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Report on the Metallurgical Industry of Albania - Outline

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19

February 1990

Visit of UNIDO metallurgical consultant to Albania
in February 1990
Time schedule

Febr. 15, Febr. 16

Arrival at Tirana

Meeting in Tirana with Mr. Edmond Bonguri, Chief of Metallurgical Section in Ministry of Industry, Mines and Energy and the Senior Engineers Mr. Ylli Danaj and Mr. Alqi Nase.

Continuation of discussion at the Iron and Steel Combine in Elbasan. Discussion with Mr. Robert Zonja, General Director of Metallurgical Combine "Steel of Party". Technical introduction to the processes by Technical Directors of

- Nicaro plant,
- Agglomeration plant,
- Steel plant,
- Rolling mill.

Febr. 17

Visit of the Nicaro plant and technical discussions with Mr. Gazmend Balashi, Chief of the Technological Office, and Mr. Skender Çerma, Chief of the Nicaro plant.

Visit of the Ni-Co-plant and technical discussion with Mr. Aleko Hysaj, Technical Director, and Mr. Rafail Shore, Chief Engineer of Ni-Co-plant.

Visit of steel plant and technical discussion with Mr. Skender Katana, Technical Director of the steel plant.

Febr. 18

Continuation of talks with Mr. Robert Zonja, General Director of the Steel Combine Elbasan.

Febr. 19

Visit of the Ferrochrome Plant Elbasan. Technical discussion with Mr. Mentar Sula, General Director of the Ferrochrome Plant and Mr. Ylli Llanaj, Chief Engineer.

Febr. 20

Visit of the Copper Smelter Rubik and discussions with the General Director Mr. Nikolla Gega and Mr. Zef Lleshi, Chief Engineer of Metallurgical Institute Laç, Department of Non-ferrous Metals.

Febr. 21

Visit of the Chemical-Metallurgic Combine Laç. Technical discussions with Mr. Kurt Sallaku, Chief Engineer.

Febr. 22

Visit of Cable Factory Skoder. Technical discussion with Mr. Hashim Mokçi, Chief Engineer.

Febr. 23

Technical discussion with Mr. Fatmir Manushi, Institute of Metallurgy Tirana, Section Chromium Metallurgy.

Febr. 24

Final discussion with Mr. Edmond Bonguri, Ministry of Industry, Mines and Energy.

Synopsis

The report presents a review of the Albanian metallurgical industry and an evaluation of its present potential.

The information which forms the basis of the report had been obtained by a fact finding mission of the undersigned to Albania. The main purpose of the visit was

- to collect information on the ferrous and non-ferrous metals industry,
- to analyze the present situation,
- to give recommendation for future assistance and development.

The mission to Albania commenced on February 15 and ended on Febr. 26, 1990. During this time the following authorities, institutes and industrial enterprises were contacted:

- Ministry of Industries, Mines and Energy, Tirana
- Metallurgical Combine "Steel of Party" Elbasan with all divisions
- Ferrochrome Plant Elbasan
- Copper Smelter Rubik
- Chemical-Metallurgic Combine Laç
- Wire factory Skoder
- Institute of Metallurgy, Section Chromium Metallurgy.

Thanks to the detailed information received from the Albanian experts, the presented survey on the metallurgical industry could be elaborated.

From the data obtained it became evident that chromite ores, nickel containing iron ores and copper ores are of paramount importance to the Albanian economy. These materials are treated in the country and exported as well, mainly in the form of chromite ores, ferrochromium, copper (wire) and nickel.

An important objective of the economy is now to increase and improve the export performance. For reaching that, huge investments are necessary in the current and next Five-year Plan for new mining activities and equipment, in particular for the chromium and copper industry.

According to the state of the art, the metallurgical plants in Albania cannot be regarded as modern industrial enterprises, especially not in respect to automation, measuring and control systems and environmental protection*.

International co-operation will be indispensable for improving the prevailing technical and environmental situation and for filling the technological gaps. As it will be shown below, UNIDO can play an important role accelerating the development of the metallurgical industry in Albania.

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* Since the environmental aspect of the country's premier industrial complex in Elbasan had already been subject of another UNIDO consultancy, the undersigned did not analyze the situation in Elbasan.

Table of Content

1. Introduction

The mining and metallurgical sector is regarded as a priority in the economy of Albania. The relatively small country with 3.5 million inhabitants on a surface of less than 30 000 km^2 has rich resources in metals, such as chromium, iron, nickel and copper containing ores. The deposits are mainly located in the northern part of the country, in the so-called Internal Albanides.

During the 8th Five-year Plan ending 1990, mining of minerals, primary and refined, is given priority and trading in minerals, primary and refined, shall expand.

Albania has begun to widen its international contacts and established new trade agreements with state and market economy countries. In addition, a process of opening to the outside world is being underway.

According to the Albanian chamber of Commerce, the volume of exchange of goods during the current Five-year Plan will be 35 % higher as compared to that of the 7th Five-year Plan. Also the export rate will be much higher (+ 45 %). The main metallurgical goods being exported are:

Alumo-chromium concentrate (38 % Cr_2O_3, 15 % Al_2O_3 15 % FeO)
Basic carbonate of Nickel (Ni 50 %, Co 1 %)
Bauxite (Al_2O_3 46 % base, 45 % min., SiO_2 max. 8.5 %)
Chrome concentrate (Cr_2O_3 50 %, ratio Cr/Fe 3/1)
Chrome ore - base 22 - 28 % Cr_2O_3
base 30 - 34 % Cr_2O_3
- base 41.6 % Cr_2O_3 ratio Cr/Fe 3/1
- powder, base 38 % Cr_2O_3
Chromite sand (min. 38 % Cr_2O_3)
Copper, cathodic (99,97 % Cu)
Copper slags (abrasive material)
Copper wires - bare rods
- convered with PVC
- enamelled
Ferro-chrome, high carbonic (base 60 % Cr)
Ilmenite concentrate (41 - 42 % TiO_2)
Iron-nickel ore (base 42 % Fe, 1 % Ni, 0.06 % Co)
Iron (merchant bars, profil I ; L , U)
Magnetite concentrate (Fe_3O_4 56 %)
Nickel silicate (10 % Ni)
Electrol. Nickel
Nickel silicate ore (Ni 1 %, SiO_2 36 % max.)
Power cables (tension up to 1 kV covering PVC, armoured and unarmoured)
Pyrite - ore (base 46 % S)
- contentrate (46 %S)
Pig iron
Selenium (95 % Se)
Sulphur (99 % S)
Titano-magnetite ore (TiO_2 5 - 8 %)
Zinc concentrate
Zircon concentrate (65 % Zr_2O_3)

2. Iron and Steel

The "Steel of Party" combine at Elbasan is the contry's premier heavy industry establishment. The Elbasan combine makes more than 50 types of steel and over 60 types of rolled stock. It produces most of the home demand of

- coke,
- pig iron,
- steel rods,
- steel moulds,
- refractory material.

The steel production is based on the important nickel iron resources of the country.

These nickeliferrous ores are first submitted to a nickel extraction process (see p. 19). The residue presents an iron concentrate which is used for the production of alloyed pig iron.

The capacity of the nickel plant is in the range of 900 000 tpy of ore. Presently only 60 % of the available capacity is being used.

The steel plant at Elbasan is equipped with

- 2 blast furnaces
- 4 top blowing converters (LD-typ), 20 t each
- 3 electric arc furnaces, 15 t each

60 - 70 000 t of the pig iron are exported, 110 - 120 000 t are further treated in the steel plant. Presently 150 000 t of steel are produced, wherefrom 50 000 t come from the electric arc furnace.

