Khyber Pakhtunkhwa: A Province Rich of Natural Resources

Study of major mines and minerals resources of KPK

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Chapter 1. Introduction

1.1. Background and Introduction

Pakistan is endowed with huge reserves of minerals covering an outcrop area of 600,000 sq. Kms. There are 92 known minerals of which 52 are commercially exploited with a total production of 68.52 million metric tons per year. The sector is a promising one with an average growth of 2-3% per annum, existence of above 5,000 operational mines, 50,000 SMEs and direct employment of 300,000 workers.

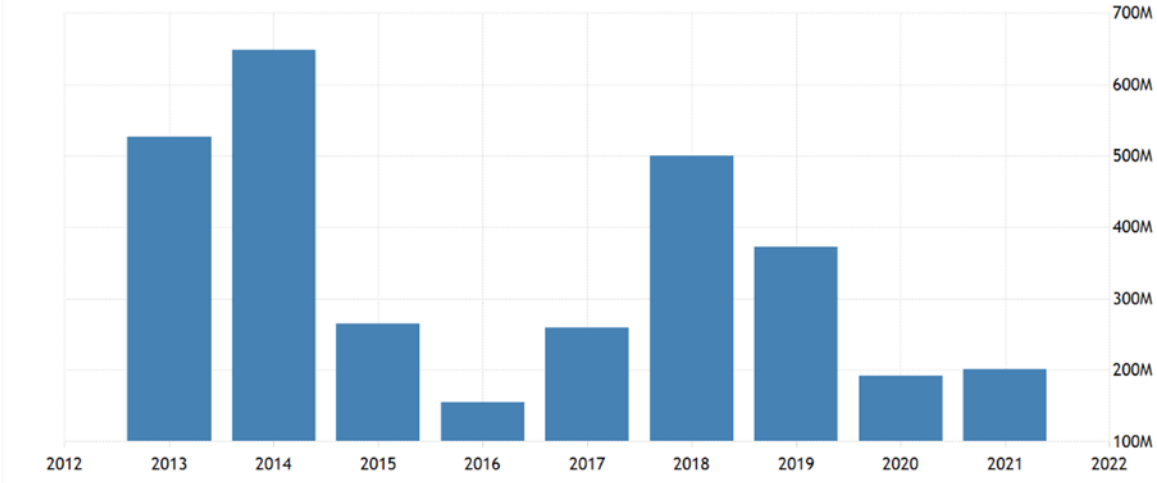
The country has the world's second largest salt mines and fifth largest copper and gold reserves, and second largest coal deposits, as well as estimated billions of barrels of crude oil. Despite huge potential, contribution of mineral sector to Pakistan's GDP is around 3 % and country's exports are only about 0.1% of the world's total.

Technology adopted both in the quarrying and processing sub sectors is outdated and is unable to produce standardized and uniform quality products for domestic market in general and for export market in particular. The quarry wastage in Pakistan reaches 75% as compared to the international standard of up to 45%.

1.1.1. Pakistan's Exports

Pakistan Exports of mineral fuels, oils, distillation products was US$201.35 Million during 2021, according to the United Nations COMTRADE database on international trade. Figure 1 showing exports of mineral fuels, oil and distillation products one decade. The exports are at its peak during years 2013, 2014 and 2018 while 2016, 2020 and 2021 shows a drastic decline in the exports.

Figure 1 Pakistan Exports



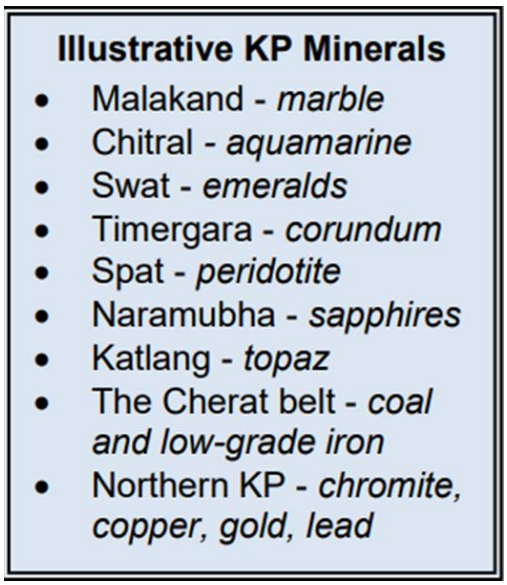
Source: United Nations COMTRADE database on international trade

Chapter 2. Khyber Pakhtunkhwa Reserves of Natural Resource

Khyber Pakhtunkhwa (KP) is host to a large array of minerals. The primary mining in KP is marble and granite as well as coal (ranging from lignite to bituminous) and limestone KP divides its mineral categories into:

1. Dimension stone
2. Gemstones
3. Industrial rocks (i.e., rock salt, limestone, phosphates, gypsum, soapstone)
4. Fuel minerals
5. Metallic minerals (southern province, i.e., coal, base metals, lead) and construction materials. Figure 2. Showing illustration of KPK minerals resources

