# The Geology of Liberia: a Selected Bibliography of Liberian Geology, Geography and Earth Science.

**By R. Lee Hadden**

Originally prepared by the US Geological Survey Library staff as part of an
US Department of State project to restore the Geological Library of Liberia, 1998-1999.
Revised and Updated through 2006.


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This bibliography on the water and geological information of Liberia was begun in 1998 as a request through the US Department of State by the Government of Liberia. It brings together selected citations from a variety of different cartographic, geographical, geological and hydrological resources and specialized library collections. Most of the citations have location information on where these items can be located and used on site, and either borrowed through inter-library loan or purchased through a commercial document delivery services.

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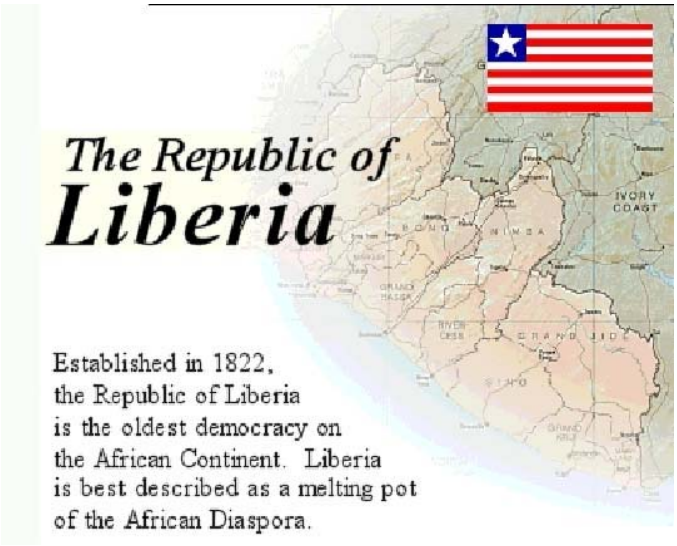
Preface

Government representatives of the Republic of Liberia and the US Department of State visited the US Geological Survey Library in late 1998 and again early in 1999. The National Library of Liberia in Monrovia was destroyed by the awful civil war in their country, and their representatives desired assistance to rebuild their country's written heritage. At the request of the Department of State, the USGS Library was able to supply them with a complete bibliography of USGS publications written about Liberia.




The USGS Library staff was also able to supply them with copies of other publications written about their country by their own Liberian Geological Survey, as well as reports and maps by other private, commercial and governmental organizations. It was discovered that the USGS Library had a far greater collection on the geology of Liberia than their national library had owned before it was destroyed.

The Liberian representatives applied for a grant from the US Department of State to cover the cost to copy the materials published by the US Geological Survey in the USGS Library for the use of their library, since these government documents and maps had no copyright restrictions. Later, the plan was to extend the bibliography to comprehensively cover the geological literature of Liberia, as they intended to purchase those copyrighted items needed to refill their library collections.

By collecting so many publications over so many years through exchanges, gifts and purchases, the US Geological Survey Library staff has built up a significant collection of the world's knowledge of the earth's sciences. It was also a remarkably cost effective collection, since many of these publications were acquired through scientific exchange with the government of Liberia and their agencies. As a result, there was little cash spent on obtaining their reports and maps, since for many years, extra copies of USGS scientific publications were simply exchanged for their geological publications. By collecting in this manner over time, the USGS Library acquired an excellent reservoir of earth science information about their country, which cannot be compared with any other library for the breath and scope of our collection of Liberian materials.

By doing this with so many different countries, of which Liberia is only one example, and exchanging their reports, books and maps and reports with their private organizations as well, the USGS Library has been able to build up a massive amount of information that is freely available to the earth science community, at relatively little cost.

The willingness to share the USGS Library collection and services with Liberia and other countries whose libraries are harmed by natural disaster or war, recapitulates the USGS Library mandate for the increase and diffusion of knowledge.

The backbone of this bibliography are the publications of the US Geological Survey. Without a doubt, the largest number of publications have been written by the US Geological Survey, often in cooperation with the Liberian Geological Survey. In this revised and updated report, additional materials have been identified and located in university, government and corporate libraries around the world.

Wherever possible, the information concerning the location of the identified materials or where they can be viewed is also given. Standard numbers, such as ISSNs, ISBNs and OCLC numbers are listed when possible to help locate and verify these publications. While materials in some libraries, particularly maps, frequently can't be borrowed, others can be sent through inter-library loan agreements or by other library collaborations.

Other materials can be located and purchased through various document delivery companies such as AMRS or the American Geological Institute. For a fee, they will locate and supply to their customers copies of journal articles, maps or reports.

## Introduction

The Republic of Liberia has it's origins in 1821, when the American Colonization Society began it's campaign to send freed slaves from the United States back to Africa. The country was settled by freed American slaves from 1822 through the 1860s, who had few interactions with the indigenous people. The republic, dating from 1847, is the oldest independent country in Africa. Liberia, meaning "Land of the Free", has about 43,000 square miles, and is about the size of the state of Tennessee.

Liberia is a few degrees north of the equator and lies along the great western bulge of the continent. The coastline of Liberia is nearly 370 miles long, and extends from West Africa westward to Sierra Leone. Going inland, the republic varies from 100 to 200 miles in width, and ascends from sea level to the Guinea Highlands and the country of Guinea. The "Pepper Coast" is the name of a coastal area in western Africa, between Cape Mesurado and Cape Palmas. It encloses the present republic of Liberia and got its name from the melegueta pepper. It is also known as the "Grain Coast."

Liberia is divided into 15 counties and they are subdivided into districts. The counties include: Bomi; Bong; Gbarpolu; Grand Bassa; Grand Cape Mount; Grand Gedeh; Grand Kru; Lofa; Margibi; Maryland; Montserrado; Nimba; River Cess; River Gee and Sinoe.

Regretfully, Liberia has witnessed two civil wars, the Liberian Civil War (1989–1996), and the Second Liberian Civil War (1999–2003), that have displaced hundreds of thousands of people and destroyed their economy and the nation's infrastructure.

Transportation in 1999 had a total road network of about 10,600km. There were 657km of paved roads and 9,943km of unpaved roads throughout Liberia.

## Geology

Liberia is perched on the West African Shield, a rock formation from 2.7 to 3.4 billion years old. The West African Shield that is made of granite, schist, and gneiss. In Liberia this shield has been intensely folded and faulted and is interspersed with iron-bearing formations known as itabirites. Along the coast lie beds of sandstone, with occasional crystalline-rock outcrops.

Monrovia stands on such an outcropping, a ridge of diabase (a dark-colored, fine-grained rock). Most of the crystalline rocks are of Precambrian age. The western half of country is typically of Archean age. In the eastern half of the country, lenses of Proterozoic greenstone belts occur

surrounded by rocks of probable Archean age. Rocks of Pan African age extend northwesterly along most of the Liberian coastline from the Cestos shear zone.

Along the Atlantic Ocean, the coastline is characterized by lagoons, mangrove swamps, and river-deposited sandbars. Inland, the grassy plateau supports limited agriculture.

**Climate**

Liberia is known for its sustained heat and heavy rainfall.

Because the republic lies south of the Tropic of Cancer and only a few degrees north of the equator, the days vary little in length. The tropical solar radiation is intense and the radiation is uniform across the country. Temperatures remain warm throughout the country, and there is little change in temperature between seasons. The mean annual temperatures in Fahrenheit range from the 70s to the 80s. The mean monthly maxima decline from the low 90s to the mean 80s during the rainy season. The mean monthly minima range from the low 60s in the highlands of the northwest to the low 70s at Monrovia and along the coast. Temperatures inland are warmer than along the coast, but the diurnal range is also greater inland.

More rain falls than in other areas of West Africa. The relative humidity is high throughout the county, and averages from 70 to 90 per cent, especially along the coat. The continental and maritime masses of air alternate their movements back and forth, and from north to south. This brings some seasonal differences in rainfall intensity. The coastal region has the heaviest rainfall, from between 155 to 175 inches annually in the west, and with nearly 100 inches of rain annually in the southeastern part of the country. Monrovia receives almost 180 inches of rain annually.

Rainfall decreases going north and inland. But the rainfall increases again in the highlands and the northernmost part of the republic. The driest part of the country is along a strip of the eastward flowing Cavalla River, but even there, the land receives over 70 inches of rain a year.

In Liberia, the rainy season begins in April or May, and reaches a peak in July through September, and tapers off again in October. Monrovia and Buchanan, on the coastal plains, receive a heavy rain earlier in the season, then they experience a period of reduced rainfall called the “middle dries” before heavy rains return in August. In the southeastern part of the country, the rainy season begins in April and lasts for two or three months, and then is followed by a drier period of two or three months. Then a second rainy season begins in September and lasts until November. The “middle dries” are not dry enough to be called a true dry season.

Water supplies have been improved in both rural and urban areas so that some 40 percent of the population has access to potable water. Surface water is abundant, and groundwater reserves are ample and regularly replenished by the country's heavy rainfall.

**Rivers**

The major rivers of Liberia are the Cavalla, the Cestos, the Lofa, the Mano, the Morro, the Saint John and the Saint Paul. The Mano and Morro rivers in the northwest and the Cavalla River in the southeast are boundary lines for part of the country. Most of the rivers of Liberia flow from the mountains inland in the northeast to the coast in the southeast, and parallel each other. Among the low mountains and hills, the river beds are steep and irregular, with frequent falls or rapids. Many rocks, waterfalls, rapids and sandbanks reduce navigation of these rivers very far inland. Closer to the coast, the river grade becomes less, and tidal current prevent the rivers from removing sand bars and accumulations. However, most streams overflow their banks regularly, and during the rainy seasons there is often severe flooding along the coastal plains. Many rivers flow long the coast for miles before they enter the Atlantic Ocean.

The rivers have been harnessed to generate hydroelectric power. The Farmington River is one source of hydroelectric power. The Mount Coffee hydroelectric station outside Monrovia on the St. Paul River is the country's largest hydroelectric installation. Electrical production in Liberia from all sources was 509.4 million kWh in 2003.

The Cavalla River in western Africa runs between the Ivory Coast and Liberia. The river is alternately known as the Cavally, Youbou, or Diougou River. The Cavalla rises north of the Nimba Range in Guinea and flows south to form more than half of the Liberia and Côte d'Ivoire border. The Cavalla enters the Gulf of Guinea 13 miles (21 km) east of Harper, Liberia, after a course of some 320 miles (515 km). With its major tributaries, the Duobe and the Hana, it drains an area of 11,670 square miles (30,225 square km).

The St. Paul River was first sighted by Portuguese sailors in the 15th century on St. Paul's Day. The river begins in southeastern Guinea, crosses into northern Liberia about 30 miles (50 km) due north of Gbarnga, in Bong County. It then flows through Montserrado County, and eventually becomes the dividing line between Monrovia and Brewerville where it flows into the Atlantic Ocean.

**Topology**

The main physiographic regions of Liberia parallel the coast. These regions are: the coastal plains, the rolling hills, and the highlands. The Forest Zone covers all of Liberia.

The coastal plains are about 350 miles (560 kilometers) long and extend up to 25 miles inland. They are low and sandy, with miles of beaches interspersed with bar-enclosed lagoons, mangrove swamps, and a few rocky promontories. The highest promontory is Cape Mount (about 1,000 feet or 305 meters in elevation) in the northwest, with Cape Mesurado in Monrovia, and Cape Palmas in the southeast. Its deepest extensions lie along the watercourses. The shore is broken by river estuaries, tidal creeks, swamps, and a few rocky capes and promontories that appear as landmarks from the sea. Except for those promontories and capes and an occasional small hill, the altitude of the coastal region usually rises no higher than 30 to 60 feet. The mouths of the rivers are so obstructed by shifting sandbars and submerged rocks that there are no natural harbors. The surf is normally heavy all along the coast but is worse at the height of the rainy season.

Parallel to the coastal plains is a region of rolling hills some 20 miles wide with an average maximum elevation of about 300 feet; although a few hills rise as high as 500 feet. It is a region suitable for agriculture and forestry. Further on, the country consists of rolling plateaus and low-lying hills rising to the higher elevations of 600 to 1,000 feet that constitute almost half of Liberia's terrain. In the far northwest and north central portions of the territory are the outliers of the Guinea Highlands. This land is well watered, and a number of narrow, roughly parallel river basins run to the sea at right angles to the northwest-southwest trend of the belts of relief.

Most of this country lies in the heaviest rainfall zone in West Africa. Precipitation, however, decreases progressively inland, and rainfall belts, like relief belts, run roughly parallel to the coast. There is normally some rain during every month of the year, but most of the country is characterized by wet and dry seasons. The climate is warm and humid, and the annual temperature variation is quite small. At the northern edge of this belt, a steep rise indicates the southern edge of a range of low mountains and a plateau that constitutes nearly half the country's interior.

The highlands are behind the rolling hills, most of the country's interior is a dissected plateau with scattered low mountains ranging from 600 to 1,000 feet in elevation. The long ridges and dome shaped hills that constitute the northern highlands are part of the Guinea Highlands and occupy those sections of Lofa and Nimba counties that thrust much farther north than the rest of

Liberia's boundary with Guinea and Ivory Coast. These mountains, mainly the Wologizi Range in Lofa County and the Nimba Range north of the town of Sanniquellie, rise to altitudes above 4,000 feet. Mount Wutivi, the highest peak in the Wologizi Range, reaches about 4,450 feet, and the Nimba Range's Guest House Hill is, at 4,540 feet, the highest point in Liberia.

In West Africa, the forest zone refers to the southern part of the region once largely covered by tropical rainforest. The forest zone of West Africa, in the strict sense, covers all of Liberia and Sierra Leone, most of Guinea, the southern halves of Côte d'Ivoire and Nigeria, and parts of Ghana, Togo and Guinea-Bissau. In the eastern part of the forest zone, because of the influence of Mount Cameroon, soils are often fertile and there are large areas of subsistence farming. Major crops include millet, yams and rice, whilst plantation agriculture is extensive on the best soils, producing chiefly cocoa. Further west, due to the ancient geology of the region, soils are much less fertile and farming becomes chiefly confined to the raising of perennial crops, with cocoa remaining pre-eminent. Forestry has devastated much of the natural rainforest in countries such as Côte d'Ivoire and Liberia. Farmers without land have been pushed onto land with marginal soil for agriculture by population growth, which, despite frequent warfare, continues to be among the highest in the world.

## Land Resources

Soil- More than 80 percent of Liberia's soils can be used for agriculture. Although there have been some local soil surveys, countrywide data are insufficient for a broad evaluation of soil potentials and agriculture. This is an area for future research. Cultivable land to meet the needs of the subsistence population, as well as for expansion of export tree crops, was quite satisfactory.

According to estimates of the Food and Agriculture Organization (FAO) in the early 1980s, only about 1,430 square miles of the country's total land area (roughly 3.9 percent) were used for cultivation. Permanent tree crops, such as rubber, coffee, and cacao, occupied 946 square miles, or two-thirds of the cultivated area; short-life crops, mainly foods, were produced on about 485 square miles. The FAO also calculated that more than 21,000 square miles of additional land was in a temporary bush and tree fallow state, and much of this is at a stage available for agricultural use. There was little pressure on the fallow areas in the less heavily populated rural regions, and about 80 percent of the subsistence farmers in those regions were reportedly using for crops new land on which the age of the tree or bush stands was seven or more years. The situation was different, however, in heavily peopled areas near the towns where the fallow cycle on good land has been found to be as short as four years, a period generally inadequate to allow the replacement of natural soil nutrients.

Four types of soil are found in Liberia: latosols, lithosols, regosols and alluvial soils.

Latosols are of low to medium fertility and occur in the rolling hill country and cover about 75 percent of the total land surface in Liberia. Latosols, (formed from “laterite” and “solum”, which is Latin for soil), are a soil that is rich in iron, alumina, or silica, and which formed in tropical woodlands under very humid climate with relatively high temperature. These latosols were formed on the extremely old, largely granites gneisses and other gneissic and schistic bedrock that underlie most of the country. These soils have been intensively leached by the heavy tropical rainfall and are of only medium to low fertility. Latosols are the soils on which upland rice, the largest single food crop in Liberia, is grown. Their limited amount of plant nutrients requires, without the use of fertilizer, a constant shifting of cultivation to new fields in order to maintain subsistence production levels. Large areas of these soils also support the country's major tree crops.

Shallow and coarse lithosols, in the hilly and rugged terrain, cover about 16 to 17 percent of the land in Liberia. Lithosols are a thin soil consisting of rock fragments, and is a soil with poorly defined layer horizons that consists mainly of partially weathered rock fragments. These are soils that are characterized by imperfect weathering and have low humus and mineral nutrient content. Although they support tree and other woody vegetation, these soils have little value for agriculture.

Infertile regosols, or sandy soils, are found along Liberia's coastal plains. Regosols cover about 2 percent of Liberia, and are found along the coast that is generally infertile, although they support large numbers of coconut trees, as well as oil palms. Regosols are a type of soil consisting of unconsolidated material from freshly deposited alluvium or sand.

Highly fertile alluvial soils represent only about 3 percent of the land area of Liberia, and these soils are utilized largely for agriculture. Alluvial soils are found in the river bottoms, and in swamp soils. Swamp soils, especially those known as half bog soils, are naturally rich in humus, and when drained they provide excellent conditions for swamp rice and similar crops.

The principal food crops grown are rice, mostly of the upland variety, and cassava. These crops were grown throughout the country in the traditional sector, but cassava cultivation was more heavily relied on the southeastern coastal region, where rainfall and cloud conditions were less favorable for rice. A variety of vegetables were also grown to supplement the two main staples. Climate and soils in Liberia were variously well suited to tropical tree crops, including rubber, coffee, cacao, oil palm products, and coconuts. Tree crops have been a major source of export earnings; in the period between 1979-81 rubber, coffee, cacao, and oil palm products accounted for almost one quarter of all export receipts.

With the exception of a small area in the northwest bordering Sierra Leone, the narrow coastal zone, and a region in the southeast, all of Liberia was considered ecologically suitable for commercial production of rubber. The area potentially usable for coffee cultivation was also large. In general, cacao could be grown throughout the same area; but soils required for satisfactory tree growth were less extensive, and rainfall factors placed some restrictions on profitable commercial cultivation. Oil palms grew naturally and were widely distributed, but for commercial planting the southeastern one third of the country offered the greatest future possibilities.

## Mining

### Gold

Gold in Liberia is mined almost entirely from alluvial deposits. Gold mining began in 1881 with the establishment of a Liberian-owned company. Other operators and individual miners exploited gold-bearing alluvial deposits in the early 1900s, but the total amount of gold recovered before War World I was routinely quite small. After WWI, gold was found in numerous river and stream deposits throughout Liberia, and placer mining became widespread. Mine output varied greatly, and many deposits were small and they were soon exhausted. In 1938 some 2,080 ounces were exported. In 1943 a new discovery of gold in Grand Cape Mount County led to a gold rush; that year almost 31,000 ounces were exported, and nearly the same amount was exported in 1944. A decline in output subsequently occurred, but in 1950 exports still were above 12,000 ounces a year. Available data on gold for the 1950s and 1960s were based on purchases by the Bank of Monrovia, to which by law any gold mined in Liberia had to be sold. During these two decades the amount bought in most years was less than 2,000 ounces. Until the late 1970s purchases continued to remain small because the fixed purchase price was $35 an ounce at a time when open market prices were substantially higher. Gold mining was also restricted to Liberian citizens.

These regulations were altered by the Gold-Diamond Act of 1979, which revised the earlier 1958 legislation on diamond prospecting, mining, and trading to encompass gold as well. The law permitted foreigners to participate with Liberian owners of gold claims in developing the deposits. Approval was also given to brokers and dealers to purchase and export gold, and a gold appraisal office was established in the Ministry of Lands and Mines to facilitate exportation. Provision was also made to adjust the local price of gold regularly, depending on world prices. A thriving open market reportedly developed. From 1,086 ounces exported in 1979, the amount rose to 7,243 ounces in 1980 and to almost 19,200 ounces in 1981. A substantial drop occurred in 1982, but nearly 15,400 ounces were exported in 1983. The revised law had apparently resulted in some foreign investment, and one company was reported to have introduced mechanized digging equipment.

**Diamonds**

The existence of diamonds was reported in Liberia in the late nineteenth century, but these reports remain unconfirmed. The first confirmed discoveries were made in 1906, when some stones were recovered from alluvial deposits that were being panned for gold. Since then diamonds have been found in different parts of the country, but the major locations have been in Lofa and Nimba counties. Most mining was carried out on a small scale using crude equipment. Output remained quite small until after World War II. In 1950 finds in the lower parts of the Lofa River, as well as subsequent discoveries, resulted in mass diamond rushes that involved tens of thousands of potential prospectors. Many of the prospectors were workers from the rubber plantations, and their departure caused serious disruption in rubber collecting. In 1958 the government passed legislation to control prospecting, mining, and trading in diamonds. At the same time substantial fees were established for licenses.

Data on Liberia’s diamond production have not been considered reliable. Liberia's use of the United States dollar as its unit of currency and domestic factors in neighboring Sierra Leone, where 3 substantial quantities of diamonds were also produced, were believed to result in extensive smuggling of diamonds into Liberia for sale. Both gem quality and industrial diamonds are found in Liberia, and annual export earnings vary depending not only on world price fluctuations but also on the relative quantities of each category of diamonds found. In 1970 some 800,000 carats having a value of $5.7 million were exported. In 1976 only 320,000 carats were exported, but earnings from fewer stones totaled $16.6 million, or 3.6 percent of the value of all exports from Liberia. Prices soared, and in 1979 the value of diamond exports reached a high of $39.6 million, or 7.4 percent of total export receipts. In 1983 some $17.2 million was received from the sale of 330,000 carats of diamonds. Under President Charles Taylor, Liberia was accused of supplying troops to support rebel forces in Sierra Leone's civil war. Taylor, a long-time ally of the Revolutionary United Front (RUF) in Sierra Leone, had supplied the rebels with arms in exchange for diamonds.

In 2000 the United Nations placed an 18-month ban on the international sale of the diamonds in an attempt to undermine the RUF, and in May of the following year it also imposed sanctions on Liberia. In 2003, because of the progress made in Liberia, President Gyude Bryant requested an end to the UN embargo on Liberian diamonds and timber, but the Security Council postponed such a move until the peace was more secure.

**Iron**

Liberia is rich in natural resources, especially in iron. Since 1951, Liberia was among the leading producers of iron ore in Africa, and Liberia is one of the principal exporters of iron ore in

the world. Sizable reserves are found primarily in four areas: the Bomi Hills, the Bong Range, the Mano Hills, and Mount Nimba, where the largest deposits occur. Other minerals include diamonds, gold, lead, manganese, graphite, cyanite, and barite. There are also possible oil reserves off the coast.

The largest mining operation was the Liberian-American-Swedish Minerals Company (LAMCO), a joint venture that accounted for about half of Liberia's annual iron ore output. LAMCO's concession in the Nimba Range, near the border with Guinea, was given in 1953 but LAMCO only began shipping ore in 1963, when the port of Buchanan, which the company had constructed, finally opened for traffic. Their capacity was about 12 million tons of ore a year from a deposit at a proven reserve of some 250 million tons of 60 to 70 percent iron content. In the late 1970s ore output dropped to about 9 million tons, as American and European ore demands declined.

There also were proposals to move the potentially large output from ore deposits across the Guinean border via the LAMCO rail line to Buchanan if they were developed. In 1983 LAMCO's production had declined to 6.6 million tons. The second largest iron mining operation was in a 30-square mile concession located 50 miles north of Monrovia that had been granted in 1958 to the German-Liberian Mining Company. The firm was owned jointly in equal shares by the government and a consortium of German steel companies. Actual operations were carried out by the Bong Mining Company (BMC), and the ore was shipped to the German and Italian owned plants. The ore body had an average iron content of about 38 percent, which was increased to about 65 percent by concentration. Pelletizing, which required a high energy input, was also carried out. The profitability of the mine slumped as the 1970s progressed because of rising petroleum fuel costs. The production from the mine, which began in 1965, was shipped to the BMC pier at Monrovia port over a company-built rail line. By the early 1970s the output was over 5 million tons a year. From 1974 through 1975 output was generally over 6 million tons, and from the late 1970s to 1983 it averaged more than 7 million tons.

**History**

Declared a sovereign state in 1847, Liberia is unique among African countries. Next to Haiti, Liberia is the oldest black republic in the world and is the oldest republic in Africa. All the other countries in Africa have a history of colonization by white foreign nations. The colonial era of Liberia started when freed American slaves began to settle along the coast. The territory of Liberia was purchased from the native population for six firearms, one keg of gunpowder, three pairs of shoes, a box of beads and other trade goods.

