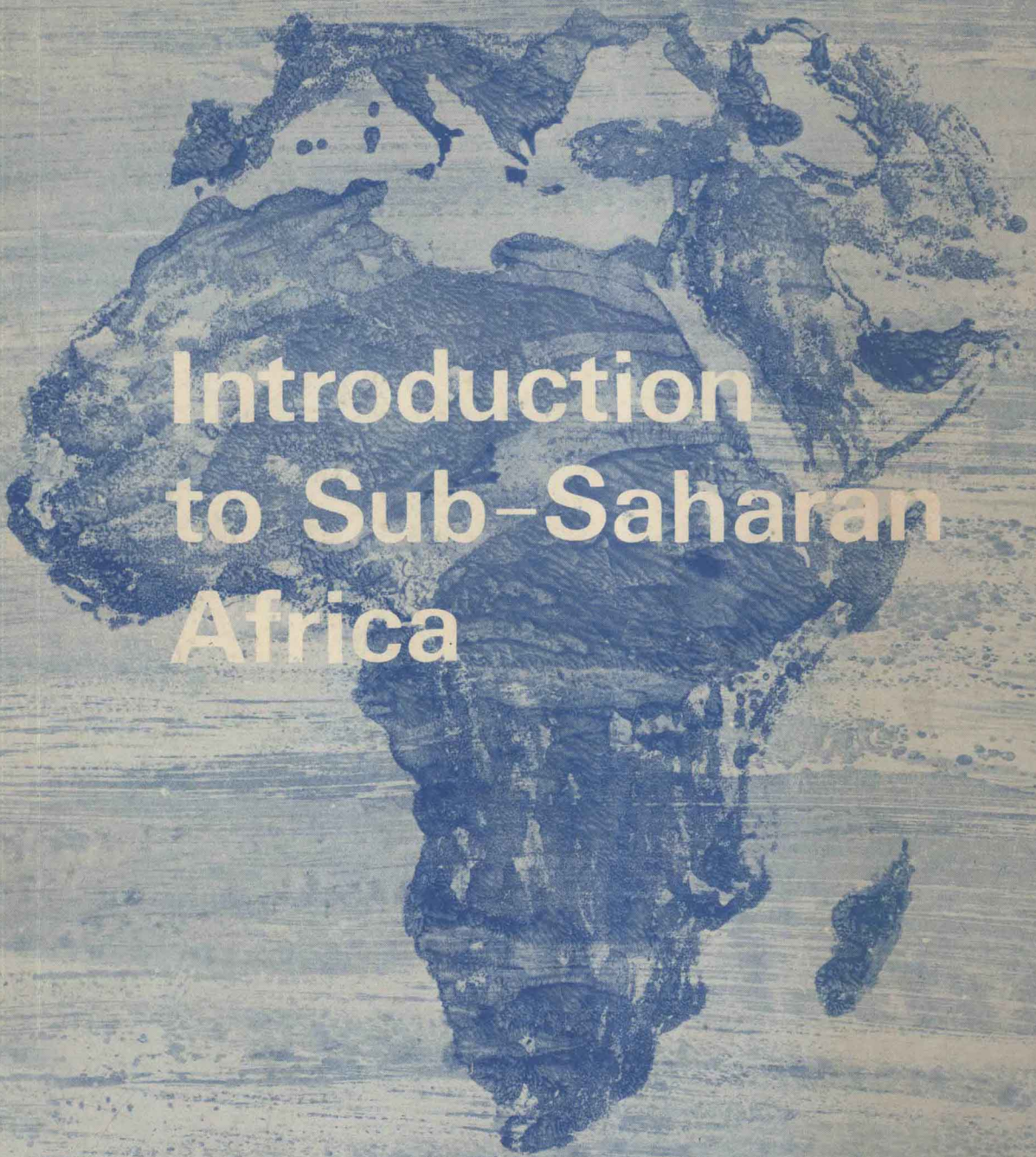

Introduction to Sub-Saharan Africa

EDGAR S. EFRAT

INTRODUCTION TO SUB-SAHARAN AFRICA

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Preface

Introduction to Sub-Saharan Africa differs from most other works covering the same area in its attempt to present the facts, issues and problems of contemporary Africa by means of a detached, academic approach. No other continent undergoes change with such breathtaking speed and frequency. As a result, much of what is written about it is overtaken by events and developments before it appears in print. The present volume was prepared in the expectation that it will remain up to date for an extended period.

The contributing authors, academicians with long personal experiences in African studies, geared their essays toward an understanding of Africa by educated laymen. This approach, in addition to its value as a general reader, makes the book suitable for introductory courses in African studies.

The essays' topics are divided along lines suggested by the major disciplines within the social sciences and the humanities. The authors have been given considerable latitude within space limited by necessity. The variance in style and approach, it is hoped, will contribute to readability and retention of interest.

The essays are largely empirical studies. Although many excellent books dealing with the problems of contemporary Africa have been published recently, each one—including the present work—can derive only limited information and experience from the past. As with the well-known iceberg example, any examination of Africa's problems faces much that is submerged. A study of these problems, based mainly on Western premises, encounters obstacles which to the Western mind are not only irrational, but also at times even intangible. Yet these "Western premises" are essential, at least as an intellectual point of departure, if the Western reader intends to embark on a study of Africa and its problems.