Figure 2 List of KPK Minerals



Source: USAID small and medium enterprises activity

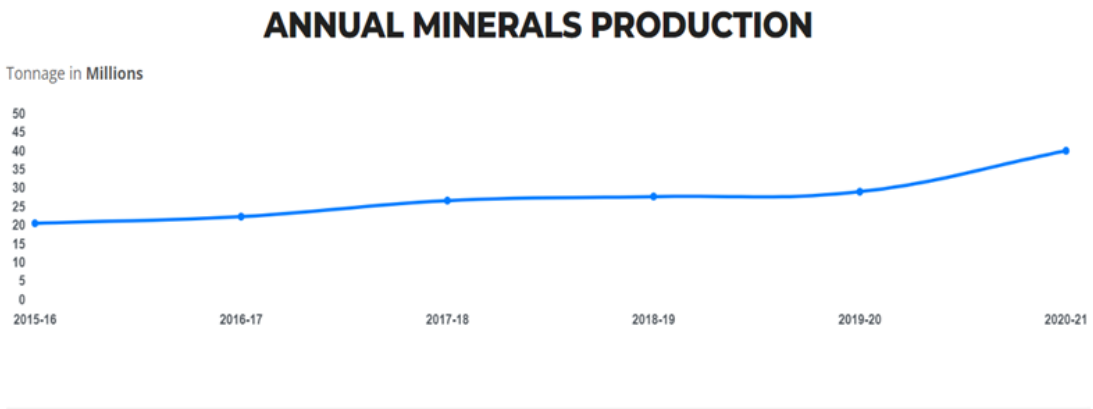
2.1. Khyber Pakhtunkhwa Minerals Map

Figure 3 illustrates the mineral strengths by district. This demonstrates that the Malakand district is rich in natural resources such as antimony, marble, granite, emerald, aquamarine, copper, and so on. However, Hazara, Kohat, and DI.Khan have abundant coal, gypsum, and limestone sources. This study provides information on the occurrence, technique of extraction, production, and job creation for major minerals present in Khyber Pakhtunkhwa.

Figure 3 KPK Minerals Map

Figure 4. Showing graphical representation of mineral production specifically for Khyber Pakhtunkhwa based on latest data which is showing growth trend in the production from past one decade. For year 2020-21 the peak production of mineral is around 40 million ton.

Figure 4 KPK Annual Production of Minerals



Source: Minerals Development Department Government of Khyber Pakhtunkhwa

Below Table is indicating major mines occurrence in Khyber Pakhtunkhwa from 2018 to 2021 taken from D.G. Mines & Mineral Govt. of Khyber Pakhtunkhwa, Peshawar.

Table 1: Major Minerals of KPK

Type of Minerals	Khyber Pakhtunkhwa (Tons)		
	2018-19	2019-20	2020-21
Barytes	2,114	1,535	646
Bentonite	1,077	2,020	4,484
Bauxite	5,655	6,855	6,115
Chromite	25,482	22,145	21,811
Coal	452,924	257,540	205,935
Dolomite	469,772	302,045	388,038
Emerald	4,351	3,706	225
Feldspar	298,381	343,075	451,985
Fire Clay	19,421	11,372	21,720
Garnet Schist	7,960	1,719	7,520
Granite	187,861	184,227	328,569
Graphite	3,200	13,285	8,173
Gypsum	950,554	911,616	1,256,763
Iron Ore	30,731	17,481	36,376
Latrite	318,639	281,165	451,222
Lead	3,877	15,244	0
Lime Stone	20,176,968	19,710,713	28,230,911
Magnasite	5,817	1,405	546
Marble	5,471,770	3,824,427	5,838,385
Phosphate	96,208	87,325	120,216
Quartizite	1,245	4,675	4,195
Quartz	112,308	4,167	20,203
Rock Salt	158,005	175,185	212,577
Shale Clay	2,388,740	2,165,716	3,284,496
Silica Sand	297,478	21,082	39,651
Slate Stone	569,375	634,288	678,538
Soap Stone	158,109	170,093	289,968

Source: D.G. Mines & Mineral Govt. of Khyber Pakhtunkhwa, Peshawar

Table2: District Wise Mineral Reserves

Types of Minerals	Abbottabad (Tons)		
	2018-19	2019-20	2020-21
Barytes	1,539	1,335	266
Coal	3,706	1,934	1,887
Dolomite	82,579	31,261	19,281
Feldspar	140	-	3,796
Fire Clay	8,591	8,547	19,049
Iron Ore	-	139	78
Latrite	-	-	1,465
Lime Stone	1,701,279	1,234,747	970,509
Magnasite	5,817	1,405	426
Marble	-	952	876
Phosphate	96,208	87325	120,216
Soap Stone	106,488	99915	186,775

