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**DEPARTMENT OF STATE**

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NONCAPITAL PROJECT PAPER (PROP)

Country: Liberia Project No. 669-51-210-071

Submission date: August 1969 Original X

Project Title: Geological Survey and Appraisal (formerly titled as Geological Exploration and Resources Appraisal, "GERA").

U.S. Obligation Span: FY 65 through FY 72

Gross life of project financial requirements:

J.S. dollars (grant and loan) \$4,764,500\*

Cooperating country cash contribution 1,122,288\*\*

Total \$5,886,788\*

\* This includes the amount of \$296,000 expended on related activities prior to 1965 and small amounts expended for subprojects not directly related to the Geological Survey program.

\*\* This includes an estimated amount of \$85,000 spent by the GOL during the period 1946 through 1964.

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## I. SUMMARY DESCRIPTION:

The economy of Liberia has benefited increasingly over the past ten years from the growth of the mining industry until at present it is estimated that from one-fourth to one-third of the total economy is based on mining and directly related activities. Continued growth of this industry will bring corresponding benefits to the economy, and it is to help achieve this growth that the present project is addressed.

As mining and mineral development in Liberia is carried out primarily by private companies operating under government concession agreements, the means by which mining activities can be increased is through encouragement and stimulation of these companies. One means of achieving this is by compiling geologic and geophysical data for the entire country which can provide the basic information needed by interested parties for scientific exploration and prospecting for mineral deposits. The responsibility for obtaining and disseminating this basic information is the function of a government geological research organization which in Liberia is the Liberian Geological Survey (IGS) in the Bureau of Natural Resources and Surveys (BNR&S). Therefore this project was conceived as a cooperative agreement to work within the framework of the Liberian Geological Survey for the purpose of increasing the quality and quantity of fundamental geographic, geological, and geophysical information and making it available to the government for development planning and control purposes and to the public to stimulate mineral production.

In addition to the direct benefit of stimulating development of the mineral industry in Liberia, this project at the same time will affect other sectors of the economy by improving the quality and productivity of the Liberian Geological Survey in other capacities besides those related to mineral deposits. A modern government geological research organization can provide many essential services to the country including: 1) studies of mineral resources and their economic potential, 2) the compilation of regional and local geologic maps, 3) organization of geological archives and assembly of the geological and mining library, 4) the study of geologic conditions at highway and major construction sites where problems in foundation conditions exist, 5) assistance to private mineral deposit owners who lack the technical staff needed for appraisal and advice, 6) laboratory services for the investigation and analysis of a wide range of problems related to the earth sciences, and 7) advice to the government on mineral and water policies and problems. The organization in addition provides a means by which technical personnel can remain in contact with rapidly advancing technical developments in other parts of the world. All these services and capabilities are essential to a nation that plans to develop its natural resources. An intent of this project is to develop the competence and productivity of the Liberian Geological Survey so that it can serve the country in these capacities. The specific targets are:

1. Prepare and publish maps of Liberia including: base maps, geologic reconnaissance quadrangle maps, large scale maps of mineral deposits, maps of major geologic provinces, a small scale interim geologic map, large scale maps where needed for pertinent engineering projects, geophysical maps of the country showing the results of aeromagnetic, aeroradiometric, and gravity surveys, and commodity maps showing distribution of economic minerals.
2. Study and evaluate known mineral deposits and explore for new deposits. Methods used include geologic mapping, geochemical prospecting, and application of geophysical techniques. Studies will be made of mineral commodities including sand, clay, and other industrial minerals for appraisal of possibilities of developing local industries.
3. Promote the development of a more effective Liberian Geological Survey. This is to be accomplished through in-service training of counterparts by U.S. Geological Survey personnel, through academic and practical training of Liberian personnel in the U.S., and through providing modern equipment for the laboratories and field activities. Liberian personnel will gain experience in all phases of the operation of a modern geological survey organization including the field investigation, laboratory study, report writing, map compilation, and publication of maps and reports.

The major result anticipated from this program is an increase in the economic viability of Liberia. This anticipated result will be achieved through an increase in activity in the mineral industry due to interest generated by publications on new mineral deposits (Gibi barite, Mt. Montro kyanite), an increase in mineral exploration due to the availability of new geologic and geophysical data (Bomi Hills), and as a result of project interpretations of applicable data the generation of interest in mineral possibilities not previously known or considered (offshore petroleum). In turn these activities are expected to result in increased mineral production and concurrent increase in Liberia's GNP. Other results anticipated include the development of a capability by the Liberian Geological Survey to carry out geological mapping and mineral investigations in the future without further outside assistance.

The project was started in 1963 and tentatively scheduled for completion in 1972. During this time personnel from the U.S. Geological Survey will be assigned under a PASA agreement as advisors to the Liberian Geological Survey. The skills represented at a given time will depend upon the need of the program at that stage. In the course of the project, geologists, geophysicists, mineralogists, a cartographer, and administrative personnel are to be part of the team. The size of the staff will depend upon the need of the program, the number of counterparts available, and the funding available. On an average the staff is expected to range from seven to ten persons. However, it must be recognized that accomplishment of target objectives is related directly to the quality and amount of human resources utilized and that the desired results can not be achieved without expending the man years required to do the job.

In addition to providing advisors, funds will be allotted for the purchase of commodities to equip the Liberian Geological Survey to adequate modern standards, for participant training of professional personnel, and in addition to a loan will provide for an airborne geophysical survey of the country. The following table provides the projected costs per year for the USAID and GOL.

