THE ECONOMIC IMPORTANCE OF MINERAL PRODUCTION IN IRAN, PAKISTAN AND TURKEY IN VIEW OF CO-OPERATION IN MINERAL EXPORTS AND INTERREGIONAL TRADE*

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ABSTRACT.— Possibilities of co-operation are discussed regarding exports of mineral commodities, namely, chromite and marble which are produced by the three regional countries. In order to improve the opportunities for the regional trade among Iran, Pakistan and Turkey, the following minerals can offer potentialities: coking coal, sulphur, barite, bentonite, magnesite, lead and zinc ores and boron minerals, which are in short supply in one country and abundant in another.

INTRODUCTION

Minerals form the principal natural resources of any country. Iran, Pakistan and Turkey are trying to achieve the industrial development and axiomatically the mineral development will play an important role in industrialization of the three countries. Mineral exports may contribute a great deal in obtaining foreign exchange currency, which is essential in carrying out various development projects, for capital investment requirements in respective countries.

Mineral deposits of the three countries do now show much similarity in view of their magnitude and the value in spite of having a close relationship of geological background. Turkey appears to be rich in the metallic and non-metallic minerals. Iran has large petroleum reserves and is one of the leading oil-producing and exporting countries of the world. In addition, she is sufficiently endowed with the ores of the base metals, namely, lead and zinc. On the other hand, Pakistan, still being in an early stage of the mineral development, looks promising in the field of non-metallic minerals and natural gas resources. (Tables I and II show mineral positions of the three countries with respect to the production and exports.)

Pakistan (23) exported 3.5 million Rs (US $ 735,000) of chromite from April 1965 to August 1966 and 700 thousand Rs (US $ 147,000) of marble from January 1965 to May 1966.

In Turkey, the gross value of metals and minerals production reached US $ 303,037,000 in 1966, representing 3.4 % "of GNP of approximately US $ 8.9 billion. The value of exports (almost 50 million dollars) formed 10.19 % of the total value of exports (490.5 million dollars in 1966) and 16.4 % of the value of total production (metals and minerals).

It is readily seen from the Tables I and II that the mineral exports and products in Iran and Pakistan are considerably less than the Turkish figures.

In the third Five-Year-Plan (1965-70) of Pakistan (13), Rs 1650 million (4.76 Rs = 1 US $) allocation was made for the development of fuels and minerals so that coal production will be increased to 3 million tons in 1970 and similarly increases of about 25 %, 20 %, 78 %, and 20 % are expected for rock salt, chromite, limestone and gypsum.

The fourth Five-Year-Plan of Iran (27) allocated 60 million dollars for the mineral exploration and mining development to be concentrated on those minerals needed for the internal development of Iran.

Table - I

Production of principal metals and minerals in Turkey (36) in 1966; Iran (27) (29) and Pakistan (23) in 1965

