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A SUMMARY REPORT

THE INVESTMENT OPPORTUNITIES

IN THE HELEZ FIELD LEASE

ISRAEL

Prepared For

Lapidoth Israel Oil Prospectors Corporation Ltd.

June 1999

FORREST A. GARB & ASSOCIATES, INC.

INTERNATIONAL PETROLEUM CONSULTANTS

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June 10, 1999

I. INTRODUCTION

The Helez field (actually a complex of three fields: Helez, Brur, and Kokhav) is located 55 kilometers (km) (34 miles (mi)) south of the city of Tel Aviv, Israel, and 12 km (7 mi) east of the Mediterranean coast line. Discovered in 1955, it was the first oil field found in the Eastern Mediterranean area. The field, as of the end of 1998, had produced almost 18 million barrels of oil from primarily Lower Cretaceous formations, with minor production from Upper and Middle Jurassic limestones. The original oil in place in the four principal producing zones has been estimated volumetrically to have been about 40.3 million barrels. Each zone is divided into multiple reservoirs, separated by a significant fault system. Most of the reservoirs are open down-dip to a large aquifer to the east and have produced under an active water influx. Additional reserves are anticipated from continued operation of existing producing reservoirs, from rehabilitation and possible workovers of wells, from extensions and exploration of additional Lower Cretaceous and Upper Jurassic structural features, and from exploration of deeper Lower Jurassic, Triassic, and other prospects.

II. CONCLUSIONS

The Helez field, though approaching depletion under the current operating activity, offers several opportunities for augmenting the reserves from existing reservoirs, and still offers exploration potential in both a shallow Cretaceous-Upper Jurassic play and a deeper Lower Jurassic-Triassic, or even Paleozoic program. A summary of the economic opportunities discussed in this report is outlined below:

- Exploration for Lower Jurassic-Triassic and deeper reservoirs: it is common to find deeper reservoirs in areas of shallow production. A 3-D seismic survey should be incorporated in the exploration for these targets.

- Exploration for Cretaceous-Upper Jurassic reservoirs currently interpreted from existing seismic information: a 3-D seismic survey should be incorporated in confirming these prospects.

- Water flooding of the K Sand in the B Block: a reservoir simulation of this block indicates that approximately 260,000 barrels of oil might be recovered by water flood operations. Details of the simulation and the results are in an appendix to this report.

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- Work-overs and rehabilitation of certain well bores where historic production information indicates reserves may remain; this will require a comparison of historic production data to the volumetric oil in place estimates for each block and, in some instances, for each well.

Although the options having the greatest risk are the exploration programs, they also have the greatest potential. The combined options offer an existing small production base and a water flood activity which can be initiated while the exploration seismic surveys are taken and interpreted. Details on each of the above options are enclosed in this report.

III. GEOLOGICAL SETTING OF ISRAEL

Israel and its offshore area are situated in the oil-prolific zone surrounding the Arabo-Nubian shield. Major hydrocarbon accumulations characterize this zone, which extends from Egypt through Israel, Syria, and SE Turkey to Iraq and the Persian Gulf. Fig. 1 delineates basins and elevated blocks in this zone. The Alpine thrust front forms its northerly limit.

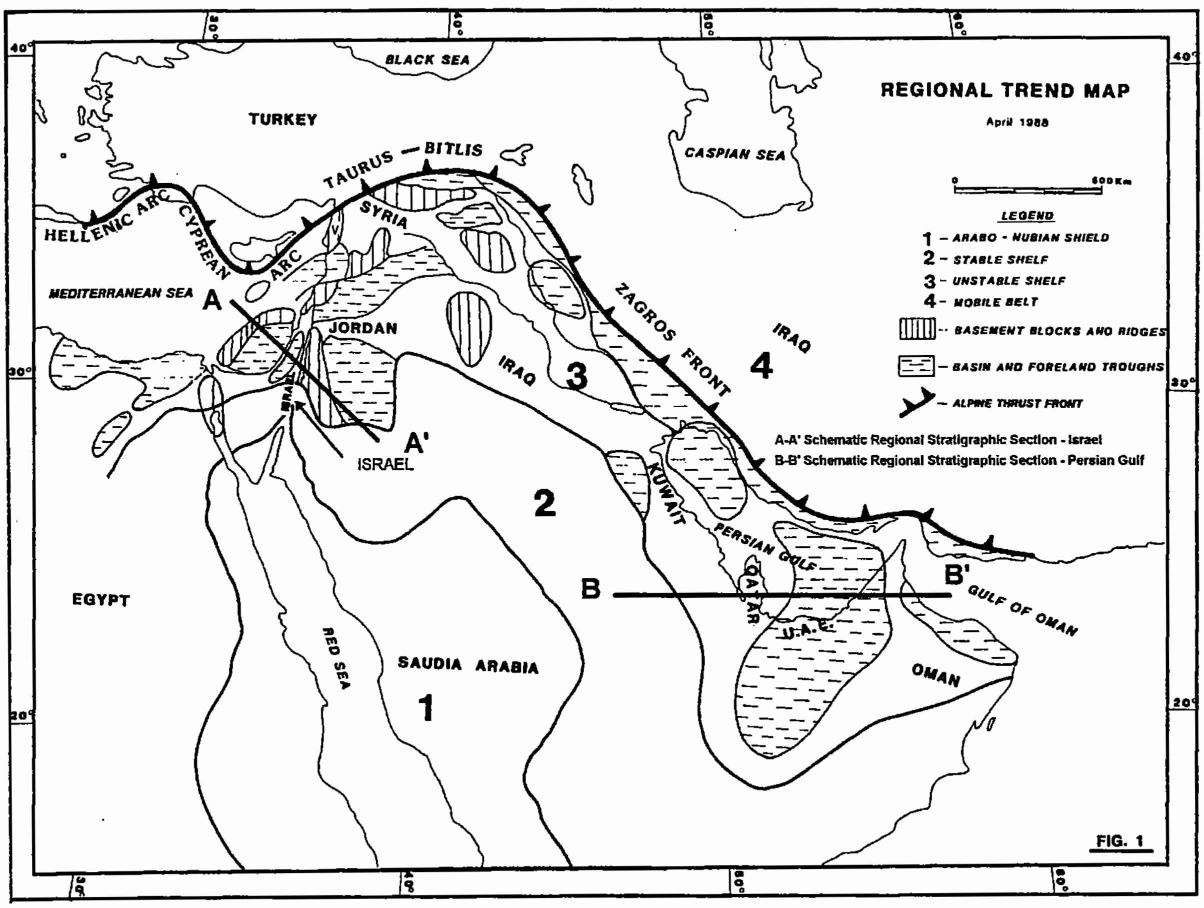
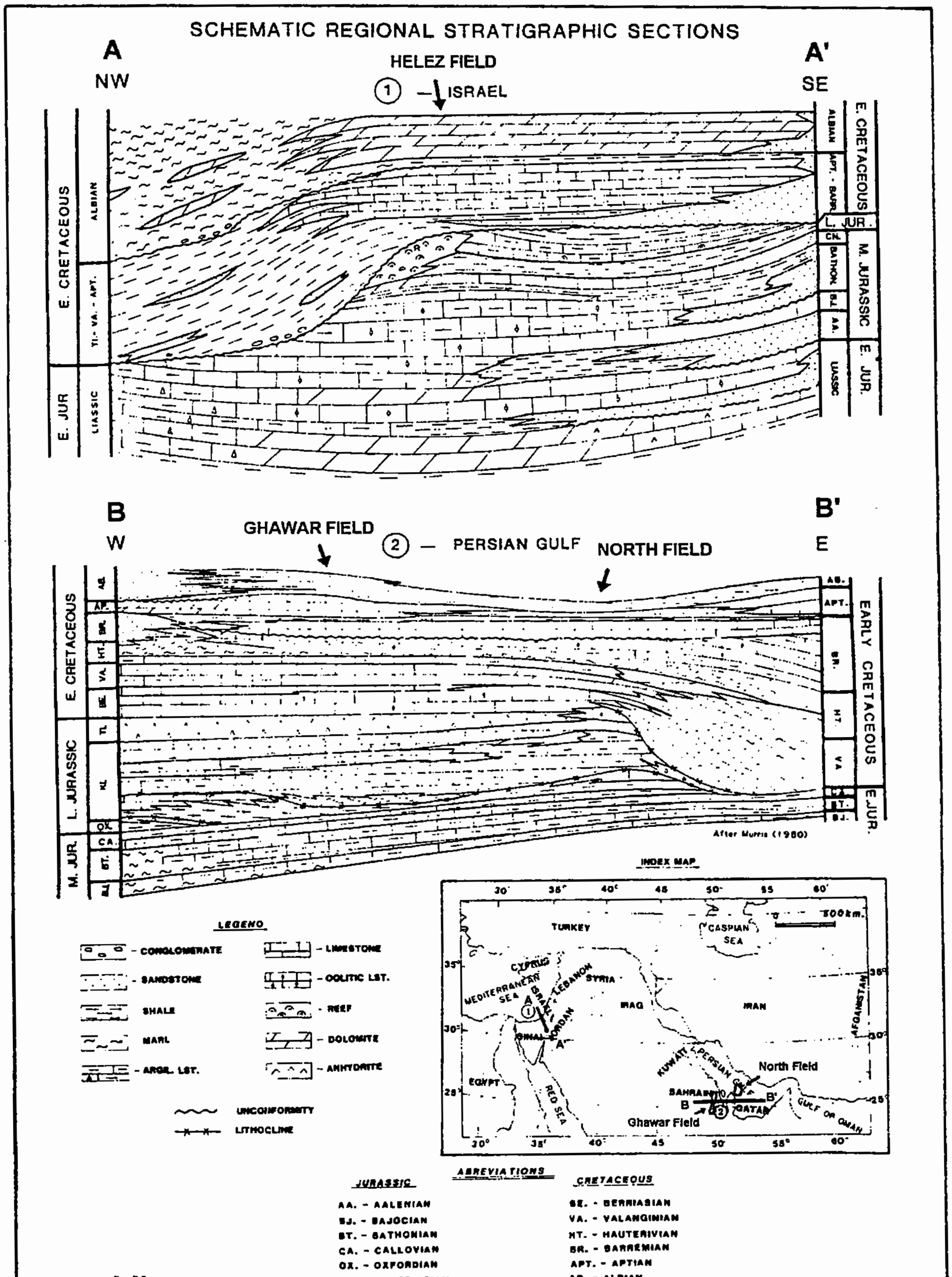


FIG. 1

The similarity between Israel and the unstable zone of the Persian Gulf is shown in Fig. 2. The sections are similar in (1) general appearance, (2) position relative to the shield and Alpine front, and (3) the nature of sedimentary history and stratigraphy.



A-A'
B-B'
Location of Schematic Regional Stratigraphic Section Also Shown On Figure 1.

FIG. 2

April 1988

Another site of major oil accumulations is the great crustal lineament that extends from the East African rift valleys to northern Syria (with a northwestward arm, the Suez Graben). There are large oil fields in the Gulf of Suez (October, Morean and Belayim, Marine and others). In Syria, there are gas and gas-condensate fields in the Palmyra Rift (Ash Shaer, Arak, Najie and others). The section in Israel is known as the Jordan Rift Valley. It extends from the Gulf of Elat (Aqaba) to the Hula Valley and northward. Oil and gas shows, sub-commercial and commercial production are associated with the Jordan Rift Valley (Fig. 3). This confirms the widespread presence of source rocks, reservoir rocks, effective traps, and favorable geothermal conditions in many areas of Israel.

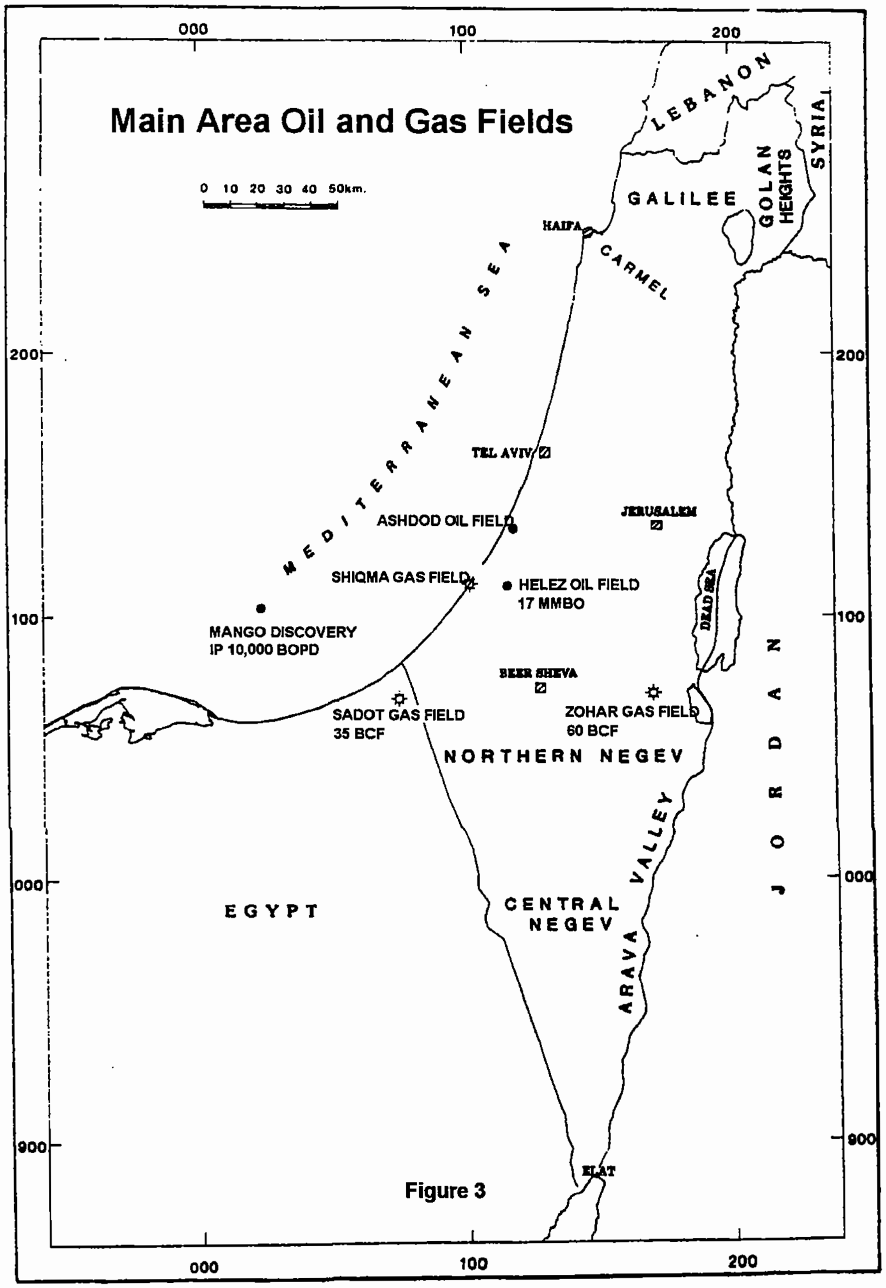


Figure 3

Israel occupies the eastern part of the Sinai-Israel subplate bounded on the east by the Jordan Rift Valley and by the Gulf of Suez on the southwest. Located on the margins of the Arabo-Nubian massif, the Sinai-Israel subplate is covered by a sequence of continental and marine sediments up to 12 km thick intersected in places by thick accumulations of volcanic rocks.

Paleozoic sediments about 230 meters (m) (750 feet (ft)) thick are exposed in the southern Israel - Eilat area. Cambrian dolomites, shales, and arkosic sandstones (Yam Suf Group) overlie preCambrian crystalline basement. The Cambrian sequence is overlain unconformably by Carboniferous quartzose sandstones (Negev Group).

The few deep boreholes drilled in central Israel found Permian quartzitic sandstones (Saad Formation) overlying complex basement rocks. Figure 4 shows the locations of deep wells in the Helez area.

Pre-Cretaceous tectonic activity usually is attributed to epeirogenic movements of the Arabian massif. The interpretation of well logs and the limited exposures of Lower Paleozoic rocks in southern Israel indicate general northwestward tilting of the margins of the massif with the development of a few wide basins. Large, open, and relatively deep basins developed during the Triassic and Jurassic period. Cretaceous to Eocene tectonic activity began with a phase of intense regional uplift and erosion associated with volcanism. It caused truncation as deep as the Paleozoic sequence in southern Israel. There were several epeirogenic phases during the Early Cretaceous. Post-Eocene tectonism of the Sinai-Israel subplate involved amplification of the Syrian Arc folds as late as Pliocene time. However, the predominant activities were the breaking away of the subplate from the Arabian plate and the 105 km (65 mi) of left-lateral shear along the Dead Sea rift.

A paleodepositional hinge belt during Cretaceous, Jurassic, and probably Triassic times along the present Israel coastline has been postulated from data accumulated from drillholes and seismic surveys carried out in the Coastal Plain and Continental Shelf of Israel. This belt separated shallow-marine and continental sediments deposited on the Arabian Platform to the east and the continental slope and rise sediments in the Levant Basin to the west. The sharp facies boundary, accompanied by deep canyon incision and the accumulation of deepwater sediments in the form of sedimentary prisms, indicates that this hinge belt coincides with the Mesozoic continental margins of the Arabian plate. Ultrabasic rocks of mantle origin, which are surrounded by sheeted intrusions and pillow lavas, outcropping in the Troodos massif in Cyprus and the massifs of Baer-Bassit in northwest Syria, are interpreted as a mid-Tethyan ridge and spreading center. This center is assumed to have been active in the Late Triassic to Late Cretaceous time interval (200-70 million years before present) between the Arabian and Turkish plates. During the Paleozoic, the Tethys ocean extended only to the north of Iran or Turkey. These two continents were split away from Africa-Arabia by Late Triassic rifting. The new Troodos-Baer-Bassit Mesozoic spreading center accreted a new ocean floor in the new southern Mesozoic branch of the Tethys. (Figs. 5 and 6).

