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**INSTITUTIONAL EXCELLENCE PROJECT (IEP)**

**SIX-YEAR DEVELOPMENT PLAN  
for the  
DEPARTMENT OF GEOLOGY AND  
CENTRE OF EXCELLENCE IN MINERALOGY  
UNIVERSITY OF BALOCHISTAN  
QUETTA, PAKISTAN**

**May 1991**

**Prepared by:**

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International Activities, Inc. (MUCIA)**

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**University Grants Commission  
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**and**

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## PROJECT PURPOSE

The purpose of the Institutional Excellence Project (IEP) is to improve Pakistan's capabilities to develop, adapt, and utilize advanced scientific and technology innovations in support of economic and social development. This purpose will be achieved by strengthening research, teaching and outreach in selected science and technology departments in cooperating universities. The primary mechanisms to be employed in this effort will be the establishment of formal and informal linkages among Pakistani and U.S. scientists and their institutions, education and training and a small grants research program.

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# CONTENTS

|  | Page      |
|--|-----------|
| <b>EXECUTIVE SUMMARY .....</b>                                     | <b>1</b>  |
| <b>1. INTRODUCTION .....</b>                                       | <b>2</b>  |
| 1.1 Purpose .....  | 2         |
| 1.2 Site Visit.....  | 3         |
| 1.3 History of the University of Balochistan.....                  | 6         |
| 1.4 Previous Reviews .....   | 7         |
| <b>2. STATUS .....</b>   | <b>12</b> |
| 2.1 Existing Program-Centre of Excellence in Mineralogy (CEM) .... | 12        |
| 2.1.1 Governance, Structure and Goals .....                        | 12        |
| 2.1.2 Faculty/Staff Expertise and Background .....                 | 14        |
| 2.1.3 Academic Program Enrollments/Graduate Rates .....            | 16        |
| 2.1.4 Research .....   | 17        |
| 2.1.5 Facilities and Equipment .....                               | 18        |
| 2.1.6 Linkages .....   | 21        |
| 2.1.7 Professional Environment .....                               | 22        |
| 2.1.8 Costs and Financing.....                                     | 22        |
| 2.2 Existing Program - Department of Geology.....                  | 24        |
| 2.2.1 Governance, Structure and Goals .....                        | 24        |
| 2.2.2 Faculty/Staff Expertise and Background .....                 | 24        |
| 2.2.3 Academic Program/Enrollments/Graduation Rates.....           | 26        |
| 2.2.4 Research .....   | 30        |
| 2.2.5 Facilities and Equipment .....                               | 31        |
| 2.2.6 Linkages .....   | 32        |
| 2.2.7 Professional Environment .....                               | 33        |
| 2.2.8 Costs and Financing.....                                     | 34        |
| 2.3 Synthesis of Issues .....                                      | 34        |
| 2.3.1 External Efficiency.....                                     | 34        |
| 2.3.2 Internal Efficiency.....                                     | 35        |
| 2.3.3 Management and Administration .....                          | 43        |
| <b>3. STRATEGIES FOR CHANGE.....</b>                               | <b>50</b> |
| 3.1 Problem Analysis.....  | 50        |
| 3.1.1 Goals of the Centre of Excellence in Mineralogy.....         | 50        |
| 3.1.2 Goals of the Department of Geology .....                     | 51        |
| 3.2 Program Needs .....  | 57        |
| 3.2.1 Technical.....   | 58        |
| 3.2.2 Institutional.....   | 59        |
| 3.2.3 Administrative .....   | 60        |

|           |   |           |
|-----------|---|-----------|
| <b>4.</b> | <b>IEP AND INSTITUTIONAL RECOMMENDATIONS .....</b>                      | <b>61</b> |
| 4.1       | Recommended Geologic Discipline for the Purpose of IEP .....            | 61        |
| 4.2       | Administrative Changes Needed for Successful<br>IEP Implementation..... | 62        |
| 4.2.1     | Use of Combined Facilities and Faculty .....                            | 62        |
| 4.2.2     | Use of Unexpended Funds .....   | 62        |
| 4.3       | Strategies to Implement Recommendations.....                            | 63        |
| 4.3.1     | Constraints.....  | 63        |
| 4.3.2     | Time Plan.....  | 64        |
| 4.3.3     | Monitoring and Evaluation.....  | 68        |
| <b>5.</b> | <b>REFERENCES.....</b>  | <b>71</b> |

**APPENDICES**

|             |   |    |
|-------------|---|----|
| Appendix A. | Checklists for Pre-Visit Notifications of Data Needs .....                  | 73 |
| Appendix B. | Guides for Assessment of Facilities .....                                   | 75 |
| Appendix C. | Facilities and Equipment of the Centre of<br>Excellence in Mineralogy ..... | 78 |
| Appendix D. | Facilities and Equipment of the Centre of Geology .....                     | 85 |
| Appendix E. | Equipment Inventory of the Department of<br>Geology Storeroom .....         | 91 |

## **EXECUTIVE SUMMARY**

The Institutional Excellence Project (IEP), funded by USAID and managed by the MUCIA consortium, is intended to upgrade science and technology in Pakistan. This will be done by strengthening the research and graduate education capabilities in selected Pakistani universities. The purpose is to raise the personnel and material resources to a position of being able to successfully address pressing national needs in research and development.

The project commenced with a four-week-long visit by a Geology Assessment Team in August-September 1990 to examine the current status and future prospects of two companion units--the Centre of Excellence in Mineralogy and the Department of Geology at the University of Balochistan, Quetta, Pakistan, by means of in-depth interviews with administrators, faculty and staff of the Department and the Centre, as well as scrutiny of existing physical facilities and equipment, library resources, undergraduate and graduate student research programs, faculty publication records, and students' post-graduation employment statistics. In light of those assessments and reckoning of subject areas that interface with future opportunities in research funding, student employment, and regional and national development needs, this assessment report and proposal for a six-year development plan recommends some administrative changes and targets hydrogeology as the focal point of earth-science program development in this desert region. Development of hydrogeology requires support of collateral disciplines such as seismology, structural geology, stratigraphy, and geochemistry that participate in locating and exploiting artesian water resources and in monitoring groundwater pollution from agriculture and industry.

Strengthening of the hydrogeology program will require outside funding, along with the collegial and institutional cooperation of the Department and Centre and collaboration with the Geological Survey of Pakistan and other university units. There is now the timely opportunity to catalyze and develop a project of excellence that could be a science and technology accomplishment of national significance.

# **1. INTRODUCTION**

## **1.1 PURPOSE**

The Institutional Excellence Project (IEP) is a 10-year effort for the design and implementation of a program to strengthen Pakistan's institutions of higher education in the areas of science and technology. The major objectives of the IEP are to advance the development of the scientific potential of selected universities and fields, and to promote the conduct of research and training of the technical professionals that are essential to Pakistan's sustainable economic development. A nation without significant self-dependence in science, technology, and development of its own natural resources is a nation increasingly vulnerable--economically and otherwise--in today's world. The IEP will link researchers and faculty from higher-education institutions in the U.S. with their counterparts in Pakistan in a program to augment Pakistan's scientific capability and resources. Specific technical disciplines identified as key academic areas for the project include: geology, chemistry, electrical engineering, biology, physics, economics, agriculture, and pharmacy.

The IEP's major goals include: further development of graduate programs and training in Pakistani universities; provision of scientific, technological and research information exchange; research and development; and exchanges of graduate student and research faculty between Pakistani and U.S. universities. In addition, the project will provide research grants, graduate-student scholarships, upgrading and equipping of science and technology facilities, and workshops and seminars.

The project's initial phase is an assessment of specific Pakistani university units and facilities by technical teams of discipline specialists. The sites were selected in consultation with the University Grants Commission (UGC) of Pakistan. Each MUCIA-assembled assessment team is comprised of technical experts from both the U.S. and Pakistan.

In the assessment, special attention was given to:

- selection of fields of scientific research that are important to national and provincial economic development priorities; and identification of individual researchers and teams in those subject areas who have the potential to attain international respect.

- qualifications of the faculty, staff, and administrators and their interest in and commitment to upgrading research and graduate instruction, and thus to the goals of the project.
- quality and availability of facilities and equipment.
- strengths of and impediments to present and future activity in research.
- existing or prospective national and international linkages with other institutions and researchers that would support progress.
- past productivity and prospects for future productivity and improvement of it.
- prioritizing needs for upgrading and support, and selecting the appropriate mix of equipment, training, research aid, and networking (both internal and external for the unit) that will maximize project outputs.
- means for monitoring and evaluating progress programs sponsored by under the IEP.

**This assessment phase aims to map a strategy for institutional development of significant research and training strength. This includes a survey of personnel, material resources (instruments, equipment, computers, library), and formulation of a research plan and procedures. The subsequent "Small Grants" program component aims to further encourage research initiative and progress by providing an opportunity for: 1) support of project expenses; 2) cooperative linkages of discipline-specific departments/centers with the private sector, government research institutes, and researchers at other universities, both within Pakistan and in the U.S.; and 3) development of a national system of peer review for evaluating and funding research plans and proposals.**

## **1.2 SITE VISIT**

**A Geology Assessment Team was assembled by MUCIA to visit Pakistan, intensively review the selected facilities, and to prepare a report on prospective funding strategies for USAID. The team leader visited the MUCIA office in Washington, D.C. for two days prior to embarking for Pakistan in order to arrange and prepare materials and procedures for the upcoming assessment. The team made its initial visit to**

Pakistan in August/September 1990, which also inaugurated the on-site phase of the Institutional Excellence Project. The agenda is summarized as:

- August 20 U.S. technical members arrive in Pakistan; Team assembles in the capital of Islamabad for preparatory activities.
- August 22 Travel to Quetta province of Balochistan to visit the University of Balochistan.
- August 23 - Sept. 7 Team visits the University of Balochistan's Department of Geology and the associated Centre of Excellence in Mineralogy (CEM), gathers data, visits facilities and interviews personnel, and begins writing of report.
- September 8 Return to Islamabad.
- September 9 - U.S. members formalize and complete initial draft of report.
- September 14 Distribute some portions, conduct meetings with Dr. Ansari of the University Grants Commission and with Mr. James Norris, USAID Mission Director.

The Assessment Team for the Geology subject area had the following members:

*Dr. Robert Carmichael*, Professor of Geology and Geophysics, University of Iowa. MUCIA's geology facilitator and U.S.-based geology coordinator and team leader;

*Dr. Lon Ruedisili*, Professor of Geology, University of Toledo. U.S. technical subject-area consultant.

*Dr. George McCormick*, Professor of Geology and Mineralogy, University of Iowa. MUCIA's Pakistan-based Academic Director and Chief-of-Party;

*Dr. M. Qasim Jan*, Professor of Geology, University of Peshawar, Pakistan, and Director of Centre of Excellence in Geology;

*Dr. John Monagle*, USAID/Islamabad Project Officer and AID representative; formerly Director of Arts and Sciences Research Center of New Mexico State University;

The Geology Assessment Team was accompanied on the site visit by:

*Dr. David Sprague*, Chief of Human Resource Development, USAID/Islamabad;

*Dr. M.H. Qazi*, Special Advisor, University Grants Commission, Islamabad;

*Dr. A. Q. Ansari*, Chairman, University Grants Commission, Islamabad.

The team had visits, conferences, consultations, and facilities visits in individual, small-group, and whole-group sessions during the 16 days on site at the university. Participants and interviewees included faculty and graduate students, and the following:

Vice-Chancellor (and chief operating officer)

*Dr. Shaukat Hussain Baloch* (in office since March 1990)

Department of Geology

*Dr. Akhtar Mohammad Kassi*, Chairman

Senior faculty, junior faculty, graduate students, and staff of the Department of Geology

Centre of Excellence in Mineralogy

*Dr. Abdul Haque*, Acting Director since 1989. (The Director, *Dr. Zulfiqar Ahmed*, is on leave in the U.S. until 1991.)

Faculty, graduate students, staff of the CEM

Geological Survey of Pakistan (a federal agency, in Quetta)

*Ali Hamza Kazmi*, Director-General

Other administrative and research staff of the GSP

Institute of Biochemistry

*Dr. Nasir-ud-Din*, Director

Other faculty of the Institute of Biochemistry

Department of Chemistry

*Drs. Sher Akbar and Abdullah Khan*

University Grants Commission

*Dr. A. Q. Ansari*, Chairman, UGC

*Dr. M. H. Qazi*, Special Advisor, UGC

The team was well received throughout its stay and by all concerned. The Pakistanis were welcoming, hospitable, helpful, and forthcoming to the team's requests. The faculty and students were articulate, thoughtful, and unstintingly frank. The participation and cooperation experienced was encouraging and was greatly appreciated by the team.

The gathering and assembling of the data and materials for this report were done by the team as a whole. McCormick was a special asset for logistics and arranging visitation because of his previous experience in Pakistan (total of 2-1/2 years) including the University of Balochistan. Monagle, as the USAID representative, was a helpful provider of advice and supporting documents. Jan contributed useful perspective as an accomplished and administratively knowledgeable member of the Pakistani scientific community.

### **1.3 HISTORY OF THE UNIVERSITY OF BALOCHISTAN**

The University of Balochistan is located in suburban Quetta, the capital city of the province. Quetta is in the northwest extremity of the province, about 70 km from Afghanistan. The Geological Survey of Pakistan is immediately adjacent to the university.

The University of Balochistan was established in 1970, opened in 1971, and occupies an area of 180 acres. It has a Faculty of Arts and a Faculty of Science. Within the former are teaching departments of English, Economics, Urdu, Political Science, International Relations, Sociology, Islamic Studies, Philosophy, Psychology and History, and professional disciplines in Social Work, Commerce, Administrative Science, Mass Communications, and Education and Library Science. It has a student enrollment of about 1500. There are nine teaching departments in the Faculty of Science--Geology, Physics, Chemistry, Mathematics, Statistics, Botany, Zoology, Geography and Pharmacy, with an approximate enrollment of 1000 students. To augment the science disciplines, there is an English Language Centre which is located in the Geology building. This Centre was originated by the Asia Foundation and is now run in cooperation with the UGC. The university has an Institute of Biochemistry and three specialized centers for advanced studies and research--Centre of Excellence in Mineralogy, Pakistan Study Centre, and Area Study Centre for the Middle East and Arab Countries. The university has one constituent Law College and twelve affiliated colleges including Bolan Medical College, Agricultural College, and the Engineering and Technology College at Khuzdar.

Classes at the University of Balochistan commence in March and end with examinations in December. This is the only Pakistani university on this academic

schedule. The others begin in September and end in June, similar to the academic years in Europe and the U.S.

The prescribed language of instruction in the university, as for post-secondary schools throughout Pakistan, is English.

University-level credentials in science consist of a B.Sc. degree after two years of study, followed by an M.Sc. after another two years. This would then be the equivalent of a typical undergraduate degree in North America and Europe. Students going on for graduate work typically proceed towards an M.Phil. (Master of Philosophy) degree, and then a Ph.D. Since the doctorate-granting programs are limited in number and opportunity in Pakistan, aspirants typically go overseas for Ph.D. degrees. Common destinations are Britain or other commonwealth countries, western Europe, and the U.S.

#### **1.4 PREVIOUS REVIEWS**

The Assessment Team carefully reviewed the most recent studies relevant to review of the CEM and the Department of Geology. At our disposal were the following reports:

- **MUCIA, June 1990, Institutional Excellence Project (IEP), "Preliminary Institutional Analyses," 19 pp.** - a preliminary analysis of four Pakistani Universities (Gomal, Balochistan, Lahore, and Sind) following site visits from 4-13 June 1990 by Dr. A. Q. Ansari and Dr. M. H. Qazi (UGC) and Dr. Mary Pigozzi, Dr. George McCormick and Dr. Charles Rhykerd (all of MUCIA).

Relevant observations reported were the following "strengths" contributing to the University of Balochistan (CEM and Department of Geology) being ready to participate in IEP: The Vice-Chancellor is supportive and forward-looking, staff is adequate for strengthening if both the CEM and Department of Geology are considered together, and the faculties recognize the need to cooperate and to develop focussed interest. The concerns identified were that the CEM does not have sufficient qualified personnel, and the Department of Geology lacks resources (funding, equipment, facilities, and field transport), there is duplication of some resources, there are no computer facilities, and the extent of cooperation between the two units (CEM and Department of Geology) is unclear. It is noted that "The differences between the

Department and the Centre are significant. They cannot be resolved by MUCIA. The solution must address financial as well as organizational issues. . The solution will take a skilled leader." The report's general conclusions include that "Some units are accepted conditionally for IEP in this initial assessment. Some of these units may have to meet specific conditions before participating fully in the program."

■ **World Bank, February 1990, "Higher Education and Scientific Research for Development in Pakistan," Vol. I (105 pp.) and Vol. II (209 pp.), Report No. 8231-PAK - Findings of Missions to Pakistan in February/March and September/October 1989.**

This thorough and far-reaching report includes such observations as ". . .lack of success and low productivity in research in Pakistan stem directly from the absence of overall planning. Without clearly stated and understood targets and priorities, it is impossible to reward success and avoid waste", "some of the many research establishments are too small to function effectively and yet make no coordinated effort to collaborate", "The highly constrained resources. . .are improperly deployed," "computer illiteracy (in today's world) ensures a nation's technological dependence", "The procedures for the appointment and appraisal of academic and support staff militate against establishing and maintaining high academic and vocational standards", and "student indiscipline emerges as a serious and pervasive problem."

■ **U.S. Geological Survey, November 14, 1989, "Institutional Development in Earth Sciences in Pakistan," including General Review of Facilities and Current Capabilities of the Centre of Excellence in Mineralogy, University of Balochistan, Quetta, 21 pp. - a report of facilities appraisal compiled by Bruce Wardlaw and Wayne Martin, U.S.G.S., Reston Virginia, during visits in 1989 and to Quetta November 11-13, 1989.**

Some observations are that, "Earth sciences, specifically coal and mineral resource development, hydrocarbon assessment, water resources and analysis, and environmental geology, are key aspects to the proper development of Pakistan", and "The Centre of Excellence in Mineralogy of the University of Balochistan has no direction, and no dynamic programs or ideas for such programs. . . .the very small faculty of the CEM limits (its) ability. . ." In general, "in addition to well-trained imaginative scientist/professors, there is the need for modern analytical instruments,

reliable utilities supply, properly-trained instrument operators, and some form of reliable maintenance. . . Without the ability to quickly repair instruments, the analytical capabilities of the institute are greatly reduced." "The CEM shows potential for growth and expansion of research capabilities if support is given in the proper order and in measured amounts." "The CEM is seen as slow to progress as an attractive institution to students and to enthusiastic, well-educated faculty alike. Research programs are limited by the small number of faculty. . ."

