UCRL-CR-125620
P.O. B291867

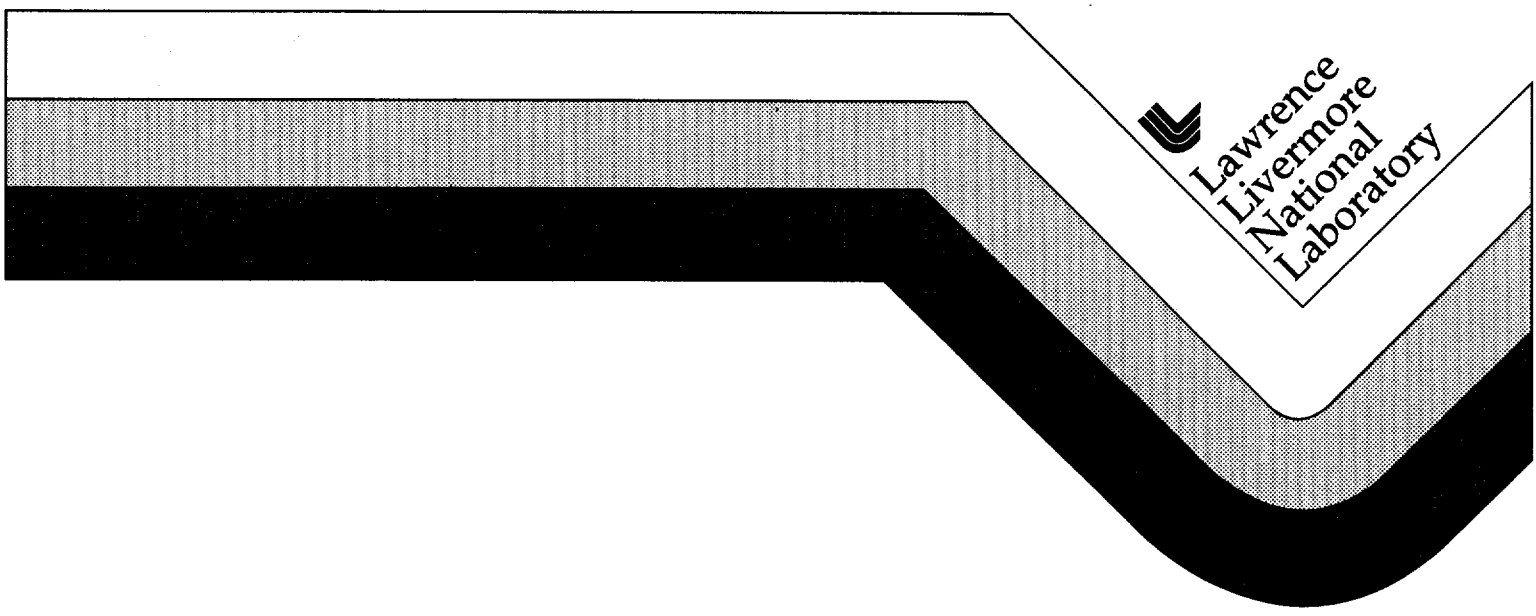
Estimated Use of Explosives in the Mining Industries of Egypt, Jordan, Syria, Tunisia, and Turkey

David R. Wilburn
Carl Di Francesco
Donald I. Bleiwas

U.S. Geological Survey, Golden, CO

This report was prepared for the U.S. Department of Energy's
Office of Non-Proliferation and National Security

November 1996



Work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract W-7405-ENG-48.

Foreword

This work was performed under Memorandum of Agreement B 291867 between the Lawrence Livermore National Laboratory (LLNL), and the U.S. Geological Survey (USGS) in Golden, CO.

The USGS authors were formerly with the U.S. Bureau of Mines' Minerals Availability Field Office in Denver, CO. Earlier, they performed for LLNL a similar study concerning Algeria, Iran, Iraq, and Lybia. The corresponding report is UCRL-CR-122186, dated September 1995.

The study was initiated and directed by F. Heuze, at LLNL. It is part of the activities under the LLNL Comprehensive Test Ban (CTB) Treaty Program. J. Zucca was the Program Leader.

This work was supported by the LLNL CTB Seismic Project under contract W-7405-ENG-48 between LLNL and the U.S. Department of Energy (DOE). D. Harris was the Seismic Project Leader.

The Program Monitor at DOE was L. Casey of the Office of Non-Proliferation and National Security (NN-20).

Egypt

Table of Contents

TABLES

FIGURES

1.0 EXECUTIVE SUMMARY

This report was prepared under Memorandum of Agreement B291867 between Lawrence Livermore National Laboratory (LLNL) and the U.S. Geological Survey (USGS). It provides LLNL information on the mining industry of Egypt, and quantitative information on the blasting potential of this industry. The USGS identified mining activities through the use of the Minerals Availability data base, its data collection and analytic capabilities, and an extensive network of information sources.

While a wide variety of minerals may be found in some areas of Egypt, large scale mining is limited to a few mineral commodities, notably iron ore, phosphate rock, limestone and cement, and gypsum. Most mineral production comes from small scale mines; production of over 25 minerals in Egypt has historically come from more than 600 mines, quarries, and evaporite basins. Mining is concentrated in the Nile Valley and Eastern Desert regions of Egypt, with some mining occurring on the Sinai Peninsula. Research conducted for this study resulted in the identification of 644 mineral properties. Most properties require minimal blasting. The blasting potential for 20 properties is reported.

Egypt possesses the raw materials, technology and facilities to manufacture blasting agents and detonation systems suitable for mining applications. Blasting is generally conducted on a small scale but may occur frequently where mine geology requires explosive use. Ammonium nitrate-fuel oil (ANFO) is the most commonly used explosive agent, but dynamite or ANFO/gel mixtures are also used. Estimates for daily ANFO consumption from the largest mines in Egypt range from 10-50 metric tons of ANFO equivalent.

1.1 Authority

This report was prepared under Memorandum of Agreement B291867 between Lawrence Livermore National Laboratory (LLNL) and the U.S. Geological Survey, Minerals Availability Team, currently the Minerals & Materials Analysis Section of the Minerals Information Team (MIT).

1.2 Project Scope

As part of this agreement, MIT is to identify mining activities in Egypt, Jordan, Syria, Tunisia, and Turkey as they relate to monitoring/verifying compliance of the Comprehensive Test Ban Treaty. The MIT is to use the Minerals Availability and the Mineral Resources Data System data bases, its data collection and analytic capabilities, and an extensive network of information sources to provide background information focusing on the use of explosives by the mining industry of these countries. This information is of particular interest because the normal blasting activities of mining can cause false alarms during monitoring and disguise nuclear blasting events.

Reports with accompanying figures and tables summarize location, type of mining method, commodity(ies), estimated frequency and size of mine blasts, operational status, and distribution to foreign or internal markets for the specified countries.

Once country data were collected and verified, the explosive use at selected sites was evaluated. Focus was placed on locations that consume large quantities of conventional chemical explosives. Undeveloped sites and small scale mines which consume minimal amounts of explosive material (included in Appendices A-C of this report) were not analyzed in terms of the site's anticipated use of explosives. Mineral prospects generally make only small use of explosives and small mines (some of which are operated on an intermittent basis) are assumed to require minimal blasting. Appendix A lists producing and developing mineral properties in Egypt, Appendix B lists known past producers, and Appendix C lists identified prospects and undeveloped

properties. These listings provided the basis from which the principal Egyptian mines with the greatest explosive consumption potential were selected.

Based upon known site information (geological conditions, mine technology, production capacity, and current blasting practices), the blasting potential for significant mining sites was evaluated. Where site-specific data were not available, estimates for representative, important properties were developed based upon accepted industry practice, knowledge of the Egyptian mining industry, and regional geologic characteristics.

2.0 SOURCES OF INFORMATION

Data for this report were derived from published sources, unpublished documents, and personal communications through an extensive network of public and private contacts. Public sources of information are listed in Appendix D. Much of the industry summary was drawn from data reported by the U.S. Bureau of Mines Mineral Yearbook chapter on Egypt, from the years 1992-1994. Information for 1995 was obtained from the U.S. Geological Survey, Minerals Information Team, International Minerals Section, Reston, VA (formerly the U.S. Bureau of Mines, Division of International Minerals).

Principal agencies contacted include, but were not limited to the U.S. Geological Survey, the U.S. Department of State, Central Intelligence Agency, Defense Intelligence Agency, the United Nations, the World Bank, World Resources Institute, and International Studies of Minerals Issues (ISMI). In addition, selected academic and industry contacts, explosives manufacturers and suppliers, and trade groups were contacted.

3.0 THE MINING INDUSTRY OF EGYPT

Mineral deposits in Egypt, particularly sites containing gold, copper, and gemstones, have been known and exploited by the ancient Egyptians for thousands of years. Such minerals were found in complex form in hard rock deposits. In contrast, the main economic minerals exploited in Egypt today include iron ore, phosphate rock, gypsum,

limestone, and salt. These typically come from sedimentary sequences as native elements or simple compounds. Tin is the only mineral that has been recently produced from hard rock sources; gold and copper mineralization is widespread, but not of high enough grade to be economically viable at present prices[1].

While a relatively wide variety of minerals may be found in the Eastern Desert and Nile Valley regions of Egypt, mining occurs on a limited scale, except for some iron ore, phosphate rock, gypsum, and salt deposits. Egyptian mining operations have produced approximately 25 commodities from more than 600 mines, quarries, and salt pans, most of which operate on a very small scale. Exploration and production on the Sinai Peninsula has been limited since 1967, when hostilities broke out in the region between the Arabs and Israelis. Large amounts of low grade phosphate have been identified on the Abu Tartur plateau, northwest of El Kharga in the Western Desert. Development of this resource is ongoing, although full production is not expected until 1997[2]. Similarly, the Marghara coal mine in northern Sinai southwest of El Arish is in the process of beginning production. Production of 2 of the 5 planned longwall faces is not scheduled until 1998. Production is planned to feed the Ain Musa power station. Israel has expressed interest in importing Marghara coal to reduce the high transport costs associated with delivering coal to Israeli power generating plants[2].

While the hydrocarbon sector accounted for more than 15% of the gross domestic product (GDP) in 1994, non-fuel minerals contributed only a small portion of industrial production. Non-fuel production levels remained relatively low when compared with global competitors. Egypt's economy is heavily reliant upon oil sales, tourism, and revenues from both the Suez Canal and the SUMED oil pipeline. Revenues from tourism dropped in 1994 as a result of threats of terrorist activity.

---

[1] A.M.A. Wali. Industrial Minerals of Egypt. Paper 90-77 presented at SME annual meeting, Salt Lake City, 1990.

[2] Mining Annual Review 1996. Mining Journal, Sept. 1996, p. 159.

Mineral trade operating via the Suez Canal continues to be critical to the Egyptian economy. Industrial mineral exports of phosphate rock, aluminum manufactured goods, coke and semicoke, fertilizers and salt accounted for approximately 25% of total export value in 1994. Mineral imports accounted for 8.8% of total import value in 1994[3]. Mineral imports included chromite, copper, iron and steel products, lead, nickel, silver, tin, titanium, tungsten, and zinc. Industrial mineral imports included asbestos, barite, coal, graphite, pumice, and sulfur. Nations of the European Union are the largest trading partners with Egypt, although trade with neighboring Middle Eastern countries is increasing.

Virtually all mining and mineral processing in Egypt is carried out by Government-owned mining companies. The parastatal Mining and Refractories Corp (Maric) controls the mining and refractories industries and also controls five major companies that dominate the Egyptian mining industry. The companies are the El Nasr Phosphate Co., Red Sea Phosphate Co, Misr Phosphate Co., the Sinai Manganese Co., and the El Nasr Saline Co[4]. Administration and mining legislation is conducted by the Egyptian Geological Survey and Mining Authority (EGSMA). Foreign investors in the mining industry coordinate exploration activities through EGSMA. In 1993, EGSMA completed a draft unified law for all quarries, mines, and salt operations, which is currently under review.

Egyptian mineral production estimates for 1993 and 1994 are provided in table 3.1. Summaries of mineral site data are provided in Appendices A-C. Data on significant producing sites, past producers, prospects, and undeveloped mineral occurrences are provided in tabular form. Maps showing mineral property locations are provided in Appendix map sets A-C. It should be noted that not all mineral occurrences are reported in this study. Sites with unverifiable information or lacking specific site locations may not be included. Data are reported for 87 producers, 222 past producers,

---

[3] U.S. Bureau of Mines. Egypt, Ch. in Mineral Industry Surveys 1994, by T. P. Dolley.

[4] Ibid.

Table 3.1 -- Reported Mineral Production in Egypt,
1993 and 1994 (Metric tons, except as noted)

Commodity (1)	1993 Production	1994 Production (e)
METALS		
Aluminum metal	180,000	180,000
Chromite	600	600
Copper, refined (secondary)	4,000	4,000
Iron ore and concentrate	2,190,000	2,100,000
Ferromanganese	30,000	30,000
Manganese	15,000	15,000
INDUSTRIAL MINERALS		
Asbestos	436	400
Barite	4,090	4,000
Cement, hydraulic	16,000,000	16,000,000
Clay, bentonite	15,000	14,000
Clay, fire clay	421,000	420,000
Clay, kaolin	157,000	156,000
Feldspar, crude	38,900	39,000
Fluorspar	773	800
Gypsum and anhydrite, crude	1,200,000	1,200,000
Lime	748,000	750,000
N content of ammonia	941,000	900,000
Phosphate rock	1,590,000	1,600,000
Salt, marine	972,000	1,000,000
Soda ash	51,000	50,000
Sodium sulfate	26,500	26,000
Stone products:		
Basalt (cubic meters)	551,000	600,000
Dolomite	952,000	1,000,000
Granite, dimension (cubic meters)	12,900	13,000
Gravel (cubic meters)	7,180,000	7,200,000

Limestone (cubic meters)	18,100,000	18,000,000
Marble blocks (cubic meters)	15,800	16,000
Sand, glass	743,000	740,000
Sand, construction	21,700,000	22,000,000
Sulfur, elemental and byproduct	4,100	4,000
Talc and related products	2,100	2,000

Source: U.S. Bureau of Mines. Egypt. Ch. in Mineral Industry Survey series, 1994, by T. P. Dolley.

(e) Estimated

(1) Table includes data through March 1995. Previously published and 1994 estimates are rounded to three significant digits; may not add to totals shown. In addition to the commodities listed, pig iron, ferrosilicon, crude steel, sandstone, sulfuric acid, and vermiculite are produced for local consumption. Data on coke, natural gas and petroleum products are not reported here.

and 335 mineral deposits. It is believed that all sites with significant potential have been reported.

3.1 Industrial minerals

While metallic minerals from Egypt were mined thousands of years ago, industrial minerals today provide a greater source of raw materials and revenue than do metals. Domestic feed sources for the Egyptian cement and fertilizer industries are abundant, and raw materials needed for the local building and construction industry are readily available.

3.1.1 Phosphate

Phosphate has been a principal mineral commodity in Egypt since the beginning of the 20th Century. There are two main sources of production: (1) the Red Sea coast between Quseir and Safaga, and (2) along the banks of the Nile River near Sebaiya. Production from the Nile Valley deposits normally feeds the local fertilizer industry while production from the Red Sea region is directed to exportation. During the 1970's, exploration work revived phosphate production in the Quseir area, at a time when most of the old mines were thought to be nearing exhaustion.

At about the same time, exploration further defined large reserves on the Abu Tartur plateau, located in the Western Desert between Kharga and Dakhla. Since that time, the area has undergone various stages of exploration and preliminary development. Reserves are estimated to exceed 988 Mmt @ 23% P_2O_5[5]. Development has been hindered by the site's remote location, estimated high production costs, and lack of available funding. This project would be the largest industrial mineral project in Egypt.

Plans call for a capital expenditure of over $400 million for a mining and beneficiation facility with a production capacity of 4.5 Mmt of phosphate ore (2.2 Mmt per year of

[5] Mining Annual Review 1995. Mining Journal, Nov. 1995, pp. 151-152.

concentrate), directed initially for domestic production of fertilizer[6]. Surplus production would be used to generate export revenues. Infrastructure would include a 400-km railway to transport the phosphate from Abu Tartur to the port of Safaga. After full production is reached, it is initially estimated that about 30% of the total phosphate produced would be exported. Egypt's sole phosphoric acid plant is at Abu Zaabal, northeast of Cairo. Uranium has the potential to be a significant byproduct of Egyptian phosphate production, but is not currently recovered.

Mining of the Red Sea coast phosphates began in 1910 for export to the Far East. The phosphate rock requires calcination to upgrade the product. Presently, the largest mine operating is the Hamrawein underground site, operated by Misr Phosphates, with a production capacity of 1.2 Mmt/yr. Recent production has dropped to 592 Kmt due to a lower phosphate price and high mine costs. As with all Egyptian mines on the Red Sea coast, ore is extracted from carbonates by room & pillar and shortwall mining methods, processed, then marketed to Europe and the Far East. Other mines in the area include the Safaga and Quseir complexes, both of which consist of multiple small mines operated by the Red Sea Phosphate Co.

Domestic needs for phosphate rock as feed for fertilizer production are supplied from the Nile Valley deposits at Sebaiya. The ore-bearing Duwi formation includes three phosphate units interbedded with marls and limestones. The Abu Zaabel Fertilizer Chemical Co. owns and operates the East and West Sebaiya mines. While older areas were mined by underground methods, newer areas are most commonly mined by surface methods using draglines from open pits. Most of the Nile Valley output is delivered to the phosphate fertilizer plants of the Nile delta.

3.1.2 Limestone & cement

Egypt has sufficient raw materials to meet domestic needs for limestone to feed its building and construction industries and for cement production. The Eocene limestones

[6] Mining Annual Review 1996. Mining Journal, Sept. 1996, p. 159.

and clays exposed near Helwan and south of Suez are extensively quarried for the cement industry. In addition, the sintering plant of the Helwan Steel Complex uses limestone for sintering ore fines, and as a fluxing agent. Certain limestones in the region are also suitable for making concrete blocks.

Lime production needs are met from limestones in the Cairo-Suez district. Limestones west of Alexandria are also used for production of lime and soda ash.

The extensive Eocene limestone exposures located near Cairo satisfy the needs of the Egyptian building and road construction industry. Cretaceous limestone exposed at Abu Roash is extensively quarried for road construction materials, while dimensional limestone blocks are obtained from the Mukkatam deposit for building needs in Cairo. West of Alexandria, limestone ridges provide raw material for building purposes. High grade material is quarried from the Eocene limestone at Samalut. The product is highly valued and is used in many industries.

The Egyptian cement industry has the capacity to produce up to 20 Mmt/yr of cement, requiring approximately 36 Mmt of raw material feed (limestone, clay, etc). Egypt continues to be virtually self sufficient in the mineral commodities needed to manufacture cement. The industry, however, is under increasing pressure to address environmental problems. All cement and associated raw material production is currently under the control of the Egyptian Government, by means of various parastatal cement companies. The Government unsuccessfully tried to privatize several cement companies in 1994. A second round of privatization talks were being conducted in 1995.

The Helwan Portland Cement Company mines near Helwan are representative of quarries in Egypt. The quarry complex produces 15,000 tons of limestone per day. The site operates a 3-shift operation using a 200 man crew. Blasted rock is loaded and transported during the day shift. Blasting operations, repairs, and maintenance are done with smaller crews on the second and third shifts. Ammonium nitrate mixed with fuel oil

(ANFO) is used in blasting, generally twice a week. The company extracts both clay and limestone feed for the cement plant from separate open pits located near the cement plant. Feed to the kiln is approximately 85% limestone and 15% clay. Up to 3.5% gypsum may be added to the raw material feed, depending upon required cement composition and market requirements.

3.1.3 Gypsum

Egypt is one of the world's largest gypsum producers (1.2% of world production in 1994), producing approximately 1.2Mmt/yr of gypsum. Much of this gypsum is found in deposits on the Sinai Peninsula and the Mediterranean coast area of Egypt. Extra pure gypsum for exportation principally came from the Sinai until 1967. Gypsum for local consumption in construction, as an additive in agriculture, and in the cement industry comes from several small quarries west of Alexandria and from Girza. Mining is conducted by means of small quarries requiring limited blasting.

3.1.4 Other industrial minerals

Sinai used to be the main source of kaolinitic clay consumed by the porcelain industry until hostilities broke out in the Sinai in 1967. The Egyptian Geological Survey had discovered an important deposit at Kalabsha, which had been put into production at a rate of 50 kt/yr. It is believed that the site resumed production in the 1990s, but this has not been confirmed.

White sand for local glass manufacture also came principally from the Sinai until 1967. Other sources of lower quality glass sand from sites on the Gulf of Suez (Zaafarana) and at a site east of Cairo could not substitute for Sinai ore.

Common salt is extracted from several evaporite basins along the Mediterranean coast near Alexandria, Port Said and Damietta. Additional production comes from small operations at Mersa Matruh, Idku, Baltim and Rosetta. Three grades of salt are produced: industrial (85% NaCl), washed (98% NaCl) and refined (99% NaCl). Natural

rock salt deposits about 300m thick occur at Ras Gharib, Gabal al Zeit and Ras Gemsa on the Gulf of Suez. The upper layers often are rich in potassium salts, containing 4-6% K2O. Salt production currently is approximately 1 Mmt, most of which is used domestically. Salt is most commonly extracted without the use of explosives by surface methods.

Among ornamental stones, marble, alabaster, serpentine, breccia, and the famous pink granite of Aswan are all quarried. Building stones are cut from small quarries scattered along the scarps bordering the Nile River. Most quarries are small operations mined intermittently as building needs require. Beryl is present in appreciable amounts in quartz veins associated with tin-tungsten deposits, as well as other areas of the Eastern Desert. Gem quality beryl was mined during Greco-Roman times, but has since been exhausted.

Other ores are being exploited for diversified needs. Talc and soapstone are mined from Darheib and Atshan in the southeastern desert as filling material in local industries. Production typically averages 5 t/yr. Bentonitic clays from Kasr el Sagha is quarried (5 kt in 1979) for local consumption. Diatomite from Kom Oushim is likewise quarried at a small rate for local needs. Feldspar and fluorspar are mined from many sites in the Eastern Desert. Feldspar is exported to Turkey and Saudi Arabia. Asbestos, vermiculite, magnesite, chromite, barite, and graphite have also been mined at various times for local industries. Native sulfur and potassium salts occur near Gemsa and other localities bordering the Gulf of Suez.

Exploration for mineral fuels in Egypt took place since the early 1950s. Carbonaceous shales were discovered outcropping at Bedaa and Thora; coal was discovered at Ain Mousa at depths ranging between 420 m and 620 m. With the discovery of the Maghara coal deposit in 1959, focus was shifted to developing this significant reserve. The first longwall face is reported to have commenced operation in November 1995,

although production of two faces is not scheduled until 1998[7] Production will likely be tailored to market demand, but it is expected that the primary markey will be the domestic power industry.

3.2 Metals

Egypt produces few metals. Its largest production in the metals sector is primary aluminum metal, produced at one plant from imported ore, and iron production used in the domestic steel industry. Egypt mines iron ore and recovers ferrosilicon and ferromanganese byproducts for its domestic steel industry. Manganese, chromite, and refined copper from secondary sources are also produced.

3.2.1 Iron ore

Egyptian iron ore is currently mined primarily from the Bahariya area in the Western Desert. The ore occurs in sedimentary deposits as lenticular bands alternating with sandstone, limestone, and clay beds. While both high grade and low grade ores are present in this area, only high grade ore (52-55% Fe) is presently mined by surface methods at the El Gedida mine. Production capacity of the region is 3 Mmt/yr, but current production is estimated at approximately 2.2 Mmt. Iron ores of the Bahariya area are sufficient to meet the needs of the Helwan steel plant for the immediate future.

In addition to the Bahariya iron deposits, Egypt has traditionally produced iron ore from mines east of Aswan, which supplied the Helwan furnaces prior to the discovery of Bahariyan deposits. Ore is a oolitic hematite interbedded with limestones and clays. The average ore thickness is 1 m; production in the region was 500 kt/yr in the 1980's. Other potential sources of iron include 14 sites of metamorphosed iron ore in the Eastern Desert south of Quseir. While these sites have not produced, they are considered resources for the future. Ore has the potential to produce a concentrate containing 58.5% Fe and 14% SiO2, and achieve an 87% recovery.

---

[7] Mining Annual Review 1996. Mining Journal, Sept. 1996, p. 159.

3.2.2. Manganese

Manganese oxides were used by the ancient Egyptians in the ceramic industry; more recently, manganese was used in steel making, and for paints and pigments. Deposits of potential economic interest are found at Um Bogma in the Sinai Peninsula and at Halaib in the Eastern Desert. The Um Bogma deposits, discovered in 1898, represent the largest occurrence of manganese in Egypt. The region produced for exportation during the period 1911-1967, and achieved a maximum production rate of 300 kt/yr. Rehabilitation of the facility was completed in 1990, but significant production has not been achieved as of 1995. Minor production is reported to occur at the Halaib deposit in the Eastern Desert and in the southwestern desert between Hamata and Elba. Manganese ore occurs as lenticular bodies filling fractures in sediments.

Manganese ore is generally lower grade than those mined in other countries, and ranges from 25-40% Mn. Ore is transported to the 40 kt Abu Zenema steel plant, where it is blended with imported material to produce high carbon ferromanganese and slag. More than 50% of the ferromanganese produced is used in Egypt's steel industry. Export markets include Germany, Japan, Libya, Taiwan. and several Persian Gulf states.

3.2.3 Other metals

Egypt produces aluminum metal at one 180 kt/yr facility from imported material. While there is no bauxite in Egypt, there are deposits of nepheline syenite, which has the potential to be used as a raw material in the aluminum industry. Deposits at Abu Khrug occur as ring inclusions in alkaline rocks.

Chromite occurs in the Eastern Desert at eight sites. It occurs as lenses associated with serpentine and talc-carbonate rocks. Production of chromite ore in 1994 was limited to 600 tons.

Gold mineralization is recorded at more than 95 locations in the Eastern Desert,

practically all were worked in ancient times at shallow depths. Gold quartz veins cut various basement rocks of Precambrian age. Deposits are small, total production for the 1902-1958 period is reported to be about seven tons. Remaining ore is located at a depth requiring underground mining methods. Metal content of in-situ ore reached 28 g/t, while tailings areas at Sokari, Barramiya, and Um Gariat average 5 g/t[8].

Copper deposits in Egypt were exploited on a small scale by the ancient Egyptians. Copper ores occur in two regions, the Sinai Peninsula and the Eastern Desert. Sinai copper deposits occur associated with sandstones and clays or as fracture fillings in Precambrian rocks. Eastern Desert copper deposits occur as fracture fillings (Al Atawi), gold bearing quartz veins (Hamash), and as impregnations in sandstone. Copper content is generally less than 1% Cu.

Copper is also found associated with sulfide mineralization in the Eastern Desert. The Abu Suwayel copper-nickel deposit was exploited by the ancient Egyptians, while the Akarem copper-nickel deposit, discovered in 1972, hosts disseminated and massive sulfide ore. Lead-zinc-copper mineralization occurs at Um Samiuki and Um Gheig in the Eastern Desert. A number of smaller ore zones have also been identified in the Eastern Desert.

Small deposits of other metals have also been identified. Deposits of tin, tungsten, tantalum, niobium, and molybdenum occur in the Eastern Desert of Egypt. Nickel is found on St. Johns Island in the Red Sea. Ore is associated with gem-quality peridotite, which as been mined in the past. Uranium and thorium is found is selected localities in the Eastern and Western Deserts, and in the Sinai.

4.0 MINE-RELATED EXPLOSIVES USE

Egypt uses both internally produced explosives and imports raw materials for explosive

---

[8] F. Habashi and F.A. Bassyouni. Mineral Resources of the Arab Countries. Chemecon Pub. (Quebec), 1982, pp. 18-27.

manufacture. It possesses raw materials, technology and facilities to manufacture blasting agents and detonation systems suitable for mining applications. Most surface and underground mines in Egypt utilize ammonium nitrate-fuel oil (ANFO) blasting agents.

Some mines use explosives to fragment or loosen rock and consolidated material prior to excavation. Bulk or packaged explosives and blasting agents are detonated after emplacement in material to be excavated. Minor quantities of sachet (bagged powder explosives) and shaped charges may be used for secondary breakage and other special applications.

The type and amount of explosives used are influenced by the nature of the rock or ore, the mining methods employed, the production rate of the mine, the type and availability of explosives and detonation systems, hydrologic conditions, mining equipment, drilling equipment, mine geometry, level of technical expertise, and external constraints such as the proximity of residences and costs. At almost any mine, the size of each blast can vary significantly due to local conditions, production schedules, weather, etc.

Surface mines typically shoot much larger blasts than underground operations and tend to have higher production rates than underground mines. In addition, limitations of working room, limited free faces, type of mineralization, ventilation requirements, and drilling limitations may constrain maximum blast sizes in underground mines.

Where blasting is required, most Egyptian mines use ANFO blasting agents. This may include some of the newer emulsion and/or aluminum boosted products presently available. While an ANFO/dynamite mixture is believed to be in use at some mines in Egypt, ANFO systems are preferred in most mining applications due to their ease of manufacture, low cost, inherent safety, and bulk loading advantages. High explosives, however, would be preferable for small underground operations that use drill sizes that are below the critical diameter needed for emplacing ANFO blasting agents, or under

wet conditions, in methane-rich atmospheres, and conditions that require higher detonation velocities and/or convenience of packaged explosives. Many small mines in Egypt are labor intensive and employ non-mechanized ore recovery methods, where blasting is not used.

In most cases, site-specific blasting information was unaccessible. Consequently, estimates were based upon estimated production rates, mine geology, and typical mining practices. Experience, engineering judgement, and available data were incorporated into calculations and estimates. Explosive use can vary considerably as mining conditions change. ANFO consumption was assumed to be dependent upon mine production rate, average stripping ratio, specific gravity of the host rock, assumed powder factor limits, and mining method. Only a small number of mines in Egypt require significant blasting, primarily because of the small size of most sites.

For each site, a stripping ratio (quantity of overburden or waste removed per metric ton of ore mined) and powder factor (quantity of rock blasted per unit of ANFO blasting agent equivalent) limits were estimated. A range of ANFO consumption was calculated for both daily blasting requirements and for an assumed maximum blasting event. Daily ANFO requirements were estimated assuming a 300 day production schedule[9]. Consumption estimates for all sites were calculated in a similar manner. The lower consumption value applies a minimum powder factor while the higher value assumes a maximum powder factor. Unlike daily consumption estimates, a maximum blasting event would not take place on a daily basis. For this study, it was assumed that a maximum blasting event (an estimated technical upper limit of cumulative explosive usage) would use 10 days worth of explosives for a surface mine and 5 days worth for an underground mine. Such events are designed to account for such factors as blasting delays, geological irregularities, and mining method variations that require a higher ANFO consumption than the typical blasting event. Mine development or pillar

[9] Production schedule determined by available country information. Schedule may vary from country to country.

extraction conditions, for example, often require larger blasts.

The following examples illustrate typical blasting calculations using the estimation procedure described above:

Bahariya ANFO daily consumption lower limit (L):

L = Production rate * [1 + (stripping ratio * (specific gravity of ore + waste))] * [Low powder factor / 1000 (converts kg to mt)] / Operating days per year

L = 3,000,000 * [1 + (0.1 * 2.7)] * [0.13 / 1000] / 300

L = 1.65 2 mt ANFO equivalent (rounded to nearest unit)

Bahariya ANFO daily consumption higher limit (H):

H = Production rate * [1 + (stripping ratio * (specific gravity of ore + waste))] * [High powder factor / 1000 (converts kg to mt)] / Operating days per year

L = 3,000,000 * [1 + (0.1 * 2.7)] * [0.23 / 1000] / 300

L = 2.92 3 mt ANFO equivalent (rounded to nearest unit)

Bahariya maximum blasting event ANFO consumption (M):

M = Production rate * [1 + (stripping ratio * (specific gravity of ore + waste))] * [High powder factor /1000 (converts kg to mt)] / Operating days per year * maximum blast cycle time (working days between blasting events)

M = [3,000,000 * [1 + (0.1 * 2.7)] * [0.23 / 1000] / 300] * 10

M = 29.2 30 mt ANFO equivalent (rounded)

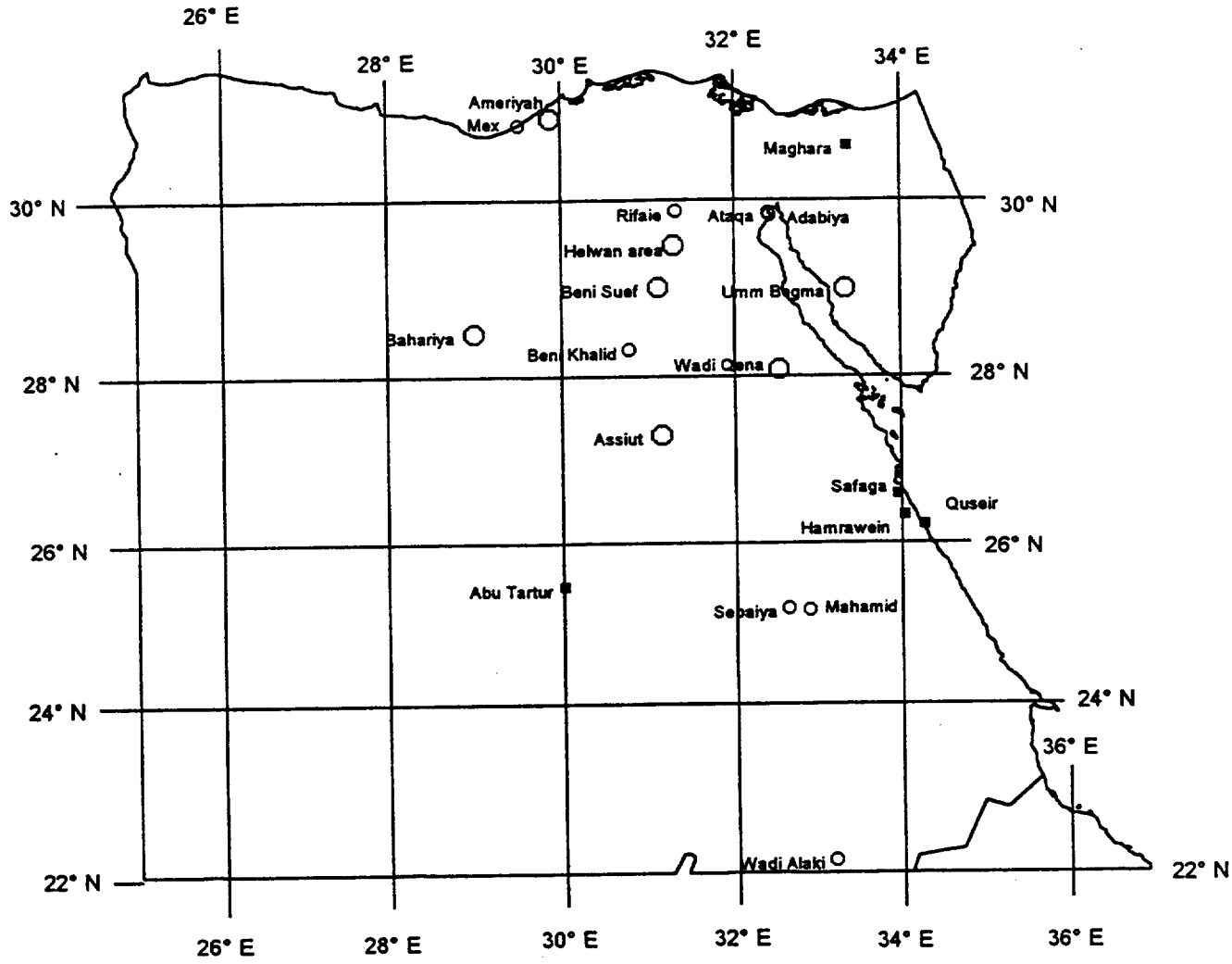
Table 4.1 provides the corresponding blasting range estimates for the main Egyptian mines identified in this study. Figure 4.1 shows site locations for the mines reported in table 4.1. Symbols reflect mine type (surface or underground) and maximum ANFO consumption for a given blasting event.

There were no mine sites that had calculated maximum blasting events greater than 50 mt ANFO equivalent, and only nine sites with an estimated explosive potential in the range of 10-50 mt of ANFO equivalent for a maximum blasting event. Several

Table 4.1--Estimated Explosives Usage at the Main Egyptian Mines
Used in this Study in Order of Estimated ANFO Consumption

Mine	Latitude	Longitude	Primary Product	Mine Type (1)	Production (Mmt/yr) (2)	Daily Consumption (mt ANFO) (3), (4)		Maximum Blast Cycle Time (days) (5)	Maximum Blasting Event (mt ANFO)
						Low	High		
Assiut	N 27° 15'	E 31° 11'	Cement feed (6)	S	7.020	3	5	10	50
Helwan area	N 29° 31'	E 31° 20'	Cement feed (6)	S	6.840	3	5	10	48
Bahariya	N 28° 28'	E 28° 58'	Iron	S	3.000	2	3	10	30
Ameriyah	N 31° 02'	E 29° 53'	Cement feed (6)	S	3.780	2	3	10	27
Umm Bogma (7)	N 29° 00'	E 33° 21'	Manganese	S	0.300	1	2	10	22
Abu Tartur (8)	N 25° 26'	E 30° 02'	Phosphate	UG	4.500	2	3	5	15
Beni Suef	N 29° 01'	E 31° 09'	Cement feed (6)	S	1.800	1	1	10	13
Wadi Qena	N 28° 02'	E 32° 34'	Cement feed (6)	S	1.800	1	1	10	13
Mex	N 31° 07'	E 29° 51'	Cement feed (6)	S	1.440	1	1	10	10
Sebaiya	N 25° 10'	E 32° 40'	Phosphate	S	0.481	0	1	10	9
Hamrawein (9)	N 26° 17'	E 34° 03'	Phosphate	UG	1.200	1	1	5	5
Rifaie	N 29° 55'	E 31° 22'	Limestone	S	0.750	0	1	10	5
Beni Khalid	N 28° 16'	E 30° 49'	Limestone	S	0.750	0	1	10	5
Mahamid	N 25° 09'	E 32° 55'	Phosphate	S	0.099	0	0	10	2
Wadi Alaki	N 22° 09'	E 33° 12'	Marble	S	0.150	0	0	10	1
Ataqa	N 29° 54'	E 32° 27'	Dolomite	S	0.100	0	0	10	1
Safaga	N 26° 32'	E 33° 58'	Phosphate	UG	0.170	0	0	5	1
Adabiya	N 29° 52'	E 32° 28'	Dolomite	S	0.093	0	0	10	1
Maghara (8)	N 30° 42'	E 33° 23'	Coal	UG	0.125	0	0	5	1
Quseir	N 26° 10'	E 34° 20'	Phosphate	UG	0.200	0	0	5	1

(1) S--Surface; UG--Underground
(2) Mmt/yr--Million metric tons per year
(3) mt ANFO--Metric tons of Ammonium Nitrate/Fuel Oil blasting agent equivalent. Estimate based on equations reported on pages 11-12.
(4) Assumed production schedule for all sites is 300 days/yr.
(5) Assumed maximum blasting cycle time for surface operation - 10 working days; underground operation - 5 working days.
(6) Typical raw material feed for cement plant is 85% limestone and 15% clay; minor amounts of gypsum and other materials may also be required. Production rate reflects total feed required to feed plant; raw materials assumed to come from local quarries near plant.
(7) Rehabilitation of the site was completed in 1990, but significant production had not been achieved by 1995.
(8) Sites are in the final development stage. Production at Abu Tartur began in 1995, but production halted by fire. Reported production rate reflects rate when in full production. Sites to use longwall mining, requiring only limited blasting.
(9) Reported production rate reflects full production capacity. In 1994, site produced 592kt/yr, well below production capacity.



LEGEND

Underground Surface Maximum Blasting Event*

0 200 400 Kilometers

Not Applicable ○ 10 to 50 metric tons

■ ○ Less than 10 metric tons

*ANFO Equivalent

N
W E
S

FIGURE 4.1 – Selected Egyptian Mines and Estimated Maximum Blasting Events

sites included in this range provide limestone/clay feed material for cement production. It should be noted that production from such sites often comes from numerous small quarries feeding the nearby plant, rather that one large mining operation, so individual site explosive consumption would be smaller that the aggregated estimates reported in Table 4.1. Several sites were not producing in 1995, but were included in Table 4.1 because of their significant potential. Developing mines such as the Abu Tartur and Marghara mines use mechanized mining technology that requires only limited blasting. Production levels reported in the table reflect maximum capacities; in several cases actual production is well below that reported here.

5.0 CONCLUSIONS

While Egypt has potential to produce a wide variety of minerals, current production centers around several industrial minerals. Most mines are small, and few are world class mining operations. The largest mining units in Egypt have an estimated maximum explosive consumption potential of less than 50 mt ANFO equivalent. Most mines require less than 10 mt of ANFO equivalent per day. Mining is centered in two areas, the Nile Valley and Eastern Desert regions of Egypt.

APPENDICES

APPENDIX A: PRODUCING MINERAL PROPERTIES IN EGYPT.

	MAP KEY (1)	NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	MARKETS (6)	COMMENTS
	1	Manzala Manzallah	N 31° 00'	E 32° 00'	Gypsum	2,4,13,16,30	General	Producer	Surface	Domestic	Ore in lake basin. Friable beds about 80cm thick overlain by salt.
	2	Matariya	N 31° 00'	E 31° 55'	Salt	22	General	Producer	Surface	Domestic	Produced in 1979.
	3	Abu Khashaba	N 28° 11'	E 33° 10'	Titanium	4	General	Producer	Surface	Domestic	Upper 12 m contains 7.5Mmt sand with 707kt economic minerals.
	4	Ambaut	N 24° 51'	E 34° 49'	Chromite	22	General	Producer	Unknown	Domestic	Produced in 1979.
	5	Beni Hassan	N 27° 57'	E 30° 57'	Limestone	22	General	Producer	Surface	Domestic	Producer in 1979.
	6	Beni Khalid	N 28° 16'	E 30° 49'	Limestone	22,31	General	Producer	Surface	Domestic	Resources for cement 10.5Mmmt. Annual production 750kt.
	7	Bir Hafafit	N 24° 29'	E 34° 47'	Anthophyllite	4	General	Producer	Surface	Domestic	Mined since 1944 @ 500 tpy.
	8	Darhelb Darhib Um Selelmat Elgat	N 23° 59'	E 35° 05'	Talc soapstone	4,22,30	General	Producer	Surface Underground	Domestic	Produced in 1979. Used as filler in local industries. Lenses confined to 40m thick shear zone in rhyolite. Annual production 5kt.
	9	El Alshan area Hugban Helelfi Khashir Hashim Bir Disi Anguria	N 24° 15'	E 35° 12'	Talc soapstone	4,22,30	General	Producer	Underground	Domestic	Talc near basalts, rhyolites in association with sulfides. Talc in greenstone. Annual production 5kt.
B	10	Gabal Duwi	N 26° 15'	E 33° 58'	Phosphate	22	General	Producer	Surface	Domestic	Produced in 1979.
A	11	Giran El Ful	N 29° 59'	E 31° 03'	Dolomite Limestone	4,22	General	Producer	Surface	Domestic	Quarry products.
	12	Hafafit	N 24° 50'	E 34° 30'	Asbestos Feldspar	22,30	General	Producer	Surface	Domestic	Produced in 1979. Annual production 440 tpy.
	13	Halaib	N 23° 30'	E 35° 00'	Manganese	4	General	Producer	Unknown	Domestic	Ore occurs in belt 70km x 7km replacing conglomerates or limestones. Mined in 1982 at 500 tpy.
B	14	Hamrawein El Hamra Kuelk	N 26° 17'	E 34° 03'	Phosphate	5,16,30	General	Producer	Underground	Exported Europe/Far East	Hamrawein mine is 1.2M tpy using UG methods. Mining began in 1978. 1990 production 592kt. Ore grade 28% P_2O_5.
B	15	Haramiya	N 26° 11'	E 33° 55'	Talc	22	General	Producer	Surface	Domestic	Produced in 1979.
	16	Homr Mikbid	N 24° 09'	E 34° 21'	Fluorspar	22	General	Producer	Surface	Domestic	Produced in 1979.
B	17	Kab Um El Abas	N 26° 19'	E 33° 18'	Talc, magnesite	22	General	Producer	Surface	Domestic	Produced in 1979.

APPENDIX A: PRODUCING MINERAL PROPERTIES IN EGYPT.

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	MARKETS (6)	COMMENTS
	18	Khasm El Galala	N 28° 42'	E 32° 22'	Limestone	2	General	Producer	Surface	Domestic	Total production of crystalline limestion in Egypt reported to be 9000 m3/yr in 1984 from all sites.
	19	Medinet Negrus Sakait	N 24° 40'	E 34° 47'	Beryl	1,4,16,22	General	Producer	Surface	Domestic	Dump sites visible, worked in ancient times. Production from Roman times in schists. Intermittent producer.
B	20	Quseir area Hamadat Atshan Duwi Anz Abu Tundub Abu Shegella Gohelna	N 26° 10'	E 34° 20'	Phosphate	1,2,4,5,16, 17,22,28,30	Confirmed	Producer	Underground	Exported	65% P2O5 Phosphate separated by limestone. Mining began in 1910 for export to the Far East. Ore requires calcination to obtain marketability. Largest mine operating in 1990 Hamraweln(592kt). Operation consists of seven mines, All mines use room & pillar undergound methods. Excluding Hamrawein, production 150-300kt/yr.
	21	Ras Shukeir Ras Shujeir	N 28° 05'	E 33° 18'	Salt	22,28	General	Producer	Surface	Domestic	Used in maunfacture of drilling mud for petroleum industry.
B	22	Safaga area Um El Howeitat Gasus Wasif Mohamed Rabah	N 26° 32'	E 33° 58'	Phosphate	1,2,4,5,16 17,22,28,30	Confirmed	Producer	Underground	Exported	Sediments tilted by faulting, mined by inclined shaft. P2O5 ranges from 22-30%. Mining began in 1910 for export to the Far East. Ore requires calcination to obtain marketability. Phosphate separated by limestone. Overburden 140 ft. Mining by room & pillar, shortwall mining methods. Ore blasted, broken before transport to port of Safaga. Capacity: 170kt/yr.
B	23	Sagia	N 26° 20'	E 33° 43'	Magnesite	22	General	Producer	Surface	Domestic	Produced in 1979.
B	24	Seleimat	N 26° 16'	E 33° 40'	Talc	22	General	Producer	Surface	Domestic	Produced in 1979.
	25	Um Gerifat	N 25° 36'	E 34° 34'	Ochre	4	General	Producer	Surface	Domestic	Mined intermittantly on a small scale. Res: 0.4Mmt.
	26	Um Hobal	N 23° 45'	E 33° 11'	Kaolin	4	General	Producer	Surface	Domestic	Produced in 1979.
	27	Um Kabu	N 24° 36'	E 34° 52'	Emeralds Beryl	16,22	General	Producer	Surface	Domestic	Ancient workings. Intermittent producer.
	28	Unnamed	N 25° 00'	E 33° 40'	Dolomite	4	General	Producer	Surface	Domestic	Low grade glass sand.
	29	Wadi Alaki	N 22° 09'	E 33° 12'	Marble dolomite	2,22	General	Producer	Surface	Domestic Exported	In association with limestone & dolomite. Opened in 1982. CaO content 33-42%. Largest marble quarry in Egypt.
B	30	Wadi Alalla	N 26° 12'	E 33° 28'	Stone	2	General	Producer	Surface	Domestic	Serpentine ornamental stone.
B	31	Wadi Bint Abu Gursly	N 26° 16'	E 34° 02'	Graphite	22	General	Producer	Surface	Domestic	Small producer in 1979.
	32	Wadi El Tom	N 23° 33'	E 33° 13'	Barite	22	General	Producer	Surface	Domestic	Produced in 1979.

APPENDIX A: PRODUCING MINERAL PROPERTIES IN EGYPT.

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	MARKETS (6)	COMMENTS
B	33	Wadi Hamamat	N 25° 59'	E 33° 35'	Stone	2,22	General	Producer	Surface	Domestic Exported	Breccia verde ornamental stone. Produced intermittantly from ancient times.
	34	Wadi Sannur	N 28° 52'	E 31° 05'	Alabaster	2,4,22	General	Producer	Surface	Domestic	Quarry production was 400 m3/yr in small blocks. Mined since Pharaonic times. Ore in limestone fractures.
	35	Wadi Sikeh Wadi Seifeh	N 25° 06'	E 34° 43'	Chromite	4,22	General	Producer	Unknown	Domestic	2 lenses, 250 tons, 35% Cr2O3. Operating in 1979.
	36	Wadi Sitra	N 25° 31'	E 34° 18'	Graphite	22	General	Producer	Surface	Domestic	Produced at 500 tpy.
	37	Zabara	N 24° 45'	E 34° 41'	Beryl, tin Emeralds	4,16,22	General	Producer	Surface	Domestic	Zone 1-20m thick in mica schist. Intermittent producer.
	38	Zaafarana Wadi Dakhal	N 28° 43'	E 32° 32'	Limestone Glass sand	2,4	General	Producer	Surface	Domestic	Total production of crystalline limestion in Egypt reported to be 9000 m3/yr in 1984 from all sites. High quality glass sand. Sandstone about 100m thick. Res: 2Mmt @ 99.27% SiO2. Can use without treatment.
	39	Alam El Margab	N 30° 43'	E 30° 08'	Limestone	22	General	Producer	Surface	Domestic	Assay: 99.2% SiO2, 0.02% Fe2O3.
	40	Idku	N 31° 15'	E 30° 15'	Salt	4,22	General	Producer	Surface	Domestic	Produced in 1979.
	41	Harrara	N 30° 53'	E 30° 19'	Salt, natron	1,22,30	General	Producer	Surface	Domestic	Ore deposited by evaporation. Two shallow lakes.
	42	Rashid Rosetta Damietta	N 31° 25'	E 30° 23'	Salt Iron	4,17,22	General	Producer	Surface	Domestic	Produces both sodium carbonate and sulfate. Ore deposited by evaporation. Produces salt, no iron production.
A	43	Unnamed	N 30° 13'	E 30° 48'	Bentonite	22	General	Producer	Surface	Domestic	Produced in 1979.
	44	Wadi Natrun	N 30° 21'	E 30° 18'	Salt, natron	1,22,28,30	General	Producer	Surface	Domestic	Oldest occurrence of natural soda. Series of evaporite lakes. Natrun is used in domestic soap, oil, and glass industries.
	45	Baharlya area El Gedida Ghorabi Nasser El Harra	N 28° 28'	E 28° 58'	Iron barite	2,4,6,16, 17,18,19,22, 27,30,31	Confirmed	Producer	Surface	Domestic	Ore thickness 2-25m, avg, 9m. Ore is blended to produce 53% Fe used at Helwan. 1994: High grade ore being mined. Ghorabi res: 57Mmt @ 48% Fe. El Gedida res: 126.7Mmt @ 53.6% Fe. Nasser res: 29Mmt @ 44.7% Fe. El Harra res: 56.6Mmt @ 44% Fe. Prod (1985) 3Mmt/yr.
A	46	Unnamed	N 29° 52'	E 30° 48'	Basalt	22	General	Producer	Surface	Domestic	Produced in 1979.
	47	Ameriyah Ameryia	N 31° 02'	E 29° 53'	Limestone	22	General	Producer	Surface	Domestic	Produced in 1979.

APPENDIX A: PRODUCING MINERAL PROPERTIES IN EGYPT.

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	MARKETS (6)	COMMENTS
	48	Mex	N 31° 07'	E 29° 51'	Dimension stone Lime Soda ash Salt	1,4,22,28	General	Producer	Surface	Domestic	Supplied Alexandrian construction industry. Two types of quarries: 'Gebel' quarries mined by coventional explosive methods; 'Fehera' quarries below sea level, cut in-situ into blocks with no explosives required. In 1922, 421 quarries in the area were being exploited.
	49	Kom Oushim Kom Aousheim	N 30° 32'	E 30° 55'	Diatomite	22	General	Producer	Surface	Domestic	Produced in 1979 at 5 kt/yr.
	50	El Menya Idmu	N 28° 06'	E 30° 36'	Limestone	2,22	General	Producer	Surface	Domestic	Total production of crystalline limestion in Egypt reported to be 9000 m3/yr in 1984 from all sites.
	51	Samalut	N 28° 18'	E 30° 42'	Limestone	4	General	Producer	Surface	Domestic Exported	Hi-grade products with varied uses. Grade 96.4-98.8% $MgCO_3$.
	52	Tona El Gabel	N 27° 45'	E 30° 40'	Limestone	22	General	Producer	Surface	Domestic	Producer in 1979.
A	53	Helwan area	N 29° 51'	E 31° 20'	Limestone Clay	1,4,18,22,31	Confirmed	Producer	Surface	Domestic	Quarries used for cement production. Plant has a capacity of 1.4Mt. Blasting done on shifts 2 and 3; twice a week. Blast holes on 5m centers, 6m from face, depth 30-55m. ANFO used as explosive. 15000 tpd mined.
A	54	Rifale	N 29° 55'	E 31° 22'	Limestone	22,31	General	Producer	Surface	Domestic	Produced in 1985. Production 750kt/yr.
A	55	Tura Tourah	E 29° 56'	E 31° 16'	Limestone	1,18	General	Producer	Surface	Domestic	Old quarry site reported to be closed in 1992. Plant has a capacity of 1.4Mt.
A	56	Abu Zaabal	N 30° 11'	E 31° 25'	Basalt	22	General	Producer	Surface	Domestic	Large scale producer.
A	57	El Ahmar Gabal El Ahmar	N 30° 03'	E 31° 18'	Limestone Quartzite Sandstone	1,4,22	General	Producer	Surface	Domestic	Old quarry site.
A	58	El Gigia	N 30° 00'	E 31° 00'	Dolomite	4	General	Producer	Surface	Domestic	Selective quarrying methods used.
A	59	Gabal Mukkatam	N 30° 00'	E 31° 10'	Limestone	4	General	Producer	Surface	Domestic	Dimensional limestone blocks for construction.
A	60	Maadi	N 29° 58'	E 31° 15'	Glass sand	2,4	General	Producer	Surface	Domestic	Production has occurred for at least 50 yrs. Low quality (97% SiO_2, 1%Fe_2O_3) glass sand.
	61	Baltah El Baltah	N 30° 43'	E 32° 20'	Gypsum	2,4,13, 16,22,30	General	Producer	Surface	Domestic	Ore in lake basin. Res: 11Mmt. Friable beds about 80cm thick overlain by salt.
	62	Port Said	N 31° 13'	E 32° 22'	Salt	22	General	Producer	Surface	Domestic	Produced in 1979.
	63	Dokhan	N 31° 21'	E 25° 25'	Stone	2	General	Producer	Surface	Exported	Imperial porphyry ornamental stone.
	64	Mersa Matruh	N 31° 21'	E 27° 17'	Salt	4,22	General	Producer	Surface	Domestic	Ore deposited by evaporation.

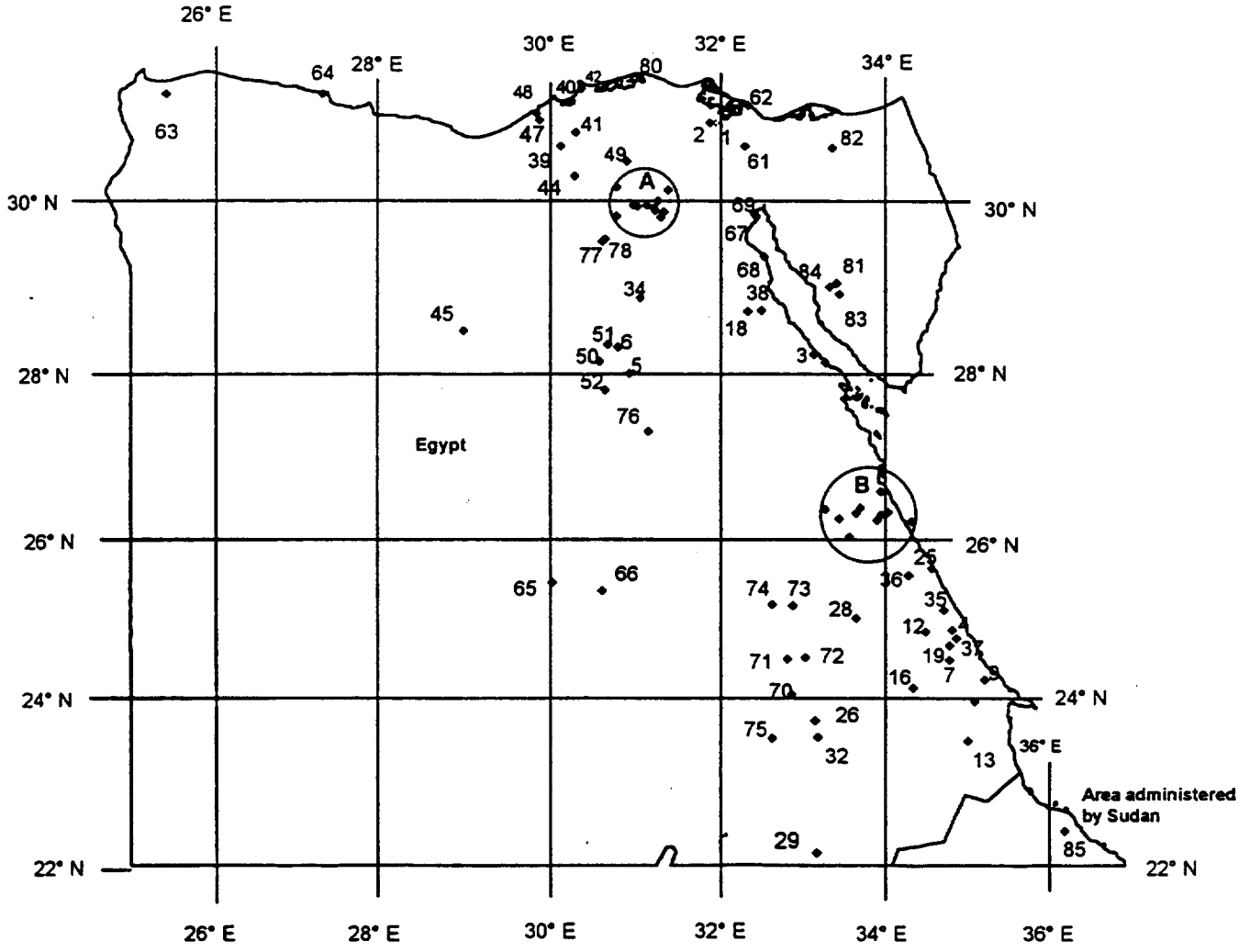
APPENDIX A: PRODUCING MINERAL PROPERTIES IN EGYPT.

MAP KEY (1)	NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	MARKETS (6)	COMMENTS
65	Kharga area Abu Tartur	N 25° 26'	E 30° 02'	Phosphate Alumina salts Magnesium salts	1,2,4,5,14, 17,19,30	General	Planned (7)	Underground	50% Domestic 50% Exported	35-65% P2O5 Salts recovered since Roman times. Oasis connected to Nile River by 180km railway Plans call for 2.2Mmt production at 31% P2O5 (1994). Development delayed by low price of phosphate. Abu Tartur located about 50 map minutes w. of Oasis. Ore to be mined by underground longwall methods. Blasting of ore would be limited. Reported reserves of 988Mmt @ cutoff of 23% P2O5.
66	Kharga	N 25° 20'	E 30° 38'	Ochre clays	1,22	General	Producer	Surface	Domestic	Intermittant production.
67	Adabiya	N 29° 52'	E 32° 28'	Dolomite	22,27,30	General	Producer	Surface	Domestic	Operated by Egyptian Iron & Steel. Production 1985 93kt.
68	Abu El-Darag	N 29° 22'	E 32° 34'	Limestone Glass sand	2,4	General	Producer	Surface	Domestic	Total production of crystalline limestion in Egypt reported to be 9000 m3/yr in 1984 from all sites. Low quality glass sand.
69	Ataqa	N 29° 54'	E 32° 27'	Dolomite	4,22,30	General	Producer	Surface	Domestic	Products used in glass, ceramic, and steel. Annual production 1982 100kt.
70	Aswan	N 24° 04'	E 32° 54'	Granite	2	General	Producer	Surface	Domestic Exported	22 sites in area. Regional production in 1984 reported as 4200 m3.
71	Kom Ombo	N 24° 30'	E 32° 51'	Limestone	22	General	Producer	Surface	Domestic	Produced in 1979.
72	Kom Ombo	N 24° 31'	E 33° 04'	Clay	22	General	Producer	Surface	Domestic	Produced in 1979.
73	Mahamid East Sebalya	N 25° 09'	E 32° 55'	Phosphate	22,28	General	Producer	Surface Underground	Domestic	Mahamid mine worked by UG room & pillar till 1980's. Mahamid open pit and West Sebalya mined by open pit and draglines.
74	Sebala Sharawna Oweinlya Qurayat Hagarla Mostah Yassin West Sebalya	N 25° 10'	E 32° 40'	Phosphate	1,2,5,16,17, 22,26,28, 30,31	General	Producer	Surface Underground	Domestic	65% P2O5 Res: 75Mmt. Overburden 3m of gravel and mud from Nile River. Capacity 481kt/yr. Overburden varied from loose gravel to hard material. Maximum stripping ratio for open pit is 13:1. Mines operate 6 days/week, either 2 or 3 shifts/day. Drill & blast on 2 shifts. Ore transported to Assiut, Cairo, and Mankabot.
75	Kalabsha	N 23° 32	E 32° 40'	Kaolin	4,16,22,30	General	Producer	Surface	Domestic	Res: 16.5Mmt. Produced 20-50kt/yr.
76	Assiut Wadi El Assiuty Basra Asyut	N 27° 15'	E 31° 11'	Limestone Alabaster	2,4,22	General	Producer	Surface	Domestic	Total production of crystalline limestion in Egypt reported to be 9000 m3/yr in 1984 from all sites.
77	El Kharsha	N 29° 33'	E 30° 38'	Diatomite	22	General	Producer	Surface	Domestic	Produced in 1979.
78	Kasr El Sagha	N 29° 35'	E 30° 40'	Glass sand, bentonite	22	General	Producer	Surface	Domestic	Produced in 1979. Res: 4.8Mmt.

APPENDIX A: PRODUCING MINERAL PROPERTIES IN EGYPT.

MAP KEY (1)	NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	MARKETS (6)	COMMENTS
A 79	Damietta	N 30° 13'	E 30° 48'	Salt Black sands	22	General	Producer	Surface	Domestic	Produced in 1979.
80	Baltim	N 31° 33'	E 31° 05'	Salt	4,22	General	Producer	Surface	Domestic	Ore deposited by evaporation.
81	Abu Zenima Dehessa Farsh El Ghozan Om Eleygan Messab Salama Tleh Khabouba Hassbar	N 29° 03'	E 33° 26'	Glass sand Kaolin	2,4,22,30	General	Producer	Surface	Exported Domestic	500,000 tons suitable for tableware and sheet. Kaolin beds 2-2.5m thick under 30-40m sandstone.
82	Maghara Magharah Safa	N 30° 42'	E 33° 23'	Coal	2,4,9,14,15, 22,28,30,31	Confirmed	Planned (7)	Underground	Domestic	Mining began 1964, terminated in 1967 due to war. Workings consist of 2 drifts, 1 shaft, and 2 longwall faces. Site being rehabilitated in 1984, prod of 0.6Mmt/yr Ore is coking coal type planned for Zaafaranah plant. Reserve 51.8Mmt. To be restarted in 1996 at 125kt/yr if funding available. Main seam 3 foot thick, with hi S. To be blended. Safa mined at 18kt/yr from 1964-67.
83	Serabit el Khadem Sarabeit El Khadim	N 28° 55'	E 33° 28'	Turquoise	1,22	General	Producer	Surface	Domestic	Intermittant producer since ancient times.
84	Umm Bogma Wadi Nassib Wadi El Noaman Wadi Shallal Abu Qafas Wadi El Hussenl El Adidiya	N 29° 00'	E 33° 21'	Manganese Copper	1,4,16,22, 30,31	General	Planned (7) Past producer	Surface	Domestic	Discovered 1898. Produced 1911-1967. Multiple occurrences in area. Mn occurs between ls and ss @ 35% Mn. Total production was 5.5Mmt, Reserves 4Mmt. Plans call for rehabilitation and production by 1990. Produced at a rate of 300kt/yr. Ore lenses average 2m in thickness.
85	Elba area	N 22° 25'	E 36° 10'	Manganese Chromite	16,22	General	Producer	Unknown	Domestic	Mined since the 1960's. Ore from 11 sites.
86	Beni Suef	N 29° 01'	E 31° 09'	Limestone Gypsum	22	General	Producer	Surface	Domestic	Began production in 1991.
87	Wadi Qena	N 26° 02'	E 32° 34'	Limestone Glass sand	22	General	Producer	Surface	Domestic	Production began in 1991.

(1) Represents property or property grouping as defined in Appendix map A-1.
(2) Due to software limitations, site names do not include any diacritical markings. Spelling of individual site names vary considerably by source.
(3) Complete list of data sources found in Appendix D.
(4) General - denotes limited data; Confirmed - denotes deposit information confirmed by several sources.
(5) Because of the varying age of source information, the status of individual sites may not be current.
(6) Reflects whether primary market for product is internal or for export.
(7) Sites are not currently operating at full production level. Development has been completed but financing not yet secured.



LEGEND

Producing or Developing Mineral Property*

* Letter represents property grouping as defined in appendix.

0 200 400 Kilometers

N W E S

APPENDIX MAP A-1: PRODUCING MINERAL PROPERTIES OF EGYPT

APPENDIX B: PAST PRODUCING MINERAL PROPERTIES IN EGYPT.

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	COMMENTS
	1	Dakhla	N 25° 30'	E 29° 10'	Phosphate Alumina salts Magnesium salts	1,4,22,30	Confirmed	Past producer	Surface	35-65% P2O5 Salts recovered since Roman times. Mining ceased at beginning of the 20th century.
	2	Umm Rus Om Rus	N 25° 29'	E 34° 35'	Gold	1,2,3,4, 16,22	Confirmed	Past producer	Surf/UG	Alluvial gold prod. around 1905. Old wokings, including 1906-7, 1943-46. Ore in granodiorites and granites. Recent exploration work conducted, several shafts sunk. Res (1955): 16kt @ 11g/t Au. Gold content increases with with depth.
M	3	Umm Garalat	N 22° 30'	E 33° 28'	Gold	1,3,16,22,30	General	Past producer	Surface	Alluvial gold prod. around 1905. Quartz veins. 8 inclined or vertical shafts present. Large tailings @ 5 g/t reported.
H	4	Barramiyah Barramiya	N 25° 04'	E 33° 47'	Gold	1,3,4,16, 22,30	Confirmed	Past producer	Surface	Alluvial gold prod. between 1907-1919. Periodic prospecting 1937-1981. Four quartz veins in schist. Res: (5 zones) 1.85Mmt @ 2.8g/t. Tailings estimated at 54kt @ 5 g/t reported.
	5	Umm Tlour	N 22° 20'	E 34° 40'	Gold	1	General	Past producer	Surface	Alluvial gold prod. 1912-1920.
K	6	Sukari	N 24° 57'	E 34° 42'	Gold	1,3,4,22,30	Confirmed	Past producer	Underground	Lode gold, low grade. About 25 kt of ore extracted from 90 quartz veins. Site produced intermittantly, primarily between 1947-1952. Gold assays 6.1-29.4 g/t, hi-grade areas worked out. Gold related to altered granites. Tailings of 32kt @ 5 g/t reported.
G	7	Atallah Atalla	N 26° 06'	E 33° 27'	Gold silver	1,3,16,22	General	Past producer	Unknown	Worked 1914-1918.
G	8	Semna	N 26° 27'	E 33° 34'	Gold	1,3,16,22	General	Past producer	Underground	Low grade occurrence Ancient workings.
	9	Haimur	N 22° 35'	E 33° 17'	Gold	1,3,16,22	General	Past producer	Surface	Low grade occurrence Quartz veins. Worked 1904-1907.
K	10	Gebel Rossas Gebel El Rusas	N 25° 10'	E 34° 44'	Lead	1,2,11,16,22	Confirmed	Past producer	Underground	Worked 1912-1916. Sulfides in bedded ls. 1984 reserves reported at 400,000 tons @ 10% Zn. 1981 res: 375kt @ 7% Zn, 16.2% Pb.
K	11	Ranga	N 24° 25'	E 35° 08'	Lead	1,22	General	Past producer	Unknown	Small deposit, low grade. In gypsum associated with sulfur and pyrite.
	12	Zebirget Zeberet	N 23° 37'	E 36° 12'	Peridot	1	General	Past producer	Surface	No production since 1914. Gem quality stones.
M	13	Abu Seyal Abu Swayel	N 22° 48'	E 33° 45'	Copper nickel cobalt	1,4,11,16, 22,30	General	Past producer	Surface	Worked in ancient times. Workings include 69m shaft, 1205m drill core. Massive & disseminated ore in amphibolite. Lens 500m x 30m. Res: 85kt @ 2.8% Cu, 1.53% Ni.

APPENDIX B: PAST PRODUCING MINERAL PROPERTIES IN EGYPT.

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	COMMENTS
H	14	Hagar Dungash Dungash area	N 24° 59'	E 33° 57'	Chromite	1,4,22	General	Past producer	Surface	Occurrence. 8 sites, several lenses in each, 1000 tons ore of medium grade. Reported to be mined out.
J	15	Hamr	N 24° 03'	E 33° 02'	Talc	1,22	General	Past producer	Surface	Producing in 1979.
E	16	Wadi Moghara Mokateb	N 28° 50'	E 33° 30'	Turquoise	1	General	Past producer	Surface	Occurrence. In seams of sandstone.
D	17	Abu Diyaba	N 29° 37'	E 32° 06'	Amethyst	1	General	Past producer	Surface	Occurrence. Ancient workings in granite.
	18	Gemsa Ras Gemsa	N 27° 42'	E 33° 30'	Sulfur Potassium salts Diatomite	1,2,4,13,22	General	Past producer	Surface	Occurrence. Sulfur associated with gypsum in evaporates and marl. Exploited intermittantly in 1950's and 1960's; stopped 196
C	19	Dimishqin	N 29° 14'	E 30° 58'	Gypsum	1	General	Past producer	Surface	Old quarry site.
C	20	Abu Ruweish Abu Roash	N 29° 40'	E 31° 14'	Clay limestone basalt	1,4,22	General	Past producer	Surface	Old quarry site. Road construction materials.
C	21	Deir el Maimun	N 29° 45'	E 31° 20'	Clay	1	General	Past producer	Surface	Old quarry site.
C	22	Ezbet el Haggara	N 29° 43'	E 31° 20'	Clay	1	General	Past producer	Surface	Old quarry site.
C	23	Gebel el Mudil	N 28° 54'	E 31° 00'	Gypsum	1	General	Past producer	Surface	Old quarry site.
C	24	Bayad el Nasara	N 29° 04'	E 31° 08'	Gypsum	1	General	Past producer	Surface	Old quarry site.
B	25	Abu Sir	N 29° 53'	E 31° 13'	Gypsum	1	General	Past producer	Surface	Old quarry site.
F	26	Gebel el Ablad	N 28° 26'	E 30° 42'	Limestone	1	General	Past producer	Surface	Old quarry site.
F	27	Gebel Garl el Deir	N 28° 09'	E 30° 46'	Limestone	1	General	Past producer	Surface	Old quarry site.
F	28	Balansura	N 27° 55'	E 30° 41'	Limestone	1	General	Past producer	Surface	Old quarry site.
F	29	Bahnasa	N 28° 00'	E 30° 45'	Limestone	1	General	Past producer	Surface	Old quarry site.
	30	Asyut el Gharbi	N 27° 11'	E 31° 11'	Limestone	1	General	Past producer	Surface	Old quarry site.
	31	Durunka	N 27° 08'	E 31° 10'	Limestone	1	General	Past producer	Surface	Old quarry site.
	32	Abu Foda	N 27° 24'	E 30° 58'	Limestone	1	General	Past producer	Surface	Old quarry site.
	33	Ahaywa	N 26° 28'	E 31° 49'	Limestone	1	General	Past producer	Surface	Old quarry site.
	34	Haridi	N 26° 47'	E 31° 35'	Limestone	1	General	Past producer	Surface	Old quarry site.
	35	Mi'alla	N 26° 07'	E 32° 45'	Limestone	1	General	Past producer	Surface	Old quarry site.
	36	Kolet el Qasr	N 26° 03'	E 32° 18'	Limestone	1	General	Past producer	Surface	Old quarry site.

APPENDIX B: PAST PRODUCING MINERAL PROPERTIES IN EGYPT.

