This relief, such as it appears at the present time, dates from the geological period during which the upper crust was formed. At the beginning of this period, not only had the network of the original mountain chains been leveled down and replaced by a vast peneplain, but the foundation mass itself had become thoroughly consolidated ; consequently, from this time on, it opposed a stronger resistance to deformations — both faulting and folding — and reacted by long undulating movements and, in certain cases, by gigantic fractures in the upper crust.

The undulations have given rise to the vast central depression and to the mountainous rim that surrounds it. The basin of the Congo has an average altitude of 1,300 feet (1,100 at its lowest points — Lake Tumba and Lake Leopold II). It is made up of plains and terraced plateaus extending to the peripheral rim ; the latter consists of more or less dislocated plateaus — whose height averages a thousand feet in the North and in the Lower Congo — brought about by an upheaval of the Congo's ancient foundation. These plateaus keep rising progressively as they approach Katanga where they form several masses that reach a height of from 5,500 to 6,000 feet in the Kundelungu and Kibara Mountains, and 6,500 in the Marungu Mountains.

This vast undulatory movement was accompanied by still another phenomenon : the longitudinal fracture of the rim which resulted in a gigantic crevasse along the entire eastern frontier. This crevasse is part of a vast system of fractures extending from Mozambique to the Middle East where the Dead Sea is the most remote example. This phenomenon is of such a nature that it is still the subject of scientific discussions. It seems due to a sudden slackening of the forces that had caused the formation of the peripheral rim ; when these forces ceased their action, the rim split vertically, and the result was a deep crevasse which — in the Congo — measures 875 miles in length and from 25 to 30 in width, while its depth varies considerably but is not yet well known. In this depression , the great lakes came into existence : Albert, Edward, Kivu, Tanganyika. Lake Tanganyika covers an area of 13,500 square miles and has a maximum depth of 4,800 feet ; it is the deepest in the world after Lake Baikal. On both sides of this huge crevasse, the edges of the broken rim —

in a complete dislocation of the strata of the fundamental mass — have risen up and have formed mountain masses. The largest of these is Ruwenzori, a plateau rising above the neighboring regions by 6,500 to 13,000 feet ; its highest point is Mount Marguerite, whose altitude is 16,800 feet.

In this fractured area there are volcanic formations, some extinct — such as the Kahuzi Mountain in Kivu — others partially active such as the Virunga chain which bars the crevasse for a distance of 50 miles ; at present, the active volcanoes in this chain are : Nyiragongo and Nyamuragira, the latter having a crater which measures 6,500 feet across. This entire region is characterized by frequent earthquakes ; it is rich in hot springs which might some day be of value from an economic point of view.

C.

The Waters.

Bound up as it is with the structure of the country's relief and the great geological upheavals, the physiognomy of the Congolese hydrographic network is very complex in spite of an apparent simplicity. The history of Congolese waters is a record of their struggle to escape from closed basins, to link separated basins, and to find an outlet to the sea.

Aside from a little coastal river, the Shiloango, and the basins of Lakes Albert and Edward which are linked with the Nile River System, all the waters of the country now empty into the Atlantic Ocean by way of the Congo River. However, this convergence toward a common point was achieved only step by step. It is difficult to understand the character of the Congolese basin as it is today if one does not know its history. In fact, it has been formed by the junction of three basins : one consisted of a coastal river ; another was a closed basin around and about the central depression ; the third was the basin of the Upper Lualaba, which at that time was separated from the Congo of

today by a high ridge extending from Dilolo to Lubefu where it joined the Congo-Nile ridge. It is believed that the basin of the Upper Lualaba was not originally linked with the Congo but with the Nile, by means of various extensions in the direction of the great eastern crevasse. At some unknown time in the distant past, the network of the Upper Lualaba was drained by the Lower Lualaba and thus became linked with the basin of the Congo River ; the spot where the drainage occurred is marked by the rapids known as the Gates of Hell, near Kongolo.

