THE MEDITERRANEAN AND THE ENERGY PICTURE

by

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The purpose of this paper is to describe energy-related developments in the Mediterranean sea in order to assess, on the one hand, their importance in relation to the economic life of the riparian countries and to the global energy picture, and, on the other, to provide a basis for the discussion of the interplay between economic, political and military factors.

The Mediterranean sea comes into the energy picture in a variety of ways, not necessarily related to each other. The following discussion will concentrate first on the Mediterranean as a source of oil, that is, on the offshore exploration and production activities underway in the sea. In the second section, the issue of oil transportation will be considered, and the importance of the Mediterranean will be discussed in connection with developments in the broader Mediterranean region. In the third section developments connected with the exploitation of natural gas resources will be discussed - an aspect in which issues of production, transportation and utilization are inextricably interrelated. The final section is devoted to an attempt to draw a synthetic picture which may be of relevance to the discussion of political and economic variables.

Part I

Hydrocarbon exploration and production in the Mediterranean

The nature and configuration of the Mediterranean seabed

Those who are accustomed to consulting political maps of the world or geographic maps showing elevations in detail but depicting the sea areas in a uniform shade of blue may not realize that the Mediterranean is different from most other semi-enclosed seas in that it is very deep. From this point of view, the Mediterranean differs sharply from the North Sea, and also from the Red Sea which extends to great depths only in a narrow central section.

As is widely known, the African and European continents are moving closer together and "squeezing" the Mediterranean; this causes the foundering of the seabed, and both continents have almost no continental shelves on the side of the Mediterranean. Consequently, some 60% of the total seabed consists of deep sea plains between 6,000 and 9,000 feet below sea level (see Map 1).

There are only two sizeable areas where the continental shelf is considerably wide and these are in the Adriatic and in the zone between Sicily to the North, Tunisia to the West, Western Libya to the South, and including Malta.

Elsewhere around the rim the continental shelf is generally very narrow and the seabed plunges almost immediately to depths of more than 3,000 feet. The most notable exceptions to this rule are the Nile Delta coast from Alexandria to El Arish, the Gulf of Iskenderun, the Gulf of Lions and the Spanish coast in front of the Baleares.

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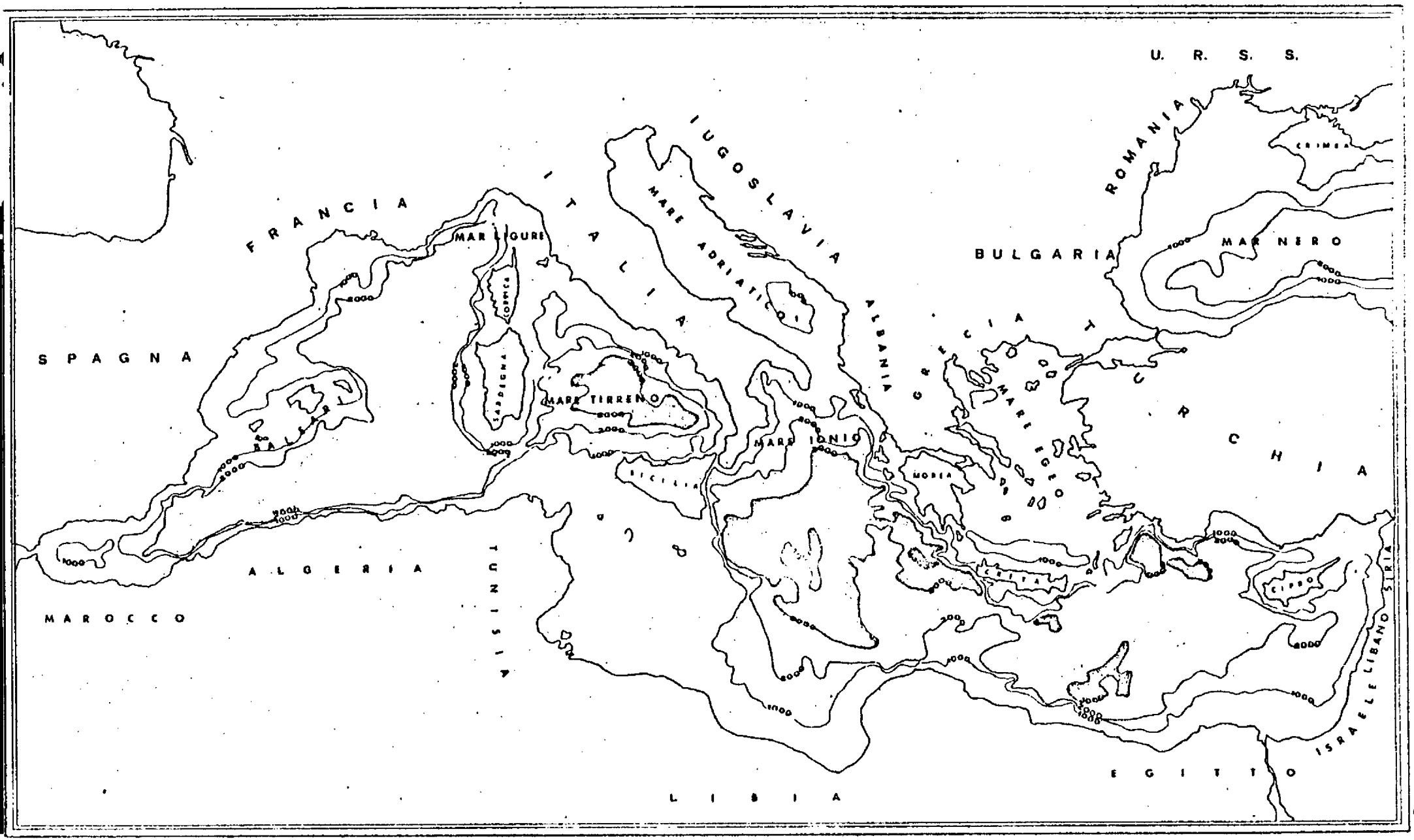

Map 1

Finally, the seabed is very "corrugated" below both the Tyrrhenian and the Aegean Seas. The former is generally very deep - actually the deepest part of the Mediterranean - but contains a number of submerged mountains, mostly of volcanic origin (including active volcanoes). The Aegean is on average not as deep, but geologically it is strongly fragmented.

The development of offshore technology

Offshore hydrocarbon exploration and production is a dynamic industry in which technological development is progressing at a fast pace. It is only in the last fifteen years that the need to increase hydrocarbon reserves and diversify them geographically has greatly augmented the interest in exploration and production under increasingly difficult conditions.

Water depth is not the only obstacle that offshore exploration and production must overcome; others include the prevalent meteorological conditions, the degree of oxygenation of the water, the presence of ice, and so on. However, in the case of the Mediterranean, depth is the critical factor.

The horizon of maximum water depth for offshore activities is rapidly improving, and a sharp distinction must be drawn between exploration and production.

In the case of exploration, there are drilling rigs that are capable of operating in water depths of 6,000 feet. Exploratory wells are presently being drilled in water depths of over 2,000 feet in numerous parts of the world. In France, CFP-Total has joined forces with SNEA (Elf) and the Institut Français des Pétroles in undertaking a program

to improve deep sea technology. This led to the development of the drillship Pélerin, which is capable of drilling in water depths of more than 3,000 feet. The ship completed her first well offshore Algeria (Habibas) in 925 metres of water, then was moved to the Atlantic. (1) There are now reports that Total will start drilling in the Mediterranean in water depths of 6,000 feet. Both Agip and Eniepsa currently employ drillships that are considered capable of drilling at such great depths, but are using them in shallower waters. (2)

On the other hand, the difficulty of carrying out production below great depths of water is much greater than for exploration and the technological limit more stringent. The difficulty of developing a field under water is two sided: there is the difficulty of laying pipes and the problem of setting up a central production unit - the two difficulties are closely interrelated.

The record for laying pipes in deep waters has been set by Saipem (ENI) with the Transmediterranean gas pipeline, which is covered by a maximum of 2,000 feet of water. The same technology could be used for somewhat greater depths, up to 3,000 feet.

All operating offshore central units are above the water, that is, they are based on a platform of some kind. A production platform, in contrast to a drilling rig, needs to be permanently positioned above the field; it must, in

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(1) Total Information, No. 78, page 33

(2) Offshore, 5 June, 1981.

other words, sit on it. The tallest existing production platform was installed by Shell over the Cognac field in Louisiana. It operates in more than 1,000 ft. of water. However, its cost was so high that it is believed that it represents the economic limit beyond which an alternative technology becomes convenient.

Such an alternative technology exists in the form of underwater production systems. These, however, are not sufficiently developed yet and it is difficult to predict how fast they will move the limit for hydrocarbon production in the deep seas. At present, a Shell-Exxon partnership is installing underwater production systems for the Cormorant field in the North Sea, but in only 490 ft. of water - although the companies claim, however, that "similar units can be used in waters several thousand feet deep". (3)

Therefore, at present, while exploration is technologically possible almost everywhere in the Mediterranean, production is possible only in the limited parts that lie under no more than 1,000 ft. of water. This is, however, a limit that will certainly be substantially removed during the next decade.

Current offshore production in the Mediterranean

Although production is logically a result of exploration, we will describe current offshore production in the Mediterranean before dealing with current exploration to give a better impression of the present situation and its potential future developments.

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(3) Petroleum Intelligence Weekly, 9 April 1981, p. 12; Business Week, March 15, 1982, p. 36.

Oil has been discovered in the Mediterranean off the shores of six riparian countries, namely Tunisia, Libya, Egypt, Greece, Italy and Spain. Both Spain and Egypt have a non-Mediterranean coast, and in the case of Egypt offshore discoveries in the Gulf of Suez are much more important than those in the Mediterranean. Discoveries off Libya and Egypt have occurred only very recently and no production is yet underway. In Greece, offshore production started in 1981 and is currently taking place at a rate of around 25,000 b.d. (4)

Table 1 gives the quantities of oil produced offshore by the other three countries in recent years.

