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MINERAL RESOURCES

By

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STATE OF ALASKA

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL AND GEOPHYSICAL SURVEYS

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Selected Data and Information on the Mineral, Petroleum, Coal, and Timber Resources of the People's Republic of China, Republic of Korea, and Japan

Forward

The following pages contain facts and information about the mineral, oil and gas, timber, and coal resources of the three countries that Governor Sheffield's Trade Delegation will visit. It is intended to be a collection of miscellaneous facts regarding production and resource potential of these countries as related to Alaska. Additional information is provided you in a separate document "Alaska's Resources". We hope these reports will serve as useful references.

Should you need additional information when you return, we will make every effort to assist you.

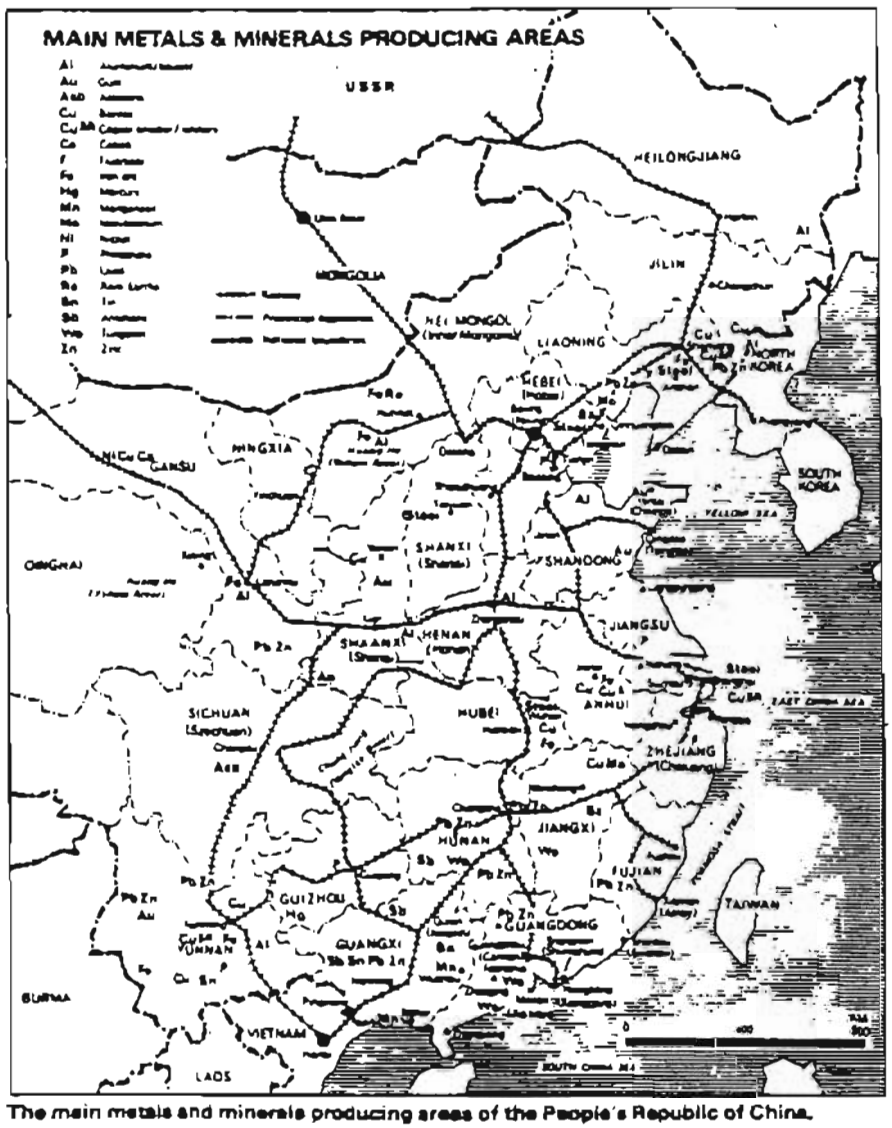
~~Bon~~ Voyage!

Ross G. Schaff
State Geologist

MINERAL RESOURCES OF CHINA

Strategic mineral commodities are those mineral commodities that are essential to the national defense and for which during war, we are wholly or in part dependent upon sources outside our national boundaries. Chromium, platinum-group metals, tungsten, manganese, aluminum, titanium, cobalt, tantalum, nickel, mercury and tin are considered the most important strategic materials for the United States. Critical minerals are those mineral commodities essential to the national defense, the procurement of which in war, while difficult, is less serious than those of strategic minerals.

The People's Republic of China has, within its borders, significant reserves of metals and minerals, many of which are considered strategic and critical to other countries. To date, reserves of 132 different metalliferous deposits within the People's Republic have significant development potential and, of these, more than 10 have metal reserves of world significance (world-class deposit) (figure 1). The People's Republic is ranked first in the world in total reserves of tungsten, antimony, tin, titanium, tantalum and rare earth minerals. Total reserves of lead, nickel, mercury, molybdenum and niobium are ranked second.



The main metals and minerals producing areas of the People's Republic of China.

Reserves of iron ore, on the order of 40,000 million tons, are sufficient to meet the current needs of the expanding industrialized society of the People's Republic, while allowing the export of more than 500,000 tons of steel during 1983. Total steel production during 1983 exceeded 100 million tons.

In the 1983, the People's Republic was also a net exporter of antimony, tin, bauxite, tungsten, zinc, barite, cement, fluorspar, salt, talc, coal, coke, and crude oil (table I).

