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THAILAND NON-METALLIC MINERAL RESOURCE : PROFILE & SOME APPLICATION

BY

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COUNTRY PAPER

PRESENTED IN WORKSHOP SEMINAR
ON NON-METALLIC MINERAL FOR
ENVIRONMENTAL PROTECTION

ORGANIZED BY

UNIDO-CZECHOSLOVAKIA JOINT PROGRAMME
FOR INTERNATIONAL CO-OPERATION
PILSEN, CZECHOSLOVAKIA
23 MAY - 1 JUNE, 1989

Thailand Non-Metallic Mineral Resources: Profile & Some Applications

by

Chaiyuth Klinsukont

1. INTRODUCTION

Thailand lies within the metallogenic belt of Southeast Asia, containing a wide complement of mineral deposits, some 40 of which have been produced to date. Among them, the discovery and mining of large-scale tin deposits, both onshore and offshore in the Peninsular South, started the modern mining industry. Subsequently, exploration and extraction followed for other mineral ores, notably zinc, fluorite, gypsum, lead, barite, tungsten, columbite-tantalite, antimony, and some 30 others. Mineral developments brought this country a foreign exchange earning of some 14,934 million baht in 1980, about three-quarters of which was from tin. With the weakening of the world economy, however, 1985 earnings dropped to 7,779 million baht, a trend which seemed likely to continue through 1986. All key economic minerals seemend to be affected by this demand slowdown.

Despite the depressed state of the world commodity market, the value of Thailand's mineral output grew significantly between 1983 and 1985, from nearly 9.7 billion baht to nearly 11.2 billion baht. Tin accounted for 66 percent of the 1983 value and for 47 percent of the 1985 value. Those are still high proportions, but are dramatically down from the 1980 situation, when tin accounted for some 82 percent of the value of the country's mineral output. Although the international tin market featured high prices and brisk demand in 1980, with unrestricted exports until April 1982, oversupply subsequently led to the imposition of export controls on producing members of the International Tin Council (ITC) and, ultimately to the collapse of the London Tin Market in October 1985.

The economic impact of the tin industry on Thailand's economy because of the metal's dominant economic role, but it is worth noting that more than 30 minerals are currently being produced commercially in Thailand (Table 1). Aside from tin, other key minerals include, in decreasing order of 1985 value, zinc, fluorite, gypsum, lead, barite, tungsten, columbite-tantalite, and antimony. Fuel minerals, including lignite, oil and gas, also make a significant contribution to the country's energy budget and GDP (Tables 2 and 3). The production of lignite, in particular, is likely to grow considerably. The distribution of mineral resources in Thailand is indicated in Figure 1.

Table 1 Mineral Production and Value 1980, 1984 and 1985

(production: tons, value: million baht)

Mineral	1980		1984		1985	
	Production	Value	Production	Value	Production	value
Tin concentrates	45,986	11,545.6	29,979	6,396.9	23,022	5,290.0
Tungsten:						
- Wolfram	2,661	519.4	1,144	162.7	856	112.4
- Scheelite	473	91.9	295	42.3	281	37.4
Fluorite:						
- metallurgical	172,784	200.3	230,228	326.6	263,059	449.3
- acid	60,108	105.1	57,151	114.0	35,840	73.3
Zinc ore	-	-	147,993	377.4	276,909	706.1
Lead concentrate	24,847	228.6	39,204	180.8	46,245	220.1
Columbite-Tantalite	356	303.4	477	230.0	268	143.2
Lignite	1,426,566	171.3	2,337,226	661.4	5,146,150	2,552.0
Gypsum	411,977	113.5	1,110,660	401.0	1,273,459	432.9
Barite	305,057	208.1	174,918	153.8	230,970	207.4
Antimony	6,862	134.8	4,636	97.8	2,917	64.7
Limestone (for cement)	3,957,929	98.9	9,223,406	203.6	9,844,610	428.1
Feidspar:						
- Sodium					92,620	114.1
- Potassium	24,158	12.1	74,404	107.9	11,966	19.3
Kaolin	19,931	14.0	58,616	41.0	106,704	74.7
Mangamese:						
- battery grade	2,716	7.2	6,110	16.1	3,930	15.9
- metallurgical	51,538	46.4	2,577	2.6	455	0.5
Silica sand	171,000	20.5	166,787	20.0	152,133	52.4
Rock salt	16,744	4.5	9,850	2.6	12,786	3.4
Marble	5,649	2.5	37,927	16.9	21,478	41.9
Others		109.7		120.9		137.0
Total value		13,937.8		9,676.3		11,176.1