Types of Minerals	Bannu (Tons)		
	2018-19	2019-20	2020-21
Iron Ore	27,414	17,053	31,510
Latrite	35,679	12,380	19,325
Lime Stone	918,970	1,358,121	1,255,028
Sand Stone	30,965	5535	3,132
Shale Clay	762,515	405615	1,055,460
Silica Sand	14,755	11,330	24,200

Types of Minerals	Buner (Tons)		
	2018-19	2019-20	2020-21
Barytes	415	200	380
Dolomite	47,745	18,684	50,661
Feldspar	5,126	5,157	7,637
Granite	608	1,482	1,426
Lime Stone	2,003	3,343	3,021
Marble	2,889,183	2,645,737	3,608,004

Types of Minerals	Charsadda (Tons)			Chitral (Tons)		
	2018-19	2019-20	2020-21	2018-19	2019-20	2020-21
Chromite	1,638	2,023	5,207	-	-	-
Dolomite	43,429	29,449	81,591	-	-	-
Iron Ore	-	-	-	-	-	1,730
Lead	-	-	-	3,877	15,244	-
Lime Stone	53,347	76,653	109,757	253	56	-
Soap Stone	-	-	-	1,362	2,170	554
Marble	-	410	-	1,775	2,399	1,526

Type of Minerals	D.I.Khan (Tons)		
	2018-19	2019-20	2020-21
Bauxite	5,655	6,855	6,115
Dolomite	124,904	56,833	-
Fire Clay	3,620	-	700
Gypsum	1,250	5,120	630
Latrite	189,312	119,376	242,070
Lime Stone	3,633,742	4,149,688	6,593,643
Shale Clay	-	370976	-
Silica Sand	37149	7265	4350

Types of Minerals	Haripur (Tons)			Karak (Tons)		
	2018-19	2019-20	2020-21	2018-19	2019-20	2020-21

Barytes	160	-	-	-	-	-
Coal	-	-	-	64,360	57,357	75,595
Dolomite	58,392	23,113	23,475	-	-	-
Granite	-	-	257	-	-	-
Graphite	-	7,175	1,330	-	-	-
Gypsum	12,925	2,346	3,309	455,388	575,393	500,203
Latrite	13,002	24,703	16,520	-	-	-
Lime Stone	3,144,384	3,775,319	6,106,475	-	300	38,691
Marble	61,490	74,614	15,937	-	-	-
Rock Salt	-	-	-	158,005	175,185	212,577
Shale Clay	382,489	384,801	674,764	-	-	-
Silica Sand	-	-	-	8,767	2,487	11,101
Slate Stone	417,288	423,109	447,069	-	-	-
Soap Stone	30,857	42,964	52,240	-	-	-

Type of Minerals	**Kohat (Tons)**			**Kohistan (Tons)**			**Lower Dir (Tons)**		
	2018-19	**2019-20**	**2020-21**	**2018-19**	**2019-20**	**2020-21**	**2018-19**	**2019-20**	**2020-21**
Chromite	-	-	-	20	138	22	-	18,666	-
Coal	281,586	186,201	253	-	-	-	-	-	-
Feldspar	-	-	-	-	-	-	3,057	120	8,140
Granite	-	-	-	3,603	3,219	489	40,119	68,861	90,973
Gypsum	480,991	328,757	752,621	-	-	-	-	-	-
Heamatite	-	-	-	130	167	-	-	-	-
Hornblendite	-	-	-	-	-	271	-	-	-
Industrial Garnet	-	-	-	124	50	278	-	-	-
Latrite	26,784	34,110	9,499	-	-	-	-	-	-
Lime Stone	3,311,211	2,837,210	3,908,062	-	-	-	19,482	14,956	32,949
Marble	-	-	-	-	-	-	-	11,565	-
Mica	-	-	-	-	-	-	-	17	18
Potash	-	-	-	-	-	-	-	399	4,349
Quartz	-	-	-	-	-	-	-	-	963
Sand Stone	-	-	-	-	-	-	-	-	542
Shale Clay	608,831	607,526	954,829	-	-	-	-	-	-