2.1 Chromium Industry

The principal use of chromite is as a source of chromium metal needed in stainless steel: a family of iron based alloys containing a minimum chromium content of about 12 %. This is the level of chromium necessary to render the steel passive due to the formation on the furface of an extremely thin but continous and stable chromium oxide film.

Stainless steel is used in both industrial and consumer applications; it has a myriad of uses ranging from pressure vessels in chemical plants to teaspoons. In order to produce the diversity of grades required for different applications, other elements are added to the steel in addition to chromium. The most important such elements are nickel and molybdenum.

2.1.1 Importance of industry to the Country's Economy

Albania ranks third amongst world chromium ore producers behind South Africa and USSR with an annual production of 1 million t. World production amounts to approximately 11 million t.

2.1.2 Mineral Resources and Supply

The chromite ores come from different mines which are located mainly around Bulquiza/Batra. The production amounts approx. to 1 million t. The following mines are in operation:

- Bulquiza,
- Batra,
- Kalimash,
- Kam,
- Klos,
- Katjel,
- Ternova.

The Cr_2O_3 content varies in a wide range. The main portion of the material is being exported. Only 200 000 t of lumpy ore and concentrate are used for the production of ferrochromium.

Bulquiza

The mine output is presently 450 000 tpy.

3 qualities of ore are produced:

- 200 000 t of ore with 42 - 43 % Cr_2O_3
- 220 000 t of ore with 36 - 39 % Cr_2O_3
- 30 000 t of ore with 24 - 26 % Cr_2O_3

From this quantity

- 220 000 t are exported
- 100 000 t are utilized for the production of ferrochromium
- 130 000 tpy go to the beneficiation plant.

The beneficiation plant has a nominal capacity of 240 000 t and is fed with ore from Bulquiza and Batra.

Batra

The production of 4 mines amounts to 400 000 t, wherefrom

- 110 000 t are treated in beneficiation plant in Bulquiza
- 160 000 t are treated in beneficiation plant in Krasta
- 130 000 t are exported.

The Cr_2O_3 content of the ore varies between 32 and 40 %.

Ternova

The mine is located 10 kms southeast of Bulquiza.

The mine production amounts to 30 000 t with 35 - 42 % Cr_2O_3.

Klos

46 000 t with 38 % Cr_2O_3.

Kalimash

200 000 t with 20 - 22 % Cr_2O_3.

The benefication plant has a capacity of 160 000 t and produces 50 000 t of concentrate with 49 % Cr_2O_3 at a recovery rate of 70 - 71 %.

40 000 t with 25 - 30 % are exported. Another mine in the vicinity of Kalimash will be shortly in operation. The reserves are estimated of being 1,5 - 2 million t.

Kam

4 mines produce presently 76 000 t. The capacity will be increased up to 100 000 t. It is envisaged to build a beneficiation plant. Presently 20 000 t of the ore are being assorted by hand.

Katjel

Mine output is 35 000 t with 32 - 34 % Cr_2O_3.

2.1.3 Production of Ferrochromium

Burrel

Presently 38 000 t of ferrochromium are produced in Burell. There are plans to increase the capacity within the next years. The plant in Burrel is equipped with three furnaces having each an installed capacity of 8 MVA. The raw material used consists of

- 60 % lumpy ore with 38 - 39 % Cr_2O_3
- 40 % chromite concentrate with 48 Cr_2O_3.

The coke comes from Elbasan and is produced from imported coal. Quartz comes from Tropoja. The recovery rate amounts to 88 %. The ferrochromium contains 64 - 65 % Cr and 6 - 8 % C.

Elbasan

The construction of the Ferrochrome Plant started in 1988. In the meantime, the first from three electric furnaces went on stream. The construction will be finished this may.

The plant will treat 100 000 tpy of chromite ore with approx. 40 % Cr_2O_3, 12 % Al_2O_3, 18 - 22 % MgO, 13 % SiO_2 and 12 % Fe_2O_3. With the exception of some improvements, the plant in Elbasan applies the Burell technology.

The installed capacity of each furnace equals 9 MVA, the energy consumption amounts to 4 500 - 4 600 kWh/t. The production of ferrochrome will be in the range of 36 000 tpy. Ferrochrome from Elbasan has the following composition:

64 - 66 % Cr, 7.5 - 8.0 % C, 0.04 % S, 1.5 - 2.0 Si. 2 000 tpy of ferrochrome are used in the Elbasan steel plant, 34 000 t will be exported.

2.2 Nickel Iron Industry

2.2.1 Importance of Industry to the Country's Ecoromy

With approx. 10 000 tpy of nickel contained in mined ore, Albania takes place No. 15 in the world production of nickel.

Table 1: Nickel production 1988: 1 000 metr. t

Producer	Mine prod.	Smelter prod.	Consumption
Albania	10.0	3.0	
EC	13.1	50.1	226.5
Europe	30.7	125.9	75.9
World	849.0	839.0	877.0

2.2.2 Mineral Resources and Supply

Nickel occurs mainly in the three ore types

- Nickeliron,
- Nickelsilicate
- Periodite.

Presently, only the nickeliron deposits are being exploited. The production amounts to 1.2 million t of ore coming from the following mines:

- Prrenjas
- Gur i Kuq
- Bitinska

Approx. 50 % of the ore is treated in the iron nickel combine of Elbasan, the rest is exported to Czechoslovakia and Bulgaria. A typical analysis of an Albanian nickeliron ore is 44 % Fe, 1 % Ni, 8 % SiO_2.

Prrenjas

Production: 600 000 t
80 % of this quantity is treated in Elbasan
20 % is exported

Gur i Kuq

Production: 300 000 t from which 165 000 t are exported

Bitinska

Production: 100 000 t
100 % of this material is treated in Elbasan.

2.2.3 Production of Nickel

The nickel extraction from the ore containing approx. 0.95 % Ni, 45 % Fe and 3.5 - 4.0 Cr_2O_3 is effected by the Nicaro process, a technology which is mainly applied in Cuba, Albania and Czechoslovakia.

The plant at Elbasan can treat 900 000 t of nickeliferrous ore. Presently, only 60 % of the capacity is used. 70 % of the raw material comes from Prrenjas, 30 % from Guri i kuq.

The nickel iron ore is dried in rotory kilns prior to the calcination and reduction process. The material is afterwards leached in a solution of ammonium cartonate. This leaching process leads to the formation of basic nickel carbonate which is separated, briquetted with coke and smelted in an electric furnace. The final product from this operation is an alloy with 90 - 93 % Ni, rest Co, Fe, Zn, Cu, S. This nickel alloy (anode nickel) is electrolytically refined whereby Co, Fe and Cu are precipitated as sulphides by the addition of sodium sulphide. Cobalt is finally won as cobalt oxide.

The iron containing residue from the Nicaro process goes to the agglomeration plant and is used as an iron concentrate for the production of alloyed pig iron. This pig iron itself presents the basis for the steel production of Elbasan.

The Nicaro plant has been designed for a capacity of 10 - 11 000 tpy of basic nickel carbonate. However, this production has never been reached as far. The present production amounts to approximately 5 500 t carbonate containing 60 - 65 % Ni in the dry substance.

The Nicaro plant is of Chinese design. The main difference to the Cuban and Czekoslovakian plant consists in the utilization of fluidized bed furnaces in Albania. All other Nicaro plants use multiple hearth furnaces.

The plant operation is charcterized by an extremely high dust emission to the atmosphere. As a consequence, the Ni recovery amounts only to 54 % which is mainly due to material losses in the preparation, roasting and reduction operation. Insufficient solubilization of the nickel during the leaching process is another reason for the low yield.

At the planning stage of the Nicaro plant, material losses of 1.5 % from the input (900 000 tpy) had been expected. The real material losses might be 10 times higher today.