Table 2 Natural Gas Production, Sales, Value and Royalties, 1983-85

(production and sales : MMscf. value and royalty : million baht)

Gas Field	1983	1984	1985
Offshore Production			
Erawan	54,097.30	68,179.50	67,574.70
Pan-Pot	1,033.00	11,139.90	8,080.80
Satun			24,969.60
Platong			21,995.60
Onshore Production			
Sirikit	1,890.16	6,186.45	10,044.62
Total Production	57,020.46	85,505.85	132,665.32
- Sales	55,169.12	82,468.23	125,859.71
- Value	3,344.38	4,940.76	8,021.63
- Royalties	422.40	617.72	1,002.69

Note : MMscf = Million standard cubic feet.

Source : Department of Mineral Resources' Petroleum Statistics, 1983-1985.

Table 3 Condensate and Crude Oil Production, Sales, Value and Royalty, 1983-85

(production and sales : million barrels, value and royalty : million baht)

Field	1983	1984	1985
Offshore Condensate			
Erawan	2.20	2.40	2.60
Pan-Pot	0.07	0.61	0.35
Satun	-	-	1.05
Pla-tong	-	-	1.21
Crude Oil			
Sirikit	2.22	5.10	7.59
Total Production	4.49	8.11	12.80
- Sales	4.31	8.26	12.68
- Value	2,722.11	5,283.33	8,988.92
- Royalties	340.26	660.44	1,123.60

Source : Department of Mineral Resources' Petroleum Statistics, 1983-1985.