These are small quantities, and they come from a small number of small fields. Table 2 shows production data broken down by individual fields.

Table 1 - Offshore daily average crude production (,000 (,000 b/d)

	1980	1979	1978	1977	1976	1975
Tunisia	43.5	48.5	45.2	45.5	37.0	43.0
Spain	31.2	22.1	20.0	23.0	33.3	32.8
Italy	6.2	4.8	4.3	12.0	10.1	10.4

Source: Offshore, 20 June 1980 and 5 June 1981

(4) Petroleum Intelligence Weekly, 9 April 1981, p. 10

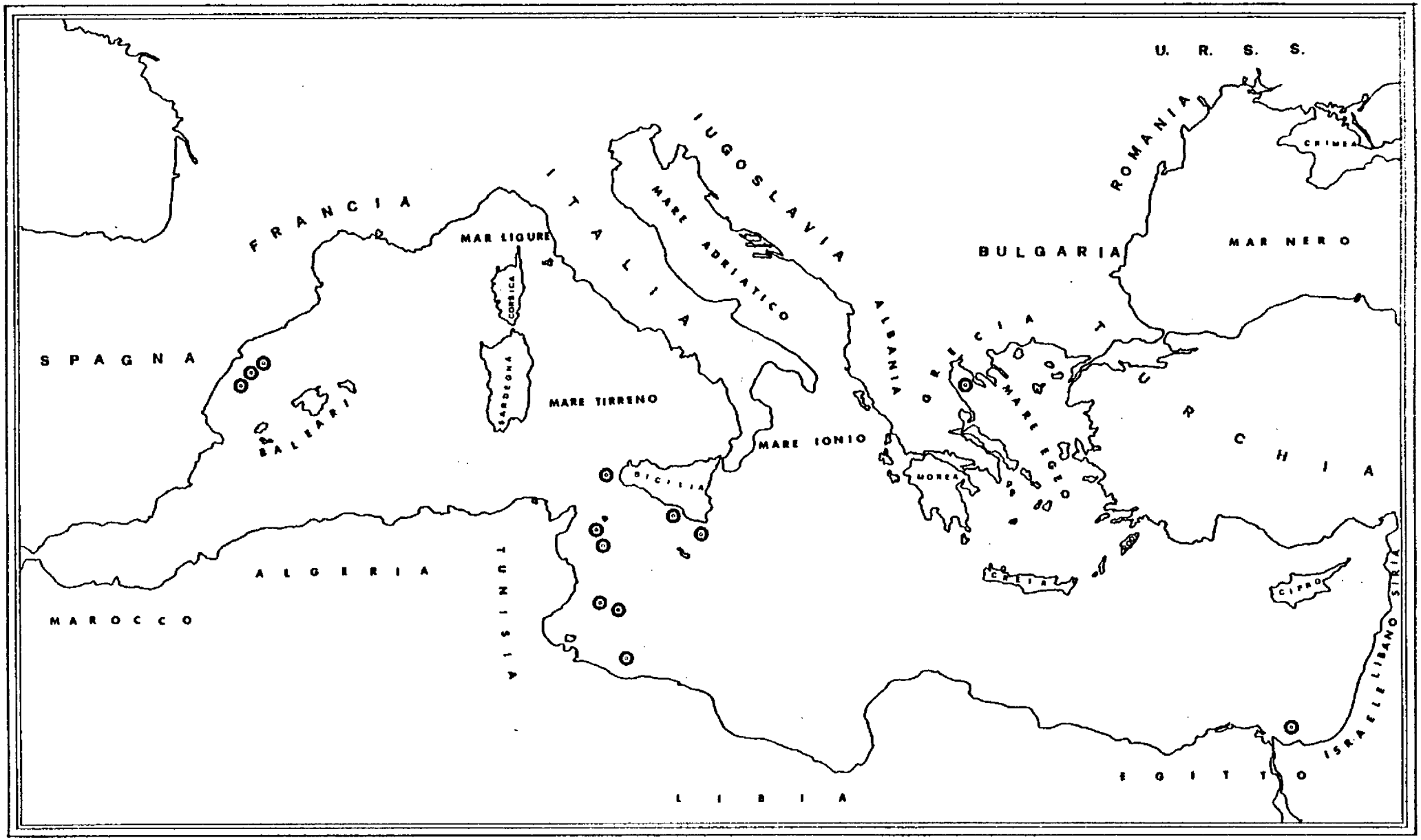
Table 2 - Average daily production (,000 b/d) and discovery date of offshore fields in the Mediterranean

Country and Field	Average daily production first semester of		Date of discovery
	1979	1980	
Tunisia			
Ashtart	45.3	43.5	1971
Spain			
Amposta Marina North	1.0	0.6	1970
Casablanca	na	11.9	1975
Castellon B	4.8	7.6	1972
Dorado	7.4	2.7	1975
Italy			
Gela	8.1	10.0	1956
S. Maria "A" Mare	5.1	5.1	1974

Source: Offshore, 20 June 1980 and 5 June 1981

The productive life of these fields has also been very short. As an example, the Amposta field in Spain started production in 1973, produced around 1.9 million tons in 1974 and 1975, then declined rapidly to a level below 0.3 million tons in 1979 and 1980 (cfr. Annuaire Européen du Pétrole 1981/82, Hamburg).

All the Spanish fields are located close to the continental coast in front of the Baleares. Of the two Italian fields, Gela is off the coast of Southern Sicily while S. Maria is in the Adriatic. The new Greek field is in the northwest Aegean, not far from Thessaloniki.



⊙ GIACIMENTI DI PETROLIO INDIVIDUATI NEL BACINO MEDITERRANEO

Map 2

To these producing fields must be added the new discoveries that have not yet been developed into production. These are particularly sizable in Tunisia, where four "exploitation concessions" were granted in addition to the one covering the Ashtart field, namely: one to Total (Compagnie Française des Pétroles) covering the Isis field, one to SNEA (Elf) covering the Halk el Menzel field, and two to Shell for the Tazerka and Birsa fields. Map 2 shows the approximate location of these discoveries.

In Libya a field was found by Agip in an area called NC-41, lying northwest of Tripoli, some 75 miles off the coast; recoverable reserves there are estimated around 600-800 million barrels. Agip intends to develop this field at a cost of one billion dollars or more, and this would involve either offshore loading or the building of a pipeline to the Tripolitanian coast. (5)

The recent decision by the ICJ left in Libyan waters a tract where two discoveries have been made by a group led by SNEA. (6)

In Egypt it was also Agip that discovered oil in the Mediterranean offshore, in the Gulf of al-Tina, about 30 miles east of Port Said. Indications are however that the oil-bearing stratum is not very deep.

Finally, Agip made a new discovery in 1980, in Italian waters 2,713 feet deep (Aquila field), yielding 3,000 b/d in test production. (7)

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(5) Petroleum Intelligence Weekly, 11 January 1982, p.5

(6) Ibid., 22 March 1982, p. 7

(7) Ibid., 15 June 1981, p. 11; Ecos No. 100-101, 1981, page 15.

Offshore exploration in the Mediterranean

Thus, current offshore production in the Mediterranean, although certainly not static, given that new discoveries are being made, is a negligible factor when compared to the global energy picture, and a marginal one when compared to the total consumption (in the case of Spain, Italy and Greece) or total production (in the case of Tunisia, Libya and Egypt) of the countries concerned.

This however does not give us an accurate feeling of the importance of the Mediterranean until we examine past and current exploration activity.

Offshore exploration activity, although growing, has been quite limited until recently, as is clearly shown by the data in Table 3.

Table 3 - Number of wells drilled per year and country

	1979	1978	1977	1976	1975
Algeria	0	0	1	0	n.a.
Egypt *	37	34	44	33	21
France **	4	2	1	2	n.a.
Greece	6	8	n.a.	n.a.	1
Israel	0	0	0	1	0
Italy	36	37	27	22	n.a.
Libya	8	0	n.a.	8	n.a.
Malta	0	0	n.a.	n.a.	0
Morocco **	2	1	n.a.	n.a.	2
Spain **	17	19	17	25	11
Tunisia	16	9	n.a.	15	12
Turkey	0	1	0	4	1