Some of these problems may be listed thus:

1. Will political development in Africa be evolutionary or revolutionary?
2. Will states that are at present economically nonviable find a way to become less dependent on external aid by federation or by utilization of resources yet untapped?
3. Will Africans find the means to enlarge their social horizons and emerge from the confinement of tribalism?
4. Will African statesmen find it possible to soar above the geographic boundaries imposed in the pre-self-determination era, to bring about more equitable frontiers?
5. Will Africans learn to distinguish between friend and foe by criteria other than immediately perceivable economic gains?

While the authors of *Introduction to Sub-Saharan Africa* do not pretend to enable the reader to prognosticate, they present their essays in the hope that he will find it possible to take a better informed look at the major issues facing Africa through time.

E. S. E.

Contents

Chapter 1

Introduction to the Geography of Africa South of the Sahara

Hildegard Binder Johnson

Africa, with an area of 11,700,000 square miles, is the second largest continent. It has been called the continent of change, the dark, the tropical, the colonial continent, and, while these attributes might now be rejected as clichés, they were not acquired without some historical and geographical reasons.

Africa is the most compact continent; its coast when compared with its enormous area is not much indented. There are no large bays or peninsulas and few estuaries; although Africa is about three times the size of Europe, it has not even half as long a coastline. No large plains extend inland from the ocean and most rivers are not navigable for long distances from the sea. The continent was difficult to explore and thus the last to reveal some major aspects of its geography. Three questions especially puzzled European mapmakers and explorers of Africa: the course of the Niger, which was thought to flow from east to west; the Mountains of the Moon, possibly the region of the source of the Nile; and the spatial association of the lakes in East Africa. In spite of a coastline rather well known for over three centuries, Henry M. Stanley as late as 1890 called his book about explorations of the Congo and Lake Victoria *In Darkest Africa.*

Africa is the continent which lies astride the equator, almost equidistant from which are its northernmost point, Cape Blanco near Bizerte (at 37° 21′ North latitude), and its southernmost, Cape Agulhas (at 34° 51′ South latitude). This is a distance of 4980 miles—corresponding to that from Roanoke, Virginia, to Santiago, Chile. More than three fourths of Africa's landmass lies between the Tropics of Cancer and Capricorn; no other continent receives the same amount of vertical rays from the sun. While the climate is much modified by relief, only parts of South Africa and Mediterranean North Africa do not have some type of tropical climate.

Only two African countries, Ethiopia and Liberia, can be said never to have been colonies. In view of the Italian occupation of Ethiopia from 1936-41 and the founding of Liberia by the American Colonization Society, even these two exceptions might be modified. The colonial heritage is ubiquitous and the map of Africa's boundaries is only one map to show how the colonizers affected the colonized. Maps of railroads and improved roads, as well as of major cash crops and the location of capitals, reflect forces from overseas.

For an understanding of peoples, one has to study their homes and lands. These are very diversified in Africa; many generalizations must be understood as guidelines to the unique local situations rather than as statements of unconditional validity. For illustrations one must move all over the continent —from west to east, south of the Sahara; across Mauritania, Mali, Niger, Chad, Sudan, and Ethiopia; thence to the south with Lesotho, an enclave in the Republic of South Africa.[1] For an overview of Africa's geogra-

phy, the many regions and countries cannot be described individually, but, if specific places are mentioned and some geographic aspects discussed, a great deal about sub-Sahara Africa can be learned at the same time.

AFRICA'S DISCOVERY AND LOCATION

The discovery of Africa, similar to all discoveries, implies that there were people for whom the continent was unknown, although they may have had vague ideas about it, and that others, especially the people who lived there, knew at least a part of it very well. Phoenicians, Greeks and Romans knew North Africa from Egypt to the Pillars of Hercules, the Strait of Gibraltar. North Africa was part of the Mediterranean realm, the front door of the continent, the "torrid zone" of the Sahara to the south man could not penetrate.

Only the Nile, a river oasis across more than one thousand miles of desert, aroused curiosity through its seasonal floods with no well-known tributary that could account for them. Hecateus of Milanus thought the Nile drained out of the River Oceanus which supposedly surrounded the earth. Eratosthenes knew of the Atbara, the last major tributary of the Nile, and postulated another junction still further upstream, later recognized as the junction of the White and Blue Nile. A student of Aristotle thought the floods were caused by rain-bringing winds from the southern ocean. By the time of Strabo, summer rains over Ethiopia were held responsible for feeding numerous tributaries. Later, the Nile was said to issue from a cave guarded by Prester John, the mythical Christian King whose realm had been lost to western Christendom; his figure was to decorate many maps of Africa during the Age of Discovery.