As for the network proceeding from the central depression, its history is more eventful. At first the equatorial waters flowed toward Lake Chad, but during the Tertiary, when the undulation that created the central depression and its peripheral rim took place, the ridge that separates today the Congolese from the Chad basin came into existence. Thus a new closed basin was created ; it included a great lake — centrally located and with no outlet to the sea — fed by various rivers. One of them was destined to play an important part ; it flowed from the Mayumbe Ridge towards the equator line by way of the present Leopoldville-Bolobo channel. Probably a million years ago, a double phenomenon took place which was to reverse the course of this river and give the waters of the central depression access to the sea. On the one hand, at the spot known today as Stanley Pool, a geological break occurred, and subsequently the river was drawn to it ; thus began the drainage of the central depression's waters. On the other hand, the coastal river previously mentioned receded upstream in accordance with a process well-known in hydrology. Its source burrowed its way underground until it met the source of the great affluent of the central depression ; this affluent drained the waters of the coastal river, thus linking the enormous equatorial basin with the Atlantic Ocean.

Farther to the East, Lake Moëro found an outlet by means of the Luvua, while Lake Tanganyika forced its way toward the Lualaba via the Lukuga River, draining the waters of the Kivu and part of the ancient southern basin of Lake Victoria-Nyanza, thus increasing the flow of the Congo River. The latter, today some 3,000 miles in length, has an average flow of 40,000 cubic meters a second ; it digs a deep submarine valley and its power

is such that some 10 miles away from the shore its current can still be felt ; furthermore, for nearly 50 miles the surface waters of the ocean remain fresh, and for a distance of over 300 miles the sea is colored by the detrital material the river carries with it.

It can readily be understood that such a mass of water, carrying with it a fanlike group of rivers which spread over an area of nearly 1,500,000 square miles, was able, by means of erosion, to force its way through the hardest rocks. The passage it literally cut out for itself through rock between Leopoldville and Matadi is the most striking example of its power. There the river, which at Stanley Pool measures as much as 18 miles in width, narrows down suddenly and flows through passes which sometimes do not exceed 1,650 feet in width. In the 220 mile stretch that separates the capital from the seaport, the river rushes swirling down the long stairway-like slope that it has carved out in the rocks and its level drops about 850 feet in a succession of some 30 falls and rapids. It is in this region that the site of Inga is located, a site which offers resources of energy unique in the world.

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The various phases in the history of the Congolese waters explain the convergence of the rivers toward a single outlet — a phenomenon which often gives them the form of a curve. The ensemble constituted by the rocky plateaus surrounding the central depression explains also the great number of rapids and falls that occur in the rivers. In the entire hydrographical basin of the Congo, the process of erosion appears to be still in full swing, and often the waters seem to be seeking more stable beds. Furthermore, throughout its entire course and according to the terrain it encounters, the Congo River either spreads itself out in depressions and level regions or narrows down to squeeze through passes where navigation is impossible. This behavior, characteristic of a young river, is in some ways a handicap ; but on the other hand, the Congo River offers long navigable stretches which total some 1,700 miles, one of them — between Leopoldville and Stanleyville — measuring as much as 1,100. Besides, it benefits

by the great regularity of its flow, which is an asset to navigation; indeed, by the very fact that it is situated on both sides of the equator line which it crosses twice, the river has an exceptionally regular flow as a result of a fortunate distribution of rain. The ratio between its minimum and maximum flow — 23,000 to 75,000 cubic meters per second — is 1 to 3 whereas in the case of the Mississippi the ratio is 1 to 20, of the Nile 1 to 48, and of the Meuse 1 to 100.

D.

The Soil.

A mixture which is made up of mineral elements resulting from the decomposition of underlying rock, and of humus consisting of microorganisms — living or dead — has been deposited in a thin layer on the geological foundation ; this constitutes the Congolese surface soil.

For a long time the luxuriance of the vast forest gave rise to the erroneous belief that this soil is exceptionally fertile. However, such is not the case. In the Congo, rich soil is rare and occurs only in certain regions. It consists of the alluvial deposits found in the central basin or along the main watercourses ; of lands regenerated by erosion, such as those in the Mayumbe Ridge, the Lower Congo or the East ; and especially of the volcanic lands of Kivu which are periodically rejuvenated by volcanic ashes carried by the wind.