* includes wells drilled in the Gulf of Suez and the Red Sea

** includes wells drilled in the Atlantic offshore

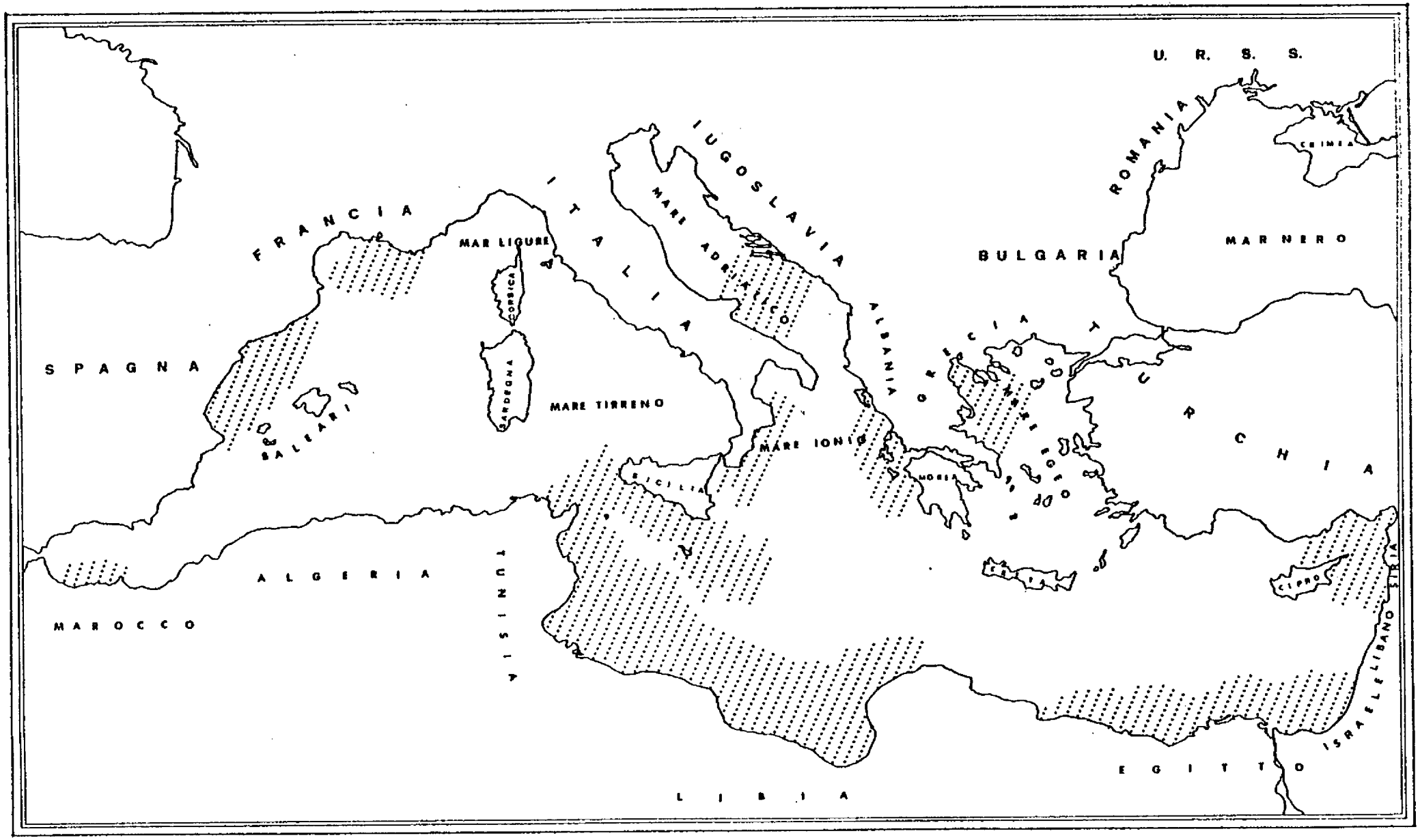
Offshore exploration in the Mediterranean was perceived as not very attractive economically before 1970, except perhaps by Italy, to which every drop of oil was important for balance of payments reasons, almost independently of cost. More recently, obstacles of a technological nature, discussed above, as well as political obstacles had to be overcome. The latter consist mostly in the lack of agreement between riparian countries on delimitations of seabed rights, as well as insufficient development of national legislation to regulate both the exploratory activities and oil production, if this is found. Yet exploration permits have been issued for large areas in the Mediterranean (Map 3).

No exploratory wells have been drilled in the Mediterranean offshore of Morocco, although Onarep, the Office National des Recherches Petrolières, holds an exploration permit and there are reports that Amoco may also have requested a permit. Shell recently abandoned an exploration permit after carrying out seismic work.

The Algerian offshore is also almost unexplored, only a dry well having been drilled (Habibas).

The picture changes when we get to the Tunisian offshore, where almost the entire offshore area is covered by various exploration permits. The lack of definition of a dividing line between Tunisia and Libya has been an obstacle, although not one that the companies have found entirely prohibitive. The issue has, in any case, recently been settled by the International Court of Justice in The Hague.

The Libyan offshore is almost entirely unexplored, mostly because of political problems. Dividing lines have yet to be defined between Libya and Malta, and there is a large zone of the seabed for which both countries have issued exploration permits. This area includes, among others, the Medina Bank, over which an Italian rig was drilling in the summer of 1981 under a permit issued by Malta when Libya sent a submarine to contest and stop the operations.



ZONE DOVE E' IN CORSO L'ESPLORAZIONE PETROLIFERA NEL MEDITERRANEO

Map 3

Apart from this, a number of companies have been dissatisfied with the economic conditions under which they operate in Libya, and both Exxon and Mobil have voluntarily withdrawn from the country. Added to this is the fact that there are large unexplored tracts offshore. All of these elements explain why the Libyan offshore has not yet been carefully explored, despite the fact that from the geological point of view it is considered to be a very promising province - an extension of the same structures that are found offshore.

The promising part of the Libyan offshore is considered to include the Gulf of Sidra, while the portion extending north of Cyrenaica, where the continental shelf is very narrow, is not considered interesting.

The same applies to the Egyptian offshore west of the Nile Delta; although no wells have been drilled there, interest in this part of the Mediterranean offshore may change as the experts gain a better understanding of the geological formations below the Western Desert where important discoveries were recently made by Shell (Badr el-Din field).(8)

Considerable exploration is underway in the offshore of the Nile Delta and the area of interest is considered to extend in front of the Sinai, although political and military conditions have prevented exploration activity there until very recently. Besides the al-Tina field (Agip and Total) that we already mentioned, a gas field was recently located by Mobil (el Temsah), which is added to the Abu Qir gas field that began producing in January 1979. Total also holds a large exploration permit west of Alexandria - called Maryout.(9) This is therefore an area in which further developments may be expected.

Israel engaged in some exploration activity in its own offshore, without success. No exploration was tried offshore Lebanon, Syria or Cyprus, because of political reasons. Agip has been exploring in the Gulf of Iskenderun, without success.

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(8) Petroleum Intelligence Weekly, 19 April 1982, p. 9

(9) Total Now, March 1982

As far as as the Aegean is concerned, exploration has been discouraged by political considerations as well as by the mediocre geological prospects, which are certainly not proportional to the degree of political controversy.

Exploration is underway in the Ionian offshore of Greece, where the state oil company has made a gas discovery off Katakolon in the western Peloponnese; Agip recently took an exploration permit around the island of Paxoi.

There is no record of exploration being carried out offshore Albania. The country does not allow foreign companies in its territory, but prospects are considered geologically interesting.

Exploration in the Adriatic is, on the other hand, quite considerable. The delimitation of national rights over the seabed has been agreed upon between Italy and Yugoslavia. Exploration has been more intense on the Italian side because it was only recently that Yugoslavia adapted its legislation and allowed for the participation of foreign companies in joint ventures. Numerous gas and oil fields have been found on the Italian side and exploration is now extending to the southern, deeper part of the Adriatic. The entire Adriatic region is geologically promising and must be expected to lead to expanded production activity.

Some finds also occurred along the Ionian coast of Italy; the continental shelf is, however, very narrow there, as it is on the eastern side of Sicily. Exploration led to positive results to the south of Sicily, and a preliminary agreement exists between Italy and Malta on the delimitation of national rights. Exploration areas have recently been allocated by Malta, covering mostly areas north of the island; no finds have been reported yet. As was mentioned earlier, the whole area between Tunisia, Libya, Malta and Sicily is considered very promising, and exploration would be more intense if there were total agreement on delimitation of national rights. Unfortunately, this is far from being the case. At any rate, there is considerable activity in all of this area. In Italian waters south of Sicily exploration permits are held by Agip, Total and a consortium including Conoco, Exxon and Hispanoil.(10)

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(10) Esso Informazioni economiche, no. 1, 1981.

Although the continental shelf is very narrow in the Tyrrhenian, some exploration was carried out along the Italian coast, leading to disappointing results. Drilling activity along the French Mediterranean coast, particularly in the Gulf of Lions, also brought no discoveries. Finally, exploration activity along the Spanish coast has been concentrated in the sector facing the Baleares, leading to the discoveries already mentioned.

In the spring of 1982 there were 28 offshore drilling rigs at work in the Mediterranean (out of a world total of some 470), of which ten were found in Italian waters.

In conclusion, we see that exploration activity is continuing and increasingly intense in the Mediterranean, but could be even more so, and we may perhaps predict that it will be so. If it were not for political constaints, exploration would certainly intensify in those areas of the central and eastern Mediterranean where the seabed lies under less than 3,000 feet of water.

At the same time a real turning point - both in terms of economic and of political impact - would only be represented by more active exploration in the deep plains below 3,000 ft. of water. These are the largest part of the sea in terms of total surface, and are as yet essentially untouched because of both technological and political problems. Seismic exploration is limited by the presence of a thick layer of salt, which acts as a screen and conceals formations underneath it. Actual drilling will therefore be necessary in order to gain a sufficient understanding of the structure of the deep Mediterranean basin. Those elements that are known point to a contradictory picture, combining factors which are very encouraging to others of the opposite sign.[11] The situation is considered,

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(11) These are briefly spelled out by Bernard Biju-Duval in "Deep basins: promising or unpromising" Total information, No. 81, 1980); see also: R.S. Byramjer, J.F. Mugiot, B. Biju-Duval: Petroleum Potential of Deep Water Areas of the Mediterranean and Caribbean Seas.

at any rate, sufficiently interesting to justify further exploration, and the fact that this is not taking place in any significant way is attributed to political obstacles - in view of the high costs and degree of risk involved.

Part II

Oil transportation in the Mediterranean

The total volume of oil which is shipped across the Mediterranean is influenced by three main variables:

a) the level of production in the Mediterranean oil-exporting countries;

b) the level of consumption in the Mediterranean oil-importing countries;

c) the pattern of transportation system connecting exporting and importing countries that lie outside of the Mediterranean.

While it is clear that oil that is exported (imported) from (to) a Mediterranean country must necessarily transit in the Mediterranean even if it is directed to (comes from) a country outside the Mediterranean, the same is not true for the case contemplated under c).