Medieval maps showed the source of the Nile close to the Red Sea; Moslem geographers showed it closer to the Indian Ocean and further south. The idea that there was a river coming into the Nile from the west, already found in Herodotus' *Historia*, gained much wider credit through the Elder Pliny's *Natural History* (77 A.D.), which exerted a far greater influence than it deserved. In view of the confusion, it is remarkable that Ptolemy believed the Blue Nile arose from a lake that apparently was Lake Tana in Ethiopia and wrote that meltwaters from snow on the Mountains of the Moon were received by the lakes of the Nile. While this cannot be identified with the Ruwenzori Mountains in Uganda, Albert Lake and Victoria Lake, it remains a noteworthy "happy guess from the vaguest hearsay."[2] The Ptolemy editions from 1477 and throughout the sixteenth century all show lakes, usually two, and the Mountains of the Moon. They remained on the Dutch and French maps of the seventeenth century in varied sizes and positions. Toward the end of the eighteenth century they were removed with many other legendary features, and the region of the Nile sources became a blank on maps and thus a great challenge for explorers.

After the Roman Empire broke up, Arab conquests barred North Africa to European traders and travelers. Vague knowledge of trans-Saharan routes and of the Sudan trade along the routes of pilgrims from West Sudanese kingdoms to Mecca sustained European merchants' curiosity in West Africa's gold and salt trade. East Africa's coast, which had been touched by Alexandria's trade realm during the first centuries A.D., also came under the control of Arab traders, and Islam began to spread to India in the thirteenth century.[3] From this second period of "discovery" by outsiders stem the first ports, such as Mogadishu, Malindi and Mombasa, which deteriorated and were refounded, and the term by which the Arabs called the Africans, "*cafirs*," infidels. The Portuguese then adopted it and through them it spread to South and Southwest Africa, where sorghum is called *kaffir* corn.

After Moorish power declined on the Iberian Peninsula, Spain and Portugal embarked on their worldwide trading, exploring and—with the help of firearms—conquering expeditions. In order to reach the Spice Islands (Moluccas) of Southeast Asia, Africa had to be

circumnavigated; while Spain concentrated on the New World, Portugal embarked on one of the most systematic exploratory enterprises of all times under the brilliant leadership of Henry the Navigator (1394-1460), son of King João of Portugal. Many place names along West Africa's coast from Cape Verde and its islands, the first green lands after sailing along the Saharan coast, to Lourenço Marques, are Portuguese in origin, including the names of two African states: Sierra Leone, meaning the lion mountains, because frequent thunderstorms are said to have reminded the sailors of roaring lions, and Cameroun, after the river of shrimps, *camarãoes* in Portuguese. When Vasco da Gama rounded the Cape in 1497, he landed on the east coast on the Day of Nativity and named it Natal; it is now a province of the Republic of South Africa. The significance of East Africa's coast for Portuguese trade with India is illustrated by the name Algoa Bay, the port of call "on the way to Goa." After serving as chief architect for the Portuguese in India for thirteen years, an Italian architect built Fort Jesus (at Mombasa) which fell to the Arabs in 1698 and deteriorated; it is a tourist attraction today. The French, who founded St. Louis at the mouth of the Senegal River in 1658, were also aiming for Southeast Asia and occupied the island of Réunion off Madagascar (Malagasy Republic). Thus East Africa was drawn, at least through some stopover places, into the Indian trade realm.

There are some Portuguese portolan charts, where the names of coastal points only were written one below the other along the coasts forming the outline of Africa's shores. Africa's shape showed rather little distortion by 1500, when South America was still labeled "Terra Incognita" on maps and its southern extent was still unknown. A beautiful chart of 1512 by Vesconte Maggiolo in the National Library in Parma shows the Portuguese approach: the uninterrupted succession of Portuguese names creates the outline of Africa around the Cape.[4] South is "up" on this map and the Atlantic Ocean is to the right—the Brazilian shore is shown at the right margin.

Soon all of West Africa's coast, the grain (the name derives from pepper grains), the ivory, the gold, the slaves, the fever coast to the Bight of Biafra, the Congo coast and Angola would face the outside world and Brazil across the Atlantic through the slave trade. It brought loss of population and severely retarded the population growth; it also gradually shifted Africa's trade and wealth away from its rain forests and interior to the coast. The Portuguese introduced many plants, among them cassava, maize, sweet potatoes, bananas and peanuts, from across the Atlantic. All these became staple foods in African diets. From Brazil, descendants of Africans whom the Portuguese had brought to Recife as slaves migrated back to West Africa. They were Catholic and constituted an early African elite, particularly in Togo and Dahomey.[5] The Brazilian two-story house is a South American import now widely spread, not only along the coast, but in inland cities, such as Ibadan in Nigeria.

With the development of the "triangular trade" between England, Africa and the West Indies, West Africa's coast became even more responsive to British colonization in America than the Portuguese-controlled African coast was to Brazil. The ancestral relationships of twenty-one million United States citizens in the twentieth century derive from westbound voyages across the Atlantic in the eighteenth and nineteenth centuries. Many of the men influential in African colonization projects for freed slaves had had experience in Jamaica, and many decisions in connection with nineteenth-century settlement projects were based on the idea that Africa's products should replace imports from tropical and subtropical America. To Freetown, founded and named for the purpose of receiving slaves who had been freed from Portuguese vessels by British patrol boats, Africans were brought back from the West Indies and Nova Scotia. Monrovia, capital of Liberia, from the Latin meaning "the country of the free," was named after an American president by an American Colonization Society. Cocoa was introduced to Fernando Po by the Spanish from Mexico and to the Gold Coast from Surinam in Dutch

Guiana by Basel missionaries.[6] Ghana has been the leading cocoa exporter of the world since 1911. Firestone's rubber plantations, a mainstay of Liberia's economy, constitute one of many examples that illustrate the increasing involvement of West Africa in the economic core area of the North Atlantic Basin.

