CNW GROUP

WaterPark Place
20 Bay Street, Suite 1500
Toronto, Ontario M5J 2N8
Canada

September 8, 2011

NOTICE TO READER

Re:Adira Energy Ltd.

To whom it may concern,

Please note that at the time of the September 7, 2011 filing for Adira Energy Ltd. the Technical Report, Consent of Qualified Person and Certificate of Qualified Person were incorrectly filed to represent NI 43-101.

Adira Energy Ltd. is an Oil and Gas company and makes no reference to NI 43-101.

The correct filing has been re-filed as “Summary of oil and gas report” on September 8, 2011.

(signed) Patricia Pauta

CNW Group
Regulatory Filing Department
1-800-825-6133

Reports for:

License #378/'Gabriella' Offshore Israel

and

License #380/'Yitzhak' Offshore Israel

Prepared According to National Instrument 51-101

As of August 31, 2011

Part A is Gabriella
Part B is Yitzhak

Prepared for:

ADIRA
ENERGY

Prepared by:

GUSTAVSON ASSOCIATES
5757 Central Ave. Suite D Boulder, Colorado 80301

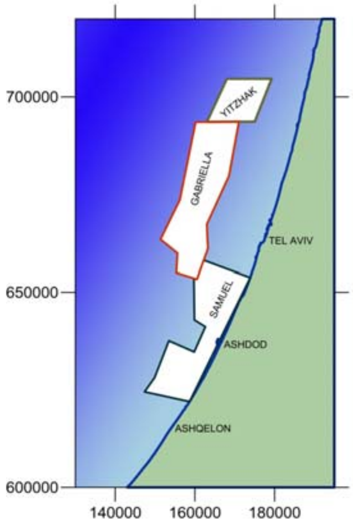
Part A

Gabriella

LICENSE #378/‘GABRIELLA’,

OFFSHORE ISRAEL

Effective Date: August 31, 2011
Prepared According To
National Instrument 51-101



Prepared for:

ADIRA ENERGY LTD

ADIRA
ENERGY

Prepared by:

GUSTAVSON ASSOCIATES
5757 CENTRAL AVE. SUITE D BOULDER, COLORADO 80301 USA

REPORT FOR LICENSE #378 / ‘GABRIELLA’, OFFSHORE ISRAEL

Effective Date: August 31, 2011

Prepared According To
National Instrument 51-101

Prepared for:

ADIRA ENERGY LTD

Submitted by:

LETHA CHAPMAN LENCIONI
29506

Letha C. Lencioni
Registered Petroleum Engineer
State of Colorado #29506

GUSTAVSON ASSOCIATES
5757 CENTRAL AVE. SUITE D BOULDER, COLORADO 80301 USA
Independent Qualified Reserves Evaluators

1. EXECUTIVE SUMMARY

Adira Energy Israel, Ltd (Adira) was awarded the License to Block #378 / ‘Gabriella’ (License) by the Israel Ministry of National Infrastructures as of 15 July, 2009 for an initial three year term. Block # 378, known as Gabriella, is located in the shallow water offshore of Israel. Adira engaged Gustavson Associates (Gustavson) in April 2011 to evaluate the hydrocarbon potential of the License, estimate the Contingent and Prospective Resources and to prepare a Report under Canada's National Instrument 51-101, *Standards of Disclosure for Oil and Gas Activities.* Gustavson was provided with certain data by Adira including two new 3-D datasets recently acquired by Adira that are located on the Gabriella block. The new 3-D data was delivered in the form of a Quick-Look cube by WesternGeco. The final processing of the 3-D volume is scheduled to be completed in December, 2011 where the two datasets will be merged.

The primary prospect on this block is the Jurassic aged carbonate structural feature that had tested oil from the Yam-Yafo 1 well in 1994. The other prospects on this block are shallower and younger horizons that are interpreted to be gas bearing and will be included in another report. The review of well and test data revealed that there were a total of three Jurassic penetrations on trend that had shows or tested oil. The evaluation includes a petrophysical analysis of the well log data from the Yam-Yafo 1 and the Yam 2 (south of the block) in the Jurassic section along with a fracture analysis. These two wells both tested 44 to 48 degree API oil at rates in excess of 800 barrels per day.

Secondary prospects on this block are in the Cretaceous and Miocene aged sections. Seismic interpretation has identified several prospects with potential hydrocarbon accumulations. The hydrocarbons in these sections are expected to be predominantly gas with condensate. Only those prospects that are contained within the block boundaries have been included in the resource estimates. There may be more Cretaceous, Miocene and even Pliocene prospects contained within the block. The final processed version of the new 3D seismic survey made show additional potential prospects.

A probabilistic estimate of the Gross[1] Contingent Resources was made using the parameters from the available data. The following Table 1 shows the estimated Gross Contingent Resources for the Jurassic of the Block #378 / 'Gabriella' in millions of barrels of oil (MMBO).

Table 1 Summary of Gross Contingent Resource Estimates, Jurassic Oil Prospects

	Low Estimate	**Best Estimate**	**High Estimate**
Oil Resources, MMBO	60	277	806

Because the Yam – Yafo 1 well penetrated the evaluated structure and tested significant rates of oil, the estimated volumes of oil for the Jurassic are classified as Contingent Resources. Contingent Resources are defined as follows[2]:

> *"Contingent resources are defined as those quantities of oil and gas estimated on a given date to be potentially recoverable from known accumulations but are not currently economic."*

There is no certainty that it will be commercially viable to produce any portion of the resources. The contingencies associated with these resource estimates are that although the Yam – Yaffo 1 well test and log data, along with the seismic data, establish this as a known accumulation, the quantity of data is not yet sufficient, given the very large expenditures required to develop the resources and get the oil to market, to establish with confidence the commerciality of future development. Thus, the Gabriella license area does not yet have any reserves.

A probabilistic estimate of the Prospective Resources was made using the parameters from the available data. The following table (Table 2) shows the summary of the estimated Gross Prospective Resources for the Cretaceous and Miocene of the Block #378 / 'Gabriella' in Billions of Cubic Feet of Gas (BCF) and Millions of Barrels of Condensate (MMB).

The Cretaceous and Miocene prospects on this block have not been tested; therefore, they contain Prospective Resources. Prospective Resources are defined as "those quantities of

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[1] Attributable to 100% of the Interest in the Block

[2] *Canadian Oil and Gas Evaluation Handbook, Volume 1*, Society of Petroleum Evaluation Engineers (Calgary Chapter) and Canadian Institute of Mining, Metallurgy & Petroleum (Petroleum Society), September 1, 2007.

petroleum estimated, as of a given date, to be potentially recoverable from undiscovered accumulations by application of future development projects. Prospective Resources have both an associated chance of discovery and a chance of development. Prospective Resources are further subdivided in accordance with the level of certainty associated with recoverable estimates assuming their discovery and development and may be sub-classified based on project maturity."[3] There is no certainty that any portion of the Prospective Resources will be discovered. If discovered, there is no certainty that it will be commercially viable to produce any portion of the resources.

Table 2 Summary of Gross Prospective Resource Estimates

		Prospective Gas Resources (BCF)			**Prospective Condensate Resources (MMB)**		
Structure	**Reservoir**	**Low Estimate**	**Best Estimate**	**High Estimate**	**Low Estimate**	**Best Estimate**	**High Estimate**
South Area	Cretaceous	205.5	837.9	2,011.4	28.5	120.1	308.8
Central Area	Cretaceous	150.2	410.5	831.3	20.9	59.3	129.5
North Area	Cretaceous	189.1	496.7	1,011.2	26.3	71.6	158.3
Total Cretaceous		**544.8**	**1,745.1**	**3,853.9**	**75.7**	**251.0**	**596.6**
South Fault Block	Miocene	0.8	2.4	5.4	0.1	0.2	0.4
Southeast Fault Block	Miocene	0.9	3.0	7.4	0.1	0.2	0.6
East Stratigraphic	Miocene	537.2	1,808.7	4,560.6	36.5	128.3	343.6
Total Miocene		**538.9**	**1,814.1**	**4,573.4**	**36.7**	**128.7**	**344.6**
Total		**1,083.7**	**3,559.2**	**8,427.3**	**112.4**	**379.7**	**941.2**

The resource estimates in this report relied on data provided by the Client prior to August 31, 2011. At the time of the writing of this report it is known that the seismic data would be processed further and therefore changes in the final output of the seismic data may cause adjustments to be made to future interpretations. At this time it is anticipated that any future changes would not have a substantial impact on future resource estimates.

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[3] Society of Petroleum Evaluation Engineers, (Calgary Chapter): Canadian Oil and Gas Evaluation Handbook, Second Edition, Volume 1, September 1, 2007, pg 5-7.

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3. INTRODUCTION

3.1 AUTHORIZATION

Gustavson Associates LLC (the Consultant) has been retained by Adira Energy Israel, Ltd to prepare a Report under Canada's National Instrument 51-101, *Standards of Disclosure for Oil and Gas Activities,* regarding the entire concession position License #378 / Gabriella in the offshore of the country of Israel.

3.2 INTENDED PURPOSE AND USERS OF REPORT

The purpose of this Report is to support the Client's potential filing with the Toronto Stock Exchange (TSX).

3.3 OWNER CONTACT AND PROPERTY INSPECTION

This Consultant has had frequent contact with the Client and their partners. This Consultant has not personally inspected the subject property but did meet with the exploration professionals in the offices of Adira Energy Israel, Ltd in Kansas City, Kansas.

3.4 SCOPE OF WORK

This Report is intended to describe and quantify the Contingent and Prospective Resources contained within the subject concession. This Report does not attempt to place a Market Value thereon.

3.5 APPLICABLE STANDARDS

This Report has been prepared in accordance with Canadian National Instrument 51-101. The National Instrument requires disclosure of specific information concerning prospects, as are provided in this Report.

3.6 ASSUMPTIONS AND LIMITING CONDITIONS

The accuracy of any estimate is a function of available time, data, and of geological, engineering, and commercial interpretation and judgment. While the resource estimates presented herein are believed to be reasonable, they should be viewed with the understanding that additional analysis or new data may justify their revision. Gustavson Associates reserves the right to revise its opinions of reserves and resources, if new information is deemed sufficiently credible to do so.

3.7 INDEPENDENCE/DISCLAIMER OF INTEREST

Gustavson Associates LLC has acted independently in the preparation of this Report. The company and its employees have no direct or indirect ownership in the property appraised or the area of study described. Ms. Letha Lencioni is signing this Report, which has been prepared by her as a Qualified Reserves Evaluator, with the assistance of others on the Gustavson staff. Our fee for this Report and the other services that may be provided is not dependent on the amount of resources estimated.

4. DISCLOSURES REGARDING PROSPECTS

4.1 LOCATION AND BASIN NAME

The Adira Gabriella block is located in the eastern Mediterranean offshore of Israel in the Levant or Levantine Basin (Figure 1). The Gabriella License is centered approximately 10 kilometers off the Israeli coast between Netanya in the North and Ashdod in the South. The Gabriella License covers a total area of 390,000 dunam[4] (approximately 390 square kilometers or 97,000 acres) and is in relatively shallow water with depths between 80 and 200 meters.

4.2 GROSS AND NET INTEREST IN THE PROPERTY

The Gabriella License Working Interest is owned by a consortium composed of Adira Energy Israel, Ltd 15%, Modiin Energy LP 70%, and Brownstone Ventures Inc 15%. Adira is the operator of the license.

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[4] 1 dunam is 0.1 hectare or 0.2471044 acres or 1,000 square meters

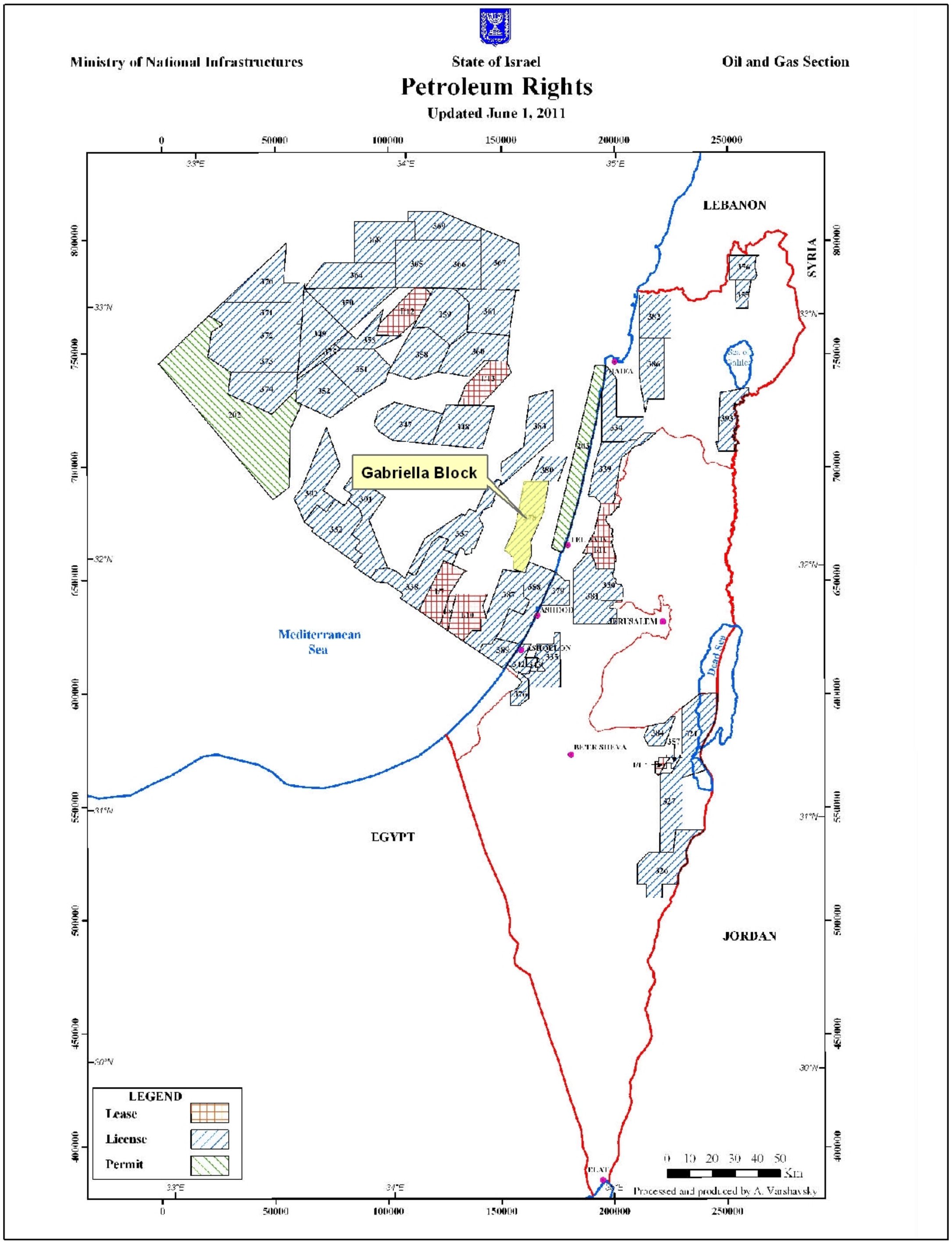

Figure 1 Gabriella Block Area

4.3 EXPIRY DATE OF INTEREST

Adira Energy Israel, Ltd (Adira) was issued License #378 / ‘Gabriella’ by the Israel Ministry of National Infrastructures (MNI) on July 15, 2009. The License was granted for an initial term of three years from the issue date, which is July 15, 2012. The agreement was revised on May 15, 2011. Certain terms and conditions were mandated by the work program as follows:

1. Gathering and studying the existing geophysical and geological material within 3 months from the date of granting the license.
2. Reprocessing of the 2D seismic lines and submission of a report summarizing the potential of the Gabriella area within 12 months, by July 15, 2010.
3. Signing of an agreement with a seismic acquisition company for the execution of a 3D seismic survey of approximately 100 square kilometer within 12 months, by July 15, 2010. (An extension of three months until October 15, 2010 was approved on July 6, 2010.)
4. Commencing acquisition of the seismic survey within 18 months, by January 15, 2011.
5. Filing the 3D data with the MNI by July 1, 1011
6. Completion of the 3D processing by December 1, 2011
7. Complete the final 3D interpretation and mapping and file a final geophysical report with the MNI by April 1, 2012
8. Present a well proposal to the MNI by June 1, 2012
9. Sign a drilling contract by July 1, 2012
10. Commencing drilling a well to the Jurassic to the depth of approximately 5,000 meters by December 1, 2012.

4.4 DESCRIPTION OF TARGET ZONES

The subject prospect is a Jurassic age carbonate that has been seen and tested in 1994 by the Yam-Yafo 1 well, which is located on the Gabriella block. The Jurassic carbonate has been subdivided into three units, the Zohar, Shederot, and Barnea.

4.5 DISTANCE TO THE NEAREST COMMERCIAL PRODUCTION AND SUCCESSFUL WELL TESTS

Oil has been produced onshore from the Heletz Field and the Ashdod Field from Jurassic aged carbonates 20 to 40 kilometers to the east. Gas has been produced from the Mari B Field from Miocene aged sands 55 kilometers to the southwest. In 1990 and 1994, two wells had successful tests of sweet crude oil from the Jurassic section. The Yam 2 well, located on the Shemen block to the south of Gabriella, tested 800 barrels of oil per day of 47° API gravity oil and the Yam-Yafo 1 well, located on the Gabriella block and on trend, tested a maximum rate of 821 barrels of oil per day of 44° API gravity oil. Both wells were considered to be non-commercial by the operator, Isramco, at the time.

4.6 PRODUCT TYPES REASONABLY EXPECTED

The Jurassic carbonate zone in the Gabriella prospect is expected to contain light sweet crude oil with a gravity of 44° API. The Cretaceous and Miocene prospects are expected to contain natural gas with condensate.

4.7 RANGE OF POOL OR FIELD SIZES

The estimate of the size of the area of the Jurassic carbonate zone in the Gabriella prospect ranges from 4.10 square kilometers to 58.75 square kilometers. The thickness of the oil accumulation is estimated to be from 60 to 310 meters. Contingent Resources range from a low estimate of 60 MMBO to a high estimate of 806 MMBO.

The estimate of the size of the areas of the Cretaceous prospects in Gabriella is 2.9 to 42.1 square kilometers with the thickness of the gas accumulation estimated to be from 70.0 to 245.0 meters. The Miocene zones in Gabriella range from 0.2 square kilometers to 50.1 square kilometers with the thickness of the gas accumulation estimated to be from 7.0 to 590.0 meters. Prospective Resources for the Cretaceous range from a low estimate of 545 BCF and 76 MMB to a high estimate of 3.8 TCF and 597 MMB of condensate. Prospective Resources for the Miocene range from a low estimate of 539 BCF and 37 MMB to a high estimate of 4.6 TCF and 345 MMB of condensate.

These estimates are based on the interpretation of the data provided.

4.8 DEPTH OF THE TARGET ZONE

The top of the Jurassic carbonate zone in the Gabriella prospect, known as the Zohar unit, would be found at approximately 4,894 meters depth. The entire prospective Jurassic section that includes the Shederot and Barnea carbonates would extend to 5,310 meters depth. Additional deeper oil bearing carbonates may be encountered in this area. The Cretaceous zones would be encountered at approximately 2,400 to 2,700 meters depth and the Miocene zones would be at a depth of approximately 1,890 to 1,970 meters.

4.9 ESTIMATED DRILLING AND COMPLETION COST

Current estimated cost to drill and complete a well to a total depth of 5,300 meters true vertical depth is US$67.1MM. This includes rig mobilization cost of US$0.9MM, dry hole costs of US$51.3MM and completion costs of US$14.9MM. Due to the water depths, depth of the target objective, and pressures expected to test the Jurassic prospect, a large jack-up rig or semi-submersible would be needed. The estimated cost to drill a well to the Cretaceous at a depth of 2,700 meters is approximately US$28.0MM and a well to the Miocene to a depth of 2,100 meters is approximately US$26.0MM. These estimates include time and equipment to test the wells but not to complete.

4.10 EXPECTED TIMING OF DRILLING AND COMPLETION

According to the terms of the revised License agreement for Gabriella, Adira will commence drilling a well to the Jurassic, to the depth of approximately 5,000 meters, by December 1, 2012. The drilling, testing and completion is estimated to take 140 days or until April 19, 2013.

4.11 EXPECTED MARKETING AND TRANSPORTATION ARRANGEMENTS

In the event of a discovery of commercial quantities of oil, a platform would be installed with production facilities that would be connected to a pipeline that would take the oil to shore. Currently, gas produced at the Mari B platform to the southwest is transported through a gas pipeline that crosses the Shemen block to the south of the Gabriella block and makes landfall in Ashdod (Figure 2). If gas is found on Gabriella it could be produced with the construction of a pipeline that would tie into the line to the south. An oil pipeline could be constructed along the same path as the existing gas pipeline or, if permitted, could be built directly to shore to the Tel Aviv area.

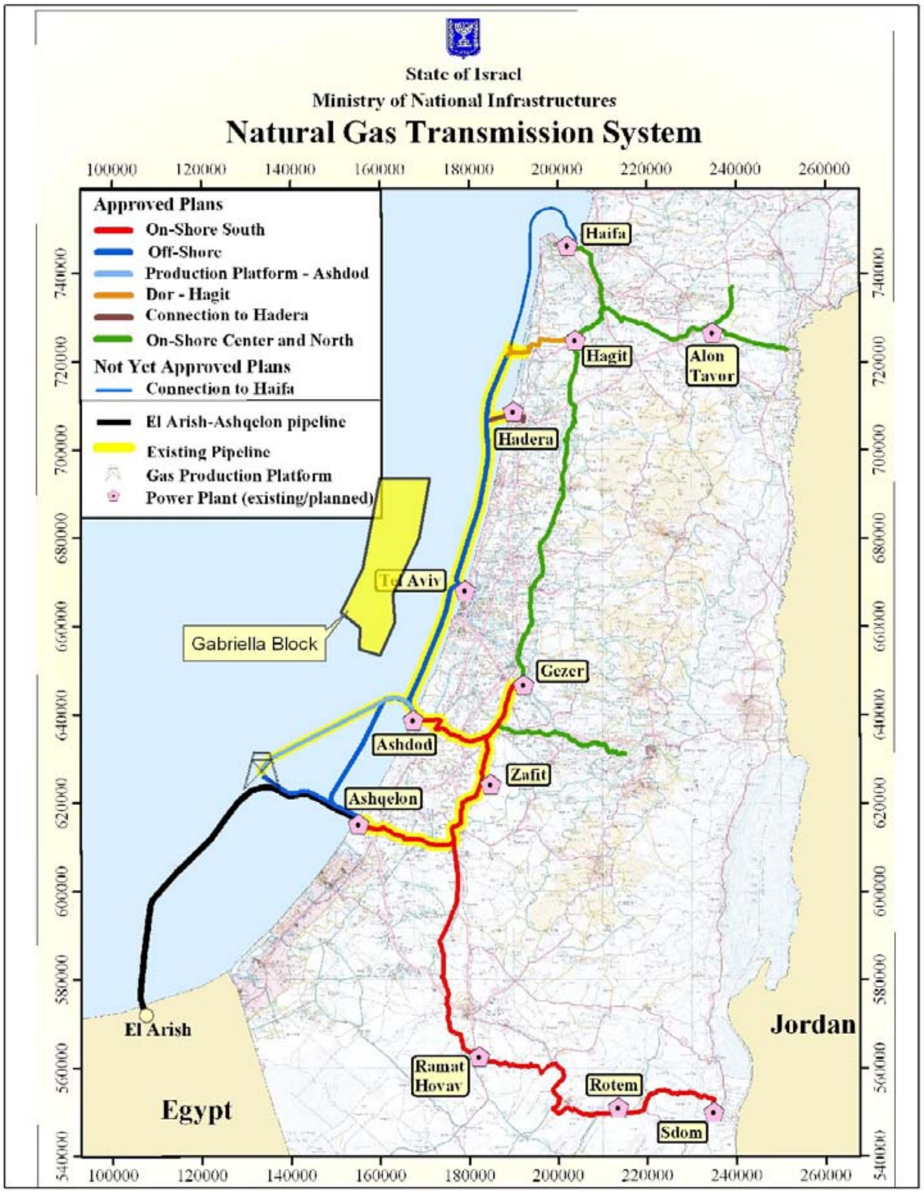

Figure 2 Current and Planned Israel Infrastructure

4.12 IDENTITY AND RELEVANT EXPERIENCE OF THE OPERATOR

4.12.1 Adira Energy Ltd[5]

Adira Energy Ltd is a Canadian domiciled Oil & Gas exploration and development company that explores for oil and gas onshore and offshore Israel. It has acquired four petroleum exploration licenses (or interests therein); the Eitan, Gabriella, Yitzhak, and Samuel Licenses. The onshore acreage includes the Eitan License which covers 125,700 dunam (126 square kilometers, 31,060 acres) in the Hula Valley located in Northern Israel. The offshore acreage in addition to the subject Gabriella License includes the Yitzhak License covering 127,700 dunam (128 square kilometers, 31,555 acres) centered approximately 17 kilometers offshore Israel between Hadera and Netanya, directly to the North of and contiguous to Gabriella License, the Samuel License covering 361,000 dunam (361 square kilometers, 89,205 acres) adjacent to the coast offshore Israel between Ashkelon and Rishon LeTziyon, southeast of and contiguous to Gabriella License, with indications of gas.

Adira Energy offers investors a unique opportunity to participate in a previously underexplored, new Oil & Gas frontier, Israel. The corporate vision is to build a world class energy company with the aim of achieving energy self-sufficiency for the State of Israel.

Adira Energy Ltd is led by an excellent team with a track record of project execution through the ability of their technical and executive management.

4.12.2 Gustavson Associates, LLC

Gustavson Associates, LLC is a global consulting firm consisting of geologists, geophysicists, and petroleum engineers, as well as economists and financial experts dedicated to the business of problem solving in all aspects of natural resource evaluations. Gustavson's work ranges from the first steps of prospecting to design and assessment of production facilities. The company has a 30+-year track record of quality consulting to industry and governments worldwide and utilizes

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[5] Adira Energy Ltd

the latest technology to quickly and economically analyze large volumes of data. Technology services include basin analysis, resource favorability studies, 3-D and 2-D seismic interpretation, source rock and maturation studies, alongside economic assessments encompassing reserve estimates and financial forecasts, reservoir analysis, secondary and EOR Studies, and expert testimony. Report services include third party reserve and resource reports, NI 51-101, SEC, mineral appraisals, and other property evaluations. Gustavson Associates is working with Adira on this project.

4.13 RISKS AND PROBABILITY OF SUCCESS

4.13.1 Jurassic

The subject Jurassic prospect, as is inherent with all oil and gas prospects, has a level of risk that can be characterized based on the available data. This particular prospect has data and information that helps to mitigate the risk as compared to other prospects. The Gabriella prospect is considered to be a ‘drill-ready’ prospect that is reasonably well documented with seismic data and well test information. The quantification of the range of risk or the chance of finding commercial quantities of hydrocarbons in any single prospect can be characterized with the following variables:

Structure: defined as the presence of a structure or stratigraphic feature that could act as a trap for hydrocarbons;
Seal: defined as an impermeable barrier that would prevent hydrocarbons from leaking out of the structure;
Reservoir: defined as the rock that is in a structurally favorable position having sufficient void space present whether it be matrix porosity or fracture porosity to accumulate hydrocarbons in sufficient quantities to be commercial; and
Presence of Hydrocarbons: defined as the occurrence of hydrocarbon source rocks that could have generated hydrocarbons during a time that was favorable for accumulation in the structure.

Table 3 shows the Chance of Success (COS) or favorability that the above defined variables would occur. The Overall COS is the product of all four variables.

Table 3 Chance of Success (COS) for the Zohar (Jurassic)

Chance of Success (COS)	%	Comments
Structure	95	Seismic and mapping data indicates the presence of a structure
Seal	95	Good seal evidenced by overpressure in the Jurassic
Reservoir	60	Production test and petrophysical analysis
Presence of HC	100	Production test
Overall	**54.1**	The product of the above factors

The predominant risks relate to the presence of a fracture system that could create an effective reservoir sufficient for the creation of commercial accumulations of oil and gas.

4.13.2 Cretaceous and Miocene

The Cretaceous and Miocene prospects are based mainly on seismic data response with very little well control and are therefore higher risk targets. The wells that have been drilled in the area to date have targeted deep structures and the wells encountered few reservoir quality sands or carbonates. However, with the discovery of the Miocene gas at Tamar and Dalit along with the Cretaceous discovery in the offshore of Egypt there is exploratory potential for finding hydrocarbons in these sediments. The quantification of the risk or the chance of finding commercial quantities of hydrocarbons in any single Cretaceous or Miocene prospect can be characterized in Table 4.

Table 4 Chance of Success (COS) for the Cretaceous and Miocene

Chance of Success (COS)	%	Comments
Structure	75	Seismic and mapping data indicates the presence of structures
Seal	70	Thick shale intervals should provide seals
Reservoir	45	Amplitudes and sediment thick areas on structures seen on seismic
Presence of HC	85	Shows in the wells
Overall	**20.1**	The product of the above factors

4.14 HISTORY AND LOCATION OF GABRIELLA BLOCK

The Gabriella block is located in shallow water (between 80 and 200 meters) offshore of Israel in the eastern part of the Levant or Levantine Basin (Figure 3). The Levant Basin is a thick sedimentary basin filled with Late Paleozoic to recent aged deposits[6] and is located in the eastern Mediterranean north of the Nile River Delta and west of the countries of Lebanon and Israel. The basin has been subjected to several episodes of tectonic deformation and sediment deposition which includes both carbonates and clastics. The basin is part of the Afro-Arabian plate that is moving along the Dead Sea transform fault generally to the north and colliding with the Eurasian Plate which has resulted in regional tectonic compression that is called the "Syrian Arc".

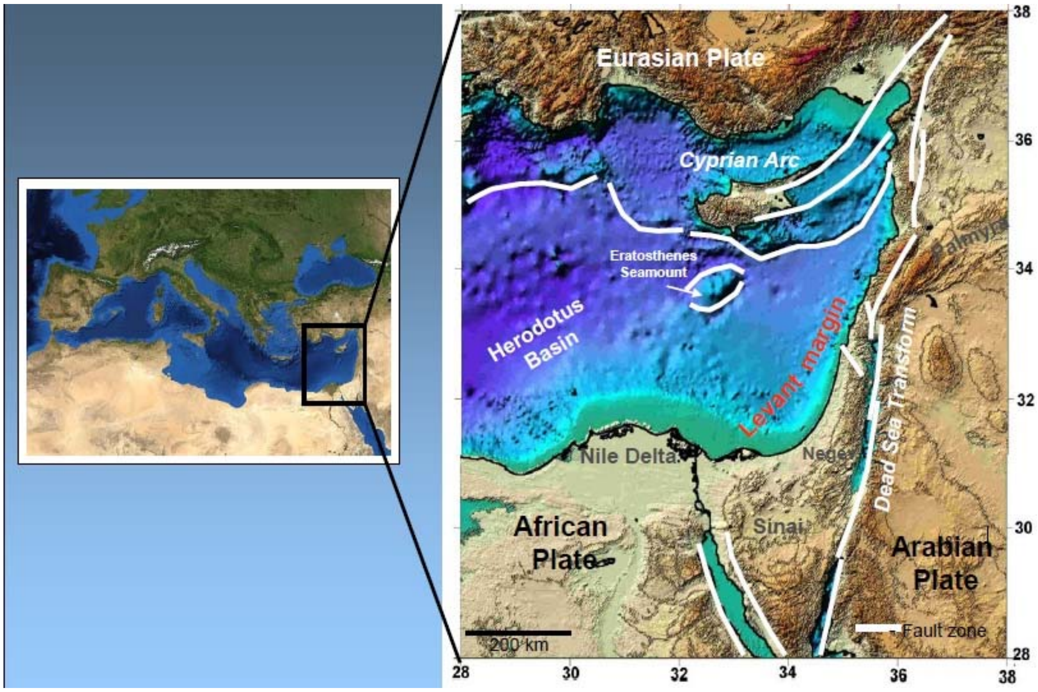

Figure 3 Map Showing Location of Levant Basin in the Eastern Mediterranean

The recent USGS assessment for the Levant Basin area, shown in Figure 4, established the potential recoverable oil and gas in the offshore of Israel as 1.7 billion barrels of oil (BBO) and 122.0 trillion cubic feet of natural gas (TCF).

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[6] Roberts and Peace, 2007

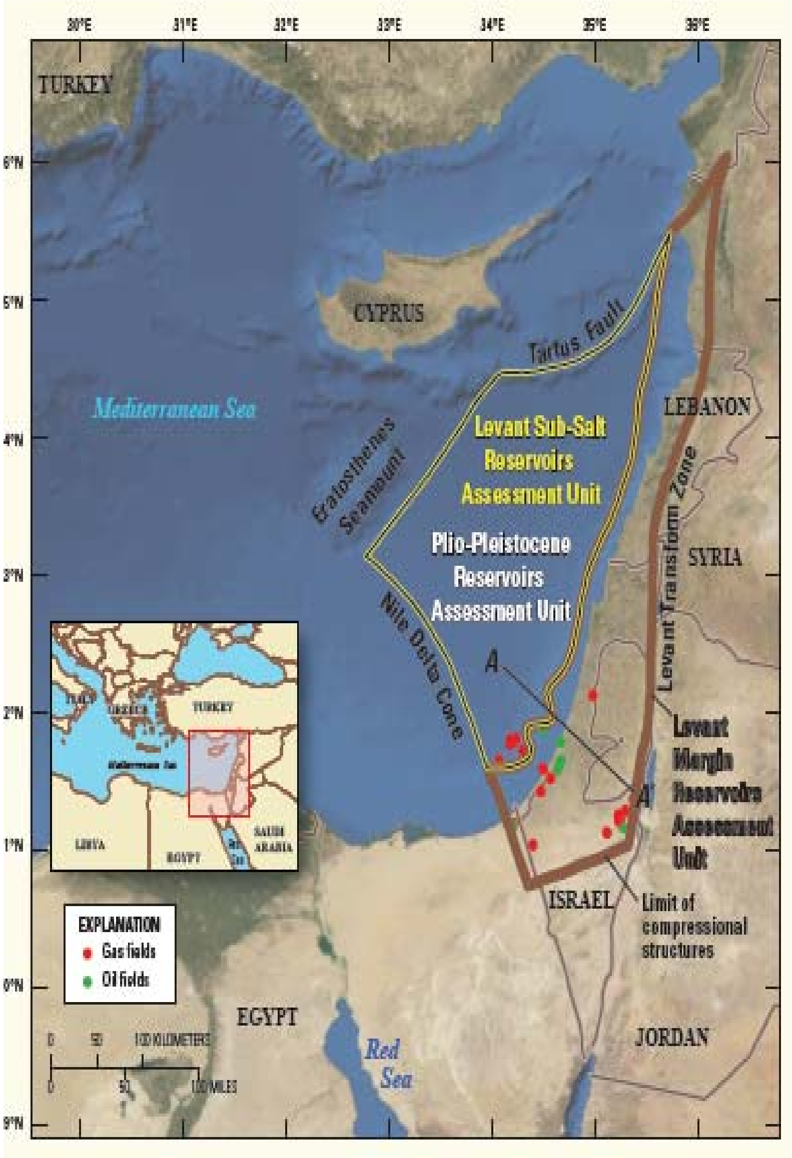


Figure 4 USGS Assessment Area in the Levant Basin

From 1969 through the present time, there has been sparse and intermittent drilling in offshore Israel (Figure 5) and mostly in the shallower water. Due to economic, technological or political issues, the offshore of Israel has been underexplored until recently.

The government of Israel is very interested in having these potential oil and gas resources explored and developed. The only major oil production that has been established in Israel to date is in the onshore Ashdod field which produced from the Zohar equivalent and the Heletz-Kokhav field (Figure 5). Discovered in the mid 1950’s, this Mesozoic oil field complex produced 17.2 MMBO from the Lower Cretaceous and Jurassic.

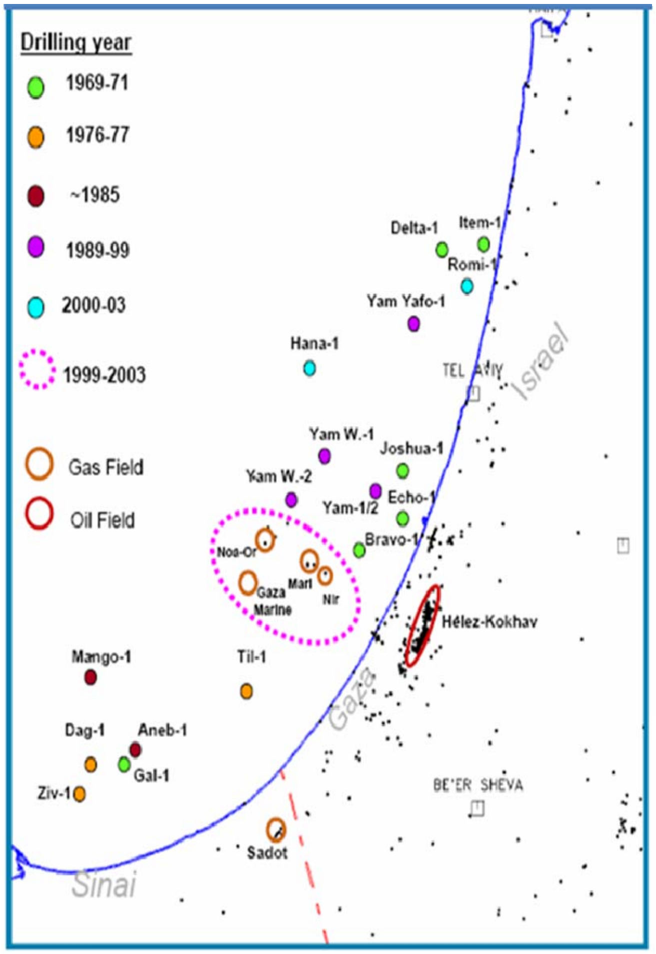


Figure 5 Offshore Drilling History and Main Hydrocarbon Occurrences (Gardosh)

In 1990 and 1994, two wells had successful tests of sweet crude oil from the Jurassic section. The Yam 2 well located on the Shemen block to the south (Figure 5) tested 800 barrels of oil per day of 47^o API gravity oil and the Yam-Yafo 1 well located on the Gabriella block tested at a maximum rate of 821 barrels of oil per day of 44^o API gravity oil. A review of the test data indicates that the Yam 2 well could have flowed at a maximum rate of 1,000 barrels of oil per day and the Yam-Yafo 1 produced 1,300 barrels per day of total fluids.

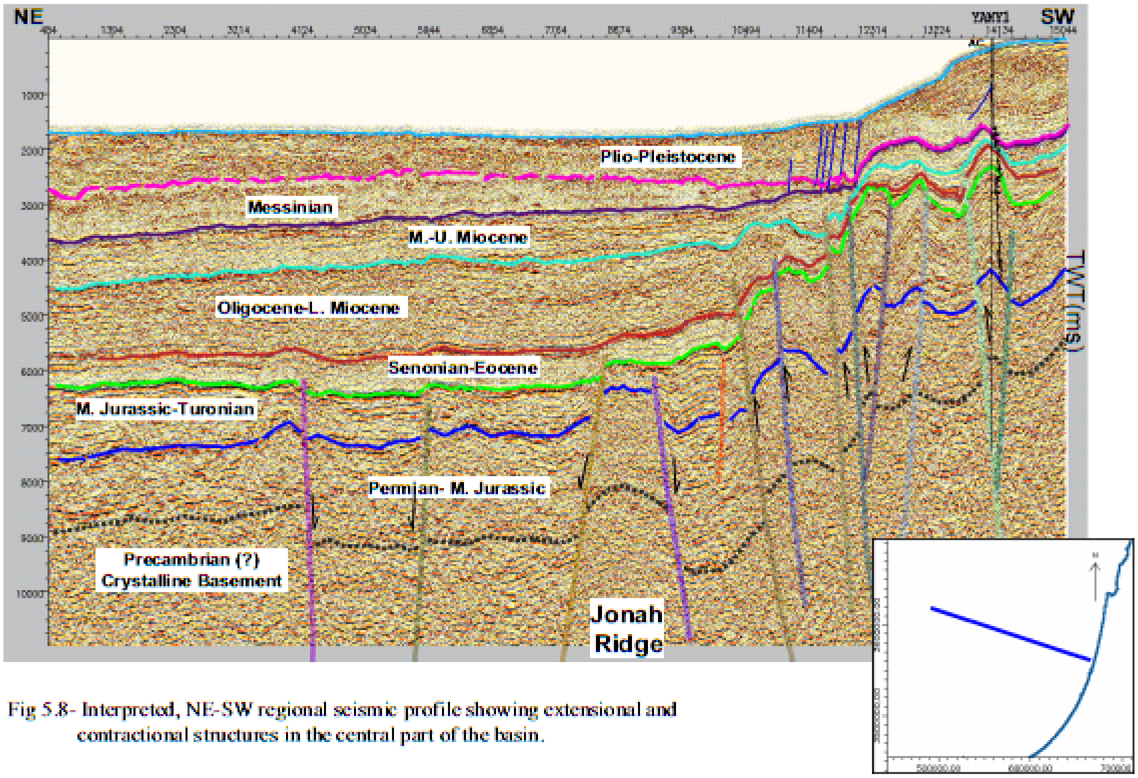


Fig 5.8- Interpreted, NE-SW regional seismic profile showing extensional and contractional structures in the central part of the basin.

Figure 6 Seismic Profile through the Yam Yafo 1 Well (Gardosh et al, 2008)

The seismic section depicted in Figure 6 is from an older 2-D seismic line which illustrates the major unconformities and stratigraphy in the area. It also shows the Jurassic anticline that was tested in the Yam Yafo 1 well that penetrated 903 meters of the section.

During the past few years, trillions of cubic feet in proven gas reserves from several Israeli and Gaza fields have been discovered. This is an extremely important development for a country with very limited domestic energy resources. The Mari, Noa and Or fields, located just approximately 61 kilometers southwest of the Yam-Yafo 1 well on Gabriella, are large natural gas fields with estimated reserves of 1.7 to 3.0 TCF of gas. Both were discovered by the Yam Tethys Joint Venture, consisting of Noble (formerly Samedan) Mediterranean, Avner Oil Limited Partnership, Delek Drilling Ltd Partnership, and several other Delek group entities. In 2000, the British Gas-Isramco group announced that it had discovered a large gas field 19.3 kilometers offshore at its Nir 1 well, which is located south of the Gabriella block boundary in the Shemen License. The well reportedly discovered gas reserves of 274 billion cubic feet (BCF) but was declared non-commercial. Deliveries of gas from the Mari B Field began in February 2004 through a pipeline located to the south of the Gabriella block.

BG Group discovered a large gas field 24.1 kilometers offshore Gaza under an exploration license granted to it by the Palestinian Authority. Estimated to contain 1.5 TCF of gas, the Gaza Marine field (Figure 7) is located within a few miles of the Yam Tethys and BG-Isramco discoveries and 70 kilometers from the Yam-Yafo 1 well on Gabriella.

In January 2009, Noble Energy announced a natural gas discovery, offshore Israel, at the Tamar #1 well (Figure 7), located in approximately 1,676 meters of water and about 90.1 kilometers off the Israeli northern port of Haifa and 103 kilometers from the Yam-Yafo 1 well on Gabriella. The well was drilled to a total depth of 4,900 meters. The gross mean resources for the Tamar #1 were estimated by Netherland/Sewell to be 8.4 to 9.1 TCF of natural gas. In March 2009, Noble Energy announced a natural gas discovery, offshore Israel, at the Dalit well located in approximately 1,372 meters of water about 48 kilometers off the coast of Hadera and 63 kilometers from the Yam-Yafo 1 well on Gabriella. The well was drilled to a total depth of 3,658 meters and the gross mean resources were estimated to be 0.5 TCF of natural gas.

Most recently Noble has discovered the Leviathan Field, which is located 120 kilometers from the Yam-Yafo 1 well on Gabriella, with a reported 16 TCF accumulation of natural gas.

The Adira Gabriella License (Figure 8) is centered approximately 10 kilometers off the Israeli coast between Netanya in the North and Ashdod in the South. The Gabriella License covers a total area of 390,000 dunam (approximately 390 square kilometers or 97,000 acres) and is in relatively shallow water with depths between 80 and 200 meters.

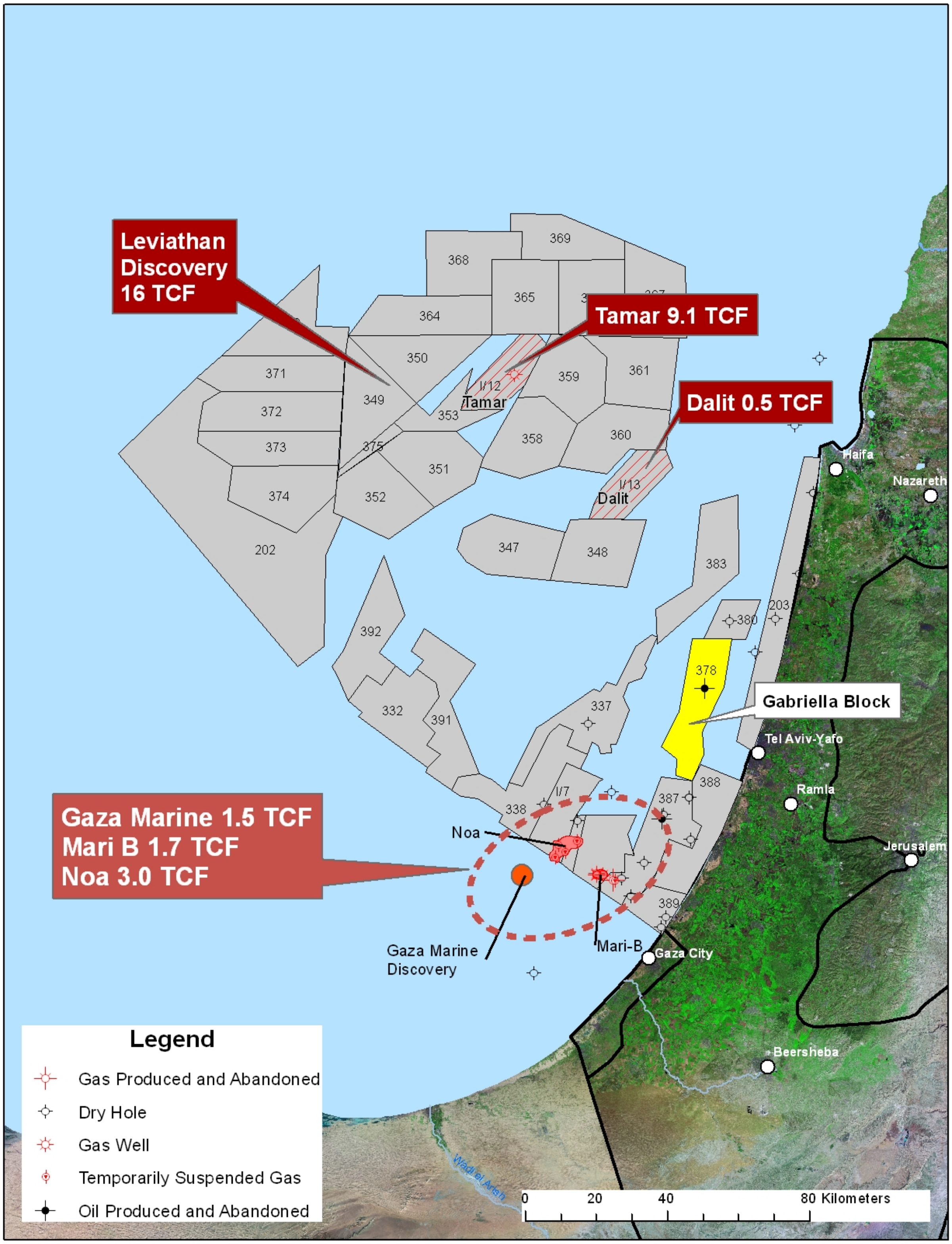


Figure 7 Locations of Recent Large Discoveries in the Levant Basin

The block is almost completely covered by a recently acquired 465 square kilometer dual azimuth 3-D seismic survey. In addition, 910 line kilometers of 2-D seismic data that covers a large area across and around the block was reprocessed. Most existing seismic data acquired in the offshore of Israel is available to qualified companies for copying costs. Adira also acquired copies of the BG Levant B, Isramco Yam and Isramco North-Central 3-D surveys from the GII.

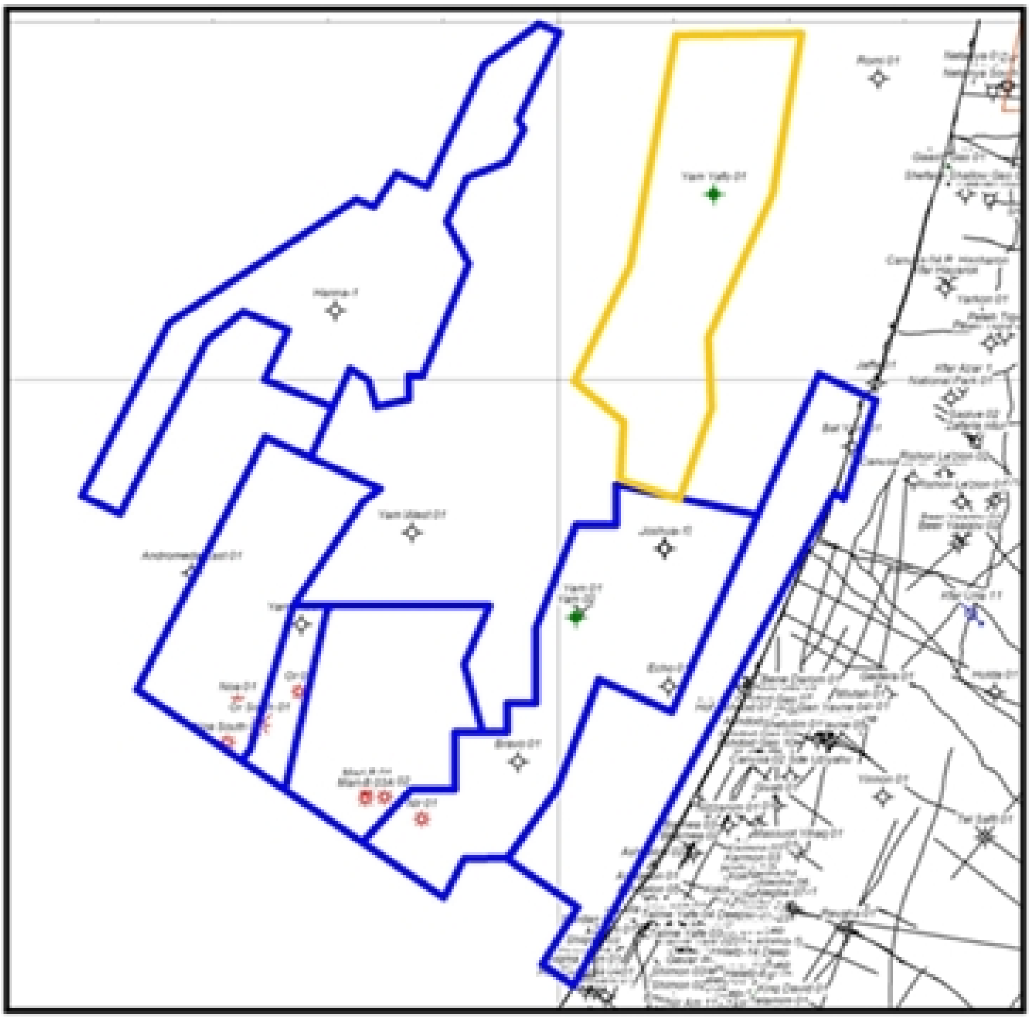


Figure 8 Gabriella Block Area

4.15 GABRIELLA LICENSE

The Gabriella License is located in the offshore waters of Israel as depicted in Figure 9.

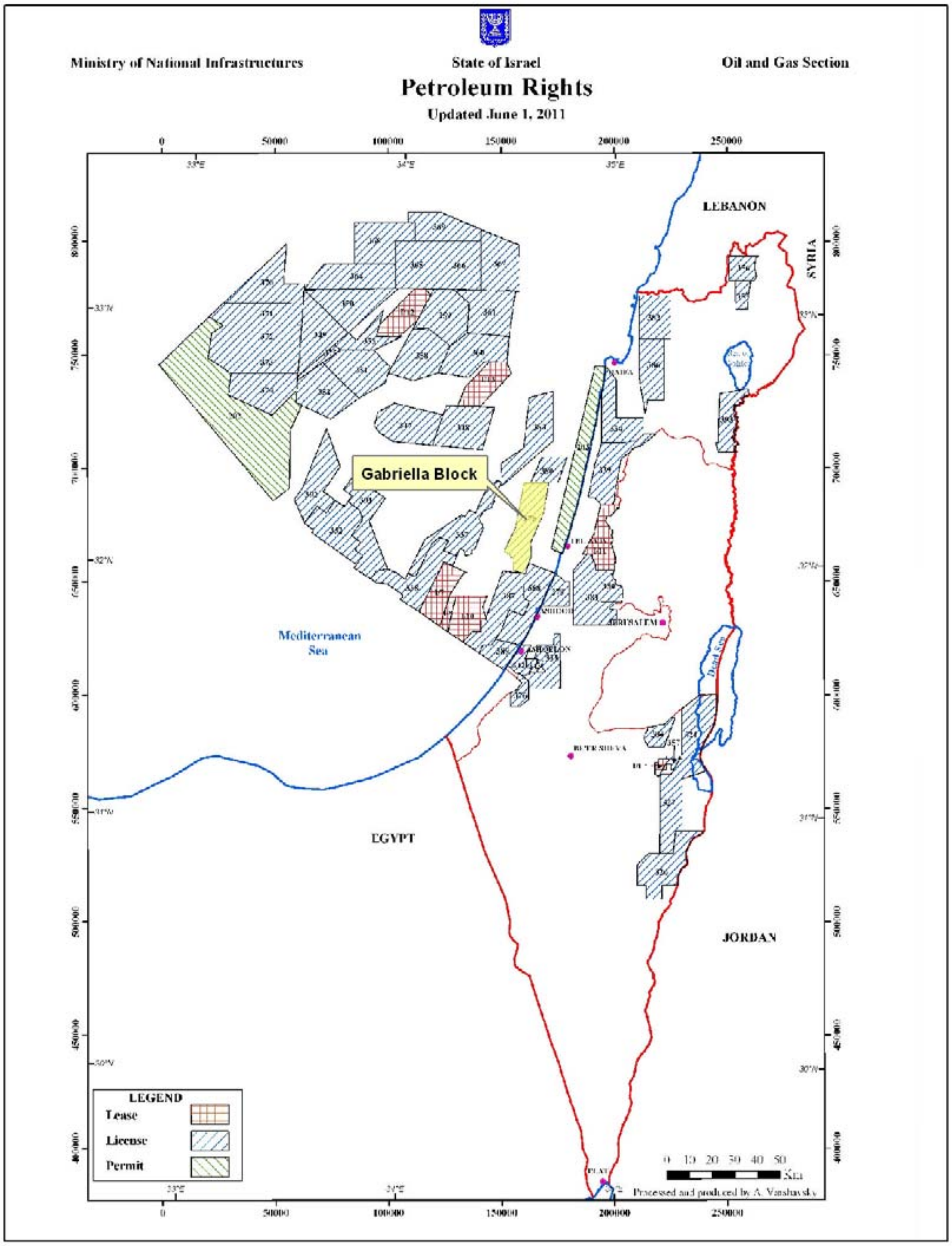


Figure 9 Location of Gabriella Block in the Offshore of Israel

The official outline of the license block, Figure 10, and New Israel Grid coordinates, Table 5, are shown below.

