

MPGAP Plan of Implementation

For October 15, 1983

To October 14, 1984

If the mineral industry is to make a favorable impact on the national economy of Egypt, it must take an aggressive approach to marketing its resources. Whereas petroleum sales are usually arranged easily in the world market system, the fact that mineral resources of other sorts exist here produces no foreign enthusiasm, even when the tenor of an ore is well established and reasonably well known. To date, the MPGAP plan has been based on an assumption that a lack of adequate documentation and publications has resulted in world-wide ignorance of the riches awaiting the mineral developer.

My inquiries tell me that the existence of metallic and non-metallic deposits in Egypt is reasonably well-known abroad, and that investment has been curtailed for quite different reasons. There is testimony that many mining companies have come to Egypt to look into mineral resources but they have left after a time, during which an adequate representation of the amount and grade of ore, the location and infrastructure, and the rules for foreign investment were made known to them. Cases of this sort have been cited, with respect to gold, glass sand, tin, tantalum-niobium, gypsum, sulfur, ilmenite, iron ore, kaolin and decorative stone.

I have seen enough of the internal reports and the mineral deposits they represent to be in awe of the natural riches Egypt possesses, relatively untouched. A nation only recently independent, such as Egypt, must look to its natural resources for income to support rapid development. EGPC succeeds in negotiating for its petroleum the greatest percentage of returns of practically any nation. The mining sector has been less successful at attracting foreign corporations, partly because similar large Egyptian shares have been required in mining ventures that typically work on small profit margins. Unfortunately for Egypt, the model contracts offered to potential investors seemed

to contain so many skimming devices that the impression was probably conveyed that there could be no profits that the investor could repatriate. There are now sincere intentions to make effective changes to improve the mining investment climate, and these are evident in more realistic contracts.

Provided contractual problems are solved, timing and circumstances may produce exceptional opportunities for Egypt: the long hiatus in most Egyptian mining areas has resulted in many unusual discoveries, some richer than average, and a few larger than usual. Also, if economic recovery is "just around the corner" then our timing for exploration, documentation and advertising is perfect. Lastly, it is apparent to many in government that the lion's share of nothing is still nothing; changes are being made to liberalize the contract terms to make profits likely, so that foreign explorationists will stay to become negotiators. Several negotiations are proceeding smoothly at this time, so we will soon be able to show other potential investors that favorable terms can be expected. AGRICO's exploration for sulfur at Gemssa, MINEX for gold at Barramiya and BABCOCK for coal at Magara are the active ones.

The MPGAP budget is appropriately unbalanced in favor of the petroleum sector, because there is a better likelihood that investment by AID will help Egypt's balance of trade if concentrated on oil versus mineral development. The course of change in the mining sector will probably take several more years before new deposits, new laws and favorable world markets act to produce significant exports of mineral commodities. But I believe the course is clearly in favor of that happening, with or without our help. Our task is to accelerate the process, and we are beginning to make some of the right moves.

Of the three essential elements for stimulating an Egyptian mineral industry, world economy is least in our control. One of the only things we can do to help it is to do our best to spend U.S. tax-payers' money wisely. The second element, depending upon the existence of unusually large or rich deposits, we can do a great

deal to further, by fostering intelligent exploration, documentation and dissemination of information. Because our scope of work in MPGAP emphasizes this area, the present and subsequent reports must emphasize it. The third element, the Egyptian investment and business climate, we should exert efforts to change, using whatever opportunities we are afforded. Earth scientists and political figures alike want to develop healthy mining industries to supplement oil revenues, and they look to the mining giants of the West, to find ways to succeed with diminishing government subsidies. MPGAP should use some of its resources to teach mineral economics and business practices that will help Egypt reach its goals. For example, I have found senior geologists, some of whom have been involved with mineral negotiations spanning many years, to be most interested in any modest suggestions regarding contract changes that would further acceptance by Western miners. One of the senior EGSMAs to travel to U.S. this coming year is the financial director, who will probably examine the business structure not only of the U.S. Geological Survey, but also the Bendix Field Engineering Corporation, and a few of the leading mining firms. It is important for him to learn how money is handled in a free-enterprise business. I am encouraged to believe that the advice of well-chosen experts in mineral law, business and contract negotiations might have favorable impact resulting ultimately in changes to stimulate investment. During this coming year, we will be searching for appropriate advisors in those fields.

Before turning to the stated objectives of MPGAP in the balance of this report, I wish to recommend another departure I feel will accelerate mineral development: comprehensive market analysis is an essential part of the program, and a computer-based system is badly needed to help steer the Egyptian efforts. I intend to program a system and at least initial 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 reciprocal trade, and
- 4) Convey transportation costs just like any other commodity. This is to meet the recurring question from so many sources, "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. In October 1983, the first senior EGSMA geologist to travel to U.S. Dr. Abdel Tawab, will be carrying newly-compiled data on grade and reserves of our salient resources, to talk to a few potential mining investors. Subsequent emissaries should go even better armed, with economic facts as well as mineral data. We need to turn geologists into businessmen, at least for critical moments, and I think it is a responsibility of AID-hired experts to help do that at every opportunity.

Internal reports and a few published reports reveal the work of the Egyptian Geological Survey. The EGSMA staff has been successful in ore-finding over the years: in the mid-50's to mid-60's, they opened limestone and dolomite quarries, located iron ore at Aswan and Bahariya, coal at Maghara, Sinai, phosphates at Abu Tartur and kaolin at Kalabsha. From the mid 60's to 1972, the Survey received substantial technical aid and commodities from the USSR. It was strongly directed towards ore-finding. The tantalum-niobium deposits were discovered, and gold deposits were evaluated. Phosphates in the Nile Valley and coal in the Sinai were investigated. The steel, phosphate and cement industries were stimulated. Regional mapping continued, but publication lagged. During the past decade, U.S. contributions to the mining industry have been restricted to equipment purchases, without much technical input. Help for the Geological Survey has been minimal. The economic disruptions of war have contributed to the sluggish nature of mining, as well as the unfavorable business climate mentioned above. Now we are becoming involved with mineral development, thanks largely to U.S. Geological Survey, World Bank and U.N. projects here in the past. A consequence is the adoption of a research-oriented MPGAP project plan including long-term developments such as quadrangle mapping, and the building of a techno-

logical base in the four agencies. There is not much of the direct ore-finding approach in the project plan. If MPGAP is to meet the underlying objectives of attracting foreign investors, it is going to have to stimulate exploration as well as documentation. Inferred deposits, such as potash, coal, gypsum and sulfur have to be physically located. The tasks of Egyptian Geological Survey work parties this year are well directed to prove ore. The other tasks are also important contributions towards MPGAP objectives.