For the first three centuries, direct European influence was restricted to the coast which in the nineteenth century came to be called the "White Man's Grave."[7] African rulers did not permit interference with their lucrative trade as middlemen between the foreigners and the interior, where the rain forests beyond the coastal lagoons with mangrove forests and swamps were difficult to penetrate–if only to the Europeans. Thus the solution of the Niger riddle did not come until the nineteenth century.

Mungo Park, a Scotsman, tried twice; he traveled up the Gambia River, crossed overland keeping east, and then found the Niger flowing east, not west. He was drowned in 1805 at the falls of Bussa in the Niger on his second attempt. Only when the Lander brothers descended the Niger in 1830 and arrived at the Oil Rivers from the interior did Europeans realize that the coastal waterways, known to them as the Rivers Excarves, Forcados and Non, were main branches of the Niger among the innumerable creeks of the delta.

A young Frenchman, René Caillé, performed the feat of traveling from Sierra Leone via Fulla Jallon to Timbuktu and of crossing the Sahara to Tangiers in 1827-28. Also noteworthy among the trans-Saharan crossings was the journey of Heinrich Barth, a German geographer, from Tripoli to northern Nigeria and thence to Lake Chad and Timbuktu in 1850-55. But for an exploration of the Congo system–the lakes, and the sources of the Nile–interior West Africa's physical obstacles were insurmountable. It was more promising to try by trekking overland.[8]

Dr. David Livingstone–another Scot–proceeded from Capetown to Bechuanaland (Botswana) and the Zambezi, then on to the west and Luanda, then back and east to the Indian Ocean. On this journey (1855), he discovered and named Victoria Falls on the Zambezi. His second exploration from the east coast led up the Zambezi and its tributary, the Shiré River, which presented great obstacles in its rapids; it revealed Lake Shirwa and Lake Nyasa. On the third journey, Livingstone ascended the Rovuma River in the hope that it would present a route to the East African lakes–it does not even drain Lake Nyasa. All three expeditions were based in Capetown. For his next attempt from the east coast, Livingstone outfitted in Zanzibar, to which he traveled via India; he then explored the land between Lakes Nyasa and Tanganyika for five years and was not heard from during that time. To find Livingstone, Henry Morton Stanley we on his first expedition, also from Zanzibar, across Tanganyika. Few people know the date and place, but almost everyone knows what Stanley said at Ujiji on the eastern shore of Lake Tanganyika on November 10, 1871.[9] The expedition was financed by the owner of the *New York Herald*, Gordon Bennett; otherwise, American names are singularly absent in the history of African exploration.

Meanwhile, John Hanning Speke and Richard Francis Burton, who had been in Indian service, reached Ujiji in 1857. Burton then went alone northwards from Tabora and named the great water, Nyanza, Lake Victoria. In 1860, Speke discovered that the outlet of Lake Victoria at Ripon Falls was the beginning of the Victoria Nile. Livingstone's death in 1873, while he was still trying to unveil the connections between the lakes, the Congo and the White Nile systems, gave renewed impetus to exploration in "darkest" Africa. Stanley identified the Lualaba as the upper Congo–not the Nile as Livingstone had thought; he followed the Congo downstream and arrived at Stanley Pool in 1877, establishing at its southern end the post named after the King of Belgium, Léopoldville, opposite the French port at Brazzaville.

The Khedive of Egypt also encouraged exploration of the upper Nile. Samuel Baker, after he had explored the Atbara, traveled the White Nile (1862-64) further upstream, traversed the Sudd, Africa's most formidable papyrus swamp and recognized that Lake

Albert also contributed to the flow of the White Nile.

Soon the Suez Canal, opened in 1869, was to change Africa's relative location once more. The Canal shortened by four to five thousand miles the sea route from western Europe to the East African coast and brought Egypt back into geopolitics, with Capetown losing much of its role as a relay and stopover point. Until 1869, Europeans who came to Zanzibar and East Africa had stopped in Capetown on their way, often after having been in India. Now, they arrived at the Afro-Asian island metropolis after traveling through the Red Sea and around the African Horn. More and more explorers converged on the interior of East Africa and circled around the Lakes Victoria, Albert and Edward, all named after members of the House of Hanover. The House of Hapsburg was put on the map by a Hungarian explorer, Count Samuel Teleki, who discovered Lake Rudolph and Lake Stefanie (1886-89).

