

DEVELOPMENT IN THE
MINERALS FIELD

DURING THE PERIOD OF
AMERICAN AID TO GREECE

1948 - 1955

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CONSTRUCTION, INDUSTRY & TRANSPORTATION DIVISION
UNITED STATES OPERATIONS MISSION TO GREECE

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I N T R O D U C T I O N

"The occupation of the miner is objectionable to nobody. For who, unless he be naturally malevolent or envious, will hate the man who gains wealth as it were from heaven?"

Gnaeus Julius Agricola
37-93 A.D. Roman General

Greece contains a rather wide variety of minerals. Many of the deposits are too small to be of economic importance; some, nevertheless, are of commercial significance, but must be operated efficiently to be economically sound. Of the minerals presently produced some are of strategic importance and there exist opportunities to increase production in the future.

The minerals industry in Greece was damaged more severely by war and guerrilla activities than most industries. Occupying troops from Italy and Germany robbed the mines of most of the developed ores which existed at the time of occupation without regard for maintenance of the mine works or equipment and left the mines wrecked to the point of complete physical impairment.

The guerrilla activities, which followed the occupation gave further damage to the mines, so that the industry faced excessive financial burdens for re-equipping and rehabilitation of the properties.

The average output of the Greek mining industry as of July 1, 1948, was 10,000 tons per month, as compared with 80,000 tons monthly in 1938. This low level of production was due to the devastation and lack of equipment to increase productivity, which resulted in high operating costs and inability to meet world market prices.

The first financial aid received by the mineral industry was through the aegis of ANAG. During the period from June 1948 through March 1949, ANAG loans were extended to eight mine operators covering the production of six different minerals totalling \$189,000 equivalent in foreign exchange and \$254,000* equivalent in local currency.

American Aid funds have since played an important role in providing the financial help needed and the technical assistance required by the Greek mine operators. From April 1949 through June 1951, ECA reconstruction loans were extended to nine operators producing seven different minerals, and totalled \$2,088,134 equivalent in foreign exchange and \$843,548 equivalent in local drachmae.

* All drachmae dollar equivalents are stated at 15,000 to \$1, the prevailing rate over the majority of the period covered, 1948-1953.

Through the medium of the Strategic Materials Program of ECA, since taken over by DMPA-GSA, seven contracts were entered into with mine operators involving three different strategic minerals. Five of these strategic materials contracts were in the nature of exploration contracts and two development program contracts, in which the return of the loan will be in metals or ores. These contracts involve advances of \$952,193 equivalent in foreign exchange and \$1,980,433 equivalent in local drachmae. In June 1953, DMPA-GSA granted an eighth strategic materials loan to the "VELPA CHROME MINES" amounting to \$400,000 in both foreign exchange and drachmae.

However, the mine destruction was so great and the depletion of developed reserves so complete that the results of this aid is only now making itself felt in increased mineral productions. The index of Mineral Production in November 1948 was 20% of pre-war average; in June 1952 this index had risen to 60% of pre-war production levels. The full year of 1954 shows a marked increase in production, which now exceeds pre-war.

Greece has been an important source of mineral wealth since ancient times. Alexander the Great (334 BC) is believed to have equipped his armies for the conquest of the Middle-East countries from placer gold won from the Gallicos River in Macedonia. The third horizon of the Laurium silver-lead-zinc mines (production to-date more than 5,000,000 tons of high grade ore) is recorded as discovered in 484 BC. Pliny (63 AD) records "the flowing of silver from the smelters at Laurium like water from a fountain." Lead produced from the mines and smelter at Laurium furnish the present needs of Greece for sheet-lead litharge and red and white lead products. The natural emery of Naxos Island is well known for its hardness. Pyrite ore from Ermioni and Cassandra mines is reduced to sulphuric acid at the Piraeus acid plant for the important use of processing phosphate rock to super-phosphate fertilizer, extensively used in Greek agriculture. Iron ore and bauxite were exported to Germany and Italy in appreciable quantities prior to World War II. Magnesite, chromite, barite, manganese, hematite, nickel bearing iron ore, antimony and sulphur were produced in commercial quantities in Greece in the past. Of the minerals mentioned, only some lead products, a part of the pyrite, sulphur and a small quantity of battery grade manganese are consumed locally.

It was recognized from the beginning of our activities in the mining field that to help the industry the Greek Government agencies would have to be reorganized to adequately perform their functions in the fields of mining and geology.

Through the efforts of the Mission the Geological Department within the Ministry of Industry was reorganized under the Ministry of Coordination as the "Institute for Geological and Sub-surface Research" under the original direction of Mr. Nicolas Liatsikas, and through Technical Assistance Programs of the Mission, foreign specialists were brought to Greece to work with the Greek geologists in the field. This organization, now under the direction of Dr. K. Zachos, is performing an outstanding service to the mineral industry by mapping the important mineralized areas of Greece and making geological and geophysical studies of specific mining properties receiving American aid, as well as supplying geological services to private mine operators, the Greek State and Mission engineers.

However, the same statement cannot be said for the Greek Mining Department, which should be reorganized to better serve the mineral industries of Greece. A program of reorganization has been proposed to the Ministry of Industry by the Mining Branch of the Mission, but little headway has been made to date in improving the services of this organization.

Due to the lack of sufficient technical personnel in Greece the mineral industries are forced to rely on Government agencies for technical help much more so than is the case in America. Thus the need for good geological and mining departments in the Government to provide such services to the public.

P A R T I

M E T A L M I N E S

TYPES OF MINERALS PRODUCED

The following list of minerals and ores have been or are now being produced in Greece in varying quantities, some of which were strategic materials, as classified for United States Stockpiling.

1. Antimony Ores*
2. Barite
3. Bauxite*
4. Chromite*
5. Iron Ore
6. Nickel Iron Ore*
7. Manganese Ore*
8. Magnesite (Raw)
9. Magnesite (Dead Burned)
10. Magnesite (Calcined)
11. Molybdenite*
12. Pyrite Concentrates
13. Lead Concentrates*
14. Zinc Concentrates*
15. Santorini Earth and Pumice
16. Sulphur
17. Ceramic Clays
18. Gold (Placer Dredge)
19. Silver (By-product of Lead Smelter)

* Were classified as strategic materials

Some of these minerals have shown good progress toward reaching at least pre-war production levels, while other are lagging far behind. The attached table of some of the more important producers shows the recovery obtained by these minerals in the past nine years. 1938 production is shown in the table as being representative of the pre-war production of these particular mineral products, and by comparison with 1938 production, it is apparent that mining has come a long way, and what has been accomplished to-date is quite encouraging, particularly since the mineral industries suffered so greatly by destruction during the occupation and guerrilla warfare. Comments on each individual ore follows the table.

(The production figures are in metric tons and are those reported by the mine operators to the Mining Branch of the Mission and do not necessarily correspond with other compilations. The export figures are from the "Monthly Bulletin of the Special Trade of Greece with Foreign Countries" of the National Statistical Service of Greece.)

PRODUCTION OF MINERALS
(Metric Tons)

<u>Mineral</u>	<u>1938</u>	<u>1946</u>	<u>1947</u>	<u>1948</u>	<u>1949</u>	<u>1950</u>	<u>1951</u>	<u>1952</u>	<u>1953</u>	<u>1954</u> *
Antimony	-	-	-	-	350	2508	3788	2746	3991	421. (conc.)
Barite	32997	-	-	18706	15603	20799	29399	21679	25459	21997
Bauxite	147265	1315	22420	44238	48852	77448	185226	348591	330749	354417
Chromite	35661	9062	2640	1500	3381	12631	23268	28883	36759	29038
Emery	7203	6000	9240	12000	3600	-	-	6000	8000	?
Iron ore	308535	15000	-	-	-	4623	49378	136721	86326	76528
Manganese	3065	15	-	-	1150	-	10592	22924	3451	7669
Magnesite (raw)	56264	726	21791	11605	25248	26256	63859	81591	106938	76531
Magnesite (calc.)	31243	-	8115	238	600	9856	20372	26678	21954	26883
Pyrites	202238	64191	58175	14805	15785	87678	180120	201238	225134	195567
Lead conc.	-	658	4329	1834	1675	1629	3935	5554	6460	5644
Zinc conc.	12658	753	2684	8712	6300	6427	9127	9061	11157	10356
Lead products	690	710	1243	2296	2945	3395	3290	2791	3505	
	837819	98410	130637	112934	125390	253250	582354	894457	879883	805051

* Incomplete data

ANTIMONY

At the present time there are two antimony mines under development. The most important mine is that of the "Hellenic Mining Company" on Chios Island, where this Company is engaged in a program of mine development and the installation of a 50-ton flotation plant and furnace for the production of antimony metal. This mine produced for a number of years prior to the war. The mine is operating on private capital and expected to have its installations completed in 1954, however, the present low price of antimony ores has forced cessation of development. The ore produced as a result of the development to-date is being upgraded to 60-65% for sale on the open market. This Company expects to produce sufficient quantities of Sb metal, if successful in their reduction process, to care for the local Greek market for antimony products.

The second mine is the "Antoniades Mine" located near Lahana, in Macedonia. This mine had a small recovery loan for minor amounts of equipment and some operating capital for rehabilitating the mine. This property also had a minor showing of febrite tungsten, which was likewise being prospected. A small tonnage of 35% Sb ore was exported in 1952 to America.

Other former producing mines, not now operating are located near Komotini, Edessa and Philadelphia in Macedonia, and were operated superficially by the Germans during the occupation. There are also other prospects of merit on the Island of Chios.

