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E.C.F. Genève 1954

Chapter 7

MINING

1. DEVELOPMENT IN THE PAST

Over the last hundred years or so, two phases of increasing mining activity in southern Europe can be distinguished. The first was dominated by private—mainly foreign—initiative and was in the nature of a faint and flickering reflection of industrial expansion in other parts of Europe. The second was characterized by a stronger element of State direction and by at least some attempts to integrate mining with other aspects of national economic development. But, in spite of some increase, the importance of mining in terms of employment remains rather limited in the southern European countries except Yugoslavia (Table 1).

Table 1

EMPLOYMENT IN MINING

Country	Year	Active males in mining as percentage of	
		Total active male population	Total active male population engaged in non-agricultural activities
Turkey	1945	0.6	2.0
Greece ^a	1950 ³	1.2	1.0
Yugoslavia ^a	1948-53	2.73	7.96.5
Italy	1936	1.0	1.9
Southern Italy	1936	1.1	2.6
Spain	1950	1.9	4.0
Portugal	1950	0.9	2.1
Western Europe ^a	1950	3.6	4.5
United States	1950	2.4	2.8

^a Average for twelve western European countries. The data relates to 1950 or nearest available year.

The First Wave of Mining Enterprise

In countries where economic life is generally stagnant, the lack of internal markets, defects in the transport and energy systems, as well as the scarcity of capital and entrepreneurship, all tend to restrict the opportunities for mining enterprise to particular instances of easily accessible resources which promise relatively quick profits—in particular for those exploited in response to foreign demand. This kind of mining development, which, broadly, was characteristic of southern Europe up to the first World War,

was largely based on foreign capital, both because it depended primarily on foreign markets and because—partly for the same reason—it required particularly risk-willing capital which was not likely to come forth from internal sources. The following paragraphs give a brief description, for each of the southern countries, of this period of mining exploitation.

Towards the end of the nineteenth century, Turkey enjoyed a position of near-monopoly in chrome, and production for export was rapidly developed by foreign capital. But the market situation was subsequently influenced by discoveries elsewhere and a decline set in after 1901. In copper, lead and manganese, also, an early start was made by foreign investors, but in all three cases the peak was reached in the years between 1900 and 1905. Turkey, incidentally, provides one of the rare cases where foreign capital also found it profitable to develop coal mining—again, largely for export.

In Greece, iron ore was extracted at an annual rate of about half a million tons in the decade preceding the first World War. But since then production has been much lower. Mining of manganese ore, zinc, and especially lead, was of some importance, but in all these cases the peak was passed before 1914. Two rare products found in Greece are emery (in the Isle of Naxos, under communal ownership) and magnesite (under British control). In both cases the level of output has been fairly well maintained, but neither of them is a first-order contribution to Greek income or exports. In the inter-war period, export demand led to the exploitation of several other mineral deposits, including chrome, nickel, bauxite and iron pyrites.

Although the substrata of Yugoslavia are unusually rich in minerals, a modern mining industry had scarcely started before the first World War. Between the wars, a rapid development took place, with foreign capital concentrating on the more profitable export sectors and coal and iron ore production developing largely under State ownership. Before the second World War, the share of foreign capital in metal-ore mining (measured by the value of output) was as much as nine-tenths. In general, the ores were exported

Sources: National censuses. Distribution between males and females estimated on the basis of earlier censuses.

as such while Yugoslavia had to import metals for its own requirements. In the 'thirties, some measures were taken to change this situation, for instance by compelling the French and British interests, exploiting respectively copper and lead, to build up smelting capacity within the country.

Sicilian sulphur is prominent among *southern Italian* mineral products. Its history has been marked, to an exceptional degree, by the vicissitudes of foreign demand and technological change.¹ At the beginning of the nineteenth century, when world demand for sulphuric acid became important, Sicily was practically the only known source for the raw material. But the high price which the monopoly made it possible to charge caused the competing process of sulphuric acid production from pyrites to be developed. In the second half of the century, Sicilian sulphur output recovered from this first crisis under the impact of a new demand for sulphur for vines. But, again, the price policy of the Anglo-Sicilian sulphur cartel encouraged massive investment in the United States for the development of the competing Frasch method of sulphur extraction. When United States production started on a large scale in the early twentieth century, Sicilian sulphur mining entered an era of decline which,

¹ See a forthcoming book by C. Rodano, *La questione del Mezzogiorno*.

Rodano,

except for sporadic revivals in times of scarcity, has lasted until the present time.