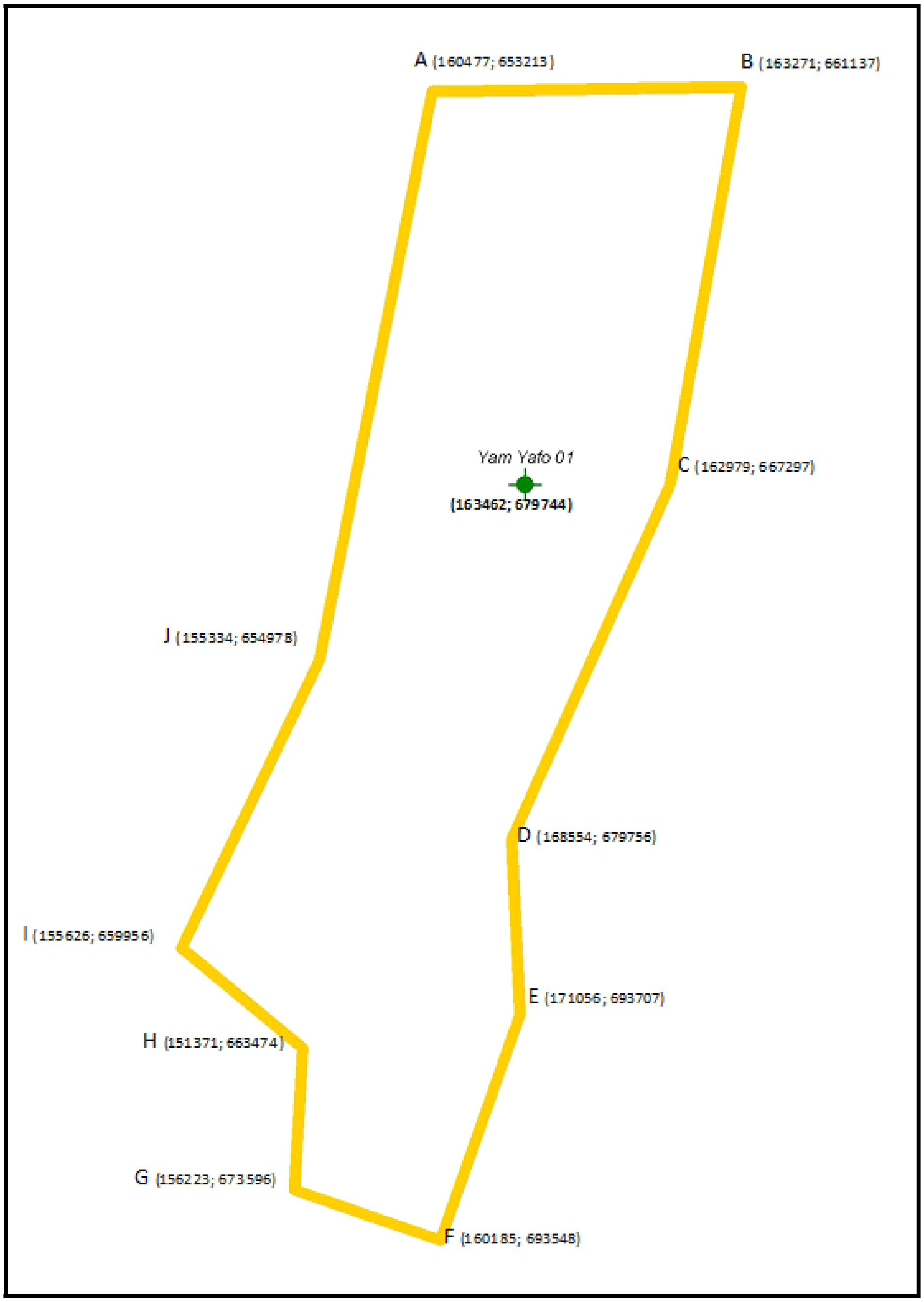


Figure 10 Detailed Map of License Area Gabriella

The license application area covers the area surrounding the Yam-Yafo 1 well that had shows of hydrocarbons. Estimated drilling depth to the top of the Jurassic target is approximately 4,850 meters deep. The revised terms of the license agreement specify that a well needs to be spudded by December 2012.

Table 5 License GABRIELLA - X, Y Co-ordinates (New Israel Grid)

The numbers shown in this table correspond with the numbered points on Figure 10.

	X	Y
A	160477	653213
B	163271	661137
C	162979	667297
D	168554	679756
E	171056	693707
F	160185	693548
G	156223	673596
H	151371	663474
I	155626	659956
J	155334	654978

The Gabriella License covers a total area of 390,000 dunam (approximately 390 square kilometers or 97,000 acres) and is in relatively shallow water with depths between 80 and 200 meters.

5. SEISMIC INTERPRETATION

Gustavson was provided with certain 2-D and 3-D seismic and well data (Figure 11) by Adira that had been obtained from the Geophysical Institute of Israel (GII). Adira also provided two recently acquired 3-D datasets shot in two different azimuths, a 465 square kilometer volume (First Azimuth) and a 197 square kilometer volume (Second Azimuth) that are located on the Gabriella block. The well data which was obtained from the GII, the Geological Survey of Israel (GSI) and the Ministry of Infrastructures included digital logs and certain reports on previously drilled wells. The new 3-D data was acquired in two different azimuths and delivered in the form of a Quick-Look cube by WesternGeco. The orientation of the 465 square kilometer survey (First Azimuth) is 23 degrees and the smaller 197 square kilometer survey (Second Azimuth) was shot at a 343 degree azimuth (Figure 12). The final reprocessing of the 3-D volume is scheduled to be completed in December, 2011 where the two datasets will be merged in order to provide a seismic depth volume, an AVO volume and be used for further processing that may provide indications of fractures. The seismic interpretation by Gustavson was based on the larger 465 square kilometer 3-D survey known as the Gabriella-Yitzhak 3-D First Azimuth.

Gustavson loaded all of the pertinent data onto a Kingdom-SMT seismic interpretation workstation. The location and extent of the 3-D and 2-D data loaded into the project is depicted in Figure 11. The 3-D data have been interpreted by Gustavson Associates and prospects defined from the interpretation.

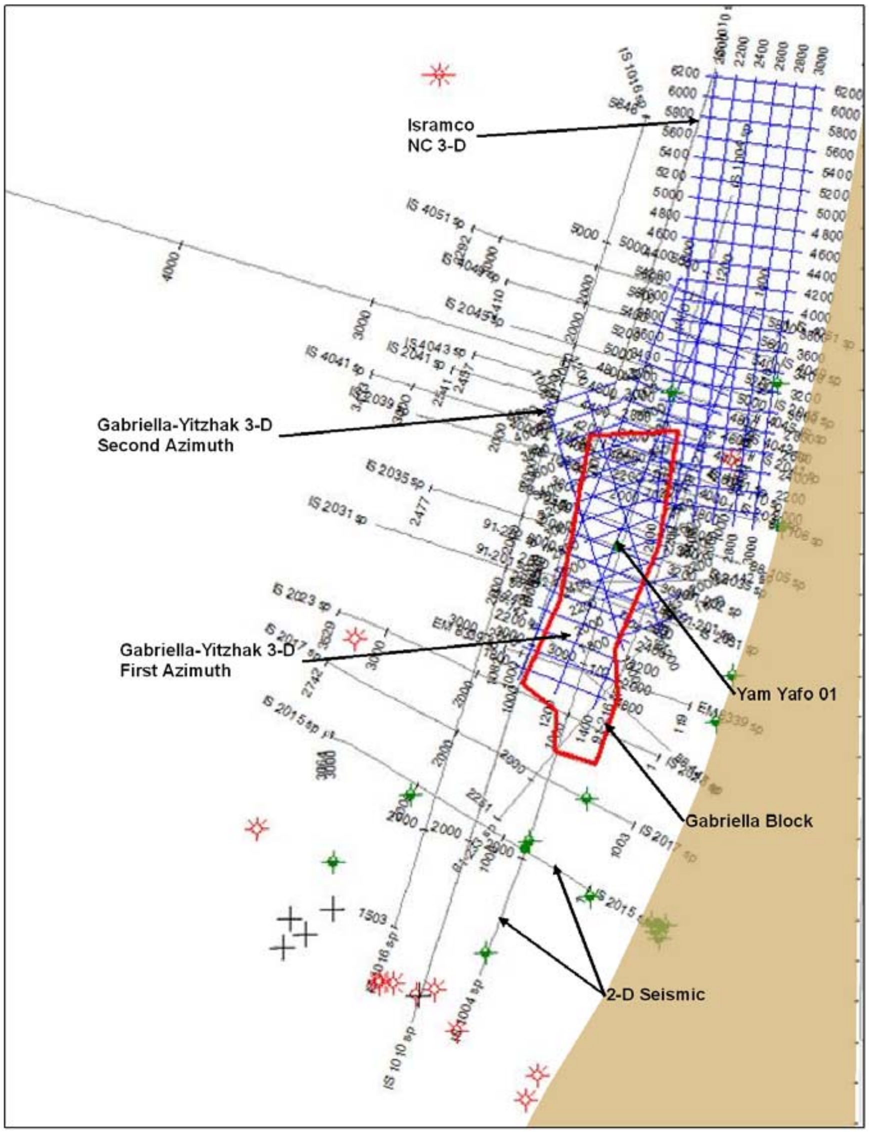


Figure 11 Seismic 2-D and 3-D Data Loaded onto the SMT Workstation

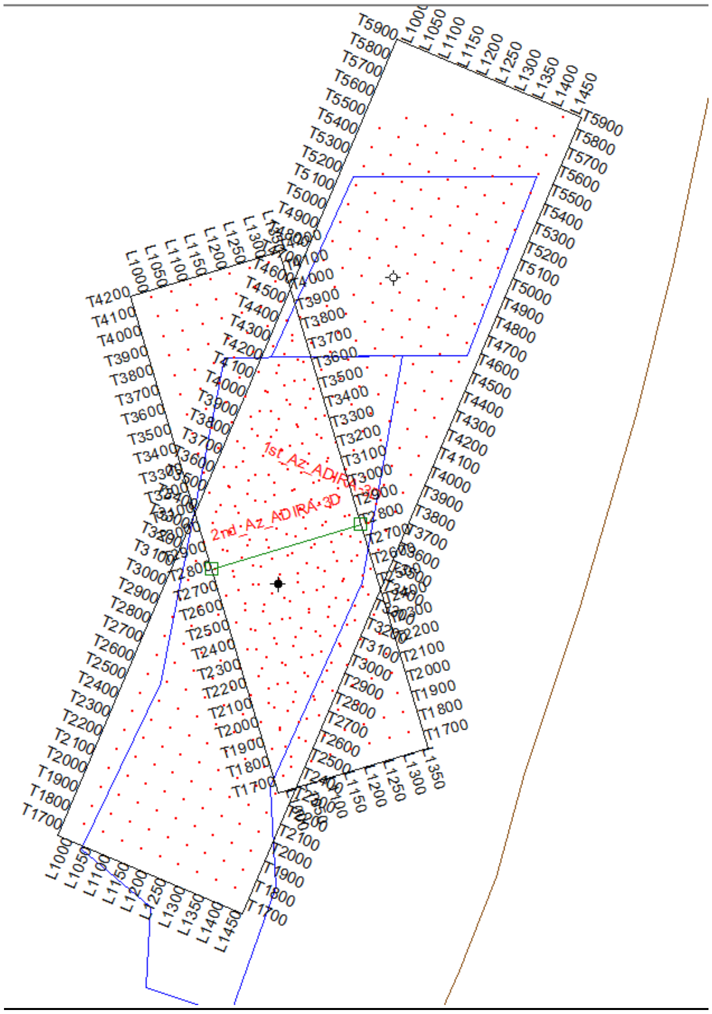


Figure 12 Detailed Location of the Gabriella-Yitzhak 3-D Seismic Surveys (2011)

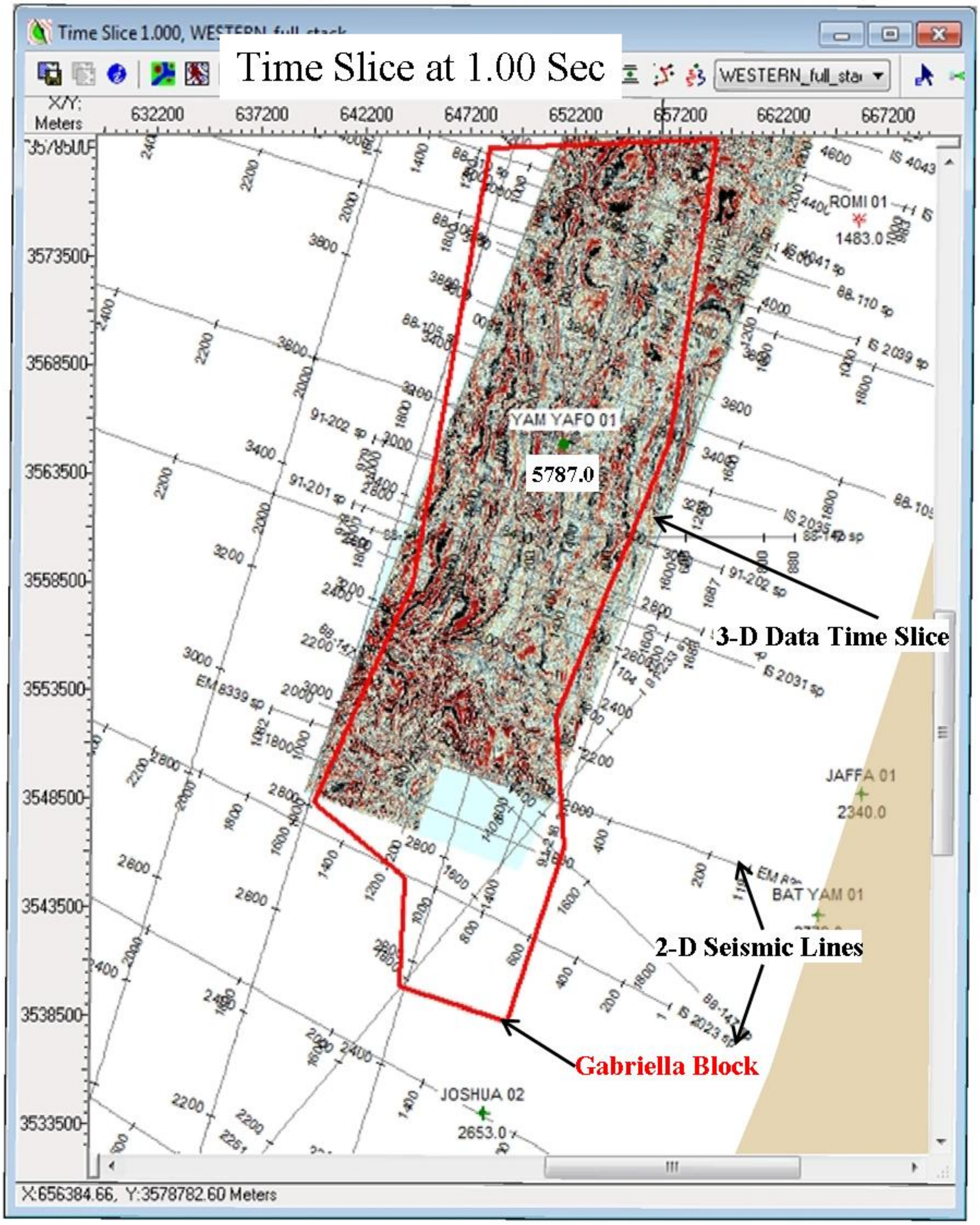


Figure 13 Gabriella 3-D Data Extent Time Slice at 1.0 Second

The extent of the new Gabriella-Yitzhak First Azimuth 3-D data as compared to the block outline and the Yam-Yafo 1 well is shown in Figure 13.

The well control (Figure 14) used for the seismic interpretation included the Yam-Yafo 1 well drilled to a Total Depth (TD) of 5,785.5 meters Measured Depth (MD) and the Delta 1 well drilled to a TD of 4,423 meters MD. Although both wells are within the extent of the 3-D survey only the Yam-Yafo 1 is located within the Gabriella license. A checkshot survey with 21 points was used for the Yam-Yafo 1 for depth to time conversion. In addition, a partial sonic (DT) and density logs were used to create a synthetic seismogram. The sonic log was run from 1,414 meters MD to TD. There is a data skip of about 340 meters from 3,725 meters MD to 4,062 meters MD, and a 20 meter skip from 4,618 meters MD to 4,638 meters MD. The density log runs from 2,800 meters MD to 5,793 meters MD with a data skip from 4,446 meters to 4,882 meters MD. The Delta 1 well had a very limited checkshot survey in addition to a DT from 342 meters to 3,904 meters.

Using these data, synthetic seismograms were created in order to accurately tie the well data in depth to the seismic data in time. Synthetic seismograms were correlated to the seismic data along with the velocity survey information to determine seismic time correlations for the formation horizons that would be interpreted on the seismic. The Yam-Yafo 1 well log curves along with selected formation tops are superimposed onto the seismic data in Figure 15. The formation tops or horizons that were correlated and mapped over the extent of 3-D included the Base Pliocene, Base Late Eocene, Talme Yafe, and the Jurassic Zohar. Also noted on Figure 15 is the location of Production Test #2 from 4,894 to 5,033 meters MD in the Yam-Yafo 1 well (Zohar to Barnea Jurassic section), which produced a maximum of 821 barrels of oil per day and 475 barrels of water per day.

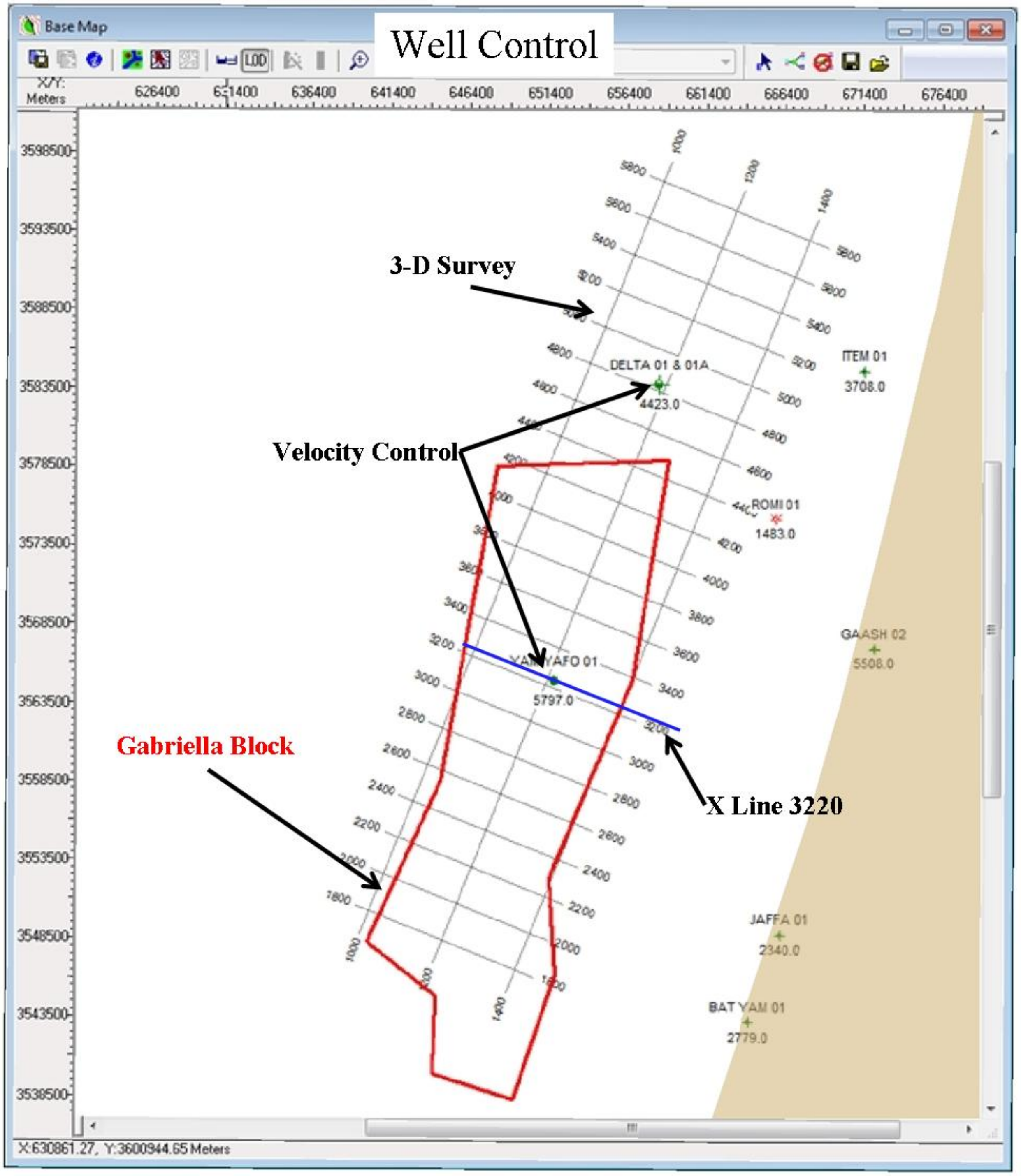


Figure 14 Map Showing the Time-Depth Well Control Used for the Seismic Interpretation

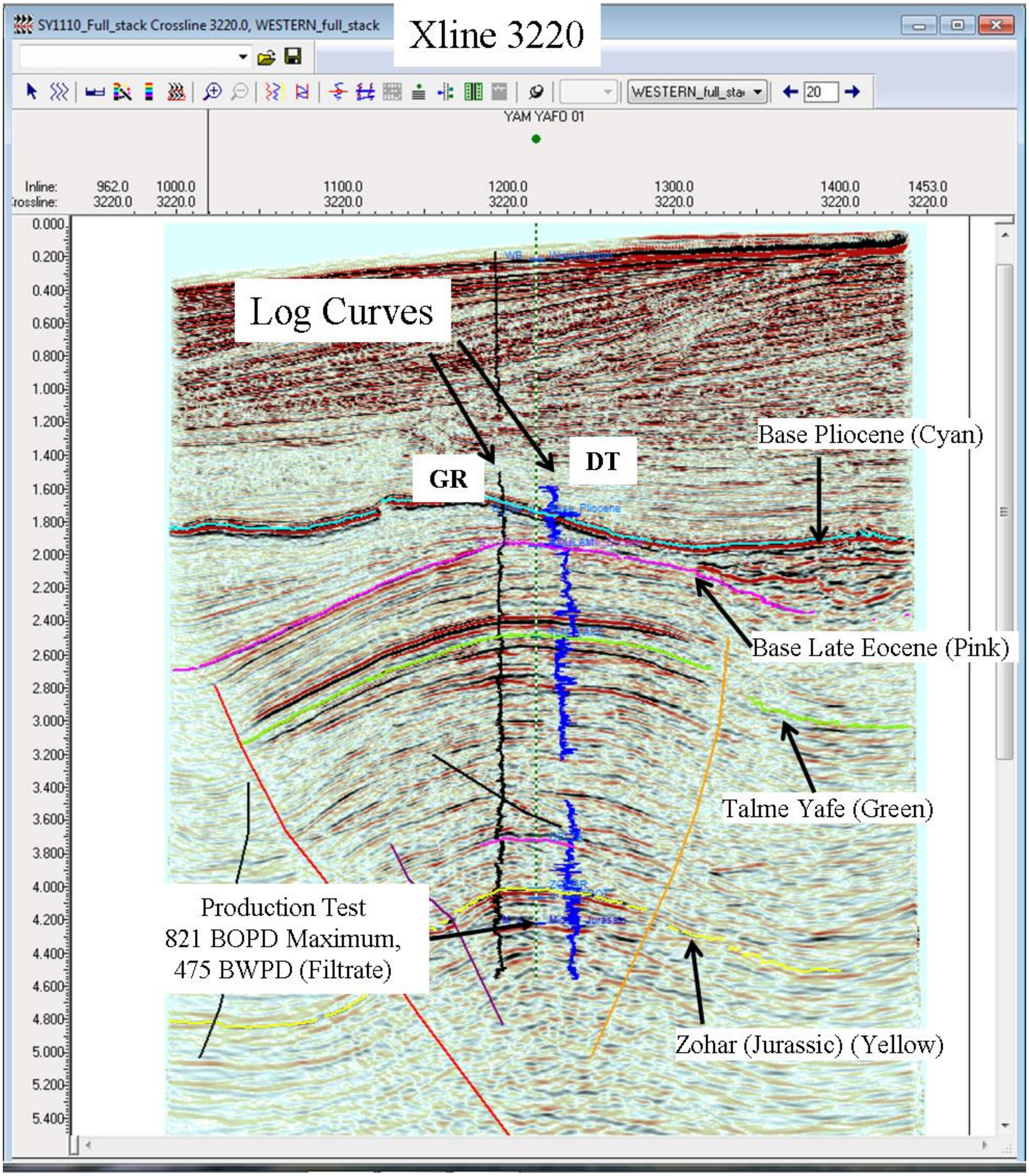


Figure 15 Line Showing the Correlation and Interpreted Horizons over Yam-Yafo 1

The seismic time horizons associated with the geologic formations from well control were interpreted on the 3-D seismic data and in conjunction with the fault interpretation resulted in seismic time maps for four horizons. The time structure map at the Base Pliocene level is depicted in Figure 16. It shows a southwest plunging nose and an associated four-way closure.

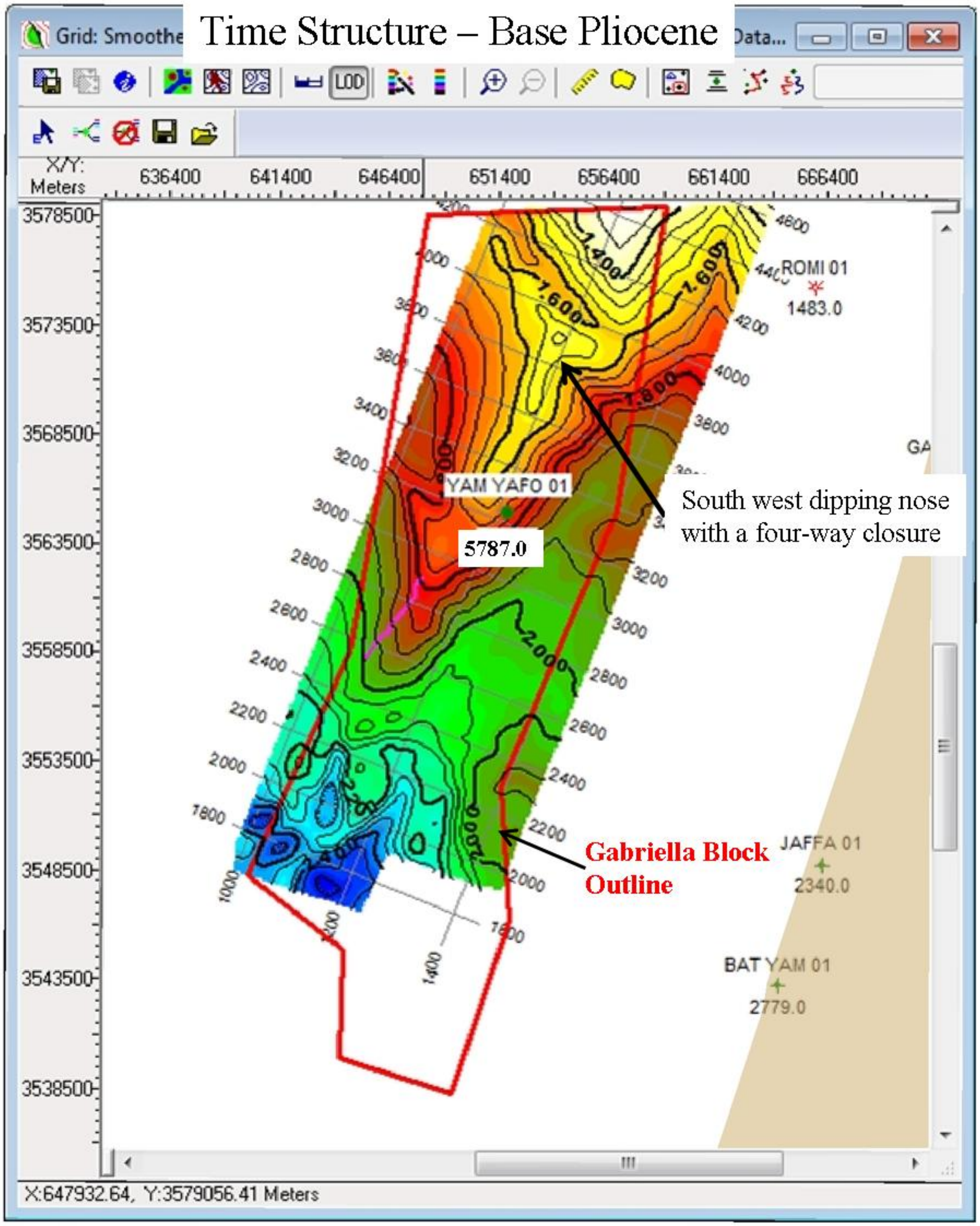


Figure 16 Base Pliocene Time Structure (warmer colors indicate higher structure)

The time structure map at the Base Late Eocene level with two limited area four-way closures is depicted in Figure 17.

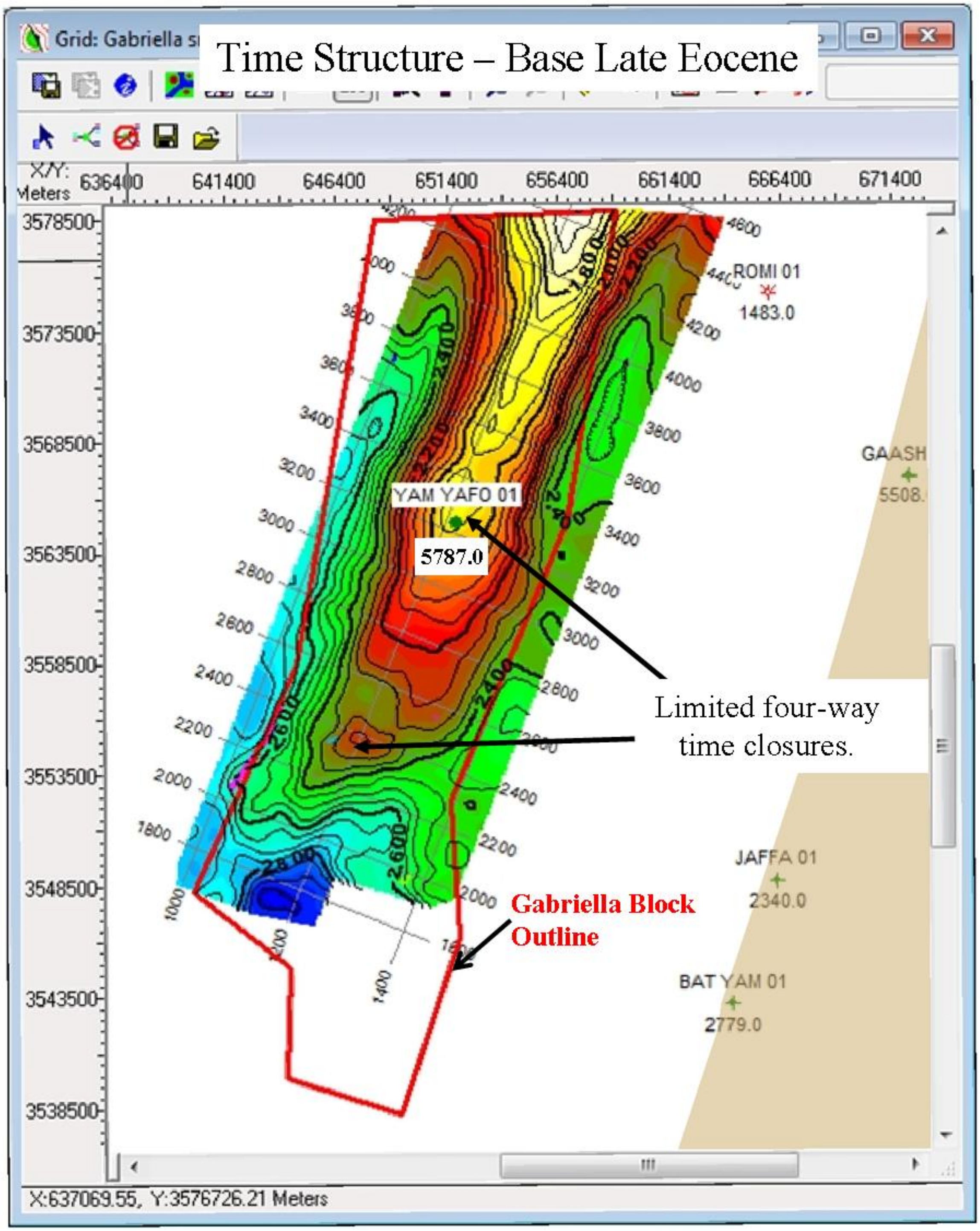


Figure 17 Base Late Eocene Time Structure

The time structure map at the Talme Yafe level depicted in Figure 18 shows two separate structural closures. The northern feature appears to be a four-way dip closure while the southern closure has a fault component on the west side.

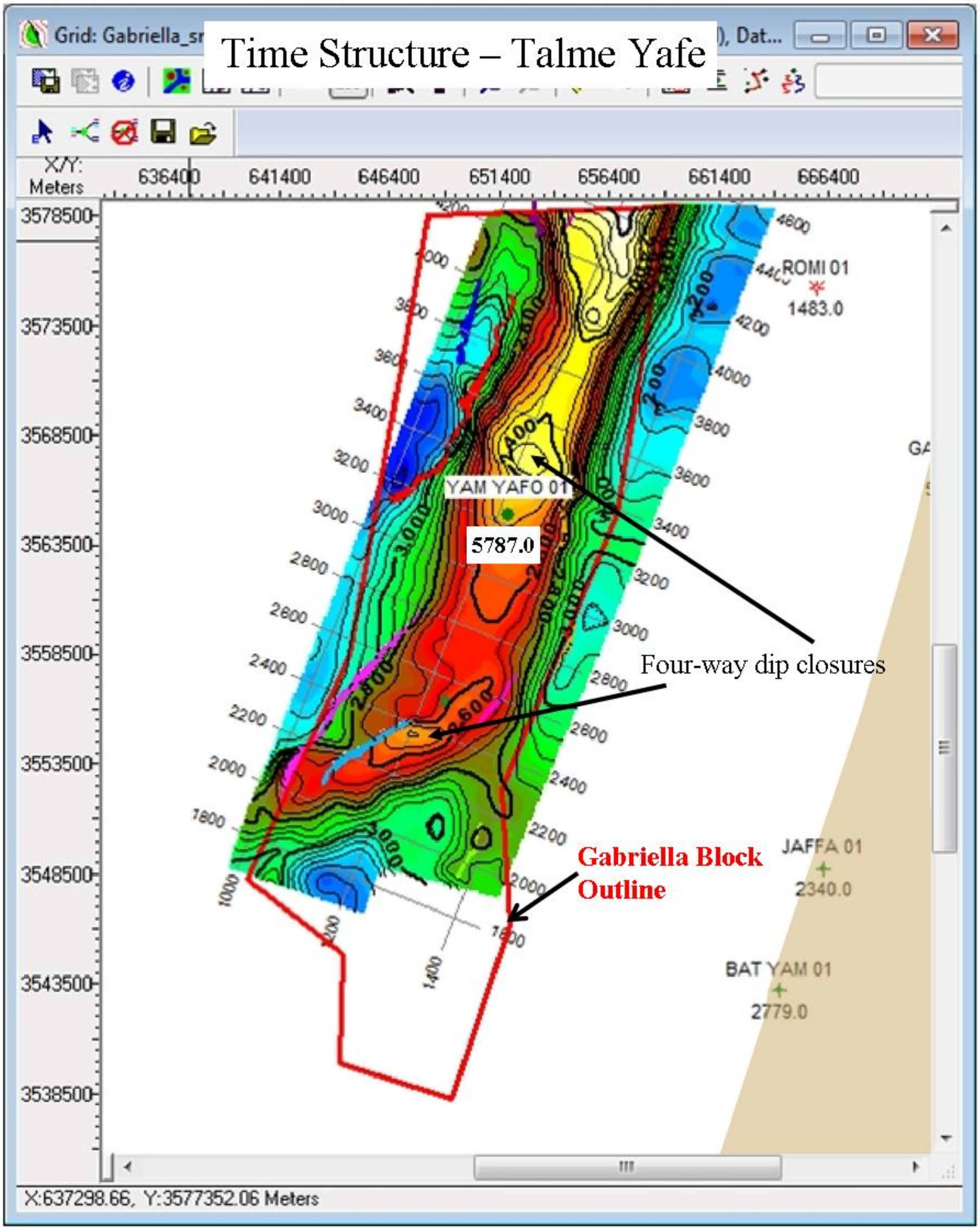


Figure 18 Time Structure Albian Equivalent Talme Yafe (Upper Early Cretaceous)

The time structure map at the Zohar level, Figure 19, shows a large closed structural prospect, which is the subject of this report.

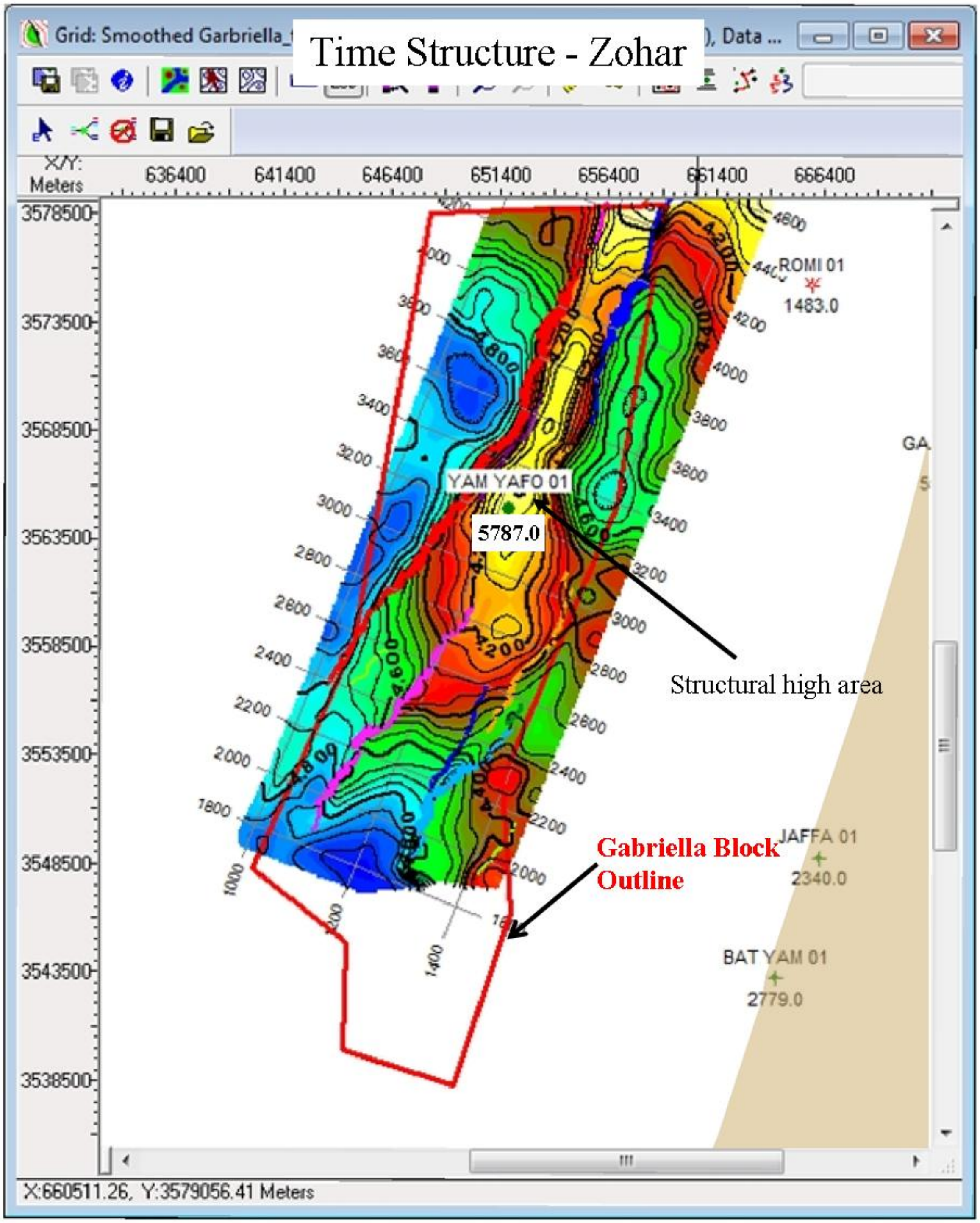


Figure 19 Zohar (Jurassic) Time Structure

5.1 INTERVAL VELOCITY METHOD

In order to derive a depth map from the Jurassic time map a series of calculations needed to be made. Tectonic activity resulted in rapid changes in the thickness of the Pliocene and the Base Pliocene to Base Late Eocene interval (Figure 20). Utilizing a single velocity function from the checkshot at the Yam-Yafo 1 well would not account for the thickness variations within the vertical units when converting to depth. Therefore, a layer method was used for time to depth conversion and is detailed below.

- Depth to Base Pliocene (apparent velocity)
- Isopach – Base Pliocene to Base Late Eocene (apparent velocity)
- Isopach – Base Late Eocene to Talme Yafe (apparent velocity)
- Isopach – Talme Yafe to Zohar (Jurassic) (apparent velocity)
- Summation of the above four grids to obtain a depth map to the Jurassic Marker

Isochrons were constructed between the interpreted time horizons by the subtraction of the time horizons maps. Apparent velocities (Figure 20), derived from the interval time thicknesses and seismic times, were then used to calculate the isopachous depth thickness by multiplying the apparent interval velocity by the isochron thickness for the four intervals. The resulting isopachous depth thicknesses were then summed to obtain the depth maps for the Base Pliocene, Base Late Eocene, Talme Yafe, and Zohar. The resulting Zohar subsea depth map is shown in Figure 21.

The depth map at the top of the Jurassic over the Gabriella structure, Figure 21, based on the Jurassic time map and the velocity conversion method discussed above, shows that the time structure is still valid in depth.

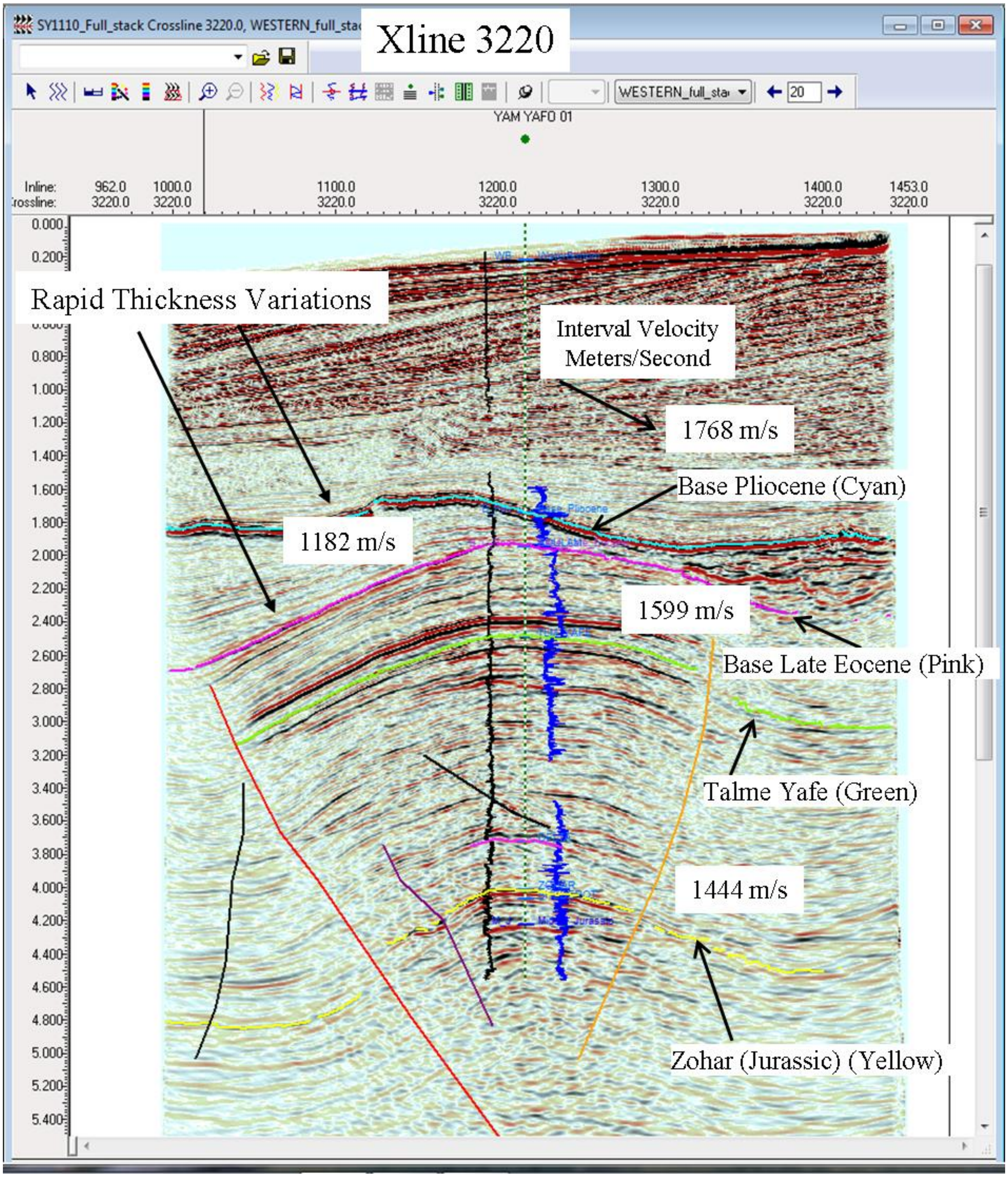
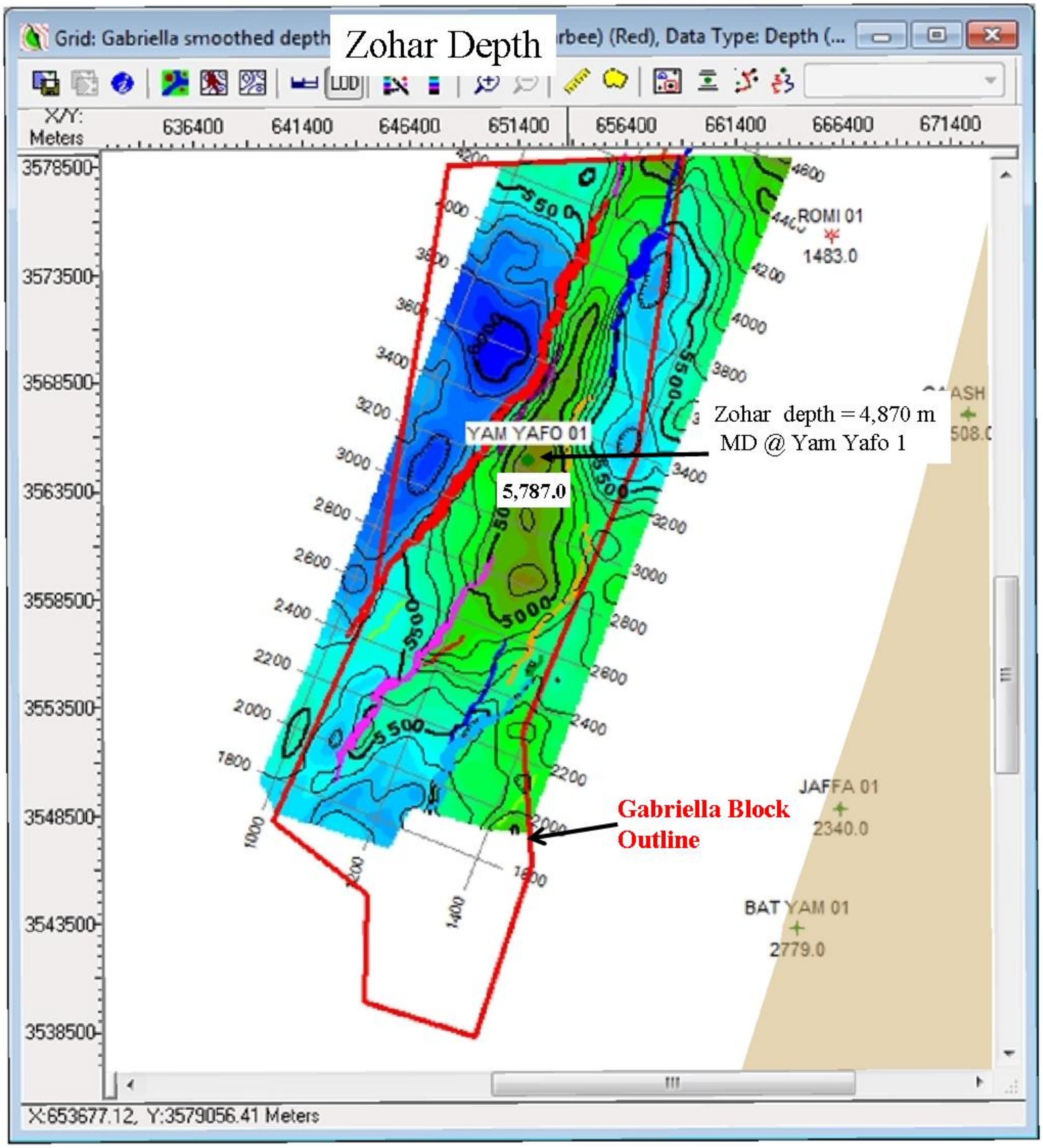


Figure 20 Seismic Line 3220



Zohar Depth

Grid: Gabriella smoothed depth … rbee) (Red), Data Type: Depth (...

Zohar depth = 4,870 m MD @ Yam Yafo 1

Gabriella Block Outline

X:653677.12, Y:3579056.41 Meters

Figure 21 Depth map of the Top Zohar (Jurassic) over the Yam Yafo Gabriella Structure

6. GEOLOGY

Gabriella lies on the near shore of the continental shelf offshore central Israel. This area (as well as the deeper Levant Basin) has been affected by Lower-Middle Mesozoic rifting followed by a short hiatus then Late Mesozoic to Tertiary compression. These tectonic events provide the petroleum system that is necessary to trap hydrocarbons in the Levant Basin. Available data suggests that Jurassic targets will be the primary objectives of the exploration program. Of the nine wells in the area of interest the Bravo-1, Delta-1, Yam Yafo-1, Joshua - 2, Echo-1, Yam-2, and Yam West-1 reached Jurassic horizons.

The Jurassic Gabriella structure is part of a structural ridge plunging to the south-southwest and limited on its eastern and western flanks by longitudinal faults. This structural ridge is composed of three sub-structures: Delta (Yitzhak) at the north, Yam Yafo (Gabriella) at the center and Yam-2 (Figure 22). The sub-structures are divided by transverse faults believed to trend in a SE-NW direction.

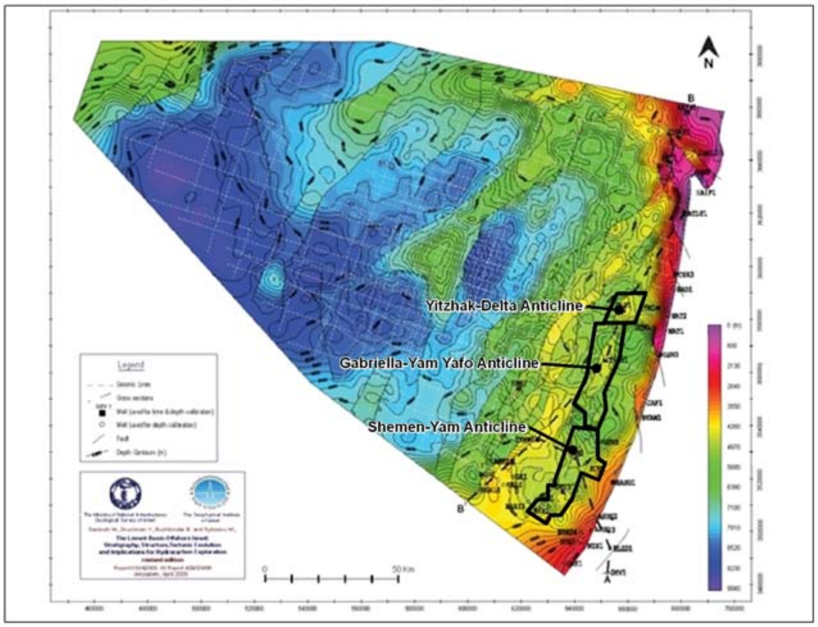


Figure 22 Depth Map of the Top of the Jurassic in the Levant Basin[7]

A generic stratigraphic column with zones with shows of gas and tested oil depicted for the Yam-Yafo1 borehole is shown in Figure 23.

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[7] after Gardosh et al., 2008

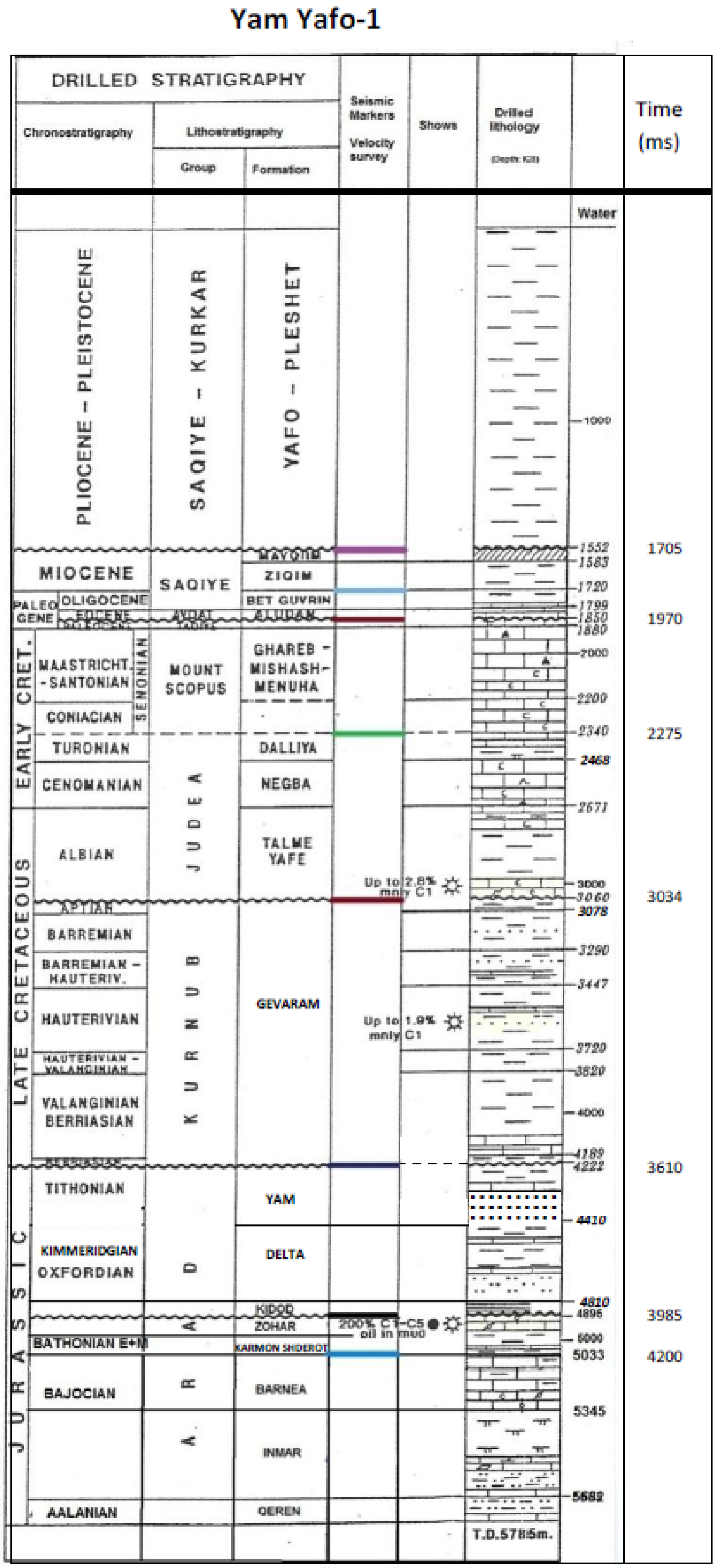

Figure 23 Generic Stratigraphy from Yam-Yafo 1 Well on Gabriella License

The Levant Basin is a deep and long existing geologic structure located in the eastern Mediterranean Sea. The southern part of the basin hosts a world-class hydrocarbon province offshore the Nile Delta. Recent discoveries of biogenic gas and various oil shows indicate that all parts of the basin including offshore Israel have significant hydrocarbon potential.