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	COMMENTS
G	37	Kubaniya	N 26° 09'	E 33° 32'	Granite Quartz Clay	1	General	Past producer	Surface	Old quarry site.
B	38	Ma'sara	N 30° 00'	E 31° 10'	Limestone	1	General	Past producer	Surface	Old quarry site.
B	39	Haysum	N 30° 00'	E 31° 10'	Limestone	1	General	Past producer	Surface	Old quarry site.
B	40	Musa	E 30° 01'	E 31° 19'	Limestone	1	General	Past producer	Surface	Old quarry site.
B	41	El Raha	E 30° 12'	E 31° 02'	Limestone	1	General	Past producer	Surface	Old quarry site.
D	42	El Harif	N 29° 56'	E 32° 02'	Limestone	1,22	General	Past producer	Surface	Old quarry site.
C	43	Rimal el Basalin	E 29° 12'	E 31° 28'	Limestone	1	General	Past producer	Surface	Old quarry site.
B	44	El Tabilta	N 30° 00'	E 31° 10'	Limestone	1	General	Past producer	Surface	Old quarry site.
B	45	El Amara	E 30° 21'	E 31° 08'	Limestone	1	General	Past producer	Surface	Old quarry site.
B	44	Athar el Nabi	N 30° 00'	E 31° 10'	Limestone	1	General	Past producer	Surface	Old quarry site.
B	44	Batn el Bagara	N 30° 00'	E 31° 10'	Limestone	1	General	Past producer	Surface	Old quarry site.
B	44	Ein el Sira	N 30° 00'	E 31° 10'	Limestone	1	General	Past producer	Surface	Old quarry site.
B	44	Zawiet Nassra	N 30° 00'	E 31° 10'	Limestone	1	General	Past producer	Surface	Old quarry site.
B	44	El Ablad	N 30° 00'	E 31° 10'	Limestone	1	General	Past producer	Surface	Old quarry site.
B	44	Meadissa	N 30° 00'	E 31° 10'	Limestone	1	General	Past producer	Surface	Old quarry site.
B	44	Dowaleqa	N 30° 00'	E 31° 10'	Limestone	1	General	Past producer	Surface	Old quarry site.
	46	Rimal el Abbasiya	N 30° 32'	E 31° 43'	Limestone	1	General	Past producer	Surface	Old quarry site.
B	47	Rimal el Ahmar	N 30° 03'	E 31° 18'	Limestone	1	General	Past producer	Surface	Old quarry site.
B	48	Gebel el Mounayar	N 30° 30'	E 31° 00'	Limestone	1	General	Past producer	Surface	Old quarry site.
	49	Ismailia	N 30° 35'	E 32° 16'	Sand & gravel Gypsum	1	General	Past producer	Surface	Old quarry site.
J	50	Aswan Lake Nasser	N 24° 05'	E 32° 56'	Iron	2,4,6,16,17, 22,30	Confirmed	Past producer	Surface	Produced intermittantly since 1500B.C. Produced 7Mmt between 1956-1973. Res: (1955) 121-135Mmt @ 31.2-62.3% Fe. Ore 2 20-350cm bands in sandstone. Res: (1979) 30Mmt by open cast mining. Production 2142 tpd.

APPENDIX B: PAST PRODUCING MINERAL PROPERTIES IN EGYPT.

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	COMMENTS
K	51	Umm Oud Umm Ud	N 24° 51'	E 34° 38'	Gold	2,3,16,22,30	General	Past producer	Underground	Disseminated ore in lenticular zones. 14,000 tons @ 25 gm/mt. Exploited during 1947-1953.
G	52	El Sid	N 26° 00'	E 33° 35'	Gold	2,4,16,22	General	Past producer	Underground	Greatest production between 1944-1961. Extraction plant on site with capacity of 70 tpd. Largest & richest gold deposit in Egypt. Between 1944-1958, produced 120kt ore. Workings (1986) included 4000m of shafts, drifts, and winzes.
	53	Fatira	N 26° 42'	E 33° 17'	Gold	2,3,16,22	General	Past producer	Underground	Gold-bearing dikes of felsite porphyry. Ancient mine.
K	54	Umm Samluki Hilgit El Maakil	N 24° 14'	E 34° 49'	Zinc, Copper Lead, Gold Silver	1,4,11,16,17, 22,23,30	Confirmed	Past producer	Underground	Known since ancient times. Recent mining began 1930, two zones developed. Investigations carried out 1958-62, 1974-76. Associated with volcanics. Assays are Zn 9.9-21.8%, Cu 1-4.4%, Pb 0.5-2.3% Au 0.3-3.5 ppm, Ag 260-1500 ppm. Res: 200kt @ 12.69% Zn, 2.1% Pb, 1.4-4% Cu. Deposit 120-160m long, 5.5-8.8m thick, 40-120m deep.
K	55	Hamata Atshan	N 24° 22'	E 35° 07'	Zinc, Copper Lead, Talc	2,22	General	Past producer	Underground	Gossans and sulfide lenses in talc. Ore grades 42% Zn, 2.5% Cu, and 0.08% Pb.
A	56	Gharbanyiat El Ghorbaniat	N 30° 53'	E 29° 30'	Gypsum limestone	2,4,16,22	General	Past producer	Surface	Salts in depression along coast. Reserves reported at 17Mmt.
A	57	Omayid	N 30° 47'	E 29° 12'	Gypsum	2,4,16,22	General	Past producer	Surface	Salts in depression along coast. Reserves reported at 17Mmt.
A	58	Hamman	N 30° 48'	E 29° 23'	Gypsum	2,13,16,22,30	General	Past producer	Surface	Salts in depression along coast. Friable beds about 80cm thick overlain by salt.
C	59	Quarret El Farass	N 29° 35'	E 30° 58'	Gypsum	2	General	Past producer	Surface	Alluvium deposits.
C	60	Giza	N 29° 27'	E 31° 12'	Gypsum	2,16	General	Past producer	Surface	Alluvium deposits.
A	61	Burqan Barkan	N 30° 36'	E 29° 30'	Gypsum	2,22	General	Past producer	Surface	Large extent, 7-10m in thickness.
D	62	Ras Malaab	N 29° 13'	E 32° 56'	Gypsum Anhydrite	2,4,13,16, 22,30	General	Past producer	Surface	Bed of large lateral extent. Res: 250Mmt. Material suitable for cement & plaster of paris. Beds vary from 17-41m thick, alternating with marl/s.
K	63	Abu Ghalaga Abu Ghalaga	N 24° 21'	E 35° 00'	Titanium, Iron Vanadium	2,4,16,22,30	Confirmed	Past producer	Unknown	Res: 41Mmt @ 34.9%TiO2, 52.2% Fe2O3, and 0.28% V2O3. Ore in gabbro and anorthosite. Main band 350m x 50m., averaging 150m thick. Explored in 1974-75. Produced 100kt/yr in the 1960's.

APPENDIX B: PAST PRODUCING MINERAL PROPERTIES IN EGYPT.

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	COMMENTS
H	64	Wadi El Miraḥ	N 25° 11'	E 33° 45'	Marble	2,22	General	Past producer	Surface	Production reached 1200 m3/yr; intermittant 1980s.
	65	Umm Gheig	N 25° 43'	E 34° 27'	Lead, Zinc copper	2,4,11,16,17, 22,30	Confirmed	Past producer	Unknown	Res: 1Mmt @ 13.9% Zn, 2.03% Pb proven; 1.5Mmt @ 11% Zn, 1.3% Pb probable. Res: 630kt @ 14.8% Zn, 1.94% Pb. Reserves in three pit areas 11km distant. Mined 1928-1968 on a small scale.
H	66	Atud	N 25° 02'	E 34° 24'	Gold barite	2,3,4,16,17, 22,30	Confirmed	Past producer	Underground	Quartz veins in gabbro. Res: 19kt @ 16.3g/t. Ancient mine. Proven ore: 8600 tons @ 12.68 g/t; Probable ore Mined during period of the Pharoahs, no recent mining activity. Exploration conducted between 1953-1969. Workings consist of 690m of drifting, 230m of shafting, and 135 surface trenches. Ore in gabbro and quartz veins.
L	67	Umm Eleiga	N 23° 37'	E 34° 59'	Gold	3,22	General	Past producer	Surface	Extensive ancient workings over 2.5 sq km area. Ore associated withgabbro and diorite, alluvium. 127 exploration pits visible.
L	68	Hutit	N 23° 27'	E 35° 11'	Gold	2,3,16,22	General	Past producer	Surface/UG	Mined by ancients and early 1900s. Ore in metavolcanic fissures filling quartz veins.
L	69	Urga El Raran Ourga Rayan Argaryan	N 23° 20'	E 35° 04'	Gold	3,22	General	Past producer	Unknown	Ore in metavolcanic tuffs cut by quartz veins. Ancient working.
L	70	Gebel El Anbat	N 23° 06'	E 35° 19'	Gold	3	General	Past producer	Surface	Ancient ruins visible. Ore in metavolcanics.
K	71	Umm Tundeba Umm Taneldba	N 24° 56'	E 34° 44'	Gold	3,22	General	Past producer	Underground	Ore in quartz vein cutting metavolcanic tuffs. Workings consist of 4 shafts and dumps.
L	72	Betan	N 23° 37'	E 35° 02'	Gold	3,22	General	Past producer	Unknown	Ancient mine.
L	73	Umm Kalib	N 23 20'	E 35° 10'	Gold	3,22	General	Past producer	Unknown	Ancient working.
G	74	El Sid	N 26° 00'	E 33° 36'	Gold	3,30	General	Past producer	Surface/UG	Ore in granodiorite stock. Ore mined in ancient times, 1944-1958. Ore apparently mined out. Ore grade range was 11-28g/t.
G	75	Hammamat	N 26° 15'	E 33° 24'	Gold	3,22	General	Past producer	Unknown	Ancient working.
G	76	Abu Mereiwat	N 26° 34'	E 33° 42'	Gold	22	General	Past producer	Unknown	Ancient working.
J	77	Kurtunos	N 23° 59'	E 33° 00'	Gold	3,22	General	Past producer	Unknown	Ancient working.
J	78	El Hudi	N 23° 57'	E 33° 08'	Gold Barite	3,4,22,30	General	Past producer	Unknown	Ancient mine. Barite veins in metamorphic rocks.
	79	Umm Ashira	N 23° 08'	E 33° 15'	Gold	3,22	General	Past producer	Surface	Quartz vein and placer. Ancient working.

APPENDIX B: PAST PRODUCING MINERAL PROPERTIES IN EGYPT.

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	COMMENTS
M	80	Harlarl	N 22° 59'	E 33° 26'	Gold	3,22	General	Past producer	Unknown	Ancient working.
M	81	Nekib Neqib	N 22° 46'	E 33° 43'	Gold	3,22	General	Past producer	Unknown	Occurrence of placer and alteration zones. Ancient working.
M	82	Block E	N 22° 36'	E 33° 20'	Gold	3,22	General	Past producer	Unknown	Occurrence of placers on alluvial terraces. Worked before WWI.
M	83	Marahik Marahib	N 22° 30'	E 33° 27'	Gold	3,22	General	Past producer	Unknown	Occurrence of quartz veins. Ancient working.
M	84	Atshanti	N 22° 34'	E 33° 33'	Gold	3,22	General	Past producer	Unknown	Occurrence of quartz veins and alteration zones. Ancient working.
M	85	Fllat	N 22° 24'	E 33° 36'	Gold	3,22	General	Past producer	Unknown	Occurrence of quartz veins. Ancient working.
M	86	Murra	N 22° 34'	E 33° 55'	Gold	3,22	General	Past producer	Unknown	Occurrence of placer and alteration zones. Ancient working.
M	87	Abu Fass	N 22° 08'	E 33° 52'	Gold	3,22	General	Past producer	Unknown	Occurrence of quartz veins. Ancient working.
K	88	Hangallya	N 24° 51'	E 34° 32'	Gold	3,16,22,30	General	Past producer	Underground	Exploited during 1938-1952. Ore in granite.
H	89	Dungash	N 24° 57'	E 33° 52'	Gold	3,22	General	Past producer	Unknown	Ancient mine.
H	90	Talat Gadalla Fila Godella	N 25° 24'	E 33° 36'	Gold	3,22	General	Past producer	Unknown	Occurrence in diorite. Ancient working.
H	91	Umm Samra	N 25° 19'	E 34° 06'	Gold	3,22	General	Past producer	Unknown	Ancient working.
H	92	Umm Hugab	N 25° 00'	E 34° 05'	Gold	3,22	General	Past producer	Unknown	Ancient working.
	93	Umm Mongul	N 27° 50'	E 33° 00'	Gold	3,22	General	Past producer	Unknown	Ancient working.
	94	Umm Balad	N 27° 29'	E 32° 46'	Gold	3,22	General	Past producer	Unknown	Ancient working.
	95	Wadi Dib	N 27° 48'	E 32° 59'	Gold	3,22	General	Past producer	Unknown	Ancient working.
G	96	Abu Qarahish Abu Drahish	N 26° 24'	E 33° 35'	Gold	3,22	General	Past producer	Unknown	Ancient working.
G	97	Kab Amiri	N 26° 22'	E 33° 35'	Gold	3,22	General	Past producer	Unknown	Ancient working.
G	98	Sagi	N 26° 21'	E 33° 49'	Gold	3,22	General	Past producer	Unknown	Ancient working.
G	99	Gidami	N 26° 24'	E 33° 26'	Gold	3,22	General	Past producer	Unknown	Ancient working.
G	100	Abu Had	N 26° 16'	E 33° 31'	Gold	3,22	General	Past producer	Unknown	Ancient working.
G	101	El Rebshi Gabal Rabshi	N 26° 12'	E 33° 42'	Gold	3,22	General	Past producer	Unknown	Ancient working.

APPENDIX B: PAST PRODUCING MINERAL PROPERTIES IN EGYPT.

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	COMMENTS
G	102	Umm Esh	N 26° 07'	E 33° 38'	Gold	3,22	General	Past producer	Unknown	Ancient working.
G	103	Umm Had	N 26° 02'	E 33° 31'	Gold	3,22	General	Past producer	Unknown	Ancient working.
G	104	Umm Selimat	N 25° 54'	E 33° 42'	Gold	3,22	General	Past producer	Unknown	Ancient working.
G	105	Hammuda	N 25° 56'	E 33° 45'	Gold	3,22	General	Past producer	Unknown	Ancient working.
G	106	El Nur	N 25° 52'	E 33° 40'	Gold	3,22	General	Past producer	Unknown	Ancient working.
G	107	Kareim	N 25° 55'	E 34° 03'	Gold	3,22	General	Past producer	Unknown	Ancient working.
	108	Tarfawi	N 25° 49'	E 34° 03'	Gold	3,22	General	Past producer	Unknown	Ancient working.
G	109	Zeldon	N 25° 44'	E 33° 44'	Gold	3,22	General	Past producer	Unknown	Ancient working.
H	110	Sigdit	N 25° 26'	E 34° 01'	Gold	3,22	General	Past producer	Unknown	Ancient working.
H	111	Abu Malawaad	N 25° 13'	E 33° 41'	Gold	3,22	General	Past producer	Unknown	Ancient working.
H	112	Daghbag	N 25° 25'	E 33° 47'	Gold	3,22	General	Past producer	Unknown	Ancient mine.
H	113	El Hisinat El Heseinat	N 25° 16'	E 33° 49'	Gold	3,22	General	Past producer	Unknown	Ancient working.
H	114	Bokari Bakari	N 25° 12'	E 33° 45'	Gold	3,22	General	Past producer	Unknown	Ancient mine.
H	115	Abu Dabbab	N 25° 20'	E 34° 33'	Gold	3,22	General	Past producer	Unknown	Worked during 1907-1917.
H	116	Abu Qaria	N 25° 15'	E 34° 00'	Gold	3,22	General	Past producer	Unknown	Ancient mine.
H	117	Umm Salatit	N 25° 11'	E 33° 58'	Gold	3,22	General	Past producer	Unknown	Ancient working.
H	118	Bezah	N 25° 10'	E 34° 03'	Gold	3,22	General	Past producer	Unknown	Ancient working.
H	119	Umm Selim	N 25° 08'	E 33° 53'	Gold	3,22	General	Past producer	Unknown	Ancient working.
H	120	Samut	N 24° 50'	E 33° 53'	Gold	3,4,22	General	Past producer	Unknown	Gold in quarz vein in granodiorite. Worked to a depth of 60m.
H	121	Urf El Fahid	N 25° 00'	E 34° 10'	Gold	3,22	General	Past producer	Unknown	Ancient working.
K	122	Kurdeman	N 24° 53'	E 34° 43'	Gold	3,22	General	Past producer	Unknown	Exploited between 1947-1952.
K	123	Allawi El Lawi	N 24° 47'	E 34° 49'	Gold	3,22	General	Past producer	Unknown	Ancient working.
K	124	Dweig	N 24° 45'	E 34° 25'	Gold	3,22	General	Past producer	Unknown	Ancient working.
M	125	Selga	N 22° 34'	E 34° 05'	Gold	3,22	General	Past producer	Unknown	Ancient working.
M	126	Umm Shashoba	N 22° 35'	E 34° 10'	Gold	3,22	General	Past producer	Unknown	Ancient working.

APPENDIX B: PAST PRODUCING MINERAL PROPERTIES IN EGYPT.

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	COMMENTS
	127	Betam	N 22° 17'	E 34° 31'	Gold	3,22	General	Past producer	Unknown	Ancient working.
	128	Umm Egat	N 22° 03'	E 34° 54'	Gold	3,22	General	Past producer	Unknown	Ancient working.
	129	Wadi Zeidon	N 25° 38'	E 33° 57'	Gold	3,22	General	Past producer	Unknown	Ancient working.
K	130	Geil	N 24° 31'	E 34° 42'	Gold	3,22	General	Past producer	Unknown	Ancient working.
K	131	Qulan	N 24° 18'	E 35° 08'	Gold	3,22	General	Past producer	Unknown	Ancient working.
K	132	Shelalik	N 24° 11'	E 35° 17'	Gold	3,22	General	Past producer	Unknown	Ancient working.
K	133	Abu Rahaya	N 24° 10'	E 35° 10'	Gold	3,22	General	Past producer	Unknown	Ancient working.
L	134	Korbiai	N 22° 49'	E 35° 09'	Gold	3,22	General	Past producer	Surface	Alluvial deposit exploited before WWI.
	135	Romit	N 22° 19'	E 35° 49'	Gold	3,22	General	Past producer	Unknown	Ancient mine.
M	136	Gabal Moqassem	N 22° 08'	E 33° 55'	Chromite	4	General	Past producer	Unknown	Six lenses containing 180 tons of med. gr ore.
M	137	Um Domi	N 22° 12'	E 34° 10'	Chromite	4	General	Past producer	Unknown	Nine lenses of small tonnage and med. grade.
	138	Um El Tiyur	N 22° 17'	E 34° 35'	Chromite gold	4,22,30	General	Past producer	Unknown	14 lenses in talc-carbonate rocks. Worked during the 1920's.
M	139	Sol Hamid	N 22° 15'	E 33° 48'	Chromite	4	General	Past producer	Unknown	13 lenses, 630 tons, 48% Cr2O3.
M	140	Um Krush	N 22° 40'	E 33° 48'	Chromite	4,22	General	Past producer	Unknown	Wadi Allaqi area. 16 lenses, 1100 tons, 49% Cr2O3.
M	141	Dyniyat El Gueleib	N 22° 40'	E 33° 48'	Chromite	4,22	General	Past producer	Unknown	Wadi Allaqi area. 6 small lenses of high grade ore.
M	142	Wadi Halmour	N 22° 40'	E 33° 48'	Chromite	4,22	General	Past producer	Unknown	Wadi Allaqi area. 1 lens, 550 tons of high grade ore.
L	143	Wadi Arayes	N 23° 35'	E 34° 51'	Chromite	4	General	Past producer	Unknown	33 small lenses enclosed in talc-carbonate rocks.
L	144	Abu Dahr	N 23° 37'	E 35° 06'	Chromite	4,22	General	Past producer	Unknown	1 lens, 2-10m thick, 53.9% Cr2O3.
K	145	Wadi Ghadir	N 24° 49'	E 34° 49'	Chromite	4,22	General	Past producer	Unknown	8 lenses, 4800 tons medium grade ore. Produced in 1979.
K	146	Wadi Umm Hegari	N 24° 44'	E 34° 42'	Chromite	4	General	Past producer	Unknown	1 lens, low grade ore.
H	147	Abu Mirelwa	N 25° 01'	E 33° 52'	Chromite	4	General	Past producer	Unknown	4 lenses, 195 tons, 36% Cr2O3.
H	148	Barramiya	N 25° 06'	E 33° 50'	Chromite	4,22,25	General	Past producer	Unknown	84 lenses over 9 sites in talc-carbonate. Small scale mining. Ore in podiform deposits in ultrabasic rocks. Ore grades 35-38% Cr.
H	149	Barramiya II	N 25° 07'	E 33° 22'	Chromite	22	General	Past producer	Unknown	Small scale mining.
	150	Kolet Um Homr	N 25° 45'	E 34° 15'	Chromite	4	General	Past producer	Unknown	17 lenses, small reserves, 42% Cr2O3.

APPENDIX B: PAST PRODUCING MINERAL PROPERTIES IN EGYPT.

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	COMMENTS
	151	Gabal El Rabshi	N 26° 11'	E 33° 40'	Chromite	4,22	General	Past producer	Unknown	18 sites, 100 lenses, 2700 tons, 44% Cr2O3. Small scale exploitation.
K	152	Ras Shait	N 24° 51'	E 34° 34'	Chromite	4,22	General	Past producer	Unknown	Small scale exploitation.
K	153	Um El Abas	N 24° 31'	E 35° 08'	Magnesite	4	General	Past producer	Unknown	Old producer.
	154	Sagia	N 30° 56'	E 32° 49'	Magnesite	4	General	Past producer	Unknown	Old producer.
	155	Umm Salatit	N 25° 10'	E 33° 56'	Magnesite	4,22	General	Past producer	Unknown	Old producer.
	156	St. John's Island	N 23° 37'	E 36° 12'	Nickel Peridot	4,16,22	General	Past producer	Surface	Two veins @ 4.86% Ni, 12.25% Fe. Res: 5-6kt of ore. Produced in 1937-38.
H	157	Hamash	N 24° 41'	E 34° 05'	Copper Gold	4,16,22,30	General	Past producer	Unknown	Porphyry copper noted at 4 sites. Res: 60Mmt @ 0.3-0.4% Cu.
H	158	Mueiha Mueilha	N 24° 54'	E 33° 55'	Tin Tungsten	4,22,30	General	Past producer	Surface	Ore from quartz veins and alluvium. Mined in the 1940's. Zone of 70 veins.
K	159	Igla	N 25° 06'	E 34° 39'	Tin Tungsten Tantalum, niobium	4,22,30	General	Past producer	Surface	Ruin of ancient tin smelter at site. Aone of 60 veins in quartz. Res: 10Mmt @ 2kt Sn, 3kt BeO, 13kt LIO.
G	160	Maghrabiya	N 26° 22'	E 33° 27'	Tungsten	4,22	General	Past producer	Surface	Three veins in granite, 150m x 30cm. 180 tons of WO3 concentrate produced in 1938.
L	161	Zargat Naam	N 23° 46'	E 34° 41'	Tungsten Chromite	4,22,30	General	Past producer	Surface	Exploited in the 1940's and 1950's.
H	162	Gabal Ineigi Eneigi	N 25° 13'	E 34° 09'	Fluorite	4,22,30	General	Past producer	Surface	Veins reportedly 2-3m in thickness, worked out.
D	163	Abu Darag	N 29° 23'	E 32° 33'	Kaolin	4,22	General	Past producer	Surface	Low grade kaolinite, production limited.
	164	Gabal Um Selim	N 25° 08'	E 33° 58'	Graphite	4	General	Past producer	Unknown	Discovered in 1938.
	165	Rosetta	N 31° 18'	E 30° 30'	Black sand REO	17,22,30	General	Past producer	Surface	Exploited during 1929-1968. No present production. Reserves estimated at 47Mmt (1982). Produced at 20kt/yr.
D	166	Abu Ritham	N 29° 14'	E 32° 28'	Copper	22,30	General	Past producer	Unknown	Ancient working.
D	167	Wadi Bikheit	N 29° 08'	E 32° 24'	Copper	22,30	General	Past producer	Unknown	Ancient working.
E	168	Sarabit El Khadim	N 29° 00'	E 33° 27'	Copper	22	General	Past producer	Unknown	Ancient working.
	169	El Agma	N 29° 34'	E 34° 45'	Copper	22	General	Past producer	Unknown	Ancient working.
	170	Regeita	N 28° 37'	E 34° 05'	Copper	22,30	General	Past producer	Unknown	Ancient working.
	171	Rahaba	N 28° 21'	E 34° 04'	Copper	22	General	Past producer	Unknown	Ancient working.
	172	Samra	N 28° 13'	E 34° 21'	Copper	16,22,30	General	Past producer	Unknown	Ancient working.

APPENDIX B: PAST PRODUCING MINERAL PROPERTIES IN EGYPT.

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	COMMENTS
	173	Gabal Darah	N 28° 00'	E 33° 05'	Copper	22	General	Past producer	Unknown	Ancient working.
G	174	Hammama	N 26° 31'	E 33° 14'	Gold	22	General	Past producer	Unknown	Ancient working.
G	175	Ereidiya	N 26° 20'	E 33° 31'	Gold	22,30	General	Past producer	Unknown	Worked in 1904, then in the 1940's.
G	176	Alallah El Mur	N 26° 11'	E 33° 25'	Gold	22	General	Past producer	Unknown	Ancient working.
G	177	Alalla	N 26° 10'	E 33° 30'	Gold	22,30	General	Past producer	Unknown	Worked during 1914-1918.
G	178	Fawakhir	N 26° 02'	E 33° 33'	Gold	22	General	Past producer	Unknown	Worked during 1946-1954.
	179	El Maasara	N 25° 30'	E 29° 01'	Ochre	22	General	Past producer	Surface	Exploited on a small scale.
H	180	Gabal Dungash	N 24° 48'	E 33° 58'	Chromite	22	General	Past producer	Unknown	Small scale mining.
H	181	Zug El Behar	N 24° 57'	E 34° 20'	Lead zinc	16,22	General	Past producer	Unknown	Ancient mine. Lead content 1.6-2.5% Pb.
H	182	Wadi Essel	N 24° 55'	E 34° 21'	Lead zinc	16,22	General	Past producer	Unknown	Ancient mine.
H	183	El Atawi	N 25° 40'	E 34° 10'	Copper	16,22,30	General	Past producer	Unknown	Ancient working.
	184	Wadi El Gemal	N 24° 38'	E 34° 52'	Copper lead, zinc	16,22	General	Past producer	Unknown	Ancient working. Four sites.
K	185	Meialeik	N 24° 13'	E 35° 13'	Manganese	16,22,30	General	Past producer	Unknown	Operated in 1956. Vein of 300m length.
K	186	Khashab	N 24° 15'	E 34° 23'	Gold	22	General	Past producer	Unknown	Ancient working.
J	187	Ras Benas	N 23° 59'	E 32° 36'	Copper, lead Zinc	16,22,30	General	Past producer	Unknown	Ancient working.
B	188	Mukattam	N 29° 58'	E 31° 18	Limestone	22	General	Past producer	Surface	Old quarry site.
C	189	Kafr El Elw	N 29° 45'	E 31° 20'	Clay	22	General	Past producer	Surface	Old quarry site.
	190	El Yahmum	N 29° 57'	E 31° 40'	Basalt	22	General	Past producer	Surface	Old quarry site.
D	191	El Shatt	N 29° 57'	E 32° 42'	Gypsum	22	General	Past producer	Surface	Old quarry site.
D	192	Wadi Rayana	N 29° 51'	E 32° 52'	Gypsum	16,22	General	Past producer	Surface	Old quarry site.
D	193	Sadat	N 29° 46'	E 32° 23'	Limestone	22	General	Past producer	Surface	Old quarry site.
D	194	Um Zeita	N 29° 49'	E 32° 12'	Limestone	22	General	Past producer	Surface	Old quarry site.
D	195	Akheidar	N 29° 41'	E 32° 15'	Limestone	22	General	Past producer	Surface	Old quarry site.

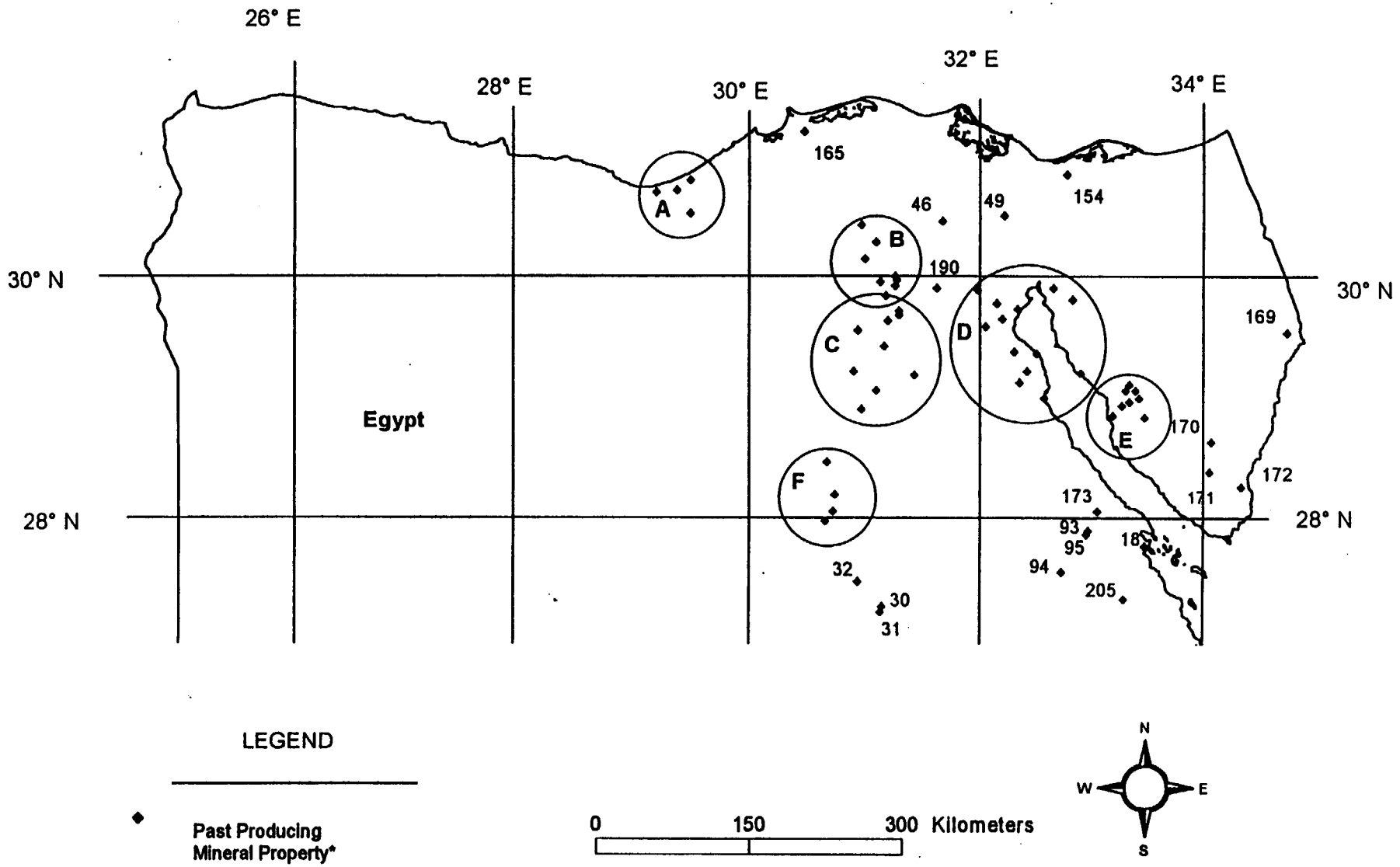
APPENDIX B: PAST PRODUCING MINERAL PROPERTIES IN EGYPT.

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	COMMENTS
D	196	Abu Sondouk	N 29° 24'	E 32° 21'	Kaolin	22	General	Past producer	Surface	Old quarry site.
E	197	Gharandal	N 29° 25'	E 33° 06'	Gypsum	22	General	Past producer	Surface	Old quarry site.
D	198	Gabal Thilmat	N 29° 00'	E 32° 37'	Limestone	22	General	Past producer	Surface	Old quarry site.
E	199	Farsh El Ghozlan	N 29° 07'	E 33° 22'	Kaolin	16,22	General	Past producer	Surface	Old quarry site.
E	200	El Khabouba	N 29° 04'	E 33° 25'	Glass sand	22	General	Past producer	Surface	Old quarry site.
E	201	Musabba Salama	N 29° 04'	E 33° 20'	Kaolin	16,22	General	Past producer	Surface	Old quarry site.
E	202	Budra	N 28° 56'	E 33° 18'	Kaolin	16,22,30	General	Past producer	Surface	Old quarry site.
E	203	Abu Natash	N 28° 58'	E 33° 22'	Kaolin	16,22,30	General	Past producer	Surface	Old quarry site.
E	204	Wadi Sidri	N 28° 51'	E 33° 13'	Gypsum	22	General	Past producer	Surface	Old quarry site.
	205	Gabal El Dokhan	N 27° 15'	E 33° 19'	Stone	22	General	Past producer	Surface	Site of old pits.
G	206	Um Esh El Hamra	N 26° 02'	E 33° 40'	Talc	22	General	Past producer	Surface	Produced in 1979.
I	207	El Kelh	N 25° 05'	E 32° 58'	Limestone	22	General	Past producer	Surface	Produced in 1979.
I	208	El Atwani	N 25° 03'	E 32° 59'	Sandstone	22	General	Past producer	Surface	Produced in 1979.
I	209	Redysia North	N 24° 57'	E 32° 58'	Sandstone	22	General	Past producer	Surface	Produced in 1979.
I	210	El Sirag	N 24° 54'	E 32° 59'	Sandstone	22	General	Past producer	Surface	Produced in 1979.
I	211	Silwa North	N 24° 45'	E 33° 00'	Sandstone	22	General	Past producer	Surface	Produced in 1979.
I	212	Faris	N 24° 33'	E 32° 51'	Sandstone	22	General	Past producer	Surface	Produced in 1979.
J	213	Unnamed	N 24° 02	E 32° 43'	Clay	16,22	General	Past producer	Surface	Reserves of 8.5Mmt.
J	214	Unnamed	N 24° 01'	E 32° 57'	Feldspar	22	General	Past producer	Surface	Produced in 1979.
J	215	El Misalla	N 24° 01'	E 33° 00'	Granite	22	General	Past producer	Surface	Produced in 1979.
H	216	Wadi Um Huqab	N 24° 58'	E 34° 01'	Talc	22	General	Past producer	Surface	Produced in 1979.
H	217	Gabal Urf Abu Hama	N 24° 45'	E 34° 01'	Barite	22	General	Past producer	Surface	Produced in 1979.
K	218	Gabal Zabara	N 24° 45'	E 34° 41'	Emeralds	22	General	Past producer	Surface	Ancient workings.
K	219	Gabal Sikait	N 24° 42'	E 34° 49'	Fluorspar Emeralds	22	General	Past producer	Surface	Ancient workings.
K	220	Ranga	N 24° 25'	E 35° 10'	Sulfur, gypsum	22	General	Past producer	Surface	Ancient working.

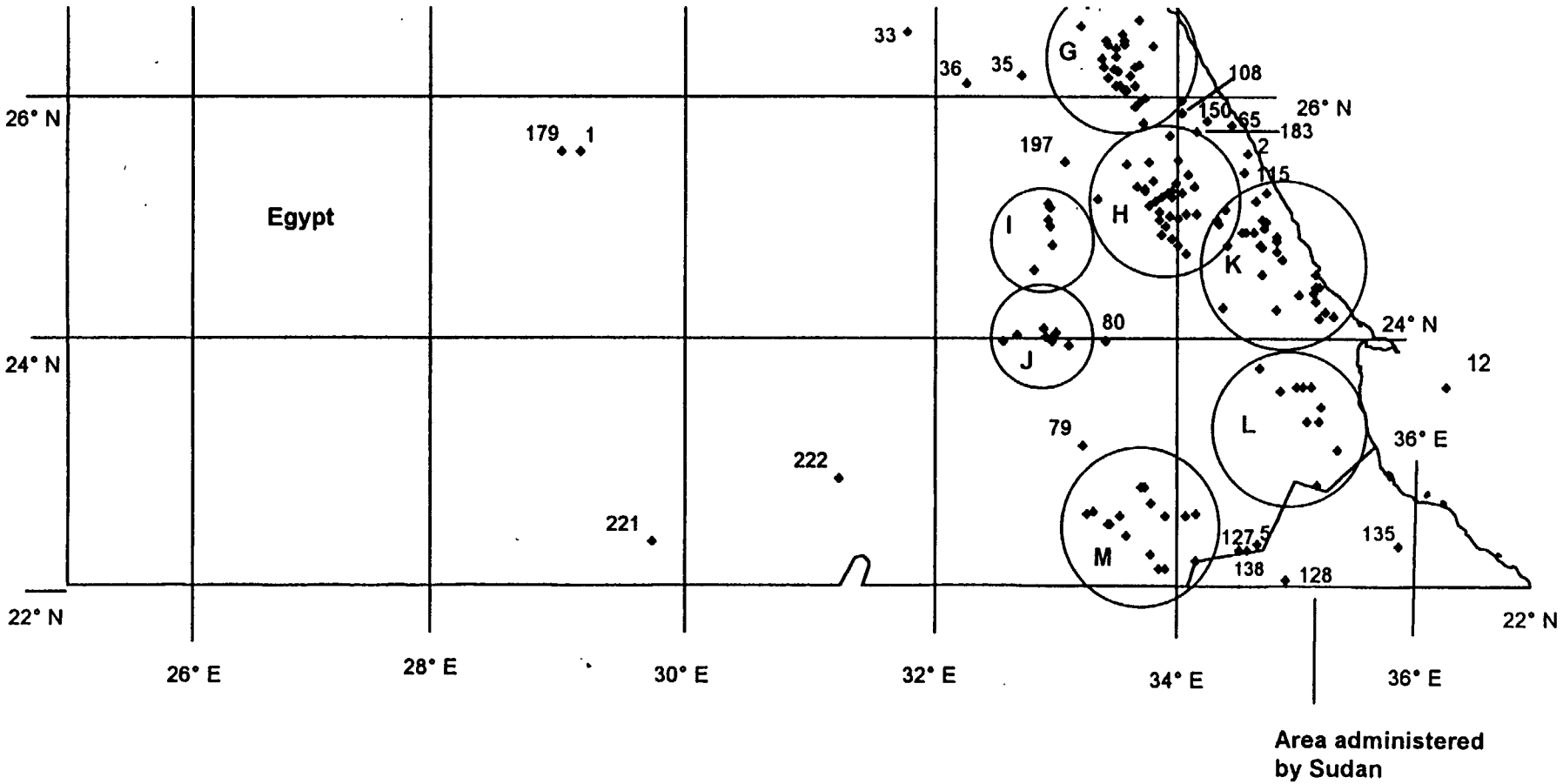
APPENDIX B: PAST PRODUCING MINERAL PROPERTIES IN EGYPT.

MAP KEY (1)	NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	COMMENTS
15 221	Bir El Shab	N 22° 21'	E 29° 45'	Alum	22	General	Past producer	Surface	Exploited since ancient times. Reserves 200kt (1979).
15 222	Chefren	N 22° 52'	E 31° 16'	Gneiss, feldspar, amethyst	22	General	Past producer	Surface	Ancient workings.

(1) Represents property or property grouping as defined in Appendix maps A-2 and A-3.
(2) Due to software limitations, site names do not include any diacritical markings. Spelling of individual site names vary considerably by source.
(3) Complete list of data sources found in Appendix D.
(4) General - denotes limited data; Confirmed - denotes deposit information confirmed by several sources.
(5) Because of the varying age of source information, the status of individual sites may not be current.



APPENDIX MAP A-2: PAST PRODUCING MINERAL PROPERTIES OF NORTHERN EGYPT



APPENDIX MAP A-3: PAST PRODUCING MINERAL PROPERTIES OF SOUTHERN EGYPT

APPENDIX C: PROSPECTS AND NON PRODUCING MINERAL PROPERTIES IN EGYPT.

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	COMMENTS
	1	Qum Wadi El Mashash	N 25° 45'	E 33° 03'	Phosphate	1,2	General	Deposit	Surface	35-65% P2O5
	2	Hamama	N 25° 42'	E 33° 45'	Phosphate	1,2	General	Deposit	Surface	35-65% P2O5
G	3	Wadi Gasus	N 26° 34'	E 34° 02'	Lead	1	General	Deposit	Unknown	Small deposit, low grade. Host rock is limestone.
J	4	Wadi Hamr	N 24° 00'	E 33° 00'	Lead	1	General	Deposit	Unknown	Small deposit, low grade. Host rock is schist.
	5	Zebirget	N 23° 37'	E 36° 12'	Nickel	1	General	Deposit	Surface	Vein width averages 2-3 feet, exposed for 50m. Ni content 5-9%.
K	6	Abu Hamamid	N 24° 10'	E 34° 30'	Copper	1	General	Deposit	Surface	Occurrence.
	7	Belih	N 32° 52'	E 27° 05'	Molybdenite	1	General	Deposit	Surface	Occurrence.
G	8	Fatira	N 33° 03'	E 26° 50'	Talc	1	General	Deposit	Surface	Occurrence.
	9	Urf	N 27° 50'	E 32° 40'	Barite	1	General	Deposit	Surface	Occurrence.
	10	El Helz	N 28° 03'	E 28° 37'	Iron	2,16,22,30	General	Deposit	Surface	El Helz res: 39Mmt @ 25% Fe, SiO2 up to 40%. Part of Baharlya Oasis. Ferruginous sandstone.
F	11	Zelt	N 27° 56'	E 33° 30'	Potash	2	General	Deposit	Surface	250 sq. km. on west coast of Gulf of Suez.
F	12	Abu Nigar	N 27° 40'	E 33° 20'	Potash	2	General	Deposit	Surface	100 km. south of Zelt
G	13	El Eredlya	N 26° 20'	E 33° 28'	Uranium	2,4	General	Deposit	Underground	Ore in granitic fracture zones.
	14	El Missikat	N 26° 24'	E 33° 24'	Uranium	2,4	General	Deposit	Underground	Ore in granitic fracture zones. Discovered in 1982 by geophysical aomaly.
	15	Darhib Darheib	N 24° 01'	E 35° 01'	Zinc, Copper Lead	2,16,22	General	Deposit	Underground	Ore in basalt, andesite, and rhyolite. Assay of 0.3-6.3% Zn, 0.1-9.5% Cu, 0.08-2.5% Pb.
	16	Abu Gurdi	N 23° 59'	E 35° 05'	Zinc, Copper Lead	2,22	General	Deposit	Underground	Ore in basalt, andesite, and rhyolite. Assay of 3.2-21% Zn, .3-3.7% Cu, 0.3-2.8% Pb.
	17	Egat Elgat	N 24° 02'	E 35° 03'	Zinc, Copper Lead	2,22	General	Deposit	Underground	Ore in basalt, andesite, and rhyolite. Assay of 0.1-9.2% Zn,0.7-7.2% Cu, 0.02-1.1% Pb.
	18	Gabal Atawi	N 25° 37'	E 34° 10'	Zinc, Copper Lead, Niobium	2,22	General	Deposit	Underground	Occurrence.
	19	Abu Dabbab	N 25° 20'	E 34° 32'	Niobium Tantalum Tin, Tungsten	2,4,17,22,30	Confirmed	Deposit	Surface	Disseminations in granites. Res: 46.85Mmt @ 13000t Ta2O5, 5500t Nb2O5, and 0.108% Sn. Ratio of Ta:Nb is 1:2. Res: 10Mmt , containing 2800 tonsTa2O5 and 800 tons Na2O5. (1976) 58 veins known to contain tin and tungsten.

APPENDIX C: PROSPECTS AND NON PRODUCING MINERAL PROPERTIES IN EGYPT.

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	COMMENTS
	20	Nuweibi	N 25° 12'	E 34° 30'	Niobium Tantalum tin, tungsten	2,4,17,22,30	Confirmed	Deposit	Surface	Two ore zones: 1- 31.9Mmt @ 0.017% Ta2O5. 2- 82.8Mmt @ 0.015% Ta2O5. Ta:Nb ratio 1.8:1. Res (1982): 70Mmt ore containing 13000 tons Ta2O5 and 7600 tons Nb2O5. Discovered in 1944.
	21	Hamr Waggad	N 25° 11'	E 34° 21'	Tin, niobium Tantalum	2,4,22	General	Deposit	Unknown	Occurrence.
	22	Um Naggat	N 25° 30'	E 34° 11'	Niobium Tantalum	2,22	General	Deposit	Unknown	Ore in granites contain 0.022% Ta2O5 & 0.02% Nb2O5.
	23	Maryut	N 31° 12'	E 30° 02'	Gypsum	2,4,13,22,30	General	Deposit	Surface	Ore in lake basin. Friable beds about 80cm thick overlain by salt.
	24	Maryut	N 31° 02'	E 29° 46'	Limestone	22	General	Deposit	Surface	Occurrence.
	25	Bardawell	N 31° 10'	E 33° 10'	Gypsum	2	General	Deposit	Surface	Ore in lake basin.
	26	Alamein	N 30° 50'	E 28° 57'	Gypsum	2	General	Deposit	Surface	Salts in depression along coast.
	27	Mersa Matruh	N 31° 12'	E 27° 12'	Gypsum	2,22	General	Deposit	Surface	Salts in depression along coast.
B	28	Buquirat Bugeirat	N 29° 23'	E 30° 22'	Gypsum	2,16,22	General	Deposit	Surface	Alluvium deposits.
	29	Abu El Daraz	N 29° 38'	E 32° 17'	Glass sand	2,4	General	Deposit	Surface	Res: 4.1Mmt. Assay 98.5% SiO2, 0.3-0.5% Fe2O3.
	30	El Arish	N 31° 08'	E 33° 48'	Glass sand	2	General	Deposit	Surface	Location approximate.
	31	Wadi El Shaghab	N 25° 20'	E 33° 27'	Phosphate	2,22	General	Deposit	Surface	Nile Valley Phosphate district contains 1.5Bmt. Site reserves 495Mmt (1979).
G	32	Gebel El Gir Qena	N 26° 06	E 33° 09'	Phosphate	2,17,22	General	Deposit	Surface	Nile Valley Phosphate district contains 1.5Bmt. Site reserves 44Mmt (1979).
G	33	Wadi Serri	N 26° 12'	E 33° 11'	Phosphate	2,22	General	Deposit	Surface	Nile Valley Phosphate district contains 1.5Bmt. Site reserves 50Mmt (1979).
G	34	Gebel Abu Had	N 26° 30'	E 33° 14'	Phosphate	2,22	General	Deposit	Surface	Nile Valley Phosphate district contains 1.5Bmt. Site reserves 317Mmt (1979).
	35	Ayun Musa	N 29° 50'	E 32° 45'	Coal Salt	2,4,28,30	General	Deposit	Underground	Res: 36.8Mmt. Discovered in 1946 Two seams; max thickness of upper seam 120cm. Lower horizon consists of 1 seam 20-120cm thick. Salt produced for the manufacture of drilling muds. Coal at depth of 420-620m.
	36	Wadi Buda Wadi Thora	N 29° 10'	E 33° 20'	Coal	2,22,30	General	Deposit	Underground	Res: 75Mmt of carbonaceous shale. Hi ash content.
	37	Umm Ashira	N 23° 30'	E 35° 03'	Gold	3	General	Deposit	Unknown	Occurrence.

APPENDIX C: PROSPECTS AND NON PRODUCING MINERAL PROPERTIES IN EGYPT.

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	COMMENTS
G	38	Boniog	N 26° 25'	E 33° 28'	Gold	3	General	Deposit	Unknown	Occurrence.
	39	Eredia	N 26° 22'	E 33° 24'	Gold	3,16	General	Deposit	Unknown	Occurrence.
G	40	Atalla El Morr	N 26° 11'	E 33° 30'	Gold	3	General	Deposit	Unknown	Occurrence.
G	41	Kab El Abyad	N 26° 12'	E 33° 35'	Gold	3	General	Deposit	Unknown	Occurrence.
G	42	Abu Marwat	N 26° 30'	E 33° 40'	Gold, silver copper, zinc	3,24	General	Deposit	Unknown	Minex Elploration drilling on site. As of 1989, reserves of 308kt @ 5.5g/t Au, 63.2g/t Ag, 0.61% Cu and 2.28% Zn defined.
	43	Sabahia	N 24° 51'	E 34° 45'	Gold	3	General	Deposit	Unknown	Occurrence.
	44	Hamash Um Hagalig Um Hamr	N 24° 40'	E 34° 04'	Gold	3,4	General	Deposit	Unknown	Occurrence in granodiorite. Quartz vein several hundred m long, 50-70cm thick. Workings to depth of 60m.
G	45	Wadi Gasus	N 26° 32'	E 33° 54'	Gold	3	General	Deposit	Unknown	Occurrence.
	46	Sherm El Bahari	N 25° 48'	E 34° 16'	Gold	3,22	General	Deposit	Unknown	Occurrence.
	47	Umm Tundeba	N 24° 55'	E 34° 45'	Gold	3	General	Deposit	Unknown	Occurrence.
	48	Lewewi	N 24° 46'	E 34° 45'	Gold	3	General	Deposit	Unknown	Occurrence.
	49	Kab El Rayan	N 24° 21'	E 35° 07'	Gold	3	General	Deposit	Unknown	Occurrence.
	50	Wadi Lawi	N 24° 50'	E 34° 47'	Chromite	4,22	General	Deposit	Unknown	10 lenses in talc-carbonate, med. grade ore.
	51	Wadi Um Khariga	N 25° 02'	E 34° 42'	Chromite	4,22	General	Deposit	Unknown	4 lenses, 350 tons, 35% Cr2O3.
	52	Wadi El Nakari	N 24° 51'	E 34° 50'	Chromite	4	General	Deposit	Unknown	Occurrence.
K	53	Wadi Khashab	N 24° 22'	E 34° 22'	Chromite	4	General	Deposit	Unknown	Occurrence.
	54	Umm Kabu	N 24° 34'	E 34° 56'	Chromite	4	General	Deposit	Unknown	Occurrence.
	55	Wadi Gerf	N 24° 57'	E 34° 49'	Chromite	4,22	General	Deposit	Unknown	Occurrence.
	56	El Geneina	N 23° 57'	E 34° 37'	Copper Nickel	4,22	General	Deposit	Unknown	Gossan with copper and nickel discovered in 1973.
	57	Abu Nimr	N 24° 36'	E 34° 46'	Corundum	4	General	Deposit	Surface	Occurrence.
K	58	Gabbro Akarem	N 24° 00'	E 34° 11'	Copper Nickel	4,22,23,30	General	Deposit	Unknown	Peridotite mass with 270kt @ 1.18 Ni+Cu and 700 kt @ 0.95% Ni+Cu. Detected in 1972.
	59	Wadi El Miyah	N 25° 17'	E 34° 00'	Titanium Iron	4,16	General	Deposit	Unknown	Two lenses in gabbro
	60	Abu Khrug	N 24° 39'	E 34° 16'	Nepheline Syenite (Al,Na,K,Cement)	4,16,22	General	Deposit	Surface	Res: 26Mmt @ 21.63% Al2O3.

APPENDIX C: PROSPECTS AND NON PRODUCING MINERAL PROPERTIES IN EGYPT.

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	COMMENTS
N	61	Um Garayat Helmur	N 22° 40'	E 33° 29'	Copper	4,22	General	Deposit	Unknown	3km southeast of Umm Garlat gold mine. Porphyry copper in granodiorite.
F	62	Gabal Gattar	N 27° 05'	E 33° 16'	Molybdenite	4,22,30	General	Deposit	Underground	Zone of veins 25m wide and 500m long. Ore in quartz veins and disseminated in granite. Res: 2500 tons @ 2.25% Mo. Prospected during the 1930's and 1940's.
F	63	Abu Marwa	N 27° 20'	E 33° 09'	Molybdenite	4,22,30	General	Deposit	Underground	Occurrence.
F	64	Abu Harba	N 27° 18'	E 33° 13'	Molybdenite	4,22,30	General	Deposit	Underground	Occurrence. Prospected during the 1930's and 1940's.
F	65	Um Disi	N 27° 00'	E 33° 31'	Molybdenite	4,22,30	General	Deposit	Underground	Occurrence.
K	66	Homr Akarem	N 24° 11'	E 34° 05'	Tin, Molybdenite Bismuth, Copper Niobium, Beryl	4,22,30	General	Deposit	Underground	Ore in zone 1100m x 800m in granite. Ore low grade @ 0.031% Mo. Res (1982) 8Mmt @ 0.3% Mo, but 300m below surface.
	67	Wadi Hafia Wadi Um Barh	N 24° 53'	E 34° 08'	Tin, Molybdenite Bismuth, Copper Beryllium	4,22	General	Deposit	Underground	Ore in zone 500m x 300m in granite. Ore low grade @ 0.03% Mo, 0.008% Sn, & 0.02% Cu, Be, and Bi.
F	68	Abu Hamad	N 27° 29'	E 33° 15'	Tungsten	4,22,30	General	Deposit	Surface	14 veins associated with granite. Discovered in 1931.
G	69	Fatira El Belda	N 26° 48'	E 33° 20'	Tungsten	4,22,30	General	Deposit	Surface	Large number ov veins up to 500m long, 10-30cm thick.
G	70	Abu Kharif	N 26° 48'	E 33° 25'	Tungsten	4,22,30	General	Deposit	Surface	Two sets of quartz veins associated with granite.
G	71	El Dob	N 26° 27'	E 33° 28'	Tungsten Molybdenite	4,22,30	General	Deposit	Surface	Series of small veins associated with granite.
	72	Um Bisilla	N 25° 21'	E 34° 01'	Tungsten	4,22,30	General	Deposit	Surface	50 small veins in greywacke.
O	73	Gash Amer	N 22° 18'	E 36° 12'	Tungsten	4,22,30	General	Deposit	Surface	Occurrence.
	74	Abu Rusheid	N 24° 37'	E 34° 46'	Niobium Tantalum	4,22	General	Deposit	Unknown	Nb2O5:Ta2O5 ratio 5:1. Thickness and grade decreases with depth. Res: 90kt Nb2O5 and 13kt Ta2O5 @ 0.02% Ta2O5.
K	75	Homret Mikbid	N 24° 10'	E 34° 23'	Beryl	4	General	Deposit	Surface	Ore as alterations in granite and small pegmatite veins.
G	76	El Atshan	N 26° 07'	E 34° 05'	Uranium	4,30	General	Deposit	Unknown	Early occurrence.
	77	Um Dowella	N 22° 17'	E 33° 26'	Uranium	4	General	Deposit	Unknown	Dike extends 10.6km, is 2-20m thick.
	78	Ranga	N 24° 27'	E 35° 12'	Sulfur	4	General	Deposit	Unknown	Occurrence.
	79	Bent Abu Geraiya	N 30° 26'	E 34° 01'	Graphite	4	General	Deposit	Unknown	Occurrence.

APPENDIX C: PROSPECTS AND NON PRODUCING MINERAL PROPERTIES IN EGYPT.

	MAP KEY (1)	NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	COMMENTS
	80	Wadi Sitra	N 28° 42'	E 26° 54	Graphite	4	General	Deposit	Unknown	Occurrence.
G	81	Abu Marawat	N 26° 31'	E 33° 39'	Iron	4,16,22	General	Deposit	Unknown	Banded iron formation. Ore bands 3-17m thick in tuff. Res: 6.5Mmt @ 44.4% Fe.
	82	Wadi Karim Wadi Kareem	N 25° 54'	E 34° 09'	Iron	4,16,22,30	General	Deposit	Unknown	Banded iron formation. Four seams in metasedimentary 130m section. Minable ore 17.8Mmt @ 44-45% Fe.
	83	Wadi El Dabbah	N 25° 45'	E 34° 13'	Iron	4,16,22,30	General	Deposit	Unknown	Banded iron formation. Ore bands up to 10m thick. Minable ore 6.1Mmt @ 39-43.8+% Fe.
	84	Um Khamis El Zarga Um Ghamis	N 25° 34'	E 34° 17'	Iron	4,16,22,30	General	Deposit	Unknown	Banded iron formation. Small (<1.5m) bands in greenschists. Res: 3Mmt @ 40-41% Fe.
	85	Gabal El Hadid	N 25° 21'	E 34° 08'	Iron	4,16,22	General	Deposit	Unknown	Banded iron formation. Ore bands in chert. Minable reserves 2.15Mmt @ 43-47% Fe.
	86	Um Nar	N 25° 18'	E 34° 15'	Iron	4,16,22	General	Deposit	Unknown	Banded iron formation. Nine groups of bands in schist. Minable ore reserves 13.7Mmt @ 40.51-45.5% Fe.
	87	Damietta	N 31° 32'	E 31° 51'	Black sand REO	22,30	General	Deposit	Surface	Occurrence.
	88	El Arish	N 31° 09'	E 33° 40'	Black sand REO	22,30	General	Deposit	Surface	Preliminary field work done in 1970's.
B	89	Gabal Qatrani	N 29° 38'	E 30° 37'	Uranium	22,30	General	Deposit	Surface	Uranium in 3 forms; black shales, phospatic deposits, and sandstone.
	90	Tabaket Ali	N 29° 20'	E 32° 25'	Iron	22	General	Deposit	Surface	Occurrence.
	91	Wadi Arabah	N 29° 07'	E 32° 39'	Manganese Copper	22,30	General	Deposit	Unknown	Res: 4kt @ 20-65% Mn.
E	92	Abu Suweira	N 28° 56'	E 33° 38'	Copper	22	General	Deposit	Unknown	Occurrence.
E	93	Abu Rudeib	N 28° 55'	E 33° 35'	Copper	22	General	Deposit	Unknown	Occurrence.
E	94	Rashadia	N 28° 54'	E 33° 31'	Copper	22	General	Deposit	Unknown	Occurrence.
E	95	Abu Zagatan	N 28° 51'	E 33° 30'	Copper	22	General	Deposit	Unknown	Occurrence.
E	96	Tawilleh	N 28° 50'	E 33° 32'	Copper	22	General	Deposit	Unknown	Occurrence.
E	97	Abu El Nimrah	N 28° 48'	E 33° 36'	Copper	22,30	General	Deposit	Unknown	Occurrence.
E	98	Tarfa	N 28° 50'	E 33° 38'	Copper	22	General	Deposit	Unknown	Occurrence.
E	99	Tarr	N 28° 45'	E 33° 36'	Copper	22	General	Deposit	Unknown	Occurrence.
E	100	Feiran	N 28° 42'	E 33° 39'	Copper	22	General	Deposit	Unknown	Occurrence.

APPENDIX C: PROSPECTS AND NON PRODUCING MINERAL PROPERTIES IN EGYPT.

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	COMMENTS
F	101	Wadi Dib	N 27° 50'	E 33° 15'	Molybdenum	22,30	General	Deposit	Unknown	Occurrence.
F	102	Wadi Abu Trief	N 27° 26'	E 33° 33'	Manganese	22	General	Deposit	Unknown	Small reserves.
F	103	Wadi Abu Shaar El Quibli	N 27° 22'	E 33° 34'	Manganese	22	General	Deposit	Unknown	Discovered in 1912. Small reserves.
F	104	Wadi Abu Dheiss El Bahari	N 27° 20'	E 33° 33'	Manganese	22	General	Deposit	Unknown	Occurrence.
F	105	Wadi Hammad	N 27° 07'	E 32° 59'	Lead, zinc	22	General	Deposit	Unknown	Occurrence.
G	106	Barrud	N 26° 51'	E 33° 36'	Copper	22	General	Deposit	Unknown	Occurrence.
G	107	El Bleida	N 26° 44'	E 33° 24'	Molybdenum	22	General	Deposit	Unknown	Occurrence.
G	108	Gabal Dob	N 26° 44'	E 33° 33'	Molybdenum	22	General	Deposit	Unknown	Occurrence.
G	109	Umm Taghir Um Tagher	N 26° 43'	E 33° 37'	Copper	22	General	Deposit	Unknown	Occurrence.
G	110	Mabari	N 26° 42'	E 33° 48'	Copper	22	General	Deposit	Unknown	Occurrence.
G	111	Abu Furad Abu Farad	N 26° 40'	E 33° 37'	Iron	22	General	Deposit	Unknown	Occurrence.
G	112	El Wahera	N 26° 28'	E 33° 44'	Copper	22	General	Deposit	Unknown	Occurrence.
G	113	Kab Um El Ab	N 26° 21'	E 33° 40'	Iron	22	General	Deposit	Unknown	Occurrence.
G	114	Abu Hayaa	N 26° 20'	E 33° 50'	Copper	22	General	Deposit	Unknown	Occurrence.
G	115	Kab Amiri	N 26° 17'	E 33° 38'	Niobium Tin	22	General	Deposit	Unknown	Rare earth content of Nb 0.02% Nb, 0.02% Sn.
G	116	Talet El Gri	N 26° 17'	E 33° 42'	Iron	22	General	Deposit	Unknown	Occurrence.
G	117	Um Selimat	N 26° 15'	E 33° 43'	Copper	22	General	Deposit	Unknown	Occurrence.
G	118	Wadi Abu Diwan	N 26° 10'	E 33° 53'	Iron	22	General	Deposit	Unknown	Reserves: 36Mmt @ 37% Fe.
G	119	Sodmein	N 26° 10'	E 33° 48'	Chromite	22	General	Deposit	Unknown	Occurrence.
G	120	Abu Ziran	N 26° 04'	E 33° 56'	Niobium Tantalum	22	General	Deposit	Unknown	Occurrence.
	121	Sharm El Sheikh	N 27° 55'	E 34° 15'	Manganese	22,30	General	Deposit	Unknown	Small reserves. Bed thickness 4m.
	122	Abu Marwa	N 25° 03'	E 33° 43'	Chromite	22	General	Deposit	Unknown	Occurrence.
	123	Abu Rakeb	N 24° 55'	E 34° 10'	Iron	22	General	Deposit	Unknown	Occurrence.
	124	Wadi El Hindusi	N 24° 53'	E 34° 10'	Iron	22	General	Deposit	Unknown	Occurrence.

APPENDIX C: PROSPECTS AND NON PRODUCING MINERAL PROPERTIES IN EGYPT.

MAP KEY (1)	NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	COMMENTS
125	Wadi Wizr	N 25° 45'	E 34° 25'	Lead zinc	16,22	General	Deposit	Unknown	Occurrence.
126	Abu Ghorban	N 25° 38'	E 34° 29'	Ochre	22	General	Deposit	Surface	Occurrence.
127	Abu Anz	N 25° 34'	E 34° 33'	Lead zinc	16,22	General	Deposit	Unknown	Res: 0.3Mmt.
128	Wadi Um Shaddad	N 25° 40'	E 34° 19'	Iron	22	General	Deposit	Unknown	Occurrence.
129	Wadi Sitra	N 25° 36'	E 34° 12'	Chromite	22	General	Deposit	Unknown	Occurrence.
130	El Atawi	N 25° 27'	E 34° 10'	Niobium Tantalum	22	General	Deposit	Unknown	Occurrence.
131	Wadi Sitra Gebel El Hadid	N 25° 27'	E 34° 15'	Iron	16,22	General	Deposit	Unknown	Occurrence.
132	Siwiqat El Soda	N 25° 08'	E 34° 45'	Lead, zinc	22	General	Deposit	Unknown	Occurrence.
133	Gabal Mudargag	N 24° 55'	E 34° 20'	Chromite	22	General	Deposit	Unknown	Occurrence.
134	Um Hamr	N 24° 41'	E 34° 06'	Copper	22	General	Deposit	Unknown	Occurrence.
135	Wadi Um El Kheiran	N 24° 37'	E 34° 50'	Niobium Tantalum	22	General	Deposit	Unknown	Occurrence.
136	Wadi El Sharm	N 24° 43'	E 35° 00'	Niobium Tantalum	22	General	Deposit	Unknown	Occurrence.
137	Wadi Um Kareim	N 24° 26'	E 35° 00'	Copper	22	General	Deposit	Unknown	Occurrence.
138	Wadi Um Salama	N 24° 23'	E 35° 03'	Copper	22	General	Deposit	Unknown	Occurrence.
139	Wadi Heleifi	N 24° 21'	E 35° 08'	Copper	22	General	Deposit	Unknown	Occurrence.
140	Wadi Sarabi	N 24° 20'	E 35° 07'	Copper	22	General	Deposit	Unknown	Occurrence.
141	Wadi Abu Ghusun	N 24° 20'	E 34° 53'	Copper	22	General	Deposit	Unknown	Occurrence.
142	Um Effein	N 24° 09'	E 35° 04'	Titanium	16,22,30	General	Deposit	Unknown	Occurrence.
143	El Aswad	N 23° 10'	E 27° 30'	Iron	22	General	Deposit	Unknown	Occurrence.
144	El Arbaein	N 23° 06'	E 30° 11'	Iron	22	General	Deposit	Unknown	Occurrence.
145	Kalabsha	N 23° 32'	E 32° 49'	Iron	22	General	Deposit	Unknown	Submerged by Aswan High Dam.water.
146	Garf Hussein	N 23° 20'	E 32° 50'	Iron	22	General	Deposit	Unknown	Submerged by Aswan High Dam water.
147	South Kalabsha	N 23° 20'	E 32° 22'	Iron	22	General	Deposit	Unknown	Submerged by Aswan High Dam water.
148	Korosko	N 22° 35'	E 32° 25'	Iron	22	General	Deposit	Unknown	Submerged by Aswan High Dam water.
149	Abu Simbel	N 22° 20'	E 31° 47'	Iron	22	General	Deposit	Unknown	Submerged by Aswan High Dam water.
150	Bir Hassin	N 23° 05'	E 31° 14'	Iron	22	General	Deposit	Unknown	Discovered in 1966.

APPENDIX C: PROSPECTS AND NON PRODUCING MINERAL PROPERTIES IN EGYPT.

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	COMMENTS
O	151	Gabal Tuyur	N 22° 42'	E 35° 43'	Manganese	22	General	Deposit	Unknown	Occurrence.
O	152	Hamra Dome	N 22° 36'	E 35° 48'	Titanium	16,22,30	General	Deposit	Unknown	Occurrence.
O	153	Dlib	N 22° 28'	E 35° 59'	Manganese	22	General	Deposit	Unknown	Occurrence.
	154	Mersa Matruh	N 31° 12'	E 27° 19'	Limestone	22	General	Deposit	Surface	Occurrence.
	155	Abu Sir	N 30° 58'	E 29° 46'	Limestone	22	General	Deposit	Surface	Occurrence.
	156	Ismailia	N 30° 28'	E 32° 19'	Salt	22	General	Deposit	Surface	Occurrence.
A	157	Dar El Belda	N 30° 03'	E 31° 51'	Basalt	22	General	Deposit	Surface	Occurrence.
A	158	Unnamed	N 30° 03'	E 31° 36'	Basalt	22	General	Deposit	Surface	Occurrence.
A	159	Unnamed	N 30° 06'	E 31° 30'	Glass sand	22	General	Deposit	Surface	Occurrence.
	160	Minkar El Munkhafad	N 29° 19'	E 26° 39'	Celestite	22	General	Deposit	Surface	Occurrence.
B	161	Dimiya	N 29° 31'	E 30° 34'	Diatomite	22	General	Deposit	Surface	Occurrence.
B	162	Abu Gandir	N 29° 14'	E 30° 41'	Sand	22	General	Deposit	Surface	Occurrence.
B	163	El Masakhit	N 29° 10'	E 30° 30'	Limestone, diatomite	22	General	Deposit	Surface	Occurrence.
B	164	Dindial	N 29° 10'	E 30° 59'	Limestone	22	General	Deposit	Surface	Occurrence.
B	165	Gabal El Nolon	N 29° 06'	E 30° 51'	Limestone	22	General	Deposit	Surface	Occurrence.
B	166	Dashasha	N 28° 58'	E 30° 47'	Limestone	22	General	Deposit	Surface	Occurrence.
B	167	El Fashn	N 28° 49'	E 30° 54'	Limestone Clay	22	General	Deposit	Surface	Occurrence.
C	168	Gabal Karara	N 28° 37'	E 30° 56'	Limestone	22	General	Deposit	Surface	Occurrence.
C	169	El Edwa	N 28° 40	E 30° 35'	Limestone	22	General	Deposit	Surface	Occurrence.
C	170	El Bahnasa	N 28° 30'	E 30° 33'	Limestone, basalt	22	General	Deposit	Surface	Occurrence.
C	171	Nazlet Amer	N 28° 28'	E 30° 54'	Limestone	22	General	Deposit	Surface	Occurrence.
C	172	Sheikh Hassan	N 28° 25'	E 30° 54'	Alabaster	22	General	Deposit	Surface	Occurrence.
C	173	Gabal El Teir	N 28° 12'	E 30° 50'	Limestone	22	General	Deposit	Surface	Occurrence.
C	174	Shousha	N 28° 15'	E 30° 31'	Limestone	22	General	Deposit	Surface	Occurrence.
C	175	Abu Rouh	N 28° 19'	E 30° 24'	Limestone	22	General	Deposit	Surface	Occurrence.
C	176	Zawyat Sultan	N 28° 04'	E 30° 52'	Limestone	22	General	Deposit	Surface	Occurrence.

APPENDIX C: PROSPECTS AND NON PRODUCING MINERAL PROPERTIES IN EGYPT.

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	COMMENTS
C	177	El Shourafa	N 28° 03'	E 30° 56'	Alabaster	22	General	Deposit	Surface	Occurrence.
A	178	Tibbin	N 29° 45'	E 31° 25'	Limestone	22	General	Deposit	Surface	Occurrence.
A	179	Bir El Fahm	N 29° 54'	E 31° 30'	Clay	22	General	Deposit	Surface	Occurrence.
	180	El Sukhna	N 29° 30'	E 32° 21'	Limestone, alabaster	22	General	Deposit	Surface	Occurrence.
	181	Ras Malarma	N 29° 30'	E 32° 50'	Gypsum	22	General	Deposit	Surface	Occurrence.
E	182	El Dehelssa	N 28° 55'	E 33° 20'	Kaolin	22	General	Deposit	Surface	Occurrence.
E	183	Gini	N 28° 53'	E 33° 22'	Kaolin	22	General	Deposit	Surface	Occurrence.
	184	Abu Durba	N 28° 28'	E 33° 22'	Sulfur	22	General	Deposit	Surface	Occurrence.
	185	Ras Gharib	N 28° 18'	E 33° 03'	Potassium salts	22	General	Deposit	Surface	Occurrence.
	186	Abu Swelra	N 28° 20'	E 33° 37'	Gypsum	22	General	Deposit	Surface	Occurrence.
	187	Wadi Araba	N 28° 59'	E 31° 58'	Limestone Clay	16,22	General	Deposit	Surface	Occurrence.
	188	Unnamed	N 29° 05'	E 31° 55'	Limestone	22	General	Deposit	Surface	Occurrence.
B	189	El Saff	N 29° 29'	E 31° 28'	Limestone	22	General	Deposit	Surface	Occurrence.
B	190	Gerza	N 29° 24'	E 31° 07'	Gypsum	22	General	Deposit	Surface	Occurrence.
B	191	Kremat	N 29° 19'	E 31° 27'	Alabaster, gypsum	22	General	Deposit	Surface	Occurrence.
B	192	Gabal Tarboul	N 29° 17'	E 31° 19'	Limestone	22	General	Deposit	Surface	Occurrence.
B	193	Abu Sir El Malaa	N 29° 13'	E 31° 04'	Clay limestone	22	General	Deposit	Surface	Occurrence.
B	194	Humrat Shybon	N 29° 07'	E 31° 20'	Limestone	22	General	Deposit	Surface	Occurrence.
B	195	Gabal Ghorab	N 28° 56'	E 31° 15'	Limestone	22	General	Deposit	Surface	Occurrence.
B	196	Gabal Mashash	N 28° 53'	E 31° 11'	Limestone	22	General	Deposit	Surface	Occurrence.
B	197	Wadi Ghayada	N 28° 53'	E 31° 01'	Limestone	22	General	Deposit	Surface	Occurrence.
D	198	El Amarna	N 27° 40'	E 30° 58'	Limestone	22	General	Deposit	Surface	Occurrence.
D	199	El Aouja	N 27° 30'	E 30° 40'	Limestone	22	General	Deposit	Surface	Occurrence.
D	200	Beni Korra	N 27° 25'	E 30° 56'	Limestone	22	General	Deposit	Surface	Occurrence.
D	201	Khashaba	N 27° 18'	E 30° 42'	Limestone	22	General	Deposit	Surface	Occurrence.
D	202	Beni Adi	N 27° 12'	E 30° 53'	Limestone	22	General	Deposit	Surface	Occurrence.

APPENDIX C: PROSPECTS AND NON PRODUCING MINERAL PROPERTIES IN EGYPT.

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	COMMENTS
D	203	Beni Ghalib	N 27° 08'	E 30° 59'	Limestone, clay	22	General	Deposit	Surface	Occurrence.
	204	Unnamed	N 26° 41'	E 30° 53'	Limestone	22	General	Deposit	Surface	Occurrence.
F	205	Wadi Dib	N 27° 50'	E 32° 58'	Marble	22	General	Deposit	Surface	Occurrence.
F	206	Gabal El Zeit	N 27° 54'	E 33° 30'	Sulfur, potassium salts	22	General	Deposit	Surface	Occurrence.
F	207	Homrat El Greigab	N 27° 45'	E 33° 19'	Amethyst	22	General	Deposit	Surface	Occurrence.
F	208	Abu Shaar	N 27° 23'	E 33° 39'	Diatomite	22	General	Deposit	Surface	Occurrence.
F	209	Wadi Bali	N 27° 20'	E 33° 30'	Celestite	22	General	Deposit	Surface	Occurrence.
F	210	Hurghada	N 27° 17'	E 33° 45'	Diatomite	22	General	Deposit	Surface	Occurrence.
F	211	Um Grouf	N 27° 08'	E 33° 05'	Asbestos	22	General	Deposit	Surface	Occurrence.
F	212	Drunka	N 27° 06'	E 33° 08'	Limestone	22	General	Deposit	Surface	Occurrence.
F	213	El Khwalid	N 27° 05'	E 33° 27'	Limestone	22	General	Deposit	Surface	Occurrence.
F	214	Hamamia	N 26° 57'	E 33° 30'	Limestone	22	General	Deposit	Surface	Occurrence.
F	215	El Zarabi	N 26° 58'	E 33° 13'	Limestone	22	General	Deposit	Surface	Occurrence.
G	216	Aghana	N 26° 50'	E 33° 20'	Limestone	22	General	Deposit	Surface	Occurrence.
G	217	Skil Saleh	N 26° 45'	E 33° 22'	Limestone	22	General	Deposit	Surface	Occurrence.
G	218	El Elsawiya	N 26° 37'	E 33° 52'	Limestone	22	General	Deposit	Surface	Occurrence.
	219	Wanina	N 26° 30'	E 31° 37'	Limestone	22	General	Deposit	Surface	Occurrence.
	220	Salama	N 26° 19'	E 31° 41'	Limestone	22	General	Deposit	Surface	Occurrence.
	221	El Arraba	N 26° 10'	E 31° 55'	Limestone	22	General	Deposit	Surface	Occurrence.
	222	El Tarif	N 26° 10'	E 32° 20'	Limestone	22	General	Deposit	Surface	Occurrence.
	223	El Twelrat	N 26° 09'	E 32° 43'	Clay	22	General	Deposit	Surface	Occurrence.
	224	El Deir	N 26° 05'	E 32° 48'	Clay	22	General	Deposit	Surface	Occurrence.
G	225	Wadi Hamara	N 26° 18'	E 33° 13'	Phosphate	22	General	Deposit	Surface	Site reserves 18Mmt (1979).
G	226	Fatiri	N 26° 48'	E 33° 25'	Jasper	22	General	Deposit	Surface	Occurrence.
G	227	Wadi Hamama	N 26° 21'	E 33° 13'	Breccia	22	General	Deposit	Surface	Occurrence.
G	228	Abu Gerida	N 26° 21'	E 33° 16'	Jasper	22	General	Deposit	Surface	Occurrence.