■ "Cooperative Accord", Department of Geology/CEM, September 4, 1989, (See Table 1) a written agreement produced by the Academic Staff Association (ASA) to try to settle differences between The Department of Geology and CEM.

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**Table 1. Cooperation Accord (Department of Geology/CEM)  
September 4, 1989**

A prolonged period of non-cooperation created an atmosphere of misunderstanding, mistrust and unprecedented lack of faith that prevailed between the Geology Department and Centre of Excellence in Mineralogy. A series of conscious and unconscious actions provoked this grave situation, in which any hope of conciliation was far from sight. The parties approached their representatives, the Academic Staff Association (A.S.A.)

The A.S.A. discussed the matter several times in their executive meetings and decided to play a conciliatory role. In this regard, A.S.A. had a brief meeting with the Vice-Chancellor to seek any guidance or help and continued meetings with both parties. A.S.A., on their part, continued looking into the matter deeply and had several meetings with both groups separately. In these efforts, when a slight glimpse of hope appeared, A.S.A. invited both parties to have a direct talk in their presence. In two such joint meetings, A.S.A. was successful in overcoming the differences and reaching a written agreement. A.S.A. is proud that with cooperation, cool-headedness, and a sense of compromise on the part of both parties, the following decisions were made:

**a. CEM Library**

It was decided that the reference library of the CEM will be open for every member of the Geology Department (teachers and students). The Department and Centre will collectively make rules and regulations for the use of the CEM library books.

**b. Return of Items**

It was decided that the Department of Geology and CEM will return each other's items. The Department and Centre will have to provide proof for their items. The items will then be returned in the presence of the Geology chairman, CEM director, two storekeepers, and general-secretary of the A.S.A.

**c. Post of Associate Professor and Other Posts**

The CEM advertised a post of associate professor in Jan. 1988, for which selection is yet to be made. The director of the CEM says that the delay is due to the imposed ban on recruitment by the Federal

Government. The director is bound to call the Selection Board as soon as the ban is lifted. The selection for the post of associate professor will be carried out according to the normal procedure of the University of Balochistan. Three other posts exist, according to the approved budget, which will be advertised as soon as the ban is lifted. Preference will be given to available eligible local/domicile candidates of Balochistan, especially those who are employees of the university.

**d. Scholarships**

It was decided that, in the future, the policy for awarding scholarships will be such that preference will be given firstly to CEM employees, then to M.Phil. students who are about to finish their degree, and finally to staff members of the Geology Department. In all cases, merit and experience will be taken into account. The scholarships to the staff of the Geology Department will be awarded on condition that the nominee will be willing to transfer to CEM and be bound to the Centre. In this regard, study leave will be given by the Centre according to the university rules.

**e. Identity Cards for M.Phil. Students**

The Centre will clarify from the Academic Section, University of Balochistan, whether M.Phil. students of the Centre are students of Balochistan University. In case they are not considered as normal University students, the Centre will provide them with I.D. cards.

**f. Teaching by Geology Staff in CEM**

It was decided that the Centre will give a written offer to the concerned teachers in the Geology Department, asking their availability and willingness to teach the required courses. Teachers of the Geology Department will be given priority to teach in the CEM.

**g. M.Phil. Degree**

It was decided that students (M.Phil.) may choose their supervisors according to the field of specialization of their own interests and availability. In the case of Mr. Khadim Hussain, the director of CEM will forward his application for registration in the M.Phil. course. If he wishes, he may start his work according to the instructions of his supervisor.

**h. Equipment to Be Repaired**

It was decided that the Centre will use all its resources to repair the inoperable equipment like the X-ray Diffraction etc. as soon as possible.

**i. Journal "Acta Mineralogica Balochistan"**

This journal's issues will be provided to the authors and to all other members of the Geology Department free of cost.

In the future, there will be mutual respect and efforts will be made for a better understanding between the staffs of the CEM and Department of Geology. In case of any misunderstanding, the matter will be brought before the A.S.A. by both parties.

(Signatures)

Sept. 4, 1989

(Retyped from the original, with minor typographical and grammatical corrections)

▪ **Geology Group, January/February 1989, Conditions of Geology Departments and Institutes in Pakistan**, a report submitted to the University Grants Commission - an assessment of research potential and teaching/research performance, from visits in 1988 by a team of Dr. Qasim Jan (Peshawar), Dr. R. Khan Tahirkheli (Peshawar) and Dr. Rais Ahmad (Jamshoro).

The team of senior geologists evaluated geology units to assess their strengths and weaknesses in teaching and research capabilities and their readiness to absorb future research funds. The visits were conducted in late 1988, to the Departments of Geology at Peshawar, Sind, Karachi, Balochistan/Quetta, the Department of Applied Geology at AJK University Muzaffarabad, the Department of Earth Science (geophysics) at Quaid-i-Azam/Islamabad, the Institute of Geology at Punjab/Lahore, and the Centers of Excellence in Geology (Peshawar) and in Mineralogy (Balochistan).

General observations were that the units with the best equipment resources were the Centre/Peshawar and Earth Science/Quaid-i-Azam, with the others suffering from inadequacy. All had inadequate field transport, the library resources are poor except at the Centre/Peshawar and at Geology/Punjab, there is a lack of qualified teaching staff and technicians, and funding is inadequate to support maintenance of equipment or of books or of significant and high-level research activity. Government support was suggested for more training of faculty in "exploration geophysics and geochemistry, mineralogy and petrology, and applied geology." The Centre/Peshawar could be used as a training resource for workers from other sites needing assistance.

▪ **Zulfiqar Ahmed, 1985, Centre of Excellence in Mineralogy, University of Balochistan, 19 pp.** In this 1985 prospectus, the CEM stated a "Future Development Plan" covering the next five years for the CEM. This included plans to:

- 1) increase its student enrollment to around 35;
- 2) increase its laboratory facilities by adding ore polishing, ore microscope, microanalytical and analytical lab; and further developing, maintaining, and updating its existing labs;
- 3) work on multidisciplinary research projects;
- 4) create and further strengthen the contacts between scientists at universities and industry, other institutions and concerned agencies, both within and outside the country;
- 5) develop effective programs for faculty development at various levels;

- 6) enhance the research capabilities of the CEM and make it useful for consultants working in the fields of mineral identification, analysis, prospecting, exploration, mining and development of minerals for both public and private sector organizations;
- 7) fully avail the facilities for development programs from foreign governments, e.g. the Fulbright program, the Pak-French Agreement;
- 8) use the facilities, equipment and instruments, often provided by other foreign governments, for collaborative work with other Pakistan agencies such as the Geological Survey of Pakistan;
- 9) arrange conferences, seminars, refresher courses and workshops
- 10) bring out an annual research journal of its own, beginning in 1985.

These studies were very helpful to the Assessment Team and gave background information concerning the operations, teaching and research facilities, and equipment/library facilities of the CEM and Department of Geology.

## **2. STATUS**

### **2.1 EXISTING PROGRAM - CENTRE OF EXCELLENCE IN MINERALOGY (CEM)**

#### **2.1.1 Governance, Structure and Goals**

The CEM is one of seven Centres of Excellence in Pakistan which were established in 1973 as a result of the New Education Policy (1972-80). The Centre originated from a special Act of Parliament (1974; revised 1976) and is under the management, overall control and supervision of its own Board of Governors. Presently, Dr. Shaukat H. Baloch, Vice Chancellor of the University of Balochistan, serves as Chairman of the Board of Governors. Other members are the Dean of the Faculty of Science, and representatives from the Ministry of Education, UGC, Pakistan Science Foundation, Geological Survey of Pakistan, Pakistan Atomic Energy Minerals Centre, CEM, and Institute of Geology/University of the Punjab.

Although the CEM is independent of the university, it is overseen by a board headed by the University's Vice-Chancellor. The latter is thus positioned to aid and

supervise the management--i.e., the directorship--of the Centre, upon recommendation to the board and University Grants Commission. The CEM is under the financial control of the UGC and the Ministry of Education (Islamabad). The CEM is affiliated with and housed in the geology building of the University of Balochistan.

The enabling parliamentary Act was "to provide for the establishment of centers of excellence in the universities for conducting high-level teaching and research." It sets forth the general "Functions of Centre" (para. 4) which included, "a) engage in goal-oriented high-level teaching and research, et seq." and which are later re-stated as objectives for the Centre of Excellence in Mineralogy as:

- 1) to engage in goal-oriented research and higher studies in the mineral sciences.
- 2) to train research workers and mineral science specialists.
- 3) to establish M.Phil. and Ph.D. programs in mineral sciences in accordance with the standards and requirements of the University of Balochistan, Quetta.
- 4) to promote cooperation in interdisciplinary relationships with other teaching and research establishments.
- 5) to arrange conferences, seminars, refresher courses and workshops for the development of teaching and research.
- 6) to conduct teaching and research in such particular disciplines as are assigned to it by the Federal government in consultation with the University of Balochistan.
- 7) to contribute to the understanding of the mineralogy and geology of Pakistan, appropriate to the needs of the country, and to project it through scientific publications.
- 8) to develop facilities to offer consulting services to mineral science organizations and private enterprises of Pakistan.
- 9) to establish and promote mineralogical studies in collaboration with the other earth science organizations within and outside Pakistan.

"Mineralogy" in the Centre name is interpreted here in a broad sense and covers all aspects of mineral science such as chemical/physical/descriptive mineralogy, crystallography, petrology, geochemistry, ore microscopy, economic geology,

gemology, isotope geochemistry, and mineral prospecting/exploration/development and exploitation.

Table 2 reviews the administrative officers of the CEM as well as of the Department of Geology. From 1974-78, the CEM developed under the leadership of a director. From 1978-84, the chairman of the Department of Geology acted as part-time director of the CEM. During this time, both units shared the building, laboratories, equipment, and library. In August 1984, a full-time director was appointed who desired to run the CEM separately of and independent from the department. As the CEM evolved as a separate unit, a rift developed which has now advanced to such an extent that there is a complete demarcation of its resources—portion of building, labs, equipment, furniture and transport, library—from those of the Department of Geology. The rift—separation of faculty and other personnel, of equipment, and of activities—has greatly diminished the research and teaching productivity of both the CEM and Department of Geology. The administrative and academic responsibilities for the CEM reside with the director (or at present, largely with the acting director).

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**Table 2. Administrative Officers of the CEM and Department of Geology**

| <u>Time</u>          | <u>Director, CEM</u>                                  | <u>Chairman, Department of Geology</u> |
|----------------------|---|--|
| 1971 - 74            | -   | Dr. Hiaz Ahmad                         |
| 1974 - 78            | Dr. Iqbal Mohsin                                      | Dr. S.M.H. Rizvi                       |
| 1978 - 84            | Dr. N.A. Durrani                                      | Dr. N.A. Durrani                       |
| 1984 - 85            | Dr. Zulfiqar Ahmed                                    | Dr. N.A. Durrani                       |
| 1985 - 86            | "   | Mr. Shamin Ahmad (Acting)              |
| 1986 - 87            | "   | Dr. Iqbal Mohsin                       |
| 1987 - 89            | "   | Dr. Mohammad Niamatullah               |
| 1989 (3 months)      | "   | Dr. Abdul Haque                        |
| Nov. 1989 to present | Dr. Abdul Haque (Acting)<br>(Zulfiqar Ahmed on leave) | Dr. Akhtar Mohammad Kassi              |

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### 2.1.2 Faculty/Staff Expertise and Background

Presently, the CEM consists of six faculty members (Table 3).

The administrative and technical staff consists of an administrative officer, accounts officer, equipment technician, photographer, draftsman, assistant, storekeeper, two clerks, two lab assistants, driver, junior mechanic, loader, two peons and a sweeper/cleaner.

**Table 3. Faculty Background and Expertise, in Centre of Excellence in Mineralogy  
University of Balochistan**

| <u>Name</u>       | <u>Rank(Gov't grade)</u> | <u>Age</u> | <u>Degree</u> | <u>Institution</u> | <u>Area of Specialization</u>          | <u>Courses Taught</u>  | <u>Graduate Supervision</u>                              |
|-------------------|--------------------------|------------|---------------|--------------------|--|--|--|
| Zulfiqar Ahmed *  | Prof./Director (20)      | 45         | Ph.D.         | London, U.K.       | Mineralogy<br>Petrology<br>Econ. Geol. | Igneous petrology<br>Metamorphic petrol.<br>Thermodynamics   | M.Phil.<br>(9 graduated)                                 |
| Abdul Haque       | Assoc. Prof. (19)        | 40         | Ph.D.         | Caen, France       | Structural<br>Geol.                    | Crystallography<br>Mineralogy<br>Thermodynamics<br>Structure | Ph.D. (3 new<br>students)<br>M.Phil. (8 new<br>students) |
| Jawed Ahmed       | Assist. Prof. (18)       | 37         | M.Phil.       | Balochistan        | Mineralogy<br>Petrology                | Geochemistry   |  |
| Mehrab Khan       | Lecturer (17)            | 35         | M.Phil.       | Balochistan        | Mineralogy<br>Petrology                | Petrology<br>Ore Geology                                     |  |
| Khalid Mehmood ** | Lecturer (17)            |            | M.Phil.       | Balochistan        | Petrology                              | Petrology  |  |
| M.A. Farooqui *** | Lecturer (17)            |            | M.Sc.         | Balochistan        | Petroleum<br>Geol.                     | Petroleum Geol.<br>Hydrology                                 |  |

\* Joined Centre in 1984; currently in U.S. on USAID DSPD postdoctorate scholarship (2 years)

\*\* Currently in France working on Ph.D.

\*\*\* Currently in U.S. working on Ph.D.

Note: All faculty belong to the Pakistan Geological Society and the Balochistan Geological Society.  
All faculty are male.

### 2.1.3 Academic Program/Enrollments/Graduation Rate

The CEM provides M.Phil. and Ph.D. programs under the auspices and in accordance with the standards and requirements of the University of Balochistan. The M.Phil. program consists of either entirely research or a combination of coursework and research. Only teachers (lecturers) of the University of Balochistan having a minimum of two years of university teaching experience are allowed a M.Phil. degree through research only. All other M.Phil. candidates must satisfactorily complete advanced courses from the list in Table 4, along with a written "dissertation" approximately equivalent to a U.S. Master's thesis. It should be noted that evidence indicates that these courses lack substance and definitely need to be strengthened.

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**Table 4. CEM Curriculum for M.Phil. Program**

|         |     |                       |
|---------|-----|-----------------------|
| Geology | 701 | Crystallography       |
|         | 702 | Mineralogy            |
|         | 703 | Thermodynamics        |
|         | 704 | Geochemistry          |
|         | 705 | Instrumental Methods  |
|         | 706 | Ore Geology           |
|         | 707 | Igneous Petrology     |
|         | 708 | Metamorphic Petrology |
|         | 709 | Sedimentary Petrology |
|         | 710 | Geology Seminar       |

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The M.Phil. dissertations have been in the following branches of geology: igneous petrology, metamorphic petrology, and clay mineralogy. This is a very narrow range of interests. M.Phil. research in mineralogy, crystallography, ore mineralogy, sedimentary petrology, geochemistry, economic geology, mineral deposits, petroleum geology, and geophysics has not been undertaken here nor initiated, in spite of advertisement to the contrary.

The duration for an M.Phil. degree is normally two years. However, successful completion of all course work and defense of the dissertation must be approved within three years from the date of registration. Table 5 shows the M.Phil. enrollments (all

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**Table 5. M.Phil. Enrollments and Graduation**

| <u>Years</u> | <u>Enrollments</u> |      | <u>Graduation</u> |   |
|--------------|--------------------|------|-------------------|---|
| 1974-83      | None               |      |                   |   |
| 1983-85      | 3 students:        | 1985 | 3 students:       | Wazir Khan<br>Abdul Salam<br>Mohd Munir   |
| 1985-87      | 10 students        | 1987 | 6 students:       | Hassan Khan Kharotai<br>Abdul Tawab (Khan)<br>Jawed Ahmed<br>Murtaza Bostani<br>Khalid Mehmood<br>Mehrab Khan |
| 1987-89      | 2 students         | 1989 | None              |   |
| 1988-90      | 5 students         | 1990 | None              |   |
| 1990-92      | 10 students        |      |                   |   |

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males) since the inception of the CEM in 1974 and shows that only 9 M.Phil. students have graduated in the intervening 16 years.

The CEM also has authorization to award Ph.D. 's. For the first time, this year (1990) three students have enrolled for the Ph.D. program. Two are from the CEM, and one from the Department of Geology.

#### **2.1.4 Research**

Presently only Dr. Zulfiqar Ahmed, Director of the CEM (on leave), is pursuing an active research program in the Centre. He is presently doing microprobe chemical analyses and radiometric age dating of samples at the California Institute of Technology. These samples are ophiolitic rocks obtained in southern Balochistan while he was working on a Pakistan Science Foundation project entitled "Ophiolites of Pakistan". The project had a budget of 3.75 Lakh rupees ( $\approx$  \$18,000) and ran from 1984-1987. There have been no publications yet from this work.

Dr. Zulfiqar Ahmed and Dr. Abdul Haque have both published a number of articles on their thesis areas; however, this work was not done in Balochistan and also was done several years ago. Dr. Ahmed's publications deal with the Sakhahot-Qila

complex in the Malakand agency, northern Pakistan, and those of Abdul Haque deal with his thesis project area in France.

Two Fulbright professors, Dr. George McCormick (1983-84, 1988) and Dr. Duane Moore (1984-85), have, together with their students at the CEM, published on their field research in Balochistan. Dr. McCormick and his student Wazir Khan published in *Acta Pakistanica Mineralogica* in 1985, at the Tethys Conference in Istanbul in 1986, and at the Oman Ophiolite Conference in 1990. Dr. Moore and his student Jawed Ahmed together with Zulfiqar Ahmed published on clays in *Acta Mineralogica Pakistanica* in 1985, and he and Jawed published on the Ghazij Shale at a Clay conference in Paris, France in 1989.

None of the analytical work, except microscopic analyses and a few X-ray patterns by Dr. Moore for the research described above, have been performed on any analytical equipment in the CEM.

The junior faculty members of the CEM do not seem interested in performing research, have not completed quality modern research programs themselves, and are not knowledgeable enough to supervise research programs by M.Phil. or Ph.D. students.

#### **2.1.5 Facilities and Equipment**

The CEM is housed on the second floor of a block of science buildings whose first floor is occupied by the Department of Geology and the English Language Training Centre. The CEM has in excess of 16,000 square feet of space, including 2 lecture rooms, a teachers' conference room, 12 offices, 6 laboratories, a storeroom, and a library. The laboratories comprise an X-ray diffraction lab, a differential thermal analysis (DTA) lab, a photographic dark room, a geochemical analyses laboratory, a petrographic microscopy laboratory, and a laboratory for preparation of petrographic polished and thin sections of rocks. A listing of these existing facilities and equipment, as of August 1990, is included as Appendix C.

