

**GOVERNMENT OF PAKISTAN
MINISTRY OF PETROLEUM AND NATURAL RESOURCES
GEOLOGICAL SURVEY OF PAKISTAN**



MINERAL PROFILE OF BALOCHISTAN

DECEMBER, 2009

MINERALS PROFILE OF BALOCHISTAN

The major mineral resources of Balochistan are described below which can be favorable for investors. Occurrences of major mineral resources in the province are shown on accompanying map (Figure-I) and basic data on minerals, being produced is presented in Annexure-I & II.

1. Antimony

Antimony is an element and an important metal. It occurs as native metal in nature but more frequently the ore is in the form of either sulphide or oxide. The most common antimony ore is stibnite (Sb_2S_3). It is used for making alloys in which antimony imparts hardness to the final product. It is also used in the manufacture of antimony compounds and other chemicals having varied commercial uses. An important antimony salt is its trisulphide which is used in the production of safety matches, in percussion caps of cartridges, in tracer bullets and similar light signals.

Antimony deposit, which has been sporadically mined in the past, is near Qila Abdullah in district Pishin of Balochistan. In this area, stibnite is associated with quartz veins which fill fractures and joints in Khojak shales of Oligocene age. More showings of antimony in similar geological setting have been recently discovered by GSP in Kharan district.

Present estimates of available ore is 26,000 tonnes but detailed investigations may prove more tonnage. The antimony content of the ore varies from 7 to 12% (Hussain, 1974).

2. Copper

Copper is next to iron in demand as metal of commercial and strategic use. It is an important metal having varied industrial uses. The largest use of copper is in electrical industry, automobiles, airplanes, conductors, circuit breakers and in many other specialised fields due to its high electrical and thermal conductivity, durability, strength and high

resistance to fatigue. It is also used for making a number of alloys with other metals which have varied industrial uses.

Balochistan Province has vast resources of copper ore. Porphyry type copper ore bodies have been discovered by the Geological Survey of Pakistan at Saindak, Dasht-e-Kain, Kabul Koh, Koh-i-Dalil, Missi and Ziarat Pir Sultan (Ahmad 1986). All these deposits occur in Chagai District. Massive sulphide type copper deposits have been reported from Chagai, Lasbela and Khuzdar districts. Preliminary investigations are in progress in Uthal, Lasbela district. Description of some of the copper deposits is given below.

i. **Saindak Cu-Au-Molybdenum Deposit**

Balochistan Province has vast resources of copper. Porphyry type copper ore bodies have been discovered by the Geological Survey of Pakistan at Saindak, Reko Diq (Koh-i-Dalil), Dasht-e-Kain, Kabul Koh, Missi and Ziarat Pir Sultan in the Chagai District (Ahmad 1986). Massive sulphide copper deposits are found in Chagai, Lasbela and Khuzdar districts.

Reserves and grade of the ore bodies, constituting the Saindak Deposit are in table-1 and estimated recoverable quantities of different metals are reflected in table-2.

Table-1: Saindak Ore Reserves and Grades

Deposit	Reserves (million tonnes)	(% of copper)
South Ore Body	111	0.430
East Ore Body	273	0.340
North Ore Body	28	0.440

Table-2: Estimated Recoverable Quantities of Metals and Values

Metals	Current Price (in US\$)	Value (in million US\$)
Copper 1.69 million tonnes	2000 / tonnes	3,380.00

Gold	2.24 million ounces	387 / oz	867.00
Silver	2.49 million ounces	5.0 / oz	12.45

Development of open-pit infrastructure, crushing plant, concentrators, smelter and mine have been completed at Saindak. Test production of blister copper started from the deposit during 1995 and stopped due to certain reasons. The production has been resumed during 2003 under a contract with a Chinese firm. It is planned to produce about 15,800 tonnes of copper blister, 1.47 tonnes of gold and 2.76 tonnes of silver annually.

ii. **Reko-Diq (Koh-I-Dalil) copper Deposit**

Reko Diq Copper –Gold deposit is a very promising deposit, discovered by GSP in 1978-79. M/S TCC has invested 150 million US \$ for exploration of the deposit which is expected to start production within next 2 years. Lately, the deposit has been sold jointly to M/S Barrik Gold of Australia and Antofagasta of Chile, both holding 37.5% share each while the Government of Balochistan is holding 25 % share. Basic facts about the deposit are given below.

Reserves	> 5 Billion tones
Copper Content	= 0.54 %
Gold	= 0.24 g/t

Very encouraging occurrences of copper have also been found in Zhob and Lasbela districts in Balochistan. These deposits are under investigation and the exploration work by GSP. Geophysical surveys and drilling will soon be initiated for evaluation of these deposits.