APPENDIX C: PROSPECTS AND NON PRODUCING MINERAL PROPERTIES IN EGYPT.

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	COMMENTS
G	229	Sodmein	N 26° 09'	E 33° 40'	Asbestos	22	General	Deposit	Surface	Occurrence.
G	230	Um Esh El Zarga	N 26° 09'	E 33° 35'	Fluorspar	22	General	Deposit	Surface	Occurrence.
G	231	Wadi Atallah	N 26° 10'	E 33° 30'	Serpentine	22	General	Deposit	Surface	Occurrence.
G	232	Fawakhir	N 26° 02'	E 33° 36'	Fluorspar	22	General	Deposit	Surface	Occurrence.
G	233	Fawakhir	N 26° 02'	E 33° 43'	Talc	22	General	Deposit	Surface	Occurrence.
	234	Unnamed	N 26° 00'	E 34° 18'	Gypsum	22	General	Deposit	Surface	Occurrence.
G	235	Hamadat	N 26° 04'	E 34° 02'	Talc	22	General	Deposit	Surface	Occurrence.
	236	Baris oasis	N 24° 42'	E 30° 33'	Clay	22	General	Deposit	Surface	Occurrence.
	237	Abu El Nur	N 25° 55'	E 32° 05'	Limestone	22	General	Deposit	Surface	Occurrence.
	238	Gabal Gama	N 25° 59'	E 32° 45'	Limestone	22	General	Deposit	Surface	Occurrence.
G	239	Abu Fannani	N 25° 58'	E 33° 45'	Talc	22	General	Deposit	Surface	Occurrence.
G	240	Hammuda	N 25° 56'	E 33° 48'	Talc	22	General	Deposit	Surface	Occurrence.
	241	Abu Ankhor	N 25° 26'	E 33° 56'	Feldspar	22	General	Deposit	Surface	Occurrence.
	242	Bir Mineih	N 25° 33'	E 33° 51'	Magnesite, fluorspar	22	General	Deposit	Surface	Occurrence.
	243	Mashash	N 25° 34'	E 33° 19'	Phosphate	22	General	Deposit	Surface	Reserves estimated at 360Mmt (1979).
I	244	Hagazah	N 25° 30'	E 32° 42'	Limestone	22	General	Deposit	Surface	Occurrence.
I	245	El Gharira	N 25° 29'	E 32° 30'	Clay	22	General	Deposit	Surface	Occurrence.
I	246	El Mataana	N 25° 28'	E 32° 45'	Limestone	22	General	Deposit	Surface	Occurrence.
I	247	Hemeidat	N 25° 24'	E 32° 44'	Limestone	22	General	Deposit	Surface	Occurrence.
I	248	El Sharawna	N 25° 17'	E 32° 48'	Limestone	22	General	Deposit	Surface	Estimated reserves 35Mmt (1979).
I	249	El Shemakhia	N 25° 09'	E 32° 44'	Sandstone	22	General	Deposit	Surface	Occurrence.
	250	Batur	N 25° 17'	E 33° 13'	Phosphate	2,22	General	Deposit	Surface	Occurrence.
	251	El Bakriya	N 25° 17'	E 33° 35'	Feldspar, fluorspar	22	General	Deposit	Surface	Occurrence.
	252	Wadi El Himari	N 25° 17'	E 33° 57'	Graphite	22	General	Deposit	Surface	Occurrence.
	253	Sewelgat El Zarga	N 25° 09'	E 33° 52'	Feldspar	22	General	Deposit	Surface	Occurrence.
	254	Barramiya	N 25° 05'	E 33° 50'	Asbestos	22	General	Deposit	Surface	Occurrence.
	255	Um Sewelgat	N 25° 02'	E 33° 51'	Talc	22	General	Deposit	Surface	Occurrence.
	256	Um Higlig	N 25° 01'	E 33° 58'	Quartz	22,30	General	Deposit	Surface	Occurrence. Large stock intruding volcanics.

APPENDIX C: PROSPECTS AND NON PRODUCING MINERAL PROPERTIES IN EGYPT.

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	COMMENTS
	257	Um Dalalil	N 24° 56'	E 33° 58'	Talc	22	General	Deposit	Surface	Occurrence.
	258	Urf El Bager	N 24° 45'	E 33° 49'	Barite	22	General	Deposit	Surface	Occurrence.
	259	Wadi Kharit	N 24° 22'	E 33° 44'	Talc	22	General	Deposit	Surface	Occurrence.
J	260	Rughama El Beid	N 24° 35'	E 33° 02'	Limestone	22	General	Deposit	Surface	Occurrence.
J	261	Rughama	N 24° 29'	E 33° 00'	Sandstone	22	General	Deposit	Surface	Occurrence.
J	262	Wadi El Lawi	N 24° 21'	E 33° 15'	Limestone	22	General	Deposit	Surface	Occurrence.
J	263	El Aaqab	N 24° 18'	E 33° 00'	Sandstone	22	General	Deposit	Surface	Occurrence.
J	264	El Aqaba	N 24° 15'	E 33° 00'	Clay	22	General	Deposit	Surface	Occurrence.
J	265	Abu El Reish	N 24° 09'	E 32° 58'	Clay	22	General	Deposit	Surface	Occurrence.
J	266	Bleida	N 24° 13'	E 32° 49'	Clay	22	General	Deposit	Surface	Occurrence.
J	267	Unnamed	N 24° 03'	E 32° 50'	Granite	22	General	Deposit	Surface	Occurrence.
J	268	Wadi Abu Agag	N 24° 07'	E 33° 00'	Quartzite	22	General	Deposit	Surface	Occurrence.
J	269	Unnamed	N 24° 01'	E 33° 10'	Barite	22	General	Deposit	Surface	Occurrence.
	270	Wadi Essel	N 25° 56'	E 34° 30'	Celestite	22	General	Deposit	Surface	Estimated reserves 2.3Mmt (1979).
	271	Wadi Sharm	N 25° 52'	E 34° 28'	Asbestos, talc	22	General	Deposit	Surface	Occurrence.
	272	Gabal Abu Tuyur	N 25° 45'	E 34° 25'	Asbestos	22	General	Deposit	Surface	Occurrence.
	273	Um Greig	N 25° 47'	E 34° 26'	Celestite	22	General	Deposit	Surface	Occurrence.
	274	Abu Ghorban	N 25° 45'	E 34° 29'	Celestite	22	General	Deposit	Surface	Estimated reserves 5.6Mmt (1979).
	275	Kadabora Hamra	N 25° 32'	E 34° 26'	Asbestos	22	General	Deposit	Surface	Occurrence.
	276	Um Naggat	N 25° 30'	E 34° 11'	Fluorspar	22	General	Deposit	Surface	Occurrence.
	277	Um Diwan	N 25° 30'	E 34° 06'	Talc	22	General	Deposit	Surface	Occurrence.
	278	Rod Ashab	N 25° 09'	E 34° 05'	Feldspar	22	General	Deposit	Surface	Occurrence.
	279	Gabal El Maylet	N 25° 18'	E 34° 19'	Magnesite	22	General	Deposit	Surface	Occurrence.
	280	Nekhella	N 25° 15'	E 34° 32'	Talc	22	General	Deposit	Surface	Occurrence.
	281	Homr Waggad	N 25° 11'	E 34° 20'	Fluorspar	22	General	Deposit	Surface	Occurrence.
	282	Rod Um El Farag	N 25° 06'	E 34° 19'	Muscovite	22	General	Deposit	Surface	Occurrence.
	283	El Taltaa	N 25° 08'	E 34° 15'	Feldspar	22	General	Deposit	Surface	Occurrence.

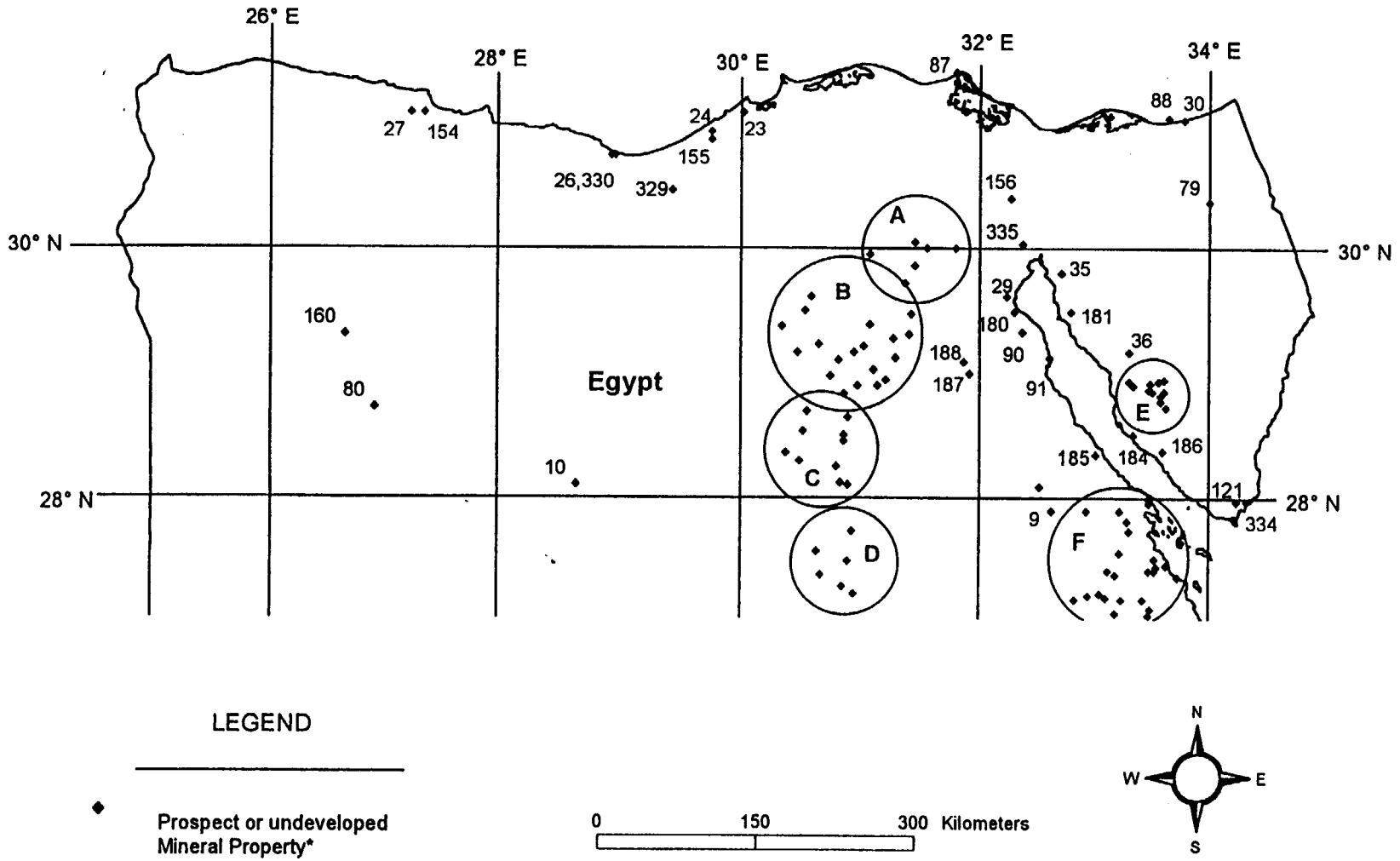
APPENDIX C: PROSPECTS AND NON PRODUCING MINERAL PROPERTIES IN EGYPT.

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	COMMENTS
	284	Rod El Buram	N 25° 03'	E 34° 04'	Feldspar	22	General	Deposit	Surface	Occurrence.
	285	Um Dalalit,	N 24° 55'	E 34° 02'	Fluorspar	22	General	Deposit	Surface	Occurrence.
	286	Gabal Urf El Fahd	N 24° 51'	E 34° 09'	Feldspar	22	General	Deposit	Surface	Occurrence.
	287	Wadi Um Tundub	N 24° 58'	E 34° 20'	Asbestos	22	General	Deposit	Surface	Occurrence.
	288	Wadi Um Khariga	N 25° 02'	E 34° 40'	Barite	22	General	Deposit	Surface	Occurrence.
	289	Nugrus	N 24° 59'	E 34° 32'	Fluorspar	22	General	Deposit	Surface	Occurrence.
	290	Wadi Homrat Mastura	N 24° 51'	E 34° 19'	Talc	22	General	Deposit	Surface	Occurrence.
	291	Wadi Natash	N 24° 38'	E 34° 12'	Barite	22	General	Deposit	Surface	Occurrence.
	292	Darb El Shugeira	N 24° 40'	E 34° 25'	Corundum	22	General	Deposit	Surface	Occurrence.
	293	Gabal Migif	N 24° 48'	E 34° 28'	Feldspar	22	General	Deposit	Surface	Occurrence.
	294	Wadi El Duweig	N 24° 49'	E 34° 24'	Asbestos	22	General	Deposit	Surface	Occurrence.
	295	Wadi Arak	N 24° 43'	E 34° 32'	Corundum	22	General	Deposit	Surface	Occurrence.
	296	Wadi Hangaliya	N 24° 50'	E 34° 36'	Asbestos	22	General	Deposit	Surface	Occurrence.
	297	Ambaout	N 24° 53'	E 34° 45'	Magnesite	22	General	Deposit	Surface	Occurrence.
	298	Gabal Ghadir	N 24° 50'	E 34° 44'	Graphite	22	General	Deposit	Surface	Occurrence.
	299	Gabal Um Seyal	N 24° 36'	E 34° 58'	Asbestos	22	General	Deposit	Surface	Occurrence.
	300	Wadi Ereir	N 24° 31'	E 35° 02'	Sulfur	22	General	Deposit	Surface	Occurrence.
	301	Abu Ghusun	N 24° 30'	E 35° 09'	Gypsum	22	General	Deposit	Surface	Occurrence.
	302	Wadi Um Ghazal	N 24° 11'	E 35° 20'	Barite	22	General	Deposit	Surface	Occurrence.
K	303	Wadi Antar	N 24° 21'	E 34° 19'	Barite	22	General	Deposit	Surface	Occurrence.
K	304	Gabal El Kahfa	N 24° 09'	E 34° 37'	Nepheline syenite	22	General	Deposit	Surface	Occurrence.
	305	Gabal Sharshar	N 23° 55'	E 30° 21'	Clay, limestone	22	General	Deposit	Surface	Occurrence.
J	306	Um Tehelwat	N 23° 58'	E 33° 00'	Quartz	22	General	Deposit	Surface	Occurrence.
	307	Kertas	N 23° 45'	E 32° 58'	Sandstone	22	General	Deposit	Surface	Occurrence.
	308	Bir Um Hobal	N 23° 40'	E 33° 14'	Marble	22	General	Deposit	Surface	Occurrence.
	309	Gara El Soda	N 23° 22'	E 31° 18'	Barite	22	General	Deposit	Surface	Occurrence.
N	310	Gabal Um Araqa	N 23° 00'	E 33° 27'	Talc	22	General	Deposit	Surface	Occurrence.
N	311	Abu Swayell	N 22° 50'	E 33° 40'	Marble	22	General	Deposit	Surface	Occurrence.

APPENDIX C: PROSPECTS AND NON PRODUCING MINERAL PROPERTIES IN EGYPT.

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	COMMENTS
N	312	Halmur	N 22° 48'	E 33° 38'	Talc	22	General	Deposit	Surface	Occurrence.
N	313	Halmur	N 22° 42'	E 33° 40'	Graphite	22	General	Deposit	Surface	Occurrence.
N	314	Wadi Kleib	N 22° 48'	E 33° 20'	Talc	22	General	Deposit	Surface	Occurrence.
	315	Abu Gurdi	N 23° 53'	E 35° 06'	Talc	22	General	Deposit	Surface	Occurrence.
	316	Wadi Bitan	N 23° 45'	E 34° 56'	Asbestos	22	General	Deposit	Surface	Occurrence.
	317	Zargat Naam	N 23° 45'	E 34° 36'	Magnesite	22	General	Deposit	Surface	Occurrence.
	318	Um Karaba	N 23° 39'	E 35° 04'	Talc	22	General	Deposit	Surface	Occurrence.
	319	Abu Dahr	N 23° 35'	E 35° 06'	Asbestos Titanium	22,30	General	Deposit	Surface	Occurrence.
	320	El Rahaba	N 23° 18'	E 35° 18'	Talc	22	General	Deposit	Surface	Occurrence.
	321	Gabal Nugrub	N 22° 51'	E 34° 56'	Nepheline syenite	22	General	Deposit	Surface	Occurrence.
	322	Gabal Mishbi	N 22° 44'	E 34° 41'	Nepheline syenite	22	General	Deposit	Surface	Occurrence.
	323	Gabal El Naga	N 22° 43'	E 34° 27'	Nepheline syenite	22	General	Deposit	Surface	Occurrence.
O	324	Wadi El Dirdira	N 22° 30'	E 35° 59'	Barite	22	General	Deposit	Surface	Occurrence.
O	325	Girara Halaib	N 22° 27'	E 35° 58'	Barite	22,30	General	Deposit	Surface	16 barite veins in serpentines and sandstones.
O	326	Wadi Elkwan	N 22° 23'	E 36° 10'	Magnesite	22	General	Deposit	Surface	Occurrence.
O	327	Sol Hamid	N 22° 20'	E 36° 10'	Asbestos	22	General	Deposit	Surface	Occurrence.
O	328	Wadi Dileb	N 22° 19'	E 36° 26'	Barite	22	General	Deposit	Surface	Occurrence.
	329	Gabel El Hagif	N 30° 32'	E 29° 26'	Gypsum	16	General	Deposit	Surface	Occurrence.
	330	El Alamein	N 30° 50'	E 28° 55'	Gypsum	16	General	Deposit	Surface	Occurrence.
A	331	Maadi Katamia	N 30° 00'	E 31° 07'	Gypsum	16	General	Deposit	Surface	Occurrence.
	332	Wadi Um Gerifat	N 24° 52'	E 34° 22'	Iron	16	General	Deposit	Surface	Occurrence.
G	333	Djebel Alda	N 26° 40'	E 33° 00'	Manganese	16	General	Deposit	Surface	Occurrence.
	334	Sherm El Sheikh	N 27° 45'	E 34° 20'	Manganese	16	General	Deposit	Surface	Occurrence.
	335	Agroud	N 30° 05'	E 32° 25'	Clay	16	General	Deposit	Surface	Occurrence.

(1) Represents property or property grouping as defined in Appendix maps A-4 and A-5.
(2) Due to software limitations, site names do not include any diacritical markings. Spelling of individual site names vary considerably by source.
(3) Complete list of data sources found in Appendix D.
(4) General - denotes limited data; Confirmed - denotes deposit information confirmed by several sources.
(5) Because of the varying age of source information, the status of individual sites may not be current.



LEGEND

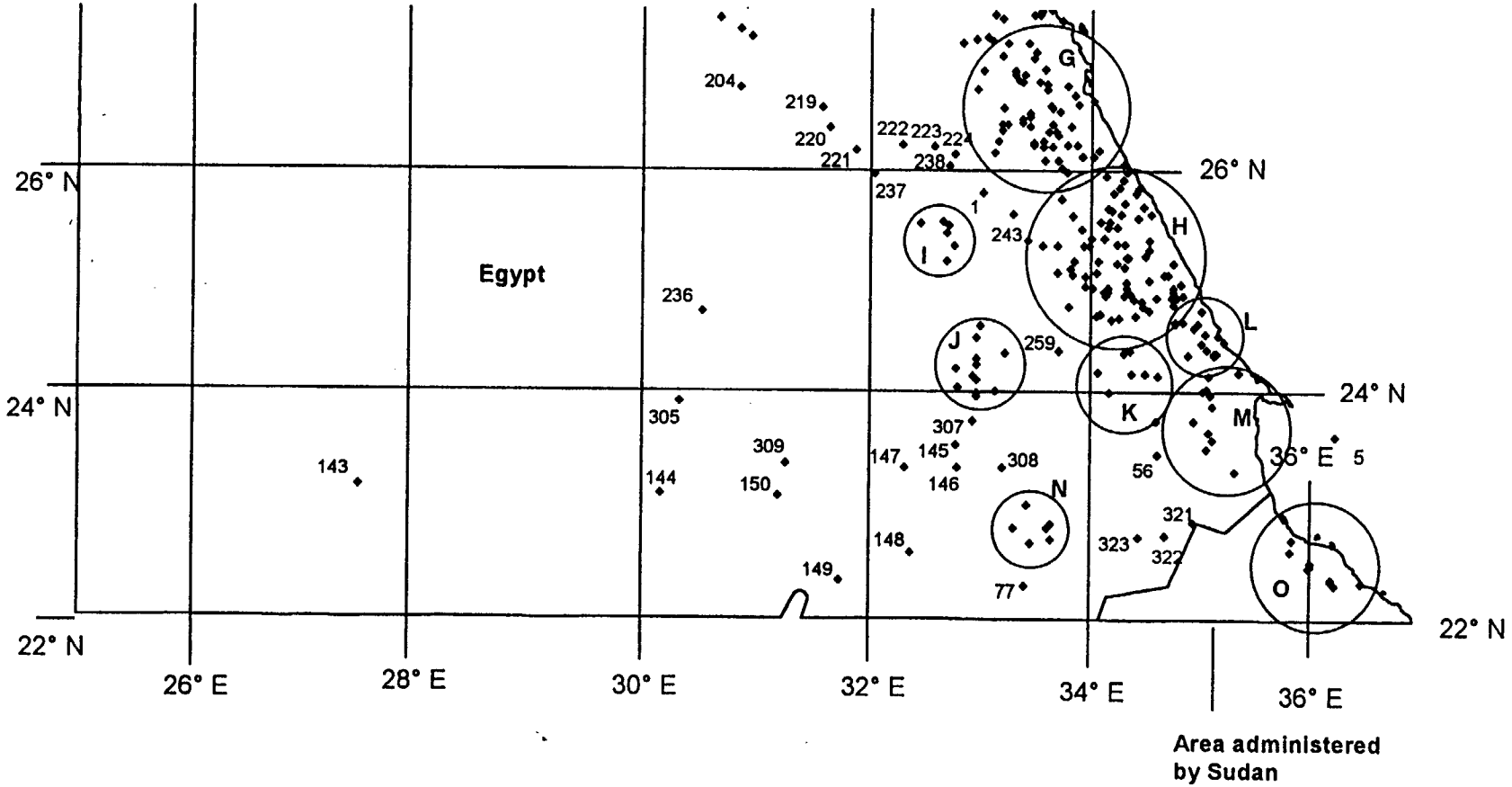
◆ Prospect or undeveloped Mineral Property*

* Letter represents property grouping as defined in appendix

0 150 300 Kilometers

N W E S

APPENDIX MAP A-4: PROSPECTS AND UNDEVELOPED MINERAL PROPERTIES OF NORTHERN EGYPT



LEGEND

◆ Prospect or undeveloped Mineral Property*

* Letter represents property grouping as defined in appendix

0 150 300 Kilometers

N
W E
S

APPENDIX MAP A-5: PROSPECTS AND UNDEVELOPED MINERAL PROPERTIES OF SOUTHERN EGYPT.

APPENDIX D: PUBLIC SOURCES OF INFORMATION

1. Report on the Mineral Industry of Egypt. Egyptian Ministry of Finance. Cairo, 1922, 50 pp.
2. Potential Mineral Resources of Egypt. Egyptian Geological Survey and Mining Authority. 1984, 144 pp.
3. Gold in Egypt - A Commodity Package. Ed. by S. Z. Gabra, Egyptian Geological Survey & Mining Authority. USAID Project 263-0105, 1986. 86
4. R. Said. The Geology of Egypt. A.A. Balkema (Rotterdam). 1990, pp. 511-566.
5. British Sulphur, Ltd. World Survey of Phosphate Deposits. 5th Ed., 1987, pp. 161-162.
6. Roskill Publication Services, Inc. Iron. 1988.
7. Cambridge Information and Research Services Limited. World Directory of Energy Information. Vol. 2, 1994. Selected country profiles.
8. Europa Publications Limited. The Middle East and North Africa 1994. 40th Ed. pp. 411-421.
9. U. S. Library of Congress. Egypt, A Country Study. Dec. 1990, pp. 195-209.
10. U. S. Energy Information Administration. The Petroleum Resources of the Middle East. Mar. 1984, 137 pp.
11. Arab Mining Journal. Apr. 1981, vol. 1, No. 3, pp. 21, 47.
12. U. S. Board on Geographic Names. Gazetteer No. 45 - Egypt and the Gaza Strip, 1959.
13. British Sulphur, Ltd. World Survey of Sulphur Resources. 3rd Ed., 1985, pp. 156-57.
14. Annual Mining Review 1995. Mining Journal, Nov. 1995, pp. 151-152.
15. Library of Congress. Egypt, a country study. 1990, pp. 197-209.
16. U. S. Geological Survey. Mineral Resources Data System (MRDS), 1996.
17. U. S. Bureau of Mines. Minerals Availability Data Base, June 1995.
18. U. S. Bureau of Mines. The Mineral Industry of Egypt. T. P. Dolley. Ch. in Minerals Yearbook 1993, pp. 41-45.
19. U. S. Bureau of Mines. Egypt. T. P. Dolley. Mineral Industry Surveys series, 1994, 8 pp.
20. Hussein, H.A., T.A. Sayyah and H.M. Shatoury. Metallogeny of Uranium and Thorium Occurrences in Egypt. 1989.
21. World Cement Directory 1991. Cimeurope s.a.r.l., pp. 180-183.
22. Mineral Map of Egypt. Egyptian Geological Survey and Mining Authority. 1979, 44 pp.
23. Roskill Publication Services, Inc. Copper. 1992.
24. Roskill Publication Services, Inc. Gold. 1991.
25. Roskill Publication Services, Inc. Chromium. 1991.
26. Industrial Minerals Directory. Metals Bulletin. 1st Ed. 1987.
27. Metal Bulletin Monthly June, 1992.
28. A.M.A. Wali. Industrial Minerals of Egypt. Paper 90-77 presented at SME annual meeting, Salt Lake City, 1990.
29. S. Omara. Phosphatic Deposits in Syria and Safaga District, Egypt. In Economic Geology. Vol. 60, 1965, pp. 214-227.
30. F. Habashi and F.A. Bassyouni. Mineral Resources of the Arab Countries. Chemecon Pub. (Quebec). 1982, pp. 18-27.
31. B. A. Kornhauser. Trip Report-Field Evaluation of the Mineral Industries of Egypt & Israel. Sept. 2-22, 1985.

Jordan

Table of Contents

TABLES

FIGURES

1.0 EXECUTIVE SUMMARY

This report was prepared under Memorandum of Agreement B291867 between Lawrence Livermore National Laboratory (LLNL) and the U.S. Geological Survey, Minerals Availability Team (MAT). It provides LLNL information on the mining industry of Jordan, and quantitative information on the blasting potential of its mining industry. MAT identified mining activities through the use of the Minerals Availability data base, its data collection and analytic capabilities, and an extensive network of information sources.

Much of Jordan's known mineral potential is associated with the Wadi al Arabah-Jordan rift zone in western Jordan. The Dead Sea, centrally located along this rift, is the source for much of Jordan's mineral salt wealth. Jordan is known for its industrial minerals, primarily phosphate and potash. Only two mines, however, have an estimated maximum blasting event larger than 100 mt ANFO equivalent. One of these mines is nearing the end of its life, however. Research activities for this study resulted in the identification of 52 significant mineral properties. Most properties operate on a small scale and require minimal blasting. The blasting potential for 6 properties is reported.

1.1 Authority

This report was prepared under Memorandum of Agreement B291867 between Lawrence Livermore National Laboratory (LLNL) and the U.S. Geological Survey, Minerals Availability Team (MAT).

1.2 Project Scope

As part of this agreement, MAT is to identify mining activities in Egypt, Jordan, Syria, Tunisia, and Turkey as they relate to monitoring/verifying compliance of the Comprehensive Test Ban Treaty. MAT is to use the Minerals Availability and the Mineral Resources Data System data bases, its data collection and analytic capabilities, and an extensive network of information sources to provide background information focusing on the use of explosives by the mining industry, which can cause false alarms during monitoring and hide nuclear events.

Reports with accompanying figures and tables summarize location, type of mining method, commodity(ies), estimated frequency and size of mine blasts, operational status, and mine product distribution to foreign or internal markets for the specified countries.

Once country data were collected and verified, the explosive use at selected sites was evaluated. Focus was placed on a limited number of larger operations, or those reported to have potential for short-term development. Undeveloped sites and small scale mines, which may be included in Appendices A-B of this report, were not analyzed in terms of the site's anticipated use of explosives. Mineral prospects generally make only small use of explosives and small mines (some of which are operated on an intermittent basis) are assumed to require minimal blasting.

Based upon known site information (geological conditions, mine technology, production capacity, and current blasting practices), the blasting potential for significant mining sites was evaluated. Where site-specific data were not available, estimates for

representative, important properties were developed based upon accepted industry practice, knowledge of the Jordanian mining industry, and regional geologic characteristics.

2.0 SOURCES OF INFORMATION

Data for this report were derived from published sources, unpublished documents, and personal communications through an extensive network of public and private contacts. Public sources of information are listed in Appendix C. Much of the industry summary was drawn from data reported by the U.S. Bureau of Mines Mineral Yearbook chapter on Jordan, from the years 1992-1994. Information on 1995 was obtained from the U.S. Geological Survey, International Minerals Section, Reston, VA (formerly the U.S. Bureau of Mines, Division of International Minerals).

Principal agencies contacted include, but were not limited to the U.S. Geological Survey, the U.S. State Department, Central Intelligence Agency, Defense Intelligence Agency, the United Nations, the World Bank, World Resource Institute, and International Studies of Minerals Issues (ISMI). In addition, academic and industry contacts, explosives manufacturers and suppliers, and trade groups were contacted.

3.0 THE MINING INDUSTRY OF JORDAN

Jordan covers an area of approximately 96,500 km^2, of which 60,000 km^2 was reportedly unexplored for minerals or fuels in 1988. Much of its known mineral potential is associated with the Wadi al Arabah-Jordan rift zone which extends the length of Jordan from the Mediterranean Sea to the Gulf of Aqaba. The Dead Sea, centrally located along this rift, is the source for much of Jordan's mineral salt wealth.

The minerals sector continues to play an important role in the Jordanian economy. In 1994, Jordan ranked within the top five in global phosphate rock production and was a major world producer of potash. Revenues for Jordanian bulk phosphate and fertilizer

exports typically account for almost one-third of the nation's total export revenues[1]. Jordan also is a major regional producer of fertilizer products, limestones and building products, and mineral salts. It also produces significant quantities of cement and kaolin clay which are used in domestic construction. Jordan does not have significant petroleum production. Output of energy minerals was modest, and oil shale and natural gas potential is uncertain.

The Provisional Law of Natural Resources 37 of 1966, amended, is the basic mining law of Jordan. The law allowed for private Jordanian or foreign national ownership of a mine or quarry with the provision that mine management be conducted by a Jordanian operator. The Jordan Natural Resources Authority (NRA) is the Government agency responsible for all activities related to the exploration and development of minerals and mineral fuels.

The manufacturing sector of Jordan has two tiers. On one level are the large-scale, wholly or partially state-owned industrial establishments (parastatals) such as the Jordan Phosphate Mines Company (JPMC), the Jordan Fertilizer Industries Company (JFIC), the Arab Potash Company (APC), and the Jordan Cement Factories Company (JCFC). On the other level are small to medium sized entities, most privately owned, that individually account for insignificant mineral production, but when aggregated, make up a sizeable portion of the minerals industry. Exploitation of the major mineral commodities of Jordan--cement, kaolin, phosphates, potash, and rock wool--are all controlled by parastatals. Building materials such as aggregates, basalt, calcium carbonate, dimensional stone, glass sand, and natural sand is produced by private sector firms.

Since independence, Jordan has imported far more than it has exported, primarily due to a dependence on imported petroleum products. It had not attempted to achieve a trade balance with any major trading partner. The United States and Western Europe supplied about half of Jordan's imports in 1988, but bought less than 10% of Jordanian

---

[1] U.S. Geological Survey. Jordan. Ch. in Mineral Industry Survey series. 1994.

exports. Arab imports were minor, but Arab nations purchased nearly half of the country's exports. Prior to the U.N. trade embargo with Iraq, this nation has received about 20% of Jordan's exports[2]. JPMC is the largest exporter in Jordan, and APC is the country's second largest exporter.

Shifting international markets for phosphates and phosphatic fertilizers in 1993 placed pressure on that sector of the Jordanian mining industry. In the late 1980's, about 30% of Jordan's phosphate products were exported to Eastern Europe. Newer Asian markets have helped offset the decrease in exports to Eastern Europe since 1991. JPMC is also developing new markets in Australia and New Zealand, and expanding markets in Arab countries. The potash industry has benefitted from increased demand from India and the Far East. There are presently no United Nations sanctions against Jordan.

Jordanian mineral production estimates for 1993 and 1994 are provided in table 3.1. Summaries of mineral site data are provided in Appendices A-B. Data on significant producing sites, past producers, prospects, and undeveloped mineral occurrences are provided in tabular form. Maps showing mineral property locations are also provided in Appendix maps A-B. It should be noted that not all mineral occurrences are reported in this study. Sites with unverifiable information or lacking specific site locations may not be included. Data are reported for 17 producers, and 35 past producers or mineral deposits. While data on small, private sector mining operations are limited, it is believed that all sites with significant potential have been reported.

---

[2] Mining Annual Review-1995. Mining Journal. London. 1996.

Table 3.1 -- Estimated Mineral Production in Jordan, 1993 and 1994[1] (Metric tons)

Commodity[2]	1993 Production	1994 Production[3]
Cement, hydraulic	3,400,000	6,600,000
Clays	47,200	47,200
Gypsum	195,000	195,000
Lime	7,270	7,270
Phosphate rock, gross weight	4,280,000	4,220,000
Potash, crude salts	1,370,000	1,500,000
Salt	26,000	26,000
Stone, limestone	5,340	5,340
Stone, marble	112,000	112,000

SOURCE: U. S. Bureau of Mines and U. S. Geological Survey. The Mineral Industry of Jordan. Mineral Industry Survey series 1992-1994. Chapters prepared by Thomas P. Dolley.

---

1 Includes data available through July 1995.

2 In addition to the commodities listed, crude steel and petroleum products are produced, but not reported here.

3 Estimated.

3.1 Industrial minerals

Jordan is an important producer of several industrial minerals, notably phosphate products, potash and other mineral salts, cement, and building and construction stone products. While phosphate and potash are principally exported, cement and construction products are produced primarily to meet domestic needs. Decreased demand from Western Europe, coupled with a significant decline in exports to Eastern Europe have forced Jordan to look toward new markets in India, Asia, and Oceana for industrial mineral products. Jordan is also looking to increase trade with its Middle Eastern neighbors.

3.1.1 Phosphate

Phosphate deposits are Jordan's primary natural resource and a major source of export income. Revenues generated from products derived from this industry accounted for about one third of Jordan's export revenue in 1993. Jordan accounted for about 3% of world phosphate in 1994[3], in spite of decreased market demand for Jordanian phosphate from the former Soviet Union and Eastern Europe.

The most important industrial company in Jordan, JPMC, controls phosphate production in the country. Phosphate rock is mined by JPMC from three mines; the Al Hasa and Wadi Al Abyad mines in central Jordan and the new Ash Shidiya mine in southern Jordan. The Ash Shidiya mine is scheduled to replace declining ore reserves at the other mines by the year 2000. In 1994, active mining at Al Hasa was limited; activity was confined to the removal of stockpiled ore. Reported 1994 phosphate rock production was approximately 4.3Mt from an industry with a production capacity of about 8.1Mt.

Phosphate mining in Jordan began at Ruseifa in 1943. Surface and underground production at Ruseifa ended in 1985. While production in the Al Hasa/Al Abyad area first began by underground methods, the relatively low overburden to ore ratio in the

---

[3] U.S. Geological Survey and U.S. Bureau of Mines. Mineral Commodity Summaries 1996.

area permitted extraction by highly mechanized open cast mining in which overburden is removed by scrapers, rippers and bulldozers; blasting is limited to selected areas. Ore is extracted in a similar manner. A walking dragline is used to remove overburden and ore in some areas. Blasting of ore is also limited.

The Esh Shidiyah began operations in 1988 using modern draglines to recover phosphate from beneath 40m of limestone/marl overburden. The operation is designed to replace production from the Al Hasa and Al Abyad sites by 2000. Present production capacity is 2.8Mt/yr. Reserves at this site are extensive and it is expected that this mine will be the primary source of Jordanian phosphate well into the next century.

Most of the phosphate rock production is exported through the port of Aqaba. In 1992, the latest year for which such data were available, about half was exported to India, Indonesia, and the Netherlands. The rest was exported to various countries, including neighboring Arab states, India, and Australia. About 1Mt/yr are used domestically by the fertilizer complex at Aqaba, where an expansion program for the phosphoric acid facilities was completed in 1994.

3.1.2 Potash

Potash is the second major component of Jordan's mining sector. Jordan produced 11% of the world's potash in 1994[2]. Production is conducted by the Arab Potash Company (APC), which was established in 1956 by a combination of Arab and private interests. In 1958, the APC was granted a 100 year concession to mine and produce chemicals from the Jordanian portion of the Dead Sea. The mine and extraction plant are located near Safi at the southern end of the Dead Sea, south of the Lisan Peninsula and east of the truce line with Israel.

Production began in 1982. Since 1985, APC has sustained levels greater than 90% of the plant's 1.8Mt KCl production capacity (1995). Potash production from Dead Sea brine requires solar evaporation to concentrate the brine and produce sylvite (KCl) and

carnallite, a hydrated mineral containing KCl and $MgCl_2$, and subsequent refining to produce agricultural grade potash (KCl at 60-62% K_2O equivalent) from the carnallite. Extraction at the full production rate requires pumping 288Mt/yr of brines from the Dead Sea to a series of evaporation basins (salt pans) where the brine is concentrated and salt is removed. Blasting is not required in this process. APC was considering plans in 1995 to increase surface area for evaporation and to purchase a bucketwheel suction dredge to mine salt. The Jordanian Dead Sea Minerals Company was created in 1994 to study methods for recovery of bromine and other non-potash mineral salts from the Dead Sea, both from the Safi site and from the Lisan Peninsula to the north.

Potash is also exported. Principal export destinations in 1992 were India, China, and Indonesia. Currently APC is directing its marketing efforts to increase sales to third world countries and expand sales to its Arab customers.

3.1.3 Cement

Cement production within Jordan is primarily for domestic consumption, with some available for export to neighboring countries such as Egypt. The Jordan Cement Factories Company (JCFC) is the primary cement producer in Jordan, with a 3.4Mt plant at Fuheis near Amman.

Cement in Jordan is derived primarily from nodular limestones east of the Rift in northern Jordan. While reserves are practically unlimited, most of the production occurs in the industrialized area around Amman. As with most countries in this area, mining of cement raw materials comes from small pits or quarries located near destination markets. Because the limestone deposits are often located near the surface, little overburden removal is required. Typical small scale quarrying techniques are most often employed. Mining requires limited and infrequent blasting.

The cement industry in Jordan is becoming increasingly important as solutions for Jordan's water shortage require increased demand for cement. Approximately 60% of

Jordan's water supplies come from aquifers in the eastern part of the country. In recent years, however, much of Jordan's population has migrated to the west while intermittent rainfall has not recharged the aquifers sufficiently to meet growing domestic needs. Jordan is in the process of building several major dams in an attempt to make maximum use of limited water supplies. While not all dams are made of cement, dam construction requires increased quantities of cement, and the Jordanian industry has increased production in an attempt to meet that demand. In addition, several major pipeline projects and increased building construction have impacted the demand for cement. Cement production is expected to increase significantly by 2000.

3.1.4 Stone

Due to a lack of timber, many different rock types have been used as building stones in Jordan since ancient times. Near Petra, in southwestern Jordan, the Nabateans chiseled stone tombs with impressive facades from local sandstone. Basalts are used for construction purposes in northeast Jordan. Oolitic limestones from the western Jordan valley supplies the construction industry in the Amman area. In the Jerusalem and Amman area, polishable limestone "marble" is often used as ornamental building stone.

Unlike the major mining industries, construction aggregates, basalt, limestone, dimensional stone, glass sand and natural sand exploitation is controlled by small, private sector firms, often operating very small pits or quarries requiring a small number of personnel to operate. As a result, information on the number and size of these operations is difficult to ascertain. While information on significant deposits is available, often it is difficult to verify the operating status of these sites. Consequently, data reported in Appendices A-B for stone products may be incomplete or assigned an inappropriate status.

3.2 Other minerals

Other industrial minerals produced include clays, gypsum, lime, and salt. Jordan also

has a small steel plant near Zarqa, which processes imported raw material and scrap for domestic use. Jordan possesses some barite, chromite, copper, manganese, and nickel resources, none of which is considered economic. Iron was produced in ancient times from the Warda deposit, but no production has occurred recently. Uranium could be recovered as a byproduct of phosphate production. Jordan also has the potential to produce energy from its bituminous rocks and oil shale.

4.0 MINE-RELATED EXPLOSIVES USE

Almost all mines use explosives to fragment or loosen rock and consolidated material prior to excavation. Bulk or packaged explosives and blasting agents are detonated after emplacement in material to be excavated. Minor quantities of sachet and shaped charges may be used for secondary breakage and other special applications.

The type and amount of explosives used are influenced by the geotechnical nature of the rock, the mining methods employed, the production rate of the mine, the type and availability of explosives and detonation systems, hydrologic conditions, mining equipment, drilling equipment, mine geometry, level of technical expertise, and external constraints such as the proximity of residences, availability of explosives, and available funding. At almost any mine, the size of each blast can vary significantly due to local conditions, production schedules, weather, etc.

Surface mines typically shoot much larger blasts than underground operations and tend to have higher production rates than underground mines. In addition, limitations of working room, limited free faces, type of mineralization, ventilation requirements, and drilling limitations may constrain maximum blast sizes in underground mines.

Jordan is not limited to domestically produced explosives, and has sufficient raw materials to produce what is needed. Jordan has the military-related technology and facilities to manufacture blasting agents and detonation systems suitable for most mining applications.

Where blasting is required, most Jordanian mines use ammonium nitrate-fuel oil (ANFO) blasting agents. ANFO systems are preferred in most mining applications due to their ease of manufacture, low cost, inherent safety, and bulk loading advantages. High explosives, however, may be preferable for small underground operations that use drill sizes that are below the critical diameter needed for emplacing ANFO blasting agents, or under wet conditions, in methane-rich atmospheres, and conditions that require higher detonation velocities and/or convenience of packaged explosives. Few such underground mining sites operate in Jordan, however.

In most cases, site-specific blasting information was unavailable. Consequently, estimates were based upon known or estimated production rates, mine geology, and typical mining practices. Experience, engineering judgement, and available data were incorporated into calculations and estimates. Explosive use can vary considerably as mining conditions change. ANFO consumption was assumed to be dependent upon mine production rate, average stripping ratio, specific gravity of the host rock, assumed powder factor limits, and mining method. Only a small number of mines in Jordan require significant blasting, primarily because of their small size.

For each site, a stripping ratio (Quantity of overburden or waste removed per mt of ore mined) and powder factor (Quantity of rock blasted per unit of ANFO blasting agent equivalent) limits were estimated. A range of ANFO consumption was calculated for both daily blasting requirements and for an assumed maximum blasting event. Daily ANFO requirements were estimated assuming a 330 day production schedule. Consumption estimates for all sites were calculated in a similar manner. The lower consumption value applies a minimum powder factor while the higher value assumes a maximum powder factor. Unlike daily consumption estimates, a maximum blasting event would not take place on a daily basis. For this study, it was assumed that a maximum blasting event could occur every 10 working days for a surface mine and every 5 working days for an underground mine. Such events are designed to account for such factors as blasting delays, geological irregularities, and mining method variations that require a higher ANFO consumption than the typical blasting event. Mine development

or pillar extraction conditions, for example, often require larger blasts.

The following examples illustrate typical blasting calculations using the estimation procedure described above:

Esh Shidiyah ANFO daily consumption lower limit (L):

L = Production rate * [1 + (stripping ratio * specific gravity of waste)] * [Low powder factor / 1000 (converts kg to mt)] / Operating days per year

L = 2,800,000 * [1 + (2.0 * 2.5)] * [0.11 / 1000] / 330

L = 5.60 6 mt ANFO equivalent (rounded)

Esh Shidiyah ANFO daily consumption higher limit (H):

H = Production rate * [1 + (stripping ratio * specific gravity of waste)] * [High powder factor / 1000 (converts kg to mt)] / Operating days per year

L = 2,800,000 * [1 + (2.0 * 2.5)] * [0.20 / 1000] / 330

L = 10.18 10 mt ANFO equivalent (rounded)

Esh Shidiyah maximum blasting event ANFO consumption (M):

M = Production rate * [1 + (stripping ratio * specific gravity of waste)] * [High powder factor / 1000 (converts kg to mt)] / Operating days per year * maximum blast cycle time (working days between blasting events)

M = [2,800,000 * [1 + (2.0 * 2.5)] * [0.20 / 1000] / 330] * 10

M = 101.82 102 mt ANFO equivalent (rounded)

Table 4.1 provides the corresponding blasting range estimates for the main Jordanian mines identified in this study. Figure 4.1 shows site locations for the mines reported in table 4.1. Symbols reflect mine type (surface or underground) and maximum ANFO consumption for a given blasting event. Where a mine produces using both underground and surface methods, the predominant method is shown on figure 4.1.

Only two mining sites, the El Hasa and Esh Shidiyah phosphate mines, had calculated maximum blasting events that exceeded 100 mt ANFO equivalent. The El Hasa (as

Table 4.1--Estimated Explosives Usage at the Main Jordanian Mines
Used in this Study in Order of Estimated ANFO Consumption

Mine	Latitude	Longitude	Primary Product	Mine Type (1)	Production (Mmt/yr) (2)	Daily Consumption (mt ANFO) (3), (4)		Maximum Blast Cycle Time (days) (5)	Maximum Blasting Event (mt ANFO)
						Low	High		
El Hasa (6)	N 30° 49'	E 36° 00'	Phosphate	S	3.800	10	18	10	184
Esh Shidiyah (6)	N 29° 46'	E 35° 54'	Phosphate	S	2.800	6	10	10	102
Wadi al Abyad (6)	N 30° 58'	E 36° 00'	Phosphate	S	1.500	4	7	10	73
Fuheis (7)	N 32° 01'	E 35° 46'	Limestone	S	3.400	1	2	10	21
Dead Sea (8)	N 31° 06'	E 35° 31'	Potash	S	1.800	0	0	10	2
Wadi Mujib	N 31° 28'	E 35° 34'	Sulfur	S	0.045	0	0	10	1

(1) S--Surface

(2) Mmt/yr--Million metric tons per year

(3) mt ANFO--Metric tons of Ammonium Nitrate/Fuel Oil blasting agent equivalent. Estimate based on equations reported on pages 11-12.

(4) Assumed production schedule for all sites is 330 days/yr.

(5) Assumed maximum blasting cycle time for surface operation - 10 working days; underground operation - 5 working days.

(6) Assumes both overburden and ore removed on a daily basis. In actual practice, overburden removed by contractor prior to mining a site. Blasting of ore is limited to selected areas, therefore figures reported here represent maximum consumption if both overburden and ore were blasted concurrently. The El Hasa and Wadi al Abyad mines are nearing the end of their mining life, and most overburden has been removed. It is expected that current blasting is minimal.

(7) Limestone for cement production is recovered from local quarries. Capacity is total for region, so ANFO consumption at an individual site should be lower.

(8) Potash and salt production from Dead Sea sites is conducted by solution mining which generally does not require blasting. Production is total for the complex.

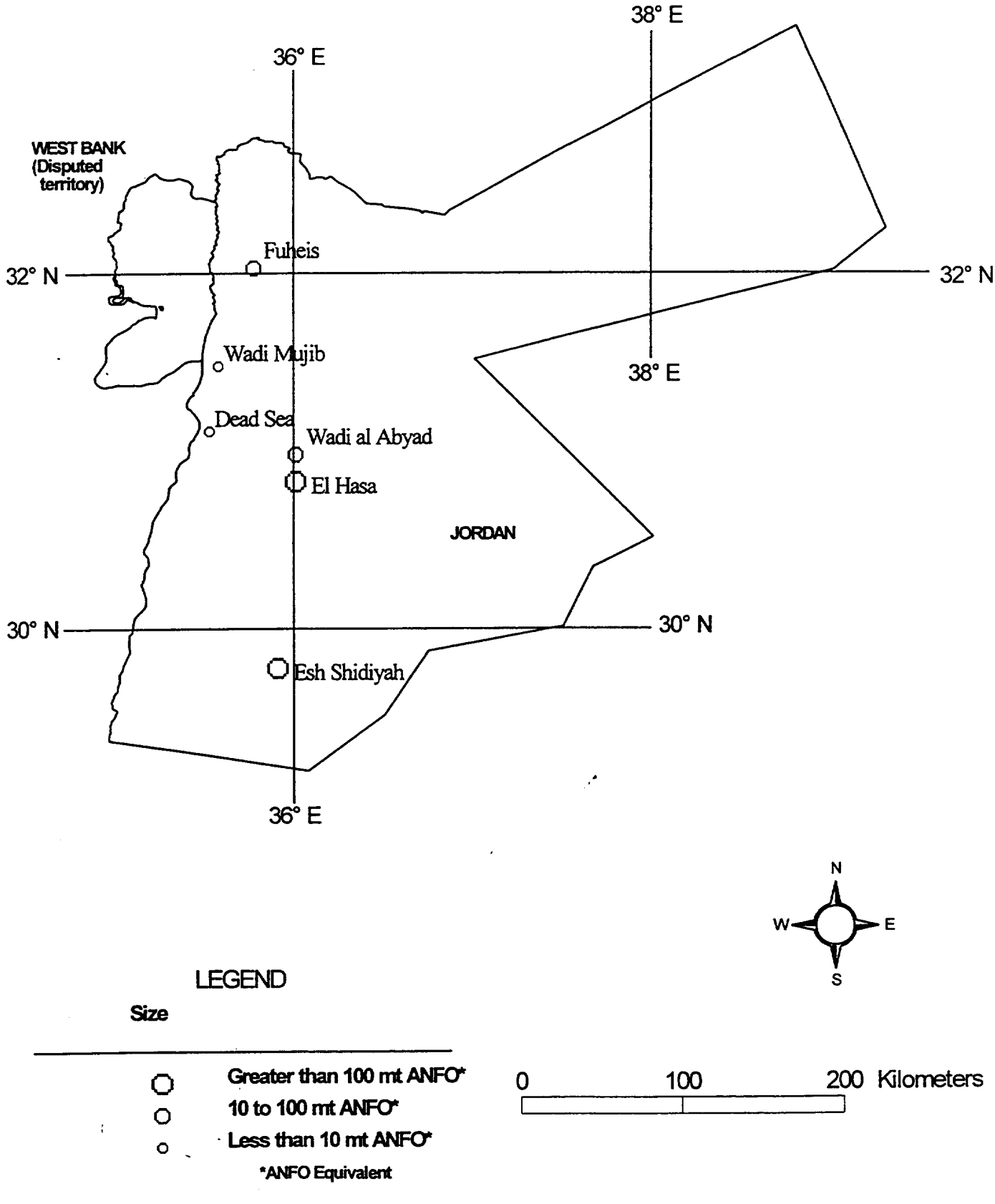


FIGURE 4.1–Selected Jordanian Mines and Estimated Maximum Blasting Events

well as the Al Abyad site) were only recovering stockpiled ore in 1994, due to limited reserves. The Esh Shidiyah mine is being developed to replace the other sites. The While both sites have the potential for a maximum blasting event of over 100 mt ANFO equivalent, under normal circumstances this is unlikely. Jordanian phosphate mines employ open cast mining techniques and require selected blasting. Overburden is commonly removed by contract prior to ore mining, so mining often requires only limited blasting of hard ore or separate blasting of ore or overburden. On a daily basis, however, ANFO consumption for both overburden and ore is given, although blasts may occur in separate areas.

In addition to the two sites previously mentioned, there are several sites that have an estimated explosive potential of less than 25 mt of ANFO equivalent for a maximum blasting event. While mining of Dead Sea salts and potash typically does not require blasting, the Table 4.1 blasting consumption estimate assumes that a minor quantity of blasting will be required for ancillary operations. Limestone production feeding the Fuheis cement plant comes from numerous small quarries feeding the nearby plant, rather that one large mining operation, as suggested in Table 4.1.

5.0 CONCLUSIONS

While the mining industry of Jordan is an important regional producer accounting for about one third of Jordan's export revenue, it is not significant on a world scale, except for its production of phosphate and potash. Identified resources are associated with the rift zone in western Jordan. Resource potential in eastern Jordan has not been fully explored, but is not thought to be important. Explosive consumption by the mining industry of Jordan is low, particularly when its largest phosphate mines face depleted resources and reduced production.

APPENDICES

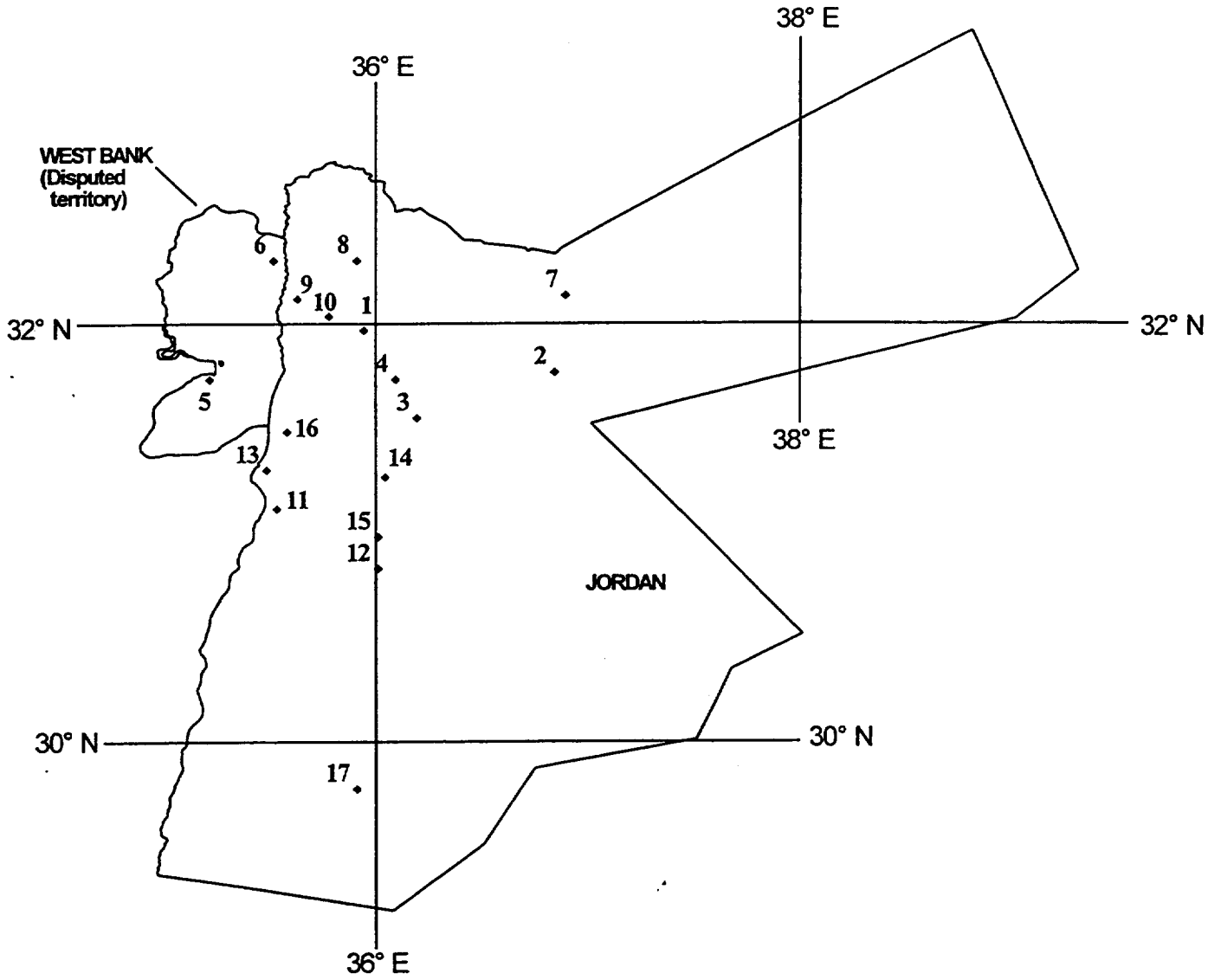
APPENDIX A: PRODUCING AND DEVELOPING MINERAL PROPERTIES IN JORDAN

MAP KEY (1)	NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
1	Amman	N 31° 57'	E 35° 56'	Stone	1,2	General	Producer	Surface	Domestic	Limestone used for building stone.
1	El Azraq	N 31° 45'	E 36° 50'	Salt	1,2	General	Producer	Surface	Domestic Export	Massive evaporites in desert. Salt collected in shallow basins, no blasting.
1	Qasr el Hammam	N 31° 32'	E 36° 11'	Marble	2	General	Producer	Surface	Domestic	Polishable limestone used for building stone.
1	Unnamed	N 31° 43'	E 36° 05'	Stone	1,2	General	Producer	Surface	Domestic	Oyster shell limestone used for building stone.
2	Bethlehem	N 32° 43'	E 35° 12'	Stone	1,2	General	Producer	Surface	Domestic	Limestone used for building stone.
2	Kirbat as Samra	N 31° 39'	E 35° 10'	Stone	1,2	General	Producer	Surface	Domestic	Oolitic limestone used for building stone.
3	Jabal ar Rutayn	N 32° 07'	E 36° 53'	Tuff	1,2	General	Producer	Surface	Domestic	Used in thermal insulation and road making.
3	Jarash	N 32° 17'	E 35° 54'	Stone	1,2	General	Producer	Surface	Domestic	Caliche used for building stone.
6	Deir Alla	N 32° 06'	E 35° 37'	Travertine	1,2	General	Producer	Surface	Domestic	Beds of 10-20m thick occur.
6	Fuheis Amman district	N 32° 01'	E 35° 46'	Cement	1,2,15	General	Producer	Surface	Domestic	Portland cement produced from area limestones. Area quarries supplied about 74% of Jordanian cement in 1992.
7	Dead Sea Safi Ghor as Safi	N 31° 06'	E 35°31'	Potash Salt Bromine Iodine	1,6,10, 14,15,16	Confirmed	Producer	Surface	Domestic Export	Recovered from evaporites in Dead Sea. No blasting required. Capacity 1.8Mt/yr KCl, operating at about 90%. India bought 33% of potash. Production begun in 1982. Brine pumped from Dead Sea, to salt pan for evaporation and subsequent treatment. Operation works 365 days/yr. Production 1992-1.4Mt, 1994-1.8Mt. Purchased $2M dredge in 1994 to mine salt.
7	El Hasa district Al Hasa	N 30° 49'	E 36° 00'	Phosphate Uranium Gypsum	1,2,5,10, 14,15,16	General	Producer	Surface Underground	Export Domestic	Produces 5.3Mt ore per year by strip mining. Ore occurs as lenses in limestone, marls, & cherts. Mining began in 1961 by UG methods, but was converted to open cast methods in 1964. Mining similar to southern mines at Ruseifa. Overburden removed by dozers, dragline, blasted if necessary. Ore removed without blasting. Only hard ore blasted. waste:ore = 7:1 In 1994, only stockpiled ore recovered, ore near depletion. Production 1992-3.3Mt
7	El Lisan	N 31° 17'	E 35° 28'	Salt Potash Bromine Iodine	1,6,7	General	Producer	Surface	Domestic Export	Recovered from evaporites in Dead Sea. No blasting required. Potash presently not recovered from this location. Potash beds at depths of 149-165, 347-351m.
7	Qatrana	N 31° 15'	E 36° 02'	Stone	1	General	Producer	Surface	Domestic	Quarried for decorative stone and floor tiles.
7	Wadi al Abyad Wadi al Abluth Wadi Abu Ubaydah	N 30° 58'	E 36° 00'	Phosphate	2,5,10, 14,15,16	General	Producer	Surface	Export Domestic	Came on stream in 1979 with design capacity of 1.5Mt/yr. Considered part of El Hasa complex. Walking dragline used to strip ore, overburden.

APPENDIX A: PRODUCING AND DEVELOPING MINERAL PROPERTIES IN JORDAN

MAP KEY (1)	NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
										In 1994, only stockpiled ore recovered, ore near depletion. Production 1992-3Mt
7	Wadi Mujib Al Moogeb	N 31° 28'	E 35° 34'	Gypsum Sulfur	1,2,4	General	Producer	Surface	Domestic	Thickness of 15m reported. Reported to produce 45kt of gypsum per year. No byproduct sulfur being produced. Used in domestic building and construction industry.
8	Esh Shidiyah	N 29° 46'	E 35° 54'	Phosphate	5,10,14, 15,16	General	Producer	Surface	Export Domestic	Mine being developed to replace El Hasa/Al Abyad. Full production expected by 2000. Production capacity 2.8Mt/yr; produced 1.9Mt 1994. Average depth to mineralization 40m, thickness 8m. Production 1992-1.5Mt

(1) Represents property or property grouping as defined on Appendix Map A.
(2) Due to software limitations, site names do not include any diacritical markings. Spelling of individual names vary considerably by source.
(3) Complete list of data sources found in Appendix C.
(4) General - denotes limited data; Confirmed - denotes deposit information confirmed by several sources.



0 100 200 Kilometers

LEGEND

Producing or Developing
◆ Mineral Property*

* Letter represents property grouping as defined in appendix

N
W E
S

APPENDIX MAP A-1: PRODUCING MINERAL PROPERTIES OF JORDAN

APPENDIX B: PAST PRODUCERS, PROSPECTS AND UNDEVELOPED MINERAL PROPERTIES IN JORDAN

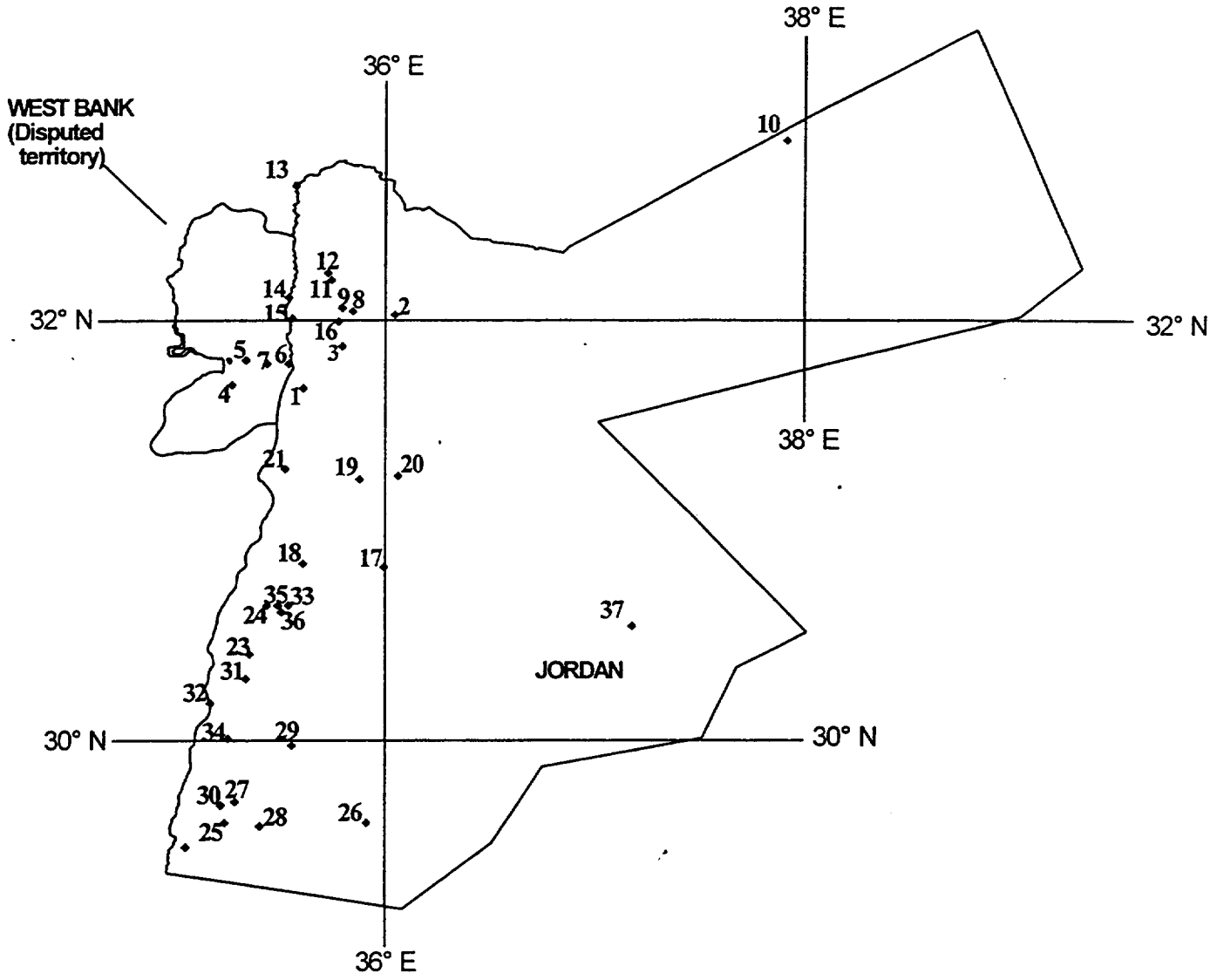
MAP KEY (1)	NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
1	Humrat Ma'in	N 31° 40'	E 35° 36'	Ochre	1,2	General	Deposit	Surface	NAp(5)	Wedging lenses about 1m thick in sediments.
1	Ruseifa district North mine Ras al Ain Zarqa A Zarqa B Far South Area	N 32° 01'	E 36° 02'	Phosphate Uranium	1,2,5, 10,13,14	General	Past producer	Surface Underground	Export Domestic	Four seams 1.3-3.2m thick mined until 1980. Deposit covers over 4300 hectares, in marls. ls. Mining came from 5 sites. North and Ras al Ain mines (north of Ruseifa) were mined by UG shortwall retreat methods. Southern mines average 2.5m overburden, mined by strip mining with scrapers. Blasting of overburden depends on ore characteristics.
1	Unnamed	N 31° 52	E 35° 47'	Glass sand	1,2	General	Deposit	Surface	NAp	Good quality glass sand occurrence.
2	Beit Sahur	N 31° 41'	E 35° 16'	Barite	1,2	General	Deposit	Unknown	NAp	Ore zone 30m x 15m x 12m in marls, limestone.
2	Hatrurim	N 31° 48'	E 35° 20'	Chromium	1,2	General	Deposit	Unknown	NAp	Traces in chalk, marls; ore is not economic.
2	Lisan lake	N 31° 47'	E 35° 32'	Sulfur Potash	1,2	General	Deposit	Surface	NAp	Associated with evaporites, shales, and marls.
2	Nabi Musa	N 31° 47'	E 35° 26'	Bitumen	1	General	Past producer	Surface	Domestic	Bituminous marls, limestones quarried for local consumption.
3	Suweilih	N 32° 02'	E 35° 50'	Phosphate	1,2	General	Deposit	Surface	NAp	Phosphorite beds 35-40m thick identified.
3	Suweilih	N 32° 03'	E 35° 47'	Apatite	1,2	General	Deposit	Surface	NAp	Apatite altered from phosphorite. Occurs along 2200m strike length, up to 8.3m thick. Reserves (1974) 300kt proven, 650kt possible.
3	Unnamed	N 32° 51'	E 37° 54'	Barite	1,2	General	Deposit	Unknown	NAp	Barite dikes 0.6m thick about 60m in length.
3	Wadi Huni	N 32° 11'	E 35° 44'	Gypsum	1,2	General	Deposit	Surface	NAp	Layer 2-3m thick in marls.
3	Warda Tell Ekweder	N 32° 13'	E 35° 43'	Iron	1,2,3	General	Past producer	Underground	Domestic	Mining dates back to Crusades, no recent mining. Ore body about 200m wide, 300m long, and 9.8m thick. Ore surrounded by chalky limestone. Reserves (1962) 561kt @ 67.9% Fe.
3	Yarmuk River	N 32° 38'	E 35° 34'	Bitumen	1	General	Past producer	Surface	Domestic	Bituminous marls, limestones to produce quick lime. Reserves for sufficient for oil shale production.
4	Zerqa River	N 32° 06'	E 35° 32'	Pyrite	1	General	Deposit	Surface	NAp	Crystals in sandy limestone, non-commercial.
6	Ghor Kabid	N 32° 00'	E 35° 33'	Clay	1,2	General	Deposit	Surface	NAp	Clay layer of 2.8m suitable for ceramics. 1975 reserves: 47kt @ 32-37% Al2O3.
6	Mahis	N 31° 59'	E 35° 46'	Clay	1,2	General	Deposit	Surface	NAp	Clay layer of 4.2m suitable for ceramics. 1975 reserves: 46kt @ 32-37% Al2O3.
7	Al Hasa	N 30° 49'	E 35° 59'	Bitumen	1	General	Deposit	Unknown	NAp	Bituminous limestones, shales up to 30m thick.
7	Al Tufeila	N 30° 50'	E 35° 36'	Gypsum	4	General	Deposit	Surface	NAp	Occurrence.
7	Lajjun El Lajjun	N 31° 14'	E 35° 52'	Bitumen	1	General	Deposit	Unknown	NAp	Oil shale with reserves of 420M barrels @ 28.1gal/t.

APPENDIX B: PAST PRODUCERS, PROSPECTS AND UNDEVELOPED MINERAL PROPERTIES IN JORDAN

MAP KEY (1)	NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
7	Qatrana	N 31° 15'	E 36° 03'	Chromium	1,2	General	Deposit	Unknown	NAp	Occurrence.
7	Wadi Kerak Al Kark	N 31° 17'	E 35° 31'	Gypsum	1,2,4	General	Deposit	Surface	NAp	Layer 2-3m thick in marls.
8	Aqaba	N 29° 29'	E 35° 03'	Glass sand	1,2	General	Deposit	Surface	NAp	Good quality glass sand occurrence.
8	Bir Madhkur	N 30° 24'	E 35° 21'	Copper	1	General	Deposit	Surface	NAp	Mineralization in dolomite, Cu content less than 1%.
8	Feinan	N 30° 38'	E 35° 26'	Nickel	1,2	General	Deposit	Unknown	NAp	Reported to contain 0.2-0.7% Ni.
8	Gharandal	N 30° 12'	E 35° 14'	Barite	1	General	Deposit	Unknown	NAp	Occurrence of barite dikes.
8	Hatilya	N 29° 36'	E 35° 54'	Phosphate	1,2	General	Deposit	Surface	NAp	Phosphorite beds abundant but less than 1m thick.
8	Quweira	N 29° 42'	E 35° 17'	Feldspar	1,2	General	Deposit	Unknown	NAp	Occurrence in granite pegmatite.
8	Ram	N 29° 35'	E 35° 24'	Manganese	1	General	Deposit	Surface	NAp	Mineralization in jointing of granite over 60m length.
8	Ras en Naqb	N 29° 58'	E 35° 33'	Glass sand	1,2	General	Deposit	Surface	NAp	Good quality glass sand occurrence.
8	Unnamed	N 29° 41'	E 35° 13'	Quartz	1	General	Deposit	Unknown	NAp	Exposed for about 25m by 25m.
8	Wadi Abu Khusheiba Nabatean	N 30° 17'	E 35° 20'	Copper	1,2	General	Deposit	Surface	NAp	Copper in sandstone. Ore low grade. Some sites mined intermittently in the past.
8	Wadi Araba	N 30° 10'	E 35° 10'	Copper Silver	1,7	General	Deposit	Surface	NAp	Copper in diabase dikes up to 3m thick. Feasibility study done in 1983 yielded reserves of 60Mt @ 1.36% Cu and 5g/t Ag. As of 1992, production of 3Mt/yr proposed, but no financing secured.
8	Wadi Dana	N 30° 38' N 31° 00'	E 35° 32' E 35° 22'	Manganese Copper	1,2,14	General	Deposit	Surface	NAp	Thin beds of higher grade Cu, Mn ore. Grade reported to average 1.4% Cu, 40-43% Mn. 1974 reserves estimated at 64kt. Proposed capacity 3Mt/yr.
8	Wadi es Sik	N 30° 00'	E 35° 15'	Glass sand	1,2	General	Deposit	Surface	NAp	Good quality glass sand occurrence.
8	Wadi Ghuweir	N 30° 38'	E 35° 29'	Copper	1	General	Deposit	Surface	NAp	Mineralization in sandstone-ore low grade.
8	Wadi Halid	N 30° 36'	E 35° 30'	Copper	1,2	General	Deposit	Surface	NAp	Mineralization in sandstone-ore low grade.
8	Zakimat El Hasa	N 30° 32'	E 37° 10'	Barite	1,2	General	Deposit	Unknown	NAp	Occurrence of barite roses in sandstone.

---

(1) Represents property or property grouping as defined on Appendix Map B.
(2) Due to software limitations, site names do not include any diacritical markings. Spelling of individual names vary considerably by source.
(3) Complete list of data sources found in Appendix C.
(4) General - denotes limited data; Confirmed - denotes deposit information confirmed by several sources.
(5) NAp - Not applicable; prospects and undeveloped deposits have no current markets.



