資　　料

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LIGNITE RESOURCES IN JAPAN

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Although the lignite resources have recently become of less value as an energy source in Japan, the deposits occur in many places through our country. From Hokkaido in the north to Kyushu in the south through Honshu, 13 areas are known as lignite fields and smaller deposits have been found in 46 prefectures.

Among these, the three fields of Owari-Mino, Miyagi and Mogami are economically important. (Fig. 1, Table 1) Almost all of the lignite fields in Japan are Miocene and Pliocene in age, and some lignites are included in Quaternary system.

The classification of lignite was decided by the Ministry of International Trade and Industry in 1954 and it is divided into two classes, F_1 and F_2. The Japanese coal classification differs from other countries in some subjects, that it is based on calorific value and fuel ratio. The fuel ratio means the value of fixed carbon divided by volatile matter in proximal analysis. (Tables 2, 3)

The Japanese lignite is less than 7300 cal/kg in calorific value,F_1 ranges 6800–7300 kcal/kg and F_2 5800–6800 kcal/kg.

Table 1　Geological classification of coal fields of Japan

Geologic age		Name of coal field	Name of prefecture
Tertiary	Pliocene～Miocene	Owari-Mino (Lignite)	Gifu & Aichi pref., Honshu
		Miyagi (Lignite)	Miyagi, Honshu
		Mogami (Lignite)	Yamagata, Honshu
		Tempoku (Lignite)	Hokkaido
		Sasebo	Nagasaki, Kyushu
	Oligocene	Kushiro	Hokkaido
		Joban	Fukushima, Honshu
		Fukuoka	Fukuoka, Kyushu
		Chikuho	Fukuoka, Kyushu
		Kokura	Fukuoka, Kyushu
		Karatsu	Saga, Kyushu
		Sakito-Matsushima	Nagasaki, Kyushu
	Eocene	Ishikari	Hokkaido
		Ube	Yamaguchi, Honshu
		Miike	Kumamoto, Kyushu
		Takashima	Nagasaki, Kyushu
		Amakusa	Kumamoto, Kyushu
Mesozoic•Triassic		Omine	Yamaguchi, Honshu

* Fuel Department

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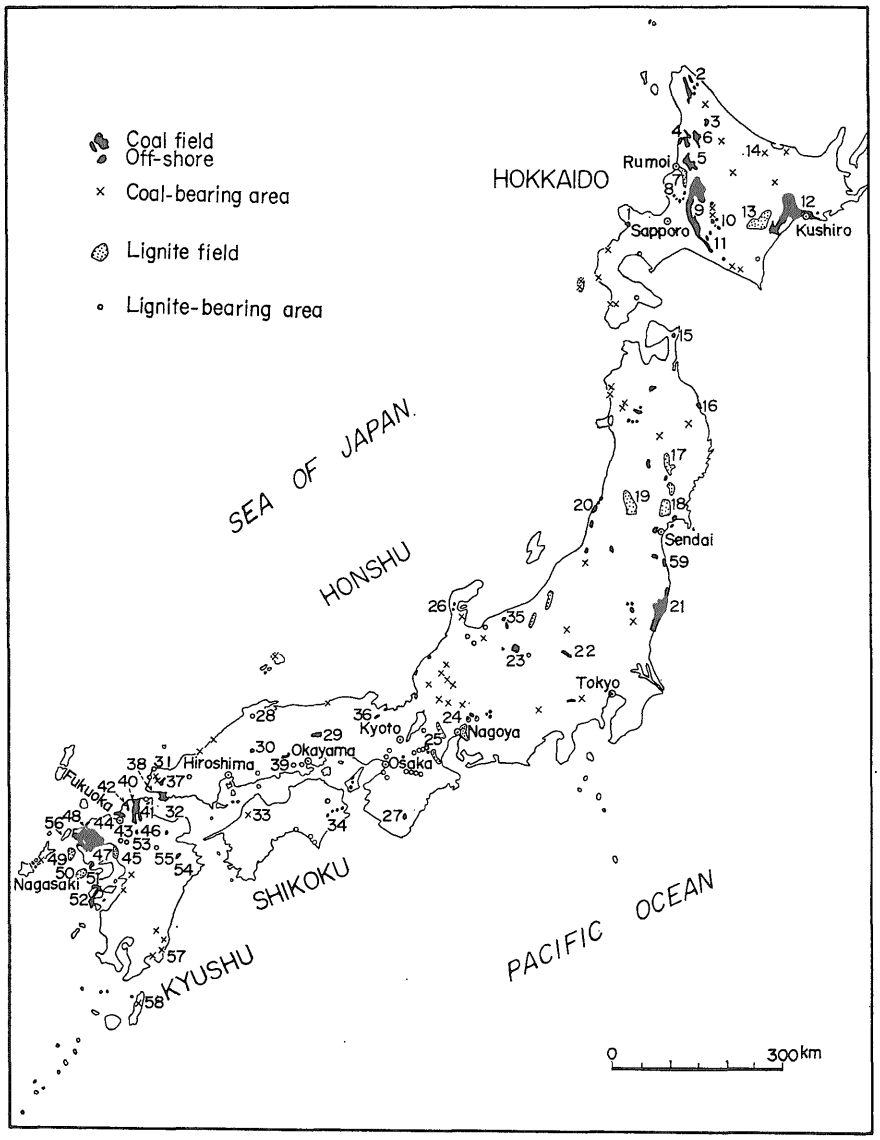