TABLE I
RECENT EXPORTS OF MINERAL COMMODITIES FROM THE PEOPLE'S REPUBLIC OF CHINA (METRIC TONS)

	1981	1982	1983
Antimony	8,213	13,432	12,216
Bauxite	22,708	27,588	57,001
Steel	613,578	904,558	534,031
Tin	7,329	3,068	3,643
Tungsten			
ore	26,839	11,188	24,990
metal	494	183	65
Barite	914,310	1,091,218	792,285
Cement	816,802	699,940	380,193
Fluorspar	522,224	617,702	523,029
Salt	1,110,000	919,000	960,000
Talc	386,045	521,166	523,378
Coal	6,940,000	6,730,000	6,860,000
Coke	260,000	470,000	330,000

The People's Republic is a net importer of aluminum, copper, chromite, iron ore, steel, zinc, caustic soda, fertilizers, soda ash, sulfur and coal (table II).

TABLE II
IMPORTS OF MINERAL COMMODITIES BY THE PEOPLE'S REPUBLIC OF CHINA (METRIC TONS)

	1981	1982	1983
Aluminum	57,772	169,566	283,756
Copper	53,689	110,938	485,863
Chromite	80,079	224,841	307,479
Iron Ore	3,355,142	3,713,381	3,924,101
Steel	3,544,271	3,772,213	9,626,295
Zinc	12,409	108,084	228,708
Caustic Soda	51,674	66,551	247,021
Fertilizers			
Ammonium Sulfate	345,677	188,853	80,110
Urea	2,598,961	3,261,627	4,252,409
Other	2,609,591	2,606,533	3,662,791
Soda Ash	203,846	247,154	608,888
Sulfur	260,534	337,698	357,082

MINERAL RESOURCES OF JAPAN

The mineral industry of Japan has for many years supplimented large imports of mineral resources with production from mines within Japan. Recent world-wide metal-price fluctuations have greatly affected the viability of domestic mineral production in Japan. Many old, inefficient mines have been closed in recent years, due to their noncompetitive nature on the world minerals market.

Table III lists domestic refined metal consumption levels for Japan in 1982, for silver, copper, lead, zinc, tin, and nickel.

Copper production in Japan in 1982 was about 37,400 tons of copper, while consumption of copper by Japanese industry exceeded 1 million tons. Japan also imports large amounts of silver, lead, zinc, tin, and nickel to meet the demand of industry.

TABLE III
JAPAN'S REFINED METAL CONSUMPTION FOR 1983
(METRIC TONS)

	Silver(kg)	Copper	Lead	Zinc	Tin	Nickel
Demand	1,965,821	1,330,212	254,293	690,947	28,695	32,768

Japan produces over 15% of the western worlds output of cadmium, over 12% of its bismuth, over 31% of its selenium and over 27% of its tellurium (table IV). The production of these mineral commodities by Japan is important from a strategic point of view to the western world.

TABLE IV
RECENT OUTPUT OF REFINED METALS FOR JAPAN AS A FUNCTION
OF WESTERN WORLD'S TOTAL MINERAL OUTPUT
(METRIC TONS)

	1971	1981	PERCENT OF WESTERN WORLD'S OUTPUT
Aluminum	887,000	771,000	6.2
Bismuth	655	315	12.9
Cadmium	2,675	2,036	15.3
Cobalt		2,400	11.1
Copper (metal)		1,050,000	14.5
Indium	9	5	10.0
Lead	71,000	47,000	1.9
Selenium	238	453	31.7
Silver	351	279	3.3
Tellurium	36	80	27.1
Zinc	294,000	242,000	5.5

MINERAL RESOURCES OF THE REPUBLIC OF KOREA

The mineral industry of the Republic of Korea underwent a decline (in real terms) of 0.4% during 1983 as a result of decreased exports (table V) caused by an increase in domestic demands by Korean industry. Total value of domestic mineral production in Korea during 1983 exceeded $1,057 million, based on current metal prices. The total export value of mineral commodities during 1983 was $54 million.

TABLE V
RECENT MINERALS AND METAL PRODUCTION AND CONSUMPTION FOR THE REPUBLIC OF KOREA (METRIC TONS)

	1981	1982	1983	Consumption, 1983*
Iron Ore	593	620	655	
Zinc	81	91	105	107
Lead	27	24	25	60
Tungsten	5	4	5	
Graphite	34	26	32	
Pyrophyllite	395	466	461	
Talc	169	75	171	
Kaolin	694	625	684	
Cement	15,599	17,822	22,045	
Aluminum	17	15	13	154
Copper (refined)	113	118	105	168
Steel	10,753	11,758	11,915	15,000

*Incomplete figures

MINERAL PRODUCTION OF ALASKA

Historically, Alaska has been a major producer of mineral resources. Since the mid to late 1800's, miners in the state have produced almost $20 billion in mineral resources when standardized to 1980 dollars (table VI).

TABLE VI
ALASKAN MINERAL PRODUCTION 1880-1980

MINERAL	TOTAL VALUE 1980 DOLLARS (millions)
Gold	13,612.50
Sand and Gravel	3,755.60
Copper	1,242.00
Coal	684.00
Platinum Metals	213.78
Silver	169.91
Uranium	46.00
Tin	35.40
Lead	25.50
Marble	23.00
Barite	18.00
Antimony	16.05
Mercury	14.20
Gypsum	3.90
Tungsten	1.79
Chrome	0.84
Asbestos	0.20
Graphite	0.15
TOTAL	$19,862.82

Today, production from Alaska's mineral industry is dominated by sand and gravel operations and by one large coal mine at Healy. However, small-scale gold mining still plays a major role (table VII). Gold production in 1983 exceeded 169,000 ounces.