The "Americo-Liberians," as these black settlers were known, never exceeded more than 5 percent of the country's total population. They settled in the urban centers they formed along the coast and maintained a society based on the cultural models they were familiar with back in the United States. The national majority of Liberia, the indigenous peoples, was eventually classified by the government into 16 different "tribes." Most of the native Africans were encouraged to remain in their homelands in the interior of the country; a region vaguely designated the "Hinterland." Exceptions were made, however, when inexpensive labor was needed on the large estates established by Americo-Liberians. Ironically, forced labor and other compulsory labor practices on these plantations were very often like the slavery experiences of the Americo-Liberians had left behind. The select minority of Americo-Liberians effectively excluded the indigenous majority from Liberia's social, political and economic life for over 130 years.

The Firestone Rubber Company began an experiment in rubber plantations in 1926, and the company's name would then become associated with Liberia for well over forty years. Prior to that, Liberia had a "century of survival," in that most of the efforts of the country were in preventing other countries and colonial powers from encroaching on their territory. After the strategic importance of Liberia was shown in WWII, America built a modern seaport and airport at the capital of Monrovia, named in honor of US President James Monroe.

In 1980, President Tolbert was assassinated in a coup led by Master Sergeant Samuel K. Doe. Twenty years of political violence, corruption and bad government ensued. A period of war and conflict lasted until 1997, and it is estimated that between 150,000 and 200,000 lives were lost, and many thousands of other people became refugees. Multiparty presidential and legislative elections held in July 1997 brought Charles Taylor to power. Under Taylor, the country remained economically depressed while he and his associates enriched themselves by looting their country's resources. In mid-2001, fighting erupted in Northern Liberia between anti-Taylor rebels and government forces. The civil war intensified during the next year, and the rebels continued to expand the war into other regions of Liberia in 2003. By mid-2003, the rebels controlled roughly two thirds of the country and were threatening to seize the capital, Monrovia.

In August, Charles Taylor resigned and went into exile, and he was succeeded for a short time by his vice president, Moses Blah. A peace agreement was signed with the two rebel groups, and several thousand West African peacekeepers, supported temporarily by an offshore U.S. force, arrived. In October 2003, the West African force was placed under UN command and was reinforced with troops from other nations; businessman Gyude Bryant became president of a new power-sharing government.

Despite the accord with the rebels, fighting initially continued in parts of the country; tensions among the factions in the national unity government also threatened the peace. Bryant's government was hindered by corruption and a lack of authority in much of Liberia, but the peace enabled the economy recover somewhat in 2004.

In the presidential election in the fall of 2004 former soccer star George Weah won the first round with 28% of the vote, but lost the runoff in November to Ellen Johnson Sirleaf, a politician and former World Bank official who received nearly 60% of the second round votes. Ellen Sirleaf thus became the first woman to be elected president of an African nation. At the same time a new national legislature was also elected, with no party securing a controlling position.

Civil war, corruption and government mismanagement have destroyed much of Liberia's economy, especially the infrastructure in and around Monrovia. Meanwhile, continued international sanctions on diamonds and timber exports limit growth prospects for the foreseeable future. Many businessmen, engineers and technicians have fled the country and the violence, taking their capital and their expertise with them. Some refugees have returned to Liberia, but many never will return.

Richly endowed with water, mineral resources, forests, and a climate favorable to agriculture, Liberia had been a producer and exporter of basic products- primarily raw timber and rubber. Local manufacturing, mainly foreign owned, had been small in scope. The government's changes have helped diffuse the political crisis, but have done little to encourage economic development. International donors, who are ready to assist reconstruction efforts, are withholding funding until Liberia's business and trading environment improves. A plan was created in October 2005 by the International Contact Group for Liberia to help ensure transparent revenue collection and allocation, and to put the brakes on government corruption. This was something that was lacking under the transitional government and this has also limited Liberia's economic recovery.

The reconstruction of infrastructure and the raising of incomes in this ravaged economy will largely depend on financial investment and technical assistance from other countries.

**Abbreviations used:**

(All links and URLs in this bibliography are current as of June 2006)

AGI: American Geological Institute, Alexandria, VA. See: www.agiweb.org

AGS: American Geographical Society Library, University of Wisconsin, Milwaukee Campus. See: http://www.amergeog.org

AMRS: Africa Mineral Resource Specialists Inc. 5 Blue Cedar, Suite 101, Littleton, Colorado 80127. AMRS owns a significant number of original geologic reports and maps for Liberia. This collection of data includes geologic reports, geologic maps and topographic maps. See: http://www.africaminerals.com/

DTIC: Defense Technical Information Center, Alexandria, VA. See: www.dtic.mil

FAO: Food and Agriculture Organization, United Nations, Rome, Italy. See: www.fao.org

GeoRef: American Geological Institute, Alexandria, VA. The American Geological Institute not only identified materials for the abstracting database, GeoRef, but also locates and supplies materials as a document delivery service. See: www.agiweb.org

ISBN: International Standard Book Number. This unique number can be used to identify and locate library holdings of a particular book or report title. See: http://www.isbn.org/standards/home/index.asp

ISSN: International Standard Serial Number. This unique number can be used to locate libraries which have subscriptions to this journal, magazine or serial. See: http://www.issn.org/

LC or LOC: Library of Congress, Geography and Map Dvision, Washington, DC. See: www.loc.gov

LCCN: Library of Congress Control Number. This is a unique number applied by the Library of Congress to identify individual publications. This number can be used to identify copies of this item in libraries held in the US and abroad. See: http://www.loc.gov/marc/lccn_structure.html

NTIS: National Technical Information Service, Alexandria, VA. See: www.ntis.gov

OCLC: Online Computer Library Center, Inc., Dublin, OH. See: www.oclc.org

UN: United Nations Library, New York, NY. See: www.un.org

USGS: US Geological Survey Library, Reston, VA www.usgs.gov

"An act approving the mining concession agreement entered into by and between the government of the Republic of Liberia and Liberian Gold and Diamond Corporation: approved October 12, 1976." Liberia. Ministry of Foreign Affairs. Monrovia: Ministry of Foreign Affairs. Description: 55 leaves; 28 cm. Subjects: Mining law-Liberia. Mineral industries-Law and legislation-Liberia. Notes: Cover title. OCLC: 54114366.

"L'Activité minière et activité industrièlle du Liberia telles qu'elles apparaissent á partir de rapport économique pour 1971." In: Industries et travaux d'outremer. Translated Title: "Industries and work of the overseas territories." Paris: R. Moreaux. Language: French. 19e année. No. 212, Jullet 1971. Pages 548-550. ISSN: 0019-9362; LCCN: 57-49914; OCLC: 2401146.

Adam, J.G. 1970. "The Vegetation of the Littoral Belt and Lagoons of Cape Palmas (Liberia)." (In French). Bulletin de la Société Botanique de France. Vol. 117, No 7/8, P 419-427. 1970. Illus. English Summary. Museum National D'histoire Naturelle, Paris (France). Abstract: Several vegetation zones are distinguished. No endemics were encountered. Descriptors: Cape; Lagoons; Liberia; Littoral Communities; Palmas; Vegetation; Zonation. ISSN: 0037-8941; OCLC: 1765763.

Aero Service Corporation. 1957. Planimetric map, Liberia. [Monrovia?]: Government of Liberia. 1 map in color; 51 x 51 cm. Descriptors: Liberia- Maps. Scale 1:1,000,000; Hotines rectified skew orthomorphic projection; (W 120--W 70/N 90--N 40). Notes: Relief shown by hachures. Alternate Liberia. "Published ... through the Joint Liberian-United States Commission for Economic Development; the United States Coast and Geodetic Survey; the Liberian Cartographic Service and the Bureau of Mines and Geology, Treasury Department, Republic of Liberia." "National boundary not shown. No field check." Compiled from shoran controlled mosaics of aerial photographs of 1953 by Aero Service Corporation, Philadelphia, PA. OCLC: 23531957; USGS Library.

Aero Service Corporation. 1957. Planimetric map, Liberia. Washington, D.C.: U.S. Coast and Geodetic Survey. 2 maps: col.; 82 x 58 cm. Contents: West half- East half. Scale 1:500,000; Hotines rectified skew orthomorphic proj.; (W 11030'--W 7030'/N 8030'--N 4030'). Notes: Relief shown by hachures. Alternate Liberia. "National boundary not shown. No field check." From shoran controlled mosaics of aerial photographs of 1953 by Aero Service Corporation, Philadelphia, PA. OCLC: 23531947.

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Allersma, Egge and Tilmans, Wiel M. K. 1993. "Coastal conditions in West Africa; a review." Ocean and Coastal Management. 19; 3, Pages 199-240. 1993. Elsevier Applied Science. Essex, United Kingdom. 1993. Descriptors: Africa; Atlantic Ocean; Benin; changes of level; coastal sedimentation; Ghana; Gulf of Guinea; human activity; Ivory Coast; Liberia; Niger Delta; Nigeria; North-Atlantic; review; sedimentation; shore features; shorelines; southeastern Liberia; southern Benin; southern Ghana; southern Nigeria; southern Togo; Togo; Volta Delta; West Africa; West Africa Coast; Engineering geology. References: 45; illustrations, including 9 tables, geol. sketch maps. Abstract: This paper describes the coastal system between Cape Palmas bordering the Ivory Coast and Liberia and Mount Cameroon, as a basis for regional coastal-erosion management. The area includes the rocky coasts of the Ivory Coast and Ghana, the long sandy beaches of Togo and Benin and the deltas of the Volta and Niger Rivers. Important elements of the system appear to be its geographical setting, its geological history, oceanological impacts, the sediment supply by rivers and coastal erosion, littoral transport and the rise of mean sea level. The morphological processes are influenced by human activities in the catchments of the rivers (dams), in the estuaries (dredging) and along the coasts (port construction). It appears that future human interventions and the impact of increased sea-level rise will require intergovernmental co-ordination in coastal-erosion management, as the various coasts are all part of one system. ISSN: 0964-5691.

American Colonization Society. 1800s. North west part of Montserrado County, Liberia: in ten mile squares. Liberia; Montserrado County. Year: 1800s. Description: 1 map on 5 sheets: manuscript, color; 89 x 62 cm. Series: American Colonization Society map collection; 21. Subjects: Montserrado County (Liberia)- Maps. Manuscript. Notes: Sheets taped together to form irregular shape. Pen-and-ink and watercolor. Available also through the Library of Congress Web site as a raster image. Scale [ca. 1:265,000]. LCCN: 96-684997; OCLC: 37986411. Access Path: http://hdl.loc.gov/loc.gmd/g8883m.lm000018

American Colonization Society. 1830s. "Map of Liberia, West Africa." G.F. Nesbitt & Company. N[ew] Y[ork]: Lith. G.F. Nesbitt & Co. Description: 1 map; 24 x 36 cm. Series: [American Colonization Society map collection; 1] Subjects: Tribes- Liberia- Maps. Liberia- Maps. Notes: Relief shown by hachures. Shows boundary of tribes, mission stations, colonist towns, and native towns. Available also through the Library of Congress Web site as a raster image. Map Info: Scale [ca. 1:1,380,000]. LCCN: 96-684983; OCLC: 37491634. Access Path: http://hdl.loc.gov/loc.gmd/g8881e.lm000007

American Geographical Society of New York and Herbert E. Budek Films and Slides (Firm). 1956. Liberia. New York: American Geographical Society; Hackensack, N.J.; Herbert E. Budek Co. Description: 1 filmstrip (50 fr.): color; 35 mm. and manual. Abstract: Outlines the principal elements of Liberia's economy; presents details of rubber production, picturing life on a rubber plantation; describes iron mining operations at Bomi Hills, and shows transport facilities. Contrasts views of the urban port of Monrovia with scenes of primitive native villages. Subjects: Liberia-

Economic conditions. LCCN: 57-2127; OCLC: 16952795.

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data." Geologichnyy Zhurnal (1995) = Geological Journal. 1998; 3-4, Pages 81-86. 1998. Natsional'na Akademiya Nauk Ukrayini, Institut Geologichnikh Nauk. Kiev, Ukraine. 1998. Language: Russian; Summary Language: English; Ukrainian. Abstract: The first find of fossil microorganisms from the Mali-suite deposits of the northwestern outskirt of Liberian shield are analogous to ones from the Proterozoic deposits (vendian) of the Ukrainian shield. This analogy allows us to carry out the transcontinental correlation of these open-casts. Descriptors: Africa; algae; argillite; biostratigraphy; clastic rocks; Commonwealth of Independent States; correlation; Europe; Liberia; Liberian Shield; Mali Suite; microfossils; Neoproterozoic; Plantae; Precambrian; Proterozoic; Russian Platform; sandstone; sedimentary cover; sedimentary rocks; Ukraine; Ukrainian Shield; upper Precambrian; Vendian; West Africa; Stratigraphy. References: 9; illustrations. ISSN: 1025-6814.

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Assessment of Energy Options for Liberia. Final Report. 1983. Oak Ridge National Lab., Oak Ridge, TN, United States. Funded by: Department of Energy, Washington, DC. Nov 83. 101p. Contract number: W7405ENG26; Report number: ORNL5989. Descriptors: *Liberia; Cogeneration; Combustion; Commercial Sector; Data Compilation; Energy Analysis; Energy Demand; Energy Source Development; Energy Supplies; Evaluation; Forecasting; Gasification; Hydroelectric Power; Industry; Petroleum Refineries; Planning; Residential Sector; Theoretical Data; Transportation Sector; Wood; Wood Fuels; Wood Fuel Power Plants; Energy conversion non propulsive Conversion techniques; Energy Miscellaneous energy conversion and storage; Energy Policies regulations and studies; Energy use supply and demand. Abstract: Under funding from the U.S. Agency for International Development (USAID), the Oak Ridge National Laboratory provided energy planning assistance to the National Energy Committee of the Government of Liberia (GOL), West Africa, during a period of one year ending March 31, 1983. This report outlines the scope of activities of the joint GOL/USAID project and summarizes the major findings by Liberian and U.S. project participants. The study included an examination of current energy use by sector and fuel type, projections of future energy demands, and a preliminary evaluation of a variety of alternative energy resource and technology options for Liberia. The primary finding is that Liberia has significant opportunities for the substitution of indigenous energy resources for imported petroleum. The principal candidates are wood energy and hydroelectric power. The major alternatives for wood are gasification technology for small-scale electric and non-electric applications (e.g., those under about 25-gigajoule/hour input requirements) and wood-fired steam electric generation for larger scale applications where hydroelectric power is unattractive. For major hydroelectric development the principal candidates are the St. Paul River Proposal and the Mano River Proposal. The Mano River Proposal is the smaller of the two and would meet Monrovia area electrical grid requirements and some iron ore mine demand for about the next two

decades. An additional important finding of this study is that the Monrovia Petroleum refinery is highly uneconomical and should be closed and petroleum products imported directly. 25 tables. NTIS Number: DE84004110XSP.

Avery family. 1916-1976. Johnston and Virginia Hall Avery private papers. Archival Material ca. 3376 items. Descriptors: Governors -- North Carolina. Senators -- United States -- Correspondence. Natural resources -- Africa -- Liberia. Abstract: The collection consists of carbon copies of correspondence and papers which reflect Johnston Avery's involvement with several important issues of his time. The majority of papers consist of correspondence written or received by Avery including holograph, typewritten and typewritten carbon copy letters. Important correspondents include William V.S. Tubman, President of Liberia from 1944 to 1971 and other Liberian government officials; Robert R. Reynolds, U.S. Senator from North Carolina from 1933 to 1945; J.C.B. Ehringhaus, North Carolina governor from 1933 to 1937; and various businessmen involved in the LAMCO Joint Venture. A few items were not addressed to Mr. Avery. These items include letters written by or addressed to his wife, Virginia Hall Avery. Notes: Bio/History: Mr. Johnston Avery, a North Carolina native, pursued several careers. He was a newspaperman, political campaign aide, government official and businessman. He assisted Senator Robert R. Reynolds in his campaign for repeal of the Eighteenth Amendment (Liquor Prohibition Amendment). He served as Assistant Chief of Decartelization Branch of the U.S. Office of Military Government (OMGUS) in Berlin following World War II. He became convinced that OMGUS was blocking attempts by the Decartelization Branch to carry out its mission of breaking up the German cartels, he resigned and brought charges against OMGUS. A Congressional investigation ensued which substantiated these charges. Mr. Avery became involved in the economic development and exploitation of natural resources of Africa, specifically in Liberia. With the State Department, he was Assistant Administrator of the Point Four Program, which was established to aid developing countries acquire technical expertise. He resigned this position to become President of the Liberian American Swedish Minerals Company (LAMCO) Joint Venture, a position he held until his death. OCLC: 49886402.

Axelrod, J. M.; Carron, M. K.; and Thayer, Thomas P. 1952. “Phosphate mineralization at Bomi Hill and Bambuta, Liberia, west Africa.” American Mineralogist. 37; 11-12, Pages 883-909. 1952. Mineralogical Society of America. Washington, DC, United States. Abstract: Iron phosphate minerals which cement talus ore below cliffs formed by massive magnetite- hematite deposits at Bomi hill, Liberia, and also occur in place in fissures and caves in the ore both at Bomi hill and Bambuta, were formed by the interaction of bat dung and iron oxides. The minerals include leucophosphite (previously known only from Western Australia), phosphosiderite, and strengite. Analyses of the leucophosphite are included. Descriptors: Africa; Bomi hills; Bambuta area; Liberia; mineral data; Phosphate minerals; West Africa. Illustrations. No. 3-4, pages: 284. ISSN: 0003-004X.

Axelrod, J. M; Carron, M. K; Milton, C.; and Thayer, T. P. 1951. “Phosphate mineralization at Bomi hills and Bambuta, Liberia, west Africa.” Geological Society of America Bulletin. 62; 12, Part 2, Pages 1421-1422. 1951. Geological Society of America (GSA). Boulder, CO, United States. Descriptors: Africa; Bomi hills, Bambuta area; Liberia; mineral data; Phosphate minerals; West Africa. ISSN: 0016-7606.

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Balsley, J. R. (investigator). 1979. Liberia. U. S. Geological Survey Professional Paper #P1150. Pages 326. 1979. U. S. Geological Survey. Reston, VA. Descriptors: Africa; areal geology; Liberia; maps; West Africa; Geologic maps. ISSN: 1044-9612.

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Barnes R. F. W. and Dunn, A. 2002. “Estimating forest elephant density in Sapo National Park (Liberia) with a rainfall model.” African Journal of Ecology 40, no. 2 (2002) p. 159-163. Abstract: The number of elephant dung-piles lying on the forest floor is a function of the number of elephants present and the rainfall in the 2 preceding months. We present the results of a stochastic model that describes this relationship and we show how it can be used to estimate elephant numbers. The data from a survey in Sapo NP (Liberia) in 1989 are used as an example. The dung-pile density was estimated at 152 km-2 with confidence interval from 72 to 322, and the number of elephants was estimated to be 313 with confidence interval from 172 to 617. References: 14. Descriptors: Animal ecology; mammals; population ecology; population density. ISSN: 0141-6707.

Barron, W. F.; Hobbs, B. F.; Samuels, G.; and Kawah, L. M. 1985. Background Paper on Electrical Services Provided by the Liberia Electricity Corporation (LEC). Performer: Oak Ridge National Lab., Oak Ridge, TN, United States. Funded by: Liberia Electricity Corp., Monrovia. Planning Dept. Funded by: Department of Energy, Washington, DC. Contract number: AC0584OR21400. July 1985. 43p. Report number: ORNLTM9425. Advisory: Portions of this document are illegible in microfiche products. Original copy available until stock is exhausted. Descriptors: Data Compilation; Electric Power; Energy Consumption; Fuel Consumption; Power Demand; Power Generation; Prices; Sales; Electric Utilities; Liberia. Abstract: This report is one of a series of project papers providing background information for an assessment of energy options for Liberia, West Africa; it presents data on electrical services in Liberia (as of early 1983) with primary emphasis on the operations of the Liberia Electricity Corporation (LEC). The LEC is a semiautonomous agency owned by the Government of Liberia that has primary responsibility for

generating electricity throughout Liberia. The LEC system consists of a central grid covering an area roughly 175 by 100 km with Monrovia as its focal point, and nine rural stations serving ten towns. The central grid has a total capacity of 177 MW (64 hydro and 113 diesel engines and gas turbines) and produced 378 million kWh in 1981. The rural stations with a total capacity of 13 MW (all diesels) produced 27 million kWh in 1981. Information provided by this paper includes historical sales data by customer class, growth in demand, hourly load data, petroleum consumption, prices, and problems. Major problems include uncollected bills, illegal hookups, inoperable generating equipment, and fuel shortages. (ERA citation 10:048914). NTIS: DE85018123XSP.

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Bauseler, K. H. 1970. "Planning and construction of a blending plant for crude ore and its influence on mining operations." Bulletin of the Geological, Mining and Metallurgical Society of Liberia. Volume 4; Pages 56-70. 1970. Notes: Vol. 4. Geological, Mining and Metallurgical Society. Monrovia, Liberia. Descriptors: Africa; Bong mine; economic geology; Liberia; mineral resources; production; West Africa; Economic geology, general. Illustrations. ISSN: 0367-4819.

Behrendt, John Charles. 2005. Interview. Editor: Shoemaker, Brian. March 20, 2006, July 15, 2005, March 14, 2000. Note: John Behrendt first visited Antarctica in November, 1956, where he spent the winter at Ellsworth Station as an assistant seismologist to Edward Thiel, and he remained there until January, 1958. He became interested in geophysics while a student at the University of Wisconsin in Madison. Some earlier research at Lemon Creek Glacier in the Juneau Ice Field at Juneau, Alaska, had given him valuable experience with crevasses. Behrendt spent some more time in Antarctica in several expeditions, and he returned home in February, 1962. He mentioned for the first time that he had been married the day before he left Madison to start the traverse. He left the University of Wisconsin and went to work for the U.S. Geological Survey in 1964. He was also a new father by this time. He thought he was through with Antarctica, but found himself there once again for the 1965-66 season. He led the geophysical part of a major field camp operation. The party went to the Pensacola Mountains, had a camp in the Neptune Range, and did aeromagnetic surveys of the entire Pensacola Mountains, including the Dufek Massif. Much gravity work was done. They gathered a large amount of geologic and topographic mapping data, and compiled these into maps. His duties were completed in a month, and he returned home to work for the USGS. Later he spent several years working in Liberia, accompanied by his wife, and by then, two young sons. Later he moved to Wood's Hole, Massachusetts, where he became Chief of the Atlantic Gulf Branch of Marine Geology. He made several brief trips to Antarctica between 1978 and 1995. Altogether he made 12 trips to Antarctica. Behrendt joined the U.S. delegation that helped draft the Convention on the Regulation of Antarctic Mineral Resource Activities (CRAMRA), which, as later amended, was partially blended into the Environmental Protocol to the Antarctic Treaty. The following season, 1984-85, he worked with the German-Antarctic North Victoria Land Expedition and flew aeromagnetic surveys over northern Victoria Land. Various countries have participated in Antarctic research in recent years, including Brazil, Japan, Germany, USSR, Russia, and France. Italy has been especially active. But the U.S. Geological Survey has cut its Antarctic and Arctic research in the last 5 years [prior to 2000] or so. His last trip to Antarctica was in the 1994-95 season. In recent years there has been environmental concerns expressed in some quarters about the effect of tourism and fishing in or near Antarctica. Behrendt feels that by and large the tour operators have been responsible, but some fishing ships have been pirating the protected Antarctic bonefish. Chilean sea bass sold in the US is probably pirated from Antarctic waters. Behrendt comments on several of the cruise ships visiting Antarctica, including the Polar Queen and the Polar Duke. Since 1996 he has been a Fellow at the University of Colorado at the Institute of Arctic and Alpine Research, and has continued his researches on Antarctica to the present day [March, 2000]. He has served as a leading advisor to the State Department on the Environmental Protocol to the Antarctic Treaty, and also worked on CRAMRA, the convention on the Regulation of Antarctic Mineral Resource activities. He attended 22 international meetings between 1977 and 1995. He reports that the U.S. continues to operate the South Pole Station, and significant scientific research continues from various groups and countries. The icebreaker, the Nathaniel Palmer, continues to do very good research. NOAA currently is not very active in Antarctica. Behrendt published a book in 1957, "Innocents on the Ice: A Memoir of Antarctic Exploration" and is working on another one. He hopes to return to Antarctica again. Notes: Knowledge Bank at Ohio State University. Funded by a grant from the National Science Foundation. 3 audio tapes available in the OSU Archives. Polar Oral History Program. Record Group Number: 56.36. Subjects: Antarctica- Discovery and exploration- Interviews; Behrendt, John C., 1932-Interviews. URL: http://hdl.handle.net/1811/6057.

Behrendt, John Charles. 1970. "An aeromagnetic and aeroradioactivity survey of Liberia." Geophysics. 35; 6, Pages 1162. 1970. Society of Exploration Geophysicists. Tulsa, OK, United States. Descriptors: Africa; geophysical methods; geophysical surveys; Liberia; magnetic; magnetic methods; radioactivity; radioactivity methods; regional; surveys; West Africa; Applied geophysics. ISSN: 0016-8033.

