

MPGAP Plan of Implementation

For October 15, 1984

To October 14, 1985

The object of MPGAP is to stimulate mineral and petroleum resource development so as to make a favorable impact on the national economy of Egypt. A strong effort to promote its natural resources is therefore needed. Whereas petroleum exploration and production is active, mining of metals and non-metallic minerals is almost non-existent. For a country that is developing its industrial base, it is unwise to neglect local sources of raw materials while more and more are being imported. The facts developed during early phases of MPGAP have substantiated that a great variety of minerals exist in Egypt. However, that does not guarantee investor activity, from either abroad or at home.

The pre-1983 concept of MPGAP was based on the assumption that the existence of favorable deposits was largely unknown abroad, and therefore the missing ingredient was improved publication or advertisement. It was believed that accomplishing such work would accordingly stimulate foreign mining investors to take concessions. Yet, it could be noted that many of the world's major mining firms had investigated one or more mineral prospects in Egypt, but that none had remained to do business. Further, the work of the Egyptian Geological Survey, largely preserved in internal reports accessible to visiting investors, has been found to be generally adequate for purposes of establishing whether or not exploration would be worthy, should investors want to evaluate the economic feasibility of mining projects. Study of the model concession agreement being offered to visitors to indicate the Egyptian concept of foreign mining involvement suggested to the writer that the main obstacle is that visitors quickly find that the prospects are poor for repatriatable profits. Egypt must create a favorable business climate or it cannot hope to realize its aims of significantly increasing foreign investment in mining.

It can be just as useful to develop mines with Egyptian capital as to bring in foreign money. Egypt is rich in untouched natural resources, many of which are produced in other countries for export to Egypt. Egyptian firms enjoy preferential treatment in comparison with foreign firms. If a product that meets specifications can be made, import regularization can generate a captive market; such import substitution can have a direct effect on the balance of trade. An equally important objective to be met by mining is the establishment of a material base for industry. Proliferation of supports for industry has a healthy multiplier effect on the economy. Whereas there is Egyptian capital available, lack of experience and mining traditions

have hampered internal development, even though the mining law makes it very easy and advantageous for an Egyptian to start such works. There is a wide spectrum of minerals available, mostly non-metallic, that are good candidates for exploitation, and it would be good policy for MPGAP to find means to stimulate Egyptian businessmen to become active in mining.

At this writing, there are several negotiations known to be in progress with foreign firms. These involve gold and sulfur. Others remain confidential. Negotiations for sulfur, gold and coal have broken off during the past year. None of the above have been as a result of MPGAP activities. But there are three multinational mining firms that have recently expressed interest in obtaining a foothold in Egypt, one by developing a small gold mine, another by offering a training program to EGSMA. Also, there are two potential Egyptian investment companies known to have a strong interest in mining prospects - all these are results of MPGAP promotional activities. We should examine our program to see what should be done to multiply the number of such interested parties, and even more, to create conditions that will induce them to become productive operators.

An effective program should include activities of four types, that together will result in improved investment in minerals:

- A. The Egyptian business climate must be improved.
- B. Information on mineral deposits has to be improved in quality, made readily accessible and well advertised.
- C. Markets and potential developers need to be identified.
- D. Contacts have to be made with foreign and domestic capital sources, promoting projects and aiding them in their evaluations.

There are two other requirements for success that are beyond our control: favorable world-wide market conditions for mineral commodities and rich mineral deposits in favorable circumstances for mining and marketing. Fortunately, we are facing a period of business recovery world-wide, and Egypt's long isolation from foreign intervention has kept its mineral wealth intact. MPGAP is timely in these respects.

The prospect of falling oil prices places stronger emphasis on mining and increases need to generate hard currency by mineral exports or import substitutes. Simultaneously, it stimulates world business by promising cheaper energy: Egypt can recoup some of its loss of oil revenues by attracting more mineral investors.

The first of the above requirements, A., is the only essential one, for existing

communications have, and will continue to attract a few companies, but if profit potential is lacking, no mining can begin. Just as Western businessmen study books on Arab business practice, negotiation methods and psychology, so should Arab promoters study Western thinking and methods when the time comes to seriously sell natural resources to profit-motivated Westerners.

There is no unanimity of opinion that legal and economic controls on mining are responsible for the lack of mining, or that change is necessary. The current version of the model concession agreement is patterned closely after the production-sharing concession contracts so successful in the petroleum field. This version is being offered to all foreign interests, and some companies are negotiating along such lines, believing that workable arrangements can be made. AGRICO and EGSMa tried for two years to come to terms. After \$2 million expended in negotiations, AGRICO has seemingly broken off until Egypt makes a major conciliatory move. Among Egyptians, much hope had been placed on the success of the AGRICO negotiations, for it could be a prototype for a procession of foreign investments. Failing conclusion, no others seem likely to follow. Perhaps Egypt needs to set terms so favorable as to be sacrificial, to overcome inertia against investment in Egypt, though probably, all that is needed are fair terms by Western standards.

I hear arguments that the model offers a flexible guide and that it should be attractive since everything is negotiable. Actually, I understand it to represent terms so far from profitable that the Western viewer has no hope of successfully negotiating enough changes in his favor. The very large number of ways Egypt hopes to take profit is discouraging, and I recommend it be limited to a fixed small royalty, plus a reasonable share (related to equity) in the after-cost revenues plus fixed-rate income taxes and infrastructure fringe benefits. Import-export tariffs, bonuses, fees, title transfers, preferential domestic sales, payments for existing information and undeserved bond forfeitures should be eliminated because they are not typical of Western contracts. These devices create distrust in an environment where confidence is already lacking. The transfer of title to land, improvements and equipment repaid out of cost-sharing is a direct confiscation that supports the foreigners' fears of total nationalization.

Major revisions of the model contract can be made, still returning royalty, taxes, profits and corollary benefits to Egypt. The changes can have beneficial psychological effect on investors as well as real improvements in their profit projections. Without such changes, only a few companies will attempt to negotiate. It should be understood that exploration is inactive everywhere except U.S., Canada

and Australia, thus special inducements are needed to interest companies in Egyptian ventures. Many Egyptians and most Western observers recommend changes in the contract offerings: more effective contractor control, less threat of confiscation, fewer methods of Egyptian profit-taking and better prospects of repatriatable profits are areas for possible revision that would stimulate foreign investment.

It might make a vital contribution to Egyptian mining if we were to use MPGAP funds to expose EGSMA to new management views. I recommend use of the services of disinterested experts, such as UN counsellors in mining legislation and contracts, and to arrange visits by representatives of other developing countries that have found good solutions to the problems of sovereignty over resources and the need to attract foreign capital. It would be useful also to arrange visits by top Egyptians to such developing countries as Turkey, Phillipines, Indonesia and others. Formal training in certain institutions may be available for learning Western business practices.

Funds budgeted for VIP travel to US can be diverted instead for travel to developing countries to learn their methods of conducting mining business. I believe these visits are more likely to have beneficial effects than are travels in U.S.

It is the opinion of the Project Coordinator and of Bendix Co.'s Resident Manager and U.S. Liaison Officer that we must stimulate EGSMA to make significant changes in the model concession agreement for succeeding negotiations to implement, or MPGAP will fail to reach its stated objectives, negating most efforts and AID investments in other facets of development. This is the only 1st-order priority activity of MPGAP, yet we have no accord with EGSMA on a plan to do anything about it in the immediate future. There is no agreement even that the model contract is deficient. At the Spring, 1985 MPGAP semi-annual meeting, a symposium is planned on mining contracts, to which will be invited several foreign experts from developing countries and agencies devoted to their needs.

The acquisition, documentation and dissemination of mineral data, together with market research and promotional activities are important means of stimulating mining in Egypt, but they would proceed in some manner even if no MPGAP effort were devoted to it. Thus tasks related to mineral data are of second order priority. These are the established tasks of EGSMA under the MPGAP project.

The engagement of a geologist experienced in project management, Mr. Randell Chew, has given us the opportunity to initiate marketing efforts much as a new well financed corporation would do. The object is to train a cadre of qualified EGSMA people to carry on activities of direct influence on potential investors, both foreign

and domestic.

One recommendation made a year ago is even more appropriate now that a marketing staff has been initiated. It will accelerate mineral development if we can conduct a comprehensive market analysis utilizing a computer-based system to help steer the efforts. We can program a system and initiate data-collection this year that will: 1) Identify potential customers for Egypt's resources and mineral products, 2) Record transactions, prices, units and qualities to use in market projections, 3) Identify the competition and opportunities for counter trade, and 4) Convey transportation costs just like any other commodity. This is to meet the recurring question "Who would buy our product if we were to offer it?". It also will tell which resources we should avoid, like phosphate 1000 km from port, and will tell how innovative we must be to undercut the competition.

An important result of market studies is that we can then approach buyers with evidence of profit for them, rather than wait for them to discover profit potential in Egypt. EGSMAs VIP geologists travelling to U.S. as well as Mr. Chew and other coached by him should be carrying newly-compiled data on grade and reserves of our salient resources, to talk to potential mining investors. They should also be armed with economic facts as well as mineral data. We need to turn some geologists into part-time businessmen, and I think it is a responsibility of AID-hired experts to help create pragmatism at every opportunity.

Once we have identified likely customers for known Egyptian resources of demonstrable economic character, it is suggested that Mr. Chew and assistants travel to make a formal presentation and to carry the documentation supporting their claims. Feasibility studies can be presented. An important part of the presentation would be an accurate portrayal of contract expectations and business conditions the foreign entrepreneur would find in Egypt.

It is apparent that the Bendix contract contains sufficient travel budget to support Mr. Chew's international movements during his year here, but travel expenses for EGSMAs staff would require new funding to be established.

There have arisen occasions during the first year when exploration funds would help EGSMAs do its work, but since the Project did not include consultation, engineering studies, drilling programs or metallurgical testing, such work has to be conducted with Egyptian funds. Nevertheless, it should be noted that a mining industry needs public research in areas other than geology if it is to develop at maximum speed. Currently, only a little process, metallurgical or ceramic industrial

research is being done. Reliance on foreign solutions to domestic problems is likely to slow the process of mineral development, and it certainly hampers Egyptian mining companies if it must rely on foreign technology alone. Thus, I suggest that AID engage a consultant from an agency like the U.S. Bureau of Mines, to survey Egypt's needs and to propose a program parallel to MPGAP, that has similar objectives of stimulating the mining industry.