Although the flows generated from cases a) and b) are not to be forgotten, it is not the purpose of this paper to propose yet another projection of future oil demand and supply. A few data on the production level in the Mediterranean exporting countries will suffice (Table 4). One should note that in the case of Libya and Algeria the maximum rated production capacity is greater than actual production (in the case of Libya very much so). However, it is unlikely that production will approach maximum capacity in these countries during the current decade. On the other hand, production in Tunisia and Egypt will tend to be much closer to maximum capacity, and in the case of the latter is expected to grow rather rapidly, reaching a level of one million b/d by 1985.(12)

(12) Petroleum Intelligence Weekly, 19 April 1982

Table 4 - Production of crude oil in some Mediterranean countries

million tons/year

	1980	1965	1970	1975	1980
Algeria	8.5	26.0	47.3	45.1	44.9
Egypt	3.3	6.5	20.9	11.7	30.0
Libya	-	58.8	159.2	72.4	85.6
Tunisia	-	-	4.2	4.6	5.2
TOTALE	11.8	91.3	231.6	133.8	165.7

Source: Energia ed Idrocarburi, 1981

The redirection of oil logistics and the Mediterranean

However, what is affecting most remarkably the importance of the Mediterranean in the broader picture of oil flows is a number of changes being introduced or planned for the logistics of oil. In essence, these changes are intended to reduce the necessary reliance on transportation across the Persian Gulf, the Strait of Hormuz and around the African continent - a route which is seen as being increasingly vulnerable to a wide array of possible threats (ranging from non-governmental use of force, to interference from regional or outside governments).

This tendency is in the direction of recreating the balance which existed until 1967. The Mediterranean was historically seen as the natural outlet for Middle East oil, witness the very considerable diplomatic activity surrounding the establishment of the IPC pipeline, connecting the northern Iraqi fields to the ports of Banias, Tripoli and Haifa. The exact routing of the line, as well as its multiple outlets, was the result of complex negotiations between the U.K. and France in 1919; [13] at the time a pipeline connecting the Persian fields to the Mediterranean was also considered. [14]

The development of oil in Saudi Arabia led to the establishment of another pipeline to the Mediterranean (the Tapline) connecting the fields around Dhahran to the harbour of Sidon.

The creation of Israel led to a considerable disruption in this system. Not only was the flow of oil to Haifa interrupted, but the reality of continuing war on the eastern Mediterranean coast acted to discourage the expansion of this overland transportation system to the Mediterranean. The Tapline was repeatedly interrupted by terrorist attacks.

A further discouragement came from recurring conflict over the fees that were to be paid to the countries whose territories the pipeline crossed. The best known episode is the one which saw Syria opposed to the IPC in 1966-67, leading to a stoppage of the oil flow. [15] Tensions resurfaced in the 1970s after Iraq nationalized the IPC, proving

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(13) Marian Kent, Oil and Empire, British Policy and Mesopotamian Oil 1900-1920, Macmillan, pp. 141-150.

(14) Ibid., p. 143

(15) For a detailed discussion of this see G.W. Stocking, Middle East Oil, Vanderbild 1970, chapters 12-13, pp. 270-299.

that in itself nationalization was no solution to the problem.

As a consequence, a larger portion of the oil came to be loaded on ships directly in the Gulf; but it still prevalently crossed the Mediterranean, after entering from the Suez Canal.

However, in 1967, Israeli forces occupied the Sinai and the Canal was closed. This accelerated a tendency to increase the size of new tankers and rely on route around the Cape. It must be stressed at this point that Very Large and Ultra Large Crude Carriers (VLCCs and ULCCs) raise many more problems than just transit through Suez. Besides being more accident prone and a greater hazard to the environment than the medium-size tankers are, their economic advantage was substantially eroded during the 1970s because of the increase in the price of oil itself - they are "bunker guzzlers". Furthermore, many major harbours around the world are still not equipped to accomodate these ships, and it is only recently that the so-called LOOP became operational in Louisiana, the first American harbour capable of receiving ULCCs. In other words, it is likely that, had the Suez Canal not been closed by the events in 1967, the average size composition of the tanker fleet would not have increased as dramatically as it did. Nowadays, of course, many of these tankers lie idle, expectations within the industry are gloomy, and considerable scrapping is under-

way. (16)

Developments in Iraq in the 1970s

After the 1967 war, a further development that affected the logistics of oil was Iraq's attempt to reduce its dependency on the Syrian pipeline. This was accomplished through the creation of two further pipelines:

a) A first pipeline runs from north to south, and is sometimes called "strategic". Its purpose is to establish a line of communication between the northern Iraqi fields around Kirkuk, and the southern ones around Basrah. Hitherto, Kirkuk oil could only be shipped across Syria, and Basrah oil could only be loaded on the Gulf at the mouth of the Shatt-al-Arab. Both outlets were (and are) unreliable, in the case of Syria because of the recurring conflicts over the level of transit fees (which occur in the context of a generally conflictual relationship at the economic as well as at the political level), and in the case of Iran because of the border dispute over the mouth of the Shatt (itself occurring in the context of tense relations because of the Kurdish problem, the Shia opposition, etc.). It was only in 1975 that the dispute over the Shatt was "solved" by an agreement between the Shah and Saddam Hussein, only

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(16) Intertanko expects that a supply-demand balance for VLCCs will be reached by 1984-85 only if one-fourth of the global fleet is scrapped. In 1980, 26 VLCCs sold for scrap and another 23 as of mid-July 1981 (PIW, 7 September, 1981, p. 10).

While independent owners are selling large tankers for scrap, oil companies are starting to question the need to own a tanker fleet at all.

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to be opened once again at the end of 1980, as Iraqi troops crossed the river and marched into Iran.(17)

The outbreak of the IranIraq war brought Iraqi shipments from the Gulf to a complete halt and a determined effort was made to utilize the pipeline to Banias and Tripoli. Theoretically, this pipeline has a maximum capacity of 1.4 million b/d, but it had been allowed to deteriorate considerably during the years (e.g., the Tripoli terminal had been inactive since 1975). Thus the operational capacity at the beginning of 1982 was considered to be around 800,000 b/d. The Iraqi efforts have not been entirely successful because of repeated damage done both by Iranian air attacks and by terrorist bombings. However, the line was being used to export some 400,000 b/d immediately before April 10, 1982, when Syria unilaterally decided to close it, while at the same time starting to import Iranian oil.(18)

(16 cont.)

In the first quarter of 1982, oil companies sold nine VLCCs for scrap, while the total for 1981 was eleven. "Oil companies lose money even on modern ships. And many would require further substantial investment to cut their fuel consumption and to comply with new international safety and anti-pollution requirements". (PIW, 19 April 1982, p. 2).

(17) These historical details must be recalled lest the reader should think that once the Iraq-Iran conflict is resolved Iraq will again be happy with shipping its oil from the Gulf.

(18) Middle East Economic Survey, 19 April 1982, p. 4.

The "strategic" pipeline is characterized by the fact that it is capable of operating in both directions, thus making it possible to export Kirkuk oil from the Gulf and Basrah oil from the Mediterranean. If it operates southward it has a maximum throughput of one million b/d, while if it operates northward maximum capacity is 800,000 b/d; the difference is due to the fact that in the second case it operates against gravity. Since its opening, it has operated mostly in the southward direction, until the beginning of hostilities with Iran in 1980.

b) A second pipeline was built connecting the Kirkuk fields to an outlet at Ceyhan (Turkey), without crossing Syria. It has a maximum throughput of 700,000 b/d, has been operational since 1978, and has played a vital role for Iraq since the beginning of hostilities with Iran. Its maximum throughput could easily be increased to 900,000 b/d.(19)

Although both of these pipelines were mainly intended to reduce Iraqi dependence on Syria, they also happened to allow a reorientation of Iraqi oil flows from the Gulf to the Mediterranean, which actually took place dramatically after September 1980.

The Saudi East-West pipeline

Out of concern for political and military conditions in the Gulf and the vulnerability of the oil flows at Hormuz, Saudi Arabia has also installed a "strategic" pipeline running from east to west and connecting the Saudi fields to the Red Sea port of Yanbu. This pipeline became operational in mid-1981 and has a maximum throughput of I.85 milion b/d.

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(19) Middle Eastern Economic Survey, 3 May 1982

It was initially expected that this pipeline would allow a further lowering of the transportation cost for Saudi crude, particularly for destinations in the Mediterranean. However, the Saudi authorities set the transportation fee at a relatively high level (60 cents a barrel) to amortize the investment speedily, and buyers of Saudi crude had to be pressured into using the pipeline. The Aramco partners requested Saudi Arabia to average out the 60 cents and sell at the same price both at Yanbu and Ras Tanura, allowing the companies to choose freely where to load the oil from.(20) This request was not granted, but at the beginning of 1982 Petromin started "waiving" the requirement to lift at Yanbu and utilization of the line dropped instead of progressively increasing to maximum capacity.

This situation should, however, be understood in the context of a generally weak oil market and declining Saudi output. It is very likely that the Saudi interest in the East-West pipeline was not in the least reduced because of the less than enthustiastic reception that it met initially.

It is therefore appropriate to record that while, as we said, the present maximum capacity of the line is 1.85 million b/d, consideration has already been given to the possibility of looping the pipeline to raise its capacity to 2.45 million b/d. Further improvements could bring the capacity of the line to 3.7-4 million b/d, which would certainly provide substantial flexibility, especially now that Saudi production has declined to around 6 million b/d from a maximum of more than 10 million.(21)

(20) Petroleum Intelligence Weekly, 19 October 1981, p. 3.

(21) Ibid., 27 April 1981; MEES, 9 November 1981, p. 6.

There has also been some speculation that Saudi Arabia might be considering the creation of a massive strategic oil reserve near Yanbu (1.5 billion barrels). This was prompted by the fact that a company was asked to study underground caverns in the proximity of Yanbu, that could be used for storage.(22) Such speculation was promptly denied by Saudi Oil Minister Yamani; however, the creation of such a reserve would appear to be a logical step, and, if it were being considered, or indeed accumulated, one would expect the Saudi authorities to deny its existence and to maintain it secret.

The Sumed and the reopening of the Suez Canal

The partial withdrawal of Israeli forces from the Sinai allowed Egypt to reopen the Suez Canal on June 5, 1975. While the Canal was closed, Egypt had endeavoured to provide an alternative to oil transportation around the Cape through the laying of a pipeline connecting the Red Sea to the Mediterranean - the Sumed. The Sumed has a maximum throughput of 1.6 million b/d, and has been utilized very close to its maximum capacity.