LEGEND

0 100 200 Kilometers

N
W E
S

Producing or Developing
• Mineral Property*

* Letter represents property grouping as defined in appendix

APPENDIX MAP B-1: NON PRODUCING MINERAL PROPERTIES OF JORDAN

APPENDIX C: PUBLIC SOURCES OF INFORMATION

1. F. Bender. Geology of Jordan. Gebruder Borntraeger Press (Berlin). English Edition. 1974, 196 pp.
2. F. Bender. Geology of the Arabian Peninsula: Jordan. USGS Prof. Paper 560-I, 1975, 136 pp.
3. A. Zitzmann. The Iron Ores in Jordan. Ch. in The Iron Ore Deposits of Europe, Vol. 1, 1977, p. 219.
4. British Sulphur, Ltd. World Survey of Sulphur Resources. 3rd Ed., 1985, p. 197.
5. British Sulphur, Ltd. World Survey of Phosphate Deposits. 5th Ed., 1987, pp. 165-167.
6. British Sulphur, Ltd. World Survey of Potash Resources. 3rd Ed., 1979, pp. 57-61.
7. Roskill Publication Services, Inc. The Economics of Potash, 2nd Ed. 1989, pp. 38-39.
8. Cambridge Information and Research Services Limited. World Directory of Energy Information. Vol. 2, 1994. Selected country profiles.
9. Europa Publications Limited. The Middle East and North Africa 1994. 40th Ed. pp. 411-421.
10. U. S. Library of Congress. Jordan, A Country Study. Dec. 1989, pp. 148-173.
11. U. S. Energy Information Administration. The Petroleum Resources of the Middle East. Mar. 1984, 137 pp.
12. U. S. Board on Geographic Names. Gazetteer No. 37 - Iraq, 1957.
13. U. S. Geological Survey. Mineral Resources Data System (MRDS), 1994.
14. U. S. Bureau of Mines. Minerals Availability Data Base, July 1996.
15. U. S. Bureau of Mines. The Mineral Industry of Jordan. T. P. Dolley. Ch. in Minerals Yearbook 1992, Vol. III, pp. 45-54, 1993.
16. U. S. Bureau of Mines. The Mineral Industry of Jordan. T. P. Dolley. Ch. in Minerals Yearbook 1993, Vol. III, pp. 37-45, 1994.
17. U. S. Geological Survey. Jordan. Mineral Industry Survey series. 1994, 5 pp.
18. World Cement Directory 1991. Cimeurope s.a.r.l., pp. 180-183.
19. Mining Annual Review - 1995. Mining Journal (London). P. 165.

Syria

Table of Contents

TABLES

FIGURES

1.0 EXECUTIVE SUMMARY

This report was prepared under Memorandum of Agreement B291867 between Lawrence Livermore National Laboratory (LLNL) and the U.S. Geological Survey, Minerals Information Team (MIT) (formerly the Office of Minerals Information). This report provides LLNL information on the mining industry of Syria, and quantitative information on the blasting potential of this industry. MIT identified mining activities through the use of its Minerals Availability System data base, its data collection and analytic capabilities, and an extensive network of information sources.

Crude petroleum and phosphate rock production account for the largest share of Syria's income [1]. Ferrous, non-ferrous and industrial minerals also occur and add to the mineral wealth of the country. Research activities for this report resulted in the identification of 26 mineral properties in Syria, however, most properties operate on a small scale and require minimal blasting. The blasting potential for 13 main Syrian mines is reported, with only 4 operating mines having the potential to produce blasts of over 35 metric tons of ammonium nitrate-fuel-oil (ANFO) equivalent at any given time as part of normal mining activities.

---

[1]The Mining Journal. Mining Annual Review 1995. London, U.K. PP. 164.

The largest mining sector is phosphate mining, which is generally centered around the deposits of the Khadir Al Hamar region. The region is comprised of 3 operating surface mines, the Khneifess mine and the Shakira A and B which are in the immediate Al Sawanat Al Hamra proximity. These have maximum blasting events in the 35-50 metric ton of ANFO equivalent range.

Syria uses internally produced explosives or imports and possesses the technology and facilities to manufacture blasting agents and detonation systems suitable for mining applications. Most surface mines in Syria utilize ANFO blasting agents.

1.1 **Authority**

This report was prepared under Memorandum of Agreement B291867 between Lawrence Livermore National Laboratory (LLNL) and the U.S. Geological Survey, MIT.

1.2 **Project Scope**

As part of this agreement, MIT is to identify mining activities in Egypt, Jordan, Syria, Tunisia and Turkey. This information will be used for monitoring/verifying compliance of the Comprehensive Test Ban Treaty. MIT will use the Minerals Availability System data base, the Mineral Resource Data System, its data collection and analytic capabilities, and an extensive network of information sources to provide background information on the use of explosives by the mining industry of these countries. This information is of particular interest because the normal blasting activities of mining can cause false alarms during monitoring and disguise nuclear blast events.

Reports with accompanying figures and tables summarize location, type of mining method, commodity(ies), estimated frequency and size of mine blasts, operational status, and distribution of products to foreign or internal markets for Syria.

Once country data were collected and verified, the explosive use at selected sites was evaluated. Focus was placed on locations that consume large quantities of conventional chemical explosives. Undeveloped sites and small scale mines which consume minimal amounts of explosives (included in Appendix A-B of this report), were not analyzed in terms of the site's anticipated use of explosives. Mineral prospects generally make only small use of explosives and small mines (some of which are operated on an intermittent basis) are assumed to require minimal blasting. Appendix A lists all the known producing mineral properties in Syria, while Appendix B lists all the known non producing properties (past producers and undeveloped deposits) in Syria. These listings were used as the basis from which the main Syrian mines consuming explosives were selected. It should be noted that available data indicated the potential of additional mineral occurrences in Syria, but confirmation of site data

was not possible. Information on these potential sites was not included in this study.

Based upon known site information (geological conditions, mine technology, production capacity, and current blasting practices), the blasting potential for significant mining sites was evaluated. Where site-specific data were not available, estimates for important properties were developed based upon accepted industry practice, knowledge of the Syrian mining industry, and related geologic characteristics.

2.0 SOURCES OF INFORMATION

Data for this report were derived from published sources, unpublished documents, and personal communications through an extensive network of public and private contacts. Public sources of information are listed in Appendix C. Much of the industry summary was drawn from data reported by the U.S. Bureau of Mines Mineral Yearbook chapter on Syria, from the years 1992-1994. Information for 1995 was obtained from the U.S. Geological Survey, Minerals Information Team, International Minerals Section, Reston, Virginia (formerly the U.S. Bureau of Mines, Division of International Minerals).

Principal agencies contacted include, but were not limited to, the U.S. Geological Survey, the U.S. Department of State, the Central Intelligence Agency, the Defense Intelligence Agency, the United Nations, the World Bank, the World Resources Institute, and the International Strategic Minerals Institute (ISMI). In addition, selected academic and industry contacts, explosives manufacturers and suppliers, and trade groups were contacted.

3.0 THE MINING INDUSTRY OF SYRIA

The mining industry of Syria is minor when compared to the minerals fuels industry, the leading industrial sector. The estimated gross domestic product (GDP)-purchasing power parity- for Syria in 1994 was $74.4 billion (est)[2]. In 1993, the mineral industry

[2]United States Central Intelligence Agency. Syria. CIA-95 facts-Government publications. 10 pp.

accounted for about $6 billion of the nation's $30 billion gross domestic product[3]. As of 1995, Syria's credit was in poor condition. Syria has been working to resolve its $700 million arrears on debts to foreign states with the individual creditors and with the Paris Club (an institution to assist the severely indebted low-income countries with special repayment terms for debt relief). It was also trying to resolve its $400 million debt to the World Bank.

Phosphate rock is the only mineral product beside hydrocarbons which is being produced on a worldwide scale (in 1994 it produced 1% of world production). Syria increased its export volumes of phosphate rock by 24% in 1994. Estimated output was up from a 1993 level of 931,000 metric tons (mt) to 1,200,000 mt in 1994, but did not reach the 1992 level of 1,270,000 mt. Local sales of phosphate rock were not up due to a refitting of the Homs phosphoric acid plant. A proposed chemical plant in the desert could increase mine production potential[4].

Syria has a socialist economic system but has permitted the emergence of a private sector. The mining industry (mining-processing-distribution) is still owned and controlled by the Government. Legislation adopted in 1994 encouraged domestic and foreign private participation by lifting restrictions on foreign exchange transactions, as well as providing tax and customs concessions. Most private investment in 1994 was directed toward agricultural and tourism industries. Petroleum refining and petrochemical ventures were expected to be the next large industrial segments to utilize private investment.

As shown by table 3.1, other industrial minerals produced include gypsum, hydraulic cement, marble, salt, and sand and gravel. As shown by the table, in 1994 phosphate production was estimated to increase by 261,000 mt from 1993. This 1994 production

---

[3]Michalski, Bernadette. The Minerals Industry of Syria. USBM Yearbook Chapter-1993. PP. 74-77.

[4]The Mining Journal. Mining Annual Review 1995. London, U.K. PP. 164.

level was not, however, as high as in 1992, which was 70,000 mt higher, for a total production of 331,000 mt in 1992. During the same time the estimated production of crude oil showed a slight increase, from 208,000 barrels to 211,000 barrels in 1994[5]. Syrian exports have been dominated by purchasing from the United States for petroleum products and mainly Europe for phosphate rock consumption. Some phosphate rock is exported to India.

[5]Michalski, Bernadette. Syria. Mineral Industry Survey series. USBM. 1994.

Table 3.1 -- Estimated Mineral Production in Syria,
1993 and 1994 (Metric tons)(1)(2)

Commodity (3)	1993 Production	1994 Production(e)
Cement, hydraulic	4,500,000	4,500,000
Gypsum	235,000	235,000
Nitrogen content of ammonia	66,700	66,700
Nitrogen, urea	75,000	75,000
Phosphate rock, gross weight	931,000	1,200,000
Salt	130,000	130,000
Stone, dimension marble (cu m)	18,000	18,000
Stone, sand & gravel	4,200,000	4,200,000
Sulfur, byproduct of petroleum and natural gas	30,000	30,000

Source: U.S. Bureau of Mines. Minerals Yearbook, 1994.

(e) Estimated

(1) Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

(2) Table includes data available through June 1, 1995.

(3) Limestone quarried for cement manufacture is substantial; however, information is inadequate to make accurate estimates of output.

3.1 Phosphate

Phosphate is mainly produced from the Khadir Al Hamar region of Syria (see Appendix A) from the Shakira A and B mines. The other area of phosphate deposits and mining is near Khneifess, which has one mine currently in operation. Syria exports most of its phosphate rock to countries in Europe where it is further processed. In 1994, local sales of phosphate rock were at a stand still until the chemical plant located at Homs was revamped. A major growth in capacity to the present mines or development of additional mines could occur if a proposed chemical complex in the desert is completed.

3.2 Other industrial minerals

Limestone and clays for cement feed are quarried from sites near the plants for usage at the ten cement plants operating in Syria. Total cement production in 1995 was estimated to be 4.5 million mt. While limestone production was substantial, information is inadequate to make accurate estimates of output.

Gypsum facilities are located at Damascus and Latakia, but specific mine locations are not available.

Salt mines are located south east of Aleppo and near Dayr az-Zawr, with specific locations not available.

Clay, dimension stone, sand and gravel, and sulfur (byproduct of petroleum and natural gas) were also recovered in 1994.

3.3 Other minerals

Syria also possesses mineral resources of bituminous rock (natural or rock asphalt), chromium, copper, iron, lead, and sulfur. Presently, these commodities are not being

mined.

4.0 MINE RELATED EXPLOSIVES USE

Syria uses internally produced explosives or imports, and possesses the technology and facilities to manufacture blasting agents and detonation systems suitable for mining applications. Most surface mines in Syria utilize ammonium nitrate-fuel oil (ANFO) blasting agents.

Most mines utilize explosives to loosen or fragment rock and other consolidated material prior to excavation. Bulk or packaged explosives are detonated either electrically or thermally after being placed in the material to be excavated. Minor quantities of sachet (bagged powder explosives) and shaped charges may be used for secondary breakage and other special applications.

The type and amount of explosives used are influenced by the nature of the rock or ore, the mining methods employed, the production rate of the mine, the type and availability of explosives and detonation systems, hydrologic conditions, mining equipment, drilling equipment, mine geometry, level of technical expertise, and external constraints such as the proximity of residences and costs. At almost any mine, the size of each blast can vary significantly due to local conditions, production schedules, weather, etc.

Most Syrian mines use ANFO blasting agents where blasting is required. ANFO systems are preferred in most mining applications due to their ease of manufacture, low cost, inherent safety, and bulk loading advantages.

In most cases, site-specific blasting information was unaccessible. Consequently, estimates were based upon estimated production rates, mine geology, mining systems, and typical mining practices. Experience, engineering judgement, and available data were incorporated into calculations and estimates. Explosive use can vary considerably as mining conditions change. ANFO consumption was assumed to be

dependent upon mine production rate, average stripping ratio, specific gravity of the host rock, assumed powder factor limits, and mining method.

For each site, a stripping ratio (quantity of overburden or waste removed per metric ton of ore mined) and powder factor (quantity of rock blasted per unit of ANFO blasting agent equivalent) limits were estimated. A range of ANFO consumption was calculated for both daily blasting requirements and an assumed maximum blasting event. Daily ANFO requirements were estimated using a 312 day/year production schedule. Consumption estimates for all sites were calculated in a similar manner. The lower consumption value applies a minimum powder factor while the higher value assumes a maximum powder factor. Unlike daily consumption estimates, a maximum blasting event would not take place on a daily basis. For this study, it was assumed that the maximum blasting event (an estimated technical upper limit of cumulative explosive usage) would consume 10 days worth of explosives for a surface mine and 5 days worth for an underground mine. Such events are designed to account for such factors as blasting delays, geological irregularities, and mining method variations that require a higher ANFO consumption than the typical blasting event. Mine development or pillar extraction conditions, for example, often require larger blasts than normal production.

The following examples illustrate typical blasting calculations for the Sharkaya A mine using the estimation procedure described above:

Sharkaya A mine ANFO daily consumption, lower limit (L):

L = Production rate * [1 + (stripping ratio *(combined specific gravity of ore and waste))] * [Low powder factor / 1000 (converts kg to mt)] / 312 (assumed operating days per year)

L = 790,000 * [1 +(2.8 * 2.5)] * [0.11 / 1000] / 312

L = 2.23 2 mt ANFO equivalent (rounded to nearest unit)

Sharkaya A mine ANFO daily consumption higher limit (H):

H = Production rate * [1 + (stripping ratio *(combined specific gravity of ore and waste))] * [High powder factor / 1000 (converts kg to mt)] / 312 (assumed operating days per year)

H = 790,000 * [1 + (2.8 * 2.5)] * [0.20 / 1000] / 312

H = 4.05 4 mt ANFO equivalent (rounded to nearest unit)

Sharkaya A mine maximum blasting event ANFO consumption (M):

M = Production rate * [1 + stripping ratio *(combined specific gravity of ore and waste))] * [High powder factor / 1000 (converts kg to mt)] / 312 (assumed operating days per year) * maximum blast cycle time (working days between blasting events)

M = [790,000 * [1 + (2.8 * 2.5)] * [0.2 / 1000]] / 312 * 10

M = 40.5 41 mt ANFO equivalent (Rounded to nearest unit)

Table 4.1 provides the corresponding blasting range estimates for the main Syrian mines identified in this study. Figure 4.1 shows site locations for the mines reported in Table 4.1. Symbols reflect the maximum ANFO consumption for a given blasting event.

Table 4.1--Estimated Explosives Usage at the Main Syrian Mines Used in this Study in Order of Estimated ANFO Consumption

Mine	Latitude	Longitude	Primary Product	Mine Type (1)	Production (MMT/YR) (2)	Daily Consumption (mt ANFO) (3),(4) Low	Daily Consumption (mt ANFO) (3),(4) High	Maximum Blast Cycle Time (days) (5)	Maximum Blasting Event (mt ANFO)
Tartous	N 34° 53'	E 35° 53'	Cement Feed (6)	S	3.231	3	5	10	47
Sharkya A	N 34° 43'	E 36° 42'	Phosphate	S	0.790	2	4	10	41
Sharkya B	N 34° 43'	E 36° 42'	Phosphate	S	0.776	2	4	10	40
Khneifess	N 34° 05'	E 38° 05'	Phosphate	S	0.757	2	4	10	39
Aleppo	N 36° 19'	E 37° 12'	Cement Feed (6)	S	1.377	1	2	10	20
Adra	N 33° 37'	E 36° 30'	Cement Feed (6)	S	1.270	1	2	10	18
Musulmiyeh	N 36° 19'	E 37° 12'	Cement Feed (6)	S	1.148	1	2	10	17
Hama I, II	N 35° 08'	E 36° 45'	Cement Feed (6)	S	0.632	1	1	10	9
Musslemieh	N 36° 19'	E 37° 12'	Cement Feed (6)	S	0.459	0	1	10	7
Shiek Said	N 32° 50'	E 36° 02'	Cement Feed (6)	S	0.459	0	1	10	7
Dummar	N 33° 32'	E 36° 14'	Cement Feed (6)	S	0.294	0	0	10	4
Rastan	N 34° 55'	E 36° 44'	Cement Feed (6)	S	0.188	0	0	10	3
Burj Eslam	N 35° 41'	E 35° 48'	Cement Feed (6)	S	0.125	0	0	10	2

(1) S--Surface
(2) Mmt/yr--Million metric tons per year
(3) MT ANFO--Metric tons of Ammonium Nitrate/Fuel Oil blasting agent equivalent
(4) Assumed annual production schedule of 312 days per year; results may differ if another production schedule used.
(5) Assumed maximum blasting cycle time for surface operation - 10 working days.
(6) Typical raw material feed for cement plant is 85% limestone and 15% clay; minor amounts of gypsum and other materials may also be required.

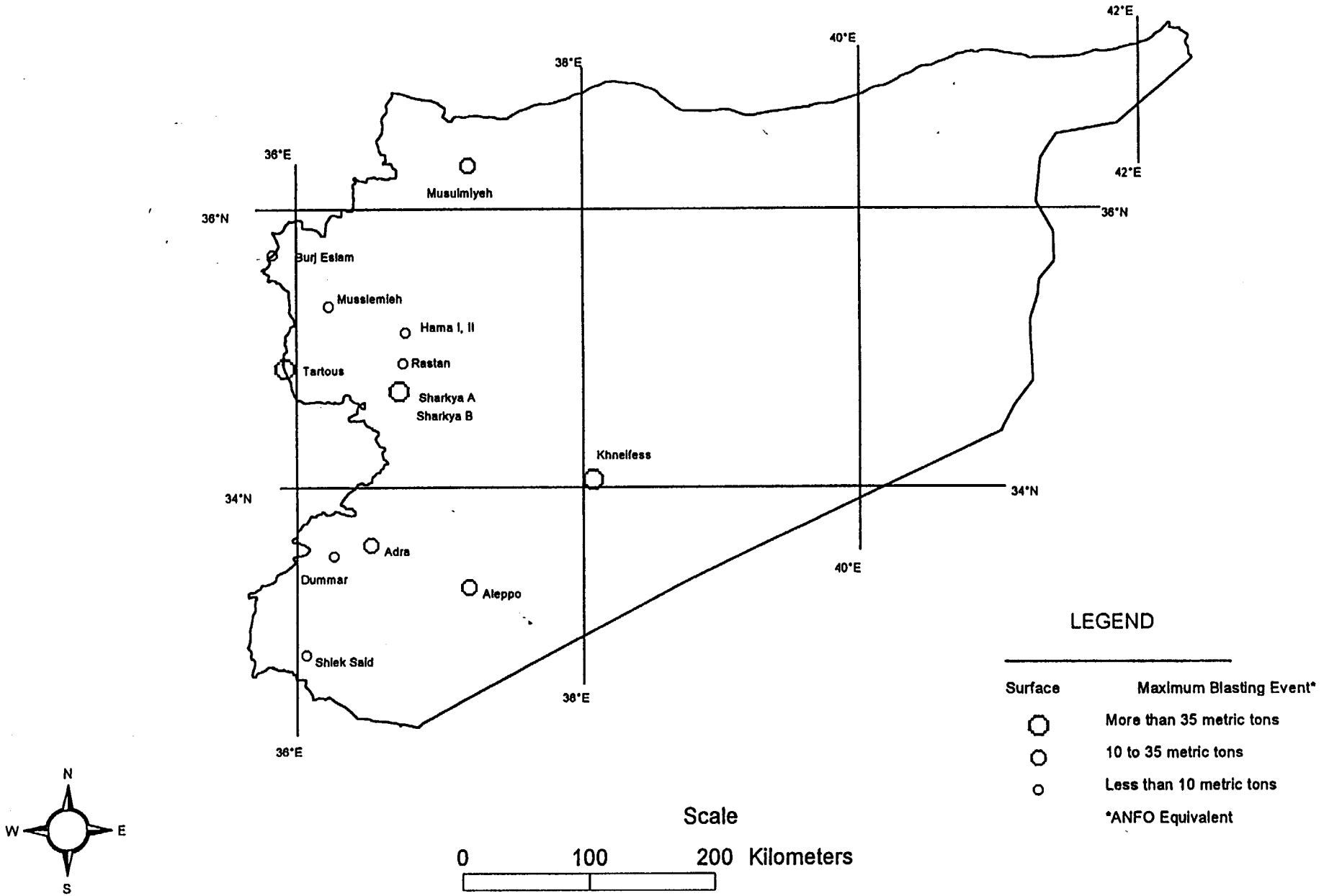


FIGURE 4.1--Selected Syrian Mines and Estimated Maximum Blasting Events

5.0 CONCLUSIONS

Mining in Syria is dominated in the Khadir Al Hamal region (Sharkaya A and B Mines) by phosphate rock mining. These are primarily surface operations. In the Khadir Al Hamal region, maximum blasting events for surface operations are in the 35-50 metric ton of ANFO equivalent range.

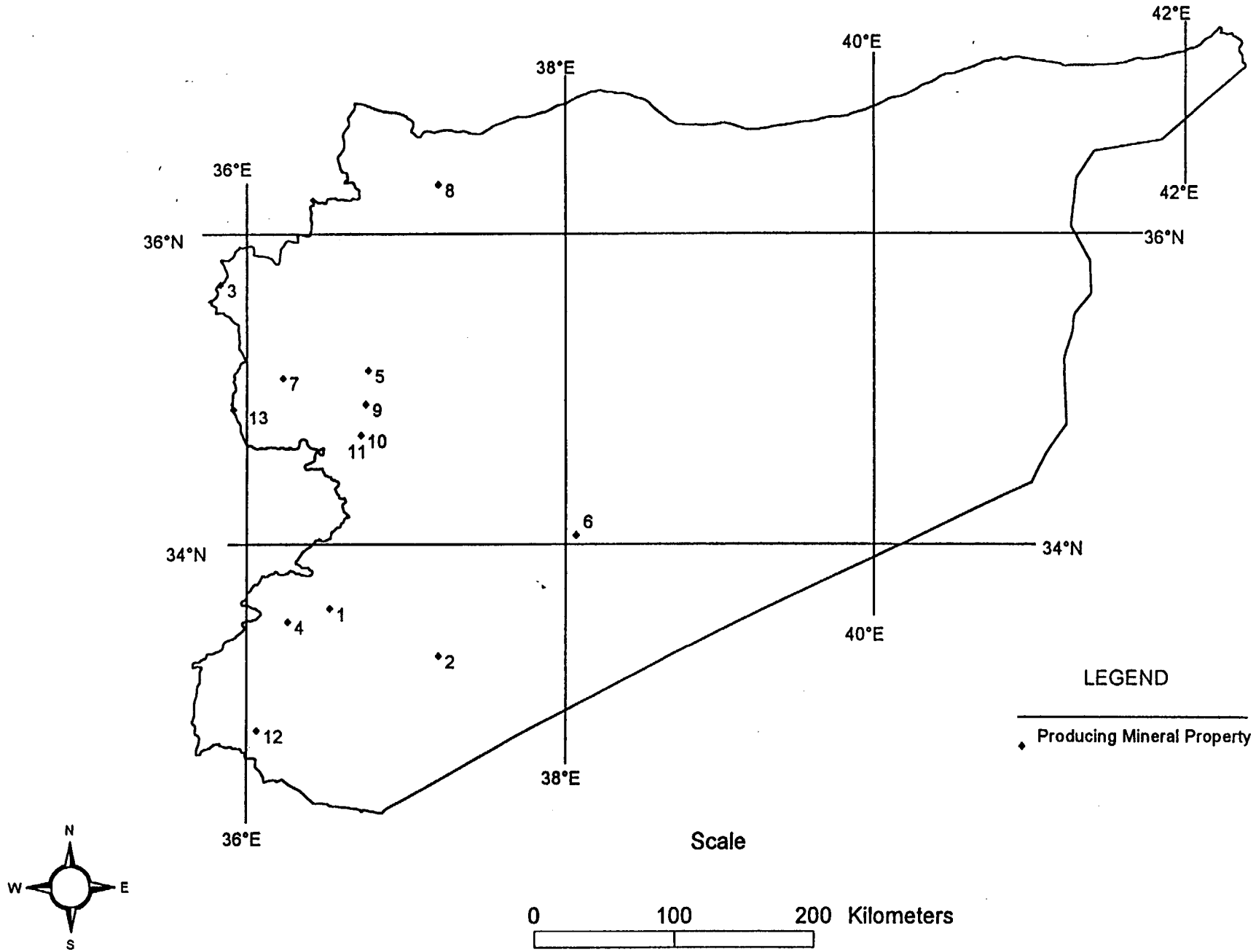
While only a few individual sites possess the capacity to produce regularly scheduled blasts over the 35 metric ton (ANFO equivalent) range, there are several areas where multiple surface mines are operating. Hence, it could be feasible for operators to fire several individual mine blasts at the same time, thus effectively creating a larger event.

APPENDICES

APPENDIX A: PRODUCING MINERAL PROPERTIES IN SYRIA

MAP KEY	NAME (1)	COORDINATES LAT.	LONG.	COMMODITY	DATA SOURCES (2)	STATUS (3)	MINE TYPE	MARKETS	COMMENTS
1	Adra	N 33° 37'	E 36° 30'	Limestone	4,18	Producer	Surface	Domestic	capacity reported at 1,270,000 mt/yr
2	Aleppo	N 33° 19'	E 37° 12'	Limestone	4,18	Producer	Surface	Domestic	capacity reported at 1,377,000 mt/yr
3	Burj Eslam	N 35° 41'	E 35° 48'	Limestone	4,18	Producer	Surface	Domestic	capacity reported at 125,000 mt/yr
4	Dummar	N 33° 32'	E 36° 14'	Limestone	4,18	Producer	Surface	Domestic	capacity reported at 294,000 mt/yr
5	Hama	N 35° 08'	E 36° 45'	Limestone	4,12,18	Producer	Surface	Domestic	capacity reported at 632,000 mt/yr
6	Khneiless	N 34° 05'	E 38° 05'	Phosphate rock	1,2,3,9,12,13,14, 15,16	Producer	Surface	Domestic & exported	capacity reported at 757,000 mt/yr
7	Musslemieh	N 35° 19'	E 36° 12'	Limestone	4,12,18	Producer	Surface	Domestic	capacity reported at 459,000 mt/yr
8	Musulmiyeh	N 36° 19'	E 37° 12'	Limestone	4,18	Producer	Surface	Domestic	capacity reported at 1,148,000 mt/yr
9	Rastan	N 34° 55'	E 36° 44'	Limestone	4,18	Producer	Surface	Domestic	capacity reported at 188,000 mt/yr
10	Sharkya A	N 34° 43'	E 36° 42'	Phosphate rock	1,2,3,9,12,13,14, 15,16	Producer	Surface	Domestic & exported	capacity reported at 790,000 mt/yr
11	Sharkya B	N 34° 43'	E 36° 42'	Phosphate rock	1,2,3,9,12,13,14, 15,16	Producer	Surface	Domestic & exported	capacity reported at 776,000 mt/yr
12	Shiekh Said	N 32° 50'	E 36° 02'	Limestone	4,18	Producer	Surface	Domestic	capacity reported at 459,000 mt/yr
13	Tartous	N 34° 53'	E 35° 53'	Limestone	4,12,18	Producer	Surface	Domestic	capacity reported at 3,231,000 mt/yr

(1) Due to software limitations, site names do not include any diacritical markings. Spellings of individual site names vary considerably by source.
(2) Complete list of data sources is shown in Appendix C.
(3) Because of the varying age of source information, the status at individual sites may not be current.

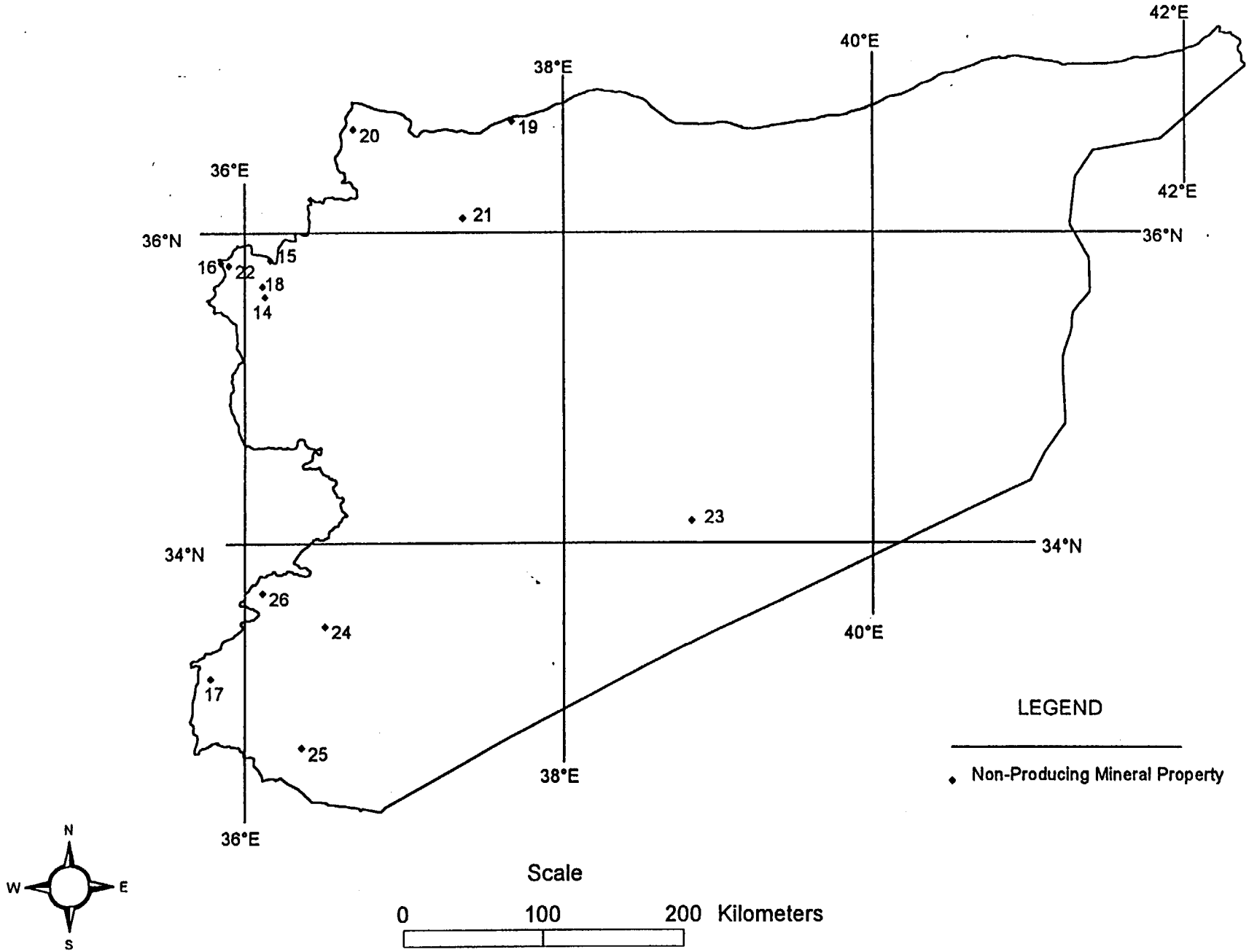


APPENDIX MAP A-1: PRODUCING MINERAL PROPERTIES IN SYRIA

APPENDIX B: NON PRODUCING MINERAL PROPERTIES IN SYRIA

MAP KEY	NAME (1)	COORDINATES LAT.	LONG.	COMMODITY	DATA SOURCES (2)	STATUS (3)	MINE TYPE	COMMENTS
14	Ain Layloun	N 35° 36'	E 36° 06'	Phosphate rock	9	deposit	unknown	high grade residual = 31% P2O5=2 Mmt
								low grade 10.4 Mmt of which 6 Mmt = 18.3% P2O5
15	Al Baer	N 35° 50'	E 36° 08'	Chromium	4,15	deposit	unknown	30-40% Cr2O3 + 10% Fe-reserves = 18,000 mt/lenses
								in peridotite; strike lengths of 30-3000 meters.
16	Al Basit	N 35° 49'	E 35° 49'	Chromium	4,15	deposit	unknown	30-40% Cr2O3 + 10% Fe-reserves = 18,000 mt/lenses
								in peridotite; strike lengths of 30-3000 meters.
17	Al Konitera	N 35° 45'	E 33° 07'	Lead	4,15	deposit	unknown	fissure filled calcite veins containing galena
18	Kafaria	N 36° 05'	E 35° 40'	Bituminous rock	4,5,15	deposit	unknown	limestone, sandstone, or marl-50 Mmt reserves
								also deposits at G. Al Beshry and North Al Dameer.
19	Makharet Al Shugira	N 36° 43'	E 37° 41'	Sulfur	15	deposit	unknown	18 km from Tadmur; deposit is uneconomic
20	Radjou	N 36° 40'	E 36° 40'	Iron	4,14,15	deposit	unknown	Fe=38%,SiO2=9%,Al2O3=10%,CaO=4%,TiO2=5%,
								P2O5=0.3%,S=0.1%
21	Ras Al Ayn	N 36° 06'	E 37° 22'	Sulfur	4,5,15	deposit	unknown	deposit is uneconomic
22	Sazak	N 35° 48'	E 35° 52'	Copper	4,15	deposit	unknown	associated with basic and ultrabasic rocks
23	Tarag el Hbarl	N 34° 01'	E 38° 50'	Phosphate rock	2,3	deposit	unknown	400,000,000 mt reserves.
24	W. Al Nashab	N 33° 30'	E 36° 29'	Iron	4,14,15	deposit	unknown	lies in the Al Akrad district in N-W Syria w/Radjou
25	W. Al Rakhim	N 32° 43'	E 36° 20'	Phosphate rock	4,15	deposit	unknown	3.3 m thick, reserves = 15 Mmt @ 23.2% P2O5.
26	Zabadani	N 33° 43'	E 36° 05'	Iron	4,15	deposit	unknown	red and yellow oxides in cretaceous sandstone-Fe=27%

(1) Due to software limitations, site names do not include any diacritical markings. Spellings of individual site names vary considerably by source.
(2) Complete list of data sources is shown in Appendix C.
(3) Because of the varying age of source information, the status at individual sites may not be current.



APPENDIX MAP B-1: NON-PRODUCING MINERAL PROPERTIES IN SYRIA

APPENDIX C: PUBLIC SOURCES OF INFORMATION

1.---Omara, S. Phosphatic Deposits in Syria and Safaga District, Egypt. Economic Geology. Vol. 60. 1965. PP. 214-227.
2.---U.S. Geological Survey. MRDS The Mineral Resource Data System. (1996)
3.---U.S. Geological Survey. MAS The Minerals Availability System. (1996)
4.---Defense Mapping Agency. Gazateer of Syria-Second Edition. Washington, D.C. 1983.
5.---Defense Mapping Agency. Operational Navigation Chart-1:1,000,000. ONC G-4. 1974.
6.---Michalski, Bernadette. Syria. Mineral Industry Survey series. USBM. 1994.
7.---Michalski, Bernadette. The Minerals Industry of Syria. USBM Yearbook Chapter-1993. PP. 74-77.
8.---Collelo, Thomas. ed. Syria-A Country Study. Foreign Area Studies The American University. 1986. PP. 146-153, 160-163.
9..---The British Sulfur Corporation Limited. Syria. World Survey of Phosphate Deposits. 1987. PP. 173-178.
10.---The Mining Journal. Mining Annual Review 1994. London, U.K. P. 161.
11.---The Mining Journal. Mining Annual Review 1995. London, U.K. PP. 164.
12.---Michalski, Bernadette. The Mineral Industry of Tunisia. USBM Yearbook Chapter 1992. PP. 90-98.
13.---Atfeh, S. The Phosphorite Resources of Syria. Phosphate Deposits of the World Vol 2. Ed. A. G. J. Northolt, R.P. Sheldon, D.F. Davidson. Cambridge University Press 1989. PP. 357-362.
14.---Habashi, Fathi and Foad A. Bassyouni. Mineral Resources of the Arab Countries. Department of Mining & Metallurgy-Laval University, Quebec City, Canada 1978. PP. 100-102.
15.---Habashi, F. and F. A. Bassyouni. Mineral Resources of the Arab Countries-2nd ed. Department of Mining & Metallurgy-Laval University, Quebec City, Canada 1982. PP. 49-51.
16.---Khawlie, M. R. Beyond the Oil Era-Arab mineral resources and future development. Mansell Publishing Ltd. London. 1990. 132 pp.
17.---United States Central Intelligence Agency. Syria. CIA-95 facts-Government Publications. 6 pp.
18.---World Cement Directory 1991. Cimeurop s.a.r.l., 4 pp.

Tunisia

Table of Contents

TABLES

FIGURES

1.0 EXECUTIVE SUMMARY

This report was prepared under Memorandum of Agreement B291867 between Lawrence Livermore National Laboratory (LLNL) and the U.S. Geological Survey, Minerals Information Team (MIT)(formerly the Office of Minerals Information). It provides LLNL information on the mining industry of Tunisia, and quantitative information on the blasting potential of this industry. MIT identified mining activities through the use of its Minerals Availability System data base, its data collection and analytic capabilities, and an extensive network of information sources.

Crude petroleum and phosphate rock production accounts for the largest share of Tunisia's income [1]. Ferrous, non-ferrous and industrial minerals also add to the mineral wealth of the country. Research activities resulted in the identification of 135 mineral properties in Tunisia, however, most properties operate on a small scale and require minimal blasting. The blasting potential for 21 main Tunisian mines is reported, with only 4 operating mines having the potential to produce blasts of over 75 metric tons of ANFO equivalent at any given time as part of normal mining activities.

The largest mining sector is phosphate mining, which is generally centered

---

[1]The Mining Journal. Mining Annual Review 1995. London, U.K. PP. 154-155.

around the low grade deposits of the Gafsa region. The region is comprised of 9 operating mines, 8 of which are in the immediate Gafsa proximity and the Kalaa Khasba mine, which is further to the north.

Tunisia uses internally produced explosives or imports and possesses the technology and facilities to manufacture blasting agents and detonation systems suitable for mining applications. Most surface and underground mines in Tunisia utilize ammonium nitrate-fuel oil (ANFO) blasting agents. High explosives may be used in a few small underground operations where geologic conditions and characteristics require its use.

1.1 **Authority**

This report was prepared under Memorandum of Agreement B291867 between Lawrence Livermore National Laboratory (LLNL) and the U.S. Geological Survey, MIT.

1.2 **Project Scope**

As part of this agreement, MIT is to identify mining activities in Egypt, Jordan, Syria, Tunisia and Turkey. This information will be used for monitoring/verifying compliance of the Comprehensive Test Ban Treaty. MIT will use the Minerals Availability System data base, its data collection and analytic capabilities, and an extensive network of information sources to provide background information on the use of explosives by the mining industry of these countries. This information is of particular interest because the normal blasting activities of mining can cause false alarms during monitoring and disguise nuclear blast events.

Reports with accompanying figures and tables summarize location, type of mining method, commodity(ies), estimated frequency and size of mine blasts, operational status, and distribution to foreign or internal markets for the specified countries.

Once country data were collected and verified, the explosive use at selected sites was evaluated. Focus was placed on locations that consume large quantities of conventional chemical explosives. Undeveloped sites and small scale mines which consume minimal amounts of explosives (included in Appendix A-B of this report), were

not analyzed in terms of the site's anticipated use of explosives. Mineral prospects generally make only small use of explosives and small mines (some of which are operated on an intermittent basis) are assumed to require minimal blasting. Appendix A lists all the producing and developing mineral properties in Tunisia, while Appendix B lists all the known past producers and undeveloped deposits in Tunisia. These listings were used as the basis from which the main Tunisian mines consuming explosives were selected.

Based upon known site information (geological conditions, mine technology, production capacity, and current blasting practices), the blasting potential for significant mining sites was evaluated. Where site-specific data were not available, estimates for representative, important properties were developed based upon accepted industry practice, knowledge of the Tunisian mining industry, and related geologic characteristics.

2.0 SOURCES OF INFORMATION

Data for this report were derived from published sources, unpublished documents, and personal communications through an extensive network of public and private contacts. Public sources of information are listed in Appendix C. Much of the industry summary was drawn from data reported by the U.S. Bureau of Mines Mineral Yearbook chapter on Tunisia, from the years 1992-1994. Information for 1995 was obtained from the U.S. Geological Survey, Minerals Information Team, International Minerals Section, Reston,

VA (formerly the U.S. Bureau of Mines, Division of International Minerals).

Principal agencies contacted include, but were not limited to, the U.S. Geological Survey, the U.S. Department of State, Central Intelligence Agency, Defense Intelligence Agency, the United Nations, the World Bank, World Resources Institute, and the International Strategic Minerals Institute (ISMI). In addition, selected academic and industry contacts, explosives manufacturers and suppliers, and trade groups were contacted.

3.0 THE MINING INDUSTRY OF TUNISIA

The mining industry of Tunisia is minor compared to the minerals fuels industry, the leading industrial sector. The estimated gross domestic product (GDP)-purchasing power parity- for Tunisia in 1994 was $37.1 billion (est)[2]. In 1994, the mining industry activity accounted for about $300 million in foreign exchange[3]. Of the minerals and metals produced in Tunisia, only phosphate is produced on a scale to be considered important by world standards. In 1994, approximately 80% of the 12,000 people employed in the mining sector in Tunisia were employed in the phosphate industry[4]. The Government parastatal Compagnie des Phosphates de Gafsa (CPG), founded in 1896 entirely controls phosphate production.

---

[2]United States Central Intelligence Agency. Tunisia. CIA-95 facts-Government Publications. 6 pp.

[3]Dolley, Thomas P. The Minerals Industry of Tunisia. MIS Mineral Industry Survey series. USBM 1994. 5 pp.

[4]Ibid.

As shown by table 3.1, other industrial minerals produced include barite, hydraulic cement, construction clays, gypsum, lime and marine salt. Metal production includes iron ore and pig iron, lead and zinc, but production is not large on a worldwide basis. As shown by the table, in 1994 phosphate production increased slightly from 1993. During the same time however, the production of crude oil showed a slight decline[5]. The production of acid grade fluorspar ceased in 1992. Tunisian trade has been dominated by the European Union (EU) (75%) - generally exporting mostly to France (30% of total trade) and importing mostly from Italy. India has, however, accounted for about 50% of Tunisia's phosphoric acid exports. In 1994 phosphate rock exports increased from 1.1 Mmt in 1993 to 1.3 Mmt. In Tunisia, most mining and mineral processing plants are state owned, while cement plants were in the process of being privatized in the Tunisian economy. The Tunisian legal system, which is based on French civil law, had a unified investment code introduced in 1993 to help facilitate foreign investment in the minerals industry, with further legislation being planned. Tunisia has also determined that its industry should take a leadership role in the environment, among north African nations. The Government's plan includes a forestry program; a 10-year action plan for water and soil conservation; a national strategy to combat desertification; and a national action program to combat pollution, preserve the country's archaeological heritage, protect the marine environment and beaches and preserve the quality of life of the urban and rural populations.

---

[5]Dolley, Thomas P. The Minerals Industry of Tunisia. MIS Mineral Industry Survey series. USBM 1994. 5 pp.

Table 3.1 -- Estimated Mineral Production in Tunisia,

1993 and 1994 (Metric tons)

Commodity (1)	1993 Production	1994 Production(e)
INDUSTRIAL MINERALS		
Barite	15,300	15,700
Cement, hydraulic	3,300,000	3,300,000
Clay, construction	350,000	350,000
Gypsum	100,000	100,000
Lime	600,000	600,000
Phosphate rock, gross weight	5,500,000	5,660,000
Salt, marine	435,000	414,000
METALS		
Iron ore & concentrate, gross weight	299,000	240,000
Iron, pig iron	140,000	140,000
Lead mine output, Pb content	863	4610
Zinc mine output, Zn content	1,350	15,000

Source: U.S. Bureau of Mines. Minerals Yearbook, 1994.
E/Estimated
(1) Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.
(2) In addition to the commodities listed, a variety of crude construction materials (common clays, sand and gravel, and stone) is produced, but output is not reported, and available information is inadequate to make reliable estimates of output levels. Limestone quarried for cement manufacture is substantial; however, information is inadequate to make accurate estimates of output.

3.1 Phosphate

Phosphate is mainly produced from the Gafsa region of Tunisia (see Appendix A) which has operating mines. The other area of phosphate deposits and mining is the Tebessa-Thala area, which has two mines in operation. Tunisia exports most of its phosphates as phosphoric acid to countries in Europe, Asia and Africa. These phosphoric acid plants are located near the ports of Sfax, La Skhira and Gabes. In 1994, Tunisia was the world's fifth largest producer of phosphate in the world with a 4% share of the world's output. Making up only 5% of world reserves (3.5 to 4 billion metric tons), and 1% of Tunisia's

's GDP in 1994, phosphates are still the most important mineral commodity in Tunisia's economy.

CPG has proposed the development of another open pit at Moulares by 1996.

3.2 Other industrial minerals

Limestone and other cement feed is quarried for usage at the seven cement plants operating in Tunisia. Total cement capacity in 1996 is 5.29 million metric tons per year. The government has recently announced that the cement industry will be sold to the private sector in the coming months. Since 1977, four new cement plants have come on line. This, added to the diversification of products, the start up of hydraulic lime (sets and hardens under water) factories at Thala in 1987 and introduction of a white cement (Portland cement with a low iron content) work at Feriana in 1988, and advanced technology has provided for a rapid progression of the overall profitability of

the industry. An important element of Tunisia's cement profitability is the distribution of factories throughout the country, assuring each plant an appropriate market share. In 1995, a quarter of national production of clinker and cement was sent as exports, earning US$ 60 Million in hard currency.

Salt is also recovered near Sousse, although at a small rate and primarily for local usage. Barite, clay and gypsum were also recovered in 1994.

3.3 Iron

The four main areas of iron deposition in Tunisia are 1) Djerissa, (Djerissa mine) near the Algerian frontier; 2) Tamera, near the coast and the Algerian frontier; 3) Douaria, near Tamera (Tamera-Douaria mine), and 4) Djebel Ank in the Gafsa region. The Tamera-Douaria mine is currently being operated as a surface-underground operation. The Djerissa mine is operated as an underground operation, and was scheduled to close in 1997. However the operators, Societe du Djebel Djerissa (SDD), stated that it could have an extended mine life by utilizing modern mining equipment.

3.4 Lead and Zinc

Lead and zinc are mined in Tunisia on a small scale at the 3 Compagnie Miniere du Nord-Ouest (COMINO) mines. The Bougrine Mine, which came into production in 1994 and has an expected production life of 15 years at 350,000 metric tons per year, is the largest producer of Pb-Zn in Tunisia. It employs about 300 people and has reported

minable reserves of 5.3 million metric tons grading 11.7% zinc and 2.6% lead. It utilizes drift and fill and sublevel mining. It was the only private sector mine in Tunisia in 1995. Construction took 18 months and included two mine entrances, twin declines, underground drifts and raises, the installation of fixed mining equipment, an underground explosives magazine, and electrical facilities. The ore is disseminated in the micron-size range within metasomatized galena and sphalerite. The other operating mines are small, and production only amounts to about 13,000 mt combined contained lead and zinc output. The owner, Metall Mining Corp., and the Government are continuing to explore for other carbonate or sediment-hosted-lead-zinc deposits similar to Bougrine.

3.5 Other minerals

Tunisia possesses additional mineral resources of copper, fluorspar, barite, mercury, lignite, uranium and vanadium. Presently, these commodities are not being mined. Copper exploration is underway at the Ghardimaou-Cap Serrat fault in northern Tunisia.

4.0 MINE RELATED EXPLOSIVES USE

Tunisia uses internally produced explosives or imports and possesses the technology and facilities to manufacture blasting agents and detonation systems suitable for mining applications. Most surface and underground mines in Tunisia utilize ammonium nitrate-fuel oil (ANFO) blasting agents. High explosives may be used in a few small

underground operations where geologic conditions and characteristics require its use.

Most mines utilize explosives to loosen or fragment rock and other consolidated material prior to excavation. Bulk or packaged explosives are detonated either electrically or thermally after being placed in the material to be excavated. Minor quantities of sachet (bagged powder explosives) and shaped charges may be used for secondary breakage and other special applications.

The type and amount of explosives used are influenced by the nature of the rock or ore, the mining methods employed, the production rate of the mine, the type and availability of explosives and detonation systems, hydrologic conditions, mining equipment, drilling equipment, mine geometry, level of technical expertise, and external constraints such as the proximity of residences, and costs. At almost any mine, the size of each blast can vary significantly due to local conditions, production schedules, weather, etc.

Surface mines typically shoot much larger blasts than underground operations and tend to have higher production rates than underground mines. In addition, limitations of working room, limited free faces, ventilation requirements, and drilling limitations may constrain maximum blast sizes in underground mines.

Most Tunisian mines use ANFO blasting agents where blasting is required. ANFO systems are preferred in most mining applications due to their ease of manufacture, low

cost, inherent safety, and bulk loading advantages.

In most cases, site-specific blasting information was unaccessible. Consequently, estimates were based upon estimated production rates, mine geology, mining systems, and typical mining practices. Experience, engineering judgement, and available data were incorporated into calculations and estimates. Explosive use can vary considerably as mining conditions change. ANFO consumption was assumed to be dependent upon mine production rate, average stripping ratio, specific gravity of the host rock, assumed powder factor limits, and mining method.

For each site, a stripping ratio (quantity of overburden or waste removed per metric ton of ore mined) and powder factor (quantity of rock blasted per unit of ANFO blasting agent equivalent) limits were estimated. A range of ANFO consumption was calculated for both daily blasting requirements and an assumed maximum blasting event. Daily ANFO requirements were estimated using a 330 day/year production schedule. Consumption estimates for all sites were calculated in a similar manner. The lower consumption value applies a minimum powder factor while the higher value assumes a maximum powder factor. Unlike daily consumption estimates, a maximum blasting event would not take place on a daily basis. For this study, it was assumed that the maximum blasting event (an estimated technical upper limit of cumulative explosive usage) would use 10 days worth of explosives for a surface mine and 5 days worth for an underground mine. Such events are designed to account for such factors as

blasting delays, geological irregularities, and mining method variations that require a higher ANFO consumption than the typical blasting event. Mine development or pillar extraction conditions, for example, often require larger blasts than normal production.

The following examples illustrate typical blasting calculations for the Djellabia mine using the estimation procedure described above:

Djellabia mine ANFO daily consumption, lower limit (L):

L = Production rate * [1 + (stripping ratio *(specific gravity of ore + waste))] * [Low powder factor / 1000 (converts kg to mt)] / 330 (assumed operating days per year)

L = 1,478,000 * [1 +(4.0 * 2.8)] * [0.11 / 1000] / 330

L = 6.01 6 mt ANFO equivalent (rounded to nearest unit)

Djellabia mine ANFO daily consumption higher limit (H):

H = Production rate * [1 + (stripping ratio *(specific gravity of ore + waste))] * [High powder factor / 1000 (converts kg to mt)] / 330 (assumed operating days per year)

H = 1,478,000 * [1 + (4.0 * 2.8)] * [0.20 / 1000] / 330

H = 10.93 11 mt ANFO equivalent (rounded to nearest unit)

Djellabia mine maximum blasting event ANFO consumption (M):

M = Production rate * [1 + stripping ratio *(specific gravity of ore + waste))] * [High powder factor / 1000 (converts kg to mt)] / 330 (assumed operating days per year) *

maximum blast cycle time (working days between blasting events)

M = [1,478,000 * [1 + (4.0 * 2.8)] * [0.2 / 1000]] / 330 * 10

M = 109.3 109 mt ANFO equivalent (Rounded to nearest unit)

Table 4.1 provides the corresponding blasting range estimates for the main Tunisian mines identified in this study. Figure 4.1 shows site locations for the mines reported in Table 4.1. Symbols reflect the mine type (surface or underground) and maximum ANFO consumption for a given blasting event.

Table 4.1--Estimated Explosives Usage at the Main Tunisian Mines Used in this Study in Order of Estimated ANFO Consumption

Mine	Latitude	Longitude	Primary Product	Mine Type (1)	Production (Mmt/yr) (2)	Daily Consumption (mt ANFO) (3),(4) Low	Daily Consumption (mt ANFO) (3),(4) High	Maximum Blast Cycle Time (days) (5)	Maximum Blasting Event (mt ANFO)
Djellabia	N 36° 09'	E 08° 25'	Phosphate	S	1.478	6	11	10	109
Kef Eddour	N 34° 01'	E 08° 25'	Phosphate	S	1.393	6	10	10	103
Kef Eschafair	N 34° 23'	E 08° 28'	Phosphate	S	1.293	5	10	10	96
Sra Ouertane	N 36° 30'	E 09° 30'	Phosphate	S	1.178	5	9	10	87
Redeyef	N 34° 22'	E 08° 25'	Phosphate	S	0.921	4	7	10	68
Sousse	N 35° 42'	E 10° 38'	Cement Feed (7)	S	1.530	1	2	10	22
Jebel Oust	N 36° 28'	E 10° 14'	Cement Feed (7)	S	1.354	1	2	10	19
Tadjerouine	N 35° 54'	E 08° 34'	Cement Feed (7)	S	1.148	1	2	10	16
Gabes	N 33° 53'	E 10° 06'	Cement Feed (7)	S	0.979	1	1	10	14
Djerissa	N 35° 50'	E 08° 39'	Iron	S	0.240	1	1	10	11
Jebel-Jelloud	N 36° 55'	E 10° 10'	Cement Feed (7)	S	0.612	0	1	10	9
Tamera-Douaria(6)	N 36° 49'	E 08° 41'	Iron	S-UG	0.246	1	1	10	5
Bizerte	N 37° 10'	E 09° 50'	Cement Feed (7)	S	0.383	0	1	10	5
Feriano	N 34° 53'	E 08° 30'	Cement Feed (7)	S	0.306	0	0	10	4
Sehib (Sector 10)	N 34° 12'	E 08° 41'	Phosphate	UG	1.397	0	1	5	4
M'Rata	N 34° 28'	E 08° 08'	Phosphate	UG	1.280	0	1	5	4
Bougrine (8)	N 36° 30'	E 08° 30'	Lead, Zinc	UG	0.628	0	0	5	2
Moulares	N 34° 29'	E 08° 16'	Phosphate	UG	0.732	0	0	5	2
M'Dilla	N 34° 18'	E 08° 46'	Phosphate	UG	0.490	0	0	5	1
Metlaoui	N 34° 19'	E 08° 25'	Phosphate	UG	0.475	0	0	5	1
Kalaa Khasba	N 35° 40'	E 08° 40'	Phosphate	UG	0.233	0	0	5	1

(1) S--Surface; UG--Underground
(2) Mmt/yr--Million metric tons per year
(3) mt ANFO--Metric tons of Ammonium Nitrate/Fuel Oil blasting agent equivalent
(4) Assumed annual production schedule of 330 days per year; results may differ if another production schedule used.
(5) Assumed maximum blasting cycle time for surface operation - 10 working days; underground operation - 5 working days.
(6) Site presently operates using surface methods only, although underground methods were used in the past.
(7) Typical raw material feed for cement plant is 85% limestone and 15% clay; minor amounts of gypsum and other materials may also be required.
(8) As of October 1996, Societe Miniere Bougrine has indefinitely suspended operations at Bougrine due to current zinc price levels.

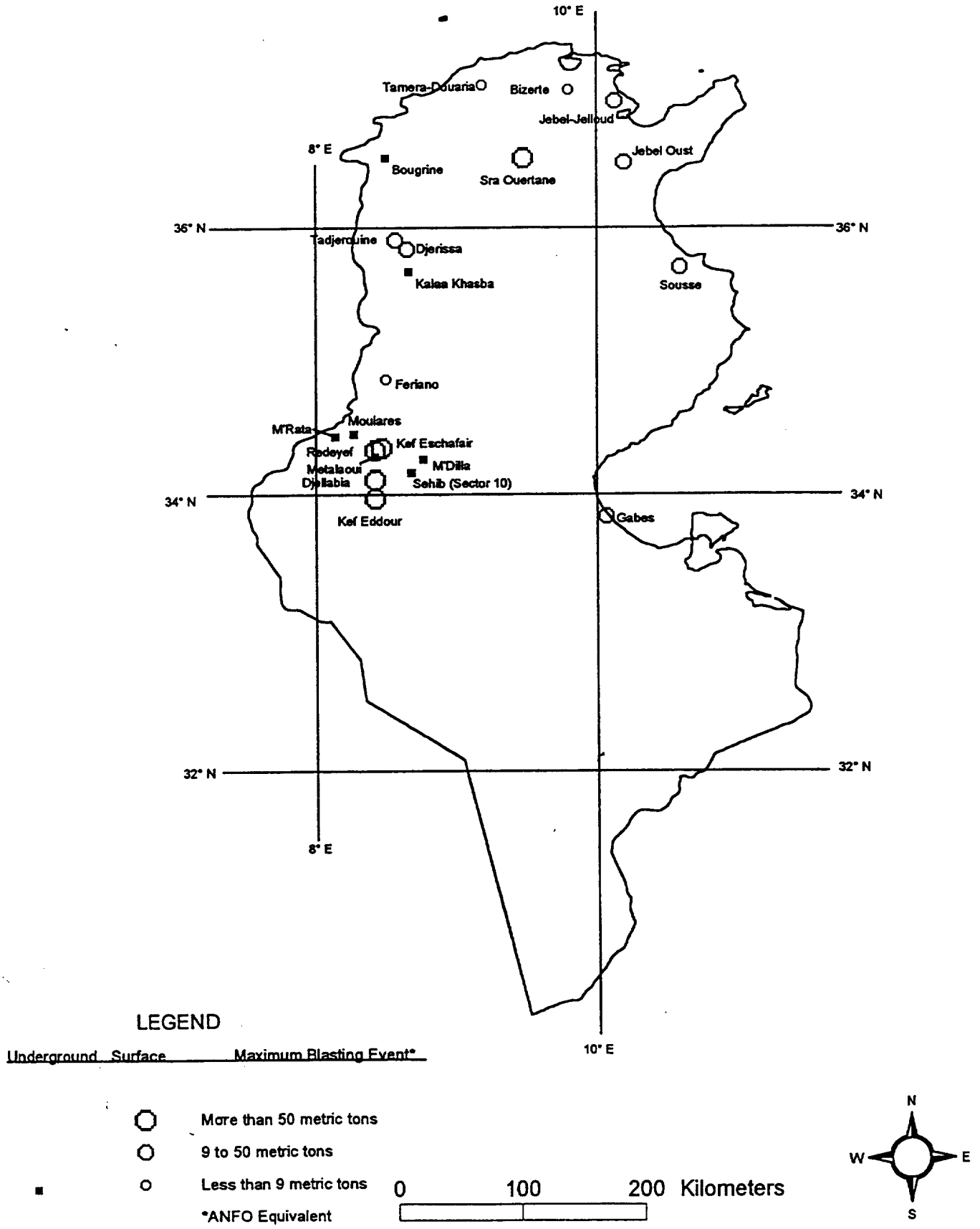


FIGURE 4.1--Selected Tunisian Mines and Estimated Maximum Blasting Events

5.0 CONCLUSIONS

Mining in Tunisia occurs primarily in the Gafsa region(circle G on Map A) for phosphate extraction. These are primarily surface operations. Most underground operations have maximum blasting events under 5 metric tons of ANFO equivalent per event at an individual site. Surface mining operations are generally on a larger scale. In the Gafsa region, maximum blasting events for surface operations are in the 65-110 metric ton of ANFO equivalent range.

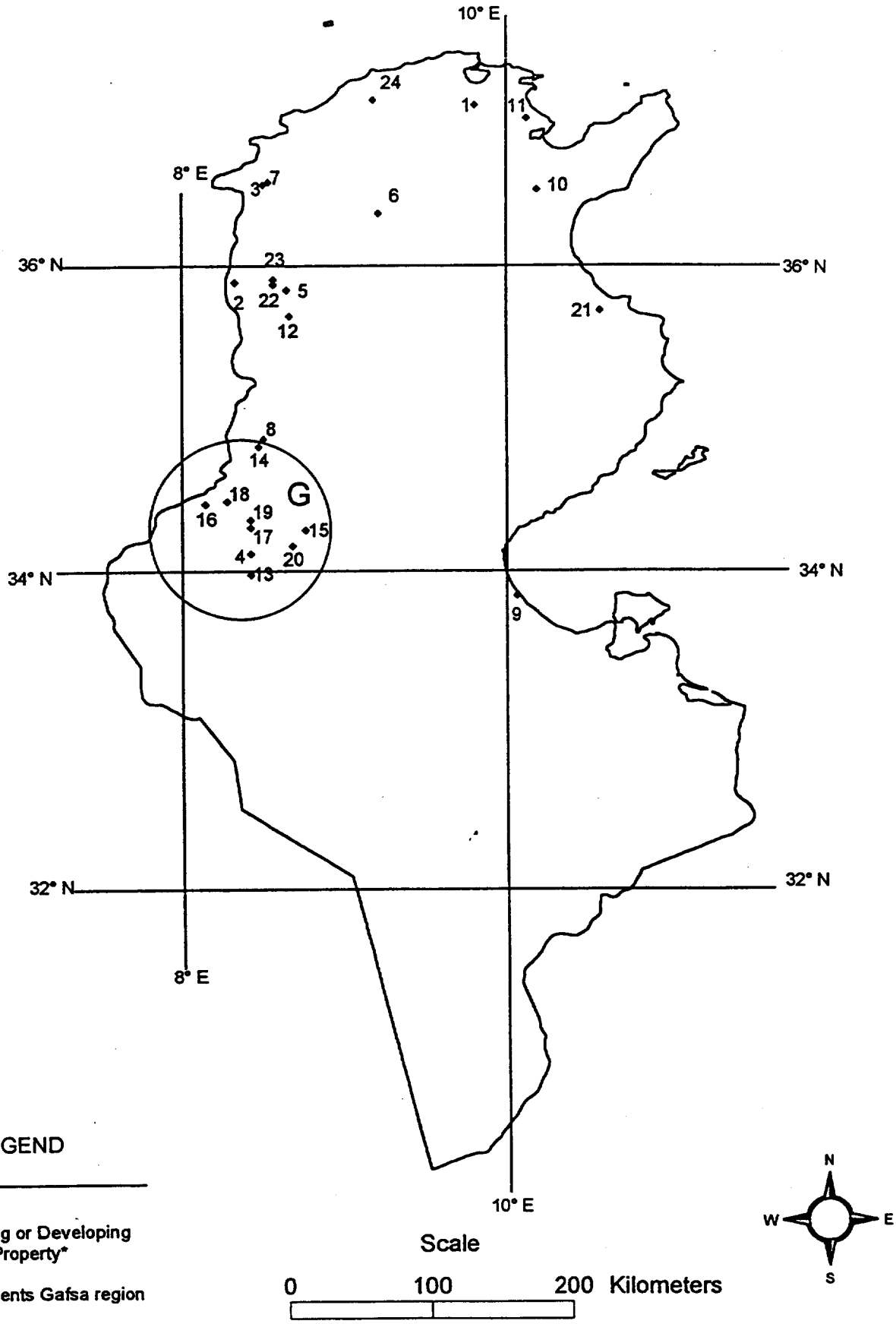
While only a few individual sites possess the capacity to produce regularly scheduled blasts over 75 metric tons (ANFO equivalent), there are several areas where multiple surface mines are operating. Hence it could be feasible for operators to fire several individual mine blasts at the same time, thus effectively creating a larger event.

APPENDICES

APPENDIX A: PRODUCING OR DEVELOPING MINERAL PROPERTIES IN TUNISIA

MAP KEY (1)	NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES	DATA SOURCES (3)	STATUS (4)	MINE TYPE	MARKETS	COMMENTS
1	Bizerte	N 37° 10'	E 09° 50'	Cement	29,30	Producer	Surface	Domestic	plant capacity 300,000 mt/yr
2	Bou Jabeur	N 35° 53'	E 08° 19'	Lead, Zinc,Barite, Fluorspar	1,2,3,4,18,23	Producer	Underground	Domestic	also Boujabeur
3	Bougrine (5)	N 36° 30'	E 08° 30'	Zinc, Lead	3,18,22,38,39	Producer	Underground	Domestic	capacity reported at 628,000 mt/yr
G4	Djellabia	N 34° 09'	E 08° 25'	Phosphate	3,22	Producer	Surface	Domestic& Exported	capacity reported at 1,478,000 mt/yr
5	Djerissa	N 35° 50'	E 08° 39'	Iron, Phosphate	3,4,5,7,17,18,22	Producer	Underground	Domestic	capacity reported at 560,000 mt/yr
6	El Akhout Boukhil	N 36° 19'	E 09° 14'	Lead, Zinc	4,18,22	Producer	Underground	Domestic	
7	Fej Hassen	N 36° 31'	E 08° 32'	Zinc	3,4,18,23	Producer	Underground	Domestic	
8	Feriano	N 34° 53'	E 08° 30'	Cement	29,30	Producer	Surface	Domestic	plant capacity 220,000 mt/yr
9	Gabes	N 33° 53'	E 10° 06'	Cement	20,23,29,30	Producer	Surface	Domestic	plant capacity 800,000 mt/yr
10	Jebel Oust	N 36° 28'	E 10° 14'	Cement	20,23,29,30	Producer	Surface	Domestic	plant capacity 850,000 mt/yr
11	Jebel-Jelloud	N 36° 55'	E 10° 10'	Cement	20,23,29,30	Producer	Surface	Domestic	plant capacity 400,000 mt/yr
12	Kalaa Khasba	N 35° 40'	E 08° 40'	Phosphate	3,4,18,22,23	Producer	Underground	Domestic& Exported	capacity reported at 233,000 mt/yr
G13	Kef Eddour	N 34° 09'	E 08° 25'	Phosphate	3	Producer	Surface	Domestic& Exported	capacity reported at 1,393,000 mt/yr
G14	Kef Es Schfair	N 34° 23'	E 08° 28'	Phosphate	2,3	Producer	Surface	Domestic& Exported	capacity reported at 1,293,000 mt/yr
G15	M'Dilla	N 34° 18'	E 08° 46'	Phosphate	2,3,4,23	Producer	Underground	Domestic& Exported	capacity reported at 490,000 mt/yr
G16	M'Rata	N 34° 28'	E 08° 08'	Phosphate	2,3	Producer	Underground	Domestic& Exported	capacity reported at 1,280,000 mt/yr
G17	Metlaoui Mine	N 34° 19'	E 08° 25'	Phosphate	2,3,4	Producer	Underground	Domestic& Exported	capacity reported at 495,000 mt/yr
G18	Moulares	N 34° 29'	E 08° 16'	Phosphate	2,3,4,23	Producer	Surface	Domestic& Exported	capacity reported at 732,000 mt/yr
G19	Redeyef Mine	N 34° 22'	E 08° 25'	Phosphate	2,3,4,22	Producer	Underground	Domestic& Exported	capacity reported at 921,000 mt/yr
G20	Sehib Mine(Sector 10)	N 34° 12'	E 08° 41'	Phosphate	2,3,22	Producer	Underground	Domestic& Exported	capacity reported at 1,397,000 mt/yr
21	Sousse	N 35° 45'	E 10° 38'	Cement	20,22,29,30	Producer	Surface	Domestic	plant capacity 1,200,000 mt/yr
22	Sra Ouertane	N 35° 52'	E 08° 34'	Phosphate	2,3,18	Producer	Surface	Domestic& Exported	capacity reported at 1,178,000 mt/yr
23	Tadjerouine	N 35° 54'	E 08° 34'	Limestone	29,30	Producer	Surface	Domestic	plant capacity 800,000 mt/yr
24	Tamera-Douaria	N 37° 02'	E 09° 11'	Iron	2,3,5,23	Producer	Surface-Underground	Domestic	capacity reported at 240,000 mt/yr

(1) Represents property or property grouping as defined on Appendix map A.
(2) Due to software limitations, site names do not include any diacritical markings. Spellings of individual site names vary considerably by source.
(3) Complete list of data sources found in Appendix C.
(4) Because of the varying age of source information, the status at individual sites may not be current.
(5) As of October 1996, Societe Miniere Bougrine has indefinitely suspended operations at Bougrine due to current zinc price levels.