3. **Gold**

It is a precious metal being used by the mankind for jewelry and as a status and power symbol since times immortal. In the present day world along with its major consumption in Jewelry, the metal is being used as an important industrial metal also.

The Chagai Island Arc area, Geological Survey of Pakistan has identified at least 12 porphyry type deposits which may contain appreciable quantities of gold along with copper

and silver (Khan et. al. 1996). Favourable environment for localization of tele- thermal vein type and skarn type deposits also occur in the Chagai Arc area. Broken Hill Propriety (BHP) of Australia in collaboration with Balochistan Development Authority is exploring for gold deposits in the area and has located several drilling targets. The drilling of first target has started and it is expected that soon world class gold deposits will be discovered in Chagai district of the Balochistan province.

4. Iron

Iron ores are used for the extraction of iron which is the most commonly exploited metallic mineral in the modern world. Iron is used for making steel and a number of other alloys.

Iron, being the third most abundant element on the earth's crust, is found in a variety of geological environments. All three major classes of rocks, i.e. igneous, metamorphic and sedimentary, serve as host for the mineralization of iron ore.

Many small and large deposits of iron ore have been found in different parts of the province. Important among these are Dilband, Chilghazi, Chigendik and Pachin Koh deposits. The iron ore deposits recently discovered by the GSP at Uthal appear to be of economic significance. Reserves and grade of the major iron deposits are given in Table-3, while description of some important iron ore deposits in Balochistan follows.

Table-3: Location, Reserves and Grade of Iron Ores in Balochistan

S. No.	Area/Locality	Reserves (million tonnes)	Quality	
			Chemical	Mineralogical
1.	Dilband, Kalat District	250	40- 60% Fe ₂ O ₃	Sedimentary ore with predominant hematite
2.	Chagai District (Chigendik, Pachin Koh, Chilghazi).	85	20-55% Fe	Magnetite.

3.	Uthal Lasbela District, Balochistan	Not estimated	Up to 45% Fe	Metamorphic ore with predominant magnetite.
	TOTAL	335		

i. **Dilband Iron Deposit:**

Dilband iron deposit, recently located by the GSP, is a very promising deposit containing > 250 million tonnes of iron ore, ranging 40-60% Fe₂ O₃. Production of iron for supply to Pakistan Steel mills has commenced.

ii. **Mashki Chah Iron Deposit:**

Mashki Chah iron deposits, Chagai District, can be reached by a road from Nokkundi. The deposit consists of several small exposures 4 to 5 km north west of Mashki Chah. The deposits are estimated to contain 1000 tonnes of haematite in form of veins along with jasper in Sinjrani volcanics.

iii. **Chgendik Iron Deposit:**

Chgendik iron deposit, Chagai District is located at Kundi Baluchap, 26 kms to the northeast of Dalbandin, which is 363 kms from Quetta.

Two types of mineralization is present. One type of mineralization is in the form of Siderite-Calcite veins in basic volcanics of Cretaceous age. A 1 to 6 feet thick vein is intermittently exposed for about one km. The other type of mineralization in the form of disseminated grains of hematite-magnetite in garnet-epidote skarn rocks. A total of 29 holes have been drilled at Chigendik.

Metallurgical tests on Chigendik iron ore have been carried out by different organizations in Pakistan and abroad and the results prove the suitability of this ore for use in the Pakistan Steel Mills, which can eventually substitute 47% of the imported ore. Hussain

(1983) has suggested that this ore is suitable for the direct reduction plus electric arc furnace process combination. This process can produce steel billets at about 30% lower costs.

The deposit contain iron with Fe_2O_3 67-82%, SiO_2 9-22%, Al_2O_3 1.4-4.4%. The reserves are estimated to be 5 million tonnes by PIDC.

iv. **Bandgan Iron Deposit:**

Bandgan iron deposit is located along the northern margin of eastern Raskoh Range about 3 km west of Shehin Peak and 16 km south east of Nok Chah levy post. The Quetta - Taftan Railway and metalled Road runs through Nok Chah.