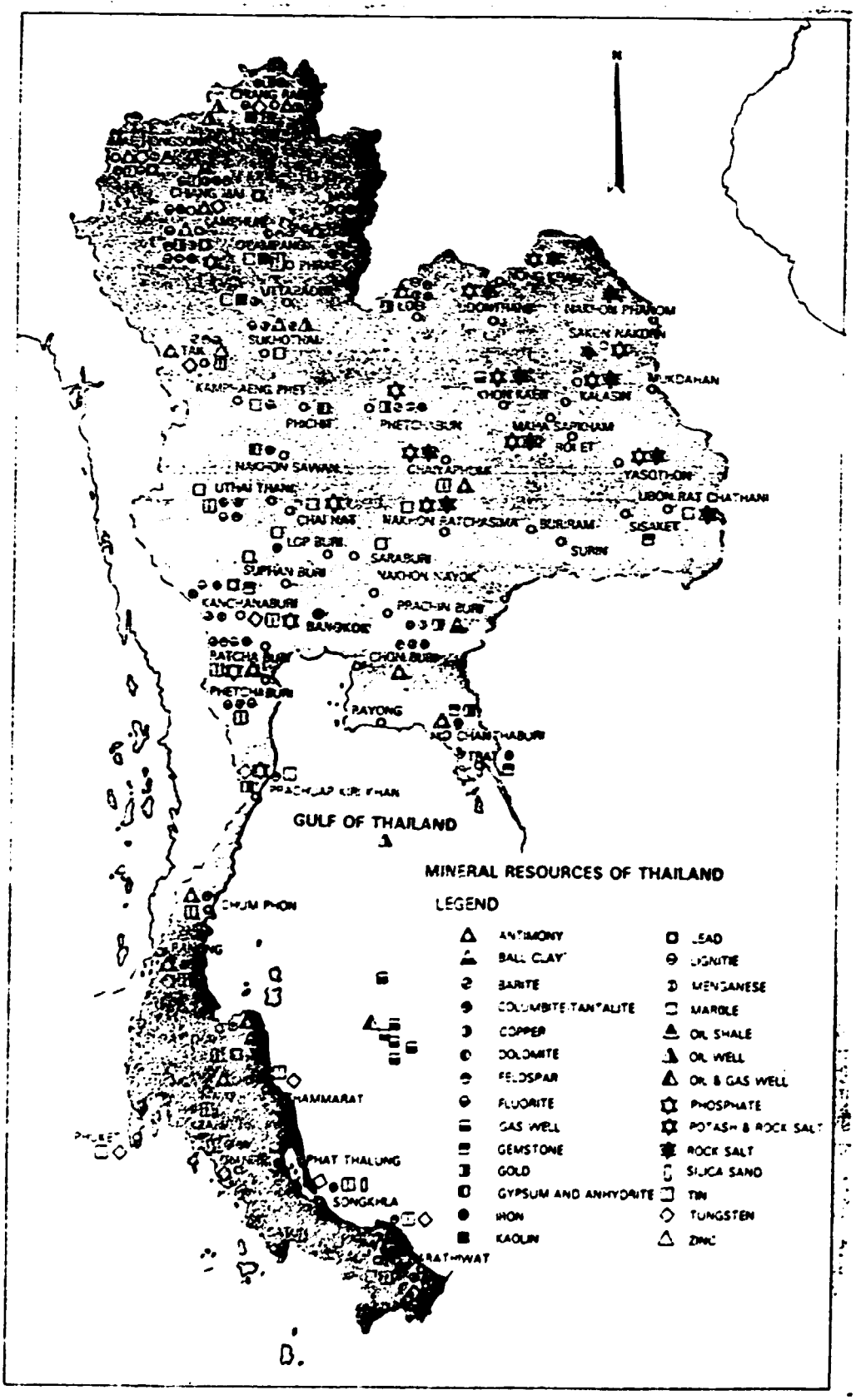

Figure 1 Distribution of Mineral Resources in Thailand

However, this paper will lay more emphasis on non-metallic mineral resources profile of Thailand. Some of their reserves and consumptions will also be presented especially to those specific minerals that their applications and utilizations are of interested regarding environmental protection aspects, such as anthracite, diatomite, bentomite, and perlite etc.

2. Non-Metallic Minerals

2.1 Distribution Production and Consumption.

Non-metallic mineral is a mineral or naturally occurring substance (as rock or cley) that is not used for extraction of its metal content. The distribution of non-metallic mineral resources in Thailand is illustrated in Figure 2 The major deposits are located in the Northern and the central part of the country.

Table 4 Number of Mines, by Mineral in 1980, 1984 and 1985

Mineral	No. of mines		
	1980	1984	1985
Fluorite	58	61	55
Lignite	9	14	15
Gypsum	9	20	15
Barite	38	56	44
Limestone	8	23	24
Kaolin	15	38	37
Feldspar	15	25	25
Silica sand	11	20	18
Marble	4	36	39
Others	77	129	141
Total	244	422	413

Source: Department of Mineral Resources' Mineral Statistics. 1980-1985

Table 4 presents variation of the number of active mines by mineral in 1980, 1984 and 1985. It can be seen that the total number was considerably increase in 1984 and 1985. Table 5 presents the mineral consumption in 1980, 1984 and 1985 excluding fuel minerals such as lignite which is the major local consumption valued about 60 per cent of the total consumption. It is encouraging to note that growing