Type of Minerals	Malakand			Mansehra			Mardan			Nowshera		
	2018-19	2019-20	2020-21	2018-19	2019-20	2020-21	2018-19	2019-20	2020-21	2018-19	2019-20	2020-21
Chromite	4,422	1,318	15,512	761	-	-	-	-	-	-	-	-
Coal	-	-	-	574	102	39	-	-	-	12,118	11,946	15,661
Dolomite	-	-	-	1,527	3,771	2,239	490	-	80	60,090	83,464	143,001
Feldspar	-	366	572	290,058	336,107	426,970	-	-	-	-	-	-
Fire Clay	-	-	-	-	-	-	-	-	-	7,210	2,825	1,971
Garnet Schist	7,900	1,400	3,010	60	319	1,187	-	-	-	-	-	-
Granite	-	84	850	137,942	100,456	185,475	2,340	7,063	12,655	-	-	-
Graphite	3,200	6,110	6,773	-	-	-	-	-	-	-	-	-
Latrite	-	-	-	-	-	-	-	-	-	8,282	90,596	87,262
Lime Stone	20,290	55,551	55,556	371	7,794	4,166	424,600	424,492	527,495	5,065,984	5,450,849	6,460,330
Marble	51,106	22,438	35,942	-	200	30	573,827	980,361	1,419,120	2,744	2,498	2,024
Quartz	1,421	3,382	7,043	1,008	25	1,705	-	-	-	-	-	-
Shale Clay	-	-	-	-	-	-	-	-	-	634,905	395,948	599,443
Slate Stone	15,950	2,522	3,244	-	-	-	-	-	-	133,950	203,797	217,317
Soap Stone	-	-	-	36	-	218	-	-	-	1,995	4,815	4,132

Type of Minerals	Swabi			Swat		
	2018-19	2019-20	2020-21	2018-19	2019-20	2020-21
Dolomite	50,616	55,470	67,710	-	-	-
Emerald	-	-	-	4,351	3,706	225
Feldspar	-	-	-	-	1,325	4,870
Granite	3,249	2,177	3,182	-	885	4,338
Lime Stone	242,990	285,014	572,311	22,837	36,620	44,643
Marble	79,680	72,363	94,256	6,510	10,890	18,895
Quartizite	1,245	4,675	4,195	-	-	-
Slate Stone	2,187	2,032	3,250	-	2,828	7,658

Type of Minerals	Bajaur			Mohmand			Khyber		
	2018-19	2019-20	2020-21	2018-19	2019-20	2020-21	2018-19	2019-20	2020-21
Chromite	45	-	170	18,086	-	900	-	-	-
Flurite	-	-	-	-	-	-	241	-	40
Granite	-	-	28,924	-	-	-	-	-	-
Latrite	-	-	-	-	-	-	25,700	-	63,520
Lead	-	-	-	-	-	-	-	-	-
Lime Stone	-	-	-	81,991	-	-	1,533,234	-	1,548,275
Magnasite	-	-	-	-	-	-	-	-	-
Manganese	120	-	150	135	-	-	-	-	-
Marble	53,778	-	22,217	1,658,933	-	523,638	90,394	-	94,825
Nephrite	30	-	-	1,020	-	544	-	-	-
Quartz	60	-	170	108,847	-	-	528	-	4,444
Soap Stone	60	-	-	13,935	-	-	-	-	545

Type of Minerals	Orakzai			Kurram			North Waziristan		
	2018-19	2019-20	2020-21	2018-19	2019-20	2020-21	2018-19	2019-20	2020-21
Chromite	-	-	-	-	-	-	510	-	-
Coal	90,520	-	95,648	-	-	16,852	60	-	-
Copper	-	-	-	-	-	-	420	-	-
Latrite	19,880	-	9,261	-	-	-	-	-	-
Soap Stone	-	-	-	1,620	-	40,186	-	-	-

Source: D.G. Mines & Mineral Govt. of Khyber Pakhtunkhwa, Peshawar

Chapter 3. Marble

Khyber Pakhtunkhwa hosts major marble reserves of the country i.e., 2,900 million tons which is about 99% of the country's reserves. The total marble bearing areas of KP are divided into four belts Table 2. Major marble mining areas include Buner, Mardan, Swabi, Nowshera, Mansehra, Malakand and Chitral districts. Among these, one of the best quality marble reserves in the country is located near Bampokha village in district Buner. Besides above localities, substantial reserves of good quality marble are found in the ex-FATA areas Khyber Pakhtunkhwa i.e., Khyber, Mohmand and Bajaur districts. Moreover table 3 and 4 showing summary of different types of marble found in Pakistan and districts wise data of subs sectors, number of units, annual production (Tons/Sq Ft), number of employees, total investment (Million Rs.).

Table 3 Major marble belts occurrences in KP

S. No.	Belt	Reserves (Million tons)
1	Reshun marble	1,000
2	Shoghore marble	1,000
3	Nowhsera Pink marble	100
4	Swat and Kohistan Regions and Southern part	800
Total		2,900

Source: GSP (2017), DGMM KP (2004).