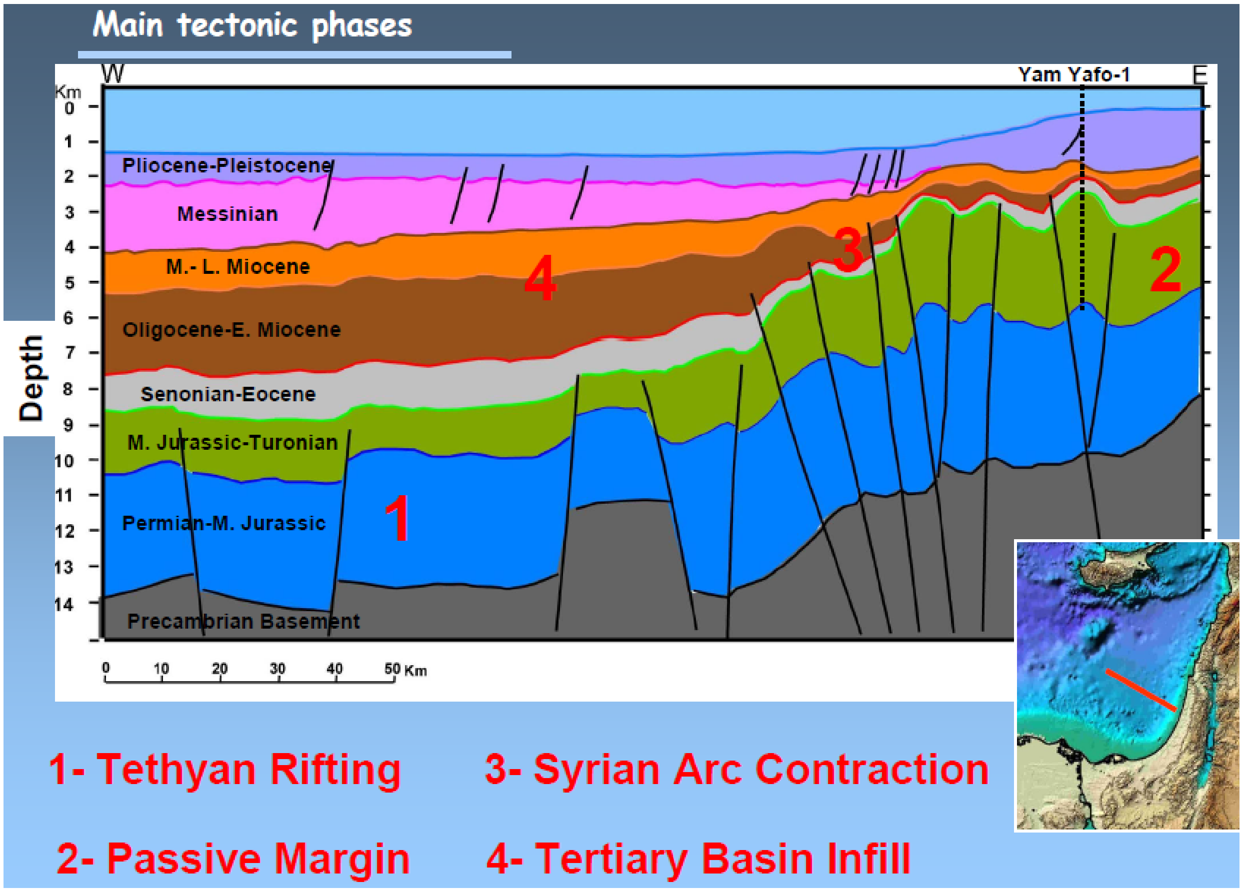

Figure 24 Depiction of the Geologic History of the Area
(Gardosh et al, 2008)

The reconstructed basin history[8] shows that the Levant Basin was shaped in several main tectonic stages. Early Mesozoic rifting resulted in the formation of an extensive graben and horst system, extending throughout the Levant both onshore and offshore.[9] Late Jurassic to Middle Cretaceous, post-rift subsidence was followed by the formation of a deep marine basin in the present-day offshore and a shallow-marine, carbonate dominated margin and shelf near the Mediterranean coastline and further inland. This rifting in the Levant region began in the Late

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[8] Gardosh, M., et al, 2008
[9] ibid

Permian and continued into early to Middle Jurassic.[10] Significant vertical movements took place in the region both onshore and offshore. These vertical movements formed horsts and grabens accompanied in the north by volcanism (Asher Volcanics).

Large scale horst and graben development produced the Judea Graben onshore while offshore the Jonah and Leviathan horsts developed in the central Levant Basin. Closer to shore, the horst and graben developments are amplified by compression with force folds as the shelf rises and is proximal in the transpressional faulting of the Dead Sea and the movement of Africa against the Arabian Plate.

The Late Cretaceous and Tertiary convergence phase between the Afro-Arabian and Eurasian plates resulted in inversion of Early Mesozoic structures and the formation of extensive, Syrian Arc type contractional structures throughout the Levant Basin and margin. The Levant passive margin was reactivated during the late Tertiary. Sedimentation rates and subsidence increased after a period of long gradual decay.[11] The Tertiary convergence was further associated with uplift, widespread erosion, slope incision and basinward sediment transport. A Miocene incision through the paleo-Israeli shelf, called the Afiq Canyon which trends southeast-northwest, acted as a channel for Late Miocene and Early Pliocene clastic sediments derived from the Israeli onshore.[12] A Late Tertiary desiccation of the Mediterranean Sea was followed by deposition of a thick evaporitic blanket that was later covered by a Plio-Pleistocene siliciclastic wedge. The Phanerozoic basin-fill ranges in thickness from 5 to 6 kilometers on the margin to more than 15 kilometers in the central part of the basin.

A variety of structural and stratigraphic traps were formed in the Levant Basin during the three main tectonic stages. Possible hydrocarbon play types are: Triassic and Lower Jurassic fault-controlled highs and rift-related traps; Middle Jurassic shallow-marine reservoirs. Lower Cretaceous deepwater siliciclastics; the Tertiary canyon and channel system and associated deepwater siliciclastics found in either confined or non-confined settings; Upper Cretaceous and Tertiary Syrian Arc folds; and Mesozoic and Cenozoic isolated, carbonate buildups on

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[10] ibid
[11] Gvirtzman, et al, 2008
[12] Sanderson and Oates, 2000

structurally elevated blocks. Shallow gas discoveries in Pliocene sands and high-grade oil shows found in the Mesozoic section indicate the presence of source rocks and appropriate conditions for hydrocarbon generation in both biogenic and thermogenic petroleum systems. The size, depth and trapping potential of the Levant Basin suggest that large quantities of hydrocarbons can be found offshore Israel. Recent discoveries of biogenic gas and various oil shows in onshore and offshore wells indicate that the central part of the basin offshore Israel has significant hydrocarbon potential. Several gas occurrences are present along the Afiq Canyon. The most prospectivity in the area exists in the Pliocene biogenic gas bearing sands. Reservoir potential also exists in the Upper Miocene Ziqlig reef, or its equivalents, immediately below the Messinian evaporites. Discoveries have also been made in the Middle Jurassic limestones and the Upper Jurassic reefal limestones.[13]

The area near the Gabriella block has been subject to compressional and extensional forces over geologic time including NW-SE oriented rifting during Mesozoic time (1 in Figure 24) with syntectonic deposition and carbonate platform building on the passive continental margin when the Tethys Sea existed (2 in Figure 24). The rifted succession was then inverted by SW-NE oriented compression in the late Cretaceous through late Eocene with continued growth into the Miocene (3 in Figure 24). The inversion was characterized by 'pop-up' style fold structures, such as the Yam-Yafo (Gabriella) anticline (Figure 24), framed by occasional antithetic faults that splay away from the re-activated, former normal faults. Growth of the structures is recorded in late Cretaceous through Miocene syntectonic sediments from the Nile River and the Israel landmass that onlap the flanks of growing structures (4 in Figure 24).

The Syrian Arc Ridge, also referred to as the Eastern Levant Ridge, (Figure 22) is divided into at least three sub-structures the Yitzhak - Delta, Gabriella – Yam - Yafo and the Shemen – Yam and Bravo. This ridge lays 10 to 25 kilometers offshore Israel and is oriented and plunges in a NNE – SSW direction.[14] The Gabriella sub-structure is located in the central portion of the ridge shallower than the Shemen – Yam and Bravo and deeper than the Yitzhak - Delta structure and

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[13] Sanderon and Oates, 2000

[14] Gardosh et al, 2008

presents a typical anticlinal profile. The ridge is bounded by longitudinal (reverse) faults on its western and eastern flanks.

The structural formation of the Syrian Arc and other previous tectonic events caused the brittle Jurassic carbonates to fracture. Tensile (Mode 1) Jurassic reservoir fractures provide essential reservoir porosity and permeability. These fractures allow for large drainage areas in each well resulting in fewer wells needed for field development. The best wells in fields with these fractures commonly are drilled early in development, frequently with high initial production. Since these fractures provide porosity and permeability, production can occur from non-reservoir quality and nonstandard rocks.[15] The carbonates in the area are characterized by very low matrix porosity and low matrix permeability, therefore, effective drainage is dependent on the occurrence of open fractures.

The fractures in the area are typically stratabound, sub-perpendicular to bedding and commonly abut the bounding stratigraphic surfaces. To a large extent the density and height of fractures (Figure 25) are controlled by the mechanical stratigraphy, which is controlled by the depositional environment and cycles.[16]

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[15] Nelson, 2001
[16] Wennberg et al., 2007

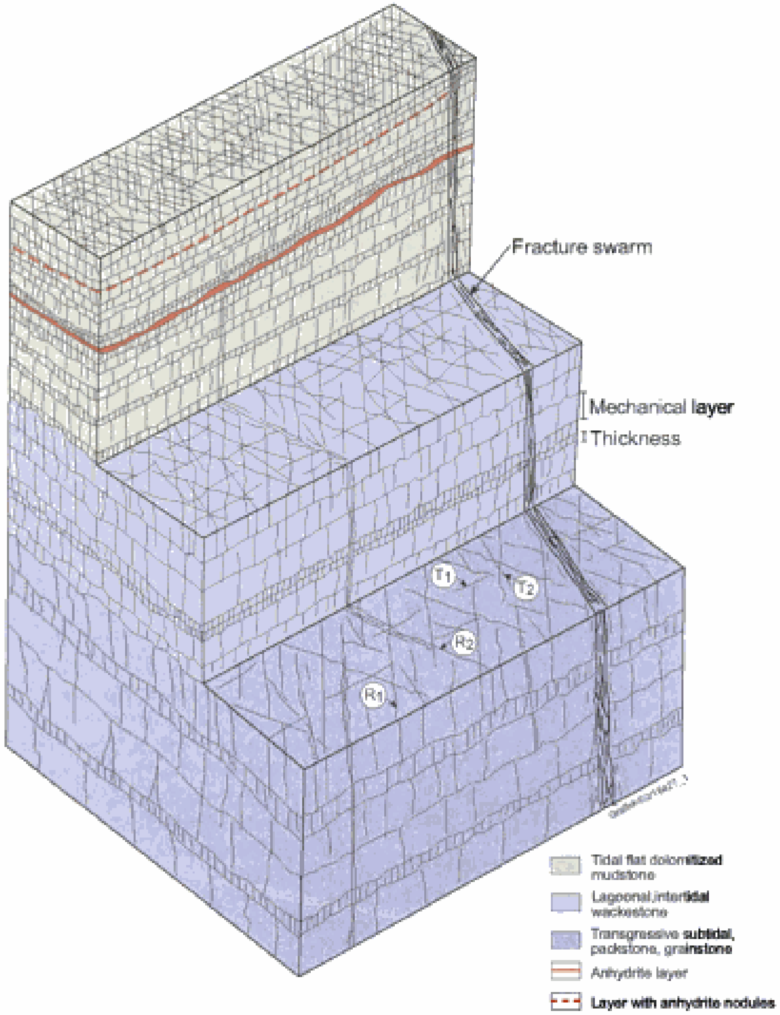


Fig. 6. An ideal shallowing up cycle of the Asmari Formation with a typical fracture pattern in a forelimb of a Zagros anticline.

Figure 25 Diagram of Typical Fracture Pattern
(Wennberg, et al., 2007)

Present day WNW-ESE (Figure 26) directed maximum horizontal stress orientations may help keep open WNW-ESE fractures when fluids are withdrawn. The fold axis parallel NNE-SSW fractures may be kept open depending on their position on the fold (i.e., is the present day maximum horizontal stress enhancing flexure and extension or compression and closure).

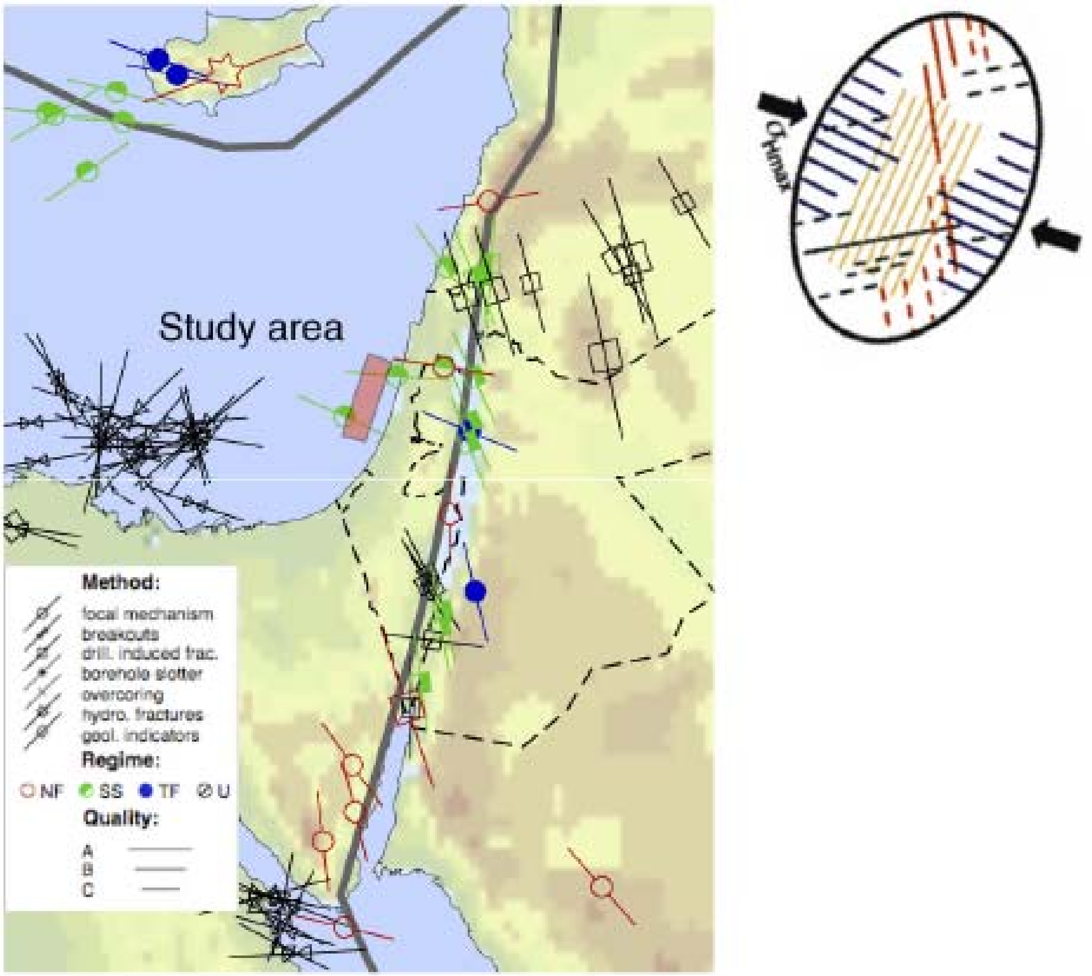


Figure 26 Current Levant Basin Stress Map
(World Stress Map, 2008)

7. PETROPHYSICAL

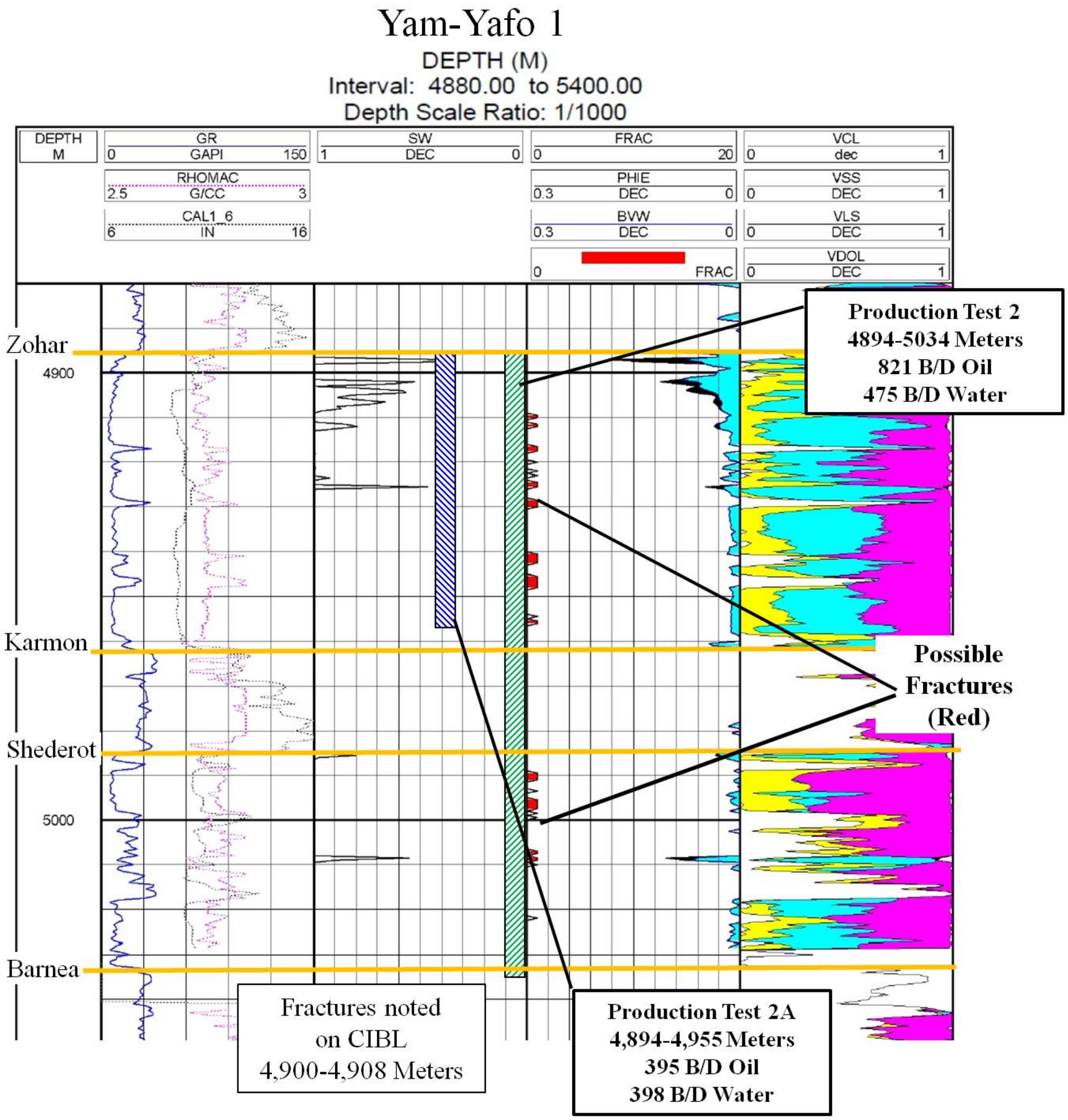
7.1 GENERAL LOG EVALUATION

The Isramco Yam-Yafo 1 and the Isramco Yam 2 wells both penetrated the Jurassic carbonate formation and both had oil recovered during production tests. A petrophysical analysis using the available digital files was done with the results shown in Figure 27 and Figure 28. These displays show the intervals of possible fracturing that are expected in this zone and the intervals tested with test rates.

The Yam-Yafo 1 has two distinct carbonate intervals in the Jurassic formation. The lower interval from 5,210 meters (17,093 feet) to 5,331 meters (17,490 feet) was not reached in the Yam 2 well. The Upper zone, the Zohar, in the Yam- Yafo 1 at 4,895 meters (16,060 feet) to 4,963 meters (16,283 feet) correlates to the interval in the Yam 2 seen in Figure 28.

Petrophysical evaluation determined that three intervals the Zohar, Shederot, and Barnea have potential for oil production. The Zohar zone has a net pay of 0.9 meters with an average porosity of 13.9% and water saturation (Sw) of 36.7%. The Shederot zone has net pay of 0.4 meters with an average porosity of 13.1% and a Sw of 48.4%. The final zone Barnea has net pay of 2.9 meters with an average porosity of 13.6% and a Sw of 26.5%.

The drill stem test (DST) and production test data report volumes and rates of produced oil that could not be sourced from the matrix porosity. Therefore, this produced oil must be from a secondary porosity system such as fractures. Fractures were reported in the sample descriptions in the mudlog reports from both the Yam-Yafo1 and Yam 2 wells and interpreted to be present on the Continuous Borehole Image Log (CBIL) taken in the Yam-Yafo 1 well. The CBIL log was run from 4,860 meters to 5,134 meters and had indications of natural fracturing in the carbonate sections where the data was good. Although determining fractures is very difficult in complex carbonate formations without a good formation image log, using the combined log responses, one can determine the specific intervals that have the greatest probability to be fractured. The fracture probability is based on log responses and is determined by comparing the matrix corrected sonic porosity to the total porosity. Total porosity or matrix plus fracture porosity is calculated from the density-neutron porosity which is then compared to the sonic porosity. The sonic porosity does not respond to the fractures and represents matrix porosity alone. When the sonic porosity is less than the total porosity it is interpreted that there is a high probability for fractures. Other logs that were used to determine fracture probability were micro log spiking, increased gamma-ray readings and caliper logs.



Production Test 2
4894-5034 Meters
821 B/D Oil
475 B/D Water

Possible
Fractures
(Red)

Fractures noted
on CIBL
4,900-4,908 Meters

Production Test 2A
4,894-4,955 Meters
395 B/D Oil
398 B/D Water

Figure 27 Petrophysical Analysis of the Jurassic Section in the Yam-Yafo 1 Well

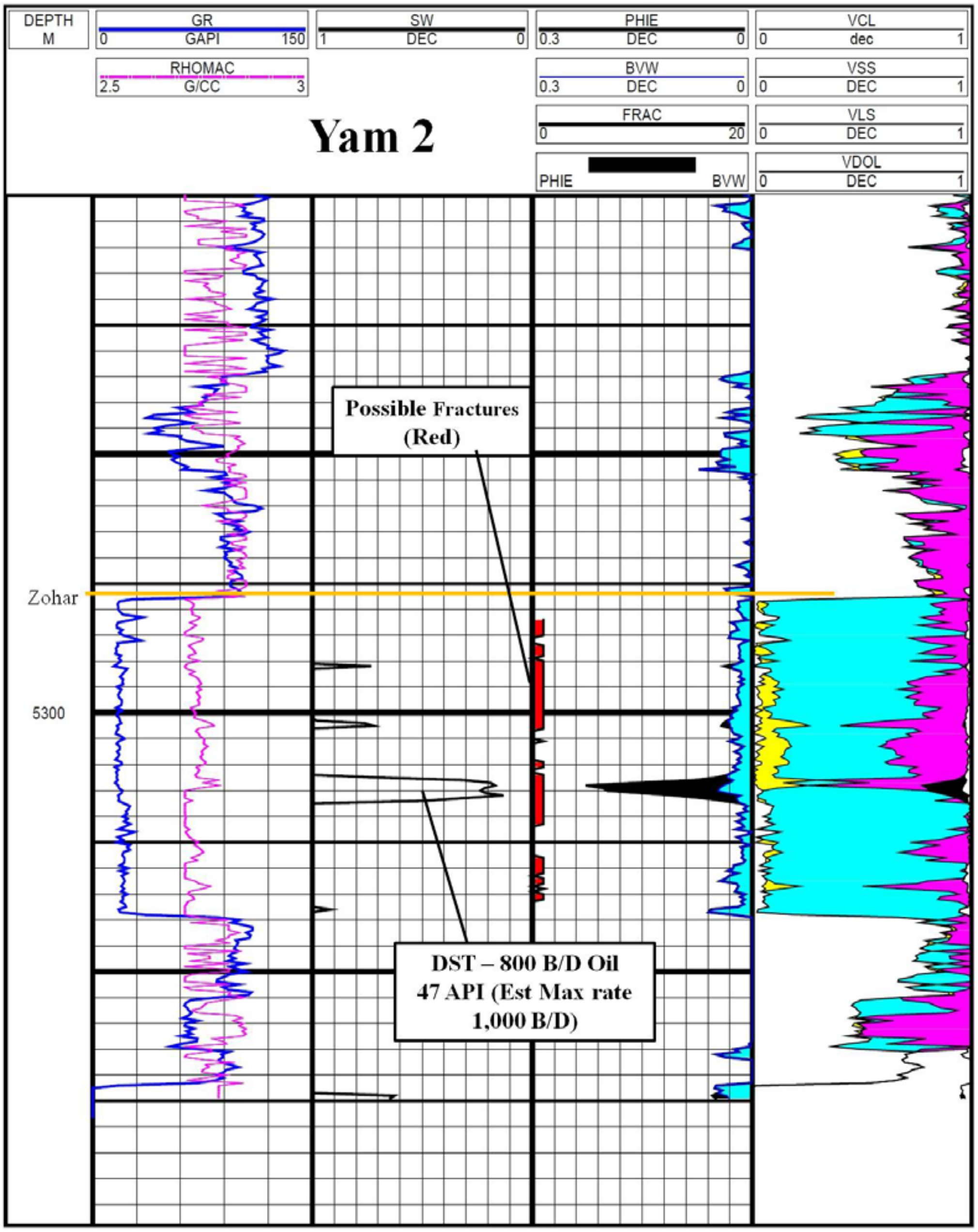


Figure 28 Petrophysical Analysis of the Jurassic Section in the Yam 2 Well

The petrophysical results for the Yam 2 well in the Zohar interval from 5,278 to 5,339 meters (Figure 28) include 2.74 meters of matrix pay with an average porosity of 14.5% and an average net Sw of 33.5%. The display also shows the intervals of possible fracturing noted in red that are interpreted in this interval. The mudlog data noted that fractures were observed in the cuttings throughout the Jurassic interval. The interval from 5,309 to 5,317 meters of the Jurassic zone was tested at a rate of 800 barrels per day of oil in the Yam 2 well and an estimated maximum flow rate of 1,000 barrels of oil per day was derived from the testing. This test rate strongly suggests that the fractures in this zone contributed to the flow rate. Therefore, it would be interpreted that considerably larger net pay than the tested interval is indicated by the analysis.

7.2 RW DETERMINATION IN YAM - YAFO 1

One of the key variables used to estimate resources is the Water Saturation (Sw) or the amount of pore space that is occupied by water rather than hydrocarbons. The Sw equations all use a Resistivity of Water (Rw) variable that is compared to the measured formation resistivity from the wireline logs. The Rw value used for Sw determination for the Yam – Yafo 1and Yam 2 wells was 0.05 ohms at 127°C or 36,333 parts per million (ppm) of salt (NaCl). This value was computed from several sources.

The primary source was the computed Rwa, formation Rw apparent, in the Zohar formation in the Yam - Yafo 1 well. Rwa, computed by using Archie's Sw equation, is the value computed from resistivity and porosity when Sw (Archie) equals 100% water.

Archie Equation

$$Sw = (Rw / (Rt * phi^2))\ \hat{}0.5$$

Therefore, when Sw = 100% water Rw can be solved by the equation:

$$Rwa = Rt * phi^2$$

Where:

Rt = Formation Resistivity Deep
phi = Formation Porosity
Rwa = apparent formation water resistivity
Rw = formation water resistivity

Using observation and histograms of the computed Rwa curve in the Zohar interval the value of 0.05 ohms at 127°C was determined.

Other methods used to determine this Rw were:

1. The Resistivity of the Mud Filtrate (Rmf) was measured at 0.06 at 170°C or 22,786 ppm NaCl.
2. Fluid testing results in the Yam - West 1 well recovered formation fluid from the Jurassic carbonate with 0.14 ohms resistivity at 23.6°C or 46,126 ppm NaCl. At a formation temperature of 170°C the recovered formation fluid value would be 0.031 ohms.

These values are relatively within the same range and indicate that the formation water in the Jurassic carbonate section in the Gabriella, Yitzhak and Shemen areas would have salinity in the range of 22,780 to 46,150 ppm NaCl

7.3 FRACTURE EVALUATION FROM WELL LOGS

A Fracture Probability Analysis was done to determine if there was evidence of fractures in the reservoir zones. A Fracture Probability Analysis is a summation and review of the fracture response of the well logs recorded on each well. In this study two wells were evaluated, the Isramco Yam-Yafo 1 located on Gabriella and the Isramco Yam-2 located to the south. These logs were processed with Fugro-Jason Powerlog software's complex mineral model. In this study each well was reviewed with the available recorded logs to determine the probability of fractures in the Jurassic interval.

7.3.1 General Overview of Fractures Responses from Well Log Data

The following information can be derived from certain well logs:

- Spontaneous potential (SP) logs can exhibit streaming potential (electro kinetic energy) due to fluid flow into open fractures.
- Gamma-ray responses may have very high API values due to radioactive salts deposited by fluid flow thru fractures.

- Caliper logs may read wash-out or show roughness due to large fractures; typically no wash-outs occur in micro fractures.
- Resistivity logs may show invasion profiles where fractures have mud filtrate invasion.
- Micro-resistivity log curves spiking due to invasion of conductive mud filtrate into open fractures.
- Changes in the density correction curve (Drho) may be due to mud filtrate invasion into fractures and the mud cake sealing the fractures.
- Comparison of porosity logs such as the difference between the Total Porosity and Sonic Porosity would indicate secondary porosity or fractures.

7.3.1.1 Resistivity Logs

There are two types of resistivity logs, induction and lateral. They have different responses to fractures. A critical factor in resistivity logs being able to respond to fractures is the mud filtrate. Typically open fractures will fill with mud filtrate. If the mud filtrate is fresh, non-conductive, there will be lesser response than with conductive salt mud systems. Induction logs have a lesser response than lateral logs to fractures because their current flow is perpendicular to or around the borehole. However, Induction logs still may exhibit separation due to various depths of investigation measured by the tool that responds to the invasion of conductive mud-filtrate into fractures, in very low matrix porosity formations. This response is not noticeable in higher porosity formations. The current from the tool in Lateral resistivity logs and micro-focused resistivity logs is forced or focused to be parallel to the formation and therefore is greatly affected by the fluid filled fractures. An example of this is micro-resistivity log curves spiking due to the invasion of conductive mud filtrate into the fractures. Similar to the induction curves, in low porosity rock, separation occurs between the lateral curves with different depths of investigation such as the laterolog shallow and the laterolog deep that would detect the presence of fractures.

7.3.1.2 Porosity Logs

Porosity curves can also be helpful in determining fractures. In both of the subject wells, three different porosity logs, the density, neutron and sonic, were recorded. The input logs used for this analysis included a compensated formation density log (RhoB), a borehole compensated sonic travel time (DT), and the compensated neutron porosity measured on a limestone matrix. Output curves from the complex mineral model included the corrected matrix values for the density (Rho matrix) and the borehole sonic (DT matrix). These were then used to calculate matrix corrected porosities for the density and sonic porosities. Total porosity was then computed from the corrected density porosity and the compensated neutron porosity. Since, the total porosity includes both matrix and fracture porosity it can be compared to the sonic porosity which is only matrix porosity to indicate the presence of fractures. In other words, when the total porosity is greater than the corrected sonic porosity this difference may be attributed to secondary porosity. This secondary porosity can be fractures, vugs, or oolites. In this case, the target formations in this prospect are interpreted to be fractured limestones.

7.3.1.3 Other Logs

The density correction curve (Drho) can also be useful in fracture detection. This curve represents the amount of correction applied to the density curve due to mud cake thickness and the invasion of mud filtrate. Changes in the correction curve in an in-gauge hole may be due to mud filtrate invasion into fractures and the mud cake sealing the fractures.

The photo electric, Pe, curve responds to the lithology of the formation. The Pe reading for various reservoir rocks ranges from approximately 1.8 in sandstone to 5.0 in limestones. Shales typically read around 4.0 and barite has a reading of 266.0. Barite in a mud system will cause spikes to the Pe curve where the barite mud cake seals the fractures. Array sonic tools can be processed to determine fractures from compressional or shear wave attenuation, frequency changes and anisotropy. Image tools such as the FMI, Sonic Scanner and others give a “picture” of the formation that can be used to determine fracture presence, frequency, dip and azimuth. An oriented whole core can be used to determine fractures and the orientation of these fractures.

7.3.2 Fracture Probability Analysis for the Yam-Yafo 1

The intervals selected for possible fracture analysis in the Yam-Yafo 1 well are in two low porosity Jurassic limestone intervals that are separated by 190 meters of shale (Figure 29). The upper interval from 4,896 to 5,020 meters correlates to the upper Jurassic Zohar limestone in the Yam 2 well. The lower section, which has a greater fracture density than the upper zone, is from 5,220 meters to 5,310 meters.

Potential fractures in this well were estimated from four indicators: the caliper log, the density correction curve (Drho), resistivity curve response and the comparison of total porosity to the corrected sonic porosity using the density (RhoB), and neutron and sonic (DT) logs. The CBIL log, where the data is good, shows natural fractures in the carbonate sections.

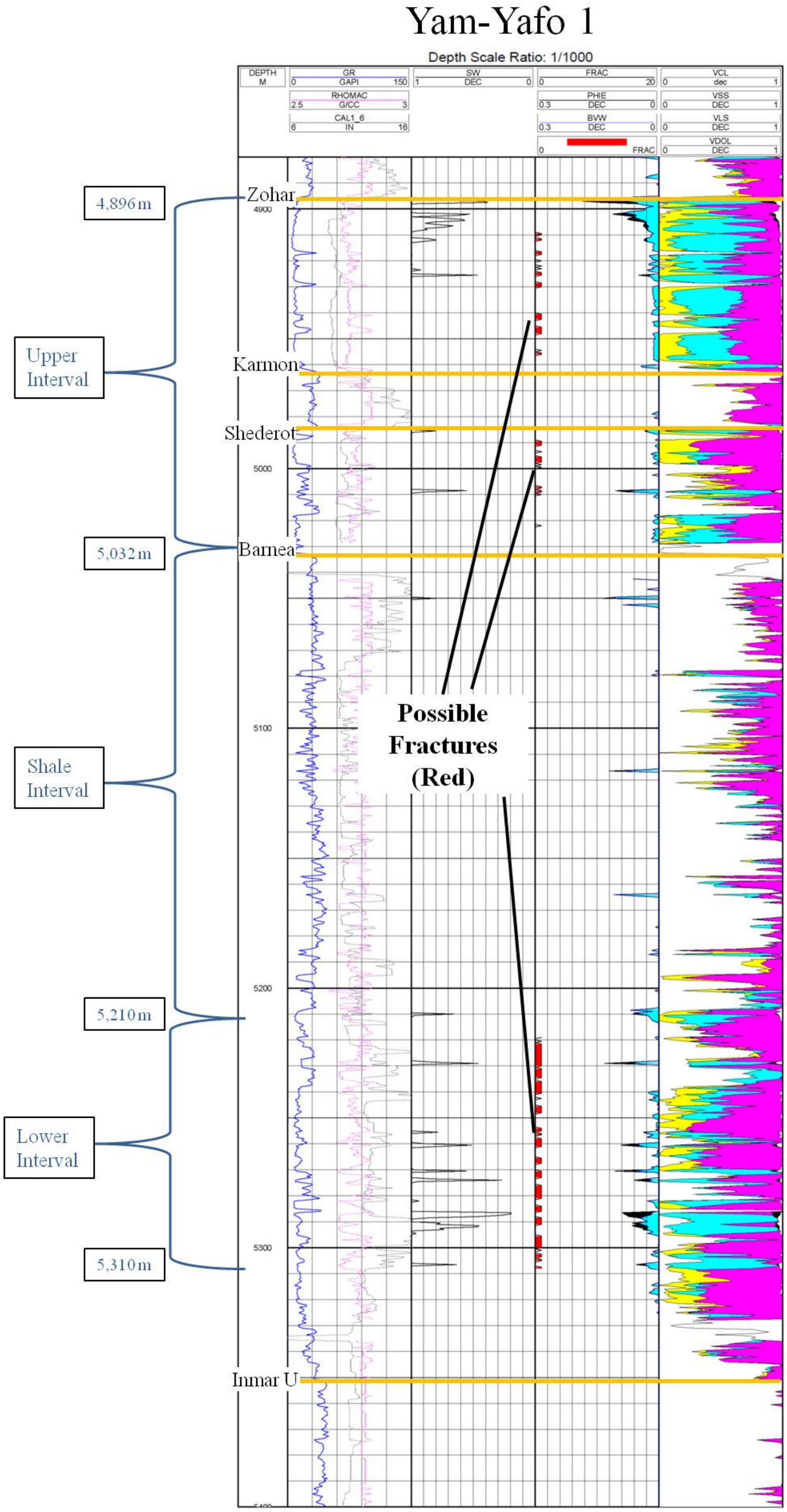


Figure 29 Yam-Yafo 1 Well Petrophysical Evaluation

7.3.2.1 Caliper Log

The values of the caliper (cali_6 from the las[17] file) log, are not equal to the 8 3/8 inches in-gauge hole size that should have been drilled based on the drillbit size on the log header. The caliper scale on the lithology plot is 8 to 18 inches (Figure 30). The minimum value of the caliper curve is 9 inches and the caliper log averages 10 to 11 inches. Caliper logs can be used to determine potential fractures where the caliper readings are less than the in-gauge hole size or the presence of fractures can be postulated when the hole is ‘washed-out’ or much larger than the in-gauge hole size due to the formation falling apart after drilling. However, the absolute value of this curve was not used to determine fractures in this case. Using a qualitative approach, when in apparent gauge or smooth low caliper and clean gamma ray readings, the caliper curve was used as a good hole indicator. Typically, in the Yam-Yafo 1 well, the caliper curve readings indicate a rough washed-out hole in the limestone and a very large washed-out hole in the shale sections. This could indicate that the limestone is fractured.

7.3.2.2 Density Correction Curve (Drho)

The density correction curve (Drho) depicted in Figure 30, was the second fracture indicator used for this analysis. This indicator responds to fluid filled fractures by recording a negative correction response to fluid filled fractures. Since wash-out and rough hole can affect the Drho log, these data were used in conjunction with the caliper log and probable fracture intervals were selected that had good apparent in-gauge hole with smooth character, and cleaner gamma ray response. This was applied to both the upper and lower limestone intervals.

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[17] Digital log files

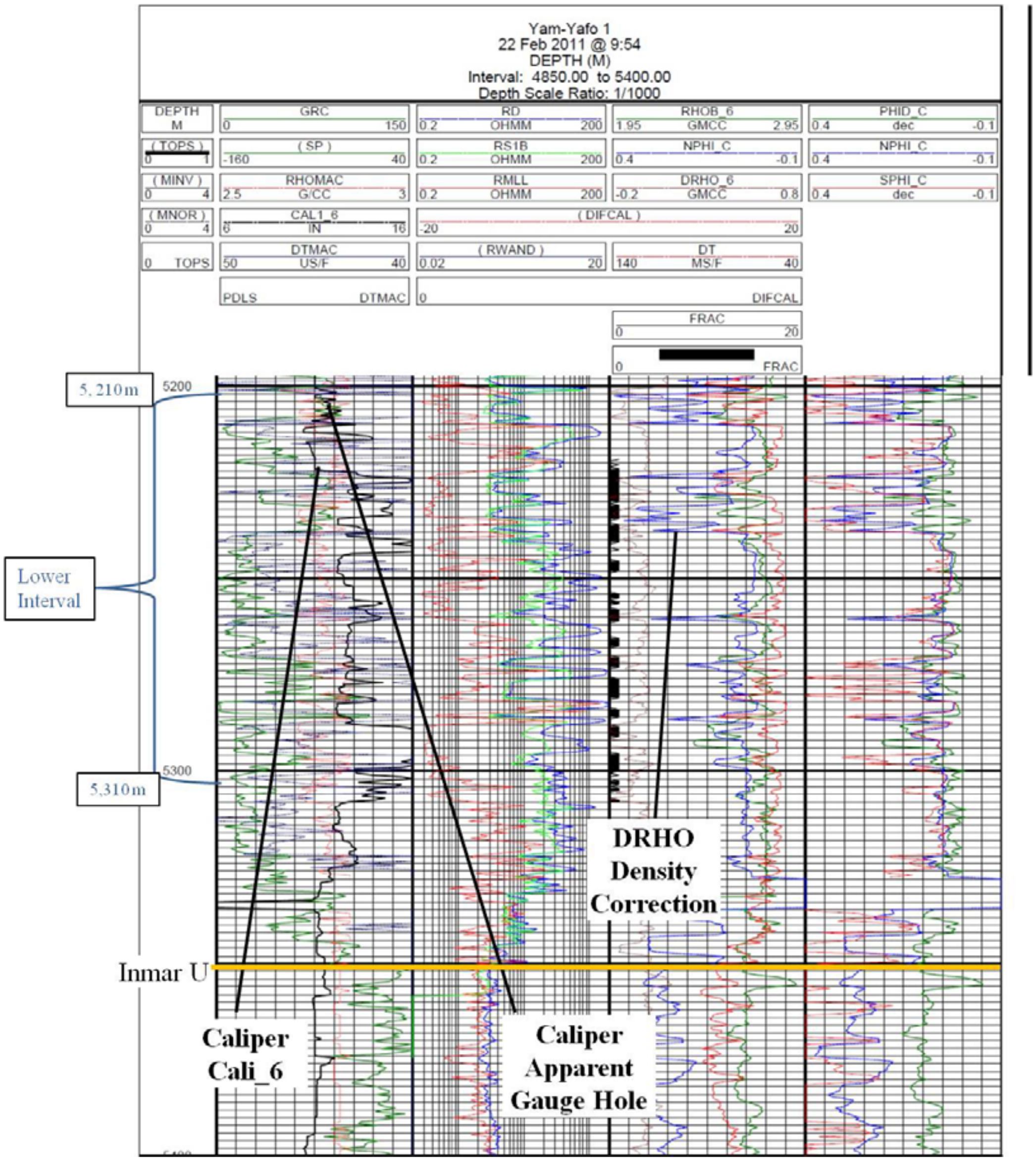


Figure 30 Yam-Yafo 1 Well Log Data Highlighting the Density and Caliper Data

7.3.2.3 Resistivity Curve Response

The third method is the resistivity curve response. Resistivity curves (
Figure 31) used in this well were: a deep resistivity (RD), shallow resistivity (RS) and a micro laterolog resistivity (RMLL). Although the type of deep resistivity, RD, was not reported or indicated in the las file, it appears to be a deep laterolog (LLD) resistivity. A shallow resistivity (RS), was recorded in the lower interval on this well and the curve response appears to be a shallow laterolog (LLS). Shallower depth logging runs used induction type resistivity tools.

The LLD, LLS and RMLL are a common logging tool combination used in wells with salt water mud systems and highly resistive formations such as low porosity limestones. Typical fracture responses observed on laterolog data are a separation of the LLD and LLS curves in fractured intervals. In fractured hydrocarbon intervals the mud filtrate fills the open fractures, displacing the oil. The salt mud is very conductive, and oil is non-conductive so this invasion of salt mud has a greater effect on the LLS than on the LLD thus the separation of the two curves. The RMLL, micro laterolog is a pad tool that was very helpful because of the vertical resolution of 4 inches and shallow depth of investigation of about 2 inches. In fractured or high permeability zones the RMLL reads the resistivity of the invaded zone. In these salt mud systems the resistivity of the invaded zone is much lower, more conductive than what the LLS responds too. In fractured intervals the RMLL spikes to lower resistivity values in the fractures because of the log's more detailed vertical resolution. In washed out hole and very rough hole conditions quite often the RMLL pad loses contact with the formation. In using the RMLL to aid in fracture detection one must be wary of the borehole conditions.

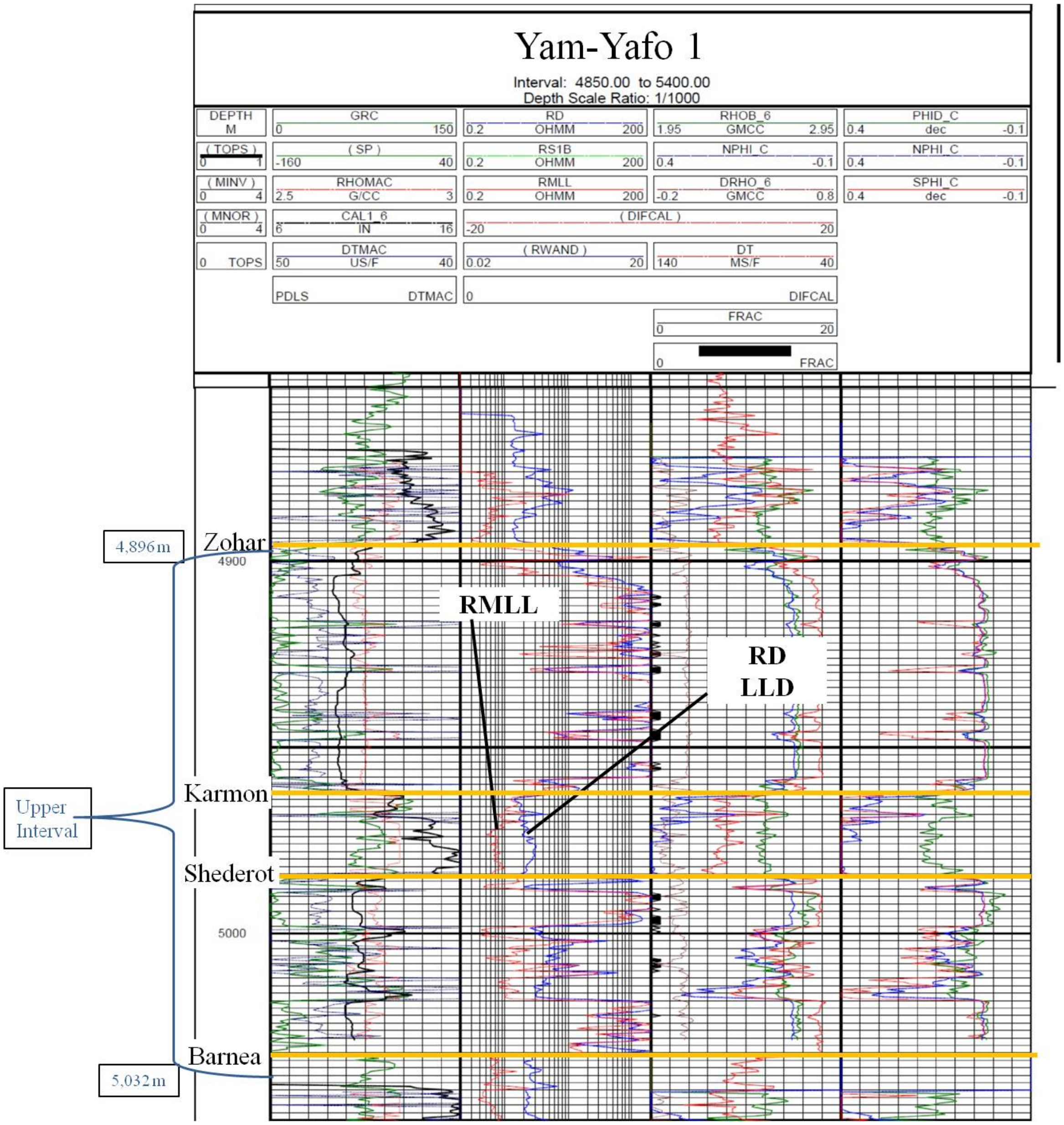


Figure 31 Yam-Yafo 1 Well Log Data Highlighting the Resistivity Data

7.3.2.4 Comparison of Total Porosity to the Corrected Sonic Porosity

Porosity data can also be helpful in the determination of potential fractures. In Yam-Yafo 1 well three porosity curves including density (Rhob), neutron, and sonic (DT) were recorded (Figure 32). These were processed in a complex mineral model to calculate corrected matrix values for each sample depth. The inputs for this processing were; Rhob, DT, and neutron porosity on a limestone matrix. The corrected matrix values for Rho matrix and DT matrix were used to calculate matrix corrected porosities for the density and sonic porosities. Total porosity was then computed from the corrected density porosity and the neutron porosity. Since, the total porosity includes matrix, vugs, oolites, and fracture porosity it can be compared to the sonic porosity, which represents only the matrix porosity, to indicate the presence of secondary porosity. In other words, when the total porosity is greater than the corrected sonic porosity this difference may be attributed to fractures, secondary porosity. This technique was helpful in this well, as the total and sonic porosities demonstrated some intervals of secondary porosity where total porosity was greater than the corrected sonic porosity.

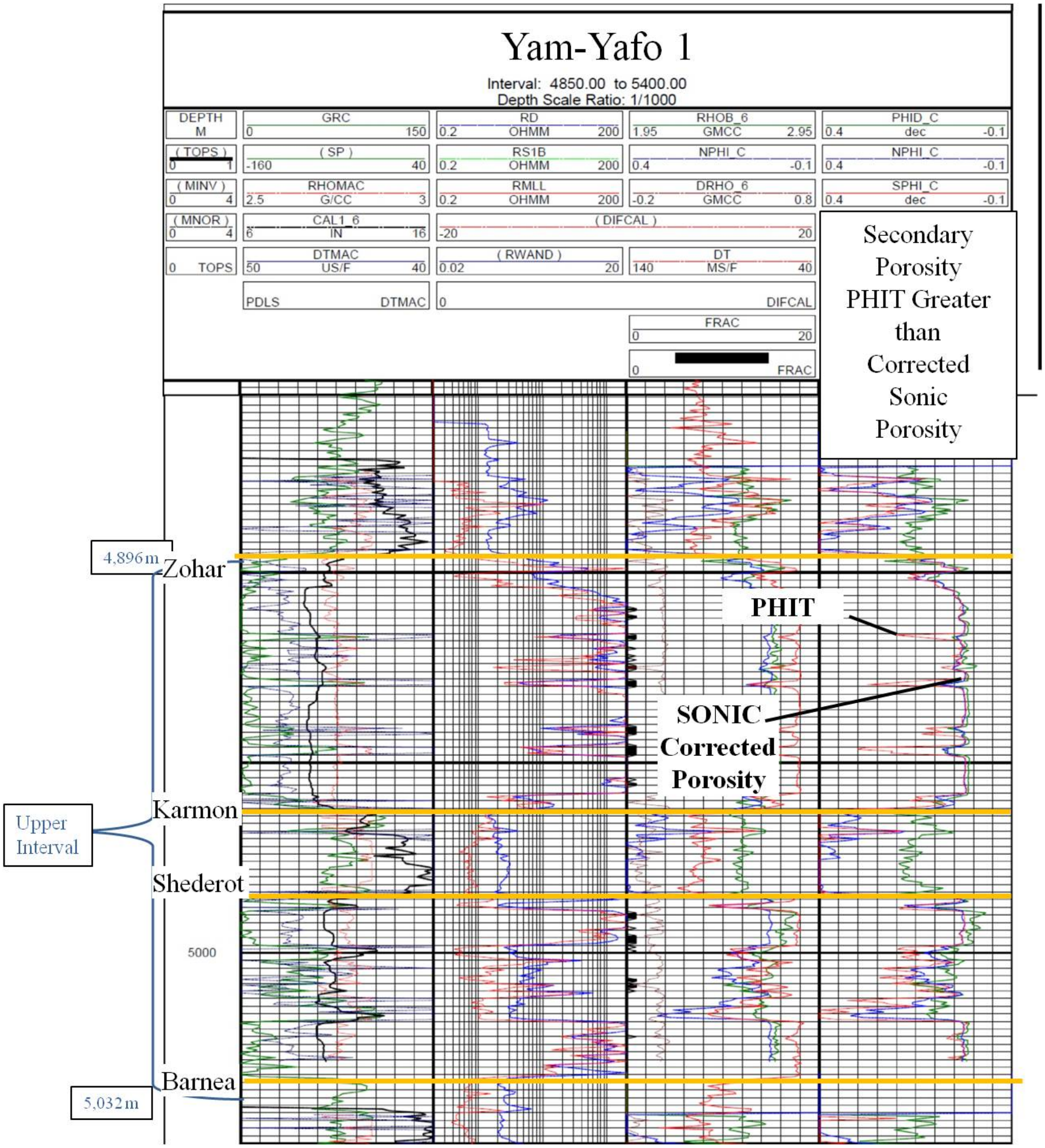


Figure 32 Yam-Yafo 1 Well Log Data Highlighting the Sonic Porosity Data

7.3.3 Fracture Probability Analysis for the Yam-2

The interval analyzed for possible fractures in the Yam-2 well was in the limestone section from 5,278 meters to 5,339 meters which has a low matrix porosity of 3% with the exception of the interval, from 5,312 meters to 5,316 meters, where there is a thin interval of matrix pay 2.74 meters thick with 21% porosity and a Sw of 20%. The petrophysical results for the Yam-2 well are shown in Figure 33 with possible fracture zones depicted in red in the fluid track. Potential fractures in the Yam 2 well were identified using two indicators the Drho curve and the Resistivity Separation technique.