TABLE VII
MINERAL PRODUCTION FOR ALASKA

MINERAL	PRODUCTION 1981	1982	1983
Gold (tr. oz.)	134,000	174,900	169,000
Lead (s. ton)	0	0	0
Mercury (flasks)	0	0	0
Antimony (s. ton)	0	0	22,400
Platinum (tr. oz.)	900	0	0
Silver (tr. oz.)	13,420	22,000	33,200
Tin (lbs.)	106,000	198,000	215,000
Tungsten (stu)	305	0	0
Coal (s. ton)	800,000	830,000	803,000
Sand and Gravel (s. ton)	46,000,000	46,000,000	50,000,000

Large reserves of lead, zinc, copper, molybdenum, and asbestos are proven in Alaska. However, world economic uncertainties and the lack of adequate infrastructure within the state have frustrated the development of these resources. Nonetheless, several world-class mines are in the predevelopment stage and should be in production within the next decade. The People's Republic of China, Japan and the Republic of Korea could be consumers of these mineral resources.

TIMBER RESOURCES

BY

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TIMBER RESOURCES OF PEOPLE'S REPUBLIC OF CHINA, REPUBLIC OF KOREA, AND JAPAN

The largest forested areas in China are in the northeast and southwest regions. The northeast region is dominated by coniferous, mixed coniferous and deciduous, deciduous, and steppe forests. The southwest region is dominated by evergreen and monsoon-rain forests. Korea is dominated by deciduous forests, although mixed coniferous and deciduous forests occur in the northern part of the country. The northern island and the central part of the northern half of the south island of Japan are dominated by mixed coniferous and deciduous forests; deciduous forests are present elsewhere in Japan (figure 1).

The immediate availability of current timber-resource data for China, Korea, and Japan is poor. Table 1 (page 12) lists timber-resource statistics published by the Chinese Ministry of Forestry in 1963 and the United Nations Food and Agriculture Organization (FAO) in 1960. On the basis of data collected in the 1960 world forest inventory, the projected demand for timber products in China in 1975 was estimated to be 150 million m^3; the supply was projected to be 107 million m^3, resulting in a deficit of 43 million m^3. The projected demand for timber products in Korea and Japan combined in 1975 was estimated to be 108 million m^3; the supply was projected to be 89 million m^3, resulting in a deficit of 19 million m^3. These supply figures do not include additional supply from afforestation programs. An idea of the success of afforestation programs and harvest capability is afforded by production, importation, and exportation figures (table 2).

Table 2. Production, importation, and exportation of timber products in China, Korea, and Japan in 1980.

Production (million m^3)	China	Korea	Japan
Coniferous	105.6	28.2	20.2
Nonconiferous	119.0	40.2	13.5
Total	224.6	68.4	33.7
Importation (million m^3)	7.6	6.1	50.7
Exportation (million m^3)	0.07	0.00	0.02

Importation and exportation figures suggest that China, Korea, and Japan are all potential markets for importation of timber products. The supply falls far short of the demand in Japan and is slightly less than the demand in Korea. That Korea exported no timber products in 1980 suggests that all types of timber products are required. Early projections by the Chinese Ministry of Forestry indicated that by 1987, when existing afforestation programs have been effected, production will be 300 million m^3, which would satisfy all demands. Indeed, their production is approaching this figure. A possible importation commodity to China is large-diameter timber.

Table 1. Forest-resource statistics for China, Korea, and Japan

Country	Population (million)	Forest Area (million/ac)	Accessible Forest (million/ac)	Total Land (million/ac)	Accessible Forest (% of land)		Accessible Forest (ac/capita)
China	700.000	237.216	177.912	2404.283	9.9	7.4	0.13
Korea	23.303	15.992	14.567	22.412	72.0	65.0	0.26
Japan	91.540	56.932	53.497	91.348	63.0	59.0	0.20

Country	Accessible Growing Stock (million m^3)	Growing Stock (m^3/capita)	Over-all Accessible Volume/Area (m^3/ac)
China	5625	8.03	32
Korea	53	2.27	4
Japan	725	7.92	13

Source: data other than those for China are derived from FAO 1960 world forest inventory. China data are from the Ministry of Forestry, 1963. Population data are from UN (1964) for 1958, except for China, which is for 1962.