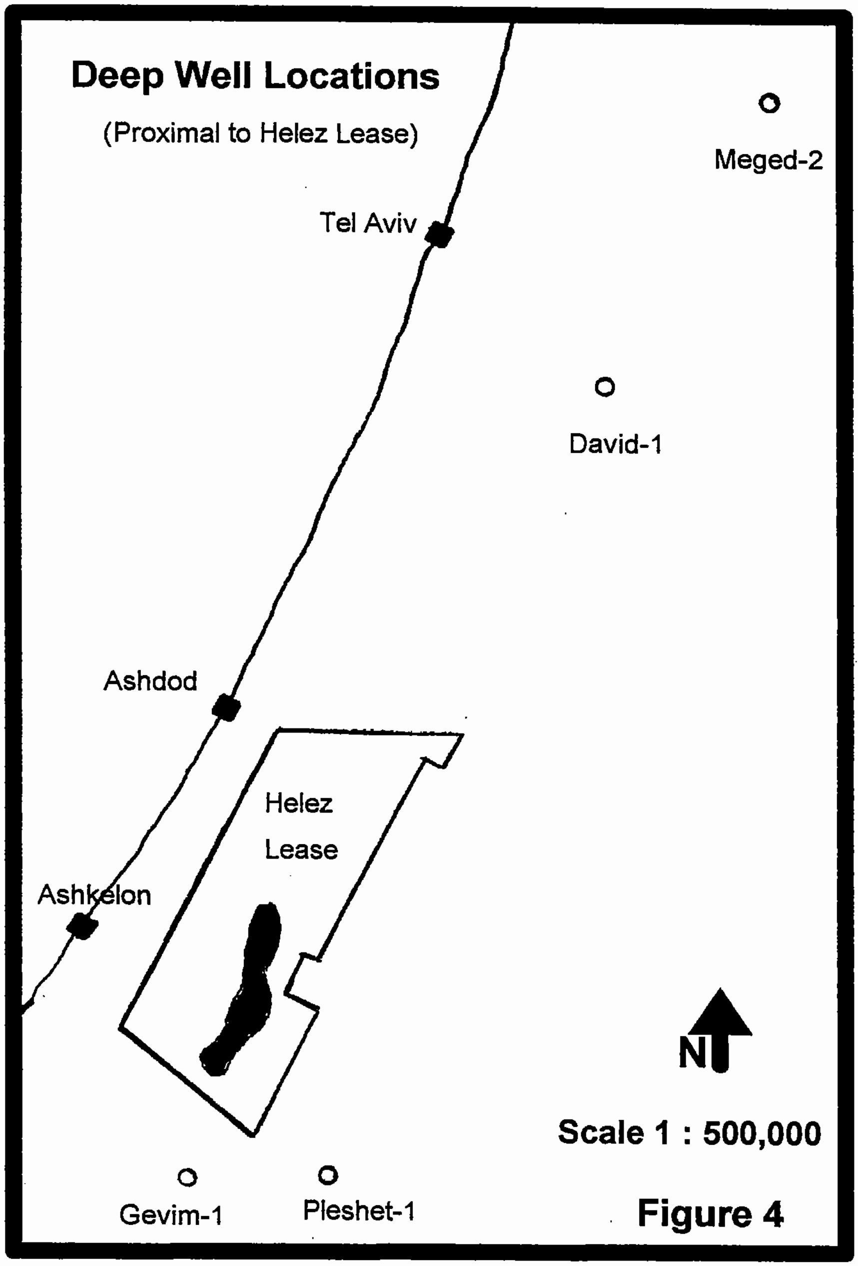

Deep Well Locations
(Proximal to Helez Lease)
Meged-2
Tel Aviv
David-1
Ashdod
Helez
Lease
Ashkelon
N
Scale 1 : 500,000
Gevim-1
Pleshet-1

Figure 4

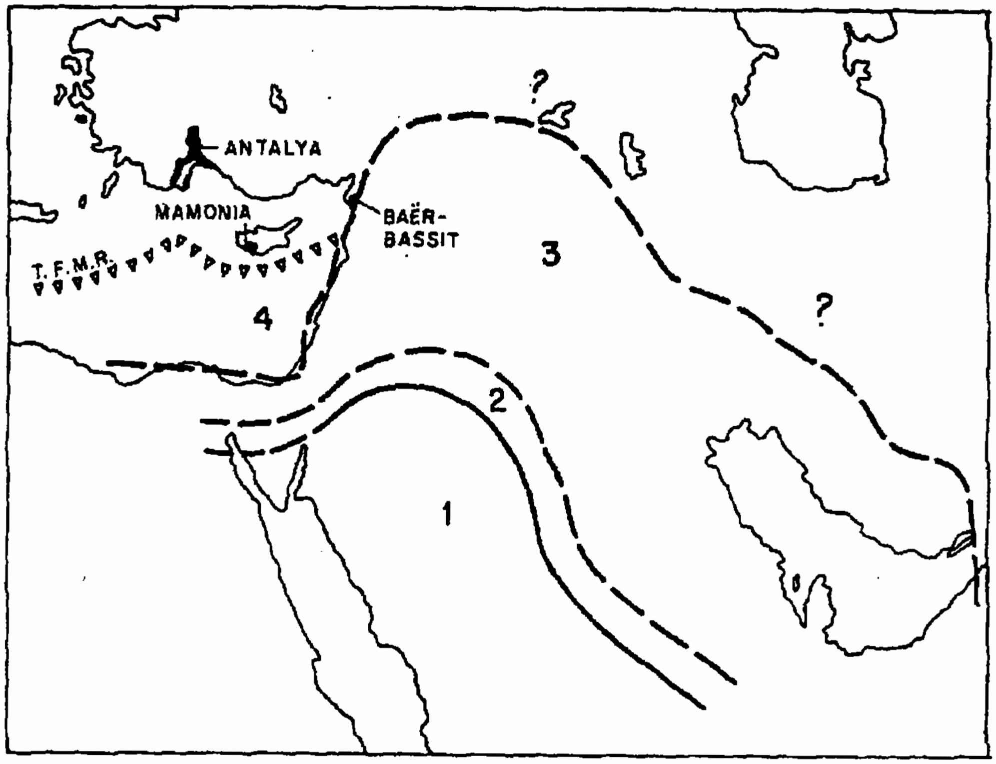


Figure 5 - Facies distribution and environments of deposition of Upper Triassic in the northern margins of the Arabian Platform (after Druckman et al., 1975).

1 - Continental: clastic red beds
2 - Transitional: continental and thin marine intercalation
3 - Sea marginal flats, sabkhas and shallow marine: dolomite, anhydrite, limestone
4 - Oceanic: micrites, radiolarites and nodular limestone associated with ophiolites (Baer-Bassit, Syria; Mamonia, Cyprus; Antalya, Turkey)
T. F. M. R. - Thrust front of the Mediterranean Ridge orogenic belt

The boundary between belts 3 and 4 in the eastern Mediterranean is highly hypothetical. Although the oceanic Upper Triassic outcrops are situated in the orogenic belt and are allochthonous, it seems that the facies distribution concept is still valid.

The activity along the spreading center ceased in Late Cretaceous time; and in the process of collision and subduction between Turkey-Iran and Africa-Arabia along the Zagros-Taurus-Mediterranean Ridge since the Tertiary, the Mesozoic ocean floor between the Turkish plate and the Troodos-Baer-Bassit spreading center was consumed. Therefore, the Levant Basin is only a remnant of the Mesozoic ocean floor.

Two main tectonic elements control the geological setup of Israel:

1. There was consistent compression in a west to north-northwest direction and associated orthogonal extension. The Syrian Arc System appears to affect Israel mainly by folding and faulting from Cretaceous to Eocene, but there are some indications of earlier Triassic and Jurassic initiation. The Syrian Arc fold and monocline trends vary systematically from almost north-south (Hebron monocline) to east-west (northern Sinai) forming an "S"-shaped feature 1,000 km (620 mi) long.

2. The Dead Sea rifting probably began in Early Miocene and is still active. The total sinistral transform movement of the Israel-Sinai subplate against the Arabian plate is 105 km (65 mi).

Volcanic activity was prominent in central Israel during the Jurassic and the Cretaceous and in northern Israel in the Neogene. Thick evaporitic sequences are observed in Triassic exposures and deep boreholes. Evaporites were encountered in Late Miocene sections in western Israel and are related to the Messinian desiccation event of the Mediterranean.

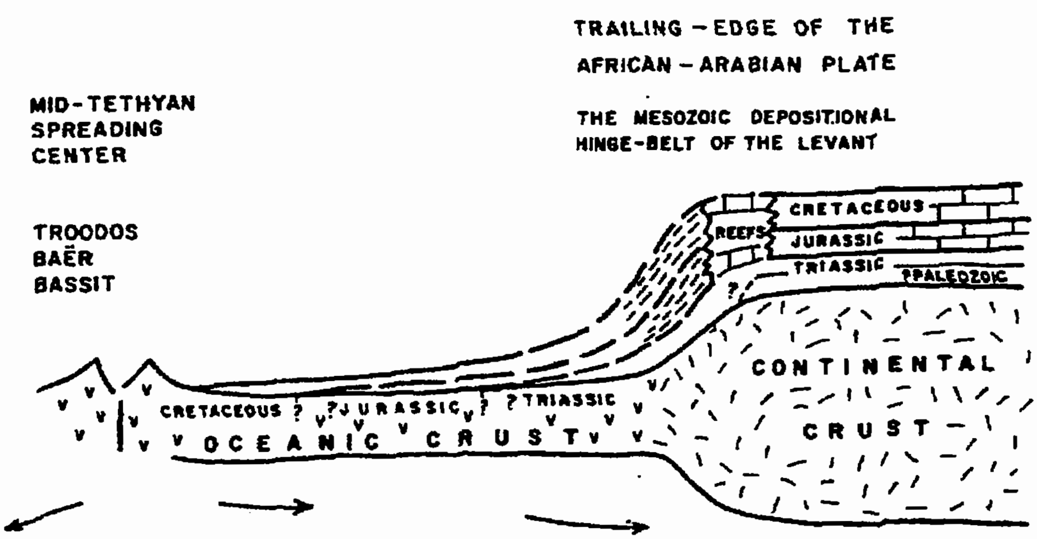


Figure 6 - Schematic representation of the hypothetical structure of the Levant Basin and the Arabian plate during the Mesozoic. Note that the diagram is not to scale. The width of the hinge-belt, which is about 10 km, is much exaggerated compared to the distance from the continental margin to the spreading center.

IV. GEOLOGIC SETTING OF HELEZ FIELD AREA

The Helez-Brur-Kokhav field is within the Helez Lease, Israel, and is in the Eastern Mediterranean basin. It was the first oil field discovered in the Eastern Mediterranean basin, which is considered a passive margin basin.

Depth of basement is estimated at approximately 7 km (23,000 ft), based on area well penetrations. A Paleozoic section has been penetrated by the Pleshet 1 and Gevim 1 wells, about 5 km (3 mi) south of the Helez Lease boundary (Fig. 4). If such a section is present in the Helez Lease, it most likely would be formed of arkosic clastic wedges derived from the Arabo-Nubian craton to the south and southeast. At least a portion of the Helez area was exposed before or during Permian time. In this case there may be Permian sediments above an angular unconformity on the older Paleozoic or preCambrian section.

Only one well has penetrated the Triassic sediments or the basement on the Helez Lease. Near the bottom of this well, the Helez Deep 1A well (6,093 m (19,990 ft) TD), the drill passed from Triassic sediments directly into preCambrian schist. The Paleozoic sedimentary section was faulted out. Based on the Pleshet 1 and Gevim 1 wells, it is likely that Paleozoic sediments are present elsewhere on the Lease. However, improved resolution of seismic imaging and more drill control are needed to answer the question of whether there are prospects for Paleozoic pays in the Helez Lease.

Mesozoic sediments are host to most of the known Helez oil and gas accumulations. These sediments were shed from the Arabo-Nubian Craton or precipitated beneath shallow seas on the flanks of that rock mass. Typical shallow platform sediments and reefs are the most common sedimentary rocks, but rapid lateral changes in these facies are common. This implies frequent eustatic changes during Mesozoic deposition.

In Early Cretaceous time uplift occurred, and a submarine canyon was cut into the Mesozoic section across the Helez Lease. This is known as the Gevar-Am Canyon and is filled with deepwater deposits. Submarine canyons often are filled with the products of gravity slides and turbidite channels or fans. These more porous intervals then are sealed by the shales which are native to the greater water depths involved. Such deposits have been found in the Gevar-Am Canyon, but detailed exploration for these deposits requires high resolution 3-D imaging which has not yet been applied in the Helez Lease.

V. HELEZ FIELD DESCRIPTION

A. LOCATION

The Helez field complex is located some 55 km (34 mi) south of Tel Aviv and 12 km (7 mi) east of the Mediterranean coast line (Fig. 7). It is Israel's most significant oil-producing field.

The main producing formations are Neocomian (Lower Cretaceous) sand beds and fringing dolomitic reef, with Oxfordian barrier reefs (Upper Jurassic) and Middle Jurassic calcarenites of secondary importance. The producing beds are overlain by Cretaceous and Tertiary sediments, the latter becoming very thick to the west. The field is 11 km (7 mi) long and 1 to 1.8 km (0.5 to 1.1 mi) wide, with a producing area of 12.5 square kilometers (km^2) (5 square miles (mi^2))(Fig. 7). Fig. 7, although outdated, still is of interest and indicates the approximate outline of the Helez Field. Cross sections A-A' and B-B' are shown on Figs. 12 and 17, respectively.

The field is operated by Lapidoth Israel Prospectors Corp. Ltd. In the past Lapidoth granted limited farmouts to other operators (Naphtha Israel Petroleum Corp. Ltd. and Delek Oil Exploration Ltd.) for exploration and development activities. The ultimate recovery is estimated to be about 19 million barrels.

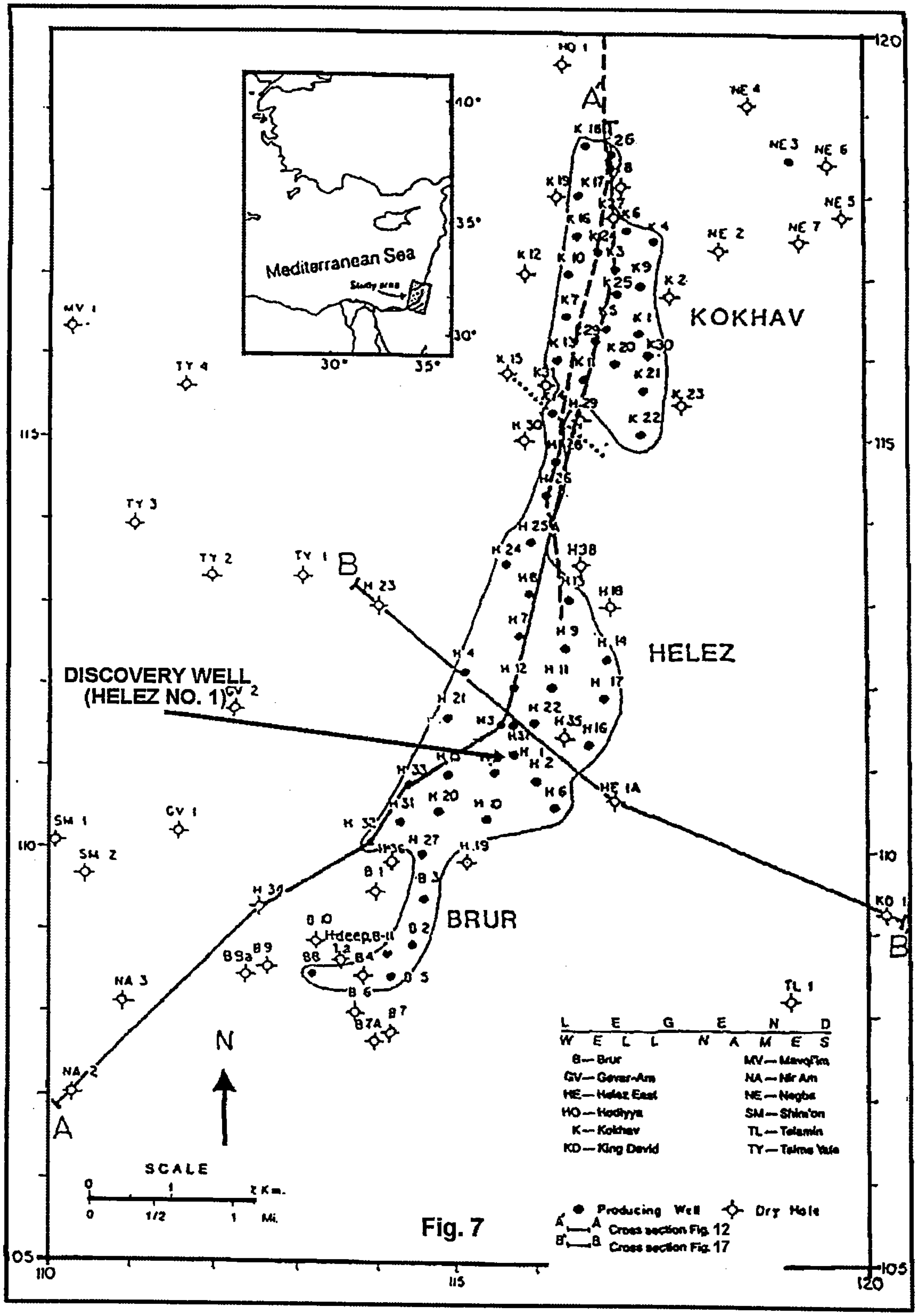

Mediterranean Sea
Study area
KOKHAV
HELEZ
BRUR
DISCOVERY WELL
(HELEZ NO. 1)
LEGEND
WELL NAMES
B — Brur
GV — Gevar-Am
HE — Helez East
HO — Hodiyya
K — Kokhav
KD — King David
MV — Mavqi'im
NA — Nir Am
NE — Negba
SM — Shim'on
TL — Telamim
TY — Talme Yafe
Producing Well
Dry Hole
Cross section Fig. 12
Cross section Fig. 17
SCALE
N

Fig. 7

B. HISTORY

1. Pre-Discovery

During the British Mandate government, the Iraq Petroleum Co. (IPC) carried out gravity surveys in the coastal area of Israel. The surveys revealed a 50 km (31 mi) long trend of positive anomalies in the south, between Ashqelon and the Sinai border. Seismic surveys across the gravity maximum of the Huleiqat feature (now Helez) led to the spudding of the Huleiqat 1 well on 25 September, 1947. The first targets, the Cenomanian dolomites, which are the country's major aquifers, were encountered containing brackish water; and the underlying Albian-Aptian beds were found to be predominantly carbonates with no hydrocarbon shows. At a depth of 1,055 m (3,660 ft), 11 ¾-inch casing was set. Because of political unrest, drilling was suspended without any positive results in February 1948.