Commodity	IRAN		PAKISTAN		TURKEY	
	1000 M.T.	Value US $ 1000	1000 L.T.	Value US$ 1000	1000 M.T.	Value US$ 1000
Bituminous coal (saleable)...	274	2 740e	—	—	4 903	63 450
Lignite (saleable).....	—	—	1 212	8 484e	4 774	30 800
Iron ore.....	—	—	—	—	1 615	—
Steel ingots.....	—	—	—	—	939	140 850
Red oxide of iron.....	10.5	322	—	—	—	—
Chromite (all grades)	150	3 000	14.2	284e	511	10 560
Copper (blister).....	—	—	—	—	26.2	34 350
Ferrochromium	—	—	—	—	7	2 100
Boron minerals	—	—	—	—	225.3	5 400
Sulphur (refined).....	22	1 188e	N.A.	N.A.	22.6	1 230
Mercury (76 lb flasks)	—	—	—	—	(3 420)	1 650
Salt	345.0	3 450e	227	2 270e	285	2 665
Manganese ore.....	32	544	—	—	21.9	263
Lead concentrate.....	45.6	3 465	—	—	1.5	200e
Lead-zinc ore.....	20.0	1 260	—	—	16.6	1 050
Zinc ore (calcined).....	77.8	2 723	—	—	7.15	465
Zinc concentrate.....	—	—	—	—	1.77	250
Antimony (regulus).....	—	—	—	—	0.13	137
Antimony (ore and concentrate)	—	—	—	—	3.08	728
Pyrite	—	—	—	—	52.9	265
Pyrite (cupreous).....	—	—	—	—	120.6	1 700
Bauxite (refractory).....	—	—	—	—	32.2	321
Asbestos (crude).....	—	—	—	—	3.63	143
Asphaltite	—	—	—	—	10.8	73
Barite	85.0	850e	8.7	80e	17.1	167
Marble	N.A.	N.A.	10.4	312e	23.0(m³)	1 725 (31)
Meerschaum (kgs).....	—	—	—	—	(57 200)	67
Magnesite (crude ore).....	—	—	—	—	41.6	618
Magnesite (calcined).....	—	—	—	—	24.1	1 264
Emery.....	—	—	—	—	29.5	316
Sodium sulphate	—	—	—	—	7.4	161
Fluorspar	—	—	—	—	1.75	69
Total :	—	19 582		11 430		303 037

Table - II

Exports of metals and minerals : Turkey (36) in 1966 and exports of principal minerals : Iran (27) (29) in 1965 (March 21, 1965 - March 20, 1966)

Commodity	IRAN		TURKEY	
	1000 M.T.	Value US $ 1000	1000 M.T.	Value US $ 1000
Red oxide of iron	10.5	322	—	—
Copper (blister)	—	—	19.9	24 757
Chromite (all grades)	131.8	2 706	499.1	10 160
Ferrochromium	—	—	7.3	2 210
Boron minerals	—	—	175.3	4 864
Mercury (76 lb flasks)	—	—	(3111)	1 333
Pyrite, (cupreous)	—	—	91.2	1 276
Salt	—	—	51.8	140
Manganese ore	31.8	541	9.7	224
Lead (ore and concentrate)	49.9	3 396	—	—
Lead-zinc ores	N.A.	N.A.	11.1	1 110
Zinc ore (calcined)	77.5	2 611	7.1	466
Antimony (ores and concentrate)	—	—	2.9	711
Asbestos	—	—	0.6	44
Barite	—	—	11.1	110
Emery	—	—	26.8	307
Magnesite (crude ore)	—	—	41.6	618
Magnesite (calcined)	—	—	24.1	1 264
Meerchaum (kgs)	—	—	(29 000)	113
Marble	3.6	120	8.0	240
Total :		9 696		49 947

N. A. = Not available.

Petroleum figures are not included in the Tables I and II though the export of crude and refined petroleum products from Iran constitutes a major portion of the country's foreign exchange earnings.

The study of the Table I shows that coal, chromite, salt, barite and marble have been produced by the three countries. Iran and Turkey, both, produce manganese, lead and zinc ores.

Marble and chromite are exported by the three countries and the export of these two mineral commodities can be the basis of co-operation by Iran, Pakistan and Turkey.

CO-OPERATION IN MINERAL EXPORTS

The fifth paragraph of conclusions of the Report of the CENTO Symposium on Industrial Minerals, December 1962, reads as follows :

The regional countries should investigate the possibility of joint marketing programmes for minerals which are common to all three countries, such as marble, chromite, etc.

Chromite

Chromite constituted 20 % of the total mineral exports in value from Turkey in 1966. Turkey has been one of the leading chromite (especially metallurgical grade) exporting countries of the world for many years.

Iran (35) appears to be richly endowed with chromite reserves as well and has developed her chromite deposits in recent years. There are transport difficulties in Iran affecting chromite exports as the ore has to be brought to the seaside from the inaccessible areas. With the improvement of Bandar Abbas Port, the total exports of chromite will reach 200 thousand tons in the near future.