B A R I T E

There is only one operating mine in Greece, located on Milos Island, and owned by the "Silver and Barite Ore Mining Company." The mine is an old producer of barite, and is operated as an open pit mine. The ore occurs as a flat lying bed, and power shovels are used to strip the overburden from the deposit, and the barite mined by quarrying methods.

The Company has a grinding and sacking plant, and ocean wharf facilities for loading the product on steamers. Operations ceased during the hostilities, but were resumed in 1948. Production has not reached its pre-war level as yet.

The market for the ground barite is largely in the Near East for oil drilling purposes. Production can be increased here to meet an increase in demand by the installation of a flotation plant to clean up lower grade barite and present quarry rejects.

A promising prospect of high grade barite on the Island of Mykonos is presently being investigated by "Magnet Core Barium Corporation," Houston, Texas, with the intention to develop in cooperation with the Greek owners.

BAUXITE

There are a number of areas in Greece of relatively large deposits of bauxite. The most important deposits are those in the neighborhood of Eleusis, Distomon and Mt. Parnassos. Other large deposits are located near Lamia, Exharchos and on the Chalkidiki on the mainland of Greece, and on the Island of Euboea and Amorgos.

The principal producer of bauxite is the "Eleusis Bauxite Mines, Inc." located at Eleusis and Mandra, about 40 km. distant and northeast of Athens. This Company had a Strategic Materials contract and delivered 450,000 tons of bauxite to the United States Government, part of which was used to repay advances made to "Eleusis." The development of this property is completed and production has now reached 25,000 metric tons or more monthly. The property is composed of a number of mines located on scattered deposits over an area of fifty square kilometers. This Strategic Materials loan contract was consummated under ECA, but was transferred to DMPA-GSA who were delegated to handle former ECA-MSA Strategic Materials development.

The U.S. Government bauxite from "Eleusis" was shipped to Germany for processing by the German aluminium companies. "Eleusis" also ships bauxite under commercial contracts to six aluminium companies located in Norway, Switzerland and Germany. Production from "Eleusis" exceeded 300,000 metric tons in 1952; in 1954 production was 240,000 metric tons.

A second operating mine is that of "Barlos Bros. Co." whose mines are located in the area of Distomon. Sales in the past to commercial markets have been to "Lafarge Co." in England as refractory bauxite for cement manufacture. This company's holdings include a large number of deposits of bauxite, some of which are not of the soluble type and as such cannot be used for aluminum manufacture.

"Barlos Bros. Co." received a small A.I.A.G. loan in 1949 for some minor amounts of equipment, which initiated the resumption of operations on a relatively small scale. The normal yearly production has been limited by the demand of this type of bauxite for cement manufacture at about 30,000 metric tons yearly. It is asserted by "Barlos Bros." that many of their deposits contain bauxite suitable for aluminum production also.

The largest pre-war production of bauxite came from the Mt. Parnassos area of Greece, near Delphi. Here are

located a number of large deposits many of which can be utilized for aluminum manufacture. The largest pre-war producers were taken over by the occupying Germans, who shipped the bauxite to German plants for reduction. Most of the mines in this area were eventually sequestered by the Greek Alien Property Custodian, and as yet have not been brought back into production. The "Iliopoulos Bros." were formerly the largest producers of bauxite for aluminum from this area, and they are now in small production from some of their former mines. We have been recently informed that German interests have regained their holdings in this area and will negotiate with "Eleusis Bauxite Mines" to operate the property.

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CHROME

Although at the present there are only two principal companies producing refractory chrome ore, there are numerous prospects of merit including former producing mines which have not resumed operations. The chrome mines were some of those hardest hit by the occupation and later by guerrilla warfare. Lack of good transportation facilities for marketing the ore is retarding possible increase production, as well as lack of funds and facilities for production. The location of these properties is, of course, limited to the areas of the host peridotite rock in which the ore occurs.

Alexander Apostolides is the largest single operator in Greece, and operates the "Tsangli Mine" near Farsala in Thessaly and the "Rhodiani Mine" near Kozani in Macedonia. Apostolides owns a number of the better chrome prospects also, but these are not now operating; however, this office has not been successful in obtaining any activity reports from Mr. Apostolides.

The other principal operator is the "Union Miniere Company" who own the "Domokos Mine" in Thessaly. This Company received a substantial ECA reconstruction loan for the purpose of rehabilitating its mine and surface plant, and it is expected that the mine will reach its production goal of 30,000 metric tons yearly. The mine has a production record of about 500,000 m. tons in the past.

There are a few smaller operators of little importance as yet, but it is expected that the "Vavdos Mine" on the Chalkidiki will, within a reasonable time, be producing some quantity of refractory grade chromite ore. The operator of the "Vavdos Mine," Mr. Vryonis, is severely handicapped by lack of funds to develop this property. Some 200,000 m. tons of chromite were shipped before the war from several deposits on this property.

In the area south of Kozani in Macedonia and not far from "Rhodiani Mine" of Apostolides there occurs a large deposit of low grade chromite which has excellent economic possibilities if properly financed and developed. The mine is known as the "VELPA Chrome Mine" and is presently being financed by a DMPA-GSA loan for a development program establishing a concentrating plant to produce a substantial quantity of metallurgical grade chromite concentrate yearly, possibly as much as 40,000 tons if the program goes through as planned. Production is now underway with very satisfactory results.

IRON ORE

Iron ore production before the war was the largest single production of mineral ores from Greece. In 1938 production reached 308,500 m. tons or about one third of the whole tonnage of mineral products that year.

Recovery of iron mines have been slow and not until 1951 was any appreciable quantity of ore produced, production then being 49,400 m. tons. The year of 1952 showed a material improvement in production, reaching 136,700 m. tons. 1954 production was 76528m/t.

The principal producer of iron ore is the "Chevalier Mine" of the "Hellenic Company of Chemical Products and Fertilizers," at Cassandra, Chalkidiki. This mine received a substantial ECA reconstruction loan in 1949. Its average monthly production is about 7,000 m. tons.

The second largest producer of iron ore now is Mr. Chondrodinos who is producing at a rate of about 5000 m. tons monthly.

Another producer of iron ore is the "Serifos Mine," located on the Serifos Island of the Cyclades Group. This mine is now producing at the rate of 3000 m. tons monthly. This is reputed to be the best grade iron ore in Greece.

Iron ore deposits are pretty well scattered in Greece. The Cyclades Islands of Kithaos, Serifos, Sifnos contain deposits, the most important of which is Serifos. Crete has a number of deposits which are of economic importance and which should be developed. Skyros Island has iron ore deposits also which are presently being worked on a small scale. There appears to be some real opportunity to develop a number of iron ore mines, none of which will be too large by itself, but the aggregate could comprise a material increase in present production.

The plans at the "Larymna" iron-nickel development call for the reduction of the iron ore recovered by the operation to be processed into soft pig or sponge iron, a product vital to the needs of Greece where scrap iron has been the only source of raw material for the manufacture of reinforcing bars and simple iron products.

LEAD & ZINC CONCENTRATES

At present time there are two properties for lead and zinc concentrates in Greece, the "Mediterranean Mines, Inc." and the "Societe Francaise des Mines du Laurium" (French Laurium) both located at Laurium on the south end of the Attica Peninsula.

"Mediterranean Mines, Inc.," operating the "Greek Laurium" property, received an ECA reconstruction loan which was later liquidated through a Strategic Materials Development Program advance-against-production loan. The operation was forced to close down the first of March 1953 due to the low lead and zinc prices. The Company has a 250-ton capacity selective flotation metallurgical plant and operated scattered mines of the "Greek Laurium Company." The ore was trucked to the central mill at Laurium and there the lead, zinc and pyrite minerals were separated into three concentrates. The lead and zinc concentrates were marketed in Europe and the pyrite concentrate sold locally for the manufacture of sulphuric acid. Pending loan settlement the mill and mine are being leased to the "Hellenic Company of Chemical Products and Fertilizers," who are concentrating local and ore shipped from their Cassandra properties in Chalkidiki.

The "French Laurium Company" has its own selective flotation plant for the treatment of the sulphuric ores and tailings from an old gravity concentration plant. It also has its own lead smelter in Laurium for the reduction of the lead concentrates and lead carbonate ores to metallic lead and oxides which the Company sells in the local Greek market. The zinc concentrate produced in its selective flotation plant is exported to France for refining to zinc metal there. The Company also produces silver and arsenic acid as a by-product of its smelting operations.

The "Cassandra Mine" of "Hellenic Company of Chemical Products and Fertilizers" received an ECA reconstruction loan in 1949-1950 fiscal and completed the installation of a selective flotation plant for the treatment of complex lead-zinc sulphide ores. Thus the production of lead and zinc concentrates is materially augmented.

Another project on which DMPA-GSA had an Exploration contract for strategic materials is the lead-zinc deposits on the Island of Santorini (Thira). Here the "Mediterranean Mines Co." carried out a prospecting program and some complex sulphide ores of lead and zinc have been found. However,

it is considered that these ores are not of commercial value and the loan has been written off.

Another good prospect is that occurring on the Island of Chios and also some indications of good ore on the Island of Samothraki. These require considerably more work before any definite statements can be made as to their commercial value.

In any case, the opportunities for increased production of lead and zinc concentrates in Greece are believed to be excellent. The Laurium district presents excellent geological opportunities in the development, particularly of the lower ore horizon (3rd Contact Ores,) and to a certain extent in the undeveloped upper ore horizons where large areas remain to be prospected. Investigations considering the possibilities of treating gravity concentration tailings of the older "Greek Laurium" operation by flotation for the recovery of lead values are also underway. Large tonnages of these tailings have been stockpiled in the past. When and if prices warrant, these opportunities should be thoroughly studied.