TOTAL ESTIMATED FUNDING REQUIRED  
FOR  
LIBERIAN GEOLOGICAL SURVEY PROGRAM OF DNR&S

Fiscal Year	GOL Participation <u>1965 est.</u>	Actual or current <u>estimate</u>	U.S. contribution <u>1965 est</u>	Actual or current <u>estimate</u>
1946-63	E 50,000	E 50,000*	69,000*	69,000*
1964	E 35,000	E 35,000	227,000	227,000
1965	51,150	65,250	253,200	247,000
1966	73,640	90,974	571,900	419,000
1967	1,310	112,373	421,700	392,000
1968	36,900	94,018	471,000	543,000
1969	6,60	93,673	484,200	557,000
1970	91,060	E 156,900	465,700	E 471,000
1971	117,20	E 160,000	451,200	E 413,000
1972	<u>135,30</u>	E <u>170,000</u>	<u>421,900</u>	E <u>455,000</u>
Totals	80,080	L,032,286	3,836,800	3,863,000

In addition to above there have been PSL loan amounts expended as follows:

PSL AID No. 669-H-010	\$33,000
PSL AID No. 669-H-012	8,500
PSL AID No. 669-H-015	<u>10,000</u>
Total	\$51,500

AID loan financing provided for an airborne geophysical survey of the country at cost of:

AID loan No. 669-H-014	\$850,000
GOL contribution	<u>90,000</u>
Total	\$940,000

## Gross costs:

## U.S. dollars:

Project	\$3,863,000
PSL loan	51,500
Geophysical survey loan	850,000
Total	<u>\$4,764,500</u>
Cooperating country	
Cash contribution	1,032,286
Geophysical survey	90,000
Total	<u>1,122,286</u>
<hr/> <hr/>	
Grand Total	<u>\$5,886,786</u>

\* Includes all previous projects related to mineral industry

E = Estimate

## II. SETTING

The minerals industry is one of the major dollar earners in Liberia, and projected trends indicate that minerals production will be a major source of revenue for many years to come. Scientific exploration for minerals and efficient development of the deposits depend on basic regional geologic data supplied by high quality geologic maps and reports. As procurement of these data is, in most cases, beyond the capability of the individual mining companies, the logical function of the Liberian Geological Survey is to provide this information required for development.

Large areas of Liberia are unexplored and it is quite possible that heretofore unknown economic mineral deposits or mineralized districts may be found during the course of the geological mapping activity. It is because of this possibility that the geochemical and heavy minerals prospecting activities are included as part of the geological mapping program.

Liberia at the inception of the project had limited geologic information, no minerals exploration program, and a geologic staff with only a small amount of experience but with reasonably adequate academic training. The staff was and is underpaid and in addition field operating funds were insufficient to support necessary field activities.

It is proposed that the program be an operational type activity which will use the IGS geologists as much as possible and which will attempt to maximize GOL participation. It is clear, however, that in view of the existing operational difficulties of the IGS and its parent BNR&S, and the obvious need for extensive technical orientation and experience as a functioning survey organization, it is improbable to expect a major contribution from the IGS staff for several years to come. In order to achieve target objectives the following major activities will be carried out:

1. Produce multi-purpose base, geologic, and geophysical maps of Liberia;
2. Carry on concomitantly an exploration and minerals development program;
3. Develop a functioning Liberian Geological Survey division within the BNR&S.

It is believed that the last item can be accomplished by making the IGS geologists part of an active geological survey program in cooperation with U.S. geologists. This would provide desirable technical guidance, a good working environment, and a stimulating scientific atmosphere.

### III. STRATEGY

The development of the mineral resources of Liberia depends to an extent on the availability of information on the geology of the country. The present project is addressed to obtaining and disseminating this information by means of a two-fold approach: 1) a team of U.S. technicians is making geological and geophysical studies of the country and 2) concomitantly is training and advising Liberian counterparts in this work. At the termination of the project these Liberian counterparts who comprise the staff of the Liberian Geological Survey will have the training and experience to continue the work. In this way much information will become available within the period of the project and at the same time Liberia will gain a viable institution which can serve the geological needs of the country in the future.

One alternative approach to the problem of providing geological information to accelerate development of the mineral industry would be to hire a contract team of geologists from a private firm to do the work. This would be a rapid way of completing an initial survey but has two significant disadvantages. One, the cost would be considerably greater than by means of the present project if a comparable result were to be realized. Two, at the termination of the work Liberia would be in no better position than before to continue this work.

A second alternative would be to train Liberian geologists in other countries who on their return would become the staff of the Liberian Geological Survey to carry out the necessary work. However, experience indicates that this approach would result in production at a level too modest to keep up with the

developing needs of the country. Academic training overseas without further guidance and training on the job in the country itself is less productive and effective than a combination of the two.

#### IV. PLANNED TARGETS, RESULTS, AND OUTPUTS

For each of the major operational activities stated above, the specific activity targets are given below:

##### 1. Production of multipurpose maps of Liberia:

###### A. Geographical base maps

- (1) Systematic compilation and production of scale 1:40,000 form-line base sheets covering the 506 mosaic blocks of Liberia (each complete sheet covers an area of approximately 86 square miles).
- (2) Reduction and compilation of the mosaic block maps to scale 1:125,000 intermediate quadrangle work sheet copy.
- (3) Reduction and compilation of the intermediate materials to scale 1:250,000 shaded relief quadrangle map publication materials, and
- (4) Publication and release of the base maps so that they can be utilized not only in geological survey activities, but also for planning and implementing both public and private sector development activities of many types (development of mineral, agricultural, hydroelectric, transportation, and even human resources).

###### B. Geologic maps

- (1) To prepare and publish a set of multicolor geological maps covering appropriate quadrangle areas of Liberia at a scale of 1:250,000, with accompanying explanations and descriptive texts.
- (2) To prepare and publish maps of selected areas at larger scales for industrial or mineral development.

###### C. Geophysical maps

- (1) To prepare and publish sets of geophysical maps covering quadrangle areas of Liberia at a scale of 1:250,000 with accompanying explanations and interpretive text.

