資　料

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Triennial review of mineral resources development activities in Japan (1981-1984)

Noriyuki FUJII*

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1. Introduction

The Natural Resources Division, ESCAP, is used to summarize and publish a regional review of mineral resources development activities every three years. The present paper was prepared as the country report of Japan for the review, according to the request of ESCAP, and submitted by the names of the Agency of Natural Resources and Energy and the Geological Survey of Japan (GSJ), Agency of Industrial Science and Technology, Ministry of International Trade and Industry (MITI).

The statistics in this report were compiled mainly by the former Agency, and the text was written, based on the above statistics and some topics provided by the organizations concerned.

2. Exploration and Development

(1) Geoscientific mapping and survey (Table 1-a)

Mapping survey is conducted mainly by governmental institutions such as the Geological Survey of Japan (GSJ). Also, their recent activities have been focused on geologic hazard mitigation and environment conservation as well as resources development. The GSJ is conducting geological sheet mapping in areas specified as sensitive from a seismological viewpoint. Twelve to fifteen geological sheet maps of 1:50,000 scale and a few 1:200,000 geological maps are published every year. In addition, six sheets of the 1:500,000 neotectonic map were completed during this period.

The 1:200,000 marine geological maps also are being prepared by the GSJ. Mapping of the offshore area along the Pacific Ocean-side of Honshu-Shikoku-Kyushu islanda was almost completed. The present and future research cruise will be concentrated to the Sea of Japan-side of these islands. One of the most noticeable publications during this period is a 1:3,000,000 marine geological map around the Japanese Islands. This was compiled on the basis of eight sheets of 1:1,000,000 marine geological map, which were prepared mainly from seismic reflection profiles and rock samples dredged in places.

The GSJ has carried out airborne magnetic survey continuously focusing on the continental shelf and slope zones around the Japanese Islands since 1969. During the reviewed period, the airborne survey was performed in the offshore area of the Okinawa Islands, and the 1:200,000 aeromagnetic maps of the northwest offshore areas of Okinawa-jima (I, II) were completed. It is noticeable that Curie-point depth analysis was applied in the offshore areas through the above survey. The results of this survey is expected to provide relevant information on geothermal gradient, that influenced the maturity of hydrocarbon

* Overseas Geology Office

Table 1-a Geoscientific Mapping and Survey (1982-1984).
—Geological Survey of Japan—.

Item	1982		1983		1984	
	Total area (sq km)	Number of sheet	Total area (sq km)	Number of sheet	Total area (sq km)	Number of sheet
1/50,000 Geological Map	5,400	14	6,500	15	5,000	12
1/200,000 Geological Map	13,400	2	20,000	3	20,000	3
1/200,000 Marine Geology Map	11,670	1	23,340	2	11,670	1
	Total area (sq km)	Total length (km)	Total area (sq km)	Total length (km)	Total area (sq km)	Total length (km)
Aeromagnetic Survey	24,000	4,800	20,000	3,900	18,000	4,200

Remarks: Only published maps were figured out

Table 1-b Mineral Exploration and Drilling (1982-1984).
—Metal Mining Agency of Japan—.

Item	1982		1983		1984	
	Total area (sq km)	Number of project	Total area (sq km)	Number of project	Total area (sq km)	Number of project
Regional Geological-survey in mineralization areas	1,140	4	1,615	6	911	6
Gravity Survey	300	1	—	—	340	2
Electric and Electromagnetic Survey	153	6	328	3	236	5
Geochemical Survey	204	5	308	6	270	6
	Total length (m)	Number of project	Total length (m)	Number of project	Total length (m)	Number of project
Drilling for geologic structure	12,050	17 holes	9,130	14 holes	8,707	13 holes
Drilling for detailed prospecting	11,755	20 holes	14,450	26 holes	11,200	21 holes
Tunnell prospecting	1,560	6	1,155	5	880	6

Table 1-c Geothermal Exploration and Drilling (1982-1984).
—New Energy Development Organization, Japan—.