What I have been saying in the above paragraphs is that the MPGAP concept of mineral information documentation and dissemination are necessary but not sufficient means to attain the investment objectives.

The Egyptian Geological Survey and Mining Authority

Task 1: Regional Mapping

Of the six 1:1,000,000 maps to cover Egypt (see accompanying map), two, NG35 and NG36, have been completed. NF36 can be compiled easily, and is expected to be done during 1984. NH35 has few corrections to be done, and will be compiled though not finished this year. NF35 must wait for shuttle radar interpretation, whereas NH36 is very complex, and must be postponed to the end of the project.

Several 1:500,000 maps will be completed this year. First will be the Qena Quadrangle Metallogenic Map, currently compiled but awaiting the editor's metal superpositions. NG36 NW, NE, SE and SW can be finished together this year, after necessary checking is done. NF36 NW and NE are to be done in a subsequent year, whereas there is no plan to do 1:500,000 sheets of NH36 because much field work remains to be done .

In most cases, the 1:250,000 sheets must await compilation and pending completion of the 1:500,000 series. The Ras Banas and Wadi Kuffa geologic maps are still in the editor's hands, but it is expected to complete them this year, following the metallogenic map.

There are numerous large-scale geologic maps being prepared by field parties this year: Wadi Kied and Wadi Samra in the SE Sinai, the Red Sea and Gulf of Suez coastal strip from Ataq to Ras Banas, South Aswan, Dongalla and Talaat Godalla areas, and several others. Some of these will be compiled or begun this year.

Furthermore, Annal No. 13 is being prepared, for which many maps and figures are to be drafted this Fall. There are many general tasks to be done to facilitate mapping, such as geomorphology of the Eastern Desert and Sinai, river systems in the Western Desert in support of the SIR-B project, regional stratigraphy projects and other special-purpose maps, such as water-supply for St. Paul's Monastery. The cartography group provides photogeologic assistance on many of these ongoing projects, as well as drafting innumerable figures for reports. Editor

Stout is undertaking a review of unpublished internal reports with the EGSMA editorial staff he is training, and it is expected that several worthwhile map compilations will be initiated this year from that backlog. There is a commitment to begin this year the collection of geologic data packages in support of the MPGAP objectives of attracting financial assistance, and much of the reproduction will entail redrafting of figures and maps.

A large order of map paper and chemical supplies has been placed to provide for some of the first products this year. Printing is to be done in Egypt. The large-format camera is to be delivered in about 6 months, facilitating photographic work with the maps. There will be a two-week training course with its installation. Although no cartographic training in U.S. has been scheduled, the pending failure of other departments to produce English-qualified candidates may make it feasible to consider cartographic training at such places as USGS. The EGSMA staff has decided not to have the U.S. expert arrive until January 1985, but we are watching the progress of the cartography group carefully, for if they encounter difficulties with the photographic work, they may require expert help on short notice.

One important procedural change we expect to implement this year is 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, depending on the success of the initial job. Editor Stout is to collaborate with the authors in text preparation. He is also working with the cartography group on standardization of nomenclature and Annal No. 13 preparation.

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Task 2: Geophysical and Geochemical studies

During the 1983-1984 field season, geochemical prospecting will be carried out in several field areas: Wadi Kied and Samra in the Sinai, and in SW Aswan.

Several geophysical tools that have been lacking, key to many of the Survey's exploration needs, will be delivered this year. To accommodate their availability, a program of staffing and training has been arranged: they will add two new geophysicists this year, two the next and 5 the following year. They also plan to hire a technician to help maintain and repair the gear. Training has already begun in some areas.

Notable in that respect is the program of preparation for the receipt of the voluminous products of the aeromagnetic and radiometric surveys underway. Geophysicists are now being trained in interpretation techniques. Under the admirable leadership of Dr. Baha El Hakim, close liaison with GPC and Aeroservice Co. is being maintained, and he has spent time in the field to be well acquainted with the contractor's operation procedures. Some advance products, proofs in actuality, are being received now, and will be used for training this year. Already some striking new anomalies have appeared: a uranium occurrence SE of Luxor may be in phosphate rocks known to be there, and a potassium anomaly appeared at the N. end of the Bahariya depression.

Aeromagnetic and radiometric surveying is currently being flown in Area II by Aeroservice Co. under subcontract to EGPC. Whereas some of the data will be available in preliminary form during this year, the full delivery is not expected until January 1985. EGSMA need not decide this year whether to submit a proposal for evaluation of anomalies until the volume of field work can be determined. The checking of anomalies will include many local field investigations, leading in some favorable cases to mapping and drilling programs.

New geophysical equipment will be purchased during 1984, 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. Certain U.S. consultants will contribute to the training of EGSMA geophysicists and in program planning.

A high priority study of potash occurrences in Miocene rocks of the Gulf of Suez-Red Sea coast of Africa is being started in Nov. 1983. Study of the geophysical logs of over 40 oil wells has revealed likely potash and magnesium salts, with special attention to finding potash in onshore areas. Whereas the resources extend offshore, development will be concentrated in such areas as Zeit Bay and Gemsa, where a mine and processing facilities can be situated adjacent to a port. Sulfur prospects in the same area will be explored by AGRICO, whose contract is nearing final form. The new well-logging tools will be vital to the fullest use of everyone's drill holes in the evaporites to be completed this year.

Poleodrainage systems of regional interest have been detected by SIR-A, the shuttle-based side-looking radar system. The next flight, in 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. Insofar as no immediate prospect of high-valued ores exist in this remote area, the remote prospect of useful water or placer deposits requires that a low priority be attached to the work, as opposed to such as drilling programs in support of known deposits in accessible areas.