Extraction of metal ores in Sardinia remained insignificant until the middle of the nineteenth century, when, partly because of the exhaustion of central European mines, foreign demand for Italian lead became important. At this stage a considerable proportion of Sardinian mining was in the hands of foreign companies and all the output was exported as crude ore. Not before the nineteen-thirties was sufficient smelting capacity for lead built in Sardinia, and zinc has still to be sent to the Italian mainland as crude ore.

Spanish iron ore, of excellent grade and situated very favourably on the Biscayan coast, was early exploited with the participation of British capital. Production, almost all of which was exported as ore, rose steadily to a peak of 9 million tons in the period 1910 to 1914, but subsequently declined steeply mainly through exhaustion of the more easily exploitable of the known deposits. Now that the Spanish steel industry is growing, it is seriously handicapped by the fact that the best mines have been exhausted. Similarly, the easiest and richest deposits of copper, lead, zinc and tin were exploited at an early stage for the most part with foreign, especially British, capital, and for each of them the peak output was reached

Table 2
MINING PRODUCTION IN SOUTHERN EUROPEAN COUNTRIES
1928-34 = 100

Index numbers —

Period	TURKEY		GREECE		YUGOSLAVIA		SOUTHERN ITALY		SPAIN		PORTUGAL	
	Coal mining	Other mining	Coal mining	Other mining	Coal mining	Other mining	Coal mining	Other mining	Coal mining	Other mining	Coal mining	Other mining
1901-06	30	145	..	78 ^a	..	..	..	..	44	151	..	..
1907-13	50	113	..	251 ^b	..	..	62 ^c	119 ^c	58	164	..	..
1914-20	28	26	109	110	49 ^d	9 ^d	247	79	80	108	..	..
1921-27	50	58	116	109	79	32	162	86	88	105	73 ^e	82 ^e
1928-34	100	100	100	100	100	100	100	100	100	100	100	100
1935-39	150	308	77 ^f	156 ^f	102 ^f	188 ^f	967	114	74	64	128	194
1940-45	201	230	..	..	..	..	220	77	147	47	220	205
1946	243	216 ^g	103	20 ^h	140 ⁱ	159 ⁱ	2 600	48	166	54	204	96
1947	255	276	109	27 ^h	193	207	3 200	76	163	49	194	192
1948	263	423	99	24	217	246	2 200	91	164	57	202	234
1949	277	564	144	27 ^h	247	277	2 500	97	167	62	231	254
1950	287	560	148	5 ^h	257	300	2 400	117	171	72	216	245
1951	310	751	157	104 ^h	240	301	2 700	135	178	83	214	349
1952	..	..	206	176 ^h	261	324	2 500	146	..	..	224	368

Sources and methods: See Appendix B.

NOTE. — The series for coal mining cover hard-coal and lignite production. The series for other mining cover the following minerals: Turkey: Chrome ore, lead-zinc ore, ~~mercury ore~~, antimony ore, copper ore. Greece: Magnesite, iron ore, iron pyrites, lead ore, zinc ore, chrome ore, bauxite. Yugoslavia: Lead-zinc ore, copper ore, iron ore, chrome ore, bauxite, iron pyrites, antimony ore. Southern Italy: Sulphur, lead ore, zinc ore, bauxite. Spain: Copper and iron pyrites, iron ore, zinc ore, lead

ore, mercury ore, sulphur, manganese ore, tin ore, tungsten ore. Portugal: Copper pyrites, tin ore, tungsten ore.

The horizontal line indicates a break in the series.

^a 1900-09. ^b 1910-13. ^c 1911-13. ^d 1919-20. ^e 1922-27. ^f 1935-38.

^g Including iron ore from 1946 onwards.

^h Excluding lead ore and zinc ore from 1946 onwards.

ⁱ From 1946 onwards the series refer to present frontiers.

manganese ore

The data are adequate to indicate general trends only in particular, no corrections have been made for changes in territory.

before the first World War. On the other hand, Spanish coal production developed slowly, and Spain was until recently a heavy importer of coal.

Portugal, like Yugoslavia, had no important mining activity before the first war. In the inter-war period, British capital developed the mining of wolfram, of which Portugal has some of the very rare known workable deposits, and of tin and copper. Pyrites were extracted by British and Belgian firms which also—rather an exceptional case in southern Europe—built capacity for processing a part of the product within the country. On the other hand, mining of the rich iron-ore reserves of Portugal has not yet begun, although a concession was given to a French firm in the early 'twenties. Sulphur deposits have been worked to meet the needs of the vineyards for many years.