Pakistan (30) exports about 15 to 25 thousand tons of chromite annually, which does not amount to a large figure in the world market. On the other hand, chromite occurs in the tribal areas. Chromite mining offers jobs to a number of people and plays an important role in the economic life of the country. To develop and exploit chromite resources will be a great contribution to the economic development of Pakistan.

Chromite concentrates and fines are more difficult to market than the lump ores. Dr. T.P. Thayer (33) states the following : *«It would seem wise for producers in the CENTO countries to learn more about the factors involved in use of fines, and the limits on potential use. As was discussed at the recent minerals working party meeting in Ankara, the feasibility of pelletizing or otherwise agglomerating fines and concentrates should also be studied, because of its fundamental importance to the chromite mining industry.»* In this connection, a research project has been started recently on pelletizing of Turkish chromite concentrates and fines in the Middle East Technical University, Ankara.

The production of chromite *As* about one percent of the crude steel production on the world basis (7). In 1963 the total world production of chromite and crude steel were 4,475,000 tons and 425 million tons respectively. The total crude steel production of the world is forecast to reach a figure of 600 million tons in 1970. For this, about 6 million tons of chromite will be required. Considering the availability of chromite reserves, it looks promising to market lany increased production of chromite coming out of Iran, Pakistan and Turkey for markets in U.S.A., Japan and European countries in spite of the Russian competition.

In order to avoid unnecessary competition, especially, Iran and Turkey must have understanding and co-operation to secure new markets at favorable prices for the chromite exports in the future. Unnecessary competition would not be significantly beneficial to the steel producing countries lacking in chromite, but would damage the mineral economy of Iran, Pakistan and Turkey needlessly.

Marble

In recent years, marble deposits, especially the onyx variety, have been developed by the three countries. According to the Geological Survey of Pakistan (5), proved reserves of green marble (onyx) in the Chagai district, and of other marbles in the Peshawer region total about 120 million cubic feet (22) (34 mil-

lion cubic meters). Large reserves of onyx marble occur in Pakistan, Iran (6) and Turkey.

Mr. M. Arıkan (4) pointed out that Turkey can produce annually for export 11,800 cubic meters of marble amounting $ 1,835,500 in value 1000 cubic meters of which can be onyx marble.

If onyx marbles are developed and exploited efficiently, a considerable amount of foreign exchange currency can be earned by co-operating in the export of this commodity. The present and future market appears to be favorable both in U.S.A. and Europe.

In 1965, Italy (3) exported more than 750,000 tons of dimension stone and worked material in the value of 50 million dollars corresponding to 44.4 % of national production. In 1963, marble imports of U.S.A. were estimated at about 20 million dollars, mainly from Italy, Spain, France, Greece, Portugal, Belgium, Luxemburg and Mexico.

There are a number of marble deposits all over the world, but the multi-colored onyx marble is precious and in demand. It would be advisable to export onyx marble as worked material. The co-operation in marketing of their onyx marble would prove beneficial to Iran, Pakistan and Turkey and would be a wise policy to consider and adopt.

CO-OPERATION FOR INTERREGIONAL TRADE

The third paragraph of Recommendations of the Report of the CENTO Symposium on Industrial Minerals, December 1962, reads as follows:

It is recommended that a study also be made by an appropriate body of CENTO countries in non - metallics which are in short supply in one country, but available in surplus quantities in another. Examples are boron (Turkey), phosphate (Turkey), soda ash (Pakistan), sulphur (Iran) and barite (Pakistan).

Let us investigate the possibilites of stimulating interregional trade as far as minerals are concerned, and consider the following.

Coking coal

Pakistan (20) produced 1,212,000 long tons of coal of inferior quality in 1965. Recently she started to utilize her natural gas resources such as Sui gas in West Pakistan and Sylhet in East Pakistan. Some industrial undertakings are using natural gas especially in power generation. Pakistan has also begun to develop low-rank coal deposits discovered in East Pakistan. Generally speaking, Pakistani coals are of comparatively recent origin with a high percentage of volatile matter, sulphur, ash, moisture and low calorific value and are mainly used for fuel in brick and cement kilns.