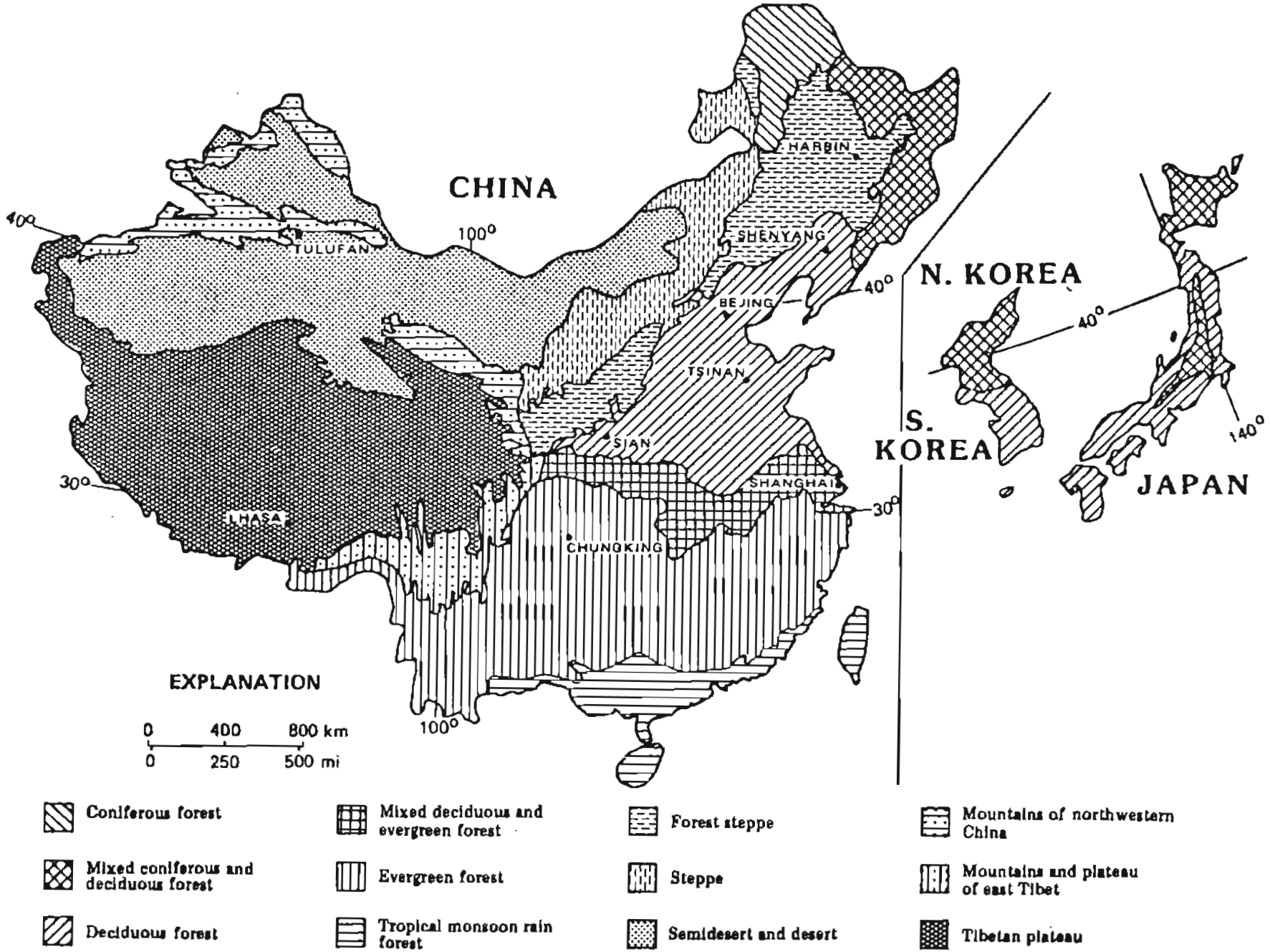

Figure 1. Forest areas of China, Korea, and Japan. After Richardson (1966) and United Nations FAO (1961).

TIMBER RESOURCES OF ALASKA

Alaska has two main forest regions, the coastal area and the interior area (figure 2; table 3). Coastal forests are an extension of coastal rain forests of the Pacific Northwest and contain comparatively large trees -- hemlock, Sitka spruce, and cedar. In contrast, small trees dominate interior forests -- white and black spruce, birch, aspen, cottonwood, and poplar.

Table 3. Forest-area statistics of Alaska

Alaska	
Gross land area	374.9 million acres
Net land area	365.5 million acres
Forest area	110.0 million acres (33% of land area)
Commercial forest area	28.2 million acres
Coastal region	
Land area	32.926 million acres
Forest area	13.247 million acres (40% of land area)
Commercial forest area	5.749 million acres
Interior region	
Land area	341.999 million acres
Forest area	106.000 million acres (32% of land area)
Commercial forest area	22.5 million acres

Forest-volume statistics for Alaska are listed in table 4.

Table 4. Forest Volume in Alaska

	Net Timber Volume	
	Coastal	Interior
Sawtimber	833 million m^3	102 million m^3
Poletimber	3.2 million m^3	36.9 million m^3
Total Stock (all timber on commercial forest land)	837 million m^3	139 million m^3
Average Stock per acre	183 m^3/acre	19 m^3/acre
Maximum Stock per acre	309 m^3/acre	123 m^3/acre
Current Annual Growth Increment (commercial forest only)	1.8 X 10^6 m^3/yr	6.0 X 10^6 m^3/yr
Current per acre Annual Average Growth Increment	0.31 m^3/yr	0.27 m^3/yr
Feasible Annual Growth Increment		
Commercial Forest Area	18 X10^6 m^3/yr	6 X 10^6 m^3/yr
Noncommercial Forest Area	2 X 10^6 m^3/yr	--

World-market conditions, the distribution infrastructure, and the cost of energy resources other than wood have limited the use of Alaska's

timber. Importation of timber products into Alaska is now eight times the production (table 5). At the same time, only a small percentage of the production is used in Alaska.

Table 5. Timber Production in Alaska between 1975 and 1979

Year	Volume (million m^3)			
	State Land	BIA and BLM	National Forest	Total
1975	0.15	0.004	1.87	2.03
1976	0.19	0.010	2.14	2.33
1977	0.27	0.036	2.06	2.37
1978	0.14	0.017	1.85	2.00
1979	0.15	0.003	2.08	2.23

References

Davis, Neil, 1984, Energy/Alaska, University of Alaska Press, Fairbanks, 530p.