The developments described so far cover roughly the time up to the first World War and, in some respects, the inter-war period also. There are striking similarities in all six countries. The initiative for mining activity came in the vast majority of cases from foreign capital, and the tendency was to exploit the immediately profitable opportunities offered by already known (or suspected) deposits. Moreover, production was usually started to meet acute foreign demand and, as production facilities were developed elsewhere, the particularly favourable prices at first enjoyed frequently proved to be only temporary. Thus, in surprisingly many cases (especially in Turkey, Greece, Sicily and Spain) the zenith of production was passed during the first two decades of this century. (See Table 2). Finally, the ore was almost invariably exported in its crude form or as metal; only in a very few cases was capacity built up for further processing.

This picture of a more or less rapid increase followed by decline is, perhaps, not peculiar to southern Europe. It is found in other countries, too, and indeed this production curve may be said to be in the very nature of mining, consisting as it does in the depletion of a given reserve which, in the short run, means reserves within reach of the country's transport system and technical capacity. What seems to be peculiar to southern Europe, and to other countries producing mainly for export, is the shortness of the cycle of growth and decay.

Recent Policies for the Development of Mining

In more recent years, all southern European countries have taken steps—more or less far-reaching—to promote the general development of their economies. In these circumstances, mining has been regarded not as an easy venture for quick returns, but as an integral

part of an economic structure to be purposively built up.

While Government intervention was not wholly absent in any of the countries, by far the most comprehensive measures were taken in Turkey and Yugoslavia. In 1937, the Turkish Government greatly increased direct state participation in mining (as well as in other basic sectors of the economy). Very large investments were made, especially in coal and iron ore mining/as well as copper and chrome, and spectacular increases in production resulted. More recently, government enterprise in mining has been more limited and in the next few years a decline in government investment is envisaged.

In Yugoslavia, as already mentioned, those fields of mining (coal, iron ore and oil) which were needed as a basis for Yugoslav industry and did not attract foreign capital were in the inter-war period developed under *régie fiscale*. Since the war, with socialization of practically all mining, there has been heavy investment/especially in coal and lignite, petroleum and gas, bauxite, iron ore, chrome and some other non-ferrous metals, and in several cases production is already much greater than before the war.

In Greece, an active mining policy has been adopted only very recently. The Government envisages an increase in mining production—in particular, of lignite and iron ore—of 180 per cent in the period from 1951 to 1954/55. This is to be secured through public credit facilities—and possibly fiscal incentives—to private undertakings. Furthermore, the plans include the building up by the State or with State aid of industries using Greek minerals.

In Spain, Government intervention is mainly concentrated on expansion of lignite production by the provision of finance through the State holding company INI.

In Portugal, as in Greece, State intervention has been limited. So far, it has not gone beyond mining research, which has resulted, however, in the discovery of rich iron-ore deposits. The recent six-year plan envisages the building up of a steel industry, drawing its supplies from these deposits. Thus, Portugal is no longer an exception to the general trend away from mining for export and towards mining for the supply of home industries.

In southern Italy, the mining of strategic metals and of Sardinian coal was developed and carried out at the time of the inter-war "autarky drive", and some State enterprises were organized which still exist. Sardinian coal production was particularly responsive to this combination of public investment and expanding demand and further investment is now envisaged.

The depressed condition of sulphur mining has called for repeated State support in recent decades. In 1940, a special public agency was set up to replace the cartel and to channel State assistance to the industry.

These few examples may suffice to indicate the extent and the forms of the new wave of mining activity in southern Europe in the last quarter-century. In some cases, new enterprises arose spontaneously as a result of new demand from local industries. But far more frequent and important are the cases where Governments undertook—although by widely differing methods—to develop mining. In this process, the stress has been almost invariably placed on mining to supply home industry and particular efforts have been made to improve the home supply of fuel and of iron ore.

The reasons for these more recent trends towards increased activity by the State and increased emphasis on mineral production for home use will be further considered in the following sections of this chapter. First, however, it may be stressed that, in their endeavours to promote development of their mineral resources, the southern European countries have had to face the handicap of being late-comers, in addition to their general problems of capital shortage and weak internal demand. Even with regard to their own domestic consumption, not to speak of foreign

demand, it is often cheaper to supply marginal increments through imports from well established and highly developed producers abroad than to produce them locally. Such considerations are likely to be in private investment decisive for and it is understandable both that private venture capital concentrates on such limited possibilities as there may be for relatively quick and high returns, and that foreign capital in particular should gauge these possibilities mainly in relation to competitive conditions in the world market.