Behrendt, John Charles. 1970. "An aeromagnetic and aeroradioactivity survey of Liberia." In: Searching the seventies, from Moho to Mars. Pages 100-101. 1970. Society of Exploration Geophysicists. New Orleans, LA, United States. Conference: Society of Exploration Geophysicists, 40th Annual International Meeting. New Orleans, LA, United States. Nov. 8-12, 1970. Descriptors: Africa; geophysical methods; geophysical surveys; Liberia; magnetic methods; radioactivity; radioactivity methods; regional; surveys; West Africa; Applied geophysics.

Behrendt, John Charles and Wotorson, Cletus S.[1] 1976. "Aeromagnetic map of the Zorzor quadrangle, Liberia." Washington: U.S. Geological Survey. 7 leaves: maps (2 folded); 27 cm. Open-file report (Geological Survey (U.S.)); 1601. Notes: Project report, Liberian investigations (IR) LI-69 C. Referred to in press release dated August 2, 1971. Bibliography: leaves 6-7. USGS Library.

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[1] Cletus Segbe Wotorson (born 13 March 1937) is a Liberian politician and geologist. Director of the Liberian Geological Survey, 1973-1975.

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33. Report number: Professional Paper 810. January 1, 1974. Map Scale: 1:1,000,000. Map Type: tectonic map, geophysical survey. Maps. Annotation: Plates in pocket. Illustrations. Notes: Part of illustrative matter in pocket. Bibliography: p. 32-33. Total magnetic intensity map of Liberia is plate #2. 1 sheet, black and white. 1:1,000,000. Descriptors: Africa; airborne; Bouguer anomalies; dikes; evolution; faults; geophysical methods; geophysical surveys; gravity anomalies; gravity methods; intrusions; Liberia; magnetic anomalies; magnetic methods; maps; Phanerozoic; Precambrian; radioactivity methods; regional; structure; surveys; tectonic; tectonics; USGS; West Africa. ISSN: 1044-9612; OCLC: 1365990.

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Availability: NTIS, Springfield, VA. January 1, 1973. Date (other): January 1, 1974. Annotation: Magnetic tape. Descriptors: Africa; geophysical surveys; Liberia; surveys; USGS; West Africa. NTIS Report number: PB-223 210/6

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Behrendt, John Charles and Wotorson, Cletus S. 1972. “Tectonic map of Liberia based on geophysical and geological surveys.” Open-File Report. Report number: OF 72-0032. Pages: 78. U. S. Geological Survey, Reston, VA, United States. January 1, 1972. Map Type: tectonic map. Illustrations. Notes: Cover title. "Project report, Liberian Investigations, IR-LI-60." Notes: Some of illustrative matter folded in pocket. Prepared under the auspices of the Agency for International Development, U.S. Dept. of State. Referred to in press release dated May 3, 1972. Series: IR-LI-60. Descriptors: Africa; explanatory text; geophysical surveys; Liberia; maps; structural geology; surveys; tectonic maps; USGS; West Africa. Contents: tectonic map of Liberia-interpretation from geophysical and geological data; total magnetic intensity; generalized residual total magnetic intensity; generalized total count Gamma radiation map; geologic contact inferred from Gamma radiation data; Bouguer gravity anomalies. Structural geology. ISSN: 0196-1497; OCLC: 25309005; USGS Library; Online: http://onlinepubs.er.usgs.gov/djvu/OFR/1972/ofr_72_32.djvu

Behrendt, John Charles and Wotorson, Cletus S. 1971. “An aeromagnetic and aeroradioactivity survey of Liberia, west Africa.” Geophysics. 36; 3, Pages 590-604. 1971. Society of Exploration Geophysicists. Tulsa, OK, United States. Abstract: A 140,000 km aeromagnetic and total-count gamma radiometric survey was made over Liberia in 1967-68 along north-south lines spaced 0.8 km over land and 4 km over the continental shelf. The data approximately delineate the boundary between the Liberian (ca. 2700 m.y.) age province in the northwestern two-thirds of the country, and the Pan-African (ca. 550 m.y.) age province in the coastal area of the northwestern two-thirds of the country, as well as a boundary marking the northwest extent of the isoclinally folded paragneisses and migmatites deformed within the Eburnean (ca. 2000 m.y.) age province in the southeast one-third. A zone of diabase dikes about 90 km inland can be traced, parallel to the coast from Sierra Leone to Ivory Coast on the basis of the magnetic data. Another zone of diabase dikes about 185 m.y. old is located along the coastal area and beneath the continental shelf parallel to the coast northwest of Greenville. Intrusion of these dikes probably coincides with the separation of Africa from North and South America. The magnetic data suggest basins of sedimentary rocks

possibly 5 km thick on the continental shelf. The map indicates high-amplitude magnetic anomalies greater than 600 gammas; some reach amplitudes as great as 18,000 gammas over iron formation and about 1800 gammas over mafic and ultramafic intrusive bodies. The radioactivity data have a background level less than 100 counts per second (cps) over mafic granulite-facies rocks and unmetamorphosed sedimentary rocks in the coastal area. Granitic rocks have the greatest variation. The central area of the country has the highest background radiation level with large areas above 250 cps; the level in the eastern one-third of the country is low. These data are proving quite useful in reconnaissance geologic mapping. All anomalies over 500 cps are shown; some reach amplitudes over 750 cps. Total-count radiation levels have a significant correlation with percent K (sub 2) O in bedrock analyses, but anomalous amounts of Th and U must be present to account for the highest amplitude anomalies. A few specific anomalies have been correlated with concentrations of monazite and zircon in bedrock as well as in beach deposits. Descriptors: Africa; airborne; geophysical methods; geophysical surveys; Liberia; magnetic; magnetic methods; radioactivity; radioactivity methods; regional; surveys; West Africa; Applied geophysics. Illustrations, including map. ISSN: 0016-8033.

Behrendt, John Charles and Wotorson, Cletus S. 1971. “Aeromagnetic and Gravity investigations of the sedimentary basins on the Continental Shelf and coastal area of Liberia, West Africa.” In: Conference on African geology, 1st. Pages 4-5. 1971. Commonwealth Geological Liaison Office, London. Descriptors: Africa; coastal; continental shelf; geophysical methods; geophysical surveys; gravity methods; Liberia; magnetic methods; surveys; West Africa; Applied geophysics.

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Behrendt, John Charles and Wotorson, Cletus. 1971. “Aeromagnetic map of the Bopolu Quadrangle, Liberia.” U. S. Geological Survey, Reston, VA, United States. Open-File Report. Report number: OF 71-0020. Pages: (2 sheets). January 1, 1971. Map Scale: 1:250,000. Map Type: magnetic survey map. Annotation: 2 sheets, scale 1:250,000 (1 inch = about 4 miles). Subjects: Africa; airborne methods; Bopolu Quadrangle; geophysical methods; geophysical surveys; Liberia; magnetic methods; maps; surveys; USGS; West Africa. ISSN: 0196-1497.

Behrendt, John Charles and Wotorson, Cletus S. 1971. “Aeromagnetic map of the Gbanka Quadrangle, Liberia.” U. S. Geological Survey, Reston, VA, United States. Open-File Report. Report number: OF 71-0022. Pages: 5 (1 sheet). January 1, 1971. Map Scale: 1:250,000. Map Type: magnetic survey map. 5 [i.e. 8] leaves: color map; 27 cm. + map 44 x 45 cm. folded in envelope 30 x 24 cm. Annotation: 1 sheet, scale 1:250,000 (1 inch = about 4 miles). Descriptors: Africa; airborne methods; Gbanka Quadrangle; Geomagnetism; geophysical methods; geophysical surveys; Liberia; magnetic methods; maps; surveys; USGS; West Africa; maps. Notes: "Folio of the Gbanka quadrangle, Liberia." "Prepared under the joint sponsorship of the government of Liberia and the Agency for International Development, U.S. Department of State." Includes text

with bibliography, index map, and 2 marginal maps, on reduced scale: Tectonic map, and Residual total magnetic intensity map. ISSN: 0196-1497; OCLC: 20872388.

Behrendt, John Charles and Wotorson, Cletus S. 1971. "Aeromagnetic map of the Harper Quadrangle, Liberia." U. S. Geological Survey, Reston, VA, United States. Open-File Report. Report number: OF 71-0023. Pages: 5 (3 sheets). January 1, 1971. Map Scale: 1:250,000. Map Type: magnetic survey map. Annotation: 3 sheets, scale 1:250,000 (1 inch = about 4 miles). Notes: Five folded maps in pocket. Referred to in press release dated August 2, 1971. Bibliography: leaf 5. Descriptors: Africa; airborne methods; geophysical methods; geophysical surveys; Harper Quadrangle; Liberia; magnetic methods; maps; surveys; USGS; West Africa. ISSN: 0196-1497.

Behrendt, John Charles and Wotorson, Cletus S. 1971. "Aeromagnetic map of the Monrovia Quadrangle, Liberia." U. S. Geological Survey, Reston, VA, United States. Open-File Report. Report number: OF 71-0024. Pages: 8 (2 sheets). January 1, 1971. Map Type: magnetic survey map. Annotation: 2 sheets, scale 1:250,000 (1 inch = about 4 miles). Notes: At head of Project report, Liberian investigations (IR) LI-66 C. Some maps folded in pocket. Referred to in press release dated August 2, 1971. Descriptors: Africa; airborne methods; geophysical methods; geophysical surveys; Liberia; magnetic methods; maps; Monrovia Quadrangle; surveys; USGS; West Africa. ISSN: 0196-1497.

Behrendt, John Charles and Wotorson, C. S. 1971. "Aeromagnetic map of the Sanokole Quadrangle, Liberia" Open-File Report. Report number: OF 71-0025. Pages: 6 (1 sheet). U. S. Geological Survey, Reston, VA, United States. January 1, 1971. Map Scale: 1:250,000. Map Type: magnetic survey map. Annotation: 1 sheet, scale 1:250,000 (1 inch = about 4 miles). Notes: At head of Project report, Liberian investigations (IR) LI-67 C. Some maps folded in pocket. Referred to in press release dated August 2, 1971. Bibliography: leaf 6. Descriptors: Africa; airborne methods; geophysical methods; geophysical surveys; Liberia; magnetic methods; maps; Sanokole Quadrangle; surveys; USGS; West Africa. ISSN: 0196-1497.

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with broadly disseminated primary mineralization. Results of this study show that favorable conditions for the formation of mega- gold placers are basins adjacent to terranes with regional scale disseminated mineralization, and a paleoclimatic condition, at time of sedimentation, favoring deep chemical weathering. Enriched soils and regolith mantle over such terranes erode into adjacent basins during uplift. The high levels of gold in mega-placers result from extensive reworking of enormous quantities of the low-grade auriferous sediments. OCLC: 26707247.

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Carder, Kendall L.; Betzer, Peter R. and Eggimann, Donald W. 1974. Intercomparisons And Application To The West African Shelf. In: Suspended Solids In Water; Marine Science, Volume 4, Proceedings Of Symposium On Suspended Solids In Water, Santa Barbara, California, March 20-22, 1973. Plenum Press, New York, New York, P 173-193, 1974. 7 Fig, 2 Tab, 37 References. ONR N00014-72-0363-0001. Abstract: A property of oceanic particulate matter referred to as 'apparent density' was calculated by dividing the weight of suspended particular matter (spm) by the volume of particles. This parameter is equal to 'mass density' for particles, such as minerals, containing little water. Apparent density calculations were made for a series of samples collected on r/v trident cruise 112 to the continental shelves of Sierra Leone and Liberia. These values ranged from 0.104 to 1.79 for samples with particulate organic carbon fractions (poc/spm) ranging from 0.486 to 0.037. Cross sections of salinity, light scattering beta (45), suspended particulate matter (spm), and beta (45)/total surface area for this region of the west African shelf showed a northwestward-flowing bottom current laden with inorganic sediment having a high apparent density and s southeastward-flowing, organic-rich (low apparent density) surface current. Of the measures of particle concentration applied to these waters, spm and beta (45) showed greatest correlation (r=0.960), suggesting that apparent density is highly correlated with the particle index of refraction. Total particulate volume and total particulate surface area data were not nearly as well correlated with either beta (45) or spm; optical/physical theories were proposed to explain this phenomenon. Descriptors: suspended solids; Continental Shelf; Africa; particle size; Atlantic Ocean; properties; sea water; oceans; on site investigations; sampling; salinity; measurement;

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existent. Descriptors: continental shelf; water resources; law of the sea; boundaries, property; *water resources development; oil industry; water law; legislation; political aspects; economic aspects; minerals; governments; International Law; conservation; fishing; social-aspects; legal aspects; natural resources; International Agreements.

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meteorological features of the entire region, the study discusses the climatic controls of each of Equatorial Africa's eight 'zones of climatic commonality' in detail. Each, 'season' is defined and discussed in considerable detail, to include general weather, clouds, visibility, winds, precipitation, temperature, and other hazards. DTIC Number: ADA2939569XSP; ProxyURL/Handle: http://handle.dtic.mil/100.2/ADA293956

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could be explained by the supply of nitrogen, the root-available soil depth and precipitation. Diagnostic foliar analysis for a broad range of elements was carried out in all plantations with the exception of Nigeria. This showed that in 20% of the stands, various deficiency symptoms occur, and in an additional 40%, hidden demand of at least one nutrient is apparent. According to the Diagnosis and Recommendation Integrated System (DRIS), the most deficient nutrients besides N are Ca and P, while in 45% of all stands there is a relative Al excess. Recommendations for the evaluation and classification of site quality and the number of trees sampled for foliar analysis are given. ISSN: 0378-1127.

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Durazzo, A. and Gordon, R. L. 1967. Liberia: Mineral Wealth, Private Capital and Economic Development. Mining Magazine. Volume 117, no 5, November 1967, pages 330-339. "Dutch Exploration in Liberia." 1967. Mining Journal. Number 269, page 69 et seq. ISSN: 0026-5225; OCLC: 02438984.

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the deep sea may be greater than was previously suspected. References: 39; illustrations, including tables, sketch map. ISSN: 0304-4203.

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archaeologic materials from localities in Sweden and elsewhere. (For reference to the previous report, see this Bibliography Vol. 29, p. 409, Oestlund, H. G.). Descriptors: absolute-age; Africa; Buchanan; C-14; carbon; dates; Europe; Greece; Hoernjafjoerder; Iceland; isotopes; Italy; Liberia; radioactive-isotopes; regional; Scandinavia; Southern Europe; Sweden; Sweden, Italy, Greece, Iceland, Liberia; West Africa; Western Europe. ISSN: 0033-8222.

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Evans, Jon Michael. 2001. "Gold exploration in tropically weathered terrains: The formation, evolution and geochemistry of lateritic profiles in Liberia and Guinea, West Africa." [Ph.D. dissertation].England: University of Southampton (United Kingdom); 2001. Subjects: Gold, Lateritic, Liberia, Guinea. Geology, Geochemistry. Abstract (Document Summary): Gold-mineralisation at Largor, Liberia, is hosted within a discrete, amphibolite and granitoid bound, E-W trending zone of variably sheared and recrystallised ultramafic-mafic (amphibole+chlorite+/-serpentine+talc) schists. The host exhibits E-W-trending dextral ductile shear deformation and lower amphibolite facies (c.550°C) metamorphism. There is little evidence for pervasive hydrothermal alteration. Two distinct associations of disseminated sulphides and arsenides are developed; pyrrhotite-chalcopyrite is ubiquitous, possibly representing a remobilized primary igneous assemblage; arsenopyrite- niccolite-pyrrhotite is more locally developed, related to a later-stage As- rich fluid. Gold mineralisation is disseminated, occurring dominantly as (syngenetic?) inclusions within amphiboles, with lesser occurrences of host- rock and Au intimately associated with pyrrhotite. Intense tropical weathering has created a residual ferralitic stone-line-type profile comprising of a well developed saprolite, capped by a thin nodular/ gravelly soil and occasionally clayey-silty soils. Detailed textural studies show that weathering commences by the breakdown of primary sulphides and arsenides. Saprolitisation is isovolumetric. Upper saprolite comprises of an open box work of peripheral pseudomorphs, comprising of Fe oxyhydroxide- and kaolinite-rich rinds, developed by incongruent dissolution of amphiboles in the lowermost saprolite and chlorite in the upper saprolite. Partial gibbsitic pseudomorphs form directly during chlorite alteration. Partial kaolinite pseudomorphs after amphibole are occasionally developed in the chlorite-dominated domains of the lower saprolite. Gravelly soils (pisoliths, saprolitic relicts and quartz fragments in a kaolinitic matrix) have formed by the physical collapse of the upper saprolite. The presence of lateritic pisoliths incorporated within soils is strong evidence of a previously dismantled duricrust. More recent truncation down to saprolite levels in some locations has occurred, and residual pisoliths have been incorporated into the soils during saprolite collapse. Subsequent surficial leaching is promoting the removal of Fe, forming residual kaolinite- and quartz-rich clayey-silty soils. Localized interaction with the water-table is promoting Fe remobilization, transforming the upper saprolite into a mottled clay, eventually forming an outcropping secondary pseudo-duricrust. DAI-C 64/01, p. 109, Spring 2003.

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Fanfant, R. 1970. "Liberia: Soil Survey: Report to the Government." FAO: Rome. 26 pages, 3 tables, 1 appendix & 1 large map attached. 1970. Descriptors: soil surveys; soil chemicophysical properties; soil fertility; soil types; soil profiles; Liberia. Report No: AGL-UNDP/TA 2845. FAO Library.

Farah, Douglas. 2000. "Liberia Reportedly Arming Guerrillas; Rebel Control of Sierra Leone Diamond-Mining Areas Crucial to Monrovia, Sources Say." Washington Post (June 18, 2000):A.21 ISSN: 0190-8286. Abstract: Taylor launched his revolt against Doe in 1989, then helped Sankoh found the RUF in 1991. Compaore, Taylor and Sankoh, as well as many of their senior commanders, trained at Libya's World Revolutionary Headquarters in the 1980s. The Reagan administration regarded Libya as a primary sponsor of international terrorism and saw Doe as a reliable ally. It poured $500 million in aid into Doe's Liberia and pressured Nigeria and other pro-Western governments to intervene militarily, using Sierra Leone as a base, to fight Taylor. But

Taylor ultimately fought to a draw, signed a cease-fire and won a presidential election in 1997. "The deal was that the RUF would help Taylor 'liberate' Liberia and afterward would provide a base for the RUF to enter Sierra Leone," said [Ibrahim Abdullah]. "When the RUF entered Sierra Leone there was a Burkinabe [Burkina Faso] force under their command that Taylor arranged to send in. All the arms for Taylor and the RUF came from Burkina Faso, and were bought in Ukraine. The payment for all this was diamonds that went through Liberia, Burkina Faso and the Ivory Coast." That basic route still works, intelligence officials said. For months, Western military and intelligence officials have reported Taylor's tacit support for the rebels and friendship with their leaders. But in recent days intelligence officials, diplomats and sources with direct knowledge of RUF activities say his support has become more active and the threat of a wider regional war is growing. These sources say Taylor's recent reinforcement of the rebels is due to his determination to either maintain RUF control over the bulk of Sierra Leone's diamond fields, or back a new RUF escalation of the war. While Taylor acknowledges a friendship and historical ties with RUF leaders, he denies that he is arming the rebels now.

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of Ukraine for which a boudinage control has been explicitly described, and with the structure controlling the Nimba Range deposit, Liberia. If such a comparison is valid, then boudinage could account simultaneously for the Proterozoic age of the deposits, the localised stratigraphic thinning, the influx of iron, and the "removal" of silica. Further, on the basis of self-similarity of boudinage structure across scale, region and tectonic regime, and in conjunction with the recognition by others on different grounds that the examples described in the paper may be extrapolated world-wide, boudinage may provide a partial framework within which existing models for the formation of enriched hematite ores of Proterozoic banded iron formations can be adapted. The paper is conceptual and provides no new data. Descriptors: Africa; Australasia; Australia; Brockman Formation; chemically precipitated rocks; Commonwealth of Independent States; controls; diagenesis; Europe; Hamersley Range; hematite; iron formations; iron ores; Krivoy Rog Basin; Liberia; Marra-Mamba-Formation; metal ores; mineral deposits, genesis; Nimba Mountains; oxides; sedimentary processes; sedimentary rocks; sedimentary structures; Ukraine; West Africa; Western Australia. ISSN: 0169-1368.

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Haggerty, Stephen E. 1982. "The Mineralogy of Global Magnetic Anomalies. Progress Report, February - August 1982." Performer: Massachusetts Univ., Amherst. Dept. of Geology and Geography. Funded by: National Aeronautics and Space Administration, Washington, DC. 13 August 1982. 47p. Notes: Erts. Report number: NAS126169507; E8310034; NASACR169507; Contract number: NAS526414. Descriptors: *Earth crust; *Liberia; *Magnetic anomalies; *Mineralogy; *Rocks; *South America; Curie temperature; Earth resources program; magnetometers; Magsat satellites; earth sciences and oceanography; geology and mineralogy; NASA earth resources survey program. Abstract: The Curie Balance was brought to operational stage and is producing data of a preliminary nature. Substantial problems experienced in the assembly and initial operation of the instrument were, for the most part, rectified, but certain problems still exist. Relationships between the geology and the gravity and MAGSAT anomalies of West Africa are reexamined in the context of a partial reconstruction of Gondwanaland. NTIS Number: N83135285XSP.

Haggerty, Stephen E. and Toft, Paul B. 1985. "Native iron in the continental lower crust; petrological and geophysical implications." Science. 229; 4714, Pages 647-649. 1985. American Association for the Advancement of Science. Washington, DC, United States. Abstract: information on the mineralogy of the deep continental crust is extremely limited, and the redox state of the lower crust has never been fully addressed. Although the earth's core is probably dominated by metallic iron, terrestrial conditions at the surface are generally oxidized. Naturally occurring iron metal, native iron, is rarely formed except in coal beds, low-temperature (<500|C) serpentinites, lavas that have or may have incorporated carbonaceous sediments, and, at one locality, in a quartz garnet glaucophane lawsonite assemblage. We report the discovery of native iron in lower crustal granulites from Liberia in western Africa. The rocks (2 to 25 cm in diameter) were recovered from a diamond-bearing kimberlite pipe (10|41W, 7|33N) that erupted within the southern shield of the West African cration in the mid-Cretaceous, 90 to 120 million years ago after the breakup of Gondwanaland (4). Granulites and other xenoliths were incorporated from the walls of the volcanic conduit into the kimberlite on its upward passage from the mantle. Although high temperatures were attained, rapid adiabatic cooling has prevented thermal metamorphism of the xenoliths or chemical interaction with the kimberlite. Descriptors: Africa; continental crust; crust; geologic-barometry; geologic-thermometry; granulites; igneous-rocks; inclusions; intrusions; iron; kimberlite; Liberia; lower-crust; magnetic-anomalies; magnetic-properties; metals; metamorphic-rocks; mineralogy; minerals; native-elements; P-T-conditions; pipes; plutonic-rocks; specific-gravity; ultramafics; West Africa; xenoliths; Igneous-and-metamorphic-petrology; mineralogy-of-non-silicates. Map coordinates: LAT: N073300; N070330; LONG: W0104100; W0104100. References: 32; illustrations, including 1 table. ISSN: 0036-8075.

Haggerty, Stephen E. and Tompkins, Linda A. 1983. “Redox state of Earth's upper mantle from kimberlitic ilmenites.” Nature (London). 303; 5915, Pages 295-300. 1983. Macmillan Journals. London, United Kingdom. Descriptors: Africa; Antoschka; Fugacite oxygene; fugacity; geochemistry; Guinea; igneous rocks; ilmenite; kimberlite; Koidu; Liberia; mantle; nodules; oxidation; oxides; petrology; plutonic rocks; Potentiel redox; properties; reduction; Sierra Leone; thermodynamic properties; ultramafics; upper mantle; West Africa. References: 54. ISSN: 0028-0836.

Haggerty, Stephen E. and Tompkins, Linda A. 1982. “Opaque mineralogy and chemistry of ilmenite nodules in West Africa kimberlites; subsolidus equilibration and controls on crystallization trends.” In: Third international kimberlite conference; abstracts. Terra Cognita. 2; 3, Pages 224-225. 1982. European Union of Geosciences. Strasbourg, France. Conference: Third international kimberlite conference. Clermont-Ferrand, France. 1982. Descriptors: Africa; crystallization; geochemistry; Guinea; igneous-rocks; ilmenite; inclusions; kimberlite; Liberia; low-pressure; Mali; minerals; opaque-minerals; oxides; petrology; plutonic rocks; pressure; Sierra Leone; ultramafics; West Africa; xenoliths; Geochemistry-of-rocks,-soils,-and-sediments; Igneous-and-metamorphic-petrology. ISSN: 0290-9944.