Table 4 Different Types of Marble Found in Pakistan

S. No.	Types based on color	Occurrences	Color descriptions
1	White	Muhammad Agency, Chitral, Buner, Swat, Parachinar, Gilgit, Hunza, Swabi, Malakand	Pure white: white with pink, brown and green shades, white to grey with yellowish patches, white to light grey with yellowish brown patches, creamy white
2	Black	Buner, Bajour. Mardan, Bela	Deep black with patches of white, black with white and golden steaks
3	Green	Swat, Swabi, Buner, Azad Kashmir and Lasbela, Jhuli,Zard Khan, Zeh	Dark green, green with streak and patches of white grey and black, greenish white, dark green with layers of light green, green with streaks of white and yellow
4	Pink	Nowshehra, Chitral, Lasbela	Pink with streaks and patches white, grey,redand brown :pink with fossils
5	Grey	Buner, Bajour, Mardan, Swat, Muhammad Agency, Lasbela	Grey with white bands, grey with pink, brown and green patches
6	Brown	Bunner, Swat, Kohat, Waziristan, Khuzdar	Dark brown with white lines, brown with yellow patches, light brown with fossils
7	Yellow	Bunner, Swat, Kohat, Waziristan, Khuzdar	Yellow with golden patches, yellowish golden with fossils

Source: Ashmole Motloung, (2008).

Table 4. Showing total number of units in major marble occurring districts of KPK such as Peshawar, Noshehra, Risalpur, Abbottabad, Mansehra, Buner, Khyber Agency and Mohmand Agency. The total units are 2039 while total job creations are 25379.94.

Table 5 KPK Marble Sector Cluster Glance

Districts	**Sub Sector**	**Number of Units**	**Annual Production (Tons/Sq Ft)**	**Number of Employees**	**Total Investment (Million Rs.)**
Peshawar	Mining	105	824	144.97	31.59 million Ton
	Processing	105	824	144.97	31.59 million Ton
Noshera Risalpur	Mining	-	-	-	-
	Processing	200	33 million	2000	200
Abbottabad/Mansehra	Mining	23	105,800	1,283	1,902,636,667
	Processing	57	19,624,800	407	439,376,159
Buner	Mining	90	2.6 million tons	4,200	950
	Processing	400	45 million Sq Ft	5,800	2,000

Khyber	Mining	70	4.368 million tons	1250	600
	Processing	250	62.4 million Sq Ft	2250	2650
Mohmand Agency	Mining	438	-	4,380	4,470
	Processing	301	-	3,520	2,630
Total		**2039**	**-**	**25379.94**	**-**

Source: Ministry of Planning, Development and Reform Government of Pakistan

3.1.1. Provincial Break-up of Marble Production

Khyber Pakhtunkhwa is currently leading the production of marble in the country with 2.47 million tons. The province gad registered great growth in the number of marble producers in the past two decades while it had experienced a slump in production during militancy in several parts of the province. It has been a hub for many private investments in this sector.

As per the Economic survey of Pakistan 2017-18 with the exception of 2016-17, the mining and quarrying industry has registered growth since 2012-13 that shows the potential of marble and granite to contribute to the country's foreign exchange. Table 1. Shows provincial wise break up of marble production.

Table 6 Provincial Break-up of Marble Production

Year	Punjab	Sindh	KPK	Balochistan	Ex-Fata
2010-11	1,078	500	187,708	522,482	423,132
2011-12	205	5,090	376,996	735,211	633,031
2012-13	410	5,590	1,091,229	758,606	504,279
2013-14	660	1,100	1,490,724	947,582	479,717
2014-15	-	964	1,712,137	531,899	570,621
2015-16	-	3,125	2,473,562	1,442,346	829,682

Source: Pakistan Statistical Year Book

3.1.2. Mining techniques for extraction of dimension stone

The following mining techniques are used for extraction of dimension stone

3.1.3. Conventional mining techniques

Conventional techniques involve the use of explosives for splitting of blocks. In case of improper blasts and drilling pattern, the potato shaped blocks are obtained which not only wastes the valuable blocks but also reduce the economy of the operation. It involves two steps:

1. In first step vertical, inclined and horizontal holes are drilled at suitable locations by using hydraulic drill machine or compressed air drill machine with keeping in view the geology of the rock.

2. In second step the drilled holes are charged with suitable explosives following a proper charging and blasting pattern. The dimension stone deposits through conventional mining techniques result in huge wastage up to 85%.

3.1.4. Modern mechanized mining

This technique is also called non-blasting technique in which the dimension stone is extracted in block shape according to the market demand through Diamond Wire Saw and Chain Saw Technique. In diamond wire saw technique diamond wire is used as cutting source for dimension stone. Its best feature is that it can be used for any cut size and gives fine faces. It gives high quality and reliable cutting according to the standard size of dimension stone required as by national and international market. Besides that there are several techniques that can be used to extract marbles which can be cost efficient as well the details are given below:

Cutting of dimension stone using wire saw:

In this technique three free faces are favorable for cutting of primary block by diamond wire saw machine. If there are two faces then a V shape cut is made to open a third face. In drilling three holes are drilled at suitable location in parent rock. During drilling one hole is made vertical while other two holes are made horizontal. All the three holes should intersect each other at a single point. Normally down the hole (DTH) drill machine is used for the drilling purpose. Diameter of drill is kept such that if there is variation in the drilling alignment even then they meet at a single point. The next step after drilling is cutting of primary block. First of all horizontal cut is made. It is done so because if vertical cut is

made first then the load of the block will choke the diamond wire in horizontal cut and diamond wire can be damaged. After making horizontal cut, two vertical cuts are made step by step. After freeing the block from parental rock the block is further cut into different size or according to standard size.