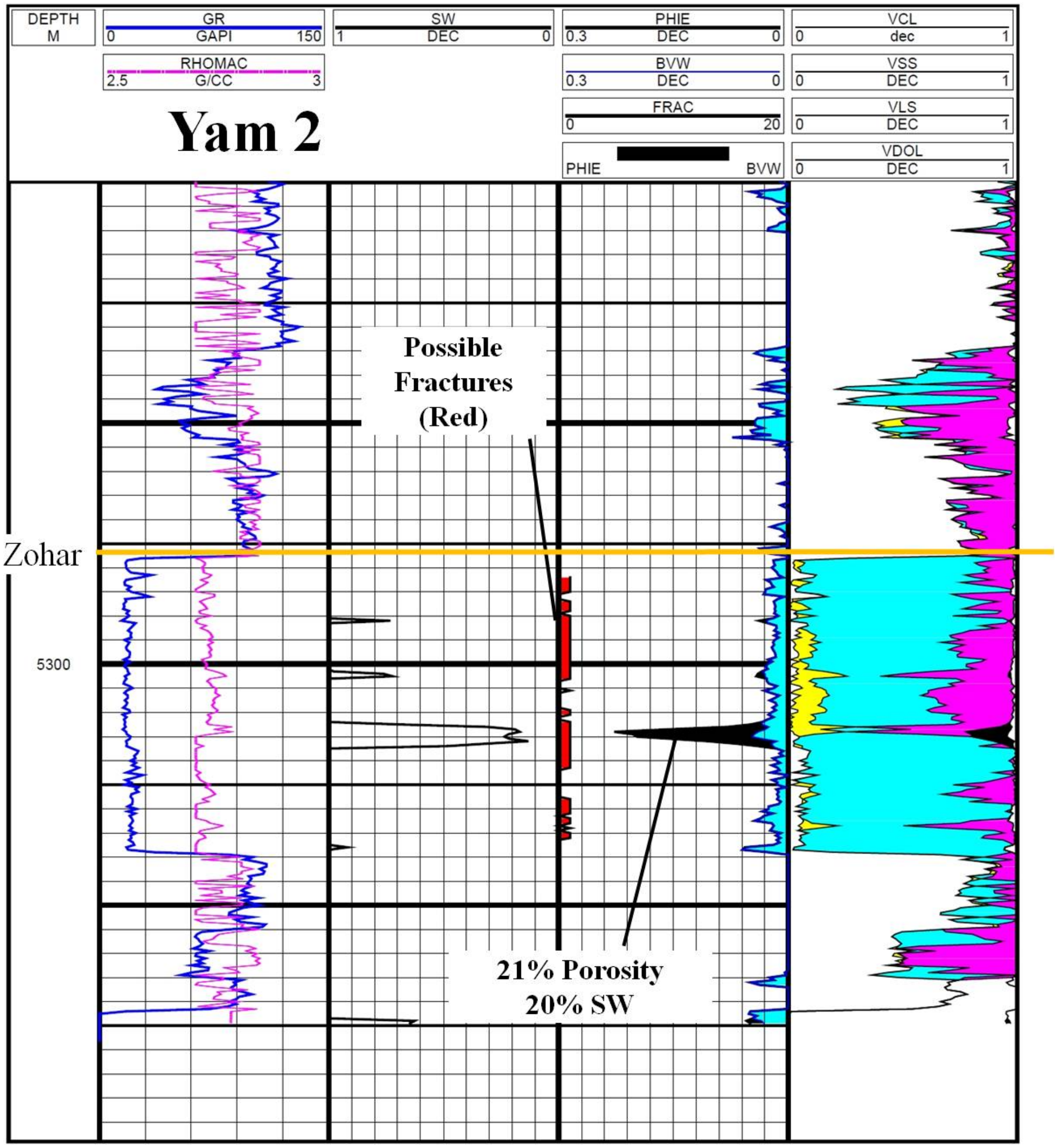


Figure 33 Yam 2 Well Petrophysical Evaluation Results

7.3.3.1 Density Correction Curve (Drho)

Although the interval from 5,278 to 5,339 meters lacked a caliper curve the Rhob curve does not exhibit the characteristics of wash-outs such as spikes in the data (Figure 34). It was therefore assumed that the hole within this interval is in gauge. Since the invasion of drilling mud filtrate into fractures causes the Drho to deflect in a negative direction it can be used as an indicator of fractures in this well.

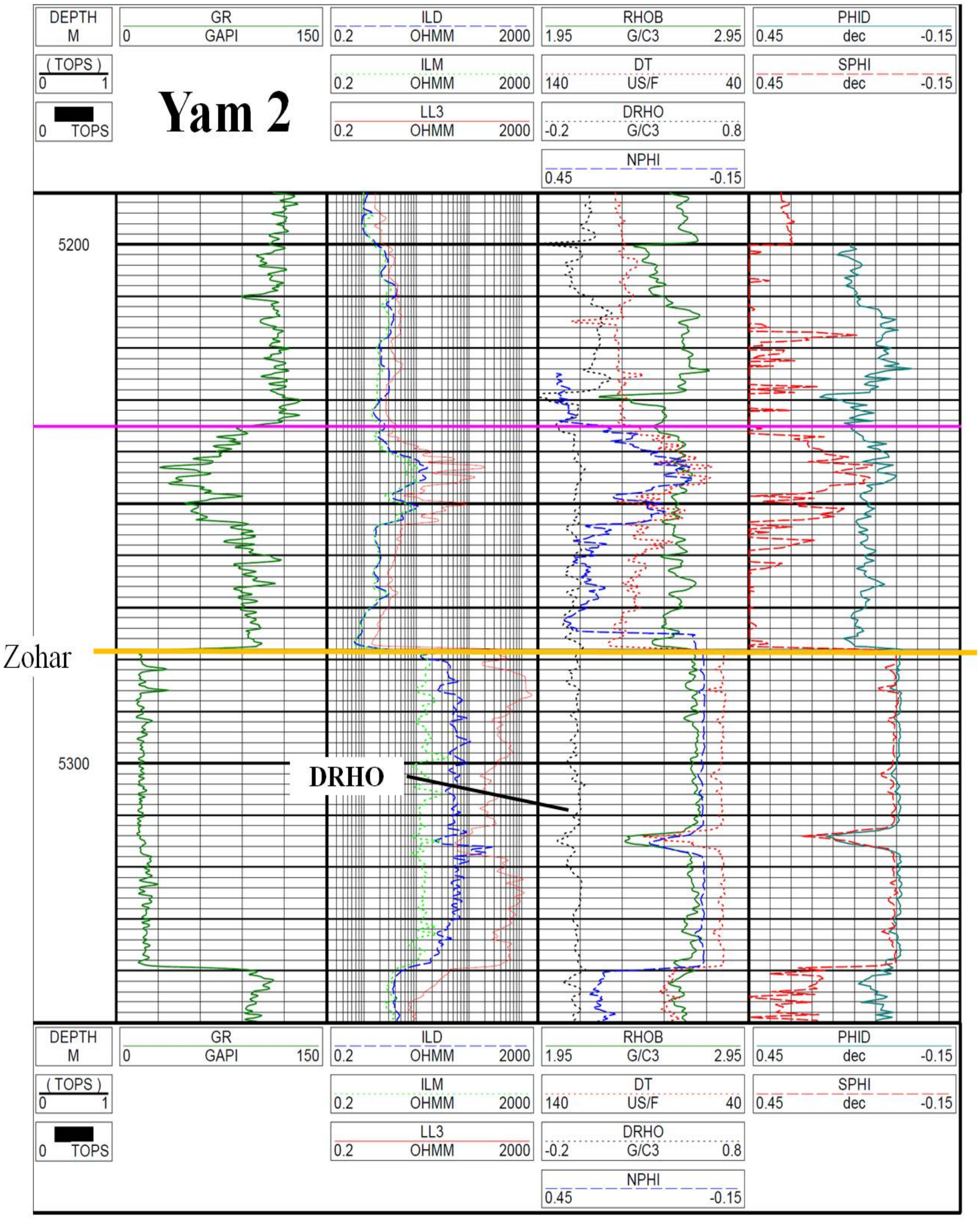


Figure 34 Yam 2 Well Log Data Highlighting the Drho or Density Porosity

7.3.3.2 Resistivity Curve Response

The second fracture indicator used in this well was the separation of the LL3 and ILD resistivity curves (Figure 35). The separation between these curves which is caused by mud filtrate filling the open fractures, in very low porosity limestone, has often been correlated to fractures in core data. In the interval from 5,313 meters to 5,316 meters, if there are fractures they are hidden by the very good limestone matrix porosity of 20% in this zone. The log curves in this interval, resistivity and porosity are more representative of a conventional reservoir than a low porosity fractured limestone. The ILD and LL3 separation in the shale above at 5,255 meters appears to be an ILD calibration error caused by temperature effects. At the base of this interval below 5,380 meters the LL3 is affected by the higher resistivity limestone. This is probably a Groningen effect or where the return current electrode enters the higher resistivity bed this causes a distortion of the resistivity readings.

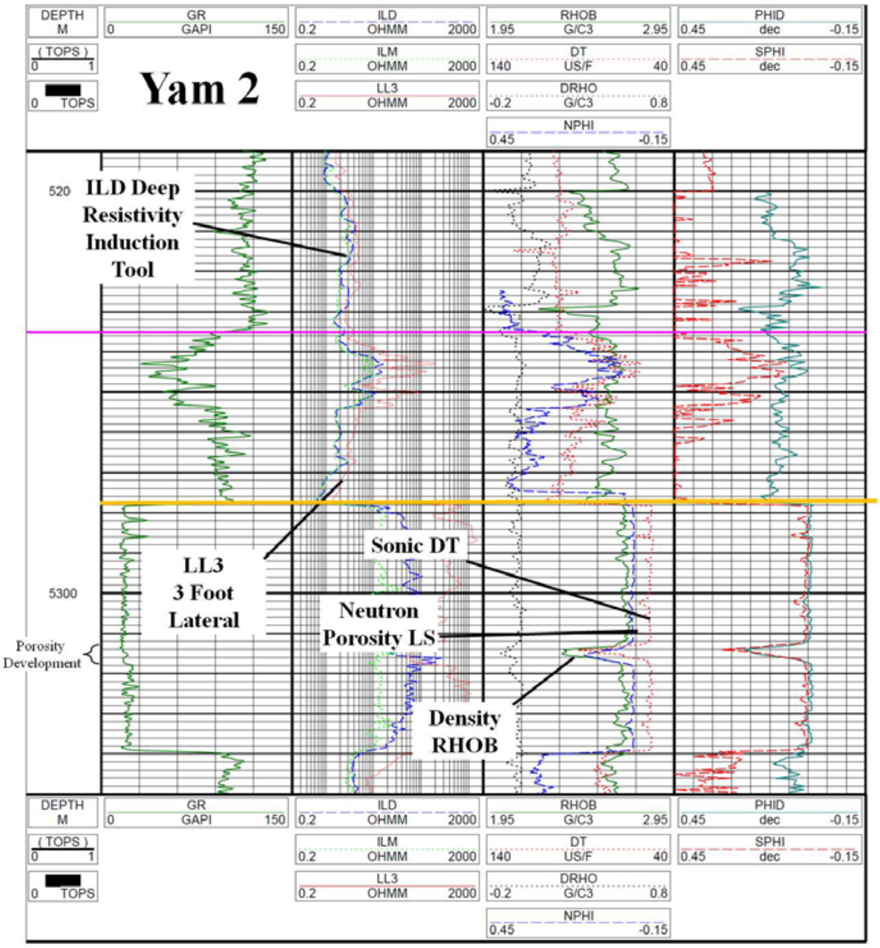


Figure 35 Yam 2 Well Log Data Highlighting the Resistivity and the Sonic, Neutron, and Density Porosity

7.3.4 Fracture Analysis Conclusions

Based on the fracture probability analysis of the Jurassic intervals seen in the Yam-Yafo 1 and the Yam 2 wells, the results show that both wells are fractured in the low porosity limestone intervals. In these two wells the higher porosity intervals may also have fractures but cannot be determined using these methods as the higher matrix porosity masks the fractures. A composite computer processed interpretation (CPI) was done on both wells over the Jurassic Limestone intervals. Possible fractures were determined from the indicators described above in each well and were summed and displayed as the FRAC curve colored in red (Figure 29 and Figure 33).

Four indicators were used in the Yam-Yafo 1 well to determine fracture probability including the caliper, Drho, resistivity and porosity curves. The Yam-Yafo 1 well has an upper limestone, from 4,995 meters to 5,032 meters and a lower limestone interval from 5,210 meters to 5,310 meters. These are separated by a shale section from 5,032 meters to 5,210 meters. Both the upper and the lower limestones are fractured. The upper limestone has a gross reservoir interval of 136 meters and the lower limestone has a gross reservoir interval of 121 meters.

The Yam 2 well has a gross reservoir interval of 61 meters where this interval in the Yam 2 Jurassic limestone correlates to the upper interval in the Yam-Yafo 1 well. The Yam 2 was not drilled deep enough to evaluate the lower limestone found in the Yam-Yafo 1 well.

The production test peak flow rate of 821 barrels of oil per day was produced from a 122.5 meter interval that may have had formation damage. It is expected that a fractured undamaged formation would produce at higher rates.

7.4 PROSPECTS

The Gabriella block has the potential for shallower gas prospects in the Cretaceous and Miocene and at least one deep Jurassic oil prospect. The outline of the Gabriella prospects and where they occur within the block area is depicted in Figure 36.

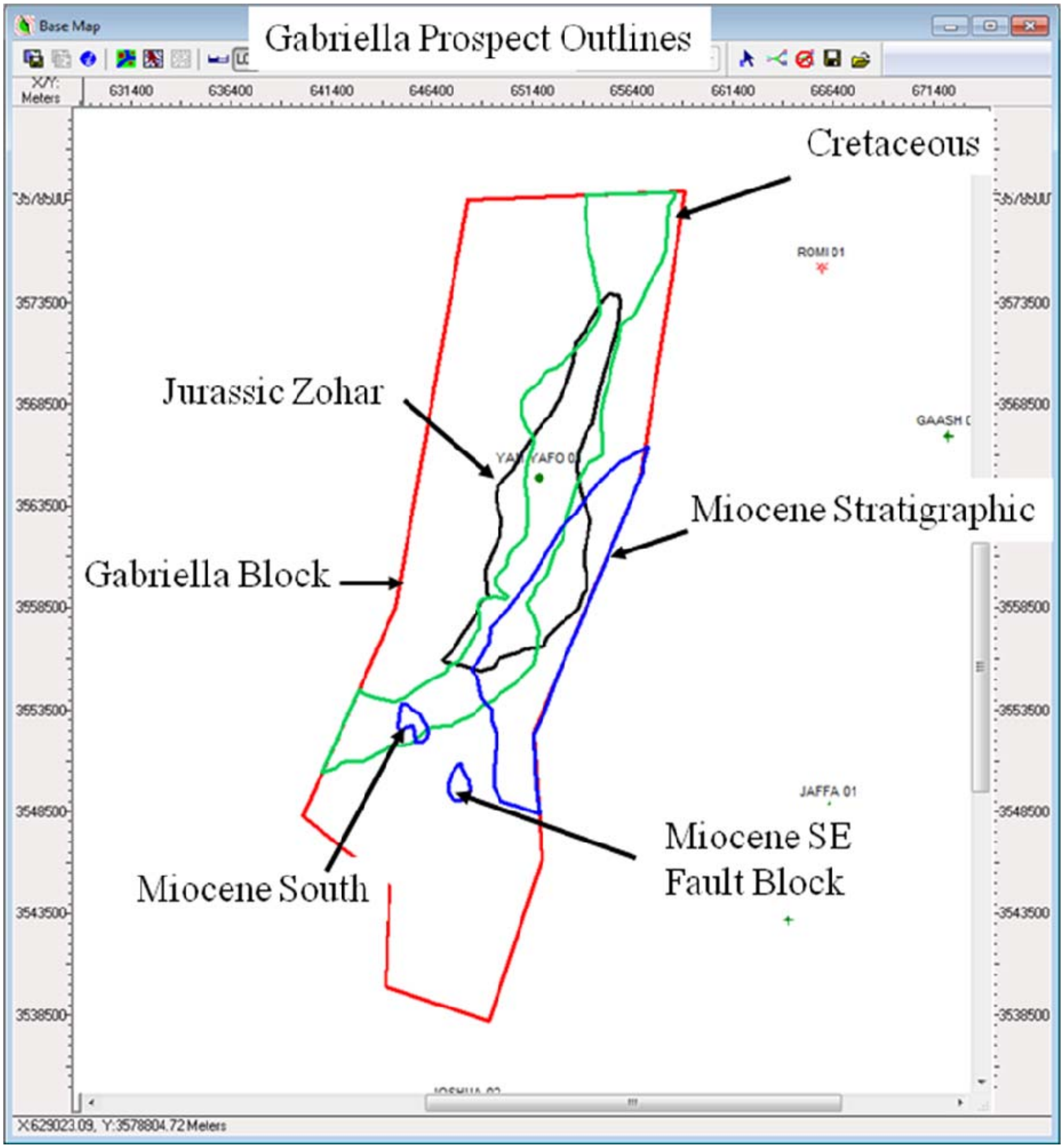
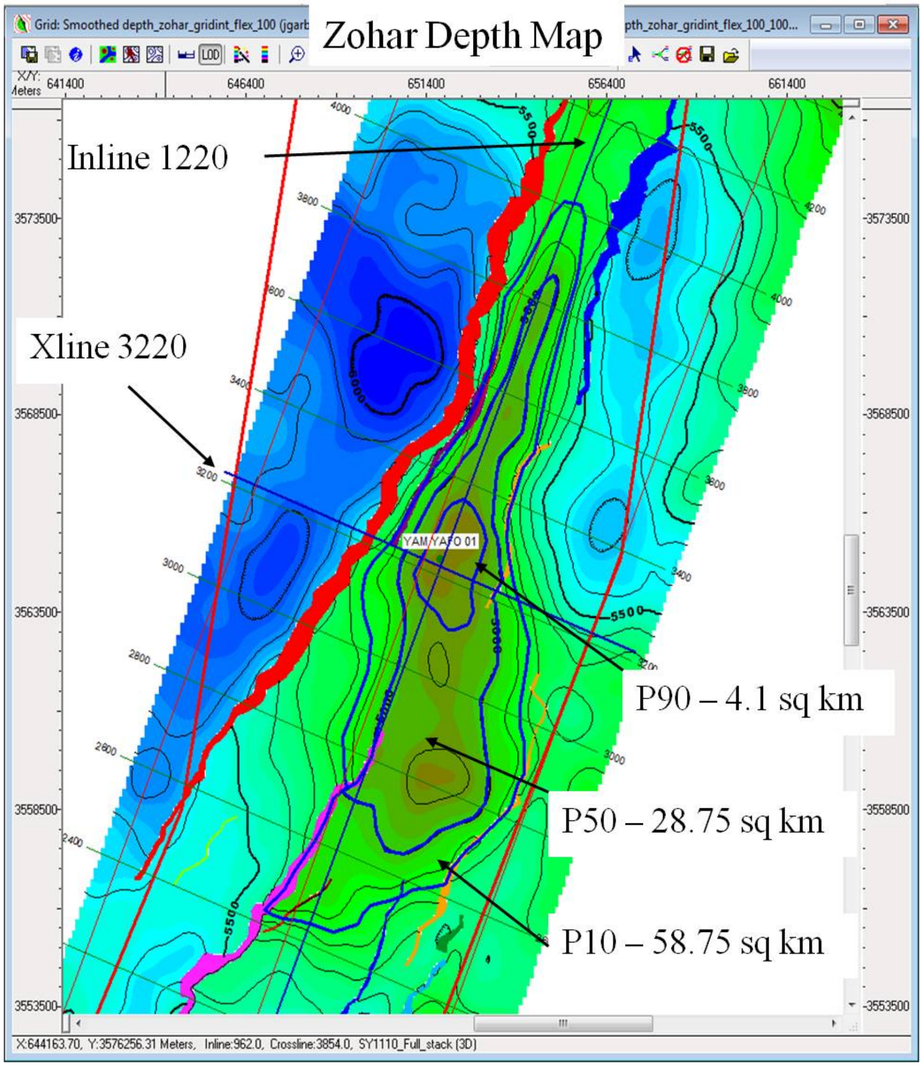


Figure 36 Outline of the Prospects on the License

7.4.1 Jurassic Prospect

In order to estimate the Probabilistic Contingent Resources for this prospect, areal and vertical closures were determined and are depicted for the Zohar level in Figure 37. A P_{10} or maximum size of approximately 58.75 square kilometers of areal closure has been calculated with an indicated maximum vertical closure of approximately 310 meters to the 5,150 meter contour. A P_{90} or minimum size of 4.1 square kilometers with approximately 60 meters of vertical closure has been calculated using the 4,900 meter closure. Finally, for the P_{50}, using the 5,000 meter contour gives an approximate areal extent of 28.75 square kilometers and a vertical closure of about 160 meters.

The Gross thickness used in the Probabilistic calculations includes only the Gross carbonate intervals seen in the Yam 2 and Yam-Yafo 1 wells. Since the matrix porosity is so low, the presence of reservoir quality rock is dependent on fractures or fracture porosity. Therefore, the Net to Gross for the Jurassic is assumed to be 1:1 and the dual porosity of matrix and fractures accounts for the Gross reservoir volume in the carbonate. This thickness and dual porosity system is assumed to be averaged over the areas used in the Probabilistic estimates.



X:644163.70, Y:3576256.31 Meters, Inline:962.0, Crossline:3854.0, SY1110_Full_stack (3D)

Figure 37 Zohar Depth Map with Areas of Closure Used in the Probabilistic Contingent Resource Estimate for Gabriella

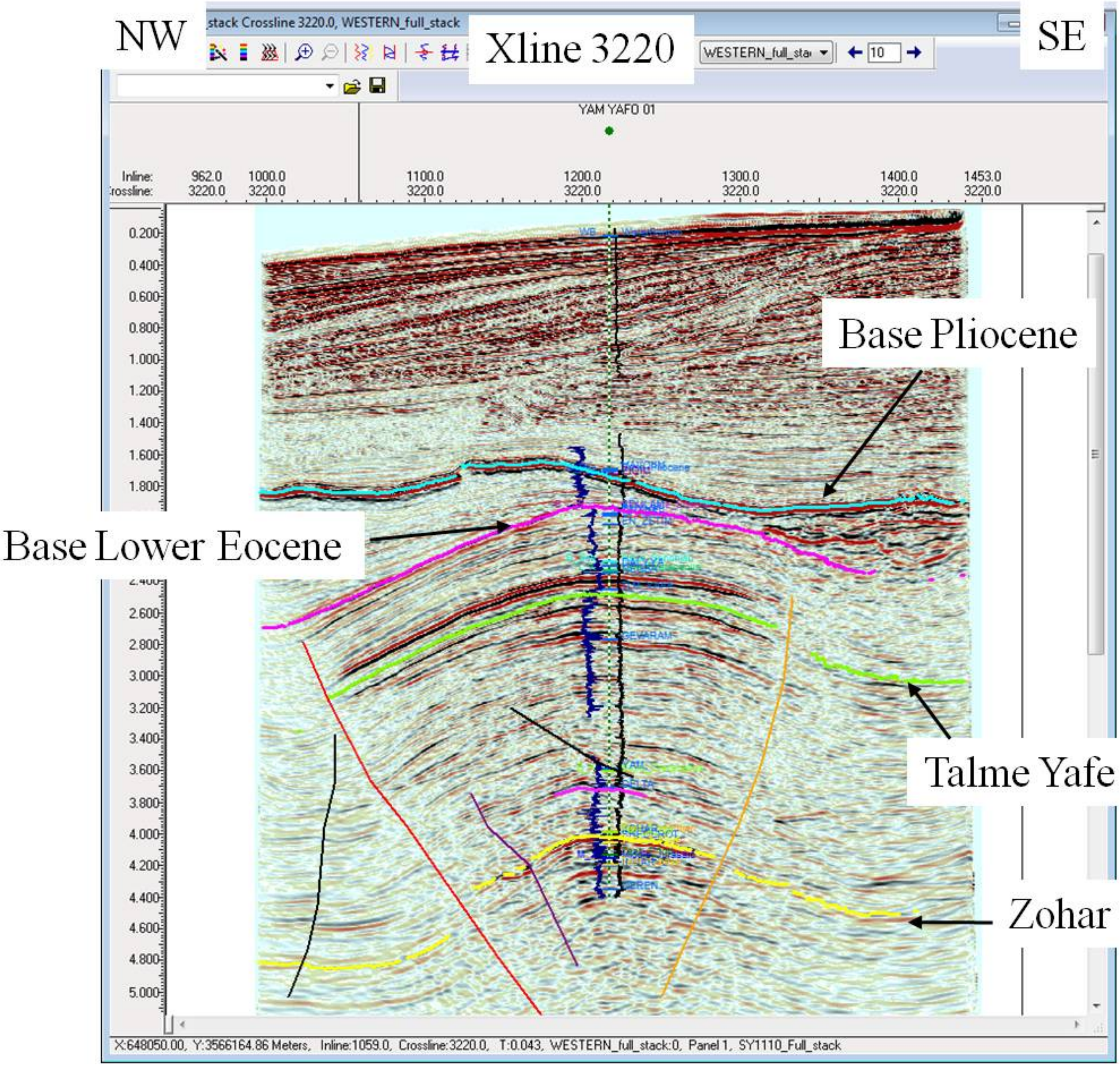


Figure 38 Cross Line from Adira First Azimuth 3D seismic survey

The Jurassic structure used for the Contingent Resource calculations can be seen on CrossLine 3220 (Figure 38) and on In line 1220 (Figure 39). These lines are extracted from the Adira First Azimuth 3D survey.

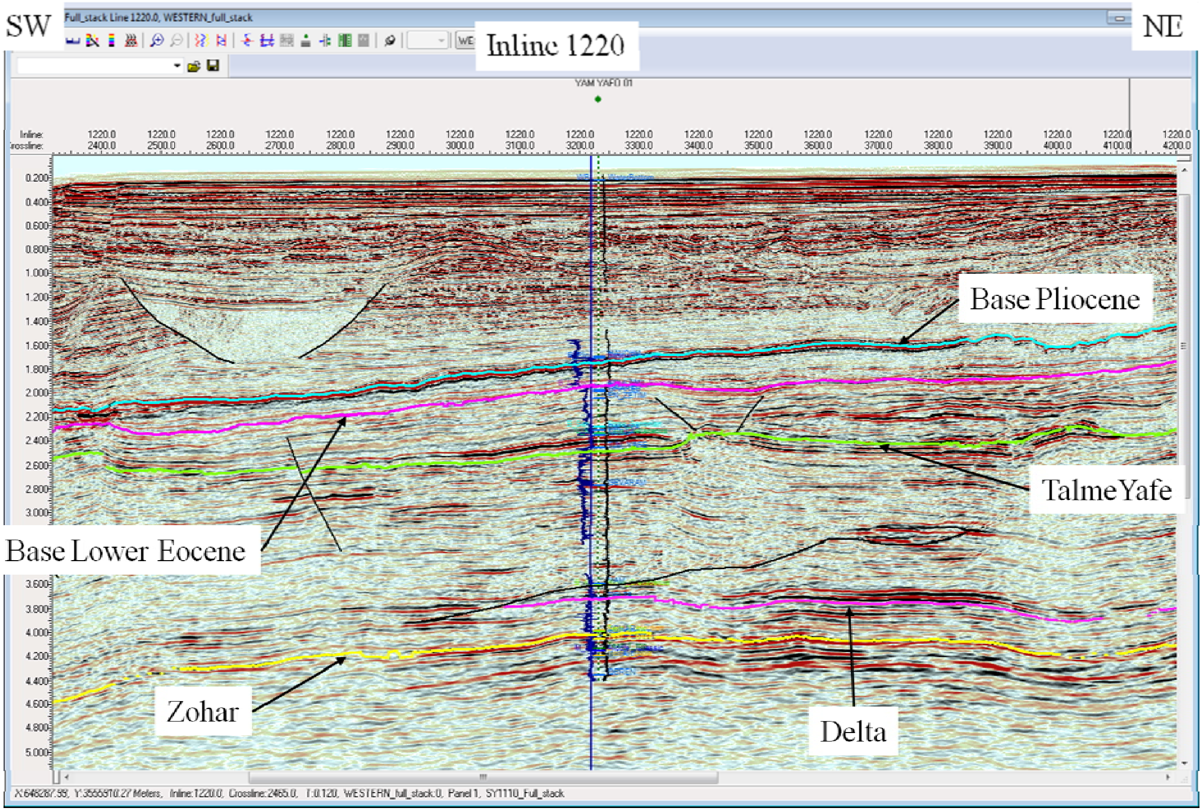


Figure 39 Inline from Adira First Azimuth seismic survey

7.4.2 Cretaceous

The Cretaceous section has indications of reservoir quality rock seen in the wells in the area. A Hauterivian sand was seen with a gas show in the Yam 2 well which had calculated porosities of 22%, unfortunately the DST of this sand recovered only water. The Yam-Yafo 1 also encountered shaley overpressured sands in the Cretaceous section with calculated porosities of 11 to 12%. Isopach thick areas may have a higher potential for sand development and therefore reservoir quality rock. Since there were post depositional tectonic changes, thick porous sands that were deposited in lows during Cretaceous time may be located on present day structural highs (inversion) and would have a greater potential for containing hydrocarbons.

The Talme Yafe depth structure map (Figure 40) shows a southwest – northeast trending ridge with three distinct highs. The Isopach map from the Talme Yafe to Zohar interval (Figure 41) shows areas of thickening that coincide with the structural highs noted on the depth structure map.

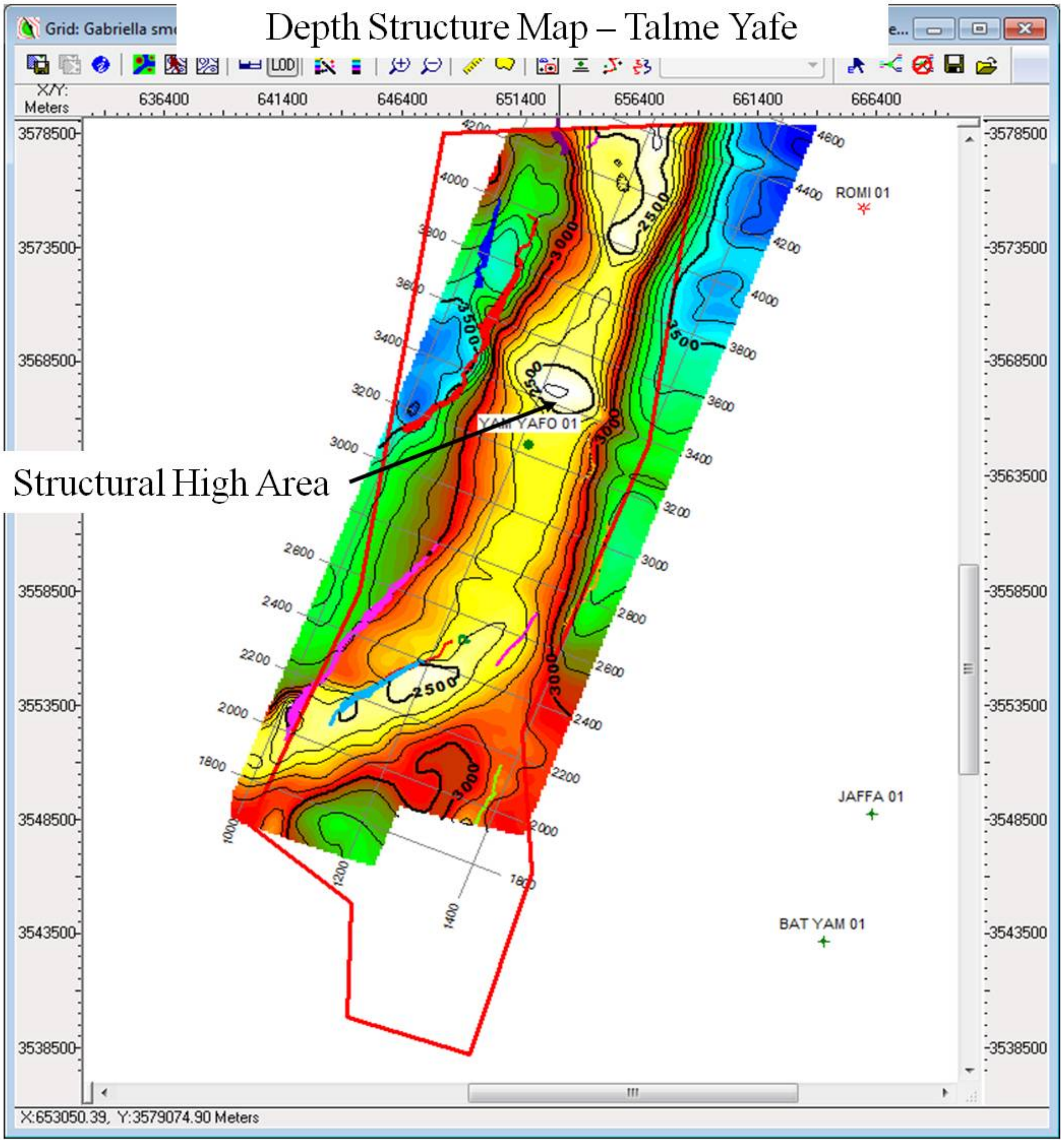


Figure 40 Depth Structure map of the Talme Yafe prospective area

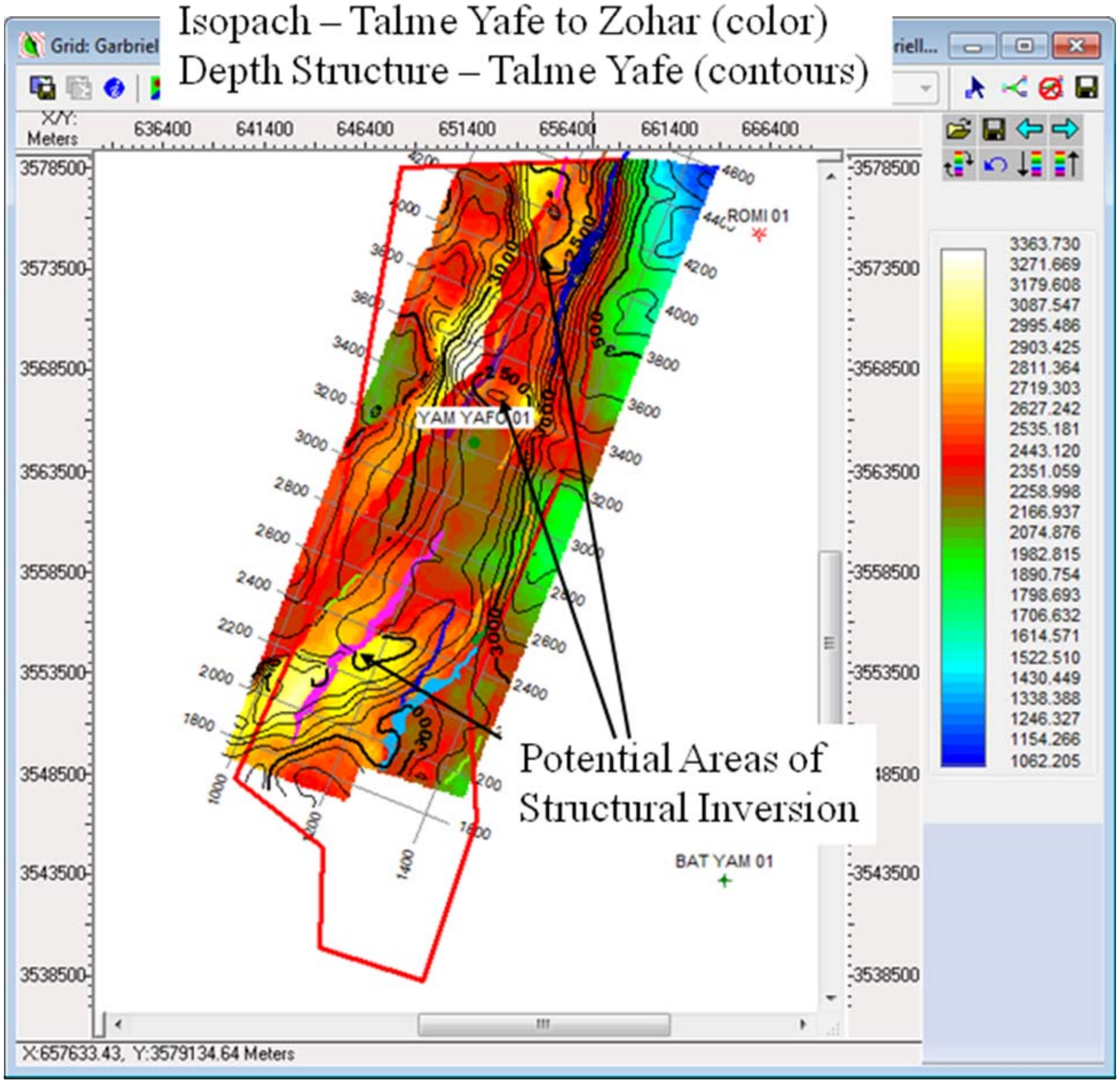


Figure 41 Isopach map of the Talme Yafe to Zohar interval thicker areas are yellow

The coincidence of structural high and thicker sediments sets up the Talme Yafe prospect. In order to estimate the Probabilistic Prospective Resources for these Cretaceous prospects, areal and vertical closures were interpreted and are depicted in Figure 42. The entire ridge is included in the P_{10}, or maximum, area with the three distinct highs used to subdivide the prospective areas for the P_{50} and P_{90} cases.

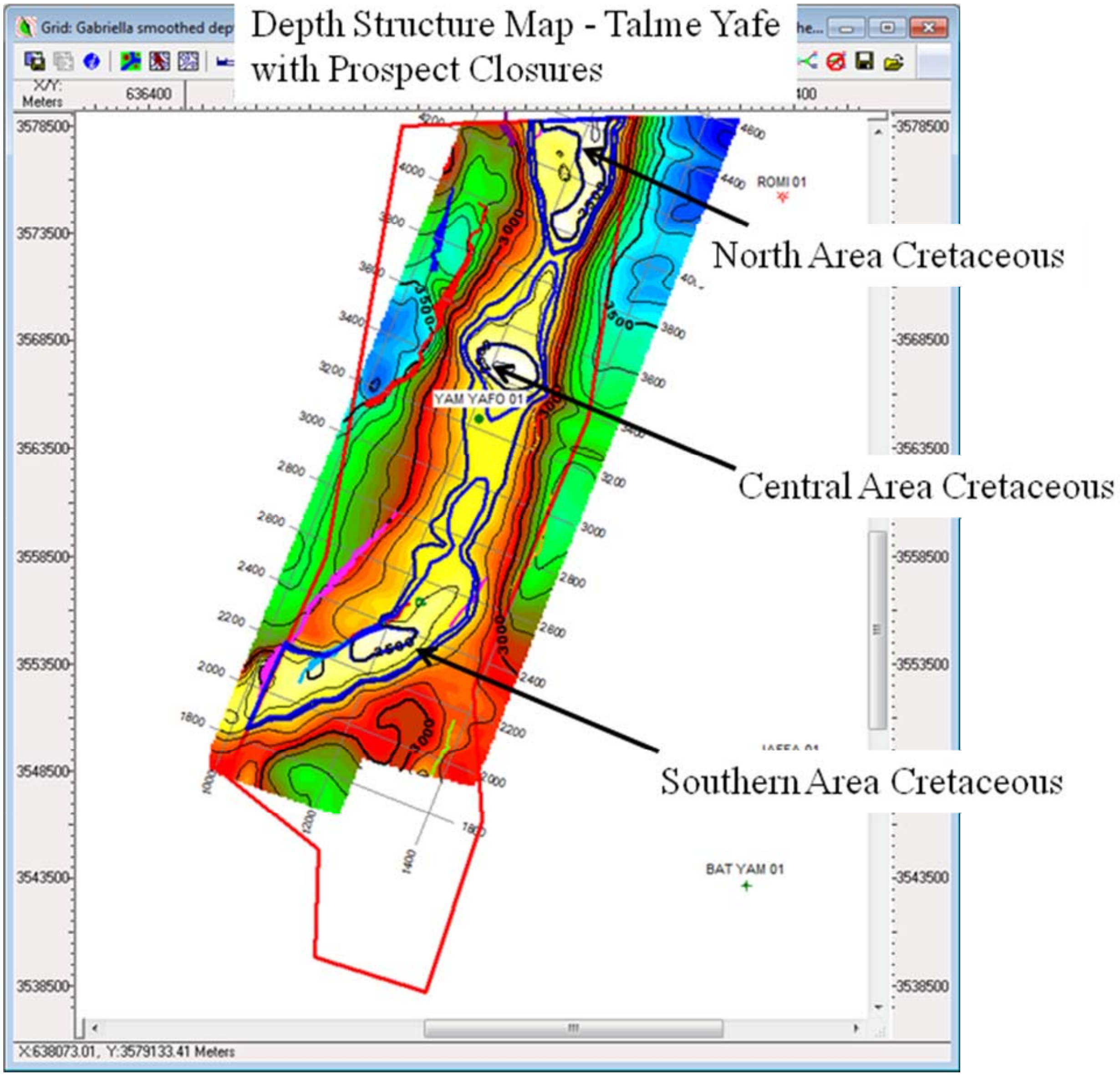


Figure 42 Depth structure map for the Cretaceous Talme Yafe Prospective closures

For the South Area Cretaceous a P_{50} or most likely size of approximately 30.24 square kilometers of areal closure has been calculated with an indicated maximum vertical closure of approximately 245 meters to the 2,675 meter contour. A P_{90} or minimum size of 2.86 square kilometers with approximately 70 meters of vertical closure has been calculated using the 2,500 meter closure. Finally, for the P_{10} area, using the 2,700 meter contour, 42.1 square kilometers out of the total 87.75 square kilometers was used with a vertical closure of about 310 meters.

For the Central Area Cretaceous a P_{50} or most likely size of approximately 15.22 square kilometers of areal closure has been calculated with an indicated maximum vertical closure of approximately 225 meters to the 2,675 meter contour. A P_{90} or minimum size of 4.26 square kilometers with approximately 100 meters of vertical closure has been calculated using the 2,500 meter closure. Finally, for the P_{10} area, using the 2,700 meter contour, 21.2 square kilometers out of the total 87.75 square kilometers was used with a vertical closure of about 310 meters.

For the North Area Cretaceous a P_{50} or most likely size of approximately 17.56 square kilometers of areal closure has been calculated with an indicated maximum vertical closure of approximately 235 meters to the 2,625 meter contour. A P_{90} or minimum size of 6.78 square kilometers with approximately 110 meters of vertical closure has been calculated using the 2,500 meter closure. Finally, for the P_{10} area, using the 2,700 meter contour, 24.5 square kilometers out of the total 87.75 square kilometers was used with a vertical closure of about 310 meters.

7.4.3 Miocene

There are several Miocene prospective areas within the block; however, some of the structures that create the prospects are located mostly outside the block boundaries. Prospective Resource estimates have only been calculated for the prospects that are extensive or entirely within the block boundaries.

The isochron from the base of the Pliocene to the base of the Late Eocene indicates a thickening trending northeast-southwest. Faulting seen on seismic would be a potential migration pathway from the deeper sediments or source rocks. The Yam 2 well had signs of gas and the Yam-Yafo 1 carried background gas that included C1 through C3 with occasional C4. There was no indicated reservoir within this section in the wells.

The Top of the Miocene depth structure (Figure 43) shows the Miocene prospects on the south part of the block. There are three separate fault blocks each containing a small anticline that make up the prospects. Since the SW Fault Block is not entirely within the block it was not included in the resource estimate.

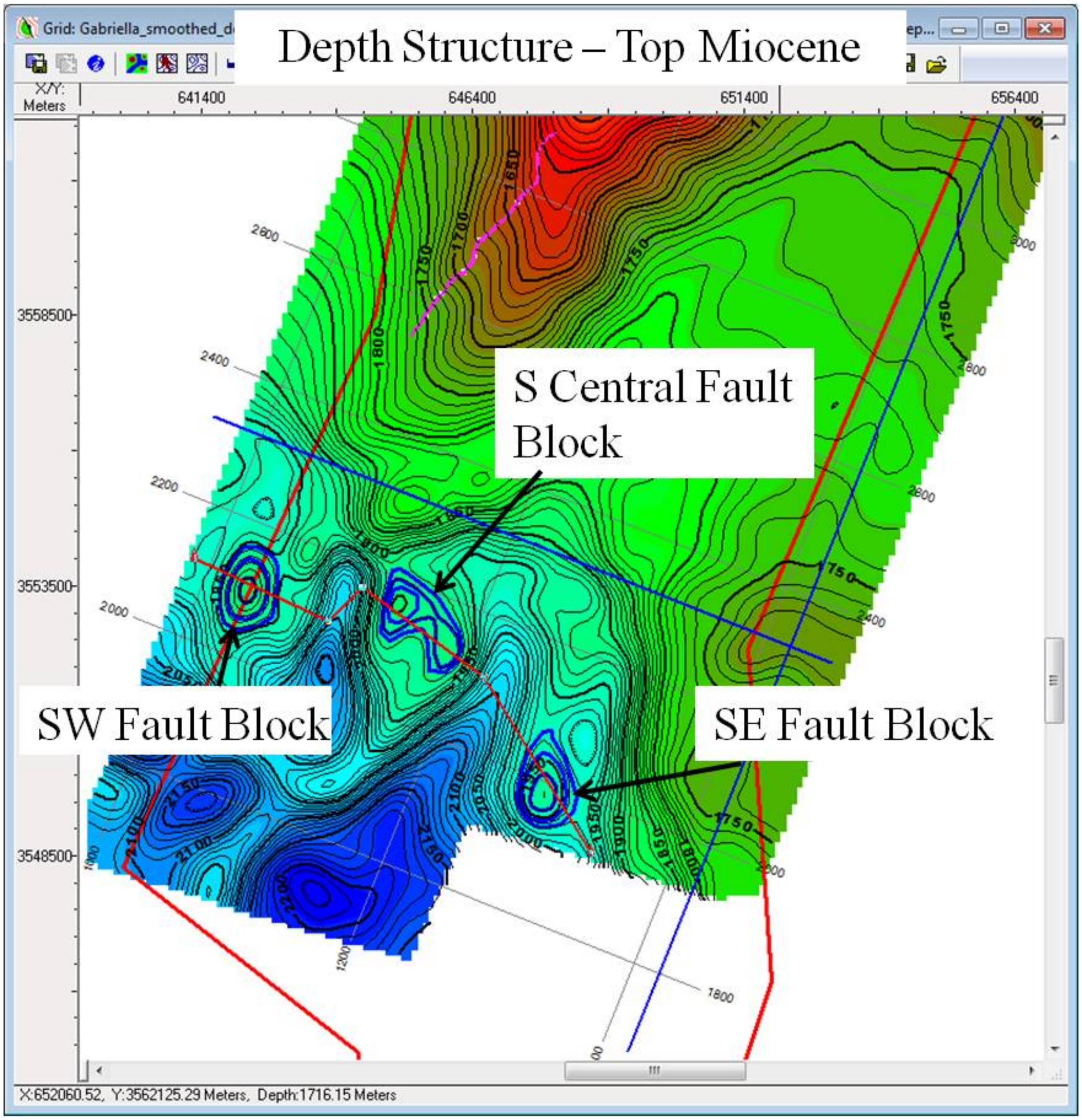


Figure 43 Depth structure map on the top of the Miocene

For the South Central Miocene Prospect a P_{50} or most likely size of approximately 0.9 square kilometers of areal closure has been calculated with an indicated maximum vertical closure of approximately 17 meters to the 1,910 meter contour. A P_{90} or minimum size of 0.3 square kilometers with approximately 7.0 meters of vertical closure has been calculated using the 1,915 meter closure. Finally, for the P_{10} or maximum area, using the 1,915 meter contour, an area of 1.5 square kilometers was used with a vertical closure of about 22 meters.

For the Southeast Miocene Prospect a P_{50} or most likely size of approximately 0.8 square kilometers of areal closure has been calculated with an indicated maximum vertical closure of approximately 25 meters to the 1,955 meter contour. A P_{90} or minimum size of 0.2 square kilometers with approximately 10 meters of vertical closure has been calculated using the 1,940 meter closure. Finally, for the P_{10} or maximum area, using the 1,965 meter contour, an area of 1.3 square kilometers was used with a vertical closure of about 35 meters.

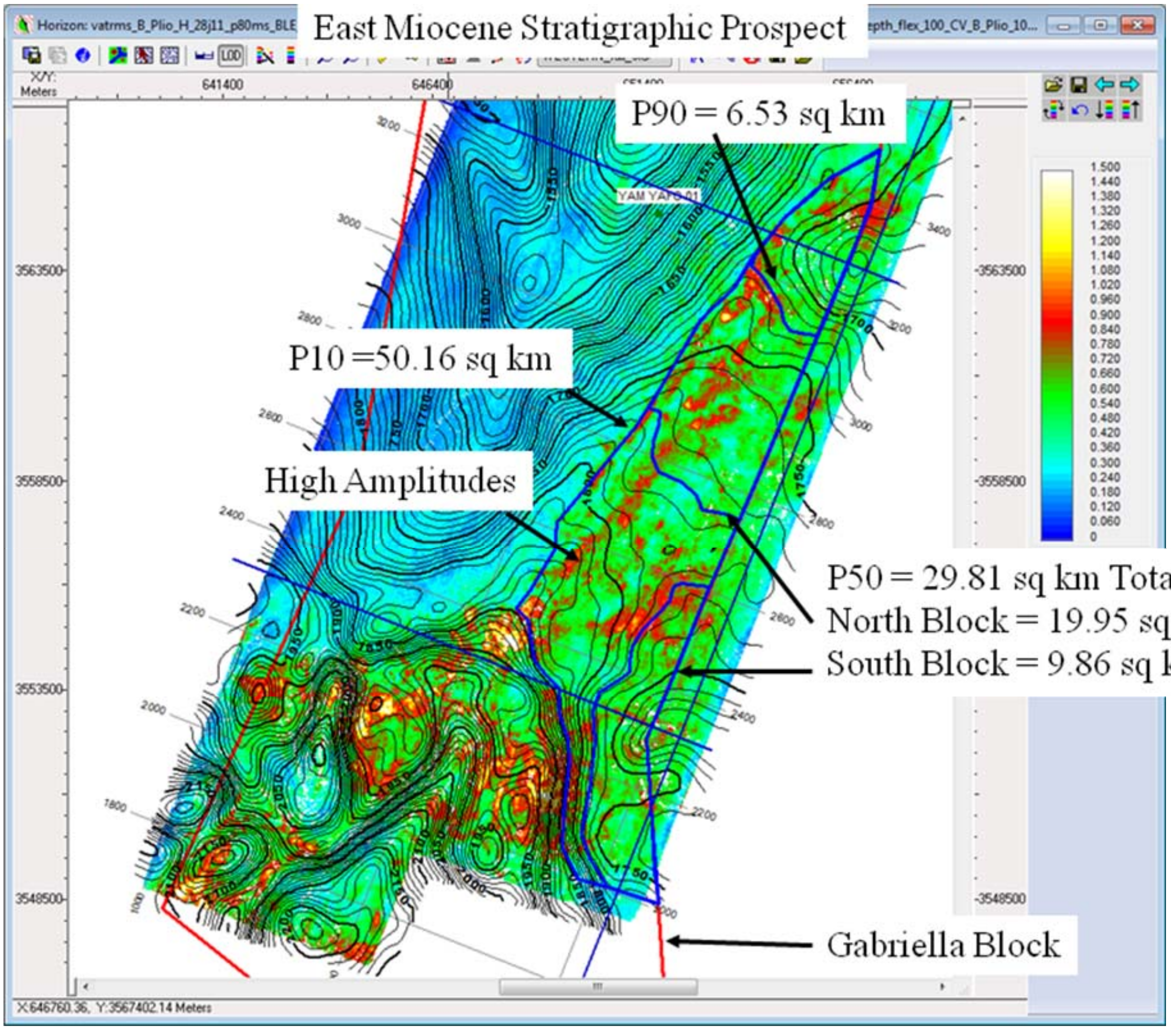


Figure 44 East Miocene Stratigraphic Prospect – Amplitudes and Time Structure

There is an area of thick sediments based on isochron mapping with associated higher amplitudes that may indicate that there is a more favorable depositional environment and a stratigraphic component to a trap in the eastern area of the block. The East Miocene Stratigraphic Prospect, Figure 44, has a P_{50} or most likely size of approximately 29.8 square kilometers of areal closure calculated with an indicated maximum vertical closure of approximately 535 meters to the 1,775 meter contour. A P_{90} or minimum size of 6.5 square kilometers with approximately 240 meters of vertical closure has been calculated using the 1,725 meter closure. Finally, for the P_{10} or maximum area, using the stratigraphic limit or the 1,850 meter contour and the eastern Gabriella block boundary, an area of 50.1 square kilometers was used with a vertical closure of about 590 meters.

7.5 SOURCE ROCKS AND PETROLEUM SYSTEM

The probable hydrocarbon source rocks for the Zohar Jurassic oil accumulation would be deeper Jurassic and Triassic sediments. It is generally accepted that the geothermal gradient has been low and that maturity was attained recently, following post-Tertiary deep burial to about 3,700 meters depth, in order to account for the observed maturation levels. There are at least two possibilities for oil generation sources since the current reservoir temperatures in the Jurassic (>300^{o}F) suggest that oil generation started fairly recently: 1.) perhaps in Pliocene time from the early Jurassic or Triassic sediments or 2.) the hydrocarbon source would be within an early Jurassic to Permian sequence where hydrocarbons probably migrated along Triassic-Jurassic tensional fault complexes to reach Upper Jurassic reservoirs in Cretaceous or Early Tertiary times. In either case there is oil in the Jurassic and gas in the younger sediments.

The data in the area of the Gabriella block supports the existence of two types of petroleum systems, a biogenic source and a thermogenic source. Onshore producing fields such as Heletz, and Ashdod fields, along with oil tests or shows in offshore boreholes in the Jurassic such as the Yam 2, Yam West 1, and Yam-Yafo 1 indicate that a thermogenic source exists. Onshore producing fields such as Shiqma and Sadot, and offshore producing fields such as Mari B, Noa and Gaza Marine and hydrocarbon shows in the same offshore wells along with the Dalit, Tamar and Leviathan discoveries support the existence of a biogenic source. The younger sediments are the source of the biogenic natural gas while the deeper rocks are the source of the thermogenic oil and gas.

7.5.1 Biogenic

Plio-Pleistocene, Oligocene and Eocene rocks in the region were found to have biogenic gas potential. Organic rich shales of Oligo-Miocene and Plio-Miocene sediments are considered as source rocks for the onshore Sadot and Shiqma gas fields (Oligo-Miocene). The natural gas found in Noa, Mari, and Gaza Marine fields is considered to be of Miocene-Pliocene origin. The gas found at Mari B is dry and was probably generated fairly recently from Miocene sediments. The gas seen at Tamar is reported by Noble to be biogenic in nature.

7.5.2 Thermogenic

7.5.2.1 Upper Cretaceous

The organic rich marl of the Mount Scopus Group is considered to be a regional prime source rock for some onshore discoveries and shows. Thermal maturity modeling shows that upper Cretaceous sediments reach maturation within the Levant Basin at depths greater than four kilometers[18]. Hence, the Senonian Mount Scopus Group rocks can be considered as a potential for oil and thermogenic gas in the deeper parts of the basin.

7.5.2.2 Lower Cretaceous

Gevram shales have a high Total Organic Content (TOC) and are considered to be potential source rocks for oil and thermogenic gas in places where maturity is reached.

7.5.2.3 Middle Jurassic

The Barnea Formation, a fine grained basinal limestone, is rich in organic matter and is considered as the source for the Heletz oil. The Barnea is known from the southern coastal plain wells and its extension into the Levant basin offshore makes it a potential source for oil generation.

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[18] Gardosh, 2002

7.5.2.4 Lower Jurassic & Triassic

Lower Jurassic and Triassic rocks were found to present source rock properties in various onshore boreholes[19]. High grade oil shows found in the middle Jurassic carbonates in the Yam 2 and Yam-Yafo 1 wells are probably related to these source rocks. Gardosh (2002) estimated that Triassic rocks reached their maturity window in the late Jurassic to mid-Cretaceous. This assumption suggests that the primary migration may have taken place prior to the Syrian Arc folding phase and potential traps can be found in the Early Mesozoic fault blocks and stratigraphic traps.

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[19] Bein et al 1984

8. ENGINEERING

Isramco and partners drilled the Yam-Yafo 1 well on their Med Tel Aviv License (now Gabriella) in 1994. The well was drilled to a total depth of 5,785.5 meters and tested oil from the interval from 4,894 meters to 5,034 meters. The well was plugged and suspended on 5 November 1994[20] and subsequently Isramco relinquished the area. From that point in time until Adira was awarded the Gabriella License in July of 2009, the only activity was the acquisition of speculative seismic data.