Since it reopened, the Suez Canal has been both deepened and enlarged. A first phase of this process was concluded at the end of 1980 and resulted in a considerable increase in traffic which went to 225 million tons during the first eight months of 1981 from 187 million tons a year earlier. With the first phase the draft in the Canal was

(22) PIW, 20 October 198 , p. 1

increased from 38 to 53 feet which is sufficient to allow for the transit of fully laden tankers up to 150,000 tons and of VLCCs up to 375,000 tons in ballast. The increased traffic consisted initially mainly in southbound tankers transiting in ballast, because with currently depressed tanker rates the cheapest combination is that of loading oil in large tankers that will follow the Cape route to the European market and return south via Suez. Table 5 shows some estimates of the relative cost of various options.

However, the relative importance of the two currents of traffic has changed since the opening of Saudi Arabia's pipeline to Yanbu. In December 1981, northbound laden tankers jumped to 5.7 million tons, from 1.3 million tons in the previous month. (23)

For the year 1981 the total number of tanker transits was 21,577, equal to a daily average of almost 60.

The importance of the Suez Canal to oil traffic may further increase in the future if a further deepening, currently under study, is carried out. This would bring the draft to 67 feet and allow passage of fully laden tankers of up to 260,000 tons. (24) There are, however, doubts as to the economic return of a further deepening, because the spectrum of potential traffic increase is rather narrow (fully laden tankers above 150,000 tons and below 260,000 tons), while there is an expectation that the average tanker size will decrease in the future. A further deepening of the Canal must be weighted against a possible enlargement of the Sumed, also considering that tankers in the 150-260,000 ton class can already transit provided they

(23) PIW, 8 February 1982, p. 9

(24) Ibid. 16 November 1981, p. 10

are not fully laden (in other words, they can unload part of their cargo at one end of the Sumed, transit the Canal partly laden and reload in the Mediterranean).

Table 5 - Estimated spot tanker freight costs for Arabian Light to representative destinations from either Yanbu or Ras Tanura, various transportation alternatives. Period of reference: April 1981, (In dollars per barrel)

	Rotterdam		Sicily		Philadelphia		Curaçao	
	Yanbu	R.T.	Yanbu	R.T.	Yanbu	R.T.	Yanbu	R.T.
Direct Voyage, ULCC, Cape round Trip	0.90	0.94	0.90	0.94	1.35	1.39	0.82	0.86
Direct Voyage, VLCC, Cape and Suez return	0.85	1.00	0.75	0.90	1.39	1.54	1.00	1.04
Suez, round trip, 150,000 tonner	0.86	1.22	0.56	0.90	1.61	2.23	1.09	1.46
Sumed, ULCC	0.65	0.89	0.49	0.73	1.58	1.82	0.85	1.09

Source: PIW, April 27, 1981, p. 2

Plans to enlarge the maximum throughput of the Sumed are more solid. Since the opening of the Yanbu pipeline, the Sumed has been operating above or close to 100% capacity and the average utilization for the year 1981 was 96%. (21) It should be remembered that the Yanbu pipeline is expected to reach maximum capacity only in the second half of 1982.

The capacity of the Sumed could certainly be raised to 1.9 million b/d and possibly further to 2.3 million b/d. Approximately 65% of the crude transported through the Sumed is Arabian Light.

In the longer run, the relative importance of Suez vs. the Cape route should be increasing also in connection with the tendency of the oil-exporting countries to process a larger share of their crude oil at home and export products rather than crude oil. Products are normally shipped in smaller vessels than crude is. Furthermore, the tendency of the oil-producing countries to diversify their oil logistics out of the Gulf is not exhausted, and there are plans for more pipelines that would bring an increase in Suez traffic. To these we now turn.

New strategic pipelines under consideration

Persistent conditions of tension in the Gulf are encouraging the oil-exporting countries in the region to further diversify their oil logistics. We already mentioned that the capacity of the Saudi East-West pipeline could be increased, and the same applies to the Iraqi Turkish line. Indeed, a protocol between Iraq and Turkey was signed in Ankara in December 1980 carrying an agreement to increase the capacity of the line to 1 million b/d. (25)

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(25) MEES, January 5, 1981, p. 6

However, there are also substantial plans for altogether new pipelines, some of which would most likely lead to an increase in oil traffic through the Mediterranean. Specifically:

a) Iraq is considering two new lines, one across Kuwait to a loading terminal in the Gulf, the second across Saudi Arabia to the Red Sea; (26)

b) the Gulf Cooperation Council (GCC) is considering a pipeline that would originate at Kuwait and terminate at either the Red Sea, Oman or South Yemen on the Indian Ocean; (27)

The Iraqi plans are probably very serious, particularly since Syria unilaterally closed down the pipeline across its territory in April 1982, dealing a final blow to the year-long effort to recover export volume that it had lost because of the war with Iran.

A pipeline across Kuwait would specifically reduce Iraqi dependence on the Shatt-al-Arab as its only outlet to the Gulf. It would not, however, amount to a significant diversification from the Gulf, and it would have no impact on traffic through the Mediterranean.

On the other hand, the proposed line across Saudi Arabia to a point slightly north of Yanbu would be a significant factor for Mediterranean traffic. The Iraqi Oil Minister Abdul Karim stated last March that work on this line could start by the end of 1982 and would take no more than two years to complete. Its total capacity would be somewhere between 1 and 1.6 million b/d. (28)

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(26) MEES, August 10, 1981, p. 1-2

(27) Petroleum Intelligence Weekly, 16 November 1981

(28) Ibid., 22 March 1982

As for the GCC plans, while the possibility of an outlet in South Yemen sounds implausible, the alternative between Oman and the Red Sea is one that must be judged in view of the final destination of the oil. If it is Japan, then an Indian Ocean loading point would make it possible to avoid both Hormuz and Bab el Mandeb. If, on the other hand, the final destination is assumed to be Europe or the United States, then the Red Sea would appear to be preferable.

Future evolution of oil traffic across the Mediterranean

On the basis of the developments listed above, the importance of the Mediterranean for international oil traffic appears destined to increase greatly, both in normal conditions and in an emergency.

The latter case is more easily discussed. On the expectation of continuing tension in and around the Gulf, we may assume that pipelines presently being considered will actually become operational. In the event of a total stoppage of Gulf shipments, this would leave a maximum capacity of 2.4 million b/d directly to the Mediterranean, and of 5 million b/d to the Red Sea, even if the GCC were to opt for an Indian Ocean outlet. We may expect that most of the oil available on the Red Sea would enter the Mediterranean through either the Sumed or the Suez Canal.

Assuming that the Sumed is fully operational with a maximum capacity of 2.3 million b/d, the Suez Canal would bear traffic of around 2.7 million b/d. This figure is very close to the projection of Suez traffic in 1985 that was put forward by Internaft at the end of 1980. (29)

(29) World Oil and Tanker Outlook to 1986, Internaft Ltd.

If we add the potential exports of Mediterranan producers, which we may estimate around 3 million b/d, we reach a total of more than 10 million b/d that would be available in the Mediterranean if the Gulf were completely closed to naval traffic in an emergency (see Table 6). This would cover some 50% of US and West European imports in 1985.

Outside an emergency, the volume of traffic would be influenced by a variety of elements, most of which are impossible to predict. However, if pipelines were laid they would tend to be used in non-emergency times as well, causing an increase in Mediterranean traffic anyway. A figure of 8 million b/d for Mediterranean oil shipments in 1985 is therefore certainly plausible.

Table 6 - Estimate of crude oil Mediterranean shipments in 1985

	in million b/d
Sumed	2.3
Suez Canal	2.7
Iraq-Turkey	0.9
Iraq-Banias	1.4
Iraq-Tripoli	
Libya [1]	1.0
Algeria [1]	0.8
Tunisia	0.3
Egypt	1.0
TOTAL	10.4

1 Maximum sustainable output is estimated today at 2.1 million b/d for Libya and 1.2 million b/d for Algeria.

Part III

The Mediterranean and the development of natural gas resources

If the Mediterranean is likely to become increasingly important in the geography of the international oil industry its significance for the development of natural gas may turn out to be even greater, all the more so because of the predominantly regional role of natural gas as an energy source.

The main obstacle to exploitation of natural gas is transportation. Delivery to the consumer necessarily requires the creation of a pipeline grid reaching each individual customer. This highly capital-intensive distribution system can be fed by local natural gas, if it is available; if not, natural gas has to be transported from the source to the inlet of the distribution grid. This can be done either in gaseous form - through a pipeline - or in the form of liquefied natural gas (LNG). In the latter case, which is relevant only for maritime transportation, the gas is liquefied in a liquefaction plant, is transported in special LNG tankers, and is then regasified at the inlet of the distribution system.

The difficulty of transportation is much increased whenever gas must be transported across the sea. There are economic as well as technological limits to the laying of pipelines on the seabed at great depths, while the LNG route is costly both in terms of initial investment and in terms of direct costs. This is the fundamental reason why the share of total energy needs which is met by natural gas varies greatly, depending on the local availability of gas.

Thus, in the USA natural gas accounts for around 26% of primary energy, while in Western Europe only some 14%.

The difficulty of transportation is the main reason why, in the past, international oil companies did not bother to develop the natural gas reserves found in the oil-exporting countries. The sheer waste of flaring associate gas is a well-known aberration, which is now beginning to disappear (only too slowly). However, the issue of full development of gas resources has not yet been systematically tackled.

Oil-exporting countries often expressed a preference for the local utilization of natural gas resources: oil may be exported, but gas is one asset that should be kept for local use. There is controversy over the netback value that local utilization of gas would bring relative to the price at which it may be exported. However, it would appear that reserves available in many countries are so large relative to all realistic estimates of potential local demand that even if there were an absolute preference for local transformation, significant quantities would still be available for export. A total ban on exports would prolong the life of known reserves to an irrationally distant horizon.