Item	1982		1983		1984	
	Total area (sq km)	Number of project	Total area (sq km)	Number of project	Total area (sq km)	Number of project
Geological mapping	—	—	—	—	1,810	5
Geophysical Survey						
Gravity	87,310	5	92,350	4	1,600	4
Magnetic	165,000	4	141,000	1	—	—
Magnetotelluric	460	6	330	5	2,080	9
Seismic	—	—		—	630	1
Geochemical Survey	—	—	410	4	1,880	8
	Total length (m)	Number of hole	Total length (m)	Number of hole	Total length (m)	Number of hole
Drilling	30,080	34	28,290	30	35,000	31

Table 2 Mine Production of Metallic Minerals in Japan.

(metric tons)

Mineral Commodities	1981	1982	1983	1984
Gold* (kg)	5,798	5,612	5,887	7,005
Silver* (kg)	288,617	281,226	323,680	322,438
Chromite ore**	10,959	11,129	8,396	6,001
Copper*	43,558	37,433	35,586	33,761
Iron ore**	441,844	361,813	297,817	324,970
Lead*	48,937	48,660	48,050	47,422
Manganese ore**	86,696	78,045	75,199	61,635
Pyrites ore**	597,965	561,179	551,289	530,473
Tin*	532	504	580	524
Tungsten ore**	1,839	1,762	1,651	1,609
Zinc*	237,807	233,591	254,869	230,659

Note: *Metal content in concentrates **Concentrates
Source: Resources Statistics, MITI

fuel resources.

(2) Mineral exploration (Table 1-b)

Various type activities related to domestic mineral exploration are conducted mainly by the Metal Mining Agency of Japan (MMAJ), which is the operational wing for promoting metallic mineral exploration under the supervision of the Ministry of International Trade and Industry (MITI). Private mining sectors not only participate in MMAJ's programmes but also carry out their own exploration work under the MMAJ's promotion. Table 1-b shows that domestic exploration activities were implemented almost constantly during the period under review. Besides the above, basic research for mineral potential evaluation was started by the GSJ and some univer-

Table 3 Import Summary of Metallic Minerals and Metals.

Commodity	1981	1982	1983	1984	Main Sources
Minerals (1,000 tons)					
Antimony ore	7	4	6	7	BOLIVIA, CHINA
Bauxite ore	4,353	3,439	3,580	3,862	AUSTRALIA, INDONESIA
Chromium ore	744	695	645	823	S. AFRICA, INDIA
Copper ore	3,338	3,628	3,135	2,930	CANADA, CHILE
Iron ore	107,820	105,974	95,151	110,427	AUSTRALIA, BRAZIL
Iron pellet	15,542	15,835	14,002	14,945	BRAZIL, CHILE
Lead ore	256	226	238	249	PERU, CANADA
Manganese ore	1,533	1,503	1,021	1,386	S. AFRICA, AUSTRALIA
Molybdenum ore	16	17	19	18	USA, CANADA, CHILE
Nickel ore	3,463	2,997	2,297	2,835	NEW CALEDONIA. INDONESIA
Titanium ore	323	368	411	646	MALAYSIA, AUSTRALIA
Tungsten ore	2	2	3	3	R. KOREA, PORTUGAL
Zinc ore	878	813	760	955	AUSTRALIA, PERU
Metals (tons)					
Antimony	2,366	2,493	3,477	5,112	CHINA
Copper	241,146	295,794	190,385	470,202	ZAMBIA, CHILE
Lead	56,940	52,373	52,249	78,137	AUSTRALIA, N. KOREA
Mercury	0	81	124	52	ALGERIA, CHINA
Molybdenium	46	65	85	19	F. R. GERMANY, USA
Nickel	17,732	19,689	26,822	31,377	CANADA, USSR
Tin	30,223	26,185	29,333	30,470	MALAYSIA, INDONESIA
Zinc	30,439	44,265	41,246	56,568	N. KOREA, PERU

Note: All minerals are concentrates Source: Resources Statistics, MITI

Table 4 Production of Crude Steel and Important Metals in Japan.

(metric tons)

Commodity	1981	1982	1983	1984
Crude steel (1,000 tons)	101,676	99,548	97,179	105,586
Gold (kg)	27,661	28,876	28,886	29,115
Silver (kg)	586,209	650,553	759,602	796,333
Antimony	195	125	106	73
Aluminum	770,602	350,706	255,900	286,728
Copper	886,409	910,725	908,965	787,303
Lead	126,434	134,558	155,275	186,394
Nickel	23,122	22,424	23,331	22,889
Zinc	337,838	315,419	324,152	413,701

Source: Resources Statistics and Iron-Steel Statistics, MITI

sities.