Hall, Chris M.; York, Derek; Onstott, Tullis C. and Hargraves, Robert B. 1984. “40Ar 39Ar spectra models; new techniques for unraveling Precambrian thermal histories.” In: GAC-MAC, 1984; program with abstracts; joint annual meeting- AGC, AMC, programme et resumes; reunion annuelle conjointe. Program with Abstracts - Geological Association of Canada; Mineralogical Association of Canada; Canadian Geophysical Union, Joint Annual Meeting. 9; Pages 70. 1984. Geological Association of Canada. Waterloo, ON, Canada. Conference: Geological Association of Canada; Mineralogical Association of Canada; joint annual meeting. London, ON, Canada. May 14-16, 1984. Descriptors: absolute age; Africa; age; alkali feldspar; amphibolites; Ar-Ar; biotite; dates; Encrucijada quartz monzonite; feldspar group; framework silicates; geochronology; granites; Harper amphibolite; igneous rocks; K-feldspar; Liberia; metamorphic rocks; metamorphism; mica group; petrology; plagioclase; plutonic rocks; Precambrian; quartz monzonite; sheet silicates; silicates; South America; Venezuela; West Africa; Geochronology. ISSN: 0701-8738.

Hancox, P. J and Brandt, D. 2000. “An overview of the heavy mineral potential of Liberia.” Journal of the South African Institute of Mining and Metallurgy. 100; 1, Pages 29-34. 2000. Abstract: Heavy mineral deposits have been known from Liberia since the 1950s from both river and beach placers. The heavy mineral content of beach sands ranges between 28-62% and the suite includes ilmenite, rutile, zircon and magnetite. These occur together with kyanite, sillimanite, staurolite and garnet. The average ilmenite content is 82% with minor zircon (11%), rutile (6%) and monazite (1%). The ilmenite is, however, of poor quality with haematite intergrowths and a titanium content ranging from 10-42.4% (average+ or -25% TiO (sub 2)). The amounts of rutile and zircon, while of suitable quality, have also previously been deemed too low for economic exploitation. Descriptors: Africa; beach placers; fluvial features; garnet group; heavy mineral deposits; ilmenite; kyanite; Liberia; magnetite; mineral resources; nesosilicates; ore bodies; ore grade; orthosilicates; oxides; placers; potential deposits; rivers; rutile; silicates; sillimanite; staurolite; West Africa; zircon. Notes: SAIMM conference, Heavy minerals 1999, November 15-17, 1999. References: 23; illustrations, including sects., 1 table, geological sketch maps. ISSN: 0038-223X.

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Hardman, Mountford N. J. and McGlade, J. M. 2003. "Seasonal and interannual variability of oceanographic processes in the Gulf of Guinea: an investigation using AVHRR sea surface temperature data." International Journal of Remote Sensing, Volume 24, Number 16, August 20, 2003, pages 3247-3268(22). Abstract: The Gulf of Guinea is situated in a critical position for understanding Atlantic equatorial dynamics. This study investigates seasonal and interannual variability in sea surface temperature (SST) throughout this region, focusing on dynamical ocean processes. A 10.5-year time series of remotely sensed SST data with 4 km spatial resolution from the Advanced Very High Resolution Radiometer (AVHRR) were used for this investigation, as they are sufficient to resolve shelf processes. Firstly, patterns of cloud cover were assessed, then spatio-temporal variability in SST patterns was investigated. Features identified in climatological SST images were the Senegalese upwelling influence, coastal upwelling, tropical surface water, river run-off and fronts. Of particular interest is a shelf-edge cooling along the coast of Liberia and Sierra Leone in February. Interannual variability, assessed using annual mean images, time series decomposition and spectral analysis, showed a quasi-cyclic pattern of warm and cool years, perhaps related to El Niño-type forcing. The results of this study show the usefulness of infrared remote sensing for tropical oceanography, despite high levels of cloud cover and atmospheric water vapour contamination, and they provide evidence for theories of westward movement of the upwelling against the Guinea current and remote forcing of the upwelling.

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Harley, George Way. 1939. "Roads and Trails in Liberia." Geographical Review, volume 29, July 1939, pages 447-460. Abstract: Technical article describing physiographic regions, trails and trade routes. Dr. Harley's mission station in at Ganta in the interior. ISSN: 0016-7428.

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Kemokai. For Central Liberia from original prismatic compass readings and some scale estimates, checked on main trails by tachometer readings. For the Central Belt from the War College map. For the Saint Paul River Vallet- partly after the preliminary base map of L. C. Daves, done with sketching board and tied into triangulation points. For the area behind New Cess, from a rough map by Rev. G. D. Mellish. This map was tied into the triangulation points and boundary survey made by Ben F. Powell, and has some claim to accuracy. A few details were used from the map by John L. Morris and Josia Massaquoi. The location of the Firestone Plantations and local details are from maps prepared by the Firestone Plantations Company. Other details were obtained by Rev. D. Heydorn, Rev. K. Noltze, Harold R. Bare and George Schwab. The South-eastern portion is most unsatisfactory, being based on the roughest possible estimate. The whole is only roughly sketched, and its only value lies in the fact that it awaits more accurate work. LCCN: 92-684748.

Harvard African Expedition (1926-1927). 1930. The African Republic of Liberia and the Belgian Congo: based on the observations made and material collected during the Harvard African expedition, 1926-1927. Edited by Richard P. Strong. Cambridge: Harvard University Press, 1930. Description: Book. 2 volumes (xxvi, 1064 p.): ill., maps, plates; 27 cm. Series: Contributions from the Department of Tropical Medicine and the Institute for Tropical Biology and Medicine ; no. 5 Contents Notes: v. 1. The African republic of Liberia. Medical and pathological investigations in Liberia and the Belgian Congo. Medical and biological investigations. v. 2. Mammals. Birds. Herpetology. Entomology. Photography. Notes: Includes bibliographical references and index. Subjects: Medical geography Liberia. Medical geography Congo (Democratic Republic). Natural history Liberia. Natural history Congo (Democratic Republic). Zoology Liberia. Zoology Congo (Democratic Republic). Botany Liberia. Tropical medicine Liberia. Tropical medicine Congo (Democratic Republic). Scientific expeditions Africa. Liberia Description and travel. Liberia Social life and customs. Other: Strong, Richard Pearson, 1872-1948. Held at the USGS Library- Call number: 590(756) H26a. LCCN: 30-28936.

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Hasselmann, Karl-Heinz. 1977. “Geography of Greenville.” Monrovia, Liberia: Dept. of Geography, University of Liberia. 156 pages: maps; 29 cm. Series: Occasional research paper, Dept. of Geography, University of Liberia; no. 17; Variation: University of Liberia. Dept. of Geography. Occasional research paper - Dept. of Geography, University of Liberia; no. 17. Descriptors: Greenville (Liberia)- Description and travel; Greenville (Liberia)- History; Greenville (Liberia)- Social conditions- Statistics. Notes: "July 26, 1977." OCLC: 38636547.

Hasselmann, Karl-Heinz. 1977. Liberia: Population, Size, and Density, 1962 and 1974. Monrovia: Dept. of Geography, University of Liberia. 62 pages: illustrations, maps; 21 cm. Occasional research paper, Department of Geography, University of Liberia; no. 16; Variation: University of Liberia. Dept. of Geography. Occasional research paper, Dept. of Geography, University of Liberia; no. 16. Descriptors: Liberia- Population; Liberia-Administrative and political divisions. Note(s): Includes bibliographical references (p. 60-62). OCLC: 6072095.

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Hasselmann, Karl-Heinz. 1974. “Robertsport.” Monrovia: University of Liberia, Dept. of Geography. 1 map; photocopy; 81 x 81 cm. Scale 1:2,500. Descriptors: Robertsport (Liberia)- Maps. Notes: “Base: Hansa Luftbild, aerial photography, 1972." Oriented with north toward the lower left. Includes index to points of interest. Mapping and drawing by Karl-Heinz Hasselmann, February 1974. LCCN: 85-690729; OCLC: 12942370.

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Hastings, David A. 1983. "An updated Bouguer anomaly map of south-central West Africa." Geophysics. 48; 8, Pages 1120-1128. 1983. Society of Exploration Geophysicists. Tulsa, OK, United States. Abstract: A new Bouguer gravity anomaly map compiled for western Africa adds data for Ghana, Guinea, and Liberia. The new data add detail to a key part of the Eburnean shield and assist in the development of a model of rifting at the time of the Eburnean orogeny, 2000 million years ago. This model includes a framework for the deposition of the region's mineral deposits. The model and existing field data can be used to guide future minerals exploration in the region. Descriptors: Africa; aluminum ores; Benin; Bouguer anomalies; Burkina Faso; diamonds; evolution; geophysical methods; geophysical surveys; gold ores; gravity anomalies; gravity methods; gravity survey maps; Guinea; iron ores; Ivory Coast; Liberia; Mali; manganese ores; maps; Mauritania; metal ores; mineral deposits, genesis; mineral exploration; Niger; orogeny; Pan African Orogeny; plate tectonics; Precambrian; processes; Proterozoic; rifting; surveys; Togo; upper Precambrian; West Africa; Applied geophysics. References: 55; illustrations, including sketch maps. ISSN: 0016-8033.

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rolling hills, a belt of low mountain ranges and plateaus, and northern highlands. This report is a preliminary review of information available in the United States on Liberia's environment and natural resources. Topics covered by the report include the nation's physical, demographic, and social and economic characteristics; renewable resources; non-renewable resources; parks, reserves, and other protected areas. NTIS Report Number: PB82130667.

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Hempton, Mark. 1995. "Opening history of the Mesozoic Equatorial Atlantic continental margins." In: American Association of Petroleum Geologists 1995 annual convention. Annual Meeting Abstracts - American Association of Petroleum Geologists and Society of Economic Paleontologists and Mineralogists. 4; Pages 41. 1995. American Association of Petroleum Geologists and Society of Economic Paleontologists and Mineralogists. Tulsa, OK, United States. 1995. American Association of Petroleum Geologists 1995 annual convention. Houston, TX, United States. March 5-8, 1995. Descriptors: Africa; Atlantic-Ocean; Benue-Valley; Brazil; clastic-rocks; crust; data-processing; Demerara-Plateau; dike-swarms; Equatorial-Atlantic; evolution; extension-tectonics; faults; Guinea-Plateau; intrusions; Ivory Coast; Liberia; Marajo-Basin; marine-environment; Mesozoic; oceanic-crust; rates; reconstruction; sea-floor-spreading; sedimentary rocks; sedimentation; shale; South-America; strain; strike-slip-faults; subsidence; tectonics; volcanism; West Africa; wrench-faults. ISSN: 0094-0038.

Hempton, Mark R. 1993. "Regional paleogeographic evolution of West Africa; implications for hydrocarbon exploration." In: AAPG distinguished lecture tours, 1993-1994. AAPG Bulletin. 77; 11, Pages 2020. 1993. American Association of Petroleum Geologists. Tulsa, OK, United States. 1993. Descriptors: Africa; Angola; Benin; Benue Valley; Cameroon; Central Africa; continental margin; data processing; deltaic environment; evolution; faults; geometry; kinematics; lacustrine environment; Liberia; Mauritania; Namibia; Niger Delta; Nigeria; paleoclimatology; paleogeography; petroleum exploration; reconstruction; rift zones; shear; Sierra Leone; source rocks; South Africa; Southern Africa; turbidite; West Africa; wrench faults; economic geology, geology of energy sources; solid earth geophysics. ISSN: 0149-1423.

Hermann, Chris; Shaw, Margaret and Hannah, John.1985. Development Management in Africa: The Case of the Agriculture Analysis and Planning Project in Liberia. Special study. Agency for International Development, Washington, DC. Center for Development Information and Evaluation. Performer: Development Alternatives, Inc., Washington, DC. December 1985. 56p. Notes: Prepared in cooperation with Development Alternatives, Inc., Washington, DC. Descriptors: Africa; developing countries; data acquisition; data processing; management methods; specialized training; national government; budgeting; agriculture; *project planning; *Liberia. developing country application; agricultural sector; sector planning; technical assistance; agriculture-and-food-agricultural economics; administration and management; management practice. Abstract: The central objective of the Agriculture Analysis and Planning Project and its predecessor, the Agriculture Development Program, was to improve the capability of the Government of Liberia's Ministry of Agriculture for the data collection and analysis necessary for sector planning. Key lessons learned are: sustainable data-related technologies must be simple and low-cost, but sufficient for basic information requirements; the transfer of technology creates management demands which must be anticipated and used as criteria in selecting technical assistance; technical assistance and training must be continuous to assure that gains made are not lost; in-country training must be emphasized to minimize the disruption of agency operations; necessary organizational changes must be anticipated; advisors should provide quality control and staff support if the agency does not; project planning should be flexible. NTIS Number: PB87155115XSP; OCLC: 17247035.

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Hildebrand, Robert S. 1994. “Are kimberlites lower plate magmatism triggered by plate collisions?” In: Geological Society of America, 1994 annual meeting. Abstracts with Programs - Geological Society of America. 26; 7, Pages 312. 1994. Geological Society of America (GSA). Boulder, CO, United States. 1994. Conference: Geological Society of America 1994 annual meeting. Seattle, WA, United States. October 24-27, 1994. Descriptors: Africa; Appalachians; Archean; basins; Canada; Cenozoic; Colorado; continental crust; convection; Cretaceous; crust; diamonds; Eastern Canada; emplacement; Eocene; flexure; fore arc basins; gems; igneous activity; igneous rocks; Innuitian Orogeny; Ivory Coast; kimberlite; Liberia; magmas; Malay Archipelago; mechanism; Mesozoic; models; New Guinea; North America; North American Cordillera; Northwest Territories; Paleogene; petrography; plate collision; plate tectonics; plutonic rocks; Precambrian; Senegal; South Africa; Southern Africa; Southern U.S.; Tertiary; ultramafics; United States; West Africa; Western Canada. ISSN: 0016-7592.

Hill, L. J. 1987. “Modeling the macroeconomy/energy economy relationship in developing countries: the case of Liberia.” Journal of Developing Areas. Volume 22, no.1 (1987) pages 71-84. Abstract: It is possible to construct a relatively simple modeling system that captures the major interactions between international economic activity, the domestic economy, and the energy sector of developing economies. This paper discusses the construction of one such system which was used to simulate energy demand by sector and fuel type in Liberia, West Africa, over the 1982-2000 time period. The paper is divided into four sections. The second section provides an overview of

the Liberian economy; its discussion on Liberia's output, export-import structure, and the energy sector serves as a preface for the discussion of the specification of the modeling system presented in the third section. The fourth section discusses the simulation results under four different scenarios. The final section presents some conclusions of the study.

Hill, L. J. 1984. Liberian Macroeconomy and Simulation of Sectoral Energy Demand: 1981-2000. Oak Ridge National Lab., TN, United States. Funded by: Department of Energy, Washington, DC. June 1984. 99p. Contract number: AC0584OR21400; Report number: ORNLTM9065. NTIS Advisory: Portions are illegible in microfiche products. Original copy available until stock is exhausted. Descriptors: charcoal; electric power; fuel oils; gas oils; gasoline; iron ores; jet engine fuels; kerosene; Liberia; natural rubber; petroleum; wood; data compilation; econometrics; energy analysis; energy demand; exports; forecasting; imports; prices; simulation. economic analyses; energy utilization; behavioral and social sciences economics; energy conversion; non propulsive conversion techniques; energy use supply and demand; energy policies regulations and studies; business and economics; foreign industry development and economics. Abstract: The primary purpose of this report is to document the results of a research effort on end-use, sector energy demand in Liberia, West Africa over the 1981-2000 time horizon. The research was undertaken as one component of a much broader integrated energy assessment of Liberia. Other components of the assessment, however, focused on current energy supply and consumption together with future energy supply options for Liberia. This particular report is devoted exclusively to a discussion of Liberian energy demand. The methodology utilized to simulate Liberian sectoral energy demand over the period 1981-2000 involved the recursive interaction of a macroeconomic model and individual, econometrically-estimated sectoral demand equations. That is, given the projections for gross output in the Liberian economy from the macroeconomic model, sectoral energy demand was simulated. The individual energy demand equations were estimated on the basis of economic variables that are theorized to influence energy consumption in the respective sectors (e.g., price, output). The primary conclusion drawn from the analysis is that, besides being sensitive to changes in international economic activity, the demand for energy in Liberia over the 1981 to 2000 horizon is highly sensitive to internal production of its two primary exports: iron ore and rubber. More specifically, as characterized in the four scenarios, future growth in Liberian energy demand is contingent on the output of three companies: the Liberian American Swedish Mining Company, the Bong Mining Company, and the Firestone Rubber Company. Therefore, expansion of Liberia's energy supply capacity in the future should proceed cautiously. 16 references, 6 figures, 15 tables. NTIS Number: DE84013665XSP.

Höll, C. and Kemle, von Mücke S. 2000. " Late Quaternary Upwelling Variations in the Eastern Equatorial Atlantic Ocean as Inferred from Dinoflagellate Cysts, Planktonic Foraminifera, and Organic Carbon Content. Quaternary Research, Volume 54, Number 1, July 2000, pp. 58-67(10). Abstract: Analysis of multiple proxies shows that eastern equatorial Atlantic upwelling was subdued during isotope stage 5.5, more intense during stages 4, 5.2, 5.4, and 6, and most intense early in stage 2. These findings are based on proxy measures from a core site about 600 km southwest of Liberia. The proxies include total organic carbon content, the ratio of peridinoid and oceanic organic walled dinoflagellate cyst species, accumulation rates of calcareous dinoflagellates, estimates of sea surface paleotemperatures, the difference in stable oxygen isotope composition between two species of planktonic foraminifera that live at different water depths, and the abundance of the planktonic foraminifera Neogloboquadrina dutertrei. Most of these parameters

consistently vary directly or inversely with one another. Slight discrepancies between the individual parameters show the usefulness of a multiple proxy approach to reconstruct paleoenvironments. Our data confirm that northern summer insolation strongly influences upwelling in the eastern equatorial Atlantic Ocean.

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Holsoe, Torkel. 1955. Forestry progress and timbering opportunities in the Republic of Liberia. Washington, DC: United States. International Cooperation Administration. 92 pages, illustrations, map. Descriptors: Forests and forestry- Liberia. LCCN: 56-60372; OCLC: 3653991.

Holsoe, Torkel. 1954. Forestry opportunities in the Republic of Liberia. Washington, DC: United States. Foreign Operations Administration. 41 pages, illustrations. Descriptors: Forests and forestry- Liberia. [by] Torkel Holsoe, forestry adviser. Foreign Agricultural Service and Forest Service, U.S. Dept. of Agriculture, cooperating. LCCN: 54-60288; OCLC: 4670101.

Hottes, Karlheinz. 1971. Liberia. 1971 [neunzehnhunderteinundsiebzig]: Ergebnisse e. Studienbereisung durch e. trop. Entwicklungsland Karlheinz Hottes [u. a.]. Paderborn: Scheoningh, 1973. 166 p.: ill., maps; 29 cm. Bochumer geographische Arbeiten: Heft 15. Notes: Includes bibliographies. Subjects: Liberia- Economic conditions. ISBN: 3506711954; OCLC: 1237598.

Hurley, P. M.; Fairbairn, H. W. and Gaudette, H. E. 1976. “Progress report on early Archean rocks in Liberia, Sierra Leone and Guayana, and their general stratigraphic setting.” In: The early history of the Earth. Windley, B. F. (editor). Pages 511-521. 1976. John Wiley & Sons. New York, N. Y., United States. Descriptors: absolute age; Africa; amphibolites; Archean; gneisses; granulites; Guyana; interpretation; Liberia; metamorphic-rocks; metamorphism; petrology; Precambrian; review; Sierra Leone; South America; West Africa; igneous and metamorphic petrology. Illustrations, including sketch map.

Hurley, P. M.; Leo, G. W.; White, R. W. and Fairbairn, H. W. 1971. “Liberian age province (about 2,700 m.y.) and adjacent provinces in Liberia and Sierra Leone.” Geological Society of America Bulletin. 82; 12, Pages 3483-3490. 1971. Geological Society of America (GSA). Boulder, CO, United States. Descriptors: absolute age; Africa; Archean; basement; Cambrian; dates; isochrons; Kambui Schist; Kasila Group; Liberia; Marampa Formation; metamorphic rocks; metasedimentary rocks; metavolcanic rocks; Nimba Mountains; Paleozoic; Pan African Orogeny; Precambrian; Proterozoic; Rb-Sr; Sierra Leone; upper Precambrian; West Africa; whole rock. References: 22; illustrations, including sketch map. ISSN: 0016-7606.

Hurley, P. M.; Leo, G. W.; White, R. W. and Fairbairn, H. W. 1970. “The Liberian age province (ca. 2700 m.y.), and adjacent provinces in Liberia and Sierra Leone.” Abstracts with Programs - Geological Society of America. 2; 7, Pages 583. 1970. Geological Society of America (GSA).

Boulder, CO, United States. Descriptors: absolute age; Africa; dates; Liberia; metamorphic rocks; Precambrian; Sierra Leone; West Africa; Geochronology. ISSN: 0016-7592.

Hütten, Horst G. 1977. “Impressions of Liberia: from the sketch-books of a journey to the Bong Range Iron Ore Mine in Liberia.” Translated title: “Mit dem Zeichenstift Afrika: aus den Skizzenbüchern einer Reise zu der Eisenerzmine Bong Mine in Liberia.” Mettmann, Markt 17: H.G. Hütten [Selbstver.]. 72 pages: chiefly ill.; 27 cm. Language: English. Descriptors: Bong Mining Company; Liberia- Description and travel. Notes: English and German. Other Titles: Mit dem Zeichenstift in Afrika. ISBN: 3921986125; LCCN: 81-137160; OCLC: 9919282.

Huvane, Kathleen. 2001. "U.N. cracks down on "conflict diamonds" (The diamond trade in Liberia) (Brief Article)." World Watch. 14. September 2001: page 9. Abstract: In an attempt to stem international trade in "conflict diamonds" from West Africa, on May 7, 2001 the United Nations imposed economic sanctions on Liberia, which has smuggled a steady flow of ill-gotten diamonds from rebel forces in neighboring Sierra Leone… …Liberia's forest industry has played an integral role in propagating the diamond-weapons trade. In addition to providing corrupt government officials and businessmen with revenue through the sale of illegally harvested tropical timber, the roads and vehicles used to transport felled trees have facilitated the movement of weapons and diamonds. Since the timber processing industry in Liberia is virtually nonexistent, the vast majority of logs are exported whole, further depriving locals of employment opportunities they might reap from their forests. Official Forestry Department statistics for the first six months of 2000, which do not account for the vast illegal timber harvest, reveal that logging during that time period exceeded that of the previous four years combined. Not counting illegal logging, the forestry department projects that Liberian forests may be commercially viable for only another ten years. Halting the illegal trade will be difficult in the face of the region's fighting and corruption. For instance, Dutch national Gus Koewenhoven, the notorious "Godfather of Liberia," heads two logging companies with significant concessions in Liberia and also serves as a board member of the Liberian Forestry Development Association (FDA)- the government agency charged with protecting and monitoring Liberia's forests. Koewenhoven has used his considerable connections to carve trade routes that allow for easy collection and transfer of timber, diamonds, and arms. International pressure is also keeping this illegal trade flowing: China and France, the primary importers of Liberian timber, used their political muscle to ensure that the economic sanctions imposed in May did not include forest products. In addition, British and Ukrainian companies have supplied arms to Sierra Leone's RUF rebels, commonly funneled through Liberian channels.

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“International Trade: Significant Challenges Remain in Deterring Trade in Conflict Diamonds. “ GAO, Washington, DC (USA). [vp]. 13 February 2002. Descriptors: crime; money laundering; diamond industry; conflict resolution; arms control; government regulations; international trade; Liberia; Sierra Leone. Abstract: As a high-value commodity easily concealed and transported and virtually untraceable to their original source, diamonds are used in lieu of currency in arms deals,

money laundering, and other criminal activity. U.S. controls over diamond imports only require certification from the country of last import--and thus cannot identify diamonds from conflict sources. Although the United States bans diamonds documented as coming from the National Union for the Total Independence of Angola, the Revolutionary United Front in Sierra Leone, and Liberia- all of which are subject to U.N. sanctions- this does not prevent such diamonds shipped to a second country from being mixed into parcels destined for the United States. GAO found that the Kimberley Process's proposal for international diamond certification incorporated some elements of accountability. However, it is not based on a risk assessment, and some high risk activities are subject only to "recommended" controls. Also, from the time when rough diamonds enter the first foreign port until the final point of sale there exists only a voluntary industry participation and self-regulated monitoring and enforcement system. These and other shortcomings significantly undermine efforts to deter trade in questionable diamonds.

“Iron may Dominate Rubber as Liberia’s Main Export.” 1959. East African Trade and Industry. Volume 6, number 66, pages 37, 39. LCCN: 60-43580; OCLC: 2446498.