3. Copper Industry

3.1 Importance of Industry to the Country's Economy

Compared to the world copper production, the output of the Albanian copper industry is with 15 000 tpy very small. Notwithstanding that, the copper production is essential for the Albanian economy.

Table 2: Copper Production 1988: 1 000 metr. t

Producer	Mine prod.	Smelter prod.	Refined prod.	Consumption
Albania			15	
EC	24.8	277.7	1 187.5	2 524.7
Europe	238.9	547.2	1 547.2	2 873.2
World	8 791.3	8 504.0	10 564.0	10 646.0

Thanks to this industry, Albania can export copper wire, copper cathodes and selenium. Furthermore, the SO_2 containing waste gas from the copper industry is converted into 35 000 t of sulfuric acid which is required for the fertilizer industry.

3.2 Mineral Resources and Supply

The copper ore deposits are located in the Internal Albanides. The ore consists mainly of pyrite and chalcopyrite. With the exception of one deposit, all the mines are located in the north of the country.

Presently the overall mine production might equal 1 million with approx. 1.5 % copper.

The following mines are in operation:

- Fushe Arrez	320 000 tpy
- Reps	300 000 tpy
- Gjegjan	100 000 tpy
- Palaj	80 000 tpy
- Derven	60 000 tpy
- Rehova	60 000 tpy
- Kurbnesh	40 000 tpy
- Golaj	60 000 tpy

Fushe Arrez

3 Mines are in operation in this area.

- Paluca:	Mine production 60 000 t 1.1 - 1.2 % Cu
- Tuc	1.2 - 1.4 % Cu, 5 - 6 % S
- Quaf Bari:	2 % Cu, 30 - 40 % S

The flotation plant of Fushe Arrez produces 25 000 t copper concentrate and 55 000 t of pyrite concentrate, with 45 - 48 % S. The copper concentrate is treated in the copper smelter of Laç and Kukes.

Golaj

Planned capacity: 120 000 tpy of ore

Gjegjan

Some kms east of Kukes. The mine production amounts to 100 000 tpy. The ore is directly treated in the smelter plant.

Palaj

25 kms northeast of Shkoder. Mine production 80 000 tpy.

Spac

20 kms south of Fushe Arrez. 3 mines are in operation in this area:

- Spac 190 000 tpy
- Thira 30 000 tpy
- Luje Reps and Kullaxhi 30 000 tpy

The flotation plant in Reps can treat 300 000 t of ore and produces 23 000 t Cu concentrate with 12.5 % Cu and 30 000 tpy of pyrite concentrate with 45 % S.

13 500 tpy of concentrate are treated in the copper smelter of Lac, the rest is treated in the copper smelter of Rubik.

Kurbnesh

40 000 tpy of ore mined in Perlat are treated in the flotation plant of Kurbnesh. 3 000 tpy of Cu concentrate go to the copper smelter of Laç.

Derven

This flotation plant receives 65 000 tpy of ore from different places. 4 500 tpy of concentrate go to the smelter plant of Laç.

Rehova

This is the only copper mine located in the south of the country. The flotation plant is close to the mine. 60 000 tpy are treated. 4 500 tpy of concentrate are sent to the smelter plant of Laç.

3.3 Production of Copper

In contrast to the chromite ore which is mainly exported, all the copper ore is treated in Albania. The following copper smelters are in operation

- Laç (called "Chemical Combine")
- Rubik
- Kukes

Chemical Combine Lac

The plant is located 35 kms northeast of Tirana. Products of the combine are:

- copper,
- sulfuric acid,
- superphosphate,
- copper sulphate,
- sodiumsilicofluoride,
- nitric acid.

The plant treats 42 000 tpy of copper concentrate with 17 % copper and 14 000 tpy of ore with 2.7 % Cu in blast furnaces (Typ Mamoda) and converters. The production amounts to 7 000 t of blister copper. This quantity is refined to anode quality with another 9 000 t blister coming from Rubik and Kukes. 8 000 t of copper are electrolytically refined. The wirebar production is effected in Rubik. The H_2SO_4 production from the metallurgical gases amounts to 35 000 tpy.

Copper Smelter Kukes

The smelter can treat approx. 150 000 tpy of copper ore and 12 500 tpy of concentrate from Fushe Arrez. The process applied is the same as in Laç. However, the SO_2 is directly emitted into the atmosphere. Blister copper production might be in the range of 4 800 tpy. The raffination of this material takes place in Laç.

Copper Smelter Rubik

The smelter has been in operation since 1937. The capacity of the plant amounts to 60 - 70 000 t of ore. This quantity includes approx. 10 - 15 000 t of concentrate which is agglomerated prior to smelting.

All the installations are completely outdated. The flowsheet consists of smelting in an open water jacket furnace (blast furnace) with an effective surface at the tuyeres of only 3.4 m^2. There are 3 small Peirce Smith converters with a capacity of 3 t each. Blister is sent to Laç and treated in 1 anode furnace with a surface of 4.45 m^2. Smelting of wire bars is effected in the same type of furnace.

The electrolysis has a capacity of 5 000 tpy.

The copper smelter produces several kinds of brass alloys. All the sulphur dioxide is emitted into the atmosphere. In the adjacent areas, there is virtually no vegetation anymore on the surrounding mountains.

4. Other Metallurgical Activities

4.1 Copper wire manufacturing

Copper wire is produced in the wire factory of Skoder in the north of the country. The capacity of the plant amounts to 12 000 tpy of wire, wherefrom 80 % is exported. The following qualities of wire are produced:

- bare wire,
- PVC insulated wire,
- enameled wire,
- different kind of cables.

The main cable products are

- power cable for low tension,
- power cable for high tension, up to 10 kV,
- control cables,
- lift cables,
- welding cables.

Furthermore, cables are produced for urban and interurban telecommunication.

One of the future objectives is to produce very thin cables (up to 0.02 mm) and very fine enameled wire with approx. the same diameter.

Presently, 2 000 t enameled wire, 1 000 t cables, 2 000 t PVC insulated wire, 4 000 t bare wire and 3 500 t Cu rods are produced.

4.2 Metallurgical Activities under Investigation

There are semi-industrial plants for the production of ferrosilicon and aluminium hydroxide. Since they are of very minor importance to the country's economy, this industry remains disregarded in the presented report.

5. Industrial Investment Opportunities in the Metal Sector

According to the work assignment, emphasis is put on very urgent investments or financial needs for streamlining the production in the steel and non-ferrous metals industry.

5.1 Iron and Steel

Technical bottlenecks

a) Refractory material

All the refractory material being used is produced in Elbasan. The required raw material stems from Albanian mines. The main qualities produced are:

- schamotte,
- dolomite,
- magnesite,
- chromium-magnesite-Cr-magnesite,
- olivinite,
- olivinite-chromite,
- olivinite-Cr-magnesite.

The plant's consumption of refractory material is extremely high. In the converters, the refractories have to be replaced after 80 - 90 melting cycles. The material (olivinite stones with bitumen) should last 300 - 400 melting cycles. There are plants known, where the refractory material of the converters endure even 1 000 melting cycles. Presently, the consumption amounts to 56 kg dolomite per ton of steel.

The commom thermic pre-treatment of the refractories at Elbasan consists of burning coke by blowing oxygen into the converter. This procedure leads to a very irregular temperature distribution and temperature gradient in the material.

The limitation of the capacity due to the high maintenance demand and the high material costs call for urgent improvement by introducing a separate thermic pre-treatment process for the refractory material.

b) Metallic losses with slag

The pig iron input per ton of produced steel is uncommonly high. The main loss is due to metallic inclusions of the slag. Presently the pig iron consumption amounts to 1 400 kg per ton of liquid steel.

c) Charge preparation time in electric arc furnace

The long charge preparation time entails an uncommonly high energy consumption which varies presently between 750 and 800 kWh/t. Technical and organisational deficiencies, particularly in the continuous casting operation are causing macroscopic faults of the rolled products.