The GSJ plays an important role in the evaluation of nonmetallic mineral resources. Investigation on undeveloped pottery and other ceramic raw-materials was conducted at more than twenty prospects in northern to central Japan.

The biggest topic in the field of metallic minerals is the discovey of the Nurukawa and the Hishikari ore deposits. The Nurukawa mine, notheast Japan, is a kuroko-type polymetallic ore deposit. Its highest ore-grades recognized by drilling are 21 g/t in Au, 818 g/t in Ag, 2.31% in Cu, 10.35% in Pb and 21.08% in Zn. The Hishikari mine, southern Kyushu, is estimated as the largest gold ore deposit in Japan. This consists of gold-bearing quartz veins containing 80 g/t gold on the average. The estimated reserves are around 1,500,000 tons. The preparation for mining operation is in progress at both mines.

(3) Energy resources exploration (Table 1-c)

Exploration for mineral fuel resources was actively carried out in both onland and offshore areas by many governmental and private sectors, including the Japan National Oil Corporation (JNOC). Development of new energy such as solar energy and geothermics also has been implemented by both governmental and private sectors, including the New Energy Development Organization (NEDO).

For geothermics, in particular, very systematic exploration using various kind of methods was conducted by the NEDO and the GSJ mainly in northeast Japan and central Kyushu. A huge amount of geoscientific data was accumulated, and a data-base system for geothermics, named SIGMA, was newly developed by the GSJ. It is expected that deep-seated geothermal resources will be evaluated through these systematic data analysis.

As one of the results of the long exploration work, a new geothermal power plant at Nigorikawa, southern Hokkaido, started operation in 1982. Its generation capacity is 50 MW.

Preparation for gas production also has been carried out at Nagaoka, Niigata Prefecture, and offshore Iwaki Gas Fields. The former is noted as a deep petroleum-gas deposit occurring in volcanic rocks about 5,000 meters deep. Its gas collecting plant, whose capacity is 1,600 m^3/day, was completed in 1984. The latter was discovered 40 km off the Iwaki Gas Fields, Pacific Ocean-side of northeast Honshu, in 1973. The production plant was completed and started the operation in 1984. Its daily output is 1,200 to 1,500 thousand cubic meters.

Besides the above, preparation for oil and gas production is in progress offshore North Aga Oilfield in Niigata Prefecture, Sea of Japan-side of central Honshu. Also, an exploratory well, which was drilled in 1983 offshore Iwafune in the same Prefecture, succeeded in the flow-out of 830 kl/day of crude oil and 440,000 m^3/day of natural gas. Some additional wildcats are being drilled there continuously.

(4) International activities

Various type of cooperative activities was

Table 5 Production of Nonmetallic Minerals in Japan.

(metric tons)

Mineral commodities	1981	1982	1983	1984
Barite*	56,369	59,492	69,699	66,018
Clays				
Acid clay	261,256	245,330	232,865	222,991
Bentonite	511,781	484,431	440,923	415,974
Kaolin*	210,858	197,346	230,720	224,614
Refractory clays				
Ball clay	412,586	379,491	368,747	371,002
Sedimentary Kaolin*	796,031	734,401	702,262	727,435
Shale clay	247,002	207,110	189,669	189,147
Diatomite	245,287	226,858	205,913	222,506
Feldspar, etc.				
Aplite*	394,519	374,647	412,454	453,265
Feldspar	25,620	30,160	30,996	35,184
Toseki (porcelain stone)	298,569	242,175	248,070	233,610
Limestone and Dolomite				
Limestone (1,000 tons)	176,702	168,259	169,780	169,821
Dolomite (1,000 tons)	5,787	4,996	4,386	4,268
Roseki (pyrophyllite, etc.)	1,149,819	1,092,428	1,064,499	1,073,589
Roseki-clay*	280,766	299,990	314,200	341,004
Silica sand*	5,026,546	5,224,688	5,032,877	4,673,162
Silica stone				
White silica stone	1,729,317	1,505,700	1,461,110	1,502,005
Soft silica stone	11,075,407	10,383,509	11,812,796	11,992,475
Refractory silica stone	717,982	602,007	499,242	478,817
Talc*	114,466	99,886	87,124	85,825

