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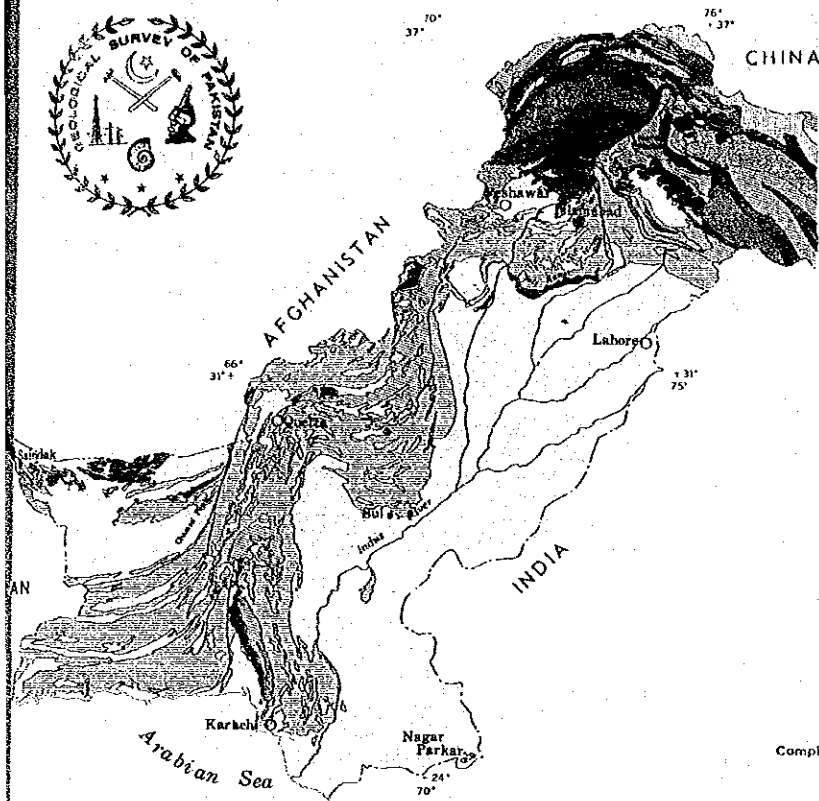
パキスタン地質調査所（G S P）紹介用パンフレット



جیولوجیکل سروس پاکستان

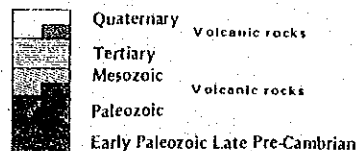
# GEOLOGICAL SURVEY OF PAKISTAN

## FACTS AND FIGURES

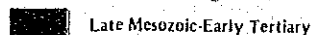


### EXPLANATION

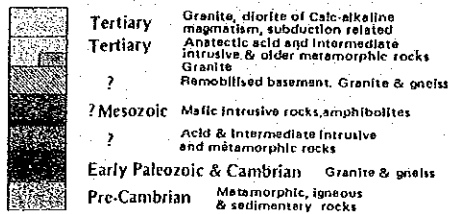
#### Sedimentary & Volcanic Rocks



#### Ophiolites & Melange



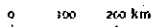
#### Intrusive & Metamorphic Rocks



Volcanoes

Faults

Compiled by Waheeduddin Ahmad, S. Ibrahim Shah, Abul Farah, M.W.A. Iqbal & Zaki Ahmad from Bakr & Jackson, 1964; Tahirkheli & Jan, 1979; W. Ahmed, 1980, and Kazmi, 1980.



GEOLOGICAL MAP OF PAKISTAN

PUBLISHED UNDER THE DIRECTION OF THE DIRECTOR GENERAL  
GEOLOGICAL SURVEY OF PAKISTAN

1986



## GEOLOGICAL SURVEY OF PAKISTAN TODAY

### Introduction

The Geological Survey of Pakistan is an attached department under the Federal Ministry of Petroleum & Natural Resources. It was established in 1947 with its office at Quetta with only five geologists. It had no laboratory facility at that time for providing technical support to field officers.

Geological Survey today is an important national department with its headquarters at Quetta and well established zonal offices at Islamabad, Karachi, Lahore and Peshawar and also at Muzaffarabad in Azad Jammu & Kashmir.

During the 39 year's life of the organization the logistic, field and laboratory support in GSP have been substantially improved. It has today chemical and other laboratory facilities available at Karachi, Lahore, Quetta and Peshawar.

Substantial areas of the country have been brought under mapping coverage. Of the total outcrop area of Pakistan, 83% has been covered on 1:250,000 and 33% on 1:50,000, scale. The stratigraphy and its nomenclature is better known today than it was in 1947.

Geologic, tectonic, siesmo-tectonic, mineral and fuel resources maps on 1:2,000,000 have been published. In addition about 108,000 and 159,885 square kilometers have been covered by aeromagnetic and ground geophysical surveys, respectively.

The country's coal basins are better defined and data on individual coalfields with number of workable coalseams, their strike extensions, thicknesses and reserves with maps and reports are available.

The mineral inventory base of the country has been significantly improved. Deposits of copper, iron, lead-zinc, chromite, uranium and industrial minerals required in flux, fertilizer, glass, ceramic, refractories, mud chemicals and marble industries have been added.

Since its inception, the Geological Survey of Pakistan has explored, proved or defined major mineral wealth with in-situ value of over Rs. 758.8 billion. The exploratory efforts of the GSP made in Bangladesh (former East Pakistan) have not been reflected here.

### Functions and Charter of GSP

The Geological Survey of Pakistan is fundamentally concerned with the question of providing comprehensive resources inventories and a clear understanding of the geological framework of the country, so as to become interpretable in terms of all national activities that make use of, or are affected by geological phenomena.

With this basic aim in view, the GSP carries out various purposes geological, geochemical, sedimentological, faunal, geophysical and mineral resources surveys of different areas of Pakistan on appropriate scales.

These surveys and other supporting studies provide technical data bases of

immense value, the analysis of which enables the geotechnicians to delineate geologic, sedimentologic, geochemic and geophysical anomalies and their dispersion patterns. Location and distribution of aforementioned anomalies leads to delineate metallogenic epochs and zones.

The Chagai Island Arc in Baluchistan and Kohistan Island Arc in NWFP have good potential for the discovery of porphyry type copper, gold and molybdenum deposits and massive sulphide type deposits of copper, lead - zinc, etc. These areas have a reasonably good potential for the localization of epithermal gold, tin and tungsten deposits. The ophiolite suites of Lasbela, Zhob and Waziristan are expected to contain chromite, maganese and massive sulphide type copper deposits. The shelf carbonate rocks in NWFP and Baluchistan have good potential for lead - zinc - barite - fluorite mineralization.

Geologic mapping and mineral resources exploration are therefore synonymous and inseperable. The programme and purpose of mapping would therefore, differ from region to region within a province or from a province to another depending on the particular geologic, mineral and tectonic framework. A clear understanding of the total geology, therefore, requires exhaustive coordinated efforts of field geologists, petrologist, mineralogists, sedimentologists, paleontologists, geophysicists, chemists and even the support of drilling engineers.

### CAPABILITIES AND FACILITIES AVAILABLE IN GSP

The GSP is capable of addressing all geologic, sedimentologic, paleontologic, stratigraphic, petrologic - mineralogic studies; structural and tectonic problems, photo-interpretation of data, chemical analyses and exploratory cum assessment drilling for the evaluation of coal and mineral resources.

GSP is now capable of undertaking from 14000 to 1'6000 km<sup>2</sup> of geologic mapping annually beside the aforementioned basic cum research studies, regional and detailed geochemical and geophysical surveys.

The following facilities are available at GSP Headquarters and various regional centres.

#### Headquarter's Office, Quetta

- \* Chemical laboratory equipped with conventional/instrumental analysis.
- \* Petrologic-mineralogic laboratory equipped with X-ray diffraction, radiometric assaying, spectroscopy, etc.
- \* Paleontologic-stratigraphic laboratories equipped with invertebrate and vertebrate fossil processing facility.
- \* Photogeologic and photogrammetric branches equipped with stereoploting equipment, stereoscopes, surveying equipment, etc. Aerial photographs and satellite imageries of large areas of Pakistan are also available.

- \* Geophysical laboratory equipped with seismic, gravity, magnetic, induced polarization, electromagnetic and resistivity instruments.
- \* Publication Branch equipped with drafting, photo-enlargement & color plates development; offset duplicator and plate making facilities.
- \* Drilling Branch equipped with 6 operational rigs to drill 6,000 to 9,000 meters each year. The capability with available drilling equipment is to drill 500-600 meters depth hole.
- \* Rocks and minerals museum with 1296 samples.
- \* Library with 25,000 books and 50,000 periodicals.
- \* A reasonably equipped workshop for the vehicles and drilling rigs.
- \* A national stratigraphic and core library stocked with data and core samples from oil companies.

#### N.W.F.P. Zonal Office - Peshawar

- \* Petrology - mineralogical laboratory.
- \* Limited Library facilities.

#### Northern Areas - Azad Jammu & Kashmir

- \* Limited library facilities.
- \* Petrology and mineralogy laboratory.

#### Punjab Zonal Office - Lahore

- \* Chemical laboratory with A.A. unit and conventional analysis facilities.
- \* Geophysical laboratory with magnetic,

gravity and resistivity equipment facilities:

- \* Two drilling rigs with accessories;
- \* Limited library facilities.

#### Sind Zonal Office - Karachi

- \* Chemical laboratory with AA unit and conventional analysis facilities.
- \* Geophysical laboratory with magnetic gravity and resistivity equipments.
- \* Petrology & mineralogy laboratory.
- \* Publication section with drafting and color processing facility.
- \* Two drilling rigs with accessories.
- \* Library facility.

#### BUDGET FOR 1986-87

The total budget of GSP for 1986-87 is Rs. 108.932 million out of which Rs. 54.306 million is the regular budget and Rs. 54.626 million is the ADP for 17 development projects. The development budget includes FEC of Rs. 32.110 million which is grant in aid committed by USAID, JICA and UNDP.

#### COLLABORATION WITH OTHER GEOSCIENTIFIC AGENCIES

##### International Collaboration

- \* With Harvard University, USA for bio-stratigraphic studies.
- \* With Howard University USA for studies in fossil mammals.

- \* With U.S. Geological Survey through U.S. AID for assessment of country's energy resources.
- \* With U.N.D.P. for the exploration and assessment of lead-zinc resources of Khuzdar District.
- \* With JICA for the evaluation of Surmai lead-zinc deposit.
- \* With British Archeological Mission and Department of Archeology Govt. of Pakistan.

#### National Collaboration

- \* With Irrigation Department of Baluchistan Government for foundation studies of small dams.
- \* With Baluchistan Government for the evaluation of parts of Sor Range and Khost-Sharig-Harnai coalfields.
- \* With State Cement Corporation of Pakistan for the study of cement, raw materials and groundwater resources.
- \* With FATADC for the investigation of copper in Waziristan.
- \* With Frontier Works Organization for study of Lowari tunnel, NWFP.
- \* With Armed Forces of Pakistan for geo-scientific investigations in various parts of Pakistan.
- \* With Environment Division of Government of Pakistan for the study of land-slides in Murree area and along Karakorum Highway.

#### MAJOR CUMULATIVE EFFORTS SINCE INCEPTION

##### Geologic Mapping

On 1:250,000 549,000 Km<sup>2</sup>.

Accomplishment is 83% of the total out-crop area.

On 1:50,000 scale 217,000 Km<sup>2</sup>.

Accomplishment is 33% of the total out-crop area.

##### Geophysical Surveys

Aeromagnetic survey 108,000 Km<sup>2</sup>.

Ground magnetic 159,885 Km<sup>2</sup>.