There are no experiences in ladle (secondary) metallurgy.

5.2 Chromium Industry

Technical bottlenecks

a) Content of fines in the ore

The chromite ore treated in the electrofurnaces should have a grain size between 10 and 80 mm. However, sometimes more than 30 % of the ore consists of friable and dusty material which heavily impedes the furnace operation. As a consequence, the chromium recovery amounts only to 85 %. In contrast to this figure, modern ferrochrome smelters should operate with metal recoveries above 92 %.

For a smooth operation, the introduction of an agglomeration step is necessary. Agglomeration can either be done by briquetting or by pelletizing.

b) Outdated electrical control system

Lifting and submerging of the electrodes can only be effected by interrupting the arc furnace operation. This is due to the lack of modern control systems.

c) Metal losses with slag

Presently the slag from the arc furnaces is dumped without further treatment, although 3 - 4 % of the ferrochrome production is lost with the slag. Slag treatment as applied in other Western plants would remarkably increase the metal recovery in the ferrochrome plants of Elbasan and Burell.

d) Lacking granulometric classification

The ferrochrome produced in both plants is crushed and exported in pieces of 15 - 150 mm. However, this granulometry does not comply with the needs of many costumers, who prefer fractions between 20 - 40 mm. Therefore, a mechanical classification process for both plants has to be added in order to improve the marketability of the product.

5.3 Nickel Iron Industry

Technical bottlenecks

a) Nicaro plant

There are numerous deficiencies causing the low metal recovery of only 54 %. However, the main reason for the low yield is the completely inadequate and overloaded dedusting system. In addition, the plant availability amounts to 60 %, only. Technical discussions with Western and Chinese companies are underway for a rehabilitation of the plant.

The quality of production is furthermore impeded by lacking possibilities in controlling the mass flow and the chemical data of the input and output material. A quick mass control and faster chemical analyses are prerequisites for a better control of the entire process. In addition, informatization and computerization would be very helpful in improving the present situation. This is also true in respect to preventive maintenance, stockkeeping of spare parts and economical calculations of all kinds.

b) Nickel-Cobalt plant

Although the plant is brandnew, a major bottleneck has to be eliminated in order to reach a normal production:

Up to now, the slimes from the Ni-electrolysis cannot be treated due to a lack of appropriate and economical technology. As a consequence, this valuable material has to be stocked outside the plant. If full production with 3 000 tpy of electrolytic nickel is reached, 400 t of anode slimes have to be deposited containing 35 % Ni and 1 % Co.

In order to avoid this high metal stock in the nickel plant, an economical process for the extraction of Ni and Co from the slimes has soonest to be implemented.

5.4 Copper Industry

Technical bottlenecks

a) Zinc losses

The copper ores which are mined contain in general between 0.4 and 0.8 % Zn.

The process applied in the smelters does not allow any recovery of this metal which is distributed in products as slag, blister and dust.

The only possibility recovering zinc from the ore would be the implementation of a selective flotation resulting in the production of copper, zinc and pyrite concentrate.

b) Low quality of refined copper

The electrolytically refined copper is of 99.95 grade and does not meet the requirements of the LME (99.99 % Cu). The insufficient purity entails financial losses when selling the so-called electrolytic copper on the world market. Continuous casting and wire production are only meaningful and profitable using electrolytic copper of standard quality. Therefore, the improvement of the performance of the electrolysis is indispensable.

c) Inadequate laboratory equipment

The equipment of the chemical laboratory is completely outdated and inadequate for monitoring the metal recovery of the whole plant, especially the recoveries of gold, silver and platin metals. Precious metals analyses are still done by cupellation. All standard analyzers as atomic adsorption instruments, X-ray fluorescrence analyzers are not available. Accurate analytical control is urgently required for surveying and improving the metal recovery.

d) Cu-losses in the electric arc furnace in Laç

The slag produced in the converters of Laç is submitted to a settling and purification process in an electric arc furnace. The copper recovery of this electrosmelting process amounts only to 85 %. There is no possibility to optimize the process under laboratory scale conditions. Such equipment belongs to standard installations of modern metallurgical laboratories.

5.5 Copper wire industry

Technical bottlenecks

It is planned to produce very thin wire instead of manufacturing bare wires and copper rods. This change in production will improve the profitibility of the plant's operation. (The price for very thin wire is presently approx. 12 000 US-$ per t at a LME price of 2 300 US-$ per t of copper).

Negotiations with a Western company are underway for the construction of a continuous casting plant.

Competitiveness should also be reached especially in the production of telecommunication cables, coaxial cables and cables for high voltage insulated by plastic and metallic materials.

As the plant does not import wire bars, it is completely dependent on the quality of the copper produced in the Albanian facilities. As already mentioned, the quality of the electrolytic copper is not sufficient in respect to international competition. In addition, the control of the chemical composition of the products is very poor. There is no possibility of determining for example oxygen in the copper. The same applies for selenium which affects several properties of the copper. Last not least, the wire factory does not have any metallographic equipment and express analyzer.

6. Recommendations for future assistance of UNIDO/UNDP

6.1 Steel Industry

Close contacts with modern steel plants should be established as soon as possible, either by calling in consultants or by training Albanian specialists abroad. The objective of consultancies or training should be:

- Improvement of refractory material by a controlled thermic treatment.
- Verification of bricklining concept in oxygen converters.
- Application of modern hot repair processes as gunning.
- Automation of the converter process.
- Application of ladle metallurgy (secondary metallurgy) in the fields of desoxidation, desulfurization, refining, vacuum treatment, reheating.
- Quality aspects in continuous casting.
- Increase of productiveness in the electric arc furnaces.

6.2 Ferrochrome Industry

The elimination of problems encountered in the electric arc furnace operation by the high percentage of fine grained ore would be the key for an improved chromium recovery.

As UNIDO has already a pipeline project on briquetting of Albanian chromite ores, it is suggested that activities are focussed on this urgent matter.

Briquetting of the fine chromite ores would have definite advantages as

- the briquetting process has absolute control over the size of the agglomerate,
- the size of briquettes can be easily changed to suit furnace resistance requirements,
- mixed size of briquettes can be manufactured to optimise furnace operation.

A further increase of recovery could be obtained by the application of a heavy media suspension process for rich slags as it is done at "Ferroalloys" in Greece. At a production rate of 45 000 t, 3 000 t of FeCr are there recovered by the above mentioned process. Albanian specialists should, therefore, contact this company or be trained in this Greek plant, if possible.

6.3 Nickel Iron Industry

a) Nicaro plant

The plant needs urgently rehabilitation. According to the information of the Albanian experts, reconstruction of this plant will be done in the foreseeable future. In the meantime, the preventive maintenance of this plant should be organized in such a way, that statistical data are prepared about the lifetime of equipment, durablity of spare parts, etc. All these data should be memorized in a computer system.

Furthermore, informatization and computerization should also be introduced for controlling all relevant data of the raw material and the final product.

b) Ni-Co-plant

The nickel electrolysis went on stream in 1989. The plant suffers also from the inadequate qualification of electricians who have to maintain the electronic measuring and logic systems. Most of the electronic equipment is from a Western company. In the meantime, it became evident that the training period of the Albanian personnel was too short.