The Egyptian Geological Survey and Mining Authority

Task I : Regional Mapping

Of the six 1:1,000,000 geologic maps to cover Egypt (see accompanying index map), NG 36 is completed and published, and NG 35 is in the printers hands (Hunting Co., England) since January, 1984. NF 36 is awaiting information on the Nubia formation stratigraphy, so will be delayed until 1986. NH 35 likewise needs two more field seasons for mapping. NF 35 has been aided by the shuttle-based radar imagery, but remains largely unexplored geologically. NH 36 is very complex, so will wait for petroleum company geological work, probably 2-3 years from now.

Several 1:500,000 maps are nearing completion : the Wadi Qena metallogenic map is being proofed and bids for printing by January, 1984 are solicited. NG 35 NW has been revised for new Quaternary geology. When the legend and stratigraphic description are done, it will be ready for printing, about January 1985. NG 36 NW is finished, NG 36 NE is to be finished in about 6 months, whereas neither NG 36 SW nor SE are started. All these are competing with Conoco's photo-geologic maps.

The 1:250,000 Ras Benas and Wadi Kuffa sheets, lacking the legend, are in the editor's hands again, to be completed early in 1985.

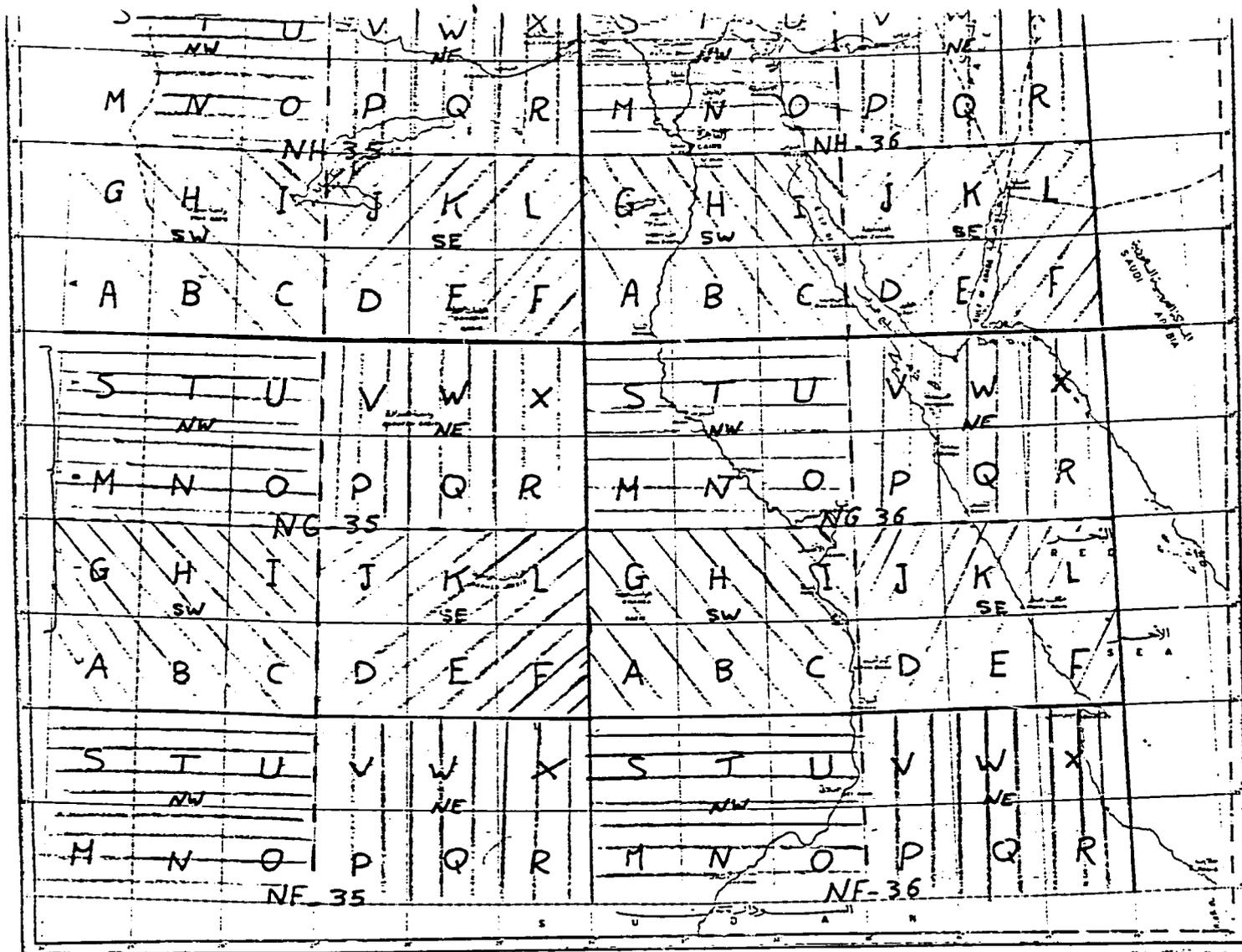
The Greater Cairo area 1:100,000 geologic map is in the printer's hands (Hunting).

Other geologic maps in progress include the Cenozoic rocks of the Red Sea and Gulf of Suez coasts from Ataq to Ras Benas. The field work is finished, but office work will require one more year. Basement geologic mapping of the Sinai south of 27°30' N and the E coast E of 34° longitude are finished, and W of 34° will be finished this 1984-1985 season. Furthermore, several exploration maps at 1:10,000 scales, such as Wadi Keid, Samra, Dongash, Umm Rus, Talaat Godalla and others finished last year are being drafted. Decisions for publication will be made.

The entire mapping schedule is behind schedule for 1983-1984, due to a variety of causes, such as 9 months for paper procurement from USA, or editor retirement and etc. Fears that the entire cartography staff would vanish have not been exaggerated: of the 5 fully trained ones, four have remained only 1 year before taking employment abroad, and the 5th is scheduled for departure in a month. In this period, the training program required to maintain strength has faltered for lack of assigned trainees. Three cartographer trainees are now nearly qualified to continue the work of the center, so it may not be necessary to bring an expert to restart the program, as has been done before.

A large order of map paper and chemical supplies was placed to provide for the first year's reproduction work. Printing is to be done in Egypt. The delivery was delayed by imprecise specifications until October, 1984, so map making has been stalled during the year. Meanwhile, the cartography staff has been decimated so that future production will be slowed until new personnel are trained. A large-format camera was to be delivered during the past year, to facilitate photographic work with the maps. There would have been a two-week training course with its installation. Because a budget problem developed (see Aeromagnetic Survey of Eastern Desert, EGPC), funds for all EGSMA commodities have been curtailed, so the camera procurement is postponed, possibly beyond 1985. Further help in cartography should await evidence that ESGMA can keep in-house training alive, otherwise the investments are soon lost. No cartographic training in U.S. has been scheduled for this coming year, due to lack of trainees.

One procedural change we expected to implement this past year was the drafting of a 3000-word geological text to be printed on the face of the two 1:250,000 sheets, and on other subsequent issues. Because editing capability did not develop, this was abandoned. A lexicon of standardized stratigraphic and geographic names has been prepared in 1984.



Key to Mapping
in Egypt

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Task II : Geophysical and Geochemical studies

During the 1983-1984 field season, geochemical prospecting was carried out in several field areas: Wadi Kid and Samra in the Sinai, and in SW Aswan. The most notable result was discovery of an area in the W.D. with about 8000 ppm copper. This anomaly will be studied further, but not in 1984-5.

The principle geochemical effort this coming year is part of a multi-disciplinary project to establish optimum methods of interpreting airborne magnetic and radiometric anomalies generated by the Aeroservice Co. project. A vast area of relatively well known geology has been selected. It spans the Red Sea Hills between Qena and Safaga. Geophysicists, economic geologists and geochemists are all working to interpret the data using remanent magnetism, structure and geochemical sampling as aids. The Nuclear Materials Corporation personnel who have worked for years on this area are being consulted. The project can serve also as a proving grounds for interagency collaboration. In return for their use of MPGAP-provided radiometric data, EGSMA may use computer, software and filed data. NMC's GAD-6 gamma-ray spectrometer would be useful in metallic exploration, and the use of field-camp facilities, transportation and communication would be economical for both agencies. The overriding fact is that radioactive minerals, some of value in their own right, are always accompanied by sulfides of metals such as zinc, copper, lead and gold. It is a proper MPGAP function to stimulate collaboration for the sake of both agencies, on the grounds that it will have a favorable impact on resulting discoveries by both NMC and EGSMA in their respective areas of responsibility.

Aeromagnetic and radiometric surveys were flown by Aeroservice Co. this year in Area II, under contract to EGPC. Area IV, a new addition flown at no cost over E. Oweinat in W.D. utilized some excess flight-line distance not consumed in Area II.

A pilot test of field techniques for interpretation of aeromagnetic and radiometric features of the E.D.'s is being implemented beginning November, 1984. The purpose is to apply ground geochemistry and geology to understand the origin of several categories of anomalies depicted by the high-quality survey data being acquired from Aeroservice Co. This will prepare EGSMA and NMC for a systematic study of anomalies revealed throughout the survey areas. A degree of collaboration may be established between economic geologists, geochemists, geophysicists and members of both agencies charged with exploration.

It is noted that a program to follow up the great prospects presented by the Aeroservice data cannot be done without building a staff-whereas 2 new geophysicists

were promised last year, only one materialized. About 10 new ones are needed to carry out the department's aims. MPGAP training would then be essential.

Geophysical projects of interest include various phases of the contract studies of Woodward-Clyde Consultants and High Dam Authority. EGSMA is collaborating on studies of Quaternary faulting along the Red Sea coast and the Lake Nasser area; no recent faults have been discovered on the coast, but recent faulting evidenced by geomorphic features are common west of Aswan and the Lake. Trenching is in progress. Seismometry is continuing, especially along a N-S fault 40 km W. of Aswan. Piezometric and hydrologic studies are underway.

A groundwater study, using gravity, magnetic and electrical traversing, drainage and geological mapping is being done in the WD for the Ministry of Irrigation. Nubian sandstone aquifers are the main targets.

A paleomagnetic study of remanent magnetism is being conducted to determine the relative ages of plutonic rocks of the E.D., especially the granites.

Several geophysical tools to have been delivered this past year remain in critical need. A line stabilizer for the paleomagnetic gear has been bought independently. Purchase of the other tools has to be postponed until a favorable settlement of the budget problem over who is to be debited for the \$4.8 million portion of the Aeroservice contract attributable to Areas IB and II. New geophysical equipment will be purchased during 1985, including resistivity sounding gear, seismic refraction equipment (budget permitting), well-logging devices and laboratory equipment for determining rock properties. These and others not listed will be field-tested, and training in their use and maintenance is scheduled. A shortcoming of the program may be that no consultants will contribute to the training of EGSMA geophysicists.