#### **LIBRARY**

The CEM library occupies a large room with many *locked* journal cabinets and a smaller adjoining storeroom where newspapers and reprints of *Acta Mineralogica Pakistanica* (Vols. I-IV, published by the CEM in English) are stored. This library is under the supervision of a full-time librarian, Abdul Ghafoor, but is not catalogued

using the Library of Congress or other system. The library contains a good collection of geologic maps and topographic sheets at the Geological Survey of Pakistan (GSP). A detailed inventory of the library revealed journal issues randomly scattered through the years. **Only two journals--*American Mineralogist* (1964-90) and *National Geographic* (1983-90) have had a continuous subscription for any length of time and up to the present. Many journals were initially subscribed to but were abruptly dropped in 1984-85 for no apparent reason. These journals include, for example, *Soil Science Society of America* (1976-84), *Geophysics* (Soc. of Exploration Geophysicists, U.S.; 1983-85), *Natural Resources Forum* (U.N.; 1983-84), *Science* (Amer. Assoc. for the Advancement of Science; 1984-85).**

Furthermore, one of the leading geology journals which publishes articles from all the disciplines of geology--*Geological Society of America Bulletin*--has a major hiatus (1980-85) in its subscription. Other journals have only recently been purchased, such as *Science Technology and Development* (Pakistan, 1984-89), *Economic Geology* (1988-90), and *American Journal of Science* (1989-90). It is readily apparent that there has been no planning for the need and purchase of journals related to research at the CEM.

In order to stay abreast of new scientific activities and developments, researchers must read the current journals in their field. This cannot be done at the CEM. It should be noted that the CEM budget has money allocated for the library to purchase subscriptions to journals and back issues of needed journals. This money has not been used.

Another serious problem is that faculty and students in the Department of Geology are often denied access to this library unless they are affiliated with the CEM. This library is also usually locked and unavailable for use after 2 p.m. daily.

#### OTHER EQUIPMENT

The CEM owns two jeeps--a 1979 Toyota gasoline-powered jeep and a 1984 Toyota diesel jeep. These were to be maintained for field geologic work to gain research data. At present, the 1979 jeep is nearly inoperable and sits in storage. The 1984 jeep runs but needs repair (gear box needs repair, steering loose, shock absorbers need replacing, bushings on springs need replacement, etc.) as well as

routine maintenance (oil change, lubrication, etc.) **This vehicle is not usable in the field but is used around town.**

The CEM also owns 20 rock hammers, 4 Brunton compasses, 10 hand lenses and 6 magnets for general and classroom use.

Geological research often requires extensive field work to be followed by laboratory analyses. In addition to modern field and lab analytical instrumentation, which is often obtained through research grants or other submissions for funds, three additional fundamental components will often determine the success of any research group's work. These are,

- reliable utilities
- trained and experienced instrument operators (technicians and faculty)
- maintenance and repair personnel and facilities.

*1) Utilities.* Reliable utilities cannot be taken for granted in Pakistan. Uniform and continuous electrical power supply is a particular problem. Most modern analytical instruments are equipped with electrical isolation devices in order to minimize the effects of line voltage fluctuations and to eliminate potentially damaging line transients. Most of these devices are designed to accommodate variations of only a few volts, and large fluctuations in line voltage commonly exceed all reasonable values here and can damage equipment. Line voltage spikes and transients (sudden short-duration extremes in voltage) may destroy fragile electronic components which are included in virtually all modern instruments. Computer equipment is especially sensitive to such variations and transients because of the high concentration of electronic components. Thus, large amounts of irreplaceable data, experiment continuity, and repair time could be lost if the line voltage supply is unreliable.

In Pakistan, the problem of electrical power interruption and voltage variation is handled (when possible, and affordable) by connecting each appliance/instrument to a voltage regulator, and sometimes installing a backup power generator (e.g. diesel-powered) for major facilities. Such remedies are inconvenient and expensive, but are necessary for voltage-sensitive equipment or when one is contemplating long-term operation (e.g. several hours continuously).

In addition to a reliable electrical supply, reliable supplies of water, compressed air, vacuum and air conditioning are required for the operation and maintenance of a modern analytical research facility. Large heat-producing instruments using external

cooling systems often rely on a steady supply of water at some minimum pressure or flow rate for continuous operation. At present, neither the CEM nor the Department of Geology has a stable, reliable electrical power supply, a compressed air system or facility-wide vacuum system, and has no air conditioned rooms.

2) *Trained and Experienced Instrument Operators.* There are presently no technicians or faculty members familiar with the operation or analytical technique associated with the chemical, X-ray, or geochemical equipment in the Centre of Excellence in Mineralogy.

3) *Personnel and Facilities for Maintenance and Repair.* Most modern analytical instrumentation is too sophisticated and complex to be repaired without extensive training. Likewise, the complexities of high-voltage supplies, vacuum systems, and electronics mandate that the equipment used for diagnostics and repair also be very sophisticated and expensive. Two options exist for maintaining an instrument: either the user calls a manufacturer's representative to the site at great cost of time and money each time the instrument needs repair, or the host institution must maintain trained personnel, repair equipment, and spare parts on the site. Without the ability to quickly repair instruments, the analytical capabilities of the institution and the researchers' effectiveness are greatly reduced. At present, the CEM can accomplish only the simplest repairs, and manufacturer's repair personnel may have to come from as far away as Germany, Sweden, Japan, or Singapore.

#### 2.1.6 Linkages

There is no evidence of active or ongoing research linkages with private-or public-sector Pakistani institutions either at the present time or in the past. Even though the Geological Survey of Pakistan is next door to the CEM, there has been little Cooperation and, in the past, considerable friction. Several of the survey employees have taken courses in the CEM, and one (Wazir Khan) completed his M.Phil. degree in the center. Even though the CEM was established to help develop the mineral industry of Balochistan, it has had no linkages with the mining industry of the province.

### **2.1.7 Professional Environment**

Any sort of professional environment in the CEM seems to be totally lacking. All decisions of both academic and administrative nature are made by the director or acting director without consulting the other faculty members. There is no effort on the part of the director or acting director to encourage and insist that junior faculty members pursue research and keep up on their areas of expertise. There also are no rewards for those who might excel, nor are there disincentives for doing nothing. Students are not properly supervised by the faculty. It appears that student field work is rarely checked by a supervising faculty member. The students are not sure of what they are doing and are unable to receive help from the faculty.

There is ample support staff; however, they are either poorly trained or not trained at all. As a result, equipment is not operational or not used. There is a serious need for several well-trained and informed laboratory technicians.

There has been no long range planning in the CEM. Current courses and programs do not address the needs of the province and the county. The result is that graduates are not marketable, and the majority of students enter the program only after they are unable to enter medical, engineering or law faculties. The resulting quality, interest, and ability of entering students is low.

Faculty members are not encouraged to attend professional meetings or to present papers at these meetings. Junior faculty members are unable to make use of the CEM vehicles for field work, which is a considerable hindrance to completion of field studies.

### **2.1.8 Costs and Financing**

Faculty pay scales at various professional grades are shown in Table 6.

### **AGGREGATE BUDGET DATA**

The review team was unable to obtain financial data from the Centre. The acting director claimed that he did not know the numbers and only Dr. Zulfiqar Ahmed, who is on leave, knows the numbers. We were able to learn that the CEM does have a considerable financial reserve banked. They also have at least two unfilled, authorized faculty positions for which they have funds. It appears that the CEM has funds available for instrument maintenance, laboratory

supplies, field vehicle expense, faculty positions, and library acquisitions that are not being expended.

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**Table 6. Teacher Salary by Qualifications**

| <u>Title</u>        | <u>Degree</u>           | <u>Pay Grade</u> | <u>Total Salary Per Month<br/>Starting at Grade</u> |
|---------------------|-------------------------|------------------|---|
| Lecturer B.Sc.      |                         | 17               | Rs. 3,200   |
| Assistant Professor | B.Sc. +<br>4 yr. exp.   | 18               | Rs. 4,000   |
| Associate Professor | M.Sc. +                 | 19               | Rs. 5,000   |
| Professor           | M.Sc. +<br>15 yrs. exp. | 20               | Rs. 9,000   |
|                     | Ph.D. +<br>12 yr. exp.  | 20               | Rs. 10,500  |

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## **2.2 EXISTING PROGRAM - DEPARTMENT OF GEOLOGY**

### **2.2.1 Governance, Structure and Goals**

The Department of Geology at the University of Balochistan is one of the original departments established in March 1971, along with the Departments of Chemistry and Physics. This Department is one of nine teaching departments in the Faculty of Science, and reports to the Dean of the Faculty of Science. The Department of Geology is administered by a chairman. Since November 1989 Dr. Akhtar Mohammad Kassi has been chairman. (See Table 2 for list.)

The department, CEM, and the English Language Centre are located in the same building; the Geology Department and language centre are on the ground floor.

Long-range planning in the Department of Geology was non-existent for many years due to frequent changes in the chairmanship (see Table 2 for list of chairmen and their duration in office). Furthermore, complications resulted because some of these chairmen were not from Balochistan and did not develop a permanent "base" in Quetta. **Another factor mitigating against long-range planning has been the rift between the CEM and the department, with the department lacking the financial support for field vehicles, computers, laboratory equipment, and research and teaching samples.** Thus, until Dr. Akhtar Mohammad Kassi become department chairman in November 1989, there was a reluctance to engage in long-range planning and development.

When the Assessment Team arrived in Quetta, we received from the chairman, on behalf of his faculty, a document stating some long-range plans for the department. This was supplemented by the department's further outlining its plans for research, according to sub-disciplines involved.

### **2.2.2 Faculty/Staff Expertise and Background**

Presently, the Department consists of two associate professors, three assistant Professors (all on leave), nine lecturers (two of whom are on leave), one assistant research officer, and one teaching assistant. A detailed list of faculty background and expertise is given in Table 7.

It should be noted that most of the teaching staff is young and inadequately trained, having only M.Sc. (i.e., undergraduate) degrees. Until those on leave return

**Table 7. Faculty Background and Expertise in Department of Geology  
University of Balochistan**

| <u>Name</u>  | <u>Rank (Gov't Grade)</u>      | <u>Age</u> | <u>Highest Degree</u> | <u>Institution</u>       | <u>Area of Specialization</u>     | <u>Graduate Courses Taught</u>                                       | <u>Supervision</u> |
|--|--------------------------------|------------|-----------------------|--------------------------|-----------------------------------|--|--------------------|
| Akhtar Mohammad Kassi*   | Assoc. Prof./<br>Chairman (19) | 35         | Ph.D.                 | St. Andrews,<br>Scotland | Sedimentology                     | Sedimentology<br>Geomorphology;<br>Field Geology<br>Structural Geol. | **                 |
| Mohammad Niamatullah   | Assoc. Prof. (19)              | 35         | Ph.D.                 | Keel, U.K.               | Structural Geol.<br>Tectonics     | Structural Geol.<br>Mineralogy<br>Photogeology                       | ***                |
| Ghulam Nabi (currently in United Kingdom working on Ph.D.)                 | Asst. Prof. (18)               |            | M.Sc.                 | Balochistan              | Igneous Petrol.                   | Igneous Petrol.  |                    |
| Abdul Salam (currently in United Kingdom working on Ph.D.)                 | Asst. Prof. (18)               |            | M.Phil.               | Balochistan              | Sedimentology<br>Oceanography     | Sedimentology  |                    |
| Shamim Ahmed Siddiqui (currently at Univ. of S. Carolina working on Ph.D.) | Asst. Prof. (18)               |            | M.Sc.                 | Punjab                   | Petroleum Geol.                   | Economic Geol.   |                    |
| Mohammad Ayub Baloch   | Lecturer (17)                  | 32         | M.Sc.                 | Balochistan              | Geomorphology<br>Petroleum Geol.  | Geomorphology<br>Economic Geol.                                      |                    |
| Bashir Ahmed Durrani (currently at Texas A&M for Ph.D.)                    | Lecturer (17)                  |            | M.S.                  | U. New Mexico            | Geophysics                        |  |                    |
| Khadim Hussain Durrani (currently in France working on Ph.D.)              | Lecturer (17)                  | 28         | M.Sc.                 | Balochistan              | Geophysics<br>Economic Geol.      | Hydrogeology   |                    |
| Mohammad Ibrahim   | Lecturer (17)                  | 26         | M.Sc.                 | Balochistan              | Stratigraphy                      | Stratigraphy   |                    |
| Nasir Karim  | Lecturer (17)                  | 30         | M.Sc.                 | Balochistan              | Hydrogeology<br>Engineering Geol. | Hydrogeology<br>Engineering Geol.                                    |                    |
| Hassan Khan Kharotai   | Lecturer (17)                  | 32         | M.Phil.               | Balochistan              | Igneous Petrol.                   | Petrology<br>Field Geol.   |                    |
| Amjad Rashid Qureshi   | Lecturer (17)                  | 29         | M.Sc.                 | Balochistan              | Sedimentology<br>Geochemistry     | Petroleum Geol.<br>Field Geol.                                       |                    |
| Abdul Tawab Khan   | Lecturer (17)                  | 34         | M.Phil.               | Balochistan              | Igneous Petrol.                   | Petrology<br>Stratigraphy  |                    |
| Mohammad Umar  | Lecturer (17)                  | 25         | M.Sc.                 | Balochistan              | Hydrogeology<br>Engineering Geol. | Hydrogeology<br>Paleontology   |                    |
| Din Mohammad Kakar   | Teaching Asst.                 | 29         | M.Sc.                 | Balochistan              | Mineralogy                        | Mineralogy<br>Paleontology   |                    |
| Mohammad Rahim Jan   | Asst. Research<br>Officer      | 30         | M.Sc.                 | Balochistan              | Museum/library<br>Curator         |  |                    |

\* joined the Department in 1978 and then returned in 1984 after Ph.D. work  
 \*\* fieldwork supervision for 1990 includes 20 students (B.Sc./Honors plus M.Sc./Prev.)  
 \*\*\* fieldwork supervision for 1989 includes 10 students (M.Sc./Final)

Notes: all faculty are male; all belong to the Pakistan Geol. Society and the Baloch. Geol. Society

with more advanced degrees and training, or the on-site lecturers receive more advanced education, this situation will persist.

### 2.2.3 Academic Program/Enrollments/Graduation Rates

The Department of Geology initially offered only an M.Sc. (i.e., undergraduate) academic program. The CEM offered the M.Phil. In 1976, the department expanded and began courses in the preparatory B.Sc. (Honors). The curriculum for B.Sc. (Honors) geology as a major subject is outlined in Table 8, along with the curriculum for M.Sc. after the B.Sc. (Honors).

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**Table 8. Geology Department Curriculum for B.Sc. and for M.Sc.,  
After Geology B.Sc. as a Major**

***B.Sc. (Honors) - Geology as major subject***

|              |             |  |
|--------------|-------------|--|
| First year:  | Course I    | Physical Geology and Structural Geology        |
|              | Course II   | Mineralogy, Crystallography and Mineral Optics |
| Second year: | Course III  | Paleontology and Stratigraphy                  |
|              | Course IV   | Petrology and Economic Geology                 |
| Third year:  | Course V    | Igneous and Metamorphic Petrology              |
|              | Course VI   | Structural Geology and Geophysics              |
|              | Course VII  | Sedimentology and Paleontology                 |
|              | Course VIII | Geomorphology and Field Geology                |
|              | Course IX   | Field Report and Oral Exam                     |

***M.Sc. after B.Sc. (Honors)***

|                                   |   |   |
|-----------------------------------|---|---|
| Fourth year:                      | Course I                                      | Economic Geology and Geochemistry         |
|                                   | Course II                                     | Applied Geology                           |
|                                   | Course III                                    | Geology of Pakistan                       |
|                                   | Course IV                                     | Specialization. Any one of the following: |
|                                   |   | Applied Geochemistry                      |
| Igneous and Metamorphic Petrology |   |   |
| Sedimentary Petrology             |   |   |
|                                   | Structural Geology and Tectonics              |   |
|                                   | Advanced Paleontology                         |   |
|                                   | Petroleum Geology                             |   |
|                                   | Exploration Geophysics                        |   |
|                                   | Advanced Hydrogeology and Engineering Geology |   |
|                                   | Course V                                      | Field Report and Oral Exam                |

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Table 9 illustrates the curriculum for the B.Sc. (Honors) with geology as a minor subject, along with the curriculum for the M.Sc. after B.Sc. (pass).

Subsequent to our visit, Geology Department chairman Kassi was able to compile an extensive amount of requested data on student enrollments (B.Sc., M.Sc.) in the department back to 1972, which are shown in Table 10.

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**Table 9. Geology Department Curriculum for M.Sc., after Geology B.Sc. as a Minor**

***B.Sc. (Honors) - Geology as a minor subject***

|              |            |   |
|--------------|------------|---|
| First year:  | Course I   | Physical Geology and Structural Geology |
| Second year: | Course II  | Paleontology and Stratigraphy           |
|              | Course III | Mineralogy and Petrology                |

***M.Sc. after B.Sc. (pass)***

|              |             |   |
|--------------|-------------|---|
| Third year:  | Course I    | Igneous and Metamorphic Petrology             |
|              | Course II   | Structural Geology and Geophysics             |
|              | Course III  | Sedimentology and Paleontology                |
|              | Course IV   | Geomorphology and Field Geology               |
|              | Course V    | Field Report and Oral Exam                    |
| Fourth year: | Course VI   | Economic Geology and Geochemistry             |
|              | Course VII  | Applied Geology                               |
|              | Course VIII | Geology of Pakistan                           |
|              | Course IV   | Specialization. Any one of the following:     |
|              |             | Applied Geochemistry                          |
|              |             | Igneous and metamorphic Petrology             |
|              |             | Sedimentary Petrology                         |
|              |             | Structural Geology and Tectonics              |
|              |             | Advanced Paleontology                         |
|              |             | Petroleum Geology                             |
|              |             | Exploration Geophysics                        |
|              |             | Advanced Hydrogeology and Engineering Geology |
|              | Course X    | Field Report and Oral Exam                    |

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**Table 10. Student Enrollment in Geology Department**

| Year | <u>B.Sc. (Honors): 1st year</u> |              | <u>M.Sc. (previous)</u> |              | <u>M.Sc. (Final)</u> |              | Age Range<br>at B.Sc./Hon.<br>1st year |
|------|---------------------------------|--------------|-------------------------|--------------|----------------------|--------------|--|
|      | <u>from Balochistan</u>         | <u>Other</u> | <u>Baloch.</u>          | <u>Other</u> | <u>Baloch.</u>       | <u>Other</u> |  |
| 1972 |                                 |              | 6                       | 2            |                      |              |  |
| 1973 |                                 |              | 13                      | 2            |                      |              |  |
| 1974 |                                 |              | 6                       |              |                      |              |  |
| 1975 |                                 |              | 12                      |              |                      |              |  |
| 1976 | 13                              | 2            | 6                       | 2            |                      |              | 17 - 23                                |
| 1977 | 18                              | 2            | 16                      |              |                      |              | 18 - 22                                |
| 1978 | 21                              | 2            | 21                      |              |                      |              | 17 - 21                                |
| 1979 | 13                              | 3            |                         |              | 10                   |              | 18 - 23                                |
| 1980 | 23                              | 1            | 16                      | 7            | 8                    | 2            | 18 - 23                                |
| 1981 | 12                              | 5            | 9                       |              | 13                   | 1            | 20 - 23                                |
| 1982 | 10                              | 2            | 8                       | 1            | 7                    |              | 19 - 23                                |
| 1983 | no admissions                   |              | 9                       | 5            | 7                    | 2            | 18 - 23                                |
| 1984 | 18                              | 1            |                         |              | 14                   | 2            | 19 - 22                                |
| 1985 | 18                              | 3            | 7                       | 1            | 11                   | 1            | 21 - 27                                |
| 1986 | 39                              | 3            | 3                       |              | 6                    |              | 18 - 21                                |
| 1987 | 24                              | 1            | 2                       | 3            | 19                   | 1            | 20 - 26                                |
| 1988 | 18                              | 4            | 3                       | 3            | 15                   | 3            | 17 - 25                                |
| 1989 | 11                              | 6            | 3                       | 1            | 10                   | 4            | 22 - 25                                |
| 1990 | 27                              | 4            | 5                       | 5            | (closed)             |              | 19 - 26                                |

Notes: (1) All are male.