In order to avoid further damages of the equipment it is recommended to send one electrical engineer for a sufficient period of time for further training to abroad.

c) Nickel electrolysis

The flowsheet of the whole process seems to be very questionable to the opinion of the undersigned. Instead of continuing the Nicaro process by solubilizing the basic nickel carbonate in sulfuric acid and performing an electrowinning process, the nickel carbonate is pyrometallurgically reduced, cast in anodes and submitted to an electrolysis with soluble anodes. This process is very costly. Furthermore, the problem of the slime treatment is still unsolved. It is, therefore, recommended to consult, if possible, specialists from Sherrit Gordon (Canada) or Outokompu (Finland), who were not involved in the engineering of this plant.

6.4 Copper Industry

a) Ore beneficiation

New geological investigations revealed important copper sulphide deposits with zinc contents of up to 0.8 %. Flotation tests on borehole samples resulted in the production of concentrates containing for example 8 - 10 % Zn, 38 % S and 20 % Cu.

Applying the pyrometallurgical flowsheet of Lac, Rubik and Kukes, the Zn content of the concentrate would be completely lost.

It is recommended to start with R&D work on selective flotation.

b) Pyrometallurgy

The electrosmelting of the converter slags leads to unacceptably high copper losses. Before starting with research work on the optimization of the metallurgical conditions of this process, close technical contacts should be established to Finnish and/or Canadian specialists.

c) Electrolysis

All efforts in this field must be directed towards the fulfillment of the LME quality requirements for electrolytic copper.

The plant must, therefore, have the required laboratory equipment for simulating electrolytic processes, as for example a galvanostate, potentiostate, thermostate, pumps, electric measuring and monitoring devices etc. Such equipment is easily available in FRG or other countries.

d) Laboratories

Up to now, all 3 copper smelters are working without express analysers. Such automates could very quickly determine the composition of blister, anodes and cathodes. Contents of arsenic and oxygen are still determined visually by comparison with standard probes. As already mentioned, the determination of precious metals is only effected by cupellation.

The situation in the laboratories must urgently be improved, at least by purchasing emission spectrographs and atomic adsorption instruments.

e) Concentration of copper production

The old copper smelters of Kukes and Rubik are so outdated and so polluting that these plants should be closed as soon as possible.

The concentration of the copper production at only one location, eventually by applying modern smelting technology (for example Outokumpu, KHD-Contop or similar processes) requires careful investigations and feasibility studies.

The introduction of Albanian economists to COMFAR would certainly be of great help in this context.

6.5 Copper wire production

The deplorable conditions of the outdated laboratories must be overcome by purchasing an express analyzer and appropriate equipment for the oxygen and selenium determination.

It is also suggested that the specialist, who should supervise in the future the production of telecommunication cables and other hightech products will be trained in a Western company, for example at SAT (France) or Kabelmetall (FRG), if possible.

7. Conclusion

The metallurgical industry of Albania failed to keep pace with its Western competitors. In general, the state of the art of the technical equipment lags far behind Western standards and is outdated.

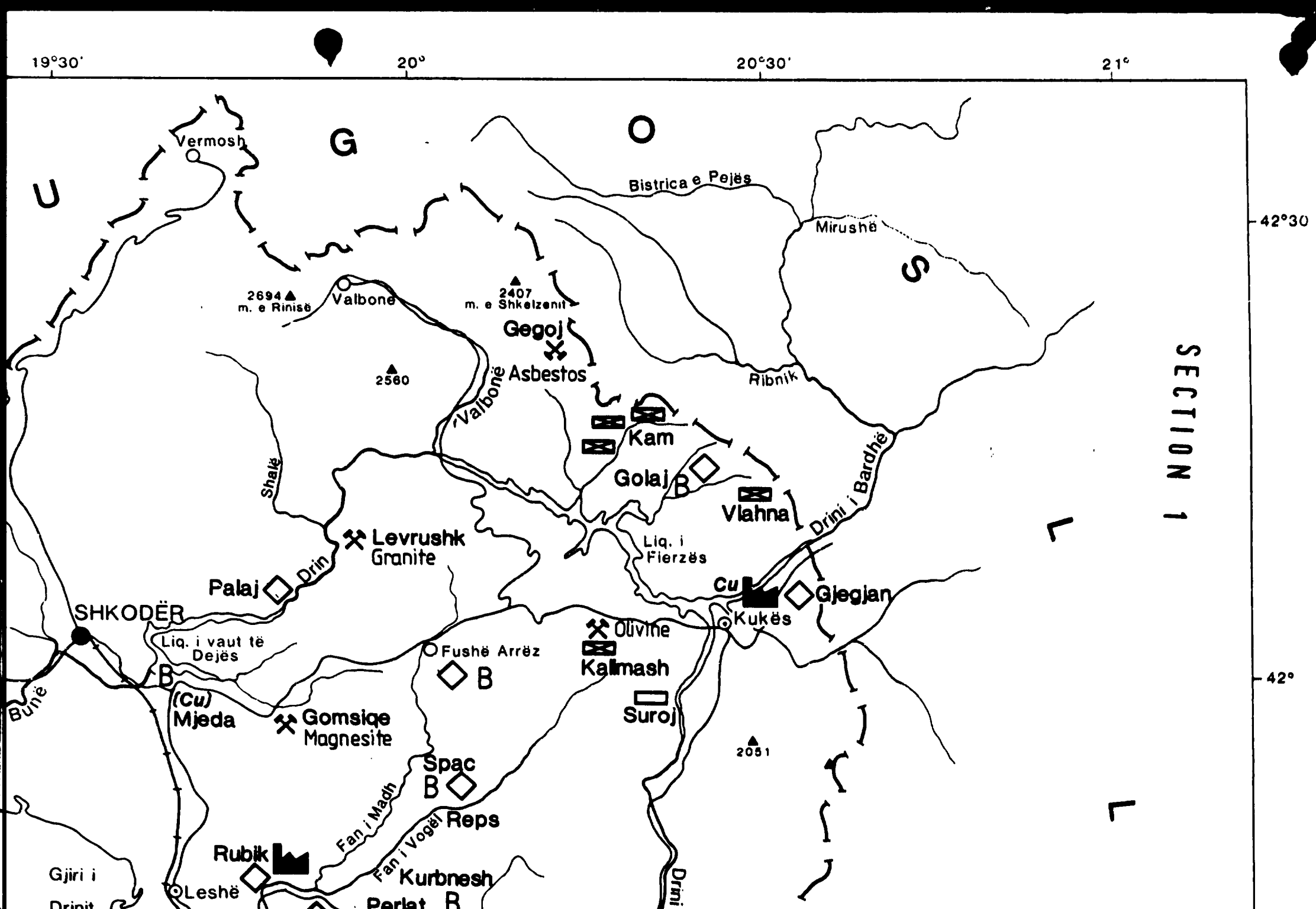
The small country must, however, increase the import of modern machinery in order to improve the effectiveness of its industrial establishments and to bring them up to world standard.

In contrast to the deplorable lack of modern technology, the management of the metallurgical industry is very devoted to work, motivated and open minded. Most of the experts speak at least one European foreign language, some of them speak also Chinese or Korean.

The conditions regarding the human resources in Albania have to be judged as ideal for overcoming the prevailing situation. Therefore, UNIDO/UNDP assistance should support any improvement of qualification of Albanian experts by training and/or consultancies. Moreover, UNIDO/UNDP could help immediately by selecting/purchasing appropriate equipment for the quality control of the metallurgical industry.