After the establishment of the State of Israel in 1948, the Weizmann Institute of Sciences carried out seismic surveys in the area. Based on these findings, the Beeri-Helez-Negba area was qualified as a good prospect. The gravity maximum prospect in that area was granted to the joint enterprise of Lapidoth and Israel Oil Prospectors (I.O.P.).

The coincidence of seismic structures with a gravity maximum, plus gas seepages detected during exploratory drilling, led Lapidoth-I.O.P. in 1954 to drill a test well at Beeri, 24 km (15 mi) south of the Huleiqat well. The Beeri 1 well was abandoned at a depth of 3,645 m (11,960 ft) in Lower Jurassic beds without encountering any significant indications of hydrocarbons.

In spite of the disappointing results, Lapidoth's Chief Geologist, H. J. Tschopp, insisted on the oil possibilities of this major structural trend. Upon concluding that the Huleiqat well did not penetrate the sand-bearing section of Neocomian age, he recommended deepening it.

2. Discovery

With the data from five exploratory holes, the drilling of Huleiqat 1 well was resumed on 26 August, 1955; and the well, renamed Helez 1, was deepened to 1,515 m (4,970 ft) (Fig. 7) and completed as an oil producer on 12 October, 1955. The initial production of the discovery well was approximately 400 bbl/d of 29° API oil from the porous Middle Sandstone of the Helez Formation (Valanginian-Barremian age) at the depth of 1,480 m (4,850 ft). (Fig. 8 - Helez Field Type Log)

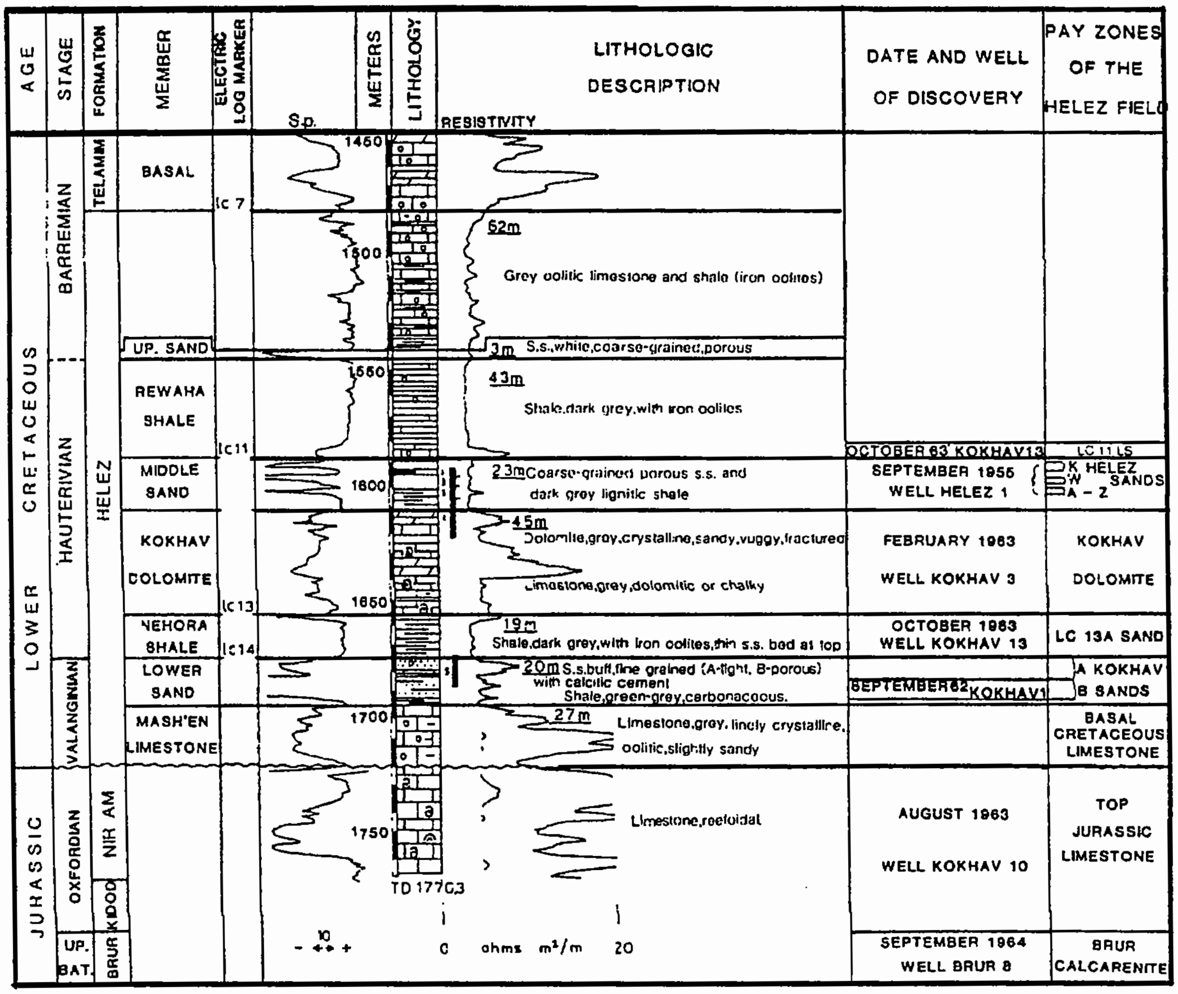


Fig. 8 Producing zone of the Helez field, presented on the log of Kokhav-2 well (**See Figure 7**). In this well the Gevar-Am Formation is missing. Kidod shale and Brur not penetrated.

3. Post-Discovery

Field expansion and subsequent development started in 1955 and proceeded in several stages. Initial development of the field was concentrated in the central part, the Helez field, and in the southern part, the Brur field. The development history for the field is outlined below:

1. 1955-August 1962: Drilling of 29 development and stepout wells in the Helez area and six wells in the Brur area. Production was limited to the Middle Sand Member of the Helez Formation (the "K," "W," "A," and "Z" Sands, Fig. 8). The "A" and "Z" Sands subsequently have been recognized as the same sand and now are referred to as the "A-Z" Sand. The northernmost stepout well (Helez 29 in Fault Block E, Fig. 10) was dry and considered to be the boundary of the field in that direction. One well, Helez 22 (TD 4,477 m (14,680 ft)), in Fault Block B tested deeper formations of Early Jurassic age without encountering new pay zones.

2. September 1962-1968: The drilling of 25 additional wells, following the oil discovery of Kokhav 1, located 1.2 km (0.75 mi) to the northeast of Helez 29. This well was recommended by W. Randall, Chief Geologist of Lapidoth, as another stepout trial to the north of the Helez field. As a result, 24 wells were drilled and production found mainly in two new horizons: the lower Sandstone member, B Sandstone, and the Kokhav Dolomite (Fig. 10). In addition there was minor production from the top Jurassic limestone. Only one well (Kokhav 7) was deepened to the Middle Jurassic and found no significant shows. Simultaneously, 14 wells were drilled in the Helez and Brur fields, some of them producing from the Kokhav Dolomite and Jurassic Limestones (Brur Calcarenite). The Helez field, defined as a hinge zone, established a new exploration approach for the area. The hinge zone reflects the shelf-slope environment.

3. 1969-end 1983: Except for one well in the Kokhav field (Kokhav 25) and a deep test to the basement in the southern portion (Helez Deep 1A), which was drilled by O.E.I.L., no drilling took place. The Helez Deep 1A was dry and abandoned at total depth of 6,093 m (19,990 ft) in basement rocks.

4. End 1983-1998: Drilling was resumed after granting farmouts to other operators. To date eleven wells have been drilled (seven in Kokhav, three in Helez, and one in Brur) with some success. Lapidoth itself opened new pay zones and deepened existing wells.

Only electric resistivity logs and micrologs, and occasionally sonic logs, were run in the older wells (to 1970). A fuller suite of logs (induction, gamma ray, compensated neutron, sonic, density, and dipmeter) is now commonly run.

C. HELEZ LEASE

The Helez Lease is located on the southern coastal plain of Israel, east and northeast of the city of Ashqelon, and is 250 km^2 (97 mi^2) in size.

The Helez Lease is divided administratively into three sections identified as A, B, and C. Section A mainly contains the Helez oil field. Sections B and C are areas targeted for oil exploration, north and west of Section A, respectively (Fig. 9).

In May 1957 the Brur area was identified, south of Helez; and in 1962 the Kokhav field was discovered, where two new productive formations were found: the Lower Sand member and the Kokhav Dolomite member.

The continuous activity in the Helez Lease slowed down after the Six Day War (1967) when Israel was active in the Gulf of Suez oil fields. From 1967 through 1984 only eight wells were drilled in Helez; and five wells were drilled outside of the field: Benyamin 1, Talme Yafe 4 (deepening), Karmon 3, Givati 1, and Nitzanim 1. In 1977 Helez Deep 1A was drilled to 6,093 m (19,990 ft) as a stratigraphic well to investigate older formations. It bottomed in basement rocks and was declared a dry hole. Out of 28 exploration wells that were drilled in the Helez Lease, except for those drilled in the Helez oil field, only Negba 3 and Niram 4 produced oil (approximately 1,600 and 1,000 barrels, respectively); and all the others were dry holes. Negba 3 is about two km northeast of the Kokhav field limits, and Niram 4 is about five km southwest of the Brur field limits (just outside of the Lease boundary). In the mid 1970's the Ashdod Oil Field was discovered by Oil Exploration Investments Ltd. about three km north of the Helez Lease and has produced several hundred thousand barrels to date. Exploration activity in the Helez Lease was renewed in the 1980's after a drilling license was granted to Naphtha and Delek, mainly north of the Helez oil field, in the Kokhav area and with deeping of existing wells by Lapidoth.

Beginning in 1994 intensive exploration activity was done via the Lapidoth Limited Partnership. Lapidoth raised money on the stock exchange based on professional work which defined new prospects. Four wells were drilled with the Partnership funds: Helez 39 in Section A with Naphtha Oil Company, Lior 1 in Section B with Avner Oil Company, and Gevar-Am 3 and Shimon 3 in Section C with Naphtha. All the wells were dry holes. During this period seismic was shot in the lease, and some of the lines were processed with prestack and poststack depth migration. All the surveys shot to date in the lease have been 2-D surveys. As is well known, the modern, advanced method for seismic in the world today for oil and gas exploration is 3-D seismic.

Deep targets (Lower Jurassic, Triassic, Permian) may exist in the Helez Lease. The Pleshet 1 and Gevim 1 wells, drilled adjacent to the Helez Lease (Fig. 9), encountered potential reservoir rocks through these sections. The Triassic and Permian were absent, probably faulted out, in the

Helez Deep 1A, which is the only deep penetration inside the Lease. Accurate structural mapping of the deep targets in the Helez Lease has yet to be done.

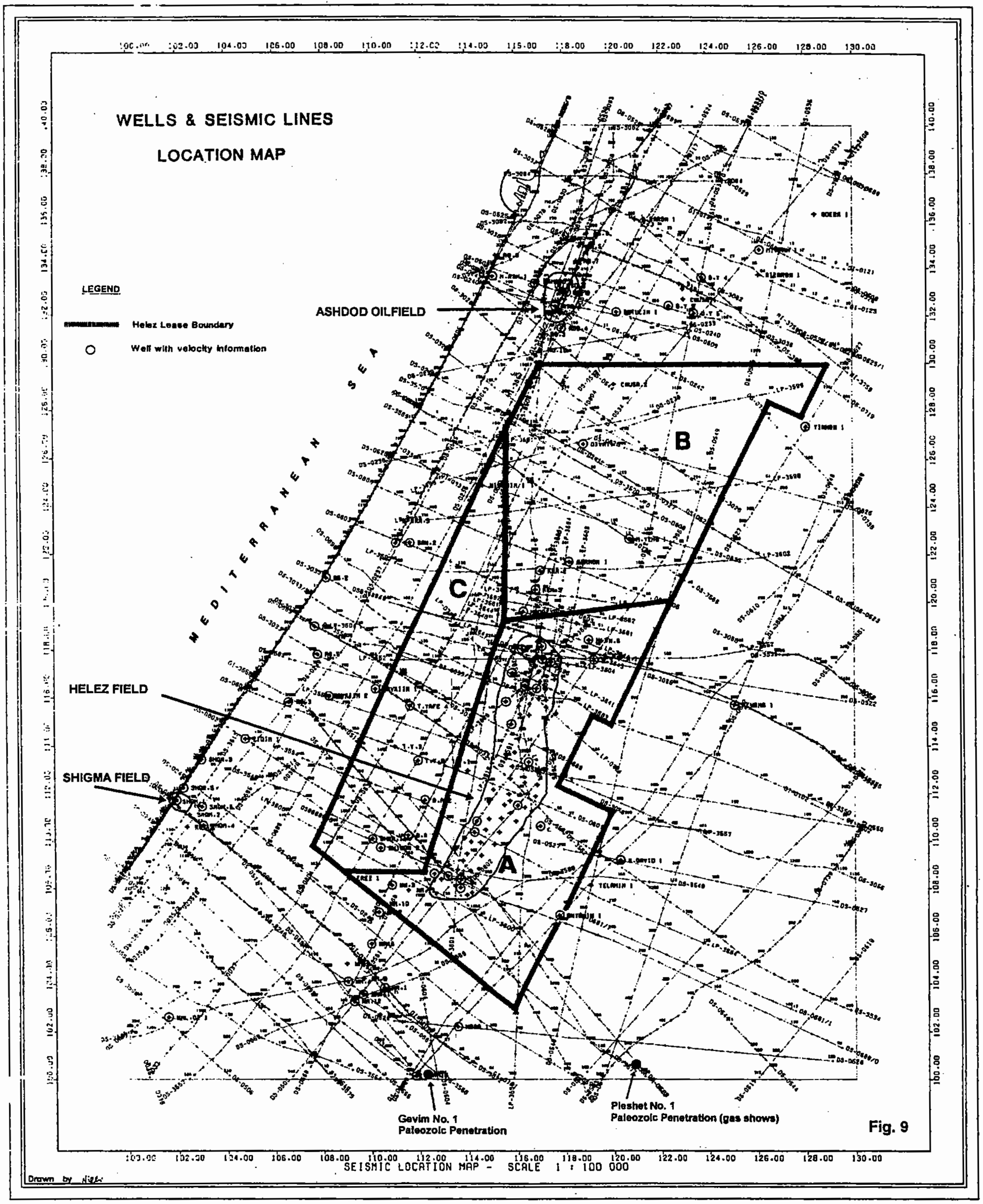


Fig. 9

D. STRUCTURE

The Helez field is located on a faulted anticline, (Figs. 10 and 11). Though Fig. 10 is outdated, it still is of interest and represents the overall structural configuration of the Helez field. The structure is characterized by a north-northeast to south-southwest Late Cretaceous-early Tertiary structural trend. The faults in the field are related to compressional folding. Truncated Upper Jurassic beds reflect the high position of the structure during the Late Jurassic and probably earlier. Post Jurassic erosion carved a canyon (Gevar-Am Channel) that crosses the Helez oil field in a northwesterly direction. This canyon formed a channel 16 km (9.9 mi) long and 7 km (4.3 mi) wide with wall slopes of about 40°. The canyon is filled with up to 1,000 m (3,280 ft) of shales belonging to the Lower Cretaceous Gevar-Am Formation (Fig. 12).