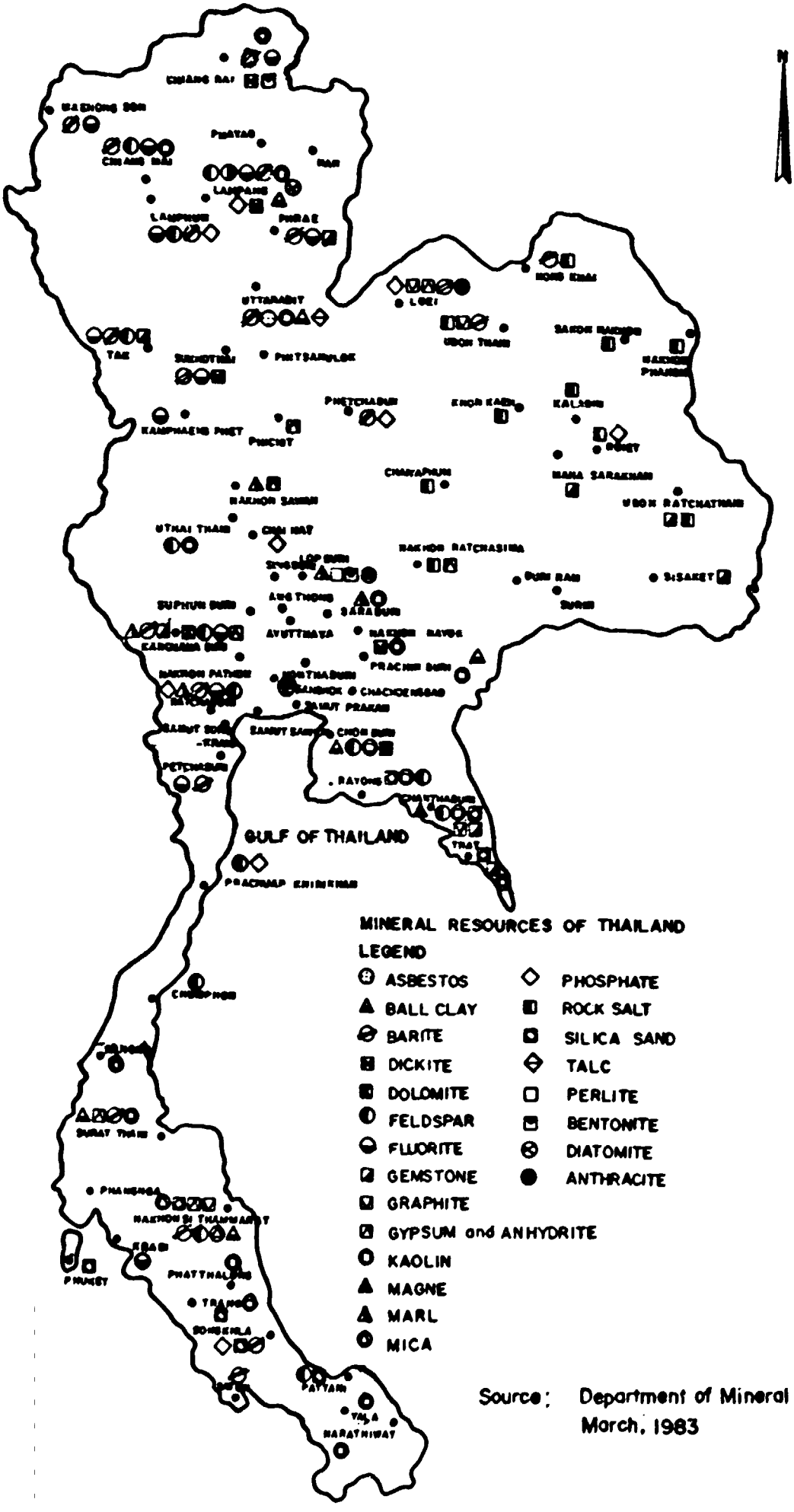

Figure 2 The Distribution of Non-metallic Mineral Resources in Thailand

Table 5 Thailand's Mineral Consumption in 1980, 1984 and 1985

(consumption : tons, value : million baht)