8.1 YAM – YAFO 1 WELL

8.1.1 Well History

The Yam-Yafo 1 well was spud on 24 Jan 1994 using the Ross Offshore/Transocean semi-submersible drillship “Benreoch”. The well was drilled and logged to a total depth of 5,785.5 meters in 200 days. Electric wireline logs were taken from 816.6 meters to 1,004.4 meters and from 1,414.2 meters to total depth. Two zones of interest were seen from 4,894.0 meters to 5,034.0 meters and from 5,195.0 meters to 5,332.5 meters. These limestone formations were overpressured and required a mud weight of 16.1 ppg to maintain well control while drilling the 8-3/8 inch hole section. Consequently these intervals were not cored. Both of the zones were tested in a cased hole with a 7 inch production liner that tied back to the surface.

8.1.1.1 Yam-Yafo 1 - Well Test #1

After displacing the well with 11.3 ppg Calcium Chloride brine and perforating using tubing conveyed perforating (TCP) guns over the interval 5,195.0 to 5,322.5 meters (a net interval of 121.5 meters), the lower zone was tested. This test produced only 39.6 barrels of brine water at a flowing pressure of 27 psi on a 16/64 inch choke. Subsequent acid stimulation using 172 barrels of 15% HCl acid failed to improve the flow and did not result in the recovery of hydrocarbons.

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[20] Final Well Report, Yam-Yafo-1, 1994

After a 17 hour test period the zone was abandoned with a notation in the test report that no reservoir fluids were recovered.

8.1.1.2 Yam-Yafo 1 - Well Test #2

The upper zone was perforated using TCP with an underbalanced column of 11.3 ppg CaCl brine. A net interval of 122.5 meters between 4,894 and 5,034 meters was perforated and after a clean-up flow period, the well produced 468.2 barrels of liquids in 9.85 hours. This volume consisted of 189.7 barrels of oil (40.5% of the Total Fluid) and 278.5 barrels of water. The final flowing tubing pressure was 1,361 psi on a 16/64" choke. Total production during the entire test was 1,351 barrels of 44° API oil at rates up to 821 barrels of oil per day; 3,892 barrels of 4,200 ppm chlorides[21] (brackish) water, and approximately 1,050 Mcf of 0.948 gravity associated gas.

8.1.1.3 Yam-Yafo 1 - Well Test 2A

In an attempt to isolate the water producing zones within the upper interval, the existing perforations were squeezed with cement and the well was plugged back to 4,955 meters. The interval from 4,894 to 4,955 meters was re-perforated but the production from the next test remained water cut. The measured production from the well was 139.6 barrels of water and 101.9 barrels of oil (42.2% of the Total Fluid) and 200 MCF of gas. Average production from test 2A was 395 barrels of oil per day and 489 barrels of water per day on a 12/64 inch choke with a flowing tubing pressure of 2,730 psi.

The well testing lasted for a total of 77 days and the Yam-Yafo 1 was abandoned as a non-economic discovery by setting one mechanical and four cement plugs in the 7 inch casing.

8.2 YAM-YAFO 1 AND YAM 2 WELL TEST SUMMARY

The Yam 2 had a Kelly Bushing of 13.2 meters and was drilled to a Total Depth of 5,377 meters. The mud weight at 5,300 meters was 14.2 pounds per gallon with an equivalent bottom-hole pressure of 12,840 psi.

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[21] Water Analysis Test

A drill stem test (DST) was conducted in the Jurassic zone @ 5,309 to 5,317 meters. The extrapolated initial shut-in bottom-hole pressure (ISIBHP) is equal to 13,558 psi @ -5,290.8 meters subsea depth. The resulting pressure gradient (Pgr) is equivalent to 2.56 psi/meter or 0.781 psi/foot which would be considered a highly over-pressured reservoir. The bottom hole temperature of 340°F yields a temperature gradient (Tgr) of 0.0153°F/ft, which is also very high. The DST recovered approximately 152.2 barrels of oil and 26.1 barrels of water in about four and a half hours, or 800 barrels of oil per day. The produced water is most likely mud filtrate from mud losses during drilling. Water analysis information from this test is not available. The PVT Analysis for the Yam 2 oil that was recovered from the test is depicted in Figure 45.

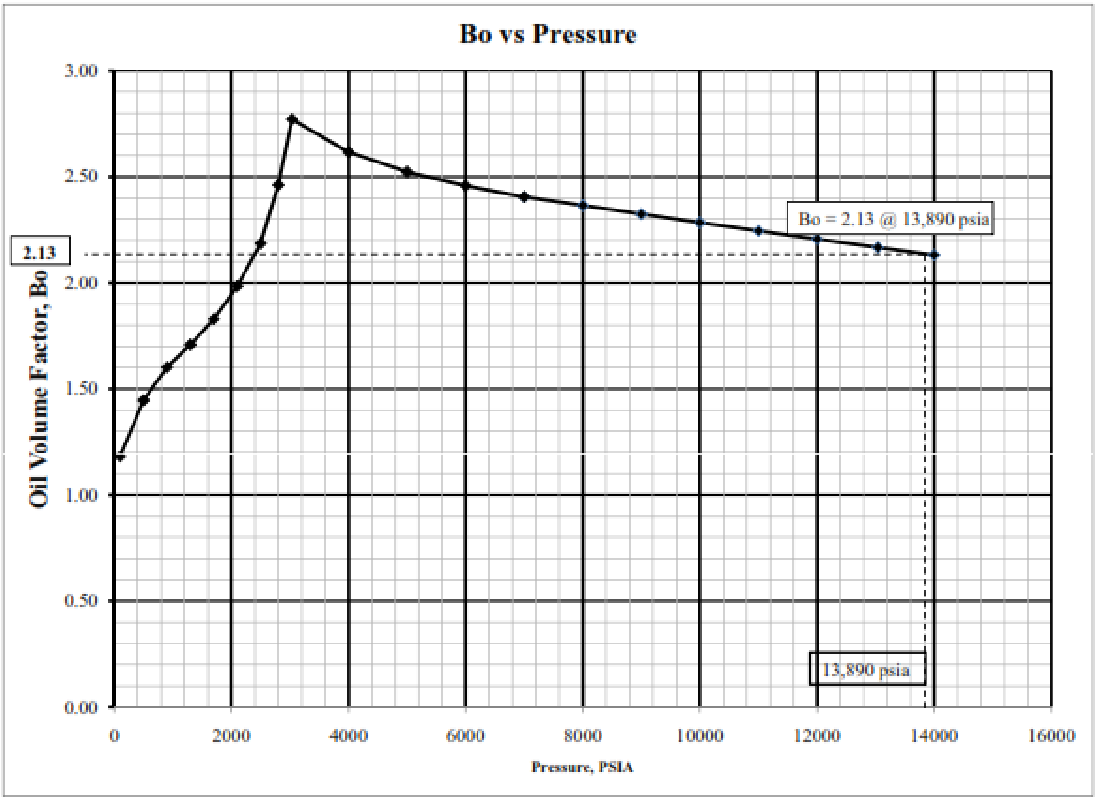

Figure 45 Graph of B_o vs. Pressure from the PVT Analysis, Yam 2

The Yam-Yafo 1 tested Jurassic section is found at a measured depth of 4,894 to 5,332.5 meters. The Pgr derived from DST data ranges from 2.79 to 2.878 psi/meter or 0.851 to 0.877 psi/foot. Based on this, the estimated Initial Shut In Bottom Hole Pressure range is from 13,681 to 14,098 psi at 4,900 meters. These pressures are based on an equivalent circulating density estimate of

16.4 to 16.9 ppg because of large drilling induced fractures observed on the well log data. Based on the PVT analysis of the oil from the Yam 2 well and an average BHP of 13,890 psia for the Yam-Yafo 1 well the B_o[22] would be approximately 2.13 (Figure 45).

The tests from both wells included water that was most likely mud filtrate from mud losses during drilling, based on drilling records and water analysis data. The Yam 2 and the Yam Yafo 1 were both tested in the Jurassic. The Yam 2 drilling report synopsis states that 25 barrels of mud were lost into the interval from 5,307.5 meters to 5,310.0 meters during the drilling of the section and another 25 barrels later. This overlaps the interval from 5,309.0 meters to 5,317.0 meters, which was tested in DST 1. Further losses at the rate of 20 barrels per hour occurred in this section until LCM was pumped into the well. Therefore, at least 50 barrels of mud and probably over 100 barrels were lost into the tested interval during drilling operations. This mud loss indicates good permeability of the limestone which must have fracture porosity in order to take this much mud at this high a rate. DST 1 tested oil, water and gas over the six hour test. The rates[23] ranged from 517 to 752 barrels of oil per day, 128 to 89 barrels of water per day and 587 to 532 MCF of gas per day. The rates are measured each hour and these values were used to estimate the total recovery of fluids which would be 152.2 barrels of oil and 26.1 barrels of water. The recovered water was most likely filtrate from the mud that was lost during drilling and this would represent only a fraction of the mud lost. The water production rate was also decreasing over time which would occur if the water source was the mud filtrate. In the summary section from the Final Well Report for Yam-Yafo 1 (Geological Section, Isramco, December 1994), it notes that drilling induced fractures occurred from 4,985 meters to 5,020 meters where an estimated 400 barrels of mud was lost. An additional 1,395 barrels of mud were lost from 4,894 to 4,925 for a total of 1,795 barrels. During DST 2A from the interval 4,894 to 4,955 meters a total of 101.9 barrels of oil and 139.6 barrels of water were recovered. These data would also suggest that the water that was produced in the tests was from mud filtrate and not formation water.

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[22] oil formation volume factor

[23] Page 6 Final Well Report Yam 2, Isramco

8.3 INFRASTRUCTURE

The local offshore infrastructure is very limited. For example the newly discovered Leviathan, Tamar and Dalit fields are located approximately 107, 90, and 45 kilometers from shore respectively and will take at least 2 years to get on line. Currently the Tamar gas would have to be transported in a new pipeline about 135 Kilometers (84 miles) south to the Mari B platform in order to get the gas to market. This gas pipeline crosses the Shemen block to the south of Gabriella and makes landfall in Ashdod (Figure 46) and transports gas from the Mari B field. If gas is found on Gabriella it will be available for sale before Tamar is ready to be produced with the construction of a pipeline that ties into the line to the south. An oil pipeline could be constructed along the same path or if permitted could be built directly to shore to the Tel Aviv area.

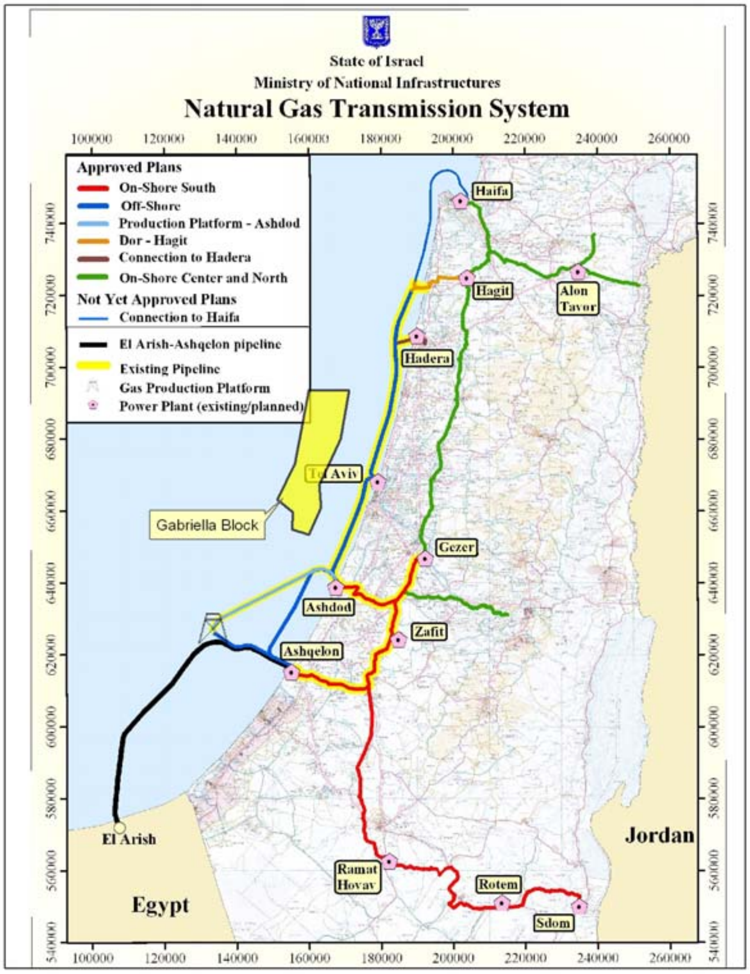

Figure 46 Map of Existing Offshore Gas Pipeline Infrastructure in Israel

9. PROBABILISTIC RESOURCE ANALYSIS

9.1 GENERAL

A probabilistic resource analysis is most applicable for projects such as evaluating the potential resources of the subject area, where some limited information exists regarding the reservoir parameters. The range of values in the reservoir data is quantified by probability distributions, and an iterative approach yields an expected probability distribution for the resources. This approach allows consideration of most likely resources for planning purposes and what potential upside there may be for the project.

The analysis for this project was carried out considering the range of values for all parameters in the volumetric equations. Therefore, triangular probability distributions, with input of minimum, maximum, and most likely values, were used.

Because the Yam – Yafo 1 well penetrated the evaluated structure and tested significant rates of oil, the estimated volumes of oil for the Jurassic are classified as Contingent Resources. Contingent Resources are defined as follows[24]:

> *"Contingent resources are defined as those quantities of oil and gas estimated on a given date to be potentially recoverable from known accumulations but are not currently economic."*

There is no certainty that it will be commercially viable to produce any portion of the resources. The contingencies associated with these resource estimates are that although the Yam – Yafo 1 well test and log data, along with the seismic data, establish this as a known accumulation, the quantity of data is not yet sufficient, given the very large expenditures required to develop the resources and get the oil to market, to establish with confidence the commerciality of future development. Thus, the Gabriella license area does not yet have any reserves.

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[24] *Canadian Oil and Gas Evaluation Handbook, Volume 1*, Society of Petroleum Evaluation Engineers (Calgary Chapter) and Canadian Institute of Mining, Metallurgy & Petroleum (Petroleum Society), September 1, 2007.

The Cretaceous and Miocene reservoir prospects have not been tested; therefore, they contain Prospective Resources. Prospective Resources are defined as “those quantities of petroleum estimated, as of a given date, to be potentially recoverable from undiscovered accumulations by application of future development projects. Prospective Resources have both an associated chance of discovery and a chance of development. Prospective Resources are further subdivided in accordance with the level of certainty associated with recoverable estimates assuming their discovery and development and may be sub-classified based on project maturity.”[25] There is no certainty that any portion of the Prospective Resources will be discovered. If discovered, there is no certainty that it will be commercially viable to produce any portion of the resources.

The fairly wide spacing of values between the low and high estimated resources reflects the level of uncertainty in this analysis. In general, the high probability resource estimates at the left side of these distributions represents downside risk, while the low probability estimates on the right side of the distributions represent upside potential.

9.2 INPUT PARAMETERS

The parameters for these input distributions were selected based on a review of all available data, for this and nearby analogous areas. Note that these parameters represent average parameters over the entire prospect and formation. So, for example, the porosity ranges do not represent the range of what porosity might be in a particular well or a particular interval, but rather the reasonable range of the average porosity for the whole reservoir.

Note that triangular distributions were used for all the input parameters. In general, the P_{90}, Mode, and P_{10} points were specified for the distributions. For drainage area and gross thickness, the probability for the low end estimates was reduced as far as necessary in order to avoid results less than zero. These values were set between zero and ten.

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[25] Society of Petroleum Evaluation Engineers, (Calgary Chapter): Canadian Oil and Gas Evaluation Handbook, Second Edition, Volume 1, September 1, 2007, pg 5-7.

For the purposes of estimating resources, it was assumed that a well drilled on the Yam-Yafo structure would encounter multiple (up to three) carbonate sections as seen in the Yam-Yafo 1 well. The gross thickness used in the Probabilistic estimate was based on the accommodation space provided by the difference between the top and base of the structure for the area used in the P_{10}, P_{50} and P_{90} cases and includes only the gross carbonate intervals seen in the Yam 2 and Yam-Yafo 1 wells. Since the matrix porosity is so low, the presence of reservoir quality rock is dependent on fractures or fracture porosity. Therefore, the Net to Gross for the Jurassic is assumed to be 1:1 and the prospective Jurassic reservoir is expected, based on analysis of the Yam – Yafo 1 well, to have a dual porosity system, with the flow dominated by a natural fracture system, supported by some storage and influx of hydrocarbons from the low-porosity carbonate matrix. This was modeled as two different systems, with the distribution for porosity, initial water saturation, and recovery factor used for both the matrix and the fracture system being an estimate of the net volume of rock that has fractured porosity, initial water saturation, and recovery factor and assumed to be representative of the average over the prospective area. Note that based on the structural analysis, the fracture systems are not expected to collapse as oil is withdrawn from the reservoir. Therefore, higher recovery of hydrocarbon fluids is anticipated.

The parameters of the input distributions are shown in Table 6 through Table 8. The oil and gas formation volume factor was estimated based on typical oil field data. In addition to the data tabulated below, a shape factor of 0.8 was used to account for the likely geometry of the reservoirs.

Table 6 Summary of Input Parameters -- Jurassic

Parameters	P_{90}	P_{50}	P_{10}
Area (Sq Km)	4.10	28.75	58.75
Gross Thickness (m)	60	160	310
Net to Gross, %	100%		
Porosity, Fracture, %	3.0%	5.0%	7.0%
Porosity, Matrix, %	2.0%	3.0%	4.0%
Water Saturation, Fracture, %	10.0%	20.0%	30.0%
Water Saturation, Matrix, %	40.0%	50.0%	60.0%
Recovery Factor, Fracture, %	40.0%	50.0%	60.0%
Recovery Factor, Matrix, %	5.0%	10.0%	15.0%
B_o, res. Bbl/STB	1.97	2.24	2.81

Table 7 Summary of Input Parameters -- Cretaceous

Parameters	P_{90}	P_{50}	P_{10}
Common to All			
Depth m	2,400	2,550	2,700
Net to Gross, %	25.0%	35.0%	45.0%
Porosity, %	20.0%	22.0%	25.0%
Water Saturation, %	30.0%	50.0%	55.0%
Recovery Factor, %	60%	65%	70%
Gas Gravity, relative to air	0.590	0.600	0.610
Temperature Gradient, °F/ft	0.014	0.015	0.016
Pressure Gradient, psi/ft	0.465	0.500	0.565
Cond/Gas Ratio, Bbl/MM	100	150	200
South Area			
Area (Sq Km)	2.9	30.2	42.1
Gross Thickness (m)	70	158	245
Central Area			
Area (Sq Km)	4.3	15.2	21.2
Gross Thickness (m)	100	163	225
North Area			
Area (Sq Km)	6.8	17.6	24.5
Gross Thickness (m)	110	173	235

Table 8 Summary of Input Parameters -- Miocene

Parameters	P_{90}	P_{50}	P_{10}
Common to All			
Net to Gross, %	25.0%	35.0%	45.0%
Porosity, %	17.0%	25.0%	30.0%
Water Saturation, %	30.0%	45.0%	55.0%
Recovery Factor, %	65%	70%	75%
Gas Gravity, relative to air	0.600	0.650	0.680
Temperature Gradient, °F/ft	0.014	0.015	0.016
Pressure Gradient, psi/ft	0.460	0.465	0.470
Cond/Gas Ratio, Bbl/MM	50	67	100
South Fault Block			
Depth m	1,890	1,903	1,915
Area (Sq Km)	0.3	0.9	1.5
Gross Thickness (m)	7.0	17.0	22.0
Southeast Fault Block			
Depth m	1,940	1,955	1,970
Area (Sq Km)	0.2	0.8	1.3
Gross Thickness (m)	10.0	25.0	35.0
Net to Gross, %	25.0%	35.0%	45.0%
Porosity, %	17.0%	25.0%	30.0%
Water Saturation, %	30.0%	45.0%	55.0%
Recovery Factor, %	65%	70%	75%
Gas Gravity, relative to air	0.600	0.650	0.680
Temperature Gradient, °F/ft	0.014	0.015	0.016
Pressure Gradient, psi/ft	0.460	0.465	0.470
Cond/Gas Ratio, Bbl/MM	50	67	100
East Stratigraphic			
Depth m	1,940	1,955	1,970
Area (Sq Km)	6.5	29.8	50.1
Gross Thickness (m)	240	535	590
Net to Gross, %	15.0%	30.0%	45.0%

In a probabilistic analysis, dependent relationships can be established between parameters if appropriate. For example, portions of a reservoir with the lowest effective porosity generally may be expected to have the highest connate water saturation, whereas higher porosity sections have lower water saturation. In such a case, it is appropriate to establish an inverse relationship between porosity and water saturation, such that if a high porosity is randomly estimated in a given iteration, corresponding low water saturation is estimated. The degree of such a correlation can be controlled to be very strong or weak. This type of dependency, with a medium strength of -0.7, was used in this study for porosity with water saturation and with net/gross ratio. Similarly, the low end of the gross thickness distributions for this prospective accumulation would generally be expected to occur when the productive area is small; therefore, a positive correlation of 0.7 was assigned to gross thickness and productive area.

9.3 PROBABILISTIC SIMULATION

Probabilistic resource analysis was performed using the Monte Carlo simulation software called "@ Risk." This software allows for input of a variety of probability distributions for any parameter. Then the program performs a large number of iterations, either a large number specified by the user, or until a specified level of stability is achieved in the output. The results include a probability distribution for the output, sampled probability for the inputs, and sensitivity analysis showing which input parameters have the most effect on each output parameter.

After distributions and relationships between input parameters were defined, a series of simulations were run wherein points from the distributions were randomly selected and used to calculate a single iteration of estimated potential resources. The iterations were repeated until stable statistics (mean and standard deviation) result from the resulting output distribution, after 5,000 iterations.

9.4 RESULTS

The output distributions were then used to characterize the Contingent Resources and Prospective Resources. Key points, summarized below in Table 9 and Table 10, from the contingent resource distribution include the 50 percent point (Best Estimate or P_{50}) the 90 percent point (Low Estimate or P_{90}) and 10 percent point (High Estimate or P_{10}). Graphs of cumulative probability versus resources were constructed. The resulting distribution curves are presented in Figure 47 through Figure 58. Note that these estimates do not take into account any risk of failure. It should be noted that an economic evaluation has not been performed as part of this report.

Table 9 Summary of Gross Contingent Resource Estimates, Oil Prospects

	Low Estimate	Best Estimate	High Estimate
OOIP, MMBO	165	724	2,028
Oil Resources, MMBO	60	277	806

Table 10 Summary of Gross Prospective Resource Estimates, Gas Prospects

		GIIP (BCF)			Prospective Gas Resources (BCF)			Prospective Condensate Resources (MMB)		
Structure	**Reservoir**	**Low Estimate**	**Best Estimate**	**High Estimate**	**Low Estimate**	**Best Estimate**	**High Estimate**	**Low Estimate**	**Best Estimate**	**High Estimate**
South Area	Cretaceous	320.9	1,294.5	3,084.3	205.5	837.9	2,011.4	28.5	120.1	308.8
Central Area	Cretaceous	234.2	633.1	1,267.7	150.2	410.5	831.3	20.9	59.3	129.5
North Area	Cretaceous	291.1	764.0	1,555.7	189.1	496.7	1,011.2	26.3	71.6	158.3
Total Cretaceous		846.2	2,691.6	5,907.7	544.8	1,745.1	3,853.9	75.7	251	596.6
South Fault Block	Miocene	1.1	3.3	7.7	0.8	2.4	5.4	0.1	0.2	0.4
Southeast Fault Block	Miocene	1.3	4.3	10.5	0.9	3.0	7.4	0.1	0.2	0.6
East Stratigraphic	Miocene	762.5	2,594.1	6,497.9	537.2	1,808.7	4,560.6	36.5	128.3	343.6
Total Miocene		764.9	2,601.7	6,516.1	538.9	1,814.1	4,573.4	36.7	128.7	344.6
Total		1,611.1	5,293.3	12,423.8	1,083.7	3,559.2	8,427.3	112.4	379.7	941.2

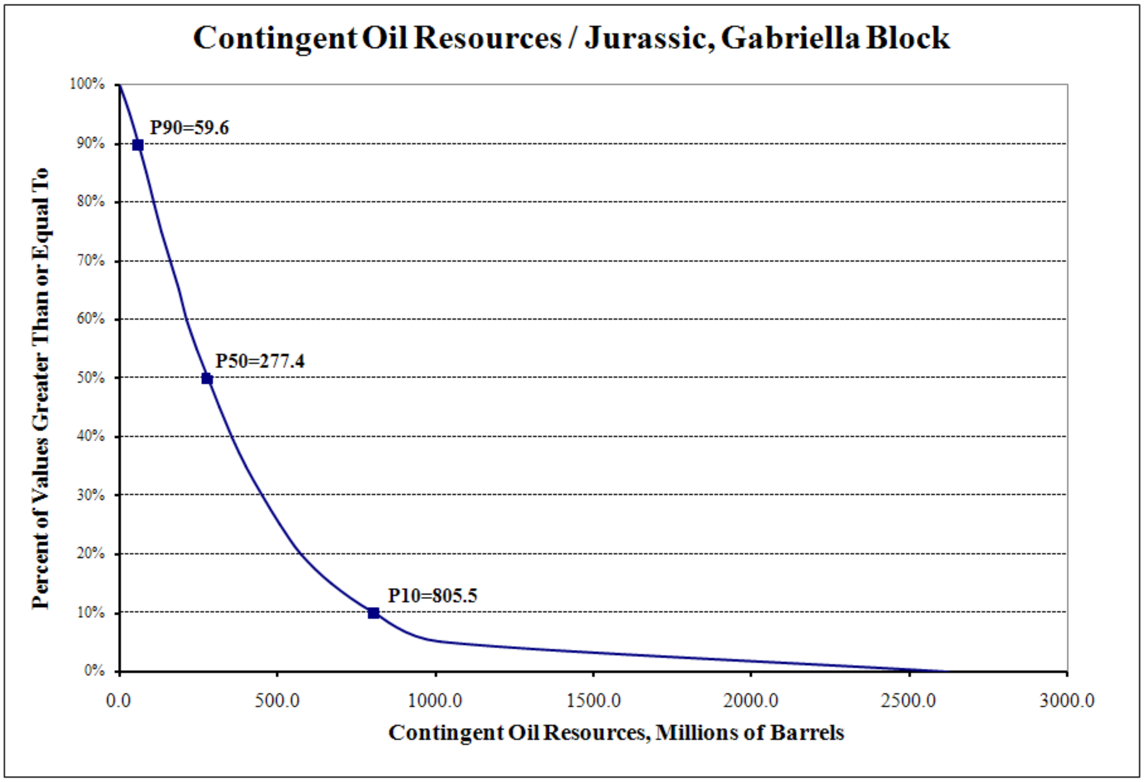


Figure 47 Distribution of Contingent Oil Resources

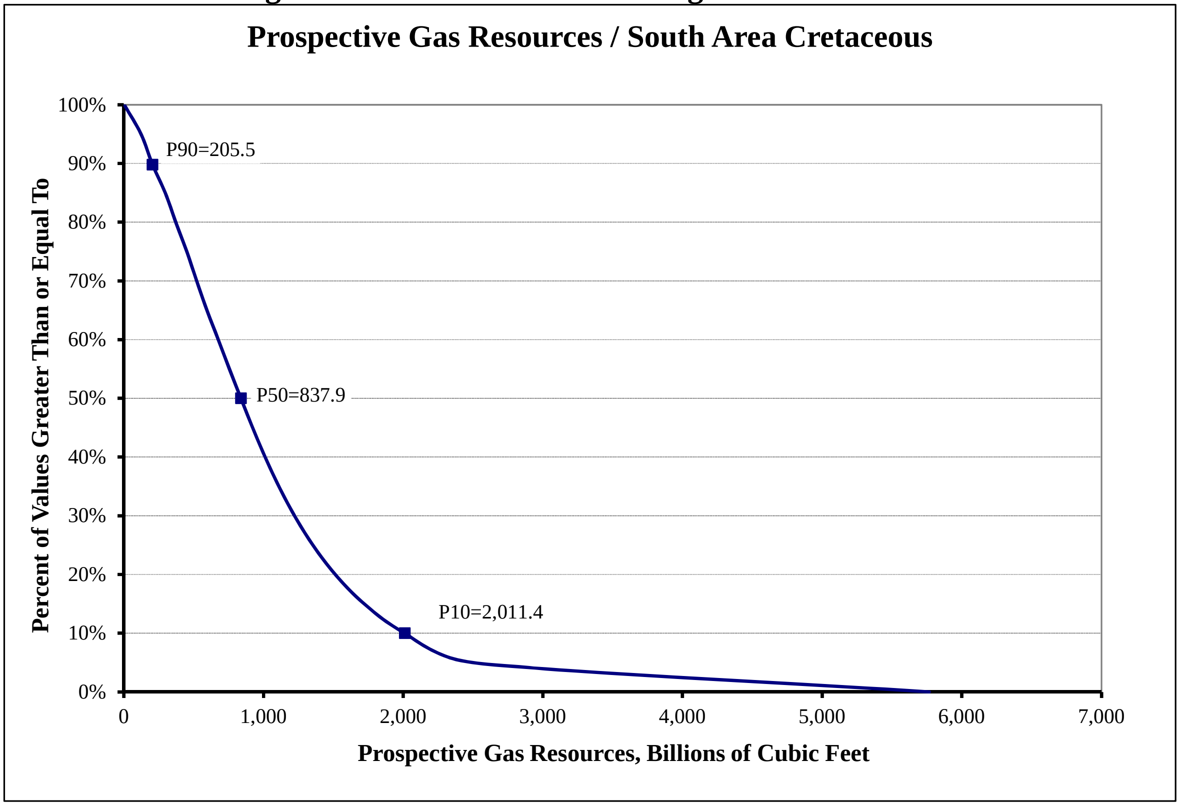


Figure 48 Distribution of Prospective Gas Resources, South Area Cretaceous

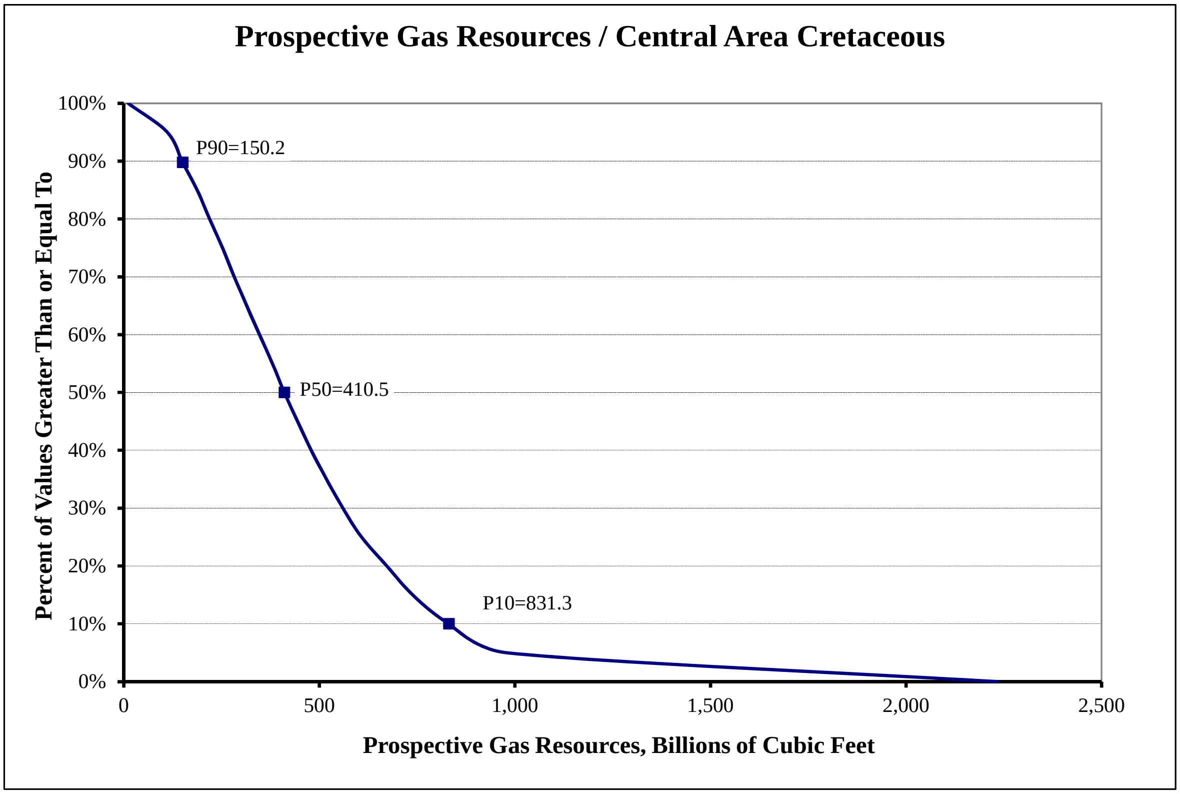


Figure 49 Distribution of Prospective Gas Resources, Central Area Cretaceous

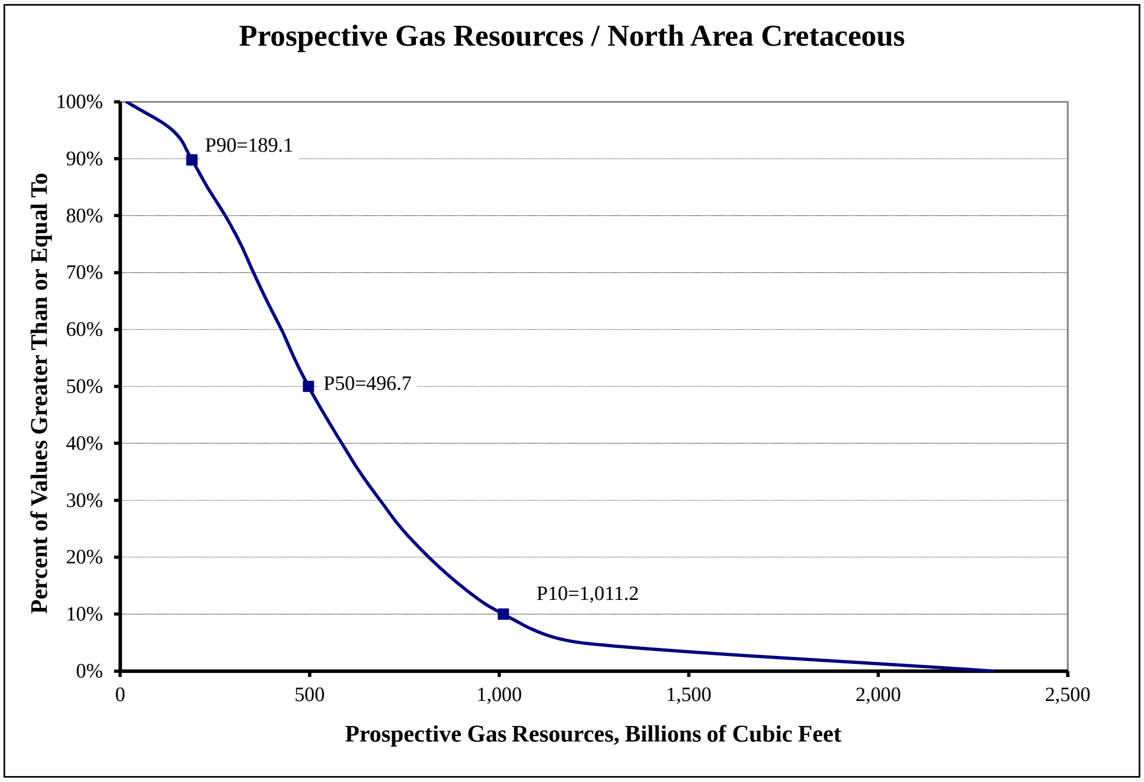


Figure 50 Distribution of Prospective Gas Resources, North Area Cretaceous

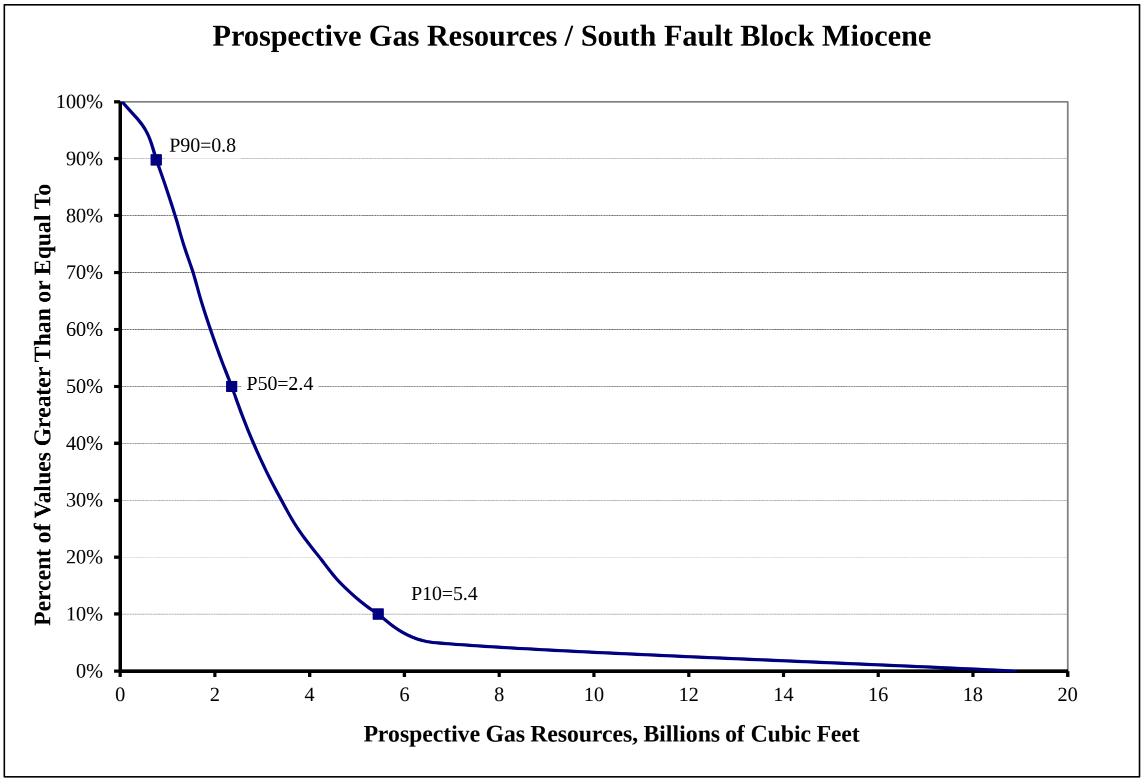


Figure 51 Distribution of Prospective Gas Resources, South Fault Block Miocene

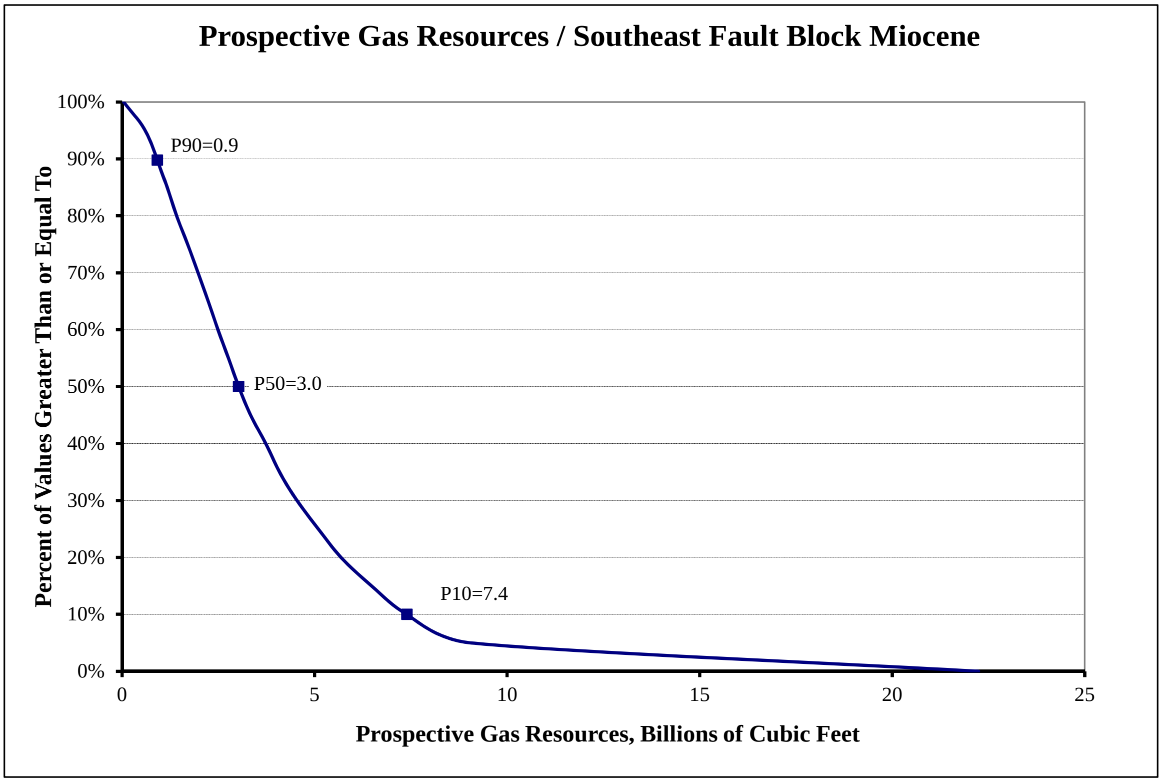


Figure 52 Distribution of Prospective Gas Resources, Southeast Fault Block Miocene

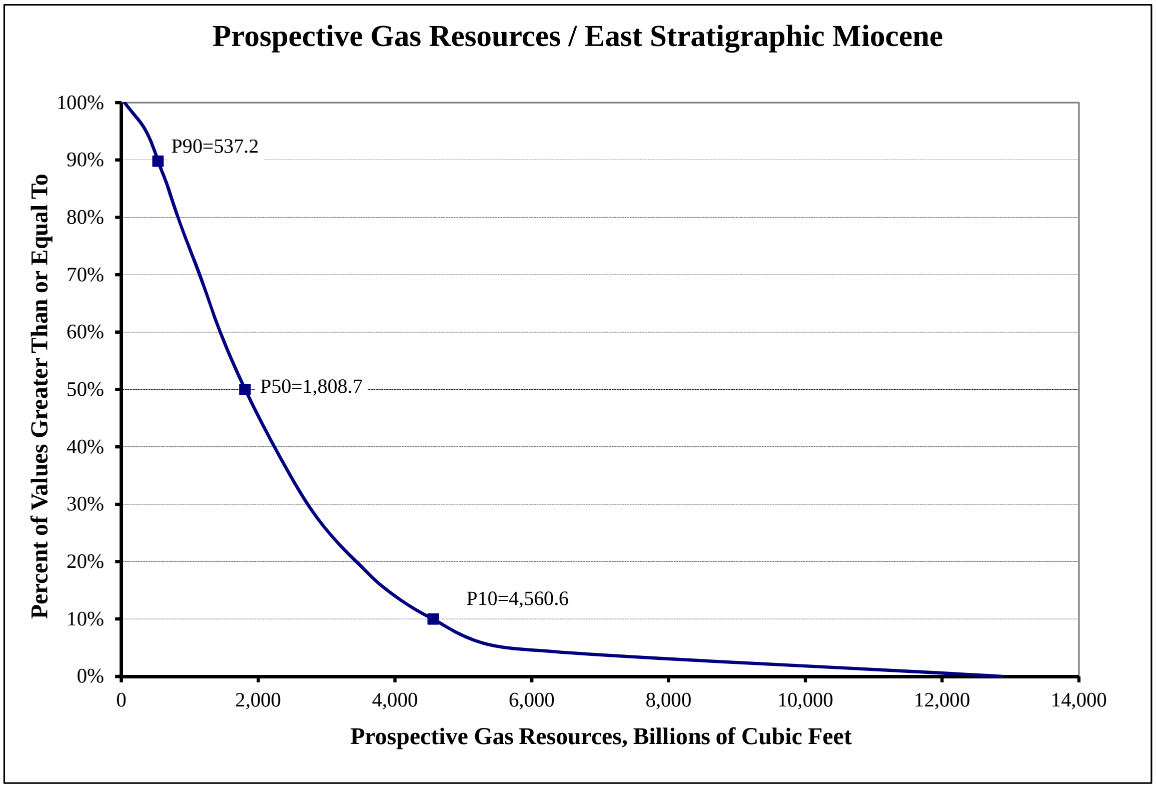


Figure 53 Distribution of Prospective Gas Resources, East Stratigraphic Miocene

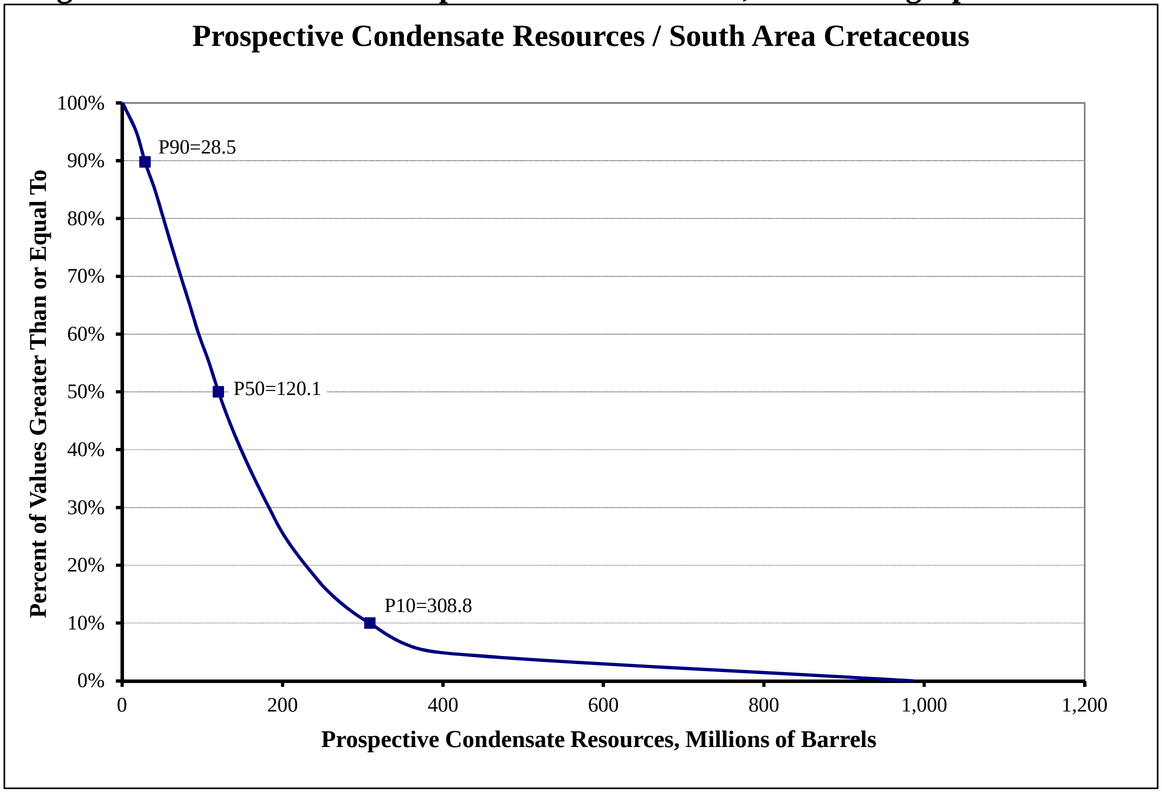


Figure 54 Distribution of Prospective Condensate Resources, South Area Cretaceous

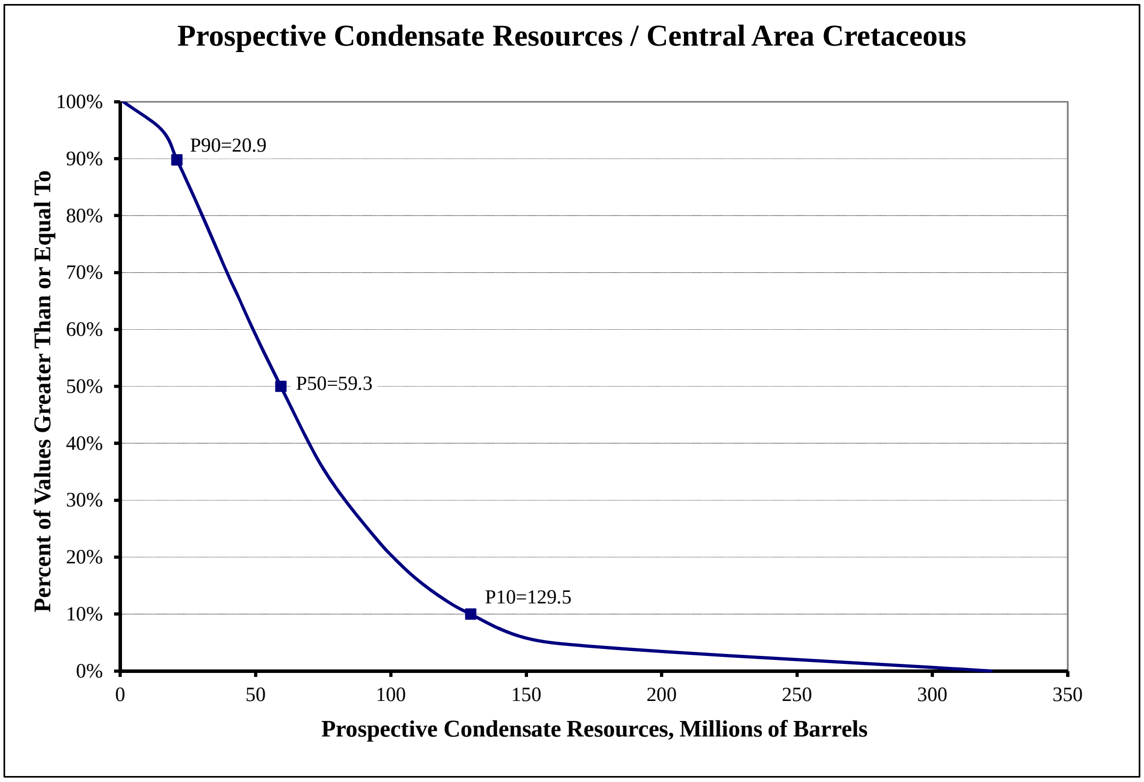


Figure 55 Distribution of Prospective Condensate Resources, Central Area Cretaceous

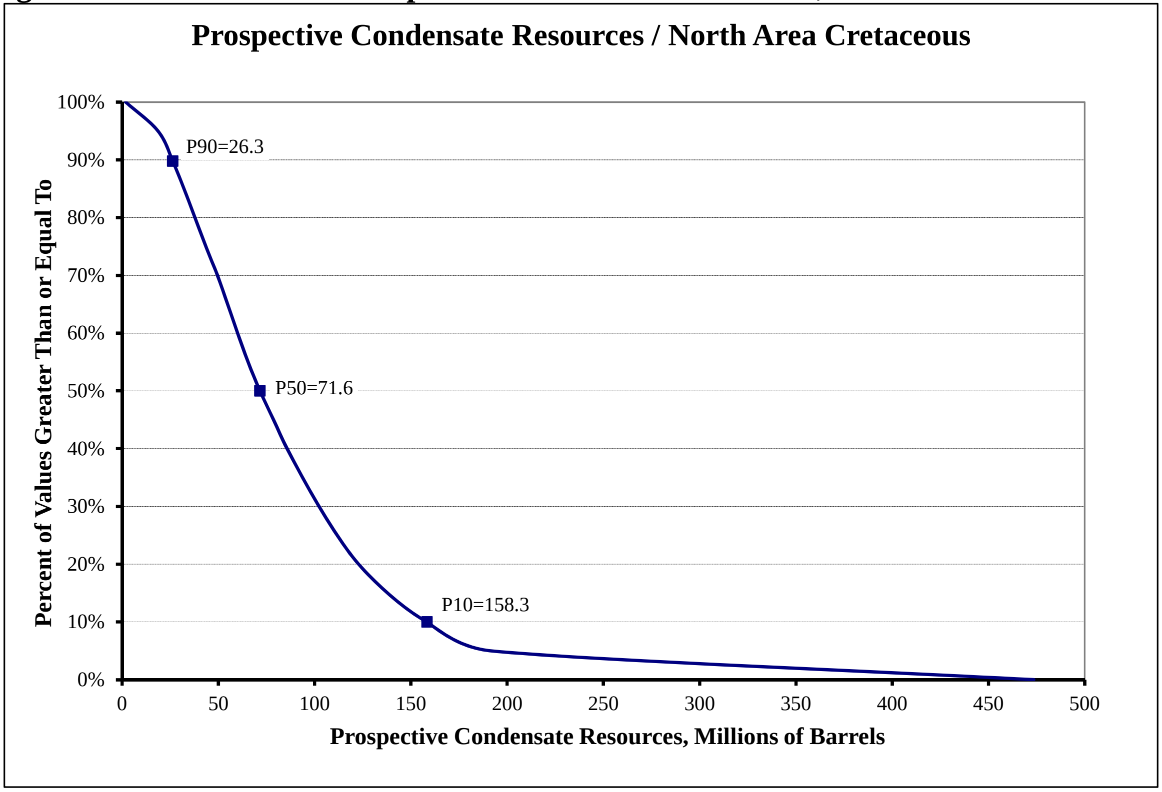


Figure 56 Distribution of Prospective Condensate Resources, North Area Cretaceous

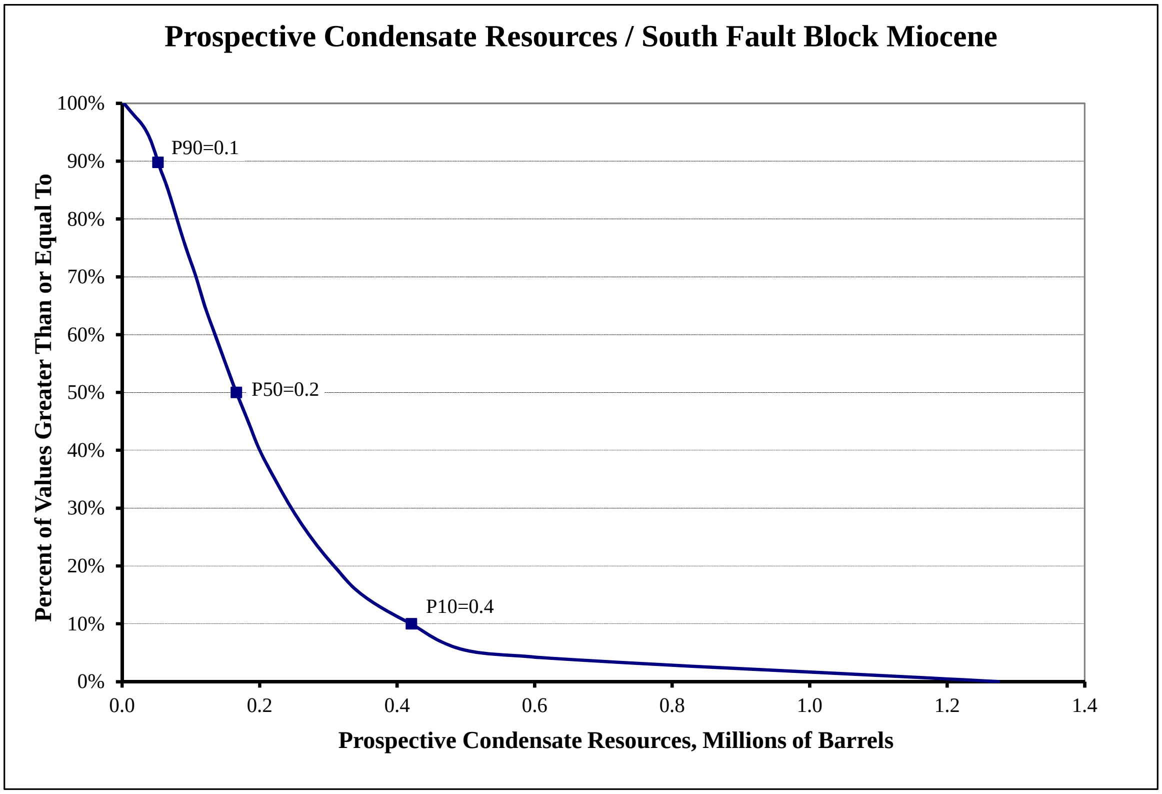


Figure 57 Distribution of Prospective Condensate Resources, South Fault Block Miocene

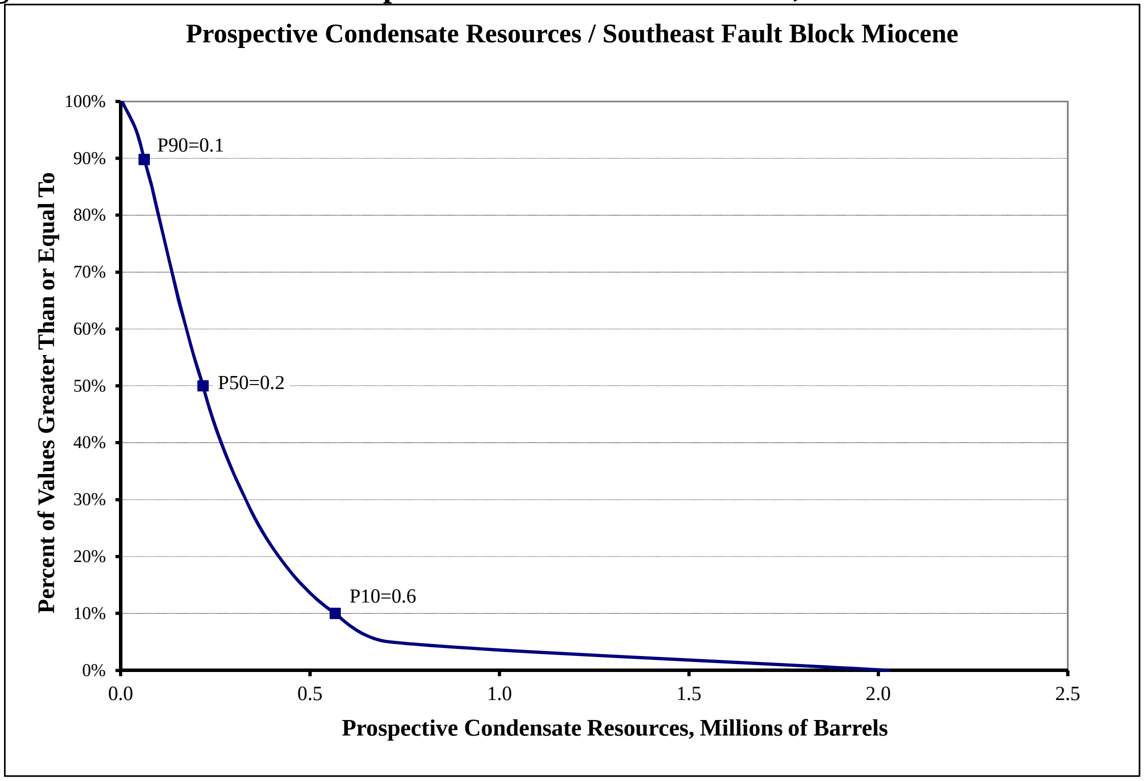


Figure 58 Distribution of Prospective Condensate Resources, Southeast Fault Block Miocene

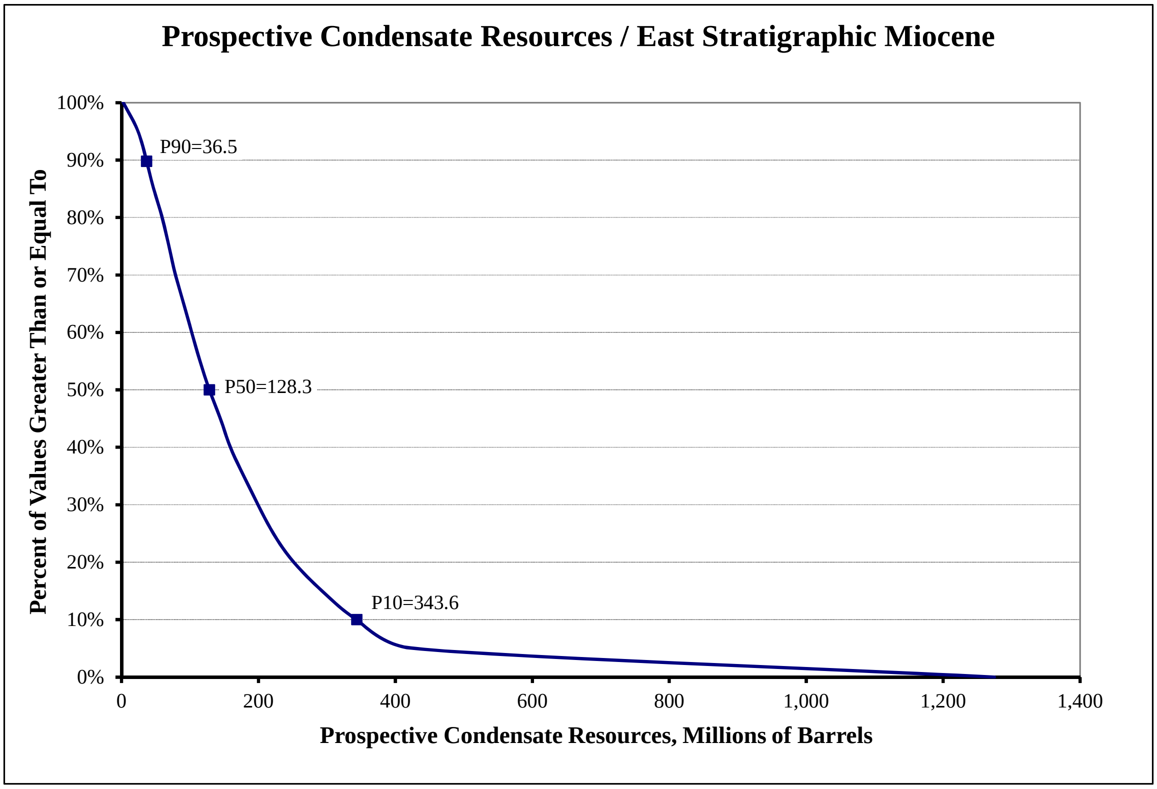


Figure 59 Distribution of Prospective Condensate Resources, East Stratigraphic Miocene

It should be noted that an economic evaluation has not been performed as part of this study.