But in any policy for the general development of mining, it makes little sense to think only in terms of marginal expansion or of isolated projects. When expansion can only come through research and investment, both for new deposits and for new methods of extraction and utilization, changes cannot but be discontinuous. And when economies are generally backward, the calculation must allow for some development of consuming industries, transportation facilities, and housing and other social investments before "external economies", like those already existing in more advanced communities, will help to make individual projects profitable. In these conditions, private enterprise is more likely to respond to a broad initiative under public sponsorship than to take the lead in a task for which it is unlikely to have either sufficient capital or a sufficiently long perspective.

2. DISCOVERY OF MINERAL RESOURCES

The State of Mining Research

Present inventories of mineral reserves must be looked at with a critical eye. They provide at best a rough indication of reserves discovered so far, and for even a rough appraisal of their significance it is necessary to know the extent and intensity of research lying behind the evaluation/

There are good reasons to be particularly sceptical of the inventories of resources in southern Europe, since in all these countries research lags considerably behind the standard reached in western Europe. Even such a basic prerequisite for geological prospecting proper as topographical maps of reasonable scale is lacking. It can be seen from the list below (Table 3) that the southern European countries which can turn to a 1 : 25,000 map covering most of the country are, comparatively, very fortunate. Even in Italy there are a number of regions where direct topographical mapping at 1 : 25,000 has not yet been completed. With regard to geological maps proper, the situation is strikingly bad. For Turkey, a geological map covering the whole country has been made on the scale of 1 : 800,000 only. In Portugal, the scale of the

major geological map so far available is 1 : 500,000, and it dates back to 1899. Stratigraphical oil prospecting is wholly or almost wholly absent in all the southern European countries, with the exception of Italy,¹ and, quite recently, Yugoslavia. In the latter country a good start was made by the Germans during the occupation, and since the war the Government has extended this work to other regions. But much remains to be done before even the more interesting zones are surveyed. In particular, the very promising Montenegrin coastal region (both inland and offshore) has hardly been touched.

While the position in the basic work of topographical and geological mapping can be given in quantitative terms, it is more difficult to assess the state of mineral research and exploration in general. It is, however, possible to point to some cases where further research may have far-reaching effects. For instance, in Italy, scientific research has recently led to new hypotheses on the formation of sulphur deposits,

¹ In the southern part of Italy, however, only Sicily can be considered to be at an advanced stage of stratigraphical prospecting.

Table 3

TOPOGRAPHICAL AND GEOLOGICAL MAPS AVAILABLE FOR SOUTHERN EUROPEAN COUNTRIES

Country	TOPOGRAPHICAL		GEOLOGICAL	
	Principal	Additional	Principal	Additional
Turkey	1 : 200,000	1 : 25,000 for one-fifth of country. Scattered areas of specific military or mining importance.	1 : 800,000	1 : 100,000 : Three-fifths of country to be completed by 1955/56.
Greece	Scales between 1 : 100,000 and 1 : 200,000.	1 : 20,000 in certain regions.	1 : 500,000	1 : 50,000. 12 sheets covering one-fifth of country.
Yugoslavia	1 : 100,000 and 1 : 50,000, both in course of publication.		1 : 100,000 and 1 : 75,000, started 1931.	
Southern Italy	1 : 50,000 for most of area.	1 : 25,000 for certain regions, including Sicily.	1 : 50,000 (1861) (not complete, 2nd ed. (1931-)).	1 : 25,000; work begun. Also 1 : 5,000, 1 : 10,000 for selected areas.
Spain	1 : 50,000, not complete. Elsewhere 1 : 200,000 or 1 : 100,000.		1 : 100,000	1 : 50,000 started.
Portugal	1 : 25,000 Central region. 1 : 50,000 Remainder.		1 : 500,000 (1889)	1 : 50,000 : Lisbon region (1950), Santarem (1953). 1 : 20,000 Lisbon District (1940).

Sources : Information supplied by Governments.

which would seem to provide new hints for the discovery of virgin deposits, in place of the empirical (and generally unsuccessful) method of digging holes around the old deposits. It also appears likely that explorations already in progress will in a not too distant future clear up the question of availabilities of hydrocarbons¹ and geothermic energy in southern Italy. On the other hand, no real start seems to have been made with exploration of the iron-ore reserves suspected to exist in Calabria.