(2) Final Exams for December 1989 have not yet been taken by the students because of the political disruption and strike. They will have to be made up in December 1990 if the University is re-opened after its closing in August 1990, or otherwise still later.

It is reported that about 60 percent of the students enrolled, pass the year-end examinations. Data on examination results (Table 11) were prepared after our visit.

**Table 11. Examination: Students Writing and Passing**

| Year | B.Sc. (Honors), 3rd year |        |               |        | M.Sc. (Final) |        |               |        |
|------|--------------------------|--------|---------------|--------|---------------|--------|---------------|--------|
|      | Annual                   |        | Supplementary |        | Annual        |        | Supplementary |        |
|      | Writing                  | Passed | Writing       | Passed | Writing       | Passed | Writing       | Passed |
| 1974 |                          |        |               |        | 7             | 3      | 4             | 3      |
| 1975 |                          |        |               |        | 5             | 5      |               |        |
| 1976 |                          |        |               |        | 12            | 9      | 2             | 2      |
| 1977 |                          |        |               |        | 10            | 7      | 3             | 2      |
| 1978 |                          |        |               |        | 19            | 5      | 13            |        |
| 1979 |                          |        |               |        | 19            | 5      | 13            | 7      |
| 1980 |                          |        |               |        | 3             | 1      | 1             | 0      |
| 1981 | 9                        | 8      |               |        |               |        |               |        |
| 1982 |                          |        |               |        |               |        |               |        |
| 1983 | 8                        | 5      | 3             | 3      | 14            | 11     | 3             | 3      |
| 1984 | 10                       | 10     |               |        | 16            | 15     | 1             | 1      |
| 1985 |                          |        |               |        | 12            | 10     | 2             | 2      |
| 1986 | 13                       | 12     | 1             | 0      | 6             | 2      | 3             | 3      |
| 1987 | 17                       | 12     | 5             | 4      | 15            | 10     | 3             | 1      |
| 1988 | 27                       | 7      | 9             | 3      | 16            | 14     | 2             | 1      |
| 1989 | (no exams held yet)      |        |               |        |               |        |               |        |
|      |                          |        |               |        | 159           | 111    | 42            | 26     |

Note: Some data for the above table are not available.

The students and graduates mentioned their concern for the lack of employment opportunities for college graduates and trained persons in Pakistan. This is also given by others as one of the causes of the unrest and frustration exhibited by students on Pakistani campuses. The best employment opportunities for geologists seem to be with federal government agencies such as the Geological Survey of Pakistan, Water and Power Development Authority, Balochistan Development Authority, and Oil and Gas Development Corporation. Subsequent to our site visit, the department chairman supplied data relating to employment of geology graduates (Table 12).

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**Table 12. Employment of Students of Geology Department, University of Balochistan**

| <u>Organization</u>   | <u>Number of Students</u> |
|---|---------------------------|
| <b>Geological:</b>  |                           |
| Geological Survey of Pakistan (Ministry of Natural Resources) | 23                        |
| Department of Geology (University of Balochistan)             | 15                        |
| Water and Power Development Authority, Pakistan               | 15                        |
| Balochistan Development Authority                             | 15                        |
| Irrigation and Power Department (Balochistan)                 | 10                        |
| Centre of Excellence in Mineralogy, University of Balochistan | 6                         |
| Oil and Gas Development Corp., Pakistan                       | 7                         |
| Gemstone Corp. of Pakistan                                    | 2                         |
| Department of Mineral Development (Balochistan)               | 7                         |
| Other geological organizations                                | 4                         |
| <b>Non-Geological:</b>  |                           |
| Various other Departments of Federal Government               | 18                        |
| Various other Departments of Balochistan Government           | 7                         |
| Banks   | 8                         |
| Secondary School Teachers, Balochistan Education Department   | 7                         |
| College Teachers  | 4                         |
| <b>Private Business</b>                                       | 10                        |
| <b>Foreign Countries</b>                                      | 7                         |
| <b>Total is given as 157</b>                                  |                           |

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#### **2.2.4 Research**

The subject areas of faculty expertise in research have been described in Table 7. With two exceptions, the faculty are generally inactive in research. Only Dr. Akhtar Mohammad Kassi (chairman) and Dr. Mohammed Niamatalluh have significant publications beyond their theses. Both have demonstrated the desire and capability to publish with only limited research resources available.

With regard to university research policies and procedures, independent research proposals go through the university channels to outside funding agencies. If approved, funds are maintained by the Treasurer's office. The principal investigating officer has total control of spending. Contracts include signatures of the researcher, funding

agency, and the university authorities. The Vice-Chancellor countersigns the agreement.

### 2.2.5 Facilities and Equipment

#### ■ FACILITIES

The facilities of the Department of Geology occupy the entire lower floor of the building, an area in excess of 16,000 square feet, plus a portion of the basement (mineral-rock sectioning/thin-section lab and storeroom) and a second-floor museum. The Department has 10 offices, 2 lecture halls, 1 seminar room, 1 lecture hall/laboratory, 3 laboratories, 1 projection room-classroom/storeroom, 1 library, 1 museum, and 1 storeroom (basement). A listing of these existing facilities (as of August 1990) is included as Appendix D.

#### ■ LIBRARY

The Department of Geology library occupies a large room which presently has only limited supervision. On occasion a librarian/museum curator will sit at a desk in the room. Within the library are three tables with 19 chairs, 20 locked glass-fronted cabinets for books, and a 5-drawer map cabinet containing a few geologic maps and topographic sheets from the GSP. There are good fluorescent lights and windows in the library.

The library contains a limited number of journals--mostly older volumes of journals found in the CEM library. They received on a regular basis some U.S. Geological Survey publications (e.g., Water Supply Papers, Circulars, Professional Papers). **There are no current subscriptions to any journals in the geological sciences, either Pakistani or international.** All M.Sc. theses are found in the library. There is a limited number of textbooks, most of them far out of date. In order to get new books, the Department of Geology must make a request to the main university library. These requests have been unsuccessful recently; **there have been no new books purchased in the past four years.** It should be noted that none of the journals, reports, maps, theses, or books are catalogued. Students and faculty have to waste much time searching for materials, which may not be there anyway.

Other tremendous drawbacks of this library include the following: **The library is often locked between 9 a.m. and 2 p.m., and always locked after the end of**

classes at 2 p.m., due to lack of a full-time librarian. The Department of Geology lacks the library budget available to the CEM library and is severely handicapped in establishing a viable library. Further, the Department of Geology faculty and students are often denied the use of the newer or supplementary resources in the CEM library.

- **MUSEUM**

The museum is located on the second floor in a large room. It is under the supervision of Mohammad Rahim Jan (curator). There are glass display cases and wall displays of maps and diagrams. There is a set of minerals, rocks and fossils purchased from Ward's Company (U.S.). There is a display of wood blocks depicting crystal forms, along with a set of crystallographic models. Scattered through the museum were uncatalogued samples of minerals, rocks and fossils from throughout Pakistan.

- **STOREROOM**

The Department of Geology storeroom is located in the basement of the geology building. It is under the current supervision of Anwar Ali (technician). Its equipment inventory is listed in Appendix E. A very large open area in the hallway outside the storeroom is available for storage.

### **2.2.6 Linkages**

The faculty of Geology at the University of Balochistan has few linkages with universities inside and outside Pakistan or with the Geological Survey of Pakistan located next door. Previous chairmen have made no effort to establish linkages; any such initiatives were left to individual faculty members. However, the new chairman Dr. Akhtar Mohammad Kassi, would very much like to develop linkages not only internally but also with universities in the United Kingdom (where he received his Ph.D.) and in the United States.

- **OTHER UNIVERSITIES**

It should be noted that linkages to other Pakistani Universities are almost non-existent, because the majority of faculty graduated from the University of Balochistan and have no experience of bonds to other faculty. Furthermore, only a few of the faculty have attended workshops and conferences in Pakistan. For instance, only after

our questioning did one member decide to attend "The Second Pakistan Geologic Conference" held at Bara Gali in September 1990, sponsored by the University of Peshawar's Centre of Excellence in Geology.

- **PRIVATE SECTOR**

Linkages with the public and private sectors in Pakistan are extremely limited. The geology faculty indicated little knowledge of the various industries with which they might produce collaborative research. No efforts have been made for faculty to visit Pakistan's various industries, nor were industrial executives or scientists ever invited to visit the Department of Geology. There also are no student internships available for on-the-job industrial training.

- **GEOLOGICAL SURVEY OF PAKISTAN**

The Geological Survey of Pakistan (GSP) has its national headquarters in Quetta, immediately adjacent to the university and the latter's Geology building. It has a sizable staff and useful equipment. Its operation has been assisted by collaboration with the U.S. Geological Survey. While it is a governmental agency with the consequent more formal and bureaucratic operation, it would be well positioned geographically and scientifically to enjoy mutual benefits by association with the university's Department of Geology and CEM. For example, there could be sharing of equipment, costs of projects, seminars by staff, and so on.

Apparently there has been virtually no collaboration between the GSP and the Department of Geology and CEM in recent times, to the detriment of education and useful science. At the current time, it is perceived by the GSP that the Geology Department is unable to make useful contributions to the activities of the GSP.

### **2.2.7 Professional Environment**

The Department chairman and senior faculty are very interested in geology and are actively pursuing research and publishing, even though the department has few pieces of equipment, no field vehicles, and a minimal budget for research. They have set an example for junior faculty members, of which several are also doing small research projects. Five faculty members are presently abroad working on Ph.D. degrees. When these five return, they are expected to contribute to the research atmosphere of the department.

The current chairman needs funds from any source possible in order to send faculty members to conferences in Pakistan and encourage them to present papers. Important academic and administrative decisions are made by the chairman after consulting with concerned and involved faculty members.

**There is a healthy, fraternal atmosphere among all the faculty in the department – they work well together. They attempt to do their best with their meager resources and make use of all facilities available to them, but the department has only a thin section technician and storeroom clerk as scientific support staff. The lack of a field vehicle, minimal laboratory equipment, inadequate support staff, and minimal funds for laboratory supplies for teaching and research seriously hamper the best efforts of the young faculty of the department. It must be even more frustrating to them to know that unused equipment and underused support staff in the CEM upstairs in their building are unavailable to them.**

#### **2.2.8 Costs and Financing**

The teacher salaries and qualifications for hiring and promotion are the same as those for the CEM (see sec. 2.1.8). We were unable to obtain budget figures for the department. We were told that funds made available to the department over and above those for salaries will not cover necessary supplies for the teaching laboratories. The department can only obtain funds for research equipment or vehicles on special request to the vice chancellor; all requests to the present time have been denied. The department is solely supported by the University of Balochistan through its budget process, unlike the CEM which is directly supported by the University Grants Commission.

### **2.3 SYNTHESIS OF ISSUES**

#### **2.3.1 External Efficiency**

The extreme isolation of most faculty in the CEM and Department of Geology from the world-wide scientific community has contributed to the limited research activity of the Geology Department faculty. Most of the senior faculty have received graduate degrees outside Pakistan and have traveled abroad. Most of the junior faculty

are inbred and have never traveled outside of the province of Balochistan. Thus, interactions with other Pakistani or foreign scholars has been limited. The opportunity for interdisciplinary research that often crosses science and technical disciplines (e.g., physics, chemistry, biology, computer science, statistics) or transcends sub-disciplines of geology is available to all faculty, but is seldom utilized. This networking is essential to developing any program of excellence.

Neither unit has made a concerted effort to involve the Geological Survey of Pakistan or other governmental agencies or Pakistani industries in any teaching or research activities. These resources would not only bring practical but also updated information to the classroom and would encourage faculty and students to combine traditional academic studies with Pakistan's technological developments. By knowing industrial demands, faculty can educate students with these skills. Creative problem solving utilizing field and laboratory equipment and instruments must be stressed. These "partnerships" often lead to joint industry/university research projects (often funded by industry), "co-op" programs for students, and increased opportunities for industrial employment for the students.

Both earth science academic units at Balochistan must recognize that the "isolationist" attitude of the faculty has resulted in inadequate preparation of students. The faculty must try to attend as many conferences in Pakistan as possible, as well as international meetings if the opportunities are available. Seminar programs or short courses by scientists passing through the province or by industrial associates should be encouraged. The absence of recent foreign journals in the libraries has also contributed to this isolation. It is imperative that the faculties of both units and the university administration seek ways to eliminate the isolation of the geologists at the University of Balochistan.

### **2.3.2 Internal Efficiency**

Internal efficiency can be measured by how well the educational system in Pakistan, in general, and the University of Balochistan, specifically, has used the available resources to achieve their goals. The impression of the Geology Assessment Team was that the CEM has extensive equipment and financial resources that are not being used or being used improperly, whereas the Department of Geology is using its meager resources effectively to provide the best possible education within their means for their students. The Assessment Team feels strongly that there

*must be a collaborative geology program at the University of Balochistan.* With this goal in mind, there are a number of strengths and opportunities as well as constraints and impediments at this university.

■ **STRENGTHS**

1) *Location.* Geology is, traditionally, a field-based science, and the location of the University of Balochistan is ideal from this point of view. Many areas of geological interest and application are within easy reach of Quetta. Vegetation is sparse, the rocks are generally fresh, and rock exposures are abundant. Balochistan has interesting geology, possibly dating back to Early Proterozoic (over 1 billion years old). There are continental-collision suture zones with ophiolitic (seafloor crust) complexes, and a variety of mineral deposits, some of which have seen exploited commercially for many years (e.g., coal, chromite, onyx, limestone). Therefore, the area provides ample opportunities for:

- imparting adequate geological training to students,
- pursuing a dynamic research program in several branches of geology, and
- appraising the economic potential of its mineral and fuel and groundwater resources.

One research topic of prime importance is hydrogeology. The arid climate of Balochistan and adjoining areas and the rapidly increasing needs for water for human, agricultural and industrial consumption, require detailed investigation and analysis of the water resources of the region. The Department of Geology and CEM are ideally located to get involved seriously in a program of advancement with a focus on hydrogeology.

A major advantage of the Department Geology and CEM at the University of Balochistan is that the headquarters of the Geological Survey of Pakistan (GSP) is located next door to it. The GSP has an excellent library, a large number of earth scientists, and better resources and facilities. The geology faculty can take advantage of this situation by increasing collaboration and professional exchange with the GSP.

2) *Faculty.* The Department of Geology has a total of 16 faculty members, of whom two are Ph.D. and three are M.Phil. Five faculty members are pursuing graduate studies abroad. The Centre of Excellence in Mineralogy (CEM) has six

faculty members (two with Ph.D., two M.Phil. and two abroad for higher studies). The CEM has at least two or three vacant posts waiting to be filled by suitably qualified persons.

The Department of Geology, upon the return of its faculty from abroad (Europe and USA), would have several well qualified persons. Together with the faculty of the CEM, an adequate human resource base of well trained and qualified scientists would be available in a few years. These faculty members would have Ph.D.-level expertise in several disciplines of earth sciences: mineralogy, petrology, sedimentology, structural geology, tectonics, petroleum geology, hydrogeology, and geophysics. With overseas training opportunities more common than in the past, other faculty members may improve their qualifications.

The Department of Geology faculty consists of a well-knit and organized group who display a considerable amount of enthusiasm. They are aware of their limitations and are eager to work and improve. They have a dynamic, efficient and realistic leadership. Better facilities, adequate funds, useful advice of experts, proper planning, and close collaboration with CEM should bring out the best in the geology faculty. Additional support can be had from other departments (e.g., chemistry) for multi-disciplinary research and collaboration. The enthusiasm and total support of the current Vice-Chancellor adds considerably to the overall potential for development. Therefore, there is a good prospect for initiating a potentially successful program of development and excellence sponsored by the USAID/IEP.

3) *Facilities.* Despite some pieces of expensive equipment being either obsolete or out of order, many small and several major instruments are in working condition and can be put to immediate use. Besides the field gear and several small items, there are several microscopes, sieves and shakers, centrifuge, drill machine, electronic balances, magnetic separator, particle size analyzer, research microscopes, high-temperature furnaces, DTA unit, an atomic absorption spectrophotometer, and a variety of geophysical instruments (seismograph, electrical resistivity meter, proton magnetometer), all of which are reportedly in working condition. Indeed, the atomic absorption spectrophotometer and geophysical instruments have hardly ever been used.

A number of other facilities exist: A joint museum; a thin-section-making facility; and cartography, photocopying, photographic labs, and field vehicles belonging to the CEM. The CEM and Department of Geology together have

instruments that can be put to good use. There is a need to improve and upgrade the existing facilities, but a collaborative research program can be initiated without waiting for the establishment of additional laboratories and new equipment.

Both the CEM and Department of Geology have their own libraries. They were formerly together. The two contain a fair collection of books, but the supply of research journals is erratic, inadequate, and currently has essentially ceased. There is no problem of space. If duplication of labs and libraries is avoided with proper planning and cooperation between the CEM and Department of Geology, there is abundant space for immediate expansion, as well as setting up new facilities.