Pakistan (25) is planning to develop an iron and steel industry. For this she will require coking coal, of which she has no measured reserves.

Let us now study the possibilities of importing coking coal from either Turkey or Iran.

There are sufficient reserves of hard coal and lignite in Turkey (17). Coal mining is well developed, but the current production only meets the internal needs of the country. When the capacity of Ereğli Iron and Steel Plant is increased, there will not be any surplus of coking coal for the export. Besides, Turkey will start to put up a third iron and steel plant in the near future.

Iran produced 220,000 tons of coal in 1963. Presently coal mining (28) is lagging due to the availability and the increased use of oil. All coal-consuming plants and factories are tending to convert to oil.

Iran has decided to found an iron and steel plant with a capacity of 600,000 tons of steel ingot to be expanded in the future date. Coke will be used in the blast furnace, which means the development of Jurassic coal fields (27) occurring in the northeast of Kerman province and revitalization of coal mining. The exploration, both tunneling and drilling, have indicated reserves of good-quality coking coal more than adequate to supply the needs of the iron and steel plant being built at Esfahan.

A feasibility study should be completed to determine whether Iran can export coking coal or coke to Pakistan. To obtain coking coal or coke from Iran might be attractive to Pakistan because of potential expanded reciprocity instead of importing from other countries. Already, Pakistan and Iran (15) within the framework of Regional Co-operation for Development (RCD) have decided to participate in two joint industrial ventures; namely, an aluminum refinery and a carbon black plant, both to be built in Iran.

If Pakistan and Iran can formulate an agreement on coking coal or coke, the position of coal mining in Iran will be strengthened by providing coke to the Pakistanian Iron and Steel Industry. In addition, foreign exchange currency earnings will be contributed to the Iranian economy.

Sulphur

Turkey produces about 20 thousand tons of sulphur from the Keçiborlu mine (18) in the western part of the country. This sulphur is consumed internally by agriculture, sulphuric acid production and various chemical industries including the rubber industry and the manufacture of carbon disulphide.

Iran has sufficient reserves of sulphur deposits (11). In addition, sulphur has been extracted from natural gas. In 1963, 20 thousand tons of sulphur were produced from natural gas and consumed in the petroleum refineries. Iran is planning to construct a petrohecmical industry from which sulphur might be available for export.

In 1961, Pakistan produced 8 thousand tons of sulphur at the Karachi sulhur refining plant by using Koh-i Sultan sulphur ore (1). In the future, the requirements of Pakistan for sulphur will increase considerably. Therefore, it may be possible to import sulphur from the Iranian Petrochemical Plant or sulphur ore from sulphur deposits occurring along the Persian Gulf to be treated in the Karachi Refining Plant.

Barite

Both Turkey (16) and Pakistan (21) have over one million tons of barite reserves (exploitable). The annual barite production of Pakistan amounts to 3 or

4 thousand tons, most of which is sold to domestic petroleum and paint manufacturing concerns. Turkey recently entered in the barite export market and exported more than 10 thousand tons in 1966. The possibilities of barite exports from Turkey and Pakistan are favorable, providing a good-quality barite can be produced at a competitive price in the world market.

Iran has two barite plants near Ghom belonging to Magobar and Iran Barite Companies (14). About 40,000 tons of locally produced barite are consumed in Iran mainly in oil-well drilling where excessive oil and gas pressures are encountered. In the future, barite consumption will be increased in Iran. If good-quality barite ore becomes scarce in Iran, there may be a possibility of using Turkish or Pakistani barite for the increased requirements of Iran.