Chain saw

In this method the cutting machine used contains an arm, which can cut in horizontal as well as in vertical direction. The length of the arm is normally 3.5 meter longer. Cutting tool is an endless chain that runs along the frame and contains Tungsten Carbide at some angle for cutting purposes. Great care must be taken in ensuring regular supply of water to machine and maintaining appropriate velocity of the chain. When the block is separated from the bottom, wedges are inserted in order to reduce load on the cutting arm. This method can be applied to almost all types of quarries. It is preferred for soft stone quarrying. Its production is about 8 to 10 m2 per hour in carbonated marbles. Analysis shows that around 60% of power is consumed in friction losses. Therefore, extensive lubrication is required for the machinery that again increases the cost of operation. Chain cutting method is more productive. There is no need of horizontal and vertical holes drilling. It is more time saving method. When this machine is combined with diamonds wire cutting machine and drilling rigs, then its productivity and economy increases. This method requires high skill and therefore, is not widely used.

Cracking/expansion powder

Expansion powder known as SPLIT.AG, Expansive mortar, Non-Explosive demolition agent, is a non-toxic and cementation powder, which consisting of calcined oxides of 27 calcium, silicon and aluminum, SPLIT.AG produces a highly powered amazing expansive pressure of 18000 psi when mixed with water. Marble, granite, limestone, boulders, and ledge are fractured overnight without noise, vibration, or fly rock. Especially, used as environment constraints or when explosive is not permitted for use. In mining and quarrying industry, Split-AG helps to achieve perfect slabs and blocks from limestone, onyx, marble, granite or any other type of stone you are working with. Compares to blasting, Split-AG avoids wastage of valuable stone, high insurance, costly storage and labor.

Extraction of dimension stone using cracking powder

First the cracking powder is prepared by mixing 1.5liters (0.4us gallon) clean water with one bag (5kgs) of Split AG powder in container. All the material mixed is stirred gradually until it got good fluidity. The cracking powder is now prepared to use for extraction of dimension stone block. The dimension stone block is extracted through drilling of holes using stich drill machine as shown in figure 7, filling of drilled holes from cracking powder, curing (Cover the filled holes with a plastic cover etc. to avoid any accident caused by blow out shots. The time required for crack formation in material at 20 to 68oC is approximately 10-20 hours the lower the temperature is, the longer the time for crack formation. Spraying the surface with water after cracks initiate tend to expand the width of cracks and speed up the cracking process) and finally the required size block is extract from parental/extracted rock portion.

Pre-splitting

Presplitting, sometimes called preshearing. This is the most successful and widely adopted controlled blasting method and creates a plane of shear on the desired line of break, exposing the half barrel of the blast hole after excavation. In this method drilled holes are fired before any of the adjacent main blast holes. The light explosive charges propagate a crack between the holes. The light powder load may be obtained by using specially designed slender cartridges, partial or whole cartridges taped to a detonating cord down line, an explosive cut from a continuous reel, or heavy grain detonating cord. A heavier charge of tamped cartridges is used in the bottom few feet of hole. The maximum depth for a single Presplit is limited by the accuracy of the Drill holes and is usually about 50 feet (15 m). Depths between 20 and 40 feet (6 and 12 m) are recommended. A deviation of greater than 6 inches (152 mm) from the desired plane or shear will give inferior results.

Chapter 4. Coal

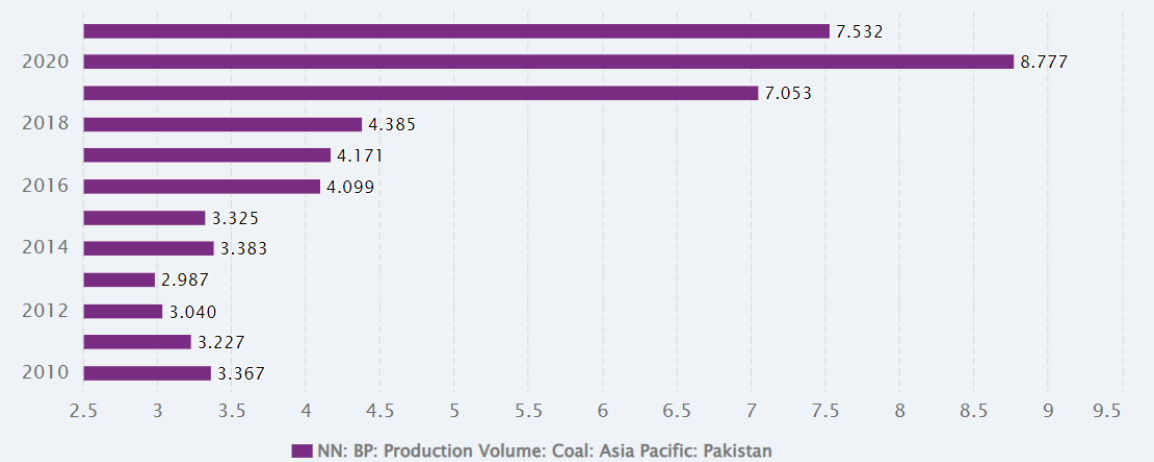
Pakistan holds 3,377 million tons (MMst) of proven coal reserves as of 2016, ranking 20th in the world and accounting for about 0% of the world's total coal reserves of 1,139,471 million tons (MMst). Pakistan has proven reserves equivalent to 331.1 times its annual consumption. This means it has about 331 years of Coal left (at current consumption levels and excluding unproven reserves).