The skarn type deposits occur as vein or massive form in the Kuchakki volcanics of Cretaceous age measuring 18 x 200 m and 15 x 30 m. The main minerals identified are magnetite and hematite, in association with hornblende garnet, biotite, epidote etc. The reported Fe content varies from 25 to 54%. Reserves are estimated at 7,000 tons magnetite and 18,000 tons hematite.

v. **Pachin Koh Iron Deposit:**

Pachin Koh iron deposit, Chagai district, can be reached through 80 km unmetalled road to the north west of Nokundi which is 552 km from Quetta. The Quetta Taftan Railway line runs through Nokundi. It is rated as major deposit and contains iron and copper. Fe_2O_3 varies from 20.40 to 67.20% and averages 48.3%, silica is upto 53% but in high-grade ore it is 2.79 to 5.76%, Al_2O_3 is low, CaO is variable, MgO is low. Sulphur is 11.85 to 22.93%.

The magnetite hematite mineralization occurs in the Cretaceous volcanic rocks of Sinjrani Group in the form of lenses. The ore bodies are in the form of volcanic flows centred around fumarolic area. As many as 18 wedge shaped, semi lunar to tapering bodies were seen in drill cores. Each volcanic pulse of andesite to basaltic flow is sequentially followed upward by younger zones of sericite tourmaline magnetite and travertine marble which is again followed by another partly basaltic flows, sericite, tourmaline hematite, etc. At Pachin Koh 62 holes have been drilled.

Reserves are estimated at 45 million tonnes with 48.35% iron. (30 million tonnes proven). Geological and geophysical investigations suggest that the indicated iron ore prospects at this locality are likely to be 100 million tonnes.

PIDC carried out prospecting pits and adits at two points. No mining activity reported.

vi. **Chilghazi Iron Deposit:**

Chilghazi iron deposit lies in Chilghazi River bed area, about 50 km to the north west of Dalbandin and is accessible through a un- metalled fair weather jeepable road. Commodities found, here, include iron, copper and gold containing FeO 10 to 55%, Sulphur 0.1 to 1.96%, Cu is 13% and P₂O₅ 0.5%. Certain zones carry gold upto 2 ppm and above.

The magnetite deposit of Chilghazi area are believed to be of volcanic origin which may have been deposited as late hydrothermal bodies which occur as layers, bands or wedges in three horizons. The first horizon iron bands are followed by the second and the third zones at 130 m and 500 meters depths, Iron ore occurs as massive to disseminated globles in Sinjrani volcanics. The reserves are estimated at 20 million tonnes in disseminations and 3.36 million tonnes in separate iron ore bodies.

vii. **Sheikh Budin Hills / Pezu Iron Deposit:**

Sheikh Budin Hills iron ore deposit is located at about 2.5 kilometers southeast of Pezu village in Chagai district.

The iron ore beds are formed in Cretaceous strata similar to the Chichali Formation. The deposit is comprised of an upper, reddish, ferruginous bed which has lower iron content and a lower yellowish brown bed, which has a higher iron content ranging from about 30 to 34 percent and it is comparable to the Chichali ore.

Chemical composition of Sheikh Budin / Pezu iron ore (%)

Type	Fe	SiO ₂	Al ₂ O ₃	CaO	MgO	Ignition loss
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1. Jatan	34.4	21.9	7.51	4.0	2.3	11.5
2. Khaurai	30.3	30.5	8.67	2.2	3.27	9.2

Total reserves down to an incline depth of about 260 meters are 66 million tones.

viii. **Lasbela – Khuzdar Iron Deposits:**

The Khuzdar – Bela ophiolitic belt, during the last fifteen years has emerged as important producer of chromite, manganese, magnesite, soap stone, serpentine, and a variety of building stone including re-crystallized limestone, fossiliferous limestone, pure dark coloured limestone, gabbro and basalts. A number of occurrences of iron ore especially in the areas near to Uthal have been identified.

The mode of occurrence, mineralization and association of other rock and minerals clearly indicate that all iron ore deposits in Lasbela - Khuzdar region are associated with matasomatism due to emplacement of large gabbroic bodies in calcareous shale and calcareous siltstone. This kind of mineralization is quite important as it has been observed over a large area, has got good percentage of iron, shows simple mineralogy, contains low concentration of undesired gangues and near to Karachi, the main consuming center. The deposits found in Lasbela – Khuzdar ophiolite belt are under investigation.

5. Lead - Zinc

Lead and zinc, due to their normal close association in nature, are being dealt with together. Both these metals form important alloys having varied industrial uses. Lead is an important strategic mineral as it is used in ammunitions.

Though a number of oxides, carbonates and sulphates of lead and zinc occur in nature which are being exploited for commercial extraction of lead and zinc, but the most common minerals of economic significance are galena (Pb S) and sphalerite (Zn, Fe)S.