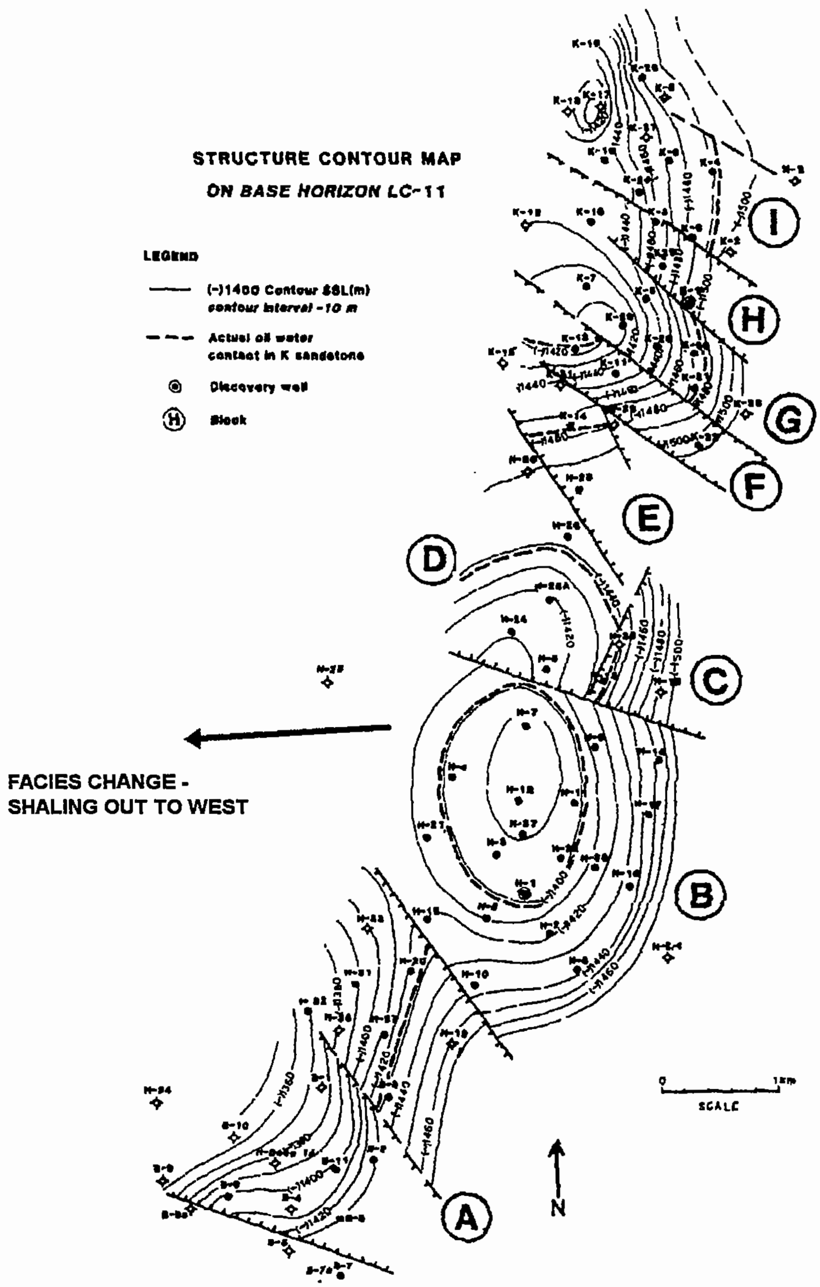
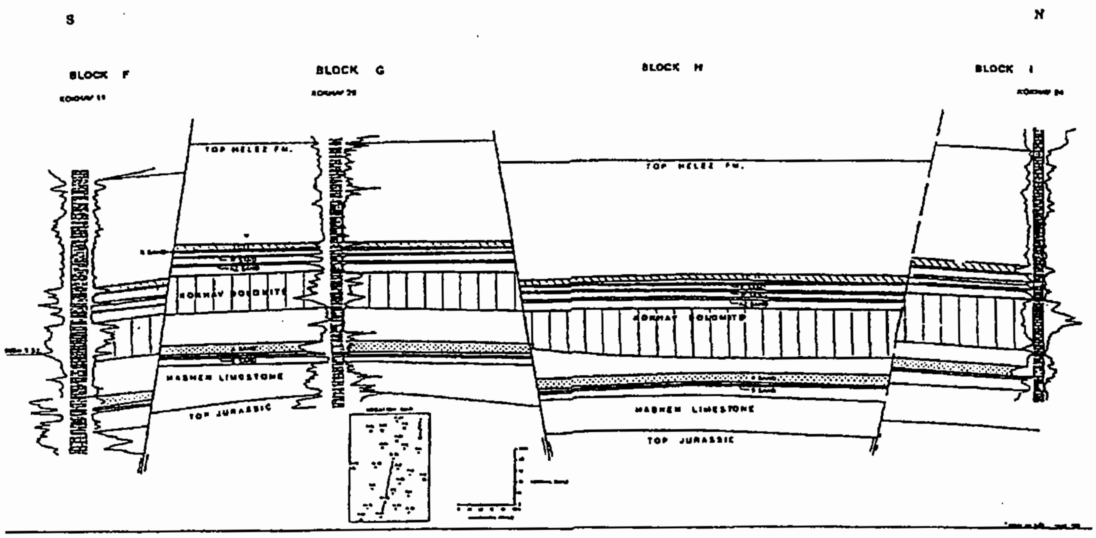
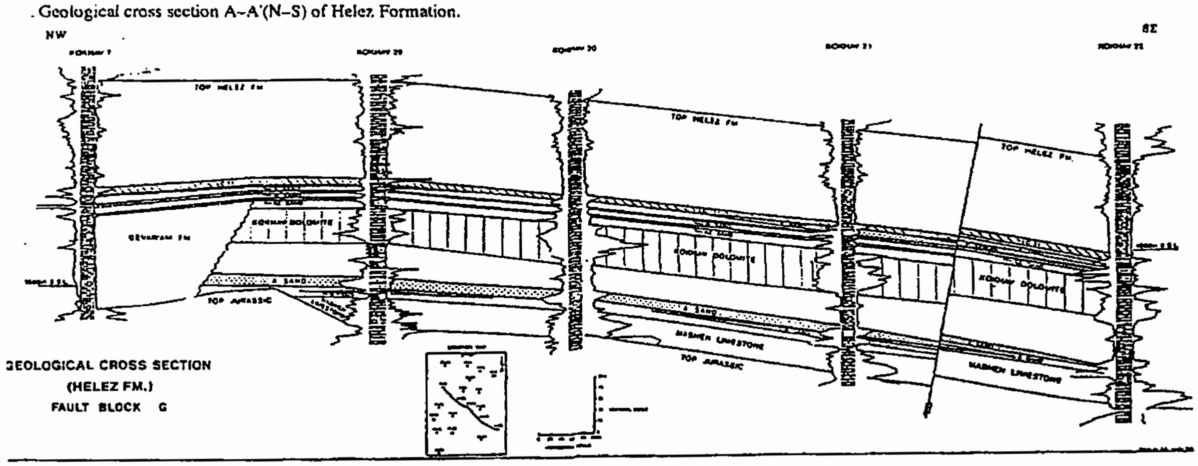


Fig. 10. Helez-Brur-Kokhav field, structure contour map on base horizon LC-11, C.I. - 10 m.



. Geological cross section A-A'(N-S) of Helez Formation.



Geological cross section B-B'(SE-NW) of Helez Formation, fault block G.

Fig. 11

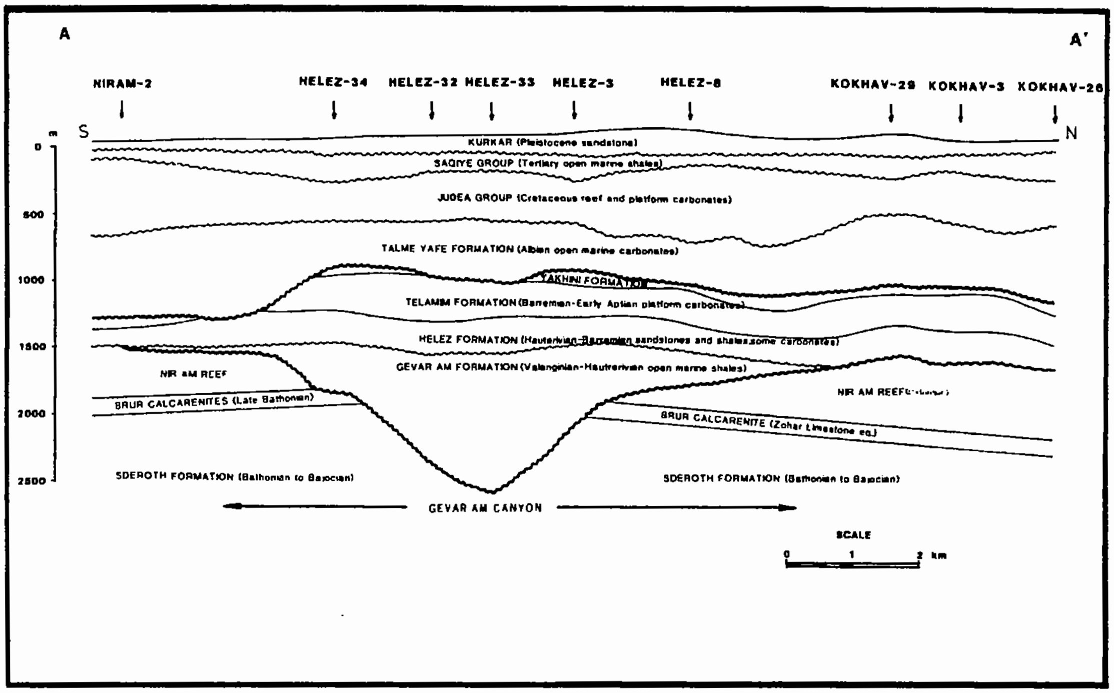


Figure 12 Geologic cross section in the Helez oil field showing the position and shape of the Gevar-Am canyon. (Location is shown on Figure **7**)

The known faults that affected the area are related to the following events:

1. Uplifting and tilting at the end of the Jurassic.
2. The Alpine folding phase of Late Cretaceous and early Tertiary times.
3. Neogene tensional movements

During the Neogene events, transverse faults divided the Helez field into several blocks.

E. STRATIGRAPHY

Israel is located on the northern margin of the Arabo-Nubian massif that stabilized during the Precambrian, some 600 million years ago. The geological history of the country is closely related to the interplay of this huge, rigid, cratonic mass and the sea lying to the north and northwest of it. The vast epeiric seas that characterized the area during long geological periods are a direct result of the shield's proximity. Most of the sediments were deposited on a platform under varying continental and epicontinental environments. The stratigraphic column in the platform area is considered to be approximately 7 km (23,000 ft) thick, mostly of Mesozoic age. In the early Tertiary, on the other hand, the topographic relief was high and the sea began to retreat. West of this platform, beyond the hinge line, a thicker sedimentary column was deposited on the Cretaceous and Neogene continental slope and outer shelf, underlying the present-day coastal plain and shelf.

The Arabo-Nubian massif contributed large quantities of clastic sediments of Mesozoic age to the shallow, adjacent basin. In the Pliocene and Pleistocene the Nile River also distributed the massif's clastics on the ancient shores of Israel. The clastics intermingled with shallow sea carbonates of biogenic origin; and their very fine detrital derivates also spilled over the shelf edge, accumulating at the base of the continental slope.

The Helez field is located on the edge of this platform. In the boundaries of the Helez Lease, only one well (Helez Deep 1A) penetrated the entire sedimentary column, commencing in Pleistocene sediments and drilling through the Middle Triassic (Paleozoic and early Triassic sediments are absent, probably faulted out.). The stratigraphy of the area is summarized in Fig. 13.

Fig. 13 Generalized stratigraphic column for the Helez area.

Age				Group or Formation: Basin	Group or Formation: Platform
Pleistocene-Holocene					Kurkar
Neogene				Saqiye	
Upper Cretaceous			Cenomanian-Turonian		Judea
Lower Cretaceous			Albian	Talme Yafe	Yakhini
			Upper Aptian		
			Lower Aptian	Gevar-Am	Telamim
		Neocomian	Barremian		
			Hauterivian		Helez
			Valanginian		
			Berriasian		
JURASSIC	Late		Oxfordian		Nir-Am/Beer Sheva Kidod
	Middle		Bathonian		Karmon
			Bajocian	Barnea	Shederot
			Aalinian		Upper Nirim
	Upper		Lias		Nirim Upper/Lower Mish'hor
Triassic			Anisian		Gevanim Raaf
			Scythian		Zafir Yamin
Permian					Arqov Saad
Paleozoic					Basement

A detailed stratigraphic column of the productive formations in the oil reservoirs of Helez-Brur-Kokhav is shown in Fig. 14.

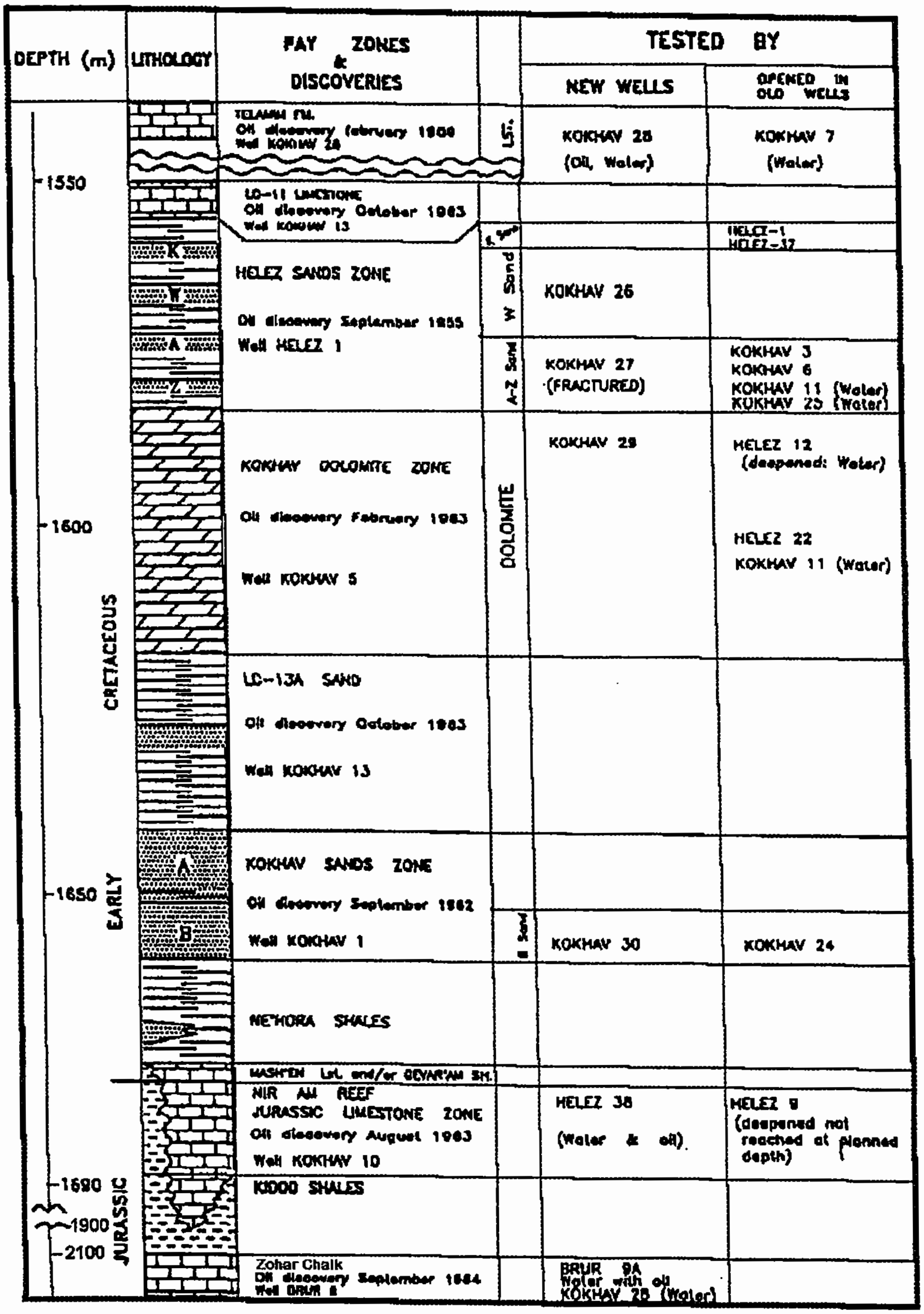


Fig. 14. Stratigraphic column of productive formations in the Helez-Brur-Kokhav Fields.

1. Paleozoic

Acid igneous rock, probably of Paleozoic age, overlies older, green Doroth schists at a depth of 6,000 m (19,680 ft) in Helez Deep 1A. Several wells in Israel relatively close to the Helez Lease have penetrated a Paleozoic sedimentary section (Pleshet 1, Gevim 1, David 1 (Fig. 4)), and it is well developed elsewhere in the Arabo-Nubian shield

The Paleozoic rocks, specifically the Silurian shale, are reported to have sourced much of the oil found in Saudi Arabia.

2. Triassic

The Erez acid igneous rocks are overlain by a 315 m (1,030 ft) thick section of Middle Triassic or Haner Conglomerate. The missing Paleozoic section may have been not deposited or faulted out locally during Triassic movements. A sequence of Upper Triassic shallow-marine dolomites and limestones overlies the conglomerate.

3. Jurassic

The Jurassic sequence in the Helez area is extremely thick, being almost 3,000 m (9,840 ft). It is subdivided into three distinct units:

1. The Lower Jurassic unit penetrated in the Helez Deep 1A well consists of 1,400 m (4,590 ft) of shallow-marine carbonates.

2. The Middle Jurassic unit is characterized by open-marine, spiculitic limestone (Barnea Limestone) and shale, as well as high-energy, oolitic shoal and shallow-shelf sediments

3. In the Late Jurassic the Helez area was located on a high-energy reef trend. This threshold zone separates a deep, open-marine area and probably a "starved basin" to the west from a shallow, inner-shelf basin and shelf carbonates to the east (Fig.16).

