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

To: Project Officer, Sherif Arif

From: Project Coordinator, D. T. Snow

Subject: Annual Report, May 15, 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 May 12, 1985

Attached is the Annual Report for 1985. This replaces the bi-monthly report, and constitutes a Final Report, in my case.

David T. Snow
Project Coordinator, MPGAP

Minerals, Petroleum and Groundwater Assessment Program
(MPGAP) Philosophy

The elements of the Project Agreement of 1980 included infusion of U. S. funds providing commodities, training, consultation and management, while similar GOE funds were to provide logistical support, manpower and all other resource evaluation, development and many of the information dissemination costs. As I examine the detailed objectives, the expected outputs and results, it will become clear that at this two-year landmark, very few of the expectations are being met by any of the four agencies:

I believe that the different agencies have fallen behind expectations for different reasons, and the course of future actions to remedy the rate of accomplishment should be different for each. Only the Petroleum and Mineral sectors can directly influence the balance of Egypt's international trade, and it is from the Egyptian General Petroleum Corporation (EGPC) and the Egyptian Geological Survey and Mining Authority (EGSMA) that we look for new investor activities to influence business. The Desert Research Institute (DRI) and Remote Sensing Center (RSC) are, in this context, service organizations assisted by MPGAP because they facilitate the work of EGPC and EGSMA.

EGPC never had a staff to do the work thought necessary to stimulate new oil concessions, since its role is mainly the administration of the concessions. So its research needs are to be met by contracting with consulting and service firms. The first Western Desert (WD) study of Robertson Research taught EGPC that it must have staff competent and dedicated to supervising such projects, or the contractor may waste the effort uncontrolled. Thus EGPC postponed nearly all the intended MPGAP projects for two years. Now, a senior EGPC geophysicist has been repatriated and put in charge of projects, otherwise free of administration. So the organization has proposed seven projects for MPGAP funding, including many of the original ones. If our consultants' recommendations are followed, contracts may be let to undertake some of the following: 1) aeromagnetic surveys of the Nile Delta, Northern Sinai and SW Sinai. Since GPC is well organized to administer the current Aeroservice Co. survey, a new one can

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be added efficiently. 2) seismic surveys of several possible basins near the Nile in mid-Egypt. EGPC might choose to supervise such a contract, or delegate it to GPC. 3) expansion of physical storage facilities for all exploration data held by EGPC, by service companies and by oil companies here and abroad, and the provision of modern data-handling (digitization and electronic memory) facilities. I recommend that EGPC hire an engineer that would be dedicated to that vitally-important project while being implemented under contract, and in future. Another proposal recently received contemplates funding development of geochemical analytic capabilities in the Egyptian Petroleum Research Institute (EPRI). That is another good source of Egyptian supervisory talent. I believe that the number and complexity of research projects undertaken should be kept in check unless additional senior scientist staffing is done in EGPC. I am aware of similar limitations in GPC.

The MPGAP objectives in the petroleum sector seem well on the way towards their intended result of providing data to stimulate new oil concessions, but it is not because MPGAP has succeeded in making any changes; rather, timing has been governed by new Egyptian supervisory capabilities.

I am aware, however, that EGPC is seemingly willing to initiate many projects simultaneously, some of which may have doubtful value. Therefore MPGAP and AID need to devote considerable attention to the initial and progressive stages of those projects in EGPC if wise expenditures are to be expected. I recommend a full-time senior petroleum geologist be added to the Bendix staff, and their contract modified accordingly.

The Agreement elements can be carried out much as planned and brought to fruitful conclusion because no major change in EGPC organization or Egyptian budget is necessary. When the specific research-oriented projects are concluded, the corporation goes back to its usual work of administering concessions and negotiating new ones. There are two notable exceptions to that:

- 1) The acquisition of a major training aid, the Rig Floor Simulator and its installation at the Ras Gharib Training Center makes possible a new, self-perpetuating business in GPC, namely, the training of drillers of all oil companies, formerly trained in Texas or Europe at much greater

cost. Revenues from such training courses as they plan to institute should keep the Center well-staffed, well-equipped and updated if some of the income is re-cycled to the Center. I feel that is a vital administrative matter for GPC to manage; without some of the revenues generated, the Center will slowly die of neglect, instead of thrive.

2) Enhanced Oil Recovery (EOR) is work which I have championed because it has great potential of increasing future sales of Egyptian crude, generating handsome profits from the heavy crudes common to much of the Gulf of Suez. We are about to let to bid a feasibility study of one major field, Bakr-Amer, and I see little doubt that it will justify pilot programs for enhanced production, probably with steam, that should grow in a few years to a field-wide development with a billion-barrel potential. It can extend to several other fields and influence the entire Egyptian and Middle-East oil industry. But MPGAP should be the source of seed-money only: a portion of any production should be re-invested in EOR to finance the next expanding stage of development. It is vital to negotiate revolving funding for any EOR job, including the first pilot test, otherwise the country's treasury will strangle the development.

Fueled by the huge profits to be made in producing a new oil field, petroleum exploration is active, and in the past, quite successful in Egypt. In the presence of declining prices and world oil demand, the future is less bright, especially since Gulf of Suez targets of exploration are increasingly difficult. Probably MPGAP contributions to the technology may have less impact on exploration than will world conditions and the maturing of the oil region. MPGAP can have a larger overall effect on the economy via EOR funding, increasing the total recoverable oil volumes significantly. It lacks the spectacularity of exploration success, but with lower profit/investment ratios, EOR is still better than most businesses (such as mining). Each step in investment can be designed upon the preceding studies and pilot tests.

EOR work has already been started in GPC, using GOE funding for first a feasibility study, and now a pilot test of the Nullipore reservoir, Ras Gharib Field. Though executed by a competent consulting firm, it can be a technical success and a management failure. Excessive delays have occurred because of slow commodities procurement by GPC. A critical valve

lost in sea shipment can make the project uneconomic if all work is halted a year. To assure success for EOR, contractors must have control of all critical elements of a project, during which the Egyptian team may have to adapt its domestic organization to function efficiently. It is certainly necessary for GPC to increase its staff of competent professionals, to supervise contracts properly, and to take over the work in subsequent stages as contracts phase out. At the moment, a handful of young, inexperienced reservoir engineers crowded into a single small office are trying to manipulate paper records of all GPC reservoir operations. They cannot be expected to do another EOR project. Thus I suggest MPGAP help to train the staff, through schooling in U. S., training by temporary experts brought to Egypt, and by providing tools such as a personal computer. But GPC is responsible for filling the ranks with new graduates to train. Seemingly, that is a limitation not easily overcome: few graduates want to work for the government, whose wages are limited. If training opportunities are made available, that would provide inducement for new staff, and an active EOR program would perhaps even bring older men into reservoir engineering.

Whereas EGPC functions already as an industry that is one of the country's most economic, it is well recognized that it takes more than oil to support Egypt's economy, and dependence on oil for a major part of it makes the country vulnerable to market forces. Thus the weak mineral industry draws attention as a possible source of needed hard currency, either by substituting local for imported raw materials, or by producing products competitive on the international markets. That proves to be more difficult to achieve than to help the oil industry.

The Geological Survey, inheritor of classical mapping, mineral analysis and exploration techniques of the British Survey, expanded to perform drilling, ore testing and economic evaluations after the Revolution, serving as the leading edge of the state mining enterprises. Thus they are prone now to take a pragmatic approach to geology. But because mining has largely been uneconomic under social-governmental order, support for EGSM has generally been insufficient to produce many successes in the field, where expensive equipment and operations far exceed the budget designed for low-cost labor and mineral logistics. If they had the physical

means to conduct explorations by drilling and driving underground, discoveries would probably be made without recourse to foreign concessions.