Many African place names reflect European exploration, and newly independent nations are often sensitive to the colonial origin of these names. It is expensive to change them, and time may obviate the resentment over a name that commemorates the past. Many western European cities have names derived from Latin and they cherish their Roman antiquities. Batavia, the Dutch name for the capital of Indonesia, meant the city of "Batavi," as Roman colonizers called the Germanic tribes on the islands of the Rhine delta. To the Indonesians the name meant colonialism, and they changed it to Djakarta. Formerly Northern Rhodesia, Zambia would rather not commemorate the name of Cecil Rhodes, so revived the old name of Zambezia. The Gold Coast changed its name to that of Ghana, an African kingdom situated farther inland centuries ago. The former territory of French Equatorial Africa was called Ubangi and Shari after two rivers and is now the Central African Republic (République Centrafricaine). Léopoldville was changed to Kinshasa, and Elizabethville, named after the Belgian Queen, to Lubumbashi. Will Thysville be changed, also? It was named after General Thys, who surveyed the railroad between Kinshasa and Matadi which relieved thousands of Africans from the cruel toil of carrying goods through valleys and over mountains around the cascades of the Congo. South Africa is rich in names which commemorate Dutch settlers: Krugersdorp, Paul Kruger's village; Johannesburg, Johannes Brand's mount or village; Pretoria, after Pretorius, the father of the first president of the South African Republic; Pietermaritzburg after Pieter Retief and Gert Maritz. The literal meaning of Bloemfontein, the fountain of flowers, and Vryheid, freedom, could be acceptable, but they are in a language which at present is possibly the least liked non-African language of all in Africa south of the Sahara. To rid Africa's map of Portuguese place names, colonial as they may be, seems an impossible task. Still, students of the continent of change are advised to watch for the change of place names.

THE PHYSICAL ENVIRONMENT

Africa's physiography affected the opening of the continent. One unfavorable geographic factor is the generally narrow coastal plain south of Africa's "waist." Where the coastal plain is more extended, as in Nigeria, its access from the ocean poses problems. From Senegal to the Bight of Biafra, the shores consist often of lagoons, swampy lowlands and deltas formed by sluggish and sediment-carrying streams. Sandbars hide the entrances to small sheltering inlets; mudflats choke the mouth of even larger rivers, such as the Senegal; and tidal waves coming in from the southwest build out sandspits pointing east. The opening to the lagoon, which is the modern harbor of Lagos, has to be dredged constantly; access to the sea for Abidjan's harbor in Ivory Coast had to be created by breaching a sandbar; Ghana's port of Takoradi, opened in 1928, is completely artificial. Farther south, Cameroun's harbor, Douala, had to be deepened; formerly, ocean vessels held up by sandbars lightened 25 miles away from the city's piers. At Port Gentil, harbor for Libreville, ships still anchor quite a distance from shore to await

lighterage. Benguela, often misquoted as the western ocean terminus for the "Benguela Railroad" from Katanga, is too shallow. Good port facilities have been built some miles to the north at Lobito, possibly the best natural harbor along Africa's west coast and superior to the port of the older and larger Luanda.

Further south, the coast becomes merely a barren strip with sand dunes, nearly waterless in Southwest Africa; Walvis Bay represents its only natural sheltered bay. There "a wide, bleak piece of empty land separates the wharf from the town,"[10] with a main street half a mile away from the ships. Continuing south one can see from a low-flying plane darker spots in the water along the shore—the hulks of sunken ships. Table Mountain dominates the approach to Capetown, where the limited shelter afforded by the wide bay is improved by breakwaters. Still more impressive is the escarpment of the Drakensberg Mountains on the eastern side, where the drop from the crests to the bottom of the continental shelf under water is about 20,000 feet. Port Elizabeth is not a well-protected natural harbor; East London is completely artificial; Durban is the best and largest of the three. Lourenço Marques on Delagoa Bay, the best bay along all of East Africa's coast between Capetown and Cape Guardafui, is one of Mozambique's ports; the other is Beira, upstream on Pungue River, its shore silted and lined with mangrove growth. Neither of these two ports is situated at the mouth of one of the two great East African rivers, the Limpopo and the Zambezi. Dar-es-Salaam, Tanzania's capital and best harbor, is inside a well-protected, nearly round bay, with a narrow entrance channel, but its hinterland is uninviting. Mombasa is situated on an island, where the coral reef along the shore permits entrance; its deep port, Kilindini, is on the landward side. Behind the shore is a broad coastal plain, with dried shrub and acacias invariably discouraging to travelers, according to all descriptions.

With deeper probing into the interior, Africa reveals itself as an unimaginably extensive plateau, much higher and far more dissected in the east than in the west. When the plateau is scaled, it stretches as a highland with vast depressions, such as the Congo Basin, but also with unexpected rises of land. Africa, southeast from a curving line drawn from about the northern tip of Ethiopia to about the mouth of the Congo River, can be said to be higher than 3000 feet. Northwest of this line is Low Africa, with only the Guinea Highlands and Cameroon Mountains rising considerably above the general level, south of the Sahara. West Africa generally does not rise beyond 1600 feet and even where greater heights occur they do not create distinct climatic regions. Among the effects from this general monotony of relief is the fairly parallel arrangement of climatic belts throughout West Africa and concomitant belts of soil and vegetation. Another effect is the reaction of tourists: there are no impressive mountain landscapes, colorful and photogenic, and, when a rather unpleasant climate and near-absence of great game parks are considered, it is clear that West Africa's tourist industry must base its appeal on history, people and art, rather than on geography. Even as exciting a river as the Niger, 2600 miles long, or the view from the Akwapim Ridge over Accra's coastal plain, or the rounded cone of Mount Cameroon, are hardly a match for Table Mountain, with its regular afternoon rim of white clouds which children in Capetown call its tablecloth, or for Victoria Falls of more than double the height of Niagara Falls, and certainly not for the fabulous Rift Valley system of East Africa.