The Geological Survey of Pakistan has discovered several deposits of lead and zinc ore in Las Bela-Khuzdar region of Balochistan Province. These deposits are associated with carbonate rocks of Windar Group and Shirinab Formation. Three of these deposits namely Gunga, Surmai and Duddar have been investigated in some details by GSP with the help of UNDP and JICA. The results of these investigations were found very encouraging (Ahsan et. al. 1994).

i. Duddar Lead, Zinc deposit

The most important lead-zinc deposit is located at Duddar in Balochistan. The reserves are estimated to be over 13 million tonnes with 11.51 % total metal content. The deposit has also been drill explored by GSP and later on by an Australian firm. Presently a Chinese firm has acquired the lease of the deposit and extensively working to bring the deposit into production very soon.

ii. Gunga Lead, Zinc deposit

The preliminary estimates made by the GSP indicate the availability of over 10 million tonnes of lead-zinc ore with about 8 % total metal value at Gunga near Khuzdar (Ahsan et.al.1994). These deposits are now being evaluated jointly by Enner of Ireland and Bolan Mining Enterprises (a joint venture of Pakistan Petroleum Ltd; and the Government of Balochistan). Preliminary work undertaken by the consultants has given hope of finding larger deposits of better grade than earlier estimates.

iii. Surmai Lead - Zinc deposit

At Surmai, exploration work carried out by GSP and JICA and proved the presence of 2.93 million tonnes of ore with average metal content of 6.5 percent (Ahsan et. al. 1994). Further exploration may reveal additional reserves in the area.

6. Chromite

Chromite with a general chemical formula $(\text{Mg}, \text{Fe}^{2+}) (\text{Cr}, \text{Al}, \text{Fe}^{3+})_2 \text{O}_4$ is the only source of chromium metal which is mainly used in the manufacture of stainless steel.

Chromite is used in making chemicals and salts of chromium and has a wide range of industrial uses. The use of chromite as refractory material is also quite common.

Chromite is associated with ultramafic rocks, which occur as layered intrusions (Bushvelled and Stillwater, etc) or as ophiolitic sequences (Sumail and Varinuous, etc). Chromite ore in layered intrusions occurs as large extensive layers with huge tonnage while chromite ore bodies associated with ophiolitic type of rocks are generally irregular, podiform in shape and small in size. The chromite deposits associated with ophiolitic rocks are known as alpine type. The chromite deposits of Pakistan are of the alpine type as they are associated with ophiolitic rocks emplaced along the colliding plate boundaries. The chromite is found as pods, lenses and irregular shaped bodies in dunite. The dunite occurs in the basal part of the ophiolites, i.e., in ultramafic tectonites and ultramafic cumulates.

In Balochistan chromite is found in Zhob, Killa Saifullah, Chagai, Kharan, Khuzdar and Lasbela districts. The most important among these are the Muslim Bagh deposits in Killa Saifullah district, Kabbar (Wadh), Pat Nadi and Sonaro deposits in Khuzdar district. In the Balochistan valley chromite deposits are podiform type found in ophiolitic rock sequence. At present chromite is being produced from Muslimbagh, Wadh and Sonaro areas in Balochistan. A total production of 25,735 tonnes was achieved during the year 2002-2003. Some of the important chromite deposits are described below.

i. Muslim Bagh Chromite Deposits, Balochistan

The Muslim Bagh deposits occur as interlayered massive pods, tabular, lenticular bodies and in disseminated form in serpentinized dunite, peridotite and serpentine. Muslim Bagh deposit has been producing Chromite since 1903 with an average annual production of about 30, 000 tonnes. Preliminary reconnaissance survey of other deposits was also conducted by the GSP.

ii. Khuzdar Chromite Deposits, Balochistan

The deposits at Kabbar (Wadh), Pat Nadi and Sonaro in Khuzdar district are associated with harzburgite and dunite in the form of small lenses to massive tabular bodies (See map).

The Kabbar, Pat Nadi and Sonaro deposits in the Khuzdar District have emerged as significant chromite producers with more than 10,000 tones annual production, which compares favourably with the present production from Muslim Bagh area.

6. Manganese

Manganese ores in Balochistan are found at many localities in Lasbela, Khuzdar, Chagai and Zhob districts. The most important among these are, the deposits found in Khuzdar and Lasbela districts. The host rock of almost all the manganese deposits is the volcanic assemblage of olivine basalt and pillow lava belonging to Bela volcanic Group. The manganese minerals mainly the psilomelane, and pyrolusite occur in the jasperoitic layer above pillow lava and below shally sedimentary rocks.

The manganese occurrences in Chagai district are found as coating and film in the quartz veins cutting limestone beds and basalts of Cretaceous age. These occurrences are reported from Siah Koh and Sotkinoh in Chagai district.