Dr.-Ing. Christian Beinhoff

Tirana, February 1990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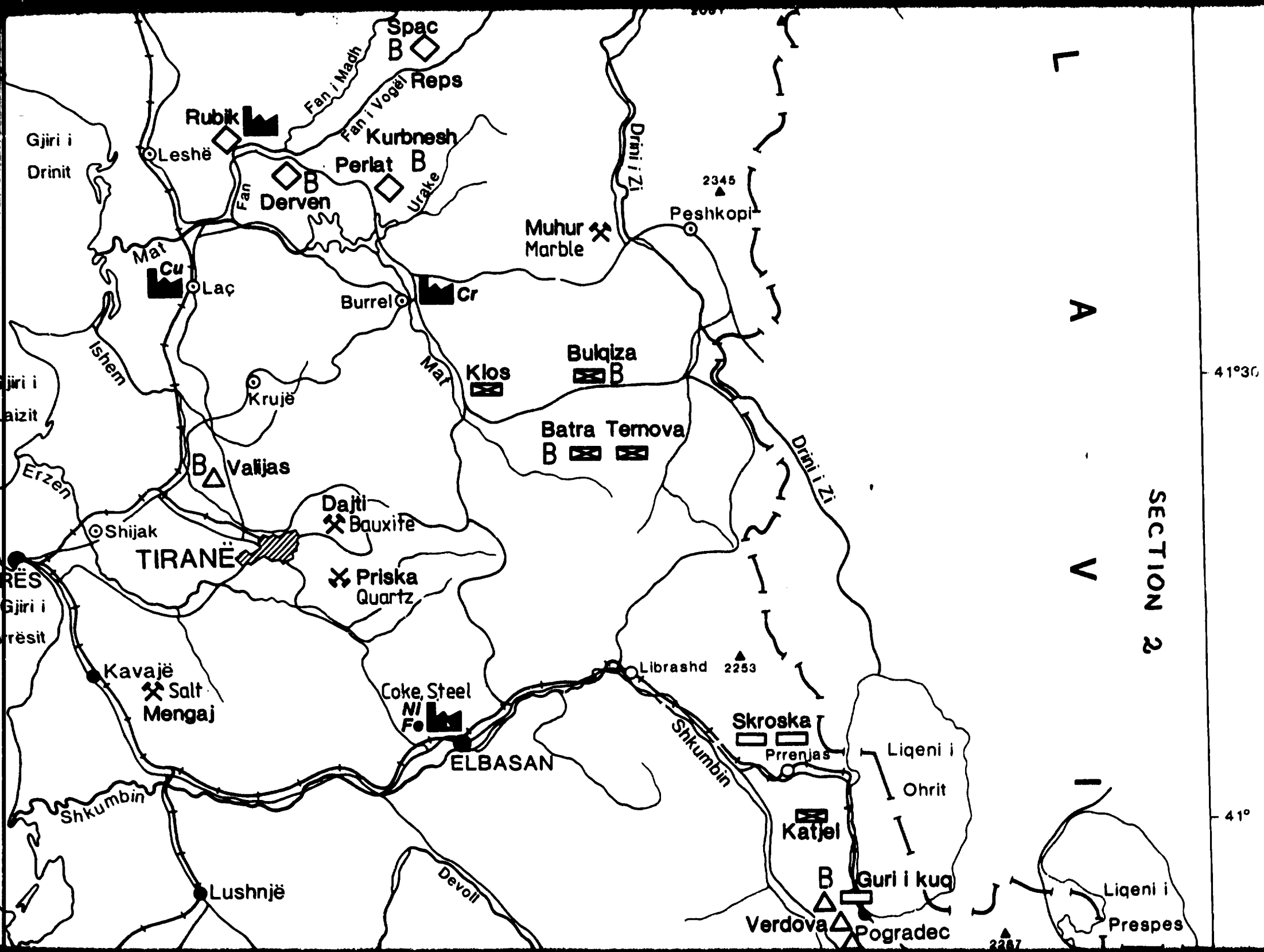
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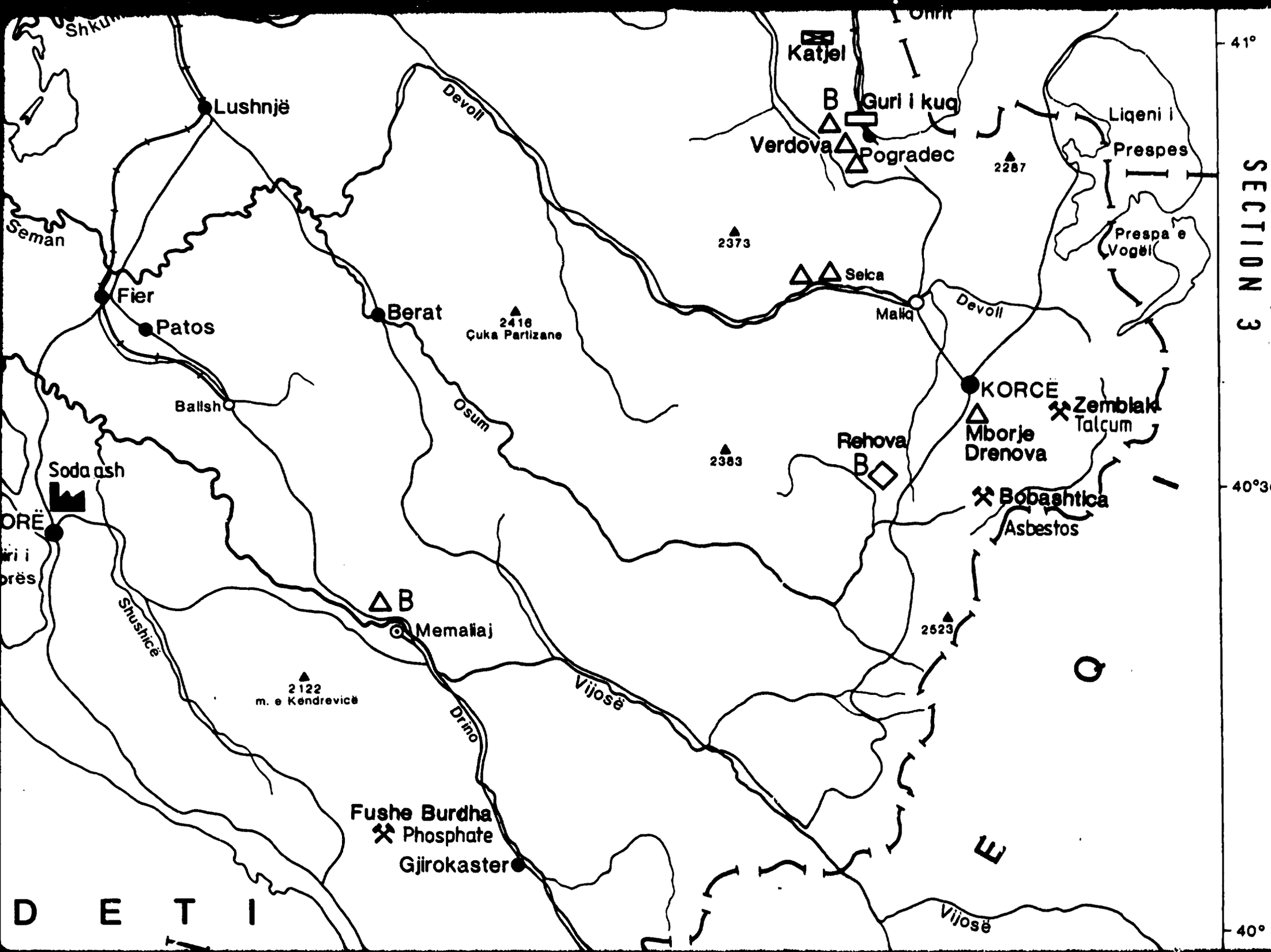