#### ■ CONSTRAINTS AND IMPEDIMENTS

1) *General Atmosphere.* The university, provincial, and national political situation over the past couple of years has conspired to seriously disrupt the educational environment of the University of Balochistan. Students and graduates complained about disruptions in their academic year and graduation progress due to the university being closed and examinations being postponed. Student unrest and factionalism resulted in a strike against writing exams, and the final exams of last year (December 1989) have still not been written. Since then, classes have been cancelled or otherwise held sporadically. With the current closing since August 24, 1990, the educational process has been suspended. The campus remains closed, and if the campus cannot be opened prior to the start of the next school year in March because of national elections and between-year break, then the entire academic year will be effectively lost. Again, the examinations of December 1989 and 1990 will have to be made up in the future.

2) *Institutional.* The University of Balochistan's academic calendar (school year) runs from March through December. This allows the school to diminish operation and heating costs in January and February, the coldest months of the winter. This schedule is different from that of other Pakistani universities or most foreign calendars, which typically extend from late August to early June. This non-correspondence of school schedule can present inconvenience when arranging transfer of students for graduate work, setting up conferences or workshops, etc.

The customary teaching and work day is 9 a.m. to 2 p.m. Many persons leave at 2 p.m. and are unavailable to those who are pursuing research or other

activity for a full workday. A work ethic encouraging independent and productive work (such as research) after 2 p.m. would aid in promoting productivity.

3) *Local Administration.* The Department of Geology and CEM have expanded considerably since their establishment in the early 1970's. Neither of the two, however, has attained a high-level capability in any discipline of geology. Despite adequate resources, the CEM is seriously below its budgeted staffing level for professionals/faculty, it has poorly equipped and maintained laboratories, has no discernible research plan, and has a library which subscribes to only a couple of current journals. The Centre leadership (the director and acting director) lacks ideas, dynamism and drive for institution-building. There is no urge to fill its current vacant posts and no desire to involve the expertise of the Department of Geology in collaborative work. As a consequence, the Centre has an unambitious research program, limited in scope and lacking diversity. The Department of Geology, on the other hand, is suffering from lack of funds and facilities despite the desire of its faculty to improve its teaching and research program. There is an urgent need for a closer collaboration between the Centre and the department. It is only with synergistic cooperation (i.e., with the total being greater than the sum of the separate parts) that geology here will achieve significant accomplishment and productivity.

As a result of Carmichael's post-trip telephone conversation (September 28, 1990) with the CEM director, Dr. Zulfiqar at his current post in California, it was learned that:

- Director Zulfiqar has current plans to return to Quetta from his leave next February or March. There has been uncertainty about this among the staff at the CEM, with an expectation he might be returning in May or so.
- He believed there were at least two or three faculty posts currently vacant (unfilled) at the CEM. During our visit there, no one seemed to know what the staffing level should be or was budgeted to be.
- He holds the view, apparently from discussions held during the formative stages of IEP project planning, that the AID/MUCIA support

is to be directed only to the CEM at the Quetta site. That is, Zulfiqar is adverse to considering a sharing of the potential IEP funding with the Department of Geology.

- This view would, if the well-reported history of the past few years is continued, effectively doom all hope for successful and productive geoscience research and higher education at the University of Balochistan;
- He had considered at one time, because of the persistent student unrest at the university, having the CEM re-located to an off-campus site. While this might make the CEM's setting even more tranquil than is currently is, it would seriously degrade the prospects for graduate instruction or research activity.

4) *Duplication of Facilities.* Several pieces of equipment, some sophisticated and costly, are duplicated in the CEM and Department of Geology. One of the worst examples of duplication of facilities is the existence of two separate libraries, leading to artificial boundaries, division of resources, and inaccessibility of necessary materials. The current condition of both the libraries is unsatisfactory, both materially and managerially--no photocopier, no librarian in the Department of Geology, short operating hours, no proper cataloguing, and few journals.

5) *Field Work Problems.* There is currently inadequate transport to support necessary geologic field work. The only two jeeps are with the CEM, and are not made available to students and faculty of the Department of Geology. Indeed, two jeeps simply cannot cater to the needs of so many students and faculty for graduate training, education, and research expeditions. At least two more vehicles would be desirable.

Permits are needed to visit certain areas and sites in the province and nationally, due to military restrictions. Permission can sometimes be obtained but only after long uncertain delays. Similarly, required data (e.g., topographic maps, gravity map data) is sometimes unavailable, again because of military restrictiveness. The bureaucratic

There are also concerns for personal security in some areas, due to the social conditions of unrest and conflict. This is a real and ongoing problem for domestic geologists doing field work, as well as for visiting foreigners.

6) *Conditions of Laboratories.* The current status of the laboratories is not conducive to performing serious and advanced research. Many do not have properly installed equipment, several have different types of instruments located together that require different and conflicting operating conditions. Supplies of spare parts and consumables are not adequate. The thin section preparation lab, for example, has only one cutting instrument in working condition, with the last and only cutting blade presently in use.

The main electrical power supply is unreliable; there are frequent power losses and voltage surges. This clearly is unacceptable for equipment that needs a constant and uniform supply of voltage and electrical current and is fatal for sensitive equipment that is unprotected from such power variations. It is unacceptable for experiments or procedures that require extended periods (e.g., hours) of operation. In practice, facilities (homes, offices, factories) can try to employ surge protectors and voltage stabilizers and even independent generators (e.g., diesel-powered) to provide necessary protections. The hardware and maintenance for compensating power equipment for the university labs would be expensive, apart from whether it is technically feasible.

7) *Technical Support Staff.* This is one area in which Balochistan is no exception to much of Pakistan. There is an acute shortage of skilled technicians who can look after costly instruments. The CEM and Department of Geology together have only one skilled technician, one thin-section maker, and one carpenter. There is a need for an electronics technician.

In normal circumstances, one would hope that there would be a faculty member capable of running specialized instruments, either through his past experience or through training at the time of installation. This does not seem to be the case in geology at Balochistan. The atomic absorption spectrophotometer and geophysical equipment acquired several years ago have no persons knowledgeable in their maintenance or operation.

8) *Basic Facilities/Utilities.* For the establishment and smooth running of most modern laboratories, one or more of the following facilities/utilities are usually necessary: steady and uninterrupted power supply, continuous flow of water, adequate supply of distilled/deionized water, dust-proofing, proper drainage system, sinks, chemical hoods and fume cupboards, air conditioning, desiccators, adequate furniture, storage facilities, and so on. The laboratories in the CEM and in the Geology Department do not have proper provisions. Likewise there also is no computer to process and analyze data.

9) *Instructional Concerns.* Some problems exist within the academic programs offered by the CEM and Department of Geology. Students in and graduates from the above programs seemed eager to learn but expressed concerns about: (1) the possible need for curriculum revisions and courses strengthened with more updated and rigorous material, (2) the lack of practical lab exercises and "hands-on" use of the instruments and equipment, (3) the lack of updated textbooks and laboratory materials and (4) less instruction by reading of text material to the students.

These academic problems exist because the majority of the faculty are young and inexperienced, and they teach as they were taught at the same university. Owing to their lack of updated knowledge, inbreeding of faculty and limitations on library resources, some lecturers read to the students from outdated textbooks and scientific journals. Most learning comes from tutorial interaction with the professor, which is a major weakness of the system because students expect to be told what to do and, therefore, do not learn the experimental scientific method or creative thinking. Students tend to avoid making mistakes at all costs and tend to only memorize the material. Tools to develop problem solving skills, data analysis and creative thinking such as homework problems, quizzes or assigned readings are used sparingly or not at all. Also, more emphasis must be placed on research for the M.Sc. students. Sufficient resources in the form of field vehicles, equipment and supplies must be available to all faculty and students alike. Faculty should be encouraged to write grant proposals, especially to the Pakistan Science Foundation and University Grants Commission (which has rarely been done) and to seek external private donations to strengthen teaching and research. The faculty must actively pursue all possible sources of support, including requesting more governmental and institutional support for the CEM and Department of Geology, respectively. It should be further noted that, due to

the current rift between the CEM and the Department of Geology, the Department is now considering offering an M.Phil. program.

**As stated above, a major academic problem exists because all the junior faculty in the CEM and Department of Geology have their M.Sc. degrees from the University of Balochistan. This practice of recruiting faculty from one's own students is contrary to current practices found at other Pakistani university geology departments or in the United States. This situation must be altered and will be if the junior faculty -- many of whom desire to -- obtain Ph.D.'s from distinguished universities in Pakistan, Europe, Canada, or the United States.**

### **2.3.3 Management and Administration**

The visit of the MUCIA\USAID Assessment Team energized discussions between the CEM and Department of Geology on academic, research, administrative and institutional issues. In chronological order, the following written accords were developed:

- AUGUST 22, 1990** Dr. Abdul Haque, acting director of CEM, presented the following summation:  
"Pedagogic, Research and Administrative Visit of the Respected Delegation of the USAID and UGC to the Centre of Excellence in Mineralogy, University of Balochistan under the Institutional Excellence Project, during August 22, 1990 to September 7, 1990", 5 p. - summarized previous USAID visits and previously-stated CEM activities.
- AUGUST 27, 1990** Dr. Akhtar M. Kassi, Chairman of the Department of Geology, gave an oral presentation along with a written summary entitled:  
"Presentation to USAID-IEP on Behalf of the Department of Geology," 6 p. - summarized the history, existing staff, instruments and equipment, and curriculum, along with problems with the CEM and long-range plans for the Department of Geology.

**AUGUST 27, 1990** Drs. Haque and Kassi discussed how their two groups could cooperate and work for the benefit of both groups. From this meeting, the following document was prepared and signed by both administrators:

**"Points to be observed during the cooperation between the CEM and Department of Geology, under the Institutional Excellence Project through USAID", 2 p. (Table 13) - initial attempt to bridge the rift between these two groups, and to get the CEM to cooperate with the Department of Geology.**

The above, and its twelve points of agreement, were apparently the first action by the CEM to collaborate with and assist the Department of Geology faculty and students. With this and subsequent exchanges, realization began to set in that the CEM should probably affiliate itself more with the work and activities of the Department of Geology.

**AUGUST 28, 1990** In response to the joint meeting on August 27, the CEM and Department of Geology submitted written statements concerning possible individual unit and joint teaching and research and activities:

**"Future Teaching and Research Plans," From the Department of Geology, 2 p. (Table 14).**

**AUGUST 29, 1990** **"Petrology, Economic Geology and Mineral Exploration of Balochistan and Pakistan", 3 p. (Table 15).**

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**Points to be Observed During the Cooperation Between the Centre of Excellence in Mineralogy and Geology Department, Under the Institutional Excellence Project through USAID. August 27, 1990. (As quoted here.)**

- 1) Free access of the teachers/research workers/supervisors of both sides (Centre and Geology Department) to use their respective libraries and laboratories under the presence of respective librarians and technicians-in-charge.
- 2) Undergraduate students may use the CEM library (books and maps etc.) only within the library. They will not be allowed to withdraw books.
- 3) With written permission of the chairman, the undergraduate students would be allowed to use the laboratory instruments in the presence of respective technicians-in-charge.
- 4) For graduate students, the library materials would be issued in the name of his/her supervisor(s), but only those books having more than two copies will be issued. Otherwise, within 48 hours a photocopy of the book may be provided to the students.
- 5) With written permission of respective supervisor(s), graduate and post-graduate student(s) would be allowed to use the laboratory instruments in the presence of respective technicians. Preference will be given to post-graduate students.
- 6) If any faculty member on either side, Ph.D. doctors and M.Phil. fellows, would like to supervise M.Sc./M.Phil./Ph.D. students belonging either to the Centre of Geology Department, supervision allowance may be allowed according to the CEM and University of Balochistan rules.
- 7) Teachers and professors from both sides are always welcomed to teach classes in their respective subjects, and payment will be made according to CEM and University of Balochistan rules.
- 8) Field vehicle with CEM driver will always be available for the faculty members/research workers/students of the Geology Department for their respective field work, for a maximum period of one month subject to the following conditions:

- a) the jeep should be ready in every respect before handing it over for the field work.
  - b) if the jeep is already engaged in field work of M.Phil./Ph.D. students/ research workers/members of CEM, then the Geology Department is supposed to get a university vehicle for their field trip.
  - c) a written proposal should be submitted two weeks prior to the date of starting their field/research work.
  - d) the repair, maintenance of the jeep during the field period would be paid by the users' department.
  - e) fuel charges should be paid by the users' department.
- 9) Duplication of sophisticated equipment and periodicals will not be allowed. The students for M.Phil. and Ph.D. degrees should be registered only in the CEM, University of Balochistan.
  - 10) The photocopy machine may be used by members of both departments, in the presence of photocopying in-charge and payment made according to AID the existing rules of CEM.
  - 11) Photographs for research purposes or official use shall be made by the photographer of the CEM, on concessional rates.
  - 12) Until the Department of Geology employs a technician of its own, the Technician of the CEM will work to take care of the instruments in the Geology Department in afternoon time, and payment will be paid to the technician according to university rules.

(signatures)

August 27, 1990

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**Table 14. Future Teaching Plans and Research From the Department of Geology,  
August 28, 1990**

We hereby propose the following disciplines in order of priority, to be developed in the future--keeping in mind the necessities of the Balochistan area which is the most under-developed area of Pakistan.

1. Hydrogeology
2. Geochemistry
3. Mineralogy, Petrology, and Mineral Exploration.

Other disciplines which need to be developed later on are sedimentology, structural geology and tectonics, photogeology, geophysics, and petroleum geology.

1. Hydrogeology

There is a great need for proper utilization and management of water resources in Balochistan. Also water quality and other relevant problems need to be tackled in order to take full advantage of available groundwater resources. The Geology Department has two faculty members already taking interest in this topic. One (Mr. Bashir Ahmed Durrani) has already gone for higher training in geophysics, and he may play an important role in this area. We propose that higher training of the faculty members and development of the library and laboratory is required in this topic.

2. Geochemistry

The Geology Department has a geochemistry laboratory. Two faculty members at present have shown willingness and interest in this field. Furthermore, one senior member of the Department (Mr. Shamim Ahmed Siddiqui) is already in the U.S. working on the geochemistry of lead and zinc deposits of the Khuzdar (Pakistan) area. Therefore further training and development of the laboratory and library is required.

3. Mineralogy, Petrology, and Mineral Exploration

The Centre of Excellence has already been working in this area. The laboratory and library of the CEM are appropriate for this purpose. At present, the CEM has at least two experts and two have gone for higher training. Also, the Geology Department has at least two members who have M.Phil. degrees in igneous petrology, and one member (Mr. Ghulam Nabi) who will join within one year.

Dr. Akhtar Muhammad Kassi and Mr. Abdul Salam (at present in the U.K.) will work on sedimentary petrology and sedimentology.

Therefore, we propose that further steps may be taken to develop mineralogy and petrology.

Dr. Akhtar M. Kassi (signed)  
Chairman, Geology Department  
University of Balochistan

August 28, 1990

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**Table 15. Petrology, Economic Geology and Mineral Exploration of Balochistan and Pakistan from the Centre of Excellence in Mineralogy, August 29, 1990**

Amongst developing countries, Pakistan is one having great mineral potential. The geological and geographical resource areas which constitute these mineral deposits are outcropping in its mountainous region defining Balochistan and Northwest Frontier Province as a whole and parts of Sind and the Punjab provinces.

The Centre of Excellence in Mineralogy and the Geology Department which come under the I.E. Project are situated in Balochistan, near all important mineral deposits.

Balochistan's territory has fortunately all mineral deposits showing important outcrops, situated differently such as: 1) lead-zinc and manganese deposits in the Las-Bela area, 2) the geological, petrological and structural importance of ophiolites of Pakistan, 3) barite deposits of Khuzdar, 4) fluorite deposits of Dilband, 5) iron-copper and marble deposits of Chagai area, 6) coal and clay-minerals deposits of Sor-range and Harnai, 7) chromite deposits of Las-Bela and Muslimbagh, 8) magnesite deposits of Muslimbagh, 9) phosphate deposits of Lorelai, 10) sulphur deposits of Koh-i-Sultan, 11) zeolite deposits of Balochistan, and 12) galena deposits of Killa Abdullah etc.

In order to utilize and make profitable these mineral resources for the national economy of Pakistan, as well as for the future scientific development of CEM, a joint research project is essential to be carried out under the auspices of CEM and Geology Department, University of Balochistan.

Moreover, under such joint project it is essential to keep in mind the projects of regular students of M.Phil. degree, registered in CEM, because annual academic progress is one of the important items of development of the CEM.

The above-entitled joint project needs the support of the following geological sub-disciplines:

- 1) **Petrology.** Apart from related geological instruments, the Centre has one Ph.D. and one M.Phil. fellow, while Geology Department has two M.Phil. fellows, one of them being a candidate for Ph.D. program in the Centre.
- 2) **Mineralogy and crystallography.** The Centre has two Ph.D.'s and one M.Phil. fellow who will contribute their knowledge to solve all the related problems.
- 3) **Geochemistry.** The Centre has sophisticated equipment such as Atomic Absorption spectrometer, and only needs an expert to establish the geochemistry section under I.E. project.
- 4) **Geophysics.** The Centre has the same situation as mentioned for geochemistry. However, one of the members of the Geology Department, Mr. Bashir Ahmed Durrani, under CEM scholarship program, would be useful after completion of his studies in the U.S.
- 5) **Tectonics-structure and micro-structures.** The Centre and Geology Department have one Ph.D. each, and their services will be ready for such project.

- 6) Clay mineralogy. The Centre has one M.Phil. fellow who is also a candidate for Ph.D. program in the Centre and can run the corresponding installed instruments in the CEM labs.
- 7) Computer science. The Centre has one Ph.D. and one M.Phil. student who know successively the basic knowledge of computer and can write programs in Fortran and Pascal languages and can utilize facilities of Chi-writer and Word-Star packages. Moreover, the Centre is in a position to buy a PC computer for its requirements and an expert is highly recommended for the Centre through this I.E. Project.

With the help of these different geological disciplines which are besides extremely important for the running of projects (under IEP and the registered students of CEM), the important mineral deposits of Balochistan would be completely investigated for further worthwhile results. Thus, after having discussions with the members of the Geology Department and CEM the following points arose:

1. A joint project may be envisioned under I.E. Project between Geology Department and CEM, University of Balochistan, in HYDROGEOLOGY. In this joint project the Geology Department will play the role of Principal Investigator, while the Centre has the duty to act as a cooperating investigator from both field and instrumental point of view. The Centre will also provide for such joint project their skillful knowledge in every sense to get the worthwhile results from such project. Moreover, the project has been already explained by the Chairman of the Geology Department in our previous meeting and a photocopy is already handed over to the members of I.E.P.
2. A joint project can be carried out under Institutional Excellence Project entitled "PETROLOGY, ECONOMIC GEOLOGY AND MINERAL EXPLORATION OF BALOCHISTAN AND PAKISTAN," for which the Centre of Excellence will play the role of Principal Investigator with the Geology Department as helping investigator. The project would be organized in every respect, in full atmosphere of cooperation between the corresponding investigators.
3. The supporting geological disciplines in addition to those which have already proper teachers/professors both in Geology Department and CEM, which we have discussed, are to be developed academically with their respective laboratories both for Geology Department and Centre of Excellence in Mineralogy, University of Balochistan.