MPGAP was designed to produce a stream of information that would attract venture capital into minerals. A huge reserve of internal reports documenting discoveries of years past has been largely hidden from the world. In the past two years, efforts by MPGAP staff have succeeded in developing the means of getting the reports and data accessible, by assembling mineral information packages. It has only been recently (November, 1984) possible to free these for public use, since they were formerly considered national wealth. Perhaps it is clear now that minerals left in the ground have no value.

During the coming year, I believe it will be possible to complete mineral information packages on essentially all minerals known to occur in Egypt, such as gold and limestone (completed), then clays, silica, dolomite, mica, gypsum, potash, phosphate, brines, salt, barite, celestite, zinc-lead-copper, manganese, iron ore, ilmenite/vanadium, niobium/tantalum, sulfur, others. But when existing information is thus assembled, or even partially published, what will be the source of new data? It has to come from continued exploration, guided by market needs and commercial opportunity as well as by occurrence. I am aware of limitations imposed by lack of GOE funding, that make explorations commonly unsuccessful. MPGAP will not accomplish its aims of attracting investors unless it sees the means of facilitating explorations in depth.

The gold, gypsum and potash prospects seemed hottest for MPGAP, and they were so designated for attention. The explorations have largely failed so far, mainly because they were under-funded. I will explain:

Gold deposits of quartz-vein type have been the targets at Um Rus, Atud, Dongash and Atallah, plus their associated wall-rocks. At Um Rus, surface mapping and sampling was done, but underground they were stopped by water. An ancient pump was tried, but clearly better equipment was needed. At Atud, diamond drilling was attempted, but the equipment is so worn and inadequate that scarcely any core is recovered. Only a few 10's of meters were drilled. In 1985, some of the effort will be devoted to mapping and sampling bedded submarine volcanic units identified by

consultant Dr. James as prospects for gold mineralization of the sort that have made headlines in Canada and Australia, involving millions of tons. In Saudi Arabia, similar rocks at Mad Ad Dahab host a stockworks of auriferous veinlets, the deposit of 10^6 T averaging 26 g/T. Thirty km E of there, a new discovery suggests a virtually unlimited volume of ore. To find such deposits and to prove their subsurface extent, EGSMA will need efficient and portable drilling machines. Otherwise, discovery has to be ceded to foreign exploration companies. There are many facets to mineral exploration that need polish, including better analytical abilities, faster reporting, analysis of more diagnostic indicators of potential ore, better field mapping techniques, more education for geologists, better hand tools, literature and inspired leadership. All these take time and money to develop.

The gypsum program started with a reconnaissance of the Gulf of Suez, west shore prospects, and two sites likely to be water-saturated were selected for drilling. The EGSMA equipment for coring shallow (< 40 m) holes is adequate, but it took a whole field season to complete 10 holes. The expectations of EGSMA are low because of a history of difficulties with equipment that breaks down, that doesn't fit, that lacks some important part, or whatever. The exploration was successful in what it did, delineating some potential deposits, but I would have preferred 200 holes in a season, either to block out an economic deposit, or better, to investigate 10 sites for further work. I see a need to streamline all aspects of the drilling department.

The potash project, stimulated by studies of geophysical (oil well) logs by one EGSMA geologist, was implemented by two core holes completed to 451 and 275 m, using an old Russian (UBC-500) rig. EGSMA learned the method of brine-mud drilling from GPC, so as to core evaporites. Since no deep drilling had been done for many years, the completions were considered a technological success, even though no economic sylvite was found. They should appreciate what a modern rig can do, however, when compared to BRGM's potash drilling program at Farasan, Saudi Arabia: on a good day they core up to 175 m, completing dozens of holes in a season.

A limitation of 450 or 500 m means the end of the Egyptian potash project for now because the favored targets (up to 60 m of radioactive saline rock) lie in the 500-1000 m range. Either we get new drilling equipment or let someone else do it.

I suggest that the time has come to consider means of improving the drilling department directly. Its fleet of antiquated rigs should be gradually retired in favor of more efficient modern American drills. The equipment should be accompanied by capable drillers to give not only instruction, but to re-educate the department to the sort of production expected from such costly tools. A million-dollar rig cannot sit for months unused! The program should also be designed to re-equip the EGSMAs shops, and to stock sufficient accessories and spares to guarantee continued operation. When drilling consultant McCaslin comes to help DRI, add to his duties a full appraisal of EGSMAs needs. Consider funding on the \$5 to 10-million order, to do it right.

The Project Coordinator worried for months how to avoid creating a useless monument by the purchase of DRI's drill rig, recently bid and soon to be contracted. The provision of GOE funds for a garage and machine tools, and guarantee of annual budget amounts to assure a supply of parts, accessories and tools was the answer. To rebuild EGSMAs drilling department around 4 or 5 new rigs, from which we can demand high performances, will require even stronger guarantees for continuity.

I suggest that EGSMAs will become an income-generating organization in the next few years if its exploration, publications, promotional and contracting efforts are strongly developed. It can do so by retaining royalties. Soon to be approved is the Minex Co. agreement, involving a 5030 km² concession in the Red Sea Hills and several of the better gold vein-deposits known. A portion of the royalty to be paid to GOE is going to be retained by EGSMAs. Though the first gold concession may not be successful, I am optimistic that others will be let to international mining companies that will introduce modern exploration techniques. I also look for concessions in potash and gypsum, glass sand, barite and bentonite, all

of which should have terms of royalties retained by EGSMA, ultimately sufficient to fund an exploration program after AID support is concluded. If drill rigs are not income-generating here, other such sources will be required, otherwise one cannot justify buying rigs whose maintenance cannot be guaranteed.

The object is to stimulate EGSMA explorations: discover sulfur, potash, trona, gold, massive sulfides, chromite, coal, etc., within a few years rather than at some distant, unlikely future date by a foreign concessionaire. If the government does indeed establish an enlightened policy of retaining some production for its national exploration arm, that arm will grow in competence, justifying AID seed money. The alternative of MPGAP funded as at present is less likely to produce results because real financial support of exploration by GOE is not feasible, so development based on current knowledge of minerals will be slow.

I have long maintained that the petroleum concession agreement, as applied to minerals, has driven many investors away, and that it will continue to do so unless significantly changed. I have reported that EGSMA has proposed two agreements wherein the profit-sharing vanishes, i.e., all production after a small (4-7%) royalty may defray costs. If approved by the Minister, this change could stimulate serious mining interests. I consider such change also as a pre-requisite to major AID funding, so such negotiations need to be watched for favorable developments.

Another area in which an enhanced MPGAP program can stimulate the mineral industry is in remote sensing. Once the upgraded MDAS system is emplaced, all projects committed can, and doubtless will be executed, namely the Atlas preparation and the training courses. But I believe AID should stimulate application of the full powers of the system by funding a multi-method demonstration project on areas selected by and in collaboration with EGSMA, utilizing Landsat, and enhanced color photography, multi-spectral scanner, thematic mapper, and if possible, shuttle-imaging radar. It should be scheduled immediately to take full advantage of Dr. Larry Lepley's presence (through June, 1986). The use of such modern tools can be more effective than years of ground study by conventional geologic methods, as is recommended. I envision funding on the million-dollar level.