Bentonite

Pakistani bentonite resources (32) occur mainly in West Pakistan and adjoining areas of Azad Kashmir. The tests carried out on indigenous bentonites showed that they can compete with, and be substituted for, imported non-swelling bentonites and can be used as a sealant to make irrigation earthen canals more impervious. After digesting with acid, these non-swelling bentonites can be applied to decolorize and clarify petroleum, animal and vegetable oils and fats. Pakistan (2) is planning to erect a plant with a capacity of 20 tons per day for the manufacture of activated earth from the local bentonite to be used in oil refining and oil hydrogenation industries in the country.

There are bentonite deposits totalling over millions of tons in Turkey (10), which are suitable as a bond in molding sands in iron foundries and as a constituent in drilling mud. Bentonite consumption per year is about 5000 tons at the present, but will increase with the more oil activity in the future.

In recent years, bentonite has found another important field of application in pelletizing iron ores. There are no pelletizing projects in the three countries at present. In such plants, Turkish and Pakistani bentonites can be consumed.

Bentonites occurring in Pakistan and Turkey can meet the requirements of the three countries and it may even be possible to export surplus bentonite in the world market. U.S.A., Europe and Japan can become promising markets for bentonite in view of their needs for bonding clay in iron-ore pelletizing plants.

Magnesite

Magnesite is mainly used in the manufacture of refractorites. In Turkey, large reserves of magnesite were determined and two calcining plants were erected in the western part of the country (37). The third plant is being built near Konya under the Public Sector which will calcine magnesite for manufacturing refractory bricks. In 1968, Turkey will be able to produce 28,000 tons of caustic calcined magnesite and 76,500 tons of dead burned magnesite, the most of which will be available for export.

The requirements of magnesite refractory bricks for Iran and Pakistan can be met by completion of the refractory plant in Turkey.

The scattered deposits of magnesite which occur in West Pakistan are associated with ultrabasic rocks, and the reserves are estimated at 26,000 tons (34). Only one magnesite deposit bas been worked intermittently.

There are extensive outcrops of ultrabasic rocks in Iran and Pakistan. Prospection and exploration in ultrabasic rocks, which are serpentinized, may be fruitful in finding new magnesite deposits in both countries.

Lead and zinc minerals

There are abundant lead and zinc ore deposits in Iran (19) (40) and Turkey (12). There is a big potential in production and exports of these two commodities if the mines are run according to the modern mining practice.

In recent years, there was increased activity in the exploration and development of new lead and zinc ore bodies in Turkey (38), showing a big promise in mining and milling operations.

The reserve of lead and zinc deposits should be measured and if justified serious thought must be given to establish a central smelting plant either in Turkey or in Iran in order to treat lead and zinc ores of both countries for extracting not only lead and zinc but silver and other by-products.

Boron minerals

The reserve of boron minerals in Turkey is the second largest in the world, California U.S.A. being the first. They are estimated to be in the order of several hundred million tons. The principal boron minerals (8) of Turkey are priceite (pandermite) and colemanite, both calcium borate; and ulexite, a calcium sodium borate. Turkey produced 225.3 thousand tons and exported 175.3 thousand tons of boron minerals with a value of almost 5 million dollars in 1966.

The construction of a borax plant (9) will be completed in the near future at Bandırma by Etibank with an annual capacity of 5000 tons of boric acid and 20,000 tons of sodium borax.

There are no boron mineral deposits known either in Iran or in Pakistan. Here a systematic exploration work should be carried out in the areas which are geologically favorable. It is appropriate to mention that Dariala brines (26) in the Salt Range of Pakistan contain 8 grams per liter of sodium borate.

It will be of interest to Iran and Pakistan when Turkish boric acid and sodium borate are available in view of further development in enamel and glass industries in these two countries (39). In 1963 Iran and Pakistan imported 268 and 645 tons of boron compounds, respectively, from the U.S.A.

Several mineral commodities have been discussed in view of improving the opportunities for trade among Iran, Pakistan and Turkey. Lead and zinc minerals, sulphur, coking coal and boron minerals can be considered for co-operation in the near future. On the other hand, magnesite, bentonite and barite can be taken as long-range projects.

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