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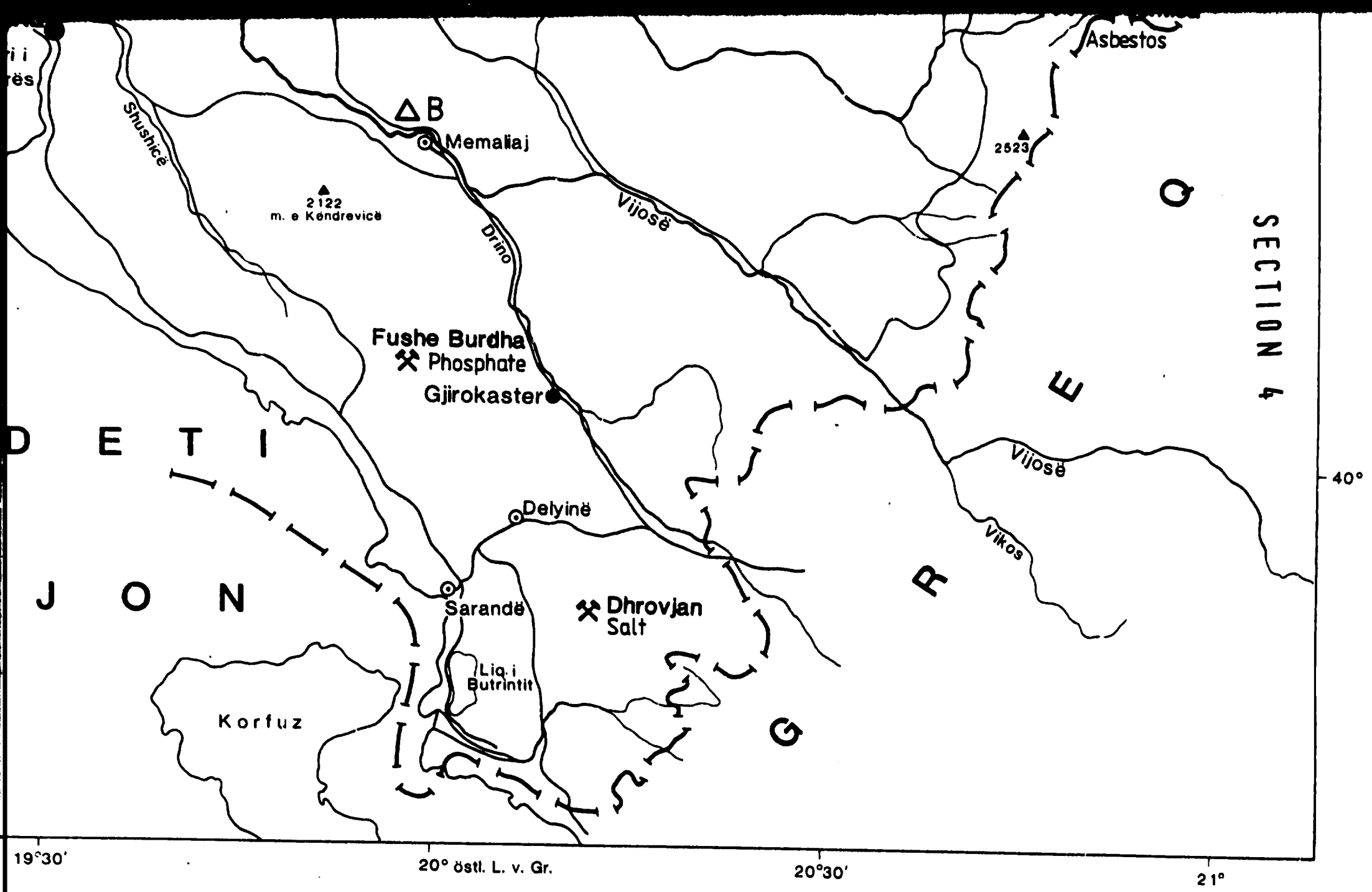
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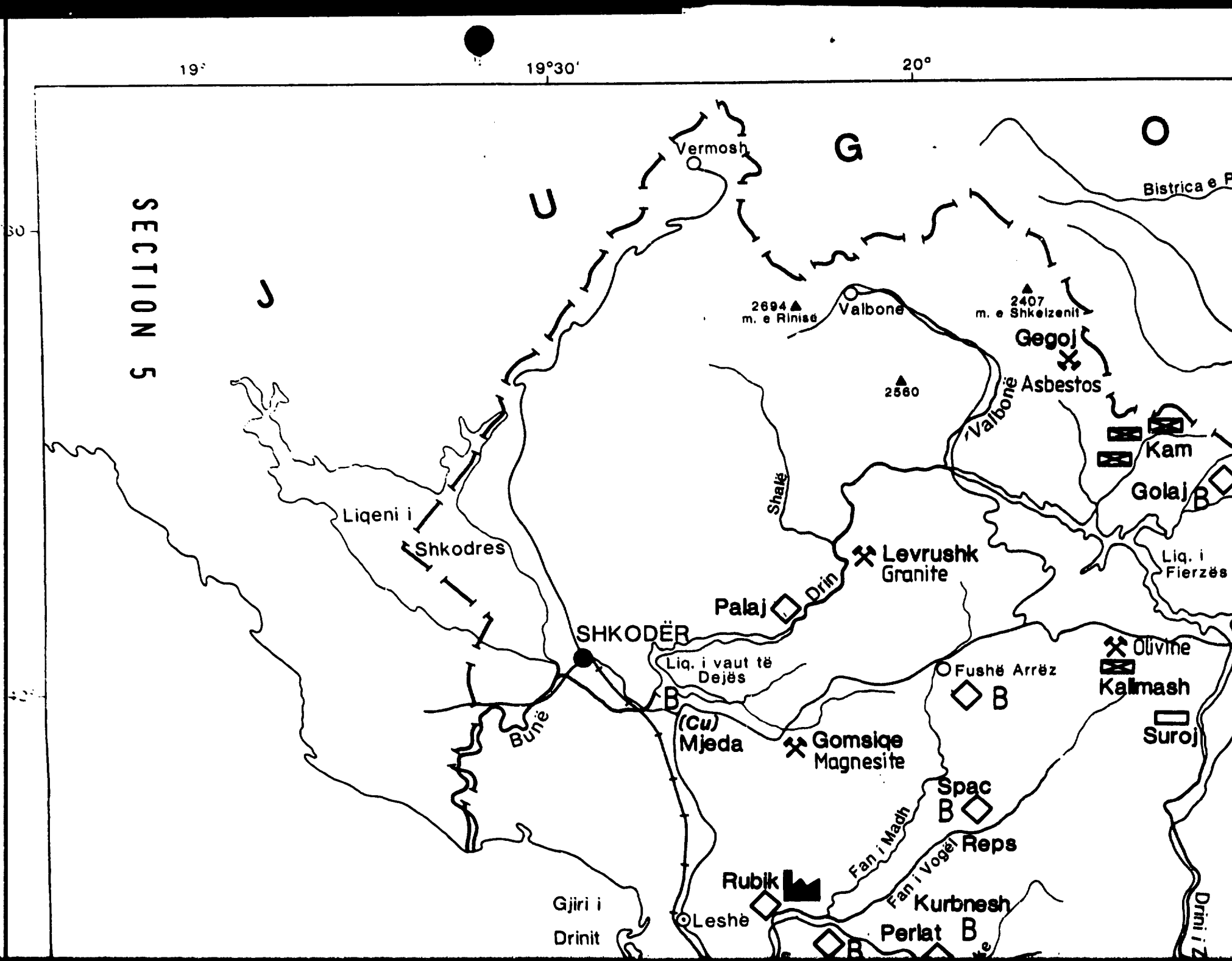
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