- (2) To prepare and publish maps of various areas of Liberia that show the significant results of geophysical investigations in Liberia.

2. Mineral resources evaluations:

- a. To prepare interim reports as necessary and a final report by the end of the project, summarizing the available information on mineral resources and mineral development possibilities in Liberia.
- b. To prepare comprehensive reports on selected mineral commodities of economic significance.
- c. To prepare reports of investigation of individual prospective mineral deposits to stimulate exploration and development by the private sector.

3. Development and expansion of the Liberian Geological Survey division of the BNR&S:

- a. To provide guidance and experience for existing staff of the Liberian Geological Survey in the field, office, and laboratories under the tutelage of USGS specialists.
- b. To provide academic and practical training in the U.S. for twelve (12) participants; selected and approved jointly by the Director of BNR&S, the Chief of LGS, and the Project Advisor. Participants are selected on the basis of academic records and their actual performance and potential, demonstrated on assignments with the Liberian Geological Survey. Objective of this training is to develop a technical staff qualified to carry out geological mapping and resources appraisal in Liberia as specific responsibilities and functions of the Liberian Geological Survey.
- c. To help establish desirable operational procedures and organizational structure for the Liberian Geological Survey. To assist the BNR&S in preparation of a management manual that defines and establishes BNR&S management control functions.
- d. To encourage the GOL to recognize the need for a competent Liberian Geological Survey organization and the services it can provide. A measure of this recognition will be indicated by the extent to which the funding needs of the Liberian Geological Survey are met.

**V. COURSE OF ACTION****1. Prepare geographical base maps of Liberia:**

Adequate base maps of Liberia are vitally needed not only as fundamental source material for geological survey activities but also for planning and implementing both public and private sector development activities of many types (development of mineral, agricultural, hydroelectric, transportation, and even human resources). In order to provide the base maps necessary to compile geological data, the GERA project undertook systematic production of scale 1:40,000 form-line bases in FY 1967 utilizing the USGS Branch of Special Maps in Washington, D. C. The individual mosaic block form-line sheets are reduced and compiled into smaller scale base materials by GERA staff in Liberia.

**2. Prepare basic geological maps of Liberia:**

- a. Map specific quadrangle areas to provide geologic data for maps of 1:250,000 scale. Field efforts have been concentrated initially in the Voinjama, Bopolu, Zorzor, and Monrovia quadrangles in northwestern Liberia. Compilation of preliminary base maps for these quadrangles is planned for completion by the end of FY 1970 and geologic map manuscripts are in preparation.
- b. The primary quadrangle mapping program is to be supplemented by country-wide geologic and minerals field reconnaissance in critical areas. The desirability of such additional preliminary reconnaissance is evident with receipt of regional geophysical data. This basic geologic intelligence will provide a preliminary basis for interpretation of geophysical survey data and for scheduling more intensive systematic mapping and evaluations of possible mineral deposits.
- c. An interim geologic map of Liberia showing the known geology and data sources is to be compiled. Information derived from rapid field reconnaissance is to provide as much basic geologic coverage as possible.
- d. The geology of sites for engineering purposes (such as dams or other major structures) is to be mapped if necessary to help in reaching basic decisions which will result in lowest cost construction within adequate safety margins.

**3. Evaluate the mineral resources of Liberia and prepare recommendations for future mineral exploration development:**

Inventory and evaluate all known or discovered mineral deposits and document the results in the form of maps and reports so that favorable deposits can be brought to attention of developers and producers. Specific efforts in progress or scheduled include the following:

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- a. Mineral commodity maps based on available information are being compiled in conjunction with the interim geologic map of Liberia. Individual commodity reports will be prepared when warranted by priority interest and sufficient data.
  - b. Intensive investigations of favorable mineral prospects made by utilizing detailed geologic mapping, geophysical techniques and geochemical analyses where applicable.
  - c. An airborne geophysical survey of Liberia, financed by AID Loan 669-II-014, is part of the exploration program. The results of this survey will serve as a direct guide to magnetic and radioactive minerals and is expected to be of significant assistance in resolving many evaluation and geologic mapping problems. It has already served to indicate the likelihood of sedimentary rock formations offshore which has stimulated intense interest among petroleum companies.
4. Help establish a more effective Liberian Geological Survey in the Bureau of Natural Resources and Surveys:

Improve the competence of the Liberian Geological Survey in terms of its ability to accomplish geological mapping and mineral evaluation studies both in the field and in the laboratories and in terms of administrative and management activities necessary to implement an efficient geological survey organization. Upgrading will continue along the following lines:

a. Improving technical competence:

- (1) Existing staff members including subprofessional assistants, will continue in-service training by working in counterpart positions in all mapping, evaluation, and supporting activities.
- (2) Existing and future staff members are receiving academic degrees and practical experience in the United States in USAID-sponsored Participant Training programs.

b. Improving field and laboratory facilities:

With assistance of PASA backstopping, AID grant, Project Support Loan and some GOL funding, stocks of field equipment and various supplies adequate to carry on efficient and safe operations for several field parties are being established. Laboratory equipment items and sufficient supplies to accomplish necessary laboratory work are being installed and maintained.

c. Improving technical backstopping:

- (1) Through the USGS technicians, the IGS Branch of Publications and Geologic Cartography receives assistance in providing base materials and documentation of results of investigative studies in forms suitable for release in official publications.
- (2) A technical data depository is being developed. Technical data report and map files are being indexed by areas, author, mineral commodities and major geologic subjects; the scientific library is being assembled and organized; and the museum is accumulating a collection of representative rock and mineral specimens of Liberia.

d. Improving work facilities and conditions:

Additional usable space in the Liberian Geological Survey building, funded essentially by the GOL, is being gained by conversion of areas formerly used for other purposes, by better utilization of existing space, and by construction of a new four-room annex.

e. Improving administration and management support:

- (1) Continue the efforts to upgrade the Liberian management and administrative activities required to operate and maintain an effective technical organization. A middle level administrative assistant in the Liberian Geological Survey has been employed as of mid-1969.
- (2) Continue to assist in improving the management and administrative operation of the IGS and the BNR&S by in-service and participant training.