Task III : Economic Viability and Estimation of Potential Resources

Metal-mining has been so depressed world-wide that exploration and new starts are nil. Only precious metals have done well throughout the recession. Whereas it is safe to say that few mineral deposits will sell themselves, there are some more marketable than others. Industrial minerals and building materials are presently more saleable than metals, so our short-term aims should stress their documentation and advertisement, while maintaining modest commitments to base metal sulfides.

Unlike petroleum plays whose potential may be 100 times the investment, mineral deposits generally present marginal profit potentials, so EGSMA should become adept at salesmanship to attract scarce mining capital to Egypt. Because richer-than usual deposits have been neglected here, and because special trading prospects exist, there is opportunity to entice optimistic investors. But we need to seek them out, rather than wait for them to be attracted. Captive Egyptian markets put some minerals in favorable condition for exploitation.

It is evident that a variety of mineral commodities could be produced for export in raw form, but when viewing the array of value-added products that dominate world trade, it becomes clear that EGSMA could benefit from contacts with industry. For instance, gypsum is such a low unit cost item that Egypt can hardly compete in world markets. But wall-board, tiles or plaster of Paris are more valuable products that can compete better because of advantages here of low labor and energy costs as well as cheap sea transport. Capital remains the scarce ingredient.

Items in critical short supply, like tantalum or chromium can be worth exploration and development, if we can show high enough grade as well as other economic factors. Recognition of such opportunities remains imperfect.

A computer program to identify market opportunities was proposed but not implemented last year, for lack of computer and staff. We were to collect records of transactions in mineral commodities, and to obtain Commerce Dept. statistics on imports and exports of consumer nations. A program was being designed, but was not implemented. With the hiring of geologist Randall Chew, with marketing as one of his assignments, there will be marked progress in the area of organization of such data. He is expected to augment his own talents with additional consultants, as well as to mobilize EGSMA to form a permanent marketing staff. All TDY experts for mining or geology are being sought, in part, for their ability to market the resources of Egypt.

Whereas foreign sources of funding are the original objective of MPGAP, it is

evident that it is worthwhile to devote attention to local contacts in industry, the potential Egyptian consumers who could turn producers, as well as entrepreneurs, bankers and capitalists that can be stimulated into a field uncommon to most Egyptian businessmen. These are probably the quickest sources that can be developed to stimulate mining.

A critical subject is the development of a model contract. A committee in EGSMIA including the P.C., has revised the old form to make it more suitable for mining, but further modifications are worth consideration. The fact that the AGRICO negotiations were broken off, perhaps irrevocably, suggests that changes are needed for further negotiations to succeed. MINEX is still in process, though no signatures have been obtained. MPGAP will help this coming year by bringing in consultants knowledgeable and specializing in mineral industry contracts between foreign firms and developing countries. Also, the 3rd Semi-Annual MPGAP Symposium is scheduled to include representatives from successful developing countries, to provide Egypt with opportunities to analyze their own contractual conditions.

The Geological Survey is obtaining from the consultants advice on the optimum exploration for attracting investment. But implementation depends upon Survey funding and motivation. Many of the non-metallics, such as glass-sand, limestone or gypsum require little exploration. In some cases, geological uncertainty must be minimized by thorough drilling, sampling and testing, leading up to a feasibility analysis. When heavy national investments have been made in a deposit, such as a coal vein or gold mine, it may be an attractive option for the GOE to do the production itself. But gold mines will generally have insignificant impact on the economy. It is better to use them to interest foreign mining companies into business in Egypt, believing that their involvement and education will lead to sizeable investments in other minerals having significant impact. Only if there develops a prospect of stratiform deposits of disseminated gold of low-grade, large-tonnage character, foreign participation may be necessary, for capital and technology.

Originally, certain minerals, such as gold, gypsum and potash were singled out for MPGAP effort. Because the methods being developed to advertise, document and market them are equally applicable to other mineral commodities, MPGAP participation has spread to glass sand, bentonite, bauxite, tantalum, niobium, massive sulfides, and potentially, many more. Thus, the benefits derived from the program will be enhanced by enlarging the list to include any and perhaps every one that can be an asset to Egypt, especially in foreign trade or import substitution. Glass sand or gravel aggregates for example, could produce more significant exchange in shorter development time than could a lead-zinc mine. The Mineral Commodity Summary (Sept. 23, 1983) by the Project Coordinator listed the attractive commodities. The November,

1984 Semi-Annual Meeting Proceedings will enlarge on many of these, and the Summary should be updated this year. Newsletter releases will keep abreast of exploration results, and advertise the program abroad.

Potash Program

The 1983-84 Implementation Plan included the exploration program for potash, most of which was accomplished. The study of Miocene occurrences of potash along the Gulf of Suez coast was completed, and an exploration plan was developed by Mr. Abdulla Wassef. The geophysical logs of over 40 oil wells revealed likely potash salts, several of which are onshore, at shallow depths. Exploration has been concentrated in the Gemsa and Zeit Bay areas, where a mine and processing plant could be situated adjacent to a port sulfur prospects in the same area have not yet been explored, but a new negotiation has been opened, following conclusion of talks with AGRICO. EGSMAs new geophysical logging tools were not available for use in the drill holes completed in evaporites this year, but the old Russian logger was run in the two holes, to 451 m at Gemsa, and 275 m at Ras El Behar NE. These tests did not find mineable sylvite, but lab analysis of radioactive horizons suggests polyhalite. The work suggests that Zeit Formation anomalies are not good targets, but the much thicker beds of the 1st Salt, S. Gharib Formation must now be tested. Following a period of data evaluation, a new drilling program for Ras El Dib is expected to be implemented in 1985, while collaboration of oil companies to provide side-wall cores in development wells is being sought. It will depend on Ministerial approval of a budget for coring. The drilling done served the good purposes of retraining EGSMAs for deep drilling, to give them skills in evaporite drilling with brine mud, and in the logging and interpretation of evaporite cores. High-level consultation is not appropriate at this time until further cores have been collected in both Zeit and R. Gharib radioactive beds. Because sylvite discoveries remain highly likely in this region, negative results from the 1983-84 drilling cannot be reason for curtailing the program. EGSMAs did a commendable job in its two technically successful deep holes, executed with scarcely any budget for the purpose. Because the work has retrained EGSMAs crews in deep-drilling techniques lost in recent years, it is desirable to continue the program with at least one more hole, using the UBC rig. The selected site may be at Ras El Dib, with depth 500 m. The coring interval would be 175 to 500 m. The same procedures as used in 1984 should be successful, and similar laboratory tests completed.

A detailed program of drilling, according to a designed drilling pattern, is to be executed in case an economic deposit is found in any of the boreholes. At least

10 boreholes are to be drilled at each discovery site to evaluate the deposit, or more if structural complexities are discovered. This stage of exploration is to facilitate the calculation of reserves, and to optimize the mining methods, as well as to provide samples for technological and economic analysis of the deposit.

MPGAP participated in the EGSMA-USGS Western Desert expedition of 1984, evaluating with backhoe trenches the poleodrainage systems of regional interest detected by SIR-A, the shuttle-based side-looking radar system. The next flight, in November 1984, will feature a program of continued study by USGS, et.al., of the Western Desert Quaternary geology. These are of general relevance to MPGAP, due to our commitment to help with regional mapping. In addition to groundwater resource developments, the results have relevance to regional exploration and geochemistry by sediment sampling. Also the mapper essentially strips the sand cover from the extensive, unmapped Precambrian terrane, of higher metamorphic grade than the E.D. There should be extensive ore-search in coming years, over the SW desert areas.

Gold Mine Evaluation

Two mines were developed, for the purpose of making them accessible and attractive to investors. Mines not actively being worked soon become dangerous for inspectors. One whose hoists, ventilators, timber and trackage have deteriorated requires almost as much cost of rehabilitation as for the opening of a new mine. The two mines chosen for this project, Atud and Umm Rus, located W and N of Marsa Alam, respectively, had been explored in the early 1970's, but disuse had filled them with water and decay. Thus, in each case, it was necessary to repair existing machinery, to add machinery, to restore the surface plant, including ventilation fans, and to make the main and mine drifts safe for occupation. Underground drill sites were prepared.

At each mine, a 1:10,000 surface geologic map of about 2 km² was prepared, and underground mapping was begun. At Atud, the 1st and 2nd levels were mapped, whereas the 3rd level is only partly accessible. At Umm Rus, a pump to dewater levels 2 and 3 was not installed until October, so mapping was confined to the 1st level.

Sampling for geochemical analysis was done at the surface at 50 m spacings along lines, with additional samples of quartz veins. Underground, the routine spacing is 5 m from quartz veins and altered zones, especially making channels to represent the disseminated gold in the wall-rocks. These have been sent to Dokki for gold analysis, by way of a sample preparation station at Marsa Alam, re-

activated this year.

The work is intended to explore the extent of workable ore at all levels, so as to increase reserves. New ore is being sought by diamond drilling at Atud. Though drilling equipment was delivered to Umm Rus, lack of crews prevented action there. Their object is to sample the wallrocks for assay, and to search for parallel veins. At Atud, proper mine mapping alone disclosed that the "main vein" workings are actually on two veins, 2 m apart, thus increasing reserves and economy considerably. Only development work to block out ore has been done at Atud, thus it is in excellent condition for starting a small mining operation. Umm Rus was extensively mined in this century. At Atud, a bulk sample of development ore was collected and shipped to Cairo for heap-leach testing.

In 1984-1985, work will continue at these mines, and work will start at three others: Umm Ud, Semna and Hangalia, old mines where some explorations have been done in modern times. At Wadi Karim, a large felsite area with many pharaonic pits but no recent exploration will be studied. Surface geologic mapping and sampling will be the major tasks there this year.

Gypsum Program

EGSMA's gypsum exploration program is aimed primarily at opportunities to develop an exportable commodity. Gypsum is already mined and consumed locally (about 700,000 T/yr) for Portland cement inhibitor, for building plaster and tiles and as soil conditioner. No export program has been developed by public or private mining companies. Other countries like Spain and Iran produce 7-8 times as much as Egypt with smaller populations, so there is reason to expect markets to exist. Finished products are more economic than raw gypsum rock, because of the value added, and these are areas worth developing, even though capital-intensive.