The enthusiasm for economic mineral exploration already stimulated by the MPCAP program has resulted in the formation of some new, unanticipated work parties in EGSMA, as detailed more fully in Task 3. Diversion of manpower and funds has therefore required postponement of some projects formerly scheduled, namely the iron-ore studies in the

South-Western desert, and studies of massive sulfide deposits in the southern Red Sea Hills. Since these latter are considered by MPGAP staff to have great potential importance to Egypt, we expect to develop a plan for later exploration, utilizing some new remote sensing tools as well as conventional mapping, geochemistry, geophysics and drilling.

Placer tin in Wadi Igla is to be mined and milled by EGSMA during 1984, as soon as AID-financed CIP processing equipment can be set up at Marsa Alam. Although this may not be an ideally-designed operation, it is significant in that it moves EGSMA from the realm of scientific inquiry into an area of application, where engineering skills in mining are required. Sequel modifications of the plant and the mining and transporting of ores will strengthen EGSMA abilities and confidence levels to demonstrate the feasibility of any mining scheme.

Wadi Igla, Wadi Abu Dabbab, Nuweibi and Abu Rusheid are all high-valued deposits of tin, tantalum, niobium or tungsten that have been extensively explored in past years. Efforts will be made to market those prospects this year, but there presently is no plan of further explorations. Experts to visit EGSMA during the year will be required to help in formulating sequel explorations, if any, required to document the value of deposits for prospective investor interests.

Task 3: Economic Viability and Estimation of Potential Resources

During a recession that has driven most mines to the brink of bankruptcy and over, there are few mineral deposits that will sell themselves. Unlike a petroleum play whose potential is a hundred-fold the investment, mineral deposits generally present marginal profit potentials, so we must become adept salesmen to attract scarce mining capital to Egypt. Only because richer-than-usual deposits have been neglected here, or because special trading prospects are shown to exist, is there hope of enticing optimistic investors.

We are paying attention to market conditions and factors governing production costs, in order to target our energies. There is no advantage in exploring gypsum, for instance, unless such a low unit-cost item from Egypt can compete in world markets. Items in critically short supply, like tantalum, can be worth developing. We intend to collect records of transactions in certain mineral commodities of interest, as well as to utilize all available Commerce Dept. statistics on imports of consumer nations. A computer program is being designed. Further, all TDY consultants are being selected in part for their practical approach and experience with mines, minerals and marketing, and their skills will be applied to Egypt's development.

Another critical economic area is the subject of contract terms. The underlying premise of this project has been that in the past, politics isolated Egypt and that geological information was not available to mining companies of Western nations. On the contrary, it is the writer's opinion that failure to attract mining investments to Egypt in years past has not been because the data in support of ore grades and reserves has been unavailable, but rather, because adverse politics and unfavorable contracts discouraged investors; profit possibilities were limited more by unbalanced Egyptian shares than by physical conditions which were adequately, if imperfectly documented. AGRICO and MINEX contracts for sulfur and gold, respectively, are nearing signature stage, and they reflect a healthy awareness of changes needed. Further changes will probably be made, hopefully wise ones for Egypt's sake. MPGAP can help this year by bringing in a consultant knowledgeable and specializing

in mineral industry contracts between foreign firms and developing countries. Also, the MPGAP staff will continue to contribute to the discussions, as far as invited.

It will be important for MPGAP and EGSMA to convey data on mineral resources, not just to the mining companies, but especially to the investment and banking community. When the few foreign-exploration companies of the world are in financial difficulties, new starts have to be initiated by entrepreneurs. We must seek business audiences, not scientific.

The Geological Survey also would use advice on the optimum degree of exploration for attracting investment. If potential rewards are great compared to investment (e.g. petroleum), then the bulk of the work should be left to the investor. But if the margin is narrow, geological uncertainty must be minimized by thorough drilling, sampling and testing, leading up to a feasibility analysis. Gypsum may be such a marginal resource. Furthermore, when heavy national investments have been made in a deposit, it may be an attractive option for the GOE to do the production and marketing itself.

Although certain minerals, namely gold, gypsum and potash were singled out for MPGAP effort, the methods being developed to advertise, document and market them are equally applicable to other mineral commodities. 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. Glass sand or gravel aggregates for example, could produce more significant exchange in shorter development time than could a lead-zinc mine. In a recent (Sept. 23, 1983) bimonthly report, the Project Coordinator has summarized his current perception of the attractive commodities. In future meetings, news releases and publications, the results of obscure but already-completed geological reports will be publicized, as will current accomplishments.

The following exploration plan, written by Mr. Abdullah Wassif of EGSMA, describes the program of exploration for potash. Our minimum

objective this year is one fully-cored interval of potash in the evaporites of the Zeit formation, to demonstrate conclusively that the resource is significant or not.

Recommendations for Potash Exploration in the Gulf of Suez Area

The study of geological data of several oil wells drilled in the Gulf of Suez area has revealed large resources of potash. The study of side-wall core samples proved the existence of a 3 m thick bed of high-grade sylvite (KCL).

At least 2 beds of potash can be correlated over long distances between Ras Gharib and Hurghada. The top bed is in the Zeit Formation, while the other is in the fifth salt bed from the top of the South Gharib Formation. The average thickness of the Zeit potash bed is 7.8 m and lies between the depths of 277 and 410 m. The South Gharib potash bed reaches a thickness of 25 m, at depths less than 1300 m.

Two drill sites are selected at the shallowest, most promising areas, one at Ras El Behar and the other at Ras El Dib. Structural highs have been selected, using the results of petroleum exploration work. Faulted areas are to be avoided.

1. Ras El Behar Potash Borehole No. 1:

Proposed depth, 500 m, to test several salt beds between depths of 170 to 500 m. Complete coring is planned below 50 m. Salt-saturated mud is suggested for drilling the borehole. Geophysical logs are to be run after completion of drilling. The samples are to be tested mineralogically and chemically.

2. Ras El Dib Potash Borehole No. 1:

Suggested depth, 500 m, coring interval 175 to 500 m. Programs as at Ras El Behar.

Additional Work:

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 previous boreholes. At least 10 boreholes are to be drilled at each structure to evaluate the deposit, 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.