The figures in Table 4 for reserves as at present assessed should be read with due regard to the deficiencies in research and prospecting described above. In recent years very important new discoveries have been made, such as the hydrocarbons in Yugoslavia or the iron ore of Moncorvo in Portugal, and from Turkey there are frequent reports about the discovery of additional deposits of ores or coal.

¹ Important oil discoveries were made in Sicily in October 1953.

With intensified and modernized research there is every reason to expect revolutionary changes in the estimated resources.²

The Need for Co-ordinated Research

The previous discussion suggests that the foremost requirement for progress in the field of mining in southern Europe is intensified search for mineral

² Even if geological knowledge could be assumed to be complete and reliable, the inventory of economically significant reserves remains highly uncertain. Examples are abundant of technical changes making exploitation possible where hitherto it had been assumed to be uneconomic. With regard to southern Europe, lignite is a particularly striking example. By drying, compressing or sorting the "tout venant", lignite can be made valuable enough per kg. to pay for its transport; or it can be transformed into thermo-electric power at or near the pithead (as in the new big Ptolemais scheme in Greece); or, finally, it can be used as raw material for chemical industries near the pithead. Some lignite deposits used to be considered as poor because of a high sulphur content, until it was recently found that the sulphur can be extracted from them. This may be of particular significance for southern Italy.

Table 4

KNOWN MINERAL RESERVES OF SOUTHERN EUROPEAN COUNTRIES

Millions of tons, unless otherwise stated

	Turkey	Greece	Yugoslavia	Southern Italy	Spain	Portugal
Hard coal	400	—	39	Sardinia 600-700 ^a	8 000	20
Iron ore (iron content)	12	57	198	Sardinia 15-20 ^b	630	22
Lead (metal content)	+	0.12 ^c	+	Sardinia 0.27 ^b	1.09	0.01 ^d
Zinc (metal content)	+	0.15 ^c	+	Sardinia 0.62 ^b	1.00	0.01 ^d
Copper (metal content)	5 ^e		0.75		4.50	
Pyrites		2.50	+		273	7
Bauxite (metal content)		15	26	Apulia 5 ^a	+	
Chromite (metal content)	7.80 ^e	2	12			+
Fluorspar (ore) 35% CaF ₂					2.72	
Manganese (metal content)	4.80	0.22 ^c	0.15	Sicily 0.46	+	2.54 ^f
Antimony (metal content)		+	0.05-0.08			
		(Possibly large)				
Tungsten (WO ₃ content)					0.59	1.09
Mercury (million flasks)			0.70		1.00	
Potash (K ₂ O content)				Sicily +	270-500	
Other important reserves	Lignite Magnesite Gold Silver Emery Oil	Lignite Nickel Baryte Molybdenum Magnesite Emery	Lignite Asbestos Magnesite Oil Molybdenum	Sulphur (Sicily) Oil	Lignite Magnesite Tin	Cassiterite Asbestos

Sources : For hard coal and iron-ore : *World Iron-ore Resources and their Utilization* (United Nations publication, Sales No. 1950:11.D.3) 1950. For copper, pyrites, chromite and manganese : Hermann : *Les richesses minérales du monde* (Payot) Paris, 1950. For the remainder from : *Resources for Freedom*, Vol. II—*The Outlook for Key Commodities*, A Report to the President by the President's Materials Policy Commission, Washington, June 1952, with the following exceptions *are as follows* :
^a Svimez : *Contributi allo studio del problema industriale del Mezzogiorno*, 1949.
^b Società Elettrica Sarda : *Il Gruppo elettrico sardo e gli impianti dell'Alto Flumendosa*, Rome, 1949.

^c UNRRA : *Mineral Resources of Greece*, Athens, 1947, and information supplied by the Greek Government.

^d Centro de Estudios Economicos : *Revista*, No. 13, 1953.

^e Emil-Paul Lorentz : "The Undeveloped Mineral Resources of the Turkish Republic", *Mining and Metallurgy*, Vol. 29, No. 504, December 1948.

^f *Resources for Freedom*, op. cit.

+ No figures available for reserves.

reserves capable of being exploited. All experience points to the existence of very great possibilities of further discovery. Indeed, it may not be too paradoxical to say that the relevant distinction is not between naturally "well endowed" and "badly endowed" countries, but between countries which have proved more or less efficient and quick in advancing along the path of discovery.¹ The efficient organization of mining research and prospecting is therefore of prime importance.