The manganese deposits reported from Zhob district occur in altered siliceous limestone associated with pillow lava of Parh Group of Cretaceous age. The manganese localities in Zhob district are at Naweoba and Warsak Killi area.

A total of 580,500 tonnes of manganese ore has been estimated in various deposits. The average range of manganese content of Balochistan manganese deposits is from 8.2% to 50.56%. Description of some important deposits in Balochistan is given below.

i. Waltoi Rud Deposit:

Waltai Rud, Killa Saifullah District, toposheet No. 39 B/2, (30o 40' N; 68o 01' E). It lies 16 km to the south of Nasai, which is connected by Quetta – Zhob metalled road.

The manganese oxide minerals are in layers up to 3 inches thick in altered siliceous limestone, associated with the pillow lavas of Parh Group volcanics. No further details of the deposit are available.

ii. **Naweoba Deposit:**

Naweoba, Zhob District, toposheet 39 E/6, (31° 33' N; 69° 22' E). It is located at 1.6 km to the north east of the village Naweoba which lies to the north of Zhob town on Zhob – Dera Ismail Khan metalled road. A metalled road connects Zhob with Quetta.

Showings of manganese are seen in shale, limestone and volcanic rocks of Parh Group of Cretaceous age adjacent to ultramafic rocks of ophiolitic type. No further details are available.

iii. **Khabri Deposit:**

Khabri, Lasbela District, toposheet No. 35 J/7, (26° 28' N; 66° 25' E). The deposit is north of Khabri village and 6 km south of Haji Muhammad Khan Bent, which is 26 km to the north east of Bela. The road is only up to Bela Town. Three grab samples were analyzed to contain 17.99 to 23.99 % Mn. Reserves are estimated at 65,000 tons. Some mining was done in the past but with no recorded history.

The psilomelane and pyrolusite constitute manganese deposit, which is in a 1.5 to 4 m thick jasperitic layer between the overlying pillow basalt of the Bela Volcanic Group of Cretaceous age and the underlying shale member of the volcanic - sedimentary sequence.

iv. **Sanjro Deposit:**

Sanjro, Lasbela District, toposheet No. 35 J/7 (26° 28' N; 66° 27' E). The deposit is located between Muhammad Khan Bent and Khabri deposits and lies 38 kms to the north of Bela, and is accessible through un - metalled road.

Mineralization is in the Bela Volcanic Group of Cretaceous age. Brunite ($3 \text{ Mn}_2\text{O}_3$, Mn SiO_3) mineralization has developed in minor association with calcite and hematite in Hill No.1, 2 and 3, and is 100 to 300 m long, 1 to 5 m thick and 7 to 60 m deep along dip direction.

Average Mn content is 8.2% but two channel samples carried 18.68% and 19.82% Mn. Reserves are estimated at 21, 500 tons. The deposits have been mined intermittently. No record of mining history and production is available.

v. **Siro Deposit:**

Siro, Lasbela district, toposheet No. 35 J/11, (26o 17' N; 66o 35' E). The deposit lies 29 km to the east north east of Bela town and can be reached from Tiaran Pir along Gajri Nai bed for 21 km. The Bala town is on Quetta – RCD Highway.

Psilomelane and pyrolusite bearing spheroids in dolerite in cracks and joints constitute the main mineralization. The deposit is the best known in the Lasbela District.

Manganese contents are reported to 2.88 to 31.72 % and reserves estimated at 450,000 tons. The deposit has been mined intermittently but presently there is no mining activity.

vi. **Kohan Jhal Deposit:**

Kohan Jhal, Lasbela district, toposheet No. 35 J/6, (26o 37' N; 66o 19' E). The deposit is 64 km to the north of Bela near the headwaters of Kohan Jhal. It can be approached from Bela -Wad road.

A discontinuous and lenticular layer of jasperoid rocks 1 to 6 m thick contains irregular patches of psilomelane and pyrolusite in pillow basalt, dolerite, shale and limestone of the Bela Volcanic Group of Cretaceous age. There are five separate deposits. One grab sample contains 36.85% manganese. The reserves in five deposits were estimated at 11,000 tons.

vii. **Kharari Nai Deposit:**

Kharari Nai, Lasbela district, toposheet No. 35 J/12 (25o 54' N; 66o 45' E). The deposit is accessible by 20 km fair weather jeep able road from Uthal, which is on Quetta – Karachi, RCD Highway.