The uplift and tilting at the end of the Jurassic exposed Jurassic rocks in parts of the Helez field area to subaerial erosion, forming the latest Jurassic-earliest Cretaceous unconformity phase. This erosional phase probably coincides with the initial development of a submarine canyon (Gevar-Am channel) and the karstic phenomena in the Jurassic Nir-Am barrier reef (Fig. 16).

4. Lower Cretaceous

During Early Cretaceous time, as in the Late Jurassic, the Helez field area was located on a "shelf break" or hinge zone. Here Lower Cretaceous platform sediments were deposited over a gently inclined Jurassic erosional surface, and the shaly facies equivalent was formed on the basinward side. During the Neocomian-Lower Aptian, the interplay between the rate of supply of sedimentary material, as well as temporary periods of minor uplift, continuously shifted the position of the hinge line and, along with it, the related environments

The Lower Cretaceous is divided into five formations, easily distinguished by their lithological properties (Fig. 13):

1. Gevar-Am Formation: Berriasian to Berremian; 0-940 m (0-3,080 ft). The Gevar-Am Formation, filling the old erosional Gevar-Am channel that traverses the Helez Field, is a prodeltaic sequence which was deposited earlier and contiguously, west of the deltaic Helez Formation. It is comprised of a series of gray, silty shales interlayered with turbiditic sandstones overlying conglomerates of Jurassic origin comprising the very bottom of the formation. It was followed by a regressive system, the upper section of which interfingers with the deltaic Helez Formation (Figs. 12 and 15).

2. Helez Formation: Valanginian-Barremian; 160-370 m (520-1,200 ft). This formation is comprised of a series of alternating beds of shale, sandstone, and a subordinate amount of limestone and dolomite. Overall, the sediments tend change to thick continental sediments in the east (Hatira Formation - Nubian), and to thicker, marine deposits in the west (Gevar-Am Formation) (Figs.14 and 17).

3. Telamim Formation: Upper Barremian-Lower Aptian; 160-290 m (520-950 ft). This formation is comprised of dolomitic, oolitic, or sandy limestone with several sandstone beds at the base and a reef bank at the top. Towards the west there is a facies change to the Telme Yafe Formation.

4. Yakhini Formation: Upper Aptian; 430-530 m (1,400-1,700 ft). This formation is comprised of limestone, chalky limestone, dolomitic limestone, dolomite, and marl. Toward the west there is a facies change to the Talme Yafe Formation.

5. Talme Yafe Formation: Aptian-Albian; 0-850 m (0-2,800 ft). This formation is comprised of a series of light gray marlstones with streaks of gray or buff, pellitic limestone, thickening westward in the form of a wedge.

Generally, two environments of deposition can be distinguished in the Helez area: (1) platform or shallow marine-littoral deposits of shale, sandstone, limestone, dolomite, and dolomitic reefoidal limestone of the Helez, Telamim, and Yakhini formations, and (2) deep basin continental slope sediments consisting of dark shales of Berriasian-Aptian age (Gevar-Am Formation) and marls with conglomerate and carbonate detritus of Aptian-Albian age (Talme Yafe Formation). The two basinal formations unconformably overlie older strata without being congruent in their extension or direction of development (Fig. 17).

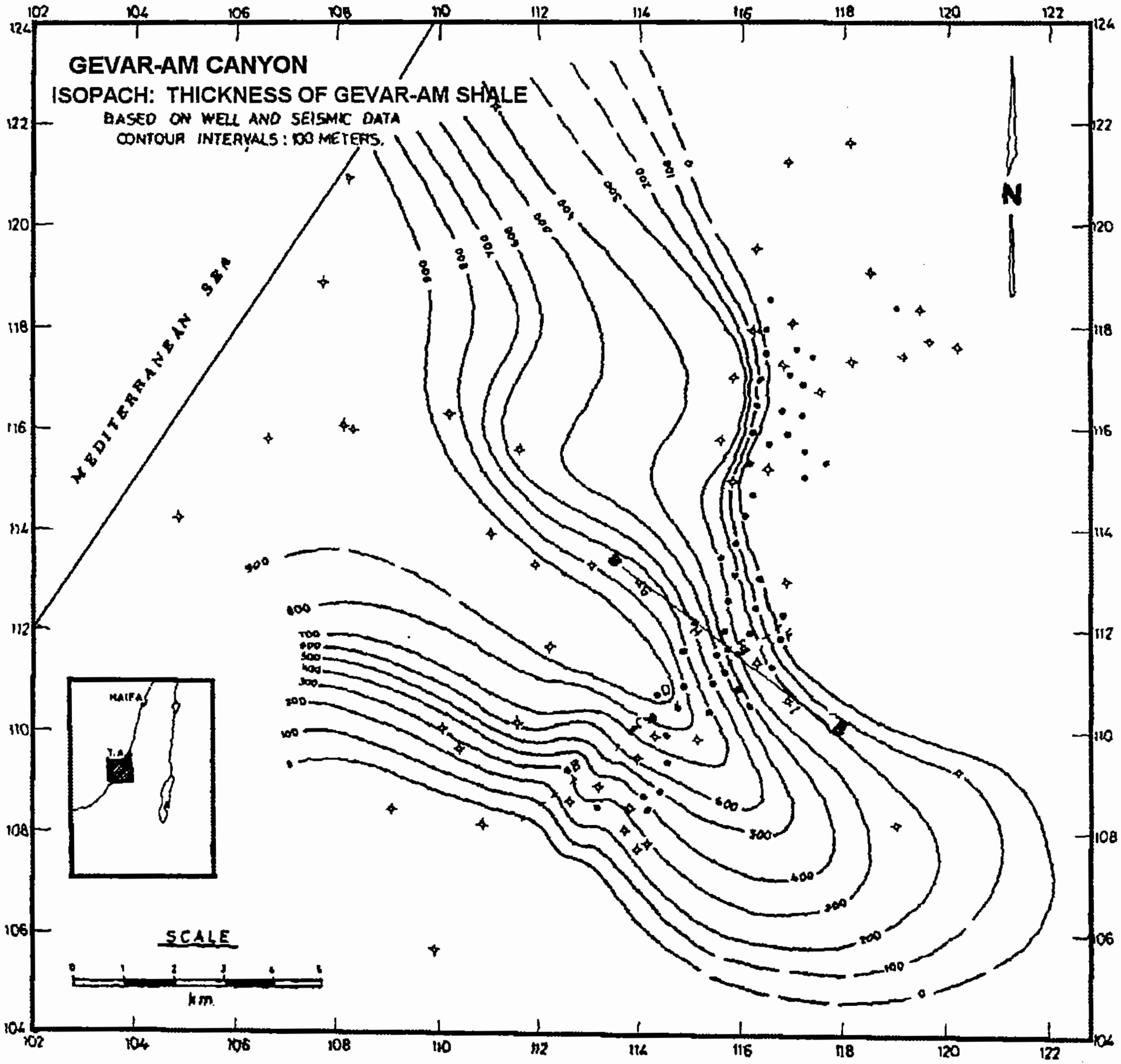


Fig. 15. Location map, Gevar-Am canyon, Helez oil field, Israel. Isopach contours show thickness of Gevar-Am Shale.

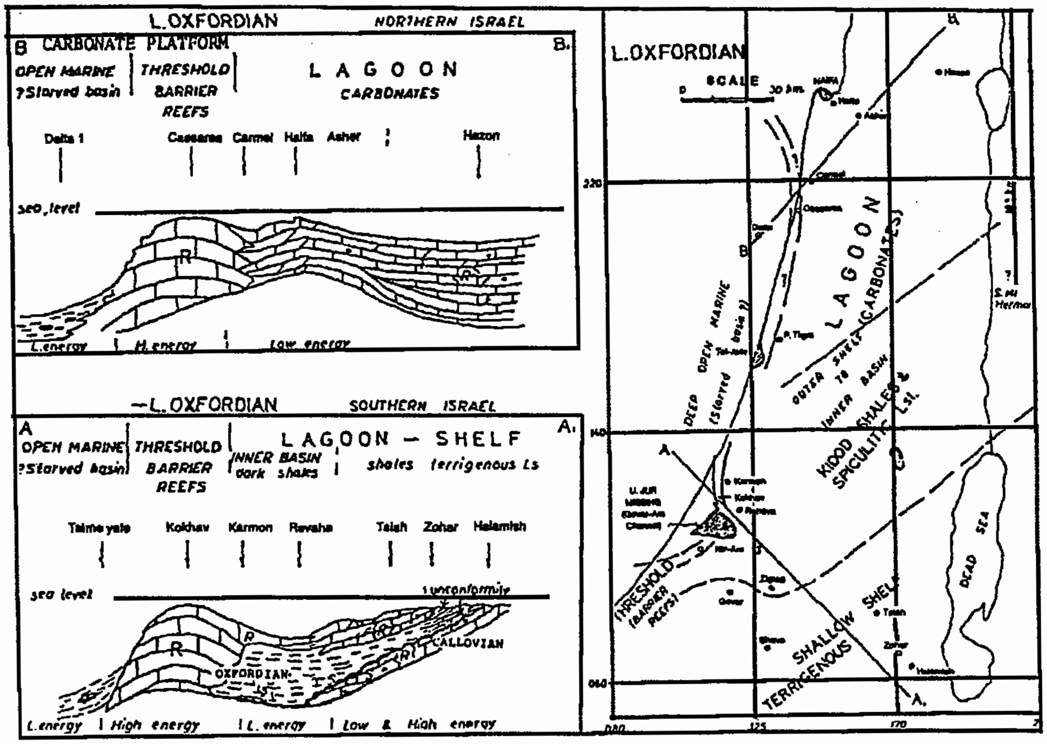


Fig. 16 Upper Jurassic environments of deposition. R, reef.

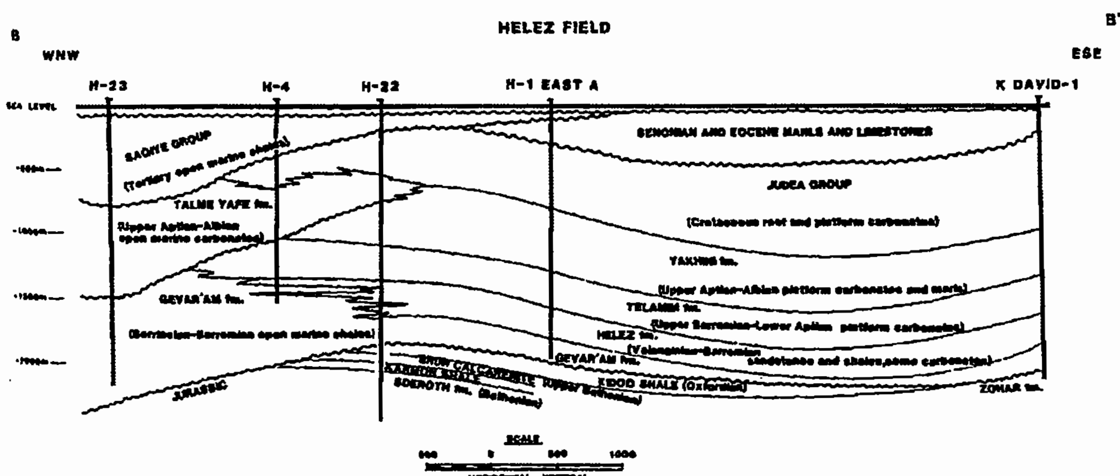


Fig. 17. Geologic cross section through the Gevar-Am canyon, showing erosional contact with underlying Jurassic rocks. (Location is shown in Fig. 7).

5. Upper Cretaceous

The Upper Cretaceous sequence consists of Cenomanian-Turonian age (Judea Group) shelf carbonates (dolomites and limestones).

6. Tertiary

Paleocene and Eocene formations are missing in the Helez area, and a very thin section of shale and marl of late Eocene to Pleistocene age (Saqiye Group) unconformably overlies the Cretaceous beds. The Tertiary sequence is clearly divided into two main parts separated by an unconformity: (1) the late Eocene-Miocene and (2) Pliocene-Pleistocene. Late Miocene aged evaporites are developed generally west of the Helez field, as well as in the whole Mediterranean basin (the Messinian crisis).

7. Pleistocene-Holocene

The youngest sediments in the area consist of calcareous sandstones (Kurkar Group) covered by soils.

F. TRAP

The Helez field is a group of combination stratigraphic-structural traps located on a northeast-southwest-trending faulted anticline (Figs. 10 and 11). The Jurassic Reef and the Lower Cretaceous sandy pay zones, which change laterally into shales to the west, are controlled by the physiographic hinge zone - shelf slope transition.

The hinge zone area was formed into anticlines by the Upper Cretaceous-Early Tertiary Syrian Arc compressional phase. The Helez sandstone and Jurassic reservoir rocks themselves are sealed by overlying and interbedded shales (Figs. 8 and 17).

G. SOURCE

The Helez oil source rock and the oil migration path remain a matter for discussion. As described above, part of the Helez field is crossed by the deep Gevar-Am canyon that cut over 900 m (over 3,000 ft) at its deepest point into Jurassic limestones during Early Cretaceous time, and which was subsequently filled by shales of the prodeltaic Gevar-Am Formation. In places these shales interfinger with the Helez Formation in which most of the oil has been found, and they also lie in contact with the Jurassic limestones containing some of the oil produced in the Helez-Kokhav trend (Fig. 15). Therefore, it was logical to conclude that the Gevar-Am shales are the source rocks of the Helez oil. Later it was noted that the Gevar-Am shales in the Helez area are immature for oil generation; while in the west, near Ashqelon where they are buried much deeper, they have a higher degree of maturation. These facts indicate that the more deeply buried Gevar-Am shales in the west could be a potential source rock.

A recent study made significant progress in understanding the mechanism of the Helez oil migration. Extracts of the Middle Jurassic Barnea Formation were found to have a geochemical similarity with the oil accumulations and shows found in the Helez-Kokhav, Ashdod, and Ashqelon wells. Average total organic carbon (TOC) of the Barnea limestone is 0.5%, reaching a maximum of 2.6%, and its kerogen type is II. No similarity was found between these hydrocarbons and those found in the Gevar-Am formation.

In the Meged 2 well, drilled in1994 northeast of the Helez Lease, the operator (Givot Olam) has reported that they have deduced a Silurian source rock. In addition there have been gas shows in the Pleshet 1 well to the south and David 1 well to the northeast (Fig. 4).

H. OIL MIGRATION

It is suggested that the oil generated in the west at the depth of 4,500-5,000 m (14,800-16,400 ft) by a common source rock, the Jurassic Barnea limestone, was later expelled, migrated updip eastwards below the blanket of the Gevar-Am shale, and then accumulated in the Helez sands and Upper Jurassic limestones (Fig. 18). The migration was possibly aided by faulting and fracturing.

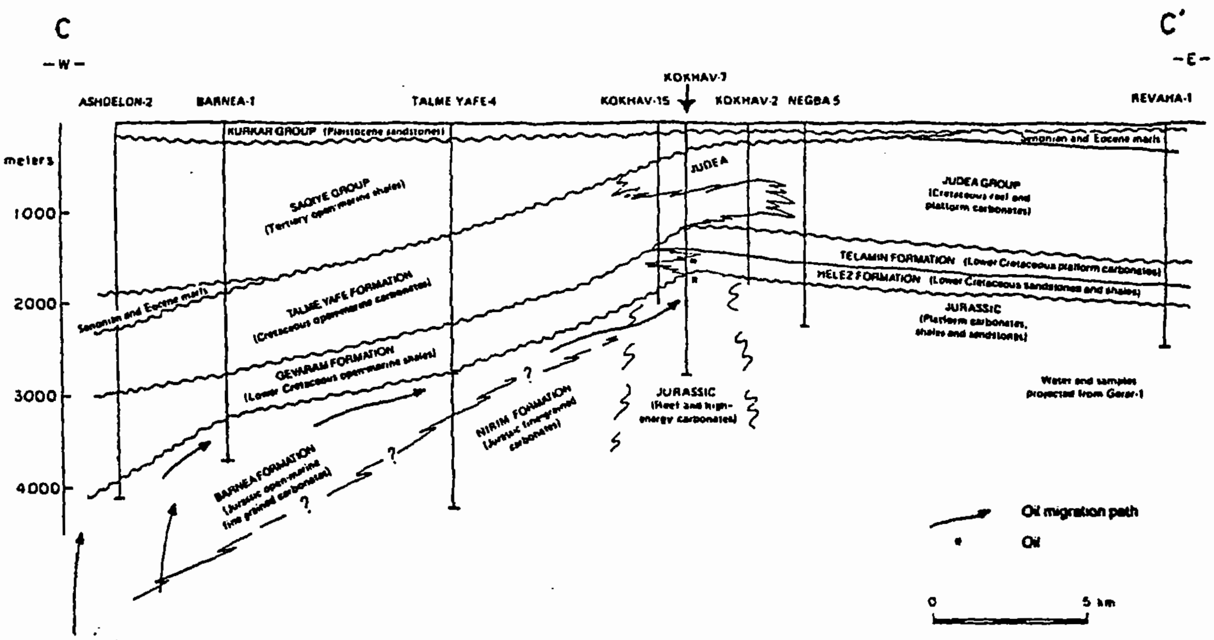


Figure 18 Oil migration paths in the Helez area.

However, it is not yet clear whether the bitumen extracted from the Barnea limestone is indigenous or a product of migration from other sources. Therefore, in addition to the Barnea limestone and Gevar-Am shales, deeper Triassic beds are considered a potential source. The existence of such Triassic source rocks best explains the oil shows in the Lower Jurassic in the Ramallah wildcat (north of Jerusalem) and in the Triassic in Ga'ash 2 well located in the central Coastal Plain.