According to a recent report by Abdel Moneim Kamel, there are great reserves of gypsum, in 6 areas: 1) the shallow littoral lagoons along the Mediterranean coast, notably at Ballah, have crystalline gypsum with some silty contamination easily removed to make 11×10^6 T of high quality. 2) Inter-ridge deposits from Alexandria to Mersa Matrouh, in beds up to 2.5 m thick, yellowish and impure, about 80% $\text{Ca}_2\text{SO}_4 \cdot 2\text{H}_2\text{O}$, at least 20×10^6 T reserves. 3) Surficial crusts with detritus, spongy, dirty, but good for agriculture and located favorably in Fayoum and Beni Suef areas, with about 20×10^6 T of 44-77% $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$. 4) 46 km inland from Hamman is a 7-10 m bed with several km extent. It is massive and crystalline. 5) Highest-grade gypsum lies near the W. coast of Sinai from Suez to Ras Malaab with at least 240×10^6 T

reserves. Sinai Mn Co. and National Cement will be opening mines soon, for plaster of Paris and cement manufacture, respectively. Future work by EGSMA will extend these reserves northerly. 6) The Miocene evaporites of the Zaafarana to Berenice reach of Red Sea coast contain enormous reserves not explored significantly until this year's program revealed commercial grade (72-92%) gypsum in 2-6 m beds at Gemsa Peninsula and the N. end of Zeit Bay. A program to evaluate other deposits on the coast is being planned, though not for execution until 1985. All of the coastal deposits have export potential, and along the Red Sea coast, their presence together with other minerals such as phosphate, potash, sulfur, salt, anhydrite, lime, magnesia, silica, petroleum, waste gas, atmospheric nitrogen, possible halides and solar evaporation potential all suggest a chemical industry on an important seaway.

Mr. Kamel's report of _____ describes the stratigraphy revealed by the 10 drill holes put down in 1984 to 10-40 m. The best discovery to date, at Zeit Bay, is below sea level. The water hazard in quarrying has not been evaluated. Geologic work should be done to plan a more thorough drilling program along the 400 km extent of gypsum on this east coast of Egypt.

Though no drilling is scheduled as yet, completion of work at Maghara and vicinity will release rigs later to permit explorations on the west coast of Sinai north from Ras Malaab to Suez, where enormous reserves probably exist. Also, a possible deposit near Abu Ghuzun will be studied for drilling.

Other Commodities

In my Implementation Plan of 1983-84, I proposed a gravel resource evaluation of deposits along the Red Sea coast, where I recognized good quality alluvial gravels at locations favorable for export. Though that project was not undertaken in the past year, it remains feasible for completion in the current year. A market study is needed to sustain my belief that gravel is an exportable commodity, especially by sea.

Discovery of high-grade bauxite by Riofinex in Cretaceous rocks of central Saudi Arabia suggested to me this past year that similar settings in Egypt should be studied to locate deposits that could ultimately free the country from the costly (200 million E) imports of Australian alumina. Riofinex has proposed, at our invitation, to conduct a training program here that will transfer their techniques of exploration and evaluation applicable specifically to the occurrence.

They have found that the bauxite formed as a laterosol during Albian-Aptian time, under topographic and climatic settings we can learn to recognize in the rocks of the Sinai and Eastern Desert. I recommend an ongoing program to bring the project to a state ready for feasibility evaluation.

Resources of clay have been sporadically studied by various agencies in scattered localities in Egypt. The brick supply crisis brought on by outlawing use of the Nile silts used for thousands of years has stimulated a new project for a wide-ranging reconnaissance and testing of replacement clay and silt deposits near the Nile Valley-seeking materials that can be processed in the time-favored way. A brick-plant being built at Fayoum will be used to demonstrate new sources for adoption by the brick-makers all along the Nile.

The same approach is suggested for location of more exotic clay: kaolin and montmorillonite for industrial and drilling needs. The former is being mined at Kalabsha and Sabana Salama, Sinai, and EGSMA has a project for continued exploration for the Sinai Manganese Co. The National Research Center has a project for evaluation and beneficiation of bentonites, which has worked with a Fayoum deposit, and with clays found along the Cairo-Alexandria desert road. A systematic search has never been under done for either commodity, except locally for certain governorates, who have held the information proprietary. Because clays, silts and shales of many ages occur in Egypt, the stratigraphic information gained by regional mapping and drilling projects should be studied and used to conduct field reconnaissance of numerous potential sources. Testing, and in some favorable cases, detailed backhoe or drillhole exploration should follow, aided by an expert brought by MPGAP. The collected information including releases of governorate reports, should be publicized for foreign and local investor use.

Studies of massive sulfide deposits in the southern Red Sea Hills are considered by MPGAP staff to have great potential importance to Egypt. We have developed a plan for later exploration, utilizing some new remote sensing tools, such as the new Multi-spectral scanner, as well as conventional mapping, geochemistry, geophysics and drilling. A proposal for new MPGAP funding is being readied.

Placer tin in Wadi Igla is being mined and processed by EGSMA during 1984, and as soon as AID-financed CIP processing equipment can be set up at Marsa Alam, it will be milled. This operation is developing engineering skills in mining.

Following training of two geologists in the evaluation of deposits of tin, tantalum, niobium or tungsten, in a U.S.-based training course that included visits to key study sites in Cornwall, England, Spain and Portugal, the Egyptian deposits of those metals in Wadi Igla, Wadi Abu Dabbab, Nuweibi and Abu Rusheid will be evaluated and promoted by EGSMA this coming year.

Task IV : Upgrading the Analytical Laboratories

There have been two geological consultants concerned with gold explorations that have examined the Analytical Laboratories this past year. One of their charges has been to advise us how might the laboratory be improved. From inconsistencies of check analyses of samples, Mr. Harry Godbe was able to show that the spectrometric data have been giving erroneous results for gold, which is usually in trace amounts. Dr. Laurence James confirmed that the typical method of gold analysis in other labs is the AA spectrometer, and that with proper methods of concentration, the modern equipment at Dokki is excellent for the purpose. He recommends that flame spectrometry be continued for general reconnaissance use for other elements, but that AA be more fully employed for gold.

Significant changes in laboratory procedure are needed to upgrade the quality of its output and usefulness to field geochemical parties. The one-year turnaround prevalent today can be replaced by prioritized analysis such that the samples collected by an active field party are analyzed and results returned in one month, so that results can guide further sampling. The number of samples can decrease, thereby, because barren areas or leads would be sparsely sampled in favor of concentrated work in areas of promising anomalies.

We are waiting for the Dokki Laboratory to volunteer methods of rapid turnaround, which might entail air shipment or courier delivery of samples weekly, automated laboratory procedures and radio return of results to the field parties. Such a method would revolutionize the use of geochemistry, improving results significantly over the grid-sampling procedures in vogue since the Russian expeditions of the 1960's and 70's. It would also smooth out the work load at Dokki, because the habit of delivering thousands of samples to the lab at the end of the field season creates excessive strain on the personnel and facilities during the summer months.

The laboratory's capabilities have always been limited in the X-ray area. A Russian device gave out years ago, so they have either done without, borrowed time on the National Research Center's equipment, or used substitute tools such as DTA. Research cannot flourish in that environment, and I am sure there is no laboratory of comparable size or through-put that has so long endured without X-ray diffraction, at least. So the main objective of MPGAP procurement is to increase the depth of analytical capability.

Also scheduled for acquisition this year is X-ray fluorescence equipment.

In 1984, two technicians were sent to U.S. and trained in X-ray techniques. The timing of the bid tender remains unknown, pending resolution of the budget problem between EGSMa and EGPC.

One other device recommended by the Project Coordinator is a DTA to replace the existing Hungarian relic. It was inoperative when first inspected in 1983, due to a broken hair-thin resistor wire that could not be replaced, there being no longer a source from the manufacturer, and certainly no local source. It was repaired by using some of the remaining, unbroken part of the filament. Clearly, it deserves retirement in favor of a modern DTA with a better recorder and more automation. This machine is important for detailing the hydration states between anhydrite and gypsum, as well as for clay analysis.

Task V: Geologic Museum

After a slow start, the preparation of the library spaces on the Corniche in Dar-As-Salam has gotten under way, using a combination of public and privately-furnished money. Though far less space is available than the collection occupied in Tahrir Square, the old display cases are being restored and arranged to good advantage for minerals and fossils. The separate, new building to house staff and research activities is nearing completion. The facility is scheduled to open to the public shortly after New Years, 1985.

Some museum staff training has been provided by MPGAP this year: the Head of the Department went on tour of US museums in December 1983 - January 1984, to learn modern display exhibit design and curating methods. Upon return to Cairo, he was relieved of his duties, but the problem may be resolved by the court in 1985 to permit him to regain his post. Otherwise, the training is lost. Two other trainees were sent to US in January, 1984. During September-November, 1984, a library expert has helped with the reorganization of the museum library and its cataloging system.

Task VI : Mineral Commodity Program

Some of the main conclusions from internal reports of the Geological Survey, for instance on gold mine evaluation, were extracted by the Project Coordinator and assembled in a Mineral Commodity Summary (see 2nd Bimonthly Report, Oct. 23, 1983). A few releases were made from that summary during the year, in conformance with the Mining and Quarries Regulations, and under authorization by the Director of the Geological Survey and Mining Authority. One trade magazine interview (New York Business Journal, outlined some of Egypt's resources for the purpose of attracting venture capital, and Exploration Director Abdel Tawab presented the summary in November, 1983 to several U.S. and U.K. mining companies that have shown interest in Egypt in past years. Visitors and potential investors also received copies. This document will be upgraded for further dissemination this year.

Another means of making the files available and evident is by collecting packages of publications, reports and data applicable to selected commodities appropriate for a business venture. The key to release of information in that form has been approval by the Board of Directors and the Minister, reached in October, 1984. At that time, plans for package assembly were put in motion by an EGSMMA committee. A team of geologists were assigned the task of assembling all pertinent documents, with a summary written by the leader of each group, a person experienced in the unfiled information needed by potential investors. Though none of the packages are complete yet, several are nearly so. These include: gold, glass sand, clays, gypsum, limestone, and polymetallic deposits. A secondary list will be assembled later. These are all being put into storage in a new reference room in library spaces. An interested visitor may study them there, or reproduce any portions desired, at cost of reproduction only, as certified by the Minister of Petroleum and Mineral Wealth.

There are recurrent needs for market information on mineral commodities, including Egypt's imports and exports. A data-bank is also needed on a spectrum of countries and commodities that Egypt could conceivably serve. In this way, proper exploration priorities can be set, and opportunities for attracting investors can be seen realistically. Files of recent transactions in mineral commodities could give us the ability to seek investors. The Project Coordinator has outlined a computer storage and retrieval program to be implemented, one commodity at a time, when we have acquired our own super-micro desk computer. It will then be appropriate to hire personnel to amass the needed data, and to program the filing and retrieval methods.