The reader will be spared the technical vocabulary which accompanies the explanation of Africa's geological past, but two existing theories deserve mentioning. The first is called the Continental Drift theory. One of its earliest proponents was a German, Alfred Wegener; it was pursued by several French, English and South African scientists and—after years of disbelief—has been increasingly accepted by American geologists since 1952. The ancient blocks of Australia, India, Africa and parts of South America have much similarity, and the outlines of these landmasses seem to fit well, particularly the outline of the eastern-

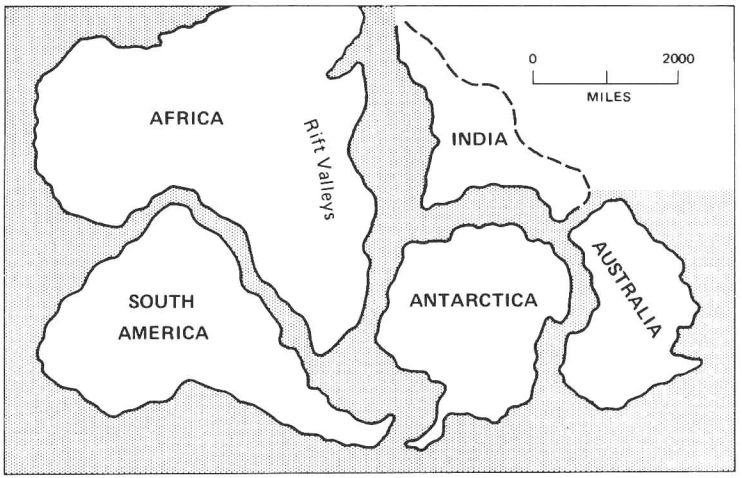

Figure 1

most extension of South America into the Bight of Africa. There are many far more sophisticated observations which support the idea that millions of years ago there was one large landmass–it has been called Gondwanaland–which split and drifted apart. (See Fig. 1.)

Related to this theory is the origin of the Rift Valley system, although one of the Rift Valley's best geological experts, J. W. Gregory, rejects the Continental Drift theory.[11] A generalized map of the East African Rift Valley shows ribbons, representing sunken valley floors with high rising scarps to one or both sides. (See Fig. 2.) They may extend as far south as Natal. The Gwembe Trough, into which the Zambesi's water has been backed up by the Kariba Dam, is another outlayer from the major "system" which has long been recognized. Beginning with Lake Nyasa in the south, a western branch is filled by Lakes Tanganyika, Kiwu, Edward and Albert. Lake Victoria is a large shallow depression on the upland. The eastern branch is more broken up, and the Uruguru and Usambara Mountains in Tanzania are part of it; the rift is well developed west of Kilimanjaro and in southern Kenya. Lake Rudolph occupies the rejoined rifts; the system is connected with the Ethiopian mountain fortress, runs through the Red Sea and the Gulf of Aqaba and ends in the Jordan Valley. The general north-south direction fits the trend of the tearing of landmasses along the Indian Ocean. Gregory explains the Rift Valley as forces of tension in the earth's crust which resulted in faulting, that is, long blocks sinking down along fault lines with rising walls on either side. It seems plausible to explain the apparent volcanism, still active at the northern end of the western rift, by molten extrusions along the faults where the crust was torn apart; however, the volcanos–active or inactive–occur over wide areas and, by no means, in any recognizable order along the faults. The theory that compression rather than tension caused the faulting does not explain the distribution of the volcanos, either.[12]

It is possible that recent investigations about the fluid quality of the earth's crust will help to explain the relationship between rift valley walls and the distribution of volcanic "bubbles." This is the term which occurred to this observer, who has a rudimentary knowledge of East Africa's geomorphology, in August, 1967, when she saw the masses of volcanic

cones on the upland above Ngorongoro Crater. The crater is really a caldera, that is, the explosion was so great that the central portion of the volcano was destroyed. Crater Lake in Oregon is an example, although Ngorongoro is dry. The inside rim of the crater is a wall that drops two thousand feet into the wide interior floor, which is a wild game reserve. Around the caldera, there are more volcanos, mostly extinct, presenting a moonlike landscape. Such arrays of cone-shaped bubbles can be seen also in the Mount Meru region, east of the Gregory Wall in the Masai steppe. In as unlikely a source as the *Saturday Review* of September 2, 1967, the author read about a pot with boiling tomato soup exhibited during a lecture in May, 1967, by J. T. Wilson, a Canadian, to demonstrate his theory about the earth's fluidity. As for the bubbles–lava rises through fractures, the volcanic eruption produces a cone that would move, slowly indeed, but similar to the froth on the bubbling tomato soup. Another volcano would erupt next to it from the same fracture, also move on, etc. The theory, based on isotopic research and magnetic measurement, has great precision. Now, the distances between the Rift Valley's bubbles will have to be measured and the time of their extrusions determined. The detection of hot brines under normal sea water at a depth of 6500 feet in the Red Sea supports the applicability to the African rifts. Deep-sea exploration of the Indian Ocean should shed further light on the connections between Gondwanaland and the Rift Valley. To those who would like to savor the landscape of the Rift Valley in Kenya through literature, two books–Ernest Hemingway's *Green Hills of Africa* and Isak Dinesen's *Out of Africa*–are recommended.