Jablonski, Donna M. (editor). 1982. “Mideast and Africa.” In the collection: Future energy sources; National development strategies. Volume 1; 1982. McGraw-Hill. Washington, DC. Pages: variously paginated. Descriptors: Africa; Asia; East Africa; economic geology; Egypt; energy sources; exploration; Indian Peninsula; Israel; Jordan; Kenya; Liberia; management; Middle East; Nigeria; North Africa; Pakistan; policy; possibilities; programs; resources; Sierra Leone; Sudan; Turkey; utilization; West Africa. Illustrations, including tables.

Jacobi, W. J. 1916. “Map of Liberia.” United States. War Dept. General Staff. War College Division. Washington: The Division. Description: 1 map: mounted on linen; 73 x 62 cm. Descriptors: Tribes- Liberia- Maps; Liberia- Maps. Map Info: Scale 1:750,000; (W 11030’--W 7030’/S 9000’--S 4030’). Notes: Relief shown by form lines. Shows names of tribes, sections, and tribal divisions. Prepared in the War College Division, General Staff; W. J. Jacobi, draftsman. OCLC: 54646827.

Jahns, Susanne; Huels, Matthias and Sarnthein, Michael. 1998. “Vegetation and climate history of West Equatorial Africa based on a marine pollen record off Liberia (site GIK 16776) covering the last 400,000 years.” Review of Palaeobotany and Palynology. 102; 3-4, Pages 277-288. 1998. Elsevier. Amsterdam, Netherlands. 1998. Abstract: Based on pollen analysis of a sediment core from the Atlantic Ocean off Liberia the West African vegetation history for the last 400 ka is reconstructed. During the cold oxygen isotope stages 12, 10, 8, 6, 4, 3 and 2 an arid climate is indicated, resulting in a southward shifting of the southern border of the savanna. Late Pleistocene glacial stages were more arid than during the Middle Pleistocene. A persistence of the rain forest in the area, even during the glacial stages, is recorded. This suggests a glacial refuge of rain forest situated in the Guinean mountains. Afromontane forests with Podocarpus occurred in the Guinean mountains from the stages 12 to 2 and disappeared after. The tree expanded from higher to lower elevations twice in the warm oxygen isotope stage 11 (pollen subzones 11d, 11b) and at least twice during the warm stage 5 (pollen subzones 5d, 5a), indicating a relative cool but humid climate for these periods. Descriptors: Africa; arid-environment; Atlantic-Ocean; biostratigraphy; biozones; Cenozoic; cores; East-Atlantic; equatorial region; floral list; forests; GIK-16776-Core; glaciation; Holocene; humid environment; isotope ratios; isotopes; Liberia; marine environment; marine

sediments; microfossils; miospores; O-18-O-16; oxygen; paleoclimatology; paleoecology; paleotemperature; palynomorphs; Plantae; Pleistocene; Podocarpus; pollen; pollen-analysis; pollen diagrams; quantitative analysis; Quaternary; rain forests; savannas; sedimentation; sedimentation rates; sediments; stable isotopes; terrestrial environment; tropical environment; vegetation; West Africa; Quaternary-geology. Map Coordinates: Lat: N034401; N034401; Long: W0112309; W0112309. Notes: Includes appendices. References: 62; illustrations, including 3 tables, sketch map. ISSN: 0034-6667.

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Johnson, D. H.; Holmes, A. J. and Cooper, B. R. 1971. “Geochemical investigations of base metal occurrences in western Liberia.” In: Geochemical exploration (International Geochemical Exploration Symposium, 3rd, Proc.). Special Volume - Canadian Institute of Mining and Metallurgy. 11; Pages 195. 1971. Canadian Institute of Mining and Metallurgy. Montreal, PQ, Canada. Descriptors: Africa; economic geology; exploration; geochemical methods; geochemical surveys; Liberia; metals; mineral exploration; soils; surveys; West Africa; Economic geology of ore deposits. ISSN: 0576-5447.

Johnson, D. H; Holmes, A. J. and Cooper, B. R. 1970. “Geochemical investigations of base metal occurrences in western Liberia.” In: Third international geochemical exploration symposium; program and abstracts. Boyle, R.W. Pages 41-42. 1970. Can. Inst. Mining Met., Geol. Div.-Soc. Econ. Geol.. Toronto, ON, Canada. Conference: Third international geochemical exploration symposium. Toronto, ON, Canada. April 16-18, 1970. Descriptors: Africa; economic geology; Galena creek; Gboeya creek; geochemical methods; Liberia; metals; mineral exploration; Sam Davis creek; soils; West Africa.

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the United States Agency for International Development, carried out jointly by the Liberian Geological Survey and the United States Geological Survey. The references were compiled from many sources, including the card catalog of the US Geological Survey Library in Washington, the holdings of the Liberian Geological Survey library, various unpublished bibliographies, references cited by authors of publications dealing with Liberian geology, and chance encounters in the literature. The list is admittedly incomplete… References to mining, metallurgy and mineral economics involving Liberia have been included, as have many papers dealing with physical geography, cartography, pedology, hydrology and related subjects." LCCN: 90-101134; OCLC: 22180090.

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author's drawings and from photographs by the author and others, 22 maps by Mr. J. W. Addison, Capt. H. D. Pearson, R. E., Lieut. E. W. Cox, R. E., and the author. OCLC: 25320061.

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Kromah, Fodee. 1971. The mineralogy and petrography of the Nimba iron ore. Master's thesis, Michigan State University. East Lansing, MI, United States. Pages: 57. 1971. Includes bibliographical references (leaves 56-57). Two maps in pocket. Descriptors: Africa; economic geology; iron; Liberia; metals; mineralogy; Nimba; petrology; West Africa; economic geology; geology of ore deposits. OCLC: 24602321.

Kryatov, B. N.; Prokof-yev, S. S.; Makstenek, I. O.; Mamedov, V. I. and Khain, V. Ye. 1985. "Stages of tectonic development and metallogeny in the western Leone- Liberian Shield, western Guinea, and Guinea-Bissau." Geotectonics. 19; 6, Pages 460-472. 1985. American Geophysical Union. Washington, DC, United States. Descriptors: Africa; evolution; Guinea; Guinea Bissau; igneous activity; Liberia; Liberian Shield; metallogeny; structural geology; tectonics; West Africa. ISSN: 0016-8521.

Kühn, Stefan. 2000. "Beitrag zur Entwicklung einer geographischen Datenbasis der Landnutzung." Translated title: "Contribution for the development of a geographical database of land use." Universität Giessen, Department of Biology and Chemistry. Language: German. Notes: "Weltweit haben menschliche Aktivitäten den Zustand der terrestrischen Biosphäreverändert. Entwaldung und die Etablierung von Ackerland sind und waren die markantesten Manifestationen dieser Aktivitäten. In dieser Arbeit werden Datensätze erstellt, die digitalisierte Informationen über das Was, Wieviel, Wann und Wo von Landnutzungsänderungen enthalten. Die räumliche Auflösung der Daten beträgt 0.5 x 0.5 Grad und richtet sich nachden Erfordernissen dynamischer regionaler oder globaler Kreislaufmodelle, die einesolche Auflösung mehrheitlich verwenden.Publikationen, die auf der Basis von Satellitenaufnahmen oder historischen Landnutzungsdaten Landnutzungsänderungen geographisch und zeitlich rekonstruieren,bestenfalls in Form von Karten, sind systematisch ausgewertet worden, um die Datensätze zu erstellen. Für 12 Länder konnten Dateien über Landnutzungsänderungen erstellt werden:Brasilien, Paraguay, die Vereinigten Staaten, Costa Rica, Liberia, Ghana, Elfenbeinküste, Nigeria, Madagaskar, Malaysia, die Philippinen und Australien.Ein wichtiger Schwerpunkt lag auf der Quantifizierung und Lokalisierung der massiven Rodungen im Amazonasgebiet.Die vorgelegten Datensätze können in Verbindung mit dynamischen Modellen dabeihelfen, die Rolle von Landnutzungs- und Landbedeckungsänderungen in den biogeo-chemischen Kreisläufen besser einzuschätzen, insbesondere in quantitativer Hinsicht. Die Ergebnisdateien sind auf Anfrage vom Autor erhältlich." Institution: Bibliotheksservice-Zentrum Baden-Wurttemberg (BSZ BW), Germany, Virtueller Medienserver. Master's Thesis. Translated notes: World-wide human activities changed the condition of the terrestrial biosphere. The establishment fields from woodland are the most salient manifestations of these activities. In this work data records are provided, and it contains digitized information about how much, when and where are these changes in land use. The spatial dissolution of the data amounts to 0,5 x 0,5 degrees and depends on the requirements of dynamic regional or global cycle models. Publications, which took historical land use data changes of land use on the basis of satellites on or geographical and temporal reconstructions, at best in the form of maps, were systematically rated, in order to provide the data records. For 12 countries files of changes in land use could be provided: Brazil, Paraguay, the United States, Costa Rica, Liberia, Ghana, the Ivory Coast, Nigeria, Madagascar, Malaysia, the Philippines and Australia. An important emphasis was on quantification and localization of the substantial vegetation reduction in the Amazon area. The submitted data records can help in connection with dynamic models to estimate the role of land use and changes of land coverage in the biogeochemical cycles better in particular in quantitative regard. The resulting files are available on request of the author. Institution: Library service center Bad- Wurttemberg (BSZ German Federal Armed Forces), Germany, virtual server. URL: http://geb.uni-giessen.de/geb/volltexte/2000/314

Kukharenko, A. A.; Mikhaylov, B. M. and Orlova, M. T. 1971. "K mineralogii kimberlitov Liberiyskogo shchita (Zapadnaya Afrika)." Translated title: "Mineralogy of kimberlites of the

Liberian shield, west Africa." Sovetskaya Geologiya. 11; Pages 91-103. 1971. Notes: Vol. 11. Izdatel'stvo Nedra. Moscow, USSR. Language: Russian. Descriptors: Africa; chemical composition; distribution; igneous rocks; kimberlite; Liberia; Liberian Shield; mineral composition; petrology; plutonic rocks; trace elements; ultramafics; West Africa; Igneous and metamorphic petrology. Illustrations: sketch map. ISSN: 0038-5069.

Kulke, Holger. 1995. "Liberia, Sierra Leone." In: Regional petroleum geology of the world; Part II, Africa, America, Australia and Antarctica- Regionale Erdoel und Erdgasgeologie der Erde; Teil II, Afrika, Amerika, Australien und Antarktis. Beitraege zur Regionalen Geologie der Erde. 22, Part 2; Pages 127-128. 1995. Gebrueder Borntraeger Verlagsbuchhandlung. Berlin-Stuttgart, Federal Republic of Germany. 1995. Language: English. Descriptors: Africa; areal geology; Liberia; petroleum; petroleum-exploration; Sierra Leone; West Africa. ISSN: 0522-7038; ISBN: 3-443-11022-3.

Kümmerly and Frey. 1970. "Liberia." Bern, Switrzerland: Kümmerly and Frey. 1 color map, 50 x 49 cm.. Scale 1:1,100,000. Notes: Prepared for Mobil. Shows roads, railways, county and international boundaries, and Mobil Gasoline stations. Includes distance table. LCCN: gm71-1884.

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Kunkel, G. 1966. "Anmerkungen über Sekundärbusch und Sekundärwald in Liberia (Westafrika)." Translated title: "Notes on Secondary Shrubs and Secondary Forest in Liberia (West Africa)." Plant Ecology. Volume 13, Number 4, July 1966. Pages: 233-248. Summary: The present abstract treats of the secondary formations of the tropical rain forest regions of Liberia. Modified high and swamp forests are analized with their particular succession sequences and compared with the so-called average-types of respective primary or well developed secondary formations. Gallery woods, savannah, mangrove and exploited forest are also discussed. The characteristics of secondary bush and woodland are easy to recognize. The results of investigations undertaken, which were of purely floristic character, confirm that: human influence (the shifting cultivation system) causes serious damage to the structure of natural forest formations; the composition of a specific area of forest is progressively impoverished if the regeneration-cultivation cycle is too short; typical secondary elements are not only more frequent than primary elements but are also characteristic in the floristic structure in general; if the underlying soil is liable to erosion continuous processes of forest degradation can lead to formation of savannah; repeated degradation of swamp forest often leads to an open type of herbaceous vegetation; certain "culture-companions" are conspicuous and serve as indicators for the identification and classification of the degradation or successive stages of such secondary formations. ISSN: 1385-0237.

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Latifi, Mohammad. 2004. Multinational Companies and Host Partnership in Rural Development: A Network Perspective on the Lamco Case. Doctoral thesis, Företagsekonomiska Institutionen, Uppsala Universitet, Uppsala, Sweden. Volume 113. (2006-05-01) Abstract: Multinational companies (MNCs) in less developed countries (LDCs) are regularly contracted to undertake rural development around their sites. Likewise, they regularly fail. How can a profit-making MNC encourage rural development in an undeveloped area? The purpose is to investigate how an MNC could fulfill its commitment in a way that benefits all involved parties. It is urgent and interesting to study how MNCs manage their relationships with non-business and business organizations in LDCs for local development. Starting points are community development and network theories. Non-business actors in business networks are focused, as this proved to furnish the most relevant description and analyze of the interaction of business and non-business organizations. The theoretical discussions explore the infusion of intermediary actors in order to bridge the gap between business and non-business actors. Beside some case studies for manifestation of this problematic issue, the study conducts two field studies at the site. This study follows ten years of Lamco Joint Venture Operating Company in Liberia which promised success in rural development, had it not been for drastically falling prices for iron ore and a civil war. Other MNCs have tried a one-directional way, whereas Lamco did co-operate in a network. The main result is that an intermediary PVO is an effective and efficient means for an MNC to fulfill its contractual commitments for rural development. The main theoretical contributions are the infusion of non-business intermediary actors to connect business and non-business actors, to enhance our understanding of relationships between MNCs and business and non-business actors in LDCs, and to understand the side-effects of business activities. The empirical contributions discuss the

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"Liberia." 1963. No author given. Monrovia? 1963? 1 map, photocopy, 34 x 34cm. Scale 1:1,500,000. Notes: Relief shown by hachures. LCCN: 96-687117.

"Liberia." 1962. Hollywood, CA: Films and Slides. Description: 1 filmstrip (26 fr.): color; 35 mm. Abstract: Depicts three styles of life (rubber plantation, city, and mining community) in the country

of Liberia, the first republic on the continent of Africa. Descriptors: Liberia- Pictorial works. OCLC: 16320296

"Liberia." 1958. Mining Journal Annual Review. Page 163.

"Liberia." 1957. Government of Liberia. Map scale 1:1,000,000. 1 sheet. Notes: Plane coordinates on Hotines Rectified Skew Orthomorphic Projection. Geographic names by the board of Geographic Names of the Republic of Liberia. National boundaries not shown. No field check. Published in 1957 by the Government of Liberia through the Joint Liberia-United States Commission for Economic Development; the United States Coast and Geodetic Survey; the Liberian Cartographic Service and the Bureau of Mines and Geology, Treasury Department, Republic of Liberia. Compiled from shoran controlled mosaics of aerial photographs of 1953 by Aero Service Corporation, Philadelphia, Pa., USA. "497B." Library of Congress, Geography & Map Division.

Liberia. Bureau of Hydrocarbons. 1981. "Distribution of Petroleum in Liberia." Monrovia: The Bureau. 1 map, photocopy, 52 x 65 cm. Scale 1:920,000. Department of Minerals Exploration and Research, Ministry of Lands, Mines and Energy. LCCN: 85-690722.

Liberia. Bureau of Natural Resources and Surveys. Annual report on the activities of the Bureau of Natural Resources and Surveys. Other Titles: Annual report of the activities of the Bureau of Natural Resources & Surveys. Annual report for the period. Monrovia: Bureau of Natural Resources and Surveys. 28 cm. Notes: Title varies slightly. Description based on: 1969/1970. Report year ends Aug. 31. Descriptors: Mines and mineral resources- Liberia. ISSN: 1010-5476. LCCN: 75-640320 //r88.

Liberia. Department of Highways. Unknown date. "Map of Liberia." Notes: "Roads" Scale: 1:500,000. USGS Library- Map Collection.

Liberia. Department of Planning & Economic Affairs. 1970. "Transportation Map of Liberia." Monrovia: The Department. Color map, 56 x 43cm. Scale 1:1,100,000. Notes: "Includes distance chart." LCCN: gm72-2699; gm72-3700.

Liberia. Department of Public Works & Utilities. 1958. "Liberian Highway System: Road Mileage Checked and the Proposed System of National Primary and Secondary Roads." Monrovia: The Department. 1 map, photocopy, 52 x 56 cm., on sheet 77 x 87 cm. Scale 1:986,655. Notes: Also shows airfields and harbors. Drawn by E. R. Tutu. Recommended…, Chief of the Division of Highways, November 3, 1959. Includes distance chart. LCCN: 97-680004.

Liberia, Department of Public Works & Utilities. Office of National Physical Planning. 1968. "Map of Road Maintenance Districts." Monrovia: The Office. 1 map, photocopy, 37 x 37 cm. Scale 1:1,000,000. Notes: Also shows existing and proposed roads. Relief shown by hachures. LCCN: 96-68-468.

Liberia. Department of Public Works and Utilities. Office of Technical Planning. 1966. “Liberia: A Road Map.” Monrovia: The Office. 1 map, photocopy, 39 x 39 cm. Scale 1:1,000,000. Notes: Shows existing and proposed roads. Relief shown by hachures. LCCN: 96-680473.

Liberia, Department of State. 1940. An act regulating the mining and prospecting of all minerals and other natural deposits within the Republic of Liberia; and Executive order no. 6, 1936, and amendment approved, February 20, 1940. Monrovia, Dept. of State. Description: 25 pages. Subjects: Mining law- Liberia. Power resources- Law and legislation. OCLC: 19718711.

Liberia. Division of Highways. 1957. “Liberian Roads and Population Densities.” Monrovia: The division. 1 map, 20 x 40 cm. Scale 1:1,420,000. Notes: Also shows railroads, both existing and under construction. Mosaic data from Resources & Economic Development of Liberia. Joint US-Liberian Commission. 1957. Oriented with north toward upper left. LCCN: 96-687098.

Liberia. Ministry of Foreign Affairs. 1980. An act to amend an Act entitled "An Act to restore and control the diamond industry in Liberia amending and consolidating the laws regulating diamonds and for other purpose"- 1958 and to include the mining and prospecting of gold and other precious minerals or metals within the Republic of Liberia: approved September 21, 1979. Description: 11 pages; 24 cm. Descriptors: Diamond industry and trade – Law and legislation- Liberia. Notes: Cover title. "January 21, 1980." LCCN: 2001-427111; OCLC: 52160303.

Liberia. Ministry of Lands, Mines and Energy. 1994. “Petroleum Exploration Opportunities in the Republic of Liberia.” Ministry of Lands, Mines & Energy unpublished un-numbered publication, 13 pages. AMRS, Inc. See: http://www.africaminerals.com/

Liberia. Ministry of Lands, Mines and Energy. Unknown date (1980's). “Mineral Resources and Concession Map of Liberia.” 1:1,000,000 scale map by Liberia Ministry of Lands, Mines and Energy blue line copy with no number or authorship. 1:125,000 scale map by Liberia Geological Survey blue line copy with no number, date or authorship. AMRS, Inc. See: http://www.africaminerals.com/

“Liberia. Mines & Minerals- Iron.” 1941. USGS. Prepared in cooperation with the republic of Liberia. Scale 1:1,000,000. Notes: Blueline print. W. part of Liberia, showing principal iron deposits, strike rock formations, etc. Library of Congress, Geography & Map Division.

Liberia. Ministry of Lands and Mines. Monrovia: Ministry of Lands and Mines. 1972- .“Report of the activities of the Ministry of Lands and Mines for the period ...” Other Titles: Annual report. Descriptors: Liberia. Ministry of Lands and Mines; Mines and mineral resources-Liberia; Periodicals; Surveying- Liberia. Periodicals. ISSN: 0304-7296; LCCN: 75-644089; OCLC: 2245983.

Liberia. Ministry of Lands, Mines, and Energy. 1980- . Annual report for the period ... [Monrovia, Liberia]: The Ministry. 28 cm. Notes: Description based on: Jan. 1, 1988 to Dec. 31, 1988; title from cover. Descriptors: Liberia. Ministry of Lands, Mines and Energy Periodicals; Mines and mineral resources Liberia. Periodicals. LCCN: 89-644120; OCLC: 10525887.

Liberia. Ministry of Public Works. Bureau of Operations. 1979. “Liberia Road Network.” Monrovia: The Bureau. 1 map, photocopy, 119 x 95 cm. Scale 1:500,000. Notes: Prepared by SAUTI-ICE, consulting engineers, advisory services, road maintenance; assisted by Planning Division, M.P.W. Shows paved roads as of August 1979 and roads to be paved by June 1980. LCCN: 85-690726.

Liberia. Ministry of Public Works. Planning and Programming Bureau. 1982. “Highway Functional Classification System: Liberia.” Monrovia: The Bureau. 1 map on two sheets, photocopy, 100 x 100 cm., sheets 125 x 61 cm. Scale 1:500,000. Notes: Traced by William C. Gray, approved by J. B. Freeman. February 26, 1982. LCCN: 85-690725.

Liberia 1:50,000. 1983. Liberian Cartographic Service. Great Britain; Directorate of Overseas Surveys. Great Britain. Ordnance Survey; Great Britain. Directorate of Overseas Surveys. Publication: Monrovia: Service [and] Directorate of Overseas Surveys, Southampton, England. Edition: Ed. 1-LCS/DOS. Description: maps: color; 74 x 59 cm. Or smaller on sheets 79 x 79 cm. or smaller. Series: Series LIB 50; Variation: LIB 50 (Series). Descriptors: Liberia- Maps, Topographic; Sierra Leone- Maps, Topographic. Map Info: Scale 1:50,000; Transverse Mercator proj. WGS 72 spheroid; (W 11030’--W 7015’/N 8045’--N 4015’). Notes: Relief shown by contours, spot heights and landform. Includes administrative boundaries map, index to adjoining sheets, magnetic declination diagram, grid zone designator and conversion table on each sheet. Includes parts of Guinea and Sierra Leone. Earlier sheets prepared jointly by the Government of Liberia (Liberian Cartographic Service) and the Government of the United Kingdom (Directorate of Overseas Surveys). Earlier sheets have the ed. statement: Ed. 1-LCS/DOS. "Published by the Government of the United Kingdom (Ordnance Survey) for the Government of Liberia (Liberian Cartographic Service)." Grid: UTM. Includes sheet history, conversion table, administrative boundary diagram, and index to adjoining sheets. Responsibility: prepared jointly by the Government of Liberia (Liberian Cartographic Service) and the Government of the United Kingdom (Directorate of Overseas Surveys). Other Titles: Some sheets titled: “Liberia 1:50,000 with part of Guinea”; Some sheets titled: “Liberia 1:50,000 with part of Côte d'Ivoire.” Responsibility: prepared jointly by the Government of Liberia (Liberian Cartographic Service) and the Government of the United Kingdom (Ordnance Survey) under the UK Government's Technical Co-operation Programme. LCCN: 97-680175; OCLC: 16575384; 36857082.

Liberia: [mineral resources]. 1994. No author given. No place of publication given. 1 map, photocopy, 24 x 17 cm. Scale 1:3,000.000. Notes: Shows undeveloped mineral resources. Includes location map. LCCN: 97-687532.

Liberia: [mineral resources]. 1970. Liberian Cartographic Service. [Monrovia]: The Service. Description: 1 map: photocopy; 49 x 57 cm. Descriptors: Mines and mineral resources- Liberia- Maps. Map Info: Scale ca. 1:986,666; (W 11030’--W 7030’/N 8030’--N 4030’). Notes: "November 1956." Blue line print. Includes table of "Liberia grand total suplus [sic] commodities." Responsibility: Liberian Cartographic Service. LCCN: 96-687104; OCLC: 36191221.

“Liberia Builds First Railroad.” 1950. Business Week. March 25, 1950, pages 136-139. Abstract: News note of a narrow gauge railroad line built by the Liberia Mining Company, and American

enterprise by Republic Steel, operating under a new government concession at the Bomi iron mines. ISSN: 0007-7135.

"Liberia Gets Its First Power Dam." 1944. Business Week. 11 March 1944. Page 109. ISSN: 0007-7135.

"Liberia is Newest Foreign source for United States Iron." 1951. Business Week. 30 June 1951. Pages 24-25. ISSN: 0007-7135.

"Liberia: Road Classification Map." 1981? Monrovia: no publisher given. 1 map, photocopy, 50 x 47 cm. Notes: In right upper margin: "Planning and Development Atlas." Annotated in pencil and various colored inks to show road classification. LCCN: 85-690712.

Liberia, Wirtschaftsdaten und Wirtschaftsdokumentation (Economic parameters and economic documentation). 1989. Bundesstelle fuer Aussenhandelsinformation (Federal Agency for foreign trade information). Cologne, Federal Republic of Germany. Pages: 2. 1989. Language: German. Descriptors: Africa; economics; Liberia; mineral economics; mineral resources; policy; West Africa; Economic geology, general, economics. ISSN: 0175-114X.