VI. PROGRESS TO DATE

1. Production of multipurpose maps of Liberia

A. Preparation of geographical base maps of Liberia:

- (1) The long standing impediment to the project resulting from a lack of adequate base maps has been overcome by arranging compilation of mosaic block scale 1:40,000 base sheets in the Branch of Special Maps of the U.S. Geological Survey in Washington. Maps from this source are now available for most immediate field requirements.

Scale 1:40,000 form-line mapping has been accomplished for over half of Liberia at the present time and is currently programmed for completion in late FY 1971 or early FY-72.

- (2) The initial scale 1:250,000 shaded relief base map (Voinjama quadrangle) is nearing publication and three other quadrangles are expected to be ready for publication within FY-70. The remaining six sheets are scheduled to follow during FY-71 and FY-72.

B. Geological Mapping and preparation of basic geological maps of Liberia:

- (1) Systematic reconnaissance field mapping has been completed over approximately 20% of Liberia and a scale 1:250,000 geological map of one of the total of 10 quadrangles covering Liberia is in preparation for publication.
- (2) Rapid geologic reconnaissance has been successfully accomplished over approximately half of the routes amenable to rapid traversing. Much of the data thus collected are already incorporated into reports and maps produced by the GERA project. All of it is available as field data and is thus utilized in preliminary interpretations of the geophysical survey results and scheduling of mapping and evaluation activities.
- (3) An interim geologic map of the western half of Liberia has been prepared and released as follows:

Leo, G. S., and White, R. W., 1967, Geologic reconnaissance in western Liberia: Symposium on Continental Drift, Montevideo, Uruguay, 16-19 Oct. 1967 (in press);

U. S. Geol. Survey open-file rept. IR-LI-13; Liberian Geological Survey rept., 29 p.

An extensively revised version of the western Liberia paper is currently in preparation for publication in early 1970 as Liberian Geological Survey Special Paper 1.

Data for an interim map of the eastern part of Liberia are being accumulated from all available sources. Compilation will commence when manpower availability permits efficient scheduling of the extensive work that will be required. Meantime these data are utilized when required for spot interpretations relative to various mineral prospects in the area.

- (4) Although the GERA project has not yet participated in any intensive mapping of sites for engineering purposes, much informal assistance has been rendered to public individuals, other GOL agencies and private contractors involved in various development activities in Liberia. Inasmuch as there is no other local capability to supply such help, the Liberian Geological Survey has become a much used source of reliable information and informal assistance.

C. Preparation and publication of geophysical maps of Liberia:

- (1) Interpretation of preliminary aeromagnetic and aeroradioactivity maps is in progress and preparation for publication will commence upon receipt of final materials from the geophysical survey contractor. There is high interest in these data and publication in a preliminary form is desirable as soon as it can be achieved. Lack of suitable base sheets will delay preparation of final geophysical map copy until the base sheets themselves have been produced (see III 1.2 above).
- (2) Interpretive results of GERA project geophysical investigations are being prepared in a timely manner. The offshore depth to basement map (Project Report IR-LI-33) and the gravity anomaly map of the Monrovia region (IR-LI-37) released in early 1969 were instrumental in obtaining favorable offshore exploration concessions for the GOL. Additional materials are currently in preparation and are expected to be released in late 1969.

3. Evaluation of the mineral resources of Liberia and preparation of documented recommendations for future mineral exploration development:

An inventory and evaluation of all known or discovered mineral deposits with documentation of the results in the form of maps and reports so that favorable deposits can be brought to attention of developers and producers is a stated target objective of the GERA project. Specific progress has been made as follows:

(1) Mineral occurrence data:

Mineral occurrence maps based on available information are being compiled in conjunction with preparation of other geologic map data. As an interim product, a general mineral resource locality map was prepared and released by the Liberian Geological Survey in September 1968.

(2) Mineral investigations:

Specific investigations have been undertaken to study a number of localities where mineralization was known or discovered during the course of investigations. The results of these investigations have been documented in official reports prepared by the GERA project. ~~(S) (C) (U) (S) (C) (U) (S) (C) (U)~~

Among the more significant investigations are the following:

- a. Barite - IGS Bull. 1, 1967. Resulted in an exploration and development concession being granted in 1968. Exploration concession fees in the amount of \$5200 per year are being paid to the GOL. Exploration is still in progress.
- b. Kyanite - IGS Bull. 2, 1968. As a direct result of GERA activity one of the major U.S. producers of kyanite-based refractory products has expressed an interest in the deposit and is currently making laboratory tests on samples from the principal deposit. If results of the tests are favorable it is anticipated that a development concession will be requested.
- c. Petroleum - The current high interest in petroleum exploration along Liberia's continental shelf has come about as a direct result of GERA project activities. Following project identification of oil-bearing carbonaceous cobbles at places along the coast of Liberia, analyses were made of bituminous residue frequently found on the beaches. Upon determination that the material was probably a crude oil (rather than a mixed residue of refined products), specifications of the proposed geophysical survey of Liberia were written to include offshore extensions of some of the geophysical traverses. On the basis of preliminary analyses of initial geophysical survey data indicating a possibly significant offshore section of sedimentary rocks, it was suggested to the GOL that they should appropriately define GOL rights to the continental shelf area. This was speedily done.

Analyses of preliminary maps received from the geophysical survey contractor confirmed previous spot interpretations of field data. GOL promotion of offshore prospects commenced when industry scouts received GOL permission to obtain the geophysical data. Reconnaissance seismic exploration was permitted, but all attempts to obtain concessions were forestalled until the applicable petroleum code was enacted and a competitive bid procedure established.