If, as I expect, natural gas is offered for export in large quantities, it will become a major factor in Mediterranean trade. Although the shipment of gas in LNG form over great distances is not to be ruled out, most of the gas trade will probably remain "regional". The reason for this expectation is that sufficient discoveries are being made in the North American continent to make it potentially self-sufficient - and the high cost of transportation will

ensure that the closer sources are tapped first. For the same reason, Japan will tend to rely on sources in southeast Asia, although it is to be expected that it will also import some LNG from the Gulf. Most of the gas available for export from the countries around the Gulf, from North Africa and Nigeria will therefore be shipped to European outlets. With the exception of potential LNG exports from Nigeria, which could remain entirely outside of the Mediterranean, all other flows would somehow cross the Mediterranean, either in gaseous or in LNG form.

There is considerable uncertainty as to the future size of this trade. Although available resources are very large (see Table 7 ; in considering these data it should not be forgotten that in most countries gas has not been systematically explored for), the growth of demand in the industrial countries may be considerably slowed down by the current insistence of the producing countries on the equalization of the price of gas and crude oil. Therefore, we will not present forecasts of the importance of Mediterranean gas trade at some specified future date, but will describe the existing export and import infrastructures in the Mediterranean as well as various projects that are being considered and may, sooner or later, be implemented.

Current infrastructure for gas trade in the Mediterranean

The Mediterranean country which has made the greatest effort to promote gas exports is Algeria. The Algerian infrastructure for gas exports consists of plants for gas liquefaction and the pipeline connecting the Hassi R'Mel field to Italy, across Tunisia and the Sicilian Channel.

Table 7 - Natural gas reserves around the Mediterranean (billion cubic meters)

Country	1970	1979	1980
Algeria	3,000	3,738	3,724
Libya	850	680	674
Nigeria	170	1,172	1,161
Other African countries	400	367	345
Abu Dhabi	-	538	566
Saudi Arabia	1,500	2,711	3,183
Iraq	600	779	777
Iran	6,000	13,877	13,735
Kuwait	1,000	949	940
Qatar	-	1,694	1,700
Other M.E. countries	750	413	407
TOTAL	14,270	26,923	27,212

Source: Eni, Energy and Hydrocarbons, 1981

Table 8 shows the global situation of existing LNG plants in operation in 1980. The leading role played by Algeria is immediately evident. Table 9 contains further information about the liquefaction industry in Algeria.

The Algerian experience is thus extremely interesting, and it points to the fact that there are numerous problems with liquefaction.[30] The Algerian government has in fact

(30) For a detailed discussion of this experience see: Ali Belhadj, "The Liquefaction of Natural Gas in Algeria: Development, Technologies, Experience", paper submitted to Algiers symposium, pp. 329-352.

Table 8 - Operational L.W.G. Projects in 1980

Exporting country	Market area	Start-up year	Contract volume MMSCFD[a]
Algeria	United Kingdom	1964	100
Algeria	France, Le Havre (1)	1965	50 (*)
OSA, Alaska	Japan	1969	140
Libya	Italy	1969	235
Libya	Spain	1969	110
Algeria	France, Fos (2)	1972	350 (*)
Brunei	Japan	1972	750
Algeria	Spain	1976	450 (100 in 1980)
Abu Dhabi	Japan	1977	360
Indonesia	Japan (1)	1977	1060 (1180 in 1980)
Algeria	USA, Boston (1)	1978	120 (*)
Algeria	Usa, Cove Point et al (2)	1978	100 (*)

Contacted total	4725
Less: suspended shipments (*)	1520
Volume trading (May 1980)	3205

Table 9 - Presentation Table of Algerian LNG Plants

Plants Informations	GL 4 Z ex-CAMEL ARZEW (3 Trains)	GL 1 Z SKIKDA (3 Trains)	GL 1 Z ARZEW (6 Trains)	GL 1 K SKIKDA (3 Trains)	GL 2 Z ARZEW (6 Trains)
Year of Operation	1964	1973	1978	Actually in strat - up phase 1980	1980
Production capacity					
10^9 SCM of gas/ year	1.7	4	10.5	4.5	10.5
or					
10^6 CU.M LNG/ year	2.8	6.3	17.5	7.3	17.5
or					
10^9 BTU/day	210	450	1.720	520	1.720
Sub-products T/Year	Butane: 25,000	Ethane: 163,000 LPG : 190,000	-	Ethane: 165,000 LPG : 288,000	LPG : 700,000
Main utilities consumption					
Sea water CU.M/HR	25,000	90,000	180,000	80,000	175,000
Electrical Power MW	10	12	36	17	40
High Pressure Steam T/HR	300	1,050	2,300	1,030	2,200
Internal Consumption of Gas Rate %	Contract: 15.6 Actual: 20	16 13.5	14.8 11.4	13.1 13	14.3
Process Used	Conventional Cascade	TEAL	APCI	PRICO	APCI
Constructors	Technip Pritchard Rhodes	Technip	Chemico than Sechtal	Pritchard Rhodes than Pullmann Kellogg	Pullman Kellogg
CLIENTS	British methane Gas de France	Gas de France Enagas (Espagna) Distrigas (USA)	El Paso	Distrigas (USA) European Clients	European Clients

Source: Ali Balhadj

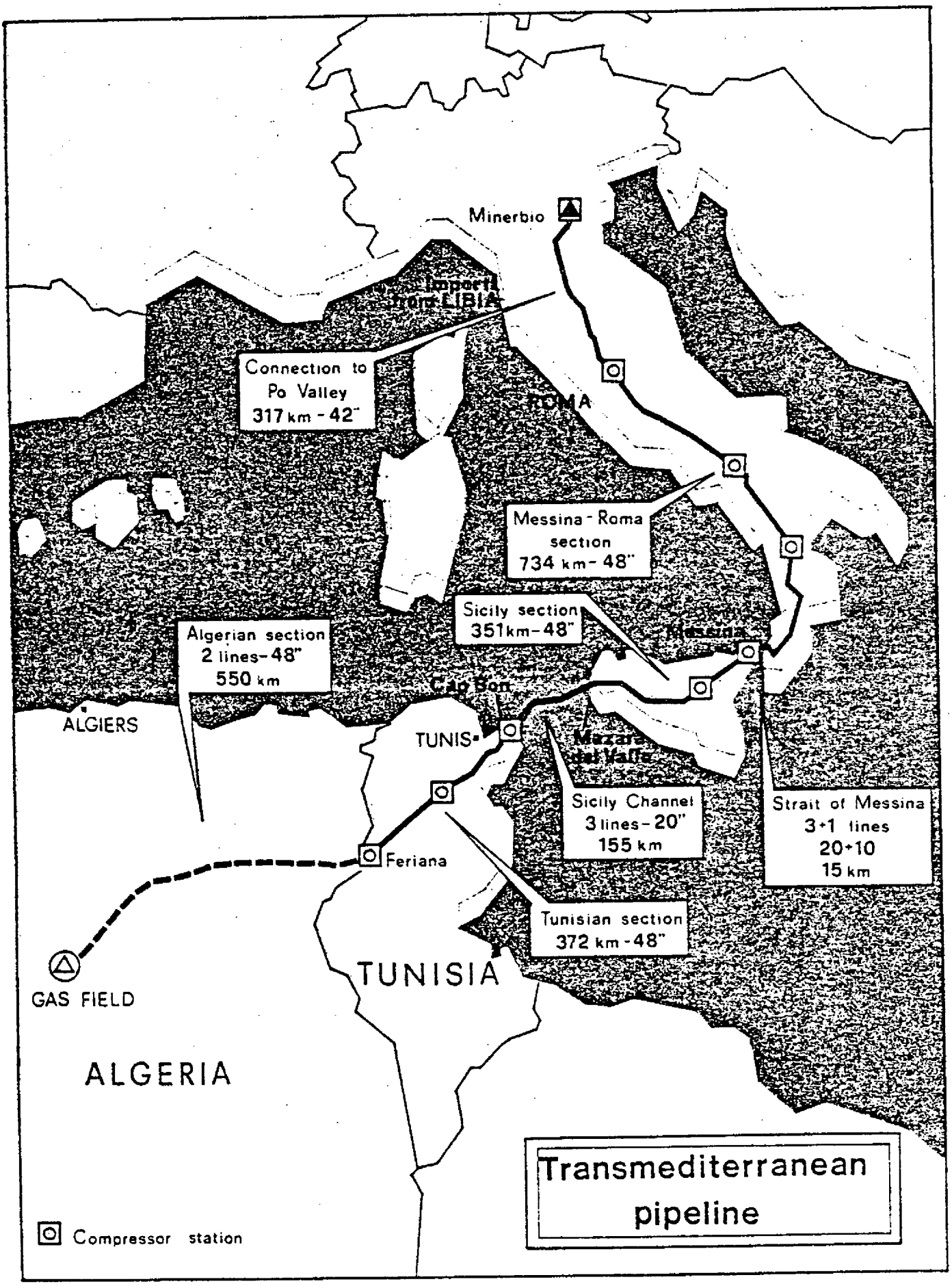
revised its commitment to the continued development of this industry, indefinitely postponing plans for a third liquefaction complex in Arzew.

In the Mediterranean context, the export of gas via pipeline may have a cost advantage over LNG and the higher the price of gas the more relevant is the advantage. For this reason much importance was attached to the Transmed pipeline as a precedent for the more efficient export of gas across the sea. Unfortunately, Algeria's insistence on a price system that would deliver gas to the Italian network at the same cost as the LNG alternative would have led to (in other words, their insistence on reaping for themselves all the benefits of building the pipeline) is considerably reducing the long-term implications of this new venture.

The Transmed pipeline represents a technological breakthrough not so much because of its total length (about 2,500 km), but because it has been laid at depths of up to 600 m. and traverses a fairly rugged seabed (Map 4-5). The pipeline has a maximum capacity of 12.4 bilion cubic meters per year.

Most of the Algerian LNG is delivered outside the Mediterranean. France is the only country on the Mediterranean coast which imports LNG. The terminal is at Fos sur Mer.