Ground gravity 159,885 km<sup>2</sup>.

Accomplishment is 73% of the total plain area.

Exploratory Drilling 73,767 meters

##### Mineral Resources Exploration/Evaluation

##### Coal

The different coalfields of Pakistan were studied in details with proved reserves ascertained to 186 million tonnes. Large scale geologic maps and reports were issued on Duki, Daghari, Lakhra, Thatta-Sonda and Salt Range coalfields. The major new coalfield of Thatta-Sonda was identified. The limit of the coalfields to the east of river Indus is scheduled to be drill explored during 1986-87.

##### Copper

A total of 10 porphyry copper molybdenum manifestations were recorded in the Chagai District and a couple of massive copper prospects were identified in Waziristan and Bela area.

The deposits of Saindak was identified

by GSP and drill explored and proved by RDC. GSP confirmed another five small to medium size porphyry copper-molybdenum deposits at Dasht-e-Kain, Kabul Koh, Koh-i-Dalil, Missi and Ziarat Pir Sultan.

#### Fluxing minerals

Dolomite and fluorite are the two main fluxing minerals now being utilized in the steel industry. Large deposits of dolomite were identified in Jhimpir, Chiltan range and Salt Range areas. The mines at Jhimpir are being operated by Pakistan Steel.

The Phade Maran and Dilband fluorite deposits were explored and assessed by GSP. The deposits are being explored by the Baluchistan Development Authority and part of the production is being sold to Pakistan Steel.

#### Fertilizer minerals

Gypsum, rock phosphate and sulphur the main fertilizer minerals were identified and explored by the GSP.

Large deposits of gypsum were identified in D.G. Khan, Mianwali, Kohat, Sibi and Loralai districts. Some of the deposits in D.G. Khan and Mianwali districts are in production.

Small deposits of rock phosphate and sulphur were explored and proved. Rock phosphate is now being exploited by the Sarhad Development Authority and the Sulphur deposits in Koh-i-Sultan are being partly exploited by private companies and B.D.A.

#### Glass, ceramics and refractory minerals

China clay, fire clay, bauxite and silica sand resources were explored and assessed in N.W.F.P., Punjab and Sind. The deposits are being partly mined.

#### Iron

All the known iron ore resources of the country were explored and assessed by the GSP in collaboration with PMDC & PIDC. The total estimated or proved reserves of iron ores in Chitral, Chagai, Hazara-Kalabagh and Salt Range stand at over 400 million tonnes.

#### Lead-zinc-silver

A new carbonate shelf belt with a very good potential of Mississippi valley type lead-zinc-silver deposits was identified and explored in the Khuzdar district of Baluchistan.

About 10 million tonnes lead-zinc-silver with over 6% combined lead-zinc was partly proved at Gunga. Extensive lead-zinc mineralization has also been identified at Malkhor, Shekran and Surmai.

JICA is collaborating in the exploration of Surmai Prospect. Baluchistan Development Authority is proposing to undertake processing studies on the representative samples to be collected from the Gunga prospect.

#### Mud Chemicals

About 10 million tonnes bedded and alteration barytes deposits were identified and proved at Gunga by the GSP.

The deposits are being worked at present by the Bolan Mining Enterprises.

#### Onyx & White marble

Very large deposits of crystalline white and onyx marble were identified and explored by GSP in Mahmand and Dir Agencies, Chitral, Mardan and Chagai Districts.

All these deposits are being partly exploited. As the marble is not being extensively used as a building stone, its mining is very limited.

Onyx marble deposits are being at present exploited by private companies mainly for export purposes.

#### Uranium

Small secondary deposits of carnotite and meta-tyuyamunite in channel sediments were assessed by GSP and Pakistan Atomic Energy Commission in D.G. Khan district. More such occurrences have been discovered in Siwalik sequences in other parts of the country.

A new prospective basin has been pointed out for exploration in the Chagai district.

#### Chemical Analysis

Samples 23,616  
Estimations 73,767

#### Publications

Maps 75 Nos.  
Reports 546 Nos.

#### DISCOVERIES IN MINERAL FIELD

##### Tungsten and tin

A new quartz porphyry disseminated/vein tungsten-tin prospect was discovered north of Saindak porphyry copper zone in 1986. The deposit is being studied. A large area is scheduled to be brought under investigation during 1986-87.

#### PROGRAMMES FOR 1986-87

A comprehensive programme for field and laboratory investigations has been planned for the year 1986-87. The programme lays stress on basic geologic mapping, coal resources evaluation, mineral resources exploration, basic support research surveys and studies in the field of palaeontology-stratigraphy, petrology-mineralogy, geophysics and chemistry.

New programmes have been added in the applied geology fields to take care of pressing needs of administrators and city planners.

Publication efforts have been enhanced substantially enabling GSP to deliver technical data, reports and maps at the subdivision, district and provincial levels. The summarized goals for 1986-87 are given

as under:-

Geologic mapping

On 1:50,000 scale	
Field mapping	17,796 Km <sup>2</sup> .
Mapping through photo-interpretation)	8, 960 Km <sup>2</sup> .
No. of projects	27
Technical manpower to be engaged	55

Economic Geology

Mainly with a view to assess the potential of: Lead-zinc, gold-silver, tin & tungsten, base metals, industrial rocks & minerals.

No. of projects	18
Technical manpower to be engaged	56

Coal Exploration and Evaluation

Coalfields to be studied	
Lakhra	Partial evaluation
Sonda	"
Khost-Sharig-Harnai	"
Sor Range	"
Cherat	Re-assessment
Kotli	"
Salt Range	Partial evaluation
No. of projects	7
Technical power to be engaged	31

Abbottabad areas.	
No. of projects	2
Technical man power to be engaged	5

Applied Geology

Urban area mapping and geotechnical investigations in Norriabad, Kohistan areas of Dadu District, Gilgit and Northern areas.

No. of projects	4
Technical man power to be engaged	11

Publications

Main emphasis is to issue:-

	(multi colors)	(two or three colors)	
Geologic maps (1:50,000)	8	15	23
	(Sind, Axial belt & N.W.F.P.)	(Punjab Div. & Chagai).	
Metallogenic maps (1:500,000)	1		1
	(Chagai Distt.)		
Geologic maps of Chagai	4		4
Environmental Geology Maps	1 (Lahore).		1
Seismic risk map of North Pakistan	1		1
Hydrogeologic & Chemical map of Thano Bula Khan District	2		2
Total maps			32

Geologic mapping support and research projects

a) Paleontology & Stratigraphy

No. of projects	6
Technical man power to be engaged	23

b) Petrology and mineralogy

No. of projects	4
Technical man power to be engaged	11

c) Chemistry

No. of samples to be handled	21,000
Technical man power to be engaged	27

d) Geophysics

i) No. of projects for tectonic and basic structures	5
Technical man power to be engaged	13
ii) Detailed geophysical exploration/mining	
No. of projects	5
Technical manpower to be engaged	19

Exploration geochemistry

Mainly with a view to provide dispersion pattern of metal elements to help in mineral exploration.

For chalcophile elements in Bela & 7

Records/memoirs	7	7
Mineral Information Series	4	4
Mineral Monograph Series	4	4
Mineral Resources Inventory	1	1
Information Release Series	5	5
Total reports	21	
Total publications		53

DEVELOPMENT PROJECTS

The provision of expenditure in the regular budget of the GSP is highly inadequate to cover fully the TA/DA and miscellaneous contingent expenses on regular and special projects which are required to be completed within a given time frame. The GSP submits to the Ministry of Petroleum and Natural Resources the PC-II and PC-I schemes on specific projects for execution under the Development Head. The cost of field operations under regular and development schemes is mostly met through funds available under various development schemes.

Besides the regular field programmes, GSP at present has a total of 17 development schemes under various stages of execution. Four of the listed 17 projects are the aided ones wherein FEC of Rs. 32 million approximately will be provided by UNDP, JICA USAID and USNSF during 1986-87 as grant-in-aid. Another project of 'Establishment of Chemical and Petrolabs has been proposed by GSP for which JICA has consented to provide Rs. 162.0 million in FE as grant-in-aid. The concept of this project has been cleared by the Government of Pakistan.



The titles, period of execution and the costs of the development projects are given as under:-

Titles	Years	Cost in million Rs.
1. Establishment of National Geodata Centre at Islamabad.	1985-87	2.85
2. Establishment of Report Printing, Cartographic and Scribbling Facilities.	1985-88	6.75
3. Construction of Residential Accommodation for GSP's Employees at Quetta.	1985-87	9.03
4. Construction of Laboratories for the GSP at Islamabad.	1985-87	8.388
5. Establishment of Paleontological and Sedimentological Laboratories at Islamabad.	1985-88	4.1
6. Construction of Laboratory Buildings for the GSP at Lahore.	1986-88	9.1
7. Construction of Laboratory Building for GSP at Karachi.	1986-88	9.4
8. Exploration of Paleozoic Coal in Punjab Division.	1986-89	9.5
9. The Salt Range Tertiary Coal Exploration, Punjab, Pakistan.	1986-89	9.298
10. Exploration and Evaluation of Kohst-Shahrig and Harnai Coal Fields, Baluchistan.	1986-88	9.6

11. Exploration of Minerals Associated with Acid Magmatism.	1986-90	23.0
12. Geological Appraisal of Mineral Resources of Azad Jammu and Kashmir (GSP-AKMIDC Joint Project).	1986-89	9.620
13. Accelerated Geological Mapping and Mineral Exploration Programme.	1986-87	6.5
14. Energy Planning and Development, Umbrella Project (Coal Resource Assessment). A GSP-USAID Collaborative Project.	1985-89	99.67
15. Tectonics and Mineral Resources of Northern Pakistan (GSP-Oregon State University, USA Joint Project).	1982-87	3.608
16. Exploration of Lead-Zinc Prospects in Lasbela-Khuzdar Metamorphic Belt, Baluchistan, (GSP-UNDP Joint Project).	1986-89	7.95
17. Exploration and Development of Surmai Lead-Zinc Project, Khuzdar District, Baluchistan, (GSP-JICA Joint Project).	1986-89	38.37

#### MAN POWER DEVELOPMENT

A total of 87 projects are planned to be undertaken during the financial year 1986-87; About 760 man months of work from technical officers of all cadres are required to undertake the assigned jobs. The present total technical strength of GSP

stands at 265 officers, more than 93% of whom will be needed to man the operations in the Provinces, Federal Territories, Tribal and Centrally Administered areas of the country. As it can be seen from table 2, there is acute shortage of supervisory technical staff at the Director's and Deputy Director's level. The present shortfall is planned to be met by engaging the available officers in more than one and different types of projects, which would enable us to complete the commitments and achieve the results.

However, it is possible that in some cases we may not be able to fully achieve the envisaged targets. To partly solve the problem short falls are planned to be met by utilizing senior Assistant Directors to supervise the field operations.

The shortage of supervisory staff has created a serious gap in GSP's training, efforts and programme leading to weaknesses now being felt in various technical specialized fields.

The programme of manpower development therefore, is to be undertaken on priority considerations if GSP is to deliver goods at the grass root level in fulfilling the aspirations of the nation and providing technical data on the mineral resources to people at subdivisions, district and provincial level for the better and purposeful utilization of development funds and for ameliorating the living conditions of their people.

GSP would thus submit a comprehensive programme for training of its technical staff so that research gaps so vital for

realising the objectives of GSP could be narrowed down in the shortest possible time.

GSP with the help of the Ministry of Petroleum and Natural Resources will partly meet the training requirements through UNDP, Colombo Plan, JICA, USAID, ITC and other such programmes offered by the aid giving international agencies.