* Processed by wet and/or dry method Source: Resources Statistics, MITI

carried out by some governmental organizations in the field of geosciences and mineral resources. Main activities in the ESCAP region are as follows;

1) Expert assignment by the JICA (Japan International Cooperation Agency) to some internatinal organizations including ESCAP headquarters, CCOP and RMRDC, and financial support to their projects.

2) Geoscientific cruise survey in the South Pacific conducted mainly by the GSJ under the sponsorship of the Science and Technology Agency. This survey aims at providing basic geoscientific data in the Indian-Pacific plate boundary arc area.

3) Technical cooperation for mineral exploration by the MMAJ and the JICA. Various style exploration work including drilling and shafting was implemented in Philippines, China, Thailand, Malaysia and Indonesia.

4) Research cooperation on mineral development within the framework of the ITIT Programme, which is promoted by the Agency of Industrial Science and Technology (AIST). Several AIST institutions are conducting this cooperation. They are the GSJ, the National Research Institute for Pollution

Table 6 Imports Summary of Nonmetallic Minerals.

(metric tons)

Mineral Commodities	1981	1982	1983	1984	Main sources
Asbestos	237,963	229,125	237,413	239,747	CANADA, S. AFRICA, USSR
Borates	37,371	28,779	49,850	54,896	TURKEY, USSR
Clays					
Aluminous shale	61,193	68,249	80,088	111,539	CHINA, MALAYSIA, AUSTRALIA
Kaolin	521,681	560,071	549,763	684,405	USA, R. KOREA, BRAZIL
Others	149,348	153,918	155,491	148,154	USA, CHINA, R. KOREA
Feldspar, etc.	4,981	6,114	7,915	9,611	CHINA, INDIA, CANADA
Fluorite	428,314	413,535	435,383	513,284	CHINA, THAILAND, S. AFRICA
Graphite	52,697	53,138	54,195	85,009	CHINA, R. KOREA, N. KOREA
Phosphorite	2,255,714	2,216,490	2,437,819	2,322,869	USA, MOROCCO, JORDAN
Silica sand	517,668	487,222	591,188	755,717	AUSTRALIA, SARAWAK, INDONESIA
Talc	401,365	554,346	591,725	592,962	CHINA, AUSTRALIA, N. KOREA

Source: Statistics of Exports and Imports, Ministry of Finance

and Resources, the Government Industrial Research Institute, Nagoya, and the Government Industrial Research Institute, Tohoku.

5) Bilateral technical cooperation sponsored by the JICA. In the field of geology and mineral resources, technology transfer on marine geoscientific survey and geochronological experiments was carried out for the Bureau of Mines and Geosciences, Philippines, mainly by the GSJ.

6) Bilateral R & D cooperation by the MMAJ. R & D for collecting rare metals from the tails of tin-ore dressing was carried out for Thailand.

3. Production and Trade

(1) Metallic minerals and metals (Table 2, 3 and 4)

In general, activities of the Japanese industries turned from continued stagnancy to modest rise with recovery of the world economy in 1984. Crude steel production exceeded 100 million tons again in 1984 after two years decline since 1981. Output of some metals such as lead, zinc and silver increased by 20 to 50% during the period reviewed. On the contrary, production of copper and nickel declined substantially, and the increased demand was compensated by imports. Production of aluminum, in particular, was drastically cut back to 287,000 tons in 1984 from 770,000 tons in 1981. This is the results of high cost of power in Japan compared to other parts of the world.

Though Japan is one of the major producers of steel and base metals in the world, the share of mine production of these metals has been reducing year by year, excluding gold and silver. Import of metallic ores also has been stagnant throughout this period, but import of metals increased considerably, particularly in 1984.