Two interpretive GERA map reports (IR-LI-31 and IR-LI-37) completed and released during the bidding period were important factors in creating additional industry interest and establishing a basis for truly competitive bids. As a result, the exploration concession agreements obtained by the GOL are exceptionally favorable to the GOL in terms of potential return to government if petroleum is developed. In the meantime the cash to be received during the first 2-year period by the GOL from signature bonus and rentals (even if oil is not found) will amount to approximately \$350,000 and thus substantially exceeds the GOL cost for the entire IGS over the period of the first 3 years of the GERA project. Because of its higher prospective value, one of the blocks yet to be released for bid conceivably could result in even greater immediate cash return to the GOL.

The amount already spent by industry in actual offshore exploration activity is estimated to exceed one million dollars. The resource input for exploration will step up very rapidly over the next 2 years and private sector exploration expenditures may substantially exceed the minimums scheduled by the existing concession agreements and a comparable amounts estimated for the two remaining blocks to be released to concessionaires (minimum total estimated at six million dollars).

On the basis of above it is obvious that the GERA project is achieving the desirable results of intensifying private sector investment in Liberia and increasing the economic viability of the nation.

- d. Other minerals - Investigations have been made of clay and silica sand deposits in the Monrovia area relative to the materials being utilized in local industry. The study results are encouraging and reports are currently being prepared for release.

Data collected in the course of other mineral investigations have been documented in reports already released or now in preparation. ~~(S) (C) (U) (S) (C) (U) (S) (C) (U)~~

(3) Mineral commodity inventory

Mineral commodity files have been established and applicable mineral locality maps are being compiled. These materials will form the basis for individual commodity reports when sufficient data are available.

(4) Airborne Geophysical Survey (AID Loan No. 669-H-014)

On the basis of a feasibility study completed in June 1966, the GOL and AID concluded a loan agreement that financed a geophysical survey for which flying was completed in February 1968. All data will be compiled and available in 1969.

4. Development of the Liberian Geological Survey Organization

- a. Professional competence of the Liberian staff has been improved by direct counterpart contact in project operations. As was reported previously, personnel and management practices have impeded the project. Though many of these difficulties still persist, there have been marked improvements. Work attitude, attendance, and standards of productions and achievement have improved. Also, more effective management and administrative practices are becoming evident in the BWR&S as the result of the management training course attended by the Assistant Director as a USAID participant.
- b. GOL financial support of the Liberian Geological Survey has substantially exceeded initial estimates. The percentage by which the amounts allotted has exceeded initial estimates since 1965 as follows:

1965	25%
1966	23%
1967	38%
1968	8%
1969	14%

This is solid evidence of the extent to which the GOL has recognized the need for the services of a geological survey organization.

- c. A more serviceable physical plant, providing suitable space for laboratories, research offices, report preparation facilities, technical data files, and field equipment storage has been organized.

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**Department of State**

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FROM - Monrovia

SUBJECT - Geological Survey and Appraisal PROP, 669-51-210-071

REFERENCE - AIDTO A-1

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The additional material to the subject PROP, as requested in refair, is hereby submitted in answer to lettered paragraphs, as follows:

1a. Funding Tables: Geological Survey and Appraisal Project (formerly GERA), funding tables are presented in Annex A, attached hereto.

Table A indicates funding component statistics (exclusive of FIO/P costs) through FY-1970.

Table B indicates component statistics covering PASA costs for the period FY-1964 through FY-1970.

Table C summarizes overall component costs and indicates the approximate percentage relationship of the components.

Discussion of funding tables:

(1) Data values: The funding figures used in the Annex tables are adjusted figures based on GERA project file data. In most cases the aggregate dollar amount shown for a cited document is thought to be correct to the rounded figure used, but some component amounts thereof have been estimated. The total amounts and the percentage figures derived from them closely reflect actual costs of the GERA project through FY-1970.

Attachment: Annex A - Tables A, B, C, & D.

*Int. State Sub. Proj*

DRAFTED BY <i>W. Conrad</i> W. Conrad / W. McDonnell		OFFICE USGS / FW	PHONE NO. 47	DATE 3/25/70	APPROVED BY: <i>J. Moller</i> FW: J. Moller
AID AND OTHER CLEARINGS PR <i>Chris D. Parker</i>					

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(2) The highly technical nature of the GERA project is indicated by the limited cost spread shown in Table C. A total of 93% of the project funds have been spent for costs related directly to technical data requirements (ie: form-line bases required to map geologic and geophysical data; purchase of the data supplied by the airborne geophysical survey). Only 7% of the project costs has been utilized for commodities.

1b. Analysis of GOL Contributions to the GERA Project: Even while funds have been generally severely limited under the GOL austerity budget, host country expenditures for the project are substantially exceeding the originally projected estimates (see E-1-CAP, dated 12/22/64, Table 8, p. SA-071-20). In addition to the GERA project amounts shown below, the GOL is now also making cash contributions and in-kind contributions towards a 2 1/2-year UN-sponsored mineral survey underway in the central and western region of Liberia. The following table indicates easily identifiable GOL funding towards the GERA Project.

<u>Fiscal year</u>	<u>GOL participation 1965 (est.)</u>	<u>Actual or current estimate</u>
1946-63	E\$50,000*	E \$50,000*
1964	E 35,000	35,000
1965	51,150	65,250
1966	73,640	90,974
1967	81,810	112,373
1968	86,900	94,018
1969	86,860	98,673
1970	91,060	140,000
1971	117,280	E 160,000
1972	<u>135,380</u>	<u>E 170,000</u>
Totals	\$809,080	\$1,016,288
	Geophysical Survey cash contribution	<u>90,000</u>
	Total LGS/GERA funding	\$1,106,288

\* Includes all previous projects related to mineral industry.