Egypt's system of joint-venture and concession contracts is still in a formative stage. after extensive committee work to modify the prior model, based on petroleum's production-sharing system. Without expert advice from agencies outside Egypt, or developing countries that have successfully reached contracts beneficial to both parties, it is apparent that the new form of contract must still differ greatly from forms proven useful elsewhere. Persons related to the developed countries, such as MPGAP staff or mining company executives cannot be effective in producing Egyptian confidence in their recommendations for fear of bias. Thus we plan to make available to EGSMA and the Ministry, the services of one or more UN experts in mining contracts and mining legislation, and to provide access to knowledgeable representatives from less-developed countries. The 3rd Semi-Annual MPGAP Seminar will be devoted to the business aspects of the mineral industry, especially foreign contracts for concessions and joint ventures, and mining legislation.

It is recommended that an aggressive foreign marketing program be initiated on behalf of and by EGSMA. The editor replacement, Mr. Randall Chew, has been selected for his breadth of management experience and geology background, expecting him to institute a commodity program and to train several senior key EGSMA people to become adept at finding potential sources of capital for development of mines that can produce mineral commodities fitting marketing opportunities they will discover. Eligible persons will be conversant in one or more languages besides Arabic, persuasive as salesmen and negotiators, and fit to travel to present and promote investment opportunities abroad. Whereas travel expense money for Mr. Chew is budgeted within the Bendix contract, additional sources may be required for EGSMA personnel, lest this additional training role deplete other training budgets.

Task VII : Publication and Documents Center

One of the principal means of attaining the MPGAP objective of enhanced foreign investor participation in the Egyptian mining business is through improved advertising, utilizing better, more visible reports, maps and publications. EGSMA has agreed to undertake several programs toward those ends:

Reorganization of the library has been active since hiring library specialist El Arini in September, 1984. They are moving the holdings from the many different 4th-floor rooms of the North wing at Abbassia, to a new arrangement of rooms of larger size in the South wing. The move will be completed after re-conditioning the new spaces, during 1984-1985. Reorganization of the catalogue system has also begun with help from the library expert. The Dewey-decimal system has been adopted, and after computer acquisition in 1985, it will be electronically stored.

An office of Scientific Reports distinct from the existing Documentation and Information Center has not yet been established, though it was recommended last year, to be formed directly under the Chairman, so that editing could be autonomously powerful. But until some editors of capability and stature have been assigned, the office will be meaningless.

Editor Larry Stout arrived in September, 1983 and remained a year for the purpose of training an editorial board at EGSMA, in order to upgrade the publications. One senior and two junior geologists were assigned, and as subject matter for training they processed some 22 papers for Annal Nr.13.

In June, 1984, Mr. Edward opted to return to Cartography, and in July, Mr. Fakhry Labib returned to his former post at Fayoum. The remaining trainee, Mr. Ihab, assisted by Mme Fadia Fawzy, have proofed two versions of the ms. Mr. Ihab will complete the publication process by about January, 1985. Partly in disillusionment since efforts to restaff the editorial board were unsuccessful, Mr. Stout left his post in September, 1984.

A new editor-geologist, Randall Chew, arrived November 17, 1984, but he will not be able to upgrade EGSMA capabilities in this area unless English-language qualified geologists are assigned for training. Suggestions for organizational changes made by Mr. Stout merit reconsideration, because the current status of publication efforts leaves much to be desired. It would be worthwhile to make some of the field work of the past year widely available to the public, and a commitment to publish some of the results of US and Egyptian training programs would also be

desireable. One publication being prepared is a summary of the observations of three geologists trained in industrial minerals, with visits to 40-odd US and Canadian mines and process plants. A draft is being edited. Another publication in preparation is the Proceedings of the First Semi-Annual MPGAP Symposium. The Proceedings of the Second Symposium will be a valuable documentation of many of Egypt's mineral deposits. In 1985, both volumes will be published and distributed to over 800 recipients.

A library expert, Mr. El Arini, has been engaged full-time to upgrade the EGSMA, DRI and RSC libraries, and to train librarians in modern techniques. He has been particularly useful in re-organizing the EGSMA library for a move to new, consolidated quarters in the S. wing at Abbassia. He is instituting an interim card-catalogue system using Dewey-Decimal system, prior to computerizing holdings. He may return for short check assignment in the Spring 1985.

Whereas opportunities for useful computerized storage of geologic information are many, the first application should be market data for mineral commodities. This can be implemented upon arrival of computer hardware. Another application ready for ADP is geochemical analysis and plotting of aerial data. Library information must be programmed this year also. EGSMA has special computer needs, because it requires scientific hardware like a digitizer and plotter as well as a powerful CPU for number-crunching (mainly geophysical applications). Data such as Aswan High Dam seismometry needs large storage, while such applications must remain compatible with the business/accounting features of most data-storage arrangements. The EGSMA effort to computerize geologic data cannot be instituted without outside help. Two trainees are scheduled for U.S. residence in January, 1985, and two thereafter. It is apparent that to establish a data-system and especially to implement it and make it habit for the staff will take years of effort. Long-term programs must be started now, while MPGAP can stimulate the technology transfer.

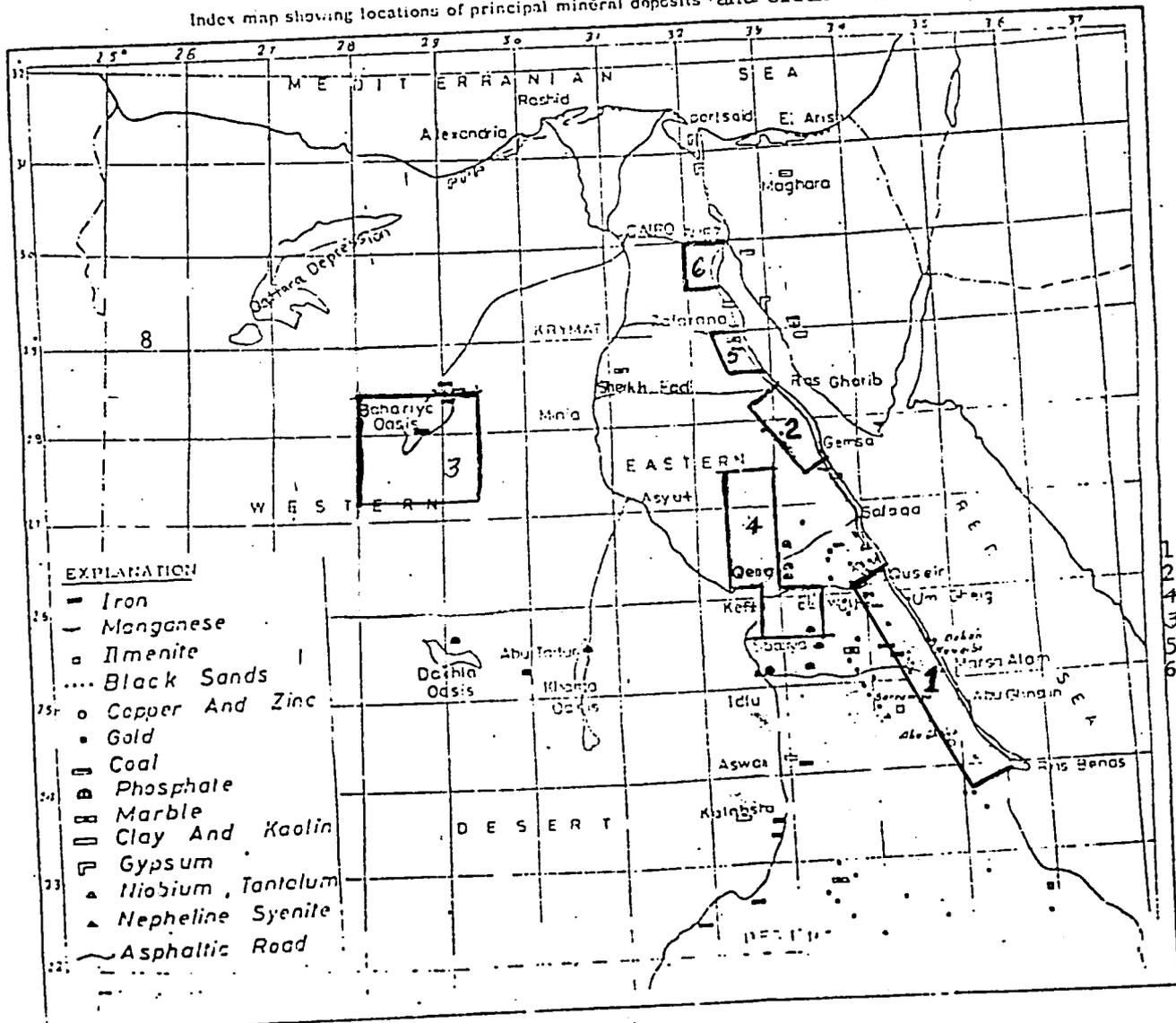
Desert Research Institute

Task I : Groundwater Exploration

The DRI program objective is to find groundwater to support the existing and potential mineral and petroleum resources. Process water, and potable water for the infrastructure are both necessary for establishing mines in desert regions. The areas committed by DRI for study were prioritized (1983-84) largely according to mineral-development expectations. DRI has interchanged the relative order of 3 and 4, below, in consideration of the availability of personnel and the time necessary to collect hydrological data. In order of decreasing priority, the areas are listed below. They are outlined on the accompanying figure:

1. Red Sea coastal strip, Qusseir - Marsa Alam - Abu Ghosoun - Ras Banas. Phosphate, tin, tantalum, niobium, gold, zinc, lead, copper, ilmenite, iron, feldspar, mica, asbestos and talc deposits abound in this region of crystalline rocks, whereas water resources are probably largely in the wadis.
2. The coastal reach from Ras Gharib to Gemsa is potentially rich in non-metallic minerals, such as potash, salt, gypsum, and sulfur, as well as petroleum. The discharge of Bir Wadi Shagar, serving Ras Gharib with about 50 l/s. suggests that Miocene bedrock may yield considerable quantities of brackish water.
3. Groundwater has been pumped from the Nubia sandstones flooring Bahariya Oasis, but little is known of its detailed hydrology. It deserves attention because of active iron mining, and potential barite extraction. Both need beneficiation, depending on a reliable water supply for feasibility.
4. The Wadi Quena - Wadi Loquita area is of moderate priority, mainly because of large known mineral resources, namely of phosphate, gold, tungsten and decorative stone. If water is discovered, it could be used also for land reclamation.
5. The Wadi Araba - Zaafarana area has potential for development, being along well-travelled routes and possessing non-metallic resources including glass sand, kaolin, limestones and gypsum. The Wadi is extensively floored with Nubia sandstone, a possible aquifer.
6. The Ataq-Suez strip is rich in limestone, shale and dolomite, and is expected to see major industrial growth because of its proximity to the Suez canal. Water now provided by the Ismailia Canal from the Nile may soon be over-utilized, demanding

Index map showing locations of principal mineral deposits and Groundwater Study by DRI



EXPLANATION

- Iron
- Manganese
- Ilmenite
- Black Sands
- Copper And Zinc
- Gold
- ▭ Coal
- ▭ Phosphate
- ▭ Marble
- ▭ Clay And Kaolin
- ▭ Gypsum
- ▭ Niobium, Tantalum
- ▭ Nepheline Syenite
- ~ Asphaltic Road

- 1 Groundwater study by DRI
- 2. Ras Gharib-Gemsa
- 4. Wadi Qena-Loqita
- 3. Baharia Oasis
- 5. Wadi Araba
- 6. Gebel Atāqa-Suez

new resources. It is probably a difficult groundwater province since the abundant carbonate/shale rocks of Jurassic to Eocene age are poor aquifers. The wadis are short, steep, ill-sorted and coarse, offering little hope of much supply.