APPENDIX MAP A-1: PRODUCING MINERAL PROPERTIES OF TUNISIA

APPENDIX B: PAST PRODUCERS, UNDEVELOPED DEPOSITS AND UNKNOWN MINERAL PROPERTIES OF TUNISIA

MAP KEY (1)	NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	STATUS (4)	MINE TYPE	COMMENTS
A1	Ain Allega	N 35° 56'	E 08° 42'	Lead, Zinc	1,4	Unknown	Unknown	Pb/Zn = 3:2
A2	Charren	N 35° 52'	E 08° 27'	Lead	4,23	Unknown	Unknown	
A3	Dagra	N 36° 10'	E 08° 47'	Lead, Zinc,Barite, Strontium	4	Unknown	Unknown	
A4	Djebel Gouraya	N 35° 47'	E 08° 46'	Phosphate	3,4,22,25	Deposit	Surface	
A5	Djebel Kebbouch	N 36° 15'	E 08° 56'	Lead,Zinc	1,4	Deposit	Unknown	Pb content greater than lead
A6	Djebel el Balloute	N 36° 18'	E 08° 33'	Lead,Zinc	1,22	Deposit	Unknown	favors fissures in limestone
A7	Djebel Toulreuf	N 36° 22'	E 08° 32'	Lead	4,22	Unknown	Unknown	
A8	Gam Alfaya-Koudiat el Hamra	N 36° 04'	E 08° 30'	Lead,Zinc	1,4,22	Past Producer	Unknown	Pb/Zn=6:1
A9	Guenaoula Sidi M'Sid	N 36° 00'	E 08° 36'	Zinc,Lead,Barite	18	Deposit	Unknown	
A10	Hameima	N 35° 58'	E 08° 22'	Iron,Manganese	4,17,22	Unknown	Unknown	1965-600,000t probable reserves-hematite
A11	Kaala Djerda	N 35° 44'	E 08° 35'	Phosphate	4,23	Unknown	Unknown	
A12	Kalaat es Senam	N 35° 46'	E 08° 21'	Phosphate	23,25	Past Producer	Unknown	
A13	Kohol	N 36° 20'	E 08° 49'	Zinc	4	Unknown	Unknown	
A14	Koucha	N 36° 10'	E 08° 21'	Lead	4,23	Deposit	Unknown	
A15	Koudiat Hanich	N 35° 54'	E 08° 46'	Zinc,Lead	18	Deposit	Unknown	
A16	Lorbeus	N 36° 06'	E 08° 56'	Lead,Zinc	4,18,22	Past Producer	Unknown	
A17	Melaliss	N 36° 24'	E 08° 47'	Lead	4,22	Unknown	Unknown	
A18	Nebeur	N 36° 18'	E 08° 46'	Iron,Manganese	4,17,19,22	Unknown	Unknown	Phosphate=18-25%
A19	Ressess Toulreuf	N 36° 23'	E 08° 36'	Lead	4	Past Producer	Unknown	
A20	Sakiet Sidi Youssef	N 36° 14'	E 08° 23'	Lead,Zinc	1,4,22	Past Producer	Unknown	
A21	Sidi Amor ben Salem	N 35° 56'	E 08° 336'	Lead,Barium, Strontium	1,4,18,22	Past Producer	Unknown	
A22	Sidil	N 36° 04'	E 08° 43'	Lead	4	Unknown	Unknown	
A23	Siata	N 35° 53'	E 08° 28'	Iron	1,4,19,22,23	Deposit	Unknown	
A24	Zagglat	N 36° 08'	E 08° 32'	Lead	4	Unknown	Unknown	
B25	Ain Kerma	N 35° 32'	E 08° 23'	Phosphate	4,22,23	Unknown	Unknown	
B26	Ain Khamouda	N 35° 24'	E 08° 45'	Zinc	4,22	Unknown	Unknown	
B27	Ain Nouba	N 35° 09'	E 08° 57'	Lead	4,22	Unknown	Unknown	
B28	Chaketma	N 35° 40'	E 09° 00'	Phosphate	4,26	Unknown	Unknown	
B29	Djebel Azerd	N 35° 32'	E 08° 06'	Lead, Zinc	4	Unknown	Unknown	
B30	Djebel El Adjered	N 35° 27'	E 08° 34'	Lead	1,22	Past Producer	Surface	capacity reported at 54,000 mt/yr
B31	Djebel ElAgab Mine	N 35° 15'	E 08° 15'	Zinc,Lead,	2,22	Unknown	Unknown	
B32	Djebel el Hamra	N 35° 26'	E 08° 29'	Lead	4,22	Unknown	Unknown	
B33	Kef Chambi	N 35° 17'	E 08° 43'	Lead,Zinc,Vanadium	1,4,12	Deposit	Unknown	Lead content greater than zinc
B34	Sidi Mabrouk	N 35° 35'	E 08° 53'	Lead	4,22	Unknown	Unknown	
C35	Bachate	N 37° 18'	E 09° 42'	Zinc	4,23	Unknown	Unknown	
C36	Bazina	N 36° 55'	E 09° 23'	Lead, Barium,Strontium	1,4,22	Past Producer	Unknown	
C37	Bechateur Mine	N 37° 19'	E 09° 45'	Lead	2,22	Past Producer	Underground	
C38	Bourchiba/Bourziba	N 37° 10'	E 09° 07'	Iron, Manganese	17,22	Past Producer	Underground	50-53% Fe,7-9% SiO2,2%Mn, 0.1% Pb
C39	Djebel ben Amara	N 36° 59'	E 09° 19'	Zinc	1,4,22,23	Past Producer	Unknown	
C40	Djebel el Grefa	N 37° 02' E	E 09° 31'	Lead	4	Unknown	Unknown	

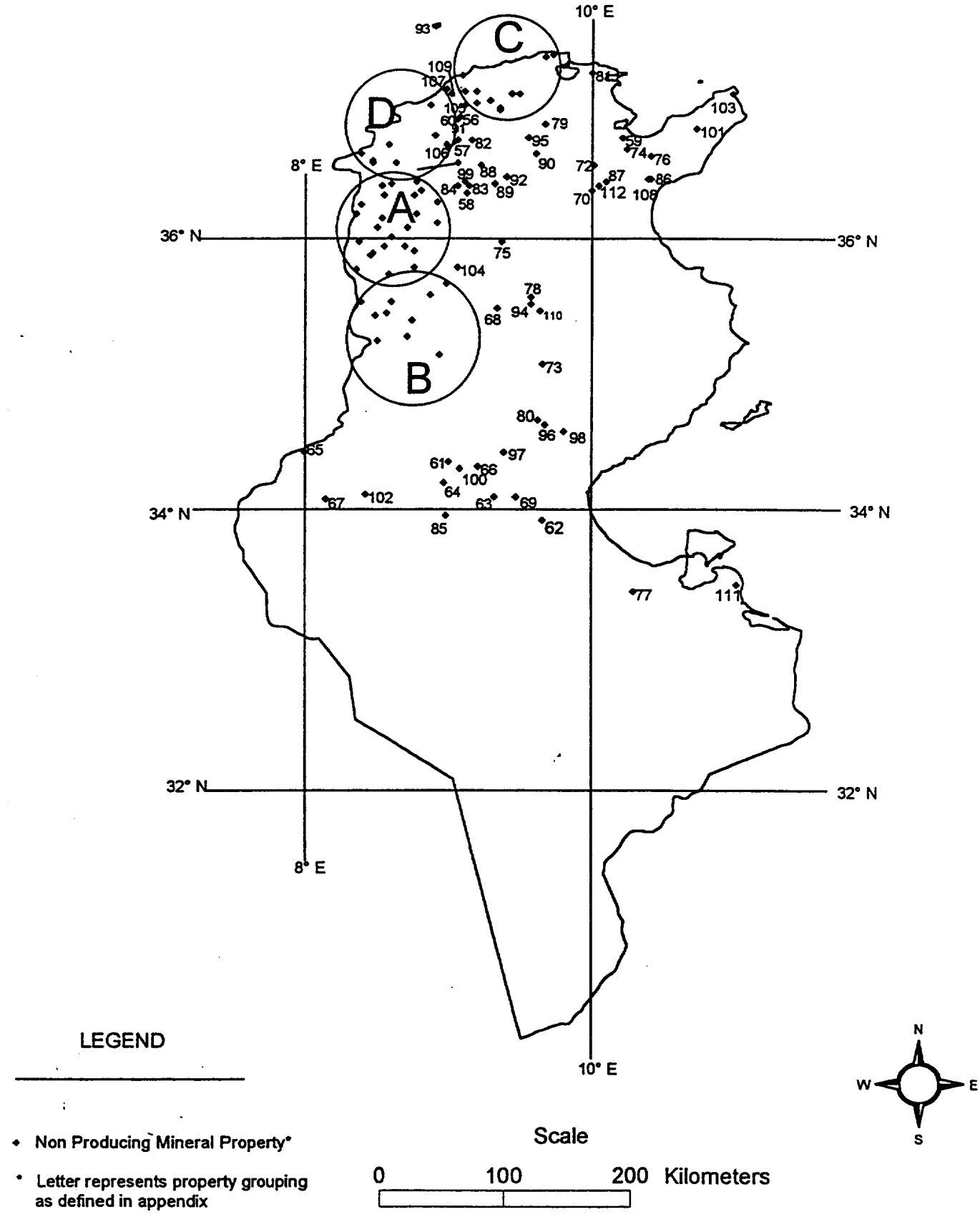
APPENDIX B: PAST PRODUCERS, UNDEVELOPED DEPOSITS AND UNKNOWN MINERAL PROPERTIES OF TUNISIA

MAP KEY (1)	NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	STATUS (4)	MINE TYPE	COMMENTS
C41	Djebel Semene	N 36° 56'	E 09° 23'	Lead	4	Past Producer	Unknown	
C42	El Grefa Mine	N 37° 03'	E 09° 13'	Lead	1,2,3	Past Producer	Surface	
C43	Jafna	N 37° 02'	E 09° 28'	Lead	18,22	Deposit	Unknown	
C44	Nefzas	N 37° 03'	E 09° 08'	Iron	19,22	Unknown	Unknown	
C45	Tabouna	N 36° 58'	E 09° 13'	Lead	4,22	Unknown	Unknown	
C46	Tamera-Ganara	N 37° 04'	E 09° 06'	Iron, Manganese	4,17,22	Deposit	Unknown	
D47	Chouichia	N 36° 32'	E 08° 38'	Iron, Mangnese,Copper Arsenic,Sulfur	4,17,19,22,23	Past Producer	Unknown	As 0.07%-0.09%, Sb 0.72-1.07%
D48	Djebba Mine	N 36° 40'	E 09° 00'	Zinc,Lead,Vanadium	1,2,4	Past Producer	Unknown	Pb/Zn 3:1
D49	Djebel Diss	N 36° 40'	E 08° 35'	Lead	4,22	Unknown	Unknown	
D50	Djebel Hallouf/ Sidi bou Aouane-Bou Salem	N 36° 44'	E 08° 55'	Lead, Zinc	1,2,3,4,18	Past Producer	Underground	capacity reported at 200,000 mt/yr
D51	Ein Al Bey	N 36° 32'	E 09° 05'	Copper	35	Deposit	Unknown	3% Cu
D52	G Tabett Ben Ksouri	N 36° 44'	E 08° 55'	Arsenic	35	Deposit	Unknown	7-8% Realgar
D53	Oued Maden	N 36° 36'	E 08° 23'	Lead,Zinc	1,4,22	Past Producer	Unknown	
D54	Rass Radjel	N 36° 57'	E 08° 53'	Fluorspar	11,22	Past Producer	Unknown	ore similar to Douaria
D55	Thubernic	N 36° 33'	E 08° 28'	Manganese	4	Unknown	Unknown	
56	Ain Grarho	N 36° 51'	E 09° 05'	Zinc	4,23	Unknown	Unknown	
57	Bou Aouane	N 36° 42'	E 09° 05'	Lead, Zinc	1,2,18	Past Producer	Underground	
58	Bou Khil	N 36° 19'	E 09° 09'	Zinc	4,22	Unknown	Unknown	
59	Bou Komine	N 36° 43'	E 10° 15'	Zinc	4,22	Unknown	Unknown	
60	Chara	N 36° 51'	E 09° 05'	Lead	4,23	Unknown	Unknown	
61	Djebel Ank	N 34° 23'	E 09° 01'	Iron,Manganese	4,17,19,22	Deposit	Unknown	1977 = 1.6-7 mmt Fe
62	Djebel Asiza	N 33° 58'	E 09° 41'	Manganese	4	Unknown	Unknown	
63	Djebel Batoum	N 34° 08'	E 09° 21'	Manganese	4	Unknown	Unknown	
64	Djebel Berda	N 34° 14'	E 08° 59'	Phosphate	4,22	Unknown	Unknown	
65	Djebel Bilji	N 34° 27'	E 07° 59'	Copper	4,22	Unknown	Unknown	
66	Djebel Chambi	N 34° 21'	E 09° 14'	Phosphate	4	Unknown	Unknown	
67	Djebel Drhoumess	N 34° 07'	E 08° 08'	Copper	4,22	Unknown	Unknown	
68	Djebel el Abeid	N 35° 29'	E 09° 22'	Lead	4	Unknown	Unknown	
69	Djebel Hadifa	N 34° 08'	E 09° 30'	Salt	4,22	Unknown	Unknown	
70	Djebel Kohoil	N 36° 20'	E 10° 02'	Lead, Fluorspar	4,22	Unknown	Unknown	
71	Djebel Lazered Mine	N 34° 00'	E 09° 00'	Lead	2	Unknown	Underground	
72	Djebel Oust	N 36° 31'	E 10° 03'	Copper,Fluorspar, Mercury	3,4,22	Past Producer	Surface	
73	Djebel Rechaib	N 35° 05'	E 09° 41'	Phosphate	4,22	Unknown	Unknown	
74	Djebel Ressas	N 36° 38'	E 10° 17'	Lead,Zinc	1,4,22	Past Producer	Unknown	
75	Djebel Sardi	N 35° 58'	E 09° 24'	Zinc	4	Unknown	Unknown	
76	Djebel Sta	N 36° 35'	E 10° 27'	Fluorspar	3	Past Producer	Surface	
77	Djebel Terbaga	N 33° 27'	E 10° 20'	Lead	4,22,23	Unknown	Unknown	
78	Djebel Trozza	N 35° 36'	E 09° 35'	Lead,Zinc	1,4,22,23	Past Producer	Unknown	
79	Djedaria	N 36° 49'	E 09° 42'	Lead	4	Unknown	Unknown	
80	Dribica	N 34° 41'	E 09° 39'	Lead,Barium,Strontium	4,23	Unknown	Unknown	

APPENDIX B: PAST PRODUCERS, UNDEVELOPED DEPOSITS AND UNKNOWN MINERAL PROPERTIES OF TUNISIA

MAP KEY (1)	NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	STATUS (4)	MINE TYPE	COMMENTS
81	El Alia	N 37° 11'	E 10° 02'	Lead	4	Unknown	Unknown	
82	El Haouaria	N 36° 42'	E 09° 11'	Lead, Zinc	1,4,18	Unknown	Unknown	Lead content greater than zinc
83	El Krib	N 36° 22'	E 09° 07'	Zinc,Lead	1,3,22,23	Past Producer	Underground	Zn/Pb=1:1
84	Fedj El Adoum	N 36° 22'	E 09° 05'	Lead, Zinc	4,18	Past Producer	Underground	
85	Fedjel Mine	N 34° 00'	E 09° 00'	Lead,Zinc	2	Past Producer	Underground	
86	Hammam Jedidi	N 36° 25'	E 10° 27'	Copper,Barite,Strontium	4,22	Unknown	Unknown	
87	Hammam Zriba	N 36° 24'	E 10° 08'	Fluorspar,Barite, Strontium	2,3,4,18,22	Past Producer	Underground	capacity 750 mt ore/day 1983-1,195,000 mt reserves-demonstrated
88	Jebba	N 36° 31'	E 09° 15'	Lead,Zinc	18	Deposit	Unknown	
89	Kat Safra	N 36° 23'	E 09° 21'	Lead	4,23	Unknown	Unknown	
90	Kef Lasfar	N 36° 36'	E 09° 38'	Lead,Zinc	4	Unknown	Unknown	
91	Khanquet	N 36° 52'	E 09° 06'	Lead,Zinc	1,2,4,22	Past Producer	Underground	Pb/Zn=1:1
92	Knane	N 36° 26'	E 09° 26'	Lead	4,22	Unknown	Unknown	
93	La Gallet	N 37° 32'	E 08° 56'	Copper	35	Deposit	Unknown	
94	Loridga	N 35° 31'	E 09° 36'	Lead	4	Unknown	Unknown	
95	Madjez el Bob	N 36° 43'	E 09° 35'	Lead	4	Unknown	Unknown	
96	Maknassy	N 34° 39'	E 09° 42'	Phosphate,Lead,Zinc	4,22	Unknown	Unknown	
97	Meheri Zebbeus	N 34° 45'	E 09° 25'	Phosphate	4,22	Unknown	Unknown	
98	Mezzouna	N 34° 36'	E 09° 50'	Lead,Barium,Strontium	4,22	Unknown	Unknown	
99	Nefats	N 36° 24'	E 09° 08'	Lead,Zinc	4,22	Unknown	Unknown	
100	Ouenza	N 34° 20'	E 09° 06'	Iron	19,23	Unknown	Unknown	
101	Oum Douil	N 36° 47'	E 10° 47'	Coal	4,22	Unknown	Unknown	
102	Oum El Khecheb	N 34° 09'	E 08° 25'	Phosphate	3,22	Past Producer	Surface	capacity=1,364 mt ore/day
103	Ras el Mlah	N 37° 02'	E 11° 02'	Fluorspar	4	Unknown	Unknown	
104	Sekarna	N 35° 47'	E 09° 05'	Lead,Zinc	4,22	Unknown	Unknown	
105	Sidi Ahmed	N 36° 57'	E 09° 08'	Zinc,Lead	1,4	Past Producer	Unknown	Pb/Zn=2:5
106	Sidi bou Aouane	N 36° 42'	E 09° 05'	Lead,Zinc	1,2,4,18,22	Past Producer	Underground	
107	Sidi Driss Mine	N 34° 00'	E 09° 00'	Lead,Zinc	1,2,4	Deposit	Underground	
108	Sidi et Tala	N 36° 25'	E 10° 26'	Lead,Zinc	1,4	Past Producer	Unknown	
109	Togara	N 37° 02'	E 09° 02'	Iron,Lead	4	Unknown	Unknown	
110	Toulla	N 35° 28'	E 09° 40'	Lead,Zinc	1,4,22,23	Deposit	Unknown	
111	Zarzis	N 33° 30'	E 11° 04'	Magnesium	3,22	Unknown	Surface	
112	Zhaghouan Djebel Lorbens	N 36° 22'	E 10° 05'	Lead,Zinc	1,4,22	Past Producer	Unknown	

(1) Represents property or property grouping as defined on Appendix map B.
(2) Due to software limitations, site names do not include any diacritical markings. Spellings of individual site names vary considerably by source.
(3) Complete list of data sources found in Appendix C.
(4) Because of the varying age of source information, the status at individual sites may not be current.



APPENDIX MAP B-1: NON PRODUCING MINERAL PROPERTIES OF TUNISIA

APPENDIX C: PUBLIC SOURCES OF INFORMATION

1.—The Mineral Resources of Africa. 1965. PP. 385-387.
2.—U.S. Geological Survey. MRDS The Mineral Resource Data System.
3.—U.S. Geological Survey. MAS The Minerals Availability System.
4.—Sainfeld, Paul. The Lead-Zinc bearing Deposits of Tunisia. Economic Geology. 1956. PP. 150-177.
5.—United Nations. Survey of World Iron Resources-Occurrence and Appraisal. New York, 1970. PP. 62-67
6.—Slim-Shimi, Najet and Said Tlig. Mixed type sulfide deposits in Northern Tunisia, regenerated in relation to paleogeography and tectonism. Journal of African Earth Sciences, Vol. 16, No. 3, 1993. PP.287-307.
7.—Pohl, W., M. Amouri, O. Kolli,and D. Zachmann. A new genetic model for the North African metasomatic siderite deposits. Mineralium Deposita 21, 1986. PP. 228-233.
8.—Burkhart-Bauman, I., J. Ottenman and P. Nicolini. Mineralogische Untersuchungen an Jordanit, Semseyit und Cesarolith von drei tunesischen Blei-Zink-Lagerstaetten. Chemie der Erde 1967. PP 256-259.
9.—Reese, Howard C., Thomas D. Roberts, Barbara Bamford, Sharon Camp, Grant V. Mc Lanahan and Taine Tompkins. Area Handbook for the Republic of Tunisia-1970. PP. 19-21, 276-281.
10.—Duwaji, Ghazi. Economic Development in Tunisia-The Impact and Course of Government Planning. Fr. Praeger, Publishers.
11.—Kuhn, Olin R. Africa's Iron Ore—An Unknown Quantity. May 14, 1927. P. 803.
12.—Shea, John C. Guidebook to the Geology and History of Tunisia. Petroleum Exploration Society of Libya-Ninth Annual Field Conference-1967-Map.
13.—Svoboda, K. Phosphates of Tunisia. Industrial Minerals. December 1984. PP. 37-47.
14.—Dolley, Thomas P. The Minerals Industry of Tunisia. USBM Yearbook Chapter-1993. PP. 189-193.
15.—Belayouni, Habib, Maurice Slanski and Jean Trichet. A study of the organic matter in Tunisian phosphate series: Relevance to phosphorite genesis in the Gafsa Basin (Tunisia). Organic Geochemistry, Vol. 15, No. 1. 1990. PP. 47-51.
16.—Ognar, S. Geothermometrie des Concentrations Plombo-Zinciferes Dans le Cretace de Tunise Centrale. Bull, Centre Rech. Pau - SPNA, December 31, 1969. PP. 377-399.
17.—Walther, H. W., and A. Zitzman ed. The Iron Ore Deposits of Europe and Adjacent Areas. International Geological Conference, Hanover 1977. PP. 303-308.
18.—Orgeval, Jean-Jaques, Denis Giot, Jalia Karoui, Jaques Monthel, and Rachel Sahli. Le Gisement de Zn-Pb de Bou Grine (Atlas tunisien). Description et hitorique de la decouverte. Chron. Rech. Min. No. 482, March 1986. PP. 5-32.
19.—Massin, J. M. Le champ ferrifere de Nebeur. Contribution a l/inventaire des resources minieres de la Tunisie. Bulletin du B.R.G.M. (Deuxieme serie) Section II, no. 4, 1970. PP. 29-33.
20.—Dolley, Thomas P. The Minerals Industry of Tunisia. MIS Mineral Industry Survey series. USBM 1994. 5 pp.
21.—Nelson, Harold D. Tunisia-A Country Study. Foreign Area Studies. The American University. 1986. PP. 148-149, 180-195.
22.—Defense Mapping Agency. Tunisia-Official Standard Names Gazateer No. 81. 1964.
23.—Defense Mapping Agency. Operational Navigation Chart-1:1,000,000. ONC G-2. Edition G 1967.
24.—Power, Tim. Tunisia-Developing Downstream Industries. International Minerals. July 1986. PP. 20-27.
25.—Tlig, S. Rare earth redistribution and fractionation during secondary mineral formation: examples from reef carbonate karst (Jebel Stah, Tunisia) and from oceanic basalts (site 417A, Nothern Atlantic). Journal of African Earth Sciences, Vol. 13, No. 2, 1991. PP. 173-182.
26..—The British Sulfur Corporation Limited. Tunisia. World Survey of Phosphate Deposits. 1987. PP. 108-114
27.—The Mining Journal. Mining Annual Review 1994. London, U.K. P. 155.
28.—The Mining Journal. Mining Annual Review 1995. London, U.K. PP. 154-155.

29.---Industrial Minerals. Mahgreb cement where next? July 1996. PP. 11-14.
30.---World Cement Directory 1991. Cimeurop s.a.r.l., PP. 40-43.
31.---Dolley, Thomas P. MIS-The Mineral Industry of Tunisia. Mineral Industry Survey series. USBM. 1992.
32.---Svoboda, K. The Lower Tertiary Phosphate Deposits of Tunisia. Phosphate Deposits of the World Vol 2. Ed. A. G. J. Northolt, R.P. Sheldon, D.F. Davidson. Cambridge University Press 1989. PP. 284-288.
33.---Grogan, Robert M. And G. Montgomery. Fluorspar and Cryolite. In Industrial Minerals and Rocks. 1975. AIME. P. 666.
34.---Habashi, Fathi and Foad A. Bassyouni. Mineral Resources of the Arab Countrie. Department of Mining & Metallurgy-Lavall University, Quebec City, Canada 1978. PP. 103-109.
35.---Habashi, F. and F. A. Bassyouni. Mineral Resources of the Arab Countries-2nd ed. Department of Mining & Metallurgy-Lavall University, Quebec City, Canada 1982. PP. 51-53.
36.---Khawlie, M. R. Beyond the Oil Era-Arab mineral resources and future development. Mansell Publishing Ltd. London. 1990. 132 pp.
37.---United States Central Intelligence Agency. Tunisia. CIA-95 facts-Government Publications. 6 pp.
38.---American Metal Market. Inmet unit suspends work at Tunisia mine. New York. Oct. 21, 1996. P. 1.
39.---The Mining Journal. Bougrine Suspended. London. October 25, 1996. P. 327.

Turkey

Table of Contents

TABLES

FIGURES

1.0 EXECUTIVE SUMMARY

This report was prepared under Memorandum of Agreement B291867 between Lawrence Livermore National Laboratory (LLNL) and the U.S. Geological Survey, Minerals Availability Team (MAT). It provides LLNL information on the mining industry of Turkey, and quantitative information on the blasting potential of its mining industry. MAT identified mining activities through the use of the Minerals Availability data base, its data collection and analytic capabilities, and an extensive network of information sources.

The geology of Turkey is complex and this is reflected in the diversity of its mineral deposits. While best known for its industrial minerals, a variety of metallic minerals are produced, although output is not large by world standards. Much of Turkey's mineral production originates from a large number of small mines spread across the country; there are very few world class producers. Research conducted for this study resulted in the identification of 1,150 mineral properties. Most properties operate on a small scale and require minimal blasting. The blasting potential for 32 properties is reported.

Turkey possesses the raw materials, technology and facilities to manufacture blasting agents and detonation systems suitable for mining applications, and has established trade relations with neighboring Middle Eastern and former Soviet republics. While the mining industry most commonly uses ammonium nitrate-fuel oil (ANFO), ANFO/gel mixtures are used for selected applications. Blasting is generally small scale, but may occur frequently where mine geology requires explosive use. Estimates for daily ANFO consumption rarely exceed 40 metric tons of ANFO equivalent. The mining area in Turkey with the greatest blast size potential is the Murgul copper district, with an estimated maximum blasting event of 93 mt of ANFO equivalent.

1.1 Authority

This report was prepared under Memorandum of Agreement B291867 between Lawrence Livermore National Laboratory (LLNL) and the U.S. Geological Survey, Minerals Availability Team (MAT).

1.2 Project Scope

As part of this agreement, MAT is to identify mining activities in Egypt, Jordan, Syria, Tunisia, and Turkey as they relate to monitoring/verifying compliance of the Comprehensive Test Ban Treaty. MAT is to use the Minerals Availability and the Mineral Resources Data System data bases, its data collection and analytic capabilities, and an extensive network of information sources to provide background information focusing on the use of explosives by the mining industry, which can cause false alarms during monitoring and hide nuclear blasting events.

Reports with accompanying figures and tables summarize location, type of mining method, commodity(ies), estimated frequency and size of mine blasts, operational status, and mine product distribution to foreign or internal markets for the specified countries.

Once country data were collected and verified, the explosive use at selected sites was evaluated. Focus was placed on a limited number of larger operations, or those reported to have potential for short-term development. Undeveloped sites and small scale mines, which may be included in Appendices A-C of this report, were not analyzed in terms of the site's anticipated use of explosives. Mineral prospects generally make only small use of explosives and small mines (some of which are operated on an intermittent basis) are assumed to require minimal blasting.

Based upon known site information (geological conditions, mine technology, production capacity, and current blasting practices), the blasting potential for significant mining sites was evaluated. Where site-specific data were not available, estimates for

representative, important properties were developed based upon accepted industry practice, knowledge of the Turkish mining industry, and regional geologic characteristics.

2.0 SOURCES OF INFORMATION

Data for this report were derived from published sources, unpublished documents, and personal communications through an extensive network of public and private contacts. Public sources of information are listed in Appendix D. Much of the industry summary was drawn from data reported by the U.S. Bureau of Mines Mineral Yearbook chapter on Turkey, from the years 1992-1994. Information for 1995 was obtained from the U.S. Geological Survey, International Minerals Section, Reston, VA (formerly the U.S. Bureau of Mines, Division of International Minerals).

Principal agencies contacted include, but were not limited to the U.S. Geological Survey, the U.S. State Department, Central Intelligence Agency, Defense Intelligence Agency, the United Nations, the World Bank, World Resource Institute, and International Studies of Minerals Issues (ISMI). In addition, academic and industry contacts, explosives manufacturers and suppliers, and trade groups were contacted.

3.0 THE MINING INDUSTRY OF TURKEY

The geology of Turkey is extremely complex and is reflected in the diversity of its mineral deposits. Best known for its industrial minerals, Turkey was the world's largest producer of boron minerals in 1995, and was a major producer of barite (3% of world production), celestite (a source of strontium; 22%), emery[1], feldspar (8%), cement (2%), magnesite (12%), marble, perlite (16%), and pumice (9%)[2]. Among secondary industrial mineral commodities, Turkey continued to be a major world producer of refined borates, cement, ceramics, and glass. A wide variety of metallic minerals was produced

[1] Turkey is one of the few producers of emery. Worldwide production data is not compiled by U.S. Bureau of Mines.

[2] U.S. Geological Survey and U.S. Bureau of Mines. Mineral Commodity Summaries 1996.

as well, but output was not considered large by world standards. Chromite was the most significant (8% of world production) of the metals produced in Turkey. Except for lignite, output of energy minerals was modest.

Turkey's primary mineral industry contributed slightly more than 1% of the gross domestic product (GDP) in 1994. Turkey's economy in 1994 reflected a period of public sector debt, unemployment, inflation, tight credit, and rapid devaluation of the Turkish lira[3]. Overall, primary plus secondary mineral sector revenues were estimated at about 1.5% of GDP. Secondary mineral commodities, such as refined petroleum products, steel, cement, glass, and certain chemicals, accounted for about 70% of the value of the nation's manufacturing output.

Much of Turkey's mineral production comes from a large number of small mines. The Government continued to be a major participant in most sectors of the Turkish mineral industry through various state-owned industrial corporations (parastatals), banks, and shareholdings in a number of private companies. Etibank, the largest mining-related parastatal, was created in 1935 to develop and operate mines, generate and distribute electricity, and provide the raw materials needed for industry. Etibank produced all of Turkey's aluminum, blister copper, boron minerals, and ferrochrome; it remains the largest producer of chromite. The Government is in the process of transferring its shares in certain parastatals to a privatization administration for sale. The private sector component has grown since a new mining law was enacted in 1985, and is expected to increase if the privatization process, begun in 1989, gains momentum. Privatization has to date been delayed by political infighting and challenges from trade unions.

Turkey has a well-developed trade network for its industrial minerals and refined metals, but is a net exporter of only a limited amount of crude metallic ore. It is one of the largest exporters of boron, cement, glass, and ceramics. Turkey has maintained strong trade relations with neighboring countries in the Middle East and Central Asia. It has

---

[3] U.S. Bureau of Mines. Turkey. Ch. in Minerals Industry Surveys 1994, by H. G. van Oss.

been reported that a significant volume of diesel fuel (a component of ANFO) was brought across the border from Iraq in 1995[4].

Turkey's minerals trade was traditionally with OECD countries, the European Economic Community (EEC) in particular. West Germany was Turkey's most important trading partner. Trade with Middle Eastern countries increased considerably after 1970. Trade with Iran and Iraq was important because these countries provided petroleum in exchange for food and minerals. Since the collapse of the Soviet Union, Turkey has traded heavily with the neighboring Central Asian republics. Trade with the United States has decreased substantially since the 1950's and 1960's.

The Turkish mining sector is reported to have about 790 mining establishments, roughly equivalent to 'company' or 'corporate division', which owned or operated about 3,000 mines in 1993. Of these, many are intermittent operations below cutoff size for this report, about which little information is available. In addition, the minerals industry also had 46 cement plants, 22 steel mills, 5 petroleum refineries, and a number of base metals refineries, glass factories, and fertilizer plants. The mining sector of Turkey possesses both the raw materials and technology to produce most types of blasting components.

Turkish mineral production estimates for 1993 and 1994 are provided in table 3.1. Summaries of mineral site data are provided in Appendices A-C. Data on significant producing sites, past producers, prospects, and undeveloped mineral occurrences are provided in tabular form. Maps showing mineral property locations are provided in Appendix map sets A-C. It should be noted that not all mineral occurrences are reported in this study. Sites with unverifiable information or lacking specific site

---

[4] Personal communication. Bernadette Michalski. U.S. Geological Survey. July 17, 1996.

Table 3.1 -- Reported Mineral Production in Turkey,
1993 and 1994 (Metric tons, except as noted)

Commodity (1)	1993 Production	1994 Production
METALS		
Aluminum, bauxite (2)	538,439	445,020
Antimony mine output, gross wt.	2,100	1,415
Cadmium	31	22
Chromite, gross wt.	767,313	1,270,431
Copper mine output, gross wt.	3,343,532	3,346,490
Gold, kilograms (3)(e)	1,110	996
Iron ore, gross wt.	6,480,000	5,755,000
Lead mine output, gross wt.	179,731	232,140
Manganese ore, gross wt. (4)	37,491	34,500
Silver mine output, Ag cont. kg(5)(e)	103,000	65,000
Zinc mine output, gross wt.	231,756	297,252
INDUSTRIAL MINERALS		
Abrasive, emery	10,988	12,000
Barite, run of mine	118,367	116,220
Boron, run of mine	1,892,356	2,092,032
Cement, hydraulic	31,241,000	29,493,000
Clay, bentonite	456,597	516,187
Clay, kaolin	210,356	179,775
Clay, other	665,351	956,012
Feldspar, run of mine	366,166	502,608
Fluorspar (e)	4,000	6,671
Glass, crude (e)	1,300,000	1,400,000
Graphite, run of mine (e)	20,000	20,000
Gypsum, other than for cement	492,705	(e)500,000
Lime (6)	1,767,000	(e)1,800,000
Magnesite, run of mine	525,640	1,279,614
Nitrogen, N content of ammonia	325,800	(e)350,000

Perlite, run of mine	147,864	164,582
Phosphate rock	77,671	--
Pumice (7)	1,224,114	947,174
Pyrite, gross wt. (e)	50,000	50,000
Salt, all types	1,426,000	1,353,000
Silica sand (e)	350,000	415,000
Soda ash (trona) (e)	385,000	385,000
Sodium sulfate	170,680	307,049
Stone, dolomite	376,518	378,004
Stone, limestone, other than cement(e)	10,852,000	11,000,000
Stone, marble (e)	730,000	750,000
Stone, quartzite	1,205,694	1,350,299
Strontium, celestite (e)	68,000	45,000
Sulfur, native, other than Frasch	(e)17,400	16,673
Sulfur, byproduct of petroleum	21,000	(e)25,000
Talc (e)	4,000	4,000
ENERGY MINERALS		
Asphalt, natural	309,348	108,364
Hard coal, run of mine	4,609,000	4,211,000
Lignite, run of mine	51,359,000	55,038,000

Source: U.S. Bureau of Mines. Middle East. Ch. in Mineral Industry Survey series, 1995, (Draft) Ed. by P. M. Mobbs

(e) Estimated

(1) Table includes data through May 16, 1996. In addition to the commodities listed, aluminum, copper, iron, lead, and zinc metals are produced. Quantities of pyrite, meerschaum and alunite are also produced for local consumption. Construction clay, sand, and gravel are quarried, as are limestone and gypsum for cement manufacture; However, information is inadequate to make estimates of output levels.

(2) Data are for public sector only. Data for private sector production are not available, but production is believed to be about 30kt/yr only.

(3) Data are estimated content of Turkish copper refinery tankhouse slimes.

(4) Does not include manganiferous iron ore from the Deveci Mine, production of which amounts to several hundred thousand tons annually and has a manganese content of 3% to 5%.

(5) Includes estimated content of base metals refinery tankhouse slimes.

(6) Data represent lime produced for steel production and do not include the widespread artisanal production of lime for whitewash and for sanitation purposes.

(7) Turkish pumice production is officially reported in cubic meters and has a density reported to range from 0.5 to 1.0 ton per cubic meter. Values in this table have been converted using 1 cubic meter=0.75 ton.

locations may not be included; producers whose output was less that 10kt/yr may also be omitted. Data are reported for 163 producers, 407 past producers, and 480 mineral deposits. It is believed that all sites with significant potential have been reported.

3.1 Industrial minerals

Turkey is endowed with a wide range of industrial minerals. Production of industrial minerals has been maintained at or near normal levels in recent years. The breakup of the Soviet Union and UN trade sanctions on Iran and Iraq have had some impact on Turkish industrial mineral trade, as these countries have traditionally been strong trading partners with Turkey. Increased competition from Chinese and Indian barite and magnesium have also had a damaging effect. Borates continue to dominate exports and the boron industry has maintained stable production levels. As a partial result of privatization, the cement industry is attracting increased foreign investment. It is expected that cement output and exports may increase as foreign companies assume a larger ownership role in the industry. Turkey has developed a significant amount of export trade in feldspar with Italy and Spain. Improving efficiency and modernization of the industrial minerals sector continues to be high on the agenda for the Turkish Government.

3.1.1 Boron

Turkey is the largest producer of boron minerals in the world. Approximately 42% of all crude ore production for boron comes from Turkey. Extensive resources are found in lacustrine deposits primarily in the Balıkesir/Eskişehir/Kütahya areas of west-central Anatolia. Borates are generally found in distinct horizons, in clay or marl forming part of a flat-lying sedimentary series several hundred meters thick. Ore zones are typically overlain by limestone. Surface exposures are altered to calcite by ground waters, making detection by surface geologic surveys difficult. Drilling, trenching, and adit exploration are used to define ore zones.

Borate mining dates back to the 13th century, but annual production was less than 50kt

until the 1850's. Current Turkish mine capacity is estimated near 2Mt run-of-mine ore, mines are operating near the full production rate to yield approximately 1.25Mt of B_2O_3 content in the boron concentrate. Mining equipment is old, and some mines are facing higher stripping ratios in ore recovery. Presently, all borate production is under the control of Etibank, a parastatal corporation controlled by the Turkish Government, except for a small amount of colemanite recovered from the reworking of dumps by private companies.

Currently, production is centered in three mining areas. The Bigadiç area produces colemanite and ulexite by both surface and underground methods. The Emet area has produced colemanite by both underground and surface methods, although most mines use open pit methods today. The Kırka area produces borax by surface methods. Surface mining consists of drilling, blasting, and removing overburden, then the ore is mined by open pit methods, prior to transport to the local concentrator for crushing, screening, washing, and export. Underground ore, where employed, is drilled, blasted, mined, then transported for crushing, screening and washing at local sites prior to export. Some ore is processed to boron chemicals at the Bandirma plant.

As with most Turkish mineral production, capacity utilization is closely tied to demand and market structure. Both boron minerals and boron derivatives (chemicals) are exported. Starting in 1968, Turkey constructed facilities to produce derivatives such as boric acid, borax decahydrate, and borax pentahydrate.

3.1.2 Magnesite

Turkey produces about 12% of the world's magnesite. Mining of magnesite in Turkey has been ongoing for many years. Most production has been conducted by State-run companies; although some production comes from numerous small private producers. In recent years, many of the smaller producers have been driven out of business by Chinese magnesium and lack of markets for raw magnesite. The largest vertically-integrated dead-burned magnesite producer in Turkey is Kumaş Kütahya Manyezit

(Kumaş), and was sold to Zeytinoğlu Holding A.Ş. in 1995. The other large parastatal company, Konya Krom Magnesit, is slated to be privatized.

There are over 300 known magnesite occurrences in Turkey, related to ophiolitic sequences that have undergone alteration and faulting. Like boron minerals, magnesite deposits tend to occur beneath limestone and volcanic tuff in the Balıkesir/Eskişehir/Kütahya region of west-central Turkey and in the Konya region of central Turkey. Ore occurs as pods or veins within altered serpentine, in areas of broad lateral extent. Ore is mined primarily by surface methods. As many as 40 small pits may be mined at one time as part of a mining operation; with ore being transported by truck up to 200km to a company-operated mill.

The largest magnesite mining complex is near Kütahya and is operated by Kumaş (now privatized). The complex consists of a number of small, scattered pits and a centralized processing plant. For the purpose of this report, all pits have been treated as one mining unit with a location based on the centralized mill. Overburden is removed prior to mining; a stripping ratio of waste to ore is reported to be 5:1. Ore is drilled and is then blasted using an ANFO/gel explosive mixture. The ore is crushed and screened, then sent to the centralized concentration plant where the dead-burned magnesite product (essentially periclase) is produced by calcination.

Mining by Konya Krom Magnesit near Konya is very similar. Magnesite is mined from stockwork ore from several pits. While underground mining was conducted on a limited basis in the past as a means of eliminating the need for overburden stripping, it proved to be costly; presently all magnesite mining is by surface methods. Ore is processed at a centralized plant in Konya that produces a variety of dead-burned magnesite products, mainly refractory brick.

Turkey's third major dead-burned magnesia producer, Magnesit AŞ (MAŞ), operates open pit mines west of Eskişehir. This private Austrian company uses similar methods

to mine the ore, which is then crushed, screened, and hand sorted at the mine before going directly to the sintering plant. Much of the sinter output is shipped to Austria for brick manufacture.

COMAG is Turkey's sole producer of caustic-calcined magnesite, from mines near Tavsanlı and Eskişehir. While mining methods are similar to other sites, overburden depth in this region is less, requiring less stripping prior to mining. Most of COMAG's output is supplied to fused magnesia producers, mainly in Europe.

3.1.3 Perlite

Turkey produces about 15% of the world's perlite. Reserves are located in the Aegean region, in central Anatolia, and in eastern Anatolia near Erzincan. Production is mainly by Etibank and three small, private sector companies, usually from small surface mines in the capacity range of 5-35kt/yr. Total production capacity is about 300kt, but production has been running about 50% in recent years, in part due to a decrease in domestic construction activity. About 130kt/yr is exported.

3.1.4 Strontium

While Turkey has been an important producer and exporter of celestite ($SrSO_4$), production has fallen in recent years due mainly to competition from Spain and Mexico. Turkey was estimated to produce about 21% of the world's strontium in 1994. The mineral is mined by surface methods by one, privately-owned company, Barit Maden, at Sivas in central Anatolia. Annual production reaches 150kt of raw celestite ore per year. Only a small quantity is used domestically, the remainder is exported. Reserves are reported to be very extensive.

3.1.5 Other industrial minerals

Other industrial minerals produced include barite, bentonite, limestone for cement, emery, pumice, sodium sulfate, sulfur, and lignite. While production for some is important on a world scale, individual mining units generally are numerous but small in

size.

Barite is produced from a number of small mines, located across Turkey. Individual mine production capacities can reach up to 150kt/yr; production varies strongly with market conditions. The largest mine is located in the Sivas region of central Turkey. Barite is also recovered in small quantities as a byproduct of lead-zinc mining. Exports are principally to the former Soviet Union republics, the Middle East, and Europe.

Bentonite production increased dramatically in 1993 to about 500kt/yr in response to strong demand in the domestic ceramic and paper industries. Large deposits are in Ankara, Edirne, Konya, Ordu, and Tokat Provinces, and a number of smaller occurrences are found in Çankırı Province. Production comes from small surface mines individually producing up to 20kt/yr. Bentonite supplies domestic and foreign refractory plants and is used as drilling mud.

Cement manufacture utilizes the abundant limestone and clay deposits found in Turkey. Turkey presently has 46 cement plants, located primarily near large cities along the Aegean and Mediterranean coasts, where cement would find a ready market. Cement plants reach a capacity of 2.75Mt/yr, cumulatively within the top 10 world cement producers. Cement production has increased in recent years due to increased domestic demand, resulting in part from a major population shift in recent years to cities, as well as several major ongoing dam construction projects (not all use concrete, however). Turkey is one of the world's largest exporters of cement. Turkish trade in cement and clinker has been affected by regional rather than overall supply imbalances. Exports accounted for about 10% of cement production, mainly to Spain and Greece. Cement production is presently being privatized. Of the 46 plants in operation, only nine were Government-controlled in 1993. If foreign companies assume ownership, it is quite possible that exports of Turkish cement will increase.

As with other countries in the region, limestone extraction is generally conducted at

small-scale open pit mining operations requiring minimal blasting. For the purpose of this study, it is assumed that each cement plant listed in the appendices is fed from nearby limestone deposits. Specific information on limestone occurrences is often not available.

Turkey produces more than 80% of the world's supply of emery. Emery has gradually been supplanted as an abrasive by electric-furnace abrasives. Deposits are located in Antalya, Aydın, İzmir, Manisa, and Muğla provinces of western Turkey. Production at individual sites in Aydın and Muğla provinces is small, with capacities up to 8kt/yr.

Turkey supplied about 9% of world pumice from deposits in central Anatolia, near Kayseri and Nevsehir, in 1994. Individual production is small, using quarrying techniques. Limited blasting is required. Pumice exports have increased following a dramatic rise in the use of the stone for textile washing. Turkey exported about 15% of its pumice produced in 1992, mainly to Europe and the U.S.

Of the mineral fuels, Turkey relies on abundant supplies of lignite. Hard coal reserves are limited to the area around Zonguldak. Lignite deposits are scattered across Turkey. Many lignite operations require additional capital to modernize equipment and process technology. In 1993, Tűrkiye Köműr Işletmesi Kurumu (TKİ) operated 38 mines throughout Turkey with a combined annual capacity of 45Mt, while private sector producers operated about 200 small mines across Turkey. Mines feed domestic power plants.

A large trona deposit was discovered in 1979 at Beypazari near Ankara. This deposit is important because nearby European countries have no known natural soda deposits. Funding to develop this deposit has not yet been secured.

Turkey is basically an agricultural country and requires much phosphate to meet its fertilizer needs. There is only one phosphate producer in Turkey, in the Mazıdağı area.

Production at this site decreased to very low levels in 1995, and is believed to have ceased altogether. Turkey does produce some sulfur from mines and as a byproduct of petroleum refining to support the fertilizer industry, but much sulfur and phosphate are extensively imported.

3.2 Metals

Turkey produced a wide variety of metals as well, but output generally is not considered large by world standards. Among the primary metallic minerals, chromite production is the most significant on a world scale, producing 8% of the world's chromium. Turkey is also a significant producer of processed ferrochromium and steel.

Much of Turkey's metallic mineral production was from a large number of mostly small mines. Capacity expansion projects continued at many secondary mineral production facilities, particularly those in the private sector. Mineral exploration by foreign companies in Turkey is primarily for gold, copper, and zinc.

3.2.1 Base metals

The history of copper and lead/zinc mining dates back to about 7,000 B.C. Over 600 copper occurrences have since been identified. There are four main copper and lead-zinc metallogenic provinces:

1. Eastern Black Sea region - Kuroko-type mineralization related to calc-alkaline volcanics.
2. Bursa Province - Skarn and vein-type mineralization along limestone-acidic intrusives.
3. Southeastern Turkey - Sulfide mineralization related to ophiolites.
4. Central Taurus Mountains of southern Turkey.

Over 99% of the copper industry in Turkey is controlled by Etibank and its subsidiary, Black Sea Copper Works (KBİ). Etibank operates open pit mines at Küre and Ergani (idle in 1995), KBİ has open pit mines at Murgul and Kutlular and an underground mine

at Kűre.

The country's main lead/zinc resource occurs in the Çanakkale region in northwestern Turkey, where numerous small deposits are reported. Six private companies are also involved with mining lead/zinc.

The largest copper mining operation occurs at Murgul, near Artvin, with the capacity to recover 3.85Mt/yr of copper ore to produce 175kt/yr of copper concentrate. Capacity has not been reached in recent years. Ore occurs in volcanics; mining is open pit with an average stripping ratio of 3:1 waste to ore. The mine and adjacent concentrator were modernized in 1987. Most other Turkish base metal mines use similar mining methods, as sulfide mineralization occurs at relatively shallow depths.

The most significant development in the base metals sector in recent years was the development of the Çayeli copper-zinc underground mine near Rize, on the Black Sea coast. The mine reached full production capacity of 600kt/yr in 1995; concentrates were exported and consequently did not affect domestic output of refined copper or zinc. Prospecting in the region is ongoing. Regional exploration has identified several potential target areas; the most notable is the Cerattepe copper-silver-gold property which is being developed by Cominco. Much of the copper ore in Turkey contains significant gold values (about 2 ppm) which is recovered from refinery slimes after transport to Europe.

Most Turkish copper ore is concentrated locally. Copper concentrates are either exported, as in the case of the Çayeli mine, or processed domestically, producing either blister (Samsun only) or refined copper. Some refined copper is exported, primarily to Europe. Turkey has one small (34kt) zinc refiner at Kayseri.

3.2.2. Chromium

Turkey produced 8% of the world's chromium in 1994. Large areas of Turkey are

covered with serpentine, the host rock for chromite. Since its discovery in Turkey in 1848, chromite has played an important part in the Turkish economy. Turkey's chromite reserves are not well defined and are spread out over several hundred occurrences across the country. Deposits can be grouped in six major areas:

1. Gũleman/Elazığ area - eastern Turkey.
2. Fethiye/Koycegiz/Denizli area - southwestern Turkey.
3. Bursa/Eskişehir area - northwestern Turkey.
4. Kayseri/Adana/Mersin area - southern Turkey.
5. Kopdağ area - eastern Turkey.
6. İskenderun/İslahiye/Maraş area - southern Turkey.

In 1990, about 100 chromite mines were producing, but most individual sites produce less than 20kt/yr. Total Turkish chromite production is significant, however. The Gũleman complex near Elazığ is the largest producing group of mines in Turkey, with a production capacity of about 150kt of ore per year. Ore occurs in peridotite complexes and is generally lenticular, tabular, or irregular in form. The Gũleman complex is actually a group of mines, each mining a separate lens of ore. Mining employs either open pit, underground cut & fill, or longwall methods. Blasting may be required, depending upon mining method selected. Most smaller mines require significant blasting to remove the hard ore, as longwall mining methods are not appropriate for this size operation.

All chromite output is directly or indirectly export-driven. The only domestic consumption of chromite is by Etibank, which converts all of its own and some privately produced ore into ferrochromium at its two domestic smelters. Additional domestic consumption is restricted to very small amounts for the manufacture of refractories and leather tanning chemicals.

3.2.3. Iron

Iron ore deposits in Turkey feed the Turkish steel industry, one of the fastest growing

steel industries in the world. There are two main metallogenic provinces for iron ore in Turkey; one in the Sivas/Malatya area of central Turkey, the other extending from Kayseri to Adana, south of the first district. Ore occurs in limestone related to metasomatism and hydrothermal activities.

The largest iron producer is the Divriği area mines northwest of Elazığ. The complex has the capacity to produce 4.5Mt/yr of ore from several sites. Ore is produced mainly by open pit methods.

3.2.4 Precious metals

In recent years, Turkey's precious metal's output has all been derived from credits in base metal refinery slime output, or as smelted metals exported to Europe. Most Turkish copper ores contain 1-2g/t gold, and variable amounts of silver. As a result of revised mining regulations favoring foreign exploration in Turkey, precious metals exploration has increased and several precious metals deposits are either beginning production or being developed. The Aktepe silver mine northwest of Kűtahya has been in production since 1987. The mine has a production capacity of 1Mt/yr.

In 1995, there were three gold deposits awaiting approvals for development. The most advanced property was the Ovacık deposit, an epithermal vein deposit in Tertiary andesite, which is planned to produce at a rate of 300kt of ore per year by surface/underground methods. The Kűçűkdere deposit east of Edremit and the Kaymaz gold deposit southwest of Ankara received environmental permits for mining in 1995, but additional permitting is required before production can begin. All three projects face strong local opposition over the proposed use of sodium cyanide for gold extraction. Gold exploration is continuing, mainly in the Aegean and eastern Black Sea coastal regions.

4.0 MINE-RELATED EXPLOSIVES USE

Almost all mines use explosives to fragment or loosen rock and consolidated material

prior to excavation. Bulk or packaged explosives and blasting agents are detonated after emplacement in material to be excavated. Minor quantities of sachet and shaped charges may be used for secondary breakage and other special applications.

The type and amount of explosives used are influenced by the geotechnical nature of the rock, the mining methods employed, the production rate of the mine, the type and availability of explosives and detonation systems, hydrologic conditions, mining equipment, drilling equipment, mine geometry, level of technical expertise, and external constraints such as the proximity of residences, availability of explosives, and available funding. At almost any mine, the size of each blast can vary significantly due to local conditions, production schedules, weather, etc.

Surface mines typically shoot much larger blasts than underground operations and tend to have higher production rates than underground mines. In addition, limitations of working room, limited free faces, type of mineralization, ventilation requirements, and drilling limitations may constrain maximum blast sizes in underground mines.

Turkey is not limited to domestically produced explosives, but has ample raw materials to produce what is needed. It traditionally has exported materials that could be utilized for explosive manufacture to neighboring countries, including countries currently under UN sanctions. Turkey has the military-related technology and facilities to manufacture blasting agents and detonation systems suitable for most mining applications.

Where blasting is required, most Turkish mines use ANFO blasting agents. This may include some of the newer emulsion and/or aluminum boosted products presently available. While an ANFO/gel mixture is believed to be in use at some mines in Turkey, ANFO systems are preferred in most mining applications due to their ease of manufacture, low cost, inherent safety, and bulk loading advantages. High explosives, however, would be preferable for small underground operations that use drill sizes that are below the critical diameter needed for emplacing ANFO blasting agents, or under

wet conditions, in methane-rich atmospheres, and conditions that require higher detonation velocities and/or convenience of packaged explosives. Many underground mines in Turkey are very small, are labor intensive, and employ non-mechanized methods.

In most cases, site-specific blasting information was unavailable. Consequently, estimates were based upon known or estimated production rates, mine geology, and typical mining practices. Experience, engineering judgement, and available data were incorporated into calculations and estimates. Explosive use can vary considerably as mining conditions change. ANFO consumption was assumed to be dependent upon mine production rate, average stripping ratio, specific gravity of the host rock, assumed powder factor limits, and mining method. Only a small number of mines in Turkey require significant blasting, primarily because of their small size. Many mines do not use the latest blasting techniques, and commonly use more explosives than is needed, resulting in shattered ore.

For each site, a stripping ratio (Quantity of overburden or waste removed per metric ton of ore mined) and powder factor (Quantity of rock blasted per unit of ANFO blasting agent equivalent) limits were estimated. A range of ANFO consumption was calculated for both daily blasting requirements and for an assumed maximum blasting event. Daily ANFQ requirements were estimated assuming a 330 day production schedule. Consumption estimates for all sites were calculated in a similar manner. The lower consumption value applies a minimum powder factor while the higher value assumes a maximum powder factor. Unlike daily consumption estimates, a maximum blasting event would not take place on a daily basis. For this study, it was assumed that a maximum blasting event could occur every 10 working days for a surface mine and every 5 working days for an underground mine. Such events are designed to account for such factors as blasting delays, geological irregularities, and mining method variations that require a higher ANFO consumption than the typical blasting event. Mine development or pillar extraction conditions, for example, often require larger blasts.

The following examples illustrate typical blasting calculations using the estimation procedure described above:

Mũrgul ANFO daily consumption lower limit (L):

L = Production rate * [1 + (stripping ratio * specific gravity of waste)] * [Low powder factor / 1000 (converts kg to mt)] / Operating days per year

L = 3,850,000 * [1 + (1.1 * 2.7)] * [0.11 / 1000] / 330

L = 5.09 5.1 mt ANFO equivalent (rounded)

Mũrgul ANFO daily consumption higher limit (H):

H = Production rate * [1 + (stripping ratio * specific gravity of waste)] * [High powder factor / 1000 (converts kg to mt)] / Operating days per year

L = 3,850,000 * [1 + (1.1 * 2.7)] * [0.20 / 1000] / 330

L = 9.26 9.3 mt ANFO equivalent (rounded)

Mũrgul maximum blasting event ANFO consumption (M):

M = Production rate * [1 + (stripping ratio * specific gravity of waste)] * [High powder factor / 1000 (converts kg to mt)] / Operating days per year * maximum blast cycle time (working days between blasting events)

M = [3,850,000 * [1 + (1.1 * 2.7)] * [0.20 / 1000] / 330] * 10

M = 92.63 92.6 mt ANFO equivalent (rounded)

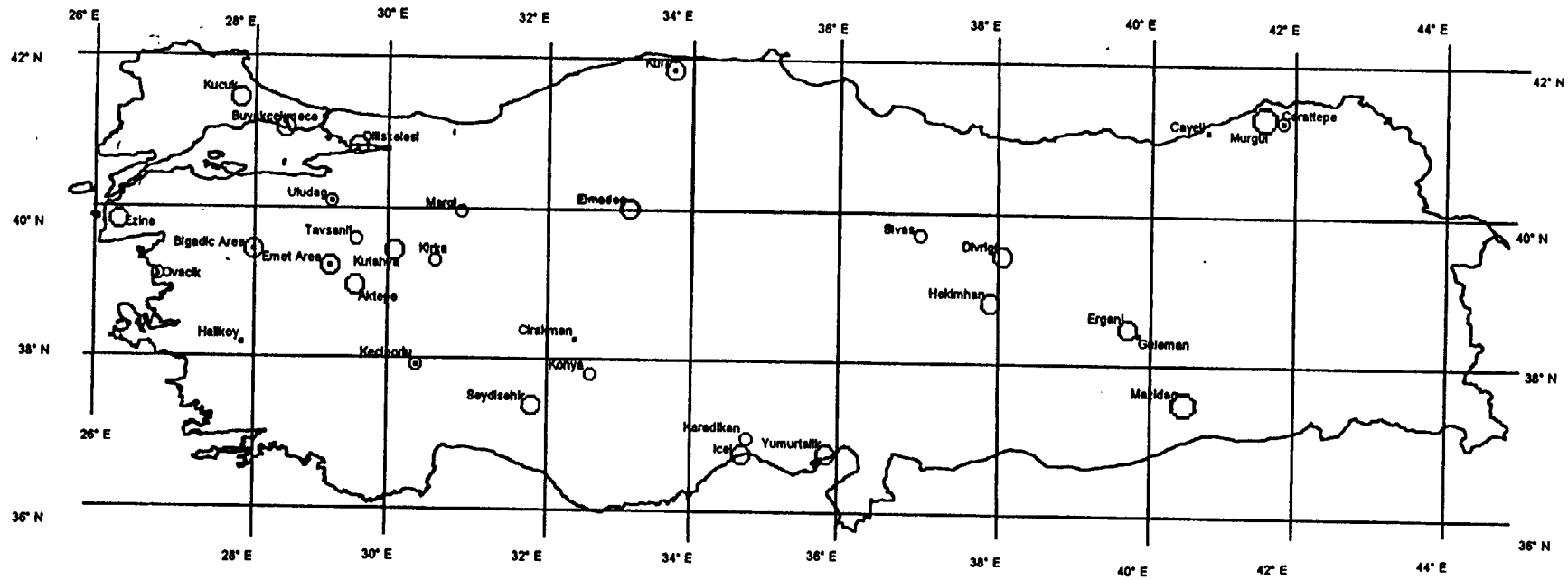
Table 4.1 provides the corresponding blasting range estimates for the main Turkish mines identified in this study. Figure 4.1 shows site locations for the mines reported in table 4.1. Symbols reflect mine type (surface or underground) and maximum ANFO consumption for a given blasting event. Where a mine produces using both underground and surface methods, the predominant method is shown on figure 4.1.

Only two mining sites, the Mũrgul copper mine and the Mazıdağı phosphate mine, had calculated maximum blasting events that exceeded 50 mt ANFO equivalent, and the Mazıdağı site reportedly closed in 1995. Both mines employ typical open pit mining techniques and requires blasting of both ore and overburden. A maximum blasting

Table 4.1--Estimated Explosives Usage at the Main Turkish Mines Used in this Study in Order of Estimated ANFO Consumption

Mine	Latitude	Longitude	Primary Product	Mine Type (1)	Production (Mmt/yr) (2)	Daily Consumption (mt ANFO) (3,4)		Maximum Blast Cycle Time (days) (5)	Maximum Blasting Event (mt ANFO)
						Low	High		
Murgul •	N 41° 15'	E 41° 33'	Copper	S	3.850	5	9	10	93
Mazidagi (6)	N 37° 31'	E 40° 30'	Phosphate	S	1.000	3	6	10	76
Buyukcekmece	N 41° 01'	E 28° 34'	Cement clay	S	2.750	2	4	10	38
Divrigi Area	N 39° 25'	E 38° 05'	Iron	S	4.500	3	4	10	36
Icel	N 36° 48'	E 34° 38'	Cement clay	S	2.500	2	3	10	34
Kure (7)	N 41° 48'	E 33° 43'	Pyrite/Copper	S	1.100	2	3	10	28
			Pyrite/Copper	UG	0.095	0	0	5	1
Ezine	N 39° 47'	E 26° 20'	Cement clay	S	2.000	2	3	10	27
Saray	N 39° 42'	E 34° 40'	Cement clay	S	2.000	2	3	10	27
Tumurtalik	N 36° 49'	E 35° 45'	Cement clay	S	1.850	1	3	10	25
Elmadag	N 39° 58'	E 33° 08'	Cement clay	S	1.300	1	2	10	18
Dilliskelesi	N 40° 47'	E 29° 31'	Cement clay	S	1.300	1	2	10	18
Ergani	N 38° 30'	E 39° 45'	Copper	S	0.724	1	2	10	16
Hekimhan	N 38° 59'	E 37° 52'	Iron	S	0.750	1	2	10	15
Kumas	N 39° 29'	E 30° 04'	Magnesite	S	0.846	1	2	10	15
Aktepe	N 38° 58'	E 29° 29'	Silver	S	1.000	1	1	10	14
Emet Area	N 39° 13'	E 29° 09'	Boron	S	0.650	1	1	10	14
Seydisehir	N 37° 25'	E 31° 51'	Bauxite	S	0.681	1	1	10	12
Bigadic Area (7)	N 39° 25'	E 28° 08'	Boron	S	0.281	1	1	10	10
				UG	0.242	0	0	5	1
Ovacik (8)	N 39° 05'	E 26° 52'	Gold	S	0.300	1	1	10	9
Karadikan	N 37° 00'	E 34° 42'	Limestone	S	0.550	0	1	10	8
Kirka	N 39° 17'	E 30° 33'	Boron	S	0.815	0	1	10	7
Cerattepe (7,8)	N 41° 12'	E 41° 48'	Copper	UG	2.280	1	1	5	7
			Gold/silver	S	0.355	0	0	10	4
Margi	N 39° 55'	E 30° 54'	Magnesite	S	0.400	0	0	10	3
Sivas	N 39° 40'	E 37° 00'	Strontium	S	0.150	0	0	10	2
Konya	N 37° 50'	E 32° 38'	Magnesium	S	0.318	0	0	10	2
Cayeli	N 41° 04'	E 40° 48'	Zinc	UG	0.600	0	0	5	2
Uludag (7)	N 40° 03'	E 29° 10'	Tungsten	UG	0.212	0	0	5	2
				S	0.038	0	0	10	2
Tavsanli	N 39° 33'	E 29° 30'	Magnesium	S	0.265	0	0	10	1
Keciborlu (7)	N 37° 57'	E 30° 18'	Sulfur	S	0.017	0	0	10	1
				UG	0.128	0	0	5	1
Cirakman	N 38° 17'	E 32° 25'	Mercury	UG	0.100	0	0	5	1
Guleman	N 38° 30'	E 39° 46'	Chromite	UG	0.250	0	0	5	1
Halikoy	N 38° 05'	E 28° 10'	Mercury	UG	0.190	0	0	5	1

(1) S--Surface; UG--Underground
(2) Mmt/yr--Million metric tons per year
(3) mt ANFO--Metric tons of Ammonium Nitrate/Fuel Oil blasting agent equivalent. Estimate based on equations reported on page 18.
(4) Assumed annual production schedule of 330 days per year; results may differ if another production schedule used.
(5) Assumed maximum blasting cycle time for surface operation - 10 working days; underground operation - 5 working days.
(6) The Mazidagi phosphate mine produced very little in 1995. It is thought to be closed.
(7) Site uses both surface and underground methods. Explosive usage for each method reported separately.
(8) Site is currently being developed for production.



LEGEND

Underground	Surface	Maximum Blasting Event*
Not Applicable	○	More than 75 metric tons
Not Applicable	○	10 to 75 metric tons
•	○	Less than 10 metric tons

*ANFO Equivalent

FIGURE 4.1--Selected Turkish Mines and Estimated Maximum Blasting Events

event of 93 mt of ANFO equivalent was estimated for the Mũrgul mine and a maximum blasting event of 76 mt ANFO equivalent was estimated for the Mazıdağı mine.

In addition to the two sites previously mentioned, there are 17 sites that have an estimated explosive potential in the range of 10-40 mt of ANFO equivalent for a maximum blasting event. Several of these relate to limestone production feeding cement plants. It should be noted that production from such sites comes from numerous small quarries feeding the nearby plant, rather that one large mining operation, so individual site explosive consumption would be much smaller that the aggregated estimates reported in Table 4.1.

5.0 CONCLUSIONS

The mining industry of Turkey is diverse, industrial minerals production is most important. While there are many mines, most mines are small and only require small amounts of explosives. The largest maximum blasting event in Turkey should be less than 100 mt ANFO equivalent. Most mines require less than 10 mt of ANFO equivalent per day.

APPENDICES

APPENDIX A: PRODUCING AND DEVELOPING MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	MARKETS	COMMENTS
A	1	Adana Gerdibi	N 37° 33'	E 35° 15'	Chromium	19,21	General	Producer	Surface	Domestic	Res: 100Mt. Production of 1kt reported in 1986.
A	2	Adana	N 37° 01'	E 35° 18'	Quartzite	17	General	Producer	Surface	Domestic	Res: 1.2Bt (1985).
A	3	Feke	N 37° 49'	E 35° 55'	Barite	21	General	Producer	Underground	Unknown	Mine output: 50kt barite.
A	4	Karsanti	N 37° 33'	E 35° 22'	Chromium	19	General	Producer	Surface	Domestic	Small operation, private owner.
A	5	Yumurtalik	N 36° 49'	E 35° 45'	Cement feedstock	17	General	Producer	Surface	Domestic	Res: 210Mt clay (1982). Plant produces 1.85Mt cement annually.
A	6	Yenice	N 36° 47'	E 35° 17'	Salt	21	General	Producer	Underground	Unknown	Annual output 700kt NaCl brine by solution mining.
B	7	Dedeli	N 39° 11'	E 43° 04'	Pumice	17	General	Producer	Surface	Unknown	Producing in 1989. Res: 28M cubic meters.
B	8	Ortakent	N 39° 57'	E 43° 18'	Pumice	17	General	Producer	Surface	Unknown	Producing in 1989. Res: 60M cubic meters.
C	9	Samadoglu Gumushacikoy	N 40° 53'	E 35° 35'	Clay	2,17	General	Producer	Surface	Domestic	Moderate size fuller's earth deposit. Res: 32.5Mt for refractory/ceramics.
C	10	Beypazari	N 40° 51'	E 35° 41'	Lignite	17	General	Producer	Unknown	Unknown	Res: 408Mt @ 2.0-2.8Kcal/kg from 3 sites.
D	11	Beypazari	N 40° 10'	E 31° 56'	Trona	10,17	General	Dev. Deposit	Unknown	Unknown	Res: 178Mt @ 45.6% Na2CO3 (1993). Mine has not yet opened, negotiations in progress.
D	12	Cankaya	N 40° 10'	E 32° 49'	Lignite	17	General	Producer	Unknown	Unknown	Res: 30Mt @ 2.0Kcal/kg. Producing in 1989.
D	13	Cayirhan	N 40° 06'	E 31° 37'	Sodium sulfate	17	General	Producer	Brine pumping	Unknown	Res: 193Mt @ 44-79% Na2SO4 (1988).
D	14	Elmadag	N 39° 56'	E 33° 08'	Cement feedstock	17	General	Producer	Surface	Domestic	Res: 88Mt limestone/marl (1987). Plant produces 1.3Mt cement annually.
E	15	Demirtas	N 36° 25'	E 32° 13'	Barite	11,17	General	Producer	Unknown	Unknown	Reserves from 5 sites: 1.5Mt @ 59-99% BaSO4 (1978). Plant produces 120kt ground barite.
F	16	Cerattepe	N 41° 12'	E 41° 48'	Copper, gold, silver	19	General	Dev. deposit	Surface Underground	Export	Deposit being developed by Cominco. Gold silver gossan cap to be mined by open pit, high grade ore will then be mined by underground methods. Development will hinge on gold resources. 1994 Reserves: 1Mt @ 9.4% Cu, plus 1.6Mt @ 4.8g.t Au and 190g/t Ag. Gossan 1.6Mt @ 5.2g/t Au, 200g/t Ag. Res. support annual output 35koz Au, 700koz Ag over 7 yrs.
F	17	Murgul Goktas	N 41° 15'	E 41° 33'	Copper, iron, sulfur, silver, gold	2,4,11,15,16,19, 23	Confirmed	Producer	Surface	Domestic Export	Res: 15.4 Mmt @ 2.03% Cu. 1988 mining capacity 3.85Mt ore yields 264kt Cu conc. Operated by Etibank. 1988 reserves: 35Mt @ 1% Cu. Open pit mining used. Plant produced 175kt Cu conc; 20kt blister copper in 1994.
F	18	Savsat	N 41° 15'	E 42° 20'	Feldspar	17	General	Producer	Surface	Unknown	Res: 369Mt (1980).

APPENDIX A: PRODUCING AND DEVELOPING MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	MARKETS	COMMENTS
G	19	Aydin	N 37° 51'	E 27° 51'	Feldspar, quartz	21	General	Producer	Surface	Unknown	Annual output 200kt Na-feldspar; 5kt K-feldspar.
G	20	Aydin	N 37° 51'	E 27° 51'	Emery	21	General	Producer	Surface	Unknown	Annual output 8kt emery.
H	21	Ayvalik	N 39° 52'	E 26° 03'	Kaolin feldspar	17,21	General	Producer	Surface	Unknown	Res: 18.4Mt @ 22-37% Al2O3 (1988). Capacity 70kt kaolin, 6kt K-feldspar.
H	22	Balikesir	N 39° 39'	E 27° 53'	Bentonite	21	General	Producer	Surface	Unknown	Annual output 22kt from 2 sites.
H	23	Bandirma	N 40° 20'	E 27° 58'	Granite	21	General	Producer	Surface	Unknown	Annual production 10kt granite.
H	24	Bayramic	N 39° 48'	E 27° 37'	Clay	17	General	Producer	Surface	Domestic	Res: 11Mt for refractory use.
H	25	Bigadic Area Tuglu Rasih ve Ihsan Maden Balikesir Begendikler Kirecilik Guneri Acep Tulidegirmeni	N 39° 25'	E 28° 08'	Boron	2,5,6,11,17,18, 21,23	General	Producer	Surface Underground	Export	Ore in 3 horizons 25m thick separated by clay. Borates occur as beds within clay/marl sequence. Incl. Begendikler, Gunevi, Kurt Pinari, Kirecilik, Acep, Tulu Degirmen, Borekci, Domus, Salmanli, Tulu pits. MTA reserves (1982): 975Mt @ 25-30% B2O3. 1987 reserves 657kt @ 30-34% B2O3. Open-pit mining employed. Capacity utilization dependant upon demand & market structure. Capacity (surface) 105kt colemanite, 75.7kt ulexite. Capacity (UG) 127kt colemanite, 115kt ulexite. Plant built 1977.
H	26	Duvertepe Sindirgi	N 39° 14'	E 28° 27'	Kaolin	17,21	General	Producer	Surface	Unknown	Res: 63.6Mt @ 13-33% Al2O3 (1986). Annual output: 180kt kaolin from 2 sites.
L	27	Hayri Ogelman	N 39° 54'	E 28° 58'	Chromite	15	General	Producer	Unknown	Unknown	Small private producer.
H	28	Kucukdere	N 39° 32'	E 27° 06'	Gold, silver	10,11	General	Dev. deposit	Surface	Unknown	Geologically similar to Ovacik deposit. Planned capacity is 250kt/yr by open pit methods. Reserves 1.5Mt @ 5.2g/t Au. Site to recover 3100kg/yr dore @ 33% Au, 67% Ag. Mining permits received in late 1994. Additional permits needed; opposition to mining expected.
I	29	Okluca	N 40° 14'	E 29° 51'	Quartz sand	21	General	Producer	Surface	Domestic	Annual output: 10kt quartz sand.
I	30	Sogut	N 40° 00'	E 30° 11'	Clay	17,21	General	Producer	Surface	Domestic	Reserves from 5 sites: 14.6Mt for ceramic/refractory. Produced 20kt in 1986.
J	31	Kiyiduzu	N 38° 35'	E 42° 23'	Pumice	17	General	Producer	Unknown	Unknown	Producing in 1989. Res: 1.1B cubic meters.
J	32	Kulaksiz	N 38° 45'	E 42° 26'	Pumice	17	General	Producer	Unknown	Unknown	Producing in 1989. Res: 210M cubic meters.
O	33	Acipayam	N 37° 28'	E 29° 22'	Chromite	15	General	Producer	Unknown	Unknown	Small private producer.
K	34	Burdur	N 37° 32'	E 29° 45'	Chromite	15	General	Producer	Unknown	Unknown	Reported to be private producer in 1991.
O	35	Sarlovla Uzunoluk	N 37° 33'	E 29° 04'	Chromite	15	General	Producer	Surface Underground	Unknown	Producer in the 1970's.

APPENDIX A: PRODUCING AND DEVELOPING MINERAL PROPERTIES IN TURKEY

MAP KEY (1)	NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	MARKETS	COMMENTS
L 36	Davutlar	N 39° 49'	E 29° 17'	Lignite	17	General	Producer	Unknown	Unknown	Res: 32Mt @ 2103 Cal/kg. Producing in 1989.
L 37	Domanic	N 39° 54'	E 29° 13'	Calcite	21	General	Producer	Surface	Unknown	Annual production 20kt calcite.
L 38	Harmancik	N 39° 49'	E 29° 13'	Chromite	15,17,23	General	Producer	Underground	Unknown	Explored by Etibank prior to 1990. Res: (Hi-gr) 32.5kt @ 30-40% Cr2O3; (lo-gr) 163kt @ 20%. Mill has capacity of 25kt/yr.
L 39	Kestelek	N 39° 58'	E 28° 34'	Boron	2,5,6,11,17,18, 21,23	General	Producer	Surface Underground	Export	Colemanite occurs in 3 horizons over 6m interval. Ore grade of selected specimens 40-44% B2O3. Etibank reserves (1982): 7Mt @ 45% B2O3. 1987 reserves: 8kt @ 30-35% B2O3. Plant built in 1979. Capacity 50.6kt (surface); 32.6kt (UG) colemanite/yr.
L 40	Orhaneli	N 39° 54'	E 29° 00'	Nepheline syenite	21	General	Producer	Surface	Unknown	Annual output 60kt nepheline syenite.
L 41	Orhaneli-Letafat	N 39° 52'	E 29° 00'	Chromite	2,15,23	General	Producer	Underground	Unknown	Site of Egemetal's Bursa area operations. County reserves 340kt @ 38-48% Cr2O3.
L 42	Uludag	N 40° 03'	E 29° 10'	Tungsten	2,15,17,23	General	Producer (6)	Surface Underground	Export	Ore in marble, thickness up to 100m. Mining began in 1971; Currently 85% UG, 15% surface. Operating below cap of 550kt due to weather/eqpt. problems. Res: 12.6Mt @ 0.5% WO3 (1995). 1994 production 37kt conc. from stocks, mine closed in 1993.
L 43	Yoruculer Bursa Toros	N 39° 52'	E 28° 59'	Chromite	15	General	Producer	Unknown	Unknown	Small private producer.
M 44	Ezine	N 39° 47'	E 26° 20'	Cement feedstock	17	General	Producer	Surface	Domestic	Produces 2Mt/yr cement from local limestones and clays.
N 45	Cankiri	N 40° 36'	E 33° 37'	Salt	2,17,23	General	Producer	Surface	Domestic	Operated in 1950's as a State Enterprise. Res: 1.75Mt @ 80-95% NaCl (1981).
O 46	Denizli	N 37° 46'	E 29° 06'	Cement feedstock	17	General	Producer	Surface	Domestic	Res: 13Mt cement raw materials (1984). Plant capacity 764kt cement.
O 47	Sirinkoy	N 37° 46'	E 29° 06'	Quartzite, marble	17,21	General	Producer	Surface	Domestic	Res: 72.5Mt (1987). Produced 10kt marble blocks in 1986.
O 48	Ulukoy Ulukent	N 37° 34'	E 29° 04'	Manganese	2,17,20,23	General	Producer	Surface	Unknown	Produced 101kt between 1950-55, high grade. 4Mt @ 33.66% Mn (1988).
P 49	Ergani	N 38° 30'	E 39° 45'	Copper, cobalt, sulfur, gold, silver, iron	2,4,11,15	General	Producer (6)	Surface	Domestic Export	Deposit in schist, limestone, and tuff. Operated by the State since 1944. 1994 Reserves: 11.4Mt @ 1.63% Cu, 0.5g/t Au, 3.2g/t Ag. Second zone 1.45Mmt @ 4.01% Cu. Smelted on site to produce 17,000 blister Cu @ 8.32 oz Ag and 0.689 oz Au/ton.
P 50	Guleman Soridag	N 38° 30'	E 39° 46'	Chromite	2,4,14,15,17,23	General	Producer	Underground Surface	Export Domestic	Largest Cr producer in the 1950's. Reserves from area: 9.6Mt @ 22-50% Cr2O3 (1987). Produced 150kt lump ore, 70kt concentrate in 1990. Mine reserves (1991): 2.8Mt @ 44-48% Cr2O3. Ferrochrome is exported.