Another tool of potential value for Egypt is shuttle-based side-imaging radar (SIR), provided by NASA through a USGS program to evaluate desert landforms. Combined with archeological work for dating deposits and culminating years of work on the Quaternary geology of the W.D., a team of dedicated scientists (Jack McCauley, Vance Haynes, Fred Wendorf, Bill McHugh, Carol Breed, Jerry Shaber and Maurice Grollier have already contributed greatly to Egyptian geology. MPGAP funding has been minute (\$25,000 for travel), whereas EGSMAs field logistical help has been large. I recommend continuing assistance by providing the 1985 SIR-B party with modest travel money as before, and provided EGSMAs assists in the field logistics. But the payoff will come from later shuttle flights when eventually, good, complete coverage of the country is provided, instead of the scant swaths of SIR-A and B. Then it can be worked into regional mapping, and in detailed evaluation of mineral prospect areas. The imaging provides startling detail of structure in Precambrian terrane. It sweeps away as much as 5 m of sand cover to show geology otherwise invisible from the ground or from air. Thus SIR opens huge areas for mineral exploration: 1) much of SW Egypt is Precambrian rock, weathered and bevelled flat during Tertiary time, now dusted with sand. But it is a huge unexplored terrane, just as competent of mineral resources as the Red Sea Hills, yet almost untouched by modern geological and geochemical exploration. Roads are making it all accessible. 2) the western fringe of the Red Sea Hills has a 0-50 km-wide strip of sand-covered Precambrian rocks, much of which could be opened for exploration with the help of SIR.

When the techniques of interpretation (bedrock, not especially the river-systems) have been developed, a program of country-wide application of remote-sensing tools that include SIR should be a wise investment for MPGAP. It would be in the best interests of EGSMAs and USGS to collaborate fully with MPGAP and RSC if it hopes to fund its project plans. Mineral exploration is the only motive currently justified under the program or any extensions likely to be approved.

An assessment of the tasks intended in the agreement follows.

I. EGSMA

A. Information in the Form of Maps and Reports

Task 1. Data Organization and Analysis

A venerable institution such as EGSMA collects mountains of paper over the years if a well-conceived system of storage, archiving and disposal is not in force. Good data become lost in that mountain. To a degree, that is the current situation, but improvements are being made.

The renovation of 700 m² of first-floor space in the Abbassia Complex for a new library, organized under librarian consultant Mohsin El Arini, is a major step towards better data storage, with clear separations between books, periodicals, internal reports, maps, photos, microfilm, duplicate copies, sales inventories, new exploration data and logs, etc. The new library of 10 rooms replaces 5 formerly jammed with materials on the 5th floor. Retrieval will be far easier in the future, and the newly-begun cataloguing system will be of great use.

A comprehensive plan for disposal, archiving and microfilming is still needed. The acquisition of computers will soon permit a new means of condensing records electronically, though the paper products will probably not diminish. Greater access and therefore use is predicted, with numbers of researchers using computers. The evidence is that since an IBM-PC was first rented in March, 1985, it has been in steady use during all working hours by geophysicists, geochemists and paleontologists. Library use has not begun yet, though several staff are being trained.

Task 2. Regional Mapping

It was agreed that three 1:1,000,000 sheets would be published under MPGAP. The vast area of desert from Dakhla and Farafra Oases west to Libya (NG-35) has been studied on a few reconnaissances, but only near Abu Tartur has much detail been done. Work on this area has been curtailed, and I see no prospect of publishing during the coming two years. Military

aerophotographic coverage has been made, and Conoco's Landsat-based geologic map series will probably precede any EGSMA product.

The southwestern quadrangle (NF-35) is still being mapped, one party working on sedimentary rocks during 1985-86. There is also a geophysical party sounding for groundwater in Nubian aquifers of the region. The SIR-A and SIR-B missions are providing some coverage in this region, and studies by USGS and EGSMA are continuing to provide insight into the Pleistocene river systems that traverse the region and provide considerable groundwater resources. The remarkably well-preserved ancient red soils are proving productive upon water application at GPC's experimental farm in the Arb-Ein Desert. An organized plan for completion of the quadrangle map is not available, thus I do not expect publication by 1987.

A regional mapping party is currently working on the NW quarter (NH-35); completion date is unspecified.

In the SE region (NF-36), three separate regional mapping parties are addressing basement rocks and sedimentary rocks.

A joint USGS-EGSMA expedition worked in the area to evaluate SIR-A imagery, which will ultimately contribute greatly to the Tertiary and basement geologic mapping. There is no expectation of any rapid completion of this area mapping.

After publishing three 1:250,000 geologic maps in NG-36 plus one metallogenic map, essentially an overlay of one of the 1:250,000 maps, the production stopped for lack of paper. Due to internal matters beyond my understanding, cartography training stopped for lack of trainees. Whereas the second metallogenic map was finished, it may not be published because of controversy over its quality. With its finished products, it cannot be considered a productive program at this time. I am aware that lack of incentives keeps the map-making staff (geologists and cartographers) at low morale, but lack of encouragement and enthusiasm for their products from top EGSMA administrators is even more demoralizing. Yet it should be evident to all that the world views the Survey through its publications, and there is need to become ever-more conspicuous internationally as a world-renowned geological survey, since capital is needed.

NH-36, the important NE quadrant and Sinai, is being mapped in some detail by several parties, because of the petroleum and mineral resources present. Complexity prolongs the task, but a special effort could be made to publish a compilation by 1987. Many large-scale geologic maps have and are being prepared by parties working on copper mineralization, glass sands, kaolin, gypsum, feldspar and coal deposits.

Task 3. Geochemical and Geophysical Exploration

I am unaware of geophysical or geochemical work done in conjunction with regional mapping projects, though if targets of detailed exploration are identified, such work is likely to follow in subsequent years. With the exception of the aeromagnetic surveys of Aeroservice Co., there are no regional geophysical projects. Two small mineralized areas per season are being mapped geochemically and by resistivity. All maps have been retained with internal reports. A test area near the Qena-Safaga road is being intensively studied geologically, geochemically and geophysically, to relate ground features to the AM data, preparatory to an anomaly-checking program. Some of the detailed studies are prepared for publication in Annals No. 14.

a. Aerial Photography

Coverage of ordinary black and white, 9-inch aerial photography centered near Bahariya Oasis, for iron-ore exploration work. In the three year's delay on this project, the explorations were concluded and military photography was completed, so no reason exists for repetition. EGSMa was unable to nominate an alternative area. But the opportunity to introduce advanced color photography has been seized by RSC, as discussed below under its heading.

b. Aeromagnetic Mapping

The Aeroservice Co. contract is nearing completion in about May, 1985, with most of the deliverables already received by GPC. Interpretation maps are last, though Area IB work was concluded and use already made of the interpretation (see EGPC). EGSMa's main interest,

Area II, is of exposed Precambrian rocks with very complex magnetic variations, mainly due to variations in magnetite content, topography and structure. In order to develop routine methods of anomaly-checking, a pilot project has been initiated in a previously-mapped area between Qena and Safaga where geology, geophysics, geochemistry and economic geology representatives are working together. It will facilitate design of a reconnaissance program for next season, after the Aeroservice interpretation work has been reviewed.

One problem I think EGSMA must address is that of manpower to carry out the systematic evaluation of perhaps thousands of anomalies requiring exploration. If the work is to lead rapidly (say in 3 years) to a number of targets for detailed exploration, several teams of at least 3 (geophysicist, geochemist, economic-structural geologist) would have to be assembled. More pressing than manpower is the lack of suitable field equipment for flying camps with at least two jeeps each.