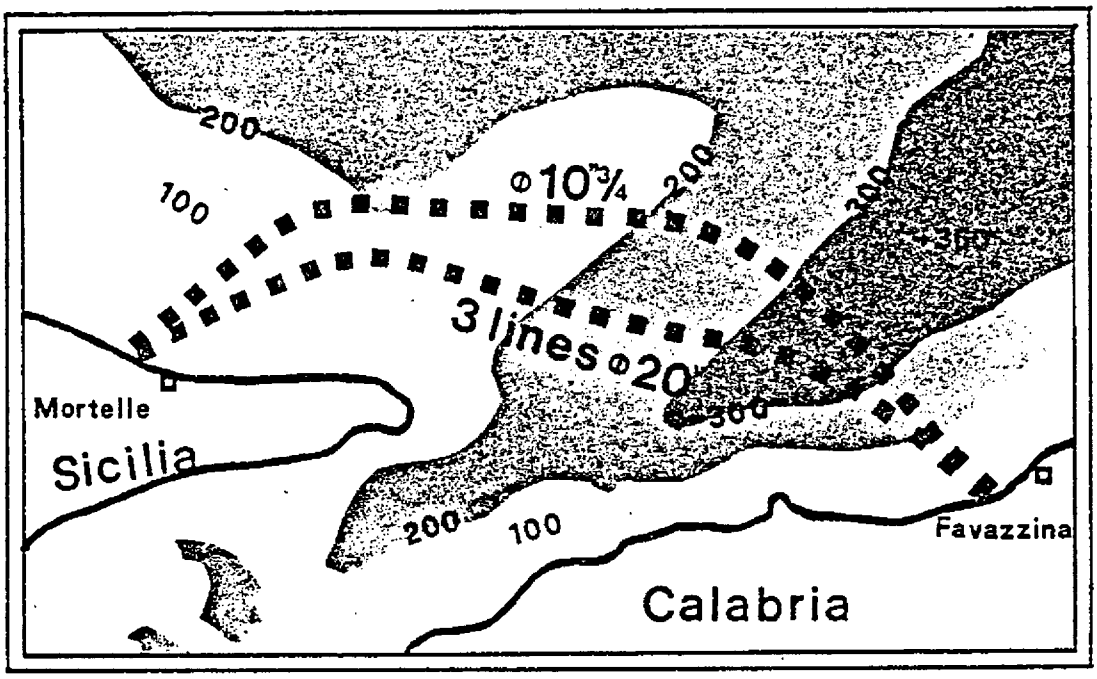
Libya is currently the only other Mediterranean country besides Algeria which possesses infrastructure for the export of gas, consisting in a relatively small LNG plant at Brega, formerly owned by Exxon, from which gas is normally exported to a terminal in Italy (La Spezia) and one in Spain.


Minerbio
Imports from LIBIA
Connection to Po Valley 317 km - 42"
ROMA
Messina - Roma section 734 km - 48"
Sicily section 351km - 48"
Algerian section 2 lines - 48" 550 km
Cap Bon
ALGIERS
TUNIS
Mazara del Vallo
Sicily Channel 3 lines - 20" 155 km
Strait of Messina 3+1 lines 20+10 15 km
Feriana
Tunisian section 372 km - 48"
TUNISIA
GAS FIELD
ALGERIA
Transmediterranean pipeline
Compressor station

STRAIT OF MESSINA CROSSING

Map 5

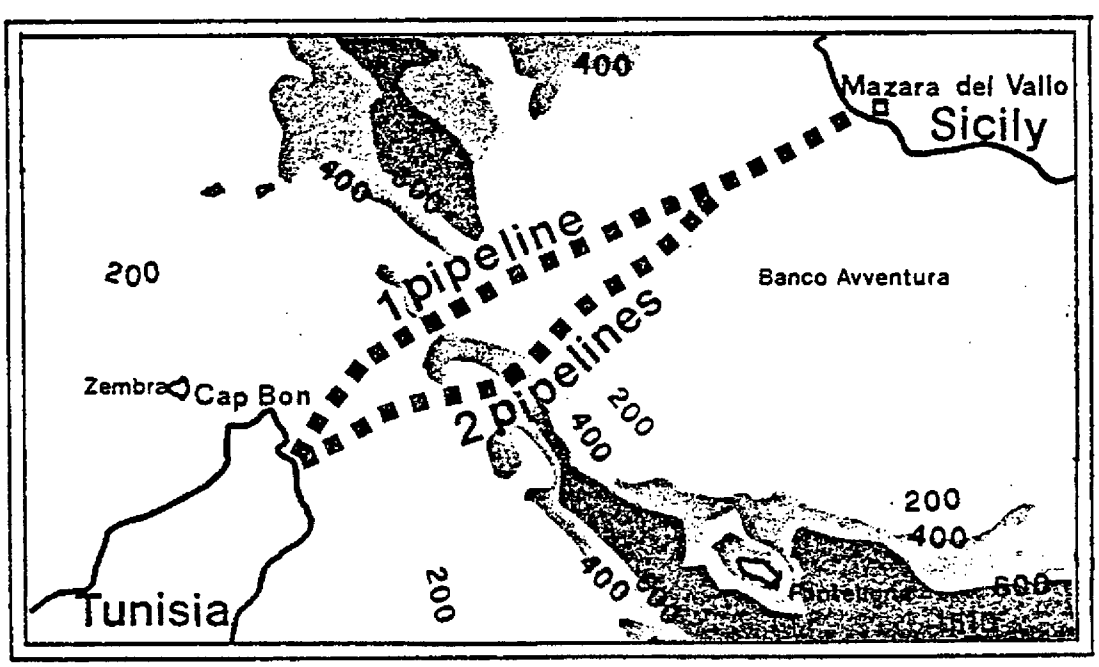
(depth in metres)



sea-line route

SICILY CHANNEL CROSSING

(depth in metres)



sea-line route

Outside the Mediterranean, there are plants for the production of LPG in a number of Gulf countries, and LNG in Abu Dhabi, but their output is at present absorbed mostly by the Japanese market and does not enter into Mediterranean trade.

Possible developments of gas trade in the Mediterranean

The most dramatic potential developments in the Mediterranean gas trade are linked to the exploitation of resources in Iran and in the Arab Gulf countries. From the technological point of view, three alternatives exist:

1) liquefaction close to the source (i.e. on the Gulf) and shipment in LNG tankers through Suez to a Mediterranean or north European terminal;
2) transportation by pipeline to a point on the Mediterranean coast, then liquefaction and transport in LNG form to a Mediterranean or north European terminal;
3) transportation entirely by pipeline.

The three alternatives are depicted in Map 6. while Table 10 summarizes a cost comparison for each alternative under a uniform set of assumptions. One should notice that the assumption on quantity at the inlet of the system is important, because the investment costs are not proportional to the quantity transported; the pipeline alternative becomes more competitive the larger the quantity to be transported. Also, the time distribution of the flow is importtant, the pipeline being better off if the flow is constant. Finally, as the table shows, the value of gas as fuel is important, as the pipeline absorbs far less of it.

Map 6

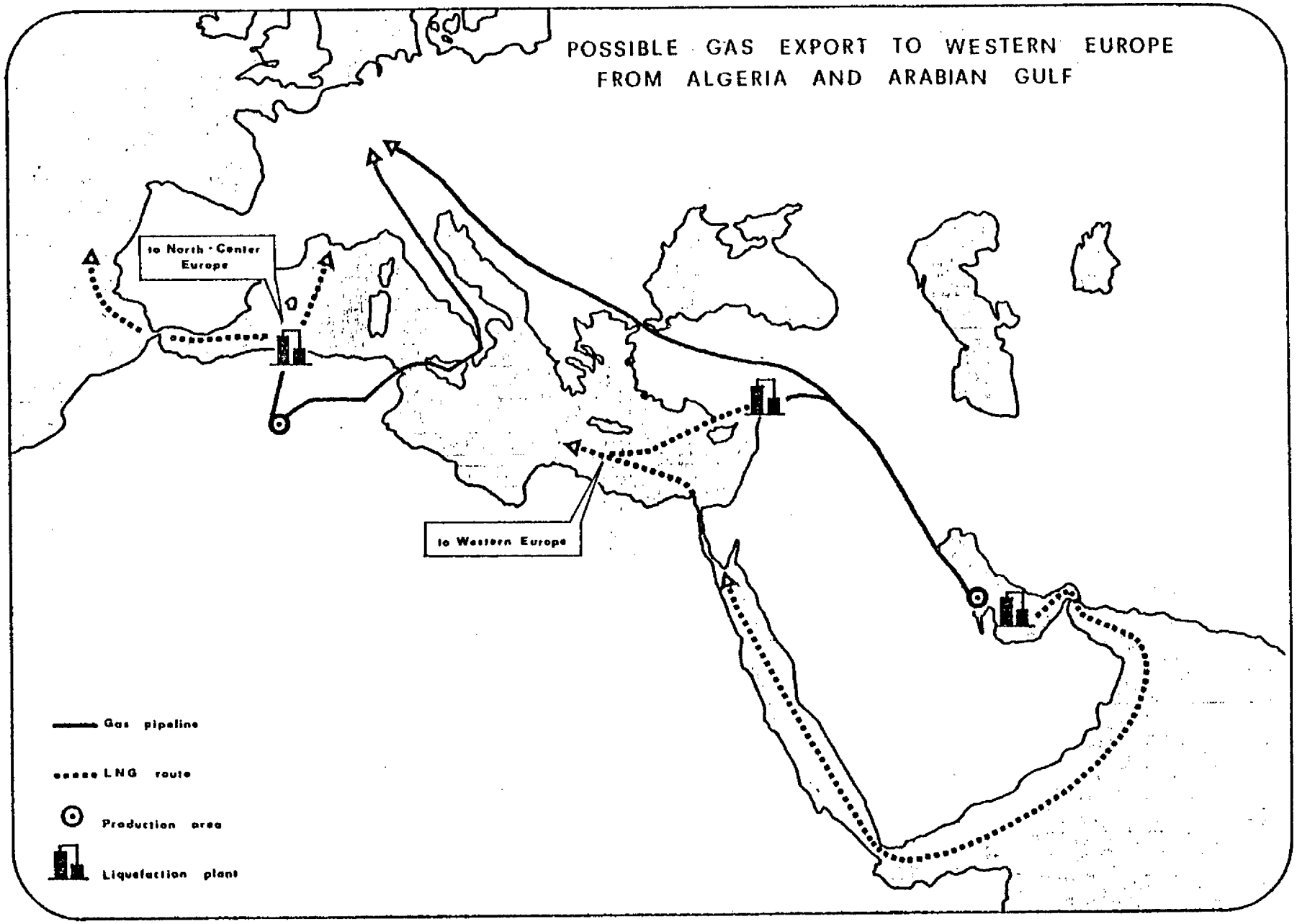

POSSIBLE GAS EXPORT TO WESTERN EUROPE
FROM ALGERIA AND ARABIAN GULF
to North - Center Europe
to Western Europe
Gas pipeline
LNG route
Production area
Liquefaction plant