APPENDIX A: PRODUCING AND DEVELOPING MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	MARKETS	COMMENTS
P	51	Kapin	N 38° 30'	E 39° 44'	Chromite	15	General	Producer	Underground	Export	Part of Guleman operation of Etibank.
P	52	Karacesme	N 38° 30'	E 39° 40'	Chromite	2,15	General	Producer	Underground	Unknown	Reported to be producer in 1991. Production reported to be 6kt in 1986.
P	53	Keban	N 38° 48'	E 38° 45'	Lead, zinc	2,4	General	Producer	Underground	Domestic	Mine worked from 1728-1877, 1952-?. Production 62,000 tpy. Ore in limestone. 1950 reserves estimated at 100,000 tons @ 10% Pb. Producing in 1973, ore to Cinkur smelter.
P	54	Kef Dagi	N 38° 29'	E 39° 43'	Chromite	14,15	General	Producer	Underground Surface	Domestic Export	Part of Guleman operation of Etibank. Mined by cut and fill, 1980 production 236kt/yr. Mine reserves (1991): 5.2Mt @ 30-38% Cr2O3. Ferrochrome is exported.
Q	55	Askale	N 39° 55'	E 40° 42'	Magnesite	21	General	Producer	Surface	Unknown	Annual output: 5kt magnesite.
R	56	Comag	N 39° 39'	E 29° 28'	Magnesium	15,21	General	Producer	Surface	Export	Total from two sites 50kt MgO concentrate.
R	57	Eskisehir	N 39° 46'	E 30° 32'	Perlite	21	General	Producer	Surface	Export Domestic	Produced 30kt in 1986.
R	58	Gocenoluk	N 39° 19'	E 30° 27'	Boron	5,6	General	Producer	Surface	Export	Discovered in 1958. Ore associated with lacustrine sediments. Borate in marls & clays over a thickness of 6m. Res: 200kt of colemanite. Development occurred, prod. limited to 20kt max. Ore overlain by hard limestone. Open cast mining used. Production in 1960 10kt. Ore transported by truck to Cekurler, to railed to ports of Derince or Bandirma for export.
R	59	Kaymaz	N 39° 31'	E 31° 11'	Gold, silver	10,11	General	Dev. deposit	Surface	Export	In epidermal system hosted by serpentinites. Reserves somewhat smaller than Kucukdere. Mining permits received in late 1994. Additional permits needed; opposition to mining expected.
R	60	Kirka	N 39° 17'	E 30° 33'	Boron	5,6,11,15,17,18, 21,23	General	Producer	Surface	Export	Borate 10-20m below limestone in marls. Ore zone 35m thick identified. 1987 reserves: 520kt @ 25-29% B2O3. Capacity 815kt borax (tincal)/yr. Deposit uses open pit mining. Plant built 1972, expanded 1985.
R	61	Kizilcaoren	N 39° 38'	E 31° 23'	Fluorspar	17	General	Producer	Unknown	Unknown	Res: 11.3Mt @ 37.44% CaF2 (1986).
R	62	Margi	N 39° 55'	E 30° 54'	Magnesite	2,11,15,17,23	General	Producer	Surface	Export	Five deposits aggregated res. 1.5-3 Mtons @ 46-47% MgO. 11,110 tons produced between 1945-1953. Plant produces 60kt of dead-burned magnesite.
R	63	Sazak	N 39° 48'	E 31° 38'	Talc	17	General	Producer	Surface	Unknown	Res: 400kt (1986).
S	64	Islahiye Burcakli	N 37° 03'	E 36° 36'	Chromite	2,15	General	Producer	Unknown	Unknown	Produced in the 1950's from 22 sites. Reserves estimated at 450kt as of 1986.

APPENDIX A: PRODUCING AND DEVELOPING MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	MARKETS	COMMENTS
T	65	Lahamos Espiry	N 40° 57'	E 38° 44'	Copper, zinc	17	General	Producer	Unknown	Unknown	Res: 2.3Mt @ 3.59% Cu, 2.38% Zn.
U	66	Bozuyuk	N 36° 16'	E 36° 15'	Clay, silica sand, magnesite	21	General	Producer	Surface	Unknown	Annual production: 10kt clay, 10kt silica sand, 10kt magnesite.
U	67	Iskenderun	N 36° 32'	E 36° 11'	Chromite	2,15	General	Producer	Unknown	Unknown	Produced in the 1950's from two sites. 1955 county reserves 250kt.
V	68	Icel	N 36° 48'	E 34° 38'	Cement feedstock	17	General	Producer	Surface	Domestic	Res: 117Mt limestone/marl (1983). Plant produces 2.5Mt cement from Icel and Nigde pits.
V	69	Karadikan	N 37° 00'	E 34° 42'	Limestone	21	General	Producer	Surface	Unknown	Annual output: 550kt calcium carbonate.
V	70	Tarsus	N 37° 09'	E 34° 36'	Lignite	17	General	Producer	Unknown	Unknown	Res: 2.6Mt @ 3000 Cal/kg. Producing in 1989.
W	71	Karaagac	N 38° 04'	E 31° 23'	Barite	21	General	Producer	Surface Underground	Unknown	In 1986, reported to produce 15kt surface, 5kt UG.
W	72	Keciborlu Kukuridere Degirmendere	N 37° 57'	E 30° 18'	Sulfur	2,11,15,17,21,23	General	Producer	Surface Underground	Unknown	State owned mine with 1960 reserves of 400kt. Capacity of 55kt/yr concnetrate (145kt ore). Two deposits, one mined by UG methods, one surface. Rhyolite dike in sediments. Res: 1.5Mt @ 47-90% S (1982). Production capacity of 123kt/yr reported in 1991.
X	73	Buyukcekmece	N 41° 01'	E 28° 33'	Cement feedstock	17	General	Producer	Surface	Domestic	Res: 117Mt cement raw materials (1970). Plant produces 2.75Mt cement annually.
X	74	Istanbul	N 41° 00'	E 29° 02'	Clay	21	General	Producer	Surface	Domestic	Annual production: 10kt refractory clay; 40kt ceramic clay.
X	75	Sile	N 41° 11'	E 29° 36'	Quartz sand	17	General	Producer	Surface	Domestic	Res: 435Mt (1980).
X	76	Sinekli	N 41° 14'	E 28° 12'	Lignite	17	General	Producer	Unknown	Unknown	Res: 66Mt @ 1950 Cal/kg. Producing in 1989.
Y	77	Bornova	N 38° 27'	E 27° 14'	Cement feedstock	17	General	Producer	Surface	Domestic	Res: 18Mt limestone/clay (1969).
Y	78	Cumaovasi	N 38° 15'	E 27° 09'	Perlite	21	General	Producer	Surface	Domestic Export	Annual production 25kt perlite. Production from several pits.
Y	79	Halikoy	N 38° 13'	E 27° 59'	Antimony	21	General	Producer	Underground	Unknown	Annual output 7980 tons stibnite.
Y	80	Halikoy	N 38° 05'	E 28° 10'	Mercury	2,11,15,17,23	General	Producer	Underground	Export	1980 Res: 1Mt @ 0.25% Hg. Ore at contact between schist & granodiorite. Ore consists of 3 veins 70-120m long. Plant produces 190kt mercury.
Y	81	Karaburun	N 38° 18'	E 26° 19'	Dolomite	17	General	Producer	Surface	Unknown	Res: 2.8Bt @ 17-21% MgO (1982).

APPENDIX A: PRODUCING AND DEVELOPING MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	MARKETS	COMMENTS
Y	82	Ovacik Dikili	N 39° 05'	E 26° 52'	Gold, silver	10,11,13,14,15	Confirmed	Dev. Deposit	Surface Underground	Export	Feasibility study completed in 1991, Approval to proceed give Permitting process to be completed late 1995. 1994 res: 1.3Mt @ 11.7g/t Au, 20 g/t Ag. Epithermal quartz/calcite veins in andesites. Mining planned at 300kt/yr to produce 3100kg/yr dore. Mining permits received in late 1994. Additional permits needed; opposition to mining expected.
Y	83	Tire	N 38° 00'	E 27° 40'	Graphite	17	General	Producer	Unknown	Unknown	Res: 710kt @ 3.5-10% C (1974).
Y	84	Torbali	N 38° 10'	E 27° 21'	Dolomite	17	General	Producer	Surface	Unknown	Res: 450Mt @ 18-21% MgO (1982).
Z	85	Tuzluca	N 40° 30'	E 42° 46'	Salt	2,17	General	Producer	Surface	Domestic	Operated in 1950's as a State Enterprise. Res: 839Mt @ 91.4% NaCl (1981).
AA	86	Daday	N 41° 26'	E 33° 26'	Quartzite	17	General	Producer	Surface	Domestic	Res: 301Mt (1982).
AA	87	Kure Askikoy Bakibaba	N 41° 46'	E 33° 43'	Sulfur, copper	2,11,15,16,21	General	Producer	Surface Underground	Domestic Export	Res: 1.6Mmt pyrite @ 1.9% Cu, 47.9% S. Plant capacity 90kt Cu conc, 460kt pyrite conc. Askikoy is surf/UG; Bakibaba is underground. Plant built in 1987 to process 3.4kt/d. Second plant at Bakibaba with capacity of 95kt Cu conc. Annual output 260kt chalcopyrite.
BB	88	Aladag	N 38° 15'	E 35° 30'	Zinc, lead	15	General	Producer	Surface	Unknown	Produced in 1977. Capacity 90kt/yr by surface mining. Res: 829kt @ 21.8% Zn.
BB	89	Kayseri	N 38° 43'	E 35° 30'	Barite	21	General	Producer	Surface	Unknown	Reported to produce 45kt in 1986.
BB	90	Pinarbasi	N 38° 43'	E 36° 23'	Chromite	15	General	Producer	Unknown	Unknown	Small producer west of Pinarbasi.
CC	91	Sitma	N 39° 41'	E 38° 09'	Fluorite	2,21	General	Producer	Surface Underground	Unknown	Produced in 1949, 1952. Reported to be producing in 1986.
DD	92	Dilskelesi Darica	N 40° 47'	E 29° 31'	Cement feedstock	17	General	Producer	Surface	Domestic	Res: 146Mt clay/marl (1983). Plant produces 1.3Mt cement annually.
EE	93	Akcalar	N 37° 32'	E 31° 51'	Lignite	17	General	Producer	Surface Underground	Unknown	Res: 59Mt (surf); 10Mt (UG) (1983).
EE	94	Aksehir	N 38° 21'	E 31° 25'	Barite	11,17	General	Producer	Unknown	Unknown	Reserves: 23Mt @ 90% BaSO4 (1975). Plant capacity is 90kt ground barite from mines in Konya and Isparta.
EE	95	Avdancik	N 37° 42'	E 31° 46'	Lignite	17	General	Producer	Surface Underground	Unknown	Res: 52Mt (surf); 80Mt (UG) (1983).
EE	96	Calca	N 38° 05'	E 32° 25'	Mercury	8	General	Producer	Underground	Unknown	Ore in limestone and thin phyllite bed. Workings include incline and 2 levels. Mineralization along steep fractures perpendicular to bedding contact. Ore zones small, irregular.
EE	97	Cirakman Sarayonu	N 38° 17'	E 32° 25'	Mercury	8,11,15,23	General	Producer	Underground	Unknown	Workings consist of 4 working levels, raises, & adits. Ore associated with marble and phyllite. Ore is brecciated dolomitic marble, replaced by Hg. Plant produces 100kt mercury.

APPENDIX A: PRODUCING AND DEVELOPING MINERAL PROPERTIES IN TURKEY

MAP KEY (1)	NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	MARKETS	COMMENTS
EE 98	Hoyuk Beysehir Huyuk	N 37° 41'	E 31° 43'	Barite	11,17,21	General	Producer	Surface	Unknown	Reserves: 13Mt @ 95.5% BaSO4 (1974). Plant produces 70kt ground barite. Huyuk mine produces 5kt crude barite.
EE 99	Konya Helvacibaba Cayirbagi Konya Krom	N 37° 50'	E 32° 38'	Magnesite	11,15,21	General	Producer	Surface	Domestic Export	Capacity 46kt dead-burned magnesia and 38kt bricks. Helvacibaba pit is closed.
EE 100	Medrese	N 38° 03'	E 32° 23'	Mercury	8	General	Producer	Underground	Unknown	Newer mine in 1970. Workings consist of 4 drifts and crosscuts.
EE 101	Mortas	N 37° 16'	E 31° 52'	Bauxite	11,15,23	General	Producer	Surface	Domestic	Part of Seydisehir mining district. District capacity 450kt bauxite. Feed for Seydisehir smelter.
EE 102	Seydisehir Mortas Dogankuzu	N 37° 25'	E 31° 51'	Bauxite	10,11,15,16,17,21	General	Producer	Surface	Domestic Export	Res: 78Mt @ 56.5% Al2O3. Capacity 681kt/yr bauxite. Annual production: 460kt yields 200kt Al2O3 conc. 2 pits producing Boehmite ore 0.8km apart. Reserves (1993): 11.5Mt @ 56% Al2O3.
EE 103	Sizma-Ladik Buyuk	N 38° 07'	E 32° 25'	Mercury	2,8,15,17,23	General	Producer	Surface Underground	Export	Ore in limestone near overlying phyllite. Stopes average 2m high, 2-5m wide, length varies. Ore smelted at site. Oldest workings caved; working 2 underground levels, and shallow pits, old stopes. Oldest, most extensive mine in district. District reserves 1.5Mt @ 0.15-0.18% Hg (1976).
FF 104	Aktepe Gumuskoy	N 38° 58'	E 29° 29'	Silver	10,11,14,16	General	Producer	Surface	Export	Began operation in 1987 @ 1Mt /yr ore to yield 122 tons Ag. Expected life is 20 years. Plant produces 75kt Ag conc./yr Res: 19.2Mt @ 194g/t Ag in 1987. Exploration added 1.5Mt @ 245g/t Ag to total.
FF 105	Emet Area	N 39° 13'	E 29° 09'	Boron	2,5,6,11,15,17, 18,21,23	General	Producer	Surface Underground	Export	Discovered in 1956. Borate occurs 20m below capping limestone in a single horizon up to 30m thick. Ore contains 0.1% to 0.4% As2O3. Most important borate region in Turkey. Ore in clay, marl, limestone sequence. 1987 reserves: 620Kt @ 30-40% B2O3. Capacity 651kt surface, 90.5kt UG colemanite /yr (includes Espey & Hisarcik). Plant built 1962. MTA reserves (1986): 644Mt @ 41-45% B2O3. Underground mining no longer used.

APPENDIX A: PRODUCING AND DEVELOPING MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	MARKETS	COMMENTS
FF	106	Espey Killik	N 39° 21'	E 29° 15'	Boron	5,6,11,17	General	Producer	Surface Underground	Export	Part of Emet Area Ore grade 40-75% Colemanite. Total production 475kt. Ore 3m thick in bentonite. UG workings- 9 adits each 200m long; now surface mined. Transported 35km truck, railed to Derince & Bandirma. Produced 76kt @ 43% B2O3 1958-60. MTA reserves (1966): 250Mt @ 40% B2O3. 1987 reserves reported under Emet region.
FF	107	Hisarcik	N 39° 15'	E 29° 15'	Boron	5,6,11,17,23	General	Producer	Surface Underground	Export	Part of Emet Area. Res: 4.65Mt of in situ colemanite indicated. Production first reported in 1959. Total production reported at 562kt. Average thickness of borate 22m. Average ore grade 44% B2O3. Developed by underground mining, now use open pit. Ore drilled, blasted (is overburden), broken. Transported 50km truck, then railed to Bandirma. Res (1971): 7Mt. 1987 reserves included under Emet region. MTA reserves (1966): 30Mt @ 35% B2O3.
FF	108	Kutahya Eskisehir Kumas	N 39° 25'	E 30° 00'	Magnesite	11,15,21	General	Producer	Surface	Domestic	Plant on site has capacity of 144kt dead-burned MgO, 46kt of bricks. Stripping ratio 5:1 waste to ore.
FF	109	Kutahya region	N 39° 10'	E 29° 03'	Feldspar	17	General	Producer	Surface	Unknown	Res: 38Mt (1988).
FF	110	Tavsanli	N 39° 33'	E 29° 30'	Magnesite	2,11,15,17,21,23	General	Producer	Surface Underground	Export Domestic	Res: 3.5Mt @ 43-47% MgO (1978). Plant produces 40kt of dead-burned magnesite. Capacity 50kt/yr magnesite.
FF	111	Tuncbilek	N 39° 37'	E 29° 29'	Lignite	2,17,23	General	Producer	Unknown	Unknown	Res: 327Mt @ 4000 Cal/kg (1985).
GG	112	Bilfer Bicir Kuluncak	N 38° 46'	E 37° 36'	Chromite	15,21	General	Producer	Unknown	Unknown	Small producer. Production reported at 20kt in 1986 from two pits.
GG	113	Hekimhan	N 38° 49'	E 37° 56'	Iron	15,17	General	Producer	Surface	Domestic	Producer in 1979. Res: (hi-gr) 14Mt @ 50% Fe; (lo-gr) 88Mt @ 37% Fe. Other mines in area produce additional 1500kt ore/yr.
GG	114	Hekimhan area Kirolar Hasancelebi Karatuztepe Culhah Sirzi Magaratepe	N 38° 58'	E 37° 54'	Iron, manganese	2,10,17,22,23	General	Producer	Surface	Domestic	Six deposits in area. Ore in limestone breccia. Reserves from 4 sites: 90Mt @ 40-50% Fe, 3-5.7% Mn. Deveci mine produces 750kt ore/yr. Mining since 1964 by open pit methods.
HH	115	Manisa	N 38° 38'	E 27° 25'	Cement feedstock	17	General	Producer	Surface	Domestic	Res: 140Mt marl (1982).
HH	116	Sogutcuk	N 39° 09'	E 28° 37'	Feldspar	17	General	Producer	Surface	Unknown	Res: 2.5Mt (1980).

APPENDIX A: PRODUCING AND DEVELOPING MINERAL PROPERTIES IN TURKEY

MAP KEY (1)	NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	MARKETS	COMMENTS
HH 117	Soma	N 39° 10'	E 27° 36'	Lignite	2,17	General	Producer	Surface Underground	Unknown	Res: 44Mt (surf); 60Mt (UG) (1982).
HH 118	Soma	N 39° 09'	E 27° 36'	Cement feedstock	17	General	Producer	Surface	Domestic	Res: 158Mt limestone/marl (1982).
II 119	Sekeroba	N 37° 17'	E 36° 43'	Barite	21	General	Producer	Underground	Unknown	Mine output: 15kt barite.
JJ 120	Mazidag	N 37° 31'	E 40° 30'	Phosphate, uranium	10,11,15,17,21,23	General	Producer (7)	Surface	Domestic	Res: 64Mt @ 22% P2O5. Plant capacity 125kt concentrate from 1Mt phosphate rock. Production ceased in 1995.
KK 121	Kandak	N 37° 04'	E 28° 32'	Chromite	15	General	Producer	Underground	Unknown	Small producer.
KK 122	Koycegiz	N 36° 57'	E 28° 40'	Chromite	15	General	Producer	Surface Underground	Unknown	Small producer since the 1970's.
KK 123	Milas	N 37° 19'	E 27° 47'	Feldspar	21	General	Producer	Surface	Unknown	Annual output: 120kt Na-feldspar.
KK 124	Milas	N 37° 19'	E 27° 47'	Emery, lignite	17,21	General	Producer	Surface Underground	Domestic	Emery Res: 55Mt from 8 sites (1964). Lignite res: (Surf) 173Mt; (UG) 4Mt + 85Mt additional. Reserves from 3 sites. Annual capacity 10kt emery.
KK 125	Milas	N 37° 19'	E 27° 48'	Bauxite	17,21	General	Producer	Surface Underground	Domestic Export	Res: 46.1Mt @ 46-61% Al2O3 (1964). Boehmite ore for chemical grade products. Capacity (surface) 150kt, (UG) 40kt diaspore.
KK 126	Uckopru	N 37° 15'	E 28° 40'	Chromite	2,15,21	General	Producer	Underground	Domestic	Produced in the 1950's. Reserves as of 1980 90 kt ore. Production reported to be 70kt in 1986. Feeds Antalya smelter.
KK 127	Yatagan	N 37° 20'	E 28° 09'	Emery, lignite	17	General	Producer	Surface Underground	Unknown	Emery Res: 1Mt from 13 sites (1964). Coal res: (Surf) 109Mt; (UG) 10Mt + 130Mt additional. Producing in 1989.
KK 128	Yatagan	N 37° 20'	E 28° 09'	Calcite	21	General	Producer	Surface	Export	Capacity 100kt/yr calcite.
LL 129	Mus	N 38° 44'	E 41° 30'	Barite	21	General	Producer	Surface Underground	Unknown	Annual output 120kt barite.
MM 130	Gulsehir	N 38° 45'	E 34° 38'	Salt	17	General	Producer	Surface	Domestic	Res: 2.4Bt @ 93% NaCl (1986).
MM 131	Salonda	N 38° 50'	E 34° 32'	Barite	21	General	Producer	Surface	Unknown	Reported to produce 10kt in 1986.
NN 132	Ulubey	N 40° 51'	E 37° 46'	Kaolin	17	General	Producer	Surface	Domestic	Res: 2.3Mt @ 17-23% Al2O3 (1986). Used in paper industry.
NN 133	Unye	N 41° 08'	E 37° 17'	Bentonite	17,21	General	Producer	Surface	Unknown	Res: 2.5Mt (1977). Annual production: 65kt bentonite from 3 sites.
OO 134	Cayeli	N 41° 04'	E 40° 48'	Zinc, copper silver, gold	10,11,15	General	Producer	Underground	Export	Began production in 1994 at 66kt or ore. Mining rate of 600kt/yr achieved in 1995. Ore grades 4.42% Cu, 8.09% Zn. Reserves: 10.6Mt @ 4.7% Cu, 7.3% Zn, 0.45% Pb, 68g/t Ag, 1g/t Au. Copper and zinc concentrates exported in 1995.

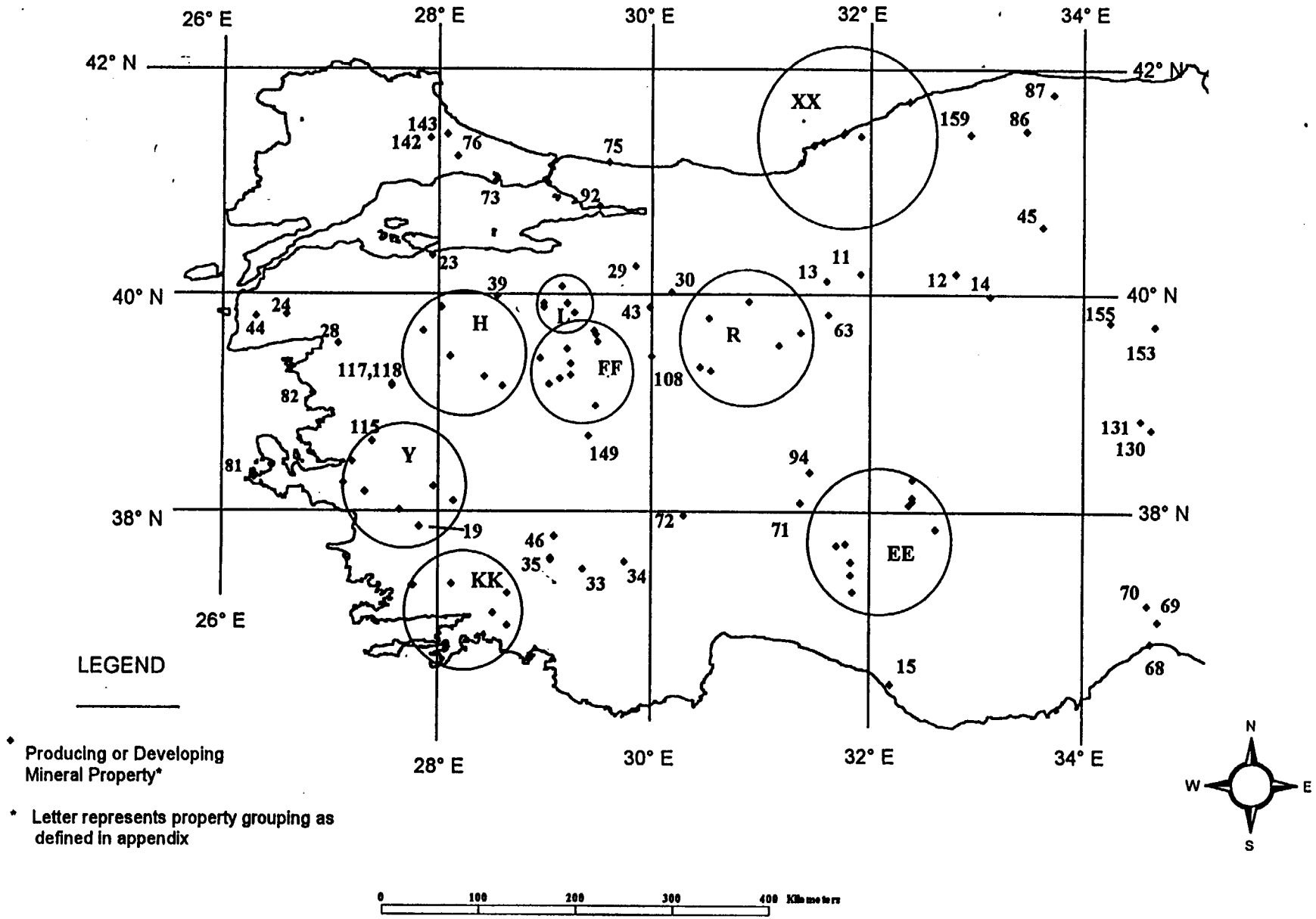
APPENDIX A: PRODUCING AND DEVELOPING MINERAL PROPERTIES IN TURKEY

MAP KEY (1)	NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	MARKETS	COMMENTS
PP 135	Sinop	N 42° 01'	E 35° 09'	Quartz sand	17	General	Producer	Surface	Domestic	Res: 47.5Mt (1979).
QQ 136	Bascayir	N 38° 44'	E 37° 15'	Chromite	15,21	General	Producer	Underground	Unknown	Producer in 1991. Production reported to be 5kt in 1986.
QQ 137	Divrigi	N 39° 25'	E 38° 05'	Iron	2,4,10,11,15,17, 22,23	General	Producer	Surface Underground	Domestic	Four principal deposits in limestone. Res: 40Mmt @ 65% Fe. Average depth 200m. Largest iron deposits in Turkey Reserves from area: 100Mt @ 54-58% Fe (1970-1986). Plant treats 3Mt/yr ore to produce 1100kt + 600kt+500kt.
QQ 138	Kangal	N 39° 15'	E 37° 24'	Chromite	2,21	General	Producer	Unknown	Unknown	Produced from 4 sites in 1954. Production reported to be 60kt in 1986.
QQ 139	Pinargozu Davutoglu Cetinkaya Kangal area	N 39° 12'	E 37° 41'	Iron	15,17	General	Producer	Surface	Export	Producer in 1975. Reserves at least 14Mt @ 49% Fe (1982).
QQ 140	Sivas	N 39° 40'	E 37° 00'	Celestite	10,14,21	General	Producer	Surface	Export	Res: 2Mt. Production ranges from 60-80kt concentrate @ 92% SrSO4. Only 120 tons used domestically.
QQ 141	Sivas Hafik	N 39° 45'	E 37° 02'	Barite	21	General	Producer	Surface	Unknown	Mine output: 150kt barite.
RR 142	Kucuk Manika Saray	N 41° 24'	E 27° 57'	Lignite	2,17	General	Producer	Surface Underground	Unknown	Res: (Surf) 62Mt; (UG) 51Mt + 18Mt additional. Producing in 1989.
RR 143	Safaalan	N 41° 26'	E 26° 06'	Quartz sand	17	General	Producer	Surface	Domestic	Res: 6Mt (1984).
SS 144	Dogantepe	N 40° 27'	E 37° 22'	Bentonite	17	General	Producer	Surface	Unknown	Res: 200Mt (1973-75). Reported to be producing in 1986.
SS 145	Tokat	N 40° 20'	E 36° 35'	Chromite	15	General	Producer	Underground	Unknown	Producer in 1992.
TT 146	Guzelyayla Macka	N 40° 50'	E 39° 38'	Copper, molybdenum	17	General	Producer	Unknown	Unknown	Res: 143Mt @ 0.3-0.4% Cu+Mo. Mining is ongoing.
TT 147	Kankoy Yomra	N 40° 58'	E 39° 54'	Copper	17	General	Producer	Unknown	Unknown	Res: 574kt @ 1.83% Cu. Mined for pyrite and copper.
TT 148	Kutlutar Surmene	N 40° 55'	E 40° 07'	Copper	11,15,17,23	General	Producer	Unknown	Unknown	Res: 1.2Mt @ 2.49% Cu. Plant produces 15kt copper concentrate.
UU 149	Usak	N 38° 41'	E 29° 25'	Kaolin, quartz	21	General	Producer	Surface	Unknown	Annual output: 15kt kaolin
VV 150	Alakoy	N 38° 40'	E 43° 11'	Pumice	17	General	Producer	Unknown	Unknown	Producing in 1989. Res: 6M cubic meters.
VV 151	Kocapinar	N 39° 06'	E 43° 12'	Pumice	17	General	Producer	Unknown	Unknown	Producing in 1989. Res: 154.6M cubic meters.
WW 152	Akdagmadeni	N 39° 40'	E 35° 59'	Lead, silver, zinc	15	General	Producer	Underground	Unknown	Producing in 1975.

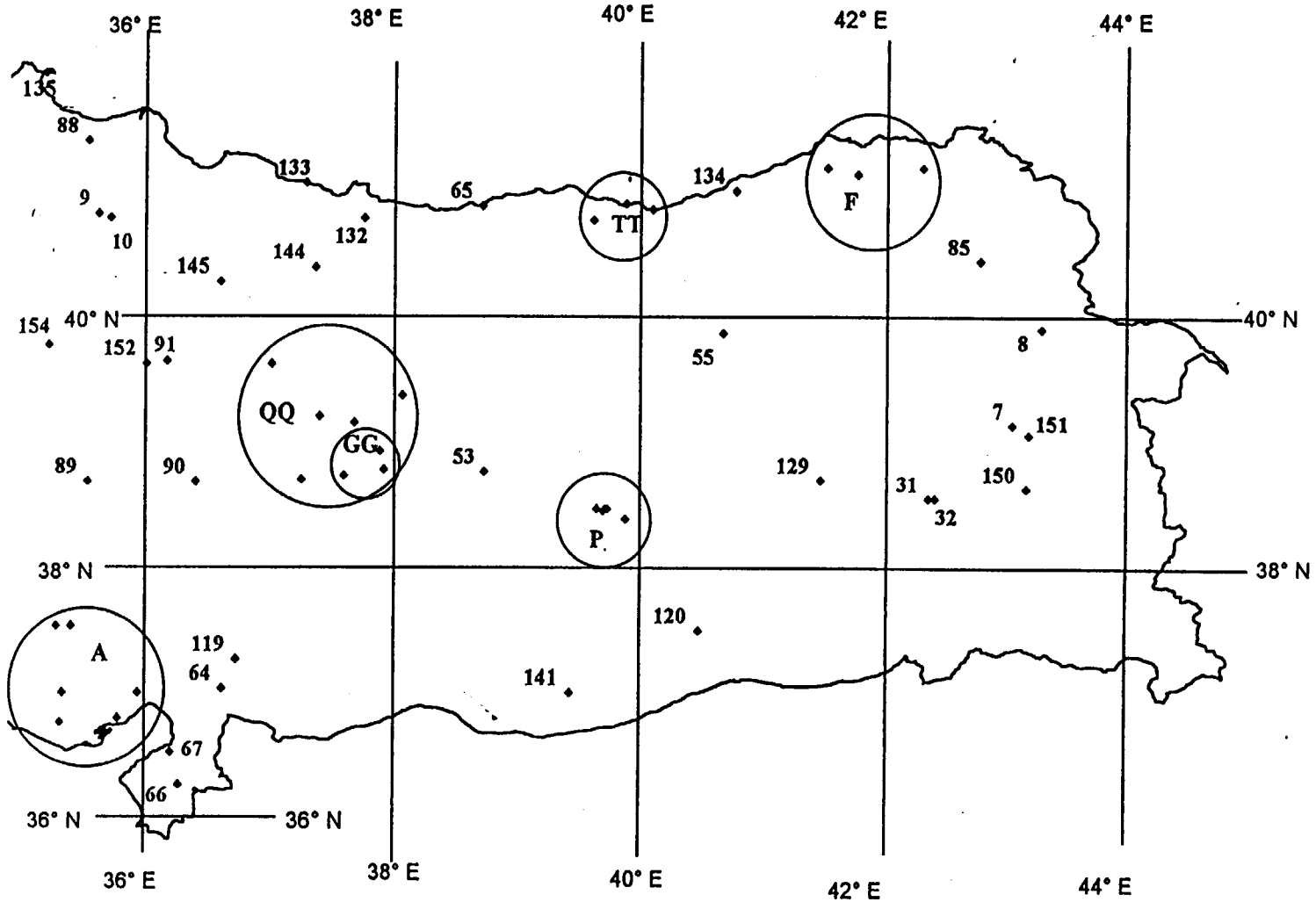
APPENDIX A: PRODUCING AND DEVELOPING MINERAL PROPERTIES IN TURKEY

MAP KEY (1)	NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS (5)	MINE TYPE	MARKETS	COMMENTS
WW 153	Saray	N 39° 42'	E 34° 40'	Cement feedstock	17	General	Producer	Surface	Domestic	Res: 50Mt limestone/clay/marl (1984). Plant produces 2Mt cement annually from pits in Corum, Sivas, and Yozgat counties.
WW 154	Sefaatli	N 39° 49'	E 35° 11'	Quartzite	17	General	Producer	Surface	Domestic	Res: 2.8Bt (1986).
WW 155	Sekili	N 39° 44'	E 34° 15'	Salt	2,17	General	Producer	Surface	Domestic	Operated in 1950's as a State Enterprise. 932Mt @ 92% NaCl (1981).
XX 156	Alapli	N 41° 11'	E 31° 23'	Quartzite	17	General	Producer	Surface	Domestic	Res: 105Mt (1980).
XX 157	Amasra	N 41° 44'	E 32° 23'	Coal	2,17	General	Producer	Underground	Unknown	Res: 287Mt to depth of 1000m (1986).
XX 158	Armutcuk	N 41° 22'	E 31° 35'	Coal	2,17	General	Producer	Underground	Unknown	Res: 91Mt to depth of 1000m (1986). 1955 county reserve 1Bt.
XX 159	Eflani	N 41° 26'	E 32° 57'	Quartzite	17	General	Producer	Surface	Domestic	Res: 124Mt (1982).
XX 160	Karadon	N 41° 30'	E 31° 32'	Coal	17	General	Producer	Underground	Unknown	Res: 474Mt to depth of 1200m (1986).
XX 161	Koziu	N 41° 26'	E 31° 46'	Coal	2,17	General	Producer	Underground	Unknown	Res: 278Mt to depth of 1200m (1986). Mined by E.K.I.
XX 162	Sepcakoy	N 41° 25'	E 31° 56'	Quartzite	17	General	Producer	Surface	Domestic	Res: 500Mt (1978).
XX 163	Uzulmez	N 41° 27'	E 31° 47'	Coal	17	General	Producer	Underground	Unknown	Res: 244Mt to depth of 1200m (1986).

(1) Represents property or property grouping as defined on Appendix map set A.
(2) Due to software limitations, site names do not include any diacritical markings. Spelling of individual site names vary considerably by source.
(3) Compete list of data sources found in Appendix D.
(4) General - denotes limited data; Confirmed - denotes deposit information confirmed by several sources.
(5) Because of the varying age of source information, the status at individual sites may not be current.
(6) Uludag mine reportedly ceased production in 1993 due to exhaustion of ore reserves. Ergani mine idle, some processing of stocks.
(7) Production at Mazidagi ceased in 1995 due to poor economics.



APPENDIX MAP A-1: PRODUCING MINERAL PROPERTIES OF WESTERN TURKEY



LEGEND

◆ Producing or Developing Mineral Property*

* Letter represents property grouping as defined in appendix

0 100 200 300 400 Kilometers

N
W E
S

APPENDIX MAP A-2: PRODUCING MINERAL PROPERTIES OF EASTERN TURKEY

APPENDIX B: PAST PRODUCING MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
A	1	Fansa (Feke) district Inderesi Karakoy Urusler Bahcecik/ Gurumze Kisenit Bekirhacih Inekderesi Hanyeri Mansurlu	N 37° 50'	E 35° 40'	Iron	2	General	Past producer	Surface	Unknown	Area covers 225 sq. mi. Center for iron industry during Ottoman Empire. Thousands of old workings. Ore in limestone. Area reserves: 37.6Mt @ 42-58% Fe. From 1978-1986 reports.
A	2	Kirec	N 38° 09'	E 36° 19'	Iron	2	General	Past producer	Surface	Unknown	Area mined in the past.
B	3	Bakirli Mevkii	N 38° 29'	E 30° 07'	Copper	2	General	Past producer	Unknown	Unknown	Old working visible from vein in limestone.
B	4	Gazligol	N 39° 00'	E 30° 27'	Magnesite	2	General	Past producer	Unknown	Unknown	Produced 1065 tons in 1954.
B	5	Kirka	N 38° 44'	E 30° 14'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 125 tons in 1951.
C	6	Celtek	N 41° 13'	E 35° 21'	Lignite	2	General	Past producer	Unknown	Unknown	Res: 7Mt @ 6265 Cal/kg.
C	7	Gumushacikoy	N 40° 53'	E 35° 14'	Lead, silver	2	General	Past producer	Underground	Unknown	Ore in limestone and andesite to depth of 250m. Ore depleted, 200,000 tons removed.
C	8	Merzifon	N 40° 53'	E 35° 29'	Copper	2	General	Past producer	Underground	Unknown	Several tunnels driven about 1870s. All but one caved.
D	9	Bolkardag	N 39° 21'	E 33° 26'	Iron	2	General	Past producer	Unknown	Unknown	Magnetite in limestone with thickness of 20m. Res:4Mmt @ 60-65% Fe (1983). Produced 1953+.
D	10	Camlisagir	N 39° 20'	E 33° 25'	Iron	2,17	General	Past producer	Unknown	Unknown	Operated in 1955. Res: 0.2Mmt @ 60-65% Fe (1983).
D	11	Cayirli	N 39° 38'	E 32° 36'	Manganese	2,17	General	Past producer	Unknown	Unknown	Produced 23.8kt between 1951-1955. Res: 150kt @ 19.45% Mn (1981).
D	12	Celebi Demirci Agapinar	N 39° 28'	E 33° 32'	Iron	22	General	Past producer	Surface	Unknown	Mining carried out in 1963-64, producing 17.5kt ore.
D	13	Denek-Keskia	N 39° 46'	E 33° 36'	Lead, silver	2	General	Past producer	Underground	Unknown	Ore at limestone-tuff contact. Ore in lenses 2m long and 0.5m thick. Mine operated intermittantly till 1955. Two shafts to depth of 135m, 90m. Grade reported to be 55-60% Pb.
D	14	Goztepe	N 40° 08'	E 33° 46'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 38.7kt between 1949-1955. 1950 reserves 50kt @ 38-40% Mn.
D	15	Kesikkopru	N 39° 23'	E 33° 26'	Iron, manganese	2,17	General	Past producer	Surface	Unknown	Ore assaying 50% Fe and 10% Mn. Quarry face 25m high. Area reserves: 11.5Mt @ 32-54% Fe (1983).

APPENDIX B: PAST PRODUCING MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
D	16	Kilevli	N 39° 52'	E 33° 46'	Molybdenum	2	General	Past producer	Unknown	Unknown	Worked in the 1930's, reserves exhausted. Ore in fractures of granite.
D	17	Kiliclar	N 39° 53'	E 33° 22'	Iron	2	General	Past producer	Unknown	Unknown	Production for the period 1947-1954.
D	18	Kilinclar	N 39° 53'	E 33° 22'	Manganese	2	General	Past producer	Unknown	Domestic Export	Sold 2/3 to Karabuk plant, 1/3 exported. 1950 reserves 40-50kt @ 47% Mn.
D	19	Kirikkale	N 39° 50'	E 33° 31'	Lead, zinc	2	General	Past producer	Underground	Unknown	Grade reported to be 18% Pb and 22% Zn. Produced in 1954.
D	20	Tilki	N 40° 16'	E 33° 29'	Manganese	2	General	Past producer	Unknown	Domestic	Two deposits discovered in 1941. Up to 8kt mined by 1946, sold to Karabuk plant. Deposits of sedimentary origin in serpentine.
E	21	Adrasan	N 36° 19'	E 30° 27'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 525kt @ 38-40% Cr2O3.
E	22	Agva	N 36° 33'	E 30° 34'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 525kt @ 38-40% Cr2O3.
E	23	Karalar	N 36° 19'	E 32° 21'	Lead	2	General	Past producer	Underground	Unknown	Ore occurs in a dome of 90 x 40 m. Worked prior to 1912.
E	24	Kumluca	N 36° 22'	E 30° 17'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 211kt.
E	25	Paralimusa	N 36° 25'	E 30° 20'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 4083 tons in 1952.
E	26	Tekirova	N 36° 30'	E 30° 32'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 525kt @ 38-40% Cr2O3.
E	27	Yukari	N 36° 33'	E 32° 01'	Iron	2	General	Past producer	Surface	Unknown	Conc. of limonite float assaying 48.47% Fe.
F	28	Cavdar	N 37° 35'	E 27° 39'	Iron	2,17,22	General	Past producer	Surface	Domestic	Parallel veins of hematite & magnetite in schist. Res: 13Mmt @ 42% Fe; Ore mined & treated locally. Produced between 1918-1922.
F	29	Kayacik	N 37° 55'	E 27° 56'	Lead	2	General	Past producer	Unknown	Unknown	Prod. 82 tons in 1946.
F	30	Sobuca	N 37° 45'	E 27° 42'	Arsenic, gold	2	General	Past producer	Unknown	Unknown	Old workings reported.
G	31	Adaviran	N 39° 38'	E 28° 45'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. County reserves 45,000 tons @ 35-46% Cr2O3.
G	32	Ayezment	N 39° 18'	E 26° 54'	Iron	2,17,22	General	Past producer	Underground	Unknown	Grade varies from 61-65% Fe with Cu up to 4%. Vertical ore shoots 10-40m thick. Res: 6.7Mt @ 51% Fe (1984). Mined between 1957-1959.
G	33	Balya	N 39° 45'	E 27° 35'	Lead, zinc copper	2	General	Past producer	Surface Underground	Unknown	Ore in altered limestone. Complex consists of 5 mining areas. Metasomatic vein type deposit. Lead content decreases with depth. Grade averages 3-4% Pb. Mine worked till 1938, prod. 4Mmt ore.

APPENDIX B: PAST PRODUCING MINERAL PROPERTIES IN TURKEY

MAP KEY (1)	NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
G 34	Cakallar	N 39° 42'	E 27° 34'	Manganese	2	General	Past producer	Unknown	Unknown	In 1951, produced 600tons.
G 35	Caltlcak	N 39° 36'	E 28° 56'	Manganese	2	General	Past producer	Unknown	Unknown	Three deposits assaying 33% -50% Mn. Res: 10-30kt.
G 36	Carmih	N 39° 42'	E 27° 24'	Iron	2	General	Past producer	Unknown	Unknown	Res: 32,000 tons @ 53.5% Fe (1982). Produced in 1953.
G 37	Demicller	N 39° 30'	E 28° 53'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. County reserves 45,000 tons @ 35-46% Cr2O3.
G 38	Demirkapi	N 39° 48'	E 28° 06'	Antimony	2,17	General	Past producer	Unknown	Unknown	Mine reported to be exhausted. Res: 11kt @ 1.62% Sb (1972).
G 39	Havran area Eymir Buyuk Eymir	N 39° 30'	E 27° 15'	Iron	2,15,17,22,23	General	Past producer	Surface	Unknown	Two deposits of sedimentary hematite. One with reserves of 11.5Mmt @ 55-57% Fe. Deposit dimensions 1100m x 200m x 30m. Preoduction reported for 1953-56. Produced since 1953 until 1977.
G 40	Hopanlar	N 39° 36'	E 28° 58'	Manganese	2	General	Past producer	Unknown	Unknown	Deposit in veins of Paleozoic schists. Worked in 1948-49 yielding 1385 tons.
G 41	Kalabak	N 39° 36'	E 27° 07'	Lead, zinc	2	General	Past producer	Unknown	Unknown	Prod. 23 tons in 1953, 53 tons in 1954.
G 42	Kalburcu	N 39° 34'	E 28° 09'	Manganese	2	General	Past producer	Unknown	Unknown	In 1948, produced 45 tons @ 45.4% Mn.
G 43	Kocadag	N 39° 30'	E 27° 08'	Iron	2	General	Past producer	Underground	Unknown	Deposit worked in 1953.
G 44	Korucu	N 39° 28'	E 27° 22'	Antimony	2,17	General	Past producer	Unknown	Unknown	Small deposit worked 1945-1948. Res: 332kt @ 6.05% Sb (1973).
G 45	Purinlik	N 39° 34'	E 26° 44'	Iron	2	General	Past producer	Unknown	Unknown	Assays 47.2% Fe in hematite-limonite. Deposit worked in 1955.
G 46	Samil Yagcilar	N 39° 48'	E 27° 53'*	Iron	2,15,17,22	General	Past producer	Surface	Unknown	Res: 3.6Mt @ 54.6% Fe (1971). Ore zone 800m x 100m x 50m. Ore mined at intervals since 1955.
G 47	Samic	N 39° 37'	E 28° 27'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 20 tons in 1954.
G 48	Semimaga Dursunbey	N 39° 35'	E 28° 33'	Chromite	2,17	General	Past producer	Unknown	Unknown	Produced in the 1950's. Res: 84.7kt @ 20-25% Cr2O3 (1986).
G 49	Seytandere	N 39° 56'	E 27° 25'	Lead	2	General	Past producer	Unknown	Unknown	As of 1957, yielded 950 tons.
G 50	Susurluk Sultancayir Aziziye	N 39° 50'	E 28° 09'	Boron	5,6,15	General	Past producer	Underground	Unknown	Mined until 1954, when reserves exhausted. Mine workings consisted of shaft 93m deep, Sultancayir zone 1500m in diameter, Aziziye zone 1200m by 600m. Average thickness 1.5m. Total production est. at 600kt. Ore sequence 250m of sediments.
G 51	Tatlisu	N 39° 24'	E 27° 55'	Antimony	2	General	Past producer	Unknown	Unknown	Mine reported to be exhausted.

APPENDIX B: PAST PRODUCING MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
G	52	Temasalik	N 39° 33'	E 27° 06'	Manganese	2	General	Past producer	Unknown	Unknown	Worked before World War I. Res: 8-10kt @ 40% Mn.
G	53	Turfular Arap Deresi Dikenli Mezitler	N 39° 29	E 28° 18'	Manganese, iron	2,17	General	Past producer	Surface	Unknown	Produced 2500 tons in 1941 in andesite. Ore in veins 0.1-1m thick, 150m long, and 50m wide. Res: 692kt @ 19.73% Fe, 13.7% Mn (1989).
G	54	Yasyeri	N 39° 39'	E 27° 03'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 18 tons in 1954.
G	55	Yenice Kayapa	N 39° 34'	E 28° 05'	Antimony	2,17	General	Past producer	Unknown	Unknown	Vertical veins 0.05-0.5m thick and 50-100m long. Res: 104kt @ 6% Sb (1970).
H	56	Bozuyuk	N 39° 54'	E 30° 03'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's.
H	57	Dudas	N 40° 01'	E 30° 14'	Antimony	2	General	Past producer	Unknown	Unknown	Mine reopened in 1957.
H	58	Gude Sorgunlu Gol Yukari Komurcu Akcakmak Bozca Armut Degirmen Bogazi	N 40° 00'	E 29° 54'	Manganese	2	General	Past producer	Surface	Unknown	District composed of 4 deposits. Produced 5300 tons 1952-53. Assays 18%-40% Mn. Ore in lenses of green schist and quartzite.
H	59	Inhisir	N 40° 03'	E 30° 23'	Tin	2	General	Past producer	Unknown	Unknown	Historical recovery reported. Tin associated with granites.
H	60	Kure	N 40° 05'	E 30° 10'	Lignite	2	General	Past producer	Unknown	Unknown	Res: 3Mt @ 4650 Cal/kg. 1955 county reserves 3.1Mt.
H	61	Kuzfindik	N 39° 54'	E 29° 56'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's.
H	62	Mihalgazi	N 40° 01'	E 30° 34'	Tin	2	General	Past producer	Unknown	Unknown	Historical recovery reported.
H	63	Nemli	N 39° 43'	E 30° 14'	Meerschaum	2	General	Past producer	Surface	Domestic	Production from one site.
H	64	Yakari	N 39° 54'	E 29° 54'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's.
H	65	Yarhisar Bahcecik Hasandere Elmabahce	N 40° 08'	E 29° 45'	Manganese	2	General	Past producer	Surface	Unknown	Produced 600 tons between 1951-54.
I	66	Sacmalipinar	N 40° 44'	E 30° 57'	Lignite	2	General	Past producer	Unknown	Unknown	Res: 1.5Mt @ 4012 Cal/kg. 1955 county reserves 25Mt.
J	67	Baslangic	N 37° 25'	E 29° 45'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 525kt @ 38-40% Cr_2O_3.
J	68	Beykoy	N 37° 39'	E 29° 51'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 525kt @ 38-40% Cr_2O_3.
J	69	Corten	N 37° 01'	E 29° 32'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 525kt @ 38-40% Cr_2O_3.
J	70	Gokarik	N 37° 25'	E 29° 45'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 525kt @ 38-40% Cr_2O_3.

APPENDIX B: PAST PRODUCING MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
J	71	Gulman-Sazak	N 37° 21'	E 29° 46'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 525kt @ 38-40% Cr2O3.
J	72	Kocakuz	N 37° 25'	E 29° 45'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 525kt @ 38-40% Cr2O3.
J	73	Manastir	N 37° 30'	E 29° 46'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 525kt @ 38-40% Cr2O3.
J	74	Muslimler	N 37° 25'	E 29° 45'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 525kt @ 38-40% Cr2O3.
J	75	Niyazlar	N 37° 28'	E 29° 45'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 525kt @ 38-40% Cr2O3.
J	76	Tefenni	N 37° 18'	E 29° 47'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 525kt @ 38-40% Cr2O3.
K	77	Artilanlar	N 39° 40'	E 29° 15'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. County reserves 340kt @ 38-48% Cr2O3.
K	78	Cardi-Kismanlar	N 39° 41'	E 29° 10'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. County reserves 340kt @ 38-48% Cr2O3.
K	79	Catak	N 40° 02'	E 28° 59'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. County reserves 340kt @ 38-48% Cr2O3.
K	80	Cepni	N 40° 21'	E 28° 50'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 480 tons in 1949.
K	81	Coken-Tekeler	N 39° 39'	E 28° 53'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. County reserves 340kt @ 38-48% Cr2O3.
K	82	Coreler	N 39° 57'	E 28° 56'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. County reserves 340kt @ 38-48% Cr2O3.
K	83	Dagdibi	N 40° 00'	E 29° 14'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. County reserves 340kt @ 38-48% Cr2O3.
K	84	Gedikler	N 39° 44'	E 29° 02'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's from two sites. County reserves 340kt @ 38-48% Cr2O3.
K	85	Goynukbelen	N 39° 59'	E 29° 03'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. County reserves 340kt @ 38-48% Cr2O3.
K	86	Inegol Sillilukoy	N 40° 08'	E 29° 15'	Gold, antimony	17	General	Past producer	Unknown	Unknown	Res: 15kt @ 0.7-28g/t Au, 6.5% Sb. Data from 1980 report.
K	87	Keles-Kuzbudaklar	N 39° 55'	E 29° 14'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. County reserves 340kt @ 38-48% Cr2O3.
K	88	Kozluca	N 39° 36'	E 29° 09'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. County reserves 340kt @ 38-48% Cr2O3.
K	89	Mirandag	N 39° 39'	E 28° 53'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. County reserves 340kt @ 38-48% Cr2O3.

APPENDIX B: PAST PRODUCING MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
K	90	Orhaneli	N 39° 42'	E 28° 56'	Chromite	2,17	General	Past producer	Unknown	Unknown	Produced in the 1950's. Res: 1Mt @ 40-48% Cr2O3 (1974).
K	91	Orhaneli-Kinik	N 39° 42'	E 28° 56'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. County reserves 340kt @ 38-48% Cr2O3.
K	92	Orhaneli-Mirandagi	N 39° 40'	E 28° 55'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. County reserves 340kt @ 38-48% Cr2O3.
K	93	Pirasalik	N 39° 38'	E 28° 48'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. County reserves 340kt @ 38-48% Cr2O3.
K	94	Piribeyler	N 39° 38'	E 28° 48'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. County reserves 340kt @ 38-48% Cr2O3.
K	95	Topuk	N 39° 59'	E 29° 00'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's at two sites. County reserves 340kt @ 38-48% Cr2O3.
K	96	Topuk	N 39° 59'	E 29° 00'	Magnesite	2,22	General	Past producer	Unknown	Unknown	two deposits; one with 30,000 tons of reserves @ 44.6% MgO and one with 10,000 tons. Production of 10kt reported in 1986.
K	97	Yakuplar	N 39° 45'	E 29° 03'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. County reserves 340kt @ 38-48% Cr2O3.
L	98	Balcilar	N 40° 10'	E 26° 51'	Copper, lead, zinc	2	General	Past producer	Unknown	Unknown	Quartz veins in dacite tuff. 22.18% Cu from mine dumps.
L	99	Camyurt	N 40° 17'	E 26° 50'	Copper, molybdenum	2	General	Past producer	Underground	Unknown	Old workings largely caved. Dumps contain 2000 tons @ 0.31% Cu.
L	100	Hacibayram Sayasi	N 40° 02'	E 27° 03'	Copper, lead, zinc	2	General	Past producer	Underground	Unknown	Five caved tunnels reported.
L	101	Karapinar	N 39° 59'	E 26° 40'	Copper	2	General	Past producer	Unknown	Unknown	Ore in veins in schists. Assays range from 2-26% Cu.
L	102	Kucukkuyu	N 39° 34'	E 26° 36'	Iron	2	General	Past producer	Surface	Unknown	Three layers: bottom: 260kt @ 48-52% Fe, 3-10m thick; mid: Assays 67% Fe, and top: 500kt @ 61.68% Fe up to 28m thick.
L	103	Sarikaya	N 40° 11'	E 27° 13'	Arsenic	2	General	Past producer	Unknown	Unknown	Small production primarily for local use 1953-55.
L	104	Yuvalar	N 40° 03'	E 27° 04'	Graphite	2	General	Past producer	Unknown	Unknown	Produced 700 tons in 1951.
M	105	Tuhlkoy	N 40° 45'	E 33° 47'	Copper	2	General	Past producer	Surface	Unknown	Small workings visible.
M	106	Urvay	N 40° 43'	E 33° 43'	Copper	2	General	Past producer	Surface	Unknown	Irregular deposit with caved workings.
N	107	Abuhemsin	N 40° 17'	E 35° 08'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 2847 tons between 1949-1953. Ore in stock with reserves of 2000 tons @ 45% Mn.
N	108	Alpagot Zanbal	N 40° 20'	E 34° 51'	Lignite	2	General	Past producer	Unknown	Unknown	Res: 22Mt. 1955 county reserves 23Mt.
N	109	Begievan	N 41° 26'	E 41° 36'	Copper, zinc	2	General	Past producer	Unknown	Unknown	Worked prior to WWI.

APPENDIX B: PAST PRODUCING MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
N	110	Besagil	N 41° 16'	E 41° 46'	Copper	2	General	Past producer	Underground	Unknown	Mine appears to be exhausted.
N	111	Bozgiret	N 41° 25'	E 42° 14'	Lead, zinc, copper	2	General	Past producer	Underground	Unknown	Worked prior to WWI.
N	112	Insa	N 41° 13'	E 41° 47'	Copper	2	General	Past producer	Underground	Unknown	Host rocks clays, marls, and sandstones. Three veins visible in workings.
N	113	Koruculer	N 41° 18'	E 41° 37'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 1374 tons in 1955. Ore in two beds parallel to tuff.
N	114	Kutonit	N 41° 20'	E 41° 16'	Copper, zinc	2	General	Past producer	Underground	Unknown	Deposit worked in 1912 and earlier.
N	115	Kuvarshan	N 41° 15'	E 41° 47'	Copper	2	General	Past producer	Underground	Unknown	Worked out prior to WWI. Assays 4-4.5% Cu.
N	116	Nigzivan	N 40° 49'	E 41° 31'	Iron	2	General	Past producer	Surface	Unknown	Remnants of old contact magnetite deposit.
N	117	Nukavur	N 41° 15'	E 41° 57'	Lead, zinc, copper	2	General	Past producer	Underground	Unknown	Ore at limestone/andesite contact. Abandoned tunnels present.
N	118	Peronit	N 41° 22'	E 41° 23'	Copper, zinc	2	General	Past producer	Underground	Unknown	Mine worked by Genoese. 50,000 tons of ore exposed.
N	119	Peronit	N 41° 22'	E 41° 23'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 1529 tons between 1954-55. Deposit is tabular, assays 25-35% Mn, in andesite.
N	120	Petek	N 41° 20'	E 41° 32'	Copper	2	General	Past producer	Underground	Unknown	Deposit worked in 1912-1913. Res: 30,000 tons @ 3.5% Cu.
N	121	Peterek	N 40° 46'	E 41° 26'	Lead	2	General	Past producer	Unknown	Unknown	260 tons mined in 1950.
N	122	Sucuna	N 41° 28'	E 41° 37'	Lead, zinc, copper	2	General	Past producer	Underground	Unknown	Deposit in andesite/dacite contact. Worked 1890s. Four tunnels filled with water.
O	123	Cayirgan	N 37° 19'	E 29° 02'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 953 tons of high grade ore 1952-53.
O	124	Erdogmus	N 37° 26'	E 28° 51"	Manganese	2	General	Past producer	Unknown	Unknown	Produced 1144 tons of high grade ore 1952-55.
O	125	Hacihuseyin	N 37° 26'	E 28° 51"	Manganese	2	General	Past producer	Unknown	Unknown	Produced 100 tons 1955.
O	126	Karaismailler	N 37° 25'	E 29° 20'	Chromite	2,17	General	Past producer	Unknown	Unknown	Produced in the 1950's. Res: 336kt @ 29-36% Cr2O3 (1988).
O	127	Kavaklar	N 38° 08'	E 29° 34'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 340 tons of high grade ore 1952-55.
O	128	Meviutler	N 37° 17'	E 29° 13'	Chromite	2,15	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 100kt.
O	129	Tetetirkaz	N 37° 55'	E 28° 56'	Sulfur	2	General	Past producer	Unknown	Unknown	Produced 375 tons in 1945.
P	130	Cagiroglu	N 38° 28'	E 40° 06'	Lead, zinc, silver	2	General	Past producer	Unknown	Unknown	Several small mines in area, worked intermittantly.

APPENDIX B: PAST PRODUCING MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
Q	131	Kurttepe	N 41° 22'	E 26° 43'	Lignite	2,4	General	Past producer	Unknown	Unknown	Res: 1.25Mt @ 4218 Cal/kg. 1955 county reserves 10.3Mt. Large reserve potential.
Q	132	Sirem	N 41° 18'	E 26° 30'	Lignite	2	General	Past producer	Unknown	Unknown	Res: 2Mt @ 3390 Cal/kg. 1955 county reserves 10.3Mt.
R	133	Asvan	N 38° 54'	E 38° 57'	Iron	22	General	Past producer	Surface	Unknown	Mineralization along limestone/diorite contact. Production occurred between 1964-68 totalling 50kt. Reserves (1977) 1.2Mt @ 58% Fe.
R	134	Dere	N 38° 42'	E 39° 37'	Lead, zinc	2	General	Past producer	Underground	Unknown	Ore assays 7-12% Pb, 28-40% Zn.
R	135	Gedik	N 38° 33'	E 40° 04'	Copper	2	General	Past producer	Underground	Unknown	Old workings caved.
R	136	Genepi	N 38° 35'	E 39° 31'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's.
R	137	Karabek	N 38° 45'	E 38° 38'	Copper	2	General	Past producer	Underground	Unknown	Old workings caved.
R	138	Maden	N 38° 23'	E 39° 40'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's from two sites.
R	139	Mahman	N 38° 36'	E 39° 55'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's.
S	140	Agamcagam	N 40° 01'	E 40° 03'	Copper	2	General	Past producer	Surface	Unknown	Old workings scattered in area.
S	141	Bizmisen Tastepe Kizilkaya	N 39° 14'	E 38° 23'	Iron	22	General	Past producer	Surface	Unknown	Ore in diorite dikes overlain by limestone. Small scale mining of Tastepe between 1968-1970. Approx. 30kt @ 54% Fe removed, 210kt remain. Kizilkaya area reserves 110kt @ 64.39% Fe (1977).
S	142	Ceplar	N 39° 28'	E 38° 34'	Copper	2	General	Past producer	Surface	Unknown	Considerable pits found in area.
S	143	Copler Karakaya Kasiye Dag Yolu Marasilk Top Tepe	N 39° 26'	E 38° 32'	Iron, copper	2	General	Past producer	Surface	Unknown	Five hematite deposits. Old mine workings and slag in area.
S	144	Erbas	N 39° 56'	E 40° 11'	Chromite	2	General	Past producer Unknown	Unknown	Unknown	Discovered in 1954. Res: 500kt.
S	145	Kopdag West	N 39° 59'	E 40° 15'	Chromite	15,17	General	Past producer	Underground	Unknown	Small, intermittant production by 1-2 man operation. Consists of 25 scattered deposits over 14-km trend. Res: 696kt @ 28-48% Cr2O3 (1981).
T	146	Balkaya	N 40° 45'	E 42° 16'	Lignite	2	General	Past producer	Unknown	Unknown	Res: 10Mt @ 5500-6000Cal/kg. 1955 county reserves 14.1Mt.
T	147	Erkek	N 40° 39'	E 42° 39'	Copper	2	General	Past producer	Surface Underground	Unknown	Workings consist of 40m open pit and tunnel.
T	148	Pitgir	N 40° 26'	E 42° 04'	Copper	2	General	Past producer	Surface Underground	Unknown	Numerous shafts and pits in area.
T	149	Semerek	N 40° 26'	E 40° 46'	Copper	2	General	Past producer	Underground	Unknown	Much old caved workings of Genoese age.

APPENDIX B: PAST PRODUCING MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
U	150	Bahtiyar	N 39° 57'	E 31° 40'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 500kt @ 34-44% Cr2O3.
U	151	Basoren	N 39° 58'	E 30° 58'	Magnesite	2	General	Past producer	Unknown	Unknown	Two deposits of undetermined tonnage @ 46-48% MgO. Produced 280 tons between 1950-51.
U	152	Basoren	N 39° 58'	E 30° 58'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 500kt @ 34-44% Cr2O3.
U	153	Basoren	N 39° 58'	E 30° 58'	Meerschaum	2	General	Past producer	Surface	Domestic	Production from two sites.
U	154	Dagkuplu	N 39° 59'	E 30° 41'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's at two sites. 1955 county reserves 500kt @ 34-44% Cr2O3.
U	155	Dagkuptu-Gelinmezer	N 39° 59'	E 30° 41'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 500kt @ 34-44% Cr2O3.
U	156	Eskisehir	N 39° 46'	E 30° 32'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 500kt @ 34-44% Cr2O3.
U	157	Gazigol	N 39° 50'	E 30° 53'	Meerschaum	2	General	Past producer	Surface	Domestic	Production from one site.
U	158	Gokceoglu	N 39° 44'	E 30° 53'	Meerschaum	2,17	General	Past producer	Surface	Domestic	Production from five sites. Res: 50kt (1982).
U	159	Gunduzler	N 39° 52'	E 30° 49'	Magnesite, chromite	2	General	Past producer	Unknown	Unknown	Eight small deposits. Produced 2,150 tons between 1949-51.
U	160	Gunduzler	N 39° 52'	E 30° 49'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's at six sites. 1955 county reserves 500kt @ 34-44% Cr2O3.
U	161	Halilogian	N 39° 49'	E 31° 40'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 500kt @ 34-44% Cr2O3.
U	162	Imsehir-Karatokat	N 39° 41'	E 30° 47'	Meerschaum	2,17	General	Past producer	Surface	Domestic	Production from eight sites. Res: 465kt (1982).
U	163	Karabayir	N 39° 57'	E 30° 04'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 500kt @ 34-44% Cr2O3.
U	164	Kavak	N 39° 55'	E 31° 40'	Chromite	2,15	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 500kt @ 34-44% Cr2O3.
U	165	Kizilcaoren	N 39° 38'	E 31° 23'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 1440 tons between 1945-1950.
U	166	Lacin	N 40° 03'	E 30° 47'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 500kt @ 34-44% Cr2O3.
U	167	Margi	N 39° 55'	E 30° 54'	Iron	2	General	Past producer	Unknown	Unknown	Operated in 1955.
U	168	Margi Sepetci	N 39° 56'	E 30° 50'	Meerschaum	2,17	General	Past producer	Surface	Domestic	Production from seven sites. Res: 883kt (1982).
U	169	Mihalicclk	N 39° 52'	E 31° 30'	Asbestos	2,17,22	General	Past producer	Surface	Domestic	Production from five sites in 1986; produced for local markets. Res: 1Mt (1987).

APPENDIX B: PAST PRODUCING MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
U	170	Omerkoy	N 39° 50'	E 31° 30'	Magnesite	2	General	Past producer	Unknown	Unknown	Produced 59 tons in 1945.
U	171	Sazak	N 39° 48'	E 31° 38'	Chromite	2,15	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 500kt @ 34-44% Cr2O3.
U	172	Sepetci	N 39° 56'	E 30° 50'	Magnesite	2	General	Past producer	Unknown	Unknown	Two deposits aggregating 2-5 ktons @ 46.72% MgO. 15 tons produced in 1947.
U	173	Sepetci-Tastepe	N 39° 56'	E 30° 50'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's at two sites. 1955 county reserves 500kt @ 34-44% Cr2O3.
U	174	Sogutcuk	N 39° 54'	E 30° 59'	Meerschaum	2,17	General	Past producer	Surface	Domestic	Production from eight sites. Res: 56.68Mt (1982).
V	175	Burunsuzlar	N 36° 57'	E 36° 50'	Manganese	2,4,17	General	Past producer	Unknown	Unknown	Produced 1044 tons between 1951-1952. Produced in 1973. Res: 17kt @ 35% Mn (1984).
W	176	Agil	N 40° 55'	E 38° 54'	Copper	2	General	Past producer	Underground	Unknown	Old site.
W	177	Boynuyolu	N 40° 47'	E 38° 51'	Iron	2	General	Past producer	Underground	Unknown	Eight old tunnels worked in Genoese times.
W	178	Duroglu	N 40° 55'	E 38° 31'	Copper, lead, zinc	2	General	Past producer	Underground	Unknown	Old workings and dumps assaying 4.17% Pb and 2.77% Cu.
W	179	Eseli	N 40° 54'	E 38° 57'	Copper, lead, zinc	2	General	Past producer	Underground	Unknown	Five drifts and inclined shafts detected. Worked by the Genoese and before WWI.
W	180	Gecit Araca	N 40° 46'	E 38° 33'	Copper	2	General	Past producer	Underground	Unknown	Abandoned mine in gabbro.
W	181	Gelevard	N 40° 57'	E 38° 43'	Iron	2	General	Past producer	Surface	Unknown	Evidence of old workings.
W	182	Girlak	N 40° 50'	E 38° 40'	Lead, zinc, copper	2	General	Past producer	Underground	Unknown	Assay yields 0.74% Pb, 4.92% Zn, 3.69% Cu, 4.13 oz Ag and 0.034 oz Au.
W	183	Gumusluk Masat	N 40° 57'	E 38° 44'	Copper, lead, zinc	2	General	Past producer	Underground	Unknown	40-80cm thick vein in andesite. Old workings present. Assay is 37.61% Pb, 23.2% Zn, 1.16% Cu
W	184	Inkoy	N 40° 59'	E 38° 51'	Copper, lead, zinc	2	General	Past producer	Underground	Unknown	Four old tunnels in andesite.
W	185	Israil	N 40° 55'	E 38° 54'	Copper	2	General	Past producer	Underground	Unknown	Worked prior to WWI. Ten potential deposits in area.
W	186	Kan	N 40° 59'	E 38° 51'	Copper, zinc	2	General	Past producer	Underground	Unknown	Caved workings and slag piles visible. Assay of ore 0.25% Pb, 5.01% Zn, 1.46% Cu and 25.75% Fe.
W	187	Karabork Cocendere Pelido Girlak	N 40° 52'	E 39° 04'	Copper	2	General	Past producer	Underground	Unknown	Deposits worked by the Genoese. All shafts and drifts filled with water.
W	188	Karagol	N 40° 54'	E 39° 00'	Lead, zinc, copper	2	General	Past producer	Underground	Unknown	Multiple veins worked in 1900s. Assay 11.01% Pb, 25.9% Zn, 3.85% Cu 5.65 oz Ag, and 0.038 oz Au.

APPENDIX B: PAST PRODUCING MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
W	189	Karakaya	N 40° 59'	E 39° 12'	Copper, lead, zinc	2	General	Past producer	Underground	Unknown	Numerous old workings.
W	190	Karavacik	N 41° 00'	E 38° 50'	Iron	2	General	Past producer	Surface	Unknown	Evidence of old workings.
W	191	Kastaria	N 40° 53'	E 38° 34'	Copper, lead, zinc	2	General	Past producer	Underground	Unknown	Operated by the Russians in 1885. Working consist of 3m inclined shaft, 25m tunnel.
W	192	Kayabasi	N 40° 53'	E 38° 30'	Copper, lead, zinc	2	General	Past producer	Unknown	Unknown	Old workings reported.
W	193	Kelete	N 40° 58'	E 38° 58'	Copper	2	General	Past producer	Underground	Unknown	Float ore high in copper from old workings.
W	194	Kiran	N 41° 00'	E 38° 49'	Iron	2	General	Past producer	Surface	Unknown	Evidence of old workings.
W	195	Kiricak	N 40° 50'	E 38° 34'	Copper, lead, zinc	2	General	Past producer	Surface Underground	Unknown	20cm hydrothermal vein in andesite. Workings consist of open pit, 30m tunnel, and 3m inclined shaft.
W	196	Kizilelma Orucbey	N 40° 28'	E 37° 58'	Lead, zinc, copper	2	General	Past producer	Underground	Unknown	Two deposits reported in andesite. Workings consist of 4 tunnels & adits.
W	197	Kizilelma	N 40° 28'	E 37° 58'	Copper, lead, zinc	2	General	Past producer	Underground	Unknown	Developed before WWII. Inclined shaft constructed to mine 40cm vein.
W	198	Koruktepe	N 40° 49'	E 38° 14'	Copper	2	General	Past producer	Unknown	Unknown	Abandoned mine reported at this location.
W	199	Lahanos	N 40° 55'	E 38° 45'	Copper, lead, zinc, gold, REO	2,15	General	Past producer	Underground	Unknown	Two groups of multiple deposits. Old workings visible.
W	200	Madendere	N 40° 44'	E 38° 45'	Iron	2	General	Past producer	Surface	Unknown	Evidence of old workings.
W	201	Osman Kiran	N 40° 57'	E 38° 44'	Copper	2	General	Past producer	Underground	Unknown	Three ore pipes in andesite. Slag in area up to 400,000 tons.
W	202	Sadi	N 41° 02'	E 39° 00'	Lead, zinc, copper	2	General	Past producer	Underground	Unknown	Disseminated copper in rhyolite/andesite. Assay of 83.4% Pb, 1.02% Zn, 16.62% Cu.
W	203	Sarpkaya	N 40° 53'	E 38° 27'	Copper, lead	2	General	Past producer	Underground	Unknown	Remains of seven tunnels. Slag assays 2.17% Pb and 0.36% Cu.
W	204	Seku	N 40° 52'	E 38° 54'	Copper	2	General	Past producer	Underground	Unknown	Three deposits in andesite. Old workings and slag dumps visible.
W	205	Sogutlendiyayla	N 41° 02'	E 39° 00'	Iron	2	General	Past producer	Surface	Unknown	Worked prior to WWI.
W	206	Tahtali	N 40° 47'	E 38° 31'	Copper, lead, zinc	2	General	Past producer	Underground	Unknown	All workings caved.
W	207	Yivdincik	N 40° 40'	E 38° 30'	Copper, lead, zinc	2	General	Past producer	Underground	Unknown	All workings caved. Four mines in area.
X	208	Aylbeli	N 40° 36'	E 38° 51'	Iron	2	General	Past producer	Surface	Unknown	Old exploration workings.

APPENDIX B: PAST PRODUCING MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
X	209	Beytarlasi	N 40° 32'	E 38° 51'	Iron	2	General	Past producer	Surface	Unknown	Old workings and float found in area.
X	210	Cayir Cukur	N 40° 40'	E 39° 05'	Copper	2	General	Past producer	Underground	Unknown	Workings consist of 5 tunnels and several shafts.
X	211	Dandi	N 40° 46'	E 38° 54'	Copper	2	General	Past producer	Underground	Unknown	Old workings visible.
X	212	Demicikkaya	N 40° 30'	E 38° 51'	Iron	2	General	Past producer	Surface	Unknown	Old workings and outcrops found in area.
X	213	Deregozu	N 40° 52'	E 39° 05'	Copper	2	General	Past producer	Underground	Unknown	Extensive workings visible.
X	214	Hazine/Kirik Pavil	N 40° 27'	E 39° 29'	Lead, silver	2	General	Past producer	Unknown	Unknown	Ore in lenses associated with quartz, limestone, and andesite. Remaining reserves run to 200,000 tons pyritic ore and 6750 tons low grade ore.
X	215	Irha	N 40° 13'	E 39° 36'	Copper	2	General	Past producer	Underground	Unknown	Deposit occurs in andesite cutting granite. Workings consist of 4 shafts and 4 tunnels. All workings are caved.
X	216	Karacukur	N 40° 40'	E 39° 10'	Copper	2	General	Past producer	Underground	Unknown	Old workings all caved.
X	217	Kizil Ata	N 40° 47'	E 39° 03'	Copper	2	General	Past producer	Underground	Unknown	Five tunnels are caved.
X	218	Kizilkaya	N 40° 32'	E 38° 53'	Iron	2	General	Past producer	Surface	Unknown	Old hematite workings found in area.
X	219	Kuru Maden	N 40° 51'	E 39° 03'	Copper, lead, zinc	2	General	Past producer	Underground	Unknown	Ore in chalk and andesite. Some workings accessible.
X	220	Livine	N 40° 27'	E 39° 21'	Copper	2	General	Past producer	Underground	Unknown	Old mine in gneiss or andesite. Workings cover 200m x 300m.
X	221	Maden	N 40° 11'	E 40° 22'	Copper	2	General	Past producer	Underground	Unknown	Mine dumps contain 10,000 cu m material. Water from caved tunnels hi in Cu.
X	222	Maden Kirani	N 40° 47'	E 39° 52'	Copper	2	General	Past producer	Underground	Unknown	Six tunnels driven in the past in andesite.
X	223	Madenhanlar	N 40° 11'	E 40° 25'	Copper	2	General	Past producer	Underground	Unknown	Old workings visible.
X	224	Nikola	N 40° 49'	E 39° 54'	Copper, lead, zinc	2	General	Past producer	Underground	Unknown	Assay of 2.06% Pb, 1.17% Zn, 2.18% Cu.
X	225	Seku	N 40° 52'	E 38° 53'	Iron	2	General	Past producer	Surface	Unknown	Old magnetite-hematite workings.
X	226	Tasilca	N 40° 43'	E 39° 03'	Copper	2	General	Past producer	Underground	Unknown	Extensive workings visible, inaccessible.
X	227	Terekli	N 40° 50'	E 38° 55'	Lead, zinc, copper, silver	2	General	Past producer	Underground	Unknown	Developed by Genoese and reopened prior to WWI. Assay is 14.69% Pb, 19.22% Zn, 0.91% Cu 5.69 oz Ag, 0.03 oz Au.
X	228	Tonan Maden	N 40° 40'	E 39° 21'	Copper	2	General	Past producer	Underground	Unknown	Three tunnels are caved.
Y	229	Gokdere	N 36° 52'	E 36° 12'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's from two sites. 1955 county reserves 250kt.