There follows a translation of the plan of exploration for the Atud and Umm Rus gold mines, written by Dr. Atif Dardir. These mines are among our best prospects for finding significant wall-rock reserves and new veins, hopefully to approach the magnitude of the Barramiya mine's value. If not, there are several others, each needing a seasons' work to fully evaluate them. Sukari is a prime candidate, and its proximity to Atud suggests it be investigated this year if work on the scheduled mines is finished before hot weather resumes.

Plan of Work During 1983/1984 Umm Rus and Atud Areas

Umm Rus Area:

1. To make a geological map, 1:10,000, approximately 1-2 km².
2. To make a geological map of the mine 1:1,000, approximately 1/3 km².
3. To collect geochemical samples along profiles at intervals of 50 m or 25 m with additional samples from quartz veins and metamorphic zones.

To repair the mine subsurface working:

- a. To repair the existing machinery and added needed machinery;
 - b. To repair the main and mine drifts and make them safe;
 - c. To collect subsurface samples along the drifts from quartz veins and metamorphic zones at intervals of 5 m, and to plot sample locations on the geological map.
6. To explore the extent of the ore and collect samples of it.
 7. To drill away from the main drift of both sides and collect samples until the metamorphic zone reached.
 8. To collect gold-bearing quartz samples and samples of metamorphic rock for milling tests.

Atud Area: Same program as above, and also to sample quartz outside the mine area for milling tests.

A brief program has been designed for testing our best gypsum prospects on the east coast. The following was written in collaboration with Dr. Abdel Moneim Kamel:

Gypsum Program

EGSMA's gypsum exploration program is aimed primarily at the opportunities to develop an exportable commodity. Gypsum is already used locally in significant quantities for Portland cement manufacture, as soil conditioner and in production of plaster of Paris for building purposes.

Gypsum in Fayoum and Beni Suef areas is used for agricultural purposes. There is production for building material in the Hammam area, west of Alexandria, and also in El Ballah area along the Suez Canal. The Sinai Manganese Co. will reactivate their quarries when they install a new calcination plant, expected to satisfy Egypt's needs for plaster, but not sufficient for export. They have plenty of raw gypsum for export, but their methods of extraction and handling have not been competitive.

The lagoonal deposits along the Mediterranean coast west of Alexandria may have merit because their shore-side location could yield low on-board costs. Those deposits have not yet been completely examined, so exploration needs are not identified. The localities are worthy of investigation.

A reconnaissance of the many potential deposits along the Red Sea coast between Ras Gharib and Abu Ghosoun has revealed several areas close to the shore, but most exposures are anhydrite of the soft, white variety. It is believed that in Zeit Formation, anhydrite has been hydrated to gypsum at depths shallower than about 100 m, but above the water table, desert conditions have caused the dehydration of the rock to anhydrite near the surface, perhaps above the 30 m level. The details of the transition zone will be important in determining stripping depths. If over 10-15% of the sulphate rock has lost its water of crystallization, the gypsum will be less valuable.

The most attractive site to start prospection for gypsum is on the Gemsa Peninsula, including only the flat wave-cut platform 10 m high, extending 3 km north-south, 1 km east-west. The surface has

exposed anhydrite and some Pleistocene gravels, but gypsum and ground water (fresh or brackish) are expected to be above sea-level. The fresh water lens is presumably stable, perched on salt water below sea level. During recent geologic time, those hydrologic boundaries have probably been no lower than their present relation to the rocks, thus dehydration should not be found below sea level.

A program will be undertaken this field-season to obtain cores from the deposits using a mobile drilling rig, Zif-150. The circulating fluid for drilling and the rock cutting tools will be selected to assure uncontaminated samples of good recovery. The interval planned to be sampled is from the surface to about 30 m below sea level. A few holes may be deeper if the gypsum exceeds that range and abundant water is not encountered in the drill-holes. Hydrologic properties will be determined in each hole to assess the feasibility of mining below sea level. The water level recovery rate in a hole is one applicable method. After stabilizing a few days after completion of a hole, the water can be bailed, after which water recovery can be logged with a water-level sounder. Water quality will be of interest also. The prospecting holes will be arranged in lines laid out across the strike to penetrate all dipping strata.

Starting at Gemsa Peninsula, 6 holes are planned to be drilled in two lines. If the results are encouraging, a suitable grid-system will be laid out and drilling will be continued to complete the exploration stage.

Other possible exploration areas include the southern end of Gebel Zeit on Zeit Bay and west of Abu Ghusoun port. Pilot holes are also planned to be drilled during this season in these two localities.

Additional shore-side sites will be selected for prospection after consulting the hydrographic charts of the coast for likely loading sites where buoys can be placed in deep water close to shore.

Exploration needs in the areas along the northern coast, as at El Hammam and El Ballah, will be determined after investigating the deposits along the Red Sea coast.

Later in the year, it is believed that the Hurghada field party will be nearing completion of its mapping program, and may be able then to undertake a study of gravel resources, as outlined tentatively below:

Gravel Resource Evaluation

Recognizing resources of natural aggregates at numerous sites along the Red Sea coast from Qusseir southwards, it is proposed to investigate and document their physical attributes for potential exploitation. The object is to justify process plant investments to produce gravel for export and/or domestic consumption. Many wadi deposits extend nearly to the shore, and some may be located close to port or sites for mooring an ore-carrier to receive materials by slurry-pipeline. Appropriate grain sizes exist in these deposits, which can be processed by screening, using fresh or salt water, together with crushing, to make highest-quality, clean products. The soundness of the aggregates is explained by the proximity of unweathered igneous sources and the rare Monsoon storms that hit this southern end of the Red Sea Hills. Distant markets, including Israel, Malaysia, Java and Indonesia are deficient in high-grade aggregates, especially for concrete, asphalt and railroad ballast and perhaps specialty sands, such as filter media. Yet once ship-loaded, the cost of transport to such remote markets may be tolerable. Materials-handling equipment may be ship-mounted thus eliminating duplication and stevedoring charges. Fresh water or other return cargoes such as bauxite are possible.