Richardson, S.D., 1966, Forestry in Communist China, John Hopkins Press, Baltimore, 237p.

United Nations Food and Agriculture Organization, 1961, Timber trends and prospects in the Asia-Pacific region, Economic Commission for Asia and the Far East (ECAFE) Publication no. E/CN.11/533, 224p.

United Nations Food and Agriculture Organization, 1982, 1980 yearbook of forest products.

Conversions

1 m^3 roundwood = 221 bd ft
1 ft^3 = 6 bd ft

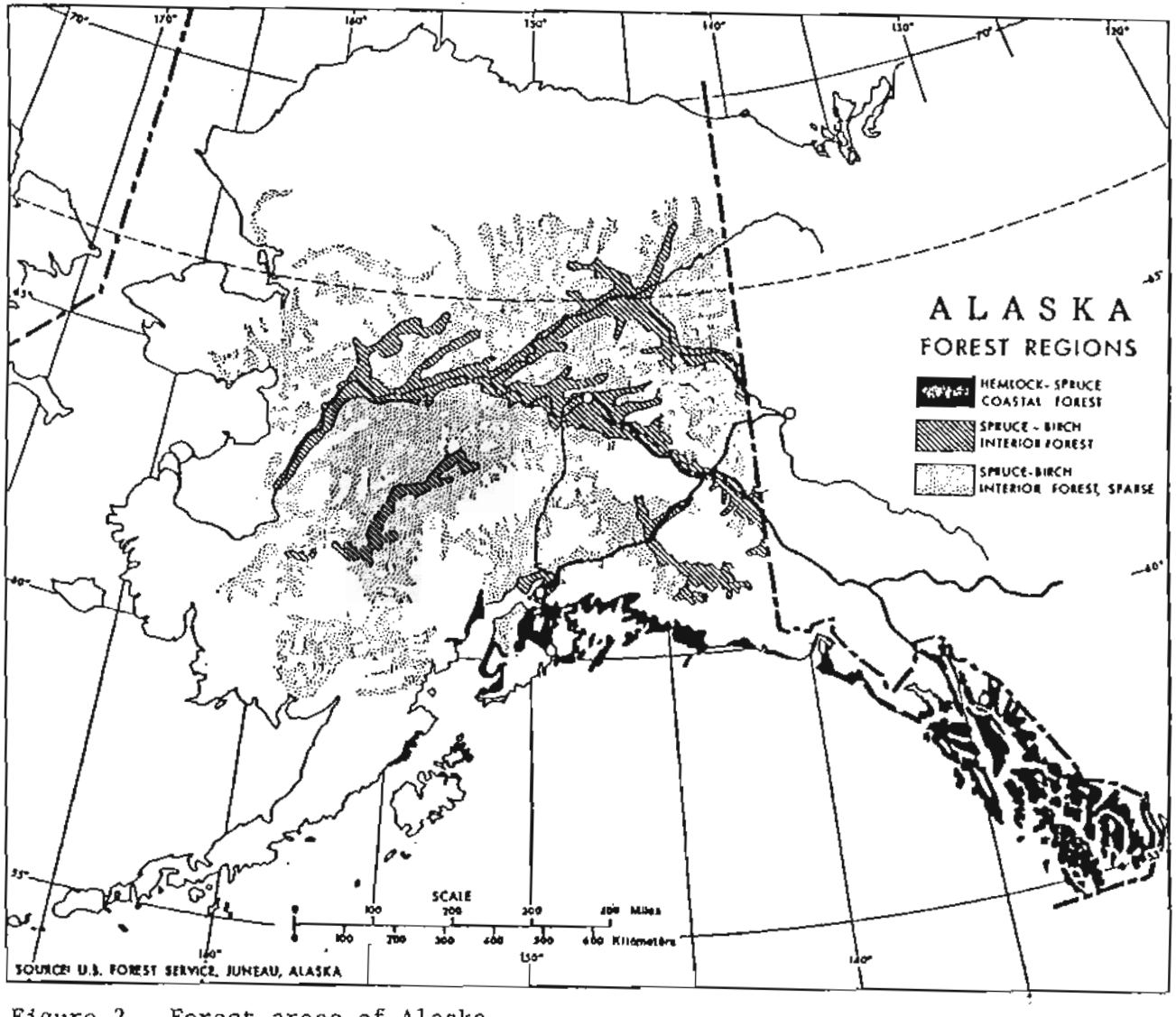

Figure 2. Forest areas of Alaska

COAL RESOURCES

BY

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COAL RESOURCES OF THE PEOPLE'S REPUBLIC OF CHINA

Geology: Pennsylvanian-, permian-, and Jurassic- aged coals make up 95% of reserves; remainder Tertiary.

Extent: Coal deposits underlie approximately 5.5% of China's land area.

Resources/Reserves: Estimated 5 trillion tons of coal resources of which 640 billion tons are recoverable.

Quality: Pennsylvanian coals are high in sulfur; Permian coals are low in sulfur but high in ash; Jurassic coals are best quality with low sulfur and ash; Tertiary coals are subbituminous and low rank lignites.

Rank: 30% low-rank bituminous; 28% subbituminous; 9% anthracite; 8% middle-rank bituminous; 8% lignite; 6% high-rank bituminous; and 11% mixed coals.