Aside from these few regions, Congolese soil is poor. Since the topsoil forms a very thin layer, it is easily destroyed by the violent action of atmospheric agents — such as water spouts, great heat, squalls, etc. — unless it is protected by sufficient vegetation. What is more, where the protection provided by vegetation disappears — due to forest depletion or fires in savannas — the topsoil is rapidly replaced by laterite formations which sometimes form a hard shell stretching over several miles

without a break and attaining a thickness of as much as 65 feet. These laterite formations result from the destruction, caused by heat, of the organic matter in the soil. This destruction is completed by the washing of basic products (magnesium, lime, silica), while hydroxides of iron or aluminum are formed ; these crystallize at the surface and kill every possibility of regeneration of the topsoil.

E.

The Climate.

The changes in the soil, the hydrographic system, the distribution of vegetation and of animal species, as well as the living conditions of human beings — all are profoundly influenced by climate. Climate is the very complex resultant of a group of factors such as temperature, atmospheric pressure, wind, rainfall, humidity, and nebulosity, factors which in their turn are influenced by local conditions.

The Congo, bestriding the equator line between 5 degrees north and 13 degrees south latitude, is included in the zone of the tropical climates. These are characterized by an average annual temperature of more than 64 degrees, by monthly averages that never fall below 64 degrees, by a slight annual variation of less than 9 degrees, and by daily variations which, in the regions farthest away from the equator may be very great. The average annual temperature in the Congolese central basin lies between 77 and 79 degrees, and on the periphery, between 75 and 77 degrees. With increasing altitude, it diminishes by 2 degrees for every 590 feet ; it becomes fixed between 64 and 68 degrees at a height of about 4,920 feet, between 61 and 63 degrees at 6,560 feet, 52 degrees at 9,840 feet, and 43 degrees at 13,130 feet. The daily variations, on the other hand, are very marked on the periphery ; there the nights are cold and, on the plateaus of Katanga, hoar frost is of frequent occurrence during the dry season.

Consequently, the climate of the Congo is determined in general — except for the high mountain peaks of the East — not by annual variations in temperature but by rainfall, the latter being in turn dependent on the apparent movement of the sun between the two tropics. This movement, together with the rainfall resulting from it, can be used as a basis for the following outline : Around the equator lies a zone with an « equatorial climate » ; this zone, both warm and humid, has no dry season but is characterized by two maximal periods of rainfall and temperature each year. On either side of this « equatorial climate » zone extends a « tropical climate » zone ; the southern one, because of the geographical location of the country, is much more extensive than the northern one. These « tropical climate » zones are subdivided in turn into a « Sudanese climate » zone having two rainy and two dry seasons, and a « Senegalese climate » zone which has only one short rainy season followed by one long dry season ; this Senegalese zone is located in the extreme southern part of the country and has a dry season lasting from May to September.

However, this is a highly theoretical outline, since it takes into consideration nothing but atmospheric influences. In reality, the climatic situation is profoundly modified by geographical factors. Thus the unequal distribution of land and sea in relation to the equator line introduces an initial disturbing influence and pushes the « thermal equator » several degrees to the north and, with it, the area of tropical calms. Other modifying factors are : the existence of the great forest which lowers the average temperature by 2 to 4 degrees ; the mountain ranges in the East which receive more rainfall than the central depression, and besides prevent the Indian Ocean from making its influence felt in the interior ; the Mayumbe Ridge which checks to a great extent the influence of the Atlantic Ocean ; the general relief of the country, a factor which makes itself felt all over and brings about a distribution of rainfall within closed areas.

Still other factors help to make the Congolese climate a complicated ensemble of microclimates where dividing lines between the main zones often become blurred and vague. There is local topography, and also variations in atmospheric humidity

— the latter playing an important part in the salubrity of a region. Mention should be made also of the winds, most of them irregular in nature ; they are often accidental and the cause of tornadoes in the equatorial zone ; elsewhere, in addition to trade winds, others occur which blow from the north or the south according to whether the sun is in the zenith in the southern hemisphere or the northern ; there exist also certain high-pressure winds which give rise to anticyclonic areas that turn clockwise in the northern hemisphere and counterclockwise in the southern.