The following steps are to determine in two years the specific attributes of the best deposits between Qusseir and Berenice;

1. Identify all potential gravel sources on existing geologic maps and aerial photographs; correlate with port/mooring sites.
2. Conduct reconnaissance: identify sound aggregates of adequate volume, minability and location for ease of shipping. Identify aggregate types: petrology, density, soundness and grain size parameters.
3. Map 6-10 sites, including limits of each prospect, thickness, lithology and granularity; sample the deposits near the surface; plan further explorations.
4. Drill (drive casing) for subsurface samples, depth and water. Do resistivity soundings where necessary. Conduct lab tests on surface and subsurface samples: a) Size distribution b) Abrasion resistance c) Soundness d) Density and porosity e) Petrography f) Potential reactivity g) Resistance value h) Possible placer values

Task 4: Upgrading the Analytical Laboratories

Mass-production techniques were instituted during the 1960's for the analysis of whole-rock composition, largely by spectrometry. The Russian approach to exploration necessitated such capabilities because some field parties literally mapped quadrangles by grid-sampling. Underground sampling in gold mines was similarly intensive. Whereas these habits take some of the subjectiveness out of mine evaluation and field mapping, they are not necessarily the most efficient means of obtaining geological insight and not even as thorough as when deductive approaches are artfully employed. The Survey's field methods have matured in the last decade, as judged by the caliber of internal reports and publications. Whereas the good aspects of thorough sampling have been retained for mine evaluations, field mapping has changed to better utilize scientific reasoning, rather than statistics.

If the number of samples handled and analyzed by some method in the Dokki laboratories has diminished in the past decade, it is still an enormous production, amounting to over 10,000 per year, thus efficient devices are desirable.

The oldest Russian flame spectrometers are still being used in steady data-production, while newer spectrometers and devices such as the atomic absorption spectrometer are also fully utilized. Wet chemistry is still employed. Optical petrography and ore microscopy are strong areas, supported by excellent equipment.

But 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 capability, not as much its volume capability.

Bids have been invited from American manufacturers of X-Ray diffraction and fluorescence apparatus, automated with the latest micro-processor to permit semi-automated utilization. With normal procurement progress, these machines should be installed and manufacturer-tested during the year. Training of the key X-Ray mineralogist begins with a U.S. university curriculum. Other technical people will be trained by the manufacturer at his facility as part of the procurement contract.

One other device recommended by the Project Coordinator is a DTA to replace the existing Hungarian relic. It was inoperative when first inspected in July, 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 will probably be important for detailing the hydration state between anhydrite and gypsum, for that exploration program will result in many 100's of meters of core to be analyzed.

Additional areas in which MPGAP training will impact the laboratory is in ore microscopy and trace-element analysis. Four people are scheduled for U.S. schooling or practical training.

Task 5 - Geologic Museum

Thanks to conscientious curators, evacuation of the Tahrir Square museum was completed before wrecking, with essentially no loss of valuable materials. The irreplaceable fossil collections were retained for subsequent systematic storage at the new building on the Corniche. As is often the case in a move, it serves as a means of beneficial house-cleaning, useless material disposed of for the betterment of the whole. The new building will be available by December, and outfitting and furnishing will take all Spring.

Some museum staff training is to be provided by MPGAP this year, two of the four curator-trainees being scheduled for U.S. work starting in January, 1984. The Head of the department will depart in December for a tour of U.S. museum facilities to learn modern display, exhibit design and curating methods.

Task 6 - Mineral Commodity Program

With a view to making some of the internal reports on mineral deposits more visible and accessible to the mining industry, the Documentation Center staff has been compiling lists of reports according to commodity. Editor Stout, together with the staff and authors (whenever possible), will select several of these each year for editing and publication. Most include geologic maps, some of which the writer finds to be of extraordinary quality, crying for publication. It has not been determined what vehicle will best play that role, but the limitations of labor for both editorial and cartographic revision may limit production to two or three this year.

Some of the main conclusions of those reports, for instance on gold mine evaluation, have been extracted by the Project Coordinator and assembled in a mineral summary (see 2nd Bimonthly Report, Oct. 23, 1983). It is expected that public releases can be made from that summary in conformance with the Mining and Quarries Regulations, and in each case under authorization by the Director of the Geological Survey and Mining Authority. One trade magazine interview (New York Business Journal, to be published soon) has outlined some of Egypt's

resources for the purpose of attracting venture capital, and one VIP is scheduled to present the summary in November to several U.S. mining companies that have investigated Egypt in past years. Opportunities of this sort will be pursued aggressively and with increasing frequency.

Another means of making the files available and evident is by collecting packages of reports and data applicable to selected deposits, groups of mines or individual mines appropriate for a business venture. Three contiguous gold mines might form such a group (e.g. Atud, Umm Rus and Sukari), and the pertinent reports from Hume, 1937 to the present can be collected in one place, reproduced and sold to serious investor prospects, not as a profit-generating exercise, but at cost.

It has been noted that 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. Only in this way can exploration priorities be set, and opportunities for attracting investors be seen realistically. Files of recent transactions in mineral commodities could give us the confidence 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. Inquiries have been made to begin to amass the needed data; some files and a program will be on line by the year's end.

A commitment is to provide a U.S. specialist in mining leasing. One of his functions is to give advice on contract matters. Whereas Egypt does not have leases, as does the U.S. because of private holdings of mineral rights, Egypt's system of joint-venture and concession contracts is in a very formative stage. A new committee, formed under EGSMa by the Ministry of Industry and Mineral Wealth, has been empowered to institute changes designed to effectively attract investors. Without expert advice, it is apparent to some of that

committee that mistakes may be made for lack of experience with foreign-company contracts. The typical petroleum-sector contracts are recognized to be inappropriate where highly-variable profit potentials exist, from one deposit to another. It is hoped to benefit from the experience of other LDC's that have successfully generated a foreign-based mining industry. A mining contract expert from a public agency such as the World Bank or U.N. is going to be sought during the coming months. Though he is currently timed for late 1984, EGSMA may ask for earlier arrival in time for effective input before new ministerial decrees are made that alter the model contracts. A mining brochure is now being prepared by the Project Coordinator and Bendix staff, to include mineral commodity data and model contracts.