For Geology Department: sedimentology, hydrogeology, stratigraphy, structure and tectonics, paleontology.

For Centre of Excellence in Mineralogy: geochemistry, geophysics, mineralogy and crystallography (just for further development if necessary), computer science.

Dr. Abdul Haque (signed)  
Director, Centre of Excellence in Mineralogy  
University of Balochistan

August 29, 1990

### **3. STRATEGIES FOR CHANGE**

#### **3.1 PROBLEM ANALYSIS**

Excellence in teaching, research and service can only be achieved in an environment in which there is hope that specific goals can be achieved. To reach these goals, it is imperative that the CEM and Department of Geology support each other by using the resources available to each unit. This will allow each to remain a separate viable unit but still cooperative in the use and maintenance of laboratories, library, museum, equipment and field vehicles.

##### **3.1.1 Goals of the Centre of Excellence in Mineralogy**

When the assessment team began collecting data and asking questions about the CEM, it became apparent to the Interim Director, Dr. Abdul Haque, that the CEM needed to establish some specific direction and goals. Accordingly, on August 29, 1990, and in response to the Department of Geology initiative (see Table 14), the CEM proposed two joint research projects with the Department of Geology (See Table 15). First, a joint project on "Hydrogeology" with the department as the principal investigator and the CEM as co-investigator and supplying various field and lab instruments. Second, a joint project on "Petrology, Economic Geology, and Mineral Exploration of Balochistan and Pakistan" with the CEM as Principal Investigator and the department as co-investigator. The CEM envisions that the Department of Geology would have strength in the following branches of geology--hydrogeology, sedimentology, stratigraphy, structural geology and tectonics, and paleontology. The Centre would have strength in geochemistry, mineralogy and crystallography, geophysics and, if necessary, computer science. In this document, the CEM further stressed the importance of Balochistan's mineral deposits such as:

- lead-zinc and manganese deposits in the Las-Bela area
- chromite deposits of Las Bela and Muslimbagh
- magnesite deposits of Muslimbagh
- iron-copper and marble deposits of the Chagai area
- barite deposits of Khuzdar
- fluorite deposits of Dilband
- phosphate deposits of Loralai

sulphur deposits of Koh-i-Sultan  
coal and clay mineral deposits of Sor-Range and Harnai  
galena deposits of Killa Abdullah, etc.  
zeolite deposits  
the geological, petrological and structural importance of ophiolites of  
Pakistan

ation stressed the important role that the two geology groups could play in  
understanding, exploration for, and development of such mineral deposits.

### **Goals of the Department of Geology**

stated earlier, since Dr. Akhtar Mohammad Kassi became chairman, the  
Department of Geology had been developing long-range plans. The department feels  
that it must strengthen its primary functions of teaching B.Sc. students, and  
teaching and doing research with M.Sc. students. This is because it is these students  
who will become potential candidates for graduate-level work in the future. The  
Department also believes that it is imperative that any long-term planning and  
development must take into account the needs of the province of Balochistan and those  
of Pakistan in general. To address these tasks, the department feels that the following  
must be accomplished.

#### **▪ STRENGTHEN THE DEPARTMENT OF GEOLOGY IN THE FOLLOWING DISCIPLINES, IN ORDER OF PRIORITY**

1) *Hydrogeology*. Balochistan is an arid province with shortages of water.  
Availability of sufficient quantity and quality of groundwater and surface water is of  
great importance to Balochistan. Collection of water data by trained hydrogeologists  
will help trained public officials to utilize properly this precious commodity. The  
future of Quetta and surrounding villages will rest in part on water availability. The  
Department presently has two lecturers, with only M.Sc. degrees (i.e., bachelor's level)  
interested in hydrogeology--Nasir Karim and Mohammad Umar. Both expressed  
interest in furthering their education in hydrogeology. Both would benefit from  
M.Phil. (or other Master's degrees). The CEM lacks faculty expertise in this field.  
Therefore, the department needs to hire senior faculty or train these lecturers in

hydrogeology. It needs to acquire instruments and equipment for hydrogeology investigations and obtain library resources for such work.

2) *Geochemistry.* The Department of Geology presently has a room designated as a geochemistry laboratory but it lacks instrumentation and supplies. Strengthening this discipline would greatly enhance hydrogeology and mineralogy/petrology/mineral exploration investigations. Presently, the department has two faculty members -- Shamim Ahmed Siddiqui (asst. prof.) and Din Mohammad Kakar (lecturer) interested in this field. Mr. Siddiqui is working on the geochemistry of lead and zinc deposits of the Khuzdar area for his Ph.D. at the University of South Carolina/U.S.A. The CEM does not have any faculty with expertise in geochemistry. Therefore, technical training in geochemistry, along with the purchase of instruments and supplies for the geochemistry laboratory and journals, books, and reports for the library, are badly needed in the Department of Geology.

3) *Geophysics.* Geophysics is a field that complements hydrogeology, petroleum geology, and mineral exploration with its techniques for investigating the properties and character of the subsurface. The Department of Geology recognizes the importance of this field, but has not stressed it to date because the only geophysical instruments -- a 24-channel seismograph, electrical resistivity meter, and portable magnetometer--are in the CEM and have thus far not been made available to the Department of Geology for use. Note that these instruments have never been used since their acquisition by gift to the CEM in 1984, because the CEM faculty lacks expertise or interest in geophysics. Sharing of these instruments with the Department of Geology would greatly expand faculty and student knowledge in geophysics and also help hydrogeologists and mineral explorationists. Geophysics is a topic which also provides good job opportunities for technical geoscientists, in both the governmental-research and industry sectors. Presently, two Department of Geology faculty members are on leave for higher education and training in geophysics. Bashir Ahmed Durrani (Lecturer) recently completed a M.S. degree in geophysics from the University of New Mexico, U.S.A. and is continuing for a Ph.D. in geophysics at Texas A & M University. Khadim Hussain Durrani (lecturer) is presently in France and hopes to complete a Ph.D. in geophysics/hydrogeology. This discipline of geophysics will

likewise need additional geophysical instruments and supplies, along with library resources.

4) *Mineralogy/Petrology/Mineral Exploration.* Balochistan has an abundance of untapped mineral resources--chromite, magnesite, marble, coal, fluorite, barite, copper, sulfur, asbestos, zeolite, glass sand, and limestone. In order to explore and produce these resources, teaching and research is needed in the fields of mineralogy, igneous and metamorphic and sedimentary petrology, sedimentology, structural geology, and mining geology. Both the CEM (Table 3) and Department of Geology (Table 7) faculty have some expertise in these, and some faculty are presently on leave to develop such expertise. Combining the teaching and research competencies of the CEM and Department of Geology along with sharing of the laboratories, instruments and library would greatly benefit the teaching and research of students and faculty at the University of Balochistan.

5) *Paleontology.* This discipline helps interpret geologic history, paleoenvironments and age of rocks. At present, there are no faculty members in either the CEM or Department of Geology with expertise in paleontology. A faculty member should be acquired or trained in this field. This field requires minimal instrumentation other than a microscope, but would require the acquisition of library resources.

6) *Photogeology/Remote Sensing.* In areas of Balochistan and Pakistan where local conditions and access for field work are unfavorable for geographic or other reasons, utilization of aerial photographs can bring an added dimension to the geologic interpretation of an area. Presently, no CEM or Department of Geology faculty member has this expertise. Such a person would complement the programs in hydrogeology, mineral exploration, and structural geology.

#### ■ ACQUIRE FIELD VEHICLES

The Department of Geology is in desperate need of a four-wheel-drive diesel-powered field vehicle. Without this, it is impossible for the faculty to do field geologic research and to take students on field trips to necessary localities. Presently, the CEM has two jeeps--a 1979 Toyota gas-powered jeep (out of service) and a 1984

Toyota diesel jeep, but these are not made available for use by the Department of Geology.

■ **ACQUIRE COMPUTER(S) AND PRINTER**

Geology, as with many other technical fields, is becoming more computerized. A computer (e.g., an IBM 386) and a printer (e.g., Epsom) can also be used for word processing (e.g., program WORD PERFECT) and for spreadsheet and numerical work (e.g., Lotus, 1,2,3). A computer is an excellent tool for storing, analyzing, and manipulating data and would be used for research and teaching in most sub-disciplines of geology.

■ **ACQUIRE ACCESS TO ALL INSTRUMENTS AND EQUIPMENT IN THE CEM AND DEPARTMENT OF GEOLOGY**

Students and faculty need to have regulated and supervised access to all the field and laboratory instruments and equipment in order to establish excellence in geology teaching and research.

■ **ACQUIRE A SKILLED AND WELL-TRAINED TECHNICIAN**

With all the sophisticated field and laboratory instruments needed to obtain good scientific data, a skilled and well-trained technician is essential. At present, there is a full-time technician (Khushnood Ahmed Siddiqui) in the CEM. However, he lacks the knowledge, skills, or enthusiasm to maintain or repair the CEM's instruments. A well-trained technician could help both the CEM and the Department of Geology.

■ **COMBINE THE CEM AND DEPARTMENT OF GEOLOGY LIBRARIES**

The libraries of these two units must be combined as was the case several years ago. This would allow the present CEM librarian to supervise the entire library operation and catalog the holdings. Presently, none of the books, journals, reports, maps or M.Sc. theses in the Department of Geology library are catalogued. A combined library would eliminate duplication of materials (maps, books, journal subscriptions, reports, magazines) and would allow for the filling in of missing portions in either library. This combined library needs to reinstate some of the recently discontinued journal subscriptions. It should have available all publications (reports, maps) of the Geological Survey of Pakistan. Presently, only a few scattered GSP

publications are available, yet the agency is located less than 100 meters away.

Likewise, the library should have the geologic publications from such sister universities as those in Lahore, Karachi, Sind, Peshawar and Quaid-i-Azam/Islamabad.

This combined library must remain open later in the day, rather than locked and unavailable for use after 2 p.m., when classes end. All CEM and Department of Geology students and faculty must have access to the necessary literature and research materials.

Utilizing the resources and budget available to the CEM, a unified geology library would clearly benefit the pursuit of education and scientific research at the University of Balochistan.

#### ■ ACQUIRE ADVANCED TRAINING SCHOLARSHIPS

The Department of Geology would like to provide scholarships to their faculty for advanced training if it had the financial resources. In the past, when the CEM scholarships were not filled by their own faculty, these scholarships were allowed to lapse. Often scholarships were offered to Department of Geology faculty by the CEM director (Dr. Zulfiqar Ahmed) on the condition that the recipient then resign from the department and join the CEM before being nominated for (and granted) a scholarship. The faculty would lose their seniority and other departmental benefits. The department requests that geology faculty, who are eligible and willing to participate, should be nominated without discrimination or unfair condition.

#### ■ ACQUIRE PHOTOCOPY MACHINE, MINERAL/ROCK/FOSSIL SPECIMEN SETS, AUDIOVISUAL EQUIPMENT, AERIAL PHOTOGRAPHS, PHOTOGRAPHIC EQUIPMENT, AND CARTOGRAPHY EQUIPMENT

This equipment and teaching/research materials are needed and should be acquired as the geology sub-disciplines, listed in (1) above, are developed.

#### ■ DEVELOP GEOLOGY MUSEUM

This museum needs to be developed to illustrate the minerals, rocks and fossils of Balochistan, in particular, and of Pakistan in general. The teaching sets of minerals, rocks and fossils along with the wooden blocks depicting crystal forms and crystallographic models must be returned to the mineralogy/petrology laboratory and another set purchased. This museum could also display rock samples used in various

thesis and dissertation research projects, along with visual illustrations showing the geology of Balochistan, Pakistan, and the world.

Subsequent to our visit, the Geology chairman transmitted (eventually FAXE to the team leader on October 3rd) a prioritized list of desirable equipment and a detailed proposal for Ph.D. graduate training of geology faculty (Table 16 and 17).

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**Table 16** List of Equipment and Other Items Most Required, in C. der of Priority  
(from Department of Geology, Post-visit)

**Item (and number)**

Toyota land Cruiser, 4-wheel drive Jeep, 2  
Computer with printer, 1  
Complete drafting equipment with drafting tables; 1  
Polarizing Microscope/research type, with built-in camera for photomicrographs, 2  
Point counter and mechanical stage, 2  
Rock-cutting machine, 1  
Rock-polishing machine, 1  
Rock-grinding machine, 1  
Overhead projector, 2  
Aerial photographs, one complete set for Pakistan/Balochistan, 1  
Slide projector, 1  
Landsat imagery, one complete set, 1  
Mechanical shaker for size analysis, 1  
Magnetic mineral separator, 1  
Complete photographic lab for developing/printing/enlarging/slides, 1  
Cameras for field work and laboratory, 4  
Refrigerator for chemicals, 1  
Water-testing equipment set, 1  
Furnace, 1200° C - 1500° C, 2  
Chemicals  
Fume hoods, 4

**Plus other major equipment (in priority order)**

Electron probe microanalyser  
X-ray fluorescence  
Scanning Electron Microscope  
X-ray Diffraction  
Dust-proofing arrangement  
Air conditioning for labs  
Electrical generator  
Spectrophotometer (ultraviolet)  
Spectrophotometer (visible)  
Flame photometer

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**Table 17 Future Plan for Training of Faculty (from Department of Geology, post-visit)**

It is proposed that two teachers from the Geology Department be sent for long-term higher training each year starting from 1991. The teaching staff will be replaced by advertising and selecting new teachers for the vacancies as soon as the training program is initiated. Thus the Department will not suffer while teachers are absent pursuing training. The scholarships will be awarded purely on merit basis, subject to the satisfactory performance of the nominees in their TOEFL and GRE or whatever tests may be necessary for the scholarship or admission to the universities. The following schedule is proposed for long-term higher training:

**PH.D. TRAINING**

**1991 First Scholarship**

principal candidate: Hassan Khan Kharoti  
alternate candidate: Nasir Karim

**second scholarship**

principal candidate: Abdul Tawab  
alternate candidate: Amjad Rashid Qureshi

**1992 First Scholarship**

principal candidate: one of the above  
alternate candidate: Mohammad Ibrahim

**second scholarship**

principal candidate: one of the above  
alternate candidate: Din Mohammad Kakar

Schedule for 1993 onwards will be made later.

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**3.2 PROGRAM NEEDS**

The location of the university, the prospect of having a well-qualified faculty in the coming few years, and the enthusiasm and desire of the faculty to improve the general conditions outweigh the impediments and hurdles referred to above. The Assessment Team feels that the Department of Geology and CEM can be supported under the IEP project because several hurdles can easily be removed and others would require only a little extra effort, provided the university's administration and its geology faculty continue to harbor the enthusiasm and willingness displayed during our

stay at Quetta. Our assessment of the feasibility of the project is now presented under Technical, Institutional and Administrative headings.

### **3.2.1 Technical**

1) The condition of the laboratories can be substantially improved with infusion of modest funds and proper planning for the lack of basic facilities and utilities. **However, an uninterrupted and steady (non-surgng) supply of electricity, however, is a fundamental problem.** The best solution to the problem is a standby diesel-powered generator and uninterrupted-power-supply unit. **The additional cost of providing a stable power supply needs to be considered before making a final decision on the type of instruments to be added to the Department of Geology and the CEM.**

2) One of the primary requirements for geological work is the collection of field data. This requires access to geologically significant field areas, access to maps, satellite images, areal photographs of the field areas, and vehicles to gain access to the field areas.

Presently there are restrictions on movement of foreigners and Pakistanis alike in Balochistan. Citing military security concerns, the government presently restricts distribution of many maps and photographs. Access to the field areas, to maps and photographs and to the use of vehicles must be assured for success of the IEP. At present, the two field vehicles in the CEM are not being used effectively. An efficient system for the field use of the jeep needs to be established. Drivers must accompany the jeep at all times. A logbook needs to be kept which shows date of use, purpose of use, mileage out and in, and any maintenance or repairs. These vehicles should be used only for field research work or field trips of a professional nature.

3) Geology will have several highly qualified faculty members (potentially 10 Ph.D.'s within four years). Their diversified interests will be an asset for the IEP. Additional faculty members can be sent to the U.S. for higher studies in those fields where additional strength is required.

4) The lack of technicians and instrument operators can be overcome by hiring suitably qualified staff, on-site training with the instruments during installation,

and further training of staff (if necessary) at the manufacturers plant operations. Maintenance of equipment (and library) can be very costly, so as a pre-condition to major equipment purchases under the aegis of the IEP, the university and the UGC should agree to long-term provision of funds for maintenance of newly acquired equipment after the project is completed.

5) The Department of Geology and CEM have no computers, and neither the faculty or students presently understand or use computers. It is necessary that computers be added to the department and CEM and that use of computers be involved in the research and teaching of both the department and CEM.

### **3.2.2 Institutional**

1) The working hours of Pakistani universities are too short; many operations begin after 9 A.M. and close by 2 P.M. It is important for the success of the project as well as for the progress of science that the laboratories and libraries are kept open for use for much longer hours, certainly not less than 40 hours per week. Therefore, besides the general supervisor having a key to his laboratory, another set of keys for all the laboratories, storeroom, and library should be kept in the Director's and Chairman's office for general use. These facilities need to be available for use by all qualified and authorized students and faculty of the CEM and Department of Geology.

2) Although the Department of Geology faculty is united, there may be some communication gaps among them and the students. Contacts with other geological organizations need to be substantially expanded, and international collaboration needs encouragement.

3) Although a few faculty members graduated from other universities, most of the geology faculty are graduates of their own department. This has led to inbreeding, lack of exchange of ideas, and provinciality. Appointments of faculty and technical positions based on merit, conducted on the basis of a nationwide or even international search for qualified applicants (there are many Pakistani expatriates elsewhere in the Middle East and overseas) are key factors in overcoming these problems.

### 3.2.3 Administrative

1) The Vice-Chancellor of the university, Dr. Shaukat Baloch, is keenly interested in the development of Pakistan, his province, and the University of Balochistan. He projects assurance that he will take all the necessary steps needed to ensure the progress of geological sciences during the tenure of IEP and subsequently. This is a major encouraging factor.

2) The faculty of the Department of Geology, in general, and the current chairman, in particular, are interested in the development of geology and exploration of the resources of the region. The chairman of the Department of Geology has an impressive plan that can be successfully executed with assistance from USAID. Such a sense of purpose, enthusiasm, and direction is not obvious from the past and continuing actions and plans of the director or acting director of the CEM. Additionally, artificial barriers have been created between the CEM and Department of Geology. It is absolutely necessary that the two units come to an understanding and formulate a joint strategy to work together. At present, the CEM is simply not credible as a scientific institute.