In my recommendations at the end of this report, I suggest a build-up of support for the Geological Survey. To this I would add that their field capabilities should be enhanced by acquisition of about 40 jeeps and 4 trucks. The 16 provided in 1983 have been well used and found excellent, whereas the rest of the fleet, consisting of Russian 4-cylinder jeeps, is degraded. I find that EGSMA treats its rolling stock with respect and appreciation. There would be nothing wrong with putting some jeeps in reserve storage either.

c. Airborne Gamma-ray Spectrometry

The Nuclear Materials Company has been receiving profiles via EGSMA, and I am told they are interpreting them and using them in their Qena field party, and elsewhere to see Uranium deposits. Since radioactive Precambrian rocks always are accompanied by metals, there is strong reason for NMC-EGSMA collaboration. For that reason, and to make most efficient use of logistical supports, I recommend their

field efforts be combined. Indeed, I have suggested MPGAP membership be considered for NMC.

Task 4. Economic Viability and Estimation of Potential Reserves

Economic analysis has never really been exercised by EGSMA. Rather, ore grade and tonnage estimates are as far as they go: these are vital components in economics, but the worthiness of a deposit has been left to potential investors. Consequently, EGSMA lacks clear direction in its pursuit of a variety of commodities. To rectify that, Bendix Co. has hired a senior geologist with experience in economic analysis, and as soon as computing facilities are available, he will teach methods of cash-flow analysis that EGSMA needs in negotiations and in exploration planning.

The object of exploration work by EGSMA keeps changing with the apparent needs and opportunities, partly motivated by requests from other government agencies, companies and governorates. The so-called MPGAP targets of gold, gypsum and potash have been continuously exercised. Whereas Baramiya still represents the single largest gold reserve, it remains unexploited. However, a concession (Minex Co.) including it is close to approval. EGSMA has revived subsurface work at two prospects, Um Rus and Atud, the latter having small vein-gold reserves blocked out in past years. Similar evaluation at Hangalya and Um Ud are planned. Surface exploration work has been done at Dongash and Atallah. New life has been injected into the program by the example of Saudi Arabia's Mad Ad Dahab, and by the teachings of consultant Larry James. EGSMA has new models for exploration. It is now recognized that Egypt possesses extensive metalliferous submarine volcanic rocks as elsewhere (Canada and Australia) prove to sometimes contain abundant (huge tonnage, maybe low-grade) disseminated gold. Also, gold is possible in iron formations such as exist in the Red Sea Hills, and in hydrothermally altered rocks known to be related to some fault zones, and to stockworks peripheral to deep-seated intrusions. EGSMA has to revamp its laboratory to emphasize trace metals indicators (As, Sb, Hg) as well as to improve detection levels for Au by AA spectrometry. MPGAP should assist by importing consultants to pursue those leads, as EGSMA has expressed willingness to try the approaches by two field parties next year,

evaluating targets suggested by Dr. James. Such responsiveness is most encouraging for the beneficial absorption of new technology.

Whereas gold has lost its international brightness, it remains one of the most actively sought commodities throughout the recession years. Given new field evidence I expect EGSMA to discover and publicize, I am sure that such firms as AMAX will respond with enthusiasm.

Kaolin as an alumina source from Kalabsha has been discounted in recent years by study of the problems of smelting. It is not cost-effective enough to justify investment. Though location (near Lake Nasser) is no worse than Safaga is as a (Red Sea) port to serve Nag Hammadi, the smelter on the Nile, the reduction of a silicate requires more energy than an oxide. Egypt imports Australian alumina. Because the aluminum refinery is in existence, a smelter here would make sense if bauxite were discovered. News of the Az Zabira deposit in central Saudi Arabia stimulates the idea of finding similar deposits in Egypt, which possesses abundant rocks of the same (Albian-Aptian, Cretaceous) age and climatic conditions favoring formation of aluminous soil horizons. Riofinex Co. has proposed to teach EGSMA the geological and analytical techniques they used successfully in Saudi Arabia, and both Reynolds and Kaiser Aluminum have expressed interest. During the coming year, MPGAP will initiate such a program, when agreement can be reached.

Phosphate exploration is at a dead stop because of adverse world markets, saturated by more economic operations in Florida and Morocco. Still, Egypt exerts pressure on AID to fund enough of the Abu Tartur infrastructure (such as 1000 km of railroad) to make the rest of the operation economic for at least domestic fertilizer needs. The Red Sea Coast mines operate at a terrible loss rate, so no efforts have been made to explore further the Wadi Qena or Loquita deposits.

Is it possible that combustible black shales in the Duwi formation, together with phosphate and contained uranium could combine to make an economic project?

The gypsum project has been pursued with imagination by EGSMA. Geologist Abdel Moneim Kamel has written an English text for special publication by EGSMA, summarizing findings from two drilling programs, Gemsa and Zeit Bay, at which were found gypsum occurrences worthy of further exploration. He has also suggested several other sites for work along the Mediterranean and Gulf shores. His assessment of market needs of Egypt alone justify further exploration because the brick industry crisis, after Nile silt consumption is outlawed in August, 1985, will stimulate new gypsum products for wall construction. Export potential awaits entrepreneurs. EGSMA should restart their drilling program in 1985-1986 to take advantage of the conditions for exploitation other than Sinai Manganese Co's. Ras Malaab deposit.

Potash exploration was not considered in the Agreement, but was introduced later as fit subject for MPGAP to promote. A senior EGSMA geologist near retirement was sent to USA for special training in geophysical log interpretation. He got GPC to do some side-wall coring in favorable-looking horizons (high gamma-ray emissions), one of which, unfortunately offshore, proved to be sylvite (K_2O) of good grade. He proposed a drilling program, soon undertaken by EGSMA, whose equipment is limited to 500 m depth. Two holes, the deepest 451 m, disclosed only polyhalite in the Zeit formation radioactive beds. Better targets, beds apparently as thick as 60 m at 1000-1300 m depth in the underlying South Gharib formation have yet to be cored, nor will they be unless 1) a concession is let to one of the three interested companies, 2) it is discovered while drilling for sulfur by a potential concessionaire (Zeit Bay area), 3) it is cored this year by a 7th GPC production well in the Zeit Bay Field, or 4) if a program for EGSMA to contract for some deep drilling is promoted and funded. Option 3 is most likely, but Option 4 should be promoted because discovery is likely and the deposit should prove to be economic because of inexpensive solar evaporation of brines, favorable port-side mining location, Egyptian and Far-East demand as well as the difficulties being experienced by explorations in Thailand and Saudi Arabia. Because timing can be critical, I suggest speed in initiating a deep coring program, as I discuss more fully in my recommendations.

B. Support Services Activities

Task 1. Upgrading the Analytical Laboratories

As explained to me by an EGSMA geologist who had years of experience with Russian geologists, techniques absorbed from them reflect the social system of make-work for the masses; it does not reflect intelligent efficiency of effort for quickest results. It is a proud accomplishment for a lab to turn out analyses of 100,000 samples per year. It requires many workers and costs a great amount. But geologists who have examined the procedures of analytical laboratories in Western countries find far fewer samples being handled to superior advantage because the samples are collected only from diagnostic locations. Grid-sampling over all the terrane places most sampling points in rocks unlikely to contain anything attractive, such as granite plutons, whereas quartz veining in metamorphics, pyritization in breccias or tuffs, or cataclasis are some of the features of a rock body that could accompany mineralization (e.g. gold), suggesting need for sampling of those likely units. Samples can therefore be more closely-spaced in such limited targets whose boundaries have to be determined by mapping before sampling. When fewer samples are submitted, the lab can afford to study them more thoroughly and to apply more sophisticated tools to obtain better precision, especially when trace quantities are known to be pathfinders to the element sought. Quick turnaround is also possible, giving the field party answers in time to return in the same season (or month) to sample again in an anomalous area of a favorable rock unit.