Mineral	1980		1984		1985	
	Consumption	Value	Consumption	Value	Consumption	Value
Dolomite	7,980	0.9	4,017	3.2	16,928	14.2
Feldspar-sodium + Potash	14,032	7.0	41,628	60.4		
- sodium					144,329	52.5
- potash					12,075	19.6
Glass sand	140,511	16.0	150,565	18.1	157,571	54.2
Gypsum	256,431	69.9	305,886	110.4	340,488	116.5
Kaolin	17,681	12.4	56,456	39.5	103,127	72.2
Limestone (for cement)	3,230,159	80.8	9,168,527	229.2	8,700,382	372.5
Marble	5,651	2.5	16,250	7.2	7,739	15.1
Rock salt	11,000	2.9	9,075	2.4	4,850	1.3
Others		100.6		40.3		50.2
Total value		284		509.7		748.4

Source: Department of Mineral Resources' Mineral Statistics, 1980-1985

Note: US $ 1 = 25.5 Baht.

Table 6 Some Non-metallic Mineral Exports in 1980, 1984 and 1985

(export : tons, value : million baht)

Mineral	1980		1984		1985	
	Exports	Value	Exports	Value	Exports	Value
Fluorite:						
- metallurgical grade	154,432	185.6	170,133	245.5	168,835	276.2
- acid grade	59,824	114.2	54,530	109.6	35,375	85.5
Gypsum	144,536	47.5	737,954	229.7	869,887	265.1
Barite						
- lump	327,000	222.7	163,449	138.5	202,942	185.2
- ground	34,732	54.8	18,549	37.5	12,730	28.1
Feldspar-sodium	924	1.4	12,400	11.1	33,902	27.1
Others		189.0		85.1		141.5
Total value		815.2		857		1,008.7

Source: Department of Mineral Resources' Mineral Statistics, 1980-1985

Note: US $ 1 = 25.5 Baht

quantities of non-metallic mineral commodities as limestone shale, gypsum, kaolin, feldspar, silica sand and marble are being used by local manufacturing industries, including the cement, ceramic, rubber, paint and building industries. Besides, the local consumption some minerals with a high production and commercial value were also exported as presented in Table 6.

2.2 Mineral Reserves and Potential

Determining how large a country's reserves of a mineral and how long they are likely to last, is rarely an easy task. Generally, the estimate must be made on the basis of past production records and present knowledge.

Estimated reserves of a number of industrial mainerals are shown in Table 7, illustrating the economic potential of some of these minerals. Although no reliable figures are available on the likely reserves of fluorite, over 5.4 million tons of metallurgical and acid grade fluorite concentrates were produced between 1964 and 1985 and the existing reserves should be able to support present production levels into the foreseeable future. Reclining demand and prices for this mineral have led to a slump in production, from a peak of some 427,000 tons in 1971 to around 200,000 tons of exports a year since 1980.

Table 7 Estimated Reserves of some industrial Minerals

Mineral	Tons	Average Grade	Remarks
Barite	18×10^6	Sp. Gr. 42	
Diatomite	50×10^6	70% SiO_2	
Dolomite	100×10^6	18% MgO	
Gypsum	40×10^6	90% $CaSO_4\ 2H_2O$	
Kaolin	45×10^6	Mixed grade	
Limestone	very large	Cement and Lime grade	
Marble and building stone	$25 \times 10^6 m^3$	Mixed	
Potash	270×10^9	5% K_2O	Mainly Carnallite
Rock salt	18×10^{12}	90% NaCl	
Silica sand	10×10^6	90% SiO_2	
	100×10^6	95% SiO_2	

Source: Sampattavanija, 1984

2.3 Some application for Environmental Protection.

In Thailand, data and information of non-metallic minerals such as anthracite, diatomite, perlite and bentonite etc, especially on their applications regarding environmental protection aspects are still very limited. This section will lay emphasis on those specific mineral deposits in Thailand and some application.