10. REFERENCES

Adira Energy, Interim Report for License #378/"Gabriella" Offshore Israel. July 2010.

Bravo 1, Drilling and Completion Report, 1970, Belpecto Israel Ltd. Internal Report.

Conway, B. H., 1981; Dinoflagellate age sequence and thermal maturity of Delta 1 well offshore Natanya, Israel: GSI paleontology div. report # P/1/81.

Conway, B. H., 2002; The oil window in the offshore Yam West 1 borehole as detected by thermal alteration indices (TAI's), GSI report #16/2002.

Final Well Report Yam Yafo 1 Offshore Israel Drilling Section , Isramco Inc., Internal Report, 1995.

Final Well Report - Yam 2 Offshore Ashdod Israel, 1995; By Technical Oil Field Services.

Gardosh, Michael A., Druckman, Yehezkel and Buchbinder, Binyamin, 2009, The Late Tertiary Deep-Water Siliciclastic System of the Levant Margin-An emerging Play Offshore Israel: Search and Discovery #10211, adapted from oral presentation at AAPG 2009, http://www.searchanddiscovery.com/documents/2009/10211gardosh/ndx_gardosh.pdf.

Gardosh, M., Druckman, Y., Buchbinder, B., and Calvo, R., 2008, The Oligo-Miocene deepwater system of the Levant Basin: Geophysical Institute of Israel Report 446/426/08 and Geological Survey of Israel Report GSI/33/2008, 73 p.

Gardosh, M., Druckman, Y., Buchbinder, B., and Rybakov, M., 2006, The Levant Basin offshore Israel: stratigraphy, structure, tectonic evolution and implications for hydrocarbon exploration: Geophysical Institute of Israel Report 429/218/06 and Geological Survey of Israel Report GSI/14/2006, 119 p.

Geochemical Evaluation of Samples from the Yam Yafo 1 and Bessor 1 Wells, Geochem Group Limited, 1995, Report #95/9630/9361/001.

Gill, D., Conway, B.H., Eshet, F., Lipson, S., Peri, M, Grossowicz-Perlis, H., Rosenfeld, A., Siman-Tov, R., 1995; The Stratigraphy of Yam West 1, Borehole: GSI Report #13/95.

Gvirtzman, Z., Zilberman, E., and Folkman, Y., 2008, Reactivation of the Levant passive margin during the late Tertiary and formation of the Jaffa Basic offshore central Israel: Journal of the Geological Society, March 2008, 165, p. 563.

Hollingsworth, R. V., 1971; PaleoLab report: Belpetco Israel Ltd internal report.

Isramco INC., Israel branch, 1994. Final Well Report Yam Yafo-1 Offshore Israel Geological Section.

Isramco, Inc, Well Test Report - Production Test #2a, 22nd October – 29th October 1994.

Isramco, Inc, Well Test Report - Production Test #1, 28th August - 21st September 1994.

Isramco, Inc, Israel Branch, Drilling Program Yam Yafo #1 Well Med Tel-Aviv License Jan 1994.

Maquilken, J., 2000; Gal Permits Petroleum Geochemistry & Basin Modeling, BG Group Internal Report.

Moore, D., 1995; A Geochemical Evaluation of Twenty Six Rock Samples from the Interval 3150-5151 meters in the Yam West 1 Well: Report #95/9725/001/01 Prepared by Geochem Group Limited for Isramco Inc.

Petroleum Resources Management System, from the Society of Petroleum Engineers, 2007, World Petroleum Congress, American Association of Petroleum Geologists, and Society of Petroleum Evaluation Engineers.

Roberts. G., Peace, D., 2007; Hydrocarbon plays and prospectivity of the Levantine Basin offshore Lebanon and Syria from modern seismic data: GeoAfrica, Vol. 12, No. 3.

Rohbauer, C., Helfman, J. A., 1989; Drilling Program Yam 2 Well Offshore Israel, Isramco Inc., Internal Report.

Sanderson, C. and Oates, M., 2000, Petroleum Potential of Shiqma Yam License, Offshore Israel, September 2000.

Wennberg, O. P., Azizzadeh, M., Aqrawi, A. A. M., Blanc, E., Brockbank, P., Lyslo, K. B., Pickard, N., Salem, L. D., and Svånå, T., 2007, The Khaviz Anticline: an outcrop analogue to giant fractured Asmari Formation reservoirs in SW Iran: Geological Society, London, Special Publications; v. 270; p. 23-42.

Yam Yafo 1 Well Test Report - Production Test #2, Isramco Inc Internal Report, 1994.

11. CONSENT LETTER

Gustavson Associates LLC hereby consents to the use of all or any part of this Resource Evaluation Report for the Yitzhak Concession Block, as of August 31, 2011, in any document filed with any Canadian Securities Commission by Adira Energy.

Letha C. Lencioni
Vice-President, Petroleum Engineering
Gustavson Associates LLC

12. CERTIFICATE OF QUALIFICATION

I, Letha Chapman Lencioni, Professional Engineer of 5757 Central Avenue, Suite D, Boulder, Colorado, 80301, USA, hereby certify:

1. I am an employee of Gustavson Associates, which prepared a detailed analysis of the oil and gas properties of Adira Energy Ltd. The effective date of this evaluation is August 31, 2011.
2. I do not have, nor do I expect to receive, any direct or indirect interest in the securities of Santos Ltd or its affiliated companies, nor any interest in the subject property.
3. I attended the University of Tulsa and I graduated with a Bachelor of Science Degree in Petroleum Engineering in 1980; I am a Registered Professional Engineer in the State of Colorado, and I have in excess of 30 years' experience in the conduct of evaluation and engineering studies relating to oil and gas fields.
4. A personal field inspection of the properties was not made; however, such an inspection was not considered necessary in view of information available from public information and records, and the files of Adira Energy Ltd.

LETHA CHAPMAN LENCIONI
29506

Letha Chapman Lencioni
Chief Reservoir Engineer/
Vice-President, Petroleum Engineering
Gustavson Associates, LLC
Colorado Registered Engineer #29506

APPENDIX

PETROPHYSICAL SUMMATIONS

Well Name	YAM-YAFO 1	
Curve Name	Pay Cutoff	Cutoff
PHIE_E	yes	0.08
SW	yes	0.6
VCL	no	0.5

Zone Name	Top Depth (MD)	Bot Depth (MD)	Top Pay (MD)	Bot Pay (MD)	Gross Interval	Net Pay Int (TVD)	Avg Phi (Pay)	Avg Net Sw (Pay)	Avg VClay (Pay)	Pay/Gross Ratio	HPVH (Pay)	PHIH (Pay)	Avg Phi (Res)	Avg VClay (Res)	Res/Gross (Res)	PHIH (Res)
TLM YAFE	2,670.0	3,077.0	-	-	407.0	0.0	0.000	1.000	0.000	0.000	0.000	0.000	0.122	0.413	0.011	0.561
GVARAM	3,078.0	4,189.0	-	-	1,111.0	0.0	0.000	1.000	0.000	0.000	0.000	0.000	0.110	0.288	0.004	0.442
YAM	4,190.0	4,409.0	-	-	219.0	0.0	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
DELTA	4,410.0	4,894.0	-	-	484.0	0.0	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ZOHAR	4,895.0	4,962.0	4,896.9	4,897.7	67.0	0.9	0.139	0.367	0.108	0.013	0.079	0.125	0.121	0.146	0.022	0.182
KARMON	4,963.0	4,984.0	-	-	21.0	0.0	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SHEDEROT	4,985.0	5,032.0	5,008.6	5,008.9	47.0	0.4	0.131	0.484	0.136	0.009	0.027	0.052	0.122	0.219	0.017	0.098
BARNEA	5,033.0	5,350.0	5,201.0	5,292.3	317.0	2.9	0.136	0.265	0.179	0.009	0.291	0.395	0.118	0.273	0.019	0.721
INMARU	5,351.0	5,681.0	-	-	330.0	0.0	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
QEREN	5,682.0	5,780.0	-	-	98.0	0.0	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total					3,101.0	4.2					0.397	0.572				2.004

Well Name	YAM 2	
Curve Name	Pay Cutoff	Cutoff
PHIE	no	0.08
SW	yes	0.6
VCL	no	0.5

Zone Name	Top Depth (MD)	Bot Depth (MD)	Top Pay (MD)	Bot Pay (MD)	Gross Interval	Net Pay Int (TVD)	Avg Phi (Pay)	Avg Net Sw (Pay)	Avg VClay (Pay)	Pay/Gross Ratio	HPVH (Pay)	PHIH (Pay)	Avg Phi (Res)	Avg VClay (Res)	Res/Gross (Res)	PHIH (Res)
GVARAM	3,130.0	4,433.0	-	-	1,303.0	0.0	0.000	1.000	0.000	0.000	0.000	0.000	0.098	0.378	0.002	0.255
YAM	4,433.9	4,764.0	-	-	330.1	0.0	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
DELTA	4,764.9	5,234.0	-	-	469.1	0.0	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ZOHAR	5,234.9	5,350.0	5,313.6	5,316.3	115.1	2.7	0.145	0.335	0.000	0.025	0.280	0.421	0.145	0.000	0.025	0.421
Total					2,217.3	2.7					0.280	0.421				0.676

APPENDIX OF ABBREVIATIONS

Gr	Gamma Ray
Cali	Calipier
Rhoma	Corrected Density Matrix
Dtmac	Corrected DT Sonic Matrix
Sw	Water Saturation
PHIE	Effective Porosity
PHIT	Total Porosity
BVW	Bulk Volume Water
FRAC	Fracture Flag
VCL	Volume of clay (shale)
VSS	Volume of Sandstone
VLS	Volume of Limestone
VDOL	Volume of Dolomite

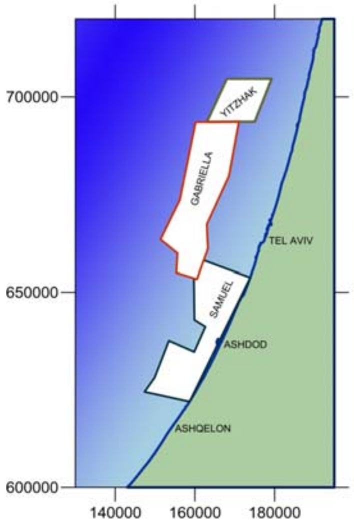
Part B

Yitzhak

LICENSE #380 / ‘YITZHAK’,

OFFSHORE ISRAEL

Effective Date: August 31, 2011
Prepared According To
National Instrument 51-101



Prepared for:

ADIRA ENERGY LTD

ADIRA ENERGY

Prepared by:

GUSTAVSON ASSOCIATES
5757 CENTRAL AVE. SUITE D BOULDER, COLORADO 80301 USA

REPORT FOR LICENSE #380 'YITZHAK', OFFSHORE ISRAEL

Effective Date: August 31, 2011

Prepared According To National Instrument 51-101

Prepared for:

ADIRA ENERGY LTD

ADIRA
ENERGY

Submitted by:

LETHA CHAPMAN LENCIONI
29506

Letha C. Lencioni
Registered Petroleum Engineer
State of Colorado #29506

GUSTAVSON ASSOCIATES
5757 CENTRAL AVE. SUITE D BOULDER, COLORADO 80301 USA

Independent Qualified Reserves Evaluators

1. EXECUTIVE SUMMARY

Adira Energy Israel, Ltd (Adira) was awarded the License to Block #380 / ‘Yitzhak ‘ (License) by the Israel Ministry of National Infrastructures as of 15 October, 2009 for an initial three year term. Block # 380 / ‘Yitzhak’ is located in the shallow water offshore of Israel. Adira engaged Gustavson Associates (Gustavson) in April 2011 to evaluate the hydrocarbon potential of the License, estimate the Prospective Resources and to prepare a Report under Canada's National Instrument 51-101, *Standards of Disclosure for Oil and Gas Activities*. Gustavson was provided with certain data by Adira including a new 3-D dataset recently acquired by Adira that covers the Yitzhak block. The new 3-D data was delivered in the form of a Quick-Look cube by WesternGeco. The final processing of the 3-D volume is scheduled to be completed in December, 2011.

The primary prospect on this block is the Jurassic aged carbonate structural feature that had tested oil from the Jurassic Zohar horizon in the Yam-Yafo 1 well which is located in Block #378 / ‘Gabriella in 1994. The Delta 1A well penetrated the Jurassic and is located on the Yitzhak block but it was not drilled deep enough to test the Zohar horizon. The other prospects on this block are shallower and younger horizons that are interpreted to be gas bearing. The review of well and test data revealed that there were a total of three Jurassic penetrations on trend that had shows or tested oil. The evaluation includes a petrophysical analysis of the well log data from the Yam-Yafo 1 and the Yam 2 (south of the block) in the Jurassic section along with a fracture analysis. These two wells both tested 44 to 48 degree API oil at rates in excess of 800 barrels per day.

Secondary prospects on this block are in the Cretaceous aged section. Seismic interpretation has identified several prospects with potential hydrocarbon accumulations. The hydrocarbons in these sections are expected to be predominantly gas with condensate. Only those prospects that are contained within the block boundaries have been included in the resource estimates. There may be more Cretaceous, Miocene and even Pliocene prospects contained within the block. The final processed version of the new 3D seismic survey may show additional potential prospects.

A probabilistic estimate of Gross[1] Prospective Resources was made using the parameters from the available data. The following tables show the estimated Gross Prospective Resources for the Jurassic of the Yitzhak Block in millions of barrels of oil (MMBO) in Table 1 and the Cretaceous in Billions of Cubic Feet of Gas (BCF) and millions of barrels of condensate (MMBC) in Table 2.

Table 1 Summary of Gross Prospective Resource Estimates, Jurassic Oil Prospects

	Low Estimate	Best Estimate	High Estimate
Oil Resources, MMBO	4.5	20.4	64.4

Table 2 Summary of Gross Prospective Resource Estimates, Cretaceous Gas Prospects

		Prospective Gas Resources, BCF, Estimate			Prospective Condensate Resources, MMB, Estimate		
Prospect	**Reservoir**	**Low**	**Best**	**High**	**Low**	**Best**	**High**
Talme Yafe	Cretaceous	34.6	147.3	382.5	4.8	20.9	58.9
West	Cretaceous	198.5	842.2	2,254.7	27.2	123.5	346.5
Total		**233.1**	**989.5**	**2,637.2**	**32**	**144.4**	**405.4**

The prospects on this block have not been tested; therefore, they contain Prospective Resources. Prospective Resources are defined as "those quantities of petroleum estimated, as of a given date, to be potentially recoverable from undiscovered accumulations by application of future development projects. Prospective Resources have both an associated chance of discovery and a chance of development. Prospective Resources are further subdivided in accordance with the level of certainty associated with recoverable estimates assuming their discovery and development and may be sub-classified based on project maturity."[2] There is no certainty that any portion of the Prospective Resources will be discovered. If discovered, there is no certainty that it will be commercially viable to produce any portion of the resources.

The resource estimates in this report relied on data provided by the Client prior to August 31, 2011. At the time of the writing of this report it is known that the seismic data would be

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[1] Attributable to 100% of the Interest in the Block

[2] Society of Petroleum Evaluation Engineers, (Calgary Chapter): Canadian Oil and Gas Evaluation Handbook, Second Edition, Volume 1, September 1, 2007, pg 5-7.

processed further and therefore changes in the final output of the seismic data may cause adjustments to be made to future interpretations. At this time it is anticipated that any future changes would not have a substantial impact on future resource estimates.

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3. INTRODUCTION

1.1 AUTHORIZATION

Gustavson Associates LLC (the Consultant) has been retained by Adira Energy Israel, Ltd to prepare a Report under Canada's National Instrument 51-101, *Standards of Disclosure for Oil and Gas Activities*, regarding the entire concession position License # 380 / ‘Yitzhak’ block in the offshore of the country of Israel.

1.2 INTENDED PURPOSE AND USERS OF REPORT

The purpose of this Report is to support the Client’s potential filing with the Toronto Stock Exchange (TSX).

1.3 OWNER CONTACT AND PROPERTY INSPECTION

This Consultant has had frequent contact with the Client and their partners. This Consultant has not personally inspected the subject property but did meet with the exploration professionals in the offices of Adira Energy Israel, Ltd in Kansas City, Kansas.

1.4 SCOPE OF WORK

This Report is intended to describe and quantify the Prospective Resources contained within the subject concession. This Report does not attempt to place a Market Value thereon.

1.5 APPLICABLE STANDARDS

This Report has been prepared in accordance with Canadian National Instrument 51-101. The National Instrument requires disclosure of specific information concerning prospects, as are provided in this Report.

1.6 ASSUMPTIONS AND LIMITING CONDITIONS

The accuracy of any estimate is a function of available time, data, and of geological, engineering, and commercial interpretation and judgment. While the resource estimates presented herein are believed to be reasonable, they should be viewed with the understanding that additional analysis or new data may justify their revision. Gustavson Associates reserves the right to revise its opinions of reserves and resources, if new information is deemed sufficiently credible to do so.

1.7 INDEPENDENCE/DISCLAIMER OF INTEREST

Gustavson Associates LLC has acted independently in the preparation of this Report. The company and its employees have no direct or indirect ownership in the property appraised or the area of study described. Ms. Letha Lencioni is signing this Report, which has been prepared by her as a Qualified Reserves Evaluator, with the assistance of others on the Gustavson staff. Our fee for this Report and the other services that may be provided is not dependent on the amount of resources estimated.

4. DISCLOSURES REGARDING PROSPECTS

1.8 LOCATION AND BASIN NAME

The Adira # 380 / ‘Yitzhak’ block is located in the eastern Mediterranean offshore of Israel in the Levant or Levantine Basin (Figure 1). The Yitzhak License is centered approximately 10 kilometers off the Israeli coast between Netanya in the North and Ashdod in the South. The Yitzhak License covers a total area of 127,700 dunam[3] (approximately 127.7 square kilometers or 32,000 acres) and is in relatively shallow water with depths between 60 and 250 meters.

1.9 GROSS AND NET INTEREST IN THE PROPERTY

The Yitzhak License Working Interest is owned by a partnership composed of Adira Energy Israel, Ltd 85% and Brownstone Ventures Inc 15%. Adira is the operator of the license.

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[3] 1 dunam is 0.1 hectare or 0.2471044 acres or 1000 square meters

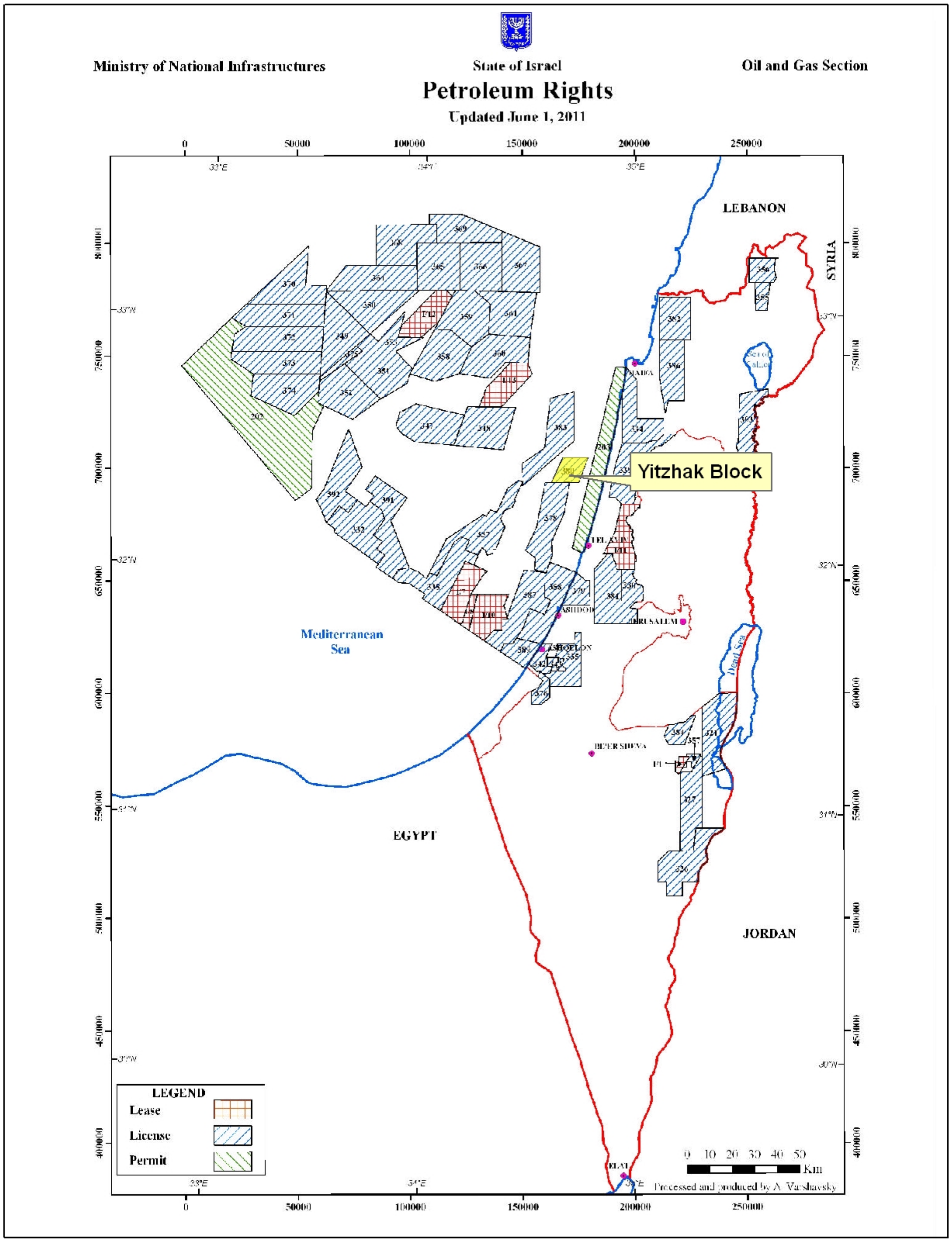

Figure 1 Yitzhak Block Area

1.10 EXPIRY DATE OF INTEREST

Adira Energy Israel, Ltd (Adira) was issued License #380 / Yitzhak by the Israel Ministry of National Infrastructure on October 15, 2009. The License was granted for an initial term of three years from the issue date, which is October 15, 2012. Certain terms and conditions were mandated by the amended work program as follows:

1. Gathering and studying the existing geophysical and geological material within 3 months from the date of the granting the license, by January 15, 2010.
2. Reprocessing of the 2D seismic lines and submission of a report summarizing the potential of the Yitzhak area within 12 months, by July 1, 2011.
3. Signing of an agreement with a drilling contractor within 24 months, by July 1, 2012.
4. Commencing drilling a well to the Jurassic to the depth of approximately 5,000 meters within 30 months, by December 1, 2012.

1.11 DESCRIPTION OF TARGET ZONES

The subject prospect is a Jurassic age carbonate that has been seen and tested in 1994 by the Yam-Yafo 1 well, which is located on the Gabriella block to the south. The Jurassic carbonate has been subdivided into three units, the Zohar, Shederot, and Barnea.

1.12 DISTANCE TO THE NEAREST COMMERCIAL PRODUCTION AND SUCCESSFUL WELL TESTS

Oil has been produced onshore from the Heletz Field and the Ashdod Field from Jurassic aged carbonates 20 to 40 kilometers to the east. Gas has been produced from the Mari B Field from Miocene aged sands 80 kilometers to the southwest. In 1990 and 1994, two wells had successful tests of sweet crude oil from the Jurassic section. The Yam 2 well, located on the Shemen block to the south of Gabriella, tested 800 barrels of oil per day of 47° API gravity oil and the Yam-Yafo 1 well, located on the Gabriella block to the south of Yitzhak and on trend, tested a maximum rate of 821 barrels of oil per day of 44° API gravity oil. Both wells were considered to be non-commercial by the operator, Isramco, at the time.

1.13 PRODUCT TYPES REASONABLY EXPECTED

The Jurassic carbonate zone in the Yitzhak prospect would contain light sweet crude oil with a gravity of 44° API. The Cretaceous and Miocene prospects are expected to contain natural gas with condensate.

1.14 RANGE OF POOL OR FIELD SIZES

The estimate of the size of the area of the Jurassic carbonate zone in the Yitzhak prospect ranges from 1.0 square kilometers to 8.5 square kilometers. The thickness of the oil accumulation is estimated to be from 28 to 168 meters. Estimated Prospective Resources for the Jurassic range from a low estimate of 4.5 MMBO to a high estimate of 64.4 MMBO.

The estimate of the size of the area of the Cretaceous zone in the Yitzhak prospect ranges from 1.4 square kilometers to 9.5 square kilometers. The thickness of the gas accumulation is estimated to be from 40 to 230 meters. Estimated Prospective Resources for the Cretaceous range from a low estimate of 233 BCF and 32 MMB to a high estimate of 2.6 TCF and 405 MMB of Condensate.

These estimates are based on the interpretation of the data provided.

1.15 DEPTH OF THE TARGET ZONE

The top of the Jurassic carbonate zone in the Yitzhak prospect, known as the Zohar unit, would be found at approximately 4,035 meters depth. The entire prospective Jurassic section that includes the Shederot and Barnea carbonates would extend to 4,451 meters depth. Additional deeper oil bearing carbonates may be encountered in this area. The Cretaceous zone would be encountered at approximately 2,075 meters.

1.16 ESTIMATED DRILLING AND COMPLETION COST

Current estimated cost to drill and complete a well to a total depth of 5,000 meters true vertical depth is US$64.1MM. This includes rig mobilization cost of US$0.9MM, dry hole costs US$50.2MM and completion costs of US$13.9MM. Due to the water depths, depth of the target objective, and pressures expected to test the Jurassic prospect, a large jack-up rig or semi-submersible would be needed.

1.17 EXPECTED TIMING OF DRILLING AND COMPLETION

According to the terms of the License agreement for Yitzhak, Adira will commence drilling a well to the Jurassic to the depth of approximately 5,000 meters by April 15, 2012. The drilling, testing and completion is estimated to take 120 days or until August 14, 2012.

1.18 EXPECTED MARKETING AND TRANSPORTATION ARRANGEMENTS

In the event of a discovery of commercial quantities of oil, a platform would be installed with production facilities that would be connected to a pipeline that would take the oil to shore. Currently, gas produced at the Mari B platform to the southwest is transported through a gas pipeline that crosses the Shemen block to the south of the Gabriella block and makes landfall in Ashdod (Figure 2). If gas is found on Yitzhak it could be produced with the construction of a pipeline that would tie into the line to the south. An oil pipeline could be constructed along the same path as the existing gas pipeline or, if permitted, could be built directly to shore to the Tel Aviv area.

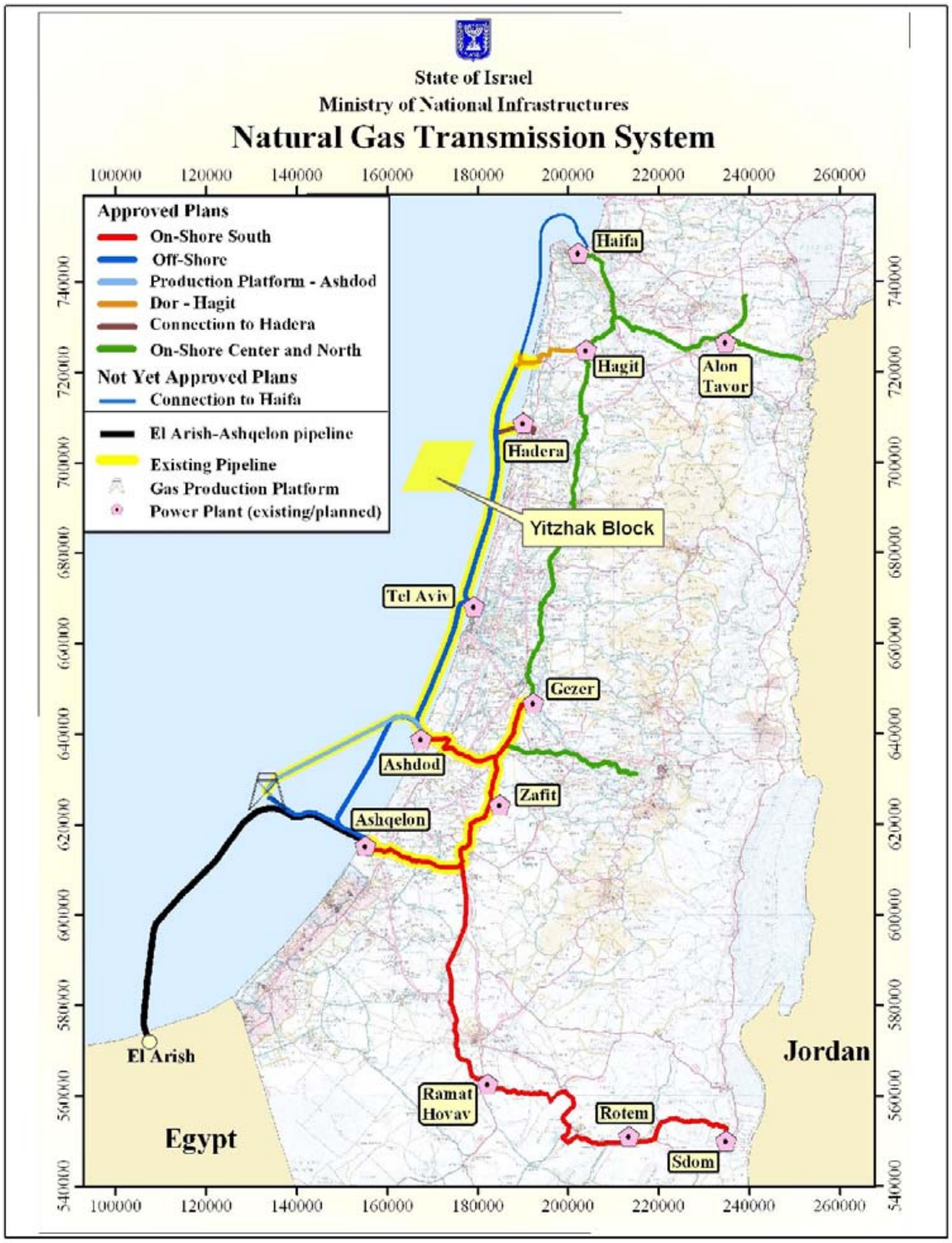

Figure 2 Current and Planned Israel Infrastructure

1.19 IDENTITY AND RELEVANT EXPERIENCE OF THE OPERATOR

1.19.1 Adira Energy Ltd[4]

Adira Energy Ltd is a Canadian domiciled Oil & Gas exploration and development company that explores for oil and gas onshore and offshore Israel. It has acquired four petroleum exploration licenses (or interests therein); the Eitan, Gabriella, Yitzhak, and Samuel Licenses. The onshore acreage includes the Eitan License which covers 125,700 dunam (126 square kilometers, 31,060 acres) in the Hula Valley located in Northern Israel. The offshore acreage in addition to the subject Yitzhak License includes the Gabriella License covering 390,000 dunam (approximately 390 square kilometers or 97,000 acres) centered approximately 17 kilometers offshore Israel between Ashdod and Netanya, directly to the South of and contiguous to Yitzhak License, the Samuel License covering 361,000 dunam (361 square kilometers, 89,205 acres) adjacent to the coast offshore Israel between Ashkelon and Rishon LeTziyon, southeast of and contiguous to Gabriella License, with indications of gas.

Adira Energy offers investors a unique opportunity to participate in a previously underexplored, new oil & gas frontier, Israel. The corporate vision is to build a world class energy company with the aim of achieving energy self-sufficiency for the State of Israel.

Adira Energy Ltd is led by an excellent team with a track record of project execution through the ability of their technical and executive management.

1.19.2 Gustavson Associates, LLC

Gustavson Associates, LLC is a global consulting firm consisting of geologists, geophysicists, and petroleum engineers, as well as economists and financial experts dedicated to the business of problem solving in all aspects of natural resource evaluations. Gustavson's work ranges from the first steps of prospecting to design and assessment of production facilities. The company has a 30+-year track record of quality consulting to industry and governments worldwide and utilizes

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[4] Adira Energy Ltd

the latest technology to quickly and economically analyze large volumes of data. Technology services include basin analysis, resource favorability studies, 3-D and 2-D seismic interpretation, source rock and maturation studies, alongside economic assessments encompassing reserve estimates and financial forecasts, reservoir analysis, secondary and EOR Studies, and expert testimony. Report services include third party reserve and resource reports, NI 51-101, SEC, mineral appraisals, and other property evaluations. Gustavson Associates is working with Adira on this project.

1.20 RISKS AND PROBABILITY OF SUCCESS

1.20.1 Jurassic

The subject Jurassic prospect, as is inherent with all oil and gas prospects, has a level of risk that can be characterized based on the available data. This particular prospect has data and information that helps to mitigate the risk as compared to other prospects. The Yitzhak Jurassic prospect is considered to be reasonably well documented with seismic data and nearby well test information. However, since the Yitzhak structure has not been tested the first well would be an exploratory well. The quantification of the risk or the chance of finding commercial quantities of hydrocarbons in any single prospect can be characterized with the following variables:

Structure: defined as the presence of a structure or stratigraphic feature that could act as a trap for hydrocarbons;
Seal: defined as an impermeable barrier that would prevent hydrocarbons from leaking out of the structure;
Reservoir: defined as the rock that is in a structurally favorable position having sufficient void space present whether it be matrix porosity or fracture porosity to accumulate hydrocarbons in sufficient quantities to be commercial; and
Presence of Hydrocarbons: defined as the occurrence of hydrocarbon source rocks that could have generated hydrocarbons during a time that was favorable for accumulation in the structure.

Table 3 shows the Chance of Success (COS) or favorability that the above defined variables would occur. The Overall COS is the product of all four variables.

Table 3 Chance of Success (COS) for the Zohar (Jurassic)

Chance of Success (COS)	%	Comments
Structure	90	Seismic and mapping data indicates the presence of a structure
Seal	80	Good seal evidenced by overpressure in the Jurassic
Reservoir	50	Production test and petrophysical analysis
Presence of HC	90	Production test
Overall	**32.4**	The product of the above factors

The predominant risks relate to the presence of a fracture system that could create an effective reservoir sufficient for the creation of commercial accumulations of oil and gas.

1.20.2 Cretaceous

The Cretaceous and Miocene prospects are based mainly on seismic data response with very little well control and are therefore higher risk targets. The wells that have been drilled in the area to date have targeted deep structures and the wells encountered few reservoir quality sands or carbonates. However, with the discovery of the Miocene gas at Tamar and Dalit along with the Cretaceous discovery in the offshore of Egypt there is exploratory potential for finding hydrocarbons in these sediments. The quantification of the risk or the chance of finding commercial quantities of hydrocarbons in any single Cretaceous prospect can be characterized in Table 4.

Table 4 Chance of Success (COS) for the Cretaceous

Chance of Success (COS)	%	Comments
Structure	75	Seismic and mapping data indicates the presence of structures
Seal	70	Thick shale intervals should provide seals
Reservoir	45	Amplitudes and sediment thick areas on structures seen on seismic
Presence of HC	85	Shows in the wells
Overall	**20.1**	The product of the above factors

1.21 HISTORY AND LOCATION OF YITZHAK BLOCK

The Yitzhak block is located in shallow water (between 60 and 250 meters) offshore of Israel in the eastern part of the Levant or Levantine Basin (Figure 3). The Levant Basin is a thick sedimentary basin filled with Late Paleozoic to recent aged deposits[5] and is located in the eastern Mediterranean north of the Nile River Delta and west of the countries of Lebanon and Israel. The basin has been subjected to several episodes of tectonic deformation and sediment deposition which includes both carbonates and clastics. The basin is part of the Afro-Arabian plate that is moving along the Dead Sea transform fault generally to the north and colliding with the Eurasian Plate which has resulted in regional tectonic compression that is called the "Syrian Arc".

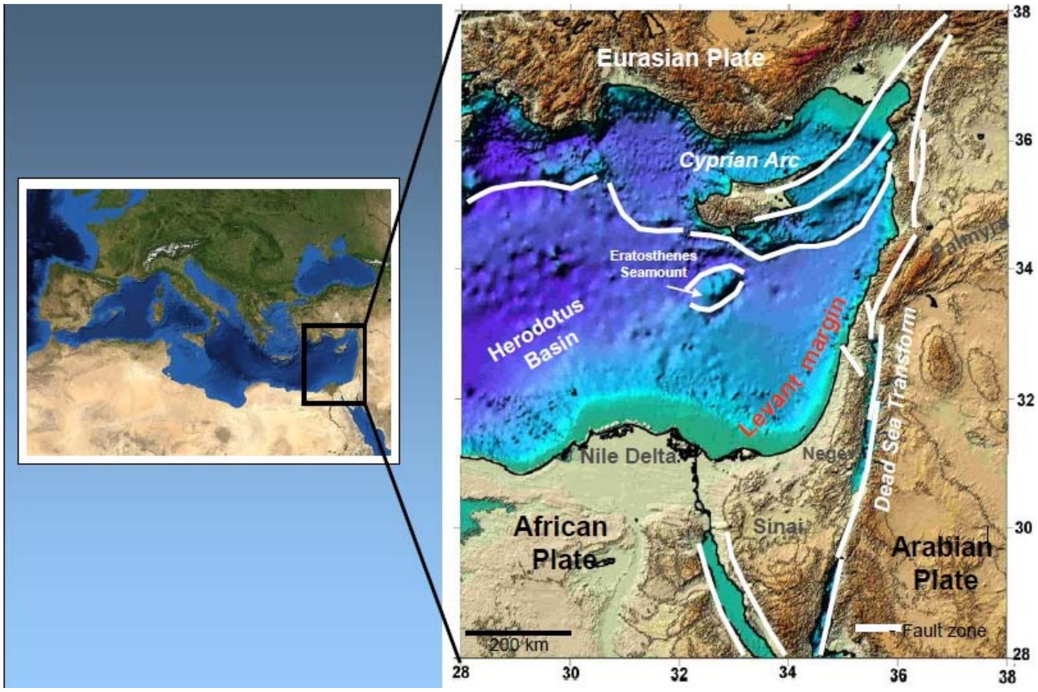

Figure 3 Map Showing Location of Levant Basin in the Eastern Mediterranean

The recent USGS assessment for the Levant Basin area, shown in Figure 4, established the potential recoverable oil and gas in the offshore of Israel as 1.7 billion barrels of oil (BBO) and 122.0 trillion cubic feet of natural gas (TCF).

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[5] Roberts and Peace, 2007

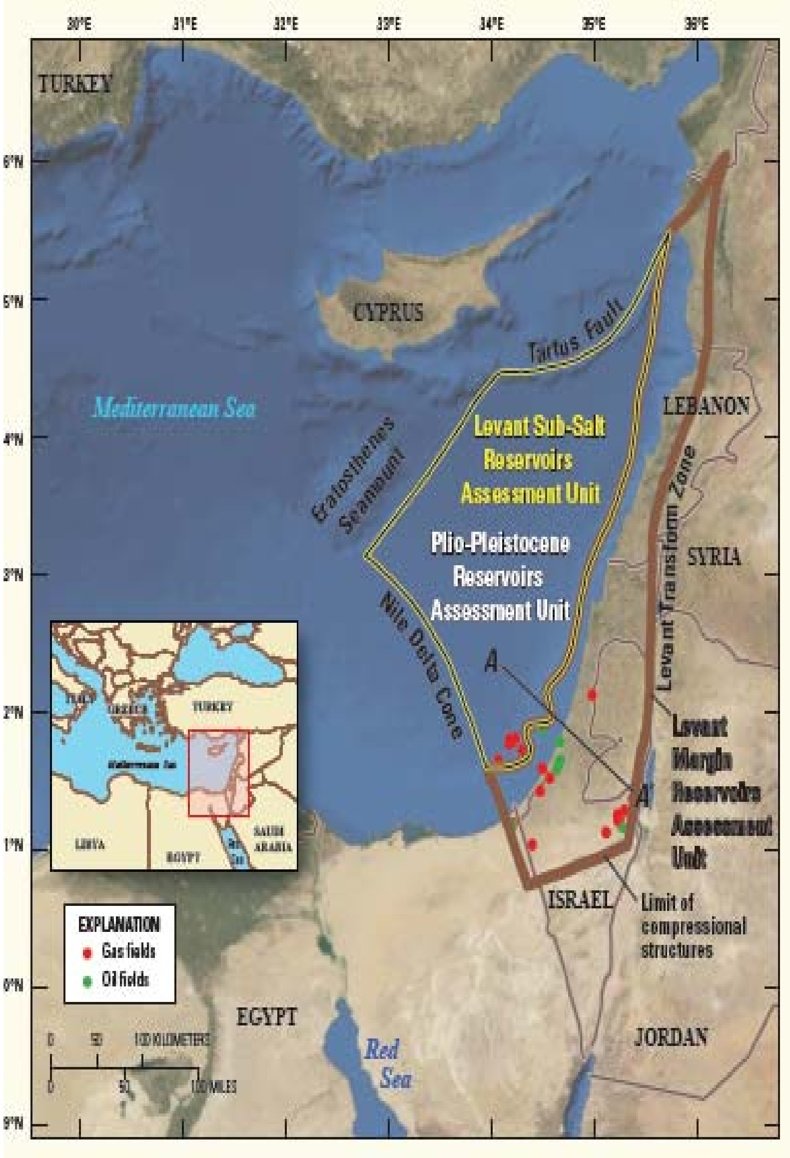

Figure 4 USGS Assessment Area in the Levant Basin

From 1969 through the present time, there has been sparse and intermittent drilling in offshore Israel (Figure 5) and mostly in the shallower water. Due to economic, technological or political issues, the offshore of Israel has been underexplored until recently.

The government of Israel is very interested in having these potential oil and gas resources explored and developed. The only major oil production that has been established in Israel to date is in the onshore Ashdod field which produced from the Zohar equivalent and the Heletz-Kokhav field (Figure 5). Discovered in the mid 1950's, this Mesozoic oil field complex produced 17.2 MMBO from the Lower Cretaceous and Jurassic.

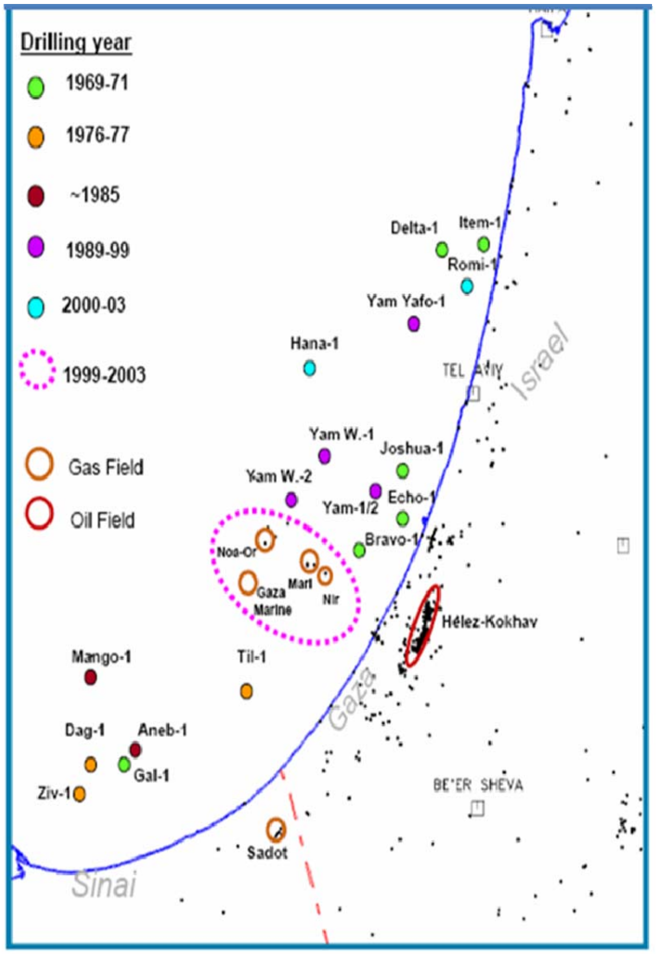

Figure 5 Offshore Drilling History and Main Hydrocarbon Occurrences (Gardosh)

The Delta 1 and 1A wells were drilled by Belpetco Israel Ltd in 1970 (Figure 5). The Delta 1 well was drilled to 4,171 meters where the hole was abandoned. The Delta 1A was drilled as a sidetrack out of the Delta 1 well and drilled to a Total Depth of 4,423 meters. The well encountered minor oil shows in several Cretaceous zones and was Plugged and Abandoned. The well did reach the Jurassic but did not drill deep enough to see the Jurassic Zohar interval. In 1990 and 1994, two wells had successful tests of sweet crude oil from the Jurassic section. The Yam 2 well located on the Shemen block to the south (Figure 5) tested 800 barrels of oil per day of 47° API gravity oil and the Yam-Yafo 1 well located on the Gabriella block tested at a maximum rate of 821 barrels of oil per day of 44° API gravity oil. A review of the test data indicates that the Yam 2 well could have flowed at a maximum rate of 1,000 barrels of oil per day and the Yam-Yafo 1 produced 1,300 barrels per day of total fluids.

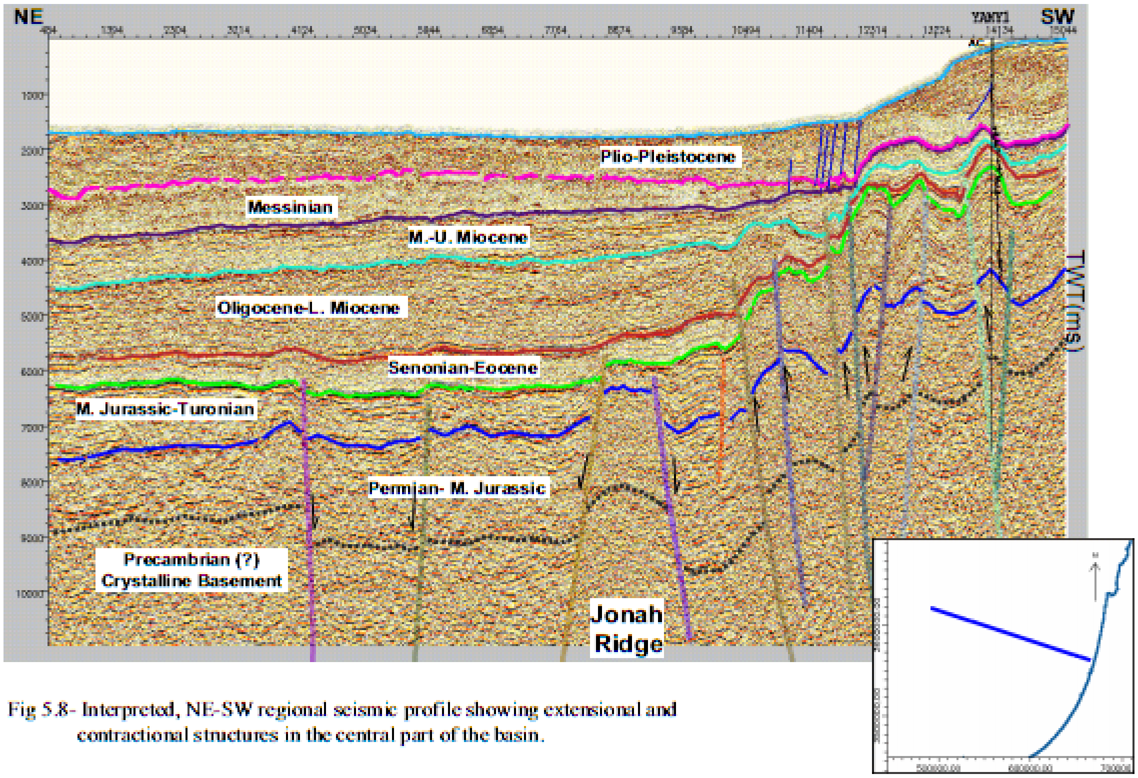

Fig 5.8- Interpreted, NE-SW regional seismic profile showing extensional and contractional structures in the central part of the basin.

Figure 6 Seismic Profile through the Yam Yafo 1 Well (Gardosh et al, 2008)

The seismic section depicted in Figure 6 is from an older 2-D seismic line which illustrates the major unconformities and stratigraphy in the area. It also shows the Jurassic anticline that was tested in the Yam Yafo 1 well that penetrated 903 meters of the section.

The Delta-1 well that was drilled on the Yitzhak block did not penetrate the Zohar formation. Based upon well control and seismic interpretation, drilling was stopped in the Delta formation only 200 to 300 meters above the potential reservoir. The stratigraphic section in Delta-1 well is quite similar to the Yam-Yafo 1 well. Therefore, it is assumed that a similar reservoir could exist in Delta-1 approximately 200 meters (or more) below the total depth of the well. Almost the entire section in Delta-1 was deposited in an open marine to slope environment.

During the past few years, trillions of cubic feet in proven gas reserves from several Israeli and Gaza fields have been discovered. This is an extremely important development for a country with very limited domestic energy resources. The Mari, Noa and Or fields, located approximately 80 kilometers southwest of Yitzhak, are large natural gas fields with estimated reserves of 1.7 to 3.0 TCF of gas. Both were discovered by the Yam Tethys Joint Venture, consisting of Noble (formerly Samedan) Mediterranean, Avner Oil Limited Partnership, Delek Drilling Ltd Partnership, and several other Delek group entities. In 2000, the British Gas-Isramco group announced that it had discovered a large gas field 19.3 kilometers offshore at its Nir 1 well, which is located south of the Gabriella block boundary. The well reportedly discovered gas reserves of 274 billion cubic feet (BCF) but was declared non-commercial. Deliveries of gas from the Mari B Field began in February 2004 through a pipeline located to the south of the Gabriella block.