Because the exact source rock of the Helez oil is not clearly identified, the timing of migration and trapping can be only speculative. It seems that the oil migrated and was trapped in the Helez field reservoirs during the Neogene, after the major tectonic movements. Intensive Oligocene-early Miocene erosion enabled the flushing of the formation's earlier fluids by the intrusion of the late Neogene sea that penetrated the exposed older (probably Cretaceous) beds. It is most likely that the oil trapping process occurred through the post-folding tensional transverse faults that cross the Helez field, ascending from deep layers in the western basin.

I. RESERVOIRS

The Helez field produced oil from the Lower Cretaceous Helez Formation (several sandstones and one carbonate zone) and to a lesser extent from Upper and Middle Jurassic porous limestones (Fig. 8). The Helez sandstones are the main oil reservoirs. The upper sandstone reservoirs ("K," "W," and "A-Z") are related to the middle sandstone member and are found at an average depth of 1,500-1,550 m (4,920-5,090 ft) (1,390-1,490 m or 4,560-4,890 ft sub-sea level (SSL)). These sandstone beds, ranging in thickness from 1 to 12 m (3 to 40 ft), are separated by shale layers. The "A-Z" Sand that appears as one sandstone body off structure to the east is separated updip into two sandstones, "A" and "Z". The "B" Sand (the lower sand member) is the most important producing sandstone in the Kokhav field and is found at an average depth of 1,650 m (5,400 ft) (1,525-1,600 m or 5,000-5,250 ft SSL).

A permeability barrier, the Gevar-Am shale, is located at the updip western limit of the sandstone. Commonly, production becomes poorer toward the west, in spite of a relatively higher structural position, owing to increasing shaliness or pinchout of the producing sandstones. Conversely, on the eastern and downdip flank of the structure, the sandstones have better porosity.

Transverse adjustment faults that divide the Helez structure into blocks separate the Lower Cretaceous sandstone pay zones into different reservoirs. These relatively small faults were located on the basis of production anomalies and reservoir pressure differences that could not be explained otherwise (Fig. 10).

The LC 11 Limestone is found immediately above the Middle Sand Member, produced from only one well (Kokhav 13), and was potentially in communication with the "K" Sand.

The reefoidal Kokhav Dolomite pay zone developed on the margin of the elevated platform and extends along the Helez field's anticlinal structure. Its productive limits are affected by the same faulting system as the producing Helez sands, as well as the diagenetic porosity changes and shaling out.

The basal Lower Cretaceous oolitic limestone, the Mashen member of the Helez Formation, and the Jurassic Nir-Am reef, although seperated by a major unconformity, generally are considered as one thick, continuous reservoir sharing a common aquifer. Even faulting does not necessarily isolate the oil trapped in different fault blocks, owing to the considerable thickness of the Jurassic beds and the apparently common fracture systems of both formations. In most areas the fractured limestones of the two formations have very low matrix porosity. Any significant porosity, therefore, is mainly secondary and developed in fractures and solution vugs. The oil-producing limestones were found at the depth of 1,600-1,700 m (5,250-5,580 ft). It should be noted that there are some instances where the two formations do exhibit separate production behavior, as opposed to the general homogeneity described above.

The Middle Jurassic Brur Calcarenite producing area is limited to the southern extremity of the Helez field. It also produces in the Ashdod Field, 3 km north of the Helez Lease.

J. PETROGRAPHY OF SANDSTONE RESERVOIRS

The major reservoirs of the Helez field are the middle and lower sand members of the Helez Formation. The sandstones of the Helez Formation constitute about 10% of the total formation and are partly mixed with tuff. Quartz, which is the dominant mineral, was derived by weathering and redeposition of Nubian sandstones exposed to the east and southeast. Other grains found in the sandstone include sanidine, volcanic rock fragments, and various carbonate, phosphate, and iron (oolite) allochems. Calcite cement tends to be found in marine sandstones, whereas dolomite cement is found in sandstones that were deposited in the coastal area.

The reservoir sandstones of the Helez formation are divided into three types.

Type I — Sandstone includes part of the lower sands and part of the middle "K" Sand. Deposited in an offshore marine environment, it contains marine fossils and is cemented generally by sparry calcite. Average grain size is medium to fine. The grains are moderately to poorly sorted. Porosity is intercrystalline and reaches a maximum of 16 %. Permeability is less than 30 millidarcies (md).

Type II — Sandstone includes middle member "A-Z", "W" Sands, and part of the "K" Sand, deposited in a tidal channel and/or lagoonal environment. It is composed of sands of medium grain size, with moderate or poor sorting and few marine fossils. Cement is calcitic and/or dolomitic. Porosity values may reach 30% (average 16%), and permeability may be up to 2,000 md (average 50 md). The lower values are related to moderate sorting and to high clay content.

Type III — Sandstone includes part of the middle member "A-Z" and "W" Sands and the lower "B" or Kokhav Sand and is probably of eolian origin, deposited in a coastal area. These sands, with grain size ranging from very fine to medium, do not contain marine fossils. The grains are mostly well sorted, loosely packed, and with low cement content. Porosity can reach 32% (average 24%), and permeability may exceed 2,000 md (average 200 md).

Most of the oil (about 40.3 million barrels of oil in place) is found in the more porous sandstones (Types III and II) that were deposited in a coastal environment, either eolian, tidal channels, or lagoons. Marine sandstones (Type I), where the porosity values are generally low, contain almost no oil.

VI. REMAINING OPPORTUNITIES

A. CONTINUED DEVELOPMENT OF HELEZ OIL FIELD (SECTION A)

The Helez Lease is divided into Section A containing the Helez-Brur-Kokhav fields, Section B to the north and Section C to the west. The location of the sections and the extensive 2-D seismic coverage is shown in Fig. 9.

The Helez oil field covers an area of 12.5 km^2 (5 mi^2). The producing formations are between 1,380-1,625 m SSL (4,530-5,330 ft). The oil in Helez is relatively high quality (28°-31° API).

The field produces primarily by waterdrive, and is in its final stage of production. Until now, the field has produced almost 18 million barrels of oil, which is 42% of the oil in place. Of 85 wells that were drilled, 56 were declared producers. The field currently produces approximately 150 barrels of oil per day (Bopd) from a total of nine wells.

It is possible to increase the Helez oil production from the current reservoirs by a combination of activities discussed below:

1. Perform major workovers that will open formations that have not been produced to date because these wells were completed in other zones that were considered more attractive at the time of completion.

2. Drill additional development wells

3. Begin secondary recovery from the "K" Sand in Block "B."

Major Workovers

The program for the major workover of six wells and the drilling of one development well is outlined below. The estimate of reserves from each of the zones in the workover wells is estimated based on volumetrics. It is assumed that each zone will be produced separately in wells having several target zones.

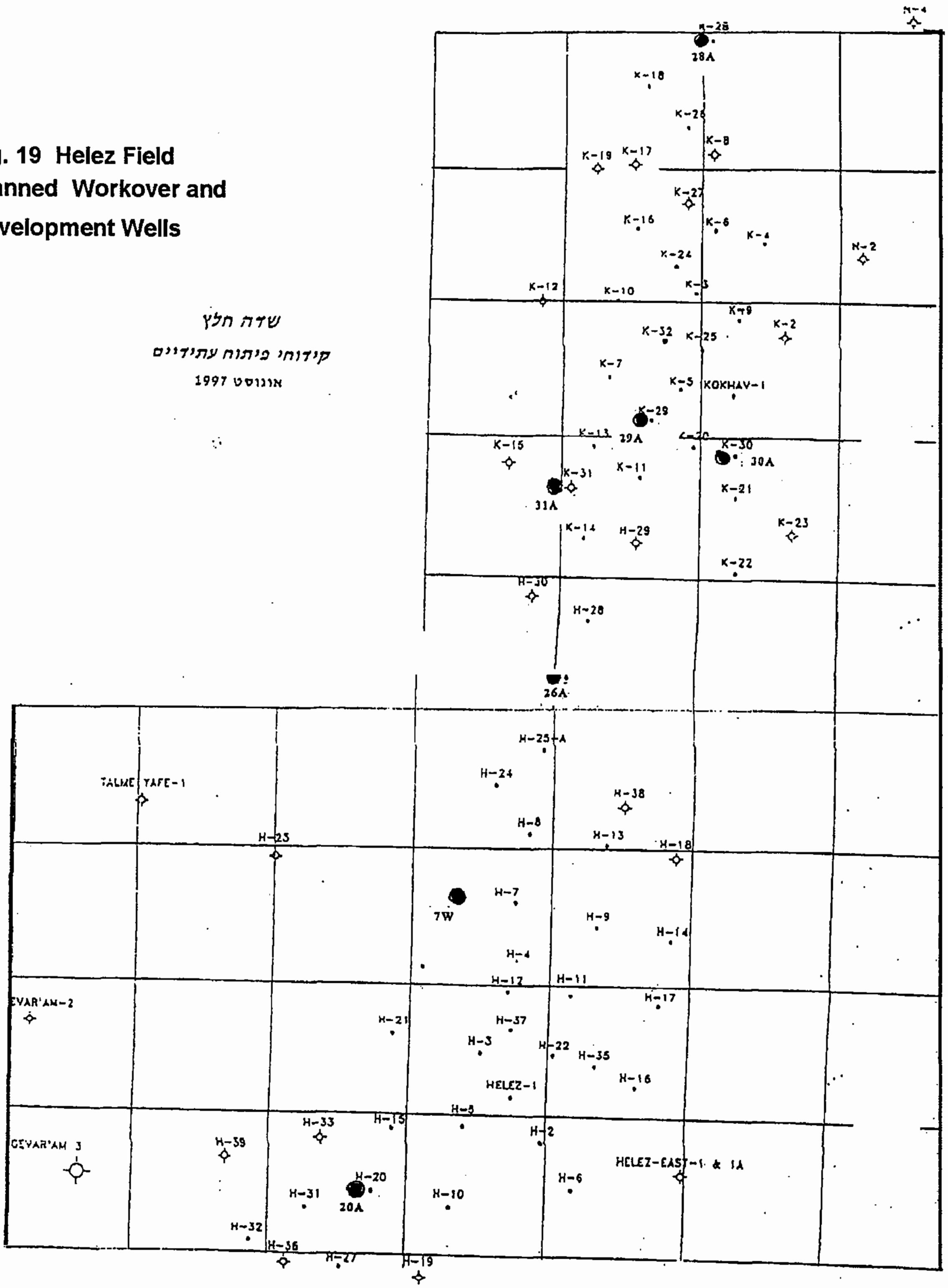
The wells in the workover and development program are shown on the informal work map Fig. 19.

Fig. 19 Helez Field Planned Workover and Development Wells

שדה חלץ

קידוחי פיתוח עתידיים

אוגוסט 1997



Helez 7W

The objective formations for the Helez 7W development well are:

a. Helez "A-Z" and "K" Sands at a depth between 1,370-1,450 m (4,490-4,760 ft) SSL.

b. The upper Jurassic section below the Gevar-Am Unconformity - the Zohar and Shederot Formations at 1,900-2,100 m (6,230-6,890 ft) SSL.

The prospect is based on structural information from area wells, seismic line DS-801, which is depth processed, and production history from the "K" and "A-Z" Sands.

The amount of recoverable oil estimated for the Helez sands is 300,000 barrels, and in the Jurassic section it is 750,000 barrels. The "K" Sand in the proposed Helez 7W well can be integrated into the proposed secondary recovery project which is discussed in Section VI B 2 of this report.

Helez 20A

Between 1957 and 1965, the Helez 20 well produced 173,000 barrels from the "K" Sand and 188,000 barrels from the "A-Z" Sand. Between 1965 and 1977, it produced 186,000 barrels from the "L" Sand alone. The water cut at the end of the production period from the "K" Sand was about 20%, and 40% for the "A-Z". These values are relatively low water cuts.

A workover which was performed in 1991 on the "K" Sand was unsuccessful.

The Helez 20A is proposed as a sidetrack from inside the current seven-inch casing at 1,390 m (4,560 ft), moving 200 m (660 ft) west to the "A-Z" and "K" Sands and 50 m (160 ft) below the top of the Jurassic (2,450 m (8,040 ft)) SSL. The amount of recoverable oil for this proposed sidetrack is estimated at about 200,000 barrels.

Helez 26A

The Helez 26 well produced, from 1960 through 1963, 25,000 barrels of oil from the "W" Sand. The water cut reached 75% at abandonment. Some attempts at pumping from the "A-Z" Sand were made (definitive information is not in the files). The well was plugged in 1971 after it was deepened to 1,740 m (5,700 ft) (top Jurassic) without finding oil.

There are no wells west of Helez 26, so the trend of the development of the sand body in this direction is not clear. The Helez 28 well, which offsets and is lower structurally, produced 120,000 barrels of oil more than Helez 26; but it is in a separate fault block and the sand is thicker.

Helez 26A is proposed as a sidetrack from inside the 8 5/8-inch casing at 1,160 m (3,800 ft) (after pulling the 5 ½ -inch casing from this depth), moving 100 m (330 ft) to the west to a depth of 1,850 m (6,070 ft) or 100 m (330 ft) below the top of the Jurassic.

The amount of recoverable oil west of the well is estimated at approximately 125,000 barrels.

Kokhav 28A

The well is located in the north of the Kokhav field. The well was completed in March 1988 in dolomite and fractured chalk in the Telamim Formation of Lower Cretaceous age (this formation was not expected to produce). The original production rate was 150 bopd water-free. After a few days, the rate dropped to 70 to 80 bopd, and it was put on pump. The water cut began to increase and reached 85% within one month. The well was shut-in August 1989 after producing a cumulative 1,050 barrels of oil.

In a pressure test that was performed in March 1989, the amount of oil in the reservoir was estimated at 900,000 barrels. The question was raised of whether the water breakthrough was due to mechanical reasons. A re-work in May 1989 conclusively showed that it was formation water, and not a mechanical leak. The water breakthrough could be due to the fractures close to the wellbore connecting to the adjacent aquifer.

Based on this information it is proposed to drill a horizontal well in the top of the Telamim Formation at a depth of 1,500 m (4,920 ft), moving 200-250 m (660-820 ft) east from the Kokhav 28 in order to move away from the fractures which are bringing in the water. We estimate that it will be possible to produce about 100,000 barrels of oil from the reservoir in this formation.

Kokhav 29A

The Kokhav 29 well is located in the western part of the Kokhav field. The well went online in April 1987 at a flow rate of 150 bopd from the Kokhav Dolomite at a depth of 1,520 m (4,990 ft). In October 1988 the well began to load and was put on pump. The well produced over 150,000 barrels of oil until August 1993. During this period the rate dropped to 20 bopd, with a 75 to 80% water cut, at which time the well became uneconomic. In August 1993 a re-work to the "A-Z" Sand was performed, but the results were disappointing.

It is proposed to drill a directional well kicked out 200-250 m to test the following target formations: Jurassic Nir-Am Limestone, Kokhav Dolomite, "A-Z," and "W" Sands in the Helez Formation at a depth of 1,500 to 1,600 m (4,920-5,250 ft) and Zohar Formation at 1,900 m (6,230 ft). The amount of recoverable oil is estimated at 200,000 barrels from all the zones.

Kokhav 30A

The Kokhav 30 is located on the eastern flank of the Kokhav structure. In November 1987 the well was completed in the "B" Sand. It produced continuously through January 1994 a total of 90,000 barrels of oil. It became uneconomic as the water cut reached 80% and the oil rate dropped off. The well was shut-in.

The "B" Sand is thickest in the eastern part of the field and thins rapidly to the west, until it disappears completely at the Kokhav 5 and 20. Kokhav 21, located south of Kokhav 30, produced 113,000 barrels of oil from the "B" Sand; and Kokhav 1, north of the Kokhav 30, produced 424,000 barrels of oil from the "B" Sand.

It is proposed to drill a directional well from the current wellbore to intersect the oil-bearing "B" Sand at the top of the structure 200 m (660 ft) northwest of the original location. It is estimated, based on volumetrics, that the well can produce 100,000 barrels of oil.

Kokhav 31A

Kokhav 31 was drilled to 1,708 m (5,600 ft) on the southwestern edge of the Kokhav field. The target zones, the Helez Sands, were found thin and wet. In the offset Kokhav 14 the same sands are thicker and oil-bearing. It is likely that a fault separates the wells.

It is proposed to drill a directional well from the existing wellbore a distance 190 m (620 ft) to the southwest (structurally higher than Kokhav 14 and 31) to the "K" and "A-Z" Sands and to the Kokhav "A" Sand. The Kokhav "A" Sand is a potential reservoir which has yet to be tested in the Helez field. The total recoverable oil from all the zones combined is estimated to be 200,000 barrels.

B. WATERFLOODING POTENTIAL ("K" Sand, Block "B")

About twenty years ago Lapidoth began to examine the various possibilities to increase oil production from Helez. Because most of the reservoir formations produce under waterdrive, and the primary recovery is relatively high (in some formations above 42%), the option for tertiary recovery was examined, whereby the formation is flooded using suitable chemicals to cause displacement of the remaining oil after the natural water displacement in the formation. It was determined that it is only practical to try this kind of "experiment" much later in the life of the field. CO_2 was found to be a suitable injection material, but because of its cost (about $20 per barrel) it was ruled out at this time because of economics.

It was determined that production could be increased by means of secondary recovery in the "K" Sand in the central block of the Helez field, Fault Block "B" (Figs. 8 and 10). This formation is closed from most directions by sealing faults, so the natural waterdrive was not effective here. Therefore, the current reservoir pressure is very low at 250 psig, versus the original reservoir pressure of 2000 psig, so the natural flow from these wells in this formation has been low. In addition, the original oil in place for the "K" Sand is estimated at 3.87 million barrels; and through 1997, production has been 1.173 million barrels, a recovery factor of 30.3% (versus the 40%-45% recovery seen in the formations benefitting from the waterdrive).