Anthracite: is a jest-black hard coal that has high luster, is brittle, and breaks with a conchoidal fracture. It ignites slowly, is smokeless, burn with a short blue flame has a low sulfur content, and has high heating value. It is restricted in distribution and was used almost exclusively for domestic heating although some is now blended with coking coal and some is used to produce carbon, It also is subdivided into varieties. At present it is used as a filter medium for the upper layer of multilayer filters. It considerably improves the filtration efficiency and offers numerous additional advantages in gravity as well as pressure filtration units.

Bentonite: is a product of the denitrification and alteration of volcanic ash or tuff. The alteration probably began as the fine-grained during diagenesis. Most bentonite consists chiefly of montmorillmite, but some montmorillonite clays are still classed as bentonite clays under commercial usage. It can be used as the loose-fill, it it a competitives material to perlite in oil-well cementing. Moreover, it is used as soil sealants for the control of highly contaminated industrial wastes.

Diatomite: a sedimentary rock, consist of microscopic silicious tests of diatoms and rarely of other silica-secreting organisms. It resembles chalk or clay but contains chieftly silica and 3 to 10 per cent water with a little alumina, iron oxides, and albalies. It is also known as diatomaceous earth, diatomaceous silica, kieselguhr, and infusorial tropoli earth. It has gone under 22 different names. In filtration, diatomite is the principal competitive material with perlite, and anthracite.

Perlite: an acid volcanic glass, when heated becomes porous and serves for insulation and light aggregated. Not all perlite expands sufficiently to be of commercial value, Perlite imparts insulating and acoustical properties to gypsum plaster and this use presently accounts for two thirds of the total annual perlite consumption. It is also used as filter aid. The use for perlite fines include fillers or extenders in rubber, paints, enamel, glazes, plastics, paper, textiles, resins, cleansing compounds and tile. One of the newer important uses is for industrial filtration. The expanded perlite substantial quantities are used annually in various horticultural application and in soil conditioning, plant propagating media, as packing material for shipment of nursery stock, and as a carrier or diluent for herbicides and insecticides. Expanded perlite with bulk densities below 4 p.c.f is used as insulation in the form of loose-fill.

