1	12
Ibenga plateau	ARo 4 – 1a	ACf, RGd	-	860	13
Mayombe	CMo 1 - 2bc	FRh, NTh	LP, GLd, PT, FRx;	610, 620,	14

highlands			lithic, rudic, skeletic phase	510	
NW Schisto-Greseux and Franceville plateaux	CMo 2 - 2/3b	FRh, ARo	ACg; lithic, rudic phase	720/1, 970	15
Cataracts plateau	FRh 1 - 3ab	FRx	FRr, GL, NT; petroferric, lithic, rudic phase	720/2	16
Kinkala hills	FRh 2 – 2b	FRx, ARo	-	810	17
Chaillu massif	FRh 3- 2b	FRu, FRx	FLd, GLd; skeletic phase	520	18
region	mapping unit	assoc. soils	inclusions and phases (partly)	terrain units	Idnr.
Ivindo and Lekona gneiss plateaux	FRh 4 - 2/3b	CMo	FLd, GLd; skeletic, petroferric phase	1010, 1020	19
Sembé-Ouésso and Dja tillite plateau	FRh 5 - 2b	NTh	FRr, CMo	960/1, 950	20
Sembé-Ouésso plateau	FRh 6 - 2b	FRr, NTh	-	960/1, 960/2	21
Mbaiki plateau (N Congo)	FRh 7 - 2ab	ARo	skeletic phase	940	22
Bambio plateaux Lango plateau	FRh 8 - 1/2a	ARo		840, 850	23
Upper Nouabalé plateau	FRh 9 - 2/3a	ACh	skeletic phase	930	24
Bomassa plateau	FRh 10	HS		980	25
Batéké plateaux remnants	FRg 1 – 1/2a	NTh, ARo	RGd, ARa, PZc, PZg	820	26
E Bouenza hills	FRg 2 - 2a	FRu, ARo	-	910	27
Niari-Nyanga hills	FRx 1 -2/3ab	GL, LXf	CMd, CMu; petroferric, skeletic phase	710/2, 630	28
- Pre-Mayombe + Niari-Nyanga plain	FRx 2 – 3a	ACp, NTh	FLd, GL, CMu; skeletic, petroferric phase	630 710/1	36
- N-N northern foothills	FRx 2 – 3ab			710/3	29
Bouenza hills, Niari tillite belt	FRx 3 – 2ab	ACh, NTh	ACp, FLd, CMu, GLd, skeletic, rudic phase	910, 920	30
Low plateaux of Congo Basin	FRx 4 - 1a	GLd, GLu	HS	410	31
Ivindo gneiss plateau and Low plateaux of the Congo	FRx 5 - 1/2a	GL, FRg	-	1020, 410	32
northern Batéké hills	FRx 6 - 1/2a	FRg, GL	ARa, PZg	830/1, 830/3	33
Mayombe highlands	NTh 1 -3c	FRh	ACu; lithic, rudic phase	620	34
Sembé-Ouésso plateau	NTh 2 - 2b	FRp, FRx	skeletic phase	960/1, 960/2	35