#### PERSPECTIVE PLANNING FOR 1988-93 (Seventh 5 Year Plan)

The Geological Survey of Pakistan is re-orienting its operational plans and taking steps to streamline the field and laboratory facilities.

Agreement on collaborative projects with improvements in laboratory and exploratory drilling equipment facilities have been signed with USAID, UNDP and JICA. Modern coal assay, petrology-mineralogy and geochemistry laboratories are planned to be set up at Islamabad, Karachi and Quetta.

Administrative and executive steps have been taken in getting new laboratories and office facilities built at Islamabad, Karachi, Lahore, Peshawar and Quetta.

It is expected that by the end year 1988, most of the construction and equipment installation work in the laboratories will be completed at various centres. With improved field, exploration and laboratory equipment facilities, GSP will then be in a position to shoulder increased responsibilities. Thus the 7th five year plan will be designed so as to enhance the

following targetted production:-

**Geologic mapping**

- i) 1:50,000 60,000 Km<sup>2</sup>
- ii) 1:250,000 40,000 Km<sup>2</sup>

**Mineral Resources exploration/assessment**

- i) Assessment of basemetal resources;
- ii) Assessment of gold in green stone complex and volcanic rocks;
- iii) Assessment of tin-tungsten mineralization;
- iv) Assessment of lead-zinc-silver in shelf carbonate environment;

**Energy resources assessment**

- i) Exploration and evaluation of segments in Khost-Shahrig-Harnai, Sor Range, Mach-Abegum coal fields in Baluchistan, Salt Range coal fields in Punjab and Thatta-Sonda coalfields in Sind.

**Basic and applied research**

- i) Geochemical coverage of promising areas on 1:250,000 or 1:50,000;
- ii) Geophysical coverage, regional as well as detailed;
- iii) Development of data files;
- iv) Basin and domain studies on carbonate, detrital, volcanic, igneous and metamorphic rocks;
- v) Petrogenesis and age dating of rocks;
- vi) Sedimentary rocks and stratigraphic studies.

All the above listed studies will allow GSP to develop the following types of end product reports and maps for the use of district, sub-division and urban centre administrators and planners:

- i) Geologic and coal resources maps and reports in multi and tri colors (1:50,000 & 1:250,000); 100
- ii) Metallogenic maps; 4
- iii) Seismic zonation maps; 4
- iv) Regional gravity and ground magnetic maps on 1:2,000,000 and 1:500,000; 5
- v) Geochemical maps; 2
- vi) Records, Memoirs, Mineral Monographs, Mineral Information Series and Information Release reports. 150
- vii) Mineral resources inventory and environmental geology maps and reports of: Khuzdar, Loralai, Uthal and Bela in Baluchistan; Karachi, Hyderabad, Sukkur and Badin in Sind; D.G. Khan, Attock, Sargodha, Khushab, Jhelum, Rawalpindi and Islamabad in Punjab; Peshawar Kohat, D.I. Khan, Bannu and Abbottabad in N.W.F.P.; Muzaffarabad and Kotli in AJ&K; Gilgit and Drosh in Gilgit and Chitral state.



MINISTRY OF PETROLEUM & NATURAL RESOURCES  
GEOLOGICAL SURVEY OF PAKISTAN

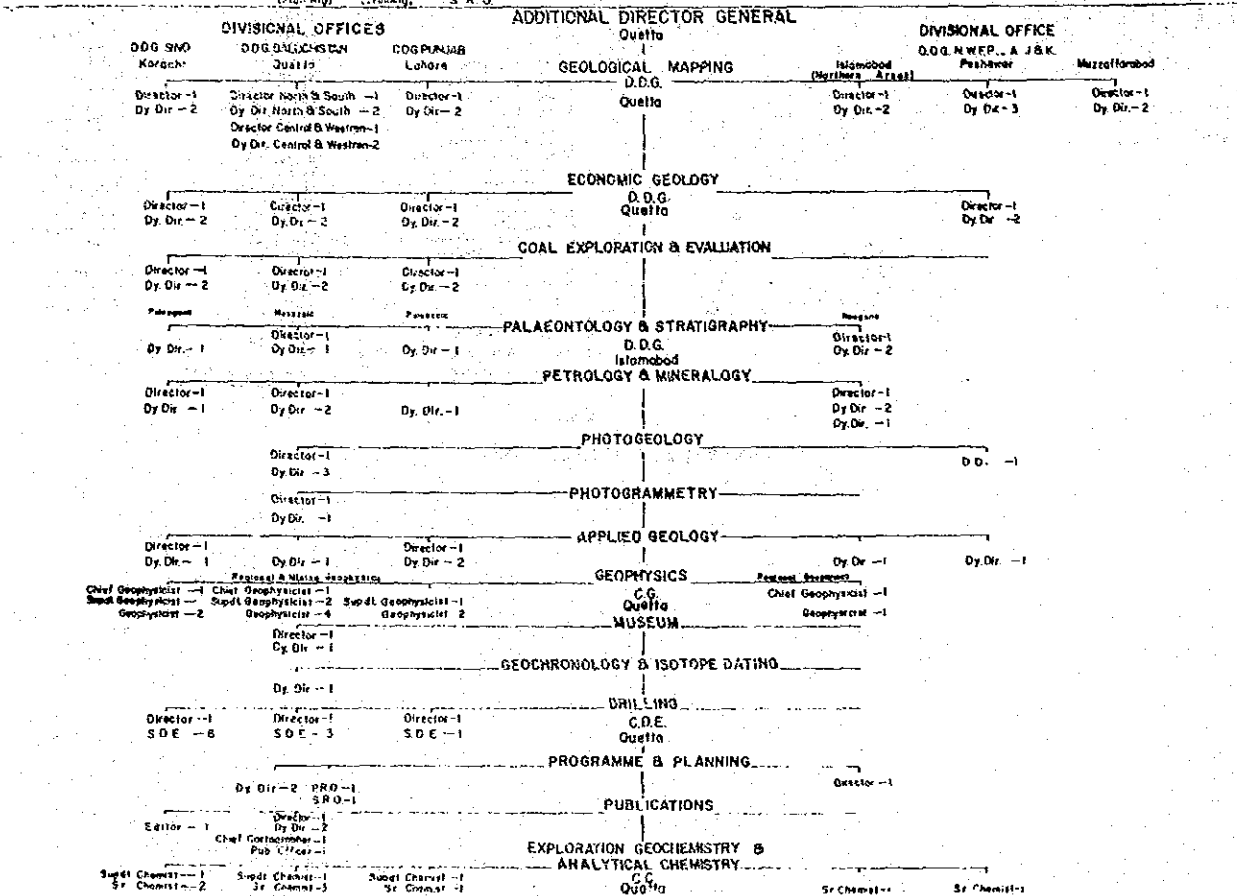
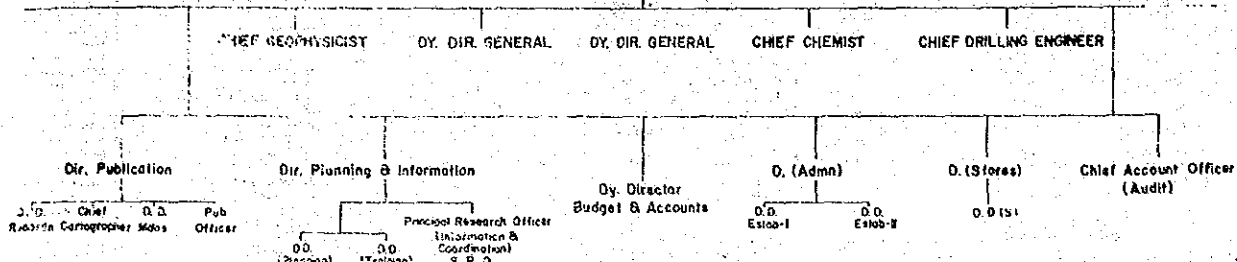
DIRECTOR GENERAL

ADVISORY COMMITTEE

Sub Committee  
on  
Publication

Sub Committee  
on  
Training & Scholarship

DEPARTMENT



- DEVELOPMENT PROJECT**
- EMER PLAN**
    - Coal Resources Assessment: Project Director (M. Khan)
    - Exploration of Lead-Zinc: Project Director (S. Khan)
    - Exploration of Lead-Zinc: Project Director (S. Khan)
    - Construction of Laboratories: Project Director (S. Khan)
  - Exploration & Evaluation**
    - Exploration of Coal: Project Director (S. Khan)
    - Exploration of Lead-Zinc: Project Director (S. Khan)
    - Exploration of Lead-Zinc: Project Director (S. Khan)
  - Establishment of National Geologic Centre**: Project Director (M. Khan)
  - Establishment of PBS Laboratories**: Project Director (S. Khan)
  - Construction of Laboratories**: Project Director (S. Khan)
  - Testing & Mineral Resources**: Project Director (S. Khan)
  - Exploration of Minerals Associated with Acid Magmatism, NWFP**: Project Director (S. H. Gouhar)
  - Geological appraisal of mineral resources of Azad Kashmir**: Project Director (Zohr Ahmad)



**LEGEND**

- |                        |                     |                  |
|------------------------|---------------------|------------------|
| ○ ANTIMONY             | ○ GRANITE           | ○ ROCK PHOSPHATE |
| ○ ARSENIC              | ○ GYPSUM            | ○ ROCK SALT      |
| ○ ASBESTOS             | ○ IRON              | ○ SOAPSTONE      |
| ○ BARIITE              | ○ KADLIN (CMAK 40%) | ○ SULPHUR        |
| ○ CELSISTITE           | ○ LATERITE          | ○ TUNGSTEN       |
| ○ CHROMITE             | ○ LEAD              | ○ VERMICULITE    |
| ○ COPPER               | ○ MAGNETITE         | ○ ZINC LEAD      |
| ○ DOLOMITE             | ○ MANGANESE         | ○ ZINC SILVER    |
| ○ FLUORITE             | ○ MARBLE/ARAVERTINE |                  |
| ○ GRANITE (B-JUNG HMM) | ○ MICA              |                  |

**GEM STONES**

- AQUAMARINE
- EMERALD
- RUBY
- TOPAZ

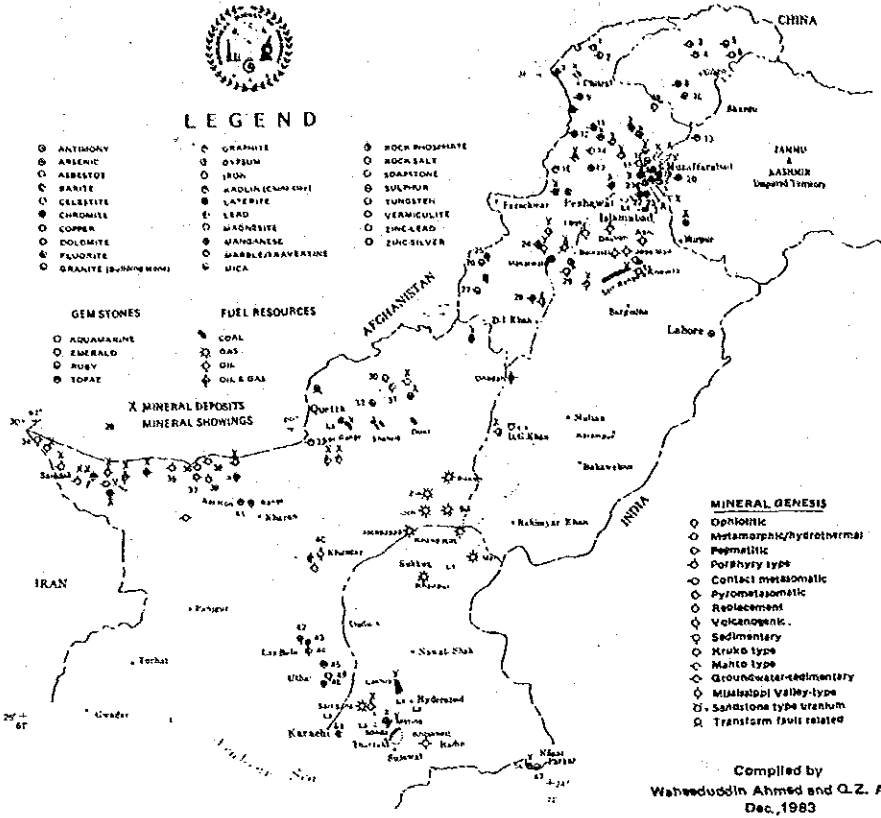
**FUEL RESOURCES**

- COAL
- GAS
- OIL
- OIL & GAS

**X MINERAL DEPOSITS  
MINERAL SHOWINGS**

**MINERAL GENESIS**

- Ophiolitic
- Metamorphic/hydrothermal
- Pegmatitic
- Porphyry type
- Contact metamorphic
- Pyrometamorphic
- Replacement
- Volcanogenic
- Sedimentary
- Krato type
- Mahto type
- Groundwater-sedimentary
- Mississippi Valley-type
- Sandstone type uranium
- Transform fault related