1 Kayanuma Coal Field
2 Tempoku Coal Field
3 Nakagawa Coal Field
4 Tomamae Coal Field
5 Rumoi Coal Field
6 Northern Uryu Lignite Field
7 Numata Lignite Field
8 Kabato Coal Field
9 Ishikari Coal Field
10 Yamabe Coal Field
11 Hitaka Coal Field
12 Kushiro Coal Field
13 Tokachi Lignite Field
14 Kitami Coal-bearing Areas
15 Shimokita Coal Field
16 Kuji Coal Field
17 Kitami Lignite Field
18 Miyagi Lignite Field
19 Mogami Lignite Field
20 Nishitagawa Coal Field
21 Jōban Coal Field
22 Takasaki Lignite Field
23 Higashichikuma Coal Field
24 Owari-Mino Lignite Field
25 Mie Lignite Field
26 Noto Lignite Field
27 Kumano Coal Field
28 Matsue Coal Field
29 Tsuyama Lignite Field
30 Miyoshi Lignite Field
31 Otsu Coal-bearing Area
32 Ube Coal Field
33 Kuma District
34 Katsuura Coal Field
35 Kotaki Coal Field
36 Maizuru Coal Field
37 Omine Coal Field
38 Tsubuta Coal Field
39 Nariha Coal Field
40 Chikuho Coal Field
41 Kokura Coal Field
42 Munakata Coal Field
43 Fukuoka District
44 Kasuya District
45 Miike Coal Field
46 Asakura Coal Field
47 Karatsu Coal Field
48 Sasebo Coal Field
49 Sakito-Matsushima Coal Field
50 Takashima Coal Field
51 Isahaya District
52 Amakusa Coal Field
53 Yame Lignite Field
54 Ono District
55 Kusu District
56 Hirado District
57 Nichinan Coal-bearing Areas
58 Tanegashima Coal-bearing Area
59 Sohma Lignite Field

Fig. 1 Coal fields of Japan (1960 Geol. Surv. Japan)

Table 2 Classification of Japanese coal

Classification		Calorific value (moisture-and mineral matter-free) (kcal/kg)	Fuel ratio	Coking property	Remarks
Class	Group				
Anthracite (A)	A_1		>4.0	Non-Coking	
	A_2				Natural coke by volcanics
Bituminous coal (B. C)	B_1	>8,400	>1.5	Strong Coking	
	B_2		<1.5		
	C	8,100~8,400		Coking	
Sub-bituminous coal (D, E)	D	7,800~8,100		Weak Coking	
	E	7,300~7,800		Non-Coking	
Lignite (F)	F_1	6,800~7,300		Non-Coking	
	F_2	5,800~6,800			

(After M. I. T. I., 1954)