In the history of mining, an enormous amount of effort has been wasted through many separate pros-

pectors having to find out independently the same thing. Not only are the results kept secret, lest competitors should benefit, but also firms seeking one kind of deposit frequently find information which, if pooled, could have been useful to others with different objectives. Geophysical prospecting and "wild-cattling" for oil could, for instance, indirectly benefit other explorers.² The obvious conclusion is that Governments should take measures to secure the pooling of all information resulting from private research and exploration.

¹ "Gradually and progressively the opinion that our substrata are extremely poor is being revised" *Plano de Fomento*, Vol. I, *Proposta de Lei*, Lisbon, page 22.

² In Sicily, for instance, there is a considerable similarity between the criteria to be followed in prospecting for oil and for sulphur. The regional Government has now established a system for co-ordinating these two lines of research.

Portugal:

A second and still more important question relates to the scope that should be given, respectively, to public and private research and prospecting. Clearly, topographical mapping and countrywide geological surveys, as well as other geological, physical and chemical research relating to mining, belong by their very nature to the field of public responsibility. As to prospecting itself, the attention of public authorities should be concentrated in those fields where the returns on the efforts invested are too remote, or too "diffuse" (in the sense of benefiting the community at large as well as the investor himself) or where the capital required is too huge to attract private initiative. Apart from the special case of oil, private initiative has tended to concentrate on fragmentary research and exploitation where immediate, though less ambitious, results could be expected. Such fragmentary activity, usually with little initial assistance from government-sponsored research, was sufficient to bring about a considerable development of mining in northern and western Europe and in the United States during the last two centuries. But this experience offers few lessons today for southern European countries, which do not have the privilege of being pioneers in the market. They are new entrants who have to compete with firmly established producers and the systematic, government-sponsored studies and exploration which could partly be dispensed with by other European countries one or two centuries ago, are essential for the southern countries.

Although not pertaining to southern Italy specifically,¹ the history of the discovery of natural gas in Italy deserves to be mentioned as an outstanding example of successful State enterprise in mining research. Private search for petrol had been going on, with very modest results, since the middle of the nineteenth century. From 1911 to 1925, the State provided some subsidies and facilities; but, in spite of this assistance and the formal reservation of petroleum to private enterprise, private research was turning away from this field, disappointed by the lack of results. In 1926, however, it was decided to supplement private initiative by a State agency, A.G.I.P. This agency adopted gravimetric and magnetometric methods, and the scientific co-ordination of many lessons emerging from past exploration led to a shift in the search to zones which had hitherto been neglected. In 1939, A.G.I.P. adopted seismographic reflection methods, and these led in 1944 to the first big result—the discovery of the gas field of Caviaga. What followed can best be illustrated by showing

¹ As mentioned earlier, the intensification of oil and gas research in southern Italy in recent years is, however, already leading to the discovery of some exploitable reserves.

the percentage of Italian energy consumption covered by natural gas :

	Percentage
1930 to 1939	0.33
1948	1.58
1952	8.79
1953 (forecast)	13.75
1958 (forecast)	40

The main thing to note in this experience is that the success was not in the nature of a lucky hit. It was the result of research over several decades, and definite progress began only when State participation made possible the pooling of results, the adoption of the most modern methods and the spending of huge sums. Even so, it took almost twenty years of publicly sponsored research.²

Southern European Governments have recognized, though in varying measures, the need for public initiative in the field of mining. All the countries in question seem to have some kind of general mining administration, mainly with a co-ordinating function, but in some cases also taking an active part in the development of the industry. There are also the purely academic bodies which cultivate research. In addition to increased financial help for these bodies, a strengthening of collaboration between them and public administration and private enterprises seems to be required in all the countries of southern Europe.

Turkey has built up, in the last seventeen years, a Government institute (M.T.A.) which carries on all the different stages of research and exploration, from general geological studies to actual drilling. It has achieved considerable practical results in carrying out research where private initiative was weak or wholly absent.³ In Greece, a public institute for the geological exploration of the country exists, but its annual budget is only the equivalent of \$50,000, a remarkably small amount for a country which is believed to be rich in minerals and where geological prospecting has hardly begun (see Table 3).

Another interesting pattern of public action is the setting up of Government-sponsored syndicates, which co-ordinate a group of mining enterprises and, *inter alia*, pool their research activities. Italy has a number of varieties of this type,⁴ and there are analogous organizations in Spain.