Compiled by  
Wahneuddin Ahmed and Q.Z. Abrid  
Dec, 1983

**MINERAL MAP OF PAKISTAN**

**MINERAL DEPOSITS**

S No. Locations

1. Kadir
2. Dammaj Nissar
3. Jhal
4. Shah Dheer
5. Mingora-Ahpor
6. Pajang
7. Rajshawali
8. Asja Shilal Patti
9. Deper
10. Chura Qab
11. Shetwan
12. Sherwan
13. Sheswan-Sirban
14. Kurnhar
15. Makul-Lagarband-Dolai
16. Kohala
17. Mutia Ghori
18. Ghundal Yarko
19. Kohat
20. Kottli
21. Bahadur Khel
22. Kalasbogh
23. Kalasbogh
24. Deou Khel
25. Khawra
26. Manti Rogha
27. Gungram
28. Sialoweli
29. Warcha
30. Zhoi
31. Sola Kan
32. Muslimbogh
33. D.G. Khan
34. Koh-I-Maran
35. Diliband
36. Maki Chah
37. Saindak
38. Koh-I-Dattil
39. Pachin Koh
40. Masuki Chah
41. Mashki Chah
42. Koh-I-Sultan
43. Junji-Balanosh
44. Gaste-Kain
45. Res Koh
46. Res Koh
47. Gunga-Khuzdar
48. Thand Buis Khan
49. Jhimpir
50. Nagar Parkar
51. Zaid Kan
52. Zen

Limestone: Purple deposits  
through out Pakistan

**MINERAL SHOWINGS**

S No. Locations

1. Aghin
2. Pak-Tori
3. Chaurusan
4. Chait
5. Hunza
6. Maittan
7. Qobako-Beck
8. Singai
9. Kistam Gof
10. Fohait
11. Ushait
12. Baira-Cambot
13. Chotla Kari Nag
14. Chaldara
15. Osh
16. Haws Qall
17. Kotsing
18. Haws Dand
19. Oshitan
20. Muzi-Izarabot
21. Hali-Almat-Pawet
22. Lantiral
23. Faqi-Mohammed
24. Kohat
25. Dattil Khaf
26. Manti Rogha
27. Gungram
28. Pazu
29. Deou Khel
30. Zhoi
31. Muslimbogh
32. Zharit
33. Shetich Walli
34. Talaruk
35. Darband Chah
36. Zharit Pir Sultan
37. Chit-hazi
38. Koh-I-Marshil
39. Kunt-Baluchap
40. Shetran
41. Rancegan
42. Kohon Jhal
43. Siro Dhoro
44. Dzu
45. Dhoindar
46. Kharitil
47. Nagar Parkar
48. Dzu
49. Sap Dhoro

< 資料 4 >

パキスタン地質調査所の業務概要



GOVERNMENT OF PAKISTAN  
GEOLOGICAL SURVEY OF PAKISTAN



**ACTIVITIES ACHIEVEMENTS AND PROGRAMME  
OF  
THE GEOLOGICAL SURVEY OF PAKISTAN**

ISSUED BY THE DIRECTOR GENERAL, GEOLOGICAL SURVEY OF PAKISTAN, QUETTA

JANUARY, 1988

## BRIEF ON ACTIVITIES AND ACHIEVEMENTS OF GEOLOGICAL SURVEY OF PAKISTAN

### INTRODUCTION:

The Geological Survey of Pakistan is an attached Department of the Ministry of Petroleum and Natural Resources. It is a national organization responsible for the study of the geology of the country in all its related details and to make a scientific assessment of country's resource potential.

The activities of the Geological Survey of Pakistan have been organized into various Divisions and Directorates, each dealing with a specified technical field and administrative matters. The headquarters of the GSP is located at Quetta whereas regional offices have been established at Karachi, Peshawar, Lahore, Islamabad and Muzaffarabad. The regional offices are responsible for geo-scientific activities in their respective areas.

Small sections of geophysics, chemistry and drilling have been added to the regional offices to ensure efficient implementation of their field projects. However, special research facilities for advanced studies continue to remain at the headquarters.

### HISTORICAL PERSPECTIVE:

The Geological Survey of Pakistan was established in 1947 with only 5 geologists of the Geological Survey of India who opted to serve in Pakistan. However it steadily expanded and by mid sixties, aided by large scale USAID technical and financial assistance it attained a strength of 240 technical officers and more than 1400 support staff. During this period GSP created vast complex of office and laboratory buildings at Quetta and established the then most modern laboratories and specialized branches in different disciplines of geoscience. Through USAID/USGS a large number of technical officers received on the job training in Pakistan and specialized training in USA.

Before Independence, the Geological Survey of India had mapped only an area of 7680 sq. km in the territory now forming Pakistan. After Independence the geological mapping programme was accorded very high priority by GSP and by 1960 it had collected sufficient field data about the general geological set up of the country that it enabled



the publication of the first ever geological map of Pakistan in 1964 on a scale of 1 : 200,000. This was the most outstanding achievement of GSP in the early years of its establishment. An area of about 537,970 sq. km was brought under reconnaissance mapping coverage on the scale of 1 : 250,000 and 1" = 4 miles. With the accumulation of this reconnaissance data it was then possible to initiate systematic regional geological mapping whose scale was thereafter standardized on 1 : 50,000 scale and is being currently followed. The regional mapping was adequately supported by other geoscientific data and exploratory drilling for a scientific and systematic assessment of natural resources of the country.

#### CAPABILITIES AND FACILITIES AVAILABLE IN GSP.

The GSP is capable of addressing all geologic, geophysical, seismologic, sedimentologic, paleontologic, stratigraphic, petrologic, mineralogic, structural and tectonic problems. Facilities exist for photo-geologic interpretation, computer indexation of data, chemical analyses of samples and exploratory drilling to evaluate mineral resources of the country. Limited facilities for publication of maps and reports also exist in GSP. These facilities are being upgraded through the technical and financial support of USAID, UNDP and JICA.

Recently the sections of Exploration Geochemistry, Mining Geophysics, Geodata Centre and Economic Geology have been added to further boost the mineral resources assessment programmes and data processing activities of GSP.

GSP can map an area of about 12000 sq. km on 1 : 50,000 annually, besides the aforementioned basic research studies and allied investigations.

#### BUDGET AND PERSONNEL:

The total budget allocation to the Department for the financial year 1987-88 is Rs.126.03 million. Of this, Rs.45.93 million are provided for current expenditure under the regular head and Rs. 80.10 million are earmarked to meet expenditure for eighteen development projects to be implemented in different parts of the country.

The sanctioned personnel strength of the GSP is 1623. There are 374 officers (186 geologists, 28 geophysicists, 28 chemists, 42 drilling engineers, 11 photogrammetrists, 79 other professional including officers

from establishment and accounts branches and 1249 support staff).  
The organizational chart of GSP is enclosed.

#### ACHIEVEMENTS:

GSP has now recovered from the set back of 1971 war when we lost our trained manpower and equipment to East Pakistan, (now Bangladesh) and faced major brain drain and mass dispersal of technical manpower during 1974-80. As a result of renewed efforts we have been able to study the geologic and tectonic framework and resources potential of the country. An area of 228,520 km<sup>2</sup> has been mapped on 1: 50,000 scale. The geological mapping is supplemented with field and laboratory studies. 85 maps and 522 reports have so far been published. As a result of these geoscientific investigations a number of mineral deposits of economic significance have been identified and evaluated. Summary of major achievements of GSP is given in the enclosed annexure. Comparison of the (average) yearly achievements is given in Table-I.

#### PROGRAMME:

Although regional geologic coverage of the country is adequate, yet nearly three-fourth of it still needs to be mapped and studied intensively, and as the pace of economic development in Pakistan is increasing the demand for geologic and resources information that GSP should provide will also increase. This increase is reflected in the envisaged targets of the year 1987-88 and the 7th Five Year Plan (1988-93) which are summarised as under:-

##### Programme for 1987-88:

- i) Geological mapping of 11,000 sq. km area on 1 : 50,000 scale.
- ii) Geophysical coverage of 7500 sq. km area.
- iii) Exploration of metallic minerals and coal in collaboration of UNDP, USAID.
- iv) Drilling of 10,000 meters and analyses of 4400 samples.
- v) Publication of 19 maps and 20 reports.

##### Programme for 1988-93:

- i) Geological mapping on 1 : 50,000 scale and updating of previous coverage; 100,000 sq. km.
- ii) Geophysical investigations of 40,000 sq. km.
- iii) Exploration of metallic minerals with emphasis on lead, zinc, silver, and gold in collaboration with UNDP and JICA. Assessment of coal resources of Pakistan in collaboration with USAID.

To achieve the above targets, GSP will need to overcome bottlenecks and deficiencies in many of its functional areas like field and laboratory instrumentation, logistic, support, operational budget and specialized foreign training. The GSP is planning to restructure its operational and specialised units and modify some of its management policies and procedures. Detailed proposals have already been submitted to the Ministry to overcome some of the above inhibiting factors with a view to optimize GSP's efficiency and the output.

A brief description of the policy programmes of GSP is given in the following pages.

## POLICY PROGRAMME

### Objective:

Introducing short term and long term policy programmes with a view to achieve technical goal of accelerated geological mapping and systematic and scientific assessment of mineral resources of the country.

### Shortcoming and Inhibiting factors:

- i) Loss of trained manpower and equipments to East Pakistan (now Bangladesh) in 1971.
- ii) Personal and selfish considerations overriding the national and departmental needs resulting in;
  - a) Brain drain for more lucrative jobs within and outside Pakistan.
  - b) Mass dispersal of manpower and the specialized branches from GSP headquarters Quetta to regional offices resulting in weakening of specialized units and science assuming the role of generalism and system converting to adhocism.
- iii) Private hiring of GSPs, regional offices in 2 to 3 buildings, widely apart resulting in (i) loose administrative and technical control (ii) duplication of efforts, (iii) insecurity of installation of laboratory equipment, telex, computer and other facilities due to shifting of the premises on the desire of landlords.
- iv) Deterioration of Publication Branch due to inadequate funds and technical manpower (craftsmen, scribes, colour separators etc.) resulting in less production of maps and reports - the end product of chartered work of GSP.

The accumulated backlog of unpublished work resulting in duplication of efforts due to the loss of some important technical data and manuscripts.
- v) Lack of equal opportunities in specialized training & promotion and transfers of scientists serving in different scientific cadres of GSP.
- iv) Inadequate residential accommodation facilities of field officers at Quetta and inadequate operational Funds resulting in slow progress.
- vii) Lack of incentive for good and productive workers and absence of system of accountability.