Production: 1980 and 1981 - 620 million tons each; 1982 - 628 million tons, making it the third largest coal producer in world; 770 million tons scheduled for 1985 and 1.2 billion tons per year planned for 2000.

Mining: 96% underground from thick and medium-thick seams; 40% from mechanized working faces; average depth less than 500 meters.

Mine Size: Mines with annual capacity of 25 million tons per year being developed, and mines with 40 million tons total capacity under negotiation.

Coal Transportation: By barges through rivers and inland waterways, and north to south by ocean transport; railroads are being upgraded and new ports developed; slurry pipeline transport to coast planned for new mines.

Coal Use: Mostly within China but growing tonnages will be available for export in the future.

Energy Consumption: 630 million tons/year of coal equivalent.

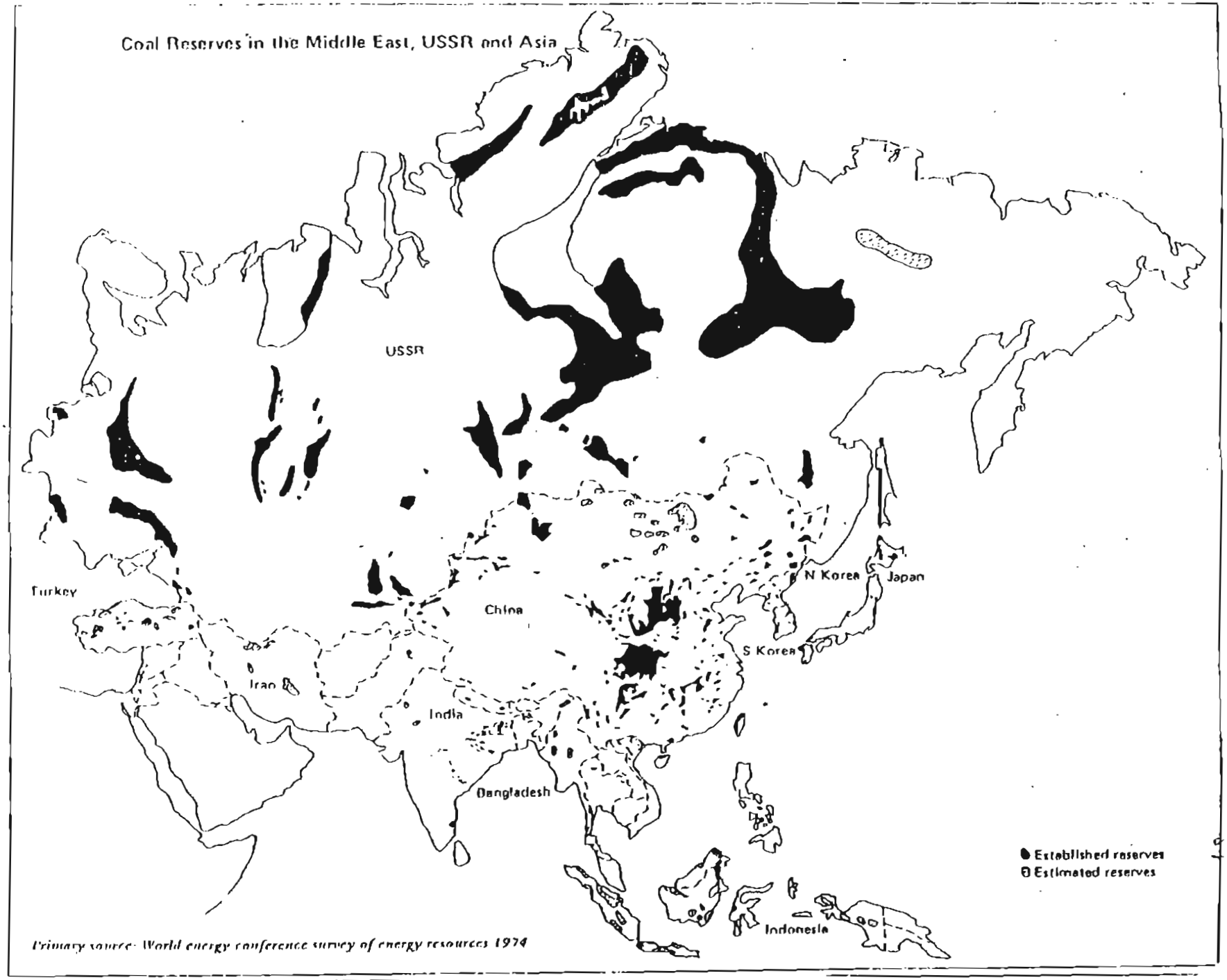
Energy Mix: 70.9% coal-generated; 22.4% from petroleum; 3.5% hydroelectric; and 3.2% natural gas.

Export: 10 million tons coal/year.

Foreign Investment: $700 million in funds; $1 billion equipment ordered.

Problems: Rail and port facilities inadequate at present to build up substantial export trade.

Potential: May become significant supplier of coal to Japan and southeast Asia but not for a long time; new mines are being developed less than 150 miles from coast with part of production committed for delivery to Japan; Japan's steam coal requirements are anticipated to increase from 5 million tons in 1980 to 22-million tons in 1985 and 53.5 million by 1990; Japan is interested in diversifying sources of coal supply, with China, Canada, South Africa, and Australia being considered in addition to United States and Alaska.