APPENDIX B: PAST PRODUCING MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
Y	230	Guvenis	N 36° 20'	E 36° 00'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's from two sites. 1955 county reserves 250kt.
Y	231	Kucukger	N 36° 20'	E 36° 00'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's from two sites. 1955 county reserves 250kt.
Y	232	Kuyuluk	N 36° 18'	E 35° 47'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 250kt.
Y	233	Payas Iskenderun	N 36° 37'	E 36° 12'	Iron	22	General	Past producer	Surface	Unknown	Sedimentary deposit with 6.1Mt @ 32.3% Fe.
Y	234	Sogukoluk	N 36° 20'	E 36° 00'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's from three sites. 1955 county reserves 250kt.
Y	235	Yenikoy	N 36° 19'	E 35° 47'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 250kt.
Z	236	Buyukecell	N 36° 11'	E 33° 35'	Iron	22	General	Past producer	Underground	Unknown	1977 reserves indicate 2.4Mt ore.
Z	237	Caglalik	N 36° 11'	E 33° 40'	Iron	2	General	Past producer	Surface	Unknown	Old working in limestone assaying 46% Fe.
Z	238	Icel Mersin	N 36° 48'	E 34° 36'	Chromite	2,15	General	Past producer	Unknown	Unknown	1955 county reserves 77kt.
Z	239	Karaisali	N 36° 08'	E 32° 59'	Chromite	2	General	Past producer	Unknown	Unknown	1955 county reserves 50-60kt.
Z	240	Mellec	N 36° 04'	E 32° 42'	Iron	22	General	Past producer	Underground	Unknown	Ore replacement in limestone.
Z	241	Ortakonus	N 36° 05'	E 32° 47'	Lead, zinc, copper, silver	2	General	Past producer	Underground	Unknown	Ore in schist and marble. Ore occurs as Type 1 (28% Zn, 22% PB) and Type 2 (2% Zn and 20% Pb). Prod. ceased in 1948, ore exhausted.
Z	242	Osmaniye	N 36° 20'	E 33° 00'	Chromite	2	General	Past producer	Unknown	Unknown	1955 county reserves 50-60kt.
AA	243	Yarikkaya	N 38° 28'	E 31° 05'	Lignite	2	General	Past producer	Unknown	Unknown	Res: 5Mt.
AA	244	Yenisarovasi	N 38° 04'	E 31° 23'	Iron	2	General	Past producer	Surface	Unknown	Ferruginous sand deposit worked in 1951.
BB	245	Agacli	N 41° 16'	E 28° 52'	Lignite	2	General	Past producer	Unknown	Unknown	Res: 16.2Mt @ 2764 Cal/kg. 1955 county reserves 17.2Mt.
BB	246	Akviran	N 41° 11'	E 28° 20'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 32kt between 1952-1955. Reported to be of low grade, sedimentary origin.
BB	247	Camlimani	N 40° 53'	E 29° 05'	Copper	2	General	Past producer	Surface	Unknown	Open pits assaying 3.3-6.2% Cu. Deposit in silicified eruptive rocks.
BB	248	Istranca	N 41° 25'	E 28° 11'	Manganese	2	General	Past producer	Surface	Domestic	Overlain by 3m of shale and sandstone. Res: 6Mt @ 32.5% Mn. Production 1955-1956, of about 10,000 tons. Sold locally to battery manufacturers.
BB	249	Podima	N 41° 27'	E 28° 20'	Manganese	2	General	Past producer	Surface	Unknown	Deposit of sedimentary origin.

APPENDIX B: PAST PRODUCING MINERAL PROPERTIES IN TURKEY

MAP KEY (1)	NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
BB 250	Rumeli Kavak	N 41° 11'	E 29° 04'	Copper, gold	2	General	Past producer	Unknown	Unknown	Veins vary from 1-3m thick, to 75m length. Worked periodically since Byzantine times.
CC 251	Cesme	N 38° 18'	E 26° 19'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 263 tons in 1949.
CC 252	Cinlikaya	N 38° 06'	E 28° 08'	Antimony	2	General	Past producer	Unknown	Unknown	Two vein systems in gneisses and schists.
CC 253	Civa Madeni	N. 38° 38'	E 26° 22'	Mercury	2	General	Past producer	Surface	Unknown	Produced intermittantly until 1955. Ore as disseminations in quartzite and schist.
CC 254	Gure	N 38° 03'	E 28° 00'	Arsenic, gold	2	General	Past producer	Unknown	Unknown	Abandoned mine reported.
CC 255	Kara Reis	N 38° 29'	E 26° 25'	Mercury	2,15,17	General	Past producer	Underground	Unknown	Mine reported to be producing in the 1950s. Res: 50kt @ 0.3% Hg (1967).
CC 256	Karaburun Izmir	N 38° 37'	E 26° 29'	Mercury	15	General	Past producer	Surface	Unknown	Small producer until 1977 when owner died.
CC 257	Kure	N 38° 04'	E 27° 59'	Arsenic, gold	2	General	Past producer	Unknown	Unknown	Abandoned mine reported.
CC 258	Lubbayayla	N 38° 13'	E 27° 59'	Lead, zinc	2	General	Past producer	Unknown	Unknown	Old workings reported.
CC 259	Sandl	N 38° 15'	E 27° 04'	Antimony	2	General	Past producer	Unknown	Unknown	Produced in 1948-1949.
CC 260	Torbali	N 38° 14'	E 27° 20'	Iron	2,17,22	General	Past producer	Surface	Unknown	Hematite & limonite in limestone. Exploration pits visible; ore mined between 1957-63. Res: 2.1Mmt @ 45.8% Fe (1962).
DD 261	Kagizman	N 39° 29'	E 43° 15'	Salt	2,17	General	Past producer	Surface	Domestic	Operated in 1950's as a State Enterprise. Res: 60Mt .
EE 262	Devrekani	N 41° 34'	E 33° 53'	Chromite	2	General	Past producer	Unknown	Unknown	Two sites produced in the 1950's. 1955 county reserves 58kt.
EE 263	Kizilkize	N 41° 20'	E 33° 55'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 58kt.
EE 264	Kure	N 41° 48'	E 33° 43'	Copper	2	General	Past producer	Surface	Unknown	Deposit in diabase. Mine worked in Middle Ages. 190,000 cu. m. pit remains, dumps est. to contain 1-2.5Mmt @ 2-9.5% Cu.
EE 265	Mahallesi	N 41° 40'	E 34° 33'	Copper	2	General	Past producer	Unknown	Unknown	Ore in schists, old workings indicated.
EE 266	Seyhasban	N 41° 22'	E 33° 47'	Mercury	15,17	General	Past producer	Unknown	Unknown	Res: 75kt @ 0.4% Hg (1969).
EE 267	Tefennikoy	N 41° 28'	E 33° 28'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 58kt.
FF 268	Celaldagi Yahyali	N 38° 10'	E 35° 35'	Zinc	17	General	Past producer	Unknown	Unknown	Res: 10kt @ 15-20% Zn. Data from 1975 report.
FF 269	Kale	N 38° 08'	E 35° 34'	Lead	2	General	Past producer	Unknown	Unknown	Produced between 1951-55.
FF 270	Kalekoy	N 38° 06'	E 35° 13'	Lead, zinc	15	General	Past producer	Underground	Unknown	--

APPENDIX B: PAST PRODUCING MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
FF	271	Karadamazi	N 38° 07'	E 35° 22'	Iron	2,17	General	Past producer	Surface	Unknown	Site consists of two deposits, one worked. Production 1952+. Res: 6.4Mmt @ 54.46% Fe (1982).
FF	272	Kovali	N 38° 11'	E 35° 11'	Iron	2,17	General	Past producer	Unknown	Unknown	Worked from 1950-1955. Res: 1.6Mmt @ 40-52% Fe (1981).
FF	273	Tasin	N 38° 51'	E 35° 52'	Iron	22	General	Past producer	Surface	Unknown	Ore in limestone assays 52% Fe. Ore mined in 1970's.
FF	274	Toklar	N 38° 26'	E 36° 01'	Chromite	2	General	Past producer	Unknown	Unknown	Two sites producing in 1955.
FF	275	Uzunpinar	N 38° 44'	E 36° 24'	Iron	22	General	Past producer	Surface	Unknown	Ore body mined 1968-1970, producing 219kt ore.
GG	276	Demirkoy	N 41° 49'	E 27° 45'	Iron	2	General	Past producer	Underground	Unknown	Abandoned site with furnace. Ore at schist-granite contact.
HH	277	Hacibektas	N 38° 57'	E 34° 35'	Salt	2	General	Past producer	Surface	Domestic	Operated in 1950's as a State Enterprise.
HH	278	Hirfanli	N 39° 17'	E 33° 32'	Iron	2	General	Past producer	Unknown	Unknown	Produced in 1954.
HH	279	Tepesidelik	N 39° 03'	E 34° 14'	Salt	2,17	General	Past producer	Surface	Domestic	Operated in 1950's as a State Enterprise. Res: 20Mt (1982).
II	280	Babakoy	N 41° 00'	E 30° 07'	Iron	2	General	Past producer	Surface	Unknown	Old hematite workings in andesite.
II	281	Camdag	N 40° 57'	E 30° 40'	Iron	2	General	Past producer	Surface	Unknown	Ore between sandstone and limestone. Ore is oolitic hematite 34-42% Fe. Reserve estimates vary up to 95.9 Mmt. Ore thickness varies from 10-25m, length 2km.
II	282	Karasu Coban Yatak Aktas Kabalak Deresi Kestanepinar	N 40° 59'	E 30° 49'	Copper, lead, zinc	2	General	Past producer	Unknown	Unknown	Consists of five areas. Ore in small masses or disseminated. Host rock limestone. Assays yield 45.56-48.91% Pb, 4.95-6.89 % Zn, 2.21% Cu, 4.28-4.5 oz/t Ag. Res: 150kt galena, 300kt sphalerite.
II	283	Sunguriu	N 41° 05'	E 29° 52'	Iron	2	General	Past producer	Surface	Unknown	Evidence of hematite float in area.
II	284	Yazilik Pinar	N 41° 02'	E 30° 25'	Iron	2	General	Past producer	Surface	Unknown	Hematite slag covers 200 sq. km.
JJ	285	Marcuhur	N 37° 19'	E 31° 51'	Bauxite	15	General	Past producer	Surface	Unknown	–
KK	286	Alabarda-Kargilli	N 39° 35'	E 29° 16'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. County reserves 180kt @ 32-53% Cr2O3.
KK	287	Avcilar	N 39° 27'	E 29° 04'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 665 tons of low grade ore between 1945-48. Reserves est. at 1000-1500 tons.
KK	288	Avcilar II	N 39° 27'	E 29° 04'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 4000 tons between 1947-1951. Ore in marble.
KK	289	Aydinlar	N 39° 32'	E 29° 51'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 6236 tons of low grade ore in 1945-49.
KK	290	Aydinlar II	N 39° 30'	E 29° 02'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 100 tons of low grade ore in 1945.

APPENDIX B: PAST PRODUCING MINERAL PROPERTIES IN TURKEY

MAP KEY (1)	NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
KK 291	Buyuksaka	N 39° 23'	E 30° 08'	Magnesite	2,17	General	Past producer	Unknown	Unknown	Res: 6.9Mt @ 43.47% MgO (1978). Produced 60 tons between 1945-47.
KK 292	Cobanlar-Kisla	N 39° 28'	E 29° 07'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 1800 tons of low grade ore 1946-49. Res: 100-300 tons @ 30% Mn.
KK 293	Dagardi	N 39° 26'	E 29° 00'	Chromite	2	General	Past producer	Unknown	Unknown	Produced 1900-1950's. County reserves 180kt @ 32-53% Cr2O3.
KK 294	Degirmisaz	N 39° 29'	E 29° 14'	Lignite	2	General	Past producer	Unknown	Unknown	Res: 2Mt @ 5900 Cal/kg. 1955 county reserves 151.5Mt.
KK 295	Derbent Karakaya	N 39° 39'	E 29° 21'	Chromite	2,17	General	Past producer	Unknown	Unknown	Produced in the 1950's. Res: 96.7kt @ 48-54% Cr2O3 (1984).
KK 296	Devekayasi	N 39° 35'	E 29° 10'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. County reserves 180kt @ 32-53% Cr2O3.
KK 297	Dumrek	N 39° 35'	E 29° 05'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 100 tons of low grade ore in 1945-46.
KK 298	Dumrek	N 39° 35'	E 29° 05'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. County reserves 180kt @ 32-53% Cr2O3.
KK 299	Elmaagaci-Bozbelen	N 39° 42'	E 29° 20'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. County reserves 180kt @ 32-53% Cr2O3.
KK 300	Ezen	N 39° 35'	E 29° 10'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. County reserves 180kt @ 32-53% Cr2O3.
KK 301	Goynuk	N 39° 01'	E 29° 39'	Asbestos	2	General	Past producer	Unknown	Unknown	Production from three sites.
KK 302	Guzelyurt	N 39° 29'	E 29° 33'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 150 tons of low grade ore in 1945.
KK 303	Ilyasli	N 38° 41'	E 29° 25'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 150 tons of 50% Mn in 1950.
KK 304	Karaagac-Akpinarozu	N 39° 33'	E 29° 28'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 295 tons of low grade ore in 1945.
KK 305	Karakoca	N 39° 15'	E 28° 55'	Lead, zinc copper	15	General	Past producer	Unknown	Unknown	Ore dimensions 1000m by 500m by 1m.
KK 306	Kayi	N 39° 21'	E 29° 25'	Manganese	2,4	General	Past producer	Unknown	Unknown	Produced 1250 tons between 1947-49. Ore in old marble. Produced in 1973.
KK 307	Kirkkavak	N 39° 26'	E 29° 00'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 200 tons in 1952.
KK 308	Kislademirli	N 39° 35'	E 29° 10'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. County reserves 180kt @ 32-53% Cr2O3.
KK 309	Simav Kalkan	N 39° 05'	E 28° 59'	Iron	17,22	General	Past producer	Surface	Unknown	Reserves from 2 sites: 4.1Mt @ 45-65% Fe (1984). Seven pits intermittantly produced.
KK 310	Sivasli	N 38° 30'	E 29° 42'	Asbestos	2	General	Past producer	Unknown	Unknown	Production from four sites.
KK 311	Sunnetciiar	N 39° 30'	E 29° 06'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 200 tons in 1946.

APPENDIX B: PAST PRODUCING MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
KK	312	Tasilca	N 39° 04'	E 29° 07'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. County reserves 180kt @ 32-53% Cr2O3.
KK	313	Yayiacik	N 39° 35'	E 29° 35'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. County reserves 180kt @ 32-53% Cr2O3.
LL	314	Callkoy	N 37° 37'	E 38° 36'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 310 tons in 1954.
LL	315	Hasan Celebi Hassan Celebi Deveci	N 38° 58'	E 37° 54'	Iron	15,17,22	General	Past producer	Surface	Unknown	Res: 865Mt @ 15% Fe (1974). Mining by open pit since 1961, total production till 1977 1Mt.
LL	316	Kulancak	N 38° 34'	E 37° 30'	Lead	2	General	Past producer	Unknown	Unknown	Produced 1078 tons in 1954-55.
MM	317	Karadut	N 37° 46'	E 36° 39'	Iron	2	General	Past producer	Unknown	Unknown	Indications of old workings.
MM	318	Kayis	N 38° 10'	E 36° 57'	Copper	2	General	Past producer	Underground	Unknown	Tunnels caved.
MM	319	Manisa	N 38° 36'	E 27° 26'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 600 tons prior to 1952.
MM	320	Suleymanli	N 37° 54'	E 36° 50'	Iron	2	General	Past producer	Unknown	Unknown	Old workings.
NN	321	Besparmak	N 37° 29'	E 27° 38'	Iron	2	General	Past producer	Surface	Exported	Specular iron in gneiss. Ore shipped to Germany in 1956.
NN	322	Bezkese-Dalaman	N 36° 44'	E 28° 47'	Chromite	2,17	General	Past producer	Unknown	Unknown	Produced in the 1950's. Reserves from 4 sites: 79kt @ 38-54% Cr2O3 (1987).
NN	323	Caldag	N 36° 49'	E 29° 10'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 1100 tons in 1955.
NN	324	Cayhisar	N 36° 58'	E 28° 52'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 1.2Mt @ 40-57% Cr2O3.
NN	325	Cenger	N 36° 46'	E 29° 08'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 1.2Mt @ 40-57% Cr2O3.
NN	326	Elcik-Siradere	N 36° 50'	E 29° 05'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 1.2Mt @ 40-57% Cr2O3.
NN	327	Eldirek-Gunlukbasi	N 36° 41'	E 29° 12'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 1.2Mt @ 40-57% Cr2O3.
NN	328	Gocek	N 36° 44'	E 28° 58'	Magnesite	2	General	Past producer	Unknown	Unknown	Reported to be exhausted.
NN	329	Gocek-Bonguc	N 36° 44'	E 28° 58'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 1.2Mt @ 40-57% Cr2O3.
NN	330	Gocek-Inilce	N 36° 45'	E 29° 01'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 1.2Mt @ 40-57% Cr2O3.
NN	331	Gocek-Kurtgedigi	N 36° 44'	E 28° 58'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 1.2Mt @ 40-57% Cr2O3.
NN	332	Gokceovacik	N 36° 47'	E 28° 59'	Manganese	2,17	General	Past producer	Unknown	Unknown	Produced intermittantly until 1935. Res: 94kt @ 32% Mn (1988).

APPENDIX B: PAST PRODUCING MINERAL PROPERTIES IN TURKEY

MAP KEY (1)	NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
NN 333	Golenye	N 36° 47'	E 28° 13'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 1500 tons in 1953.
NN 334	Gumlukbasi Fethiye	N 36° 39'	E 29° 08'	Chromite	2,17	General	Past producer	Unknown	Unknown	Produced in the 1950's. Reserves from 2 sites: 102kt @ 38-40% Cr2O3 (1981).
NN 335	Karacaome	N 36° 50'	E 29° 00'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 2820 tons in 1952-53.
NN 336	Karaturum	N. 36° 50'	E 29° 00'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 1.2Mt @ 40-57% Cr2O3.
NN 337	Kemikler	N 36° 50'	E 29° 00'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 1.2Mt @ 40-57% Cr2O3.
NN 338	Kargitoca	N 36° 42'	E 29° 05'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 1.2Mt @ 40-57% Cr2O3.
NN 339	Kizilkaya	N 36° 49'	E 28° 55'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 1.2Mt @ 40-57% Cr2O3.
NN 340	Kizilkaya-Kepez	N 36° 49'	E 28° 55'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 1.2Mt @ 40-57% Cr2O3.
NN 341	Kocabel	N 36° 50'	E 28° 49	Magnesite	2	General	Past producer	Unknown	Unknown	Reported to have produced intermittantly.
NN 342	Koycegiz-Demirkazik	N 36° 55'	E 28° 43'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 1.2Mt @ 40-57% Cr2O3.
NN 343	Kuzkavak	N 36° 50'	E 29° 00'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 1.2Mt @ 40-57% Cr2O3.
NN 344	Mesebuku	N 37° 10'	E 28° 50'	Chromite	15	General	Past producer	Unknown	Unknown	Small producer.
NN 345	Mesevle	N 37° 28'	E 28° 21'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 1.2Mt @ 40-57% Cr2O3.
NN 346	Nif	N 36° 49'	E 29° 10'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 1.2Mt @ 40-57% Cr2O3.
NN 347	Sakarkaya	N 37° 29'	E 27° 38'	Iron	17,22	General	Past producer	Surface	Unknown	Res: 3.5Mt @ 58% Fe (1981). Produced during Greek times and 1958-58.
NN 348	Sultaniye	N 36° 50'	E 29° 00'	Chromite	2,17	General	Past producer	Unknown	Unknown	Produced in the 1950's. Reserves 236kt @ 37.58% Cr2O3 (1987).
NN 349	Toparlar	N 36° 59'	E 28° 51'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's. 1955 county reserves 1.2Mt @ 40-57% Cr2O3.
NN 350	Uzumla	N 36° 44'	E 29° 14'	Chromite	2	General	Past producer	Unknown	Unknown	Produced in the 1950's at two sites. 1955 county reserves 1.2Mt @ 40-57% Cr2O3.
OO 351	Aksaray	N 38° 23'	E 34° 03'	Kaolin	17,21	General	Past producer	Surface	Unknown	Res: 2.6Mt @ 15-32% Al2O3 (1979). Kaolin with alunite. Production of 4kt reported in 1986.
OO 352	Bolkardag	N 37° 27'	E 34° 37'	Lead, zinc, silver, gold	2,15	General	Past producer	Unknown	Unknown	Res: 264,000 tons containing 15.2kt Pb, 13.2kt Zn, 3M oz Ag, and 21.4k oz Au. Ore in limestone.

APPENDIX B: PAST PRODUCING MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
PP	353	Akmescit	N 40° 47'	E 37° 36'	Copper	2	General	Past producer	Underground	Unknown	Workings consist of 2 drifts on 10m spacing. One drift 10m, other is 50m.
PP	354	Armutell	N 40° 53'	E 37° 56'	Iron	2	General	Past producer	Surface	Unknown	Evidence of old workings.
PP	355	Arpalik	N 40° 54'	E 37° 24'	Copper, lead, zinc, silver	2	General	Past producer	Underground	Unknown	Old mine in andesite with three tunnels. Ore assayed 7.61% Pb, 11.53% Zn, 2.44% Cu, and 8.61 oz/t Ag.
PP	356	Cambasi	N 40° 39'	E 37° 59'	Iron	2,17	General	Past producer	Surface	Unknown	Evidence of old workings. Res: 200kt @ 56.8% Fe (1967).
PP	357	Catak	N 40° 47'	E 37° 44'	Copper, gold, silver	2	General	Past producer	Underground	Unknown	Analysis yield 2.44 oz Ag and 0.02 oz Au.
PP	358	Korgan Geci	N 40° 49'	E 37° 22'	Manganese	2	General	Past producer	Unknown	Unknown	Produced small amounts of 40-46% Mn. ore in 1950.
PP	359	Zevil	N 40° 42'	E 37° 38'	Copper, gold, silver	2	General	Past producer	Underground	Unknown	Workings consist of 7 tunnels, each from 40-80m.
QQ	360	Cimil Dag	N 40° 47'	E 40° 33'	Iron	2	General	Past producer	Underground	Unknown	Magnetite deposit in granite. Old workings & shafts cover 3000 sq m area.
QQ	361	Latum	N 41° 00'	E 40° 44'	Lead, zinc, copper	2	General	Past producer	Underground	Unknown	Workings inaccessible. Mine worked periodically from Genoese.
QQ	362	Yanivat	N 41° 06'	E 41° 08'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 3000 tons between 1954-55.
QQ	363	Zigam	N 41° 06'	E 41° 06'	Copper, zinc	2	General	Past producer	Underground	Unknown	Workings inaccessible. Assay is 32.1% Zn and 3.8% Cu.
RR	364	Harap Maden Nebil Membai	N 37° 59'	E 42° 08'	Copper, zinc, silver	2	General	Past producer	Underground	Unknown	Workings consist of 4 tunnels in deposit area of 50 x 300 m.
RR	365	Madenkoy	N 38° 03'	E 42° 08'	Copper	2	General	Past producer	Unknown	Unknown	Remains of old mine and smelter.
SS	366	Beypinar	N 39° 31'	E 37° 44'	Chromite	2	General	Past producer	Unknown	Unknown	1955 county reserves 16kt.
SS	367	Camlikoy	N 40° 11'	E 38° 06'	Copper	2	General	Past producer	Underground	Unknown	Caved tunnel visible. Assay yields 4.65% Cu.
SS	368	Golcuk	N 40° 56'	E 39° 55'	Copper	2	General	Past producer	Underground	Unknown	Workings prior to WWI are caved.
SS	369	Hafik	N 40° 03'	E 37° 25'	Copper	2	General	Past producer	Underground	Unknown	Abandoned deposit.
SS	370	Kan	N 40° 24'	E 38° 01'	Lead	2	General	Past producer	Unknown	Unknown	Res: 100,000 tons @ 30% Pb, 30% Zn.
SS	371	Otlukilise	N 38° 53'	E 37° 19'	Iron	22	General	Past producer	Surface	Unknown	Mining since 1960 totalling more than 1Mt.
SS	372	Pinargozu Davutoglu	N 39° 15'	E 37° 52'	Iron	22	General	Past producer	Surface	Unknown	Mined intermittantly since 1957.
SS	373	Sarkisla	N 39° 18'	E 36° 42'	Chromite	2	General	Past producer	Unknown	Unknown	Produced from 3 sites in 1954.
SS	374	Yildizeli	N 39° 52'	E 36° 38'	Chromite	2	General	Past producer	Unknown	Unknown	Produced from 2 sites in 1954.

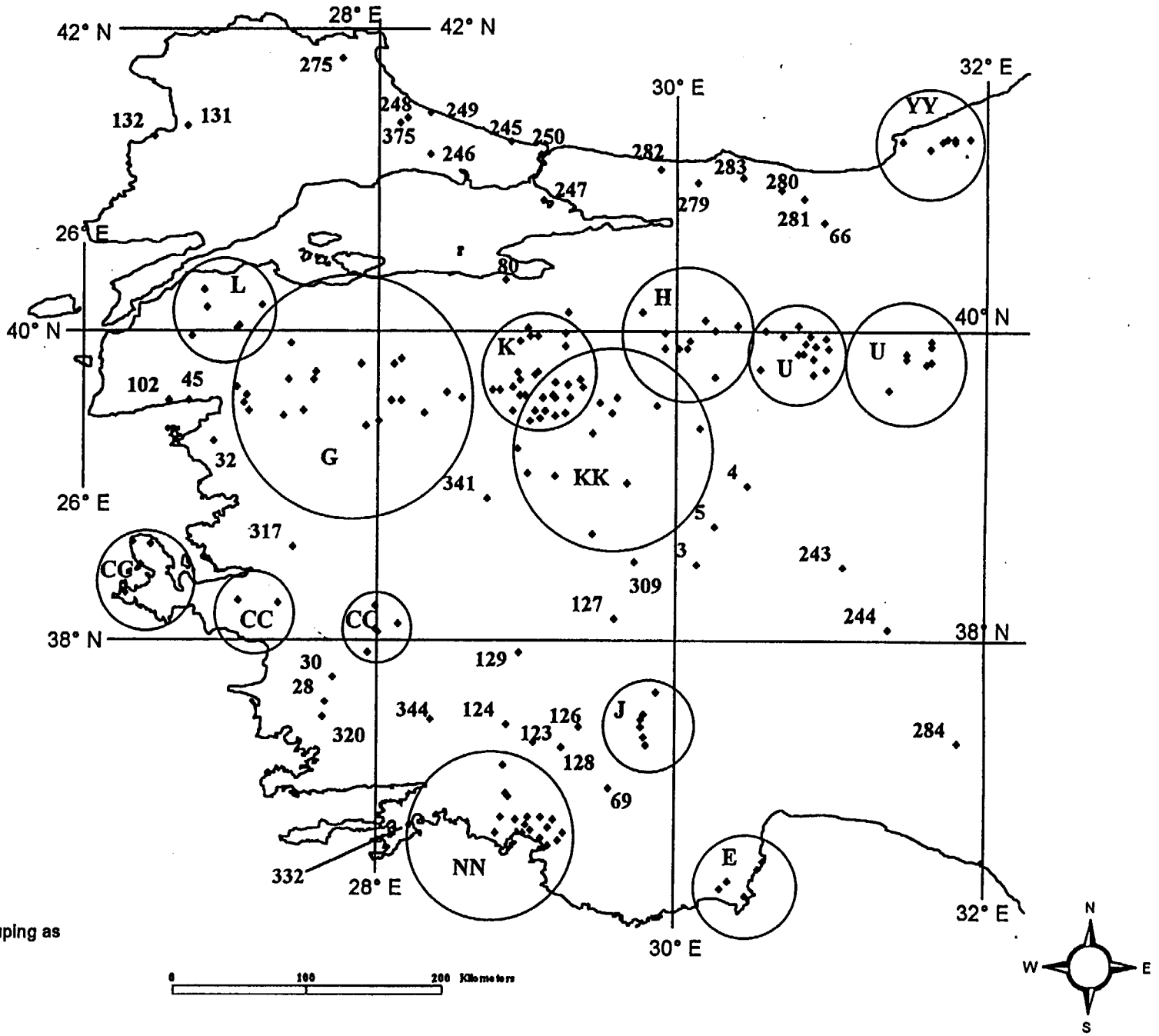
APPENDIX B: PAST PRODUCING MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
SS	375	Zara	N 39° 55'	E 37° 46'	Antimony	2	General	Past producer	Unknown	Unknown	Old workings.
TT	376	Manika Saray	N 41° 23'	E 28° 08'	Manganese	2	General	Past producer	Unknown	Unknown	In 1954, produced 15 tons. Deposit is of sedimentary origin.
UU	377	Aydogmus	N 40° 08'	E 36° 40'	Chromite	2	General	Past producer	Unknown	Unknown	1955 county reserves 20kt.
UU	378	Ibiski	N 40° 27'	E 37° 03'	Copper	2	General	Past producer	Underground	Unknown	Old workings are caved.
UU	379	Ortakoy	N 40° 24'	E 37° 21'	Copper	2	General	Past producer	Underground	Unknown	Shaft now caved.
UU	380	Turhal Ozdemir Camlica Elalmis	N 40° 16'	E 35° 52'	Antimony	2,15,17	General	Past producer	Underground	Unknown	Produced 1949-1956. Res: 1.3Mt @ 3.5% Sb. Res: 626kt @ 4% Sb (1983).
VV	381	Abyane	N 40° 56'	E 39° 54'	Iron	2	General	Past producer	Surface	Unknown	Slag piles in evidence. Magnetite zone in is 1m thick.
VV	382	Cicayra	N 40° 58'	E 39° 54'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 109 tons between 1952-53. Ore in contact between limestone & andesite.
VV	383	Kucuk Ayven	N 40° 44'	E 39° 56'	Copper	2	General	Past producer	Unknown	Unknown	Worked by the Genoese. Ore in limestone.
VV	384	Kustul-Armenos	N 40° 50'	E 39° 38'	Copper	2	General	Past producer	Unknown	Unknown	Old workings grading 3-4% Cu.
VV	385	Pirgi	N 40° 53'	E 40° 03'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 12.6 kt between 1948-1953. Ore associated with andesite & limestone. Assays range from 45-54% Mn.
VV	386	Uzmesahor	N 40° 50'	E 39° 50'	Copper	2	General	Past producer	Unknown	Unknown	Worked by the Genoese.
WW	387	Mamles	N 39° 14'	E 39° 13'	Copper	2	General	Past producer	Unknown	Unknown	Old mine in granite.
WW	388	Vanik	N 39° 14'	E 39° 13'	Iron	2	General	Past producer	Unknown	Unknown	Limonite deposit formerly worked.
XX	389	Akdagmadeni	N 39° 42'	E 35° 54'	Lead, zinc	2	General	Past producer	Surface	Unknown	Ore in crystalline schists and limestones. Grade assays 227.3% Pb, 33.6% Zn, 2-15 oz/t Ag.
XX	390	Caferli	N 39° 33'	E 34° 43'	Fluorite	2	General	Past producer	Unknown	Domestic	Produced in 1953, 1955.
XX	391	Cihanpasa Derbent	N 39° 59'	E 34° 46'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 423 tons in 1954.
XX	392	Davutlu	N 39° 43'	E 35° 57'	Iron	2	General	Past producer	Unknown	Unknown	One of five abandoned mines in area.
XX	393	Elci	N 39° 13'	E 35° 43'	Iron	2	General	Past producer	Unknown	Unknown	One of five abandoned mines in area.
XX	394	Karapinar Simbuluk	N 39° 43'	E 35° 34'	Iron	2,17	General	Past producer	Unknown	Unknown	One of five abandoned mines in area. Res: 7Mt @ 33.39% Fe (1978).
XX	395	Kecikale	N 39° 30'	E 35° 40'	Iron	2	General	Past producer	Unknown	Unknown	One of five abandoned mines in area.
XX	396	Yahyasaray	N 39° 30'	E 35° 40'	Iron	2	General	Past producer	Unknown	Unknown	One of five abandoned mines in area.

APPENDIX B: PAST PRODUCING MINERAL PROPERTIES IN TURKEY

MAP KEY (1)	NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
YY 397	Alakese	N 41° 16'	E 31° 44'	Manganese	2	General	Past producer	Unknown	Unknown	Reserves estimated at 500-1000 tons @ 35-50% Mn.
YY 398	Aydin	N 41° 16'	E 31° 49'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 2002 tons in 1947-49.
YY 399	Ayvatlar	N 41° 17'	E 31° 49'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 9420 tons in 1949-53.
YY 400	Caglar	N 41° 17'	E 31° 55'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 3275 tons in 1955.
YY 401	Cubuk	N 41° 26'	E 32° 30'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 75kt between 1950-55.
YY 402	Cubuklar	N 41° 26'	E 32° 30'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 2561 tons in 1947-49.
YY 403	Esnekoy	N 41° 17'	E 31° 46'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 7117 tons in 1953-55.
YY 404	Kepez I	N 41° 16'	E 31° 26'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 570 tons in 1951.
YY 405	Kepez II	N 41° 16'	E 31° 26'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 2535 tons in 1954-55.
YY 406	Kulah	N 41° 13'	E 31° 39'	Manganese	2	General	Past producer	Unknown	Unknown	Produced 1957 tons in 1951-52.

(1) Represents property or property grouping as defined on Appendix map set B.
(2) Due to software limitations, site named do not include any diacritical markings. Spelling of site names varies considerably by source.
(2) Compete list of data sources found in Appendix D.
(3) General - denotes limited data; Confirmed - denotes deposit information confirmed by several sources.

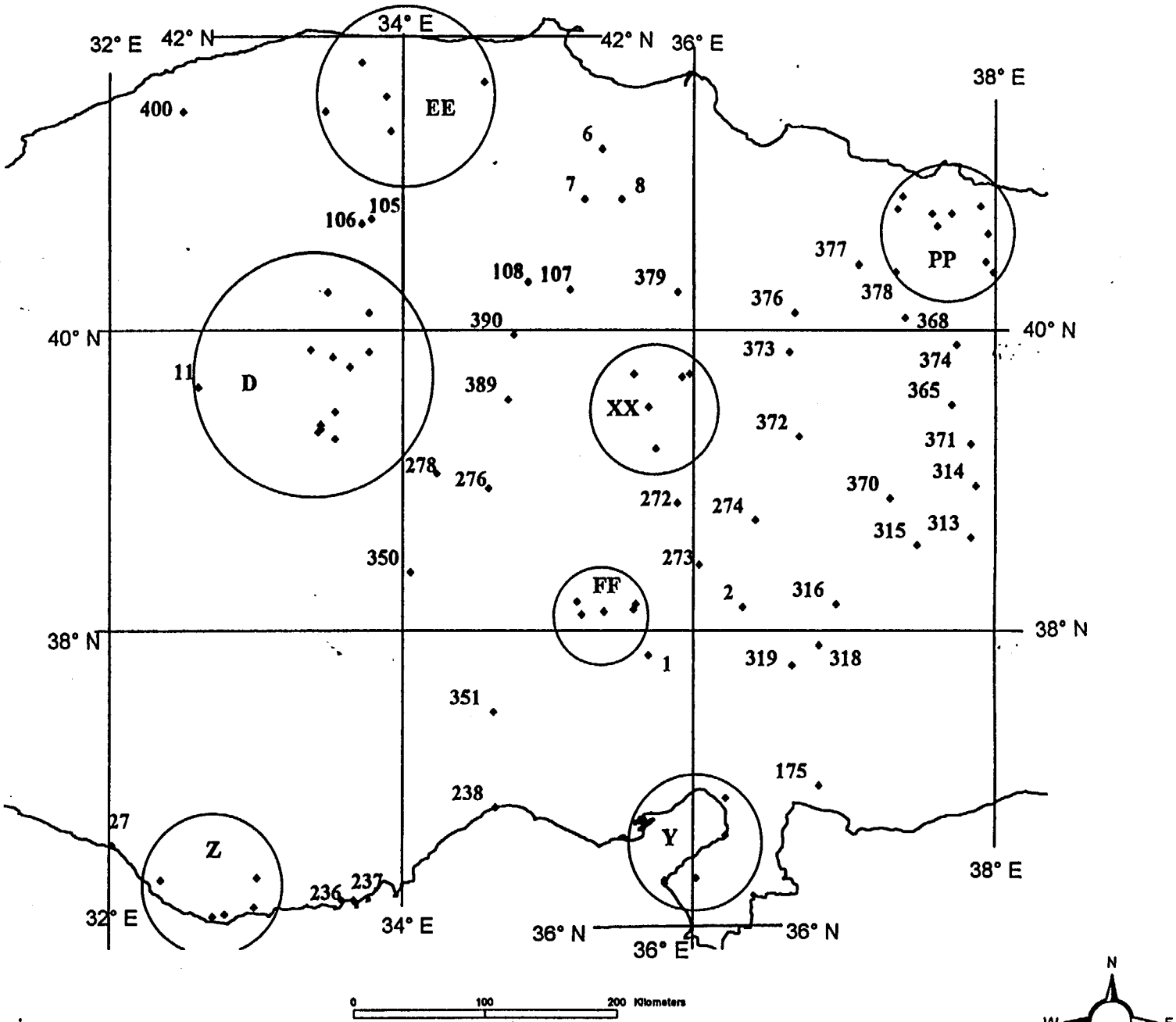


LEGEND

◆ Producing or Developing Mineral Property*

* Letter represents property grouping as defined in appendix

APPENDIX MAP B-1: PAST PRODUCING MINERAL PROPERTIES OF WESTERN TURKEY

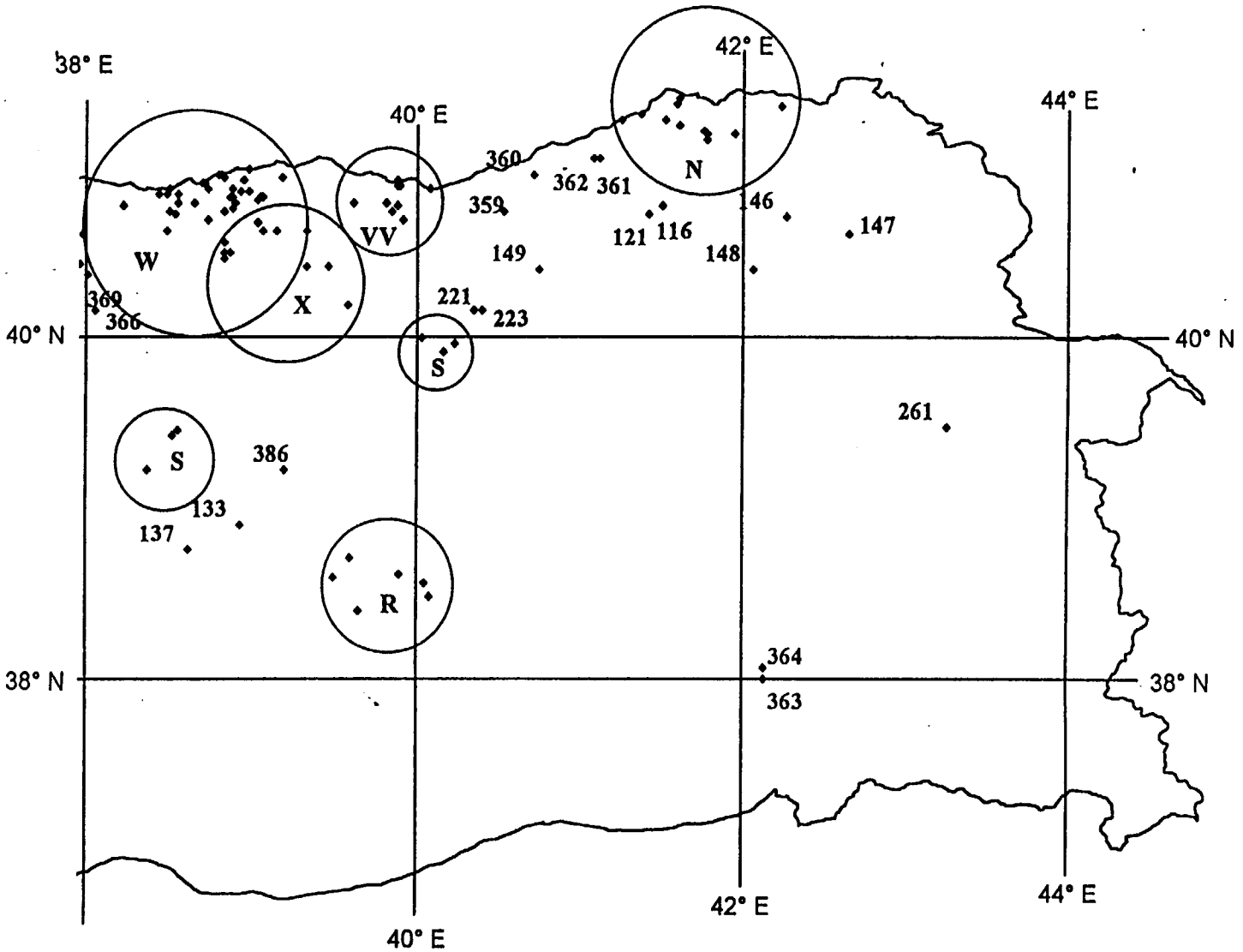


LEGEND

◆ Producing or Developing Mineral Property*

* Letter represents property grouping as defined in appendix

APPENDIX MAP B-2: PAST PRODUCING MINERAL PROPERTIES OF CENTRAL TURKEY



LEGEND

Producing or Developing Mineral Property*

* Letter represents property grouping as defined in appendix

0 100 200 Kilometers

N W E S

APPENDIX MAP B-3: PAST PRODUCING MINERAL PROPERTIES OF EASTERN TURKEY

APPENDIX C: PROSPECTS AND UNDEVELOPED MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
A	1	Adana	N 37° 01'	E 35° 18'	Limestone	17	General	Unknown	Surface	Domestic	Res: 117Mt (1972).
A	2	Belbasi Tufanbeyli	N 38° 12'	E 36° 21'	Zinc	17	General	Deposit	Unknown	Unknown	Res: 72kt @ 27% Zn; 42.6kt @ 8% Zn. Data from 1975 report.
A	3	Dokuztekne	N 37° 01'	E 35° 59'	Manganese	17	General	Deposit	Unknown	Unknown	Res: 76kt @ 16.22% Mn (1981).
A	4	Karsanti area	N 37° 33'	E 35° 24'	Chromite	17	General	Deposit	Unknown	Unknown	Reserves from 6 sites: 93Mt @ 5-35% Cr_2O_3.
A	5	Kayadibi	N 37° 27'	E 35° 19'	Lignite	17	General	Deposit	Unknown	Unknown	Res: 1Mt @ 5492 Cal/kg (1960).
A	6	Kozan Horzum	N 37° 27'	E 35° 49'	Zinc	17	General	Deposit	Unknown	Unknown	Res: 122.4kt @ 28.15% Zn. Data from 1983 report.
A	7	Saimbeyli	N 38° 00'	E 36° 06'	Iron	17	General	Deposit	Surface	Unknown	Res: 3.2Mt @ 52% Fe (1978).
A	8	Tufanbeyli I	N 38° 16'	E 36° 13'	Lead, zinc	17	General	Deposit	Unknown	Unknown	Res: 50-56kt @ 5.0% Pb, 13% Zn. Data from 1975 report.
A	9	Tufanbeyli II	N 38° 16'	E 36° 13'	Lead, zinc	17	General	Deposit	Unknown	Unknown	Res: 49kt @ 0.44% Pb, 14% Zn. Data from 1975 report.
A	10	Tufanbeyli	N 38° 16'	E 36° 13'	Bauxite	17	General	Deposit	Surface	Unknown	Res: 10.75Mt @ 50-52% Al_2O_3 (1965). Diaspore ore.
B	11	Agdikan	N 37° 44'	E 36° 09'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 225Mt clay/marl (1982).
B	12	Celikhan	N 38° 02'	E 38° 15'	Iron	17	General	Deposit	Surface	Unknown	Res: 31Mt @ 28.55% Fe (magnetite) (1984).
C	13	Akhisar	N 39° 05'	E 30° 43'	Antimony	2	General	Deposit	Unknown	Unknown	Deposit assaying 34.45% Sb.
C	14	Arizli	N 38° 19'	E 30° 45'	Chromite	2	General	Deposit	Unknown	Unknown	Two sites reportedly contain 600 tons.
C	15	Iscehisar	N 38° 51'	E 30° 45'	Graphite	17	General	Unknown	Unknown	Unknown	Res: 30kt @ 1.9-17.9% C (1981).
C	16	Kozoren	N 39° 32'	E 29° 47'	Antimony	2	General	Deposit	Unknown	Unknown	Two deposits assaying 27.65% Sb.
D	17	Agri	N 39° 44'	E 43° 03'	Limestone	17	General	Unknown	Surface	Domestic	Res: 100-150Mt (1981).
E	18	Karaibrahim	N 40° 32'	E 36° 11'	Asbestos	17	General	Deposit	Surface	Unknown	Res: 1.4Mt (1985).
E	19	Ogulbagi	N 40° 51'	E 35° 41'	Lignite	17	General	Deposit	Unknown	Unknown	Res: 3.4Mt @ 5574 Cal/kg (1983).
F	20	Aktepe	N 40° 10'	E 33° 32'	Manganese	2	General	Deposit	Unknown	Unknown	Res: 40kt @ 23.25% Mn.
F	21	Ankara	N 39° 57'	E 32° 46'	Clay	2	General	Deposit	Surface	Domestic	Sizeable fire clay deposit.
F	22	Azmak	N 40° 10'	E 31° 56'	Gypsum	17	General	Deposit	Surface	Unknown	Res: 7.5Mt (1987).
W	23	Baskil Nazarusagi	N 38° 40'	E 38° 55'	Gold, silver, copper	17	General	Deposit	Unknown	Unknown	Res: 49kt @ 2.4g/t Au, 4.2g/t Ag, 2% Cu. Data from 1984 report.
F	24	Cubuk	N 40° 15'	E 33° 02'	Perlite	17	General	Unknown	Surface	Unknown	Res: 51Mt (1979).

APPENDIX C: PROSPECTS AND UNDEVELOPED MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
F	25	Demirtas	N 40° 23'	E 33° 23'	Bentonite	17	General	Deposit	Surface	Unknown	Res: 75Mt (1984).
F	26	Karaali	N 39° 40'	E 32° 57'	Copper	2	General	Deposit	Unknown	Unknown	Ancient deposit in serpentine. Workings caved. 70kt of slag.
F	27	Kazan	N 40° 12'	E 32° 41'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 371Mt limestone/marl (1980).
F	28	Kiziicahamam	N 40° 28'	E 32° 39'	Perlite	17	General	Unknown	Surface	Unknown	Reserves from 3 sites: 43Mt (1972).
F	29	Yagcihasanlar	N 40° 38'	E 32° 45'	Lead, zinc, antimony, gold	2	General	Deposit	Underground	Unknown	Ore at andesite-limestone contact. Tunneling reported to be caved.
G	30	Agvar	N 38° 36'	E 30° 34'	Lead, zinc, copper, silver	2	General	Deposit	Unknown	Unknown	Vein 1-1.4m thick in schist.
G	31	Akseki	N 37° 02'	E 31° 48'	Bauxite	17	General	Deposit	Surface	Unknown	Res: 17.54Mt @ 47-66% Al2O3 (1965). Boehmite ore.
G	32	Alanya	N 36° 33'	E 32° 01'	Bauxite	17	General	Deposit	Surface	Unknown	Res: 4.5Mt @ 37-67% Al2O3 (1964). Diaspore ore.
G	33	Karalar Gazipasa	N 36° 19'	E 32° 21'	Barite	17	General	Deposit	Unknown	Unknown	Reserves from 5 sites: 3.5Mt @ 78-98% BaSO4 (1978).
G	34	Serik	N 36° 55'	E 31° 06'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 210Mt clay (1982).
G	35	Yarpuz	N 37° 06'	E 31° 53'	Bauxite	2	General	Deposit	Surface	Unknown	Single lenses-2-2.5Mt, total 5-15Mt ore. Ore grades 55-60% Al2O3.
G	36	Yulari	N 36° 22'	E 32° 15'	Lead	2	General	Deposit	Unknown	Unknown	Occurrence.
H	37	Ardanuc	N 41° 08'	E 42° 04'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 18Mt limestone (1980).
H	38	Borcka	N 41° 22'	E 41° 40'	Manganese	17	General	Deposit	Unknown	Unknown	Reserves from 5 sites: 156kt @ 22-42% Mn (1981).
H	39	Borcka I Akarsen	N 41° 11'	E 41° 50'	Gold, silver, copper	17	General	Deposit	Unknown	Unknown	Res: 662kt @ 28g/t Ag; 1.5g/t Au, 3.2% Cu(1986). Data from 1986 report.
H	40	Boscka II Akarsen	N 41° 12'	E 41° 50'	Copper, silver, gold	17	General	Deposit	Unknown	Unknown	Massive Res: 662kt @ 3.2% Cu, 28g/t Ag, 1.5g/t Au. Dissem. Res: 356kt @ 0.43% Cu. Data from 1986 report.
H	41	Boscka Anayatak	N 41° 22'	E 41° 40'	Copper	17	General	Deposit	Unknown	Unknown	Res: 20.8Mt @ 1.32% Cu. Data from Etibank report.
H	42	Boscka Cakmakkala	N 41° 22'	E 41° 40'	Copper	17	General	Deposit	Unknown	Unknown	Res: 32.2Mt @ 0.98% Cu.
H	43	Hendek	N 41° 21'	E 41° 27'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 100Mt limestone (1986).
H	44	Hopa Baskoy	N 41° 25'	E 41° 26'	Copper, zinc	17	General	Deposit	Unknown	Unknown	Res: 83.5kt @ 3.18% Cu, 1.24% Zn. Data from 1972 report.
H	45	Hopa Perenit	N 41° 24'	E 41° 27'	Copper, zinc, lead	17	General	Deposit	Unknown	Unknown	Res: 1Mt @ 1.4% Cu, 1.6% Zn, 0.3% Pb. Data from 1978 report.

APPENDIX C: PROSPECTS AND UNDEVELOPED MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
H	46	Hopa Sinkot	N 41° 25'	E 41° 30'	Copper	17	General	Deposit	Unknown	Unknown	Res: 5.1Mt @ 1.39% Cu.
H	47	Irschan	N 41° 11'	E 41° 50'	Copper, lead, zinc, silver	17	General	Deposit	Unknown	Unknown	Res: 659kt @ 0.63% Cu, 1.93% Pb, 4.7% Zn, 50g/t Ag. Data from 1985 report.
H	48	Mastira	N 41° 15'	E 41° 20'	Gold	11	General	Deposit	Unknown	Unknown	Drilling ongoing.
H	49	Savjat Meydancik	N 41° 20'	E 42° 17'	Copper, lead, zinc	17	General	Deposit	Unknown	Unknown	Res: 80-264kt @ 1.36% Cu, 0.36% Pb, 3.21% Zn. Data from 1973 report.
H	50	Savsat	N 41° 15'	E 42° 20'	Manganese	17	General	Deposit	Unknown	Unknown	Reserves from 2 sites: 87kt @ 23-31% Mn (1981).
I	51	Akkuzyaylasi	N 37° 50'	E 27° 56'	Lead	2	General	Deposit	Unknown	Unknown	Occurrence.
I	52	Genzile	N 37° 40'	E 28° 19'	Graphite	2	General	Deposit	Unknown	Unknown	Res: 6000 tons.
I	53	Gumus	N 37° 51'	E 27° 26'	Silver	2	General	Deposit	Unknown	Unknown	Occurrence.
I	54	Gumusdag	N 37° 45'	E 27° 24'	Emery	17	General	Unknown	Unknown	Unknown	Res: 8.7Mt (1964).
I	55	Hacilepeteni	N 37° 37'	E 27° 56'	Gold, arsenic	2	General	Deposit	Unknown	Unknown	Occurrence.
I	56	Hallaclar	N 37° 42'	E 27° 57'	Clay	2	General	Deposit	Surface	Domestic	Moderate size sand clay deposit.
I	57	Karakoy	N 37° 55'	E 27° 54'	Lead	2	General	Deposit	Unknown	Unknown	Occurrence.
I	58	Kazandere	N 37° 37'	E 28° 23'	Graphite	2	General	Deposit	Unknown	Unknown	Res: 5000 tons.
I	59	Nalpil	N 37° 52'	E 27° 28'	Silver	2	General	Deposit	Unknown	Unknown	Occurrence.
I	60	Oren	N 37° 45'	E 27° 42'	Arsenic	2	General	Deposit	Unknown	Unknown	Deposits of arsenopyrite and orpiment.
I	61	Sahinali	N 37° 47'	E 27° 57'	Lignite	2	General	Deposit	Unknown	Unknown	Res: 1.5Mt . 1955 county reserves 2.75Mt.
I	62	Terziler	N 38° 52'	E 28° 59'	Lead	2	General	Deposit	Unknown	Unknown	Occurrence.
I	64	Yaylak-Kavacik	N 37° 55'	E 28° 28'	Antimony	2	General	Deposit	Unknown	Unknown	Occurrence.
I	63	Yaygin	N 37° 38'	E 28° 35'	Emery	17	General	Unknown	Unknown	Unknown	Res: 1.6Mt (1949).
J	65	Altinoluk Edremit	N 39° 34'	E 26° 44'	Lead, zinc, silver, gold	17	General	Deposit	Unknown	Unknown	Res: 54kt @ 8.21% Pb, 6.72% Zn. 54kt @ 25g/t Ag; 134kt @ 5 g/t Au. Data from 1972 report.
J	66	Aziziye	N 39° 30'	E 26° 46'	Manganese	2	General	Deposit	Unknown	Unknown	Est. reserve of 1000 tons in andesite.
J	67	Bakirlik	N 39° 17'	E 26° 53'	Copper	2	General	Deposit	Unknown	Unknown	Occurrence.
J	68	Balya	N 39° 45'	E 27° 35'	Zinc, lead, cadmium, silver	17	General	Deposit	Unknown	Unknown	Res: 13.5Mt @ 4.54% Zn, 2.6% Pb, 0.04% Cd, 58g/t Ag. Data from 1981 report.

APPENDIX C: PROSPECTS AND UNDEVELOPED MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
J	69	Camafsar	N 39° 45'	E 27° 35'	Kaolin	2	General	Deposit	Surface	Domestic	Medium size deposit reported.
J	70	Camlik	N 39° 36'	E 27° 11'	Copper, lead, zinc	2	General	Deposit	Unknown	Unknown	Occurrence.
J	71	Davutlar	N 39° 28'	E 28° 19'	Lead, zinc, copper, gold, silver, barite	2	General	Deposit	Unknown	Unknown	Res: 125,000 tons @ 67% Pb, 1% Zn, and 15 oz/t Ag.
J	72	Dursenbey Demirboke	N 39° 35'	E 28° 38'	Lead, zinc, copper	17	General	Deposit	Unknown	Unknown	Res: 3.7Mt @ 3.91% Pb, 3.81% Zn, 0.25% Cu. Data from 1975 report.
J	73	Edremit Altincluk	N 39° 30'	E 27° 15'	Gold, silver, lead, zinc	17	General	Deposit	Unknown	Unknown	Res: 242kt @ 25g/t Ag, 5g/t Au, 8.2% Pb, 6.7% Zn. Data from 1972 report.
J	74	Fazlica	N 39° 37'	E 27° 09'	Copper	2	General	Deposit	Unknown	Unknown	Deposit about 50m long @ 16.46% Cu.
J	75	Gaybutar Gonen	N 40° 02'	E 27° 31'	Lead	17	General	Deposit	Unknown	Unknown	Res: 45kt @ 10% Pb. Data from 1976 report.
J	76	Ivrindi	N 39° 34'	E 27° 29'	Kaolin	17	General	Deposit	Surface	Unknown	Res: 1.6Mt @ 20-31% Al2O3 (1976).
J	77	Kalabak	N 39° 36'	E 27° 07'	Iron	2	General	Deposit	Unknown	Unknown	Small lenses of magnetite in marble.
J	78	Karaagac	N 39° 17'	E 28° 09'	Manganese	2	General	Deposit	Unknown	Unknown	Two deposits with res. of 41kt @ 25-50% Mn. Ore in old schists.
J	79	Kinik	N 39° 35'	E 27° 33'	Antimony	2	General	Deposit	Unknown	Unknown	Ore assays 60% Sb.
J	80	Kucukler	N 39° 33'	E 28° 17'	Boron	5,6	General	Deposit	Unknown	Unknown	Colemanite deposit with limited production.
J	81	Kulat Dursenbey	N 39° 53'	E 28° 03'	Lead, zinc	17	General	Deposit	Unknown	Unknown	Res: 252kt @ 4.4% Pb, 4.26% Zn. Data from 1977 report.
J	82	Kumluca	N 39° 31'	E 28° 22'	Mica	2	General	Deposit	Surface	Unknown	Small occurrence.
J	83	Ilica	N 39° 35'	E 26° 55'	Copper	2	General	Deposit	Unknown	Unknown	Occurrence.
J	84	Marmara	N 40° 15'	E 27° 35'	Marble	17	General	Unknown	Surface	Domestic	Res: 400M cubic meters (1970).
J	85	Narh area	N 39° 41'	E 27° 42'	Lead, zinc	2	General	Deposit	Unknown	Unknown	Associated with volcanics. Avg. assay is 27.7kt @ 6.06% Pb, 0.835 oz Ag, 0.116 oz Au.
J	86	Poyracik	N 39° 31'	E 28° 46'	Manganese	2	General	Deposit	Unknown	Unknown	Reserves est. at 100 tons.
J	87	Rahni Merasi	N 40° 24'	E 27° 46'	Talc, asbestos	2	General	Deposit	Unknown	Unknown	Reserves estimated at 1000 tons.
J	88	Sarikaya	N 39° 26'	E 27° 53'	Sulfur	2	General	Deposit	Unknown	Unknown	Occurrence.
J	89	Sarinc Kozcagiz	N 39° 33'	E 27° 06'	Zinc, lead, copper	2	General	Deposit	Unknown	Unknown	Reference point Havran. Prod. sm amounts in 1955.
J	90	Savastepe	N 39° 22'	E 27° 40'	Perlite	17	General	Unknown	Surface	Unknown	Res: 28Mt (1976).

APPENDIX C: PROSPECTS AND UNDEVELOPED MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
J	91	Sogucak	N 39° 30'	E 27° 40'	Mercury	17	General	Deposit	Unknown	Unknown	Res: 113kt @ 0.71% Hg (1976).
J	92	Susurluk	N 39° 54'	E 28° 10'	Gypsum	17	General	Deposit	Surface	Unknown	Res: 50Mt (1964).
J	93	Yasyeri	N 39° 39'	E 27° 03'	Iron	2	General	Deposit	Unknown	Unknown	Small lenses of magnetite in marble. Res: 11,000 tons @ 57.16% Fe.
J	94	Yelica	N 39° 33'	E 28° 14'	Kaolin	2	General	Deposit	Surface	Domestic	Deposit requires study.
J	95	Yildiz	N 39° 47'	E 28° 11'	Lead, zinc, copper, gold, silver	2	General	Deposit	Unknown	Unknown	Assayed at 6.54% Pb, 6.41% Zn, 4.05% Cu, 6.7 oz/t Ag, and trace Au.
K	96	Akcasu	N 40° 06'	E 30° 18'	Tin	2	General	Deposit	Unknown	Unknown	Tin discovered in the area in the 1950s.
K	97	Bahce Sultan	N 40° 03'	E 29° 46'	Manganese	2	General	Deposit	Unknown	Unknown	Res: 1000 tons @ 42.75% Mn.
K	98	Koyunlu	N 40°05'	E 30° 22'	Tin	2	General	Deposit	Unknown	Unknown	Tin discovered in the area in the 1950s.
L	99	Alikiran	N 39° 02'	E 40° 41'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 100Mt limestone (1983).
L	100	Avnik	N 38° 39'	E 40° 20'	Iron, phosphate	2,17	General	Deposit	Unknown	Unknown	Five magnetite occurrences. Area reserves: 55.7Mt @ 12-59% Fe (1982).
L	101	Cobancosme Genc	N 38° 33'	E 40° 17'	Lead, zinc	17	General	Deposit	Unknown	Unknown	Res: 21.6kt @ 45% (Pb+Zn). Data from 1978 report.
L	102	Ilicalar	N 39° 02'	E 40° 42'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 25Mt limestone (1983).
L	103	Kigi	N 39° 19'	E 40° 21'	Iron	2	General	Deposit	Unknown	Unknown	Deposit of large extent assaying 50.5% Fe.
M	104	Adilcevaz	N 38° 47'	E 42° 43'	Perlite	17	General	Unknown	Surface	Unknown	Res: 570Mt (1977).
M	105	Bahcedere	N 38° 48'	E 42° 38'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 900Mt limestone/marl/clay (1979).
M	106	Karakol	N 38° 55'	E 42° 37'	Clay	2	General	Deposit	Surface	Domestic	Moderate size fuller's earth deposit.
M	107	Tatvan	N 38° 30'	E 42° 16'	Perlite	17	General	Unknown	Surface	Unknown	Res: 370Mt (1977).
M	108	Unaldi	N 38° 17'	E 42° 03'	Iron	17	General	Deposit	Unknown	Unknown	Reserves from 2 sites: 3.1Mt @ 15.5% Fe (1983).
M	109	Zizan Merkoz	N 38° 15'	E 41° 54'	Lead, zinc	17	General	Deposit	Unknown	Unknown	Res: 5-9kt @ 12.7% Pb, 34.4% Zn. Data from 1975 report.
N	110	Bolu	N 40° 44'	E 31° 37'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 280cubic meters limestone (1969).
N	111	Cayviran plateau	N 40° 48'	E 32° 19'	Manganese	17	General	Deposit	Unknown	Unknown	Res: 105kt @ 19.63% Mn (1982).
N	112	Mengen	N 40° 56'	E 32° 04'	Lignite	17	General	Deposit	Unknown	Unknown	Res: 78Mt @ 4755 Cal/kg (1983).
N	113	Merkesler	N 40° 52'	E 31° 48'	Lignite	17	General	Deposit	Unknown	Unknown	Res: 21Mt @ 4100 Cal/kg (1983).
O	114	Akviran	N 37° 25'	E 30° 05'	Lignite	2	General	Deposit	Unknown	Unknown	Res: 2.5Mt. 1955 county reserves 2.52Mt.
O	115	Kavaklar	N 38° 08'	E 29° 34'	Manganese	17	General	Deposit	Unknown	Unknown	Res: 160kt @ 25.83% Mn (1982).

APPENDIX C: PROSPECTS AND UNDEVELOPED MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
P	116	Gelemic	N 39° 53'	E 29° 17'	Molybdenum	2	General	Deposit	Unknown	Unknown	Ore in quartz veins over 600m by 300m area.
P	117	Gemlik	N 40° 26'	E 29° 09'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 70Mt clay/marl (1966).
P	118	Gemlik	N 40° 26'	E 29° 09'	Limestone	17	General	Unknown	Surface	Domestic	Res: 156Mt (1974).
P	119	Inegol Carkderesi	N 40° 05'	E 29° 31'	Zinc, copper	17	General	Deposit	Unknown	Unknown	Res: 150kt @ 4.79% Zn, 0.90% Cu. Data from 1972 report.
P	120	Kuzbudak	N 39° 59'	E 29° 08'	Iron	2	General	Deposit	Unknown	Unknown	Small magnetite lenses in granite assaying 67% Fe.
P	121	Maden	N 39° 22'	E 26° 36'	Lead, zinc	2	General	Deposit	Unknown	Unknown	Contact between limeston and diorite. Assay of vein yields 12.6% Pb, 22% Zn, and 12.42 oz Ag.
P	122	Yk. Demirli	N 40° 16'	E 28° 48'	Manganese	2	General	Deposit	Unknown	Unknown	Res: 5600 tons @ 44.7% Mn.
Q	123	Arapucandere Yenice	N 39° 55'	E 27° 18'	Copper, lead zinc	17	General	Deposit	Unknown	Unknown	Res: 1.3Mt @ 1.35% Cu, 8.15% Pb, 2.67% Zn. Data from 1976 report.
Q	124	Armutcuk	N 39° 43'	E 27° 17'	Lead, zinc copper, silver	2	General	Deposit	Unknown	Unknown	Assayed at 13.6% Pb, 4.65% Zn, 1.6% Cu and 2.3 oz Ag.
Q	125	Bagarkac Yenice	N 39° 55'	E 27° 18'	Zinc, lead	17	General	Deposit	Unknown	Unknown	Res:1.6Mt @ 2.18% Zn, 3.8% Pb. Data from 1963 report.
Q	126	Bahadirli	N 40° 02'	E 26° 55'	Tungsten	2	General	Deposit	Unknown	Unknown	Deposit discovered in 1950's, ore assays 4% WO3.
Q	127	Bahcedere	N 39° 36'	E 26° 37'	Silver, lead	2	General	Deposit	Unknown	Unknown	Assayed at 45-58% Pb and 0.015 oz/t Ag.
Q	128	Biga Madanderesi	N 40° 13'	E 27° 14'	Copper, lead, zinc	17	General	Deposit	Unknown	Unknown	Res: 445kt @ 0.70% Cu, 2.6% Pb, 7% Zn. Data from 1969 report.
Q	129	Can area	N 40° 03'	E 27° 06'	Lignite	2	General	Deposit	Unknown	Unknown	Res: 10-50Mt @ 4071Cal/kg for 5 sites.
Q	130	Culfackuru Yenice	N 39° 55'	E 27° 18'	Lead, zinc	17	General	Deposit	Unknown	Unknown	Res: 1.2Mt @ 1.74% Pb, 2.21% Zn. Data from 1975 report.
Q	131	Gokceada Island in Agean Sea	N 40° 10'	E 25° 50'	Cement feedstock	17	General	Deposit	Surface	Domestic	Reported to have millions of tons of marl.
Q	132	Goreci	N 40° 15'	E 26° 55'	Iron	2	General	Deposit	Unknown	Unknown	Reserves 1Mt @ 50-60% Fe.
Q	133	Handere Yenice	N 39° 48'	E 27° 16'	Lead, zinc copper	17	General	Deposit	Unknown	Unknown	Res: 149kt @ 3.36% Pb, 1.09% Zn, 0.4% Cu. Data from 1983 report.
Q	134	Handeresi Yenice	N 39° 48'	E 27° 16'	Lead, zinc	17	General	Deposit	Unknown	Unknown	Res: 696kt @ 5.2% Pb, 2.05% Zn. Data from 1983 report.
Q	135	Kirazh Kartadagt	N 40° 05'	E 26° 33'	Gold	17	General	Deposit	Unknown	Unknown	Res: 50kt @ 5.2g/t Au. Data from 1963 report.
Q	136	Kirazh Madendagt	N 40° 00'	E 26° 30'	Gold	17	General	Deposit	Unknown	Unknown	Res: 15kt @ 5.8g/t Au. Data from 1962 report.

APPENDIX C: PROSPECTS AND UNDEVELOPED MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
Q	137	Kocayayla	N 40° 05'	E 26° 59'	Copper, barite lead, zinc	2	General	Deposit	Unknown	Unknown	1.5m thick vein in tuff breccia. Assays yield 15.12% Pb, 36.27% Zn, 1.5% Cu. 30,000 tons identified.
Q	138	Kurtlan Yenice	N 39° 55'	E 27° 18'	Lead, copper, zinc, silver	17	General	Deposit	Unknown	Unknown	Res: 24.4kt @ 20.8% Pb, 1.2% Cu, 9.8% Zn, 160g/t Ag. Data from 1970 report.
Q	139	Kuscayiri	N 39° 55'	E 26° 36'	Iron	2,17,22	General	Deposit	Unknown	Unknown	Reserves for 2 sites 1Mmt @ "Low"-50% Fe. Res: 370kt @ 39.6% Fe (1982).
Q	140	Lapseki	N 40° 20'	E 26° 41'	Iron	2	General	Deposit	Unknown	Unknown	Reserves 1Mt @ 50-60% Fe.
Q	141	Nuretiye	N 40° 15'	E 26° 55'	Copper, lead	2	General	Deposit	Unknown	Unknown	Ore in schist as veins in zone 10-15m wide and 120m long.
Q	142	Sametli Yenice	N 39° 53'	E 27° 23'	Lead, zinc	17	General	Deposit	Unknown	Unknown	Res: 87kt @ 2.27% Pb, 1.5% Zn. Data from 1983 report.
Q	143	Subasi	N 40° 18'	E 26° 43'	Kaolin	2	General	Deposit	Surface	Domestic	Medium size deposit reported.
R	144	Armutlu Dere	N 40° 47'	E 33° 46'	Copper	2	General	Deposit	Surface	Unknown	Outcrop assays 11.1% Cu.
R	145	Kalfat	N 40° 40'	E 33° 07'	Perlite	17	General	Unknown	Surface	Unknown	Res: 128Mt (1979).
R	146	Kirlsiar	N 40° 54'	E 33° 33'	Copper	2	General	Deposit	Surface	Unknown	Conglomerate 2m thick with 4.5% Cu.
S	147	Ucoluk	N 40° 23'	E 34° 22'	Copper	2	General	Deposit	Surface	Unknown	Sandstones containing native copper (12%)
S	148	Hot Maden	N 40° 59'	E 41° 50'	Copper	2	General	Deposit	Unknown	Unknown	Large number of veins in andesite.
S	149	Komoriu	N 40° 53'	E 41° 39'	Manganese	2	General	Deposit	Unknown	Unknown	Ore associated with limestone and tuff. Zone 1.5m thick and assays 45.63% Mn.
S	150	Kurban	N 40° 52'	E 38° 05'	Lead, zinc	2	General	Deposit	Underground	Unknown	Workings consist of 3 tunnels spaced 25m apart vertically.
S	151	Saho Ocagi	N 40° 46'	E 38° 00'	Lead, zinc	2	General	Deposit	Unknown	Unknown	Vein traced 50m, thickness up to 50cm. Ore in andesite assays 2.93% Pb, 39.38 % Zn, 2.14% Cu, 2.18 oz Ag.
S	152	Sinkot	N 41° 17'	E 41° 43'	Copper	2	General	Deposit	Unknown	Unknown	Exploratory drifts & crusscuts present. Low grade copper.
S	153	Tutunculer	N 41° 16'	E 41° 43'	Manganese	2	General	Deposit	Unknown	Unknown	French company investigated site 1907-11. No mining due to high silica content of ore. Country rock shales, sandstone, tuff, conglomerate. Res: reported as 18-54kt @ 26-76% Mn.
S	154	Tutus	N 40° 53'	E 34° 47'	Lignite	2	General	Deposit	Unknown	Unknown	Res: 3Mt.
S	155	Vezirkoy	N 41° 13'	E 41° 53'	Copper	2	General	Deposit	Unknown	Unknown	Small deposit, 150 tons mined.
S	156	Yusuflar	N 40° 57'	E 38° 10'	Lead, zinc, copper	2	General	Deposit	Underground	Unknown	Workings consist of 3 small adits. Ore in andesite assays 63.29% Pb, 11.47 % Zn, 0.48% Cu, 10.02 oz Ag.

APPENDIX C: PROSPECTS AND UNDEVELOPED MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
T	157	Babadag Tavas	N 37° 48'	E 28° 52'	Copper	17	General	Deposit	Unknown	Unknown	Res: 300kt @ 0.8% Cu. Data from 1969 report.
T	158	Cambasi	N 37° 46'	E 29° 32'	Sulfur	2	General	Deposit	Unknown	Unknown	Two deposits, one containing 10kt probable ore.
T	159	Cumali	N 37° 45'	E 29° 35'	Magnesite	2	General	Deposit	Unknown	Unknown	Deposit of 150,000 tons @ 40% MgO.
T	160	Denizli	N 37° 46'	E 29° 06'	Clay	2	General	Deposit	Surface	Domestic	Moderate size fuller's earth deposit.
T	161	Kocak	N 38° 20'	E 29° 46'	Copper	2	General	Deposit	Unknown	Unknown	Vein 20-25cm thick assaying 8.57% Cu.
U	162	Ergani	N 38° 17'	E 39° 46'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 522Mt limestone/clay (1981).
U	163	Kursunhu Dicle	N 38° 27'	E 40° 07'	Lead, zinc	17	General	Deposit	Unknown	Unknown	Res: 24.6kt @ 3-35% Pb+Zn. Data from 1978 report.
V	164	Hisarli	N 40° 43'	E 26° 13'	Bentonite	17	General	Deposit	Surface	Unknown	Res: 150Mt (1967).
V	165	Lalapasa	N 41° 50'	E 26° 44'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 39Mt limestone/clay (1985).
V	166	Uzunkopru area	N 41° 06'	E 26° 46'	Lignite	2	General	Deposit	Unknown	Unknown	Res: 20-30Mt.
W	167	Anayatak Ergani	N 38° 32'	E 39° 46'	Copper	17	General	Deposit	Unknown	Unknown	Res: 14.6Mt @ 1.39% Cu. Data from 1978 report.
W	23	Baskil Nazarusagi	N 38° 40'	E 38° 55'	Gold, silver, copper	17	General	Deposit	Unknown	Unknown	Res: 49kt @ 2.4g/t Au, 4.2g/t Ag, 2% Cu. Data from 1964 report.
W	168	Hacan Ergani	N 38° 40'	E 39° 41'	Copper	17	General	Deposit	Unknown	Unknown	Res: 40kt @ 1.69% Cu. Data from 1978 report.
W	169	Nalliziyaret Keban	N 38° 48'	E 38° 45'	Copper	17	General	Deposit	Unknown	Unknown	Res: 4.5Mt @ 0.92% Cu. Data from 1979 report.
W	170	Soganli	N 38° 46'	E 38° 46'	Tungsten	17	General	Deposit	Unknown	Unknown	Res: 255kt @ 0.6% WO3 (1958).
W	171	Weiss Ergani	N 38° 32'	E 39° 46'	Copper	17	General	Deposit	Unknown	Unknown	Res: 290kt @ 2.5% Cu. Data from 1978 report.
X	172	Aravans	N 39° 59'	E 40° 12'	Magnesite	17	General	Deposit	Unknown	Unknown	Res: 9Mt @ 44.46% MgO (1988).
X	173	Gemecik	N 40° 06'	E 42° 05'	Lead, zinc	2	General	Deposit	Unknown	Unknown	Occurrence.
X	174	Ilic	N 39° 26'	E 38° 34'	Iron	17	General	Deposit	Surface	Unknown	Reserves for 4 sites: 1.1Mt @ 51-64% Fe (1971-1983)
X	175	Ilic	N 39° 26'	E 38° 34'	Manganese	17	General	Deposit	Unknown	Unknown	Res: 174kt @ 46% Mn (1976).
X	176	Ilic	N 39° 26'	E 38° 34'	Asbestos	17	General	Deposit	Surface	Unknown	Res: 3Mt (1980).
X	177	Kemaliye	N 39° 16'	E 38° 29'	Iron	17	General	Deposit	Surface	Unknown	Reserves for 3 sites: 24.5Mt @ 40-55% Fe (1985).
X	178	Mollakoy	N 39° 39'	E 39° 35'	Perlite	17	General	Unknown	Surface	Unknown	Res: 71Mt (1977).
Y	179	Alicikrek	N 40° 03'	E 42° 18'	Lignite	2	General	Deposit	Unknown	Unknown	Res: 2Mt. 1955 county reserves 14.1Mt.

