

Taylor, George C, Jr.

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HISTORICAL REVIEW OF THE INTERNATIONAL  
WATER-RESOURCES PROGRAM OF USGS

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ETHIOPIA

Since World War II and under the leadership of His Imperial Majesty Haile Selassie I, Ethiopia followed an active policy of economic development and social improvement with monetary credits and technical assistance from the U.S. and other foreign donors. As of the end of 1968, U.S. bilateral aid to Ethiopia had reached a total of more than \$229 million during the antecedent 20 years. USGS participation in the U.S. technical assistance program in Ethiopia began first in early 1966 and has been virtually continuous since February 1968. The scope and objectives of USGS technical support are described in the following sections.

WATER-SUPPLY INVESTIGATIONS FOR NATIONAL RANGE  
DEVELOPMENT PROJECT, 1966, 1968-70

As part of its National Range Development Project with the Ethiopian Ministry of Agriculture, the U.S. Agency for International Development late in 1965 requested the short-term services of a U.S. specialist to review the water-supply problems in Sidamo (Sidamo Province) of southern Ethiopia and to identify needs for water-resources investigations and pilot development that might be undertaken to improve the pastoral economy as well as to mitigate recurrent conflicts over local water supplies among tribal peoples of the region. D. A. Phoenix, USGS hydrogeologist, was assigned to the work and during February 1966 completed ground surveys and airborne reconnaissance of some 52,000 km<sup>2</sup> in southern Sidamo Province (figs. 17, 18, and 19). In his report he identified areas favorable, semifavorable,



FIGURE 17.—Aerial view of Borana tribal village with protective thorn-bush enclosures, one for the herdsmen and the other for livestock. About 15 km east of Yabelo (Iavello), Sidamo (Sidamo Province).



FIGURE 18.—Aerial view of two native wells at Salole, 147 km northeast of Mēgā, Sidāmo. Wells used for watering camels, cattle, and goats are surrounded by thorn-brush enclosures to exclude nocturnal predators or unwanted visitors.



FIGURE 19.—Borana herdswomen lifting water for their cattle from a spring-cum-well 2 km south of Mēgā, Sidamo. These two women form part of a four-stage human lift. An empty bucket goes down and a full one comes up.

and unfavorable for development of water supplies and distinguished areas where ground-water or surface-water development could be emphasized for livestock water supplies. He also outlined the scope, personnel, and equipment requirements for a long-term project of water-resources investigations and pilot development.

In February 1968, J. R. Jones, USGS hydrogeologist, arrived in Addis Ababa to undertake implemen-

tation of certain of Mr. Phoenix's recommendations for Sidamo Province, as well as to provide general advisory services in hydrology to the Ethiopian Water Resources Department in the Ministry of Public Works and Communications. Mr. Jones remained in Ethiopia until July 1970. During his 2½ year tenure, Mr. Jones oversaw the location of sites for drilling of wells and for construction of stock-water catchments by the Community Water Supply Division of the Water Resources Department as part of the National Range Development Project. He also worked with the Water Resources Department in establishing procedures and standards and in training Ethiopian personnel in ground-water geology and hydrology. During his stay in Ethiopia he participated in brief ground-water and water-supply studies near Yabelo, Mak'amet (Nekemti), Gimma, Gondar, Keter, Mak'ale (Mekele), Robi, in the Alledeighy Plain, near Erer-Gota, Dirēdawā, Ayshā, Hārar, Jijigā, Chercher Awraja, Asalā, Qoshe, Tora, Ajjy and Dabrazabit. He also began an areal water-resources investigation in the Arreo area of Sidamo Province. Mr. Jones was especially effective as a member from September 1969 through June 1970 of the Asmara Water Emergency Committee, which was set up to develop long-range plans for alleviating water shortages resulting from recurring droughts in northern Ethiopia. After home leave, Mr. Jones was reassigned to Dacca as chief of party of the East Pakistan Ground Water Survey and was replaced by H. E. Gill, who arrived in Addis Ababa in December 1970.

SURFACE-WATER INVESTIGATIONS PROGRAM OF THE WATER RESOURCES DEPARTMENT, 1968

In response to a request of the Imperial Ethiopian Government to US AID/Addis Ababa, Walter Hofmann, USGS hydrologist, was assigned from April to June 1968 to review the status of the surface-water investigations program of the Ethiopian Water Resources Department in the Ministry of Public Works and Communications, to evaluate the adequacy of the stream-gaging network and the operational activities of the Department, to assess the training requirements of the Department in collecting and evaluating streamflow data and in using and maintaining hydrologic instruments and equipment, and to recommend a long-range program of technical support and training of Ethiopian personnel in surface-water investigations.