Present plans are to continue work at Marsa Alam in 1984-1985, as permitted by the drill performance this year. Qena-Loquita, Ras Gharib and Bahariya Oasis will be undertaken, and in 1985-1986, Ataq, Araba and the remaining work at Bahariya will be done. The last project year, 1986-1987 will be to finish all tasks and prepare a final report.

MPGAP has made possible an considerable build-up of DRI staff, including at least two senior hydrologists and fifteen junior graduates. The activities of these people, in several groups distinguishable by different goals and geographical areas of work, have in some respects exceeded the commitments made in last year's Plan of Augmentation.

After conducting a search for literature pertinent to the E.D., work on Area 1, in the Quseir - Ras Benas region, started with a geological reconnaissance and a search for all water-points, numbering 67. Water samples were taken and analyzed, and pumping tests of wells were conducted. Geological mapping and subsurface exploration included vertical electrical soundings in wadi fills, seeking depth to water and to basement. With the assistance of an EGSMA drill rig and crew under contract, two wells were drilled and tested. Interpretation of the available data permitted completion of an interim report, and a more detailed report is to follow. Further work awaits receipt of DRI's own drill rig, so that numerical evaluations can be made.

Area 1 work will be continued through May, 1985, depending upon the completion of 10-15 test holes in wadi alluvium. Whereas the hydrological and geophysical surveys suggest shallow water tables in some wadis, and deep alluvium in others, the existence of a large prism of saturated alluvium has not been proven for any wadi. Until drill holes can be completed to confirm electrical soundings to show the existence of significant mineable water in storage, there can be no assurance that there are supplies to provide mine process water.

Recharge mechanisms include occasional mudflow torrents, some portion of which may percolate to the groundwater body in the alluvium, and infiltration into bedrock fracture systems which communicate with the alluvial reservoirs. Because testimony suggests that rainfall at any one place comes on the order of once each five years, it is not feasible to quantify either rainfall or infiltration rates,

though some contributions to hydrological understanding of the process, and some approximate measures may be obtained in the course of several years' investigations.

Eight out of 10 wells produce from bedrock, because in many wadis, the alluvium is thin, and because the ancients who chose the well sites had no way to locate the thalweg, the trace of the deepest alluvium on bedrock. Pumping tests and well yields indicate capacities of a few m³/day, only rarely sufficient for processing needs, though valuable for domestic uses. It is not expected that DRI will obtain enough bedrock permeability test data to make meaningful estimates of bedrock discharge when combined with hydraulic gradients, simply because fault-dominated fracture permeability is too variable. The low porosity implies limited storage in such rocks.

Conversely, alluvium in each wadi is a concentrated drain for its watershed. A reasonable number of wells in an alluvial reach can verify the hydraulic gradient and the wetted cross-sectional area of the fill, while pumping tests measure the overall permeability. Then the groundwater discharge can be calculated. Such data can permit design of a well field to exploit calculable reserves in known volumes of saturated alluvium. Some such method can suffice to justify investments in the region, but quantitative results are essential. They are attainable only by drilling and pump-testing, which can begin in about March, 1985, according to the procurement progress.

The cooperation of EGSM in making housing available at Marsa Alam, with attendant fuel, water, shops and communications, has been of great value to DRI. Similar cooperation by GPC at Ras Gharib will probably develop.

The studies in Area 2, near Gamsa to Ras Gharib have begun in September, 1984, following procedures like those used in Area 1. Because the mineral prospects as well as the petroleum development in this area is along the coast, it is anticipated that much hydrological effort may concentrate on the potential resources of the Miocene clastic rocks, while wadi alluvium investigations are conducted in the same manner as in Area 1.

DRI will field three parties this year, two of which will work in Area 1. until everything but drilling is finished, then remove, about January 1, to the Ras Gharib area (2), where reconnaissance work, already started, will continue. The emphasis may be on the Miocene clastics, and on some Cretaceous carbonates and clastics, while wadi studies are less important. About 6 holes, to 300-400 m depth are planned for drilling, logging and testing.

Work in Area 3, Bahariya Oasis, is being started immediately because data collection will require much time. There are numerous deep wells already in existence, and DRI plans to drill about 5 piezometers. Depths to the Nubia aquifers attain 500-800 m in places. Pumping tests to establish transmissibility and storativity will be essential for developing a water budget useful for predicting long-term yields of the basin. Future mineral extraction at El Gedida or other iron ore mines will depend on such a vital analysis.

In all areas, the completion of significant work depends upon the availability of the drill rig, which is to be let to bid in a few weeks, possibly December 1. We expect to buy a versatile machine capable of all terrane and rock types, to depths of as much as 500 m, in bouldery wadi alluvium, sandstones, limestones, shales, and hard fractured metamorphic or granitic rocks. It must be capable of coring, or reaming, or driving casing, of setting and pumping units. Although designed as an exploration tool, off-season use for well drilling is likely.

Task II : Data Organization and Analysis

Upgrading the DRI library has been initiated this year, during the assignment of a library specialist September - December, 1984. He has advised and instructed the staff on methods of filing and cataloguing books, periodicals, reports and maps, sent people to school and prepared a system to be implemented largely by the staff. The holdings have been consolidated and reorganized. New acquisitions ordered in the past year have been arriving slowly.

Among the commodities scheduled for purchase this year is a mini-computer, for use in data filing as well as scientific uses. It will be procured with the help of Georgia Tech. Ultimately, the cataloguing of library holdings will be computerized. One task considered worthwhile would be the collection of data on water wells in the pilot areas, filed geographically with any evidence of depth, lithology, water level, yield and quality, etc. It would require extensive map search and liaison with several other agencies, because the data is presently widely scattered. This can be started late in this year, after training and equipment have been acquired. The computer processing of resistivity soundings is another need that cannot be met with computers in their present possession.

Remote Sensing Center

Task I : Data Organization and Analysis

The Project Director and the Remote Sensing Center staff have ordered journals, books, and reports to upgrade the library. Many of these have been received. The object is to correct the library deficiency in mineral-oriented literature. An expert on systems of map and photo filing is scheduled to assist upon arrival in February, 1985. He is Mr. Larry Carver.

A library expert was engaged September-December, 1984, to advise on re-organization of the RSC library. A librarian trainee is to follow, probably next Spring. Computerization of holdings has been planned, using the Cromenco.

Task II : Production of an Atlas of Landsat Imagery of Egypt

A contract was let in July, 84 with Earth Resources in Michigan to train RSC personnel at Ann Arbor. Two were sent in 1984 in the operation of the updated M-DAS hardware and software, and in preparing Landsat imagery. The first 7 Landsat scenes (of highest user priority) were made on equipment identical to the upgraded Egyptian MDAS system, and with photographic reproduction equipment comparable to that at RSC. Thus, those persons have already completed some of the Atlas abroad, and are trained to finish it as soon as equipment is installed. But because procurement by the Contractor, Wimvex Co., has been delayed, installation may not be until mid-1985. To get the work started, RSC has decided to lease disc drives locally. Mr. Barry McRae of ERIM is engaged for a short term to help assemble the equipment and get the tape processing work underway. Using that interim system, then the finally-purchased units, the Atlas could be in production in January, 1985, and finished 18 months thereafter, for printing in Egypt in about June, 1986. The MPGAP Director will provide some supervision.

Lack of ground control (about 600 points are needed throughout the uncharted W.D.) has been partly resolved by promised acquisition of Conoco's control, set up for their Landsat Geologic Mapping Project, and military cooperation has been assured for acquisition of other control points. There will still be many of the 81 scenes that lack the minimum 6 points, thus reducing the cartographic grade of the project as a whole.

Task III : Remote Sensing Workshops

The ERIM contract includes the training of 4 professionals from the RSC to become competent instructors in remote sensing and advanced photogeology. The first two were scheduled for October-November, 1984, but were postponed because another large project at RSC has taken priority. The beginning course in Remote Sensing is tentatively scheduled for then. A course in Advanced Geological Remote Sensing is planned for 1985, utilizing the ERIM-provided TDY expert and his Egyptian counterpart, who will have been trained at ERIM during late 1985. Planning and advertising the first workshop will be begun in whereas preparation of materials will be begun in Michigan, by the instructors, in mid-1985.

Task IV : Aerial Photography

The original plan was to have RSC contract to provide 2500 km² of geologic-grade airphoto coverage near Bahariya Oasis for the Geological Survey. When RSC announced that its plane and camera were ready, it was noted that military air photo-coverage had recently made the mission redundant . Substitute areas were sought, but good geologic reason for flying candidate areas could not be found. Efforts to write a contract were wasted. At this time, a substitute mission under consideration is to fly a color photo mission over mineralized areas of the S.E. desert, employing a Dr. Don Slaymaker, who has devised inexpensive methods of saturated-color photography to enhance geologic differences on the ground. If this mission can be approved, it can be completed in 1985. Otherwise, the task may have to be cancelled.

Egyptian General Petroleum Corporation

The MPGAP program for the petroleum sector has undergone several changes this year. Flexibility to adapt to changes of business and exploration circumstances is inherent to the program. AID responded (31 May, 1982) to an EGPC request for a major change of program (24 February, 1982), resulting in approval of the following seven technical studies. EGPC is exercising its initiative to undertake or postpone or revamp these studies according to its judgement. New studies are under consideration.

a. Aeromagnetic Study in the Eastern Desert

The contract with Aeroservice Co., Dec. 16, 1982, has been partially completed, except for many of the paper products being generated in Houston. Work is proceeding on schedule. Dr. H. Kamel, newly-appointed Chairman of the Board of GPC, has retained Project Manager status. Dr. William Hinze of Purdue University has been hired as consultant to provide quality control, making periodic visits to the company office in Houston as well as to Cairo. He inspects and approves all map products before they are delivered to GPC for distribution to EGPC and EGSM.