Task 7 - Publication and Documents Center

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

A reorganization of the library has been in planning by EGSMA for many months, since it is their intention to move from the many different 4th-floor rooms of the North wing at Abbassia, to a new arrangement of only two rooms of larger size in the South wing. That will happen after re-conditioning the new spaces, possibly this year. It is implied also that no reorganization of the catalogue system should begin without the library expert, tentatively scheduled for arrival after March, 1985. In other words, low priority for this activity postpones it while more pressing matters and numerous other consultants are present. Furthermore, modernization of the files will employ the computer, to be furnished late this year.

An Office of Scientific Reports is already in embryo, since Editor Stout is working with two designated editors, and two additional editorial staffers are being recruited. Formal establishment of this

group as a department will be accomplished this year, under which the several areas of responsibility will be organized.

The first steps in computerization of geologic information may be of an unanticipated sort, namely market data for mineral commodities, and even that must await arrival of computer hardware. It is intended that early acquisition may be made by attachment to the Georgia Institute of Technology procurement contract. However, 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). It also needs large storage, while remaining compatible with the business/accounting features of most data-storage arrangements. The EGSMA effort to computerize geologic data cannot even be conceptualized without outside help. Two trainees are scheduled for U.S. residence in September, 1984, and two in January, 1985. We will also benefit from the EGPC information specialist to come to Egypt in 1984, and an information specialist to DRI in the 2nd or 3rd year. In all agencies except EGPC, these housekeeping duties have been relegated to the future while more topical problems like exploration take precedence. It should be apparent, however, that to establish a data-system and especially to implement it and make it habit for the staffs of those agencies will take years of effort. Long-term programs should start early because MPGAP cannot last forever.

Desert Research Institute

Task 1 - Groundwater Exploration

The DRI program objective is to find groundwater resources in support of existing and potential mineral and petroleum resources. Process water, and potable water in support of the infrastructure are both necessary for establishing mines in desert regions. Though agriculture is part of the infrastructure in some localities, it has been decided that water for irrigation or land reclamation is not appropriate to MPGAP, though clearly, the same data may often apply to both mining and agricultural water-finding.

The academic environment of DRI influences its involvement: few trainees are designated, and during this year, only a librarian is scheduled for U.S. residence. The MPGAP commitment to DRI includes some training of staff professionals, and considerable build-up of field equipment. These will not only facilitate the fulfillment of exploration objectives, but the strength of the institution will be enhanced. A greater number of trained hydroscintists will be obtaining higher degrees during the program and afterwards.

Groundwater hydrology has not been formally applied in the Eastern Desert before, except for a few specific well-siting efforts and a few mine drainage programs. Therefore the literature reveals nothing and the only well records are rare locations on topographic maps. The DRI approach is to start with fundamentals, principally with geomorphology, which is the key to an understanding of surficial geology. Most of the water is to be found in wadis, whose geology is currently not well understood. Bedrock geology will be studied also, since the Nubia-lithology sandstones are the second most likely water reservoirs. Other sources, usually of small volumes, will be sought in the crystalline rocks, wherein fault zones can sometimes prove productive. Bedrock units are mainly important to an understanding of recharge areas, and for control of groundwater chemistry, especially in discharge areas.

Until much field work has been done, there will be little or no drilling to test hypothetical sources. Until the DRI has obtained its own drilling rig by AID funding, the test drilling undertaken will be by contract, largely to the EGSMA drilling department, or possibly to a private-sector company. After this year, drilling work will accelerate.

Due to the interplay of mining activities, regional geology done by EGSMA in support of exploration, and the need for local water supplies, the DRI efforts are necessarily tied to the EGSMA programs of mineral exploration. Excellent cooperation for efficient use of both geological and hydrological talent has already been established at the level of directors and department heads of both agencies. Furthermore, the field facilities already established at Ras Gharib by GPC, and at Hurghada and Marsa Alam by EGSMA will be made available for DRI accommodations and repairs.

Conforming with EGSMA priorities for mineral-resource development, DRI has agreed to concentrate field efforts in the following areas, which have changed somewhat during the past two years in accordance with changed mining-area emphasis. 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 wadi areas east of the hills. The clean nature of wadi gravels at and south of Wadi Gamal suggests a potential for high-yield wells whereas very shallow wadi fills in the mountains suggest scarcity there.
2. The coastal reach from Ras Gharib to Gemssa is potentially rich in non-metallic minerals, such as potash, salt, gypsum, and sulphur,

as well as petroleum. The discharge of Bir Wadi Shagar, serving Ras Gharib with about 50 l/s. suggests that thick wadi fills may yield considerable quantities of brackish water.