The ore is found in the form of pods and lenses in an area measuring 80 x 21 m in pillow lavas of Bela Volcanic Group of Cretaceous age. The reserves are estimated at 24,000 tons. The deposit has been a past producer and about 10 to 15 thousand tons have been mined.

viii. **Sotkinoh Deposit:**

Sotkinoh, Chagai district, toposheet No. 34 G/11, (29° 14' N; 65° 51' E). The deposit is accessible from Nushki - Dalbandin road from a point 35 km south west of Nushki. Manganese contents vary from 40 to 50% and reserve estimated at 3,200 tons.

The manganese mineralization is within a vertical fracture zone 1.5 m wide and 90 m long, and is filled with quartz manganese oxides. The host rocks comprise shale, siltstone tuff, carbonaceous limestone and vesicular basalts.

6. Fluorite

Fluorite is chemically CaF_2 , i.e., calcium fluoride, but naturally occurring fluorite contains some Mg and Fe ionically replacing Ca. Impurities such as silica and calcium carbonate are usually associated with it.

It is mainly used as flux in steel making and is the only source of fluorine which is required for hydrofluoric acid and other fluorine compounds. Balochistan province is the main producer of fluorite in Pakistan. Fluorite is found in Maran, Pad Maran and Dilband areas of Kalat district, Balochistan (Fig-6). These deposits were discovered and evaluated by the Geological Survey of Pakistan (Bakar 1965; Abbas et al. 1980). Fluorite is found as bedded replacement, shear veins and fracture filled bodies in Chiltan limestone of Jurassic age. The hydrothermal solutions depositing fluorite have deposited calcite along with the fluorite in Maran and Dilband areas while silica and barytes occur as important gangue minerals in Pad Maran area. The reserves are estimated at over 0.1 million tonnes (Abbas et al. 1980). High grade ore (over 96% CaF_2 and less than 5% SiO_2) is mined from Maran and Dilband areas

while low grade ore with less than 85% CaF₂ and high SiO₂ content is found at Pad Maran. The total production of fluorite during 1994-95 was about 1000 tonnes.

7. Gypsum and Anhydrite

Balochistan has very large reserves of gypsum/anhydrite found at Spintangi and Chamalang. The estimated reserves and chemical composition of major deposits is given in table-4.

Table: 4 Reserves and Chemical Analyses of Major Gypsum Deposits of Balochistan.

Deposits/ Localities	Reserve s of million of tons	Insolu ble %	R ₂ O ₃ %	CaO %	Mg O %	S O ₃ %	H ₂ O %	CaS O ₄ 2H ₂ O%	CaSO ₄ %
Spintangi	-								
Range Analysis	0.5	0.30	0.50	32.3 0	0.68	47. 30	18.2 0	-	-
High Gypsum	-	0.60	0.40	32.6 7	0.32	47. 44	19.1 0	-	-

8. Baryte

The baryte deposits of Balochistan were discovered by the Geological Survey of Pakistan (Ahmad and Klinger, 1967). Balochistan contains very large deposits of Baryte. These deposits are located in the area between Uthal and Khuzdar. The baryte is found in Zidi, Shirinab and Windar formations (Triassic-Jurassic) forming bedded replacement or shear veins of hydrothermal origin. The ore bodies generally contain large tonnage.

Deposits at Gunga near Khuzdar and Duddar in Bela district have been investigated in detail. It has been estimated that at these two localities over 12 million tonnes of Barytes is present (Ahsan 1994).

The production from indigenous deposits meets the total requirement of barytes for oil well drilling and barium based chemical plants of the country. The barytes deposits of the province are sufficient and suitably located for large-scale production provided local and export markets could be developed.

9. Dimension and Decorative Stones

A variety of exquisite dimension and decorative stones are found at several localities in Balochistan. The ones most commonly used and which are mined in large quantities are onyx marble, various types of limestone and igneous rocks mainly basalt, gabbro, diorite and granite.

Marble is extensively used in the construction industry, for decorative purposes in building facings, bathrooms and for floor tiles. It is also used for making handicraft items.

Onyx marble of high quality is found in Chagai District. Attractive and good quality granite occurs in Chagai, Zhob, Kila Saifullah and Lasbela areas.

10. Limestone

Balochistan has vast resources of limestone extending from the coastal region near Karachi to as far north as the Chagai and Zhob. In most places the limestone is exposed near the railway tracks or road, making its utilization easy. These rocks generally contain over 80% calcium carbonate, less than 5% silica and less than 1% iron oxide making them suitable raw material for the manufacture of cement. However, the existing cement factories utilize only a fraction of the vast resource available in the country.