E Estimate

Analysis of several previous budget requests indicates that the LGS/GERA budget figure is generally divided up into three components approximately as follows:

Personnel services	50%
Other services	35%
Commodities	15%

Although the amount for GOL commodity procural is commonly substantially cut, it should be noted that the approved current 1970 LGS budget that has just been announced (LGS direct \$122,494 + \$17,500 for 5 vehicles) includes at least token amounts for commodities and services formerly provided entirely by AID funding.

Maintenance and repairs of equipment	\$1,400
Publications, printing and binding	2,000
Small tools	300
Household and sanitary supplies	500
Printing and binding pre-publication supplies	1,000
Parts for scientific and technical equipment	1,000
Laboratory supplies	500
Photographic supplies	<u>1,500</u>
Total	\$8,200

The figure for in-country travel and subsistence (\$44,200) is also substantial and should (if utilized for allocated purpose) adequately support the LGS field activities.

It should also be recognized that the amount budgeted for personnel (at the prevailing GOL rates) provides salaries for a total of 32 LGS/GERA employes in the following personnel categories:

<u>Personnel</u>	<u>Number</u>
Professional staff	9
Middle-level assistants	8
Field and laboratory aids	12
Messengers and watchman	<u>3</u>
Total	32

The cost progression above originally estimated amounts reflects results of USGS/GERA efforts to achieve increased GOL participation in the project. The unusually high 1967 figure of \$112,000 included field travel funds in part utilized by other technical divisions of the BNR&S.

Including the amounts currently scheduled for both the GERA Project and the UN Mineral Survey, the total GOL outlay for activities related to development of the nation's mineral resources will aggregate in excess of \$1.5 million by the end of 1972. Obviously this is an expression of significant GOL interest in mineral resources development. It can be anticipated that this interest will continue in one form or another after the current GERA project ends in recognition of the long-term development aspects inherent in an active and competent Geological Survey organization.

1c. V. COURSE OF ACTION; identification of sources of financing;

1. Geographical base maps of Liberia: Primarily TC PASA funding of technicians. Work done in Washington is carried as line item in PIO/T budget (form-line maps). Equipment and supplies utilized in on-board preparation have been in part provided by both grant and loan funds.

2. Prepare basic geological maps of Liberia, and

3. Evaluate the mineral resources of Liberia: Primarily TC PASA funding of technicians. Equipment and supplies utilized in-country have been in part provided by TC PASA backstopping, and in part by TC and DL PIO/C procurement.

Entry on p. 10 (under 3c.) indicates that the airborne geophysical survey of Liberia was loan-financed under AID Loan 669-H-014. Final figures are AID Loan \$720,000 (89%) and GOL \$90,000 (11%). The GOL is currently undertaking digitization of the geophysical data and some computer processing thereof at a cost of \$173,000. An amount of \$132,055.62 has been deobligated from the loan.

4. Institution building:

a(2) Improving technical competence: Participant training costs are TC funded. Annex Table D, Participant Training, (attached hereto), shows that approximately \$120,000 have been expended to train technical staff members for the LGS/GERA project.

b. Improving field and laboratory facilities: Entry on p. 10 (under 4b) indicates various funding used to improve field and laboratory facilities. Expenditures are further detailed in Tables A, B, and C herewith.

All other "course of action" items are supported by combined PIO/T, Pro/AG funding and "in-kind" GOL contribution through the BNR&S budget. Pertinent aspects of GOL contributions are discussed in the previous section (1b).

1d. Participant Training: Table D, (attached hereto), shows AID-sponsored participant academic training related to geology and mineral industry activities in Liberia. Of the total of 16 participants,

- 11 are currently actively employed by the BNR&S (the original GOL sponsoring agency),
- 3 are currently in school in the USA as participants,
- 1 is a school teacher at LAMCO/Nimba, and
- 1 is a surveyor in Bong County.

In the terms of total 370 participant-training-months provided, the recipients of:

269 months (73%) are currently applying their efforts in the BNR&S.

Of these, 171 months (46%) are actually within the LGS organization.

77 months (21%) are currently in school, but expected to return to LGS employment at completion of school.

24 months (6%) are in outside semi-technical employment within Liberia.

Of the GERA/USAID-sponsored 198 months of participant training provided, the recipients of:

121 months (61%) are currently LGS employees, and

77 months (39%) are currently in school but expected to return to LGS employment upon completion of academic training.

All of the GERA/USAID-sponsored participants and all but the first two AID-sponsored participants (the two participants now employed outside the GOL) have worked in counterpart relationship with one or more GERA/USGS staff technicians. It ordinarily takes several years to develop a reasonably competent geologist from a participant who has completed initial academic requirements. In order to realize the most productive placement of the returned participant, he serves various periods of time working in the field and in the laboratories with persons who have particular skills in those areas. While independent work is normally assigned within a few months of returning, the assignments are actually training exercises and little professional production is realized prior to the second year. Adequate professional skills and particular aptitudes are commonly not manifested prior to the third or fourth year of practical experience in a professionally stimulating environment. While extensive LGS development has already been achieved, the personnel portion of the institution building objective of the GERA project can not be adequately accomplished without the aggregate services of USGS technicians as originally scheduled.

1e. Likelihood of Continuing Improvement in Management and Administrative Practices in BNR&S and IGS: There has been a recent upsurge of interest in proper management in Liberia. The Government has requested and obtained a number of administrative technicians, and a few are working in some Departments. The establishment of an Institute of Public Administration is in its preliminary stage. One of the chief responsibilities will be the training of middle-grade personnel in aspects of administration and management. The IGS, like all other projects, should ultimately profit from this development.