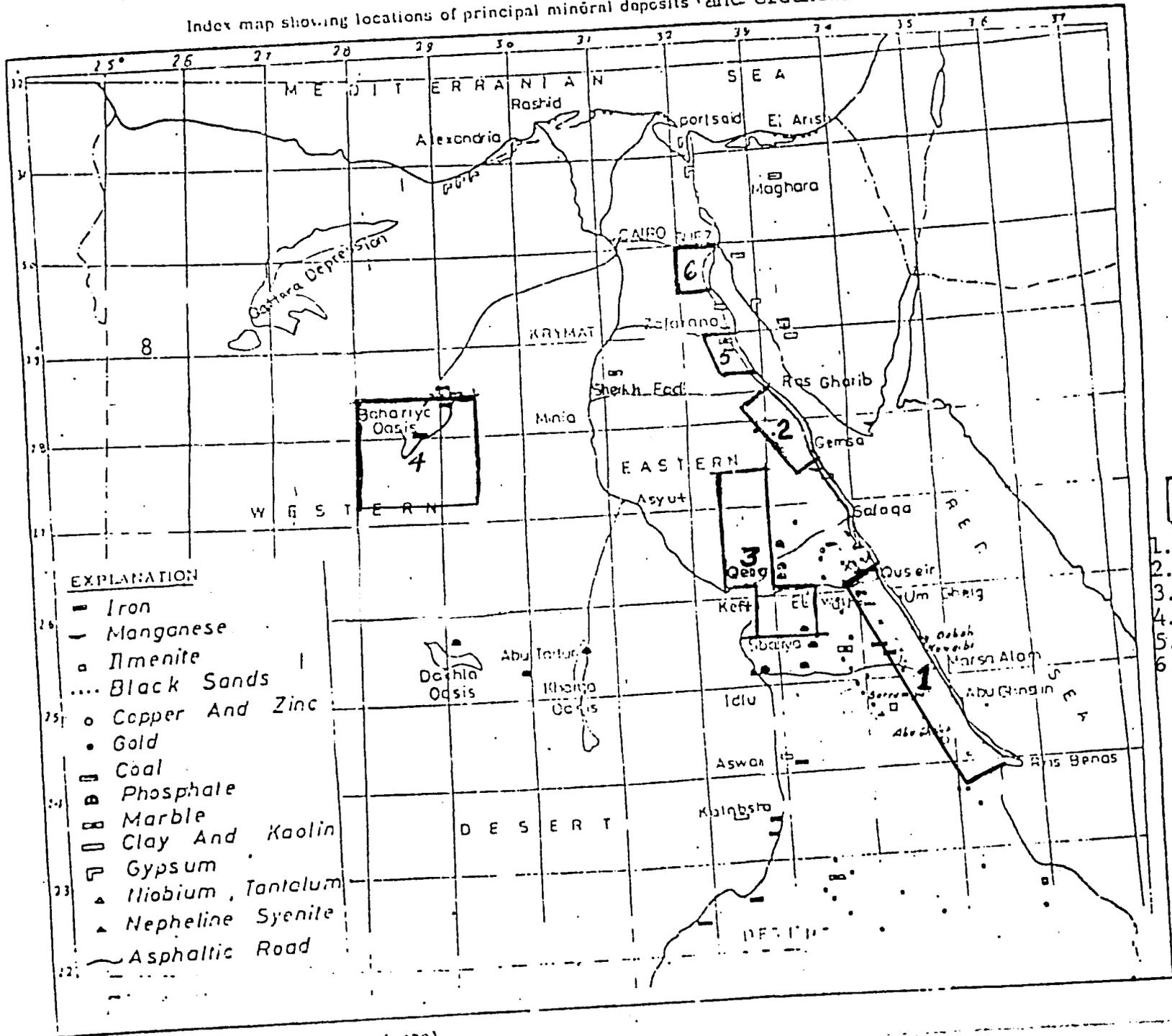
3. The Wadi Quena - Wadi Loquita area has moderate priority, mainly because of large known mineral resources, namely of phosphate, gold, tungsten and decorative stone. If water is discovered, it could be used also for land reclamation.

4. Groundwater is known to be in the Nubia sandstones flooring Bahariya Oasis, but little is known of its detailed hydrology. As an area developing because of active iron mining, it deserves attention on a low-priority basis. No minerals of potential economic interest are found in Farafra, so it has been eliminated as a target area.

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

After the year's work has begun to disclose needs and water resources, another re-ordering of priorities may be appropriate. Present plans are to commence work at Marsa Alam in 1983-1984, taking advantage of EGSM support while DRI field equipment is collected. In 1984-1985, 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.

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



- 1 Groundwater study by DRI
- 2. Ras Gharib-Gemssa
- 3. Wadi Qena-Loquita
- 4. Baharia Oasis
- 5. Wadi Arabaa
- 6. Gebel Atāqa-Suez

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

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Task 2 - Data Organization and Analysis

Updating the DRI library will be initiated during the assignment of a library specialist, whose arrival is to be determined after May, 1984. He will advise the staff on methods of filing and cataloguing books, periodicals, reports and maps, and prepare a system to be implemented largely by a U.S.-trained librarian scheduled to go to a place of the experts' recommendation during the summer of 1984.

Among the commodities scheduled for purchase this year is a mini-computer, for use in data filing as well as scientific uses. The GIT procurement may facilitate acquisition in the middle of this planning year. 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.

Remote Sensing Center

Task 1 - Data Organization and Analysis

The Contractor's Project Director is a specialist in remote sensing application in mineral exploration. Among the ways in which that expertise will be used is in designating journals, books, reports and training aids, many of which will contribute to the usefulness of the Center's courses of instruction. During the year he will order many publications using the budgeted funds, to begin to upgrade the small library, which currently is deficient in mineral-oriented literature.

A library expert is tentatively arranged through Denver University for arrival some undetermined time in late 1984. A librarian trainee is to follow, probably in the next reporting year. Computerization

of data has been determined feasible, because the Cromenco is now known to be compatible with the other machines in the GIT system.

Task 2 - Production of an Atlas of Landsat Imagery of Egypt

Negotiations on a contract have begun between Bendix and ERIM, wherein the latter will train two RSC personnel at Ann Arbor in February - March, 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) will be made on equipment identical to the upgraded Egyptian MDAS system, and with photographic reproduction equipment comparable to that at RSC. Thus, those persons will have already completed some of the Atlas abroad, and will be trained to finish it when they return. According to the procurement plan, Wimvex Co. should purchase the commodities between January and April, and installation may be by May, 1984. Depending upon RSC hiring competent people for training here, the Atlas could be in production in June, 1984, and finished 18 months thereafter, for printing about January, 1986. The MGAP contractor will be able to provide some supervision, as will ERIM.

Printing should be done in Egypt, since EGSMA has found facilities here quite adequate for high-quality multi-colored map-making. It may take some time for RSC to staff and train itself for this task. The timing of events is as shown on the pert diagram.

Task 3 - Remote Sensing Workshops

The proposed ERIM contract includes the training of 4 professionals from the RSC to become competent instructors in remote sensing and advanced photogeology. The first two are scheduled for April - May, 1984. Anticipating demand for large enrollments, it has been decided to offer a single beginning course in Remote Sensing twice, tentatively in October - November, 1984 then January - February, 1985. A course in Advanced Geological Remote Sensing, rather than photogeology, is planned for mid-March to mid-May, 1985, utilizing the ERIM-provided

TDY expert and his Egyptian counterpart, who will have been trained at ERIM during April - May, 1984. Planning and advertising the first workshop will be begun in 1983, whereas preparation of materials will be begun in Michigan, by the instructors.