In order to complete this outline of the Congolese climate's chief characteristics, it should be added that the daily insolation is of relatively constant duration, a fact which causes the days and the nights to be approximately equal.

This climate, such as it appears today, has undergone profound changes in the course of ages. Thus the entire Quaternary was marked by long alternating periods of rain and drought. The most recent period of drought dates from some 100,000 years ago ; it was of such a nature as to make the forests disappear and cause the Kalahari Desert to invade the country and stretch northward beyond the equator line. In the course of the rainy period that followed, the Congo took on the appearance it has today. But the present climate is far from being stabilized ; indeed, it is still in the process of evolution. For some time now the beginnings of a drying up process have been observed in several parts of Africa and, among these, the Congo. Can this drying up be attributed to a strictly atmospheric cause ? Is nature showing signs of man's destructive action ? Opinions are divided and this situation continues to be a subject for scientific research.

F.

The Flora.

The vegetation covering the Congolese soil can be divided as a whole into forests and savannas. This simple classification covers a great wealth of plants whose nature is determined by the combination of many physical factors.

The Forest.

The forest itself — which covers approximately half the country — has various aspects to offer that differ according to the nature of the soil and its relief, the temperature and the rainfall. Consequently, it would be inaccurate to speak of « one » Congolese forest ; there are numerous types with a great range of characteristics. However, a first examination shows three main categories of forests : those growing on damp or periodically flooded soil, on firm ground, and in the mountains. But within these three main categories, there are numerous subdivisions.

To consider first the forests found on damp ground. In the briny waters of the Congo estuary, there is the mangrove tree with its aerial roots suggestive of the legs of enormous spiders. In the vast depressions grows the swampy forest where the trees have adapted themselves to prevailing conditions by putting forth aerial or stilt-like roots, or by projecting spurs. Along the river bank are peculiar screen-like formations of « heliophile » trees and shrubs. To the west of the central basin can be found the periodically inundated forest ; for part of the year, in a strange spellbinding landscape, the trees emerge from vast sheets of water, sometimes many feet in depth. To conclude, mention should be made of the special kind of forest which covers the islands and which is closely related to the preceding type.

The same variety exists in the forests growing on firm ground. The most popular of its many aspects is that of the great dense forest. Growing in the regions where the seasons are not clearly differentiated, it is characterized by its extraordinary density, the size of its trees which may reach a height of some 130 feet, the perennial nature of its foliage, and an apparent monotony due to the fact that blossoming — although colorful and varied — takes place above the green dome. The undergrowth is amazingly luxuriant : trees, shrubs, grasses, lianas, and epiphytic plants. In regions situated on either side of this great forest with its persistent foliage — regions where the dry season

lasts two or three months — there is another type of forest in which three-quarters of the trees lose their foliage as soon as the rains cease.

In the areas where these forests are cut down, plant life slowly reappears provided that the soil is left to rest. This new vegetation, or « secondary » forest, presents aspects that vary according to its stage of development ; it is very often characterized by a species of parasol-shaped trees having very tender wood. According to estimates, it takes about a hundred years for forest land whose trees have been cut down to recover its original appearance.

There exist other types of forest growing on firm ground. In some regions can be found average-sized forests where the foliage is leathery and persistent. Elsewhere, beyond the savannas, there are scattered and thinly wooded forest lands with trees not exceeding 65 feet in height ; they grow in areas where the dry season lasts from three to six months and during which the trees lose all their leaves.

Climate and environment determine the pattern of growth of all these forests : zones, clusters, strips, rows.