WESTERFIELD

*JM*

**AIRGRAM**

**DEPARTMENT OF STATE**

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TO - MONROVIA AIDTO A-82

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FROM - WASHINGTON

DATE SENT

1-22-70

SUBJECT - PROP for Geological Survey and Appraisal, 669-51-210-071

REFERENCE - (A) TOAID A-380; (B) AIDTO A-1; (C) TOAID A-95

MONROV  
HECTO

AID/W reviewed subject PROP and additional data (refs A and C) on April 15 and finds that certain required information is still lacking.

INT

This situation stems in part from AID/W's request for additional information, ref (B), as well as possible misunderstandings of M.C. 1025.1 which sets forth the requirements for a PROP. Nevertheless, it is clear to the PROP review committee that crucial elements of the PROP are either missing or are inadequately covered, in spite of the evident care and precision which went into the material which was prepared in refs (A) and (C).

AID/W recommends that the following areas should be given special consideration in the revised PROP which is required:

1. The target of the project should be explicitly stated, i.e: the end result of our assistance or what the situation should be upon termination. The target overarches the more concrete outputs by which achievement may be determined.
2. The outputs should be achievable within the limits of the resources available and should give appropriate emphasis to institution-building aspects as well as to strictly operational or advisory considerations. The PROP precisely sets forth three outputs, two of which are operational (the production of geographic, geologic, and geophysical maps and the preparation of mineral resources evaluations) and one is institutional

PAGE 1 OF 2 PAGES

DRAFTED BY <i>RAM</i> RAMondosa	OFFICE AFR/CWA	PHONE NO 28504	DATE 4/20/70	APPROVED BY <i>Stephen Christmas</i> Acting Deputy Director Congo/Ghana/Liberia
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AID AND OTHER CLEARANCES  
AFR/DP:CHBillings (Draft) USGS:HFlensing (Info)  
AFR/MGT:HRosenbaum (Draft)  
AFR/CDF:JWAnderson (Draft) UNCLASSIFIED

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(the development and expansion of the Liberian Geological Survey). AID/W is concerned that the rate of progress to date might indicate some difficulty in achieving the map production outputs indicated by June 1972 when the project is scheduled for termination in accordance with both the PROP and Presentations to the Congress. Although project extension is doubtful, expansion can sometimes serve the same purpose by meeting established outputs with increased inputs. In this case, however, OPRED ceilings (which earlier caused a reduction in personnel which might in some measure be related to any problem in meeting project outputs) are fixed. Within present personnel limitations the Mission should again consider the adequacy of the staffing composition, giving special attention to the relative need for continuing an administrative assistant position, No. L-10. The need for this position should be reviewed whether or not the Mission finds any question of meeting the map production or other outputs. The Mission may also want to consider much greater utilization of TDY assistance during the two remaining dry seasons. Mr. Schoechle of the USGS might provide some advice in this regard. Aside from these limited possibilities, the remaining alternative would be to adjust the outputs to fit the inputs rather than the usual approach. Rather than completing geographic base maps for the whole of Liberia, selected quadrangles could be mapped if it is in fact necessary to establish more limited outputs. With respect to geologic maps (for which the outputs in the PROP are now stated in terms of "appropriate" and "selected" areas) AID/W would appreciate a specification of the output in terms of the location and number or percentage of quadrangles to be mapped. A revision of the outputs could place greater emphasis on institution-building aspects so that any urgently required mapping which the USGS team would be unable to complete could be finished by the Liberian organization. Undoubtedly the success of the project will be viewed in the future largely on the basis of the Liberian Geological Survey reaching institutional viability and self-sufficiency at the termination of AID assistance. Consequently, AID/W recommends that to the extent feasible greater attention be given to the strengthening of the Liberian Geological Survey.

3. The inputs, particularly for the remaining two years, should be directly related to ~~outputs~~. For future periods relationship of each technician, participant trainee, and commodity and other cost element to outputs should be specified in accordance with M.C. 1025.1, VII(F). This section should include tables showing position and period of funding for each proposed technician and participant. Although the PROP must serve as both a forward planning proposal and a historical document, the revision should concentrate on strengthening the latter. The funding information requested in ref (B) should be presented as shown in M.C. 1025.1, pages A-1 and A-2. Project funding data should indicate development grant and development loan funds separately, and commodities procured for this project under the Project ~~SMAN~~ Support loans should be shown in the ~~EXAM~~ DL column. Funding data provided in Annex A to ref (C) is a ~~SEEM~~ careful historical summary of considerable value. Our primary concern, however, is to develop an agreed phase out plan for the remaining years of project activity.

ROGERS

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TO - **AID/W** **SOAID A-195**

DATE REC'D. <i>65W</i>
DATE SENT <b>7/2/70</b>

1970 JUL 10 AM 10 34

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FROM - **MONROVIA**

SUBJECT - **NONCAPITAL PROJECT PAPER (PROP)**

REFERENCE -

**NONCAPITAL PROJECT PAPER (PROP)**

Country: **Liberia** Project No. **669-51-210-071**

Submission date: **June 1970** Amendment No. **1 (Supersedes pages 1, 4, 5, and 11 of original)**

Project Title: **Geological Survey and Appraisal (formerly titled as Geological Exploration and Resources Appraisal, "G.R.A.")**

U.S. Obligation Span: **FY 64 through FY 72**

Gross life of project financial requirements:

U.S. dollars (grant and loan)	<b>\$4,985,500</b>
Cooperating Country Cash Contribution	<b>1,242,288</b>
<b>Total</b>	<b>\$6,230,788</b>

OTHER AGENCY

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PAGE <b>1 (1)</b>	PAGES OF <b>16</b>
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DRAFTED BY <b>JFSeitzmda</b>	OFFICE <b>PA/US38</b>	PHONE NO.	DATE <b>6/30/70</b>	APPROVED BY: <b>William C. Wild, Jr., Director</b>
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AID AND OTHER CLEARANCES

**FW:JFMoller**  
**PR:CDParker**

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In addition to providing advisors, funds will be allotted for the purchase of commodities to equip the Liberian Geological Survey to adequate modern standards, for participant training of professional personnel, and in addition a loan will provide for an airborne geophysical survey of the country. The following table provides the projected costs per year for the USAID and GOL.