Coal Reserves in the Middle East, USSR and Asia
USSR
Turkey
Iran
India
Bangladesh
China
N Korea
Japan
S Korea
Indonesia
Established reserves
Estimated reserves
Primary source: World energy conference survey of energy resources 1974

COAL RESOURCES OF ALASKA

HISTORY:

- Coal was first discovered in Alaska in 1786 by Captain Nathaniel Portlock, an English trader, at Coal Cove (presently Port Graham) on the Kenai Peninsula.
- The oldest mine in Alaska was opened by the Russian-American Company at Port Graham on the Kenai Peninsula in 1855.
- The number of inactive coal mines and prospects in Alaska totals about 210.
- The modern era of coal production in Alaska began in 1917 with the construction of the Alaska Railroad.

GEOLOGY:

- The oldest coal in Alaska geologically is in the Point Hope field on the Lisburne Peninsula; it is Mississippian or about 330 million years old.
- Most bituminous coal in Alaska formed in the Cretaceous Period between 65 and 140 million years ago.
- Most subbituminous coal in Alaska formed in the Tertiary Period between 10 and 65 million years ago.
- The thickest known coal bed interval in Alaska is in the Farewell (Little Tonzona) field where there is over 120 feet of coal in 200 feet of rock strata.

DISTRIBUTION AND EXTENT:

- Coal is found in all geographic subdivisions of Alaska and in over half of the 153 quarter-million scale quadrangles of the State.
- The approximate land area of Alaska thought to be underlain by coal deposits is about 50,330 mi^2; since Alaska's total land area is about 591,000 mi^2, this portion accounts for some 8.5 percent of the State.

COAL FIELDS:

- There are about 20 significant coal fields presently known in Alaska.
- The three largest coal fields are: (1) Northern Alaska; (2) Cook Inlet-Susitna lowland; and (3) Nenana basin.

RESOURCES/RESERVES:

°Alaska is believed to hold half of the U.S. coal resource base, 15 percent of the world resource base, and probably 10 percent of the technically and economically recoverable reserves of the world.

°Only the Soviet Union, the People's Republic of China, and the contiguous United States contain as much coal as Alaska.

°The Soviet Union, United States (inlcuding Alaska), the People's Republic of China, and Australia account for over 90 percent of the total coal resources of the world and over 60 percent of the reserves.

°Alaska is estimated to have at least a 200 year supply of coal.

°The estimated total coal resources in Alaska are between 2.0 and 5.5 trillion short tons; in the United States as a whole are 4.5 to 9.0 trillion short tons; and in the world are between 20.0 and 25.0 trillion short tons.

°The total identified Alaska coal resources are nearly 170 billion short tons.

°The Susitna lowland (Beluga and Yentna fields) contains the largest reserves of coal recoverable by surface mining in southern Alaska.

°Alaska's coal resources are compared to those of those of the contiguous United States and the world in the table below:

Alaska's Coal Resources Compared to the Contiguous United States and the World

Country	Geological Resources	Technically and Economically Recoverable Reserves
Soviet Union	40.0	16.5
People's Republic of China	16.0	15.0
Contiguous United States	15.0	14.0
Alaska	15.0	10.0
TOTAL UNITED STATES	30.0	24.0
Australia	4.5	5.0
Canada	2.5	0.5
Federal Republic of Germany	2.0	5.0
United Kingdom	1.5	6.5
Poland	1.0	8.0
India	0.5	2.0
Republic of South Africa	0.5	6.5
Other Countries	1.5	11.0
WORLD TOTAL	100.0%	100.0%

*Data evaluated from various sources; reflects magnitude percentage of total only.

ENERGY EQUIVALENCY:

°The total energy (Btu) equivalent of the coal in Alaska surmounts by many magnitudes that present in all the oil that ultimately will flow from the State.

°The Northern Alaska coal field is the largest in the United States, and including offshore extensions is possibly the largest in the world in total energy (Btu) equivalency.

QUALITY:

°Alaska coal is generally 60 percent bituminous and 40 percent subbituminous with minor deposits of anthracite and lignite.

°The chief favorable attribute of Alaska coal is its very low sulfur and relatively low trace element contents making it environmentally some of the cleanest known coal in the world.

COAL LEASES/COAL PROSPECTING PERMITS:

°Alaska has 51 existing State coal leases covering about 102,500 acres or 160 mi^2.

°Alaska has 13 existing State coal prospecting permits covering about 20,000 acres or 31 mi^2.

PRODUCTION:

°Total coal production to date in Alaska is over 30 million tons; the estimated value of this production is over 320 million dollars.

°Peak coal production in Alaska was in 1966 when over 927,000 short tons were mined.

°The coal fields with the majority of historic coal production are Matanuska and Nenana.

°The largest export year for Alaska coal was in 1943-1944 when 10,500 tons were sold.

°The 1983 total Alaska coal production was 803,000 short tons by the Usibelli Coal Mine, Inc. near Healy of the Nenana coal field.

°The United States (inlc. Alaska) coal production for 1977 and that projected in the year 2000 is compared with similar estimates for the Soviet Union and the People's Republic of China in the table below.