The project is based on using saltwater produced from other Helez wells, which is produced together with the oil, injecting it into the "K" Sand, displacing the remaining oil into existing wellbores.

FORREST A. GARB & ASSOCIATES, INC.

In theoretical work done in 1998, which was performed by Forrest A. Garb & Associates, Inc. (Garb), via numerical simulation (portions of the study are reproduced in the Appendix to this report), the amount of additional oil to be recovered by secondary recovery was estimated at 260,000 barrels. In the first year after beginning injection, the additional production is estimated at 60,000 barrels of oil. The total production estimated for the "K" formation in the block is 500,000 barrels of oil; and this is via two current producers, Helez 1 and Helez 37, and water injection into two current producers, Helez 15 and Helez 21, which will be converted to injection wells at a cost of $300,000. In a revised, detailed estimate of the cost to convert these two wells, the cost was estimated to be below $100,000.

In the earlier Garb study, the net profit was estimated at $1.16 million, with a net present value of $350,000. As the economics were based on $17 dollars per barrel oil prices, consideration should be given to doing the project on current oil prices. Although the timing for initiating the project would be different than forecast in the study, there has been nothing to suggest that the model requires modification.

C. EXPLORATION FOR LOWER JURASSIC-TRIASSIC PROSPECTS Helez Lease (Section C)

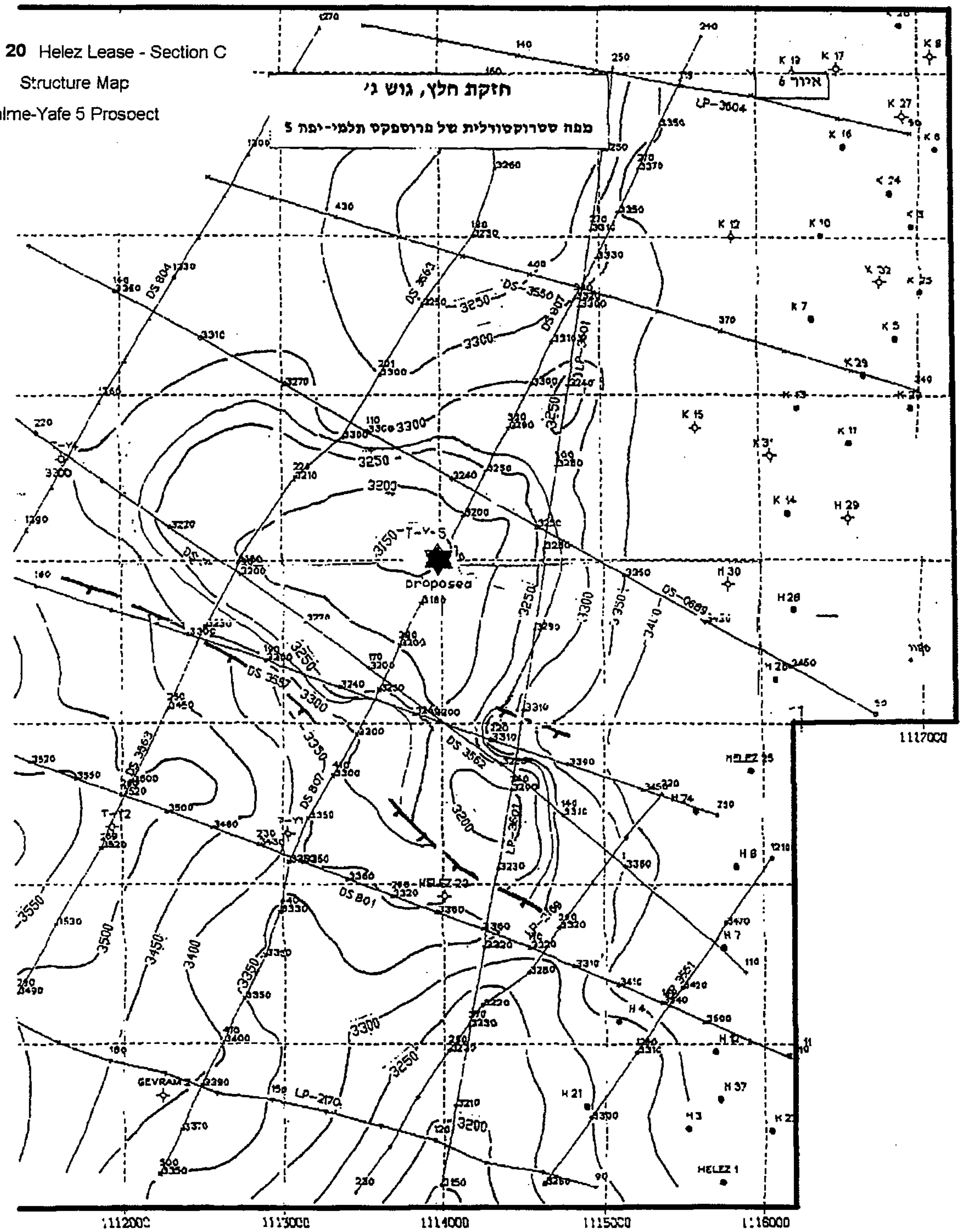
Analysis of 2-D seismic data from the 1980's indicated the possibility that geological traps exist in Section C, an area of 60 km^2 (23 mi^2) west of Section A.

Talme Yafe Structure (Talme Yafe 5)

The Talme Yafe structure which is proposed to be drilled (Talme Yafe 5) is located west of the Helez field and about 7 km southeast of the city of Ashqelon. The main target formations of the prospect are Jurassic porous carbonates (Daya, Barnea, and Nirim Formations), which are located at depths between 2,080-3,500 m (16,820-11,480 ft). Secondary targets are sandstones and conglomerates of the Gevar-Am and Talme Yafe Formations, located at a depth of 1,700-1,800 m (5,580-5,900 ft).

The structure which is proposed for drilling is about 4.5 km^2 (1.7 mi^2), and the oil reserves are estimated at 32 million barrels of oil. The informal seismic structure map on the "Q" (Qerens seismic marker of the Talme-Yafe 5 prospect) shows the structural high (Fig. 20). In our opinion the prospect is worthy of a 3-D survey, with drilling of the prospect contingent on the results of the seismic interpretation.

Fig. 20 Helez Lease - Section C
Structure Map
Talme-Yafe 5 Prospect



AFE AREA STRUCTURE CONTOUR MAP on 'Q' (GEREN) SEISMIC MARKER (depth below msl)

D. EXPLORATION FOR LOWER CRETACEOUS - UPPER JURASSIC PROSPECTS
Helez Lease (Section B)

Oil exploration activities in Section B covering an area of 95 km^2 (37 mi^2) were done most recently in the framework of a partnership with Avner Oil Company (Avner). Based on the work to date, it is highly reasonable to expect that some of the geological conditions that caused oil migration and accumulation into traps in the Helez area can also be found in a narrow strip trending north-south, stretching from the Kokhav oil wells in the south to the Ashdod oil wells in the north. The length of this strip is about 12 km (7 mi), and its width is about 3 km (2 mi). In this area six wells have been drilled to date (the last via the Avner-Lapidoth Joint Venture- Lior 1), all of which were dry.

The targets of future oil exploration in this portion of Section B will be oil traps at intermediate depths (2,000-2,700 m (6,560-8,860 ft)) and gas reservoirs in stratigraphic and structural traps relatively shallow (to a depth of 1,500 m (4,920 ft)). The structure of the area and the Ezer prospect is illustrated on Fig. 21.

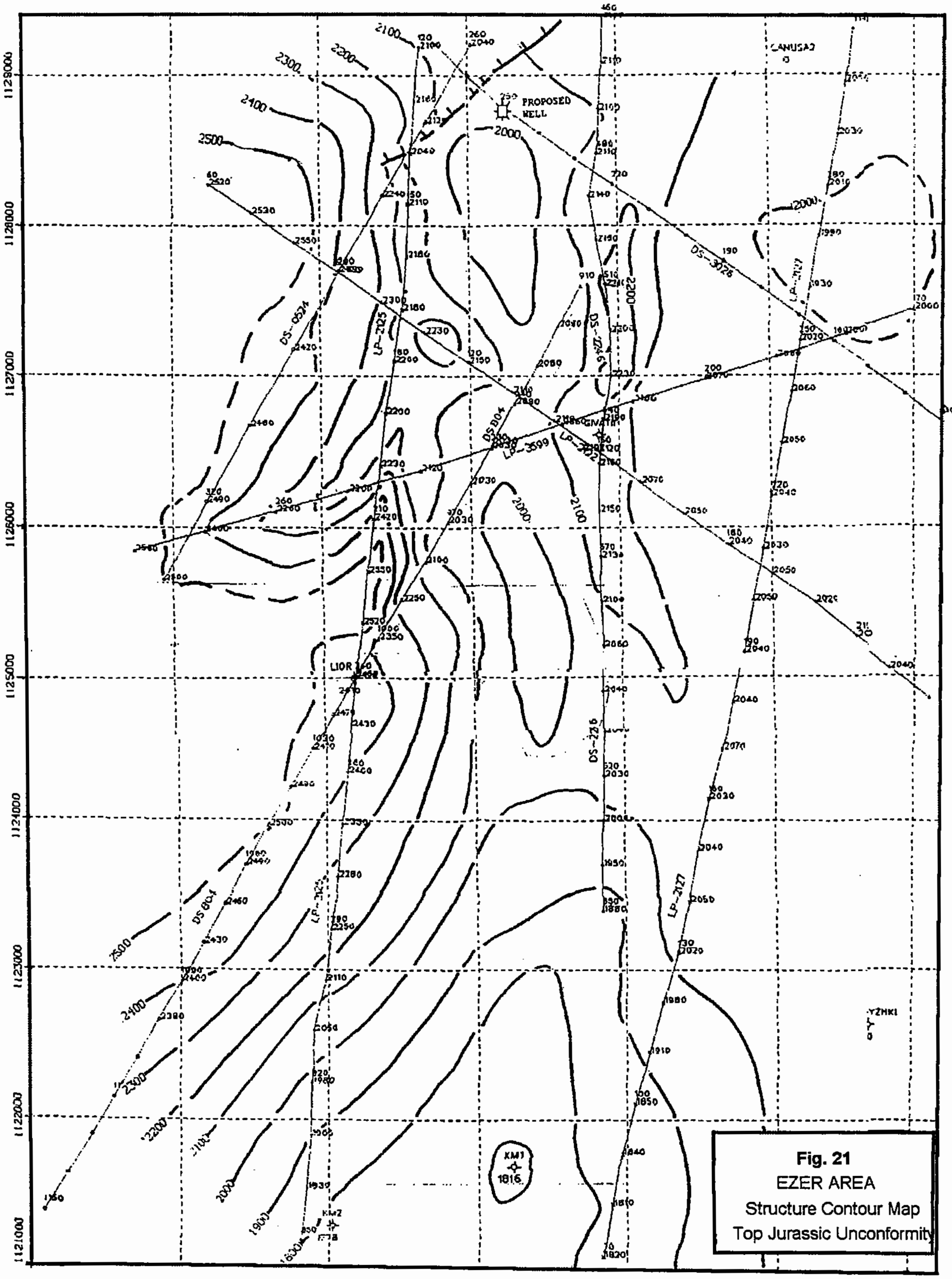


Fig. 21
EZER AREA
Structure Contour Map
Top Jurassic Unconformity

The Ezer Prospect (Ezer 1)

In the north of Section B, between the Gevati well and the Ashdod wells, there is a closed geologic structure called the Ezer structure that was mapped by Avner. A relatively new seismic line, DS 2246, which was run by Israel National Oil Company after the mapping, reportedly increases the attractiveness of the structure. This information should be incorporated into further analysis of the prospect. The targets of the Ezer structure are the upper Jurassic (Zohar and Shederot Formations) at a depth of approximately 2,000 m (6,560 ft).

The size of the structure mapped on the existing seismic is about 1 km^2 (0.4 mi^2). The structure can be defined more accurately by depth processing of the existing seismic lines or by shooting 3-D seismic.

Karmon Formation (Karmon 3A)

In the south of Section B three Karmon wells were drilled, the last being the Karmon 3 well in 1984, which found significant oil shows in the Jurassic section but could not be tested for technical reasons. Seismic mapping indicates a closed structure with the Karmon 3 well located on the southern edge. The size of the area is 0.8 km^2 (0.3 mi^2), and the amount of recoverable oil is estimated at 1.5 million barrels. This prospect can be tested by sidetracking from the Karmon 3 well (Karmon 3A). The structure of the Karmon 3A prospect is shown on the informal work map, Fig. 22. The acquisition of 3-D seismic information is recommended to confirm the size and configuration of the prospect.

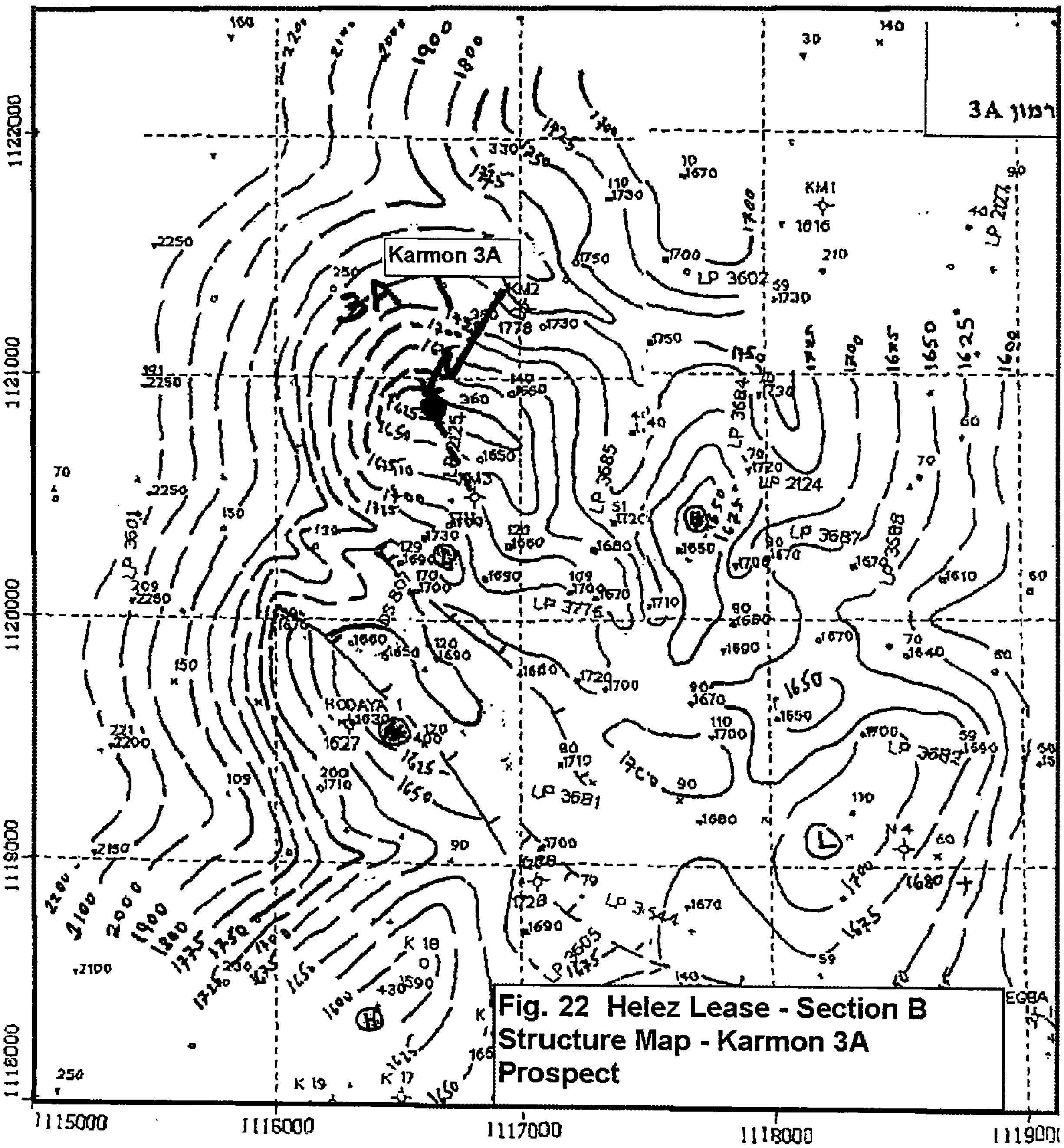
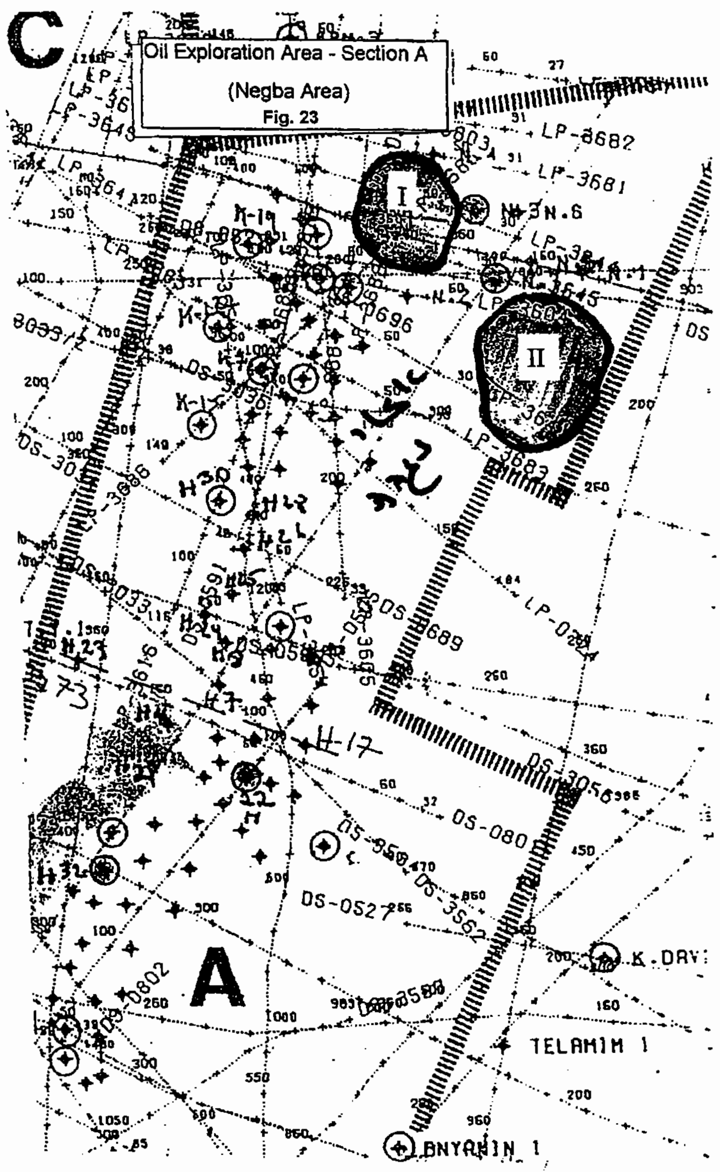


Fig. 22 Helez Lease - Section B Structure Map - Karmon 3A Prospect

E. EXPLORATION FOR LOWER CRETACEOUS - UPPER JURASSIC PROSPECTS

Helez Lease (Section A)

East of the Kokhav structure there are two unexplored areas. These are shown on the informal work map (Fig. 23). The Cretaceous and Upper Jurassic section of areas I and II is similar to the same section which is oil productive in the Helez-Kokhav area. The Negba 3 well, adjacent to Area I, produced 1,600 barrels of oil in 1970; and oil shows were found east of the proposed area in the Revaha 1 well. The wells drilled afterward, the Negba 4, 5, and 6, are located east and southwest of Negba 3; and therefore, the potential of the structures in the proposed areas has not been evaluated. Seismic line DS 3549 and the data from Negba 3 are encouraging, but 3-D seismic is recommended to confirm the potential of this area.