BG Group discovered a large gas field 24.1 kilometers offshore Gaza under an exploration license granted to it by the Palestinian Authority. Estimated to contain 1.5 TCF of gas, the Gaza Marine field (Figure 7) is located within a few miles of the Yam Tethys and BG-Isramco discoveries and 90 kilometers from Yitzhak.

In January 2009, Noble Energy announced a natural gas discovery, offshore Israel, at the Tamar #1 well (Figure 7), located in approximately 1,676 meters of water and about 90.1 kilometers off the Israeli northern port of Haifa and 95 kilometers from the center of Yitzhak. The well was drilled to a total depth of 4,900 meters. The gross mean resources for the Tamar #1 were estimated by Netherland/Sewell to be 8.4 to 9.1 TCF of natural gas. In March 2009, Noble Energy announced a natural gas discovery, offshore Israel, at the Dalit well located in approximately 1,372 meters of water about 48 kilometers off the coast of Hadera and 50 kilometers from the center of Yitzhak. The well was drilled to a total depth of 3,658 meters and the gross mean resources were estimated to be 0.5 TCF of natural gas.

Most recently Noble has discovered the Leviathan Field, which is located 120 kilometers from the center of Yitzhak, with a reported 16 TCF accumulation of natural gas.

The Adira Yitzhak License (Figure 8) is centered approximately 10 kilometers off the Israeli coast between Netanya in the South and Caesarea in the North. The Yitzhak License covers a total area of 127,700 dunam (approximately 127.7 square kilometers or 32,000 acres) and is in relatively shallow water with depths between 60 and 250 meters.

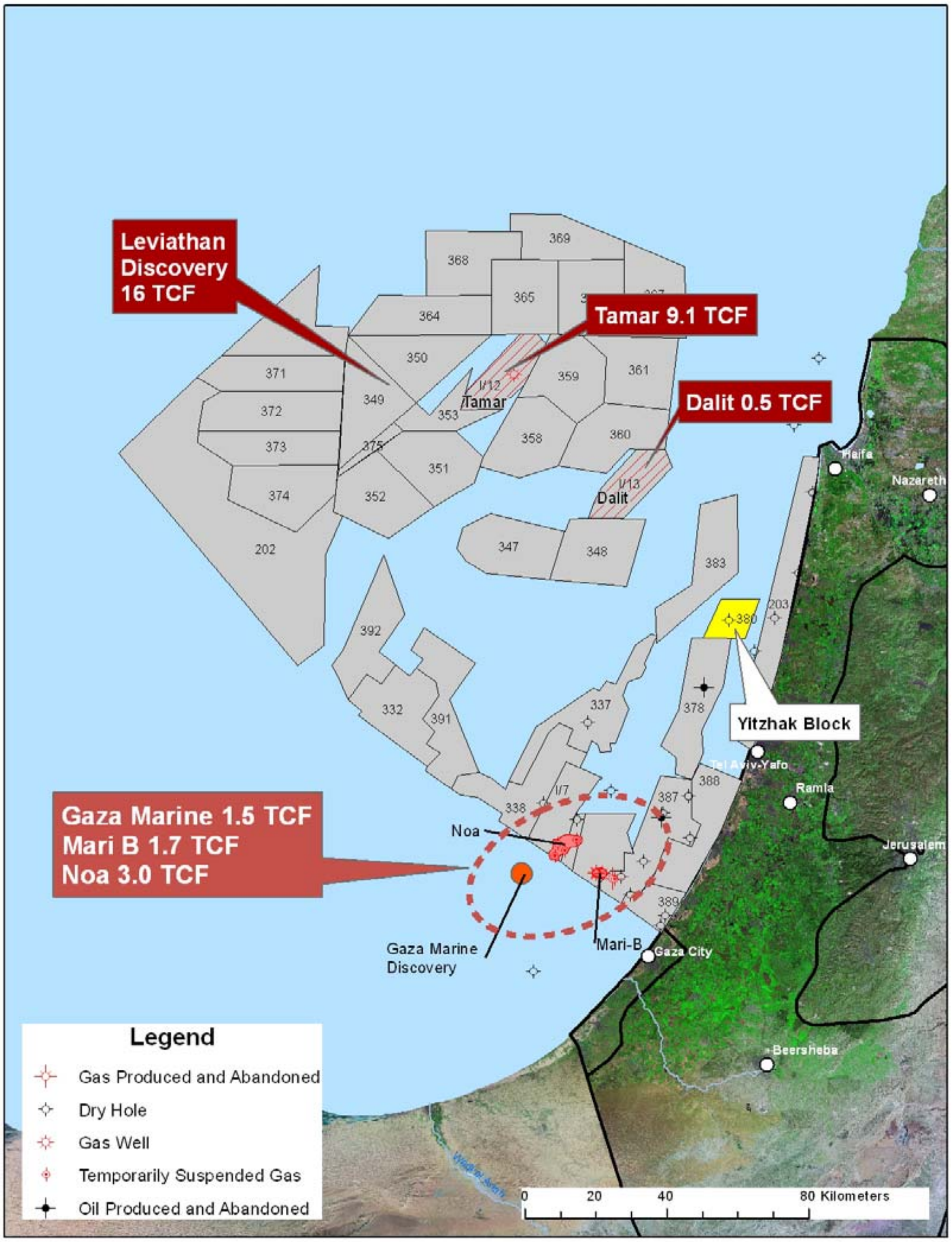

Figure 7 Locations of Recent Large Discoveries in the Levant Basin

The block is almost completely covered by a recently acquired 465 square kilometer 3-D seismic survey. In addition, 910 line kilometers of 2-D seismic data that covers a large area across and around the block was reprocessed. Most existing seismic data acquired in the offshore of Israel is available to qualified companies for copying costs. Adira also acquired copies of the BG Levant B, Isramco Yam and Isramco North-Central 3-D surveys from the GII.

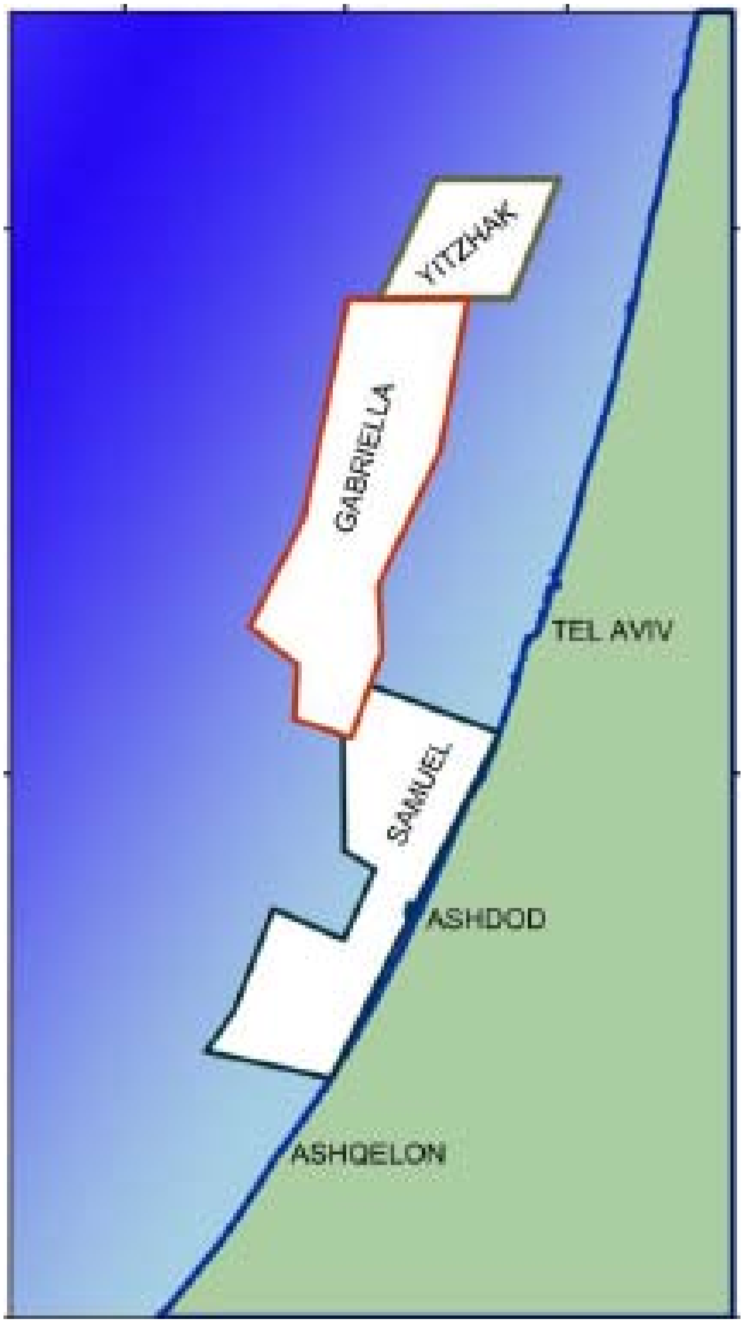

Figure 8 Yitzhak Block Area

1.22 <u>YITZHAK LICENSE</u>

The #380 / ‘Yitzhak’ License is located in the offshore waters of Israel as depicted in Figure 9.

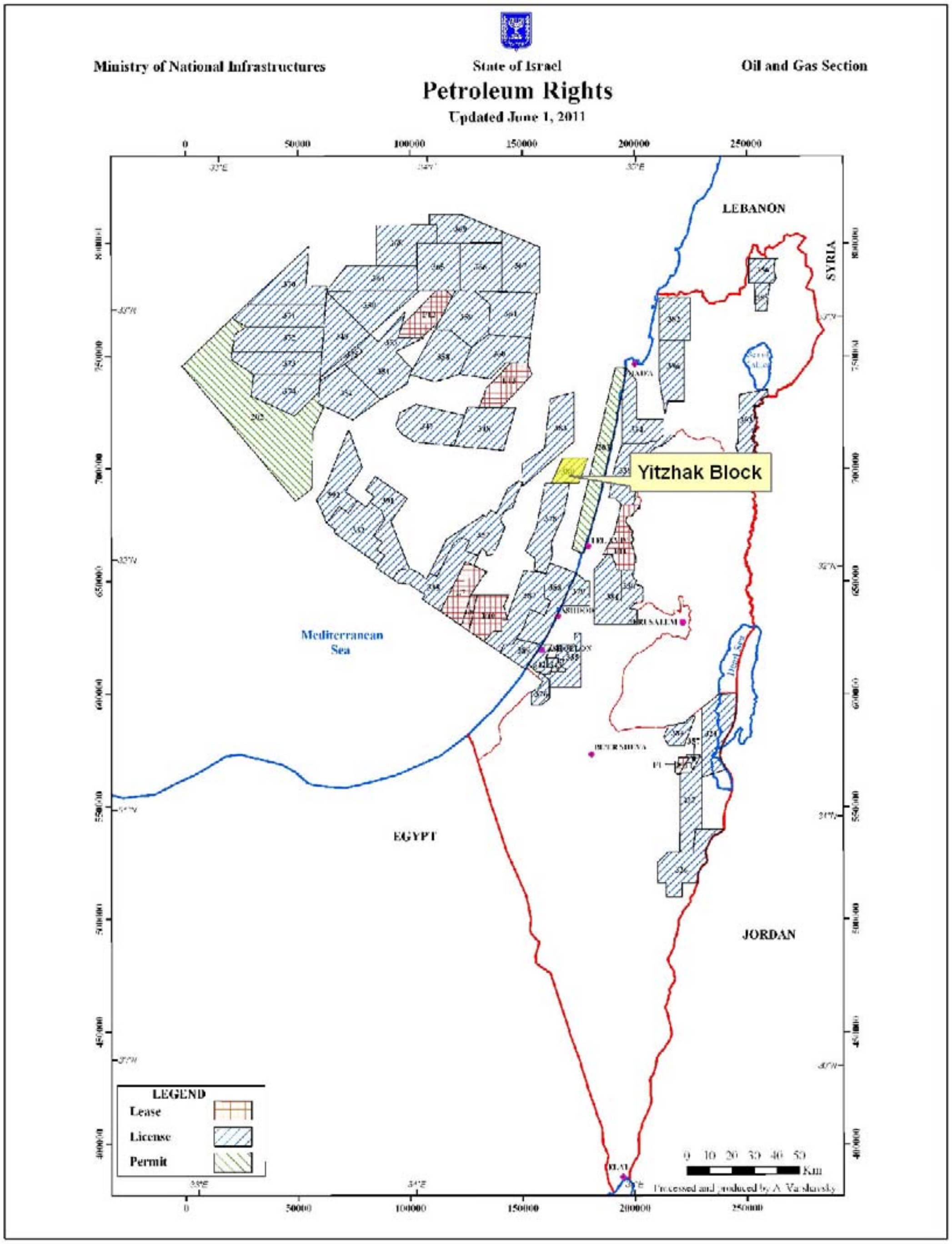

Figure 9 Location of Yitzhak Block in the Offshore of Israel

The official outline of the license block, Figure 10, and New Israel Grid coordinates, Table 5, are shown below.

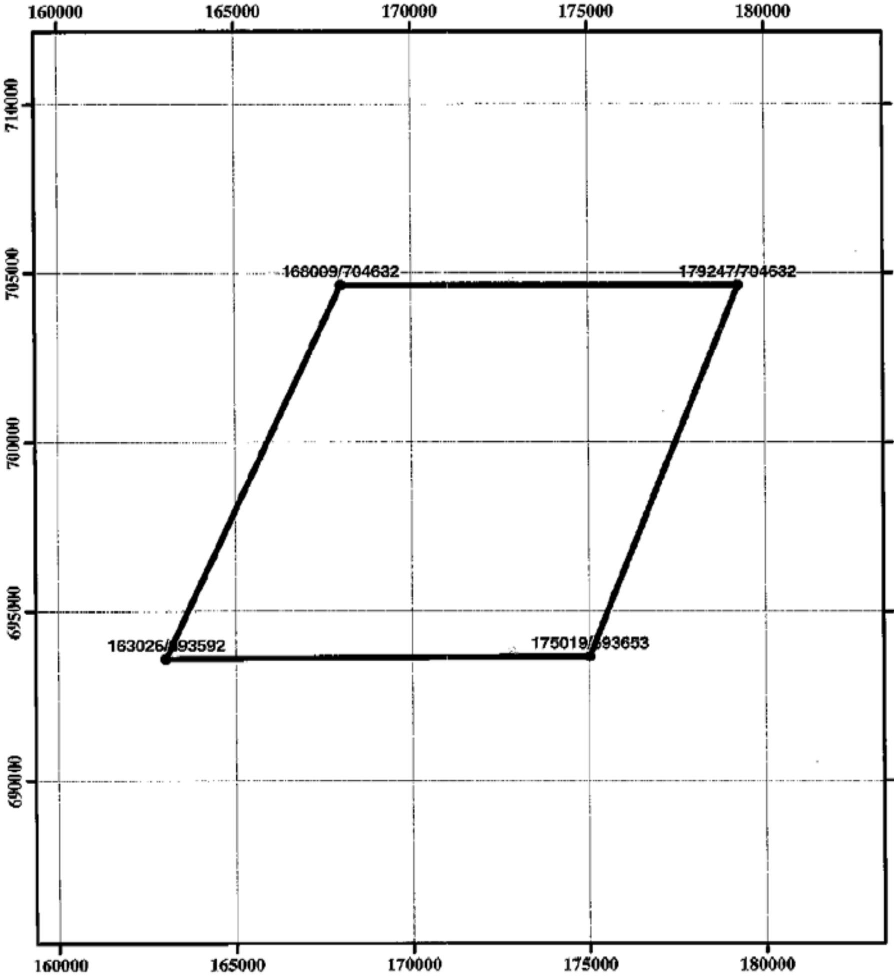

Figure 10 Detailed Map of License Area #380 / ‘Yitzhak’

The license application area covers the area surrounding the Delta 1A well that had shows of hydrocarbons. Estimated drilling depths to the top of the Jurassic targets are in the range of 4,035 meters. The terms of the license agreement specify that a well needs to be spud by January 2012.

Table 5 License #380 / ‘Yitzhak’ - X, Y Co-ordinates (New Israel Grid)

The numbers shown in this table correspond with the numbered points on Figure 10.

	X	Y	Direction
A	168009	704632	Eastward
B	179247	704632	Southward
C	175019	693653	South-Westward
D	163026	693592	Westward
A			North-Eastward

The Yitzhak License covers a total area of 127,700 dunam (approximately 127.7 square kilometers or 32,000 acres) and is in relatively shallow water with depths between 60 and 250 meters.

5. SEISMIC INTERPRETATION

Gustavson was provided with certain 2-D and 3-D seismic and well data (Figure 11) by Adira that had been obtained from the Geophysical Institute of Israel (GII). Adira also provided two recently acquired 3-D datasets, a 465 square kilometer volume and a 197 square kilometer volume that are located on the Gabriella and Yitzhak blocks. The well data which was obtained from the GII, the Geological Survey of Israel (GSI) and the Ministry of Infrastructures included digital logs and certain reports on previously drilled wells. The new 3-D data was acquired in two different azimuths and delivered in the form of a Quick-Look cube by WesternGeco. The orientation of the 465 square kilometer volume, which was used for the seismic interpretation for this report, is 23 degrees and the smaller 197 square kilometer survey was shot at a 343 degree azimuth (Figure 12). The final reprocessing of the 3-D volume is scheduled to be completed in December, 2011 where the two datasets will be merged in order to provide a seismic depth volume and be used for further processing that may provide indications of fractures and AVO. The seismic interpretation by Gustavson was based on the larger 465 square kilometer 3-D survey known as the Gabriella-Yitzhak 3-D First Azimuth. The extent of the new Gabriella-Yitzhak First Azimuth 3-D data as compared to the block outline and the Yam-Yafo 1 and Delta wells is shown in Figure 13.

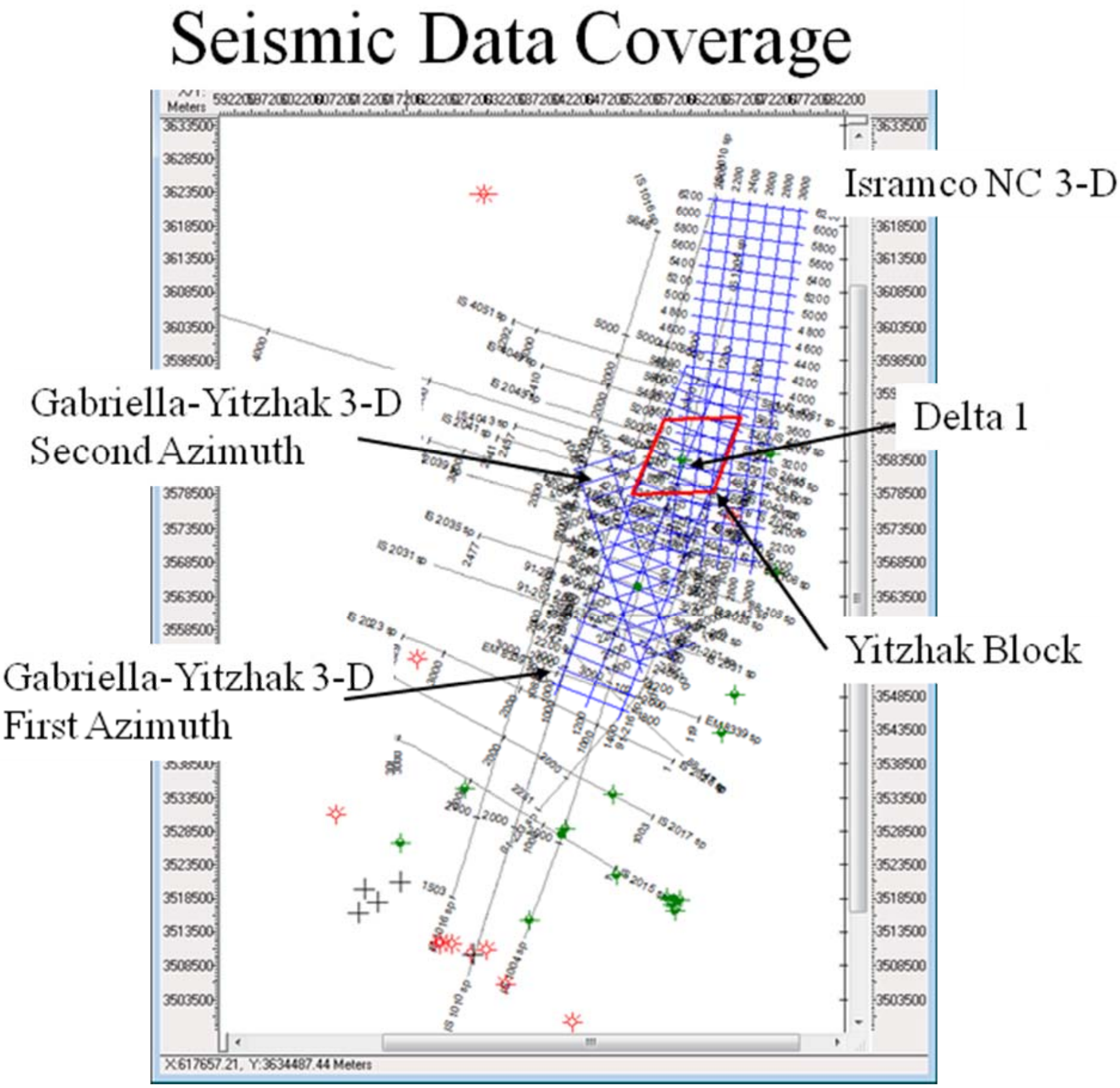

Figure 11 Seismic 2-D and 3-D Data Loaded onto the SMT Workstation

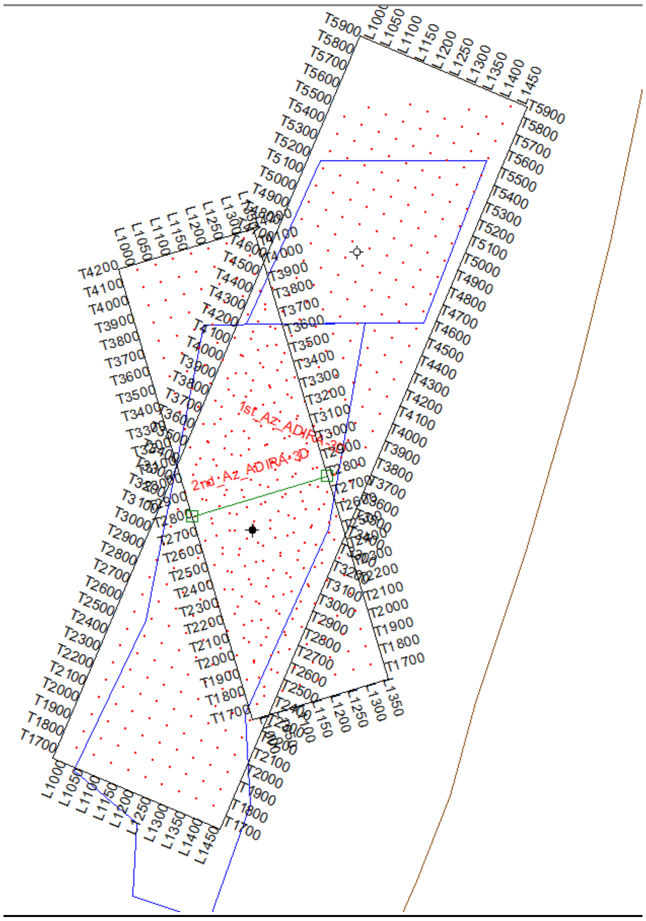

Figure 12 Detailed Location of the Gabriella-Yitzhak 3-D Seismic Surveys (2011)

Gustavson loaded all of the pertinent data onto a Kingdom-SMT seismic interpretation workstation. The location and extent of the 3-D and 2-D data loaded into the project is depicted in Figure 13. The 3-D data have been interpreted by Gustavson Associates and prospects defined from the interpretation.

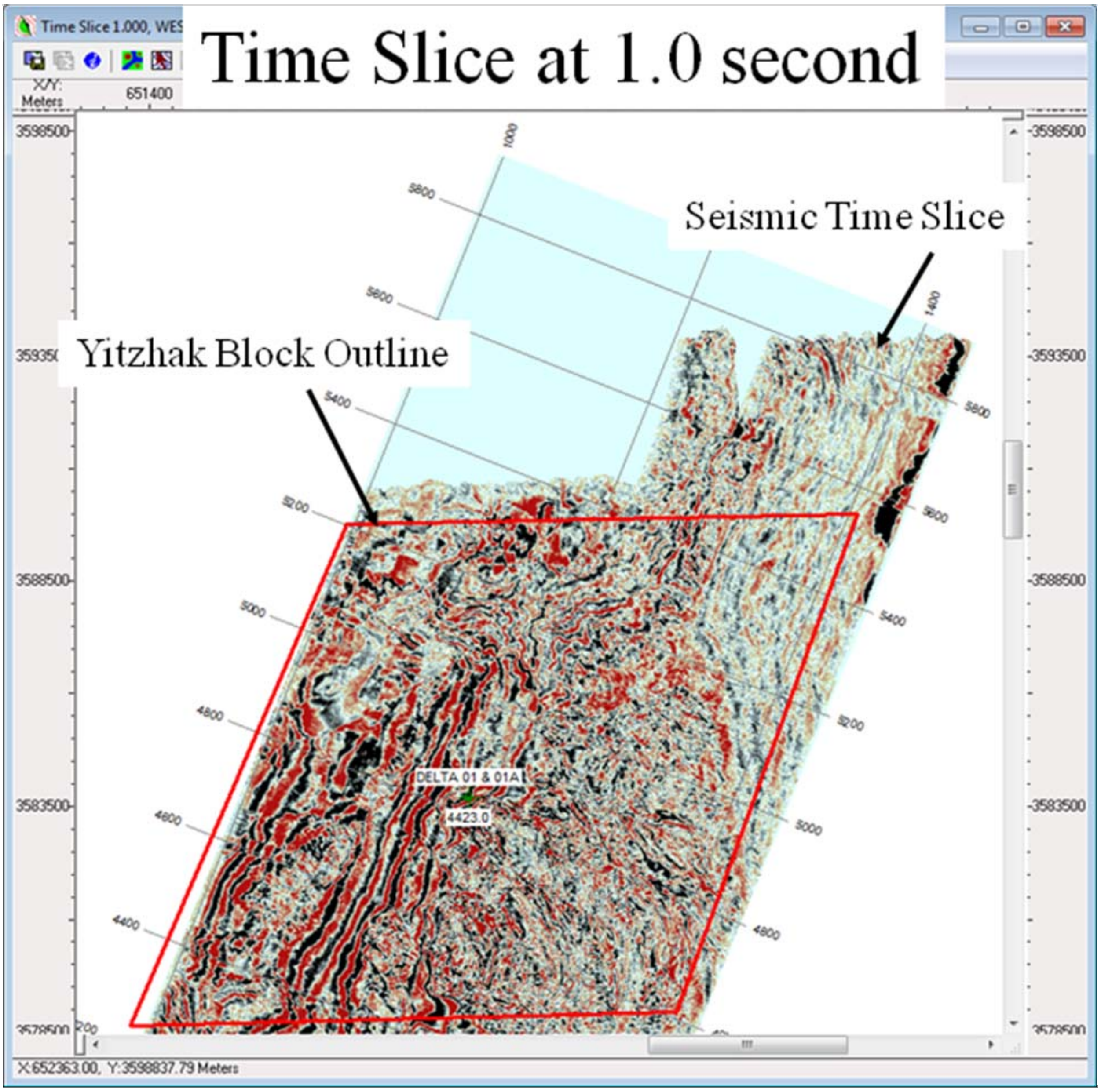

Figure 13 Yitzhak 3-D Data Extent Time Slice at 1.0 Second

The well control (Figure 14) used for the seismic interpretation included the Yam-Yafo 1 well drilled to a Total Depth (TD) of 5,785.5 meters Measured Depth (MD) and the Delta 1A well drilled to a TD of 4,423 meters MD. Although both wells are within the extent of the 3-D survey only the Delta 1A is located within the Yitzhak license. A checkshot survey with 21 points was used for the Yam-Yafo 1 for depth to time conversion. In addition, a partial sonic (DT) and density logs were used to create a synthetic seismogram. The sonic log was run from 1,414 meters MD to TD. There is a data skip of about 340 meters from 3,725 meters MD to 4,062 meters MD, and a 20 meter skip from 4,618 meters MD to 4,638 meters MD. The density log runs from 2,800 meters MD to 5,793 meters MD with a data skip from 4,446 meters to 4,882 meters MD. The Delta 1 well had a very limited checkshot survey in addition to a DT from 342 meters to 3,904 meters.

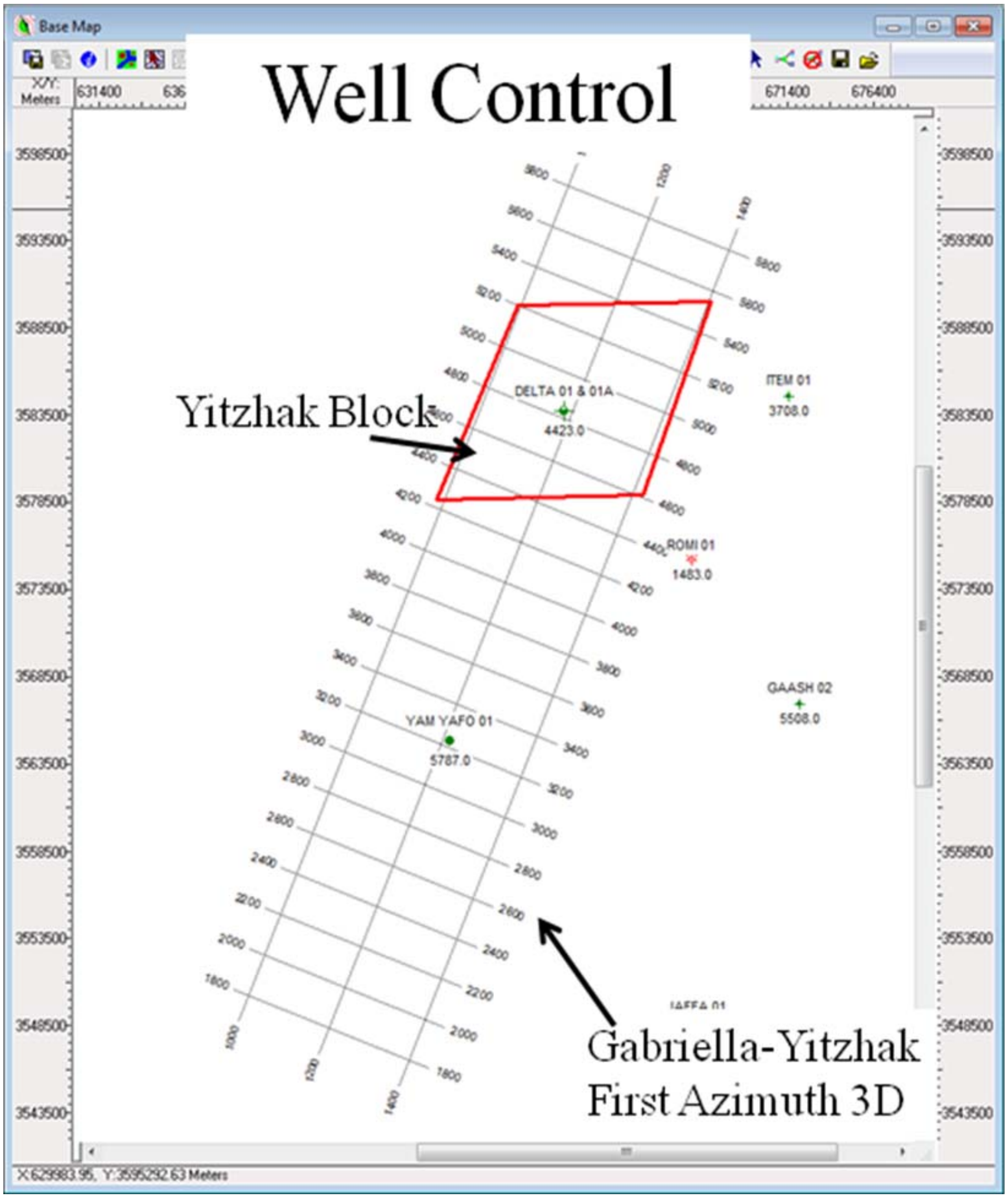

Figure 14 Map Showing the Time-Depth Well Control Used for the Seismic Interpretation

Using these data, synthetic seismograms were created in order to accurately tie the well data in depth to the seismic data in time. Synthetic seismograms were correlated to the seismic data along with the velocity survey information to determine seismic time correlations for the formation horizons that would be interpreted on the seismic. The Delta 1 well log curves along with selected formation tops are superimposed onto the seismic data in Figure 15. The formations that were correlated and mapped over the extent of 3-D included the Base Pliocene, Base Late Eocene, Talme Yafe, and the Jurassic Zohar.

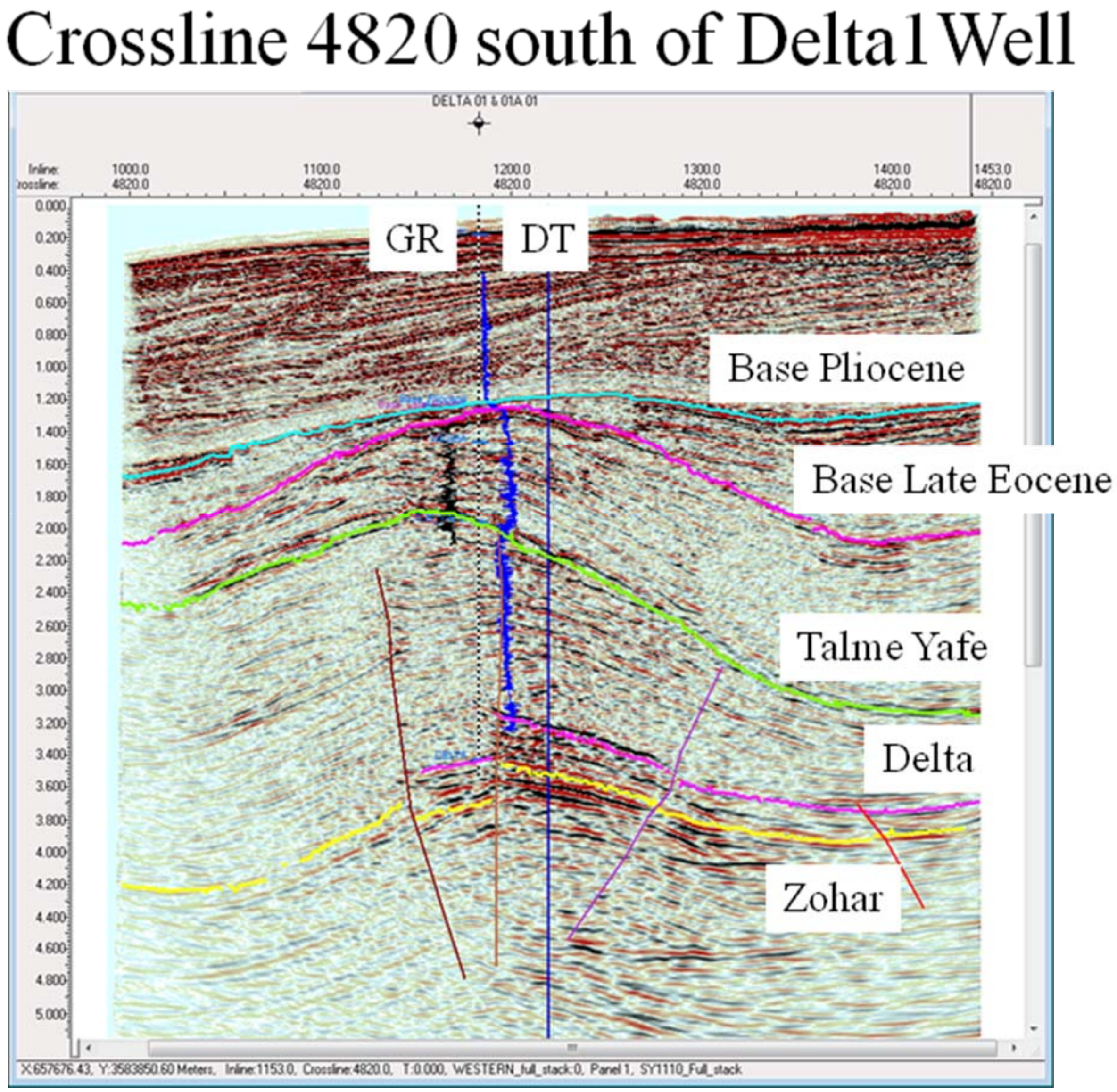

Figure 15 Line Showing the Correlation and Interpreted Horizons near the Delta 1 well

The seismic time horizons associated with the geologic formations from well control were interpreted on the 3-D seismic data and in conjunction with the fault interpretation resulted in seismic time maps for four horizons. The time structure map at the Base Pliocene level is depicted in Figure 16. It shows a southwest plunging nose and an associated four-way closure.

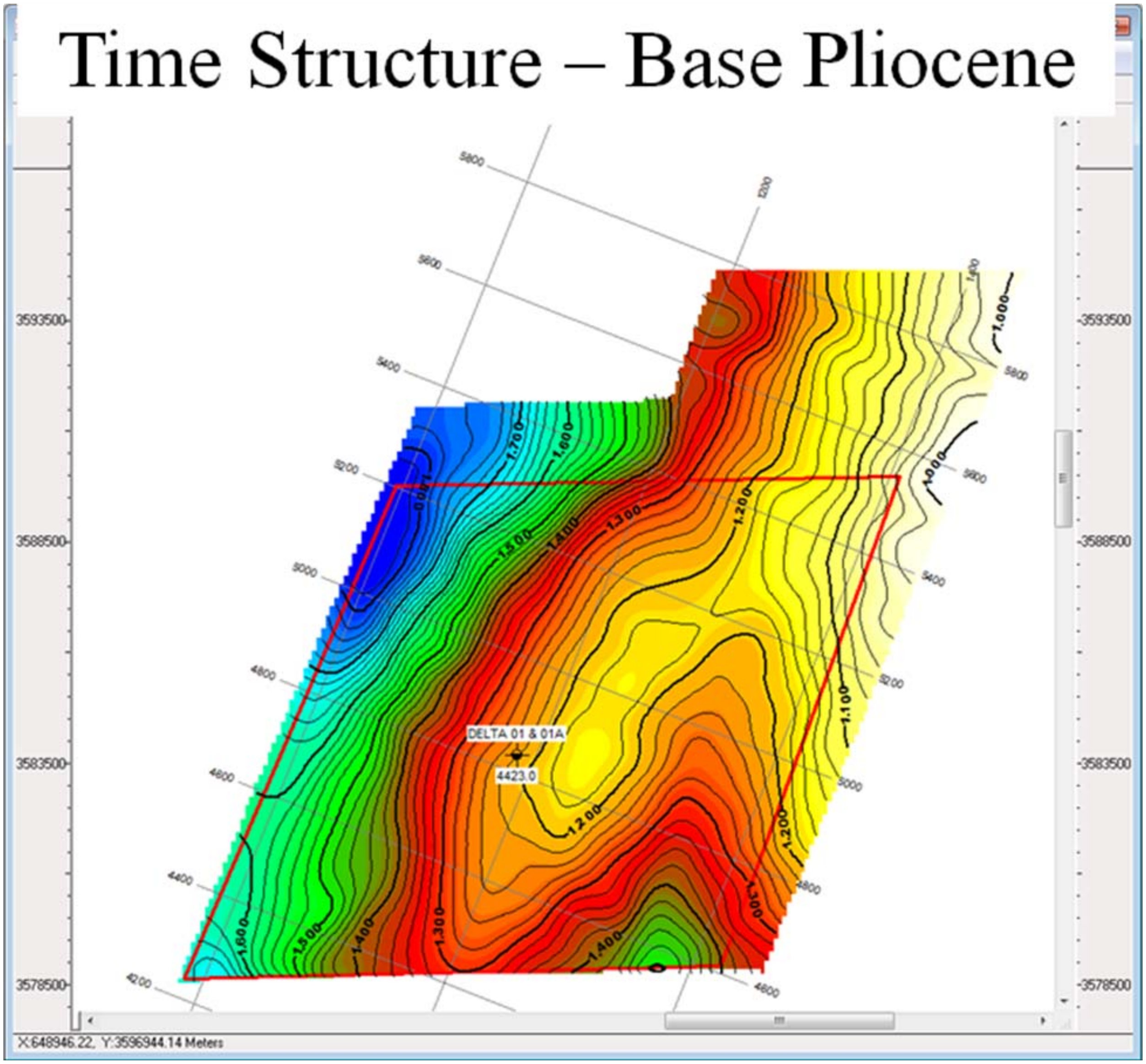

Figure 16 Base Pliocene Time Structure

The time structure map at the Base Late Eocene level with two limited area four-way closures is depicted in Figure 17. The Delta 1 well was drilled at the apparent crest of the time structure at this horizon. East-west trending extensional faulting can be observed on the map.

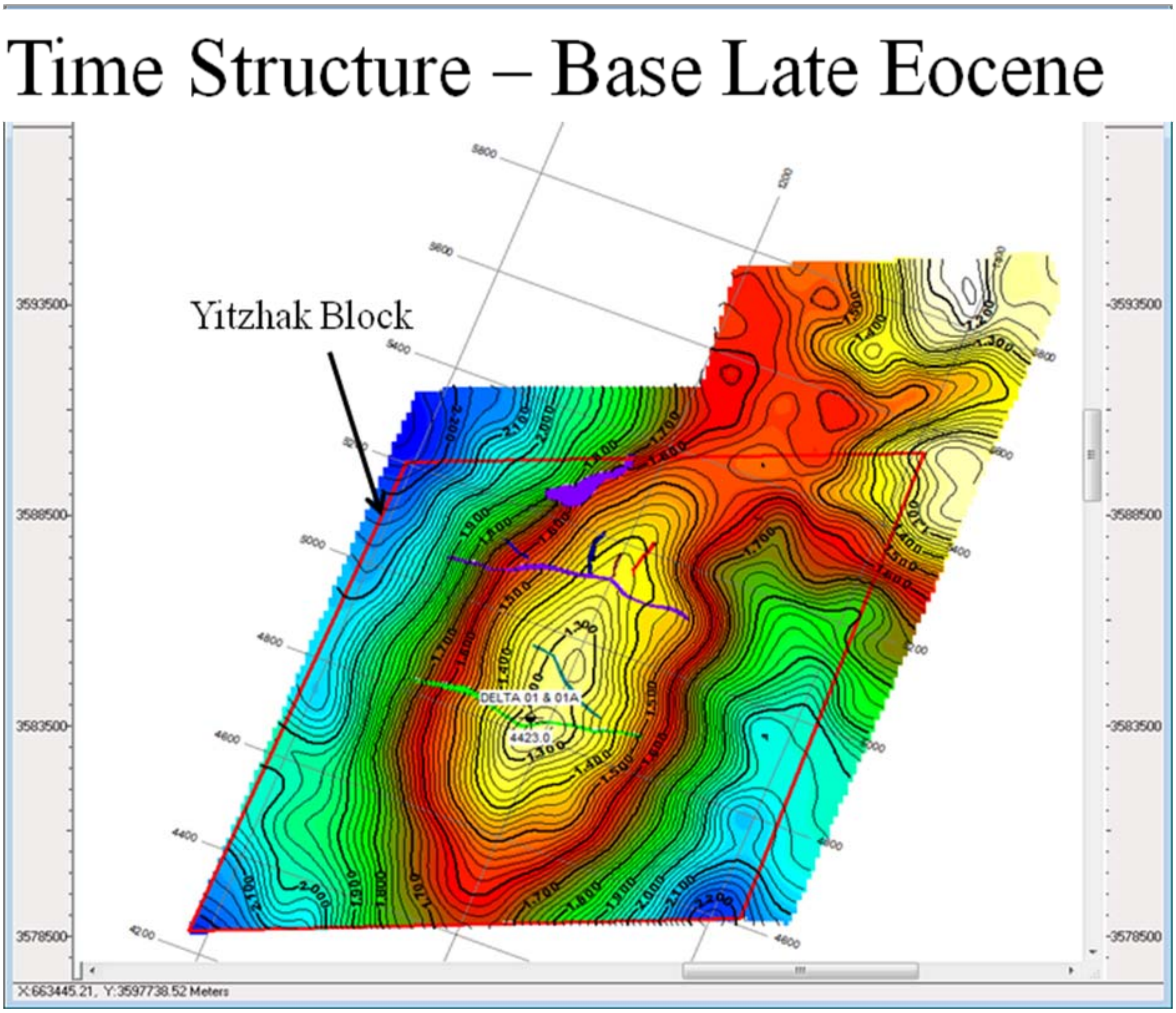

Figure 17 Base Late Eocene Time Structure

The time structure map at the Talme Yafe level depicted in Figure 18 shows east-west trending extensional faulting also at this level.

Time Structure – Talme Yafe

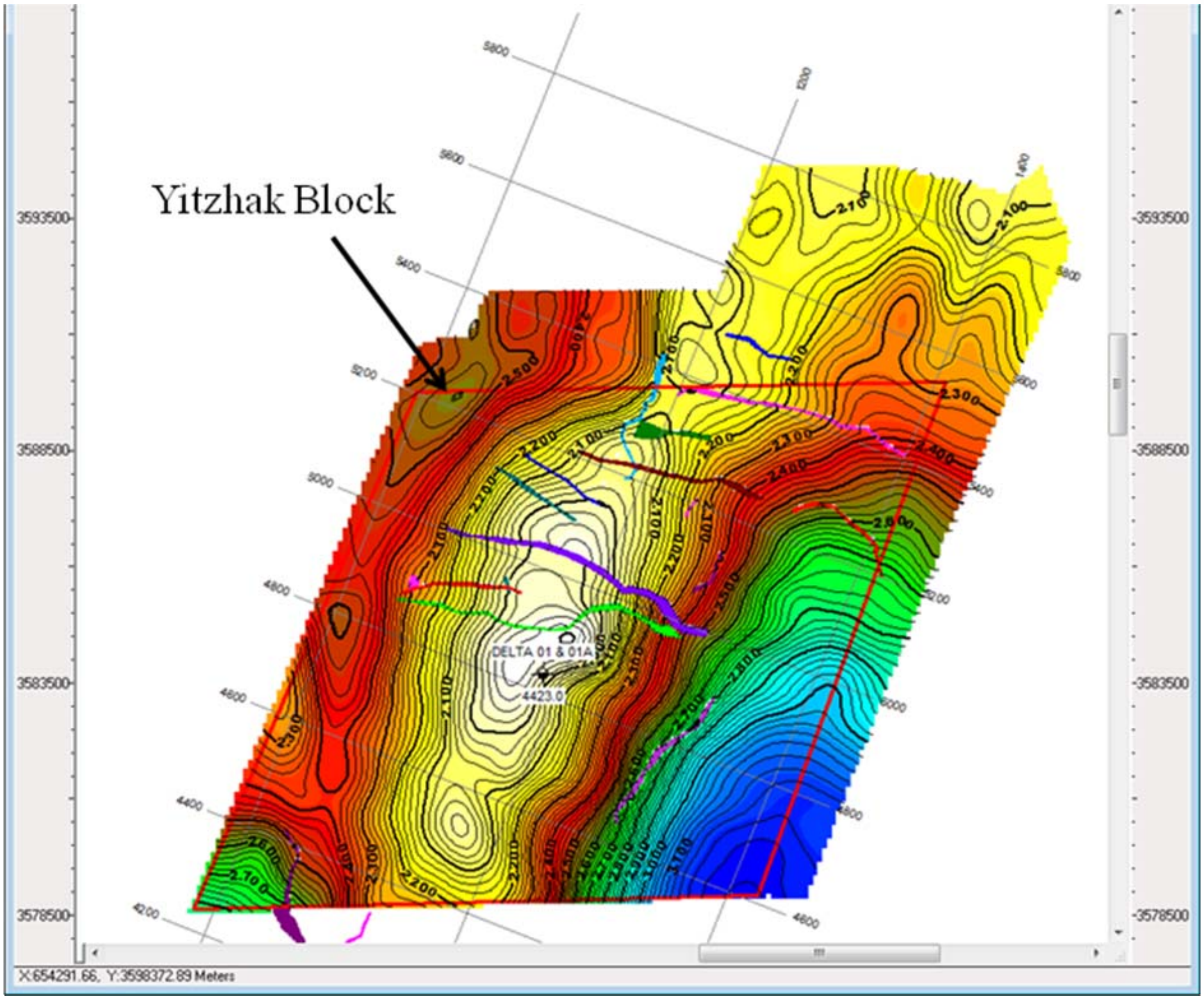

Figure 18 Time Structure Albian Equivalent Talme Yafe (Upper Early Cretaceous)

The time structure map at the Zohar level, Figure 19, shows a closed structural prospect bounded by a fault to the northeast. The northeast-southwest trending compressional faults form the inversion of the Jurassic.

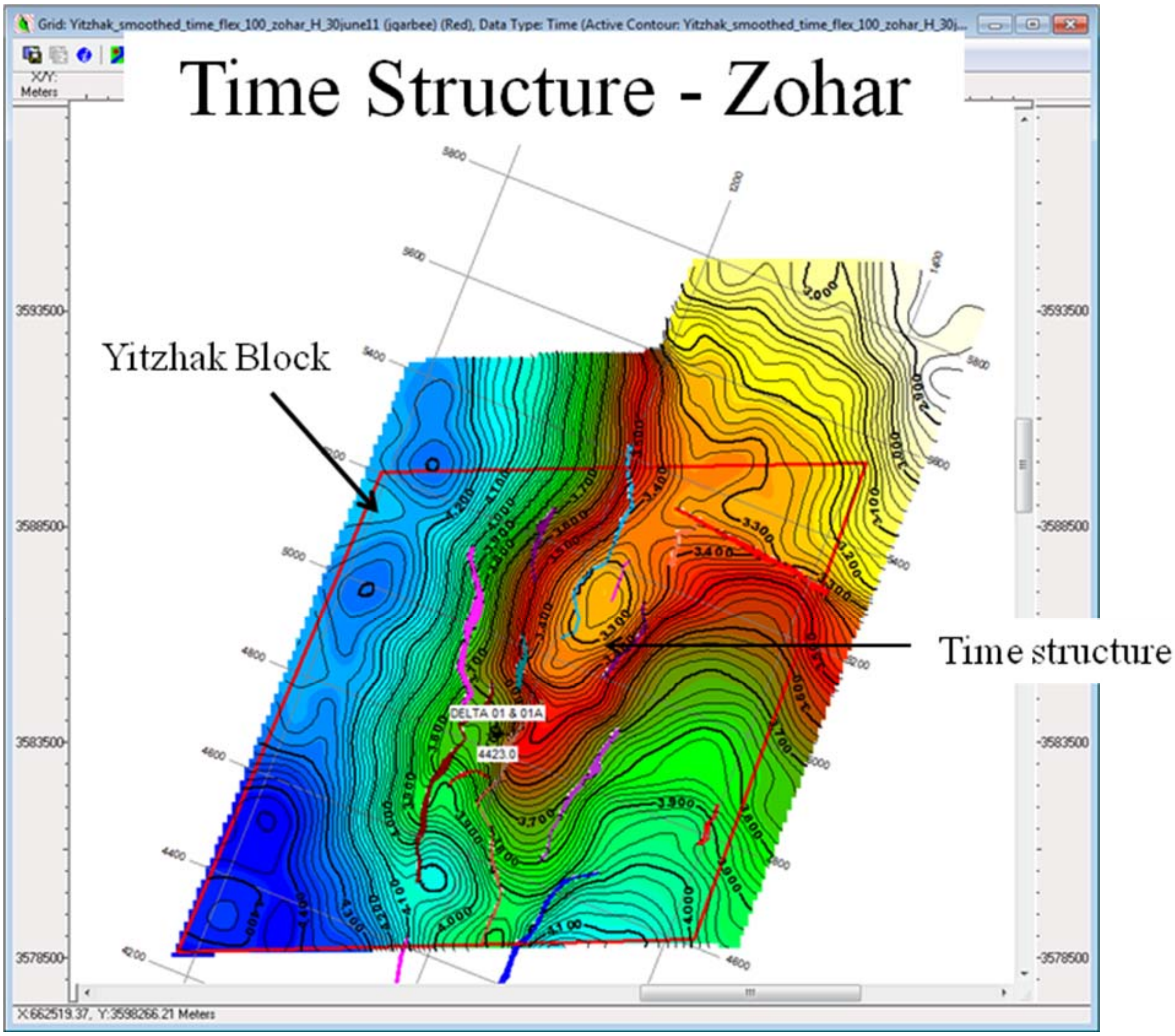

Figure 19 Zohar (Jurassic) Time Structure

1.23 INTERVAL VELOCITY METHOD

In order to derive a depth map from the Jurassic time map a series of calculations needed to be made. Tectonic activity resulted in rapid changes in the thickness of the Pliocene and the Base Pliocene to Base Late Eocene interval (Figure 20). Utilizing a single velocity function from the checkshot at the Yam-Yafo 1 well would not account for the thickness variations within the vertical units when converting to depth. Therefore, a layer method was used for time to depth conversion and is detailed below.

- Depth to Base Pliocene (apparent velocity)

- Isopach – Base Pliocene to Base Late Eocene (apparent velocity)
- Isopach – Base Late Eocene to Talme Yafe (apparent velocity)
- Isopach – Talme Yafe to Zohar (Jurassic) (apparent velocity)
- Summation of the above four grids to obtain a depth map to the Jurassic Marker

Crossline 4820 south of Delta1 well

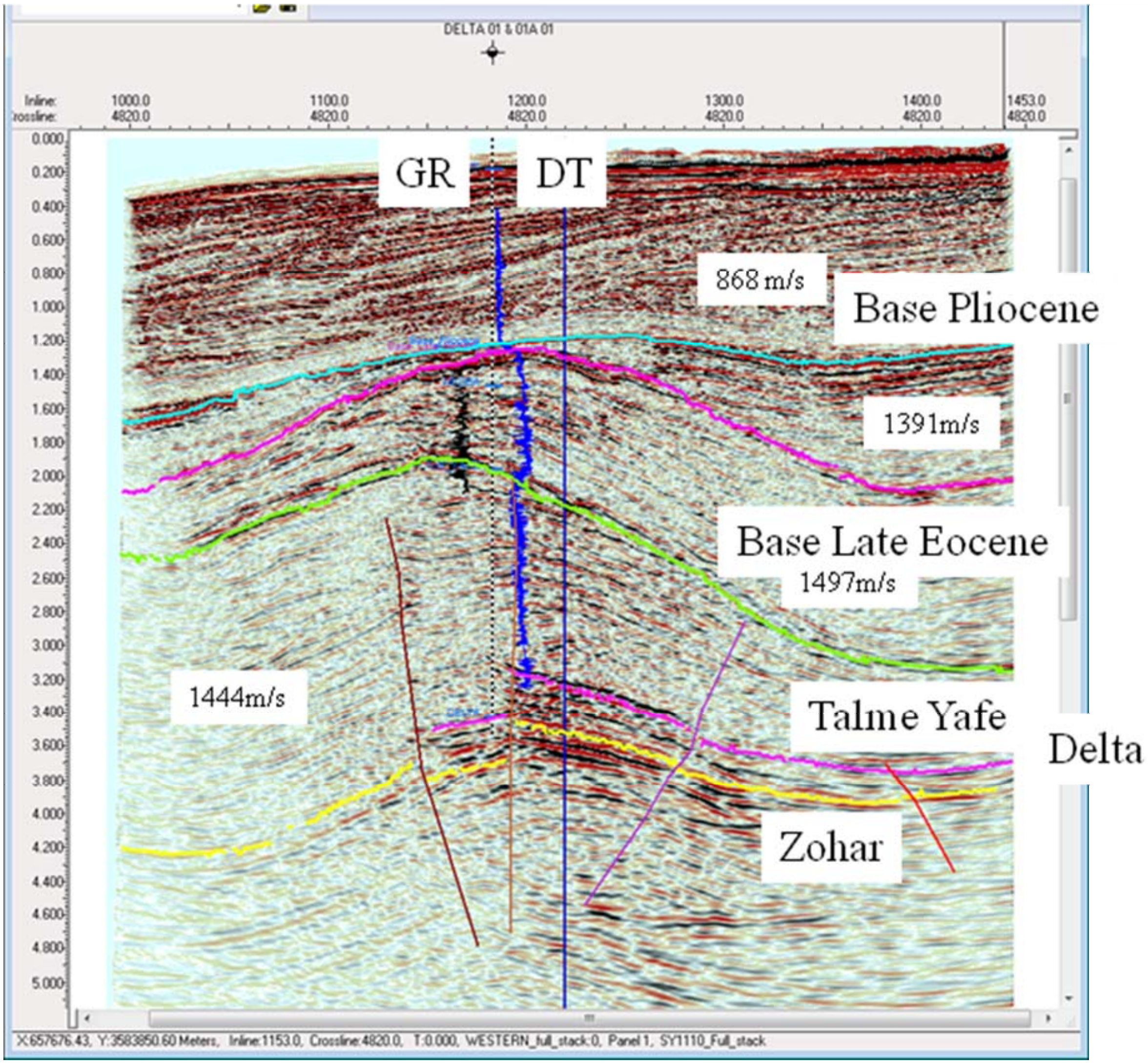

Figure 20 Seismic Line 4820

Isochrons were constructed between the interpreted time horizons by the subtraction of the time horizons maps. Apparent velocities (Figure 20), derived from the interval time thicknesses and seismic times, were then used to calculate the isopachous depth thickness by multiplying the apparent interval velocity by the isochron thickness for the four intervals. The resulting isopachous depth thicknesses were then summed to obtain the depth maps for the Base Pliocene, Base Late Eocene, Talme Yafe, and Zohar. The resulting Zohar subsea depth map is shown in Figure 21.