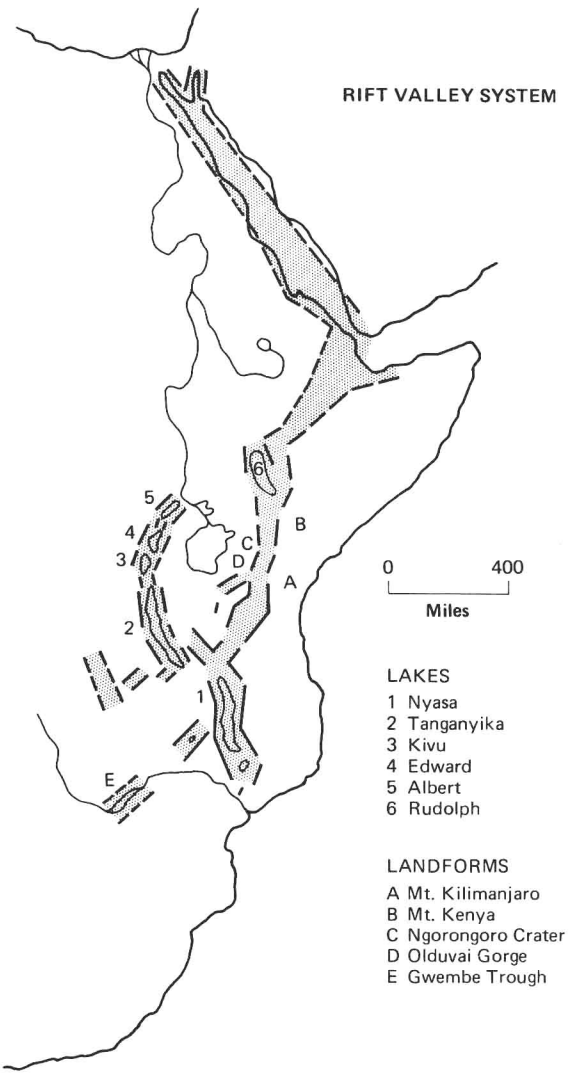

Figure 2

THE CLIMATE

Man actually experiences weather. Climate becomes known only after many daily observations throughout the years; in some parts of Africa, such observations are not very well recorded. For instance, Ghana in size is comparable to Great Britain, and it has not too different a topographical variation. Great Britain has more than 5000 rainfall observation points, Ghana has less than 500. There are also technical difficulties: most ground instruments and the guidebooks prepared for their use are geared to the environment of devel-

oped countries generally in the middle latitudes. Also, instruments are becoming increasingly more complicated. There are staffing problems and, for the information of staff, most meteorological literature available is in the language of developed countries. While French and English are known by many, other people who could handle routine observations know only Hausa, Amharic or Swahili, to name just three of the more widely spoken languages in Africa.[13]

The tropical location of the continent allows for some expectations of a general nature regarding temperature and rainfall, the most important factors of climate. But the local situation often does not conform to climatic patterns on a global scale; in East Africa, including Kenya, Tanzania and Uganda, where synoptic meteorological studies are better than in many other parts of Africa, topography and the presence of lakes produce such a variety that "there are 52 separate regions covering 30 different seasons, some of quite small area (less than 1000 square miles) but all 30 showing different seasonal characteristics."[14] Temperatures are much affected by altitude; rainfall often results from the cooling of air masses when they move as clouds across mountain ranges and, with the diversity of mountains in High Africa, this one circumstance alone is apt to produce a greater variety of climate in High than it produces in Low Africa.

Africa's tropical location, however, means that the equatorial heat belt, which shifts with summer and winter seasons, covers most of Africa; thus, plants can grow the year around. With the exception of southernmost Africa, there are rainy and dry periods, not winter and summer, and the term "season" applies to rainfall rather than to temperature. Seasonal or annual ranges of temperature are generally less than diurnal ranges, and it is quite acceptable to say that the winter of the tropics is the night. For relief from the heat, one travels to higher altitudes, not to higher latitudes.

Some aspects of air movement are understood to result from large high-pressure regions over the Sahara north, and over the Kalahari Desert south, of the equator. The lands of West and Central Africa are subject to pressure differences resulting from the increase of insolation and radiation north of the equator during summer in the North American continent, and south of the equator during the winter. From the higher pressure zone which develops over the Sahara, wind will generally blow from northeast to southwest during December, January and February, bringing little moisture, but considerable dust from the desert; this is called *harmattan.* Against this movement works the Atlantic high with moisture-laden air moving north in the American summer months. There are no fronts in the way they are experienced in the regions of the middle latitudes; rather, there is a large, elongated trough of low pressure toward which these winds converge, called the intertropical convergence zone, or simply ITCZ.