11. Coal Deposits

During the early years of world War-II, the Balochistan coal contributed 10% to the total coal production of India. At the end of war this region was producing over 130,000 tonnes of coal annually, totalling about 45% of the coal production of British India (Shah, 1990). At the time of independence, coal mining in Pakistan was carried out in seven or eight

fields. Production averaged at around 150,000 tonnes and most of it was mined from Balochistan.

There are six coal areas in Balochistan where coal-mining activities are in progress. These are - Khost–Shahrig–Harnai; Duki; Sor Rang–Daghari; Pir Imail Ziarat; Mach and recently mining was started in Chamalang area but it has been abandoned due to a tribal conflict). The present status of the coal potential of the province is based on the work done until now.

All of the Balochistan coal measures are confined to the Ghazij Formation of Early to Middle Eocene in age. The coal resources of Balochistan are described below:

Table 5 Summary of Coal Resources of Balochistan (million tonnes)

S. No.	Coalfield	Proved	Indicated	Inferred	Hypothetical	Total	Mineable
1.	Khost–Shahrig–Harnai	13	–	63	–	76	8
2.	Sor Range–Daghari	15	–	19	16	50	9
3.	Duki	14	11	25	–	50	8
4.	Mach–Abegum	9	–	14	–	23	5
5.	Pir Ismail Ziarat	2	2	8	–	12	1.2
6.	Chamalang	1	–	5	–	6	0.6
	Total	54	13	134	16	217	32

In addition to the above minerals the province of Balochistan has very large reserves of gypsum/anhydrite, building and decorative stones of attractive colour and texture (including granite, gabbro, basalt, fossiliferous and other varieties of limestone), shale, sandstone, quartzite, magnesite and soapstone. Small to medium deposits of dolomite,

pumice, fluorite, antimony, base metals and semiprecious stones, are also found in various parts of the province.

Annexure-I

**DISTRICT-WISE MINERAL PRODUCTION IN BALOCHISTAN
(2006-2007)**

S. NO.	MINERAL	QUETTA	CHAGAI	LORALAI	SIBI	BOLAN	MASTUNG
1.	Agglomerate	0	386	0	0	0	0
2.	Asbestos	0	0	0	0	0	0
3.	Baryte	0	0	0	0	0	0
4.	Chromite	0	50	0	0	0	0
5.	Clay	0	300	0	0	0	0
6.	Coal	7,524,484	0	420,929	329,878	298,839	0
7.	Conglomerate	0	0	0	0	0	0
8.	Copper	0	10,000	0	0	0	0
9.	Diorite	0	68	0	0	0	0
10.	Dolomite	0	377	0	0	0	0
11.	Fluorite	0	0	0	0	0	1,215
12.	Gabro	0	278	0	0	0	0
13.	Granite	0	2,005	0	0	0	0
14.	Iron Ore	0	139	0	0	0	0
15.	Jasper	0	113	0	0	0	0
16.	Limestone	5,144	2,148	0	0	0	63
17.	Magnesite	0	0	0	0	0	0
18.	Manganese	0	0	0	0	0	0
19.	Marble (Onyx)	0	46,554	0	0	0	0
20.	Marble (Ord.)	125	0	1,555	45	791	0
21.	Ordinary Stone	2,100	0	0	0	0	0
22.	Pumice	0	1,808	0	0	0	0
23.	Quartzite	0	0	0	0	0	0
24.	Serpentine	0	0	0	0	0	0
25.	Shale	0	0	0	0	0	0

... Annexure-I cont next page

DISTRICT-WISE MINERAL PRODUCTION IN BALOCHISTAN

(2006-2007)

S. NO.	MINERAL	KHUZDAR	KHARAN	LASBELA	PISHIN	QILA SAIFULLAH	TOTAL
1.	Agglomerate	0	0	0	0	0	386
2.	Asbestos	0	0	0	0	40	40
3.	Baryte	29,079	0	8,613	0	0	37,692
4.	Chromite	3,096	509	0	190	21,890	25,735
5.	Clay	0	0	0	0	0	300
6.	Coal	0	0	0	0	0	1,795,029
7.	Conglomerate	0	0	0	0	0	258
8.	Copper	0	0	0	0	0	10,000
9.	Diorite	0	0	0	0	0	68
10.	Dolomite	0	0	0	0	0	377
11.	Fluorite	0	0	0	0	0	1,215
12.	Gabro	0	0	0	0	0	278
13.	Granite	0	0	0	0	0	2005
14.	Iron Ore	0	0	0	0	0	139
15.	Jasper	0	0	0	0	0	113
16.	Limestone	27,342	0	228,818	0	0	263,515
17.	Magnesite	0	0	0	0	850	850
18.	Manganese	0	0	1,491	0	0	1,491
19.	Marble(Onyx)	0	0	0	0	0	46,554
20.	Marble (Ord.)	118,233	0	95,360	0	0	216,109
21.	Ordinary Stone	0	0	0	0	0	2,100
22.	Pumice	0	0	0	0	0	1,808
23.	Quartzite	0	0	352	0	0	352
24.	Serpentine	0	0	5,195	0	0	5,195
25.	Shale	0	0	563,595	0	0	563,595