We are told (Dr. James) that the existing AA spectrometer is competent to do the analyses, as will the expected new Beckman, but that better precision is possible and needed. We should provide technical help in this area, if needed by the lab.

The x-ray spectrometer and fluorescence spectrometer are badly needed. Specifications were finalized a year ago, but new training has suggested new catalogue specs, so we are recycling the requisition. Acquisition by such means is probably delayed another year.

I recommend a new DTA, since the ancient Hungarian device is vulnerable to failure, irreparable and obsolete in operation.

A new flame spectrometer has been requested lately. I strongly suggest that competent US advice be sought for the utilization and upgrading of the old mirror devices being used routinely at Dokki, also that if a consultant suggests they be retired, the replacements should be obtained after diagnostic, not catalogue-specific, specifications have been written by an expert who knows EGSMAs needs.

The course is now clear for upgrading the lab: 1) it requires study to identify the equipment needs, 2) it requires training on those devices, but mostly, 3) it requires management reorganization to vitalize the analysis of few samples in less time but fairer quality, and to coordinate the lab work to the geochemical sampling and sample preparation programs. By now, I would look for initiative from within to make changes happen, and if nothing happens or nothing is planned by EGSMAs, acquisitions should be stopped or management itself overhauled.

Task 2. Mineral Commodity Program

The Project Agreement was written to support the myth that such commodities as gold, silver, tin and tantalum are present in such richness here that all EGSMAs needs to do is tell the world - they will all come running with briefcases bulging with money, most of it to stay in Egypt. So far, it is evident that gold reserves in quartz vein deposits are really insignificant on the scale of the gross national product, though there are chances of finding significant new types of gold ores. Silver is only incidental to gold or polymetallic deposits. Tin is a plaything. The Wadi Igla tantalum-niobium deposit may be the world's largest, but grade is 1/10th what other countries are mining. The riches are seemingly in unglamorous non-metallic deposits: limestones of great variety, purity and location; dolomite as one would request it; gypsum in profusion; potash, probably ideal; likewise sulfur to be discovered; pure rock salt; silica of highest

quality, quantity and location; barite, waiting for exploration; bentonite reportedly in high quality, volume and good location; kaolin of good quality that can be beneficiated; celestite waiting for a study of its utility; feldspar of purity needing no beneficiation; talc of various grades but limited in quantity, so far; sand, gravel, building stone, marble, granite and dozens of other architectural stones; trona and bauxite might be found; phosphates, vanadates and uranium are either adequate for local use or export; coal may yet be found in economic circumstances; brines for magnesium, iodine, etc., exist. The sea as a resource and transportation medium is a natural asset as is Egypt's location for trade. Tardy development of raw materials has made the manufacturing dependent upon imports, whereas many should be produced in excess, making even exports logical. In many of these commodity areas, advertisement can indeed stimulate investment here.

EGSMA agreed years ago to release its information but insufficient authority was speaking. Finally, in late 1984, Minister Kandil gave free release his approval, which signalled the first efforts to accumulate the file data and library holding pertinent to each of a dozen different commodities. It is taking many months to get just two packages in order, limestone and gold, and the summaries in English put in useful form for investor guidance. MPGAP's commodity specialist-editor has more than his 1-year of work cut out for him. I suggest his term be extended immediately. Newsletters and publications must disseminate the conclusions to worldwide audiences.

It was quickly realized that leasing of minerals is not appropriate in a state-owned country, but that many adjustments in contract practice, as guided by petroleum concession practice, must be made to facilitate negotiations. In the past, terms of business unacceptable to Western business practice have kept investigating companies from pursuing mine feasibility studies. In the past year and a half, changes have begun to be made that have helped negotiations approach conclusion, and I am hopeful that at least in extraction processes not capital-intensive, such as

Frasch sulfur, agreements will soon be signed. EGSMAs willingness to listen to the experience and views of experts from other developing countries, and of UN experts dedicated to helping the developing countries, is a hopeful sign that change is possible, for then I believe a wave of mineral development can begin, especially if keyed to world-wide economic recovery.

Task 3. Office of Scientific Reports

No formal progress has been made in this area, because EGSMAs probably sees no need for it, since its documentation center serves the same ends. Yet cartography remains outside the center. Perhaps it should remain that way, because stimulus to publish is lacking, whatever the name. One recent policy change will help: because incentives make it a privilege to be working in the field, the privilege will be taken away if the geologist fails to meet standards of publication frequency and quality. Editing can soon gain prominence, since it is arbitrator of quality for all aspiring geologists. It is a clever move. I encourage EGSMAs to give editors increased prestige and corresponding perquisites.

Task 4. Geologic Museum

MPGAP was committed to assist only in training, whereas the move from Tahrir Sq. to new quarters in Dar Es Salam was for other funding. Yet it affected the research activities, which shifted temporarily to Abbassia. Now the museum is nearly finished, and lab space is operable. The former director was trained at U.S. museums under the project, then lost his position upon returning. Recently, the research arm has been stripped from the museum reflecting a trend away from scientific work towards more economically-oriented projects. Perhaps the paleontological, palynological and stratigraphic work formerly under museum supervision will be more practically motivated by attachment to other departments. Whereas diminished interest in Quaternary Geology, stratigraphy, paleontology, etc. seems harmless in an organization charged with developing natural resources, those scientific disciplines cannot be abandoned because their advance is needed for long-term

objectives. I note the relevance of stratigraphy and paleoclimatology for bauxite exploration. Erudite studies of subsurface geology have important impacts on petroleum exploration, for another example. Quaternary geology may be the key to water resource development in wadi-alluvial settings, and in the Western Desert channels. It is essential to keep classical fields of study in positions of prominent responsibility. MPGAP intentions of training some of them should be restudied.

II. Egyptian General Petroleum Corporation

A. Maps and Reports

Task 1. Data Organization and Analysis

The PI study, finished in 1978, was so useful to EGPC that by 1983 I could find no copy of the report in any file in Egypt. Phillip Stark, President, kindly sent me a xerox copy from Denver. Its recommendations to EGPC were so sweeping in reorganizing the company that it was rejected in entirety. It should serve as a \$300,000 lesson to move by slow, reasonable increments if you want to produce long-term change.

Automated data processing, for which PI had been hired, has remained attractive to EGPC, as they watched oil companies streamline their filing of wells, logs, production and other records. They built their own computer center, though it remains only 60% utilized. GPC hired Standardata of France to design, from no experience, a well-filing system, using EGPC's equipment. GPC now has remote terminals, and a staff of 14, diminishing rapidly by attrition. They experience lack of continuous funding for new training courses, a symptom of falling oil revenues. They appeal to MPGAP to help with such training, and I would recommend we do so, if a proposal were received from GPC via EGPC. Now EGPC has started to build their own staff to file exploration records with computer access. An experienced GUPCO leader was hired to train 8 men, and they are actually building software while canvassing the 4000-odd wells in Egypt.

Two recent proposals to digitize geophysical logs and seismic records has recently prompted a consultant review of storage problems at EGPC.