Table 3 Principal Lignite fields of Japan

		Name of Field	Area (km^2)	Name of Coal Bearing Formation	Name of Main Coal Seam	Number of Seam	Average Thickness of Seam	Calorific Value (kcal/kg)	Group	Reserves (×1,000t)
HO-KKAIDO		Kitauryu	1,200	Haboro	Honso	15	70 cm	5,034-7,300	E–F_1	—
		Numata	300	Owada	Honso, Uwaso	6	80-70	3,100	F_1	—
		Tokachi	2,000	Ikeda	—	4	60-110	4,100-4,880	F_2	19,977
HONSYU	NAGOYA	Miyagi	450	Yagiyama	Kaso	2	50-70			
				Kitayama	Honso	3	100	3,900-4,200	F_2	62,529
				Kameoka		1	140			
		Sohma	150	Sohma	Nakoso	2	100	4,500-4,900	F_2	101,569
		Mogami	600	Shinjo	Kitomo 4 shaku,	3	150	4,000-5,000	F_2	137,460
				Mogami	3shaku,Kitomo Honso					
	TO-KYO	Takasaki	200	Itahana	Honso	3	460	3,000-5,000	F_1–F_2	4,728
	SENDAI	Owari	300	Owari	—	2	—	4,000-4,500	F_2	157,020
		Mino	170	Toki	Honso	2	140	3,600-4,600	F_1–F_2	76,358
		Noto	—	Nanao	—	2	600	4,000-5,000	F_2	—
		Tsuyama	800	Uetsuki	—	2	50	7,000-7,300	E–F	713

(1956 Geol. Surv. Japan.)

The Japanese lignite is divided into two types of "coaly Atan" and "woody Atan" with the naked eye. The term "Atan" is a popular name in Japan, and it means the second-grade coal, almost same as a lignite.

The woody lignite easily splits in dry condition and the coaly lignite is massive and more black than the woody.

The principal lignite fields in Japan are shown in Table 3. The largest field is the Tokachi in Hokkaido but practically the mining is operated in the Mogami, Miyagi and Mino lignite fields. (Tables 4, 5, 6, 7)

The generalized characters of Japanese lignite seams are that the seams are widely distributed, the variation of thickness of the seams is relatively small, usually less than one meter and the number of seams in one depositional basin is so many.

The seams are generally intercalated in alternations of tuffaceous shale or sandstone and tuff, because the strata in which include lignites were formed mostly during the periods of intensive volcanic activities in Japan. Moreover, since the seams have not been affected by severe crustal movements after deposition, they show gentle geological structures, and con-

Table 4 Lignite Production

	Sendai District	Nagoya District	Others	Total (×1,000t)
1961	570	579	123	1,272
1962	536	415	106	1,057
1963	471	311	77	859
1964	406	190	45	641
1965	378	143	19	547
1966	311	95	22	428
1967	277	57	77	354
1968	245	57	15	317
1969	183	36	16	235
1970	145	12	7	174

(1971 M.I.T.I.)

Table 5 Number of Mine

	Sendai District	Nagoya District	Others	Total
1961	176	65	13	254
1962	171	58	30	259
1963	165	30	23	220
1964	148	19	12	179
1965	119	11	10	140
1966	103	11	7	121
1967	82	7	6	95
1968	78	6	3	87
1969	69	3	3	75
1970	43	1	3	47

(1971 M.I.T.I.)

Table 6 Number of Workers

	Sendai District	Nagoya District	Others	Total
1961	3,323	2,385	726	6,434
1962	3,182	1,934	192	5,208
1963	2,478	804	347	3,629
1964	2,271	438	94	2,803
1965	1,912	288	78	2,278
1966	1,597	224	69	1,890
1967	1,220	141	46	1,407
1968	1,038	106	30	1,174
1969	798	61	44	903
1970	578	2	39	619

(1971 M.I.T.I.)

Sendai includes Miyagi and Mogami Lignite fields. Nagoya includes Owari-Mino Lignite field.