To overcome the above difficulties we submitted to the Ministry during 1984-87 proposals on short term and long term policy programmes. Some of these proposals have been approved by the Ministry, others are being favourably considered. The results of these measures and the implementation status are given as under:-

#### A. Policy Programmes bearing Immediate Results:

##### Publication:

With the approval of Ministry reviewers with strong background of geology are hired to review maps and reports. This has improved the standard of our publications.

Ministry has approved PC-II scheme (cost Rs.6.7 m) to strengthen publication facilities with men and material. USAID is providing equipment worth \$ 800,000 for publication branch. This will result in efficient publication of current work and clearing the backlog.

##### Logistics (Vehicles)

Ministry and the FA Organization authorised purchase of 42 operational vehicles (30 vehicles under regular budget and 12 vehicles under development budget) to enhance working capability of GSP. This has resulted in increased output of field work as reflected in the Table on technical achievements.

##### Equipment:

USAID has provided drilling, physical, petrological, mineralogical and Geodata equipments worth \$ 8.150 million to strengthen and upgrade our facilities. Part of this equipment has been received and the results are visible. The remaining equipment is arriving. GSP will soon, say from 1988-89 be working with enhanced efficiency and output.

##### Creation of specialized units:

Specialized units of Exploration Geochemistry, Mining Geophysics, Geodata Centre and Economic Geology have been added. These areas were either non-existing or very weak prior to 1984. We are strengthening these specialized units under reorganizational plan of GSP which is supported by USAID. These units are now functional with limited scope while their benefits in the fields of mineral exploration and assessment and data indexation and dissemination are found convincing.

To promote specialization in GSP, we have instructed regional offices to undertake only regional geological and geophysical surveys and placed studies on mineral exploration and coal resources assessment under specialized divisions.

Construction of Residential Accommodation and Laboratories:

Ministry has approved construction of residential accommodation for GSP employees at Quetta and building of GSP laboratories at Lahore, Karachi and Islamabad at a cost of 38 million. 4 residential blocks have been completed to accommodate 16 families and 6 bachelors. Laboratory complex at Islamabad is partly completed. Land has been acquired for laboratories and office at Karachi and we are corresponding with LDA for land in Lahore. Credit for early implementation of this project goes to the Joint Secretary. Completion of above constructions will definitely result in satisfying our field workers at Quetta and shifting of our regional offices and laboratories to their own buildings. The obvious outcome of this venture will be increased efficiency and enhanced work output.

B. Policy Programmes having far Reaching Effects:

Career Planning;

GSP had been providing short term and degree level training to its scientists on adhoc basis. A clear policy on career planning and human resource development did not exist. During 1984-87, we have developed a long term training plan which is briefly describe as under:-

- i) A development scheme of Training Institute in GSP to provide on-the-job specialized training to 50 scientists each year. The scheme is under process of approval in the Ministry.
- ii) Short term training to 70 GSP officers was provided through USAID, UNDP and JICA in deficient areas under a long term plan.
- iii) We have selected 22 GSP officers for MS/Ph.D. courses in USA and other universities. Two officers are attending degree courses, 6 have been approved by the Ministry and case of 14 officers is under process. Besides these 22 officers who are being sponsored by USAID (\$ 1.0 million). In addition to this 3 GSP officers are undertaking Ph.D. courses in UK, Japan and USA.

#### Modern Laboratory System in GSP:

Sophisticated laboratory facilities allowing development of R&D programmes for scientific assessment of minerals do not exist anywhere in Pakistan. For this we have to depend on research and R&D programmes of foreign countries. We have succeeded in convincing JICA-Japan to build this most modern facility (on turn key basis) in GSP. JICA has expressed willingness to provide grant-in-aid of about \$ 10.0 million for this project.

The concept clearance of the project, and its inclusion in the list of JICA's pipeline projects was due to the personal efforts of the Joint Secretary and the present Secretary Ministry of Petroleum and Natural Resources. The pace of this project, however slowed down during the last few months. I must acknowledge with thanks the encouragement given by the present Secretary pushing this case to EAD through a DO letter which I am sure will remove the inertia developed in this project over the period. While in operation, the Petrolab Complex will be recognized as an ideal centre of mineral analyses and research in Asia.

#### Performance Oriented Budget:

In Pakistan, the concept of introducing performance budgeting in a scientific organization like GSP does not exist. In consultation with the Ministry and the F.A. Organization we have attempted its application to GSP.

GSP's budget for 1988-89 has been proposed on the basis of targetted performance (Table-II). Additional Rs. 3.5 million has been demanded in the regular budget under the operational head to allow 90 days of field work for geological parties against the present provision of 45 days in a year. This will increase the mapping output by 100 percent.

Through performance budgeting we will also be able to introduce system of accountability in GSP and the award of financial and positional incentives for productive workers.

We may be facing lot of difficulties in the process, but once successfully implemented, the measure will make GSP the only government agency working on performance budgeting and will transform it into a real scientific organization worth the national pride.

Review Committee:

The achievements of GSP need to be reviewed at a very high level against the operational short term and long term policies and programmes.

Review Committee comprising D.G., D.D.G. and Director GSP, and Joint Secretary and Secretary MCB, Ministry of Petroleum & Natural Resources is proposed. The Secretary, Ministry of Petroleum and Natural Resources is humbly requested to Chair this meeting.

The proposal regarding constitution of Review Committee will help in improving the efficiency and work output of GSP.



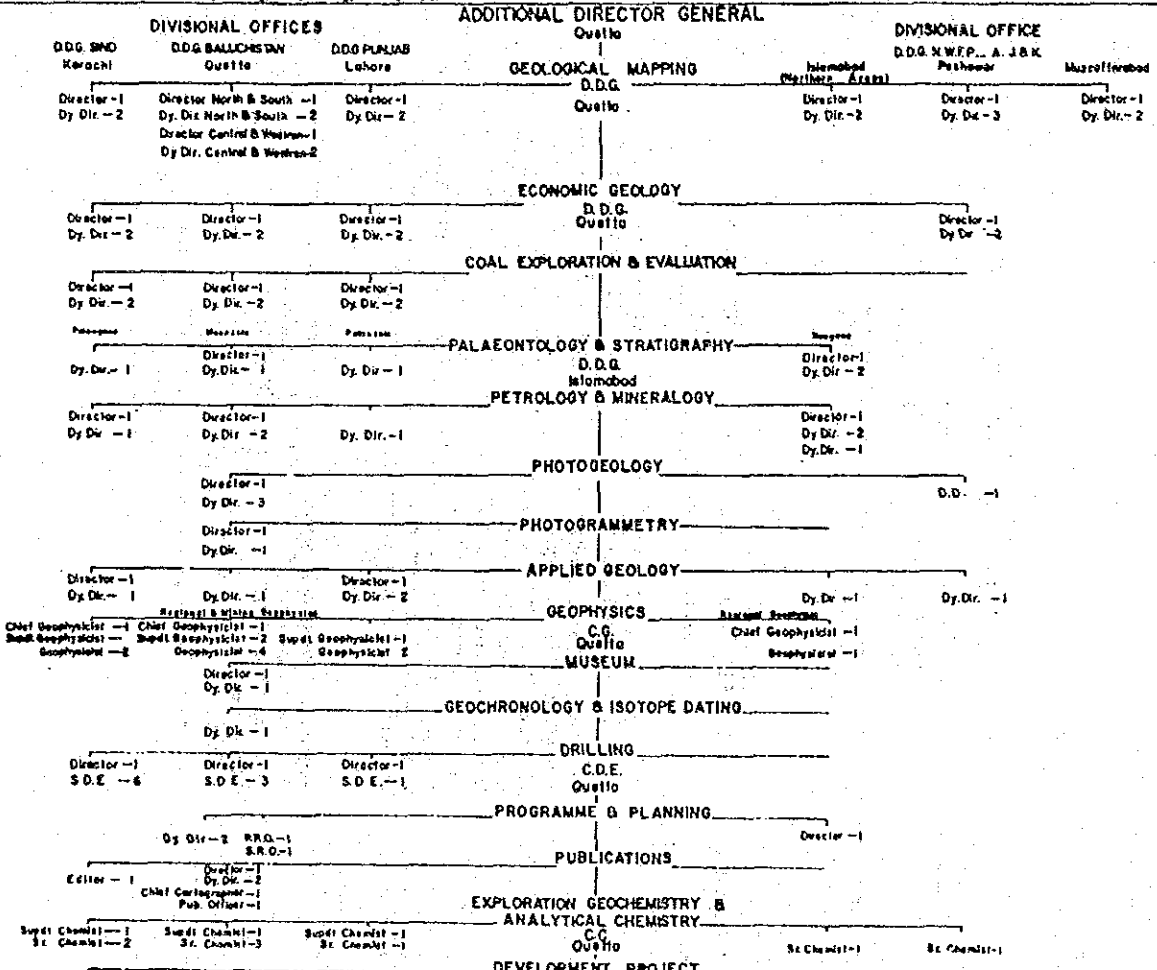
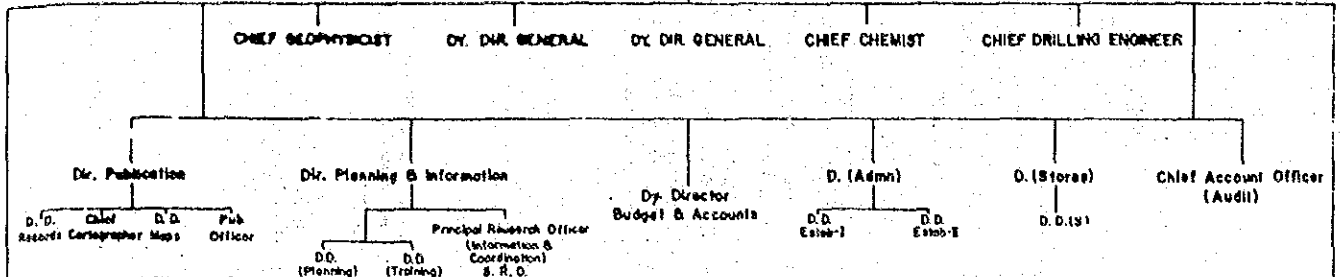
MINISTRY OF PETROLEUM & NATURAL RESOURCES  
GEOLOGICAL SURVEY OF PAKISTAN

**DIRECTOR GENERAL**

**ADVISORY COMMITTEE**

Sub Committee on Publication      Sub Committee on Training & Scholarship

**D.G.'S SECRETARIAT**



- DEVELOPMENT PROJECT**
- EMER PLAN**
    - Coal Reserves Assessment: Project Director (Farhat Hussain)
    - Exploration of Lead-Zinc: Project Director (I. H. Qureshi)
    - Construction of Laboratories: Project Incharge (S. A. Jaffar)
  - Exploration & Evaluation**
    - Khewra Shale: Project Director (S. K. Khan)
    - Exploration Development: Project Director (Ishaque Darroze)
    - Report Printing, Cartography & Scribing Facilities: Project Director (S. K. Khan)
    - Construction of Residences: Project Incharge (I. H. Usmani)
    - Accelerated Geological Mapping Programs: Project Incharge (S. Javeduddin / Qasim Abbas)
  - Exploration of Coal Purpos. Plains**: Project Director (Usman ul Din Ahmad)
  - Exploration of Coal, Salt Range**: Project Director (I. A. Shami)
  - Construction of Laboratories**: Project Incharge (I. H. Qureshi)
  - Establishment of National Geologic Centre**: Project Director (M. Ali Mirza)
  - Establishment of P & S Laboratories**: Project Director (S. M. J. Bakh)
  - Construction of Laboratories**: Project Incharge (Ishid Shukh)
  - Technical & Mineral Resources of Northern Pakistan**: Project Director (M. Ali Mirza)
  - Exploration of Minerals**: Project Director (S. H. Gouhar)
  - Geological appraisal of mineral resources of Azad Kashmir**: Project Director (Zaki Ahmad)