Liberia. Western Mining Corporation. 1989. An Act Approving the Agreement for a Joint Undertaking between the Republic of Liberia and WMC (Liberia) Limited. [Liberia?]: s.n. Description: 1 v. (various foliations): map; 30 cm. Language: English. Descriptors: Mining leases- Liberia. Named Corp: Western Mining Corporation (Liberia). Notes: Includes the text of the agreement. Other Titles: Act Approving the Agreement for a Joint Undertaking between the Republic of Liberia and Western Mining Corporation (Liberia) Limited. LCCN: 94-149062.

Liberia. Unknown date. "Transportation Map of Liberia." Scale: 1:1,100,000. USGS Library- Map collection.

"Liberia Expands Hydropower." 1990. ENR. Volume 224 (June 7 1990) page 27 et seq. Descriptors: Hydroelectric power plants- Construction; Dams- Construction; Electricity supply- Liberia. ISSN: 0891-9526.

The Liberia Mining Company: twenty years of growth and development. 1967. Monrovia: Mass Communications. 16 pages: ill. 28 cm. Named Corporation: Liberia Mining Company. Notes: Cover title. Includes bibliographical references. OCLC: 3008207.

"Liberia's Mineral Resources." Engineering and Mining Journal v. 186 (October 1985) p. 26. Descriptor: Mines and mineral resources- Liberia. ISSN: 0095-8948.

"Liberia's National Biodiversity Strategy and Action Plan." 2004. Abstract: The rocks of northern Liberia generally form part of the West Africa Cretan, recognized by its stability and general absence of tectonic activity during the last 2.5 billion years. This old and stable base was subsequently penetrated by younger rocks and then covered by metasedimentary and metavolcanic rocks of at least two younger tectonic events. The rocks of Liberian Age extend into neighboring Sierra Leone, Guinea, and Ivory Coast and predominately are highly foliated granitic gneisses

exhibiting a regional foliation and structural alignment in a northeasterly direction. Major faults along sections of the Lofa and the St. John River are parallel to regional lithological units and have significantly influenced present topography. Massive unfoliated to weakly foliated granitic rocks exist over large areas in the extreme north of the country. Within the Liberian Age Province are Metasedimentary rocks, such as quartzites, amphibolites, pelitic schists and banded ironstones technically called itabarite. Granitic gneisses and the metasedimentary rocks have been intruded by numerous northwest trending diabase dikes. These are parallel to the coast and represent intrusive activity associated with the onset of continental break-up in Jurassic time. Rocks of Eburnean Age are restricted to southeast Liberia where they extend into the Ivory Coast. Their structural trend is similar to those of the Liberian Age Province but is more biotite rich. A major tectonic feature within rocks of the Eburnean Age province is the Dube shear zone. It intersects the coastline about 40km west of Harper and strikes a NNE direction into the Ivory Coast. It is 2 to 3km wide and has been delineated on the basic of outcrops, topography and magnetic data. Rocks of the Pan-African Age are found along the coast from northwest of Greenville in the southeast to Sierra Leone. Unlike the northeastern regional trends of both the Liberian and Eburnean Age Provinces, structural trends within the Pan-African Province generally are northwesterly and parallel to the coastline. The rock types in this province range from basic igneous to peletic rock metamorphosed to the granulite and amphibolite grades. The Post Pre-Cambrian rocks in Liberia outcrop principally along the low-lying coastal area between Monrovia and Buchanan. Two onshore, sediment-filled basins also are located along this section of the coastline: the Roberts Basin filled with sediments of the Farmington River formation and Paynesville sandstone, and the Bassa Basin filled with material from the St. John River Formation. Rocks found in Liberia have been of economic importance and should continue to be in the future. Crystalline Rocks (igneous and metamorphic) are used locally in the construction industry as roadbed materials in building construction and as foundation stones in building construction. Post Pre-Cambrian rocks are used in the building industry where beach and river sands form the major constituents in the manufacture of concrete blocks. See: http://www.biodiv.org/doc/world/lr/lr-nbsap-01-p1-en.doc

“Liberia’s New Boundary.” 1908. Washington: American Geographic Society. Bulletin. Volume 40, pages 21-22.

Liberian American-Swedish Minerals Company. 1961. Liberia. Liberian American-Swedish Minerals Company (LAMCO). Joint venture. Maps, scale 1:125,000. Notes: Coverage of Liberia of the middle third of Liberia from the coast northeastward across the country.

Liberian American-Swedish Minerals Company. 1960. LAMCO joint venture agreement between the Liberian American-Swedish Minerals Company and Bethlehem Steel Corporation, dated as of April 28, 1960. Liberia? : Govt. of the Republic of Liberia. 1 volume (various pagings); 27 cm. Descriptors: Mines and mineral resources- Liberia; Joint ventures-Liberia; Community development- Liberia. Named Corporations: LAMCO. Bethlehem Steel Corporation. LCCN: 00-691243; OCLC: 47001947.

Liberian Cartographic Service. 1977. “Transportation Map of Liberia.” Monrovia: The Service. May 1977. 1 map, photocopy; 101 x 101cm. Scale 1:500,000. Notes: “Based on a planimetric map of Liberia. Includes distance chart. Series Number LCS-21-77. LCCN: 85-690696.

Liberian Cartographic Service. 1976. “Map of National Forests and Related Data.” Prepared by the Liberian Cartographic Services, Ministry of Lands and Mines. March 1976. Scale 1:1,000,000. 1 map, photocopy, 56 x 57cm. Notes: Shows forest concession areas. Forests and related data supplied by the Ministry of Agriculture. Series: LCS-18-76. LCCN: 85-690740.

Liberian Cartographic Service. 1976. “Transportation Map of Liberia.” Monrovia: The Service. May 1977. 1 map, photocopy; 71 x 57cm. Scale 1:500,000. Notes: “Based on a planimetric map of Liberia. Includes distance chart. Series Number LCS-21-77. LCCN: 85-690694.

Liberian Cartographic Services. 1974. “Map of Hospitals and Clinics in Liberia.” Monrovia: The Service. 1 map, photocopy, 71 x 57 cm. Scale 1:1,000,000. Notes: Prepared by the Liberian Cartographic Service, Ministry of Lands & Mines. Information obtained from the Ministry of National Health and Social Welfare, Republic of Liberia. Series no. LCS-4-74. LCCN: 85-690698.

Liberian Cartographic Service. 1957. “Communication map, Liberia.” [Monrovia]: The Service. Description: 1 map; 17 x 24 cm. Descriptors: Transportation- Liberia- Maps. Scale [ca. 1:2,400,000]. Notes: Shows roads, railroads, airfields, lighthouses, and radio stations. "Feb. 1957." Oriented with north toward upper left. Relief shown by hachures and spot heights. LCCN: 96-687118; OCLC: 36191276.

Liberian Cartographic Service. 1956. “Liberia [Mineral Resources].” Monrovia: Liberian Cartographic Service. 1 map, photocopy, 49 x 57 cm. Scale 1:986,666. Notes: November 1956. Blue line print. Includes table of Liberia grand total suplus [sic] commodities.” LCCN: 96-687104.

Liberian Cartographic Service. 1956. “Liberia [Road Map].” Monrovia: Liberian Cartographic Service. 1 map, photocopy, 56 x 66 cm. Notes: Shows road classification, proposed roads and railroads. Proposed road information DPWU, Division of Highway and other sources. Original by LCS March 1955. Blue line print. LCCN: 96-687115.

Liberian Cartographic Service. 1956. Republic of Liberia Geographic Names. No place of publication given. 1950-1959? Description: 29 leaves; 27 cm. Descriptors: Names, Geographical- Liberia. Notes: "Reprinted in Liberia, November 1956, by Liberian Cartographic Service." Includes index. LCCN: 78-112121; OCLC: 6086847.

Liberian Cartographic Service. 1955. Yearly rainfall and average temperature: [Liberia]. Monrovia. Liberian Cartographic Service. Description: 1 map; 17 x 22 cm. Descriptors: Rain and rainfall- Liberia- Maps; Atmospheric temperature- Liberia- Maps. Scale ca. 1:2,902,400; (W11030’--W 7030’/N 8030’--N 4030’). Notes: Shows "average temperature for the years 1954-1955." Base map: Republic of Liberia. Liberian Cartographic Service, 1952. LCCN: 96-687105; OCLC: 36191226.

Liberian Cartographic Service. 1954. Hydrographic survey, Freeport of Monrovia, Liberia. [Monrovia]: The Service. Description: 1 map: photocopy; 69 x 81 cm. Descriptors: Harbors - Liberia- Monrovia- Maps. Scale 1:5,000. Notes: "September 1954." Depths shown by contours and soundings. Blue line print. Other Titles: Freeport of Monrovia, Liberia. LCCN: 97-680002; OCLC: 36337373.

Liberian Cartographic Service. 1952. “A Proposed System of National Highways: Republic of Liberia.” [Monrovia]: The Service. Description: 1 map: photocopy; 48 x 64 cm. Descriptors: Highway planning- Liberia- Maps; Roads- Liberia- Maps. Scale 1:970,000. Notes: At head of Republic of Liberia, Department of Public Works & Utilities, Technical Cooperation Administration, Bureau of Transportation. Blue line print. LCCN: 96-687109; OCLC: 36191240.

Liberian Cartographic Service. 195- . “Liberian, Number of Huts per Photo Mosaic.” Monrovia?: The Service. 1 map, 21 x 24 cm. Scale not given. LCCB: 96-687102.

Liberian Cartographic Service and [Liberian] Department of Public Works & Utilities. 1959. Liberian highway system: road mileage checked and proposed system of national primary and secondary highways. [Monrovia]: The Department. Description: 1 map: photocopy; 52 x 56 cm., on sheet 77 x 87 cm. Descriptors: Roads- Liberia- Maps; Highway planning- Liberia- Maps. Scale ca. 1:986,655. Notes: Also shows airfields and harbors. "16-10-59." "Drawn by E. R. Tutu." "Recommended ... Chief, Division of Highways, November 3, 1959." "Base map by Liberian Cartographic Service." Includes distance chart. LCCN: 97-680004; OCLC: 36337384.

Liberian Cartographic Service and U.S. Coast and Geodetic Survey. 1952. Preliminary survey of Cape Palmas Harbor, Liberia. [Monrovia?]: The Service. Description: 1 map; on sheet 90 x 121 cm. Descriptors: Harper (Liberia)- Harbor- Maps. Scale ca. 1:2,400; (W 7043’/N 4025’). Notes: Relief shown by contours, hachures, and bath. soundings. Other Titles: Cape Palmas Harbor, Liberia. Hydrography by Liberian Cartographic Service; topographic compilation by U.S. Coast and Geodetic Survey. OCLC: 10781181.

Liberian Geological Survey. 1982. “Diamond Producing Areas, Gold and Associated Mineral Occurrences in Liberia with Their Status of Exploration.” 1:1,000,000 scale map by Liberia Geological Survey blue line copy with no number or authorship. AMRS, Inc. See: http://www.africaminerals.com/

Liberian Geological Survey. 1985. “Mineral Resources Map of Liberia.” 1:1,000,000 scale map by Liberia Geological Survey, blue line copy with no number or authorship. With WMC annotations from 1989-90. AMRS, Inc. See: http://www.africaminerals.com/

Liberian Geological Survey. 1985. “Mineral Resources Map of Liberia.” 1:1,000,000 scale map by Liberia Geological Survey copy with no number or authorship. Primary gold areas of Liberia outlined. AMRS, Inc. See: http://www.africaminerals.com/

Liberian Geological Survey. 1981-. Annual report. Monrovia: Liberian Geological Survey. 28 cm. Notes: Description based on: October 30, 1981; title from cover. Report year ends Aug. 31. Descriptors: Liberian Geological Survey, Periodicals.; Geological research, Liberia, Periodicals; Geology Periodicals. LCCN: 76-641319 //r86; OCLC: 2436513.

Liberian Geological Survey. Bulletin. Other titles: Bulletin of the Liberian Geological Survey. Bulletin- Republic of Liberia, Bureau of Natural Resources and Surveys, Geological Survey.

Monrovia: The Survey, 1967- . Language: English. Illustrations, maps; 23 cm. ISSN: 0459-2204; LCCN: 73-432442; OCLC: 5356681.

Liberian Geological Survey. Memorandum report – Liberian Geological Survey. Monrovia. Description: v.; illus.; 28 cm. Language: English. Descriptors: Geology- Liberia- Surveys. Document Type: Serial. OCLC: 48117550.

Liberian Geological Survey. 1985. "Mineral Resources Map of Liberia." Monrovia: The Survey. 1 map, photocopy, 96 x 92 cm. Scale 1:500,000. Revised May 1985. LCCN: 91-682167.

Liberian Geological Survey. 1979. "Mineral Resources Map of Liberia." Monrovia: The Survey. 1 map, photocopy, 48 x 49 cm. Scale 1:1,000,000. Notes: December 1979. LCCN: 85-690703.

Liberian Geological Survey. 1969. "Republic of Liberia: Mineral Resources Map." No place of publication given. January 2, 1969. 1 map 32 x 30 cm. Scale 1:1,750,000. Notes: Sinkor? Prepared by Liberian Geological Survey, Bureau of Natural Resources & Surveys. LCCN: gm69-2021.

"Liberian Gold Confirmed for Mano River." 1999. Mining Journal. Number 332, page 256. ISSN: 0026-5225; OCLC: 02438984.

Liberian Information Service. 1963. "Liberia, Agricultural Resources Map." Produced and printed by the Liberian Information Service, in co-operation with US/AID. [Monrovia]: The Service. Related Names: United States. Agency for International Development. Cartographic Material. Description: 2 maps on 1 sheet; sheet 36 x 27 cm. Scale not given. Contents: [Rubber, oil palm products, and palm fiber]- [Coffee, cocoa, and kola nut]. Descriptors: Agricultural resources- Liberia-Maps; Crops- Liberia- Maps. LCCN: 96-687112.

Liberian Information Service. 1963. Liberia: Mineral Resources. Monrovia: The Service. 1 map, color, 31 x 31 cm. Scale not given. Notes: Produced by the Liberian Information Service in cooperation with the Bureau of Natural Resources and Surveys. LCCN: 96-687114.

Liberian Mining. 1970- . London, The Townsman. Description: No. 1 (1970)-; v.; illustrations. Descriptors: Mines and mineral resources- Liberia- Periodicals; Mining engineering- Periodicals. Notes: "Journal of mining development, geology and new equipment in the Republic of Liberia." Serial. OCLC: 9691927.

"Lofa River plantation proposed dock: Site plan." 1968. B.F. Goodrich Liberia, Inc. Corporate Name: Stanley Engineering Company. Monrovia, Liberia and Muscatine, Iowa, 1968. Cartographic Material. Description: map 27 x 41 cm. Scale Information: Scale 1:600. Notes: Photocopy. "Figure 1." Oriented with north toward the lower left. Descriptors: Lofa River, Liberia-Maps. LCCN: 69-000728; OCLC: 27212467.

Lok, Joris Janssen. 2004. "ISIS is deployed to Liberia on board the LPD Rotterdam (integrated staff information system) (landing platform dock)." Jane's International Defense Review. Volume 37. July 2004: page 25. Abstract: The Royal Netherlands Army (RNLA)'s command-and-control information system integrated staff information system (ISIS) is deployed in a maritime

context during the deployment of the Royal Netherlands Navy (RNLN) landing platform dock (LPD) to Liberia. The ISIS system designed to enable the users to maintain and update information about ongoing land operations on a digital map is presented.

Lombard, Jean and Furon, Raymond. 1963. "Carte Gèologique de l'Afrique." Association of African Geological Surveys. Paris: ASGA-UNESCO. United Nations Educational, Scientific and Cultural Organization. Natural resources research. Number 3. Notes: Sheet 4 covers Liberia. LCCN: map 64-306; OCLC: 506488.

Luehrmann, W. H. 1969. "Seismic profile across the Atlantic." In: Unconventional methods in exploration for petroleum and natural gas. Heroy, W. B. (editor). Pages 127-137. Southern Methodist University. Dallas, TX, United States. Abstract: Film, cross section of deep ocean floor and sub-bottom sedimentary layering, Trinidad, B.W.I. and Monrovia, Liberia. Descriptors: Atlantic Ocean; bottom features; geophysical methods; geophysical surveys; marine geology; oceanography; seismic methods; surveys; West Indies- Liberia; oceanography. Notes: A symposium under the auspices of the Institute for the Study of Earth and Man, Southern Methodist University. Illustrations.

Lyday, Phillis A. 198? "The mineral industry of Liberia." U. S. Bureau of Mines, United States. Pages: 6. Descriptors: Africa; economic geology; economics; Liberia; mineral resources; production; review; West Africa; Economic geology,-general,-economics. Notes: Preprint from Minerals Yearbook, 1978-79, U. S. Bureau of Mines. USGS Library.

Lynch, William Francis (1801-1865). 1853. "Maryland in Liberia." United States. Navy Dept. Publication: [Washington, D.C.: U.S. Senate. Description: 1 map; 39 x 64 cm. Series: Senate ex. doc.; no. 1, 1st sess., 33d Cong.; [American Colonization Society map collection; number 14]; Variation: Senate executive document (United States. Congress. Senate); 33rd Congress, 1st session, no. 1. Descriptors: Maryland County (Liberia)- Maps. Notes: Relief shown by hachures. Depths shown by soundings. Inset: Cape Palmas. Available also through the Library of Congress Web site as a raster image. Map Info: Scale [ca. 1:245,000]; (W 7050'--W 6040'/N 5000'--N 4020'). LCCN: 96-684992; OCLC: 37986398; Access Path: http://hdl.loc.gov/loc.gmd/g8883m.lm000016

Lynch, William Francis (1801-1865). 1853. "Republic of Liberia." United States. Navy Dept. Washington, D.C.: U.S. House. Description: 1 map; 70 x 108 cm. Series: House executive. documents.; no. 1, 1st session, 33 Congress; [American Colonization Society map collection; 9]; Variation: Ex. doc. (United States. Congress. House); 33rd Congress, 1st session, no. 1. Subjects: Coasts- Liberia- Maps. Notes: Shows Liberian coastal area. Relief shown by hachures. Depths shown by soundings. Insets: Monrovia and Cape Musurado- Junk River and Marshall- Edina and Grand Bassa- Cestos- Sangwin River- Sinou. Available also through the Library of Congress Web site as a raster image. Map Info: Scale [ca. 1:485,000]; (W 120--W 80/N 70--N 50). LCCN: 96-684989; OCLC: 37986391; Access Path: http://hdl.loc.gov/loc.gmd/g8882c.lm000001

Maasha, Ntungwa. 1983. "Erosion of the Monrovia beaches." In: Geology for development; mineral resources and exploration potential of Africa. Kogbe, Cornelius A. (editor). Journal of African Earth Sciences. 1; 3-4, Pages 364. 1983. Pergamon. London-New York, International.

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levels. Infant foods were particularly heavily contaminated. It is concluded that when water supply programs are planned, the presence of other risk factors for water-related diseases should be investigated. To ensure maximum health benefits, water projects should, as a rule, be accompanied by other interventions. The hazardous practices of storing large quantities of drinking water in open containers, for example, as well as storage of cooked food, must be discouraged as must the potential dangers of bottle-feeding and unhygienic practices during weaning. Breastfeeding and hygienic handling of food should be encouraged. Descriptors: developing countries; public health; human diseases; drinking water; water supply; potable water; hygiene; bacteria; pathogens; enterobacter; Africa; Liberia.

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left hundreds of thousands more without access to food or clean water. With 200,000 displaced people crammed alongside the city's one million inhabitants, there is concern that an outbreak of cholera could run unchecked amid the squalor and carnage of the siege. Medecins Sans Frontieres had been treating 350 patients a week until its cholera clinics were overrun by rebel forces in the latest attack, when the town's only water treatment plant was also destroyed. Health workers fear that conditions will continue to deteriorate until a proposed US/Nigerian peacekeeping force arrives. "The epidemic of cholera now raging through Monrovia will only worsen if water and sanitation services are not provided immediately," says Sam Nagbe, who works in Monrovia for Oxfam. "People here are really suffering, but as long as the fighting continues we are unable to help them. If peacekeepers do not come, there will be a doomsday scenario."

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Onstott, T. C.; Hargraves, R. B.; York, Derek and Hall, Chris. 1984. "Constraints on the motions of South American and African shields during the Proterozoic; I, (super 40) Ar (super 39) Ar and paleomagnetic correlations between Venezuela and Liberia." Geological Society of America Bulletin. 95; 9, Pages 1045-1054. 1984. Geological Society of America (GSA). Boulder, CO, United States. Abstract: The Encrucijada Pluton of Venezuela and amphibolites near Harper, Liberia, are located on opposite sides of the Liberian Pan-African mobile belt, when South America is restored in a fit described in the literature with respect to Africa. Both units yield stable, bipolar, high-temperature magnetizations that, on the basis of thermal demagnetization data, (super 40) Ar (super 39) Ar hornblende and biotite radiometric results, and Rb-Sr whole-rock and biotite radiometric results, appear to be indistinguishable in age at 1.9 to 2.0 Ga. With South America in this reconstruction, the corresponding paleomagnetic poles suggest that approximately 1,000 km of right-lateral motion has occurred between the West African and Guyana shields, probably along the Liberian Pan-African Belt. Furthermore, the Encrucijada and Harper poles are distinct from the 1.9 to 2.0-Ga paleomagnetic poles from the Kalahari Shield and tentatively suggest that relative motion has occurred between the Kalahari Shield and on the West African and Guyana shields since that time. Descriptors: absolute-age; Africa; amphibolites; Ar-Ar; Atlantic-region; continental-drift; crystalline-rocks; dates; Eastern Venezuela; Encrucijada Pluton; faults; granites; Guyana Shield; Harper; igneous rocks; Kalahar -Shield; La-Encrucijada; Liberia; metamorphic rocks; movement; orogeny; paleogeography; paleomagnetism; Pan African Orogeny; plate tectonics; plutonic rocks; pole positions; Precambrian; Proterozoic; Rb-Sr; South America; stratigraphy; strike slip faults; tectonophysics; upper Precambrian; Venezuela; West Africa; West African Shield; Solid earth geophysics. References: 48; illustrations, including 2 tables, sketch maps. ISSN: 0016-7606.

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Orogun, P. S. 2003. “Plunder, Predation and Profiteering: The Political Economy of Armed Conflicts and Economic Violence in Modern Africa.” Perspectives on Global Development and Technology, Volume 2, Number 2, 2003, pages 283-313(31). Abstract: This paper presents a comparative analytical study that is based on a political economy perspective concerning the effects of economic violence and the specter of predation-induced armed conflicts in modern African states. Although "blood diamonds," crude oil, "conflict timber," and illicit arms trafficking have engendered and exacerbated civil wars, cross-border raids, and protracted regional destabilization in Angola and the Democratic Republic of Congo, my primary focus is on the ongoing military debacle in Liberia and the recently concluded mayhem in Sierra Leone. The "resource curse" hypothesis will be utilized to examine and to illuminate the impact of economic pillaging, illicit arms trade, and predatory warlordism on the political instability and humanitarian atrocities in these two West African countries. A review of the internal regime types and the regional security relations within the sub-region will help to contextualize the recurrent trends and discernable systemic patterns that have been associated with these pillaging wars in the post-cold war era of Africa's international relations. In short, armed conflicts have weakened state capabilities, strained the financial resources of nongovernmental organizations and even raised provocative questions about the political will and sustaining capacities of the international community and regional security organizations to keep the peace and create conditions that are conducive to long-term, sustainable and viable political stability and economic development in the conflict-ridden and war-ravaged Sub-Saharan African States.

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“Overview of land-based sources and activities affecting the marine, coastal and associated freshwater environment in the West and Central African region.” 1999. UNEP Reg. Seas Rep. Stud. no. 171, 117 pp. 1999. Descriptors: anthropogenic factors; international cooperation; environmental assessment; pollution effects; coastal zone management; urbanization; land use; marine environment; inland water environment; resource management; socioeconomic aspects; fishery resources; Africa, Northwest; Angola; Nigeria; Senegal. Abstract: This document provides a regional overview on land-based sources and activities affecting the marine, coastal and associated freshwater environment in the West and Central African region. It addresses natural conditions and processes, anthropogenic impacts and its socio-economic implications, including losses of cultural heritage sites. This overview also contains information on emerging and foreseeable problems in the region, proposing priorities for action including regional and international activities for cooperation. This document encompasses the following nations: Angola, Benin, Chad, Congo (Democratic Republic), Cote d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mauritania, Nigeria, Sao Tome and Principe, Senegal and Togo. In summary,

information received from various WACAF countries and obtained from a number of other sources shows that the major issues related to the marine, coastal and associated freshwater environment pollution in the region include: (a) The decline of water quality, due to land-based human activities, such as the introduction of sewage and waste water from industrial, domestic and agricultural run off as well as coastal urbanization; (b) Physical degradation and habitat modification; and (c) Fishery resources depletion and the loss of marine biodiversity. The socio-economic and cultural implications can be tremendous in terms of income reduction arising from a loss of fisheries stocks and catches, recreation and tourism amenities, increase of water treatment and coastal protection costs. Because of the lack of detailed scientific data on coastal, marine and freshwater environment in the WACAF region, a certain degree of uncertainty prevails in assessing the pollution load in general. There is an urgent need for a precise qualitative and quantitative assessment of the significant sources of land-based pollution in the region. Notes: 49 tables and 16 figures. ISBN: 9280718003.