Table 7 Summary Table of Coal Reserves

Categories	***Tons***	***Global Rank***
Coal Reserves	3,377,477,840	20th in the world
Coal Production	4,506,243	34th in the world
Coal Consumption	10,199,674	38th in the world
Yearly Deficit	-5,693,431	-
Coal Imports	7,107,758	-
Coal Exports	120	-
Net Imports	7,107,638	-

Moreover, resent data from CEICEDATA shows Pakistan coal production was reported at 7.532 tone MN in Dec 202, this records a decrease from the previous number of 8.777 tone MN for Dec 2020. Figure 5. Showing latest data of coal production in Pakistan.

Figure 5 Coal Production Recent Data



Source: Census and Economic Information Center

4.1.1. Coal Deposits of Khyber Pakhtunkhwa

Coal deposits of the Khyber Pakhtunkhwa (KP), Pakistan are geologically found scattered in the latest Cretaceous and Tertiary horizons like an archipelago. Extensive academic and exploratory studies have so far been carried out on these deposits by various organizations; consequently indicated reserves to the tune of 82 million tons only in Hangu/Orakzai while 9 million tons of developed reserves in Gulla Khel/Karak areas are reported by the Geological Survey of Pakistan (GSP).

Table 8 Three Year Coal Production from Kpk

Districts	**2017-18**	**2018-19**	**2019-20**
Abbottabad	22,750	5992	962
Hango	0	0	100
Haripur	7,690	2,026	30
Karak	0	56,641	56,943
Kohat	43,594	16,849	1,220
Mansehra	4,240	4,368	1,065
Nowshera	10,212	4,772	9,344
Total	88,486	90,648	69,664

Source: Directorate General Mines and Minerals, Government of KPK

4.1.2. Coal Exploration Techniques

A variety of geological techniques is used in coal exploration is including field mapping, interpretation of air photos and satellite images, and airborne and ground geophysical surveys such as gravity, magnetic and seismic studies.

Chapter 5. Chromite

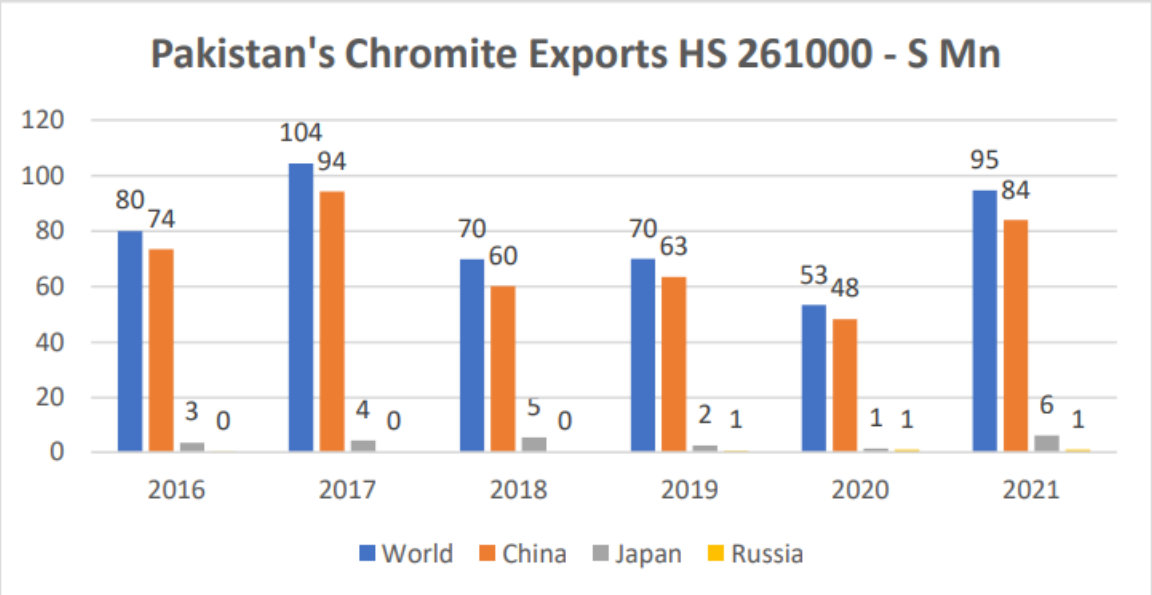
Pakistan has vast mineral reserves of over 600,000 square kilometers of the outcrop. Currently, 92 minerals have been found, 52 of which are commercially mined, with a total annual production capacity of 68.52 MMT. The sector expands at a rate of 2 to 3 percent per year on average. With over 5,000 working mines, 50,000 SMEs, and direct employment of 300,000 individuals, this industry contributes to the economy.