ANNEXURE-

ACHIEVEMENT OF  
GEOLOGICAL SURVEY OF PAKISTAN

S.No.	Discipline	Achievements upto June, 1986	Achievements during 1986-87	Achievements during 1st quarter 1987-88
1	2	3	4	5
1.	Geological Mapping: (1:50,000 scale)	217,000 sq.km.	11,520 sq.km.	Work in Progress.
2.	Geophysical surveys: Aeromagnetic: Regional Gravity & Magnetic:	108,000 sq.km. 159,885 sq.km.	- 7,000 sq.km.	Resistivity survey for groundwater investigation in Ziarat.
3.	Geochemical Prospecting:	640 sq.km.	-	Geochemical exploration of 300 sq.km. area in Marsehra District; operational plan finalized.
4.	Chemical analysis:	22,156 samples (76,639 radicals).	1767 samples (10465 radicals).	723 samples (4531 radicals)
5.	Mineral exploration under development projects:	Coal (Thatta-Sonda, Sind), lead-zinc (Gurga, Baluchistan), fluorite (Phade Maran, Baluchistan), copper (Saindak, Koha-Dalil, Durban-Cha, Baluchistan), light weight aggregate materials (Murgala Hills and Attock Chert, Punjab & NWFP), cement raw materials (Baluchistan, Punjab, NWFP).	Coal (Thatta-Sonda, Sind; Koha-Dalil, Saindak, Baluchistan and Salt Range, Punjab), lead-zinc-copper (Saindak, Koha-Dalil, Durban-Cha, Baluchistan), manganese (Murgala Hills, NWFP), light weight aggregate materials (Quetta, Baluchistan).	Coal in Koha-Saindak-Sor Range, Baluchistan and Salt Range, Punjab; drilling work in progress.
6.	Publications: Regional Geological Maps Reconnaissance Maps Aeromagnetic Maps Other Maps Reports:	75 29 191 36 522	Regional Geological Maps: 10 Other Maps: 1 Reports: 12	Regional Geological Maps: 9 (p) Other Maps: 1 (p) Reports: 20 (p)
7.	Drilling:	70,983 meters	1252 meters.	814 meters.

Contd....p/2

Miscellaneous

Residential and Laboratory Construction:  
 Ministry approved construction of residential accomodation for GSP employees at Quetta and of laboratories at Lahore, Karachi and Islamabad (1985).

Telex Facility:  
 Ministry authorized installation of Telex sets at Quetta, Karachi, Lahore, Islamabad and Peshawar (1986).

Departmentalization of GSP Accounts:  
 On Ministry's recommendations, Auditor General of Pakistan approved departmentalization of GSP accounts for internal audit (1982).

Supply of Gas & Water to GSP:  
 Ministry and FA organization approved supply of Gas & Water in GSP for the first time (1985).

Commodities through USAID:  
 USAID provided two computer units for Geodata Centre (1986).

Collaborated with:  
 . FAWAC for exploration of copper and manganese.  
 . Imperial Chemical Industries (ICI) for rock salt exploration.  
 . Govt. of Baluchistan for exploration of coal and groundwater in Baluchistan.  
 . State Cement Corporation of Pakistan for cement raw material and groundwater resources.  
 . UNDP for adding modern analytical laboratory facilities at Karachi and evaluation of lead-zinc in Gunga, Khuzdar.  
 . JICA-Japan for Sumai lead-zinc deposit.  
 . Oregon State University for study of Tectonics of northern areas, Michigan State University for study of Biostratigraphy and University of Cincinnati for study of Geodynamics of Pakistan  
 . ICS-UK for map publication and study of Salt Range geology.  
 . CIDA-Canada for aeromagnetic survey.

Residential and Laboratory Construction:  
 Constructed 4 residential blocks at Quetta. Land for lab. complex at Karachi procured. Construction of lab. complex at Islamabad partially completed.

Equipments through USAID:  
 USAID sanctioned \$ 8.1 million for procurement of equipments.

Training:  
 16 geoscientists from GSP received short term training in USA. 2 GSP officers attending MS/Ph.D. courses in USA.

Work Visit:  
 A 5 Member GOP delegation visited USGS to recommend re-organization and reworking of GSP on the pattern of USGS.

Concept Clearance:  
 Concept of Petro-lab scheme with the assistance of JICA cleared by the Planning Division.

International Collaboration:  
 Collaborative studies with JICA on lead-zinc exploration.  
 Collaborative studies with UNDP on metallic minerals of the axial belt.  
 Collaboration with Universities of Oregon State and Michigan on Tectonics of northern Pakistan and Biostratigraphy.

Equipment through USAID:  
 Equipment and supplies worth \$ 8.1 million under BCE programme of USAID started arriving.

Training:  
 16 geoscientists from GSP received short term training in USA. Training programme of 34 scientists finished with USAID.  
 6 MS degree holders from GSP scientists approved by the Ministry for FA's approval.

Construction of Survey:  
 Tender for construction of survey road floated. Discussions with Ministry and FA on award contract underway.

Reorganization of GSP:  
 Proposals regarding re-organization submitted to the Ministry.  
 Performance Budget and Performance oriented budget proposals submitted to the Ministry and FA for Peramine.

Petro-lab:  
 Secretary wrote DO letter to FAO for JICA experts with a view to expedite processing of petrolab project.

Concept Clearance:  
 Concept of Gold Exploration scheme, with the assistance of UNDP cleared by the Planning Division.

International Collaboration:  
 Collaborative studies with JICA on lead-zinc exploration entering final phase.  
 Collaboration with UNDP on metallic minerals of the Axial Belt continues.  
 Collaboration with Oregon State University and Michigan University continues.

TABLE: I

COMPARISON OF ACHIEVEMENTS OF GEOLOGICAL SURVEY OF PAKISTAN  
BASED ON AVERAGE OF THREE YEARS 1978-87

S. NO.	Discipline	Achievements during 1975-81	Average for year	Achievements during 1981-84	Average during 1984-87	Achievements during 1987-90	Average per year
1.	Geological Mapping (1:50,000 scale)	36,500 km <sup>2</sup>	12,166 km <sup>2</sup>	21,800 km <sup>2</sup>	7,266 km <sup>2</sup>	29,535 km <sup>2</sup>	13,179 km <sup>2</sup>
2.	Geophysical surveys (Regional and Detailed)	17,000 km <sup>2</sup>	5,666 km <sup>2</sup>	21,125 km <sup>2</sup>	7,042 km <sup>2</sup>	15,550 km <sup>2</sup>	6,283 km <sup>2</sup>
3.	Chemical Analysis	5,186 rock samples (16085)	1729 rock samples (5361)	6857 rocks (55315)	1619 (7599)	3800 rock samples (25305)	1266 rock samples (8435)
	Publications	Maps= 24 Reports=73	Maps=8 Reports=24	Maps=45 Reports=59	Maps=16 Reports=23	Maps=47 Reports=59	Maps=16 Reports=25
	Drillings	3059 meters	1019 meters	9230 meters	3406 meters	14,283 meters	4095 meters.





< 資料 5 >

石油天然資源省組織図





BRIEF FOR THE MINISTER FOR PETROLEUM AND  
NATURAL RESOURCES

In April, 1977, erst-while Ministry of Fuel, Power and Natural Resources was bifurcated and an independent Ministry of Petroleum and Natural Resources was set up to deal with oil, gas and mineral sectors at the National level. The functions assigned to the Ministry are carried out by its main Secretariat.

2- Ministry has two attached departments, namely;

- i) Geological Survey of Pakistan, Quetta
- ii) Technical Wing at Islamabad.

3- In addition to the above the Ministry also control the policy matters of the following Organizations having their own statutes and Board of Directors:

1. Oil & Gas Development Corporation(OGDC), Islamabad.
2. Pakistan Mineral Development Corporation(PMDC), Islamabad.
3. Gemstone Corporation of Pakistan(GEMCP), Peshawar.
4. Resource Development Corporation(RDC), Karachi.
5. Hydrocarbon Development Institute of Pakistan(HDIP), Islamabad.
6. Pakistan State Oil (PSO), Karachi.
7. Pak-Arab Refinery Limited(PARCO), Karachi.
8. Sui Northern Gas Pipelines Ltd(SNGPL), Lahore
9. Southern Gas Company Ltd(SGC), Karachi.
10. Sui Gas Transmission Company(SGTC), Karachi.

4- Brief description of the Ministry's attached departments/  
organizations is:-

## GEOLOGICAL SURVEY OF PAKISTAN

It is a national organization primarily responsible for collecting and providing geological information about the country so that the resources of the earth could be best exploited and utilized by the people.

## TECHNICAL WING

Technical Wing is comprised of 4 Directors General i.e. D.G. (Oil), (Gas), Petroleum Concessions and New and Renewable Energy Resources. The regulatory, marketing and developmental functions relating to Oil, Gas and Petroleum Concessions are controlled by the Technical Wing. The Directorate General of New and Renewable Energy Resources manages a programme of development and extension of new and renewable energy technologies solar, biogas and wind power.

## OIL & GAS DEVELOPMENT CORPORATION

OGDC is a statutory Corporation, wholly owned by the Government of Pakistan and was established on 20 September, 1961 under Ordinance No. XXXVII of 1961. Under the OGDC Ordinance, the functions of the Corporation shall generally be to plan, organize and implement programmes for exploration and development of oil and gas resources, and such other functions as the Federal Government may from time to time, assign to the Corporation.

## PAKISTAN MINERAL DEVELOPMENT CORPORATION

Pakistan Mineral Development Corporation (PMDC) is the successor organization of Pakistan Industrial Development Corporation (PIDC) which was entrusted with mineral exploration and development on national

scale in 1954. These functions were transferred to PMDC in July, 1974. The Corporation was established as a private limited company under the Ministry of Petroleum and Natural Resources. The functions to PMDC are detailed exploration and evaluation, mining development and exploitation preparation of mining development schemes, commercial exploitation of minerals, marketing of minerals in the domestic market and export of minerals and mineral based industries.

#### GEMSTONE CORPORATION OF PAKISTAN LIMITED

Gemstone Corporation of Pakistan Limited is Joint Venture with the Govt. of NWFP and was established in the year 1979 as a Public Limited Company to regulate gemstone industry in Swat and Northern areas etc and the marketing of precious stones.

#### RESOURCE DEVELOPMENT CORPORATION (PRIVATE) LIMITED

Resource Development Corporation (RDC) was established in 1974 to explore, evaluate and develop the copper deposits located at Sandak.

#### HYDROCARBON DEVELOPMENT INSTITUTE OF PAKISTAN

The Hydrocarbon Development Institute of Pakistan is the national petroleum Research and development (R&D) organization dealing with Research and development and provide technical services to the Petroleum Sector.

#### PAKISTAN STATE OIL

Pakistan State Oil Company is a storage, distribution and marketing company of petroleum products and LPG. Its equity presently

constitutes of 25.51% Federal Government, 47.65% Financial Institutions and 26.84% public and others.

#### PAK-ARAB REFINERY LIMITED

A Joint venture between Government of Pakistan and Abu Dhabi National Oil Company formed in 1974. The share holding/equity of this project between Pakistan ADNOC is 60% and 40%. The Company is responsible for operation of POL products through pipelines from Karachi to Multan.