Whereas the requested contract work was not recommended as immediately worthwhile, consultant Edward Gribi did suggest that the equipment and capability for digitizing should be acquired, so that it could be done in-house when need should arise. I hope a proposal for that is forthcoming.

What was strongly recommended however, and emphatically supported by every oil company exploration manager, was that the physical storage facilities for magnetic tapes, well logs, samples of cuttings, cores and other well reports should be given high priority. The volume of records exceeds the present facility at Egyptian Petroleum Research Institute (EPRI), and priceless data is likely to be lost. Mag-tapes are especially vulnerable. A new building, properly engineered for safe storage and efficient retrieval is of vital necessity. Old data files now held by service companies and oil companies, both in Egypt and abroad, should all be brought into the EGPC domain after proper space and order are attained. Otherwise, a potential concessionaire cannot seek the data (such as old seismic tapes he wants to reprocess) without disclosing his interest in acreage formerly relinquished by the data holder.

If an existing building cannot be requisitioned at EPRI, an alternative building should be bought soon, not built later, or the basement at the Maadi facility adapted for such storage.

Sophisticated computer recall and manipulation of a massive data-base remains of low priority, compared to the urgency of safe archiving of paper and tape records.

Task 2. Basement Tectonic and Sedimentary Thickness Maps

The World Bank lent money to EGPC to fund a comprehensive review and analysis of existing data on the northern part of the Western Desert (W.D.) and contracted Robertson Research to do the job. Using gravity, magnetic and seismic surveys to augment the well records, they compiled volumes of maps delineating not only basement, but isopachs of each major sedimentary

unit, the known facies relationships, potential petroleum maturation level and speculated on the prospects of finding oil in many basins. The documents will be a work-horse for many years of exploration. It did not favor the proposed MPGAP project for seismic studies in the W.D., so that idea was shelved.

Task 3. Geophysical and Geochemical Exploration

The notion of investment in experimental seismic methods to overcome the attenuation problems of the Miocene evaporites has not been pursued, perhaps because operating companies, notably Mobil, have invested sums approaching 100 million dollars into such studies in recent years. By computer filtering methods, the industry can now reliably map the base of the salt sequence, and sometimes sees deeper reflectors. Thus MPGAP funds are better applied elsewhere.

Source-rock and petrographic studies of the W.D. have been contracted to Robertson Research by GPC, using World Bank funds. This study is nearing completion.

The reason all these projects, originally intended for MPGAP funding, have been funded elsewhere is that EGPC could not wait for AID implementation, delayed by other Egyptian matters from 1980 to 1983.

Task 4. Estimation of Existing and Potential Petroleum Reserves

Two separate studies: 1) the aforementioned Robertson Research program now nearing completion, and 2) a similar study in the Gulf of Suez also by Robertson Research but funded by subscription of 30 oil companies, each has as objective the estimation of oil, contained gas and free gas. The critical role of petroleum in Egypt's foreign trade makes these estimates vital to national planning.

B. Support Services Activities

Task 1. Feasibility for Seismic Data Storage Center

As discussed under the heading of data organization, recommendations remain strong for establishing good storage facilities for magnetic tapes,

currently stacked in disarray in un-airconditioned basement locations at EPRI. Seemingly, there are four options: 1) occupy the basement of the costly new Maadi (GUPCO-EGPC) center, 2) build a new structure at EPRI, 3) appropriate and remodel one of EPRI's buildings for a storage center, or 4) buy an existing building elsewhere. MPGAP is a likely source of funding for at least part of such a massive project, which can do much in the long-term to stimulate concessions. We await a proposal from EGPC.

Task 2. Enhanced Oil Recovery Studies

GPC nominated Bakr Field as favorable for large known amounts of residual oil in place. Only 10% has produced by natural drive. The main reservoirs are in Turonian sandstones and Eocene limestones, quite different from the reefal Nullipore limestone being tested by steam injection at Ras Gharib Field.

Thus a feasibility study of a representative number of the 20-odd fault and strata-bounded reservoirs is justified at Bakr and Amer Fields. Now we know the HH, GG and FF, newly acquired GPC fields on the same trend, also have heavy crude. So upwards of a billion bbl are targeted. An exhaustive study of 5 companies that submitted pre-qualifications led to three to be invited to submit an RFTP. The process has taken 8 months, so far, largely because of shortage of reservoir engineers, and due to my insistence that GPC go through the process themselves. There is good prospect for funding pilot tests if the feasibility is proven by modeling. As discussed in recommendations, the sequel development of prototype enhanced recovery operations may depend on negotiating agreement with GOE to put a significant fraction of EOR production into a revolving fund. Another necessity is an enlarged GPC staff that can be trained.

Task 3. Training Equipment

Added to the project post-Agreement, this item was budgeted for \$175,000 plus inflation, etc. In attempting to maintain acquisitions

within the budget, GPC opted to cancel all except the rig floor simulator, a mechanical-electronic classroom mock-up of a drill rig platform, with all the controls and displays normally present to control drilling, fluid circulation and mud materials, and all the auxilliary equipment such as blow-out preventers. A computer assists in providing realistic problems and reaction to student manipulations. Not only does it teach the operational techniques for efficient drilling, but it permits exercise of emergency procedures for about 40 emergency situations. Clearly, if it saves one well in its lifetime, it pays off. The Training Center has the tools to provide courses for drillers of all operating companies, replacing costly US training.

III. Desert Research Institute

A. Information in Maps and Reports

Task 1. Data Organization and Analysis

A compilation of existing groundwater studies was intended by Agreement, and these were to be put into semi-automated form. ADP equipment has not yet been provided. However, collection could still be done. It is not as simple a task as envisioned. I am told that groundwater work has been done (and filed) within about 41 organizations in Egypt. Even within MPGAP, there are water exploration programs within DRI, GPC and ECSMA, with no collaboration between them, even to cross-reference the products. I think it is a challenging commitment already made by DRI to compile even the library listings of all agencies, whereas a filing of well-data would be of great national interest also. Lack of groundwater law is a serious national problem because water may ultimately out-value oil here, as it does in Saudi Arabia. DRI should perhaps volunteer to become the legal repository to which all logs must be sent for permanent filing. These topics will be aired in the 4th Semi-Annual MPGAP Symposium.

The library system at DRI was given attention by our librarian consultant, and many changes made in the holdings, storage, retrieval and cataloguing methods. Formal lectures were offered, and data management skills were learned at the P-1 computer course of Al Ahram.

Task 2. Surface Hydrologic Maps

Upon re-examination of the potential needs of the mining industry, new pilot-study areas were designated. In order of priority and sequence, these are: 1) Red Sea Hills, Queseir to Ras Banas and westward to the sedimentary contact. The surface work done in 1983-84 was to compile the watershed geology from existing sources, to delineate potential groundwater basins (wadi fills), to survey and sample all waterpoints (springs and wells), to pump-test each where possible, to conduct large numbers of resistivity soundings to locate a) the water-table and b) basement, thus defining groundwater bodies to the best ability of those methods. Drilling was attempted unsuccessfully and that phase will be conducted as soon as the new rig becomes available (Summer, 1985). Then meaningful pump-tests can be conducted, and quantitative assessment of groundwater resources can be made. No surface hydrology has been collected, except springflow and fragmental evidence of flash flows in streams. No rain-gages or meteorological stations have been emplaced. The surface hydrology awaits imaginative systematic data-collection methods. Without quantitative approaches, no real success in attaining MPGAP objectives can be expected. The work done to date has been done in a very energetic, professional way.