Task 4 - Aerial Photography

It is not planned to fly the aerophotographic mission for EGSMA this year, but it will be scheduled. Upon advice of the MGRS Project Director, it is to be standard photography, not orthophotography. RSC does not have the equipment for orthophotographic printing, and further, it is not recommended for geologic use because the contours interfere with the visibility and continuity of subtle geologic features. The contractor will review plans and capabilities this year, preparatory to RSC work on this separate AID grant.

Egyptian General Petroleum Corporation

The MPGAP program for the petroleum sector has undergone several changes since planning began. Flexibility to adapt to changes of business and exploration circumstances has and must remain 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.

a. Aeromagnetic Study in the Eastern Desert

A contract let to Aeroservice Co. December 16, 1982 has been partially completed, and is proceeding ahead of schedule. Dr. H. Kamel, Manager for Exploration of GPC, is the Project Manager. The plane returned August 29 to fly Area II, and deliverables on Areas IA, IB and III have been coming in. According to schedule, all interpretation maps may be finished by Summer, 1984.

b. Seismic Study in the Eastern Desert

When the interpretation of Area II aeromagnetic summary has been received (scheduled March, 1984), it will be possible to examine the

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findings of basement configuration in the vicinity of 28° N, 32° E, where prior gravity and seismic data indicated the existence of a sedimentary basin. The quality of the aeromagnetic interpretation will determine whether or not refraction seismic profiling will be required to delineate the basin. One new element for consideration is that Esso has taken a concession that includes the northwest quadrant of the basin, thus agency-sponsored exploration would be inappropriate there. Although we have been informed that Esso's concession was not selected in consideration of the pending results of the aeromagnetic survey, they are following Aeroservice Co. work in Houston quite closely, with obvious interest in the basement interpretations. Esso's activities in future may impact our plans, especially if things happen to encourage concessionaires into other parts of the postulated basin. The seismic work might also be cancelled in favor of a stratigraphic test hole, located by the aeromagnetic results. This is discussed further in paragraph h., below.

c. Establishment of Seismic Data Storage System and Data Library

Under discussion at EGPC is the possibility of moving its headquarters to the GUPCO building at Maadi. The old building at Nasr City required air conditioning and tape racks for a room to store the collected magnetic tapes. But until the decision to move is made and needs are known at Maadi, no efforts are appropriate on this project.

d. Source Rock/Oil Migration in the Western Desert

EGPC is not ready to undertake the study now, mainly because they feel a lack of in-house manpower to properly supervise such a contract. The same applies to the Sedimentary/Petrographic Study of the Western Desert (e., below). At this time also, there is a ministerial prohibition on trucking oil to the coast from fields remotely located in the Western Desert. Until a decision to build a pipeline has been reached, explorations in the area are being curtailed by the companies since their product cannot be marketed. Presumably, this is a temporary condition that should not impede a study that could lead to discoveries at a later date.

To ease the supervision problem, there is the possibility of an AID-supported contract for supervision, someone selected for maturity in petroleum exploration and with prior experience in Egypt. Many such are now available, including Egyptian-Americans.

In order to evaluate the Western Desert research needs, the Project Coordinator must allocate at least one month of full-time cumulative effort in digesting the Robertson Research report, a multi-volume evaluation of Western Desert data, analysis and recommendations. With such a background, Project Coordinator may be in a position to suggest a course of action to EGPC and to advise AID of the prospects of work in the Western Desert. He has been studying Gulf of Suez literature at every opportunity.

- e. Sedimentary/Petrographic Study of the Western Desert and the Gulf of Suez
- f. Estimation of Existing and Potential Oil and Gas Resources in the Gulf of Suez

These projects, for the Gulf of Suez only, have been combined and EGPC has let them for bid in one package, with the intention that it be sponsored by a multitude of the concerned oil companies. Several responses have been received. If the intended sponsors are not receptive, it may be incorporated into the MPGAP. This will be resolved within a few months.

- 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 surveying all fields under Egyptian management, including all abandoned fields, or sub-economic ones, to determine the optimum procedures that should be employed. Many fields have several isolated pays to be stimulated separately. At present, one of seven pays at Ras Gharib Field is beginning an experimental gas drive, with a contract let to Improved Petroleum Recovery Co. of Dallas.

The funding level of this project does not suggest a pilot program at any field, but rather, an assessment by an enhanced recovery expert of all applicable fields and productive zones. In some cases, it is a question of the economic feasibility of a simple field pressurization, a water injection program usually being considered secondary recovery. In other cases, gas, steam, polymer or other tertiary stimulation methods need to be evaluated in terms of reservoir depth, size, porosity, inhomogeneity, hydrocarbon viscosity, and water cut, as well as other parameters. Since this project is independent of all other works, it can be initiated in a short time, and could have very beneficial long-term effects on production.

h. Stratigraphic Study (Drilling) in the Eastern Desert

This project was approved subject to further evidence that it is required to attract concessionaires after the completion of aeromagnetic/seismic studies aimed at the new basin. As pointed out, above, the seismic studies may not be required either, depending upon the aeromagnetic data interpretation, and upon the reception by potential concessionaires. Since the aeromagnetic data is public knowledge, it may be widely sought by the oil companies.

There may also be envisioned some circumstances wherein the optimum procedure would be to drill the stratigraphic test well central to a basin delineated wholly by aeromagnetism. The object of a test well is to ascertain the existence of source rocks and their maturation; as well as reservoir rocks in the basin. This may lead to estimates of total petroleum reserves, the depth and nature of reservoirs peripheral to the basin, and ultimately, to stratigraphic trap possibilities none of which are results to be expected of refraction seismology. The latter produces structural data, which is the usual object of the exploration of concessionaires. Another consideration is the current depression in the drilling business, which we might like to exploit by competitive bidding. The experts suggest that the drilling depression may persist for about two more years. The most deliberate program, including a long delay in aeromagnetic interpretation by Aeroservice Co. and EGPC, a late decision for refraction seismology,

a bid procedure and a year's seismic field work and interpretation, followed by internal decision-making before a drilling bid is tendered, could time it possibly as late as 1986, when the well could cost millions more than present. It might be that good science is bad business in such a case.