One of the most significant minerals, chromite, and its value-added products have a lot of potential and are in high demand both domestically and abroad. There are approximately 4.5 million tons of total chromite reserves, and 115,000 metric tons may be extracted each year (Finance, 2021). Pakistan hasn't been able to reach its full potential despite having enormous wealth. With a $2 billion global demand, chromite also has a larger market.

5.1.1. Pakistan's Chromite Production and Trade

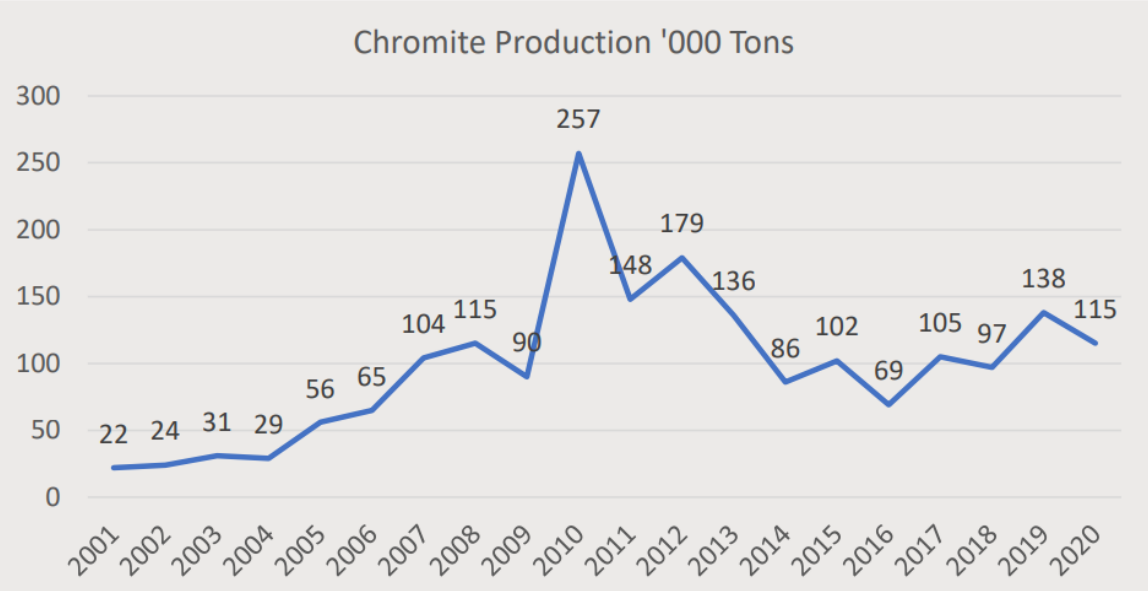
Chromite exports were valued at $ 95 million in 2021, with key destinations including China ($84 million), Japan ($6 million), and Russia ($1 million).

Figure 6 Pakistan Chromite Exports



Source: ITC Trade Map

The production of Chromite has seen an increasing trend but it remains stagnant for over 20 years.



Source: Economic Survey 2021

5.1.2. Uses of Chromite

Chromite is used directly in industrial foundries and refractory sands or converted into sodium dichromate for further refinement into other chemicals and chromium metal, but the main consumption is in ferrochrome furnaces to produce an alloy used by the steel industry. Over 95% of chromium consumption is attributable to metallurgical applications, with stainless steel alone representing 78% of consumption in 2019. Trends in stainless steel production are, therefore, the main determinant for chromium demand.

5.1.3. Chromite Deposits in Pakistan

In Pakistan, Chromite deposits are associated with ophiolite sequence resulted by the outpouring of molten material in the fractured zones of the Indian plate and Neo-Tethys ocean in Cretaceous time. In northern Pakistan, the ultramafic complexes are Dargai (Shahkot-Qila) and ShanglaMingora. The magmatic arc complexes of Indus suture zone includes Jijal complex, Sapat complex and Chilas complex of the Cretaceous age. Chromite deposits in Balochistan are located at Bela ophiolites, Muslimbagh-Zhob, and Waziristan Ophiolites.

Figure 7Location Map of Reported Chromite resources of Pakistan