APPENDIX C: PROSPECTS AND UNDEVELOPED MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
Y	180	Askale	N 39° 55'	E 40° 42'	Gypsum	17	General	Deposit	Surface	Unknown	Res: 20Mt (1968).
Y	181	Hizir Ilyas	N 40° 09'	E 42° 15'	Lead	2	General	Deposit	Unknown	Unknown	Occurrence.
Y	182	Kagdaric	N 39° 58'	E 40° 47'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 12Mt limestone (1967).
Y	183	Kavurmacukutu Kukurtlu	N 39° 51'	E 40° 36'	Lignite	2,17	General	Deposit	Unknown	Unknown	Res: 1.3Mt @ 4500Cal/kg (1982). 1955 county reserves 14.1Mt.
Y	184	Kigani	N 40° 21'	E 41° 57'	Lead	2	General	Deposit	Unknown	Unknown	Occurrence.
Y	185	Mescitli	N 39° 33'	E 41° 25'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 30Mt limestone (1967).
Y	186	Oltu	N 40° 33'	E 41° 59'	Salt	2,17	General	Deposit	Surface	Domestic	Res: 360Mt.
Y	429	Pasinler	N 39° 59'	E 41° 41'	Perlite	17	General	Unknown	Surface	Unknown	Res: 387Mt (1975).
Y	187	Sutkans	N 40° 26'	E 41° 55'	Lignite	17	General	Deposit	Unknown	Unknown	Res: 7.3Mt @ 4200 Cal/kg (1984).
Y	188	Tortum	N 40° 19'	E 41° 33'	Diatomite	17	General	Deposit	Surface	Unknown	Res: 50Mt (1984).
Y	189	Ulutas Ispir	N 40° 29'	E 41° 00'	Copper	17	General	Deposit	Unknown	Unknown	Res: 200Mt @ 0.2% Cu. Data from 1974 report.
Z	190	Balllk	N 39° 50'	E 30° 45'	Magnesite	17	General	Deposit	Unknown	Unknown	Res: 12.3Mt from 2 sites @ 47% MgO (1984).
Z	191	Beylikahir	N 39° 42'	E 31° 13'	Barite	17	General	Deposit	Unknown	Unknown	Reserves: 9.4Mt @ 31% BaSO4 (1986).
Z	192	Beylikahir	N 39° 42'	E 31° 13'	Thorium	17	General	Deposit	Unknown	Unknown	Res: 360kt.
Z	193	Dutluca	N 39° 52"	E 30° 48'	Magnesite	17	General	Deposit	Unknown	Unknown	Res: 12Mt @ 46.8% MgO (1982).
Z	194	Karacam	N 39° 39'	E 31° 30'	Iron	17	General	Deposit	Surface	Unknown	Res (Hi-gr) 520kt @ 55% Fe; (lo-gr) 1.6Mt @ 40% Fe.
Z	195	Kizlicaoren	N 39° 46'	E 31° 30'	Rare earths, fluorine, barite	15	General	Deposit	Unknown	Unknown	Res: 30Mt @ 3.14% REO, 11Mt @ 36.2% F, 9.5Mt @ 31.25% BaSO4.
Z	196	Mihalicclk	N 39° 52'	E 31° 30'	Kaolin	17	General	Deposit	Surface	Unknown	Res: 3.3Mt @ 20-33% Al2O3 (1979).
Z	197	Sazak	N 39° 48'	E 31° 38'	Talc	2	General	Deposit	Unknown	Unknown	Deposit of moderate size.
Z	198	Sazak	N 39° 48'	E 31° 38'	Clay	2	General	Deposit	Surface	Domestic	Sizeable fuller's earth deposit.
Z	199	Yukari Kuzfindik Yukari Kartal	N 39° 44'	E 30° 17'	Magnesite	2,17	General	Deposit	Surface	Unknown	Six deposits reported in area. Res: 519Mt @ 47.63% MgO (1981).
AA	200	Islahiye	N 37° 03'	E 36° 36'	Iron	17	General	Deposit	Surface	Unknown	Reserves from 2 sites: 90Mt @ 21-38% Fe (1974).
AA	201	Kilis	N 36° 44'	E 37° 05'	Manganese	17	General	Deposit	Unknown	Unknown	Reserves from 4 sites: 308kt @ 12-53% Mn (1984).
AA	202	Kozcagiz Islahiye	N 37° 03'	E 36° 36'	Iron, bauxite	2,17	General	Deposit	Surface	Unknown	Mechanical separation not possible. Res: 95.8Mt @ 40.64% Al2O3 (1974). Ferrous bauxite.
BB	203	Akkoy Merkez	N 40° 50'	E 38° 40'	Zinc, copper	17	General	Deposit	Unknown	Unknown	Res: 1.9Mt @ 2.86% Zn, 0.47% Cu. Data from 1972 report.

APPENDIX C: PROSPECTS AND UNDEVELOPED MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
BB	204	Asarcik Sebenkarahisar	N 40° 26'	E 38° 24'	Lead, zinc, copper, silver	17	General	Deposit	Unknown	Unknown	Res: 1.3Mt @ 3.38% Pb, 3.94% Zn, 0.40%Cu, 50.13g/t Ag. Data from 1986 report.
BB	205	Aviuca	N 40° 46'	E 38° 46'	Iron	2	General	Deposit	Surface	Unknown	Hematite in clay about 100m wide.
BB	206	Calsapagi-Baskirik Espiye	N 40° 44'	E 38° 49'	Copper, lead, zinc	2,15	General	Deposit	Surface Underground	Unknown	Disseminated ore in marble. Assay yields 36.53% Pb, 32.3% Zn, 0.9% Cu, 4.44 oz Ag, and 0.06 oz Au.
BB	207	Cibril	N 40° 54'	E 38° 42'	Copper	2	General	Deposit	Underground	Unknown	Workings consist of a 113m tunnel and a series of crosscuts. Res: 3750 tons.
BB	208	Cimide-Siezlik	N 40° 54'	E 38° 57'	Copper	2	General	Deposit	Unknown	Unknown	Occurrence.
BB	209	Cumanogiu	N 40° 52'	E 38° 17'	Copper. lead zinc	2	General	Deposit	Unknown	Unknown	Vein 17-30cm wide and 27m long.
BB	210	Dereli	N 40° 45'	E 38° 27'	Barite	17	General	Deposit	Unknown	Unknown	Reserves: 2Mt @ 98% BaSO4 (1974).
BB	211	Dereli	N 40° 45'	E 38° 27'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 30-40Mt cement raw materials (1985).
BB	212	Egercan	N 40° 52'	E 38° 32'	Copper, lead, zinc	2	General	Deposit	Unknown	Unknown	Vein in andesite. Assay yields 18.77% Zn, 17.34% Pb 1.08% Cu.
BB	213	Gedikli	N 40° 46'	E 38° 18'	Copper, lead	2	General	Deposit	Unknown	Unknown	Vein 20-25cm thick in andesite.
BB	214	Harkkoy Tirebolu	N 41° 00'	E 38° 48'	Copper, zinc lead	17	General	Deposit	Unknown	Unknown	Res: 2.2Mt @ 1.03% Cu, 1.75% Zn, 0.47% Pb. Data from 1980 report.
BB	215	Hisargeris	N 40° 49'	E 38° 21'	Lead, zinc, copper	2	General	Deposit	Underground	Unknown	Three drifts on vein at 5m intervals. Mineralization visible for 60m.
BB	216	Iklsu	N 40° 31'	E 39° 23'	Copper	2	General	Deposit	Unknown	Unknown	1m thick vein,
BB	217	Iklsu-Karinca	N 40° 31'	E 39° 23'	Copper, lead, zinc	2	General	Deposit	Unknown	Unknown	Vein in granite 13cm wide, 200m long.
BB	218	Ilicaktepesi	N 40° 17'	E 38° 19'	Silver, lead, zinc, copper, antimony	2	General	Deposit	Unknown	Unknown	Occurrence.
BB	219	Israil Tirebolu	N 40° 55'	E 38° 54'	Copper	17	General	Deposit	Unknown	Unknown	Res: 44kt @ 2.8% Cu. Data from 1970 report.
BB	220	Karayaylak	N 40° 52'	E 38° 17'	Copper. lead, zinc	2	General	Deposit	Unknown	Unknown	Ore in andesite tuff.
BB	221	Kizilev	N 40° 41'	E 38° 06'	Lead, gold, silver	2	General	Deposit	Unknown	Unknown	Assay is 69% Pb, 0.12 oz Au, and 6.9 oz Ag.
BB	222	Kizilkaya Espiry	N 40° 52'	E 38° 53'	Copper	15,17	General	Deposit	Unknown	Unknown	Res: 1.9Mt @ 0.8-1.14% Cu. Data from 1970 report.

APPENDIX C: PROSPECTS AND UNDEVELOPED MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
BB	223	Koprubast Harsit	N 40° 48'	E 38° 56'	Lead, zinc, copper	17	General	Deposit	Unknown	Unknown	Res: 2.3Mt @ 4.68% Pb, 6.56% Zn, 0.83% Cu. Data from 1977 report.
BB	224	Kuskunlu Espiye	N 40° 57'	E 38° 54'	Copper	17	General	Deposit	Unknown	Unknown	Res: 2.7Mt @ 0.87% Cu. Data from 1983 report.
BB	225	Kusluvan	N 40° 42'	E 37° 38'	Copper, lead, zinc	2	General	Deposit	Unknown	Unknown	Several ore bearing veins in andesite.
BB	226	Oren	N 40° 46'	E 37° 46'	Copper, lead, zinc	2	General	Deposit	Unknown	Unknown	Vein in andesite. Assay 5.36% Pb, 3.69% Zn, and 0.12% Cu.
BB	227	Semsettin Balancik	N 40° 56'	E 38° 15'	Copper, lead, zinc	17	General	Deposit	Unknown	Unknown	Res: 168kt @ 2% Cu, 3% Pb, 4% Zn.
BB	228	Surmenli	N 40° 56'	E 36° 35'	Copper, lead, zinc	2	General	Deposit	Unknown	Unknown	Vein in granite 13cm wide.
BB	229	Tekmezar	N 40° 57'	E 38° 14'	Copper, lead, zinc	2	General	Deposit	Unknown	Unknown	Hyrdothermal vein occurrence.
BB	230	Tekmezar Bularcak	N 40° 56'	E 38° 16'	Copper, lead, zinc	17	General	Deposit	Unknown	Unknown	Res: 600kt @ 0.72% Cu, 3.75% Pb, 2.62% Zn. Data from 1968 report.
BB	231	Uzumluk Obusu	N 40° 52'	E 38° 17'	Lead, zinc, copper	2	General	Deposit	Unknown	Unknown	Ore occurs in veins of fractured andesite. Assay shows 28.12% Pb, 6.45% Zn, 3.57 oz Ag, 0.02 oz/t Au.
BB	232	Yakinlik	N 40° 50'	E 38° 30'	Lead, zinc, copper	2	General	Deposit	Unknown	Unknown	Host rock is andesite. Sample assays 1.59% Pb, 39.65% Zn, 9.24% Cu, 0.71 oz Ag, and 0.06 oz Au.
BB	233	Yomra	N 40° 58'	E 39° 54'	Antimony	2	General	Deposit	Unknown	Unknown	1 m vein assaying 65% Sb.
CC	234	Alacayir	N 40° 36'	E 39° 54'	Copper, zinc, silver	2	General	Deposit	Unknown	Unknown	Deposit in greywache. Assays yield 8.9% Cu, 12.8% Pb, 2 oz Ag.
CC	235	Almacik	N 40° 51'	E 38° 54'	Copper	2	General	Deposit	Unknown	Unknown	Occurrence yielding 4.57% Cu.
CC	236	Bahcecik	N 40° 27'	E 39° 35'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 224Mt limestone/cement raw materials (1985).
CC	237	Cayircukur	N 40° 40'	E 39° 05'	Copper, lead, zinc	2	General	Deposit	Unknown	Unknown	Occurrence.
CC	238	Dandekoy	N 40° 48'	E 38° 54'	Lead, zinc, copper, gold, silver	2	General	Deposit	Unknown	Unknown	Assay is 72.5% Pb, 0.5% Zn, 0.39 oz/t Au 9.9 oz/t Ag.
CC	239	Fol	N 40° 48'	E 39° 17'	Copper	2	General	Deposit	Unknown	Unknown	Six large veins in andesite.
CC	240	Gelevera	N 40° 36'	E 38° 51'	Copper	2	General	Deposit	Unknown	Unknown	Iron rich ore, slag dumps up to 45,000 tons.
CC	241	Istala	N 40° 57'	E 40° 17'	Lead, zinc, copper	2	General	Deposit	Unknown	Unknown	Occurrence.
CC	242	Keltas	N 40° 08'	E 38° 56'	Lead, zinc, silver	2	General	Deposit	Unknown	Unknown	Hydrothermal vein in andesite.

APPENDIX C: PROSPECTS AND UNDEVELOPED MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
CC	243	Keltepe	N 40° 48'	E 39° 07'	Lead, zinc, silver, gold	2	General	Deposit	Unknown	Unknown	Vein in andesite. Assay is 13.55% Pb, 39.25% Zn, 1.99 oz Ag and trace of gold.
CC	244	Kolat	N 40° 36'	E 39° 35'	Lead, zinc, copper	2	General	Deposit	Unknown	Unknown	Five occurrences reported.
CC	245	Oksuruk Torul	N 40° 05'	E 39° 56'	Copper, lead, zinc	17	General	Deposit	Unknown	Unknown	Res: 450kt @ 3.23% Cu, 3.84% Pb, 4.98% Zn. Data from 1971 report.
CC	246	Sive	N 40° 37'	E 39° 18'	Copper, lead, zinc, silver	2	General	Deposit	Unknown	Unknown	Deposit in andesite. Assay is 5.18% Cu, 15.18% Pb, 27.15% Zn and 11.6 oz Ag.
CC	247	Tahnis	N 40° 23'	E 39° 45'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 120Mt limestone/clay (1988).
DD	248	Azginlik	N 36° 44'	E 36° 12'	Iron	2	General	Deposit	Unknown	Unknown	Res: 3Mt @ 34-35% Fe.
DD	249	Hatay Kesecikkoy Kesecik	N 36° 12'	E 36° 10'	Gold	15,17	General	Deposit	Unknown	Unknown	Res: 450kt @ 4g/t Au. Data from 1985 report.
DD	250	Iskenderun	N 36° 34'	E 36° 10'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 900Mt marl (1982).
DD	251	Karayilan Kirikhan	N 36° 32'	E 36° 19'	Bauxite, iron	2,17	General	Deposit	Surface	Unknown	Res: 6Mt @ 15-33% Fe; 9-12% Al2O3 (1978).
DD	252	Kastalkoy	N 36° 24'	E 36° 32'	Iron	22	General	Deposit	Surface	Unknown	Res: 2Mt.
DD	253	Kizildag	N 36° 21'	E 35° 57'	Asbestos	17	General	Deposit	Surface	Unknown	Res: 4.2Mt (1968).
DD	254	Payas Iskenderun	N 36° 37'	E 36° 12'	Iron	22	General	Deposit	Surface	Unknown	Sedimentary deposit with 6.1Mt @ 32.3% Fe.
DD	255	Samandag	N 36° 07'	E 35° 56'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 5.7Bt limestone/clay/marl (1982).
DD	256	Sincan Payas	N 36° 46'	E 36° 13'	Bauxite, iron	2,17	General	Deposit	Surface	Unknown	Res: 18Mt @ 35% Fe, 20% Al2O3 (1959). District reserves: 66.4Mt @ 20% Al2O3 (1974).
EE	257	Cakalli	N 36° 37'	E 33° 39'	Magnesite	2	General	Deposit	Unknown	Unknown	Reported deposit of 100,000 tons of magnesite.
EE	258	Dedeler	N 36° 15'	E 33° 37'	Iron	2,17	General	Deposit	Surface	Unknown	Hematite-limonite deposit covering 150m x 1500m. Res: 500kt @ 55.9% Fe (1977).
EE	259	Gulnar	N 36° 39'	E 34° 08'	Dolomite	17	General	Deposit	Surface	Unknown	Res: 253Mt @ 19-20% MgO (1973).
EE	260	Icel Adana Kahramanmaras	N 36° 48'	E 34° 38'	Iron	19	General	Deposit	Unknown	Unknown	Res: 30Mt ore identified in 1978.
EE	261	Nergizlik	N 37° 06'	E 34° 40'	Copper, gold, silver	2	General	Deposit	Unknown	Unknown	Expl. indicates 29.5% Cu, 0.23 oz Au, 1 oz Ag.
EE	262	Orenduzu	N 36° 20'	E 33° 25'	Iron	17	General	Deposit	Surface	Unknown	10.9Mt @ 35% Fe (1977).
EE	263	Silifke	N 36° 22'	E 33° 56'	Limestone	17	General	Unknown	Surface	Domestic	Res: 550Mt (1973).

APPENDIX C: PROSPECTS AND UNDEVELOPED MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
EE	264	Tasucu	N 36° 20'	E 33° 53'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 200Mt limestone (1983).
FF	265	Adalar	N 40° 53'	E 29° 03'	Kaolin	2	General	Deposit	Surface	Domestic	Medium size deposit reported.
FF	266	Amavutkoy	N 41° 04'	E 29° 02'	Kaolin	2,17	General	Deposit	Surface	Domestic	Res: 800kt @ 15-30% Al2O3 (1986).
FF	267	Beyaz Toprak	N 41° 01'	E 28° 58'	Kaolin	2	General	Deposit	Surface	Domestic	Good deposit reported.
FF	268	Cataica	N 41° 09'	E 28° 27'	Manganese	17	General	Deposit	Unknown	Unknown	Res: 304kt @ 30-32% Mn (1974).
FF	269	Cataica	N 41° 09'	E 28° 27'	Quartz sand	17	General	Deposit	Surface	Domestic	Res: 5.7Mt (1983).
FF	270	Kasbasi-Darlik	N 41° 04'	E 29° 34'	Copper, silver	2	General	Deposit	Underground	Unknown	Ore in Devonian chalk. Narrow veins assaying 1.46-3.55% Cu, and 3.12-5.83 oz/t Ag.
FF	271	Pasabahce	N 41° 07'	E 29° 06'	Clay	2	General	Deposit	Surface	Domestic	Moderate size sand clay deposit.
FF	272	Samandira	N 40° 59'	E 29° 13'	Copper	2	General	Deposit	Unknown	Unknown	Reported to contain 1m tons @ 2.5% Cu.
FF	273	Sile	N 41° 10'	E 29° 36'	Titanium	2	General	Deposit	Surface	Unknown	Beach sands grading 23.4% magnetite, 32.65% ilmenite, 18.72% zircon. TiO2 content assays 14.7%.
FF	274	Yakacik	N 40° 55'	E 29° 13'	Clay	2	General	Deposit	Surface	Domestic	Large size fire clay deposit.
GG	275	Arikbasi	N 38° 11'	E 27° 31'	Arsenic, gold	2	General	Deposit	Unknown	Unknown	Occurrence.
GG	276	Burgaz Odemis	N 38° 11'	E 27° 45'	Titanium	2,17	General	Deposit	Surface	Unknown	Residual rutile deposits discovered in 1950s. Reserves of 3 sites: 11Mt @ 1.1-1.8% Ti (1985).
GG	277	Ciftlik Ovacik	N 38° 16'	E 26° 17'	Clay	2	General	Deposit	Surface	Domestic	Moderate size fuller's earth deposit.
GG	278	Dikili	N 39° 05'	E 26° 52'	Gold	15	General	Deposit	Surf/UG	Unknown	Feasibility study completed in 1991, development decisio due in 1993. Res: 1.2Mt @ 11.4g/t Au.
GG	279	Gumussu	N 38° 05'	E 27° 01'	Lead, zinc	17	General	Deposit	Unknown	Unknown	Res: 135kt @ 10% Pb+Zn. Data from 1981 report.
GG	280	Kalecik	N 38° 37'	E 26° 31'	Mercury	17	General	Deposit	Unknown	Unknown	Res: 475kt @ 0.33% Sb (1981).
GG	281	Karslyikn Arapdag	N 38° 26'	E 27° 10'	Silver, gold	17	General	Deposit	Unknown	Unknown	Res: 125kt @ 46g/t Ag, 3 g/t Au. Data from 1974 report.
GG	282	Odemis Kure	N 38° 09'	E 27° 59'	Gold, silver	17	General	Deposit	Unknown	Unknown	Res: 96kt @ 1.1-8 g/t Au, 1-3g/t Ag. Data from 1979 report.
GG	283	Seydikoy	N 39° 32'	E 29° 51'	Copper	2	General	Deposit	Unknown	Unknown	Occurrence.
GG	284	Turanli	N 39° 17'	E 27° 20'	Barite	2	General	Deposit	Unknown	Unknown	Res: 1Mt.
GG	285	Yenikoy	N 38° 07'	E 27° 21'	Perlite	17	General	Unknown	Surface	Unknown	Res: 60Mt (1970).
HH	286	Kagisman Darphane	N 40° 09'	E 43° 07'	Gold	17	General	Deposit	Unknown	Unknown	Res: 9M m3 @ 0.1 g/m3 Au. Data from 1955 report.

APPENDIX C: PROSPECTS AND UNDEVELOPED MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
HH	287	Kuloglu	N 40° 05'	E 42° 57'	Arsenic	2	General	Deposit	Unknown	Unknown	Three deposits in area.
HH	288	Sarikamis	N 40° 20'	E 42° 35'	Perlite	17	General	Unknown	Surface	Unknown	Res: 2Bt (1977).
HH	289	Tuzluca	N 40° 03'	E 43° 39'	Gypsum	17	General	Deposit	Surface	Unknown	Res: 1-3Mt (1968).
II	290	Arac	N 41° 15'	E 33° 21'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 196Mt limestone/clay/marl (1979).
II	291	Asikoy	N 41° 48'	E 33° 42'	Copper	17	General	Deposit	Unknown	Unknown	Res: 15Mt @ 1.69% Cu. Data from 1985 report.
II	292	Bakibaba Kure	N 41° 48'	E 33° 43'	Copper	17	General	Deposit	Unknown	Unknown	Res: 1.8Mt @ 3.59% Cu. Data from 1985 report.
II	293	Inebolu	N 41° 58'	E 33° 46'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 150Mt limestone/marl (1975).
II	294	Kastamonu area	N 41° 22'	E 33° 47'	Marble	17	General	Unknown	Surface	Domestic	Res: 360M cubic meters (1984).
II	295	Tosya	N 41° 01'	E 34° 02'	Manganese	17	General	Deposit	Unknown	Unknown	Res: 500kt @ 23% Mn (1984).
JJ	296	Agcasar	N 38° 10'	E 35° 25'	Zinc, lead	17	General	Deposit	Unknown	Unknown	Res: 265kt @ 3.71% Zn, 5.63% Pb. Data from 1971 report.
JJ	297	Aladag Yahyali	N 38° 10'	E 35° 35'	Zinc, lead	17	General	Deposit	Unknown	Unknown	Res: 260kt @ 14.12% Zn, 6.72% Pb. Res: 50kt @ 12.6% Zn, 6.94% Pb. Data from 1986 report.
JJ	298	Bunyan	N 38° 51'	E 35° 52'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 201Mt limestone/clay (1981).
JJ	299	Cakilpinari Yahyali	N 38° 07'	E 35° 22'	Lead, zinc	17	General	Deposit	Unknown	Unknown	Res: 26kt @ 10% Pb, 20% Zn. Data from 1986 report.
JJ	300	Delikkaya	N 38° 07'	E 35° 22'	Lead	2	General	Deposit	Unknown	Unknown	Occurrence.
JJ	301	Derekoy	N 38° 05'	E 35° 19'	Lead, zinc	17	General	Deposit	Unknown	Unknown	Res: 60kt @ 9.26% Pb, 22.79% Zn. Res: 30kt @ 15% Pb, 30% Zn. Data from 1971 report.
JJ	302	Karahalka	N 38° 54'	E 36° 50'	Iron	17	General	Deposit	Unknown	Unknown	Res: (Hi-gr) 720kt @ 46% Fe; (Lo-gr) 450kt @ 54% Fe.
JJ	303	Kayseri	N 38° 43'	E 35° 30'	Gypsum	17	General	Deposit	Surface	Unknown	Res: 1-1.5Mt (1968).
JJ	304	Kiziltepe	N 38° 26'	E 35° 02'	Zinc, lead	17	General	Deposit	Unknown	Unknown	Res: 178.5kt @ 5.29-9.79% Zn, 1-6.82% Pb. Data from 1971 report.
JJ	305	Mentese	N 39° 54'	E 36° 40'	Copper	2	General	Deposit	Unknown	Unknown	Minor ore mined.
JJ	306	Sigircilli Yahyali	N 38° 10'	E 35° 35'	Zinc, lead	17	General	Deposit	Unknown	Unknown	Res: 15kt @ 9.11% Zn, 3.46% Pb. Data from 1976 report.
JJ	307	Tugrulocagi Yahyali	N 38° 10'	E 35° 35'	Zinc, lead	17	General	Deposit	Unknown	Unknown	Res: 18kt @ 25-37% Zn, 3% Pb. Data from 1984 report.
JJ	308	Yahyali	N 38° 07'	E 35° 22'	Iron	17	General	Deposit	Surface	Unknown	Reserves from 8 sites: 6Mt @ 51-59% Fe (1978-1986).
JJ	309	Yatilk Yahyali	N 38° 07'	E 35° 22'	Zinc, lead	17	General	Deposit	Unknown	Unknown	Res: 16kt @ 9.11% Zn, 3.46% Pb. Data from 1971 report.

APPENDIX C: PROSPECTS AND UNDEVELOPED MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
JJ	310	Yazilikoy	N 38° 38'	E 35° 42'	Pumice	17	General	Deposit	Unknown	Unknown	Res: 169M cubic meters (1987).
JJ	311	Zamanti	N 38° 43'	E 35° 30'	Lead, zinc, silver	15	General	Deposit	Underground	Unknown	Res: 38Mt @ 8% Pb, 12% Zn. Feasibility study conducted in 1970's.
KK	312	Igneada Mertgoli	N 41° 52'	E 27° 58'	Gold	17	General	Deposit	Unknown	Unknown	Res: 0.1-1M m3 @ 0.1-0.2 g/m3 Au. Data from 1985 report.
KK	313	Ikiztepeler Demirkoy	N 41° 49'	E 27° 45'	Copper	17	General	Deposit	Unknown	Unknown	Res: 2Mt @ 0.5% Cu. Data from 1981 report. Porphyry copper.
KK	314	Karadere	N 41° 55'	E 27° 25'	Copper	17	General	Deposit	Unknown	Unknown	Res: 221Mt @ 0.27% Cu. Data from 1988 report. Porphyry copper.
KK	315	Sukrupasa	N 41° 56'	E 27° 31'	Copper	17	General	Deposit	Unknown	Unknown	Res: 8Mt @ 0.3-0.4% Cu. Data from 1983 report. Porphyry copper.
LL	316	Acioz	N 39° 02'	E 34° 21'	Lead	2	General	Deposit	Unknown	Unknown	Ore vein 3-18m thick in limestone. Res: 20,000 tons @ 40-50% Pb; 50,000 tons @ 5-12% Pb.
LL	317	Bayindir	N 39° 25'	E 33° 52'	Fluorspar	17	General	Deposit	Unknown	Unknown	Res: 100kt @ 73% CaF2 (1978).
LL	318	Kaman	N 39° 27'	E 33° 50'	Uranium	2	General	Deposit	Unknown	Unknown	Occurrence.
MM	319	Gubrelik	N 40° 43'	E 30° 48'	Iron	2	General	Deposit	Unknown	Unknown	Indications of old workings. Hematite @ 60% Fe in lenses between sh & marble.
MM	320	Hicriye-muradiye	N 40° 48'	E 30° 45'	Copper	2	General	Deposit	Unknown	Unknown	Ore in schist averaging 4% Cu.
NN	321	Ayranci Bolkardagi	N 37° 16'	E 33° 52'	Bauxite	17	General	Deposit	Surface	Unknown	3.97Mt @ 57.55% Al2O3 (1964). Diaspore ore.
NN	322	Cataloluk	N 37° 04'	E 32° 25'	Iron	2	General	Deposit	Surface	Unknown	Oolitic hematite in shale.
NN	323	Cayirbag	N 37° 45'	E 32° 22'	Magnesite	17	General	Deposit	Unknown	Unknown	Part of Konya district Res: 14.5Mt from 3 sites @ 41-47% MgO (1978).
NN	324	Cayirbag	N 37° 45'	E 32° 22'	Chromite	2	General	Deposit	Unknown	Unknown	1955 county reserves 10kt @ +40% Cr2O3.
NN	325	Doganbey	N 37° 48'	E 31° 54'	Bentonite	17	General	Deposit	Surface	Unknown	Res: 3Mt (1981).
NN	326	Isparta	N 38° 21'	E 31° 25'	Bauxite	17	General	Deposit	Surface	Unknown	Res: 28.7Mt @ 41.7% Al2O3 (1979). Ferrous bauxite.
NN	327	Karaman	N 37° 11'	E 33° 14'	Magnesite	17	General	Deposit	Unknown	Unknown	Part of Konya district Res: 8.6Mt from 2 sites @ 46% MgO (1976).
NN	328	Kestel	N 38° 09'	E 32° 17'	Lead	2	General	Deposit	Unknown	Unknown	Occurrence.
NN	329	Kizilcakir	N 37° 11'	E 32° 36'	Limestone	17	General	Unknown	Surface	Domestic	Res: 150Mt (1974).
NN	330	Maydos	N 38° 21'	E 32° 54'	Chromite	2	General	Deposit	Unknown	Unknown	1955 county reserves 10kt @ +40% Cr2O3.

APPENDIX C: PROSPECTS AND UNDEVELOPED MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
NN	331	Meram	N 37° 51'	E 32° 24'	Magnesite	17	General	Deposit	Unknown	Unknown	Part of Konya district Res: 52.1Mt @ 46.47% MgO (1975).
NN	332	Saglik	N 37° 50'	E 32° 03'	Bentonite	17	General	Deposit	Surface	Unknown	Res: 2.4Mt (1981).
NN	333	Saritar	N 37° 33'	E 32° 59'	Limestone	17	General	Unknown	Surface	Domestic	Res: 410Mt (1974).
NN	334	Sarioglan	N 37° 12'	E 32° 33'	Lead, barite	2	General	Deposit	Unknown	Unknown	Occurrence.
NN	335	Sudur	N 37° 17'	E 33° 23'	Chromite	2	General	Deposit	Unknown	Unknown	1955 county reserves 10kt @ +40% Cr2O3.
NN	336	Taskent	N 38° 55'	E 32° 31'	Lead	2	General	Deposit	Unknown	Unknown	Occurrence.
NN	337	Yelmez	N 37° 02'	E 32° 38'	Lead	2	General	Deposit	Unknown	Unknown	Occurrence.
NN	338	Yesildag	N 37° 33'	E 31° 26'	Limestone	17	General	Unknown	Surface	Domestic	Res: 150Mt (1974).
NN	339	Yunak	N 38° 49'	E 31° 45'	Magnesite	17	General	Deposit	Unknown	Unknown	Res: 79.8Mt @ 43-47% MgO (1978).
NN	340	Yunak	N 38° 49'	E 31° 45'	Meerschaum	17	General	Deposit	Surface	Domestic	Res: 121kt (1980).
OO	341	Altinas	N 38° 59'	E 29° 27'	Kaolin	17	General	Deposit	Surface	Unknown	Res: 1.2Mt @ 20-31% Al2O3 (1982).
OO	342	Andiz	N 39° 30'	E 29° 55'	Manganese	2	General	Deposit	Unknown	Unknown	Res: 1000 tons @ 27.72% Mn.
OO	343	Ariffer-Karaagac	N 39° 41'	E 29° 42'	Manganese	2	General	Deposit	Unknown	Unknown	Res: 15-20kt reported.
OO	344	Avcilar	N 39° 27'	E 29° 04'	Copper	2	General	Deposit	Unknown	Unknown	Ore assays 25% Cu, 0.064 oz Au, 0.9 oz Ag.
OO	345	Aydogdu	N 39° 25'	E 29° 55'	Lead, silver, manganese	2	General	Deposit	Unknown	Unknown	Assay at 0.12 oz/t Ag.
OO	346	Aydogdu	N 39° 25'	E 29° 55'	Kaolin	2	General	Deposit	Surface	Domestic	Medium size deposit reported.
OO	347	Azant	N 39° 21'	E 29° 10'	Copper	2	General	Deposit	Unknown	Unknown	Occurrence.
OO	348	Baltah	N 38° 50'	E 29° 33'	Mercury	2	General	Deposit	Unknown	Unknown	Deposit of 50,000 tons @ 1.67% Hg.
OO	349	Catak	N 39° 09'	E 29° 16'	Iron	22	General	Deposit	Surface	Unknown	Res: 6Mt @ 33-56% Fe. Several small pits developed in 1965, abandoned as ht S.
OO	350	Comburt	N 38° 58'	E 29° 27'	Mercury	2	General	Deposit	Unknown	Unknown	Deposit of 140,000 tons.
OO	351	Cukurviran	N 39° 02'	E 29° 25'	Antimony	2	General	Deposit	Unknown	Unknown	Occurrence.
OO	352	Egrigoz	N 39° 24'	E 29° 14'	Lead	17	General	Deposit	Unknown	Unknown	Res: 300kt @ 4.0% Pb. Data from 1967 report.
OO	353	Emet	N 39° 20'	E 29° 15'	Iron	17	General	Deposit	Surface	Unknown	Reserves from 6 sites: 5.5Mt @ 33-61% Fe (1984).
OO	354	Emet	N 39° 20'	E 29° 15'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 130Mt clay/marl (1979).
OO	355	Gediz	N 39° 02'	E 29° 25'	Lignite	17	General	Deposit	Unknown	Unknown	Res: 23Mt @ 5200 Cal/kg (1976).
OO	356	Gediz	N 39° 02'	E 29° 25'	Gypsum	17	General	Deposit	Surface	Unknown	Res: 26Mt (1967).

APPENDIX C: PROSPECTS AND UNDEVELOPED MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
OO	357	Geriniktepe Merkez	N 39° 22'	E 29° 34'	Lead	17	General	Deposit	Unknown	Unknown	Res: 215kt @ 5.23% Cu. Data from 1974 report.
OO	358	Goynuk Derekoy Degardi	N 39° 01'	E 29° 39'	Antimony	2,17	General	Deposit	Unknown	Unknown	Three occurrences reported. Combined reserves 3.87Mt @ 1-5.75% Sb (1970).
OO	359	Hamamkoy	N 39° 12'	E 29° 17'	Boron	5	General	Deposit	Unknown	Unknown	Ore zone 6.5m thick of colemanite.
OO	360	Kinik	N 39° 33'	E 29° 55'	Magnesite	2	General	Deposit	Unknown	Unknown	Deposit of 5-6 ktons @ 43.15% MgO.
OO	361	Koseler	N 39° 42'	E 29° 16'	Manganese	2	General	Deposit	Unknown	Unknown	Res: 300 tons @ 28.64% Mn.
OO	362	Kunduren	N 39° 25'	E 29° 59'	Clay	2	General	Deposit	Surface	Domestic	Moderate size fire and pottery clay deposit.
OO	363	Kurucay	N 39° 30'	E 29° 31'	Manganese	2	General	Deposit	Unknown	Unknown	Res: 500 tons reported.
OO	364	Merkez Gumus	N 39° 28'	E 29° 46'	Silver	17	General	Deposit	Unknown	Unknown	Res: 1.7-19.2Mmt @ 193.7g/t Ag. Data from 1984 Etibank report.
OO	365	Otraca	N 39° 48'	E 29° 37'	Lead, zinc, cobalt, cadmium	2	General	Deposit	Unknown	Unknown	Assay 14% Pb, 20% Zn. Deposit width is reported at 27m.
OO	366	Seyitomer	N 39° 35'	E 29° 52'	Lignite	2,4,17	General	Deposit	Unknown	Unknown	Res: 205Mt @ 2750 Cal/kg (1985).
OO	367	Sobran	N 39° 40'	E 30° 10'	Magnesite	17	General	Deposit	Unknown	Unknown	Res: 22Mt @ 46.42% MgO (1982).
OO	368	Tavsanli	N 39° 33'	E 29° 30'	Lignite	17	General	Deposit	Unknown	Unknown	Res: 1.7Mt @ 5868 Cal/kg (1960).
OO	369	Yagmurlar	N 39° 04'	E 29° 09'	Graphite	17	General	Unknown	Unknown	Unknown	Res: 20kt @ 2-17% C (1971).
PP	370	Alvar	N 38° 54'	E 37° 38'	Lead, zinc	17	General	Deposit	Unknown	Unknown	Res: 25kt @ 20% Pb+Zn. Data from 1965 report.
PP	371	Cafana	N 38° 16'	E 38° 08'	Zinc, lead	17	General	Deposit	Unknown	Unknown	Res: 287kt @ 9.9-29.9% Zn; 920kt @ 0.9-7.7% Pb. Data from 1987 report.
PP	372	Darende	N 38° 34'	E 37° 30'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 630Mt limestone (1978).
PP	373	Dogansehir	N 38° 06'	E 37° 53'	Iron	17,22	General	Deposit	Unknown	Unknown	Res: 1.2Mt @ 40-45% Fe (1974). Low grade allowed only limited exploration production.
PP	374	Hekimhan	N 38° 49'	E 37° 56'	Dolomite	17	General	Deposit	Surface	Unknown	Res: 122Mt @ 20-21% MgO (1980).
PP	375	Hekimhan	N 38° 49'	E 37° 46'	Limestone	17	General	Unknown	Surface	Domestic	Res: 125Mt (1972).
PP	376	Yamac	N 38° 48'	E 38° 24'	Iron	17	General	Deposit	Surface	Unknown	Res: 10Mt @ 30% Fe (1972).
PP	377	Yenikoy	N 38° 21'	E 38° 31'	Iron	2	General	Deposit	Unknown	Unknown	Hematite deposit 50cm thick and 100m long. Ore grades 57.11% Fe.
QQ	378	Bahcedere	N 38° 21'	E 28° 32'	Mercury	17	General	Deposit	Unknown	Unknown	Res: 150kt @ 0.4% Hg (1967).
QQ	379	Bayramsah	N 38° 55'	E 28° 28'	Mica	2	General	Deposit	Surface	Unknown	Small occurrence.

APPENDIX C: PROSPECTS AND UNDEVELOPED MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
QQ	380	Caldag	N 38° 37'	E 27° 46'	Nickel	17	General	Deposit	Unknown	Unknown	Res: 39.4Mt @ 1.21% Ni (1986).
QQ	381	Dellier Gordes	N 38° 54'	E 28° 18'	Titanium	2,17	General	Deposit	Surface	Unknown	Ore in mica schists. Rutile placers assaying 55% TiO2. Reserves from 3 sites: 53.5Mt @ 0.5% Ti (1985).
QQ	382	Derbent	N 38° 11'	E 28° 33'	Lead, silver, gold	2	General	Deposit	Unknown	Unknown	Assay is 61.64% Pb, 31.47 oz Ag, and 0.18 oz Au.
QQ	383	Emirli	N 38° 18'	E 28° 34'	Antimony	2,17	General	Deposit	Unknown	Unknown	Small deposit. Res: 1.63Mt @ 1.6-6% Sb.
QQ	384	Konaklar	N 38° 22'	E 28°43'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 80Mt clay/marl (1980).
QQ	385	Kuzkoy	N 38° 55'	E 28° 26'	Titanium	2	General	Deposit	Surface	Unknown	Ore as secondary enrichment of marl. Placers derived from old vein deposits.
QQ	386	Pulluca	N 38° 58'	E 28° 56'	Sulfur	2	General	Deposit	Unknown	Unknown	Occurrence.
QQ	387	Rahmanlar	N 39° 04'	E 28° 35'	Lead	2	General	Deposit	Unknown	Unknown	Prod. 240 tons of ore 1947-49.
QQ	388	Rahmanlar Selendi	N 38° 50'	E 29° 01'	Lead, zinc, copper	17	General	Deposit	Unknown	Unknown	Res: 749kt @ 2.0% Pb, 2.0% Zn, 1.0% Cu. Data from 1978 report.
QQ	389	Salihli Sart	N 38° 30'	E 28° 05'	Gold	17	General	Deposit	Unknown	Unknown	Res: 20M m3 @ 96mg/m3 Au. Data from 1980 report.
QQ	390	Turgutlu	N 38° 30'	E 27° 43'	Titanium	17	General	Deposit	Surface	Unknown	Res: 30Mt @ 1% Ti (1985).
RR	391	Elbistan	N 38° 13'	E 37° 12'	Iron	17	General	Deposit	Surface	Unknown	Reserves from 3 sites: 5.2Mt @ 40-58% Fe (1978).
RR	392	Goksun	N 38° 03'	E 36° 30'	Bauxite	17	General	Deposit	Surface	Unknown	Res: 3Mt @ 32.74% Al2O3 (1966). Diaspore ore.
RR	393	Nadir	N 38° 10'	E 36° 57'	Copper, zinc	2	General	Deposit	Unknown	Unknown	Occurrence.
SS	394	Durakbasi	N 37° 08'	E 41° 06'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 30Mt limestone (1969).
SS	395	Harbul Silopi	N 37° 20'	E 42° 38'	Asphalt	2,17	General	Deposit	Unknown	Unknown	Reserves from 2 sites: 46Mt @ 5500 Cal/kg (1985).
SS	396	Kocalar	N 37° 16'	E 40° 32'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 30Mt limestone (1969).
SS	397	Yesillikoy	N 37° 20'	E 40° 50'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 40Mt marl (1969).
TT	398	Akseki	N 36° 37'	E 29° 07'	Manganese	17	General	Deposit	Unknown	Unknown	Res: 178kt @ 40.36% Mn (1985).
TT	399	Fethiye	N 36° 46'	E 29° 13'	Dolomite	17	General	Deposit	Surface	Unknown	Res: 140Mt @ 19% MgO (1975).
TT	400	Karabortlen	N 37° 02'	E 28° 30'	Chromite	17	General	Deposit	Unknown	Unknown	Res: 102kt @ 44-48% Cr2O3 (1981).
TT	401	Karacahisar	N 37° 08'	E 27° 48'	Sulfur	17	General	Deposit	Unknown	Unknown	Res: 8Mt @ 10% S (1983).
TT	402	Koycegic	N 36° 57'	E 28° 41'	Manganese	17	General	Deposit	Unknown	Unknown	Res: 70kt @ 16.8% Mn (1988).
TT	403	Oren	N 36° 45'	E 29° 23'	Lignite	2	General	Deposit	Unknown	Unknown	Res: 1Mt @ 5000 Cal/kg.

APPENDIX C: PROSPECTS AND UNDEVELOPED MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
UU	404	Mus	N 38° 44'	E 41° 30'	Barite	2,17	General	Deposit	Unknown	Unknown	Res: 0.15-1Mt (1974). Reserves from 3 sites: 3.6Mt @ 94% BaSO4 (1959). Plant produces 100kt ground barite.
UU	405	Mus	N 38° 44'	E 41° 30'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 2.4Bt clay/marl (1980).
VV	406	Acigol	N 38° 33'	E 34° 31'	Perlite	17	General	Unknown	Surface	Unknown	Res: 450Mt (1975).
VV	407	Derinkuru	N 38° 23'	E 34° 45'	Perlite	17	General	Unknown	Surface	Unknown	Res: 350Mt (1975).
VV	408	Urgup	N 38° 38'	E 34° 56'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 36Mt clay/marl (1968).
WW	409	Bolkardgi I	N 37° 33'	E 34° 33'	Lead, zinc, gold, silver	17	General	Deposit	Unknown	Unknown	Res: 284kt @ 5.4% Pb, 4.7% Zn, 10.4g/t Au 335g/t Ag. Data from 1981 report.
WW	410	Bolkardgi II	N 37° 33'	E 34° 33'	Lead, zinc, gold, silver	17	General	Deposit	Unknown	Unknown	Res: 152kt @ 2.34% Pb, 1.05% Zn, 3.12g/t Au 140g/t Ag. Data from 1981 report.
WW	411	Ispir Camardi	N 37° 50'	E 35° 00'	Lead, zinc	17	General	Deposit	Unknown	Unknown	Res: 29kt @ 6% Pb, 29% Zn. Data from 1971 report.
WW	412	Teknell Camardi	N 37° 50'	E 35° 00'	Lead, zinc	17	General	Deposit	Unknown	Unknown	Res: 340kt @ 3.6% Pb, 25% Zn. Data from 1971 report.
WW	413	Ulukisla	N 38° 03'	E 34° 19'	Gypsum	17	General	Deposit	Surface	Unknown	Res: 150Mt (1977).
WW	414	Ulukisla Bolkardagi I	N 38° 03'	E 34° 19'	Silver, gold lead, zinc	15,17	General	Deposit	Unknown	Unknown	Res: 284kt @ 335g/t Ag, 10.4g/t Au, 5.4% Pb, 4.7% Zn. Data from 1981 report.
WW	415	Ulukisla Bokardagi II	N 38° 03'	E 34° 19'	Silver, gold lead, zinc	17	General	Deposit	Unknown	Unknown	Res: 152kt @ 140g/t Ag, 3.12g/t Au, 2.3% Pb, 1.05% Zn. Data from 1946 report.
WW	416	Yapali Agzi Bogazi	N 37° 49'	E 34° 36'	Iron	2	General	Deposit	Surface	Unknown	Limonite in limestone and diorite. Ore dimensions 500m long by 50 deep. Res: 100,000 tons.
WW	417	Yaylaocaklari Camardi	N 37° 50'	E 35° 00'	Zinc, lead	17	General	Deposit	Unknown	Unknown	Res: 10.5kt @ 30% Zn, 7.7% Pb. Data from 1971 report.
XX	418	Akoluk	N 40° 50'	E 37° 42'	Manganese	2,17	General	Deposit	Unknown	Unknown	Reserves 20kt @ 36% Mn (1982).
XX	419	Karakiraz	N 40° 53'	E 37° 56'	Copper, lead, zinc, silver	2	General	Deposit	Unknown	Unknown	Res: 300 tons @ 45.44% Pb, 1.42% Zn, 1.6% Cu, 0.36 oz Au, 2.55 oz Ag.
XX	420	Kirkiraz	N 40° 53'	E 37° 56'	Lead, zinc, copper, gold, silver	2	General	Deposit	Unknown	Unknown	Res: 200-300 tons @ 45.55% Pb, 4.42% Zn, 1.6% Cu, 2.55 oz Ag, and 0.36 oz Au.
XX	421	Koruk	N 40° 44'	E 37° 01'	Copper, lead	2	General	Deposit	Unknown	Unknown	Veins in volcanic tuff. Assay is 1.22 Cu and 9.1% Pb.

APPENDIX C: PROSPECTS AND UNDEVELOPED MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
XX	422	Kumarli	N 41° 08'	E 37° 17'	Copper, lead, zinc, gold, silver	2	General	Deposit	Underground	Unknown	Veins in andesite Workings consist of three drifts and a winze.
XX	423	Saray	N 41° 03'	E 37° 47'	Gold	11	General	Deposit	Unknown	Unknown	Drilling ongoing.
XX	424	Sihman	N 40° 45'	E 37° 40'	Copper, lead, zinc	17	General	Deposit	Unknown	Unknown	Res: 116.5kt @ 22.6% Cu+Pb+Zn. Res: 249.6kt @ 16% Cu+Pb+Zn. Data from 1970 report.
XX	425	Zavikoy	N 40° 59'	E 37° 32'	Copper	17	General	Deposit	Unknown	Unknown	Res: 1.92Mt @ 0.32% Cu. Data from 1976 report.
YY	426	Madenkoy	N 41° 03'	E 40° 45'	Copper, lead, zinc	2,17	General	Deposit	Unknown	Unknown	Res: 30Mt @ 2.66% Cu, 0.11% Pb, 4.34% Zn. Data from 1977 report.
ZZ	427	Camdag	N 40° 48'	E 30° 45'	Iron	22	General	Deposit	Surface	Unknown	Deposit in limestone and hematite. Ore assays 18-41% Fe, 4-20% SiO2, ore difficult to use. Res: 74.9Mt @ 28% Fe.
AAA	428	Ladik	N 40° 55'	E 35° 55'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 915Mt clay (1982).
Y	429	Pasinler	N 39° 59'	E 41° 41'	Perlite	17	General	Unknown	Surface	Unknown	Res: 387Mt (1975).
AAA	430	Vezirkopru	N 41° 09'	E 36° 34'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 54Mt gypsum (1982).
BBB	431	Agazir	N 37° 59'	E 42° 06'	Copper	2	General	Deposit	Unknown	Unknown	Deposit in breccia over 100 x 200 m area.
BBB	432	Kurtalan	N 37° 57'	E 41° 42'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 65Mt limestone/clay (1984).
BBB	433	Madenkoy Sirvan	N 38° 06'	E 42° 07'	Copper, zinc	10,15,17	General	Deposit	Underground	Unknown	Res: 25.8Mt @ 2.06% Cu (1984). Data from 1984 report.
CCC	434	Aksu Sisorta	N 40° 29'	E 38° 09'	Copper, lead, zinc	17	General	Deposit	Unknown	Unknown	Res: 1Mt @ 1.73% Cu, 2.83% Pb, 4.32% Zn. Data from 1974 report.
CCC	435	Aktepe	N 39° 06'	E 37° 53'	Lead, zinc, silver	17	General	Deposit	Unknown	Unknown	Res: 500kt @ 27.7% Pb, 3.46% Zn, 103g/t Ag. Data from 1973 report.
CCC	436	Beypinari	N 39° 50'	E 37° 08'	Asbestos	17	General	Deposit	Surface	Unknown	Res: 5.3Mt (1985).
CCC	437	Burunsur	N 39° 23'	E 38° 07'	Copper	2	General	Deposit	Unknown	Unknown	Deposit in granite rich in fluorite & copper.
CCC	438	Caglayan	N 39° 48'	E 36° 35'	Talc	2	General	Deposit	Unknown	Unknown	Medium sized deposit.
CCC	439	Cavdar	N 39° 30'	E 37° 31'	Asbestos	17	General	Deposit	Surface	Unknown	Res: 26.4Mt (1985).
CCC	440	Hafik	N 39° 52'	E 37° 24'	Asbestos	17	General	Deposit	Surface	Unknown	Res: 2.3Mt (1985).
CCC	441	Imranli Aktepe	N 39° 30'	E 38° 00'	Silver, lead, zinc	17	General	Deposit	Unknown	Unknown	Res: 103g/t Ag, 27.7% Pb, 3.46% Zn. Data from 1973 report.
CCC	442	Manastiratli	N 39° 52'	E 37° 24'	Salt	2	General	Deposit	Surface	Domestic	Occurrence.
CCC	443	Sivas	N 39° 45'	E 37° 02'	Limestone	17	General	Unknown	Surface	Domestic	Res: 400Mt (1979).

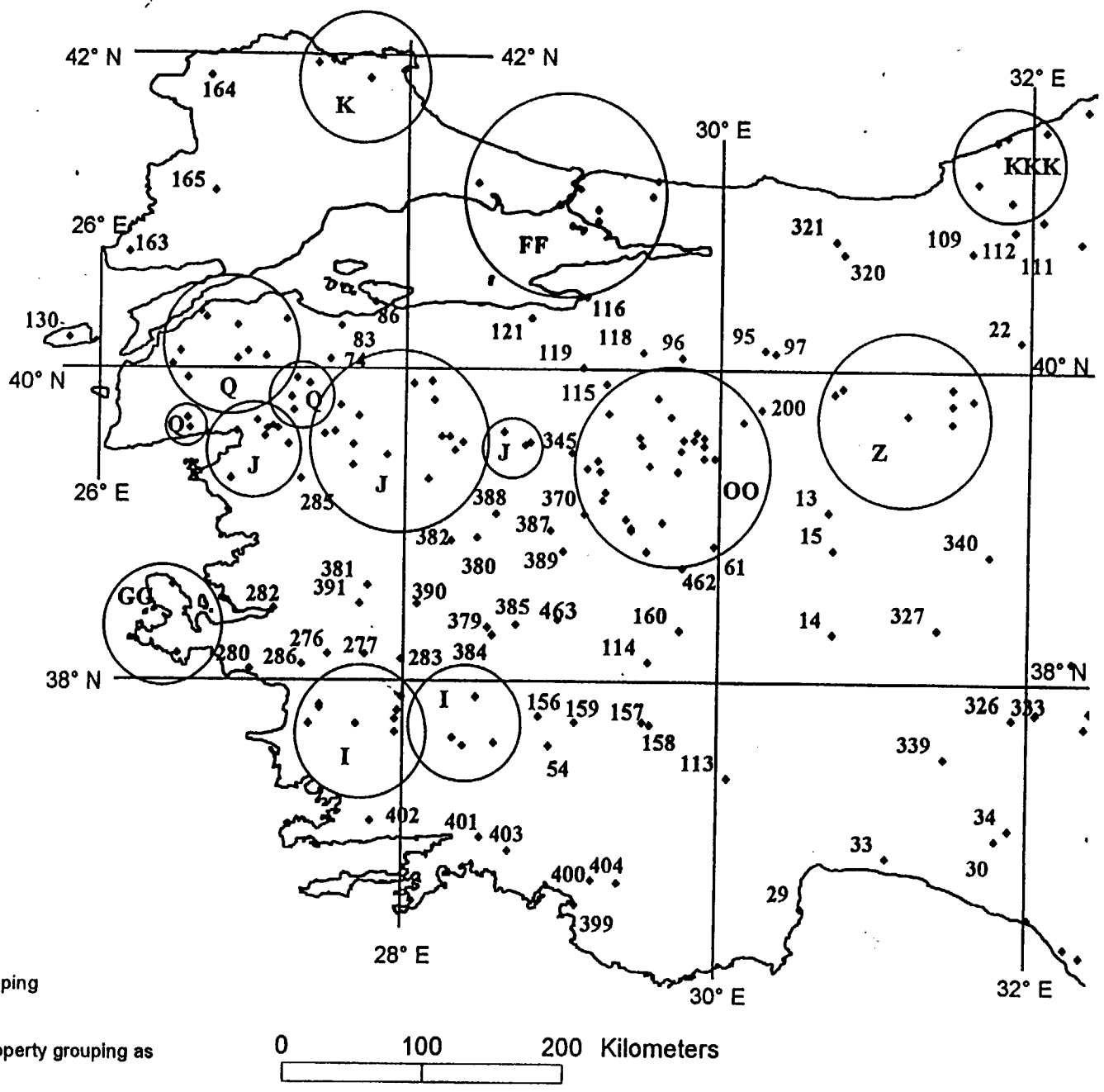
APPENDIX C: PROSPECTS AND UNDEVELOPED MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
CCC	444	Ulucayir	N 40° 01'	E 38° 32'	Lignite	17	General	Deposit	Unknown	Unknown	Res: 1.39Mt @ 4079 Cal/kg (1984).
DDD	445	Altintas	N 40° 12'	E 36° 25'	Travertine	17	General	Deposit	Surface	Unknown	Res: 175M cubic meters (1985).
DDD	446	Catalkaya	N 40° 01'	E 36° 25'	Marble	17	General	Unknown	Surface	Domestic	Res: 300M cubic meters (1985).
DDD	447	Hayati	N 40° 41'	E 36° 43'	Copper	2	General	Deposit	Unknown	Unknown	Deposit in schist and andesite.
DDD	448	Karakaya	N 40° 45'	E 36° 37'	Copper	2	General	Deposit	Unknown	Unknown	Outcrop 2m wide and 50m long.
DDD	449	Tokat	N 40° 19'	E 36° 34'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 50Mt limestone (1977).
DDD	450	Turhal	N 40° 24'	E 36° 06'	Travertine	17	General	Deposit	Surface	Unknown	Res: 190M cubic meters (1985).
EEE	451	Alacadag Trabzon	N 41° 00'	E 39° 43'	Copper, lead, zinc	17	General	Deposit	Unknown	Unknown	Res: 120kt @ 2.59% Cu, 9.63% Pb, 14% Zn. Data from 1971 report.
EEE	452	Coprubasi	N 41° 00'	E 39° 43'	Copper, lead, zinc, cadmium, silver, gold	15	General	Deposit	Unknown	Unknown	Undergoing exploration in 1975.
EEE	453	Kalafka Hatipli	N 40° 54'	E 39° 52'	Copper	2	General	Deposit	Unknown	Unknown	Occurrence.
EEE	454	Kenmaden Vakfikebir	N 41° 03'	E 39° 17'	Lead, zinc, copper	17	General	Deposit	Unknown	Unknown	Res: 138kt @ 3.6% Pb, 4.42% Zn, 0.3% Cu. Data from 1974 report.
EEE	455	Kotarakdere Trabzon	N 41° 00'	E 39° 43'	Copper	17	General	Deposit	Unknown	Unknown	Res: 900kt @ 1.28% Cu. Data from 1976 report.
EEE	456	Ogneluiya Yukari	N 40° 46'	E 39° 37'	Lead, silver	2	General	Deposit	Unknown	Unknown	Assay is 4.6% Pb.
EEE	457	Sincan-mesahor	N 40° 50'	E 39° 53'	Copper, lead, zinc	2	General	Deposit	Underground	Unknown	Exploration took place prior to WWI.
EEE	458	Yomra	N 40° 58'	E 39° 54'	Limestone	17	General	Unknown	Surface	Domestic	Res: 168Mt (1978).
FFF	459	Karagol-Viransehir	N 39° 27'	E 40° 09'	Chromite	2	General	Deposit	Unknown	Unknown	Two deposits containing 20kt @ 40-41% Cr2O3.
FFF	460	Pulumur	N 39° 30'	E 39° 54'	Gypsum	17	General	Deposit	Surface	Unknown	Res: 50Mt (1968).
GGG	461	Urfa	N 37° 08'	E 38° 46'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 150Mt cement raw materials/limestone (1984).
HHH	462	Banaz	N 38° 44'	E 29° 47'	Mercury	17	General	Deposit	Unknown	Unknown	Res: 1.3Mt @ 0.3% Hg (1969) from 8 sites.
HHH	463	Eroglu	N 38° 24'	E 28° 59'	Titanium	17	General	Deposit	Surface	Unknown	Res: 12Mt @ 2% Ti (1985).
III	464	Kocapinar	N 39° 06'	E 43° 12'	Perlite	17	General	Unknown	Surface	Unknown	Res: 1.4Bt (1973).
JJJ	465	Akcakisla	N 39° 32'	E 35° 40'	Lead, zinc	2	General	Deposit	Surface	Unknown	Veins 0.2-0.5m thick in limestone. Ore assays 2.53% Pb, 7.13% Zn.
JJJ	466	Akdagmadeni	N 39° 40'	E 35° 54'	Graphite	17	General	Unknown	Unknown	Unknown	Res: 200kt @ log grade C (1975).
JJJ	467	Arabinkoy	N 39° 38'	E 34° 29'	Lignite	2	General	Deposit	Unknown	Unknown	Res: 15-20Mt @ 4700Cal/kg.
JJJ	468	Cangili	N 39° 33'	E 35° 41'	Fluorspar	17	General	Deposit	Unknown	Unknown	Res: 50kt @ 72.5% CaF2 (1970).

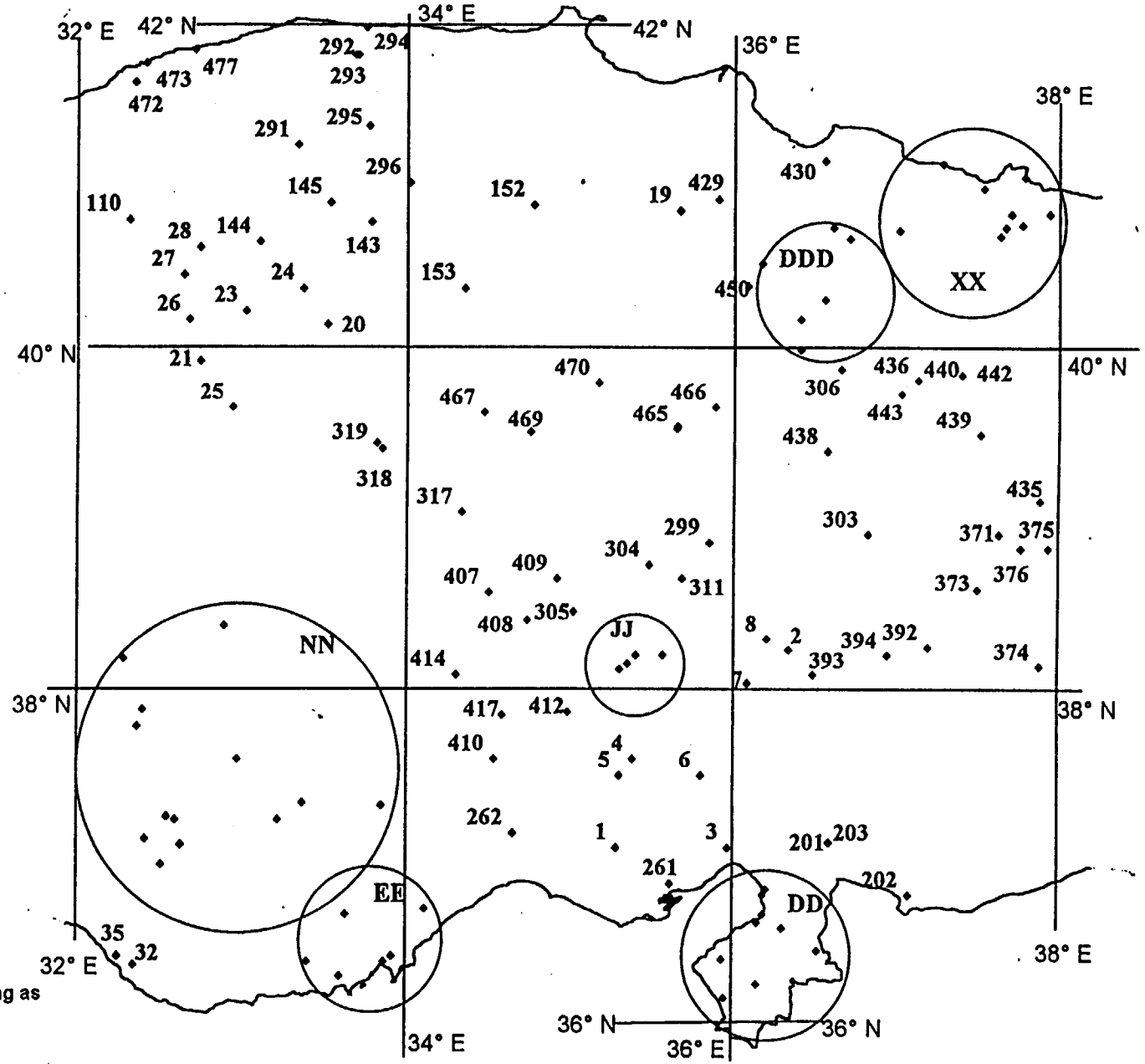
APPENDIX C: PROSPECTS AND UNDEVELOPED MINERAL PROPERTIES IN TURKEY

MAP KEY (1)		NAME (2)	COORDINATES LAT.	LONG.	COMMODITY(IES)	DATA SOURCES (3)	DATA RELIANCE (4)	STATUS	MINE TYPE	MARKETS	COMMENTS
JJJ	469	Sefaali	N 39° 31'	E 34° 46'	Cement feedstock	17	General	Deposit	Surface	Domestic	Res: 20Mt limestone/marl (1984).
JJJ	470	Sorgun	N 39° 49'	E 35° 11'	Lignite	17	General	Deposit	Unknown	Unknown	Res: 13Mt @ 4926 Cal/kg (1978).
KKK	471	Akcabey	N 41° 00'	E 31° 52'	Copper	2	General	Deposit	Unknown	Unknown	Vein width 2.5m, samples assay 7.3% Cu.
KKK	472	Bartin	N 41° 38'	E 32° 21'	Clay	17	General	Deposit	Surface	Domestic	Res: 6.8Mt for refractory use.
KKK	473	Capakdere	N 41° 45'	E 32° 25'	Clay	17	General	Deposit	Surface	Domestic	Res: 12Mt for refractory use.
KKK	474	Karadon	N 41° 28'	E 31° 50'	Clay	17	General	Deposit	Surface	Domestic	Res: 6.1Mt for refractory use.
KKK	475	Kokaksu	N 41° 30'	E 32° 05'	Bauxite	2,17	General	Deposit	Surface	Unknown	Res: 7.66Mt @ 42% Al2O3 (1981 report) Ore overlain by sandstone. Boehmite ore
KKK	476	Koslu	N 41° 26'	E 31° 46'	Clay	17	General	Deposit	Surface	Domestic	Res: 1.4Mt for refractory use.
KKK	477	Kurucaslle	N 41° 50'	E 32° 43'	Dolomite	17	General	Deposit	Surface	Unknown	Res: 120Mt @ 15-19% MgO (1981).
KKK	478	Ormanli	N 41° 10'	E 31° 39'	Dolomite	17	General	Deposit	Surface	Unknown	Res: 393Mt @ 16% MgO (1983).

(1) Represents property or property grouping as defined on Appendix map set C.
(2) Due to software limitations, site names do not include any diacritical markings. Spelling of individual site names vary considerably by source.
(3) Compete list of data sources found in Appendix D.
(4) General - denotes limited data; Confirmed - denotes deposit information confirmed by several sources.



APPENDIX MAP C-1: PROSPECTS AND UNDEVELOPED MINERAL PROPERTIES OF WESTERN TURKEY

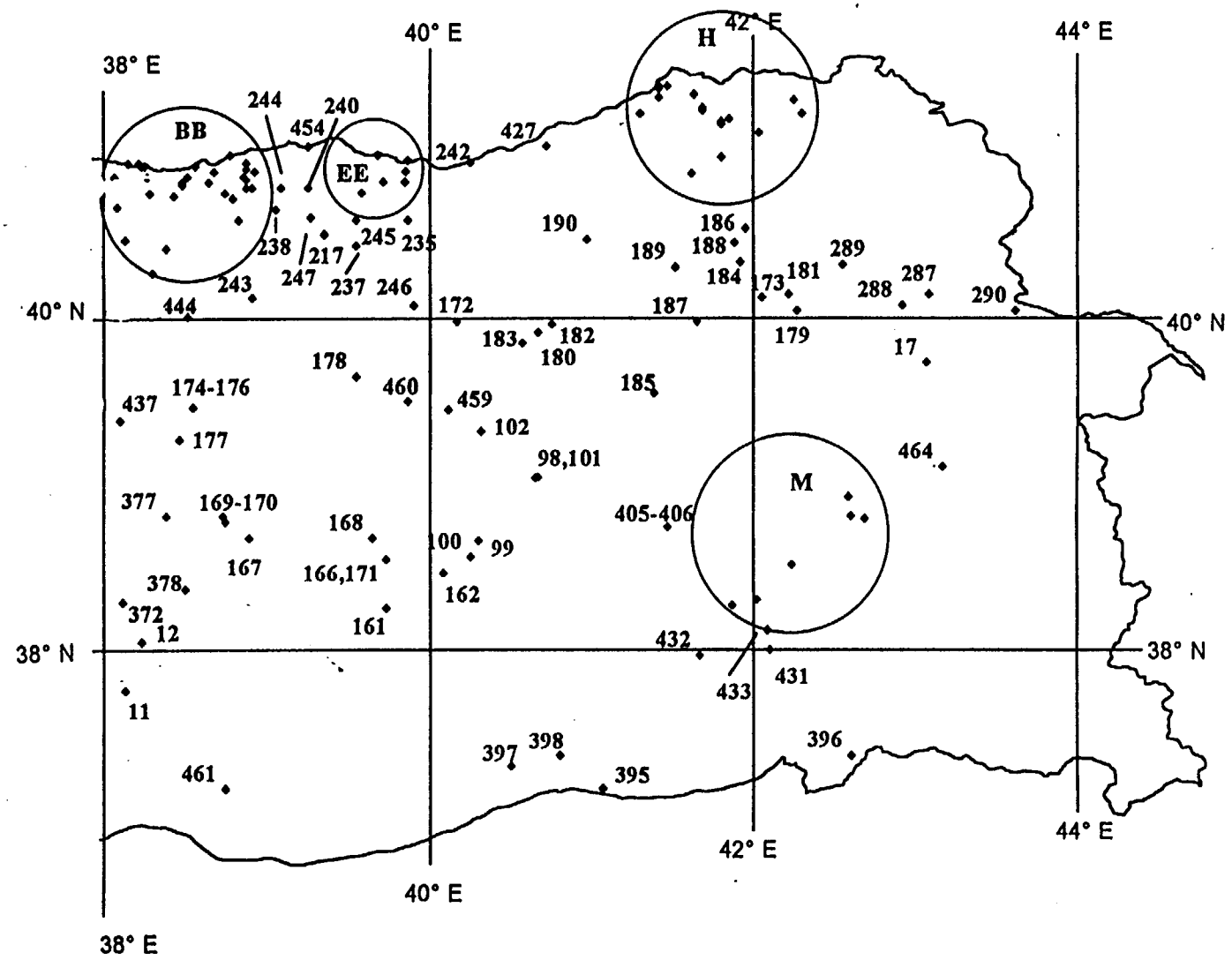


LEGEND

◆ Producing or Developing Mineral Property*

* Letter represents property grouping as defined in appendix

APPENDIX MAP C-2: PROSPECTS AND UNDEVELOPED MINERAL PROPERTIES OF CENTRAL TURKEY



APPENDIX MAP C-3: PROSPECTS AND UNDEVELOPED MINERAL PROPERTIES OF EASTERN TURKEY

APPENDIX D: PUBLIC SOURCES OF INFORMATION

1. Report on the Mineral Industry of Egypt. Egyptian Ministry of Finance. Cairo, 1922, 50 pp.
2. C. W. Ryan. A Guide to the Known Minerals of Turkey. Mineral Research and Exploration Institute of Turkey. Ankara, 1957, 196 pp.
3. Turkey, A Country Study. U.S. Library of Congress. Ed. by Paul Pitman III.,1988, pp. 92-231.
4. Area Handbook for the Republic of Turkey. R.F. Nyrop et. al. The American University, 1973, pp. 67-301.
5. Geology and History of Turkey. The Petroleum Exploration Society of Libya. Ed. by A. S. Campbell. 1971, pp. 483-492.
6. Turkish Borates. Scott, 28pp.
7. Z. Ternek. Geological Study of the Region of Kesan-Korudag. 1949.78 pp.
8. J.W. Barnes, M.P. Nackowski, and E.H. Bailey. Geology and Ore Deposits of the Sizma-Ladik Mercury District, Turkey. 1969, 55 pp.
9. J. S. Whisler. Mineral Development in the Republic of Turkey: Opportunities for Foreign Investment. 1984, 227 pp.
10. H.G. van Oss. U.S. Bureau of Mines. The Mineral Industry of Turkey. Ch. in Minerals Yearbook 1993. P. 79-95.
11. H.G. van Oss. U.S. Bureau of Mines. The Mineral Industry of Turkey. Ch. in Minerals Yearbook 1994. 14 pp.
12. United Nations. Survey of World Iron Ore Resources. New York, 1970,
13. Metall Mining Corporation. Annual Report 1993. p. 17.
14. Mining Journal. June 28, 1991, pp. 494-495.
15 U.S. Geological Survey. Minerals Availability (MAS) database. Nov, 1995.
16. Mining Journal. May 20, 1988, pp. 414-415.
17. Necdet Ersecen. Known Ore and Mineral Resources of Turkey. Turkish Geological Survey, 1989, 8pp. (Resource estimates may be optimistic.)
18. S. Anac. Etibank's in the Production of Industrial Minerals in Turkey. Presented at Industrial Minerals Conf., Istanbul, Sept. 20-22, 1987.
19. Metal Bulletin Monthly. Jan. 1989, pp. 18-19.
20. T. Engin. General Geological Setting & Mineral Resources of Turkey, in Industrial Minerals, Mar. 1988. PP. 5-29.
21. Industrial Minerals Directory. Ed. J. Griffiths, 2nd Ed., 1991.
22. The Iron Ore Deposits of Europe. Bundesanstalt fur Geowissenschaften und Rohstoffe. 1977, PP. 309-319.
23. U.S. Geological Survey. Mineral Resources Data System (MRDS). 1995.