The mountain forests are of an entirely different nature ; they are found in the East, especially in the Ruwenzori range. Located below the equator, this region is characterized by very strong rainfall throughout the year and by a temperature which remains constant for any given altitude. Consequently, these various levels of temperature determine the distribution of vegetation. Thus, along the slopes, plant life ranges from the dense equatorial forest to periglacial saxicolous vegetation, by way of half a dozen different species of which the most typical are fern forests at a height of 5,400 to 7,900 feet, bamboo forests at 6,600 to 8,500, giant fern forests at 8,500 to 12,500, and groundsel forests at 12,500 to 15,400.

The Savanna.

The savanna stretches out on either side of the dense forest ; it is essentially grassland characteristic of the tropical zones where rainfall is comparatively rare and the dry seasons are rather long.

The savanna also presents many aspects. Grasses may be high and thick, or grow in thin clusters sparsely distributed. Shrubs are scattered around and, like the grasses, they vary from place to place : twisted and stunted, they give the plain the appearance of an immense orchard ; sometimes, although mere dwarfed forms, they turn green and bloom again after brush fires, provided as they are with subterranean organs adapted to drought and fire ; elsewhere, clusters of green acacias or palmyra palm trees stand erect like candles on the plain, and baobab trees with thick, smooth trunks emerge from the grassy sea. Often, in the midst of the savanna, appear vestiges of a vanished forest vegetation ; on the other hand, in the very heart of the forests, there are grassy glades — reminiscent of savannas and known as « esobe » — which, seen from the air, brighten up here and there the dark and dense stretches of trees.

How were the savannas formed ? They had their origin in the action of climates which, after the great drying up period of the Kalahari Desert, gave the Congo its present aspect of forests bordered with a variety of savannas. But to this climatic factor the influence of man must be added. In some places he has burned the existing savannas time and again and has transformed them little by little into steppes ; elsewhere he has mercilessly ravaged the forests without giving them a chance to grow again. This destruction of the savannas was especially marked in the North of the country, so much so that the government had to take measures for the protection of the soil. On the other hand, in certain regions of the South, thanks to more rational methods of cultivation on the part of the natives, reforestation is taking place.

G.

The Fauna.

The distribution of the country's flora, determined by the environment and the climate, largely influences the distribution of its fauna, which is of exceptional interest.

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There are innumerable species of invertebrates. The museum of Tervuren possesses no fewer than three million specimens : ocean oysters, river shrimps, butterflies and giant insects, scorpions and poisonous spiders, mosquitoes and tsetse flies — a medley of useful and dangerous species, and of some that are merely pleasant to look at. The Congolese waters offer a great variety of fishes (over a thousand fresh water species have been classified down to the present time) ; they range from the perch and the catfish found in the rivers to the shark and the sawfish of the coastal waters ; from the pike and the tiger fish to the protopteron, that strange survivor from the age of fossils which hibernates during the dry season in the marshes from which the fisherman drags it out with a hoe. The study of Congolese fishes has sometimes had unexpected scientific consequences ; thus it has been proved — through the discovery of certain extinct species — that the Upper Lualaba at one time was part of the Nile basin.

A similar diversity exists among amphibians and reptiles : an abundance of tortoises, lizards, chameleons, varanians. As for crocodiles, they include three species in the Congo : the Nile crocodile which attacks man, the fish-eating crocodile, and finally, the small crocodile indigenous to the forests. Besides, there are innumerable snakes divided into many species adapted to various physical environments : water, land, and tree snakes, and also amphibian and burrowing snakes.

The world of birds is just as varied. Among the most typical are the ox-peckers, white birds that accompany in swarms the cattle which they rid of flies and ticks ; also guinea fowls, parrots, hawks, crowned cranes, the Congolese peacock, etc. In all, more than 1,200 species have been classified.

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Among all this fauna, the mammals are certainly the most interesting groups, as much for their diversity as for the exuberance of certain forms and the survival among them of fossil vestiges such as the okapi or the daman. Here too, zones of vegetation have conditioned animal life, and it has been observed that, according to the environment in which they were placed, species have progressively adapted themselves either to the soil, or the branches of trees, or the water. In this process of adaptation, the large rivers have constituted barriers and thus, by strengthening the element of isolation, have contributed to diversification. It is also noteworthy that the fauna is richer on the right bank of the Congo River. But the greatest cause of differentiation is the distribution of animal life in the forests and the savannas.