M A G N E S I T E O R E

At the present time there are twelve producers of raw magnesite ore, some of which are of very minor importance and are apparently just getting under way. The important producers of raw magnesite ore are the "Anglo-Greece Magnesite Co.," the "Financial Corporation of Greece" (Scalstiri), the "Vavdos Mine" of Vryonis, the "Lambrinidis Mine" and the "Apostolides Mine." These mines account for about 82% of the present raw magnesite ore production.

Production of raw magnesite for the year 1954 was about 76531 m./ tons. 1938 production of raw magnesite was 56,264 m. tons. This increase in present production is gratifying.

A lot of the increase in the productive capacity and rehabilitation of the magnesite mines is due to the financial support of ECA loans. The "Vavdos," "Akylas," "Lambrinidis," "Apostolides," and "Gabrielidis" mines, all received loans, and largely through such help are these mines able to now reach their present production rates.

The major portion of the raw magnesite ore is used locally at the producing mines for the manufacture of calcined magnesite, which has a better market than the raw magnesite. The best market for the magnesite mines of Greece would be that of dead-burned magnesite refractory, but so far none of the mines are yet in position to produce this product since the war. Prior to the war a number of mines were equipped for such production, but their rotary kilns and facilities were destroyed and have not been replaced. One of the ECA reconstruction loans made to the "Vavdos Mine" included facilities for the manufacture of dead-burned magnesite. Both the "Anglo-Greek Co." and the "Financial Corporation of Greece" are planning to rehabilitate former facilities for dead-burned. Unfortunately, Vryonis did not accept an offer made by "Basic Refractories" of Cleveland, Ohio to cooperate in the completion of the rehabilitation of his mine and has now been declared bankrupt with a receiver appointed.

The "Anglo-Greek Magnesite Co." and "Lambrinidis Mine" are the largest producers of calcined magnesite, followed by the "Financial Corporation of Greece." These three mines produce practically all the present calcined magnesite.

MANGANESE ORE

Prior to the war Greece produced some quantity of battery grade manganese ore, but since the war only low grade ore has been produced, which carries a high percentage of silica and which is only adaptable for a limited market.

The present production of manganese ores comes from two main sources, the "Cassandra Mines" on the Chalkidiki of the "Hellenic Company of Chemical Products and Fertilizers," and the "Granitis Mine" near Drana, Macedonia, operated by Mr. D. Scalistiri.

The "Hellenic Company" at Cassandra and the "Sinanis Mine" on the Peloponnesus were granted ECA reconstruction loans. The balance of the present producing mines were granted aid through the Strategic Materials Exploration contracts toward opening up the best appearing prospects. Unfortunately, to date the ore which was found was too high in silica content to be returned to the United States Stockpile in repayment of the funds advanced for exploration.

As a result of the effort to secure manganese ore through the Strategic Materials Program, Mining Branch engineers examined a large number of manganese prospects in an effort to determine possibilities of production. With one or two exceptions all the prospects are spotty and the ore deposits silicious and small in quantity.

The major producer of battery grade manganese in the past has been the "Granitis Mine," which operated during the Turkish occupation of Macedonia. This mine is reputed to have had a large production of high grade manganese during that period. A Strategic Materials Exploration contract was entered into with Mr. Scalistiri on this mine and the mine opened again as a result. The high grade pyrolusite ore was found to have been largely mined out to the depth of the exploration tunnel and the exploration will have to be carried out on a lower horizon than the present tunnel. Developments are now underway whereby a gravity concentration plant reduces the percentage of silica and increases the manganese content of the run-of-mine ore. Slightly more than an average of 1000 m. tons monthly is being produced here.

The "Tartana" and "Karpouslouk" properties occurring near Kato Nevrokopi in Northern Macedonia and near the Bulgarian border also have indications of developing some quantities

of manganese ore from which may be sorted some high grade ore. These properties are being operated by Mr. Scalistiri and are now only in the early stages of development. "Karpouzlouk" is now producing a small tonnage monthly and is expected that "Tartana" may soon start a small but regular production.

NICKEL - IRON ORES

Nickel-iron ores occur in the Lokris District of Central Greece which were extensively mined prior to the war for reduction in Germany. The "Larynna Mine" is reported to have produced some 124,000 m. tons of 4.90% Ni content between the years 1929 and 1935 inclusive, and from 1936 to July 1941, some 243,000 m. tons of ore assaying 2.5% Ni.

The "Larynna Mine" is now the property of the Greek State who have recently leased the mine to the "Hellenic Company of Chemical Products and Fertilizers" for 36 years. This Company is in the process of installing the "Krupp-Renn Process" of fire metallurgy to produce a Ni-Fe pellet, and expects to treat ore as low grade as 1.5% Ni content. The first phase of this development is expected to be in operation by December 1955. Yearly production is estimated at 54,000 m/tons of iron-nickel pellets running 6-8% Ni. The second phase for treating iron ore and producing soft pig is expected to be completed in 1958.

Other nickel-iron deposits occur on the Islands of Euboea and Skyros. These have not been prospected sufficiently to determine economic possibilities as yet.

Some nickel-copper deposits occur in Greece near Volos. The "Linogardi Mine" was mined prior to the war as a nickel bearing copper ore, and had extensive mine workings, now caved and flooded. This mine presents another economic possibility for the future.

PYRITE CONCENTRATES

Pyrite concentrate production comes principally from the "Maden Iakkos Mine" at Cassandra, Chalkidiki, owned and operated by the "Hellenic Company of Chemical Products and Fertilizers." This same company operates another pyrite mine at Hermioni in the Peloponnesus. Production of concentrates was approximately 200,000 m. tons for 1952, an improvement over the 1951 rate of production. 1954 production was 195567 m./t.

This Company has now completed the development of its pyrite concentration plant, which was made possible through Marshall Plan construction loans. The production of concentrates now reaches 30,000 m. tons monthly, or about double the previous capacity.

With the apparent sulphur shortage in Europe, the production of pyrite assumes considerable importance toward alleviating this condition. Greek pyrite concentrates are shipped to Germany, Belgium, Austria, Holland, Switzerland, Italy and England.

Z I N C C A R B O N A T E . O R E S

Large tonnages of zinc carbonate ores occur on the Island of Thassos which were worked prior to the war by calcining to zinc oxides. A number of other islands contain deposits also and the Laurium mines have zones of zinc carbonate ores. The difficulty toward production is that the ores are too low grade to stand the cost of shipment to zinc recovery plants in Europe. Only small quantities can be sorted by hand closely enough to allow for shipment to treatment plants.

These ores, with Laurium slime and sand tails and old smelter slags, would present an opportunity for possible treatment in a Waelz Plant. If such a plant can be eventually established in Greece, then a large quantity of zinc might be produced, as well as a large recovery of lead which is associated with these ores and residues.

G O L D M I N I N G

The "Northern Greece Gold Mines Company" have a large gold mine concession in Macedonia and Thrace, and prior to the war, had a gold dredge installed on the Gallicos River located 11 km. south of Kilkis. This Company received an ECA reconstruction loan for rehabilitating the dredging operation, and contracted with "Yuba Constructive Company" of San Francisco to re-design and modernize the dredge and for supervizing its operation. The dredge is now in operation handling 6000 cu. yds. of gravels which average 23¢ per yd. Recovery is made at the Company's offices in Kilkis and gold bricks are delivered to the National Bank of Greece at \$35 per once.

S A N T O R I N I E A R T H & P U N I C E

Large deposits of lower grade pumice (Santorini Earth) and high grade pumice occur on the Island of Santorini (Thira) which are being exploited by a number of operators.

The "Hephestos Company" received a small ECA loan for aiding in rehabilitation of its equipment in 1949. The market for Santorini Earth lies largely in the Near East, but recently some real interest has been taken in America for the pumice production from Santorini.

S U L P H U R

Sulphur was mined and refined on the Island of Milos prior to the war in small amounts for the local Greek consumption. This property has been assisted to resume operations again through financial aid advanced by the Greek Agricultural Bank. The sulphur here occurs in volcanic ash deposits which are of considerable extent, but the sulphur content appears to be fairly low grade. The sulphur was mined by room and pillar methods in the past, and crude refining processes were employed. The mine is now producing approximately 250 tons per month and has delivered to the Agricultural Bank for sale to farmers some 3000 tons over the past two years.

Sulphur occurs also on the Island of Nissyros in the form of fumaroles in volcanic ash. The deposit has not been mined in the past and presents an opportunity for open pit type of mining. How good the sulphur content here might be has never been determined.

By more moderns mining methods and metallurgy something should be done toward producing at least some of Greece's demand for sulphur from these deposits.

C E R A M I C C L A Y S

Some tonnage of ceramic clays is being produced in Greece from some of the islands, particularly Milos Island, toward satisfying the local demand for pottery and china ware.

A S B E S T O S

Greece has a number of occurrences of chrysotile and tremolite along serpentine limestone contacts. "Kennecott Copper" is presently in the field investigating a good showing and will drill for depth with the view toward development.

O I L D E V E L O P M E N T

The discovery of petroleum in commercial quantities has long been contemplated as a possibility. Oil seepage has been observed for centuries on the Island of Zakynthos off the northwest coast of the Peloponnesus; in North-Eastern Macedonia oil seepage is reported from a shallow well drilled, some years ago. Recent geological reconnaissance by experienced oil geologists working through the Mission sponsored "Greek Institute of Geology and Sub-surface Research" conclude that promising oil structures are possible and recommend further studies under modern oil prospecting techniques.