F. EXPLORATION CONCLUSIONS

The Helez Lease is worthy of further exploration and remedial work on some of the wells in the Helez-Brur-Kokhav field. Our recommendations are to:

1. Acquire 3-D seismic coverage over the Helez-Brur-Kokhav field to assist in the most accurate placement of the faults, determine the size of the fault blocks, and delineate the deeper structure in search of Jurassic, Triassic, and Permian or older prospects. Do the proposed remedial work as justified by the 3-D seismic.

2. Acquire 3-D seismic coverage over the prospects proposed above. Of interest is the Karmon formation in the proposed Karmon 3A well. An excellent oil show was found in the Karmon 3 well. This show was observed in drilling samples at the Karmon 3 well by a member of the Garb staff during the drilling of Karmon 3 well.

3. If possible, the entire Helez Lease should be covered by 3-D seismic to define all the potential prospects.

4. The newly acquired 3-D seismic should be tied, using new seismic lines or existing seismic lines of good quality, to the recent deep wells north of the Helez Lease (Meged 2 and David 1), which penetrated the Triassic and Paleozoic sections, respectively, and encountered significant oil and gas shows. The Meged 2 tested oil on a drill stem test (DST), which the operator has deduced to be Silurian sourced.

VII. 3-D SEISMIC CONSIDERATIONS & CAPABILITIES

Experience over the last decade has shown that 3-D seismic surveys of existing fields can indicate significant additional volumes of recoverable hydrocarbons. Such surveys are now considered important tools for the most thorough exploitation of existing non-homogenous (faulted and stratigraphically complex) fields such as Helez. On this basis, 3-D seismic is recommended as a first step towards extended development of the Helez-Brur-Kokhav fields.

3-D Seismic is also recommended in the Helez Lease to better define the deeper exploration prospects. Separate surveys could be shot over individual prospects, but there is better economy of scale in shooting a larger survey which would encompass the majority of the potential over the Helez Lease.

The Geophysical Institute of Israel (GII) has been in business since 1957. They have all necessary equipment and personnel for 3-D shooting and can also process it locally (see description below). In preliminary discussions with Lapidoth, the GII has expressed readiness to offer substantial discounts to get 3-D work in the Helez Lease.

The GII has done some preliminary estimates of the required surface layout to get full 3-D coverage at depth over the Helez-Brur-Kokhav fields and the offsetting Talme Yafe and Karmon prospects (Figs. 20 & 22). The Ezer prospect is located farther to the north, and could be shot separately. The Negba area could be incorporated in the Helez Field 3-D survey.

The GII estimates that 130 km^2 (50 mi^2) of surface layout is necessary to achieve full 3-D coverage down to a 5,000 m depth over a 52 km^2 (20 mi^2) area of interest. This assumes a regional dip of 10 degrees. The GII has not made an actual price quote for such a Survey. However, the GII did quote for a 3-D survey of the Ezer prospect in August 1998 - US$1 million for a 57 km^2 (22 mi^2) surface layout (18 km^2 (7 mi^2) at full coverage) - this calculates to US$18,000 per square kilometer of surface layout, which would yield US$2.3 million for the area depicted in Fig. 24. It is expected that the GII would quote a lower price than this based on the following reasons. They have stated that the area depicted in Fig. 24 is less populated and has less agriculture than the Ezer area, so the price per km^2 should be lower than their Ezer quote. Because of their current lack of work, they have indicated potential willingness to be more aggressive in their discounting on new bids. Also, a larger area should yield better economy of scale pricing.

The above information is for general information purposes only. Final decisions on location and design of 3-D survey/surveys would be made only after conclusion of a farmout with another oil company.

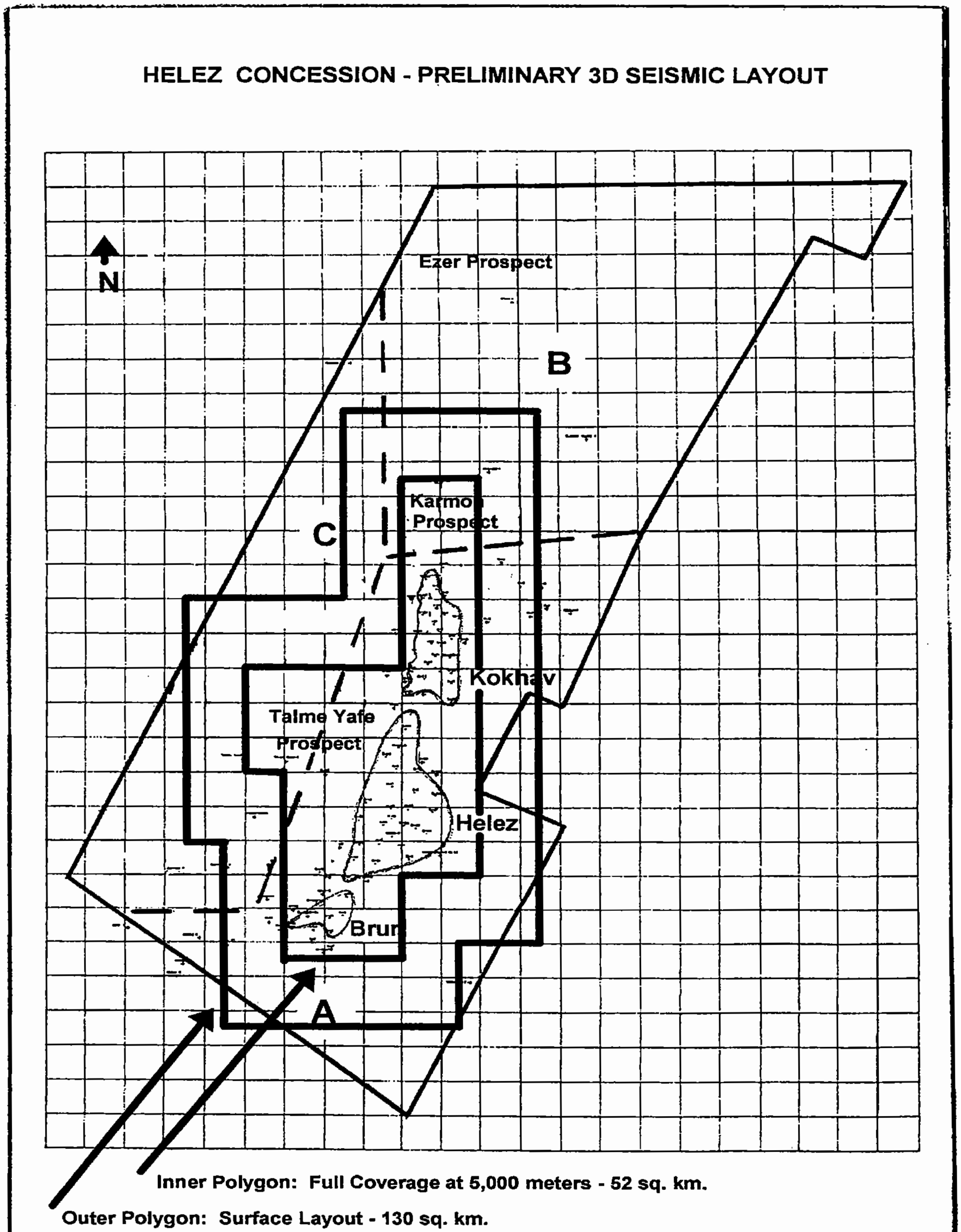


Fig. 24 Proposed 3-D seismic coverage

10 Degree assumed dip

Geophysical Institute of Israel Capabilities

Data Acquisition Equipment:

Seismic Recording
- GEO-X ARAM-24 telemetry system.
- Sercel 368-D+RAPS-1000 telemetry system.
- Geometrics STRATAVIEW, 60 channel recorder.
- ABEM Terraloc 24 channel recorder.

Seismic Sources
- Mertz/Sercel M26HD/623B buggy vibrators.
- Mertz M-25, M-27 HR vibrators.
- Pelton Advance II electronics.
- Track-mounted Dynasource.
- Track-mounted AWd-750 energy source.
- EWG-I energy sources.
- Air guns and compressor for shallow offshore survey.
- Geodetic Equipment
- Differential (RTK) GPS geodetic surveying.

Processing:

Hardware: SUN Microsystems Workstations

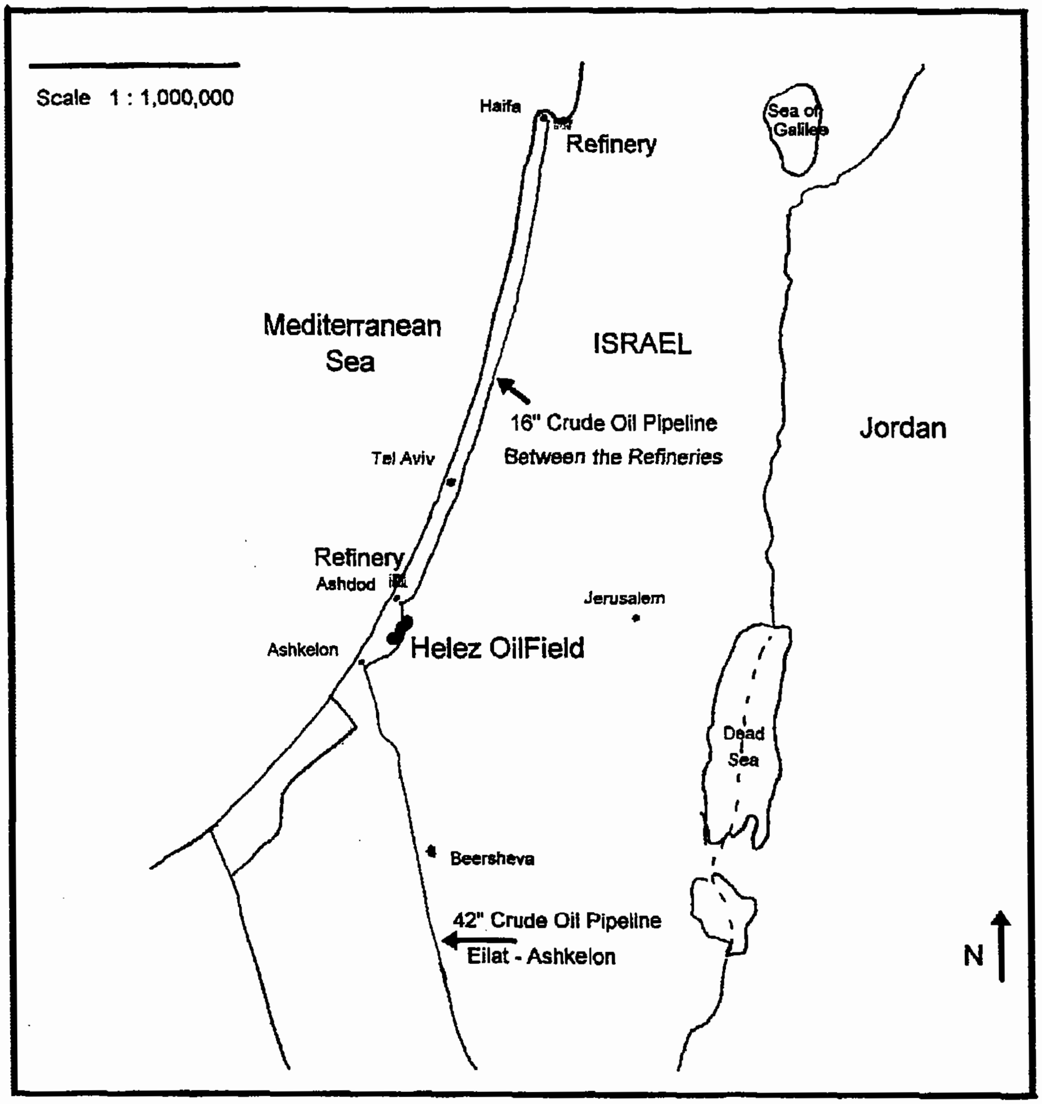
Software: Landmark Graphics - ProMAX 7.0 and SeisWorks
2-D and 3-D Capabilities, with large selection of deconvolution algorithms, residual statics routines, velocity analysis, and pre/post stack migration.

VIII. MARKET FOR OIL AND GAS IN ISRAEL

Any discovery of oil or gas can easily be absorbed internally by Israel. Seller will receive international prices. Israel has a population of six million people, with a GNP in excess of $100 billion, and imports substantially all of its energy needs. Current crude imports are approximately 240,000 Bopd, the majority on short term contracts and the spot market. The previous contractual agreement to import from Egypt (Camp David Accords) ended two years ago, is currently renewed on a yearly basis, and amounts to only about 20% of the total imports.

Israel has two refineries with a total combined capacity of 270,000 Bopd. The Ashdod refinery has a capacity of 90,000 Bopd, and is located only ten miles from the Helez oilfield. There is already a crude oil pipeline in place to transport Helez oil to this refinery (Fig. 25). The other refinery is in the north at Haifa Bay, and it is connected to the Ashdod refinery by pipeline.

Fig. 25 Map of Israel with Refineries and Pipeline



Israel currently uses very little natural gas (2 million cubic feet of gas per day (MMcfd) at the city of Arad, near the Dead Sea from the nearly depleted Zohar gas field). The Government of Israel's stated policy is to convert oil burning power plants to natural gas for environmental purposes and diversity of supply. The Israel Electric Corporation and heavy industry are actively seeking natural gas from potential foreign suppliers such as Egypt. Initial requirements are estimated at 250 MMcfd, growing steadily to 1 billion cubic feet of gas per day (Bcfd) by 2020. Any local source certainly can be incorporated into this large demand. Currently, BP-Amoco, British Gas, Italgas, and Gas DeFrance are competing to win a concession to build and finance the internal infrastructure in Israel for transportation and distribution of natural gas, assuming an initial supply agreement will be reached.

IX. FISCAL REGIME IN ISRAEL

The Israeli terms are very similar to that of the United States and are very favorable relative to other foreign regimes. There is no signature or production bonus to the Government. There is no production sharing agreement - the government simply collects a 12.5% royalty. In addition, there is a 27.5% depletion allowance, which significantly lowers the taxable income. Corporate tax is 36%, and there are tax treaties with the US and many other countries.

X. OILFIELD SERVICES IN ISRAEL

Lapidoth can supply all services necessary for drilling and production of oil and gas. Currently the company has a full yard and six rigs as follows:

- Continental Emsco A-1500, 25,000' capacity
- Ideco Super 7-11, 20,000' capacity
- Continental Emsco D-3, 13,000' capacity (Currently in Georgia, FSU)
- Cabot Franks 750 - self propelled, 7,500' capacity
- Ideco H-35-II - trailer mounted, 4,500' capacity (also workover rig)
- Ideco H-35-III - self propelled, workover rig

The company also has two cementing trucks, two units for electric logging (with all necessary logging tools), mudlogging labs, and wireline, perforating, and testing capabilities.

Helez is a currently producing field, with all production infrastructure in place, and as mentioned above, in close proximity to a large refinery via an existing pipeline. The equipment has handled 5000 Bopd production, while current production is averaging 150 Bopd.

XI. ACKNOWLEDGMENT

This report was prepared with the utilization of the reports listed in Section XII (References). Material from these references was freely incorporated in this report without acknowledgment of the

individual contributions.

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