#### SUI NORTHERN GAS PIPELINES LIMITED

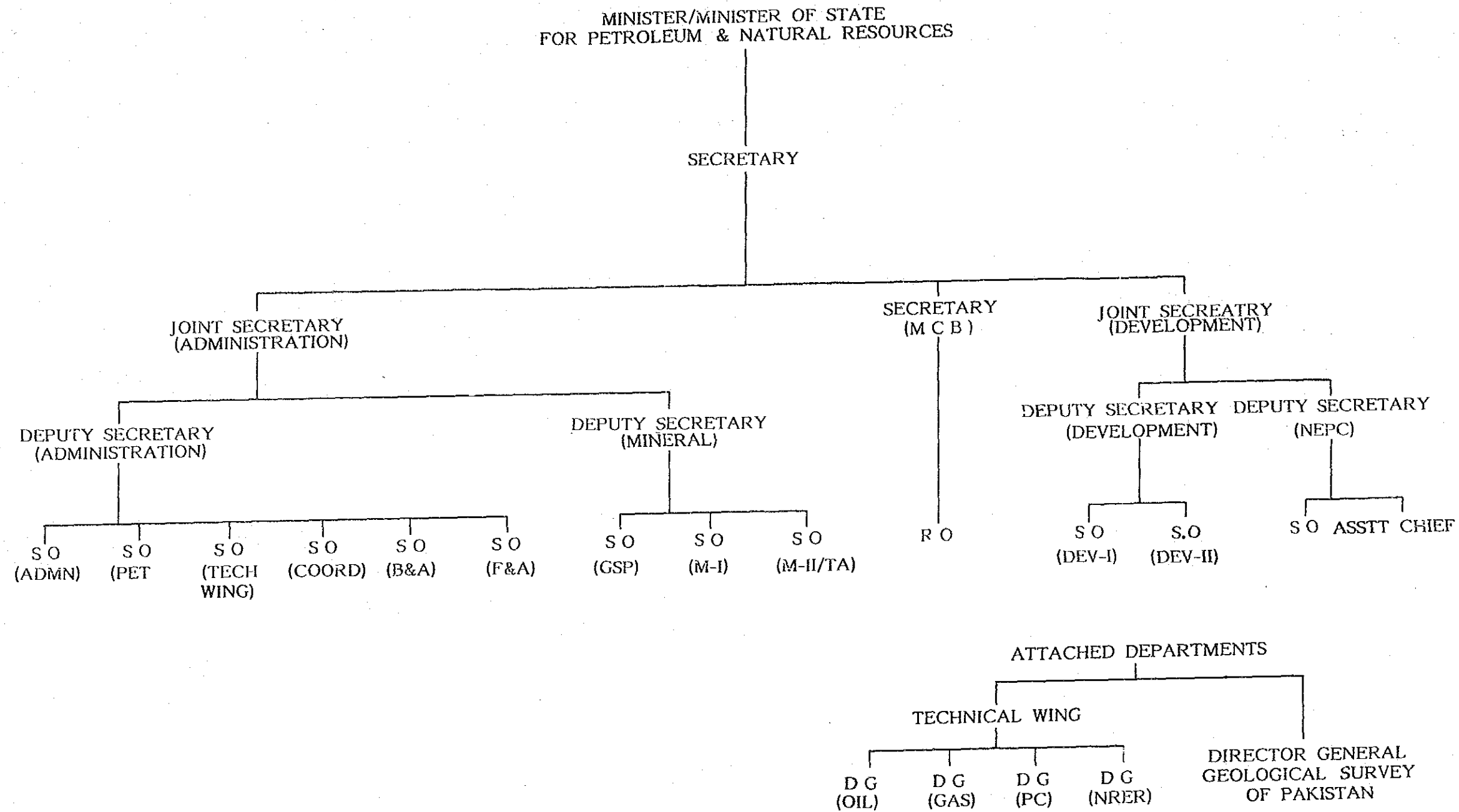
The company was incorporated as a private limited company on 17th June 1963 and was converted on 1st January 1964 into a public limited company under the Companies Act. Its functions are transmission and distribution of sui gas in Punjab and NWFP.

#### SOUTHERN GAS COMPANY LIMITED

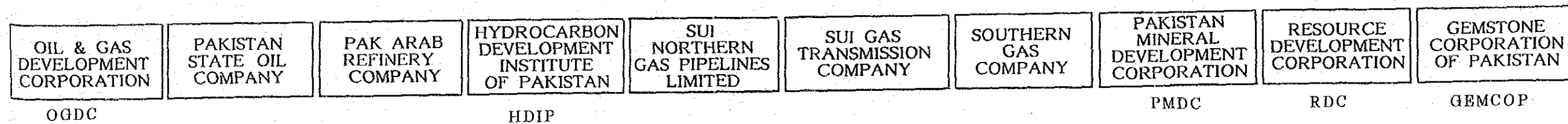
Southern Gas Company Limited has the franchise for the sale and distribution of natural gas in the provinces of Sind and Baluchistan and liquified petroleum gas in Pakistan.

#### SUI GAS TRANSMISSION COMPANY LIMITED

Sui Gas Transmission Company Limited (SGTC) was incorporated as a Public Limited company on February 13, 1954 with the twin objectives of purification of natural gas and its transmission to the Provinces of Sind and Baluchistan.



ORGANIZATIONS UNDER THE MINISTRY OF PETROLEUM & NATURAL RESOURCES





< 資料 6 >

第 7 次 五 年 計 画 ( 鉱 業 分 野 )





PLANNING COMMISSION  
GOVERNMENT OF PAKISTAN

**Vol. II**

**7<sup>th</sup>  
Five-Year  
Plan 1988-93  
and  
Perspective  
Plan 1988-2003**

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**PART III.—Seventh Five Year Plan (1988—93)**  
**E. Production Plans.**

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## CHAPTER 24

## MINERALS

Although the mineral sector in Pakistan has considerable potential, its contribution to GDP was only 2.3 per cent in 1987-88. This is largely because of the complex, heterogenous and non-renewable character of the mineral resources that are found in Pakistan, their remote and uncertain occurrences, the complicated and lengthy nature of operations and the heavy costs and high risks of commercial exploitation.

2. Managing the sector is thus a highly intricate and demanding task. Some of the problems associated with this sector are: inadequate geological knowledge and know-how; lack of adequate research and development facilities; shortage of trained and experienced manpower; and lack of adequate equipment and infrastructure. Most operations require intensive investigation work, considerable capital, advanced skills, and high risks before any stage of profitability can be reached. These tasks are largely carried out by public sector agencies. The private sector has restricted its activities to minerals that can be easily located and exploited with limited inputs.

## SIXTH PLAN REVIEW

3. The predominant focus of the Sixth Plan was on the preparation of a National Mineral Development Policy, reforming mining laws and regulations, restructuring the functions of public corporations, the establishment of a National Coal Authority, the preparation of a directory of mineral points, the gradation and specification of ores, the identification of agencies and corporations engaged in mining, and the preparation of portfolios of viable projects based on comprehensive pre-investment and investment feasibility studies.

4. Substantive progress has been made during the Sixth Plan. The National Mineral Development Policy has been prepared and is being finalized. A Mineral Concession Policy has also been formulated and a portfolio of six commercially viable projects in the North-West Frontier Province (NWFP) has been prepared.

5. The Sixth Five-Year Plan provided for an investment of Rs 5.8 billion in the public sector for mineral development. Of this, Rs 0.3 billion was provided for completion of on-going projects and Rs 5.5 billion for new projects. Of Rs 5.8 billion, Rs 2.5 billion was to be financed from the budget and Rs 3.3 billion from outside the budget. Against this, the actual investment is estimated to be Rs 1.2 billion and Rs 0.03 billion respectively. Major shortfalls occurred in public sector projects outside the budget such as Lakhra coal deposits for power generation in Sind, gypsum mining and development in the Punjab and the Lagharban phosphate rock mining and development in NWFP.

6. The total number of schemes included in the public sector in the Sixth Plan was 76, of which 54 are expected to be completed by June 1988; the remaining 22 schemes were not initiated by the sponsoring agencies. As regards physical production during the plan period, major achievements are anticipated in gemstone production.

7. In the private sector, a total investment of Rs 475 million is expected by the end of the Sixth Plan against an allocation of Rs 1.1 billion, indicating a 40 per cent implementation.

8. The private sector operates in small dispersed units. In coal mining alone, there are more than 2,000 mines in the private sector. Because of the complex and long-gestation character of mineral investments, the private sector has restricted its activities to minerals that can easily be located and exploited with little capital, have low processing requirements and technical skills, and can ensure large returns. Thus most of the non-metallic minerals which are found at or near the surface (coal, gypsum, limestone, clay, soapstone, marble, etc.) are extracted by the private sector.

#### SEVENTH PLAN STRATEGY

9. The Seventh Five-Year Plan focuses on enlarging the role of the mineral sector in the economy. The major priority areas in the Seventh Plan are as follows:

- The National Mineral Development policy will be implemented for which an action plan will

be prepared in consultation with the relevant federal ministries and provincial governments;

- The Geological Survey of Pakistan (GSP) will cover the mineralized zones on appropriate maps and establish geological reserves, develop portfolios of exploration prospects so as to attract local and foreign investments;
- The Pakistan Mineral Development Corporation (PMDC) with the assistance of foreign consultants or the proposed Pakistan Mineral Development Services (PMDS) -- a joint venture between the PMDC, the provincial governments and the private sector -- will undertake pre-investment studies to prepare a portfolio of viable projects;
- For the purpose of undertaking pre-investment studies a mineral exploration fund will be established;
- Minerals which are required to meet the needs of Pakistan Steel and phosphatic fertilizers, and those that can be exported or established locally, will be given priority. According to this criteria iron ores of Nokkundi (Baluchistan), rock phosphate of Hazara (NWFP), copper and associated precious metals of Saindak (Baluchistan), gypsum of Mianwali (Punjab), magnesite of Kumhar (NWFP), and graphite of Azad Jammu and Kashmir (AJK) will be developed;
- The number of public sector agencies in mining will be restructured to make optimal use of scarce manpower and capital resources;
- Federal and provincial governments will arrange to provide roads and power for the transportation of minerals in different provinces;

- Financial institutions, in particular the Regional Development Finance Corporation (RDFC), will provide credit facilities at reasonable rates, furnish technical assistance, and provide working capital;
  - To encourage mineral-based industries, the provincial governments will give priority to lease applications for mining;
  - Government will set up a service under an appropriate agency for low cost rapid mineral analysis and beneficiation testing for the benefit of private mine owners;
  - Equipment renting and leasing enterprises will be established to promote mechanization in the mining sector;
  - The Planning Division will set up a mineral advisory unit to provide support to the mining industry;
  - Training facilities will be enhanced for producing trained specialists and middle line supervisors; and
  - Foreign investment in the mineral sector will be encouraged by providing adequate royalties for transfer of technology, know-how and skills.
10. Specific programmes for the mining sector during the Seventh Plan are as follows.

#### MINERAL DEVELOPMENT IN THE PUBLIC SECTOR

11. Mineral development in the public sector will be undertaken in the following areas.

#### Geological Surveys

12. During the Seventh Plan period, mapping activities will be concentrated in the metallogenic belts and mineralized areas of the country. Priority will be accorded to the axial belt of



Chagai District (Baluchistan), Nagarparker and Thano Bulla Khan (Sind), Salt Range and Kirana Hills (Punjab), Hazara and Malakand Divisions (NWFP), Gilgit (Northern Areas) and Neelum Valley (Azad Kashmir). Furthermore large-scale topo-geological mapping of the identified mineral areas will also be undertaken. These will undergo an integrated survey as supported by exploratory drilling, subject to positive results of regional mapping and geo-physical and geo-chemical surveys.