While the current administration of the Department of Geology is responsive, open, and enthusiastic, the administrative leaders of the CEM are acquisitive, self-serving, and isolated. This assessment corroborates the conclusions of several other recent assessment studies.

3) The Department of Geology and CEM have little collaboration with other institutions, including the GSP next door. No joint international research project of significance has been pursued. No serious efforts have been made to benefit from opportunities existing in Pakistan. However, it is hoped that the situation will improve under the leadership of the newly-appointed chairman of the department, and if there can be a new reformed administrative leadership installed in the Centre.

## **4. IEP AND INSTITUTIONAL RECOMMENDATIONS**

### **4.1 RECOMMENDED GEOLOGIC DISCIPLINE FOR THE PURPOSE OF IEP**

Neither the CEM nor Department of Geology has much in the way of on-going research projects or active topics of research. The technical assessment team thus worked with the faculties of the two departments to choose two areas of geological research in which to concentrate for the purpose of the IEP, based on equipment available, faculty interest, and provincial needs. **We recommend that the area of emphasis be hydrogeology with supporting sub-disciplines in geochemistry, geophysics and computer science.**

The understanding and management of water resources is becoming critical to Balochistan. In recent years there has been decreasing precipitation, increasing population and an increasing number of irrigation schemes from groundwater resources. There are no geology or engineering departments in Pakistan presently teaching hydrogeology or doing research in this area. The University of Balochistan is uniquely placed in a province where economic development is very dependant on proper water management.

**The CEM was established at the University of Balochistan to aid in the exploration and development of mineral resources in Balochistan. Balochistan is the wealthiest of all four provinces in its endowment of mineral resources. Considerable mineral resources have been found and exploited, and more will be in the future. Presently coal, chromium, barite, fluorite, silver, copper, iron and gold are being mined, in addition to gypsum, limestone, and aggregates. The CEM has never actively participated in the exploration and development of natural resources, but the need is still there.**

The CEM already has considerable geochemical and geophysical equipment and facilities. It is recommended that interest and training be re-established in geochemistry and geophysics and that presently owned equipment be made operational.

Knowledge of computers is essential for conducting research and teaching in all the above mentioned fields of research. It is, therefore, essential that computer facilities and training of the staff and students to use computers be made available.

## **4.2 ADMINISTRATIVE CHANGES NEEDED FOR SUCCESSFUL IEP IMPLEMENTATION**

The CEM has the resources and facilities for conducting research programs but has very few faculty interested in or capable of research. The Geology Department has no resources for conducting research programs but does have a number of young, enthusiastic, well-trained faculty who are interested in being involved in research programs. The assessment team feels strongly that before IEP funds are expended on the University of Balochistan, certain administrative and operational changes must be made in the CEM and Geology Department.

### **4.2.1 Use of Combined Facilities and Faculty**

The CEM and Geology Department should operate as one unit for the purpose of research. There should be no duplication of equipment or facilities. The libraries should be combined into one as was the previous case. Facilities in both units should be available to all faculty, and faculty in both units should participate in the research programs.

A computer facility will be established by the IEP, but only one will be established for the combined geologic community. It is suggested that one faculty member be both chairman of the Geology Department and Director of the CEM. This should alleviate a turf battle between two administrators, which seems to have plagued the University of Balochistan for a number of years.

### **4.2.2 Use of Unexpended Funds**

**It appears that the CEM has bankrolled considerable unexpended funds. At the same time they have not filled several vacant and approved faculty positions, nor repaired instruments, and they have cancelled the subscription to a number of professional journals in the library.**

The assessment team recommends that before new IEP funds are expended on the Centre:

- the vacant faculty positions be advertised and professionally qualified personnel be hired to fill them.
- subscriptions to periodicals in the library be re-established.

- equipment be repaired and needed accessories purchased for the equipment and laboratories insofar as funds available will allow.
- at least one computer be purchased from the unexpended CEM funds.

### **4.3 STRATEGIES TO IMPLEMENT RECOMMENDATIONS**

#### **4.3.1 Constraints**

Major support from the IEP to the geology program at the University of Balochistan will need to be provided in a measured and phased way. This is because certain arrangements, preparations, and impediments will need to be addressed before funding and support can be effectively and progressively utilized. Specifically, some outstanding questions are:

1) How quickly and effectively can cooperation between the Department of Geology and the CEM be implemented by the local administration? This involves the university's central administration, as well as the administration of both units (Department and Centre) individually and together. If new, senior, outside leadership is sought for the Center of Excellence, how long will it be before that necessary new management is here? Without that new leadership in the CEM, it is unlikely that there can be a successful, productive, and collegial environment for accomplishing science or education.

2) How soon can organized research planning be undertaken for geology activity in the building, to allow maximum advantage and productivity to be gained from available personnel and resources, and from the prospective infusion of new resources from the IEP?

3) When will faculty members who are currently on educational or research leave from the Department of Geology and CEM be returning to their posts, and when will the currently present faculty be able and prepared to undertake the overseas training and upgrading deemed necessary?

4) When will the CEM be willing and able to fill its multiple vacant posts? Will the Centre be prepared to hire the "best available person" as so urgently needed, preferably including senior and accomplished researcher(s), rather than another junior person with only entry-level credentials?

### **4.3.2 Time Plan**

The assessment team proposes the detailed six-year development plan below but does not feel that it can be implemented until the necessary administrative changes are made which have been described in section 4.2 above.

#### **YEAR ONE**

##### **Training:**

- 1) Nasir Karim begins M.Sc. and Ph.D. study in hydrology in the U.S.
- 2) Amjad Qureshi begins Ph.D. study in geophysics in the U.S.
- 3) Aktar Kassi spends 3 months in the U.S. visiting hydrology laboratories and planning necessary equipment for Quetta.

##### **Technical Assistance:**

- 1) One U.S. expert in computers as applied to geology visits Quetta for two months for initial computer training. The same expert returns 6 months later and spends 1 month to assist in problems which have developed.
- 2) Upon the return of Bashir Durrani from his Ph.D. at Texas A and M, one U.S. geophysicist will visit for three months to assist in putting into operation the previously unused geophysical equipment and to plan for necessary additional purchases.
- 3) Visit by Pakistani expert from an operational atomic absorption laboratory, such as the one at the Atomic Energy Commission, to determine what is needed to make the atomic absorption laboratory operational.
- 4) Professional geologic librarian will visit for one month to train librarian to catalogue and number collections. The same professional will return 6 months later to check on completion of the task and to help with problems that have evolved.

- Commodities:**
- 1) One IBM 386 SX computer with dot matrix printer, mouse and software to include Word Perfect, Harvard graphics, Lotus 1-2-3, and several geologic packages to be chosen.
  - 2) One Phillips X-Ray Powder Diffraction system complete with computer automation.
  - 3) One uninterruptable power-supply unit
  - 4) One 4-wheel-drive field vehicle.
  - 5) All necessary supplies (glassware, pumps, etc.) for the atomic absorption laboratory.
  - 6) replacement parts for the present thin-section equipment.
  - 7) Equipment for the thin-section room to replace equipment that cannot be repaired.
  - 8) Purchase of equipment for making polished thin sections.

- Remodeling:**
- 1) Air conditioning and dust-proofing the electronic laboratory and the atomic absorption laboratory.

## **YEAR TWO**

- Training:**
- 1) Nasir Karim in Ph.D. program.
  - 2) Amjad Qureshi in Ph.D. program.
  - 3) Mohammad Umar begins Ph.D. program in hydrology.
  - 4) Two faculty are sent for 3 months training each in remote sensing at the U.S.G.S. Eros Data Center at Sioux Falls, South Dakota.

- Technical Assistance:**
- 1) U.S. mineralogist will visit for 3 months to help set up an X-ray diffraction unit and to provide a short course on the use of the X-ray diffraction unit (XRD).
  - 2) XRD company training for electronics technicians.
  - 3) Assist C.E.M. in recruiting two new faculty members by advertising for Pakistani expatriates in the U.S. Also arrange to have these candidates interviewed in the U.S.

by the Chairman of the C.E.M. and the Chairman of the Board of Governors of the C.E.M.

- Commodities:**
- 1) Satellite and Land-Sat image coverage of Balochistan.
  - 2) Library materials.

### **YEAR THREE**

- Training:**
- 1) Nasir Karim in Ph.D. program.
  - 2) Amjad Qureshi in Ph.D. program.
  - 3) Mohammad Umar in Ph.D. program.
  - 4) Dr. Niamatullah to U.S. for one year Post Doctoral study.

- Technical Assistance:**
- 1) U.S. geologist visits for 6 months to give several courses in hydrogeology.
  - 2) U.S. geologist visits for 6 months to start a program in environmental geology.
  - 3) Computer expert to visit for 2 months to assist in problems the staff have encountered and to recommend further computer purchases for the department.
  - 4) Assist in developing and presenting a seminar on the technical needs of the private-sector mineral and energy companies. Arrange for participation from both Pakistani and U.S. companies dealing in the developing countries.
  - 5) A U.S. electronics technician familiar with X-ray, X-ray fluorescence, and atomic absorption analysis techniques will spend 6 months in Quetta training one or two new technicians in the C.E.M. and Department.

### **YEAR FOUR**

- Training:**
- 1) A. U.S. geophysicist visits for 6 months to train staff on the use of geophysical equipment in field work.
  - 2) Assist the departments in arranging a Geologic Conference on the Geology of Balochistan. Invite participants from the Middle East as well as U.S. and

Europe. Arrange for field excursions complete with U.S.-quality field guidebooks.

- Commodities:
- 1) A second 4-wheel-drive vehicle.
  - 2) Complete X-ray fluorescence unit with computer automation.
  - 3) A second computer as recommended by the computer expert who visited in year three.

#### YEAR FIVE

- Training:
- 1) Nasir Karim finishes Ph.D. program.
  - 2) Amjad Qureshi finishes Ph.D. program.
  - 3) Mohammad Umar in Ph.D. program.
  - 4) Two faculty each have 1 year post doctoral fellowships in the U.S.

- Technical Assistance:
- 1) U.S. geologist spends 1 year working on hydrogeology research with staff.
  - 2) U.S. geochemist spends 6 months working on geochemical problems and instructing staff on methods of water and soil analyses.
  - 3) Assist in setting up a seminar with the Geological Survey of Pakistan and GOP energy agencies on mineral and energy resources of Balochistan. The seminar should develop a joint program of research aimed at development of resources.
  - 4) Send two department faculty members to international conferences to present research papers.

#### YEAR SIX

- Training:
- 1) Mohammad Umar finishes Ph.D. and returns.
  - 2) Two faculty each have 1 year post doctoral fellowships in the U.S.

- Technical Assistance:
- 1) One U.S. hydrologist spends 6 months on combined research and teaching.
  - 2) One U.S. geophysicist spends 6 months on combined research and teaching.
  - 3) Assist in arranging a Pakistan Geological Conference in Quetta on the current status of hydrogeologic needs and recommendations for future research.

- Commodities:
- 1) Replenish supplies of chemicals, lab ware, instrument parts, etc. to last for several years.

#### **4.3.3 Monitoring and Evaluation**

There will be a need for regular and conscientious monitoring of the research plan, progress, and productivity of the IEP-supported work and the institutional setting. This should be done by the local geology administrator(s), as well as by the IEP/MUCIA directors and USAID/Islamabad representatives. Discipline-specific assistance with technical evaluations could be provided by the Geology Facilitator to assure continuity and quality control.

Annual reviews would be advisable, with jointly authored reports by the geology administrator(s) and the IEP/MUCIA designee. By the end of the second year, there should be a comprehensive technical review prepared for submission to USAID/Islamabad. This will be used to evaluate the progress and results to date. It will provide the factual basis to expand, continue, or reduce the level of IEP support and participation, or to terminate and transfer the support.

There are a number of indicators that can be used to track and evaluate progress toward program and project objectives (USAID/Islamabad report, Dec. 1989). The need is for systematic monitoring of "purpose-level indicators" to assist in project management. Actual levels of performance can be compared previously to projected (expected) levels, in order to assist with the monitoring of financial and input and output data--in addition to evaluating achievement of the scientific objectives. Establishing a practical system involves the steps of (1) formulating a clear statement of project purpose(s), (2) selecting indicators that will be able to track progress towards the purpose, (3) reporting data over time for the same set of indicators, and (4) analyzing the data to assess the progress.

Relevant purpose-level indicators could be:

■ **FACULTY**

Highest degree earned; degree earned through project

Honors, awards, significant invitations due to project

Overseas research/teaching experience due to project

Significant collaborative work

Distribution of faculty members by appropriate speciality (sub-discipline)

Personnel policies

faculty compensated fairly, including consideration of merit and productivity;  
an overall rewards system that recognizes good work, contribution, and  
productivity (i.e., incentives for excellence)

hiring and promotion based on merit

student/faculty ratio

teaching load allows for research activity; time utilization

encouragement of self-improvement (faculty development)

vacant staff positions are filled or being pursued/recruited

■ **FACILITIES AND EQUIPMENT**

Labs are equipped, staffed, maintained

Sufficient supporting services (repair, upkeep, replacement parts,  
electricity/lighting/security, etc.)

Adequate space

Libraries with adequate instructional and research books and journals, and  
current books and continuing subscriptions

Upgrading of equipment and its capability (e.g., better computers, more  
sensitive equipment, accessory equipment)

multiple use of equipment for different projects, by various researchers (whether  
directly collaborating or otherwise)

■ **PLANNING CAPABILITY**

Planning done on an organized, regular basis

■ **RESEARCH ENVIRONMENT**

Future planning, including for raising funds; submission of research proposals,  
and success rate

Funding adequate  
Reports and scientific articles produced  
Stability of staffing

■ **INSTITUTIONAL LINKAGES**

Joint research activity within the unit

Seminars and conferences to gather colleagues, located either in-house or elsewhere

Collaborative research activity with other units on campus, or with other universities, research institutes, centers, government and industry labs and facilities

Visiting Scholars program for temporary exchange of faculty and students with other institutions (sabbatical exchanges, etc.)

Linkages with foreign universities or research institutions

■ **RESEARCH PRODUCTIVITY**

Number of projects

Number of progress reports, published research articles ranked by status of publications (in-house, national, international) and whether critically reviewed by peer colleagues prior to publication

Number of persons involved (e.g., including graduate theses completed through the project)

■ **RELEVANCE OF THE RESEARCH TO REGIONAL AND NATIONAL DEVELOPMENT**

Funding acquired from external sources other than USAID/IEP

Results and technology adopted by government, industry and other users

Employment destinations and status of graduates

The number of the Project's competitive Small Grants awards that is acquired.

In evaluating the foregoing, it should also be considered whether the existing situation and incremental improvement in it are due to the impact of the IEP and to cooperation with MUCIA/USAID efforts, or to the Pakistani UGC or Pakistan Science Foundation, or attributed to other programs and factors, or some combination of them.

## 5. REFERENCES

1. Geology Group report on conditions of geology departments in Pakistan, by Tahirkheli, Jan, and Ahmad, 14 pages including Appendix, to University Grants Commission, 1989
2. MUCIA, Preliminary Institutional Analyses (IEP), for site visits of June 4-13 1990, 19 pages
3. Parliamentary Act (Pakistan), Act No. XXIV, Centers of Excellence Act of 1974 (as amended by Act IX of 1976)
4. University of Balochistan, Prospectus (admissions catalog), in English, 1989/90
5. USAID/Islamabad, Purpose Level Monitoring System (IEP), Dec. 1989, and reissued April 30 1990
6. U.S. Geological Survey, Institutional Development in Earth Sciences in Pakistan, 1989, 21 pages; report to USAID, by team headed by B. Wardlaw and W. Martin
7. World Bank, Higher Education and Scientific Research for Development in Pakistan--Vol. I and II, Report no. 823, Feb. 1990 (limited distribution)

## **APPENDICES**

**Appendix A.** Checklists for Pre-visit Notifications of Data Needs

**Appendix B.** Guides for Assessment of Facilities

**Appendix C.** Facilities and Equipment of the Center of Excellence in Mineralogy

**Appendix D.** Facilities and Equipment of the Department of Geology

**Appendix E.** Equipment Inventory of the Department of GEOLOGY Storeroom

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## APPENDIX A

### CHECKLISTS FOR PRE-VISIT NOTIFICATION OF DATA NEEDS

IEP/MUCIA Assessment Team requests this information from the Department/Centre being reviewed:

- 1) Copies of any previous reviews and reports on the Department/Centre
- 2) Prospectus (catalog) of University; size, structure, student enrollments etc., and any brochures available on the Department/Centre
- 3) List of all Department/Centre faculty and staff. Faculty data should be tabulated on expertise and background (e.g., see Table 2 in this Report), including name, rank, gender, age, highest degree and institution, technical area(s) of specialization, courses taught, research interests, graduate students supervised. Could also provide standardized biography/vita listings for faculty, detailing such information as educational background, professional work experience, research grants, listing of published books/articles/abstracts etc., professional memberships.
- 4) List of all courses taught, seminars/workshops/professional meetings/short courses taught or attended by individual faculty for past 5 years (this might be included in biographical data above)
- 5) Statement of goals and objectives of the Department/Centre
- 6) List of present instruments and equipment (e.g., see following form on review of laboratories) including operational status and how maintained
- 7) List of long-range plans and future activities--research, faculty/staff additions and professional development, professional activities of the faculty
- 8) list of instruments and equipment needed to strengthen the area(s) of excellence and emphasis the Department/Centre would like to promote.

## APPENDIX B

### GUIDES FOR ASSESSMENT OF FACILITIES

Checklists to help evaluate on site:

- TEACHING**
- 1) Course(s) taught; syllabus for course; textbook(s); labs (topics, examples), goals for course
  - 2) Grading system; pass rate
  - 3) Rigor of course
  - 4) Ability to attract and keep graduate students
  - 5) Student problems (campus unrest, instability, interruption of teaching and other activities)
- RESEARCH**
- 1) Area(s) of speciality
  - 2) List of publications (title, journal, year, co-authored?)  
local vs. national and international
  - 3) Inspect publications
  - 4) Submission/acceptance of grants; quantity; funding monies obtained; source; quality
  - 5) Future research desires
  - 6) Equipment most often used? needed?
  - 7) Extent of working with graduate students
  - 8) Number of theses completed (say, in past 5 years); quality of theses
  - 9) Collaboration with local colleagues, industry/government, colleagues from other Pakistani universities or abroad
  - 10) grasp of language-of-currency (e.g. English) for instruction and interaction with others elsewhere; reading/writing, speaking

In addition, see section 4.3.3) of this report, "Monitoring and Evaluation," for suggested "purpose level indicators" to help evaluate current status and progress.