² Since the 1944 discovery private interest in oil and gas research has revived, and recent legislation has divided the field for future research between the State and private interests.

³ These results are now made generally available.

⁴ There are compulsory syndicates of private firms, such as the *Ente Zolfi* (sulphur), and holding companies consisting of state-owned firms, such as the *A. Ca. I.* (coal), *E.N.I.* (hydrocarbons), *A.M.M.I.* (metal ores). Such State co-ordination may be regarded as a counterpart to the trustification achieved in the remaining sectors of mining by one private company, the *Montecatini*.

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I

3. PROBLEMS AND POLICIES OF MINING EXPLOITATION

The discovery of mineral deposits is of course only the first step towards their exploitation. Several circumstances may briefly be considered which make the undertaking of actual mining operations more problematic in southern than in most other European countries. First, capital, especially of a risk-willing nature, and administrative and technical ability are scarce. Secondly, the supply of adequately trained labour often presents difficult problems. Thirdly, transport difficulties often prove a hindrance to the exploitation of otherwise economic mines. Fourthly, there are the problems arising from the fact that southern European countries have tended, in mining as in other fields, to be "technique-followers" rather than "technique-leaders".

The general problem of capital shortage is discussed in Chapter 10. With respect to mining in particular it need only be mentioned that it is typically a large-scale operation in all possible senses. The unit of operation is generally large,¹ the period of immobilization of capital very long and the margins of uncertainty about profits are exceptionally wide. Moreover, mining investments often pre-suppose complementary investments both for developing the area (residential and transport facilities, etc.) and for building up consuming industries. These are, as already indicated, reasons why in countries such as those of southern Europe, mining is one of the sectors where the need for public enterprise or public capital assistance is most likely to arise.

As to the establishment of priorities in the allocation of scarce capital and organizational ability among different possible fields of mining, one generalization can perhaps be ventured. The success of any particular branch of mining depends closely on the integrated development of all the industrial stages through which the mineral has subsequently to pass. Therefore, in countries where the industrial structure is relatively little developed, better results may be expected from concentrating investment on the creation of comparatively self-contained branches of production, than by spreading it over many different types of mining. Such considerations seem, in fact, to have been important in recent government-assisted production plans in Greece. The principle of "vertical" concentration of investment here suggested would obviously imply a preference for those mining products which meet less

specialized demands—notably coal, energy supplies in general and iron ore.

Despite the general excess of manpower in agriculture, manpower shortage is no less widespread and chronic a feature of mining in southern Europe than in other European countries. The shortage of labour may appear as a problem of absenteeism and rapid turnover. In Turkey, indebted peasants used to go to the mines and work until their debts were paid off. In Spain in recent years, many workers of the Biscayan iron mines have worked only on a half-day basis, devoting the remaining half of the day to agricultural work. Incentive measures have been introduced in Spain, though with little result, and compulsory measures were tried in Turkey during the war.

What is required is, it seems, a complex action. Higher wages are part, and probably only a minor part, of the answer. In order to attract and hold manpower and to develop it into an efficient and stable mining population, all-round community planning is necessary,² which can be all the more successful if such communities are made into integrated industrial centres by bringing transforming or consuming industries to the pit-head.

Distance from outlets and lack of cheap transport facilities are of tremendous importance in limiting the profitability of mining. These handicaps may be reduced from two sides. First, transport costs may be reduced very considerably by refining the mineral at the pithead.³ The important case of lignite has already been mentioned. Second, if a given deposit appears unprofitable because of lack of transport while a railway would be unprofitable through lack of traffic, it is possible that both investments would appear profitable if undertaken simultaneously. The example may appear trivial, but because of the size and "discontinuous" nature of such investments it is very well conceivable that such possibilities remain unexploited unless their complementary nature is made evident in the framework of a co-ordinating economic policy. The last decades in Turkish mining and railway policy provide examples of the realization of "external economies" in this sense. Spain, on the other hand, seems to provide some typical instances where similar possibilities still await exploitation.⁴

² The town of Carbonia in Sardinia provides an example of such community planning.

³ Copper ores, for instance, may by concentration be reduced to one-twentieth of their original weight.

⁴ In particular, there are considerable deposits of iron ore and lignite which at present are out of reach of the transport system.