The seepage of Zakynthos Island was observed by the team of Geologists from the USGS working in Greece in 1949 and the occurrence was sampled. Their conclusion indicated that no extensive development was justified as the oil was a heavy, dense black oil unsuitable for other than road surfacing or black top paving. However, Mr. Martin Lerman, President of "International Enterprises, Inc." of St. Louis, Mo., informs us that his company will drill this area and drilling equipment is reported enroute to the site.

The possibilities in North-East Macedonia are planned to be exploited by a Greek company who, in a working agreement with a German drilling firm, contemplate drilling the property on a cooperative basis.

A concession for the rights to explore for oil, outside of the two areas mentioned above, is held for all Greece by William Hellis, a wealthy Greek-American whose father, prior to the war drilled several dry wells in the Peloponnesus. He is presently drilling south of Pyrgos on the west coast of the Peloponnesus where his geologists have indicated a small but quite likely oil occurrence. Two of his wells were lost due to earthquake tremors in the area and negotiating extension of his prospecting permit with Government held up drilling, but, we understand, operations are now underway again.

This significance of oil discovery on a commercial basis in Greece cannot be overemphasized.

RECOMMENDATIONS

Immediate future plans for promoting a sound minerals industry in Greece should include continuing revision of the Mining Laws to force sincere efforts on the part of concessionaires to develop their holdings. Definite legislation by Parliament would be a step in the right direction.

The reorganization of the Department of Mines within the Ministry of Industry so that a useful and practical service may be rendered to the minerals industry is also essential. Toward this end the following recommendation has been made.

That there be established a Bureau of Mines whose purpose shall be to promote exploitation and production of the mineral wealth of the country through the advancement of mining, metallurgy and mineral technology; aid in the conservation of mineral resources; promote safety in the mineral industries and conduct investigation on the mining, preparation and utilization of minerals. By developing and introducing safe practices and improvements in mining and in the use of mineral substances, the Bureau of Mines shall seek to promote the progress of the industry through scientific, technical and economic studies in laboratory, office and field.

The Bureau of Mines shall consist of a national headquarters in Athens, within the Ministry of Industry, with several offices outside Athens to carry forward field work. The national headquarters office, with a director in charge, shall be composed of five principal divisions; Administration; Health and Safety; Fuels and Explosives; Mining and Metallurgy; Economics and Statistics. The field offices shall carry forward the work in their respective areas under these divisions as service to the industry requires.

An outline of the functions of each of the five divisions has been submitted and it is hoped that eventually the reorganization may be made effective. The one major block to satisfactory progress in all such revisions is the lack of skilled administrators and experienced, conscientious men to fill key positions.

P A R T II

L I G N I T E D E V E L O P M E N T

Unfortunately, our initial efforts in appraising the lignite potential of Greece were limited because of guerilla activities still quite intense outside the immediate Attica area. Actual property investigations were, therefore, confined to the southern portion of the Island of Euboea, the Oropos, Rafina and Megara districts.

In February 1949, ECA/W engaged the services, through a Technical Assistance project, of Mr. Albert L. Toenges, Principal Coal Mining Engineer, Fuels and Explosives Division, Bureau of Mines, Pittsburgh, Pa., and Messrs W.G. Pierce and M.F. Denson, Geologists, United States Geological Survey. Their assignment was for a period of 90 days, and their objective was to evaluate lignite properties, available to examination, as to commercial possibilities. The primary goal being to determine a property or properties capable of supplying the lignite required to fire an 80,000 KW thermo-electric plant. During the period February 18 to May 17, 1949, nine lignite bearing areas were examined and reports submitted.*

These reports suggested that immediate attention should be given the lignite areas of Kimi and Aliveri, as they appeared to be the only areas indicating reserves of sufficient quantity to meet thermal plant requirements.

A drilling program was initiated through Technical Assistance Project Agreement #158, to diamond core drill Kimi and Aliveri. A drilling agreement was entered into with EBASCO, who had trained Greek crews and American diamond drillers available from their hydro-electric dam drill sites. The first hole was started on September 1, 1949, and camps were established to house the American personnel at both Kimi and Aliveri.

* Report on the Lignite Deposits of Attica and Euboea, and Notes on Deposits at Velika, Koroni and Ptolemais, Greece. By W.G. Pierce and Denson

Investigation of Lignite in Greece; and the Possibilities of Development of the Kimi and Aliveri Area on the Island of Euboea. By Albert Toenges.

Thirteen holes were drilled at Kimi, and seventy-one drilled at Aliveri. The results at Kimi did not indicate mineable lignite reserves to the extent desired for a large scale operation, while at Aliveri, drillings indicated reserves in excess of those anticipated. Drilling was stopped at Kimi and all drill rigs were concentrated at Aliveri. It became quite evident that Aliveri reserves were sufficient to supply the thermo plant without production from any other source and plans were revised to suit this new concept. The Public Power Corporation changed its plans for a thermo plant on the mainland and erected a plant at the sea port of Aliveri. Well over a million dollars in barge equipment was thus saved and the yearly maintenance cost of dock loading and unloading equipment eliminated.

When it became evident that Kimi and Aliveri were the logical lignite sources for the Chalkis thermo plant, negotiations were carried on to engage a mining engineering firm to make a comprehensive study of the properties and submit a report on the technical and economic aspects of development. The firm engaged was PIERCE MANAGEMENT, Inc. of Scranton, Pa. Their "Interim Report" was submitted May 19, 1950 and their "Pre-Project Report" submitted July 15, 1950. This report confirmed the ability of the Aliveri property to supply the thermo plant alone, and a contract was negotiated between Pierce and the Greek State to engineer, develop and manage the property through to complete operation, producing 700,000 tons per year. The development and construction work was completed December 1st, 1953, but Pierce continued as operational managers to May 20, 1954, at which time the operation was formally handed over to the Lignite Division of the Greek Public Power Corporation. However, at our suggestion, the PPC retained Pierce's mine manager and mine foreman for an additional twenty four months to advise and guide the Greek operational personnel. The millionth ton of lignite was delivered to the cleaning plant on June 15, 1955, and the mine is more than able to supply the thermo plant needs.

During the period that this major activity at Aliveri was crystallizing, many other areas were being investigated, and an overall program for the development of lignite generally was being formulated. Reports were studied; on the ground investigations were carried out; many interviews and conferences were held with Greek State officials and Greek lignite men. As the guerrilla war was gradually brought under control, new areas were open to investigation, and finally in October 1949, we made our initial visit to the Ptolemais area. These studies and investigation, together with the four year program, as originally set forth by the Mission's Industry Division, outlining lignite development objectives, plus the many loan applications received and

investigated, formed a basis for setting up objective targets. Contemplated industrial installations to be powered by lignite were listed, and the required tonnage estimates noted. Locations of these contemplated industrial sites were plotted on the Greek map, and known lignite deposits contiguous to these sites were spotted. This schematic planning developed a program of investigation into seven lignite areas by the Geological Section of the Ministry of Coordination augmented by foreign specialists under a Technical Assistance Project. The results of this geological reconnaissance were rather discouraging as the areas investigated did not appear to have reserves of commercial significance. The only areas, other than Aliveri, which appeared of primary importance were Serres, Kimi (reported on by Pierce) and, of course, Ptolemais.

Ptolemais had always been considered by this Branch as the potential fuel bin of Greece. The German Professor Kegel had made an extensive survey into its possibilities for the SEK railway (Government owned) in 1938-1939. Some 200 drill holes were sunk and cores taken and a vast area of low rank earthy lignite proven. The lignite bed lies fairly flat, and the ratio of overburden to lignite averages one and a half to one, quite conducive to strip operations. Upon the strength of the Kegel report and other Greek investigations, as well as our own, the Greek Government engaged through ECA Technical Assistance, the firm of POWELL-DUFFRYN TECHNICAL SERVICES, Ltd. of London, England, to make an engineering survey on the technical and economic aspects of developing the Ptolemais area as an open pit mining operation with special attention being given to the possibilities of briquetting the raw lignite with or without binder. Powell Duffryn's report was submitted on April 18th, 1950, and recommended the feasibility of such an enterprise; (See Powell-Duffryn "Report to the Royal Hellenic Government on the Production and Utilization of Ptolemais Lignite.")

Bringing into being the development of Ptolemais was somewhat complicated. The following highlights the chain of events which has led to the present situation. We do not attempt to outline the political aspects or influences which have had bearing on the project, nor do we attempt to analyze or set forth opinions, influences, controversial issues or inferences. In fact, an expression of these sentiments is purposely avoided, in order to set forth as clearly as possible a statement of the facts.

In 1938 the Greek Government optioned to George Phillis, a Greek American residing in Buffalo, New York, the development of the Ptolemais lignite deposits. One of the conditions to validate a 40 year concession was to deposit \$400,000 with the Greek State. The last extended time limit was to December 31, 1950. Mr. Phillis was not able to meet this condition and a

reorganized group known as the "Hellenic-American General Lignite Products Company" made the deposit on December 30, 1950. This Company, we understand, is composed of the following:

<u>N a m e</u>	<u>S h a r e s</u>	<u>P e r c e n t a g e</u>
C.A. Ghertsos	1400	35%
"	640	16%
Mrs. Dokos)	421	10.53%
D.A. Ghertsos)		
Ptolemais Lignite Mines	880	22%
G.E. Phillis	659	16.47%
	<u>4000</u>	<u>100%</u>

a concession giving the exclusive rights to 110 sq. km. was granted the Company in March 1951 for a period of 35 years.