World Coal Production

Country	Production (mtce/yr)* 1977	2000	Percent of World Total 1977	2000
United States	560	1900	23	28
Soviet Union	510	1100	20	28
People's Republic of China	370	1450	15	21
Others (scattered)	1010	2330	42	35
Totals	2450	6780	100	100

*Million tons coal equivalent/year

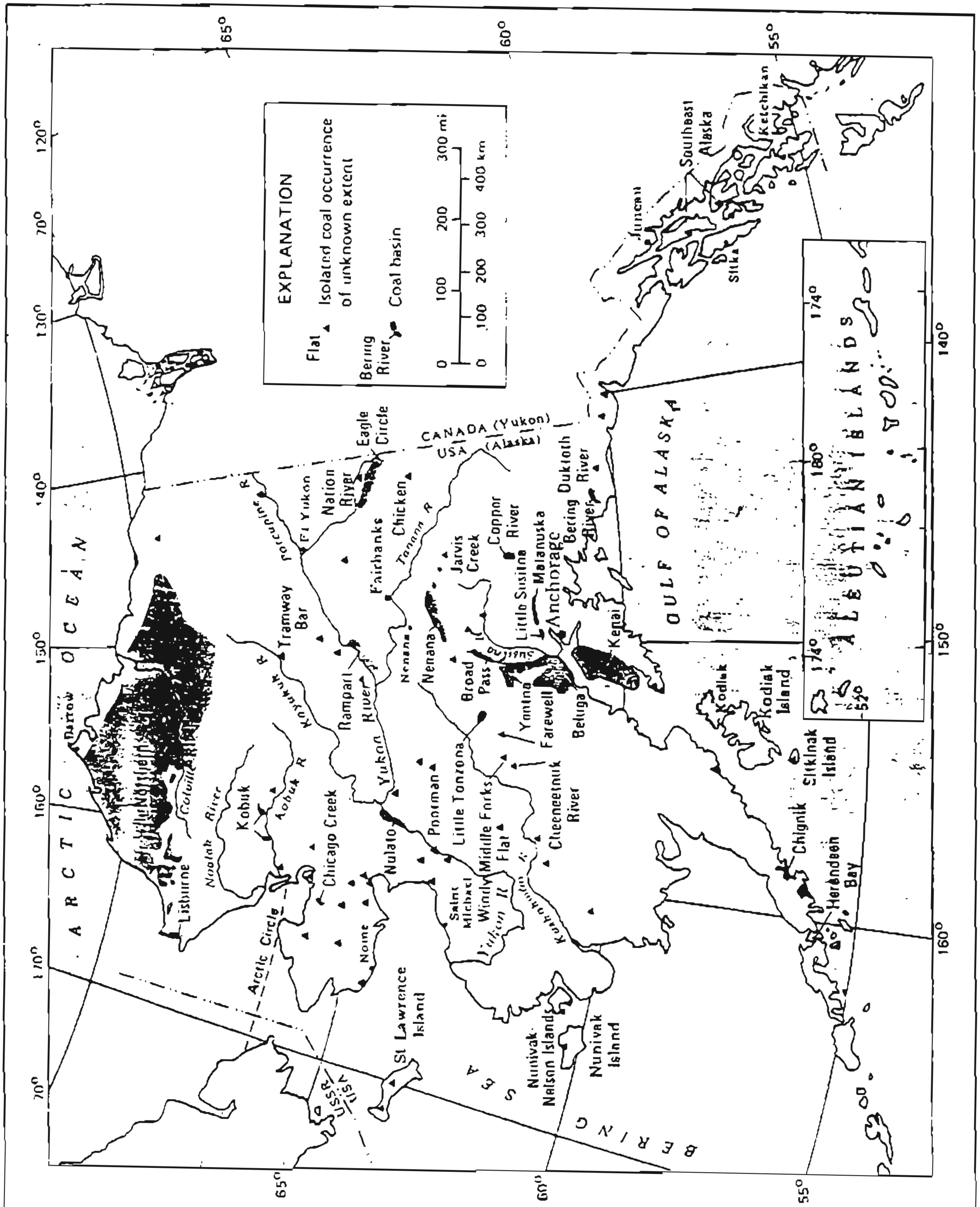
FUTURE POTENTIAL:

°Since the surficial expression of existent coal deposits in many areas of Alaska known to contain large quantities of coal is poor to absent, entire new fields may be discovered in the future.

°Coal-bearing areas in Alaska near tidewater could have the greatest future potential of any other undeveloped coal lands in the United States.

°The coal fields likely to have the newest near-term development are Jarvis Creek (of the Nenana basin), Matanuska, and Beluga.

°The new export facility at Seward will be able to handle 65,000-ton cargo capacity vessels.


EXPLANATION
Flat
Isolated coal occurrence of unknown extent
Bering River
Coal basin
0 100 200 300 mi
0 100 200 300 400 km
ARCTIC OCEAN
GULF OF ALASKA
BERING SEA
ALEUTIAN ISLANDS
CANADA (Yukon)
USA (Alaska)
USSR
USA
Arctic Circle
Barrow
Lisburne
Kobuk
Chicago Creek
Nome
Nulato
Saint Michael
Windy
Middle Forks
Flat
Little Tonzona
Poorman
Rampart
Tramway Bar
Fairbanks
Nenana
Broad Pass
Yentna
Farewell
Beluga
Little Susitna
Anchorage
Matanuska
Jarvis Creek
Copper River
Bering River
Dukioth River
Kenai
Chicken
Eagle
Circle
Nation River
Kodiak
Kodiak Island
Sitkinak Island
Chignik
Herendeen Bay
Juneau
Sitka
Southeast Alaska
Ketchikan
St Lawrence Island
Nunivak Island
Cheeneetnuk River
Yukon River
Kobuk R
Colville River
Noatak River
Tanana R
Porcupine R
65°
60°
55°
120°
130°
140°
150°
160°
170°
174°
180°

HYDROCARBON RESOURCES OF CHINA, JAPAN, AND SOUTH KOREA

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