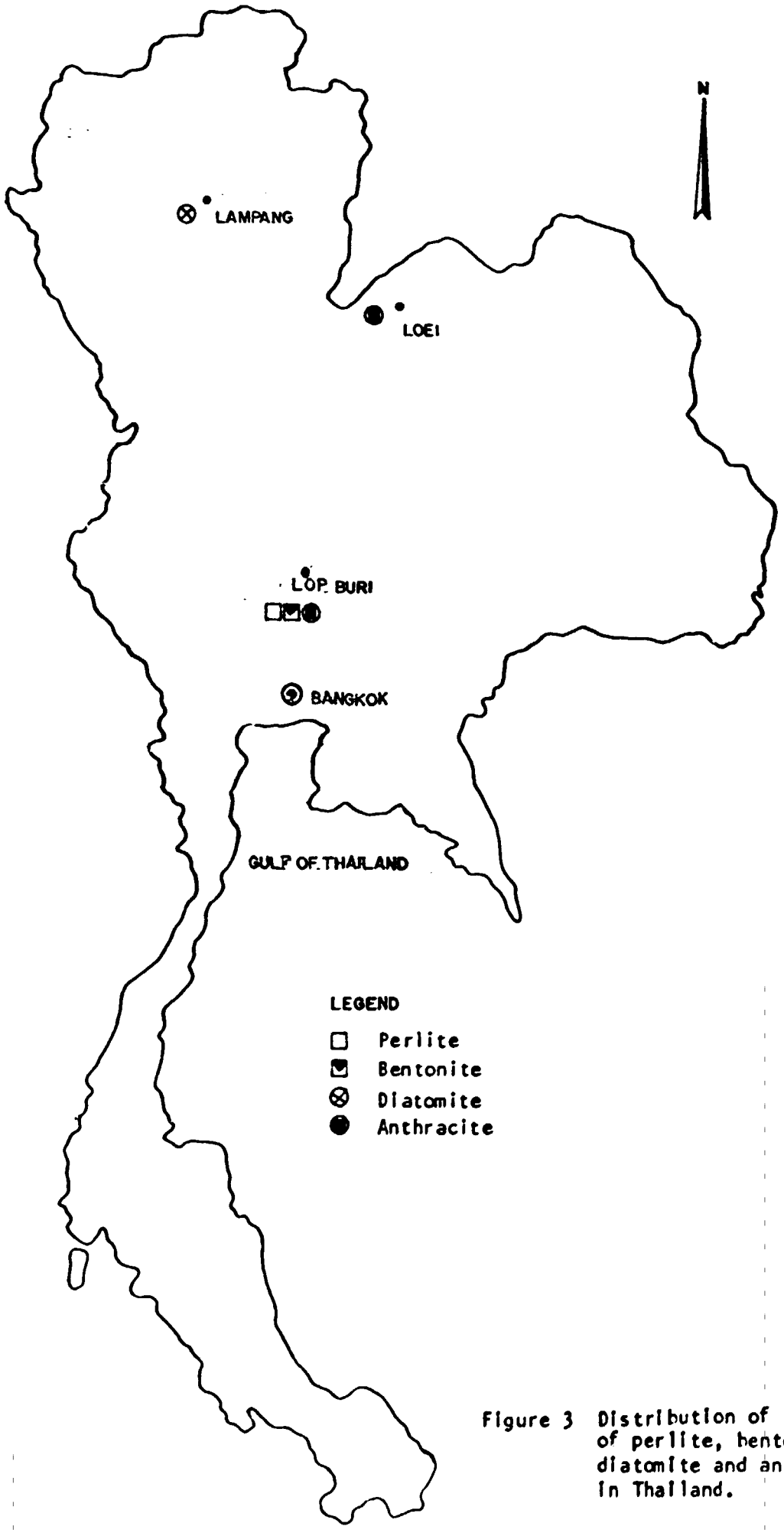

Figure 3 Distribution of the deposits of perlite, bentonite, diatomite and anthracite in Thailand.

Figure 3 illustrates distribution of the deposits of perlite, bentonite, diatomite and anthracite in Thailand. However, their reserve quantities are not yet available. Anthracite and diatomite are already in production of commercial values while perlite and bentonite reserves were also estimated with a commercial values, but there are no production yet. They are being under request for concession by private sectors. Table 8 presents their productions in 1983 to 1988. It can be seen that anthracite production was considerably increase in 1988. Almost all of anthracite and diatomite productions are for local consumption especially anthracite is being used in filtration units of water treatment plants of the Provincial Waterworks Authority and the Bangkok Metropolitan Waterworks Authority.

Table 8 Production of anthracite, diatomite, perlite and bentonite in 1983-1988.

Unit : ton

Mineral \ Year	1983	1984	1985	1986	1987	1988
Anthracite	11,110	-	3,000	2,500	8,350	15,330
Diatomite	420	471	410	204 2/	177	470
Perlite	-	-	-	-	-	1/
Bentonite	-	-	-	-	-	1/

Source: Mineral Resources Department, 1989

Note: No production

1/ commercially available, being under request for concession by private sector.

2/ Export to Taiwan, 60 tons

Reference

1. Thailand Natural Resources Profile, prepared by Thailand Development Research Institute, January 1987

2. DMR, 1981, Mineral Potential and Production of Thailand, Department of Mineral Resources.

3. Sampattavanija, S. 1984, Way for Industrial Mineral Development, Paper prepared for a Lecture at DMR, 1 March, (In Thai)

4. Mineral Factors & Problens : Perlite, Bureau of Mines, USA : Bull. No. 585, 1960.

5. Hughes, J. 1975, A Method for the Evaluation of Bentonites as Soil Sealants for the Control of Highly Contaminated Industrial Wastes.

6. Metropolitan Waterworks Authority, Dec. 1987, Bangkhen Water Treatment Plant. Booklet prepared for publicity.