On June 30, 1951, an approved CIG loan was signed with the Bank of Athens. This loan provided for foreign exchange equivalent to \$10,370,000 and drachmae equivalent (at 15,000 to \$1) to \$3,466,000, a total of \$13,836,000. The loan carried a simple 5% interest rate per annum payable on the amount drawn January and July 1 of each year. The Company was to provide 30% of the total capital required in the undertaking. This, in addition to the \$400,000 deposit, was to be made by the Company by paying 41.4% of the cost of the imported machinery estimated to total \$5,755,000. Such imports to be delivered free and clear to Hellenic-American by German manufacturers upon the payment out of loan funds of 58.6% of the delivered price. "INDUSTRIEBAU" of Zurich, Switzerland, a firm controlled by the Ghertsos interests was the prime contractor supplying the German manufactured equipment and presumably had arranged for time payment of the 41.4%. Letters of credit were opened from loan funds for the amount of \$7,641,189; only \$387,454 of this was used in payment of \$608,571 worth of equipment delivered. The letters of credit expired December 31, 1953, and the balance of \$7,253,755 was returned to the loan account.

On July 18, 1952, the "Hellenic-American Company" requested the Central Loan Committee to consider a 3 point modification of their loan:

- a) Capitalization of interim interest and deferment of installment payments until 1956,
- b) Interim interest of 2% and thereafter 3%.
- c) Cancellation of CIG's decision freezing their dollar capital deposit against drachmae loan withdrawals.

(We understand the Company had reason to expect such consideration as indicated in Mr. Keppel's (former Director, Finance Division)

memo of October 20, 1952). The Minister of Coordination addressed a letter to the Chief of Mission July 29, 1952, advising of this request and suggested approval. On October 17, 1952, Mr. Gherstos addressed a letter to the CIO urging action and on October 18, 1952, addressed a memorandum to Mr. Barrows (then Mission Chief) requesting the Mission's views on the three points be communicated to the Greek Government as early as possible. The Minister of Coordination again on October 23, 1952, referred to their letter of July 29th and indicated approval. Mr. Barrows replied to the Minister on January 15, 1953, advising that no concession be granted until such time as the Company provided adequate evidence of sound financing.

On April 29, 1953, the Minister of Coordination wrote Mr. Barrows indicating approval of new proposals by the Company expressed in its letter to the Minister, April 15th. This proposal guaranteed the following:

1. The Governor of the National Bank of Greece and Athens would be administrator of the Company through completion of the project.
2. Guaranteeing an additional \$400,000.
3. Delivery of equipment within time limits.

The new proposal also included the request to:

1. Capitalize the interest due.
2. Cancel freezing of 43% of capital on the value of drachmae loan withdrawals.
3. Extend letters of credit.
4. Advance credits to manufacturers upon bank guarantees.
5. Reduce briquettes from 600,000 to 200,000 tons.
6. Increase power plant to 40,000 KW selling excess power to the Public Power Corporation grid.

The Minister indicated approval of this proposal and requested the Mission's views and comments.

The request to reduce briquetting and increase power production was based on the results of the Company's more thorough investigation into the physical characteristics of the Ptolemais lignite deposit. The Company claims these investigations disclosed that in the area marked for initial strip mining only 35-40% of the lignite was briquettable because of high ash

content, but that this high ash content lignite was suitable for burning under boilers and for producing thermo-electric power. (See their summary of the situation dated 2/28/53).

In August 1953, Mr. Pasmazoglou, Mr. Kallinski and Professor Nicolaidis met with Mr. Barrows to discuss the Ptolemais situation and inferred at that meeting that the Government was considering Bodossakis to take over the Ptolemais project. The "Hellenic-American Company" was then requested to concede their rights to Bodossakis. They made such a proposal and negotiations between the two groups were amicably carried out as to compensation to "Hellenic-American" for their expenditure to date.

On June 20, 1955, the Greek Government signed a concession agreement with the Bodossakis group to develop Ptolemais. The concession is for forty years and obligates the concessionaire to mine 1,800,000 tons of raw lignite per year from which he will:

- 1) Supply a 60,000 KW thermo-electric generating plant to be built by the Public Power Corporation.
- 2) Manufacture 200,000 tons of briquettes of which some 150,000 tons will be used by the SEK railways, and
- 3) Produce 100,000 tons of char or semi-coke for use in the processing of the Larymna iron-nickel ores.

The concessionaire, according to the terms of agreement, will invest \$3,000,000 of his own funds, have the use of \$3,500,000 in German credits and be entitled to apply to the Greek Economic Development and Financing Organization (EDFO) for the remainder of the original loan amounting to some \$13,500,000. He is required to pay out of these loan funds interest due on the old loan and monies due the "Hellenic-American" as agreed to by the State.

The final results of our investigations indicated that reliance on lignite to fuel plants close to known lignite areas was not realistic, and if lignite were to become a major energy supplier a dependable supply of standard quality would have to be obtained from such a source as Ptolemais. Consequently, the plans for a soda-ash plant near the salt beds of Messolonghi were left pending as were the contemplated plans for an alumina plant and an iron foundry.

Throughout this period of formalizing plans and objectives several tests were being conducted on various Greek lignites to determine utilization and adaptability to chemical processes. One test for grinding and combustion had been made before this Branch took an active part in the program, and V.F. Parry of the U.S. Bureau of Mines experimental laboratory at Golden, Colorado, had run several tests on drying, grinding, briquetting, and combustion in addition to the many analyses of Greek lignite made later at our request. (See C.H. Wheeler Manufacturing Co. report, "Grinding and Combustion Tests on Greek Lignite" and "Special Report No. 101" by V.F. Parry and O.E. Wagner, US Bureau of Mines.) Forty odd tons of Aliveri lignite were prepared and shipped by the Branch to Parry, at Golden, to run grinding, drying and combustion tests. These were shipped in steel drums sealed air tight and constituted run-of-mine lignite. Several similar drums were shipped to Toenges at the Bureau's Pittsburgh plant for cleaning tests. Over three hundred tons of Ptolemais lignite were shipped to the States and to Rouen, France, for testing in the gazification process for the manufacturing of nitrogenous fertilizers. Twenty tons of Ptolemais lignite were sent to Klockner-Humboldt-Deutz, Cologne, Germany, for testing under their process of briquetting without binder. Dr. Kurt Baum also sampled and tested several of the Greek lignites for carbonization possibilities and to determine if satisfactory coke could be obtained for foundry use.

SUMMARY & RECOMMENDATIONS

A summary tabulation of the lignite development:

<u>Lignite Area</u>	<u>Estimated Reserves</u>	<u>Yearly Production</u>	<u>Foreign Exchange.</u> \$	<u>Drachmae</u>
Ptolemais	4,000,000,000	2,000,000	10,370,000	51,990 th.
Aliveri	52,000,000	700,000	6,000,548	103,000 "
Serres	70,000,000	180,000	260,000	1,195 "
Kimi	8,000,000	70,000	142,000	2,100 "
Kalogreza	<u>2,000,000</u>	<u>50,000</u>	<u>50,000</u>	<u>2,190 "</u>
	4,132,750,000	3,000,000	\$16,822,548	160,475 th.

In addition to the lignite production now under development plans are being considered for the erection of a nitrogenous fertilizers plant in the Ptolemais area to be fueled by lignite and using Ptolemais raw lignite in a gazification process for manufacture of chemical fertilizers. The KOPPERS Company completed a survey for the Greek Government in June 1955 covering this phase of the Ptolemais project. Their report is expected in September 1955. EBASCO also reported to the Greek Government its findings as to the size of thermo-electric plant suitable at Ptolemais and the PPC will erect a 60,000 KW single steam turbine generating station.

Several other major consumers of both liquid and solid imported fuels deserve study with the thought of converting to lignite. These are the thermo-plant at St. George Bay, now burning fuel oil, the Athens City Gas Works, using imported solid fuel in its gas plant, and several large cement works using imported fuels. The conversion of the oil burning boilers at the thermo plant is rather a simple matter, and the conversion of the gas works to lignite should not be difficult, but some study, tests and engineering should be accomplished to fully determine the technical and economic aspects of the project. The supply of city gas through the gazification of lignite has been successfully carried on in Germany for the past several years and their operations should be studied and their services called on to evaluate the possibilities of similar performance with lignite in Greece. Several lignite properties contiguous to the Athens area: Peristeri, Oropos, Rafina and New Heraklion

have good potentialities for supplying the required tonnage for these two enterprises, and a study of these fields is recommended as the next step in the further development of lignite utilization in Greece.

The use of lignite in the manufacture of cement is also considered feasible. Parry in his report noted that Greek lignite should be suitable for cement processing according to his observations and tests. Conversion to lignite in this field should not be too difficult, and lignite areas adjacent to present plant sites should be investigated for ability to serve. For example, the lignite areas of Katerini, Atalanti and North Euboea should be further explored to determine their ability to supply the fuel requirements for the cement plants at Volos.

Another very interesting possibility exists for the combined utilization of Greek lignite and Greek low grade iron ore to produce soft pig iron for reinforcing bars and similar simple iron foundry products. Recent advances in the metallurgical field in Germany (Klockner, Humboldt-Deutz) and elsewhere have indicated that good results may be obtained in the production of pig iron by blast furnace treatment of briquettes composed of lignite, iron ore, limestone and necessary flux. This combining of the raw materials in proper proportions in the form of briquettes seems to afford simple processing, smaller plant investment and economical production of pig iron. Lignite areas adjacent to the iron ore deposits must be studied and tested as to adaptability to this process and ability to supply the tonnages required.