**TOTAL ESTIMATED FUNDING REQUIRED  
FOR  
LIBERIAN GEOLOGICAL SURVEY PROGRAM OF ENR&S**

<u>Fiscal Year</u>	<u>GOL Participation 1965 Est.</u>	<u>Actual or Current Estimate</u>	<u>U.S. Contribution 1965 Est.</u>	<u>Actual or Current Estimate</u>
1964	E 35,000	E 35,000	227,000	118,000
1965	51,150	65,250	253,200	178,000
1966	73,640	90,974	571,900	409,000
1967	81,810	112,373	421,700	378,000
1968	86,900	94,018	471,000	504,000
1969	86,860	98,673	484,200	536,000
1970	91,060	E 156,000	465,700	E 475,000
1971	117,280	E 160,000	451,200	E 853,000
1972	<u>135,380</u>	<u>E 170,000</u>	<u>421,900</u>	<u>E 763,000</u>
Totals	759,030	982,288	3,767,800	4,214,000

In addition to above there have been PSL loan amounts expended as follows:

PSL AID No. 669-H-010	\$33,000
PSL AID No. 669-H-012	8,500
PSL AID No. 669-H-015	<u>10,000</u>
<b>Total</b>	<b>\$51,500</b>

AID loan financing provided for an airborne geophysical survey of the country at cost of:

AID loan No. 669-H-014	\$720,000
GOL contribution	<u>263,000</u>
<b>Total</b>	<b>\$983,000</b>

E = Estimate

Gross costs:

U.S. dollars:

Project	\$4,214,000
FSL loan	51,500
Geophysical survey loan	720,000
Total	<u>\$4,985,500</u>

Cooperating country:

Cash contribution	\$32,288
Geophysical survey	263,000
Total	<u>\$1,245,288</u>

Grand Total \$6,230,788

II. SETTING

The minerals industry is one of the major dollar earners in Liberia, and projected trends indicate that minerals production will be a major source of revenue for many years to come. Scientific exploration for minerals and efficient development of the deposits depend on basic regional geologic data supplied by high quality geologic maps and reports. As procurement of these data is, in most cases, beyond the capability of the individual mining companies, the logical function of the Liberian Geological survey is to provide this information required for development.

Large areas of Liberia are unexplored and it is quite possible that heretofore unknown economic mineral deposits or mineralized districts may be found during the course of the geological mapping activity. It is because of this possibility that the geochemical and heavy minerals prospecting activities are included as part of the geological mapping program.

Liberia at the inception of the project had limited geologic information, no minerals exploration program, and a geologic staff with only a small amount of experience but with reasonably adequate academic training. The staff was and is underpaid and in addition field operating funds were insufficient to support necessary field activities.

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c. Improving technical backstopping:

- (1) Through the USGS technicians, the LGS Branch of Publications and Geologic Cartography receives assistance in providing base materials and documentation of results of investigative studies in forms suitable for release in official publications.
- (2) A technical data depository is being developed. Technical data report and map files are being indexed by areas, author, mineral commodities and major geologic subjects; the scientific library is being assembled and organized; and the museum is accumulating a collection of representative rock and mineral specimens of Liberia.

d. Improving work facilities and conditions:

Additional usable space in the Liberian Geological Survey building, funded essentially by the GOL, is being gained by conversion of areas formerly used for other purposes, by better utilization of existing space, and by construction of a new four-room annex.

e. Improving administration and management support:

- (1) Continue the efforts to upgrade the Liberian management and administrative activities required to operate and maintain an effective technical organization. A middle level administrative assistant in the Liberian Geological Survey has been employed as of mid-1969.
- (2) Continue to assist in improving the management and administrative operation of the LGS and the BUR&S by in-service and participant training.
- (3) The administrative staff should at the termination of the project be capable of planning and directing the research and service activities of a geological survey organization including:
  1. The ~~development~~ of an inclusive budget,
  2. The determination of the logistic support required for field operations in geologic mapping and mineral commodity investigation,
  3. Determination of the equipment and supply requirements of field and laboratory operations,
  4. The procurement of commodities on a timely basis,

5. The effective management of the technical and clerical staff so that optimum productivity is maintained, and
6. The timely processing of reports so that publication is prompt.

The technical staff should have the capability to continue to carry out all phases of research and investigation in the type of geologic and mineral studies that were conducted during the active part of the present project. This includes geologic mapping, economic mineral studies, geochemical studies, geophysical investigations, petrographic studies, map compilation, photographic services in support of map compilation, map and illustration preparation, and all related activities.

It is proposed to provide managerial training for the GOL Project Operations Officer of the Liberian Geologic Survey similar to that provided previously for the Deputy Director, Bureau of Natural Resources and Surveys. This training has proved beneficial in improving the decision making of the supervisory officer and the general administrative management of the BNR&S.

It is further proposed to continue on-the-job training. By example and demonstration, improvement in skill and the will to perform will be realized. There is no possibility of producing an organization comparable to the USGS by the time the project terminates. The intent is to produce a foundation upon which to build such an organization, and the future belongs to those individuals who perceive the need, possess the skills, and apply their energies to this end.

#### VI. PROGRESS TO DATE

##### 1. Production of multipurpose maps of Liberia

##### a. Preparation of geographical base maps of Liberia:

- (1) The long standing impediment to the project resulting from a lack of adequate base maps has been overcome by arranging compilation of mosaic block scale 1:40,000 base sheets in the Branch of Special Maps of the U.S. Geological Survey in Washington. Maps from this source are now available for most immediate field requirements.

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