All areas of aeromagnetic and radiometric surveys had been flown by February, 1984, and deliverables on all areas have been coming in on schedule. For Area IA (E. Desert), finished products of all maps and interpretations have been delivered by October 1. All large scale maps and radiometric interpretation maps for Area IB have been delivered, and the final aeromagnetic interpretation is expected November 15. For Area II, (SE Desert), the aerometric and radiometric interpretations are underway, and delivery will probably precede the schedule date of 1 September, 1985. The Area III map (Baharia Oasis) has been delivered, but the schedule for delivery of interpretations remains unchanged. Deliverables on Area IV (E. Oweinat) have all been made.

According to our consultant, Dr. Hinze, the quality of the products we are getting are "state-of-the-art". It encourages further support of aeromagnetic survey work to stimulate exploration in Egypt.

All the scheduled contract products, including reports, are expected by Fall, 1985.

Whereas it was understood at the outset of the program that the entire cost of the Aeroservice Co. contract, \$7.6 million, was to be borne by the EGPC budget of MPGAP funds, a controversy has arisen over the budget source for Area II expenses, \$4.8 million, which is wholly for the benefit of mineral exploration. It develops

that no written concurrence that EGPC's budget would cover that part was ever executed by the former Minister, so the burden could fall on EGSMA unless the present Ministry can make an equitable solution. Otherwise EGSMA has already committed or expended the remainder of its \$8.4 million budget, and cannot complete the Program not obtain scheduled commodities for laboratory and field instrumentation

A proposal to contract for aeromagnetic surveys in several additional areas is under consideration. These include the coastal strip for Alexandria to El Alamein, and to Mersa Matrouh and nearly to Libya. The areas adoin surveys of Pan-Am and Conoco and extend offshore somewhat beyond the feasible water depth. Other prospective areas include the Nile Delta, the north end of the Red Sea including the junction with the Gulf of Aqaba and Suez, and the northern part and offshore Sinai. Another target could be the southeastern coastal strip on the Red Sea adjacent to Sudan, near a recent Sudanese discovery area.

In principle, aeromagnetic surveys are very cost-effective for initial information in newly-explored areas. It has the great advantage of extensive coverage at low unit cost, disclosing hidden basins and structural highs that can lead to more detailed seismic surveys and drilling programs. Thus it is recommended that AID consider such proposals and approve those areas meeting other criteria for feasibility. It should not be an area already under concession, though it may lie adjacent to or overlap a concession, because structures can be extrapolated from known to unknown areas. It may overlay old AM surveys done with less sophisticated techniques.

b. Seismic Study in the Eastern Desert

The basement interpretation map for Area IA was received in preliminary form in June, 1984. It revealed, not one large, deep basin near 28°N, 32°E, but rather several smaller ones of only 7,000-10,000 ft depth. The deepest are in the northerly part, in Esso's concession, which was taken during this past year, perhaps in part as a result of the aeromagnetic survey. Esso has subsequently paid EGPC \$600,00 for it, and a revolving fund has been established for such revenues that can be used for similar exploration purposes. Considerations of petroleum maturation suggest that there is no attractive exploration target in the rest of the SE desert basin. The gravity anomaly is probably related to low-density plutonic rocks rather than basement surface depressions. The seismic evaluation of basement configuration has therefore lost its appeal.

c. Establishment of Seismic Data Storage System and Data Library

Establishment of electronic data storage for EGPC's records of all exploration data, including well files, stratigraphy, magnetic, gravity and seismic information has been under discussion for several years. A 1978 study by PI of Denver recommended major changes in filing, archiving and organization before computerizing the files. But for exploration data alone, it has been decided that a new staff should be trained quickly, using Egyptian experts formerly with Gupco. The only assistance from AID anticipated will be acquisition of computer facilities not already on hand at EGPC, such as a large-format plotter for map generation.

Another portion of this project has been to solve the need for adequate air-conditioned storage for magnetic tapes, including seismic data, the aeromagnetic survey tapes from Aeroservice Co., and tapes to be generated under the above-described filing program. Various candidate sites have all been found deficient, and alternatives are to be found this coming year.

d. Source Rock/Oil Migration in the Western Desert

e. Sedimentary/Petrographic study of the Western Desert and the Gulf of Suez

The same manpower limitations that were cited a year ago as reason for postponement of contract research projects pertain today. Whereas the embargo on trucking of Western Desert crude has been lifted, there remains no inclination to augment Western Desert studies.

f. Estimation of Existing and Potential Oil and Gas Resources in the Gulf of Suez

Robertson Research Co. was awarded a bid to conduct a study of the Gulf of Suez, and successfully sought sponsorship of 31 oil companies, willing to purchase their results. They are currently collecting data from those sponsors, that they will assimilate, analyze and report.

g. R & D and Feasibility Study of Tertiary Enhanced Oil Recovery

This project, delegated to GPC to be managed by Dr. H. Kamel, is for the purpose of stimulating EOR in Egypt, in the belief that maintenance of high production rates, especially after discovery rates decline, will depend upon the success of EOR methods. It is attractive as an investment because the heavy crudes of the Gulf are normally responsible for large residual oil left in place. These

are susceptible of thermal enhancement methods that can produce up to 50% of the original oil.

Furthermore, the Minister of Finance has indicated that aid programs should be used to boost production, so that future funding for EOR should be increased. The present funding level for this purpose is of the order of a feasibility study, not a pilot project.

Accordingly, GPC has selected the Bakr-Amer Field as a prime candidate, in terms of the large volumes of residual oil in place, roughly 600 million bbl. A pre-qualification questionnaire has been processed, eliminating all but a few potential bidders for a study of the application of various candidate EOR methods to stimulate production in some or all of the 18-20 reservoirs in that field. Mathematical simulation will be required. An invitation for bid will be issued in about December, 1984, and the study may last nearly a year.

h. Stratigraphic Study (Drilling) in the Eastern Desert

As indicated in b, above, the hypothetical deep basin in the E.D. was not supported by the aeromagnetic survey interpretation, and EGPC has decided, for that reason, to cancel this project in favor of other exploration drilling.

To justify re-allocation of funds to a different stratigraphic test hole in the Gulf of Suez will require additional study, by EGPC and by consultants to AID. The proposal is to test the hypothesis that thick salt sequences, i.e. unexplored basin areas of post Mid-Miocene rocks, may actually overly structural highs undisclosed by reflection seismology because it is masked by the evaporites. Since potential test sites are offshore in the north or central zones of the Gulf of Suez, the cost might approach \$16 million, a significant fraction of the Project funding that should be invested wisely.

i. Training Equipment, Ras Gharib Training Center

A committee formed in GPC, headed by Mr. Abd El Gani El Sherbini, and actively pursued by Mr. El Bassiuni, with representation from the engineering, training, finance, and legal departments, with P.C. as ex-officio member, met frequently from June to the present to process acquisition of a Rig Floor Simulator. Three technical proposals were received. The two responsive ones were invited to bid, and Simitran was selected to supply the Ras Gharib Training Center with an advanced assembly with several optional consoles that, together, promise to provide a great

range of functions representing the operation, malfunctions, optimization, maintenance and organization of a drill rig and its crew. Delivery of the \$257,000 apparatus, expected about March 30, will make it possible for GPC to exercise its mandate to provide high-technology training to all the oil companies. We have invited Simitran to propose a training program that will extend beyond the 6-week program of training built into the contract. The Center can become a good income-generating institution while contributing greatly to operations and safety in the whole petroleum production area in all Egypt.



برنامج تقدير موارد الثروة المعدنية والبتروولية والمياه الجوفية
MINERALS, PETROLEUM & GROUNDWATER ASSESSMENT PROGRAM

To: Project Officer, S. Arif

From: Project Coordinator, D. T. Snow

Subject: Revision of Implementation Plan for 1984-1985

AID Project 263-0105

Egyptian Academy of Scientific
research and Technology

Desert Research Institute

Egyptian General Petroleum Corporation

Egyptian Geological Survey
and Mining Authority

Remote Sensing Center

Your Ref.

Our Ref.

Date March 7, 1985

Certain portions of the plan of implementation submitted December 5 were found unacceptable by the Egyptian Geological Survey. I have therefore revised the preamble of that report, and discussed the changes with Director O. Mansour. Since my own views have not changed, I have attached to the revision a separate Addendum, emphasizing my recommendations. For your information, I enclose both documents

Please distribute the Addendum and Revised Plan as you see fit.

David T. Snow

Addendum
MPGAP Plan of Implementation
1984-1985

This is to more fully express my opinions and recommendations for stimulating mining investments in Egypt, since the Revised Plan expresses views already fully agreeable to EGSMA.

The pre-1983 concept of MPGAP was based on the assumption that the existence of favorable deposits was largely unknown abroad, and therefore the missing ingredient was improved publication or advertisement. It was believed that accomplishing such work would accordingly stimulate foreign mining investors to take concessions. Yet, it could be noted that many of the world's major mining firms had investigated one or more mineral prospects in Egypt, but that none had remained to do business. Further, the work of the Egyptian Geological Survey, largely preserved in internal reports accessible to visiting investors, has been found to be generally adequate for purposes of establishing whether or not exploration would be worthy, should investors want to evaluate the economic feasibility of mining projects. Study of the model concession agreement being offered to visitors to indicate the Egyptian concept of foreign mining involvement suggested to the writer that the main obstacle is that visitors quickly find that the prospects are poor for repatriatable profits. Egypt must create a favorable business climate or it cannot hope to realize its aims of significantly increasing foreign investment in mining.

The prospect of falling oil prices places stronger emphasis on mining and increases need to generate hard currency by mineral exports or import substitutes. Simultaneously, it stimulates world business by promising cheaper energy: Egypt can recoup some of its loss of oil revenues by attracting more mineral investors.

In addition to the program efforts (page 2) enumerated for improved information I believe that

- c. The Egyptian business climate must be improved, and
- d. Contacts have to be made with foreign and domestic capital sources, promoting projects and aiding them in their evaluations.

The first of the above requirements, 'c.', is the only essential one, for existing communications have, and will continue to attract a few companies, but if profit potential is lacking, no mining can begin. Just as Western businessmen study books on Arab business practice, negotiation methods and psychology, so should Arab promoters study Western thinking and methods when the time comes to seriously sell natural resources to profit-motivated Westerners.