(2) Nonmetallic minerals (Table 5 and 6)

Contrary to the situation of metallic minerals, most of the nonmetallic minerals are being produced sufficiently to meet the domestic demand in japan. They are limestone, dolomite, silica sand, fireclay, pyrophyllite, aplite and toseki (porcelain stone), bentonite and diatomite. Japan is noted as one of the world's leading producers of cement, glass, refractories, ceramics, fertilizers, paper and others. Most of the raw

Table 7 Primary Energy Supply in Japan.

Energy source	Quantity unit	Fiscal 1973			Fiscal 1981			Fiscal 1982			Fiscal 1983			Index (%) 1983/1973
		Real	Conv	Ratio (%)	Real	Conv	Ratio (%)	Real	Conv	Ratio (%)	Real	Conv	Ratio (%)	
Petroleum	1,000 kl	315,700	315.7	77.6	267,000	267.0	64.2	240,400	240.4	61.9	256,100	256.1	61.9	81.1
(domestic)		(800)			(450)			(480)			(480)			(60)
Coal	1,000 tons	79,730	62.8	15.5	97,800	74.9	18.0	94,500	72.0	18.5	96,500	73.3	17.7	121.0
(domestic)		(21,680)			(17,500)			(18,300)			(17,800)			
Hydro power	1,000 kwh	22,590	18.7	4.6	31,600	23.6	5.7	30,400	21.0	5.4	31,200	22.2	5.4	138.1
Nuclear power	1,000 kwh	2,300	2.5	0.6	16,200	22.9	5.5	17,300	26.7	6.9	18,400	29.8	7.2	800
Natural gas	1,000 kl	6,350	6.3	1.5	26,200	26.2	6.3	27,000	27.0	7.0	31,200	31.2	7.5	491
Geothermics	1,000 kl	65	0.1	—	350	0.4	0.1	400	0.4	0.1	400	0.4	0.1	615
Others	1,000 kl	600	0.6	0.1	800	0.8	0.2	800	0.8	0.2	1,000	1.0	0.2	167
Total	10^6 kl		406.7			415.8			388.4			414.0		101.8
Energy supply/GNP	kl/100 mil.y.		281			210			190			194		69.0

Remarks: Real; real quantity Conv; converted quantity into 10^6 kl petroleum Source: Energy Statistics, MITI

materials for these manufactures are supplied by domestic mines excluding for fertilizers.

But supply of some minerals, such as paper-coating kaolin and high-grade talc, is becoming insufficient to meet the demand, and import of these minerals is increasing remarkably.

Furthermore, highly developed Japanese industries demand various kinds of raw materials, which are totally lacking in Japan. Considerable amounts of aluminous shale, fluorite, phosphorite and others are imported increasingly.

On the other hand, development of industrial technology made it possible to produce some important materials using common substances such as seawater. Japan is noted for outstanding output of seawater magnesia, sulfur recovered from petroleum and exhaust gas, and by-product gypsum.

(3) Energy supply (Table 7)

During the past decade, the Japanese GNP increased 47.4%, but the energy consumption increased 1.8% only. In this connection, it should be enhanced that the Japanese government encouraged energy saving and change of energy source from petroleum to non-petroleum fuel such as coal, natural gas and nuclear power. As the results, the ratio of energy supply to GNP has reduced 31% during the past decade. Still, petroleum remains as the major energy source in Japan, but its ratio to the total supply reduced to 62% in 1983 from 78% in 1973. Instead, consumption of other sources such as nuclear power has increased remarkably. Also, the Japanese government has given its special attention to pollution prevention. Such efforts will be continued to achieve a well-balanced social development.

我が国における最近3年間の鉱物資源開発活動の概要(1981-1984)

藤 井 紀 之

要 旨

ESCAP(国連アジア太平洋経済社会開発委員会)の天然資源部では，3年毎に域内の鉱物資源開発活

動の概要をとりまとめて出版している．本稿はESCAPの要請に応じて上記出版物のための各国別報告の一つとして作成され，資源エネルギー庁と地質調査所の名でESCAPに送付されたものである．本論中，鉱産物の生産・貿易などを始めとする諸統計資料は，主として資源エネルギー庁によってとりまとめられた．本文の執筆は，これらの資料及び関係機関から提供されたトピックスなどを基にして行われた．

（受付：1985年6月5日；受理：1985年8月25日）