According to Mr. Hofmann's report of May 1968 the Water Resources Department was then operating 50 stream-gaging stations in the Blue Nile River

Basin and some 47 other stations in the Awash, Wabi Shabalé, Takaze, Bâro, Omo, and Central Lakes Basins. He pointed out also the importance of adequate streamflow data in the design, construction, operation, and management of hydroelectric power, irrigation, flood-control, and public water-supply projects. He emphasized the need for consolidating stream-gaging activities and sediment- and water-quality data collection in the Water Resources Department. He also recommended an intensive training program with USGS support over a 2-year period that would cover all aspects of streamflow data collection, including network design; gaging-station design, installation, and operation; discharge measurements, both direct and indirect; office computations and procedures; and hydrologic-study techniques.

#### References

- Hofman, Walter, 1968, Hydrologic investigations program of the Water Resources Department, Ministry of Public Works and Communication, Imperial Government of Ethiopia: U.S. Geol. Survey open-file rept., 58 p., 4 figs.
- Phoenix, D. A., 1966, Proposed water-supply investigations, Sidamo Province, Ethiopia: U.S. Geol. Survey open-file rept., 41 p., 20 figs.

#### GHANA

When Ghana emerged in West Africa as an independent republic in March 1957, it embarked on an active program of social and economic development. Most important in this program was the Volta River Project, a \$300 million dam at Akosombo impounding the Volta where it crosses the Akwapim-Togo Range about 105 km east of Accra. The dam, which was constructed during the early 1960's and became operational in 1964, has the potential to generate 1 million kilowatts of hydropower, of which 60 percent will be used for the beneficiation of aluminum ore (bauxite) and the rest for general electrification and industrial purposes.

The need to resettle a large rural population in the area that would be inundated by the creation of Lake Volta gave impetus to the investigation and development of ground water for rural and small municipal supply, particularly in the Volta River basin of central Ghana. Accordingly, the Volta River Authority in late 1963 requested US AID/Accra to provide the services of a U.S. specialist to evaluate the status of ground-water exploration and development in Ghana and to recommend measures for strengthening the program. H. E. Gill, USGS hydrogeologist, was assigned to the work and during February-May 1964 completed a countrywide ground-water reconnais-

sance in company with representatives of the Ghana Division of Water Supplies and the Geological Survey of Ghana. His report of April 1964 contains recommendations relating to organizational and personnel requirements, collection of basic hydrologic data, and areal ground-water investigations in the Coastal Plain and Voltain geohydrologic provinces. Also a formal report, which gives a general résumé of the availability and use of ground water and describes the occurrence of ground water in the five major geohydrologic provinces of Ghana, was published as a USGS Water-Supply Paper 1757-K in 1969.

#### Reference

- Gill, H. E., 1969, A ground-water reconnaissance of the Republic of Ghana with a description of geohydrologic provinces: U.S. Geol. Survey Water-Supply Paper 1757-K, 38 p., 2 pls., 2 figs.

#### KENYA

Centrally situated in the equatorial region of East Africa and favored home of the lion, elephant, and zebra, as well as the big game safari, Kenya is a land of great geographic diversity that extends from high well-watered volcanic plateaus on the west to low semidesert steppes on the east. Kenya became a self-governing republic on December 12, 1963, within the British Commonwealth of Nations. Since independence, the U.S. has provided economic aid and technical assistance to Kenya, emphasizing agricultural and rural development and education and training for institutional management. The USGS has participated in the US AID program since mid-1967, chiefly in water-resources evaluations and pilot development in coastal and eastern Kenya.

#### WATER-SUPPLY INVESTIGATIONS OF THE RANGE LANDS IN THE COAST PROVINCE, 1967

In mid-1967 the Government of Kenya requested US AID/Nairobi to provide the services of a U.S. specialist to evaluate its water problems and to recommend a long-term program of water-resources investigations and pilot development directed toward improving the economy of selected rangelands in the Coast Province. D. W. Brown, USGS hydrogeologist, was assigned to the work and between July and October 1967 completed a hydrogeologic reconnaissance of 60,000 km<sup>2</sup> in this region. His report of October 1967 described the general hydrology of the province and identified the water problems. He proposed a 4-year investigation of the available water resources in the province necessary for planning their rational development and utilization. The