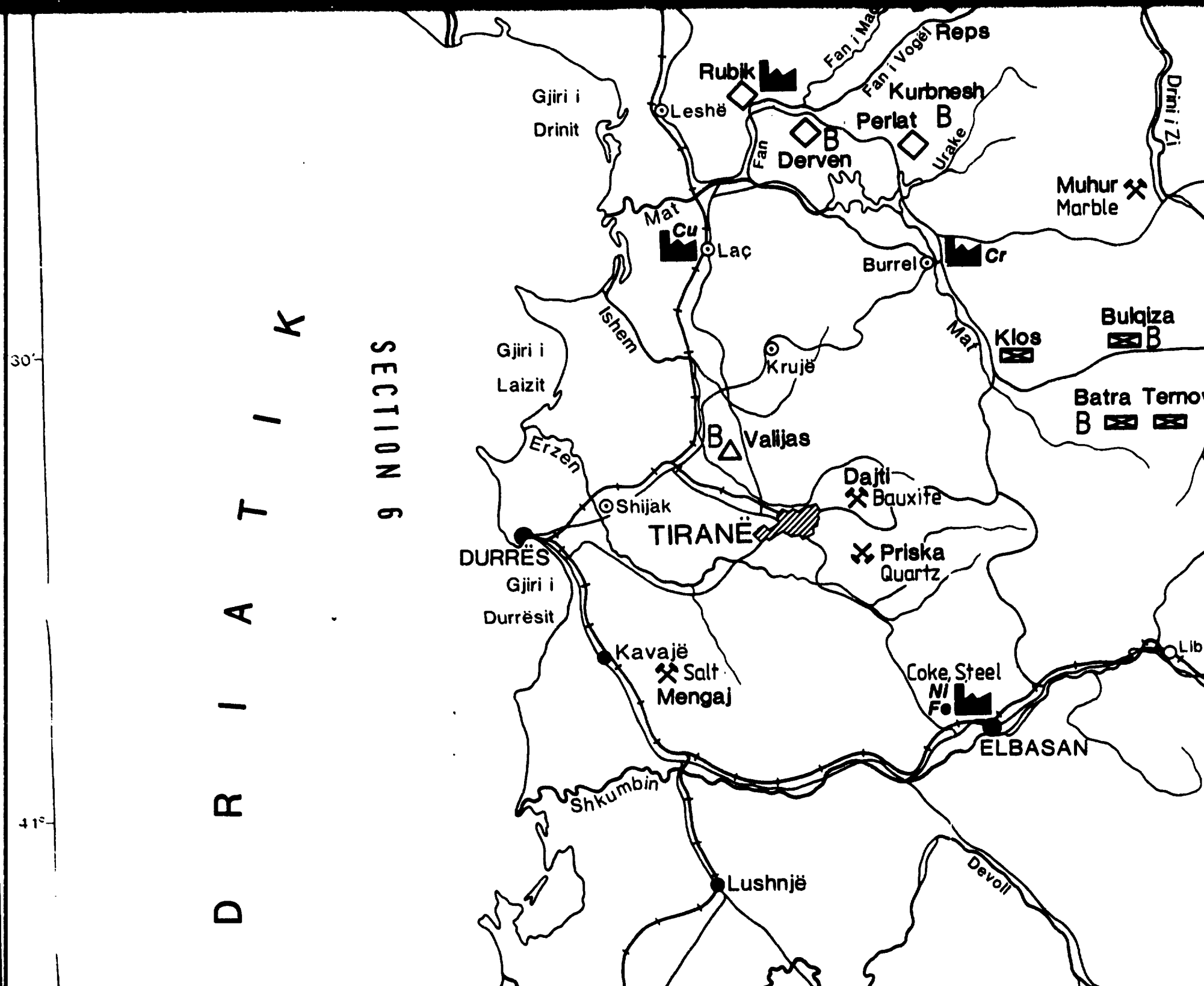
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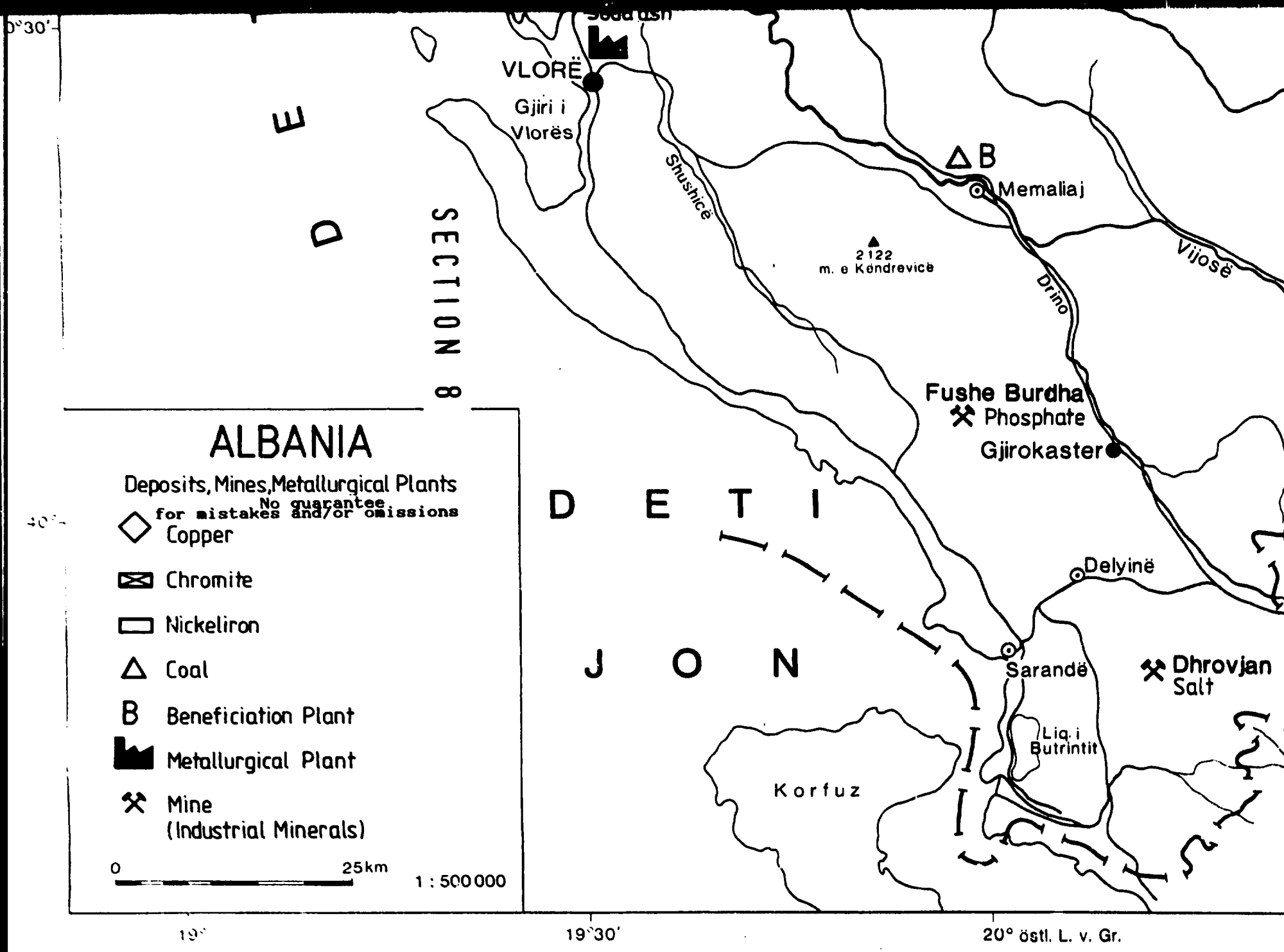
Gjirokaster
ALBANIA
Deposits, Mines, Metallurgical Plants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