Further investigation should also be given to the possibilities of rehabilitating several of the smaller mines strategically placed geographically so that all the major areas of Greece may be supplied lignite without excessive transportation. This should be of particular benefit and significance in that it would help to make all parts of Greece independent of foreign fuel supplies should an emergency cut off imports at any time.

The area north of the present workings at Kimi should be core drilled to determine the extent of the lignite basin in that direction. As markets expand and production demands increase, the lignite areas of Drama, Alexandroupolis, Katerini, Atalanti and Preveza may prove small but worthwhile operations. Two properties north of Ptolemais, Vevi and Anyteon, may also prove advantageous for further exploration in the future. These properties are presently being worked on a small scale to serve the needs of local communities, but they have a potential for greatly in-

creased production provided a market is open to them. At present the Ptolemais venture, if realized, precludes the possibility of these mines, so close to Ptolemais, competing for the markets available, but future activity may well bring Vevi and Amynteon into demand. They are well located for rail shipment and the lignite being decidedly woody in character, need not be briquetted to facilitate transportation and marketing as in the case of Ptolemais.

When the present tonnage under development is realized and the future lignite possibilities are considered, Greece should have no difficulty in becoming self sufficient in her solid fuel requirements. The need for technical know-how and experience in modern coal (lignite) production and utilization will remain a problem for some time to come, but this should resolve itself as experience by actual demonstration is gained through the program now being accomplished. The high cost of transportation and handling is a hindrance to wide distribution and is a discouraging factor in the economic use of lignite. This must be made a subject for special investigation, and reasonable rates should be established.

Marketing, distribution, adequate delivery service, and knowledge of modern utilization and combustion methods are problems now under study by Government and the major progressive and large operators. Continued advancement in these functions necessary to an efficiently operated industry serving the solid fuel requirements of Greece, is essential to successful expansion and must be continuously carried forward.

PART III

COMPLEMENTARY ACTIVITIES

Corollary to our activities in mining and actual financial aid in promoting exploration, production and export of Greece's mineral wealth, help was offered through the Technical Assistance Program and by the following Project Agreements:

1. Project No. 106 (TA)

Provided the Greek Government authority and means to hire foreign specialists in geology and geophysics to survey, map and evaluate areas of known mineralization. This project was administered through the Geological Institute.
(See Project No. 327)

2. Project No. 158 (TA)

Provided for core drilling, sampling and testing lignite areas.

3. Project No. 247

Provided for studies in the utilization of lignite and its coking possibilities.

4. Project No. 297

Provided for the survey and report on Ptolemais lignite by Powell-Duffryn Technical Services Ltd., of London, England.

5. Project No. 327

Provided for the improvement of Geological facilities, purchase of equipment, printing of reports and maps and established the basis for the creation of the Geological and Sub-surface Research Institute.

6. Project No. 340

Provided for the survey and report on Kini and Aliveri lignite by Pierce

Management, Inc. of Scranton, Pennsylvania.

7. Project No. 427

Provided for contracting the services of Pierce Management Inc. to develop the Aliveri lignite mines.

8. Project No. 443 (TA)

Provided training in the U.S. for three Greek geologists. Project cancelled 12/31/53 as trainees could not meet USGS schedule.

9. Project No. 444 (TA)

Provided training for two Greek mining students in the U.S. in Mining Methods and Ore dressing.

10. Project No. 478 (TA)

Provided for the training of 8 selected Greek nationals in the United States in mine management and operation for the Aliveri lignite mine.

11. TA/W 40-82

Provided for a specialist in strip operation for Eleusis Bauxite for one year.

12. TA/G Project Memorandum 134

Provided for four Greek combustion personnel to study lignite utilization and burning equipment in Germany for three months.

Two other major projects, one a TA for specialized foreign personnel and one a PA for purchasing equipment to implement a reorganized Department of Mines were not finalized, as the several successive Ministers with whom we worked in the Ministry of Industry were unable or unwilling to undertake the necessary steps to effect a suitable reorganization. We are at present attempting to attack the problem from a different angle by working with the United Nations Technical Assistance personnel who wish to reorganize the Department of Mines under a proposed National Research Center to be created with the Geological Institute as an efficient nucleus. We have proposed Mission TA Projects, complementing the UN TA proposals, to provide specialists and laboratory equipment for the Mining Department of the Center.

EPILOGUE

In the course of attaining whatever achievements are here demonstrated it is quite natural to formulate opinions from observations made and experiences encountered. These opinions are undoubtedly somewhat prejudiced due to our inability to completely understand the Greek personality, character and psychological background of the individual, the Ministries and the several Administrations in office during our tenure. It is quite difficult for an American to understand, and harder still to appreciate these differences in outlook, methods of approach, analysis of circumstances, rationalization of conditions, and approach toward accomplishment. These divergent precepts are no doubt the accumulative results of influences, environment, and circumstances spanning centuries of struggle for survival, dominated during the latter centuries by dictatorial governments imposed by conquest. This background has not been favorable toward expansion and systematic progress in national development, particularly in the field of natural resources. Consequently, the paramount prerequisites to national economic development: competent manpower, technical "know-how", organization, and the will to achieve through the creation of new sources of income -- both from the national and individual standpoint -- is woefully lacking. Even in the few instances where such ability is found, the absence of cooperative action and team work frustrates accomplishment. Rugged individualism, so predominant in the Greek character, degenerates to self interest and leaves much to be desired in the way of united effort, essential to industrial advancement and economic stability.

This observation in no way affect the definitive purpose of this history, but is stated with the intention to give some indication of the efficiency in experience and able manpower and the psychological impediments which hamper speedy accomplishment. Nor is the observation noted as a criticism, but rather to point out that such conditions do exist, that they should be recognized and worked with in patience and understanding. We cannot force our views or our methods on our friends, nor move too quickly, but with forbearance strive to appreciate their characteristics and with reason work with them toward the goals believed best for all concerned.

TABLES, MAP & CHARTS

M E T A L M I N I N G L O A N S

A M A G L O A N S

Operator	Type of Ore	Loans Contracted	
		Foreign Exchange**	Drachmae *
		\$	
Barlos Bros	Bauxite	-	420,089.16
Apostolidis	Magnesite	4,580.03	460,574.50
Gabrielidis	"	14,788.67	246,000.00
Lambrinidis	"	51,666.69	784,076.90
Herheastos	Purice	-	330,531.14
Hellenic Company	Pyrite	106,846.45	599,999.89
Apostolidis	Chrome	11,619.05	883,720.00
Sinanis	Manganese	-	84,332.80
TOTAL AMAG Loans		\$189,500.89	3,809,324.40

E C A L O A N S

Union Miniere	Chrome	\$126,305.00	1,127,000.00
Akylas	Magnesite	38,315.60	770,940.00
Lambrinidis	"	100,000.00	1,665,000.00
Vryonis	"	176,500.00	502,500.00
"	"	6,903.83	-
"	"	6,500.00	-
"	"	92,500.00	1,275,000.00
Hellenic Company	Pyrite	644,150.00	1,591,000.00
"	Iron	169,220.00	1,364,000.00
"	Lead zinc	163,200.00	1,045,000.00
Mediterranean Mines	" "	265,957.87	1,616,532.08
Antoniadis	Antimony	24,932.00	311,000.00
Sinanis	Manganese	10,000.00	300,000.00
Northern Greece	Gold	253,650.00	1,085,250.00
Gold Fields			
TOTAL ECA Loans		\$2,088,134.30	12,653,222.08

S T R A T E G I C M A T E R I A L S C O N T R A C T A D V A N C E S

Mediterranean Mines	Lead-Zinc	\$102,193.00	17,570,500.00
Santorini Expl.	" "	-	1,051,700.00
Samos Island Expl.	Manganese	-	388,500.00
Granitis	"	-	645,800.00
"	"	-	750,000.00
Yannitsanika	"	-	300,000.00
Eleusis Bauxite	Bauxite	850,000.00	9,000,000.00
Velpa Chrome	Chromite	110,000.00	8,697,000.00
TOTAL STR. MAT. Loans		\$1,062,293.00	38,403,500.00

* At exchange rate of 10 to \$1 for AMAG Loans
and \$1 to 15 for the rest

** Expressed in US Dollars Equivalent

SUMMARY OF FINANCIAL AID TO METAL MINES:

	<u>Foreign Exchange</u> \$	<u>Drachmae</u>	<u>Total in \$</u> <u>Equivalent</u>
AMAG loans	189,500.89	3,809,324.40	570,433.33
ECA loans	2,088,134.30	12,653,222.08	2,931,682.00
STR. MAT. loans	<u>1,062,293.00</u>	<u>38,403,500.00</u>	<u>3,622,523.06</u>
	\$3,339,928.19	54,866,046.48	\$7,124,638.33 *