5

There is no unanimity of opinion that legal and economic controls on mining are responsible for the lack of mining, or that change is necessary. The current version of the model concession agreement is patterned closely after the production-sharing concession contracts so successful in the petroleum field. This version is being offered to all foreign interests and some companies are negotiating along such lines, believing that workable arrangements can be made. AGRICO and EGSMMA tried for two years to come to terms. After \$2 million expended in negotiations, AGRICO has seemingly broken off until Egypt makes a major conciliatory move. Among Egyptians, much hope had been placed on the success of the AGRICO negotiations, for the first successful one can be a prototype for a procession of foreign investments. Under leadership of the new Minister of Petroleum and Mineral Wealth, EGSMMA and its new Chairman have increased authority and flexibility in contract negotiations. There is apparently a great deal of newly-developing interest from foreign investors, and several negotiations have begun. The first test will be the adequacy of proposed terms in the matter of Freeport Sulfur Co's concession to explore and develop sulfur in the North Sinai.

The most favorable contract change I have learned about is the abandonment of profit-sharing production. That is, after a reasonable 4-7% royalty, all production can be cost-sharing production. It may therefore become economic to initiate marginal mining operations with longer payoff periods.

I have heard arguments that the model offers a flexible guide and that it should be attractive since everything is negotiable. Nevertheless, it is an extreme proposal seemingly favorable only to Egypt. Western negotiators are not used to an initial set of conditions or terms so far from acceptable that, in their eyes, reconciliation is impossible. They may walk away instead of bargaining, and that's what they have been doing for years. The large number of ways Egypt proposes to take profit is discouraging, and I recommend it be limited to a fixed small royalty, plus a reasonable share (related to equity) in the after-cost revenues plus fixed-rate income taxes and infrastructure fringe benefits. Import-export tariffs, bonuses, fees, title transfers, preferential domestic sales, payments for existing information and undeserved bond forfeitures should be eliminated because they are not typical of Western contracts. These devices create distrust in an environment where confidence has not yet developed. The transfer of title to land, improvements and equipment repaid out of cost-sharing is a direct confiscation that supports the foreigners' fears of total nationalization.

Revisions of the model contract can be made, still returning royalty, taxes, profits and corollary benefits to Egypt. The changes can have beneficial psychological effect on investors as well as real improvements in their profit projections. Without such changes, only a few companies will attempt to negotiate. It should be understood that exploration is still inactive everywhere except U.S., Canada

and Australia, thus special inducements are needed to interest companies in Egyptian ventures. Many Egyptians and most Western observers recommend changes in the contract offerings: more effective contractor control, less threat of confiscation, fewer methods of Egyptian profit-taking and better prospects of repatriatable profits are areas for possible revision that would stimulate foreign investment.

It might make a vital contribution to Egyptian mining if we were to use MPGAP funds to expose EGSMA to new management views. I recommend use of the services of disinterested experts, such as UN counsellors in mining legislation and contracts, and to arrange visits by representatives of other developing countries that have found good solutions to the problems of sovereignty over resources and the need to attract foreign capital. It would be useful also to arrange visits by top Egyptians to such developing countries as Turkey, Phillipines, Indonesia and others. Formal training in certain institutions may be available for learning Western business practices.

Funds budgeted for VIP travel to US can be diverted instead for travel to developing countries to learn their methods of conducting mining business. I believe these visits are more likely to have beneficial effects than are travels in U.S.

It is the opinion of the Project Coordinator and of Bendix Co.'s Resident Manager and U.S. Liaison Officer that we must stimulate EGSMA to make significant changes in the model concession agreement for succeeding negotiations to implement, or MPGAP will fail to reach its stated objectives, negating most efforts and AID investments in other facets of development. This is the only 1st-order priority activity of MPGAP yet we have no accord with EGSMA on a plan to do anything about it in the immediate future. There is no agreement even that the model contract is deficient. At the Spring, 1985 MPGAP semi-annual meeting, a symposium is planned on mining contracts, to which will be invited several foreign experts from developing countries and agencies devoted to their needs.

The acquisition, documentation and dissemination of mineral data, together with market research and promotional activities are important means of stimulating mining in Egypt, but they would proceed in some manner even if no MPGAP effort were devoted to it. Thus tasks related to mineral data are of second order priority. These are the established tasks of EGSMA under the MPGAP project.

The engagement of a geologist experienced in project management, Mr. Randall Chew, has given us the opportunity to initiate marketing efforts much as a new well-financed corporation would do. The object is to train a cadre of qualified EGSMA people to carry on activities of direct influence on potential investors, both foreign

and domestic.

One recommendation made a year ago is even more appropriate now that a marketing staff has been initiated. It will accelerate mineral development if we can conduct a comprehensive market analysis utilizing a computer-based system to help steer the efforts. We can program a system and initiate data-collection this year that will: 1) Identify potential customers for Egypt's resources and mineral products, 2) Record transactions, prices, units and qualities to use in market projections, 3) Identify the competition and opportunities for counter trade, and 4) Convey transportation costs just like any other commodity. This is to meet the recurring question "Who would buy our product if we were to offer it?". It also will tell which resources we should avoid, like phosphate 1000 km from port, and will tell how innovative we must be to undercut the competition.

An important result of market studies is that we can then approach buyers with evidence of profit for them, rather than wait for them to discover profit potential in Egypt. EGSMAs VIP geologists travelling to U.S. as well as Mr. Chew and others coached by him should be carrying newly-compiled data on grade and reserves of our salient resources, to talk to potential mining investors. They should also be armed with economic facts as well as mineral data. We need to turn some geologists into part-time businessmen, and I think it is a responsibility of AID-hired experts to help create pragmatism at every opportunity.

Once we have identified likely customers for known Egyptian resources of demonstrable economic character, it is suggested that Mr. Chew and assistants travel to make a formal presentation and to carry the documentation supporting their claims. Feasibility studies can be presented. An important part of the presentation would be an accurate portrayal of contract expectations and business conditions the foreign entrepreneur would find in Egypt.

It is apparent that the Bendix contract contains sufficient travel budget to support Mr. Chew's international movements during his year here, but travel expenses for EGSMAs staff would require new funding to be established.

There have arisen occasions during the first year when exploration funds would help EGSMAs do its work, but since the Project did not include consultation engineering studies, drilling programs or metallurgical testing, such work has to be conducted with Egyptian funds. Nevertheless, it should be noted that a mining industry needs public research in areas other than geology if it is to develop at maximum speed. Currently, only a little process, metallurgical or ceramic industrial

research is being done. Reliance on foreign solutions to domestic problems is likely to slow the process of mineral development, and it certainly hampers Egyptian mining companies if it must rely on foreign technology alone. Thus, I suggest that AID engage a consultant from an agency like the U.S. Bureau of Mines, to survey Egypt's needs and to propose a program parallel to MPGAP, that has similar objectives of stimulating the mining industry.

MPGAP Plan of Implementation

For October 15, 1984

To October 14, 1985

The object of MPGAP is to stimulate mineral and petroleum resource development so as to make a favorable impact on the national economy of Egypt. A strong effort to promote its natural resources is therefore needed. Whereas petroleum exploration and production is active, mining of metals and non-metallic minerals is almost non-existent. For a country that is developing its industrial base, it is unwise to neglect local sources of raw materials while more and more are being imported. The facts developed during early phases of MPGAP have substantiated that a great variety of minerals exist in Egypt. However, that does not guarantee investor activity, from either abroad or at home.

It can be just as useful to develop mines with Egyptian capital as to bring in foreign money. Egypt is rich in untouched natural resources, many of which are produced in other countries for export to Egypt. Egyptian firms enjoy preferential treatment in comparison with foreign firms. If a product that meets specifications can be made, import regularization can generate a captive market; such import substitution can have a direct effect on the balance of trade. An equally important objective to be met by mining is the establishment of a material base for industry. Proliferation of supports for industry has a healthy multiplier effect on the economy. Whereas there is Egyptian capital available, lack of experience and mining traditions have hampered internal development, even though the mining law makes it very easy and advantageous for an Egyptian to start such works. There is a wide spectrum of minerals available, mostly non-metallic, that are good candidates for exploitation, and it would be good policy for MPGAP to find means to stimulate Egyptian businessmen to become active in mining.

At this writing, there are several negotiations known to be in progress with foreign firms. These involve gold and sulfur. Others remain confidential. None of the above have been as a result of MPGAP activities. But there are three multinational mining firms that have recently expressed interest in obtaining a foothold in Egypt, one by developing a small gold mine, another by offering a training program to EGSMA. Also, there are two potential Egyptian investment companies known to have a strong interest in mining prospects - all these are results of MPGAP promotional activities. We should examine our program to see what should be done to multiply the number of such interested parties, and even more, to create conditions that will induce them

to become productive operators.

Our program to improve investment in minerals includes development in these areas:

- A. Information on mineral deposits has to be improved in quality, made readily accessible and well advertised.
- B. Markets and potential developers need to be identified.

There are two other requirements for success that are beyond our control: favorable world-wide market conditions for mineral commodities and rich mineral deposits in favorable circumstances for mining and marketing. Fortunately, we are facing a period of business recovery world-wide, and Egypt's long isolation from foreign intervention has kept its mineral wealth intact. MPGAP is timely in these respects.

The work of the Desert Research Institute is primarily to establish that water supplies can be developed in desert areas likely to become mining areas. Water for process and infrastructure needs are being sought in several pilot areas, and the DRI has been diligently proceeding on schedule to meet those commitments designed into the MPGAP. The greatest impediment to completion has been lack of adequate drilling capability, without test holes in critical locations, the quantitative hydrology essential to the tasks cannot be done. A drill rig will be bought by Summer, 1985, so DRI can catch up in data-deficient areas.

The Remote Sensing Center has the opportunity, under MPGAP, to become focal in regional mineral exploration work throughout Africa and the Middle East. To this end, MPGAP was designed to make possible the productive of an Atlas of Landsat images to cover all Egypt capabilities, using the MDAS scanner, are to be upgraded with new new equipment and training. These tasks, and short courses to promote the technology, are all delayed but proceeding. A new mineral exploration capability in color photography may be added to the program. These will stimulate mineral exploration work.

The petroleum sector projects originally included in the project agreement were shelved for lack of host country management. Only the acquisition of a rig-floor simulator has proceeded, to stimulate training for all petroleum companies' benefit. Enhanced Oil Recovery research and development has proceeded well into the contracting phase, and prospects for implementation are good. Exploration work to data has featured the successful execution of the Aeroservice Co. contract for aeromagnetic surveys of vast areas of the Eastern Desert, and radiometric survey of the areas exposing potentially-mineralized Precambrian rocks. Now there are six proposed exploration project being investigated, to extend the aeromagnetic coverage, to test by drilling

a new structural concept in the Gulf of Suez, and to institute improved storage and filing of exploration data in EGPC. The results of these efforts are predicted to generate favorable business in petroleum exploration and production.