See the next page for the Outline/Checklist for Review of Laboratories.

**Outline/Checklist for Review of Laboratories**

Department/Centre: \_\_\_\_\_ Date: \_\_\_\_\_

Reviewer(s): \_\_\_\_\_

LABORATORY: \_\_\_\_\_

CURRENT SUPERVISOR(s):

PURPOSE:

SPACE: (adequate/inadequate)

UTILITIES: (adequate/inadequate, type, how obtained, reliability)

Electricity:

Lighting::

Drainage:

Air Handling (for room):

High-Pressure Air:

Natural Gas:

LABORATORY MATERIALS:

Sinks:

Chemical Hoods:

Chemicals Storage:

Sample/Specimen Storage:

Lab Furniture: (counters/benches/desks etc.)

INSTRUMENTATION:

List (make, model, operability, when last used, how maintained, approximate age)

ACCESSIBILITY/SECURITY:

Who has key; potential for theft; lockable cabinets?

LABORATORY NEEDS:

## APPENDIX C

### FACILITIES AND EQUIPMENT OF THE CENTRE OF EXCELLENCE IN MINERALOGY

#### GENERAL OFFICE SPACE

Space: Adequate

Utilities: Electricity: Approximately 30 amps per room  
Lighting: Good, fluorescent and incandescent  
Water: None  
Drainage system: Adequate  
Air Handling: Windows; no air conditioning  
Natural Gas: Pumped to heaters

Instrumentation: 1 - UBIX 1600 MR KOMSHROKU photocopy machine  
1 - Hermes electric typewriter with 1K memory  
1 - Hermes electric typewriter

#### LABORATORY--X-RAY DIFFRACTION

Current Supervisor: Mr. Khushnood Ahmed Siddiqui (technician)

Space: Adequate

Utilities: Electricity: Adequate service  
Lighting: Fluorescent  
Water: Pumped to instrument  
Drainage System: Adequate  
Air Handling: Window  
High-pressure Air: None  
Natural Gas: Pumped to heater

Laboratory Materials: Sinks: None  
Chemical Hoods: None  
Chemicals Storage: None  
Sample and Specimen Storage: None  
Lab Furniture/ Counters: No benches

**Instrumentation:** 1-Sigma 2060 X-ray Generator and Diffractometer  
(C.G.R., France) with coolant water chiller  
recirculator (obtained 1978; out of order since 1984)  
2-Mettler H30 analytical balances  
1-Shimadzu SA-CPZ Centrifugal Particle Size Analyzer  
(Japan); obtained 1984; in working order; not being  
used

**Accessibility/Security:** Room supervisor has the only key to lab

#### **LABORATORY--DIFFERENTIAL THERMAL ANALYSIS (DTA)**

**Current Supervisor:** Khushnood Ahmed Siddiqui (technician)

**Space:** Laboratory occupies the same room as the X-ray  
Diffraction lab

**Utilities:** Same as X-ray diffraction lab

**Laboratory Materials:** Same as X-ray diffraction lab

**Instrumentation:** 1-Shimadzu Series 30 D.T.A. (Japan); obtained 1984; in  
working order; last used in 1989

**Accessibility/Security:** Room supervisor has the only key to lab

#### **LABORATORY--PHOTOGRAPHIC DARK ROOM**

**Current Supervisor:** Mr. Hussain Uddin (photographer)

**Purpose:** Black and white photograph developing, along with  
printing and enlarging topographic sheet maps

**Space:** Lab is a small, but adequately-sized room, adjoining the  
X-ray/DTA lab

**Utilities:** Electricity: Adequate service  
 Lighting: No safe lights  
 Water: 2 sinks  
 Drainage system: Adequate  
 Air Handling: None  
 High-pressure Air: None  
 Natural Gas: None

**Laboratory Materials:** Sinks: Two small sinks (inadequate)  
 Chemical Hoods: None  
 Chemical Storage: None  
 Sample and Specimen Storage: None  
 Laboratory Furniture: Counters

**Instrumentation:** 1-Foto Fair 35 mm enlarger  
 1-Hansa 35 mm enlarger  
 1-small manual Print Dryer

**Accessibility/Security:** Lab accessible only through DTA labs

#### LABORATORY--GEOCHEMISTRY

**Current Supervisor:** Mr. Khushnood Ahmed Siddiqui (technician)

**Space:** Adequate

**Utilities:** Electricity: Adequate service  
 Lighting: Fluorescent  
 Water: None  
 Drainage System: None  
 Air Handling: Window  
 High-Pressure Air: None  
 Natural Gas: Pumped to heater

**Laboratory Materials:** Sinks: None  
 Chemical Hoods: One, but not connected  
 Chemicals Storage: None  
 Sample and Specimen Storage: None  
 Laboratory Furniture: Counters; no chemical-resistant tops; no benches

**Instrumentation:** 1-Varian Spectra Atomic Absorption-20 Spectrophotometer (Australian) with acetylene and nitrous oxide gas cylinders (obtained 1988; no one knows how to operate the instrument)  
1-KV429 Sieve Shaker (Japan) with sieves; obtained 1984  
1-Isodynamic Magnetic Separator (not used since 1984; belongs in Thin-section lab in basement)  
2-Ovens; in working order; one only has been used (once)

**Accessibility/Security:** Lab supervisor has the only key to lab

#### LABORATORY--MINERALOGY/PETROLOGY EXAMINATION

**Current Supervisor:** Mr. Mehrab Khan (Lecturer)

**Space:** Adequate

**Utilities:** Electricity: Adequate service  
Lighting: Fluorescent and incandescent  
Water: One line  
Drainage System: Adequate  
Air Handling: Windows  
High-pressure Air: None  
Natural Gas: Pumped to heater

**Laboratory Materials:** Sinks: One small sink  
Chemical Hoods: None  
Chemicals Storage: None  
Sample and Specimen Storage: Wooden specimen storage cabinets of adequate capacity  
Lab Furniture: Counters (need repair); wooden benches

**Instrumentation:** 1-Leitz Ortholux Pol Polarizing Microscope (West Germany) with camera; obtained 1974  
3-Leitz Polarizing Microscopes (West Germany); obtained 1974  
3-Olympus S2III Stereo Zoom Microscopes (Japan); obtained 1974  
6-ERMA Polarizing Microscopes (Japan); obtained 1976

2-Neaner Pol-Z44 Polarizing Microscopes (Austria);  
obtained 1974

1-Olympic Inverted-type Metallurgical Microscope  
(Japan) with camera; obtained 1984

1-Metallurgical Microscope with automatic exposure  
control unit; obtained 1984

1-Olympus BH2 Polarizing Microscope (Japan) with  
camera; obtained 1984

Accessibility/Security: Lab supervisor has the only key to lab

#### LABORATORY--MINERAL-ROCK SECTION/THIN SECTION

Current Supervisor: Mr. Anwar Ali, (technician)

Space: Adequate space in the basement

Utilities: Electricity: Adequate service  
Lighting: Fluorescent ;  
Water: Pumped to instruments  
Drainage System: Adequate  
Air Handling: None  
High-pressure Air: None  
Natural Gas: Pumped to heater

Laboratory Materials: Sinks: One small sink  
Chemical Hoods: None  
Chemicals Storage: None  
Sample and Specimen Storage: None  
Lab Furniture: Cement benches along two walls; 3  
counter tops; 4 desks; 2 small sinks (in working order);  
1 floor fan (in working order); 1 oven (in working  
order)

Instrumentation: 1-6-inch Karl Kolb cut-off Rock Saw (West Germany);  
out of order; owned by Department of Geology  
1-8-inch Struers Rock cutting Saw and Grinder  
(Denmark); grinder out of order, needs new wheel  
--owned by Department of Geology

- 1-Karl Kolb Lap Grinder (West Germany) and 12 different grit wheels -- owned by Department of Geology
- 2-Struers Lap Grinder (Denmark) with 2 wheels each -- owned by CEM
- 1-Struers DT-10 Polishing Machine (Denmark) with 1 lap -- owned by Department of Geology
- 1-Humboldt Wedag Stone Crusher (West Germany) -- owned by Department of Geology
- 1-Struers Prestopress (Denmark) for making polished sections -- owned by Department of Geology
- 5-Hot Plates -- owned by Department of Geology
- 1-Labor Muszeripari Muek Water Still (Hungary); out of order -- owned by Department of Geology

**STOREROOM (formerly Microscope and Photomicrograph room)**

- Current Supervisor:** Mr. Khusnood Ahmed Siddiqui
- Space:** Room adjoins Mineralogy/Petrology lab. Adequate for its purpose.
- Utilities:**
  - Electricity: Adequate service
  - Lighting: Fluorescent
  - Water: None
  - Drainage System: None
  - Air Handling: None
  - High-pressure Air: None
  - Natural Gas: None
- Storeroom Materials: Sinks:** None
- Chemical Hoods:** None
- Chemicals Storage:** None
- Sample Specimen Storage:** Adequate
- Storeroom Furniture:** Counters
- Instrumentation:** Microscopes listed for Mineralogy/Petrology Lab; geophysical instruments itemized below which were

obtained in 1984; no one knows how to operate them or has used them; some still in original packing from 1984; replacement cost if bought today about \$25,000 U.S.

1-24-channel Signal-Enhancement Seismograph OYO 1197-B (Japan);

1-Electrical Resistivity Meter OYO ES-G-2 2220 (Japan) with cable and batteries

1-Portable Proton Magnetometer G-816 (Japan)

Accessibility/Security: Lab supervisor has key to storeroom; however, access to Mineralogy/Petrology lab must be obtained from Mehrab Khan

#### CARTOGRAPHY/DRAWING ROOM

Current Supervisor: Mr. Ahmed Khan Mangi

Space: Adequate

Furniture: Drafting Table

Instrumentation: 1-Leroy Lettering set, assorted pens, and drafting equipment

## APPENDIX D

### FACILITIES AND EQUIPMENT OF THE DEPARTMENT OF GEOLOGY

#### GENERAL OFFICE SPACE

Space: Adequate

Utilities: Electricity: Approximately 30 amps per room  
Lighting: Good, fluorescent and incandescent  
Water: None, except for bathroom connected to chairman's office  
Drainage System: Adequate  
Air Handling: Windows  
Natural Gas: Pumped to heaters

Instrumentation: None

#### TWO-LECTURE HALLS

Lecture Room Facilities: Lecture Hall 1: 35 chairs  
Lecture Hall 2: 34 chairs  
There is also one blackboard and 1 lectern in each room.  
Lighting: Adequate  
Lecture Hall/Seminar Room

Facilities: Large, spacious; fluorescent lighting, many windows  
24 double desks; 43 chairs; 1 lecture countertop and lectern;  
2 chairs; 1 blackboard

#### LECTURE HALL/PALEONTOLOGICAL LABORATORY

Current Supervisor: Mr. Mohammad Umar (Lecturer)

Space: Adequate

**Utilities:** Electricity: Adequate  
Lighting: Fluorescent  
Water: To sink  
Drainage System: Adequate  
Air Handling: Windows  
High-pressure Air: None  
Natural Gas: Pumped to heater

**Lab Materials:** Sinks: 1 small sink  
Chemical Hoods: None  
Chemicals Storage: None  
Sample and Specimen Storage: On counter tops  
Lab Furniture: 5 counter tops; 8 stools and 4 chairs,  
1 blackboard and 1 lectern

#### **LABORATORY--MINERALOGY/PETROLOGY**

**Current Supervisor:** Mr. Hassan Khan Kharotai (lecturer)  
(Mohammad Umar has desk/office in back of lab)

**Space:** Adequate

**Utilities:** Electricity: Adequate  
Lighting: Fluorescent  
Water: None  
Drainage System: None  
Air Handling: Windows  
High-pressure Air: None  
Natural Gas: Pumped to heater

**Lab Materials:** Sinks: None  
Chemical Hoods: None  
Chemicals Storage: None  
Sample and Specimen Storage: Rocks on counter tops;  
Dept. owns Ward's set of minerals/rocks/fossils which  
must be moved from the museum (upstairs) to this lab;  
very few Pakistani rock specimens on counter tops;  
samples have not been catalogued; few thin-section  
slides

**Lab Furniture:** 7 counter tops; 10 stools; 1 desk; 1 floor fan  
**Instrumentation:** 5-Leitz HM-Pol Polarizing microscopes (West Germany)  
6-ERMA PS Polarizing microscopes (Japan)  
4-ERMA Binocular microscopes (Japan)  
1-Meopta Binocular microscope (Czechoslovakia)  
**Accessibility/Security:** Supervisor, Mr. Umar, and the Chairman's office have keys to the lab

#### LABORATORY--GEOCHEMISTRY

**Current Supervisor:** Mr. Nasir Karim (lecturer)  
**Space:** Adequate  
**Utilities:** Electricity: Adequate  
Lighting: Fluorescent  
Water: To sinks  
Draining System: Adequate, troughs on floor  
Air Handling: Windows  
High-pressure Air: None  
Natural Gas: Pumped to heater  
**Laboratory Materials:** Sinks: Small sinks  
Chemical Hoods: None  
Chemicals Storage: On counter tops  
**Lab Furniture** Counters, no benches; desk; 3 chairs; metal cabinet  
**Instrumentation:** 1-spektromon 203 Spectrophotometer (Hungary); obtained mid-1970's; out of order  
3-sieve sets  
1-sieve shaker  
2-drying ovens  
1-centrifuge  
1-water bath  
1-Ohaus 311 Balance  
**Accessibility/Security:** Nasir Karim and the Chairman's office have keys

## STOREROOM

**Current Supervisor:** Mr. Nasir Karim

**Space:** Adequate space. Room adjoins Geochemistry lab and is used for purpose of geochemistry lab storage; needs shelves

**Utilities:** Electricity: Adequate  
Lighting: Fluorescent  
Water: None  
Drainage System: None  
Air Handling: None  
High-pressure Air: None  
Natural Gas: None

**Laboratory Materials:** Sinks: None  
Chemical Hoods: None  
Chemicals Storage: None  
Sample and Specimen Storage: None  
Storeroom Furniture: 2 counters; 2 tables; 1 desk

**Instrumentation:** 1-Zeiss Photoscope (stereoscope) (West Germany)  
2-ERMA Binocular microscopes (Japan)  
6-Meopta Polarizing microscopes (Czechoslovakia)  
2-Meopta Binocular microscopes (Czechoslovakia)  
6-Universal Specific Gravity balances  
1-Stavol SVC-1000N Voltage Regulator; out of order  
1-Voltage Regulator (Thermal circuit breaker)  
2-Labor Balances (Hungary)  
1-Radelkiss OP-201/2 pH meter; out of order  
1-Excelsior Electronics Model DG-7 conductivity meter  
1-Mawta 200 gms Balance (China)  
1-Mettler AE 166 balance  
2-Labor Universal Sieve Shaker; one out of order

**Accessibility/Security:** Supervisor and the Chairman's office have keys to this storeroom and the adjoining Geochemistry lab

## **LABORATORY--SEDIMENTATION**

**Current Supervisor:** Dr. Akhtar Mohammad Kassi

**Space:** Adequate

**Utilities:** Electricity: Adequate  
Lighting: Fluorescent  
Water: None  
Drainage System: Adequate, troughs on floor  
Air Handling: None  
High-pressure Air: None  
Natural Gas: Pumped to heater

**Laboratory Materials:** Sinks: None  
Chemical Hoods: None  
Chemicals Storage: None  
Sample and Specimen Storage: On counter tops only  
Lab Furniture: Counter tops; no benches

**Instrumentation:** 1-light table

**Accessibility/Security:** Supervisor and the chairman's office have keys

## **PROJECTIONS ROOM-CLASSROOM/STOREROOM**

**Current Supervisor:** Mr. Alloudin Khan (Storekeeper)

**Space:** Small room

**Utilities:** Electricity: Adequate  
Lighting: Fluorescent  
Water: None  
Drainage System: None  
Air Handling: None  
High-pressure Air: None  
Natural Gas: Pumped to heater

**Laboratory Materials:** Sinks: None  
Chemical Hoods: None  
Chemicals Storage: None  
Sample and Specimen Storage: None  
Lab Furniture: 3 counter tops; 9 chairs; 1 lectern

**Instrumentation:** 1-Derivatograph Differential thermal Analyzer (DTA) (Hungary) with control unit, voltage stabilizer and accessories. Installed 1974; never worked well. Last used 1986. Out of order; alignment can't be fixed  
1-Leitz Epitax microscope (West Germany); out of order  
1-National Hi-Power Amplifier sound system  
1-thermo-Fax copier/Transparency Maker (Japan); out of order  
1-Overhead Projector (Japan)  
1-Emo 35 mm. Projector (Japan)  
1-Elmo 16-C1 Movie Projector (Japan)  
1-Elmo Slidecorder 801; out of order  
1-Durst M-301 Photo Enlarger; out of order  
1-Karl Kolb Dry Mounting press (West Germany); out of order  
Dark Room Supplies: Timer, red light, dryer, paper all sitting on counter top

**Accessibility/Security:** Supervisor and the chairman's office have keys

**APPENDIX E**  
**EQUIPMENT INVENTORY OF THE**  
**DEPARTMENT OF GEOLOGY STOREROOM**

- 1 Dymo punch machine
- 1 Telescopic alidade (Japan)
- 1 Ordinary alidade
- 1 Pentograph (Japan)
- 1 Diffractometer; out of order
- 1 Dial gage (Japan)
- 1 Pedometer (West Germany)
- 1 Planimeter (Japan)
- 5 Brunton compasses
- 18 Boxes photographic slide frames
- 3 Geological stratum compasses
- 3 Pocket compasses (China)
- 2 Circular protractors (China)
- 6 Trough compasses (China)
- 5 Wooden levels (China)
- 1 Cylinder gauge for oxygen (U.K.)
- 14 Forceps
- 6 Meopta Microscope lamps (Czechoslovakia)
- 14 Pocket stereoscopes (China)
- 4 Hammers
- 7 Geological hammers (U.S.)
- 1 Keffeland ASER Aby level
- 1 Drill machine
- 4 Geological scales for bearing
- 1 Gand lens
- 1 Compass (Germany)
- 2 Horseshoe magnets
- 1 Hand lens (stand type)
- 3 Prismatic compasses
- 1 Micro-surveying altimeter (U.S.)
- 35 Surveying rods (stadia)
- 7 Small, 1 large - Plane Table tripods

- 3 Plane table survey tables
- 1 Steel chain for chain survey
- 5 Large, 1 small - wooden hammers
- 1 Raynor refractometer; corroded, useless
- 1 Desk
- 6 Chairs
- 1 Floor fan
- 12 Geaters
- Assorted camping equipment (tents, stoves, lanterns, cooking utensils, tarpaulins)