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Perlack, R. D.; Barron, W. F.; Samuels, G. and Rhinelander, R. E. 1985. Analysis of the Costs of Fuel Supply for Wood-Fired Electric Power Plants in Rural Liberia. Oak Ridge National Lab., TN, United States. Report number: ORNL6136. June 1985. 66p. Descriptors: Cost; Economic Analysis; Rural Areas. Liberia; wood fuels; wood fuel power plants. Abstract: In recent years the quality of rural electric services in Liberia has been declining and the future economic viability of these power stations is a growing concern. Each of the ten operating and each of the planned rural public

power stations is designed to operate exclusively on gas oil (diesel fuel). Fuel expenditures by the Liberian Electricity Corporation (LEC) for the rural public stations represent a major and growing burden on the financially hard-pressed utility. Liberia has two potentially significant alternatives to oil-fired electric power for its up-country towns: small (1 to 5 MW) hydroelectric facilities, and wood-fired steam or gasifier plants (0.2 to 2 MW). Although small hydroelectric facilities appear viable for several locations, they cannot serve all locations and will require thermal back-up. The economics of supplying wood to a rural electric power plant or rural grid were evaluated under several scenarios involving: (1) different sources of the feedstock, and (2) differences in wood supply requirements for plants based on the use of steam or gasifier technology, and variation in the utilization level for such plants. With a few minor exceptions, wood energy supplies are plentiful throughout Liberia. Liberia has four different potential sources of wood fuel supply: the commercial cutting of retired rubber trees; the harvesting of secondary growth forest just prior to the land returning to temporary cultivation as part of a system of shifting agriculture; adding to the system of shifting agriculture the planting of fast-growing wood species and harvesting these trees when the land again is brought back under cultivation (generally after about five to seven years); and the establishment of commercial short-rotation wood energy plantations. Results indicate that the use of wood to fuel rural power stations is a viable economic option. NTIS Number: DE85015026XSP.

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depth, and crown diameter, when compared at a standardized size of 15-cm diameter at breast height, and how their architecture changed early during ontogeny. Tree height was positively correlated with adult stature and light demand. By producing a relatively slender stem, large-stature species are able to rapidly reach their reproductive size, at a low cost for construction and support. Light-demanding species need a slender stem to be able to attain or maintain a position in the canopy. Both crown depth and crown diameter are negatively correlated with adult stature, but not with light demand. This is in contrast with the hypothesis that shade-tolerant species should have a shallow crown to reduce self-shading in a light-limited environment. Investing energy in height growth rather than lateral crown growth allows a rapid vertical stem extension, but crown diameter has to be sufficiently small to reduce the risk of mechanical failure. All architectural patterns were maintained during ontogeny. The key factors driving interspecific differences in tree architecture are the costs of height extension and mechanical stability. In general, light demand and adult stature represent independent axes of architectural differentiation, affecting tree architecture in different ways. References: 28. Descriptors: Plant ecology: general; shade tolerance. ISSN: 0012-9658.

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Rosenblum, Sam. 1969. “Preliminary spectrographic analyses of monazite from western Liberia.” [Menlo Park, Ca. s.n.]: US Geological Survey. Liberian Geological Survey. United States. Agency for International Development. 11 leaves: map; 27 cm. Series: Open-file report (Geological Survey (U.S.)); 1318. Notes: "Part of the cooperative geologic program currently being conducted by the Liberian Geological Survey and the U.S. Geological Survey under the auspices of the Liberian Government and the Agency for International Development, U.S. Dept. of State." Referred to in press release dated October 24, 1969. Bibliography: leaf 11. Descriptors: Monazite Liberia; spectrum analysis. USGS Library.

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(Geological Survey (U.S.)); 1434. Notes: Bibliography: leaf 12. Descriptors: Sand,-Glass-Liberia-Monrovia. LCCN: 76-374144 //r83; OCLC: 1809483.

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Rozario, Paul. 2003. Liberia. Milwaukee, Wis.: Gareth Stevens Pub. 2003. 96 pages: ill. (some color), color maps; 26 cm. Series: Countries of the world. Contents: Overview of Liberia: Geography- History- Government and the economy- People and lifestyle- Language and literature- Arts- Leisure and festivals- Food- Closer look at Liberia: American colonization society- Birds of Liberia- Dan masks- Diamonds; a controversial resource- Indigenous alphabets- Joseph Jenkins Roberts- Kpelle- Liberian folktales- Logging and the environment- Mining- Monrovia- River Horse- Rubber- Vai arts- William Tubman- Relations with North America. ISBN: 0836823664 (lib. bdg.); LCCN: 2003-45560. Abstract: Provides an overview of the geography, history, government, people, arts, foods, and other aspects of life in Liberia. Descriptors: Liberia- Juvenile literature. Notes: Includes bibliographical references (p. 94) and index. Material Type: Juvenile (no specific ages). OCLC: 51984958

Rupert, James. 1999. “Diamond Hunters Fuel Africa's Brutal Wars; In Sierra Leone, Mining Firms Trade Weapons and Money for Access to Gems.” Washington Post (October 16, 1999):A, 1:2. Photograph; Map. Abstract: The key role of mining interests in the fighting was nothing new in Sierra Leone. The eight-year conflict that has shattered this country and brutalized its 5 million people has been fueled by foreigners' hunger for diamonds. Rival mining companies, security firms and mercenaries- from Africa, Europe, Israel and the former Soviet Union- have poured weapons, trainers and fighters into Sierra Leone, backing the government or the rebels in a bid to win cheap access to diamond fields. Charles Taylor, president of Sierra Leone's neighbor, Liberia, and his son, Charles Jr., have helped the RUF obtain foreign arms and military training, said African and Western military intelligence sources and Liberians. An American with military experience described watching at Liberia's main airport as members of one of the president's security forces supervised the unloading of two truckloads of automatic rifles and ammunition that he said were then sent to the Sierra Leonean border. A Liberian government spokesman denied that Taylor or his son had provided weapons to the RUF, or had interests in Sierra Leone's diamond trade. International diamond merchants and other sources say that by helping the RUF control Sierra Leone's diamond fields, Liberia can divert more Sierra Leonean diamonds through its territory on the way to world markets, reaping part of the profits. Descriptors: Civil war; Military sales; Mining industry; Diamonds. ISSN:  0190-8286.

Rusk, D. C.; Bennett, K. C. and Mohn, K. W. 2002. “Petroleum systems in Offshore Sierra Leone and Liberia.” Conference Sponsor: Enterprise Oil, AGIP: Exploration and Production Division. Conference: 64th Annual Meeting of the European Association of Geoscientists and Engineers, Florence (Italy), 27-30 May 2002. (World Meeting Number 0005907). Notes: European Association of Geoscientists and Engineers, P.O. Box 593990 DB Houten, The Netherlands; URL: www.eage.nl. Poster Paper No. P204.

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most pressing problem faced by Liberia during the nineteenth century was a stagnant economy. Shortage of funds inhibited government efforts to occupy hinterland territories effectively in order to prevent encroachment by European colonial powers and to implement a liberal or beneficent policy towards Liberia's indigenous population. In 1871 the treasury was empty, and President Edward James Roye was obliged to borrow 100,000 pounds from a British bank on quite onerous terms. When the loan became a political and economic problem and when cash-crop agriculture collapsed during the world trade depression from 1870 to 1900, the Republic plunged into debt obligations that it could not meet. By 1912 repeated defaults on loan repayments culminated with the establishment of an international receivership over all Liberian revenues.

Samuel, Eugenie. 2002. “Diamond wars: there's got to be a way to stop the trade that's funding terror. (This Week).(Kimberley Protocol seeks to outlaw conflict diamonds).” New Scientist. Volume 174, issue 2344. (May 25, 2002): p6(2). Abstract: Bloody conflicts being fought by rebels in Sierra Leone, Angola, Liberia and the Democratic Republic of Congo have one thing in common. They are financed by the illegal sale of diamonds from deposits in the areas they control. International efforts to halt this trade focus on the newly agreed Kimberley Protocol, which requires all diamonds to come with a certificate of origin. Though the scheme is not even in operation yet, New Scientist has learned that the human rights groups which brokered it are concerned that bogus certificates will make it almost useless. But perhaps the plan can be made to work: two teams of geologists are this week announcing possible ways of pinpointing where a particular diamond was mined. The success of the schemes will depend on governments being persuaded to fund a global database of the characteristics of stones from different regions.

Samuels, G. 1985. Liberian Energy Consumption and Sectoral Distribution for 1981. Performer: Oak Ridge National Lab., TN, United States. Funded by: Department of Energy, Washington, DC. Report number: ORNLTM9424; Contract number: AC0584OR21400; February 1985. 25p. Descriptors: Liberia; charcoal; commercial sector; data compilation; electric power; electric utilities; energy consumption; hydroelectric power; industry; mining; petroleum; residential sector; transportation sector; wood; energy conversion non propulsive conversion techniques; energy; energy use supply and demand; energy policies regulations and studies. Abstract: This report is one of a series of project papers providing background information for an assessment of energy options for Liberia, West Africa; it summarizes 1981 Liberian energy consumption data collected during 1982. Total Liberian primary energy consumption in 1981 was equivalent to 11,400,000 barrels of crude oil (BCOE) - 64% from wood, 31% from petroleum, and 5% from hydro. About 71% (8,100,000 BCOE) entered the domestic market. The difference represents exports (400,000 BCOE), refining losses (200,000 BCOE), and losses in converting wood to charcoal (2,600,000 BCOE). Of the 8,100,000 BCOE entering the domestic market, 58% was in the form of wood and charcoal, 35% petroleum products, and 7% hydro. Excluding wood and charcoal, electricity generation consumed 59% of the energy entering the domestic market. The three iron ore mining companies accounted for 60% of all electricity production; the Liberia Electricity Corporation for 35%, and private organizations and individuals for 5%. The mining operations (including electricity generation and transportation uses) consumed about 60% of all petroleum products. The transportation sector consumed 30% of all petroleum of which 85% was for road transport, 12% for the railroads owned and operated by the mining companies, and 3% for sea and air transport. Non transportation energy use in the industrial, commercial, government, and agriculture and forestry sectors is small. Together, these sectors account for less than 10% of the petroleum products

consumed. Wood and charcoal were used almost entirely by the residential sector, which also consumed an additional 530,000 BCOE of other fuels. Over 90% of the 530,000 BCOE was for electricity and 290,000 (56%) was from petroleum. Over half of the petroleum (150,000 BCOE) was for generation at the mines for their associated communities. 8 references, 10 tables. (ERA citation 10:016396). NTIS Number: DE85007361XSP.

Samuels, G. 1985. Summary of Energy Planning Technical Support to the Government of Liberia. Performer: Oak Ridge National Lab., TN, United States. Funded by: Department of Energy, Washington, DC. Contract number: AC0584OR21400; Report number: ORNLTM9676. Report date: June 1985. 18p. Descriptors: buildings; cost; energy consumption; planning; wood fuels. energy balance; energy policy; Liberia; energy conservation; energy conversion non propulsive conversion techniques; energy policies regulations and studies; business and economics; foreign industry development and economics; energy use supply and demand. Abstract: Subsequent to a general assessment of energy options for Liberia, the principal activities of this program were: (1) an assessment of the economics of wood energy in Liberia; (2) a study of the potential for energy conservation in government buildings; (3) assistance in completing the 1982 Liberian energy balance; and (4) assistance in preparing the National Energy Plan. This report discusses the first three of these activities. A draft of the National Energy Plan was submitted in January 1985 to member agencies of the Liberian National Energy Committee for their review and comments. Liberia used the equivalent of 13.2 million barrels of crude oil in 1982- 67% from fuel wood, 4% from hydro, and 29% from imported petroleum. The wood was used almost entirely (approx. 99%) by the residential sector. Iron ore mining operations accounted for about 60% of domestic consumption of petroleum products. The transportation sector accounted for another 25%. The energy consumed by the agriculture and forestry sector was less than 2% of domestic consumption and was used primarily for operations of the large rubber plantations and timber concessions. Very little energy was used for food production. Significant energy savings in government buildings would require a major remodeling effort, including replacement of the louvered windows; extensive repairs to close large gaps around windows, air conditioners, and doors; and extensive caulking. The payback period from energy savings would be long. The assessment of the economics of wood energy indicates that wood can probably be delivered to a small rural power plant at costs that make this feedstock highly competitive for some and perhaps most of Liberia's rural electric stations. (ERA citation 10:048877). NTIS Number: DE85018174XSP.

Samuels, G.; Barron, W. F.; Barnes, R. W.; Hill, L .J. and Hobbs, B. F. 1985. Evaluation of the Liberian Petroleum Refining Company Operations: Crude Oil Refining Vs Product Importation. Performer: Oak Ridge National Lab., TN, United States. Funded by: Department of Energy, Washington, DC. Report Date: February 1985. 52p. Report number: ORNLTM9472; Contract number: AC0584OR21400. Descriptors: Liberia; petroleum refineries; cost; economic analysis; fuel oils; gas oils; imports; operation; prices; profits; sales; Liberia; chemistry, chemical engineering; propulsion and fuels; fuels; behavioral and social sciences, economics; energy fuels; energy- energy use, supply and demand; chemistry industrial chemistry and chemical process engineering; business and economics Foreign industry development and economics. Abstract: This report is one of a series of project papers providing background information for an assessment of energy options for Liberia, West Africa. It presents information on a controversial recommendation of the energy assessment - that the only refinery in the country be closed and refined products be imported for a savings of approximately $20 million per year. The report reviews refinery

operations, discusses a number of related issues, and presents a detailed analysis of the economics of the refinery operations as of 1982. This analysis corroborates the initial estimate of savings to be gained from importing all refined products. 1 reference, 24 tables. (ERA citation 10:015686). NTIS Number: DE85007380XSP.

Sangmor, Samuel S. 1988. Geology, mineralization, and evolution of the Tortor Range, Bong County, Liberia. Description: xiii, 148 leaves, [2] leaves of plates: ill., maps 29 cm. Conference: Geological Society of America 1988 centennial celebration. Denver, CO, United States. October 31 to November 3, 1988. Descriptors: Africa; Archean; areal geology; Bong County; crustal shortening; evolution; geochemistry; gold ores; greenstone belts; hydrothermal alteration; Liberia; metal ores; metamorphic belts; metamorphic rocks; metamorphism; metasedimentary rocks; metasomatism; metavolcanic rocks; plate tectonics; Precambrian; retrograde metamorphism; rifting; stratigraphy; Tortor Range; West Africa. Subjects: Geology - Liberia. Geology, Structural. Physical geology. Notes: Two maps on folded leaves in pocket. Spine Geology of the Tortor Range, Liberia. Includes bibliographical references (leaves 128-138). Thesis (M.S.)--Wichita State University, Dept. of Geology, 1988. Other Titles: Geology of the Tortor Range, Liberia. OCLC: 18650464.

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Sangmor, Sam S. 1979. Report on the geology, gold, and other mineral resources of the Kokoya goldfields, Bong County, Liberia. Monrovia, Liberia: Republic of Liberia, Ministry of Lands, Mines & Energy, Liberian Geological Survey. 40 leaves, [1] leaf of plates: ill.; 28 cm. Notes: "September 1979." Bibliography: leaf 40. LC copy: page 4 bound upside-down. Descriptors: Geology; Liberia, Bong County; Gold ores; Liberia, Bong County; Mines and mineral resources- Liberia- Bong County. Notes: "September 1979." Bibliography: leaf 40. LCCN: 83-141867; OCLC: 10072000.

Sangmor, Samuel S. and Dorbor, J.K., 1982. “The Geology and Mineral Resources of the Gondoja Area, Grand Cape Mount County, Liberia.” Liberia Geological Survey unpublished un-numbered report, 43 pages. AMRS, Inc. See: http://www.africaminerals.com/

Sangmor, Sam S.; Dorbor, Jenkins K.; Hoskins, Lynn; Mason, Jonathan A, Jr.; Murray, Gester and Pshorr, Peter. 1982. “The Mt. Dorthrow manganese mineralization.” Liberian Geol. Survey Monrovia, Liberia. Pages: 53. 1982. Descriptors: Africa; airborne methods; chemically precipitated rocks; economic geology; geochemical methods; geophysical methods; geophysical surveys; Grand Gedet County; iron formations; Liberia; magnetic methods; manganese ores; metal ores; methods; mineral exploration; Mount Dorthrow; reserves; sedimentary processes; sedimentary rocks; surveys; West Africa. Notes: Project report of investigations, 1981. IGCP Project No. 108/144. References: 16; illustrations, including 4 tables, sketch maps.

Sangmor, Samuel S. and Nair, A. M. 1985. "Geology, Petrogenesis, Gold and Associated Mineralization in the Tortor Mountain Range, Bong County, Liberia." Liberia Geological Survey unpublished un-numbered report, 29 pages. AMRS, Inc. See: http://www.africaminerals.com/

Sass, J. H. and Behrendt, John Charles. 1980. "Heat flow from the Liberian Precambrian shield." Journal of Geophysical Research. 85; B6, Pages 3159-3162. 1980. American Geophysical Union. Washington, DC. Descriptors: Africa; chemically precipitated rocks; crust; geothermal gradient; heat flow; iron formations; Liberia; Precambrian; sedimentary rocks; shields; tectonophysics; temperature; West Africa; West African Shield. References: 26; illustrations, including tables, sketch map. ISSN: 0148-0227.

Schanze, E. 1982. "Joint Ventures zwischen Gaststaat und Investor im Erzbergbau." Translated title: "Joint ventures between the receiving country and the investor in the mining sector." Glueckauf (Essen). 118; 11, Pages 550-556. 1982. Verlag Glueckauf. Essen, Federal Republic of Germany. Language: German. Abstract: Legal problems that have risen from contracts between investors and the receiving countries of a mining project; two examples: the Bougainville copper mine in Papua New Guinea and the Bong iron mine in Liberia. Descriptors: Africa; Australasia; Bong Mine; Bougainville Mine; case studies; copper ores; corporate policy; economic geology; economics; global; iron ores; Liberia; metal ores; mines; news; Papua New Guinea; programs; public-policy; West Africa; Economic geology, general, economics. ISSN: 0340-7896.

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Schlee, John S. 1972. Acoustic-reflection profiles, Liberian continental margin. Report number: PB- . Pages (monograph): 30. January 1, 1972. U.S. Geol. Surv., Reston, VA, United States. Abstract: Investigations carried out as part of a cooperative marine research program (International Decade of Ocean Exploration), studies of the geologic framework and resource potential of continental margins and small ocean basins. Annotation: Map. Source Note: USGS-GD-72-006. Descriptors: acoustical methods; Africa; Atlantic Ocean; continental shelf; geophysical methods; geophysical surveys; Liberia; oceanography; surveys; USGS; West Africa. Applied geophysics. Serial Report Available Only through NTIS.

Schlee, John. 1972. USGS IDOE 5. Geotimes. 17; 8, Pages 16-17. 1972. American Geological Institute. Alexandria, VA, United States. Abstract: Geophysical surveys, structure, continental margin off Liberia. Descriptors: Africa; Atlantic Ocean; continental shelf; continental slope; East; evolution; geophysical methods; geophysical surveys; gravity methods; Liberia; magnetic methods; ocean basins; oceanography; radioactivity methods; seismic methods; structure; surveys; West Africa; oceanography. Illustrations, including sketch map. ISSN: 0016-8556.

Schlee, John; Behrendt, John Charles and Robb, James M. 1974. "Shallow Structure and Stratigraphy of Liberian Continental Margin." AAPG Bulletin. 58; 4, Pages 708-728. 1974. American Association of Petroleum Geologists. Tulsa, OK, United States. Abstract: Rifting, fracture zones, Mesozoic-Tertiary sedimentation, geophysical surveys, dredged samples, Miocene foraminifera. Descriptors: Africa; Atlantic Ocean; biostratigraphy; carbonate rocks; Cenozoic; clastics; continental margin; continental shelf; continental slope; deposition; Foraminifera; fracture zones; geophysical methods; geophysical surveys; gravity methods; history; Invertebrates; Liberia; lithostratigraphy; magnetic methods; marine; marine geology; Mesozoic; microfossils; oceanography; offshore; onshore; Paleozoic; petroleum; Phanerozoic; Protista; reflection; rifting; sedimentary rocks; sedimentation; seismic methods; stratigraphy; structure; surveys; Tertiary; West Africa; Oceanography; sketch maps. ISSN: 0149-1423.

Schlee, John Stevens; Behrendt, John Charles and Robb, James M. 1973. "Shallow structure and stratigraphy of the Liberian continental margin." Washington: U.S. Geological Survey. 44 leaves: ill., maps; 28 cm. Open-file report (Geological Survey (U.S.)); 1905; Report number: OF 73-0249. Annotation: USGS, Woods Hole Oceanogr. Inst., Woods Hole, MA, United States. Notes: Referred to in press release dated September 7, 1973. Bibliography: leaves 37-41. Descriptors: Continental shelf, Liberia; Submarine geology- Liberia. USGS Library. ISSN: 0196-1497.

Schlee, John; Behrendt, John Charles and Robb, James M. 1972. "Shallow structure of the Liberian continental margin." Abstracts with Programs - Geological Society of America. 4; 7, Pages 655-656. 1972. Geological Society of America (GSA). Boulder, CO, United States. Descriptors: Africa; Atlantic Ocean; continental drift; continental shelf; continental slope; evolution; geophysical methods; geophysical surveys; Liberia; magnetic methods; ocean basins; ocean floors; oceanography; seismic methods; structure; surveys; West Africa; Oceanography. ISSN: 0016-7592.

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Schulze, Willi. 1965. Economic development and the growth of transportation in Liberia. Translation commissioned and edited by Peter K. Mitchell. [Freetown: Sierra Leone Association]. Description: Book. 29 p. maps. 28 cm. Series: Occasional paper (Sierra Leone Geographical

Association); no. 1. Notes: Translation of Liberia: Wirtschafts- und Verkehrsentwicklung, published in Geographisches Taschenbuch, 1964/65. Includes bibliographical references. Descriptors: transportation in Liberia; Liberia Economic conditions; Other: Geographisches Taschenbuch. University of Wisconsin- American Geographical Society Collection. Call Number: HC1075 .S38x 1965.

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Schulze, W.O. 1964. “Early Iron Industry in the Putu Range in Liberia.” Liberia University Journal. Volume 4, no. 2, pages 29-35.

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Seagull Exploration Corporation. 1973. Petroleum exploration guide, African Atlantic basins: of Morocco, Spanish Sahara, Mauritania, Senegal, Guineas, Sierra Leone, Liberia, Ivory Coast, Ghana, Togo, Dahomey, Nigeria, Cameroun, Rio Muni, Gabon, Congo, Cabinda, Zaire, Angola, South Africa, Southwest Africa and general outline of West African interior basins. London: Seagull Exploration. Description: 1 case: ill., maps; 25 cm x 26 cm. x 34 cm. Descriptors: petroleum geology- western Sahara; petroleum geology- Equatorial Guinea; petroleum geology- Sierra Leone; petroleum geology- Liberia; petroleum geology- Côte d'Ivoire; petroleum geology- Africa, West. Notes: Case includes text, assorted maps and illustrations. "September, 1973". "Geology, plate tectonics, basin parameters, reserves, potential, prospects, ratings, regulations, exploration activity, political, economics, statistics, weather, recommendations." OCLC: 14269226

“Section of southern Montserrado County (Robertsfield-Oau road guide).” 1979. Liberian Cartographic Service. [Monrovia]: The Service. 1 map: photocopy; 53 x 125 cm. Subjects: Montserrado County (Liberia)- Road maps. Map Info: Scale 1:50,000. Notes: "LCS-98/79." Other Titles: Southern Montserrado County; Robertsfield-Oau road guide. LCCN: 85-690709; OCLC: 12836332.

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over large portions of the national territory. Horrors inflicted on non-combatants and the well publicized trading in 'conflict diamonds' served to focus world attention on these two small countries sharing a common border. Both countries have experienced mixed success with outside military intervention for peace keeping and nation building purposes. What has happened is all the more distressing when one considers each country's prospects at birth under the political and economic aegis of arguably two of the most powerful and enlightened countries of the time, Great Britain in the case of Sierra Leone and the United States in Liberia. Descriptors: Americo-Liberian; collapse of central authority; corruption; diamonds; Krio (Creole); peacekeeping; levantine traders.