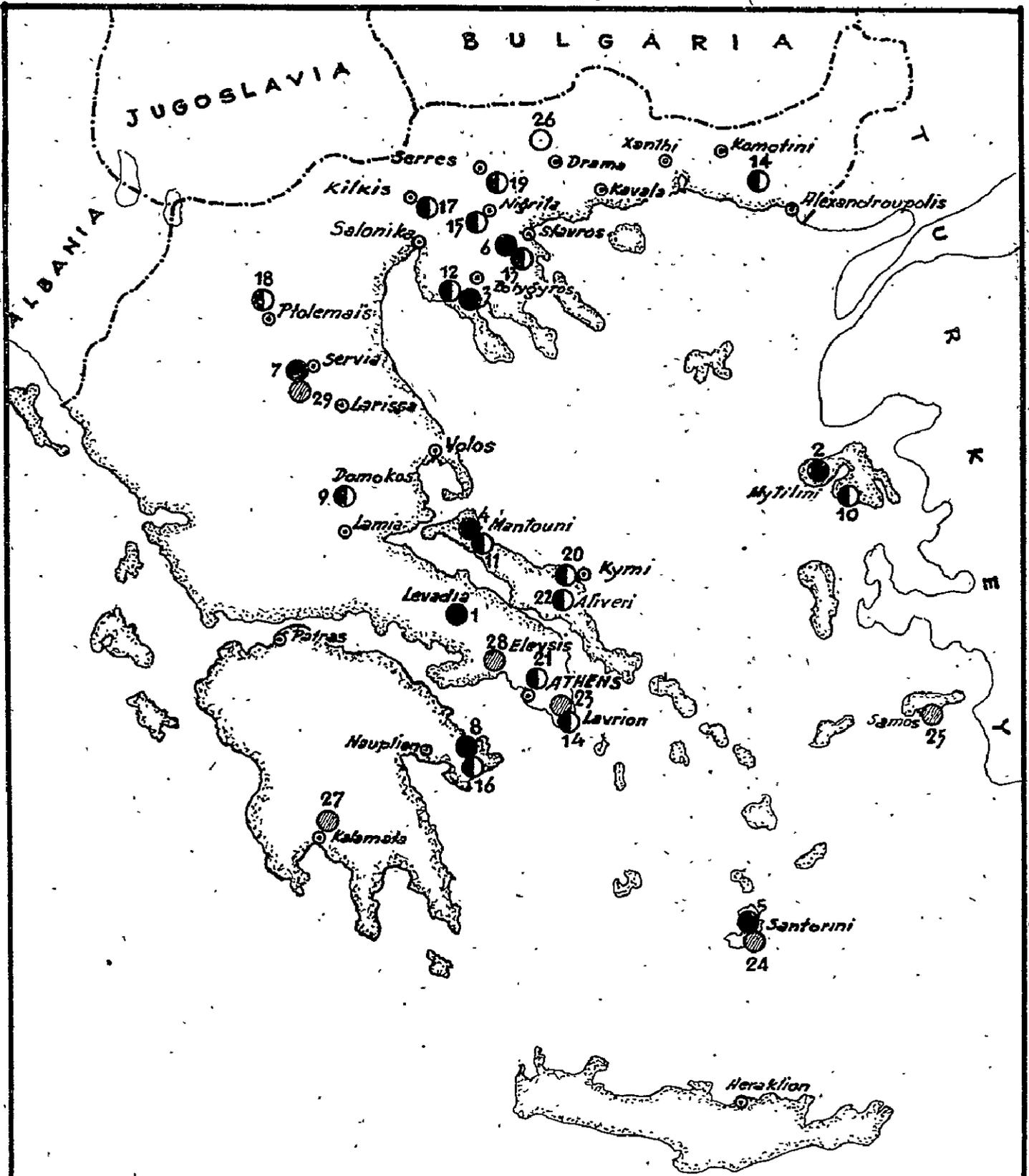
FINANCIAL AID TO LIGNITE MINES

Ptolemais	\$10,370,000.00	51,990,000.00	\$13,836,000.00
Serres	260,000.00	1,195,000.00	339,660.00
Kimi	142,000.00	2,100,000.00	282,000.00
Kalogreza	50,000.00	2,190,000.00	196,000.00
Aliveri (grant)	<u>6,000,548.00</u>	<u>103,000,000.00</u>	<u>12,867,214.00</u>
	\$16,822,548.00	160,475,000.00	27,520,874.00
GRAND TOTAL	\$20,162,475.00	215,341,046.48	\$34,645,512.33

* Rate of exchange \$1 to 10 drs. for AMAG loans
\$1 to 15 drs. for the rest

KEY TO GREEK MINES GRANTED LOANS

1.	Barlos Bros.	Bauxite
2.	Apostolidis	Magnesite
3.	Gabrielidis	Magnesite
4.	Lanbrinidis	Magnesite
5.	Hephestos	Punice
6.	Hellenic Company of Chemical Products & Fertilizers	Pyrite
7.	Apostolidis	Chrome
8.	Sinanis	Manganese
9.	Union Miniere	Chrome
10.	Akylas	Magnesite
11.	Lanbrinidis	Magnesite
12.	Vryonis	Magnesite
13.	Hellenic Company of Chemical Products & Fertilizers	Pyrite-iron-lead-zinc
14.	Mediterranean Mines	Lead-zinc
15.	Antoniadis	Antimony
16.	Sinanis	Manganese
17.	Northern Greece Gold Fields	Gold
18.	Ptolemas	Lignite
19.	Serres	Lignite
20.	Kini	Lignite
21.	Kalogreza	Lignite
22.	Aliveri	Lignite
23.	Mediterranean Mines	Lead-zinc
24.	Santorini Exploration	Lead-zinc
25.	Samos Island Exploration	Manganese
26.	Granitis Exploration	Manganese
27.	Yannitsanika	Manganese
28.	Eleusis Bauxite	Bauxite
29.	Velfa Chrome Mines	Chrome



Legend.

- *Amag loans*
- ◐ *E.C.A*
- ◑ *S.M.*

LOCATION MAP
GREEK MINES GRANTED LOANS

P R O D U C T I O N & E X P O R T S

The following are our figure on the mineral production, tons exported and the dollar export value for Greece in the twelve months period January - December 1953 and 1954.

These figures are compiled from reports of the mine operators as given us and do not necessarily compare with other compilations.

The production of lignite has also been noted to complete the total mineral production figures.

<u>M i n e r a l</u>	1953 <u>Production</u> m/t	1953 <u>Exports</u> m/t	1953 <u>Export Value</u> \$
Antimony	3991	-	-
Barite	25459	29444	494,400
Bauxite	330749	314413	1,699,935
Chrome ore	36759	27947	1,084,097
Iron ore	86326	98965	549,822
Manganese	13451	17001	491,977
Magnesite (raw)	106938	10733	131,866
Magnesite (caustic)	21954	6775	240,742
Pyrites	225134	160922	2,048,690
Lead conc.	6460	1799	289,277
Zinc conc.	<u>11157</u>	-	-
	868378	670099	7,031,306
	<u>1954*</u>	<u>1954</u>	<u>1954</u>
Antimony (conc.)	421	-	-
Barite	21997	18890	285,083
Bauxite	354417	343071	1,729,440
Chrome ore	29038	22524	851,672
Iron ore	76528	73775	453,432
Manganese	7669	16094	430,715
Magnesite (raw)	76531	12846	148,558
Magnesite (caustic)	26883	36365	1,359,761
Pyrites	195567	140039	1,962,277
Lead conc.	5644	2185	441,938
Zinc conc.	<u>10356</u>	<u>10580</u>	<u>439,636</u>
	805051	676369	8,102,512

* Incomplete data

COMPARATIVE TABLES

<u>Year</u>	<u>Production Tons</u>	<u>Export Tons</u>	<u>Export Value</u> \$
1946	98410	29159	279,902
1947	130637	115977	900,000
1948	112934	170767	1,654,976
1949	125390	100003	1,008,300
1950	253250	205230	2,288,258
1951	582354	475311	5,265,505
1952	894457	776908	9,840,261
1953	868378	670099	7,031,306
1954	805051	676369	8,102,512