Table 10

	Algeria Europe		Arabian Gulf-Europe		
	gas pipeline	LNG	Gas pipeline	LNG	Gas pipeline LNG
Route	Hass i R' Mel-Tunisia-Italy Central Nord Europe		Area of Gulf Iraq-Turkey-Greece-Yugoslavia-Central Nord Europe	Via Suez	Liquefaction at Mediterranean coast
Length of route (Km)	3,500	2,350	5,200	11,300	7,000
-of which land gas pipelines	3,320	550	5,200	-	2,300
sea gas pipelines	180	-	-	-	-
Quantity at the inlet of the system ($10^9 m^3/a$)	18	18	18	18	18
Quantity delivered to market ($10^9 m^3/a$)	16.8	15.1	16.3	14.8	14.4
Investment at Apr. 80 costs without interest during construction (10^9 $)	4.5	4.5	5.9	6.5	7.1
Transportation unit cost at April 1980 value ($/MMBtu)					
a) fuel gas value 2 $/MMBtu	1.5	2.1	2.0	2.9	3.1
b) fuel gas value 3 $/MMBtu	1.6	2.3	2.1	3.1	3.3
c) fuel gas value 4 $/MMBtu	1.7	2.5	2.2	3.3	3.5

Source: Bonfiglioli e Cima

The results of the cost comparison thus depend on the assumptions; yet it is important to note that for a reasonable set of assumptions - such as those used by Bonfiglioli and Cima - the pipeline alternative appears preferable even for gas from the Gulf. Yet this certainly does not authorize the conclusion that gas will be exported to Europe only via pipeline.

The most likely outcome is that a system for transporting gas from the Gulf to Europe will evolve gradually and in a complex way. No country will want to rely on just one source and one mode of transportation. Liquefaction plants will be opened because they can be decided upon unilaterally by each state, and because they allow a shift in the final destination of LNG. A pipeline system collecting gas from various sources around the Gulf is a difficult political proposition. It is more likely that Iran or Iraq, or both, will take the initiative to build a pipeline across Turkey to liquefaction plants on the Mediterranean (31) - and economic reasons would not be the only consideration. Thence, the system may expand, with other Arab countries possibly connecting into the Iraqi line, and European countries promoting a feeder from a gathering point in Turkey. Although this is, I think, a realistic scenario, it may very well be that political difficulties and an unrealistic price stance on the part of the gas producers will lead to a situation whereby gas exports to Europe simply fail to happen, or never grow beyond a low level. In the latter case, LNG would remain the only option.

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(30) Indeed, in December 1980 Iraq and Turkey signed a protocol in Ankara agreeing, among other things, on "The construction of a natural gas pipeline to carry Iraqi natural gas to Turkey" (MEES, January 5, 1981, p. 6)

Yet, even if the Middle East is the largest potential source of natural gas for Mediterranean trade and its future is highly uncertain, there are other important gas reserves elsewhere around the Mediterranean, in particular in Egypt and Tunisia.

As a policy measure, Egypt has decided to retain natural gas for domestic use until a minimum of 345 billion st. cu. mt. (12 trillion st.cu.ft.) of reserves are located, which will constitute the so-called "National Reserves". Once this reserve has been secured, a gas export project will be allowed, with the possibility of pooling the gas reserves of the different operators. (31). The export of gas will most likely take place in LNG form; consideration of present reserves and the time distribution of the likely discovery of new reserves leads to visualize the possibility of an LNG plant producing an initial 3 billion cu. m. in 1990, increasing to 9 billion cu.m. in 1991 and stabilizing at this figure. (32)

Another possible infrastructural development for gas trade in the Mediterranean is directly or indirectly linked to Algeria. Before the Transmed pipeline was completed and the row over the price of gas began between Italy and Algeria, the following developments had been under consideration:

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(31) M.K. El Ayouty, "Exploration and Gas Discoveries in Egypt"; G. Rustici, "The Policy of the Egyptian Government for Promoting Gas Exploration and Exploitation", papers submitted to the International Seminar on Natural Gas and Economic Development, organized by EGPC and IEOC in Cairo, 26-27 February 1982.

(33) M. Colitti, "Natural Gas and Economic Development", ECPC-IEOC Seminar.

a) An increase in the capacity of the Transmed to 18 billion cu.mt./year or more.(34)

b) The laying of a pipeline across the Otranto Channel, connecting Greece to the Transmed.

c) The laying of a second Transmediterranean pipeline connecting Algeria to Spain (from Oued Mellah to Almeria).(35)

It is not clear what the status of these projects is at present.

Offshore gas reserves in the Mediterranean

We have so far discussed the relevance of the Mediterranean for regional gas trade. The picture is, however, incomplete without consideration of offshore gas reserves in the Mediterranean.

We have already described the general conditions of offshore hydrocarbon exploration and production in the Mediterranean with reference to oil; to this we need add only a few specific remarks on gas.

A first important point is that prospects for gas in the Mediterranean are generally better than for oil, as is borne out by the fact that many more gas fields have been found than oil fields. Numerous gas fields have been found in the northern Adriatic on the Italian side.

Large gas reserves have also been discovered off Tunisia and Egypt. In the former, the Miskar field is estimated by Etap to contain 30 billion cubic meters of gas.

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(34) MEES, 21 January 1980, p. 5; 12 May 1980, p. 6.

(35) MEES, 12 May 1980, p. 6.

In Egypt the largest offshore gas find is at Abu Qir, which began normal production in January 1979 at a rate of 100 Million cu.ft./day.(36) Plans for a doubling of this capacity and further improvements have been considered for some time (MEES, 11 February 1980) and financial assistance to this end was recently offered by the World Bank.

One important aspect of offshore gas in the Mediterranean is the exploitation of minor discoveries. At present, the exploitation of an offshore gas field needs that it be connected to the coast with a pipeline; and in view of generally difficult conditions in the Mediterranean many gas discoveries may simply not deserve the investment. If a small oil deposit is found offshore, it is always possible to exploit it with minimum investment through the so-called "early production" method. This means that the oil is pumped directly from the field into a tanker which is temporarily anchored nearby, and serves as a floating reservoir from which other tankers may load. However, this is not possible with gas.

In order to exploit these fields it has therefore been suggested that gas may be utilized in situ with floating plants that would connect directly to the field. These would most probably be power plants, which would be connected to the national grid through underwater cables.

While this is at present a largely theoretical hypothesis, yet is is important to recall it as it would entail a considerable increase in the economic interests at stake over the seas.

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(36) MEES, 29 January 1979.

Conclusion

The various developments that were analyzed so far point to a growing importance of the Mediterranean for the global energy picture. However, while on some aspects it is possible to make forecasts with relative confidence, on others there is still considerable uncertainty.

Two processes stand out clearly:

a) exploration and development of oil resources in water depths of less than 3,000 ft.

b) Transportation of oil to and across the Mediterranean in growing quantities.

In political terms, the first process may be a source of conflict, and is indeed so. However it would appear that the interests at stake, while significant, are still relatively minor, and the chances that a peaceful compromise may be found are considerable. In military terms, offshore oil installations would be mostly along the coasts, and would not interfere - or be harmed - by the presence of military forces at sea. A possible exception to this conclusion relates to the Sicilian Channel, which is at the same time an important choke point and an important area for oil activities.

The second process underlines the need to maintain the role of the Mediterranean as an open sea for international navigation. It is a process that would not imply any significant change from the present political and strategic status quo. It would, rather, tend to reduce the importance attached to the Gulf and the Indian Ocean, most notably to the extent that there is a trade-off between naval superiority in these areas and in the Mediterranean.

Two further processes are possible:

a) the development of natural gas trade.

b) the extension of oil exploration and production to areas covered by more than 3,000 ft. of water.

The development of natural gas trade would increase the economic and strategic importance of the Sea very considerably. Because of its properties, gas is likely to continue as an essential component of the energy balance even in the relatively distant future; and Mediterranean gas trade is the primary alternative to growing direct dependence of Western Europe on gas supplies from the Soviet Union. All elements of the LNG chain are considerably more vulnerable to military action than corresponding installations for oil trade. It is also more difficult to maintain gas stocks that would compensate a temporary reduction in shipments - except in the form of domestic reserves which are deliberately not produced. Finally a multiplication of underwater gas pipelines would create a strong incentive for the countries concerned to establish a strong military control over specific sections of the sea, possibly limiting the presence and passage of forces of other countries.

The extension of oil exploration and production to the deep basins would alter the political and military environment very considerably. Conflict over the delimitation of underwater boundaries may become very serious, in view of the difficulty of reaching "fair" decisions in the Mediterranean context.

Furthermore, the operations would involve very sophisticated equipment and technology, which would almost certainly impinge upon the strategic balance in the sea. Not only civilian installations would have to be protected: they themselves may acquire a military significance (notably in connection with detection of submarine traffic).

Hence the importance of developing a cooperative approach to the development of resources in the deep basins. The fact that a lot of technological development and geological research is needed before these resources will acquire an immediate economic significance should enhance the chances of reaching an agreement among a large number of Mediterranean countries to approach the problem jointly. The need to precisely delineate underwater boundaries might be overcome in this context, and conditions might be more favourable to the disentanglement of civilian and military objectives and instruments.