Table 7 Coal Production per Man-month

	t/man-month
1961	16.1
1962	16.0
1963	17.0
1964	18.0
1965	18.5
1966	18.0
1967	18.3
1968	21.6
1969	21.8
1970	20.9

(1971 M.I.T.I.)

sequently the mining is easy.

The chemical components are examined by proximal analysis. The principal elements of lignite are composed generally of 10–20% of moisture, 30–60% of volatile matter, 20–40% of fixed carbon and 8–20% of ash content. It is a remarkable fact that the ash content in the Japanese lignite is generally about 10% more than the foreign lignites of nearly same calories. (Table 8)

The production of lignite in Japan has becomes downward recently, but it is estimated at about 147,000 tons in 1970. The production amounts to about 1% of the energy source in Japan, and the lignite is almost worked underground. (Table 9)

The lignite is used for a domestic fuel or raw material in minor industries, and once the "colite" was made from the lignite by dry distillation method. Recently the lignite is also used for the regulation media of viscosity of circulation water in drilling and about 500 tons of lignite are consumed per year for this purpose.

Table 8 Proximal Analysis of Typical Lignites in Japan

Geol. Surv. Japan

Coal Field	Coal Mine	H_2O %	Ash %	Volatile Matter %	Fixed Carbon %	Calorific Value Kcal./kg	S %	Colour of Ash	Group
TENPOKU	Sōya-magaribuchi	19.82	7.41	37.34	35.34	5,006			F_1
	Ariake	13.65	27.07	37.55	21.73	3,460			F_2
TOKACHI	Tokachi	16.31	12.57	46.50	25.62	4,280			F_2
MIYAGI	Hirofuchi	15.45	20.25	32.87	31.43	4,160	0.90	red	F_2
	Sanbongi	17.64	19.83	34.61	27.92	3,880	0.31	red orange	F_2
MOGAMI	Kitomo	12.94	18.45	40.79	27.82	4,550	0.73	brown	F_2
	Nakayama	15.10	8.05	41.15	35.70	5,320	0.73	dark brown	F_1
TAKASAKI	Kanai	11.45	14.11	45.78	28.66	5,132	0.73		F_1
MINO	Shoei	12.15	1.00	61.48	25.34	5,260	0.20		F_1
	Mitake	13.20	16.76	42.28	27.76	4,482	0.96		F_2

Table 9 Utilization of Lignite

(Unit: 10^3 ton)

	Industry Manufacture			Civil Demands		Household Domestic	Sales Network
	Textile	Ceramic	Chemical	Public Bath	Others		
1961	226	141	62	14	76	118	333
1962	172	104	42	12	68	138	273
1963	136	83	44	5	55	138	253
1964	72	70	39	8	45	190	122
1965	54	52	28	2	27	198	98
1966	45	24	25	3	14	162	86
1967	25	17	24	2	14	150	76
1968	19	10	30	1	24	138	43
1969	8	7	41	2	9	103	37
1970	3	3	44	2	5	79	26

(1971 M.I.T.I.)

Table 10 Germanium Content in Lignite

Coal Field Coal Mine	Ge. ppm.	Coal Field Coal Mine	Ge. ppm.	Ash %
MINO		MINO Hiyoshi	3.3	35.15
Mitakeguchi		〃	4.0	31.32
Nakasoue	2.6	〃	1.0	59.51
Nakaso	3.3	〃	6.9	33.83
Shitaso	6.0	〃	2.3	29.33
Shoei	1.0	〃	0.7	39.24

(Unit: 10 tons) (1955 Geol. Surv. Japan)

The rare metals in lignite were noticed about ten years ago. The germanium in lignite was surveyed in the Mino and Mogami lignite fields and the maximum content in a lignite of Mogami showed 120 ppm at the uppermost and the lowest parts of the seam. The cause of concentration of germanium is considered to have been deposited by circulation water through the seam during its formation.

As the facts stated above, the Japanese lignite still has a value as a part of fuels or industrial materials for the local demand.

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要 旨

東南アジアより来日の電源開発調査団からの要請で，日本の亜炭資源の概況をまとめた．東南アジアでは亜炭による火力発電が行なわれており，関心が深い．

日本の亜炭利用の現況が，これら技術者の参考となることと考えられる．