The other areas: 2) Ras Gharib, work started 1984, to be completed 1985, 3) Bahariya Oasis, 1984-85, 4) Ataga area (west of Suez), 1986, 5) Wadi Qena and 6) Wadi Loquita 1986-1987. Plans to work on Sewa Oasis have been dropped.

Task 3. Estimation of Groundwater Potential

Groundwater resource evaluation requires computation of the amount of through-flow (as in a wadi fill) that can be captured, or the

computation of the volume of water stored in a basin and the rate at which it can be depleted, and combinations of those methods. MPGAP can help DRI bridge the transition from qualitative geohydrologic description of water occurrences to the mathematical treatment of field-generated quantities needed to address the vital question: will there be water enough to process ores and support workers?

Task 4. Basin Analysis

This is actually the same as Task 3, attempting to outline the elements of a model of a basin: definition of aquifers, according to their boundaries, hydraulic conductivity and storativity, the fluid geochemistry, origin, recharge and discharge, and the piezometry. Modelling, usually digital, involves the computation of responses to stresses on the system, such a discharge at a well field, and its use in designing supply systems.

B. Support Services

Task 1. Laboratory

The upgrading of laboratory facilities has not proceeded fast enough to help DRI's project. Modern tools for chemical analysis should be acquired immediately. The desire to get into dating by radio-isotope methods has not met encouragement, because the great cost and high degree of sophistication in technique suggests that the facility is not ready to make use of it. A host of minor tools requisitioned will be purchased.

Task 2. Field Equipment

Field equipment, notably 4 jeeps, a carryall and a caravan, plus a water truck, stake truck and soon a 1500-ft. drill rig will complete the requisition. However, I can see that during the final phases, when work is going on in 3 areas simultaneously, 4 jeeps will not suffice in addition to their few Land-Rovers, so additional jeeps should be purchased.

IV. Remote Sensing Center

A. Maps and Reports

Task 1. Data Organization and Analysis

With the help of Dr. Lepley, the RSC Library has increased its holdings of modern texts and periodicals. The physical arrangements have been modified and standard librarianship has been developed by consultant El Arini. For the special problems of filing maps and photos, Dr. Larry Carver was hired for a short period. The library is now believed adequate for the training and research roles it is expected to play.

Task 2. Landsat Imagery and Aerial Photography

The Agreement indicated that RSC would provide Landsat Imagery and assist in the geologic interpretation of areas being mapped regionally by EGSMA. This is beyond the RSC scope, actually, and the task has been undertaken by Conoco Oil Co., who are producing a geology of Egypt on 1:250,000 Landsat scenes, involving a great deal of field-checking.

As mentioned elsewhere, the b/w coverage of 2,500 km² of W.D. terrane is being replaced by an enhanced-color aerophotography project of greater potential for mineral exploration.

The upgrading of MDAS hardware and software is slowly getting on track, with bids received and evaluated by Wimvex, procurement agent under contract. Delays are caused by inexperience and fear of AID red-tape.

B. Support Services Activities

Task 1. Atlas of Landsat Maps of Egypt

The Atlas of Landsat Imagery, started during training of two technicians at ERIM, Michigan, has been started by RSC who grew impatient, so undertook to rent the necessary tape drives, etc., to get image production going. It is already a year late, delaying completion of the 81 scenes into 1987, and of the training courses, which must use the upgraded MDAS.

V. Training

Whereas there were originally scheduled some 58 Egyptian trainees to be sent to America for study periods of 1-9 months each, only 15 have been completed at mid-program, with two more in progress. The pace has slowed down because candidates sufficiently qualified in English-language skills are in short supply. Many program changes have been made, attempting to fit the training to the men passing the ALIGLU test, rather than fitting men to the institutions' needs.

The developmental desires of EGSMA, DRI and RSC have also influenced programming. Change in EGSMA leadership, from soft-rock to hard-rock interests, has minimized the plans for training in Stratigraphy, Quaternary Geology, Marine Geology and Paleontology, in favor of Economic Geology and related specialty topics.

The rate of Bendix-contract expenditures has fallen behind schedule, while overhead costs fixed by initial staffing at Cairo and Grand Junction remain at their original level. Remedial efforts to cut overhead are ineffectual, nor to be expected. However, the remodeling of the program to speed training requires innovative efforts not demonstrated to date.

EGSMA approves of the concept of in-house training, replacing some of the US training with instructors brought to Egypt, thus avoiding the formal language limitations. Of course, English would remain the medium of information exchange, and inadequacies would translate into teaching problems here. Nevertheless, when instruction is done locally, close teacher-student association can minimize communication problems. Such was the approach to technology transfer intended by the USGS seven years ago, who would have taken groups of 10-30 into the field for hands-on instruction. Though Bendix and EGSMA have discussed some such programs, as in structural geology, none have yet materialized.

Another solution is to hire bilingual Egyptian instructors who have received advanced training in the US or elsewhere. Such has been the case of Mr. Mohsin El Arini, US-trained library specialist, whose tenure was recently completed, and with distinction. His work in reorganizing

all the libraries of EGSMA (3), DRI and RSC and teaching the subject in Arabic has met with great success. A similarly-qualified cartographer has been nominated. I encourage Bendix to find means of increasing the training pace by bringing more Americans here to conduct on-site programs, and to seek qualified Egyptian instructors to teach others their needed specialties.

Training in USA was not given a healthy, well-conceived initiation when the project began. The apparent motive was to reward mid-career EGSMA geologists for their past performance, and to expose them to the American culture and way of getting good living standards for themselves. I think there was tacit approval of the trainee's motives of seeing the marvels of Disneyland, the T.V. spectaculars and the shopping centers. If the honor of free training were bestowed so that the recipient could give more to Egypt's program of development upon his return, the results would be immensely more advantageous. Then we would hear of specialists applying their new-found knowledge on the job; they would organize courses of instruction for their colleagues who didn't receive the foreign training: at least, we would see the returning people working with newly-learned methods in the area of specification, rather than their old jobs. These criticisms are not universal, for I am aware of trainees in stratigraphy, sedimentology, MDAS operation and librarianship that are using their new talents to good advantage. X-ray trainees await equipment, but in industrial minerals, columbite, tantalite and quaternary geology, I think there is little utilization and no on-going training. I urge EGSMA to assign returning trainees to appropriate work, to indoctrinate them before going in the nature of their responsibilities to collect teaching materials and assume the role of teacher when they return. Such reports as were required of the four trainees in industrial minerals serve to reinforce learning, to preserve concepts and data, and to serve as a manual of instruction. If and when field training is organized in Egypt, some trainees should be designated as future instructors.

Out of an intended schedule of 22 visiting specialists, only 5 have completed TDY duties. The agencies have delayed invitation until circumstances were appropriate, i.e., until fit manpower becomes available to receive the training. The problem really developed because the MPGAP

designers thought EGSMA should drop its work to run MPGAP. Only a few senior people are really productive, and they have heavy program responsibilities, such as field work and reports to governorates, other agencies, government mining companies, or long-established EGSMA projects like regional mapping. So a consultant impacts these programs if receptive (i.e., well-trained) geologists are diverted from productive tasks. These and other constraints influence EGSMA training decisions, so it is no wonder that training committee work has never involved MPGAP staff participation. I am not of the opinion that geologist training has been pushed hard enough in EGSMA, and that management must sacrifice more current project accomplishments for the sake of future production of superior calibre.