13. The GSP will cover these activities through its regular budget. It will undertake geological mapping of an area of 60,000 square kilometers on 1:50,000 scale of which one-third is in Baluchistan.

#### Exploration and Evaluation

14. The focus of the Seventh Plan will be on narrowing the gap between exploration and discovery. This requires extensive investigative work with considerable risk capital. Initially the task of detailed exploration and evaluation of viable mineral projects will be given to PMDC with some seed money. This will eventually lead to the formulation of either a semi-autonomous body such as the PMDS, or a joint stock company. The objectives of PMDS will be to promote the profitable development of mineral resources of Pakistan in collaboration with the provinces and the private sector. The activities of PMDS will be to:

- establish a mining sector strategy focusing on the requirements of the national economy, analysis of GSP data and exploitation of mineral resources;
- assess new projects;
- build up specialised expertise for mineral development;
- provide resources to new projects (i.e., finance, staff, expertise, equipment); and
- attract private capital.

15. In the Seventh Five-Year Plan priority will also be accorded to the exploration and evaluation of metallic minerals (lead, zinc, copper, manganese, chromite, and iron ores)

industrial minerals (magnesite, china clay, fuller's earth, soapstone, nepheline syenite, potash, and graphite) and precious minerals (ruby, aquamarine, garnet, emerald, and topaz).

#### Beneficiation

16. Low grade mineral deposits are upgraded by a beneficiation process to bring them in line with consumer specifications. This task is being carried out by Pakistan Council for Scientific and Industrial Research (PCSIR) in its ore-processing, metallurgical, glass and ceramics laboratories. In recent years PCSIR facilities have been modernized further to enhance the agencies' technological competence. Mineral beneficiation facilities will be fully utilized during the Seventh Plan.

#### Mineral Development

17. Considerable reserves of several minerals like copper, antimony, iron ore, chromite, rock phosphate, magnesite, gypsum, china clay, rock salt, marble and graphite have been established. These are discussed below.

#### Agriculture Minerals

##### Gypsum

18. According to an estimate, more than 5.5 billion tonnes of high quality gypsum is present in Pakistan. Some of the major deposits are situated adjacent to existing transportation facilities and consuming centres. So far as the demand is concerned, the total extent of salt-affected soils falling within the Canal Command Areas of the Indus plain which is in the range of about 7.8 million acres, needs crushed gypsum at the rate of 2-3 tonnes per acre per year for its ammendment. Furthermore, nearly 52 per cent (or 4 million acres) of this is underlain by marginal or hazardous quality groundwater. This will also require large quantities of gypsum. It is expected that the demand will increase considerably in the years to come.

##### Rock Phosphate (Lagharban)

19. The Sarhad Development Authority (SDA) has established a total of 12.5 million tonnes of reserves of plus 28 per cent phosphorous pentaoxide. The beneficiated rock is suitable for

the manufacture of phosphoric acid and nitrophosphate. Pilot plant studies are underway to beneficiate the rocks for making high value-added phosphatic fertilizer. A mine of 0.2 million tonnes per year capacity will be developed subject to satisfactory results of the pilot plant tests.

### Construction Minerals

#### Building Stones

20. Vast reserves of building stones (e.g. marble, onyx, graphite, serpentinite, and crystalline limestone) exist. The extent of present development and exploitation varies from product to product but, because of the crude methods employed, the rate of extraction is low. During the Seventh Five-Year Plan marble deposits in the Federally Administered Tribal Areas (FATA) will be developed along more scientific lines. Large deposits of refractory materials including magnesite, chromite, dolomite, fluorite, china clay, fire clay, quartzite, graphite, serpentinite and silica sand are present in the country. With growing requirements to feed metallurgical high temperature furnace units most of the materials are expected to be further developed and processed.

#### Magnesite

21. The Pakistan Industrial Development Corporation has established about 11 million tons of 'probable' and 3 million tons of 'minable' reserves of magnesite in Kumhar area, NWFP.

#### Glass and Ceramic Minerals

22. In addition to an existing capacity near Shah Dheri (Swat), the PMDC has proven 3.5 million tonnes of china clay reserves at Nagar Parkar (Sind), which has been found to be suitable for the ceramic industry. These two sources will help achieve greater self-sufficiency in the material.

23. Silica Sand Huge quantities of silica sand are available that need to be washed and graded in order to provide a base for manufacturing high quality glass products and solar-electronic wafers. During the Seventh Plan, a number of silica sand washing plants will be established for these purposes.

24. Nephyline Syenite The SDA has established about 6 million tonnes of nephyline syenite at Koga (Mardan). The SDA has delineated certain iron-free zones of nephyline syenite as a replacement of feldspar in the glass and ceramics industry. The development and exploitation of this mineral will be carried out further during the Seventh Plan period.

25. Barite Extensive deposits of barite are present in Lasbela and Khuzdar (Baluchistan), sufficient to sustain domestic demand for such uses as oil drilling, special paints and industrial chemicals. For these purposes, an open cast mine has been developed as a joint-venture and a modern grinding mill of 24,000 tonnes per year capacity constructed in Khuzdar. An additional plant to export the material to the Middle East for its use in oil drilling is planned.

26. Salt Large salt reserves are available in the country, specially in the Salt Range (Jhelum). Mining is being done at various locations particularly at Khewra. Other areas have been investigated for development and exploitation. Moreover, a salt iodizing plant will be established at Khewra.

27. Sulphur Some sulphur reserves are available in Pakistan. The Koh-e-Sultan deposits in Chagai (Baluchistan) are being developed by the Baluchistan Development Authority. Further detailed exploration is likely to reveal additional stocks.

#### Metallic Minerals

##### Copper (Saindak)

28. The Saindak Integrated Mineral Development Project formulated by the Resources Development Corporation (RDC) established in 1974, under the Ministry of Petroleum and Natural Resources was based on the establishment of a metallurgical complex comprising copper smelter, sulphuric acid plant and steel billet mill. Following extensive investigations, the Government of Pakistan approved the project at an estimated cost of Rs 4,080 million with a foreign exchange component of Rs 2,108 million. The project on completion will yield for 16 years an average annual production of 18,604 metric tonnes of copper containing 1.56 metric tonnes of gold and 2.3 metric tonnes of molybdenum. The project will be carried out in the public sector.

### Iron Ores (Nokkundi)

29. The explored iron ore deposits in Nokkundi area are at Chigendik and Pachinkoh. The Chigendik ore body contains approximately 5 million tonnes of ore with an average iron content of 45 per cent which can be mined by open pit methods. The Pachinkoh ore body contains approximately 45 million tonnes of ores with an average iron content of 49 per cent most of which (80 per cent) can be obtained through underground methods. These ores can be concentrated upto 68 per cent iron content to be used as feedstock in pelletizing plants. According to studies by experts, the pellets so produced are suitable as charge materials for blast furnace operations and in direct reduction plants to produce direct reduced iron pellets. The project will receive the highest priority in the Seventh Plan.

### Precious Minerals

30. There is significant potential for the production of precious stones in Pakistan, specially in the northern parts of the country. For this detailed exploration is necessary. The high class ruby, emerald and aquamarine merit detailed exploration by deep drilling and underground working. Presently, out of thirty showings, two to three ruby deposits are operative in Hunza. Emeralds and aquamarine are being mined in various parts of the Northern Areas, specially Swat. An increase in production and value-added in gemstones is envisaged. Detailed exploration and development in all the promising zones, specially Azad Jammu and Kashmir, have been planned.

### Infrastructure

31. In Pakistan, economically viable minerals are found in inhospitable, underdeveloped, and underpopulated areas with little communication, power or water supply. Saindak copper ore, Nokkundi iron ore and Hazara Phosphate rock are a few examples. The costs of building the infrastructure are so high that even major projects cannot absorb them. During the Seventh Plan, the government will provide the infrastructure in the mining areas on a priority basis subject to the recovery of user charges.

### MINERAL DEVELOPMENT IN THE PRIVATE SECTOR

32. Private sector involvement in mineral development is minimal. Private mining enterprises are small units, ill-

organised, fragmented and wasteful in their methods. They are extracting most of the deposits of non-metallic nature that occur on or near the surface through either open pits or underground mining to shallow depths. Most of these operations are confined to outcrop working and are abandoned when their limits are reached. Yet, their contribution in volume terms is substantial.

33. Despite these limitations the private sector has the potential to make a major contribution to the mineral sector provided appropriate institutional arrangements and facilities are created. Various physical facilities such as availability of geological maps, exploration and evaluation data, techno-economic information on various aspects of mining are available from the Geo-Data Centre of the GSP. Furthermore, chemical analysis, mineralogical tests, and material beneficiation are provided through the laboratories of PCSIR, RDC, technical organizations, and academic institutions. Additionally, extensive efforts will be made during the Seventh Plan to support the private entrepreneur to modernize and balance his operations.

#### INVESTMENT AND TARGETS

34. The total public sector investment in the mineral sector during the Seventh Plan is Rs 7.5 billion (Rs 3.3 billion financed from the budget and Rs 4.1 billion by public sector corporations). The details of financial outlays and physical targets are given in Statistical Appendix 24.1 and 24.2 respectively. Provisional sources of financing in the public corporations are given at Statistical Appendix 24.3.

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## FINANCIAL ALLOCATIONS (1988-93)

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(Rs. Million)

Agency	Budgetary Allocation	Public Corporations	Total Public Sector
<b>A. FEDERAL</b>			
1 Ministry of Petroleum and Natural Resources	2,063	2,880	4,943
2 Ministry of Production	..	245	245
3 Ministry of State and Frontier Regions	37	72	109
4 Ministry of Kashmir Affairs and Northern Areas	41	84	125
5 Planning & Development Division	9	--	9
Sub-Total (Federal)	2,150	3,281	5,431
<b>B. PROVINCIAL</b>			
1 NWFP	462	260	722
2 Sind	98	103	201
3 Baluchistan	359	171	530
4 Punjab	61	75	136
Sub-Total (Provincial)	980	609	1,589
Total (Federal & Provincial)	3,130	3,890	7,020

SA Table 24.2

## PRODUCTION TARGETS

(000 Tonnes)

Items	1987-88 (Estimates)	1992-93 Targets
1 Copper	--	18.6
2 Gold	--	0.02
3 Silver	--	0.02
4 Molybdenum Concentrate	--	0.40
5 Iron Ore	--	800
6 Nepheline Syenite	--	30
7 Chromite	8.00	15
8 Gemstone	0.40	0.65
9 Rock Salt	670	1,000
10 Gypsum	580	2,000
11 Limestone	6,525	10,000
12 Marble	230	440
13 Rock Phosphate	80	150
14 China Clay	25	85
15 Dolomite	150	325
16 Silica Sand	256	500
17 Soapstone	35	65
18 Baryte	40	80
19 Sulphur	1.35	2.72
20 Magnesite	3.50	7.26
21 Graphite	--	15.00

Source: a) Federal Bureau of Statistics

b) Ministry of Petroleum &amp; Natural Resources



PROVISIONAL SOURCES OF FINANCING OF  
PUBLIC CORPORATIONS (1988-93)

(Rs. Million)

Agency	Total	Bank Credit	Self Financing	Foreign Loan/ Equity
1 RDC-Saindak copper Project	2,805	1,685	--	1,120
2 Gemstone Corporation	75	38	--	37
3 Ministry of Production (development of Nokkundi Iron mines)	245	100	--	145
4 AKMIDC (Graphite Deposits)	84	65	--	19
5 FATADC (Marble Deposits)	72	48	--	24
6 Baluchistan	171	101	--	70
7 Punjab	75	52	23	--
8 Sind	103	66	--	37
9 NWFP	260	194	--	66
<b>TOTAL</b>	<b>3,890</b>	<b>2,349</b>	<b>23</b>	<b>1,518</b>





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