Rain results when the relative humidity of the air reaches about 100 percent, or the saturation point. When the relative humidity is high and the air is hot to begin with, it needs very little cooling to cause the clouds to unload their moisture. Rainfall in the ITCZ is also much diversified by convectional storms. They are caused by the heating of the air, which varies from one locality to the other, with differences in soil, vegetation and height. The rising of this air, again to an altitude where this adiabatic change of temperature produces rain, produces the magnificent towering clouds of tropical Africa.

The heat that is felt is not the result of the rays received from the sun, but of radiation of the received heat back into the air. When clouds cover the sky and the radiation is held back close to the surface, the temperature can be higher than it would be under cloudless skies. On the other hand, the actually felt temperature can be moderated by slight seabreezes and local mountain breezes, so that the climate seems more pleasant than in the lowland. A good example is the Akwapim Ridge, some thirty miles from Accra, which rises to about 1500 feet. Nkrumah built his summer palace there.

A simple chart showing the average temperature and monthly rainfall throughout the year for Freetown (Fig. 3a) is an illustration of one rainy season. Freetown is one of the wettest spots of tropical Africa, because the rise of the Guinea Highlands northeast of it causes the air masses moving in from the Atlantic to unload their moisture. For Kumasi in Ghana, another chart (Fig. 3b) shows how, during seventeen years, the daily temperature in January had a greater range than the annual temperature, but there was less temperature difference between day and night in August. The annual temperature range, that is, the difference between the coldest and warmest month, was only five degrees. Lagos (Fig. 3c) has less total rainfall than Freetown, but two rainy seasons, since it is closer to the equator. Further north, Kayes receives much less rainfall and has greater annual and daily temperature ranges (Fig. 3d).

For West and Central Africa, maps show rather regular belts of high rainfall around the equator to lesser rainfall away from it, with a narrow ribbon close to the desert across the continent where rainfall decreases to only between 10 to 20 inches for a year (Fig. 4). In the south, these belts appear as crescents around the Kalahari. Here the continent is much narrower, and the proximity of the ocean has an influence from the west, where the cold Benguela Current cools the air masses which heat up when traveling over the hot land, thus reducing their relative humidity.

However, the average amount of rainfall and distribution throughout the year tell nothing about the reliability and intensity of rainfall. Rains in Africa are generally uncertain, with respect to their amount or time of arrival. King William's Town in South Africa

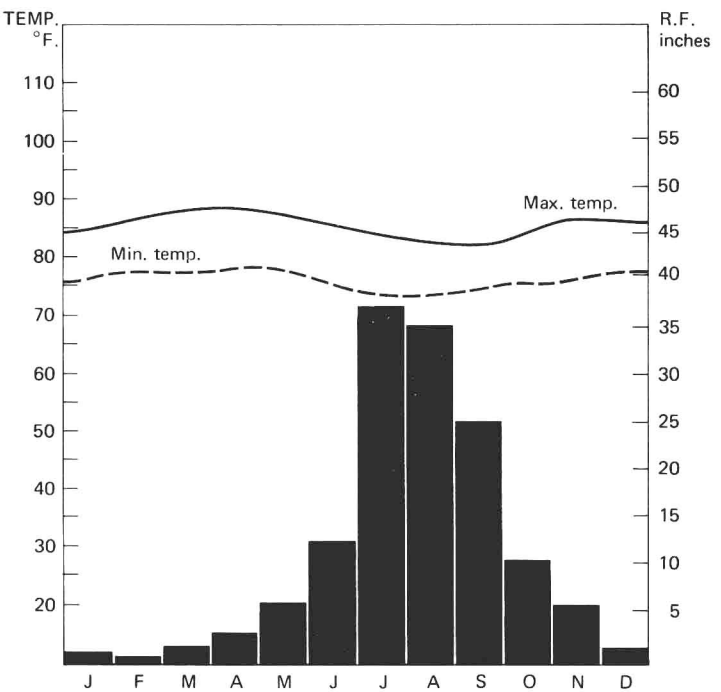

Figure 3a

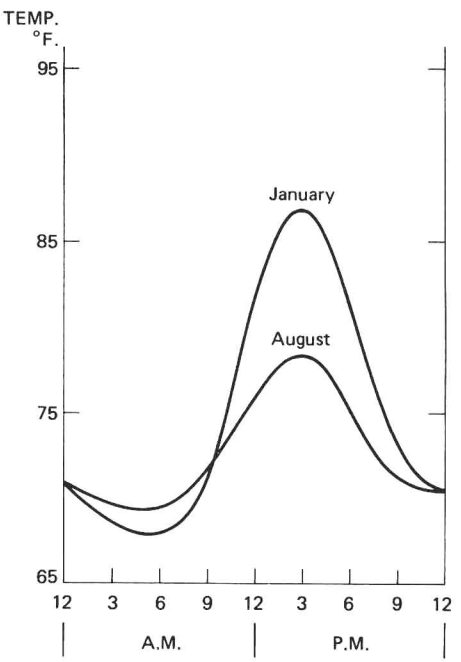

Figure 3b