ANNEXURE-II**RESERVES OF MINERALS WHICH HAVE PROSPECTS FOR ECONOMIC
DEVELOPMENT AND EXPLOITATION IN BALOCHISTAN**

Minerals	Locality	Reserve	Production potentials (in tonnes/year)	Remarks
Antimony	Qila Abdullah, Pishin district.	0.026 million tonnes	1000	Extreme weather conditions and difficult accessibility makes the exploitation difficult.
Aggregate and Building Stones	All the provinces of the country.	Very large	Very large	All sorts of building stones and other aggregates are available in very large quantities all over the country.
Barytes	Kalat and Lasbela districts.	Over 30 million tonnes	More than 3,000	Very large deposits in Khuzdar and Lasbela districts.
Bauxite/Laterite	Kalat and Sibi districts.	74 million tonnes.	More than 25,000	The deposits are only used in cement and other industries. Further investigation may prove a metallurgical grade deposit.
Chromite	Zhob and Wad (Balochistan).	FLD	20,000	Being podiform one bodies large producing mines cannot be planned but with some efforts the production can be raised many fold.
Coal	Sor Range - Deghari, Pir Ismail, Ziarat, Khost-Shahrig-Harnai Duki, Chamalang,	Over 184 billion tonnes	Very large	The production will increase many fold as soon as coal fired power plants are setup.
Copper	Chagai, Zhob and Lasbela districts.	About 412 million tonnes of ore in Saindak, and > 5	20,000 tonnes per day.	Development work on Saindak copper-gold project with annual production of 15800 tonnes of blister copper, 1.47 tonnes of gold and 2.76 tonnes of silver is in progress Extensive exploration activities are in progress at Reko

		Billion tonnes at Reko Diq		Diq by Australian and Chillian companies. The deposit is expected to be the world's largest deposit and start production by 2-3 years. Investigation is also in progress for massive sulphide copper deposits in Zhob and Lasbela districts.
Fluorite	Kalat & Khuzdar Districts.	0.1 million tonnes	5,000	Concentrated efforts are needed to increase production.
Gemstone	Zhob, Chagai and Lasbela districts.	Not estiamted	800-1600 gms/year	Exploration of Topaz deposits of Chitral and Mardan districts; and Ruby/Spinel deposits of Hunza and Dir districts may prove a sizable deposit.
Gypsum/ Anhydrite	Sibi, Balochistan.	350 million tonnes	Very large	The total demand of agricultural and industrial sector can be met locally.
Iron Ore	Chagai, Kalat and Lasbela districts.	Over 600 million tonnes	Not being exploited	Exploration and metallurgical studies of these deposits should be continued, so as to meet Steel Mill's requirements if possible. Newly discovered deposits of Kalat have a good potential of development.
Limestone	All the provinces of the country.	Very large.	Very large	Total requirement of cement and construction industries can be met locally.
Magnesite	Kalat, Khuzdar, Lasbela and Zhob districts.	12 million tonnes	50,000	Fuesed Magnesium Phosphate and refractory bricks can be made from Hazara magnesite and phosphate deposit.
Marble/Aragonite	Chagai district.	VLD	Very large	Very large deposits of recrystallized, fossiliferous and good colour limestone deposits occur all over the country, especially in the northern areas. The deposits are being mined on large scale. The produciton can be further increased many fold

				depending upon demand.
Quartz/ Quartzite	Lasbela, Zhob and Chagai districts.	FLD	40,000	Total demand of Karachi Steel Mill and local Ceramic Industry are met locally.
Soapstone/Talc	Lasbela district.	over 600,000 tonnes	24,500	Detailed exploration and development of Swat deposit for proving more reserves to meet the domestic and export requirements. Accessibility problem is hindering the development of Parachinar deposits.
Serpentine	Lasbela district.	NE	5,000	The production can be raised depending upon market.
Sulphur.	Koh-i-Sultan in Chagai and Sanny in Sibi district.	800,000	3,000	Development on scientific lines is required for optimum produciton for defense and other purposes.