A third area of training was intended for VIP visits to US, numbering about 8 over the project life (4 years). To date one EGSMA geologist and two DRI geologists have utilized the opportunity. Department heads with potential of years of leadership should be considered for travel to acquaint themselves with sister agencies in US, or with mining companies that are either potential investors or competitors in exploration or productive of mineral commodities. Modern methods of information utilization and program management are important areas for senior-level education, whereas instrumentation and agency organization are others that can influence future Egyptian agencies in their development.

Recommendation for Administrative Changes

It is not in the Egyptian character to feel comfortable delegating authority: only the top man's signature counts. In MPGAP, an Egyptian Project Officer has designed an organization fundamentally unworkable: he gave no authority to his Project Coordinator, used him as a consultant but retained all the controls on the contractor, Bendix. Yet when things didn't go well, the PC got equal criticism. Unable to exercise authority over the contractor, it was often demoralizing at the beginning of the project, because no signals were given the contractor to work through the Project Coordinator. An insecure person couldn't have survived it.

Yet AID needs competent scientific advisors in their employ, in this case, a broad-based earth scientist. It is not sufficient to put all

advisory capacity in the head of a contracting company, for the tendency is to approve readily expenditures inuring to the contract, without finding independent justification, i.e., that the money will be well-spent.

A personal-services contractor labors under some limitations: he cannot negotiate for the government, and further, he lacks the administrative training needed to handle bids, contracts, etc, unless he is an AID retiree, say. Unnecessary impediments to my efforts have been caused by lack of support from AID on matters vital to family welfare and maintenance. Whereas Mission guidelines clearly intend to give the PSC all the conveniences accorded direct-hires, I have not received them. As a result, my performance has suffered while I attended to domestic matters. Unless policy is upheld, the PSC category is not cost-efficient. I don't recommend the Project Coordinator position be filled with a PSC.

I think the only workable arrangement would be to hire directly, and train a senior earth scientist to perform as Project Officer in full charge of MPGAP, without any other duties. Then the lines of administrative and technical responsibility would be clear.

The Bendix contract (MGRS) excludes that company from petroleum-related MPGAP activities. That was made so because only host-country contracts were envisioned; EGPC has contracting experience enough. Yet I have found that to do host-country contract meeting AID's rules is even more difficult than for Egypt to do a contract, or AID to do a contract independent of the other. In the absence of a Project Coordinator, the Project Officer will need administrative and technical help, since 4 to 6 contracts are now proposed and likely. I suggest a full-time petroleum geologist be appended to Bendix' organization and that Bendix' contract be modified to incorporate responsibilities of the petroleum sector tasks. The Resident Director (RD) of Bendix needs help, for the contract commits him now to more things than one man can do. If he can delegate more of the EGSM technical liaison to the Resident Editor, and some Desert Research Institute liaison to a petroleum geologist of similar caliber, then more of the project outputs can be expected of the Resident Director.

On the Egyptian side, a sense of unity, generated by an active Coordinating Committee dedicated to using MPGAP funds to stimulate the mineral industries has been needed. Since they have met only once in two years, the Coordinating Committee has not been successful in preventing

individual agencies from putting themselves first. At a time when EGRC was unable to use all its allocated MPGAP funds, it still found opportunity to deprive EGSMA temporarily of vital funds, simply because of an administrative oversight in the budget for the Aeroservice Co. contract. I suggest that monthly meetings of the Project Managers, with the MPGAP staff in attendance, would smooth many of the tasks that the agencies have in common. As they now function, the agencies operate almost independently of one another, instead of sharing field, office and laboratory facilities.

I have suggested the logic of bringing Nuclear Materials Corp. into MPGAP. They deal with geology, minerals, energy, exploration, remote sensing, water analyses, etc, just does EGSMA, DRI and EGPC. Field location and use of the aeromagnetic and radiometric data are often in common with EGSMA. Thus cost-effectiveness could be improved by collaboration. The MPGAP Coordinating Committee should consider inviting them to join the club, since NMC benefits automatically from the products of the others. It should be mutual.

Another common problem for Coordinating Committee effort might be to find ways to stimulate GOE funding of their committed share of the Agreement. The responsibilities have not been met, so far. One mechanism suggested is in establishing revolving funds from successful mining or EOR ventures, or in the case of DRI and RSC, the profits from sale of services to industry or other entities. A drill rig, MDAS system or other MPGAP-funded hardware can thus generate money to do better work on MPGAP tasks. Other ways to improve agency budgets could result from more Committee interaction.

I have some recommendation on the EGSMA activities:

The training program has lagged behind schedule, mostly because English-language skills are not high enough among the ideal trainees, i.e. the ones needing special training may not get passing grades. Since we hope to see years of continued AID funding, act now to upgrade English skills by teaching it in EGSMA, or use GPC's language lab to its fullest. The American University is good, but attendance deprives EGSMA of all a man's service. Language should be a part-time process for all.

Support of mining as an industry has to embrace process needs as well as exploration. EGSMA is the logical place to build the equivalent of the

U.S. Bureau of Mines, which researches new mining methods and materials, extractive processing and materials handling methods. Metallurgy, hydraulics, rock mechanics, excavation and disposal technology are a few of the areas left now to foreign consultants or universities. Consider future needs, and seek now the advice of experts MPGAP can provide, to direct development in those areas vital to a healthy mining industry. VIP visits would help.

Exploration methods in EGSMA will be criticised by consultants, since changes of the last decade have not been transmitted to Egypt. Only in gold have we obtained consultants advice. I suggest that his recommendations to institute training to improve geologic mapping, especially three-dimensional work such as sections and subsurface mapping, be given priority. Gear the modern geochemical sampling schemes to geologic mapping. Speed the analysis of a small number of more critical samples. Develop analytical methods for pathfinder elements and improve gold sensitivity. For other sulfides, the AM survey and remote sensing hold promise. A program to check anomalies systematically will be expected as a result of the survey. Work with NMC for efficient use of radiometry.

More logistical support for visiting consultants is needed. One of the MPGAP jeeps should be assigned, and EGSMA resources more readily made available when a consultant wants to go in the field. Likewise, encourage MPGAP staff to spend more time with EGSMA geologists in the field. They are your consultants, and they will give you best service away from the office.

If manpower can be provided the Geophysics Dept., MPGAP consultants and training could be re-instated, for there is much technology that needs transmission. Other areas of potential usefulness would be groundwater geology and engineering geology. Work directly with DRI, perhaps by exchanging hydrologists and geophysicists. Consider the hazards of waste disposal, earth quakes, floods and wind in the design of Egyptian cities, as reasons for developing engineering geology as an EGSMA contribution.

As MPGAP training is received, plan to incorporate it most usefully in EGSMA's projects. Insist on continued education: trainees have a responsibility to pass knowledge to their colleagues. As specialty training suggests new applications for EGSMA, incorporate the work into MPGAP, for continued US-collaboration. It is not healthy for a specialist to return

to his old work, forgetting what he learned abroad.

In GPC, I have identified training needs MPGAP can fulfill: reservoir engineers in greater number should be trained by EOR contractors, and other AID programs for formal college training can be used. The full utilization of the Ras Gharib Training Center could be enhanced by obtaining, through MPGAP, the services of US companies specializing in petroleum training courses.

EGPC is embarking on many researches to stimulate concessions. To do so effectively would require more staff capabilities. I suggest long-term commitments from young graduates sent to U.S. universities for degrees in Geophysics, Structural Geology, Petroleum Geology, Petroleum Engineering, Stratigraphy, etc. If you have the men, we can find the means.