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van Straaten, Peter. 2002. Rocks for Crops: Agrominerals of sub-Saharan Africa. International Centre for Research in Agroforestry (ICRAF), Nairobi, Kenya. 338pp. Printed by Fidelity National Information Solutions Canada, Scarborough, ON, M1B 3C3, Canada. Descriptors: sustainable agriculture; soil fertility management; mineral resources; sub-Saharan Africa. Abstract: There are two small known phosphate deposits in Liberia. The deposit at the Bomi iron ore deposit, 60 km north of Monrovia, is composed of grey to cream coloured phosphatic rocks superficially resembling calcareous tufa. Secondary Fe-phosphate, mainly phosphosiderite and strengite, fill cavities and form cements between iron ore fragments. A sample from the leucophosphite (KFe2[PO4]2OH(H2O)2) at Bomi contained 33.46% P2O5 and 36.85% Fe2O3, as well as 7.86% K2O. Axelrod *et al.* (1952) interpreted this occurrence as a reaction product of bat excreta with iron oxides. There is an abundance of bat guano in the caves. No figures exist on volume and grade of the Bomi phosphate resources. The Bambuta deposit is located 70 km north-northeast of Monrovia, 25 km east of Bomi Hill iron mine (6°56' N; 10° 33' W). Results of a diamond drilling program and mapping have shown a minimum reserve of 1 million tons of phosphate rock at 32% P2O5, or 1.5

million tons of ore grading 28% P2O5 (Rosenblum and Srivastava 1979). The phosphorus bearing minerals are mainly members of the variscite-strengite series (secondary Al-Fe phosphates). Like at Bomi, the phosphates are associated with an iron ore deposit. The genesis of this deposit remains unclear although Rosenblum and Srivastava (1979) discuss the possibilities of a metasedimentary-metasomatic origin or, alternatively, origin as a result of phosphate precipitation from guano-derived solutions. ISBN 0-88955-512-5. See: http://www.uoguelph.ca/~geology/rocks_for_crops/33liberia.PDF

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”Summary of Synoptic Meteorological Observations (SSMO). West African and Selected Island Coastal Marine Areas. Volume 2. Area 9, Conakry. Area 10, Monrovia. Area 11, Ivory Coast. Area 12, Accra. Area 13, Gulf of Guinea East, Area 14, Luanda NW. Area 15, Lobito.” 1976. Naval Weather Service Detachment Asheville N C, United States. November 1976. Pages: 564. Descriptors: meteorological data; synoptic meteorology; West Africa; coastal regions; weather; tables (data); marine climatology; sea states; periodic variations; Angola; Ivory Coast. Identifiers: Guinea, Liberia, Gulf of Guinea. Abstract: This report presents marine climatological data for specific coastal areas in 21 different tables including weather occurrence, wind direct and speed, cloud amount, ceiling height, visibility, precipitation, dry bulb, relative humidity, air-sea temperature difference, sea height and period, sea surface temperature and sea level pressure. Limitation Code: Approved for public release. DTIC Number: ADA031779. Supplementary Note: See also Volume 1, AD-A031 778.

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described as one of the last areas of virtually unexplored rocks in the world. Eastern Liberia is made up of rocks of Birimian age with significant potential for gold. Western Liberia is made up of rocks of Archean age that contain diamond, gold, iron ore, nickel, manganese, palladium, platinum, and uranium. See: http://minerals.usgs.gov/minerals/pubs/country/2000/ivgvlislmyb00.pdf.

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Abbausteuerung auf der Eisenerzlagerstatte Bong Rang in Liberia/Westafrika, von J. Lersch.--Lateritische Nickelerze, von H. Gruss. Zur Entstehung und Charakteristik mesozoischer marinsedimentarer Eisenerze im ostlichen Niedersachsen, von H. Kolbe.--Feinstratigraphische und petrographische Untersuchungen im erzfuhrenden Korallenoolith (Unterer Malm) des westlichen Wesergebirges (Nordwestdeutschland), von K.--P. Freitag.--Lithostratigraphie und Biochrolologie im Grenzbereich Oxford/Kimmerdge (Malm) des Wesergebirges und Suntels (NW-Deutschland), von W. Schiebel. Notes: Includes bibliographies. Descriptors: ore deposits; Geology. Series: Clausthaler Hefte zur Lagerstattenkunde und Geochemie der mineralischen Rohstoffe, Heft 9. ISBN: 3443120091.

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Democratic Republic of Congo (DRC) as well as shorter, comparative desk studies of conflict timber in several other countries-among them Liberia. The latter country is clearly the 'poster child' of African conflict timber. The country's president, Charles Taylor, has authorized logging concessionaires to harvest timber which he has then exchanged with external partners to obtain the means of war light arms, helicopter parts, etc. These transactions have involved both timber sales, typically of raw logs, as well as logs bartered directly in exchange for arms. The People's Republic of China (PRC) has been a prominent Liberian barter partner in the recent Overview of Conflict Timber in Africa past. Taylor has used the timber-based military resources he has acquired to maintain his power at home and to pursue wars against Liberia's immediate neighbors (Sierra Leone, Guinea and, most recently, the Ivory Coast). Notes: This document is color dependent and/or in landscape layout. It is currently available on CD-ROM and paper only. CD-ROM contains a 164 page document. See also PB2005-102558 and PB2005-101559. Sponsored by the Agency for International Development, Washington, DC. Bureau for Asia and Near East. NTIS: PB2005102560.

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Paleozoic; Pan African; Precambrian; sedimentary rocks; stratigraphy; structural complexes; structural geology; tectonics; thrust; West Africa; Structural geology. ISSN: 0016-7606.

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Timmerman, Kenneth R. 2001. “Severing Liberia's sinews of war: the U.N. is preparing new sanctions against Liberia's strongman Charles Taylor, who seized that African country's profitable international shipping registry and is brokering `conflict diamonds' from guerrillas. (World: Sanctions) (Brief Article).” Insight on the News. November 19, 2001: pages 26 et seq. Abstract: In May 2000, the British government sponsored a U.N. Security Council (UNSC) resolution to impose a worldwide ban on the import of conflict diamonds from Liberia, Sierra Leone and other African states, but the Clinton administration- guided by Jackson and Payne- opposed it. A new resolution (UNSC Resolution 1343) passed with strong support from the Bush administration on March 7 and became effective two months later. In addition to the worldwide ban on conflict diamonds, it included a ban on travel by senior Liberian government officials and their spouses, as well as any other individuals "providing financial and military support to armed rebel groups in countries neighboring Liberia." But Taylor and his arms and diamond brokers continue their deadly trade. New on the radar screen are Liberia's growing timber exports, which Taylor is exploiting as a source of revenue and to provide cover for arms imports. In one particular deal in May, he attempted to purchase from Libya several thousand AK-47 assault rifles and ammunition and RPG-

7 rocket-propelled grenades. In some cases, "these arms arrive on some of the same ships that subsequently export logs," according to a recent report by Global Witness, an NGO based in London (www.oneworld .org/globalwitness/liberia/liberiareport cover.htm). In 2000, Liberia exported timber worth $187 million on the world market. And yet the Liberian government declared timber revenues for the same period worth a scant $6.7 million. The U.N. experts believe Taylor used the rest of the money to finance his personal lifestyle and war. U.N. Secretary-General Kofi Annan nonetheless appears to be taking Jackson's view that more sanctions would just create more suffering in Liberia. But Liberian opposition leader Gayah Fahnbulleh scoffs at them both. "With or without timber, people are suffering. They are destitute, impoverished. So sanctions on timber will make no difference to the plight of ordinary Liberians. But they will mean the end of Charles Taylor, because all the money goes to Taylor and his inner circle."

Toft, Paul B.; Hills, Doris V. and Haggerty, Stephen E. 1989. “Crustal evolution and the granulite to eclogite transition in xenoliths from kimberlites in the West African Craton.” In: Growth of the continental crust. Ashwal, Lewis D. (editor). Tectonophysics. 161; 3-4, Pages 213-231. Elsevier. Amsterdam, Netherlands. Conference: Workshop on The growth of continental crust. Oxford, United Kingdom. July 13-16, 1987. Descriptors: Africa; chemical composition; continental crust; crust; eclogite; geochemistry; granulites; igneous rocks; inclusions; kimberlite; Koidu; Liberia; major elements; mantle; metamorphic rocks; mineral composition; Mohorovicic discontinuity; plutonic rocks; Sample Creek; Sierra Leone; ultramafics; upper mantle; West Africa; West African Shield; xenoliths. Abstract: A petrographic, mineral and bulk chemical study of a xenolith suite of granulites and eclogites from Sample Creek, Liberia and Koidu, Sierra Leone, has been undertaken with a view to determining the nature of the crust-upper mantle interface. A broad range of xenolith compositions is present (from high-MgO eclogites to garnet-anorthosites), and a systematic AFM trend is established, consistent with mafic and ultramafic melt fractionation at moderate pressures (10-20kbar). A trend is established for the entire xenolith suite among bulk chemistry, seismic P-wave velocity, and a crust/mantle (C/M) bulk chemical ratio defined as Na2O + K2O + SiO2/FeO + MgO mole %. Three populations are present: a granulite crustal group; a granulite and eclogite transitional group; and an exclusively upper mantle eclogitic group. From these data, and coupled with garnet-clinopyroxene mineral thermometry and accessory phases (eg, diamond, graphite, coesite, kyanite) or the presence of plagioclase, a xenolith geotherm is established based on stratigraphic sequencing and phase transition boundaries. Diamond and coesite-bearing eclogites conform to the 40mW/m2 standard cratonic low heat flow geotherm, whereas the plagioclase granulites at lower pressures correspond to an average rift geotherm of 90mW/m2. The latter is ascribed to igneous underplating onto the lower crust or to thermal perturbations from an earlier tectonic event. Graphite and kyanite ecologites and the transitional group (in SG, Vp and C/M ratio) of eclogites and granulites fall between the 40 and 90mW/m2 reference geothermanuscript. References: 89; illustrations, including 5 tables, sketch map. ISSN: 0040-1951.

Tooms, J. S. 1987. “Exploration for gold in the humid tropics.” Journal of Geochemical Exploration. 1987. Descriptors: gold; rivers; sediments; geochemical surveys; surveys; tropical environments; South America; Africa, West. Abstract: Exploration for hard-rock Au deposits has been undertaken by the United Nations Revolving Fund for Natural Resources Exploration. (UNRFNRE) in a considerable number of countries. This paper summarizes the experience gained in areas of tropical rain forest in northern South America and in West Africa and is illustrated by results from Suriname and Liberia in particular. Comparative studies have been undertaken of

prospecting by panning stream sediment and by analyzing the stream sediment fines (-80 mesh fraction). Gold mineralized zones crossed by a number of streams are generally outlined by both methods. However, results at individual sites, not uncommonly, are highly divergent. ISSN: 0375-6742.

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Transportation map of Liberia. 1976. Liberian Cartographic Service. [Monrovia]: The Service. 1 map: photocopy; 71 x 57 cm. Subjects: Transportation- Liberia- Maps. Scale 1:1,000,000. Responsibility: prepared by Liberian Cartographic Service, Ministry of Lands & Mines, Apr. 1976. Notes: Blueline print. Shows roads, railroads, 1st order administrative divisions, rivers, iron ore mines, and rubber plantations. Includes distance chart. LCCN: 85-690694; OCLC: 12836252; 23269033.

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inches. Hotines rectified skew orthomorphic proj. (W 12-W 7/N 9-N 4). Descriptors: Africa; areal geology; geologic maps; Liberia; maps; USGS; West Africa. Notes: Text, "Age Province Map", and index map on sheet. "Prepared by the U.S. Geological Survey and the Liberian Geological Survey under the joint sponsorship of the Government of Liberia and the Agency for International Development, U.S. Department of State." Includes bibliography. ISSN: 0160-0753; OCLC: 10553595.

Underwood, David C. 1982. West African Oil: Will It Make a Difference? US Naval Postgraduate School, Monterey CA. Master's thesis. Report Date: Dec 1982, pages: 145. Descriptors: *economic analysis; *political science; *commerce; *petroleum products; *West Africa; developing nations; exports; production; economic impact; capacity (Quantity); theses; hydrocarbons; resource management; international trade; oils; petroleum industry; natural gas; crude oil; reserves(Energy); petroleum geology. Abstract: This thesis analyzes the commercial development of West Africa's petroleum resources and examines the implications of sudden 'oil wealth' for the region's political and economic development. Section one outlines the evolution of the petroleum industry and surveys the hydrocarbon potential of twenty nations along the coast from Senegal to Angola, and inland from Mali to the Central African Republic. An evaluation of the physical and political constraints on the development of the region's petroleum resources and an aggregate analysis of the area's potential for new oil reserves and production capacity are also presented. Finally, by drawing from the experiences of established oil producers like Nigeria, the economic and political implications of the widespread development of petroleum resources in West Africa are projected at the domestic and regional levels. Specifically, will new found oil wealth help resolve existing problems, or will it magnify them? The study concludes that for most of these countries, oil wealth will be a mixed blessing. Limitation Code: Approved for public release. DTIC Number: ADA123826. See: http://www.dtic.mil

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United Nations Humanitarian Information Centre. 2003. Liberia (various titles and editions). URL: http://www.humanitarianinfo.org/liberia/ Abstract: The HIC is a common service to the humanitarian community working in Liberia and the surrounding countries. The HIC is managed by the United Nations Office for the Coordination of Humanitarian Affairs (UN OCHA), and operates in co-ordination with a number of partners including the United Nations High Commissioner for Refugees (UNHCR), the UN Joint Logistics Cell (UNJLC), the Department for Peacekeeping Operations (DPKO), the UK Department For International Development (DFID), USAID's Office of Foreign Disaster Assistance (OFDA) and Aid Workers Network. The HIC produces prints and distributes a wide range of Cartographic and Thematic maps, as well as providing hard copies of Satellite Images relating to Liberia. These map products are freely available via the website and at any HIC office. Some of these sets of map have been produced in USA; the Liberia HIC office has produced others. All these maps mainly provide information about administrative boundaries, populated places, road and rail network, and hydrography. These maps provide basic information about the country of Liberia, showing features such as administrative boundaries, road and rail networks, and populated places. The site also includes Landsat Mosaic and Landsat Topographic images. Ikonos City maps are based on very high resolution (1m) satellite imagery. Maps are available for most of the major urban areas of Liberia.

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United States. Army Map Service. Map of West Africa. Its Series G504; Variation: United States Army Map Service; A.M.S.; G504. color maps; 47 x 17 cm. or smaller; Scale 1:250,000. Notes: Issued in quadrangles $1^0$ of latitude by $1^0$30' of longitude. "Transverse Mercator projection." Relief shown variously by contours, form lines, and shading. Each sheet includes "Glossary," "Location diagram," and "Reliability diagram." Some sheets have through route maps of cities on versos. Accompanied by index map on sheet 27 x 50 cm. LCCN: 56-381; OCLC: 6589872.

United States. Central Intelligence Agency. 1990. Liberia. Washington, D.C: Central Intelligence Agency, 1990. 1 map: color; 20 x 17 cm. MAP: Scale [ca. 1: 3,000,000] (W 12-W 7/N 9-N 4).

Notes: "Base 801529 (A02839) 6-90." OCLC: 22152577; USGS Library: M(754) v1990c.

United States. Central Intelligence Agency. 1990. Liberia. Washington, D.C: Central Intelligence Agency, 1990. 1 map: color; 20 x 17 cm. MAP: Scale [ca. 1: 3,000,000] (W 12-W 7/N 9-N 4). Notes: Relief shown by shading. "Base 801530 (A02839) 6-90." OCLC: 22152607.

United States. Central Intelligence Agency. 1987. Liberia. Washington, D.C: Central Intelligence Agency. 1 map: color; 21 x 17 cm. Scale [ca. 1: 3,000,000] (W 12-W 7/N 9-N 4). Notes: "Base 800638 (A02839) 5-87." LCCN: 87-692418 /MAPS; OCLC: 16952315.

United States. Central Intelligence Agency. 1987. Liberia. Washington, D.C: Central Intelligence Agency. 1 map: color; 21 x 17 cm. Scale [ca. 1: 3,000,000] (W 12-W 7/N 9-N 4). Notes: "Base 800639 (A02839) 5-87." Relief shown by shading. LCCN: 87-692419; OCLC: 17481370.

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United States. Central Intelligence Agency. 1955. West Africa-II (Southern Part) and Liberia. Section 23. Weather and Climate. Washington, DC.: The Agency. Descriptive Note: National intelligence survey. March 1955. 48 pages. Report number: NIS-50-II, NIS-51. Descriptors: climate; Subsaharan Africa; Nigeria; Ghana; Ivory Coast; weather; military operations; meteorological data. Identifiers: U/A reports, Dahomey, Togo, Liberia. Limitation Code: Approved for Public Release. DTIC Number: ADA950808; See also: AD-A950807.

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United States. Coast and Geodetic Survey. 1957. Liberia: planimetric map. Washington: U.S. Coast and Geodetic Survey. 1 map on 2 sheets ; 82 x 58 cm. Scale 1:500,000. OCLC: 54325777.

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United States. Dept. of State. Division of Map Intelligence and Cartography. 1946. “Liberia: Principal Resources.” Department of State, Division of Map Intelligence and Cartography. Washington, D.C.: The Division, [1946]. Cartographic Material. Description: 1 map: color; 24 x 25 cm. Scale Information: Scale 1:2,000,000 (W 12°--W 7°/N 9°--N 4°). Notes: Relief shown pictorially. "July 1946." "10423." Subjects: Liberia--Economic conditions--Maps.
Library of Congress. Call Number: G8881.G1 1946 .U5. LC Control Number: 97-680064

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United States Economic Mission to Liberia. 1951. “Republic of Liberia.” Monrovia: The Mission. Topo map, 1:500,000. Notes: “Drawn by Rives; traced by Brunson. 1 sheet, photocopy; 68 x 117 cm.. Relief shown by hachures. Oriented with north toward upper left. The Library of Congress copy is torn along fold lines and along the edges of the sheet.  LCCN: 97-680081.

United States Economic Mission to Liberia. 1949. “Republic of Liberia.” Monrovia: The Mission. Topo map, 1:500,000. Notes: “Drawn by Rives; traced by Brunson. 1 sheet, photocopy; 68 x 117 cm.. Relief shown by hachures. Oriented with north toward upper left. Blue line print. LCCN: 95-680006.

United States. Economic Mission to Liberia. 1947. An introductory study of the soils of Liberia. Washington, D.C., Dept. of State. Description: 10, [4] l. tables. 28 cm. Subjects: Soils- Liberia. Notes: Typed. With this in the folder are: Agricultural resources, Republic of Liberia. Washington, D.C., Dept. of State - Forest resources, Republic of Liberia. Washington, D. C., Dept. of State [1947]. OCLC: 3577797.

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Geographic Names and unapproved variant names, the latter cross-referenced to the standard names. Users of the gazetteer should always refer to the main entries for approved names. The density of name coverage corresponds to that of maps at the scale of 1:25,000. Entries include the names of first order administrative divisions, populated places of all sizes, various other cultural entities, and a variety of physical features." LCCN: 68-62724; USGS Library- Call number: 506 Un28g No.106.

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Utter, Thomas. 1993. "Gold mining potential of West Africa."Erzmetall. 46; 10, Pages 563-572. 1993. Dr. Riederer-Verlag. Stuttgart, Federal Republic of Germany. 1993. Language: English; Summary Language: German. Descriptors: Africa; Burkina-Faso; Ghana; gold ores; Guinea; Ivory Coast; Liberia; Mali; metal ores; metallogeny; mineral-deposits,-genesis; mineral exploration; production; Senegal; Sierra Leone; West Africa; Economic geology; geology of ore deposits. References: 12; illustrations, including portraits, 1 table, geological sketch maps. Reference includes data from Geoline, Bundesanstalt für Geowissenschaften und Rohstoffe, Hanover, Germany. ISSN: 0044-2658.

"Various Geologists [sic]." 1986. "Gold Mineralization in the Tortor Mountain Area: A Proposal to the United Nations." Liberia Geological Survey unpublished un-numbered report, 7 pages. AMRS, Inc. See: http://www.africaminerals.com/

Varnie, Josep Natanael, II. 2004. "Wealth extraction, not economic development: A case study on Liberia." 123 pages; [M.A. dissertation].United States, Massachusetts: University of Massachusetts Lowell; 2004. Abstract: Liberia, like many other third world countries, has not been able to attain any significant level of sustainable economic development since she declared her independence in 1847. In this thesis I discuss problems associated with the country's lack of sustainable development even though it is endowed with natural resources and fertile soil. Liberia had the potential to develop programs that would have resulted in a sustainable economy but because almost all of the country's resources were mortgaged to foreign concessions in the 1900s to maintain its independence it lacked the financial capacity to do so. To provide an historical account of what led to the country's prevailing economic situation, this research reviews four time periods: late 19th century during which the settlers arrived, the 1900s to 1940, the 1940s through the 1960s and the 1970s through early 1980s. This research pays particular attention to the 1940-1960 period when there was a major investment rush in Liberia by companies in extractive industries. Gross domestic income more than quadrupled, revenue receipts rose more than eightfold, the volume of imported goods nearly quadrupled, rubber exports rose by one-third from an already high export base, iron ore exports increased from nothing to nearly three million long tons per year, and labor market demand nearly tripled. Despite this economic expansion the vast majority of Liberians remained poor and lacked access to health facilities, schools, and safe drinking water. This research

discusses the underlying factors that are responsible for the country's backwardness and lack of sustainability.

Venkatakrishnan R. and Culver S. 1989. "Tectonic fabric of Sierra Leone, West Africa: implications for Mesozoic continental breakup." Journal of the Geological Society, Volume 146, No. 6, 1989, pp. 991-1002(12). Abstract: A lineament map interpreted from Landsat images has been integrated with available geological and geophysical data from both offshore and onshore regions of Sierra Leone. The lineament patterns are related to intraplate and plate marginal reaction of pre-existing structures during Mesozoic rifting events that resulted in strong tectonic controls on magmatism. Of four main lineament trends, the NNW-SSE to N–S, NNE–SSW, and ENE–WSW trends are directly relatable to Archaean fabric in the Leo Uplift. A NW–SE trend reflects coast-parallel late Mesozoic dykes that follow the Rokelide Pan–African fabric (reactivated Archaean NNW and N–S trending structures). NW–SE trending faults defining offshore basins are segmented and offset by ENE–WSW trending continental extensions of ocean fracture zones. Both the Guinea and Sierra Leone Fracture Zones have nucleated on ENE–WSW trending sinistral Archaean shear zones in the Leo Uplift. The four lineament trends focused Mesozoic magmatic events through protracted reactivation. Spatial and geometric relationships between the magmatic provinces and tectonic fabric indicate that intraplate deformation occurs far inland during rifting events. The angular relationships between the Permo–Triassic NE trending Guinea Belt, the Jurassic–Triassic NW–SE trending coast-parallel dykes, and the ENE–WSW trending ocean fracture zones centred on the early Jurassic Freetown basic igneous complex, suggest that the Sierra Leone–Liberia continental margin evolved as an obliquely-sheared, rift–rift–transform passive margin during Mesozoic continental breakup.

Villeneuve, M. 1993. "The West African fold belts; structure and evolution." Comptes Rendus de l'Academie des Sciences, Serie 2, Mecanique, Physique, Chimie, Sciences de l'Univers, Sciences de la Terre. 316; 3, Pages 411-417. 1993. Gauthier-Villars. Montrouge, France. 1993. Language: English; Summary Language: French. Abstract: Before 1984, only two main orogenic periods had been considered in the West African fold belts (the first of Pan-African or Caledonian age, the second of Hercynian age). The discovery of two different Pan-African orogens ([I], [II]) partially reworked by a Hercynian tectonic event, was a substantial change in the interpretation of this fold belt. The first orogenic stage (Pan-African I) occurred in the northern part of the area around the Senegalese block; meanwhile, the second one (Pan-African II) occurred in the southern part, around the Rokelide block. The third stage (Hercynian) occurred only around the Senegalese block. The Pan-African I was first identified in the Bassaride ridge (South East Senegal), the Pan-African II in the Rokelide belt (Sierra Leone and Guinea) while the Hercynian has strongly reworked the Mauritanide belt. Each has different geodynamical patterns and geologic evolution despite their appearance as a single belt from Mauritania to Liberia. Descriptors: Africa; Caledonian-Orogeny; faults; Guinea-Bissau; Liberia; Mauritania; metamorphism; ophiolite; orogenic-belts; orogeny; Paleozoic; Pan-African-Orogeny; plate-collision; plate-tectonics; Precambrian; Proterozoic; rifting; sedimentation; Senegal; strike-slip-faults; suture-zones; tectonics; thrust-faults; upper Precambrian; West Africa; West African-Shield; Structural-geology. Illustrations: References: 26; illustrations, ISSN: 0764-4450.

Vladimirov, Boris Mikhaylovich; Tverdokhlebov, Viktor Aleksandrovich and Kolesnikova, Tamara Pavlovna (Tverdokhlebov, Viktor Aleksandrovich. [from old catalog] Kolesnikova,

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