The savanna is above all the habitat of the larger carnivora — the lion, the leopard, the hyena, the jackal ; and also the larger herbivorous mammals — the black buffalo and the tall antelope. The monkeys found there are often of the genus cynocephalus. Certain species of mammals are confined to definite regions : the zebras in the grassy plains of Katanga, the rare white rhinoceros in the « reservation » of the Garamba National Park, the giraffe in the bushy savannas of northern Uélé.

In the forest, animal life is concentrated especially in the open spaces, and along the edges and the watercourses. It varies in kind not only according to the region, but also according to the specific location in the forest : the ground, the borders, the glades, the undergrowth, the hollow trunks, the epiphytes, the various heights of the treetops are all habitats of different species

of fauna. The forest is the favorite dwelling place of all sorts of monkeys. Among these, the anthropoid apes are the most picturesque group : there are two sorts of chimpanzees separated by the river, a cave-dwelling chimpanzee to the north and the east of the river, and a midget chimpanzee between the Kasaï River and the left bank of the Congo ; also two sorts of gorillas, the forest gorilla in the Mayumbe Ridge, and the mountain gorilla of which three varieties are found in the East of the country. One of the most unusual mammals in the Congolese forest is the okapi. It was not discovered until the beginning of the twentieth century, and the only region in the world where it is known to exist is the forest zone of Uélé and of Aruwimi Ituri, in the Northeast of the Congo ; it is a giraffe-like animal, shy and nocturnal, a vestige of the Tertiary. Other inhabitants of the forest are : antelopes — generally smaller than the species found in the savanna ; and various carniverous animals and red buffalos that can be classified in several types.

Elephants are found in both the savanna and the forest, but the forest type is smaller and darker ; in certain forests, especially in Uélé in northern Kasaï, there is a midget elephant whose weight is only half that of the ordinary African elephant.

Rodents such as rats and squirrels ; carnivora such as wild-cats and polecats ; swine such as wart-hogs in the savannas and river hogs in woodland strips ; cave bats and forest bats, orycteropes, shrewmice, and insect-eating hedgehogs — all these, together with a host of other varieties, complete this brief outline. However, mention must also be made of the pangolin, which feeds on termites and ants that it drags out of their nests by means of its long sticky tongue, after tearing the nests to pieces with its claws ; and another queer animal, the lava rat, a kind of daman which has adapted itself to living conditions in the volcanic fields of Kivu.

Rivers and lakes also harbor mammals which are adapted to the special conditions prevailing in such a habitat. Among these is the amphibious hippopotamus whose weight may reach two tons and whose sensory organs have undergone curious periscopal changes. Another aquatic animal is the manatee, an

old terrestrial mammal whose structure has been profoundly modified by its environment ; in this process of adaptation, the body has been lengthened like a spindle, the hind limbs have disappeared, the forelimbs have been transformed into flippers, and the tail into a kind of paddle. The manatee belongs to the group known as the sirenians ; it is found at the mouth of the river and in the vicinity of certain waterfalls in the interior ; its existence has given rise to numerous African legends which are counterparts of tales known in the western world, tales born of the belief in sirens immortalized by Homer.

CHAPTER II

THE PEOPLE'S CONTRIBUTION

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SUMMARY

1.

The Traditional Congolese Community.

It was not until the end of the 19th century that a systematic European penetration extending to the entire territory that makes up the present day Congo was organized.

Started barely a few decades ago, this penetration has profoundly changed the nature of both the Congo and its people, and the transformation process is continuing at an ever-accelerating pace. This evolution gravitates between two poles : one is the new European element representative of the western world ; the other, based on custom, is the ancient traditional way of life. It is absolutely necessary to understand these ancient traditions, because even among the natives who have deliberately rejected their authority, they still determine certain reflexes, attitudes, concepts, and ideas about the world. They are in fact the tree upon which occidental civilization has been grafted. A new society is bound to result from this operation, but for the present it is still in the making.