¹ In present Italian conditions, the minimum amount of capital necessary to tap the natural gas from an already known deposit is \$3 million. (M. Boldrini: *Problemi economici del metano in Italia*, Rome, w.d. (1953)).

without date

In the past, southern European countries have typically adopted technical patterns evolved in other more developed countries for application to different types and qualities of resources. As already mentioned, they have been "technique-followers". Plants have, for example, commonly been designed to burn or carbonize given kinds of English, German or American coal. The fact that so wide a range of southern European mineral reserves are at present classified as economically inferior may partly be imputed to their being evaluated with reference to such imported techniques. A readaptation of technical outlook, processes and equipment is, therefore, needed to widen the range of possible lines of development in southern Europe.

One of the principal opportunities lies in the technical advances now being made in the treatment of lignite. Another example of the scope for technical flexibility is the attempt made in Spain during the war to use indigenous bauxite, hitherto considered unfit for producing aluminium. An important problem, still to be solved, is the use of the sulphurous ferrous ores found in several southern European countries.¹

¹ It will be recalled that France had a serious problem with its phosphorous iron ore (minette) until the Thomas process was evolved to deal with it.

Autonomous experimentation, and eventually the spreading of new patterns of end uses should be regarded as a major element in southern European mining policy. Here again Government-sponsored research is likely to be necessary, both because the uncertainty of the results may discourage private research and because of the wide range of industries on which research must be directed.

Moreover, the "inferiority" of mineral deposits is a question not only of quality, but also of quantity. For instance, a deposit of iron ore may appear to be profitable provided that a steel-making plant is established near the pithead. But, if the ore deposit is less than 20 to 25 million tons, it could not supply the input for a blast-furnace of 1,500 tons per day for a period sufficiently long to amortize the investment. It follows that the deposit would have to be left idle unless a technique were found for producing steel economically on a smaller scale. There are certain new techniques, based on the "iron-sponge" process, which deserve to be taken into consideration as possibly providing a solution to this problem. These techniques are now being examined in some southern European countries.

² See *Recent Development in Iron and Steel Technology*, Economic Commission for Europe, E/ECE/147, July 1952.

13 and trends

4. MINING FOR EXPORT OR FOR DOMESTIC INDUSTRIES

The preceding sections of this chapter have already provided some elements for a discussion of the comparative merits of mining production for export or for use in domestic industries.

It was seen that in the case of minerals extracted for processing within the country there are greater opportunities to secure a balanced and steady development which takes the fullest advantage of available resources. Production for foreign markets is more risky. Export markets may dwindle with the development of competing supplies, as happened with Sicilian sulphur mining after it had for some time enjoyed an apparently safe monopolistic position in the world market. Similarly, other natural monopolies of southern European countries may prove transitory. Moreover, besides the eventual risks of long-run decline, the violent short-term fluctuations caused in certain export lines by any change in market conditions may cause serious disturbance. An instance of extreme sensitivity is provided by the southern European production of pyrites.

Where the choice exists, there is a strong case, therefore, for developing mining principally as a

source of raw materials for home industries, thereby reducing the dependence on imports and on the vagaries of foreign demand. However, with the outstanding exception of bauxite, the products which are most promising as export items tend to be also those which are unlikely to provide starting points for industrial development at home. In fact, southern European countries could produce a handsome list of minerals for which a continued keen export demand is likely. For example, the Paley Report listed the following strategic requirements: chrome from Turkey, wolfram from Spain and Portugal, bauxite from Yugoslavia and Greece, sulphur from Italy and Portugal, fluorspar from Spain and Italy, and mercury from these two countries and Yugoslavia.

The question of developing exports of these products is closely bound up with that of attracting

³ According to one source, the ranking of southern European countries among the chief world producers of some important minerals is as follows: Turkey ranks third for chrome (with 15 per cent of total world production); Portugal third for wolfram (8 per cent); Italy first (39 per cent) and Spain second (37 per cent) for mercury.

See F. Friedensburg, *Die Bedeutung des Bergbaus in der Weltwirtschaft und in der Weltpolitik*, Berlin 1953, page 9.

foreign capital. Both Turkey and Greece have recently drafted new laws intended to attract private foreign capital, not least for mining enterprise. It may be, of course, that foreign capital, from the point of view of the capital importing country, could be more advantageously employed in other fields than in mining enterprise for immediate export. But it must be remembered that foreign private capital of the risk-willing kind here required is likely to be

available, if at all, only for the particular purpose of mining for direct export. There is much to be said, therefore, for reserving for foreign capital these mining opportunities which are interesting only for export in raw or crudely processed form, while concentrating the scarce domestic capital resources available on mining projects which are more directly related to the building up of a balanced industrial structure.