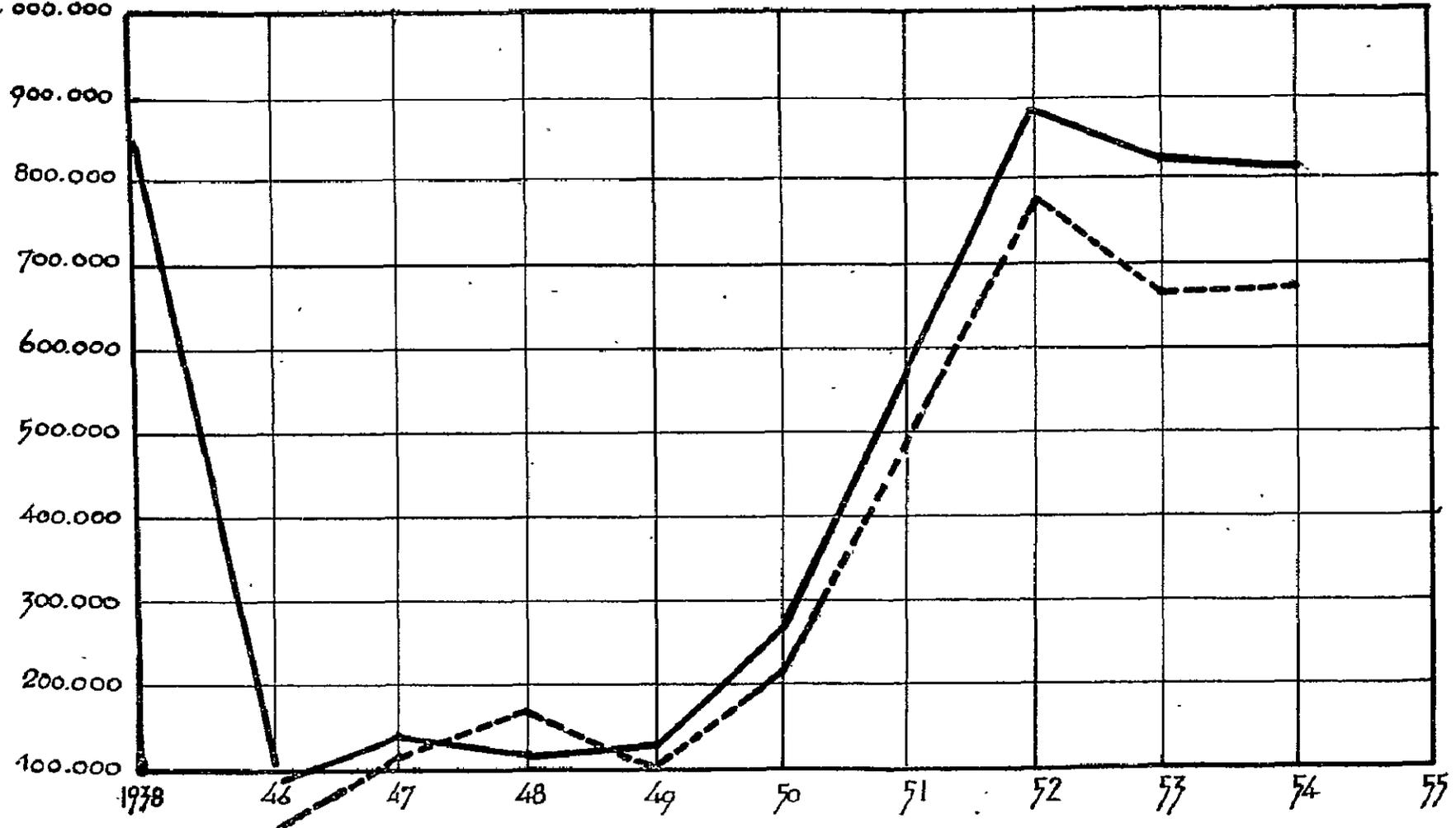
L I G N I T E

1938	108000
1948	125650
1949	175850
1950	163164
1951	190018
1952	252580
1953	444484
1954	803274

METALS

Legend:
Production ———
Export - - - - -

Metric Tons
1.000.000



LIGNITE

Legend:
Production ———

Metric Tons

1,000,000

900,000

800,000

700,000

600,000

500,000

400,000

300,000

200,000

100,000

1938

45

46

47

48

49

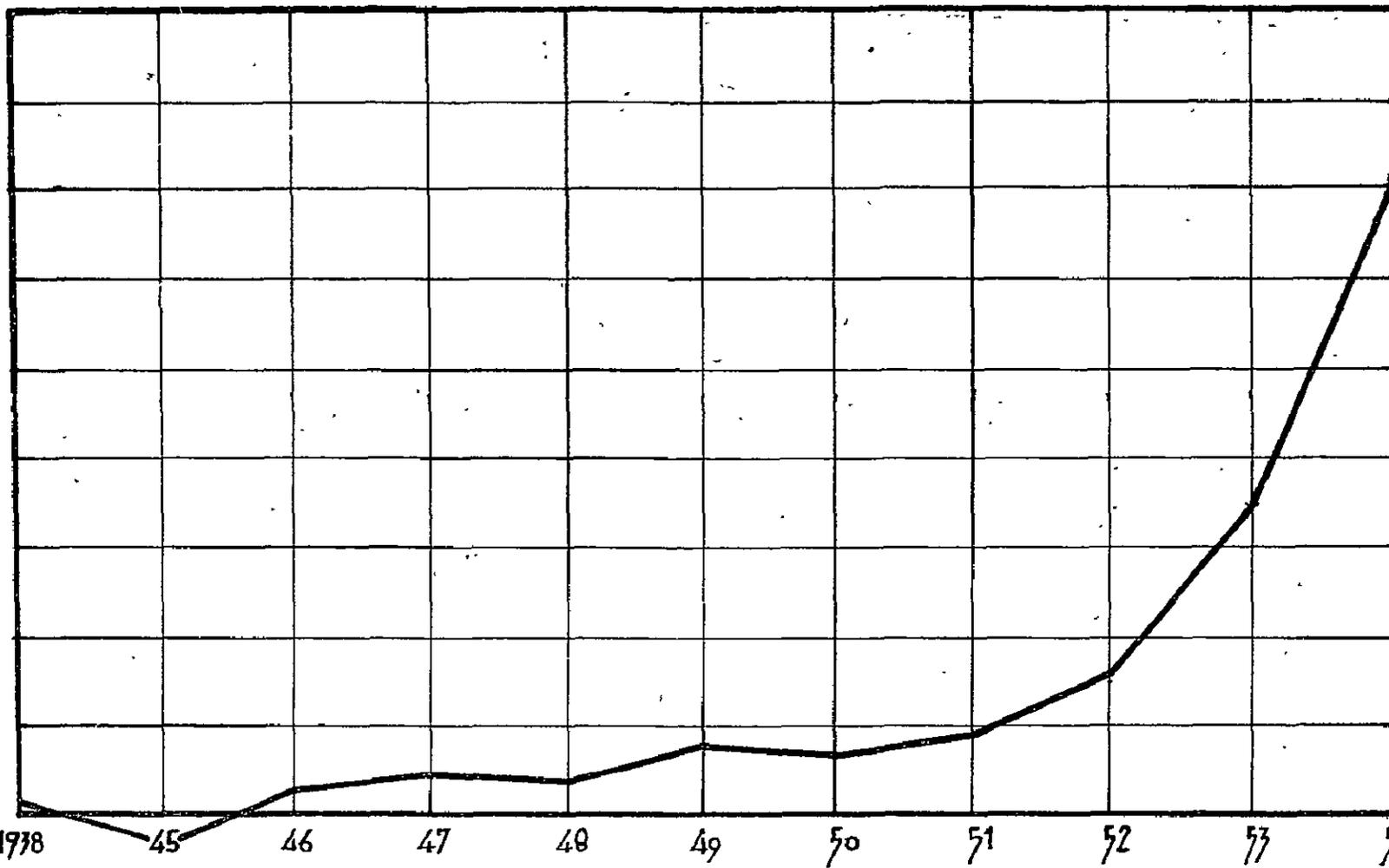
50

51

52

53

54



PRINCIPAL PRODUCERS AND PRODUCTION REPORTED BY THEM

	<u>OPERATORS</u>	<u>PRODUCTION</u>	
		<u>1953</u>	<u>1954</u>
<u>ANTIMONY:</u>	Hellenic Mining Corporation	3991	421 conc.
<u>BARITE:</u>	Silver & Barite Company	25459	21998
<u>BAUXITE:</u>	Barlos Bauxite Co.	16202	13336
	Eleusis Bauxite Mines	210550	239708
	Parnassos Bauxites	103997	101373
<u>CHROME ORE:</u>	Hellenic Mining Corporation	6642	16476
	Union Miniere	13970	12437
	Vryonis	1312	125
<u>IRON ORE:</u>	Chemical & Fertilizers Co.	63624	34093
	Chondrodinos	18000	36435
	Serifos-Spiliazeza	4702	6000
<u>IRON PYRITE:</u>	Chemical & Fertilizers Co.	222043	191616
	French Laurium	2927	3951
<u>LEAD CONC.:</u>	Chemical & Fertilizers Co.	1671	3748
	French Laurium	4452	1896
<u>MAGNESITE:</u> (raw)	Akylas	4206	3905
	Anglo-Greek	20410	26164
	Financial Corporation	16679	19196
	Lambrinidis	16584	23970
	Scalisticis	9176	2561
	Vryonis	8399	735
<u>MAGNESITE:</u> (Caustic)	Akylas	1090	723
	Anglo-Greek	7937	12460
	Financial Corporation	4118	5794
	Lambrinidis	6363	7906
	Vryonis	2999	-

OPERATORS

PRODUCTION

1953 1954

MANGANESE:

Scalstiris
Sinanis

7286
4500

7146
523

ZINC CONC.:

Chemical & Fertilizers Co.
French Laurium

3852
7028

5362
4994

MISSION MINING PERSONNEL & ORGANIZATIONS

1948 - 1955

INDUSTRY DIVISION

Metal Mining Section

	<u>From</u>	<u>To</u>
O. Perry Riker	June 1948	July 1950
R. Tsirimonaki	June 1948	
G. Vaindirilis	June 1948	Oct. 1949

Lignite Mining Section

C.M. Watts	Mar. 1949	
Th. Nerbari	Sept. 1949	
C. Vallides	Aug. 1949	

Mining Geology Section

Geo C. Heikes	July 1949	
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INDUSTRY & TRANSPORTATION DIVISION

Mining Branch

Geo. C. Heikes, Chief		Sept. 1951
R. Tsirimonaki		
V. Vaghias	Mar. 1950	July 1951
* James D. McPherson, Chief	Oct. 1950	May 1952
* C. Allan Botsford	Nov. 1950	Dec. 1951
C.M. Watts, Lignite		
Th. Nerbari		
C. Vallides		

CONSTRUCTION, INDUSTRY & TRANSPORTATION DIVISION

Mining Branch

C.M. Watts, Chief		date
St. Androutselis	Oct. 1952	date
Th. Nerbari		date
G. Theodossakis	July 1951	Nov. 1953
R. Tsirimonaki		Aug. 1953
C. Vallides		June 1953

* Transferred to-DMPA