The depth map at the top of the Jurassic over the Yitzhak structure, Figure 21, based on the Jurassic time map and the velocity conversion method discussed above, shows that the time structure is still valid in depth.

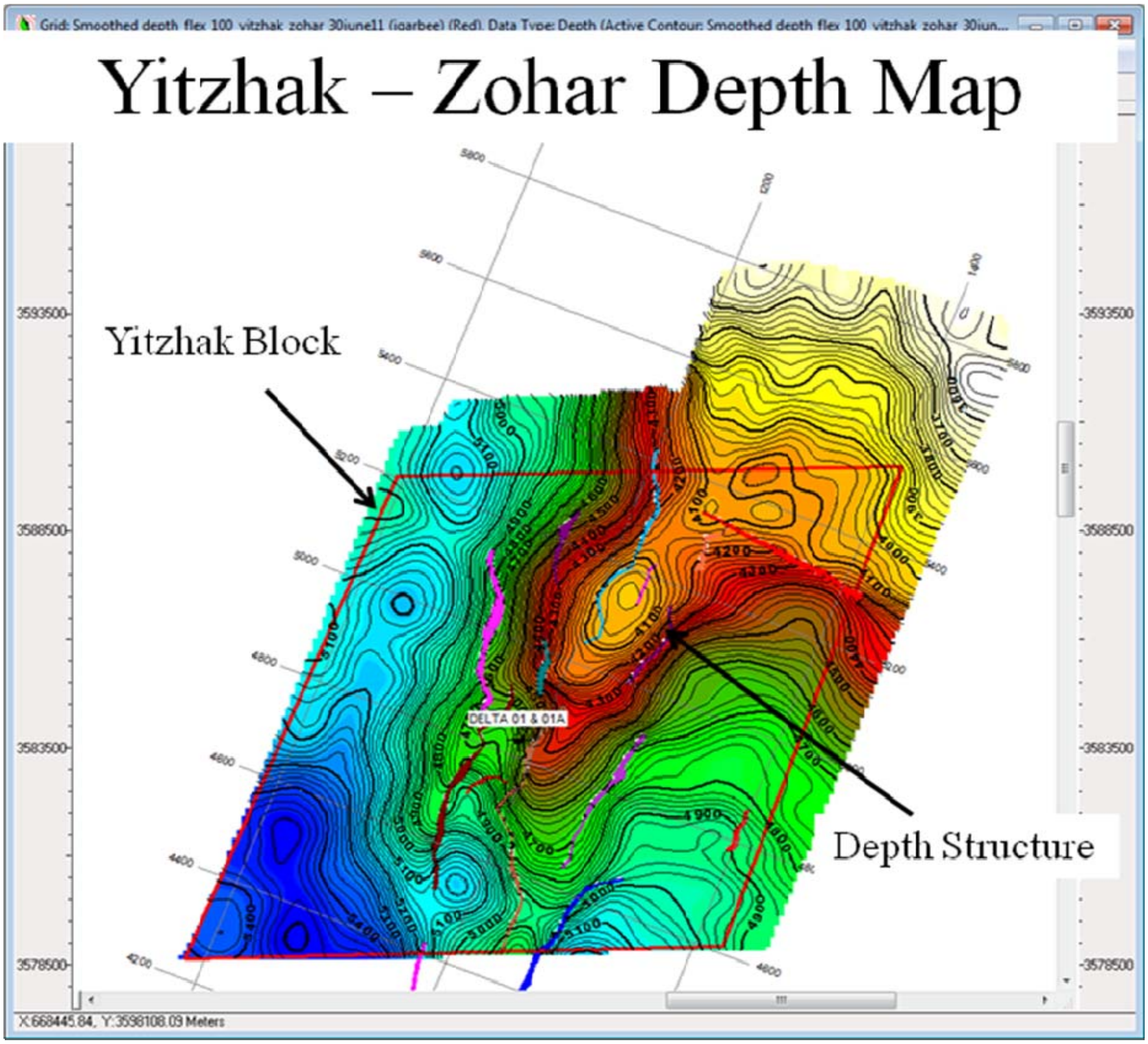

Figure 21 Depth map of the Top Zohar (Jurassic) over the Delta Yitzhak Structure

6. GEOLOGY

Yitzhak lies on the near shore of the continental shelf offshore central Israel. This area (as well as the deeper Levant Basin) has been affected by Lower-Middle Mesozoic rifting followed by a short hiatus then Late Mesozoic to Tertiary compression. These tectonic events provide the petroleum system that is necessary to trap hydrocarbons in the Levant Basin. Available data suggests that Jurassic targets will be the primary objectives of the exploration program. Of the nine wells in the area of interest the Bravo-1, Delta-1, Yam Yafo-1, Joshua - 2, Echo-1, Yam-2, and Yam West-1 reached Jurassic horizons.

The Jurassic Yitzhak structure is part of a structural ridge plunging to the south-southwest and limited on its eastern and western flanks by longitudinal faults. This structural ridge is composed of three sub-structures: Delta (Yitzhak) at the north, Yam Yafo (Gabriella) at the center and Yam-2 (Figure 22). The sub-structures are divided by transverse faults believed to trend in a SE-NW direction.

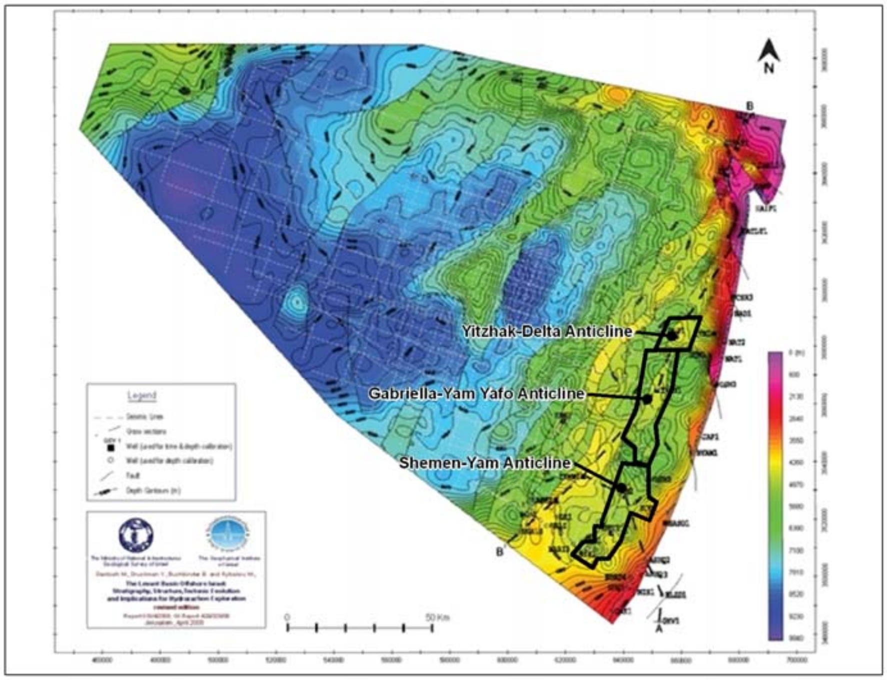

Figure 22 Depth Map of the Top of the Jurassic in the Levant Basin[6]

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[6] after Gardosh et al., 2008

A generic stratigraphic column with zones with shows of gas and tested oil depicted for the Yam-Yafo1 borehole is shown in Figure 23.

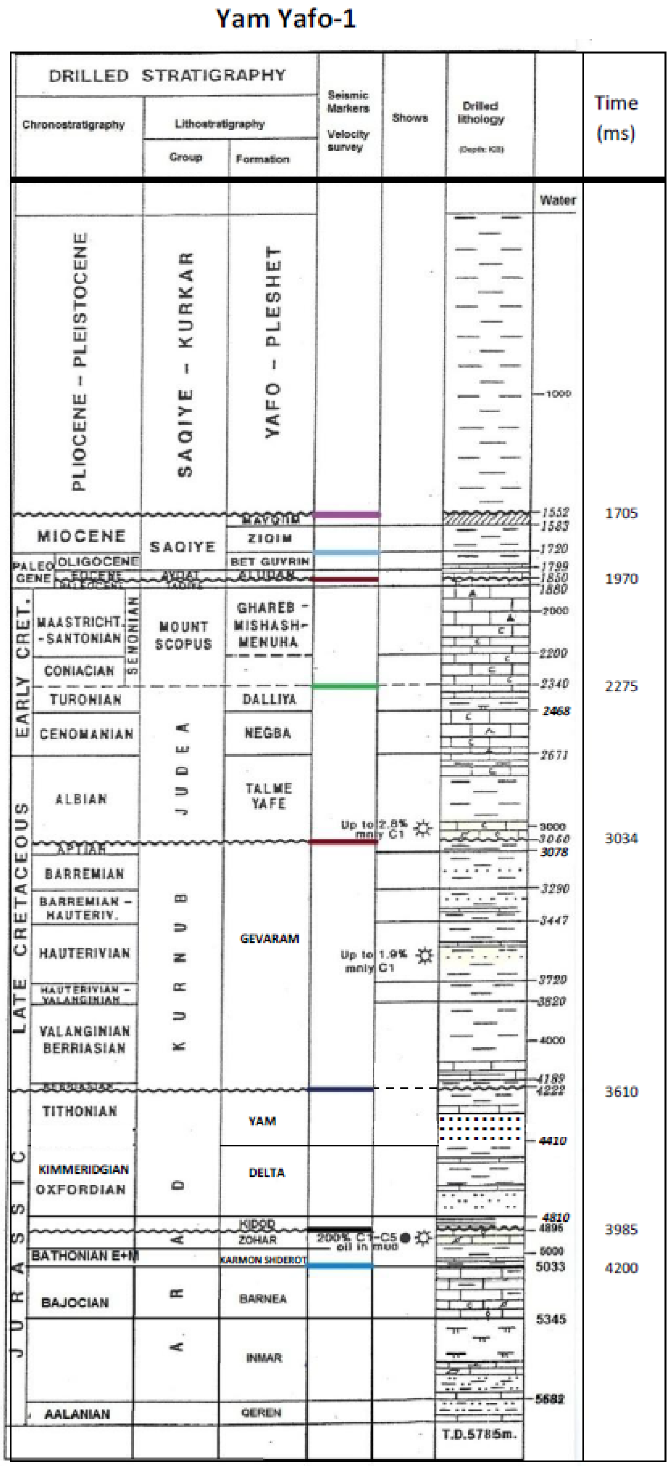

Figure 23 Generic Stratigraphy Yitzhak License

The Levant Basin is a deep and long existing geologic structure located in the eastern Mediterranean Sea. The southern part of the basin hosts a world-class hydrocarbon province offshore the Nile Delta. Recent discoveries of biogenic gas and various oil shows indicate that all parts of the basin including offshore Israel have significant hydrocarbon potential.

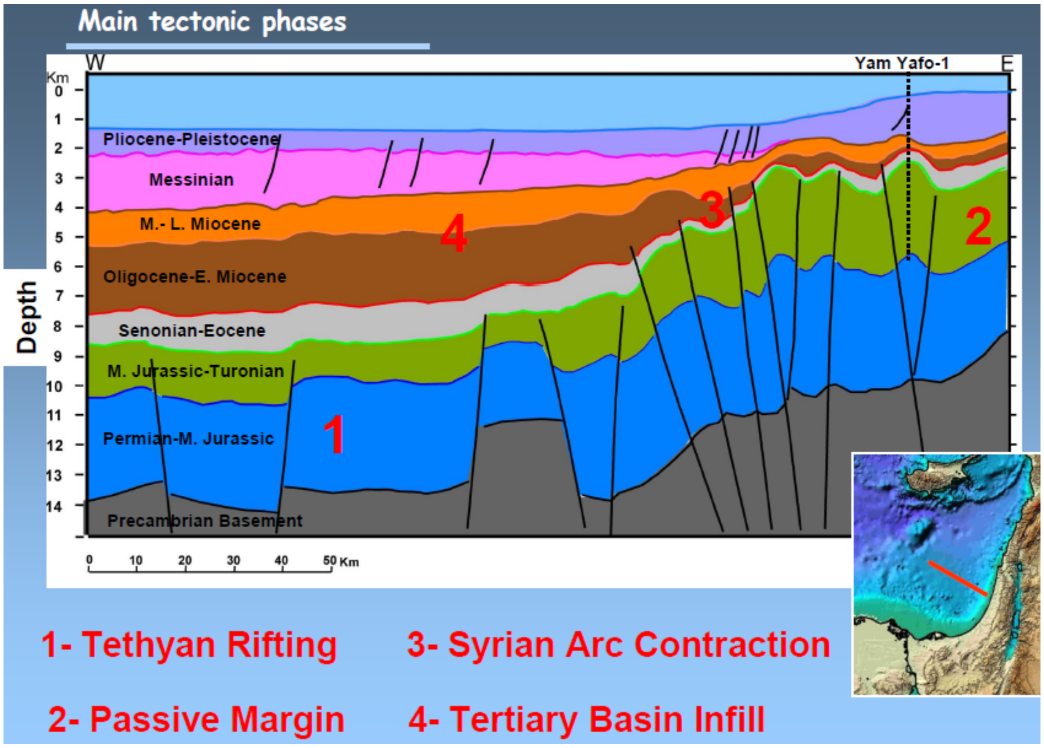

Figure 24 Depiction of the Geologic History of the Area
(Gardosh et al, 2008)

The reconstructed basin history[7] shows that the Levant Basin was shaped in several main tectonic stages. Early Mesozoic rifting resulted in the formation of an extensive graben and horst system, extending throughout the Levant both onshore and offshore.[8] Late Jurassic to Middle Cretaceous, post-rift subsidence was followed by the formation of a deep marine basin in the present-day offshore and a shallow-marine, carbonate dominated margin and shelf near the Mediterranean coastline and further inland. This rifting in the Levant region began in the Late Permian and continued into early to Middle Jurassic.[9] Significant vertical movements took place

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[7] Gardosh, M., et al, 2008
[8] ibid
[9] ibid

in the region both onshore and offshore. These vertical movements formed horsts and grabens accompanied in the north by volcanism (Asher Volcanics).

Large scale horst and graben development produced the Judea Graben onshore while offshore the Jonah and Leviathan horsts developed in the central Levant Basin. Closer to shore, the horst and graben developments are amplified by compression with force folds as the shelf rises and is proximal in the transpressional faulting of the Dead Sea and the movement of Africa against the Arabian Plate.

The Late Cretaceous and Tertiary convergence phase between the Afro-Arabian and Eurasian plates resulted in inversion of Early Mesozoic structures and the formation of extensive, Syrian Arc type contractional structures throughout the Levant Basin and margin. The Levant passive margin was reactivated during the late Tertiary. Sedimentation rates and subsidence increased after a period of long gradual decay.[10] The Tertiary convergence was further associated with uplift, widespread erosion, slope incision and basinward sediment transport. A Miocene incision through the paleo-Israeli shelf, called the Afiq Canyon which trends southeast-northwest, acted as a channel for Late Miocene and Early Pliocene clastic sediments derived from the Israeli onshore.[11] A Late Tertiary desiccation of the Mediterranean Sea was followed by deposition of a thick evaporitic blanket that was later covered by a Plio-Pleistocene siliciclastic wedge. The Phanerozoic basin-fill ranges in thickness from 5 to 6 kilometers on the margin to more than 15 kilometers in the central part of the basin.

A variety of structural and stratigraphic traps were formed in the Levant Basin during the three main tectonic stages. Possible hydrocarbon play types are: Triassic and Lower Jurassic fault-controlled highs and rift-related traps; Middle Jurassic shallow-marine reservoirs. Lower Cretaceous deepwater siliciclastics; the Tertiary canyon and channel system and associated deepwater siliciclastics found in either confined or non-confined settings; Upper Cretaceous and Tertiary Syrian Arc folds; and Mesozoic and Cenozoic isolated, carbonate buildups on structurally elevated blocks. Shallow gas discoveries in Pliocene sands and high-grade oil shows

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[10] Gvirtzman, et al, 2008
[11] Sanderson and Oates, 2000

found in the Mesozoic section indicate the presence of source rocks and appropriate conditions for hydrocarbon generation in both biogenic and thermogenic petroleum systems. The size, depth and trapping potential of the Levant Basin suggest that large quantities of hydrocarbons can be found offshore Israel. Recent discoveries of biogenic gas and various oil shows in onshore and offshore wells indicate that the central part of the basin offshore Israel has significant hydrocarbon potential. Several gas occurrences are present along the Afiq Canyon. The most prospectivity in the area exists in the Pliocene biogenic gas bearing sands. Reservoir potential also exists in the Upper Miocene Ziqlig reef, or its equivalents, immediately below the Messinian evaporites. Discoveries have also been made in the Middle Jurassic limestones and the Upper Jurassic reefal limestones.[12]

The area near the Yitzhak block has been subject to compressional and extensional forces over geologic time including NW-SE oriented rifting during Mesozoic time (1 in Figure 24) with syntectonic deposition and carbonate platform building on the passive continental margin when the Tethys Sea existed (2 in Figure 24). The rifted succession was then inverted by SW-NE oriented compression in the late Cretaceous through late Eocene with continued growth into the Miocene (3 in Figure 24). The inversion was characterized by ‘pop-up’ style fold structures, such as the Delta (Yitzhak) anticline (Figure 24), framed by occasional antithetic faults that splay away from the re-activated, former normal faults. Growth of the structures is recorded in late Cretaceous through Miocene syntectonic sediments from the Nile River and the Israel landmass that onlap the flanks of growing structures (4 in Figure 24).

The Syrian Arc Ridge, also referred to as the Eastern Levant Ridge, (Figure 25) is divided into at least three sub-structures the Yitzhak - Delta, Gabriella – Yam - Yafo and the Shemen – Yam and Bravo. This ridge lays 10 to 25 kilometers offshore Israel and is oriented and plunges in a NNE – SSW direction.[13] The Yitzhak sub-structure is located in the northern portion of the ridge (Figure 25) shallower than the Shemen – Yam and Bravo and the Gabriella – Yam- Yafo structures and presents a typical anticlinal profile. The ridge is bounded by longitudinal (reverse) faults on its western and eastern flanks.

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[12] Sanderon and Oates, 2000
[13] Gardosh et al, 2008

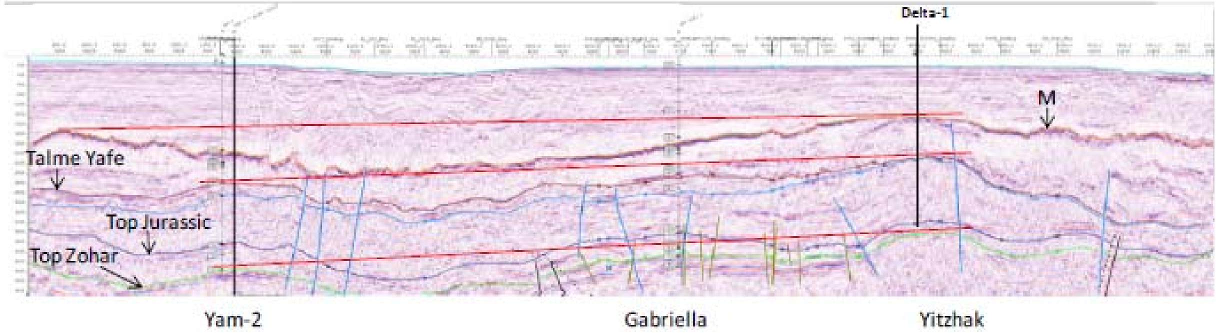

Figure 25 South to North 2D seismic line illustrating that the Yitzhak structure is the highest on trend[14]

The structural formation of the Syrian Arc and other previous tectonic events caused the brittle Jurassic carbonates to fracture. Tensile (Mode 1) reservoir fractures provide essential reservoir porosity and permeability. These fractures allow for large drainage areas in each well resulting in fewer wells needed for field development. The best wells in fields with these fractures commonly are drilled early in development, frequently with high initial production. Since these fractures provide porosity and permeability, production can occur from non-reservoir quality and nonstandard rocks.[15] The carbonates in the area are characterized by very low matrix porosity and low matrix permeability, therefore effective drainage is dependent on the occurrence of open fractures.

The fractures in the area are typically stratabound, sub-perpendicular to bedding and commonly abut the bounding stratigraphic surfaces. To a large extent the density and height of fractures (Figure 26) are controlled by the mechanical stratigraphy, which is controlled by the depositional environment and cycles.[16]

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[14] Adira Energy, Interim Report for License #380/"Yitzhak" Offshore Israel. October 2010

[15] Nelson, 2001

[16] Wennberg et al., 2007

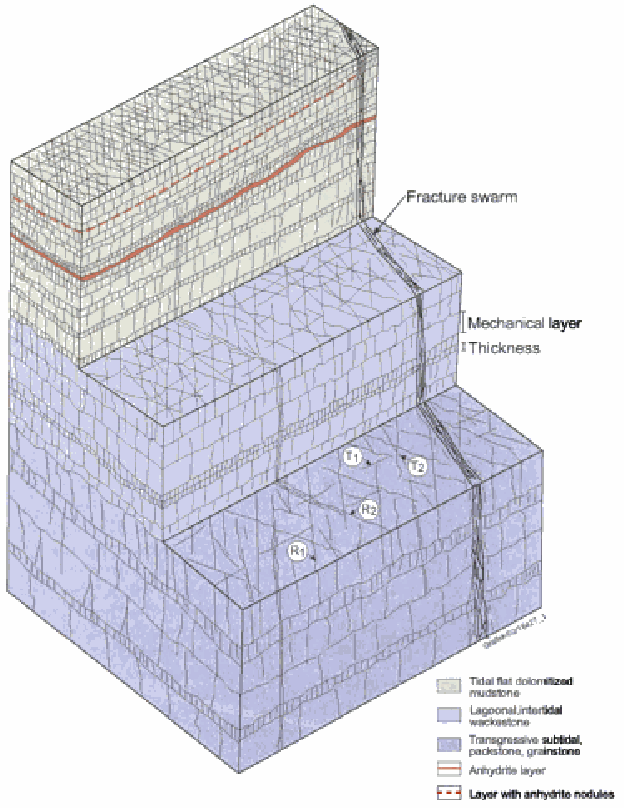

Fig. 6. An ideal shallowing up cycle of the Asmari Formation with a typical fracture pattern in a forelimb of a Zagros anticline.

Figure 26 Diagram of Typical Fracture Pattern
(Wennberg, et al., 2007)

Present day WNW-ESE (Figure 27) directed maximum horizontal stress orientations may help keep open WNW-ESE fractures when fluids are withdrawn. The fold axis parallel NNE-SSW fractures may be kept open depending on their position on the fold (i.e., is the present day maximum horizontal stress enhancing flexure and extension or compression and closure).

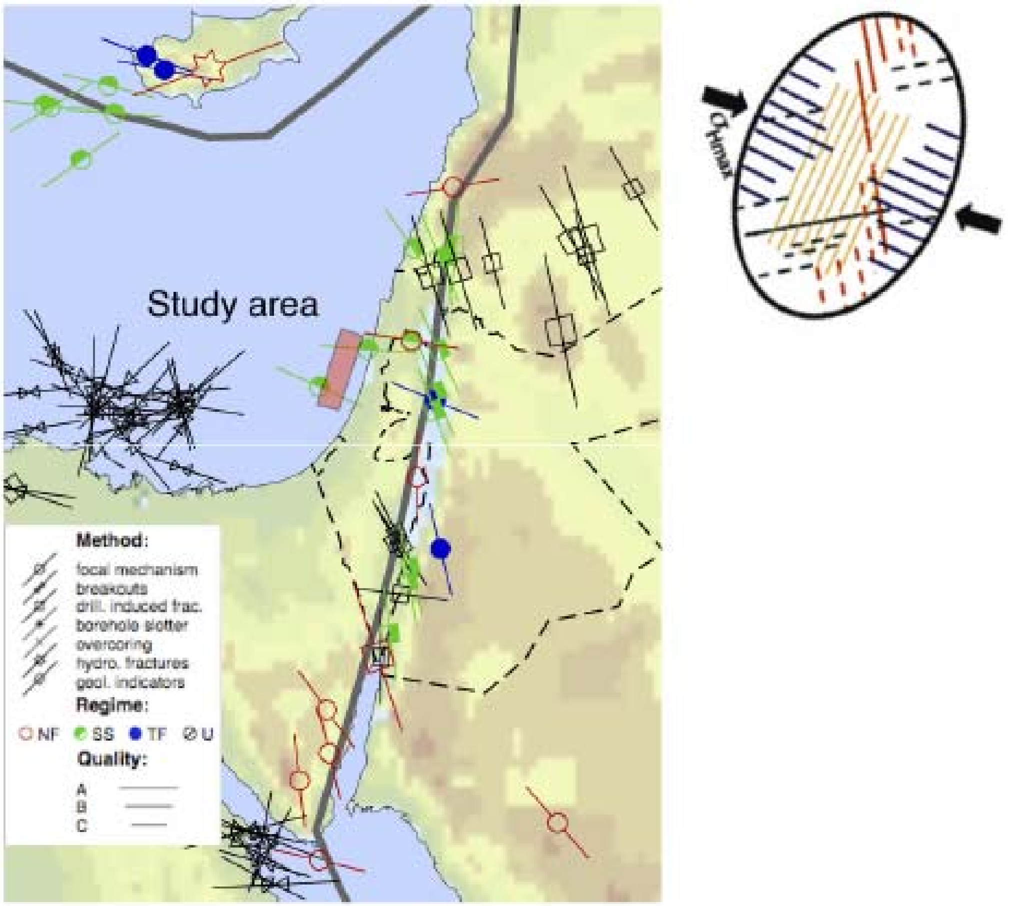

Figure 27 Current Levant Basin Stress Map
(World Stress Map, 2008)

7. PETROPHYSICAL

1.24 GENERAL LOG EVALUATION

The Isramco Yam-Yafo 1 and the Isramco Yam 2 wells both penetrated the Jurassic carbonate formation and both had oil recovered during production tests. A petrophysical analysis using the available digital files was done with the results shown in Figure 28 and Figure 29. These displays show the intervals of possible fracturing that are expected in this zone and the intervals tested with test rates.

The Yam-Yafo 1 has two distinct carbonate intervals in the Jurassic formation. The lower interval from 5,210 meters (17,093 feet) to 5,331 meters (17,490 feet) was not reached in the Yam 2 well. The Upper zone, the Zohar, in the Yam- Yafo 1 at 4,895 meters (16,060 feet) to 4,963 meters (16,283 feet) correlates to the interval in the Yam 2 seen in Figure 29.

Petrophysical evaluation determined that three intervals the Zohar, Shederot, and Barnea have potential for oil production. The Zohar zone has a net pay of 0.9 meters with an average porosity of 13.9% and water saturation (Sw) of 36.7%. The Shederot zone has net pay of 0.4 meters with an average porosity of 13.1% and a Sw of 48.4%. The final zone Barnea has net pay of 2.9 meters with an average porosity of 13.6% and a Sw of 26.5%.

The drill stem test (DST) and production test data report volumes and rates of produced oil that could not be sourced from the matrix porosity. Therefore, this produced oil must be from a secondary porosity system such as fractures. Fractures were reported in the sample descriptions in the mudlog reports from both the Yam-Yafo1 and Yam 2 wells and interpreted to be present on the Continuous Borehole Image Log (CBIL) taken in the Yam-Yafo 1 well. The CBIL log was run from 4,860 meters to 5,134 meters and had indications of natural fracturing in the carbonate sections where the data was good. Although determining fractures is very difficult in complex carbonate formations without a good formation image log, using the combined log responses, one can determine the specific intervals that have the greatest probability to be fractured. The fracture probability is based on log responses and is determined by comparing the matrix corrected sonic porosity to the total porosity. Total porosity or matrix plus fracture porosity is calculated from the density-neutron porosity which is then compared to the sonic porosity. The sonic porosity does not respond to the fractures and represents matrix porosity alone. When the sonic porosity is less than the total porosity it is interpreted that there is a high probability for fractures. Other logs that were used to determine fracture probability were micro log spiking, increased gamma-ray readings and caliper logs.

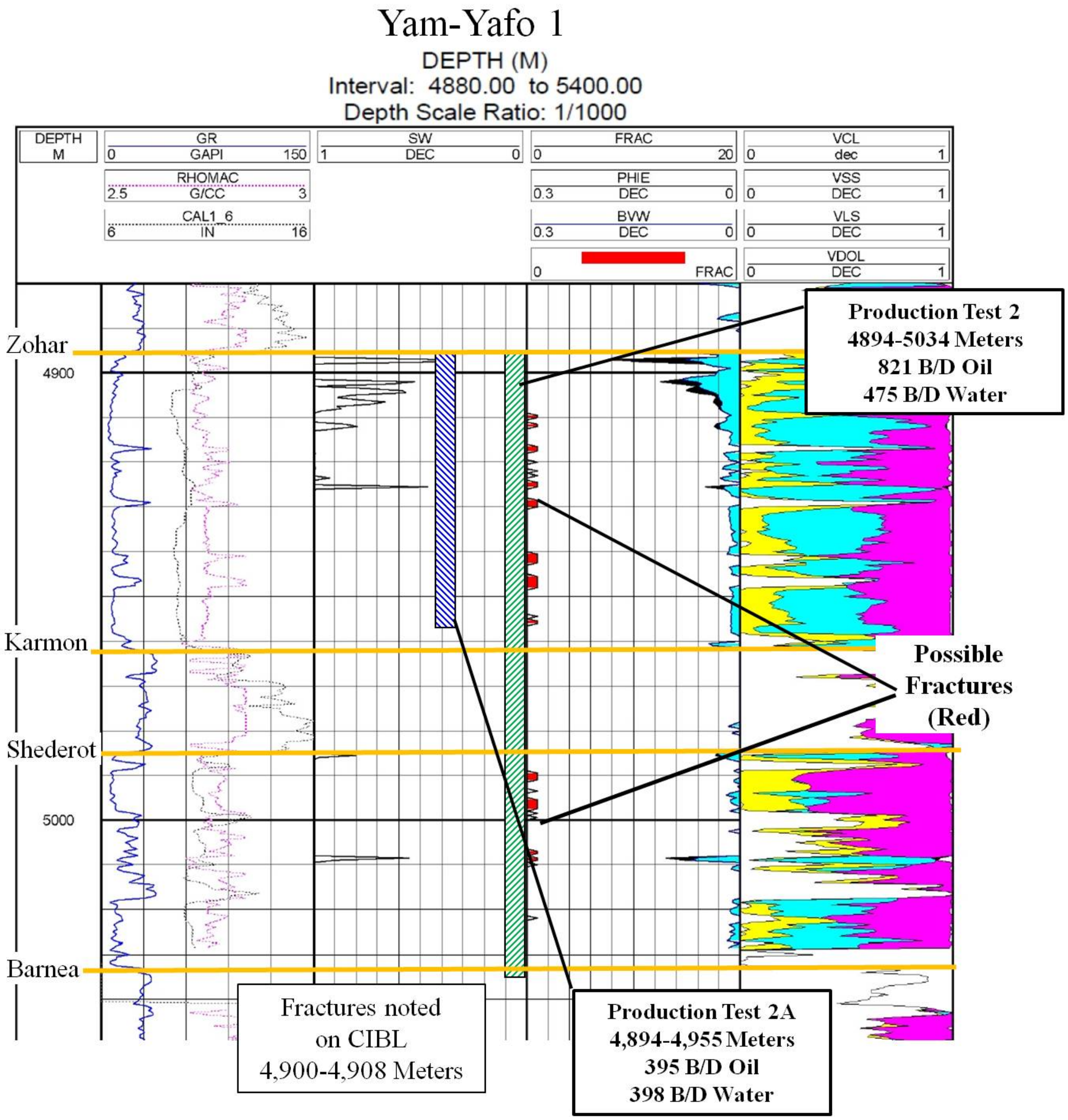

Figure 28 Petrophysical Analysis of the Jurassic Section in the Yam-Yafo 1 Well

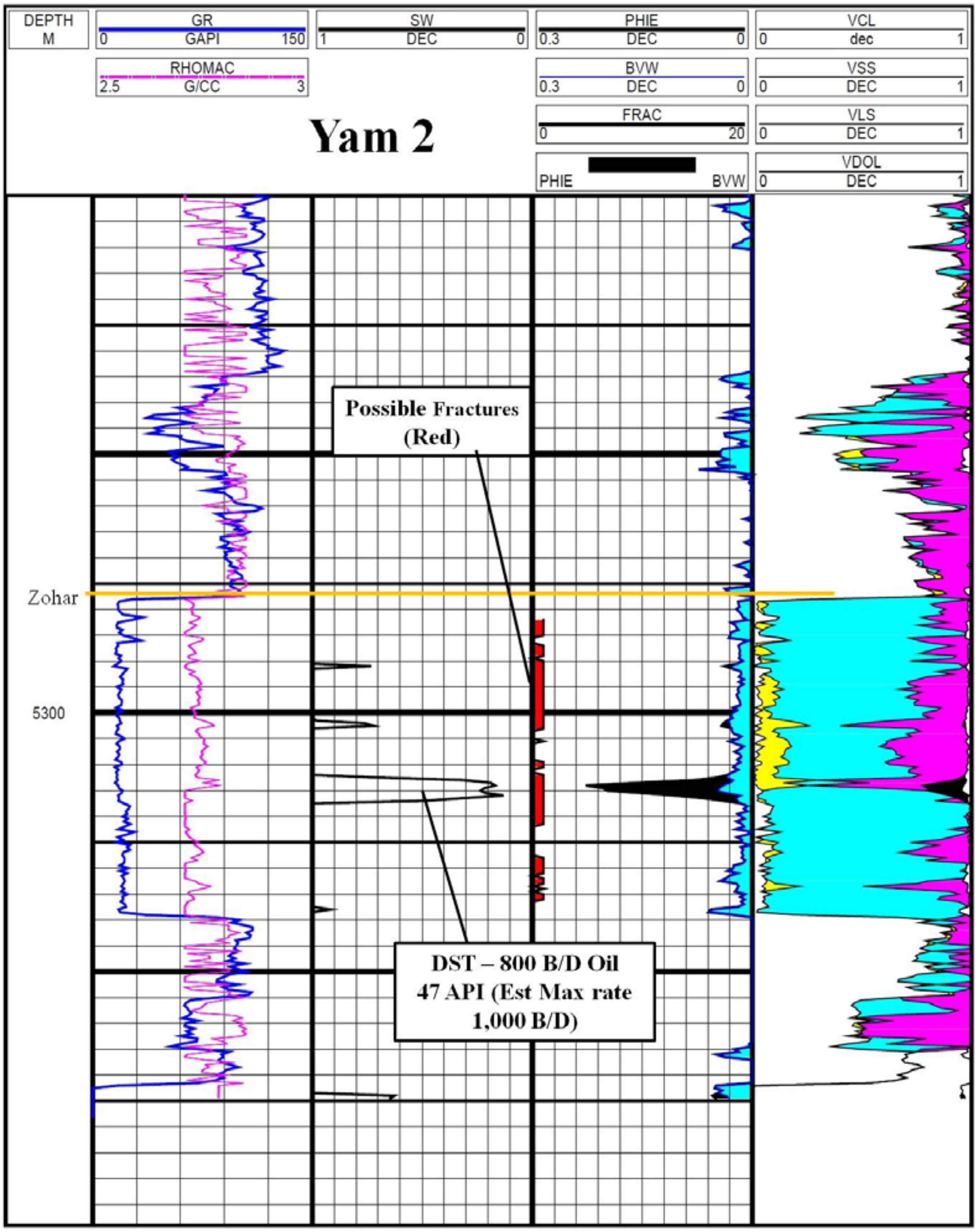

Figure 29 Petrophysical Analysis of the Jurassic Section in the Yam 2 Well

The petrophysical results for the Yam 2 well in the Zohar interval from 5,278 to 5,339 meters (Figure 29) include 2.74 meters of matrix pay with an average porosity of 14.5% and an average net Sw of 33.5%. The display also shows the intervals of possible fracturing noted in red that are interpreted in this interval. The mudlog data noted that fractures were observed in the cuttings throughout the Jurassic interval. The interval from 5,309 to 5,317 meters of the Jurassic zone was tested at a rate of 800 barrels per day of oil in the Yam 2 well and an estimated maximum flow rate of 1,000 barrels of oil per day was derived from the testing. This test rate strongly suggests that the fractures in this zone contributed to the flow rate. Therefore, it would be interpreted that considerably larger net pay than the tested interval is indicated by the analysis.

1.25 RW DETERMINATION IN YAM - YAFO 1

One of the key variables used to estimate resources is the Water Saturation (Sw) or the amount of pore space that is occupied by water rather than hydrocarbons. The Sw equations all use a Resistivity of Water (Rw) variable that is compared to the measured formation resistivity from the wireline logs. The Rw value used for Sw determination for the Yam – Yafo 1and Yam 2 wells was 0.05 ohms at 127°C or 36,333 parts per million (ppm) of salt (NaCl). This value was computed from several sources.

The primary source was the computed Rwa, formation Rw apparent, in the Zohar formation in the Yam - Yafo 1 well. Rwa, computed by using Archie's Sw equation, is the value computed from resistivity and porosity when Sw (Archie) equals 100% water.

Archie Equation

$$Sw = (Rw / (Rt * phi^2)) \wedge 0.5$$

Therefore, when Sw = 100% water Rw can be solved by the equation:

$$Rwa = Rt * phi^2$$

Where:

Rt = Formation Resistivity Deep
phi = Formation Porosity
Rwa = apparent formation water resistivity
Rw = formation water resistivity

Using observation and histograms of the computed Rwa curve in the Zohar interval the value of 0.05 ohms at 127°C was determined.

Other methods used to determine this Rw were:

1. The Resistivity of the Mud Filtrate (Rmf) was measured at 0.06 at 170°C or 22,786 ppm NaCl.
2. Fluid testing results in the Yam - West 1 well recovered formation fluid from the Jurassic carbonate with 0.14 ohms resistivity at 23.6°C or 46,126 ppm NaCl. At a formation temperature of 170°C the recovered formation fluid value would be 0.031 ohms.

These values are relatively within the same range and indicate that the formation water in the Jurassic carbonate section in the Gabriella, Yitzhak and Shemen areas would have salinity in the range of 22,780 to 46,150 ppm NaCl

1.26 FRACTURE EVALUATION FROM WELL LOGS

A Fracture Probability Analysis was done to determine if there was evidence of fractures in the reservoir zones. A Fracture Probability Analysis is a summation and review of the fracture response of the well logs recorded on each well. In this study two wells were evaluated, the Isramco Yam-Yafo 1 located on Gabriella and the Isramco Yam-2 located to the south. These logs were processed with Fugro-Jason Powerlog software's complex mineral model. In this study each well was reviewed with the available recorded logs to determine the probability of fractures in the Jurassic interval.

1.26.1 General Overview of Fractures Responses from Well Log Data

The following information can be derived from certain well logs:

- Spontaneous potential (SP) logs can exhibit streaming potential (electro kinetic energy) due to fluid flow into open fractures.
- Gamma-ray responses may have very high API values due to radioactive salts deposited by fluid flow thru fractures.

- Caliper logs may read wash-out or show roughness due to large fractures; typically no wash-outs occur in micro fractures.
- Resistivity logs may show invasion profiles where fractures have mud filtrate invasion.
- Micro-resistivity log curves spiking due to invasion of conductive mud filtrate into open fractures.
- Changes in the density correction curve (Drho) may be due to mud filtrate invasion into fractures and the mud cake sealing the fractures.
- Comparison of porosity logs such as the difference between the Total Porosity and Sonic Porosity would indicate secondary porosity or fractures.

1.26.1.1 Resistivity Logs

There are two types of resistivity logs, induction and lateral. They have different responses to fractures. A critical factor in resistivity logs being able to respond to fractures is the mud filtrate. Typically open fractures will fill with mud filtrate. If the mud filtrate is fresh, non-conductive, there will be lesser response than with conductive salt mud systems. Induction logs have a lesser response than lateral logs to fractures because their current flow is perpendicular to or around the borehole. However, Induction logs still may exhibit separation due to various depths of investigation measured by the tool that responds to the invasion of conductive mud-filtrate into fractures, in very low matrix porosity formations. This response is not noticeable in higher porosity formations. The current from the tool in Lateral resistivity logs and micro-focused resistivity logs is forced or focused to be parallel to the formation and therefore is greatly affected by the fluid filled fractures. An example of this is micro-resistivity log curves spiking due to the invasion of conductive mud filtrate into the fractures. Similar to the induction curves, in low porosity rock, separation occurs between the lateral curves with different depths of investigation such as the laterolog shallow and the laterolog deep that would detect the presence of fractures.

1.26.1.2 Porosity Logs

Porosity curves can also be helpful in determining fractures. In both of the subject wells, three different porosity logs, the density, neutron and sonic, were recorded. The input logs used for this analysis included a compensated formation density log (RhoB), a borehole compensated sonic travel time (DT), and the compensated neutron porosity measured on a limestone matrix. Output curves from the complex mineral model included the corrected matrix values for the density (Rho matrix) and the borehole sonic (DT matrix). These were then used to calculate matrix corrected porosities for the density and sonic porosities. Total porosity was then computed from the corrected density porosity and the compensated neutron porosity. Since, the total porosity includes both matrix and fracture porosity it can be compared to the sonic porosity which is only matrix porosity to indicate the presence of fractures. In other words, when the total porosity is greater than the corrected sonic porosity this difference may be attributed to secondary porosity. This secondary porosity can be fractures, vugs, or oolites. In this case, the target formations in this prospect are interpreted to be fractured limestones.

1.26.1.3 Other Logs

The density correction curve (Drho) can also be useful in fracture detection. This curve represents the amount of correction applied to the density curve due to mud cake thickness and the invasion of mud filtrate. Changes in the correction curve in an in-gauge hole may be due to mud filtrate invasion into fractures and the mud cake sealing the fractures.

The photo electric, Pe, curve responds to the lithology of the formation. The Pe reading for various reservoir rocks ranges from approximately 1.8 in sandstone to 5.0 in limestones. Shales typically read around 4.0 and barite has a reading of 266.0. Barite in a mud system will cause spikes to the Pe curve where the barite mud cake seals the fractures. Array sonic tools can be processed to determine fractures from compressional or shear wave attenuation, frequency changes and anisotropy. Image tools such as the FMI, Sonic Scanner and others give a “picture” of the formation that can be used to determine fracture presence, frequency, dip and azimuth. An oriented whole core can be used to determine fractures and the orientation of these fractures.

1.26.2 Fracture Probability Analysis for the Yam-Yafo 1

The intervals selected for possible fracture analysis in the Yam-Yafo 1 well are in two low porosity Jurassic limestone intervals that are separated by 190 meters of shale (Figure 30). The upper interval from 4,896 to 5,020 meters correlates to the upper Jurassic Zohar limestone in the Yam 2 well. The lower section, which has a greater fracture density than the upper zone, is from 5,220 meters to 5,310 meters.

Potential fractures in this well were estimated from four indicators: the caliper log, the density correction curve (Drho), resistivity curve response and the comparison of total porosity to the corrected sonic porosity using the density (RhoB), and neutron and sonic (DT) logs. The CBIL log, where the data is good, shows natural fractures in the carbonate sections.

1.26.2.1 Caliper Log

The values of the caliper (cali_6 from the las[17] file) log, are not equal to the 8 3/8 inches in-gauge hole size that should have been drilled based on the drillbit size on the log header. The caliper scale on the lithology plot is 8 to 18 inches (Figure 31). The minimum value of the caliper curve is 9 inches and the caliper log averages 10 to 11 inches. Caliper logs can be used to determine potential fractures where the caliper readings are less than the in-gauge hole size or the presence of fractures can be postulated when the hole is ‘washed-out’ or much larger than the in-gauge hole size due to the formation falling apart after drilling. However, the absolute value of this curve was not used to determine fractures in this case. Using a qualitative approach, when in apparent gauge or smooth low caliper and clean gamma ray readings, the caliper curve was used as a good hole indicator. Typically, in the Yam-Yafo 1 well, the caliper curve readings indicate a rough washed-out hole in the limestone and a very large washed-out hole in the shale sections. This could indicate that the limestone is fractured.

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[17] Digital log files

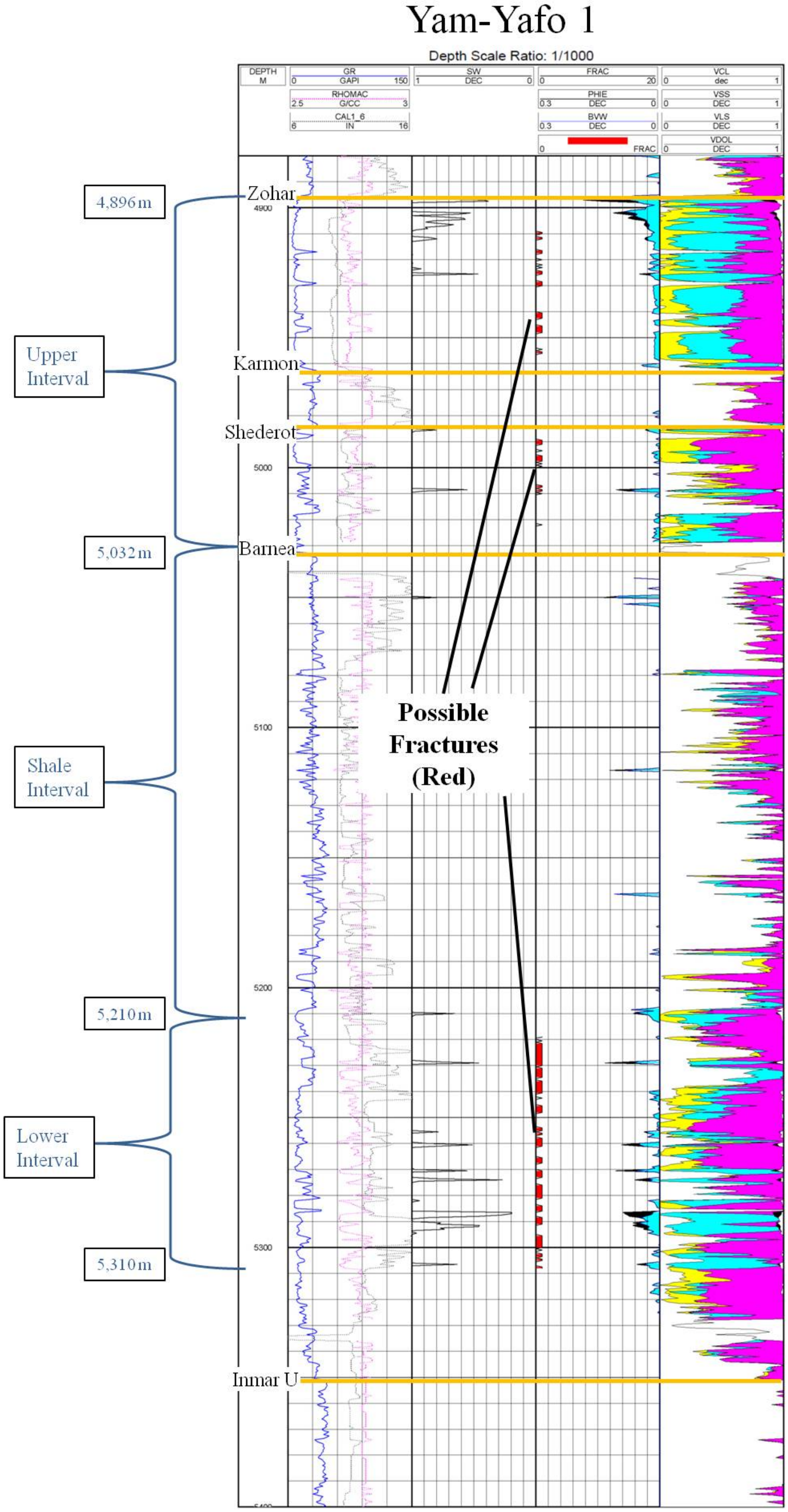

Figure 30 Yam-Yafo 1 Well Petrophysical Evaluation

1.26.2.2 Density Correction Curve (Drho)

The density correction curve (Drho) depicted in Figure 31, was the second fracture indicator used for this analysis. This indicator responds to fluid filled fractures by recording a negative correction response to fluid filled fractures. Since wash-out and rough hole can affect the Drho log, these data were used in conjunction with the caliper log and probable fracture intervals were selected that had good apparent in-gauge hole with smooth character, and cleaner gamma ray response. This was applied to both the upper and lower limestone intervals.

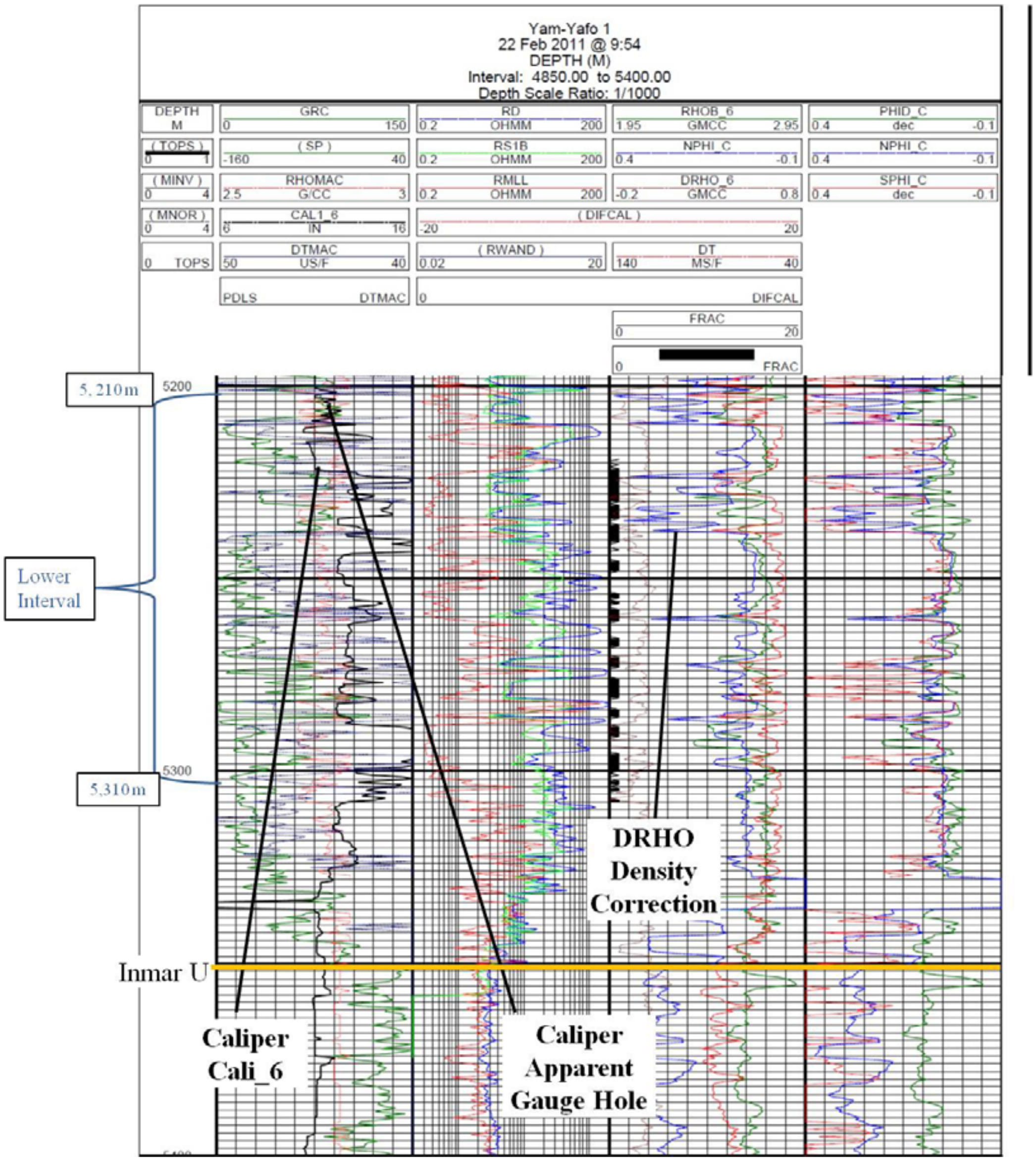

Figure 31 Yam-Yafo 1 Well Log Data Highlighting the Density and Caliper Data

1.26.2.3 Resistivity Curve Response

The third method is the resistivity curve response. Resistivity curves (Figure 32) used in this well were: a deep resistivity (RD), shallow resistivity (RS) and a micro laterolog resistivity (RMLL). Although the type of deep resistivity, RD, was not reported or indicated in the las file, it appears to be a deep laterolog (LLD) resistivity. A shallow resistivity (RS), was recorded in the lower interval on this well and the curve response appears to be a shallow laterolog (LLS). Shallower depth logging runs used induction type resistivity tools.

The LLD, LLS and RMLL are a common logging tool combination used in wells with salt water mud systems and highly resistive formations such as low porosity limestones. Typical fracture responses observed on laterolog data are a separation of the LLD and LLS curves in fractured intervals. In fractured hydrocarbon intervals the mud filtrate fills the open fractures, displacing the oil. The salt mud is very conductive, and oil is non-conductive so this invasion of salt mud has a greater effect on the LLS than on the LLD thus the separation of the two curves. The RMLL, micro laterolog is a pad tool that was very helpful because of the vertical resolution of 4 inches and shallow depth of investigation of about 2 inches. In fractured or high permeability zones the RMLL reads the resistivity of the invaded zone. In these salt mud systems the resistivity of the invaded zone is much lower, more conductive than what the LLS responds too. In fractured intervals the RMLL spikes to lower resistivity values in the fractures because of the log’s more detailed vertical resolution. In washed out hole and very rough hole conditions quite often the RMLL pad loses contact with the formation. In using the RMLL to aid in fracture detection one must be wary of the borehole conditions.

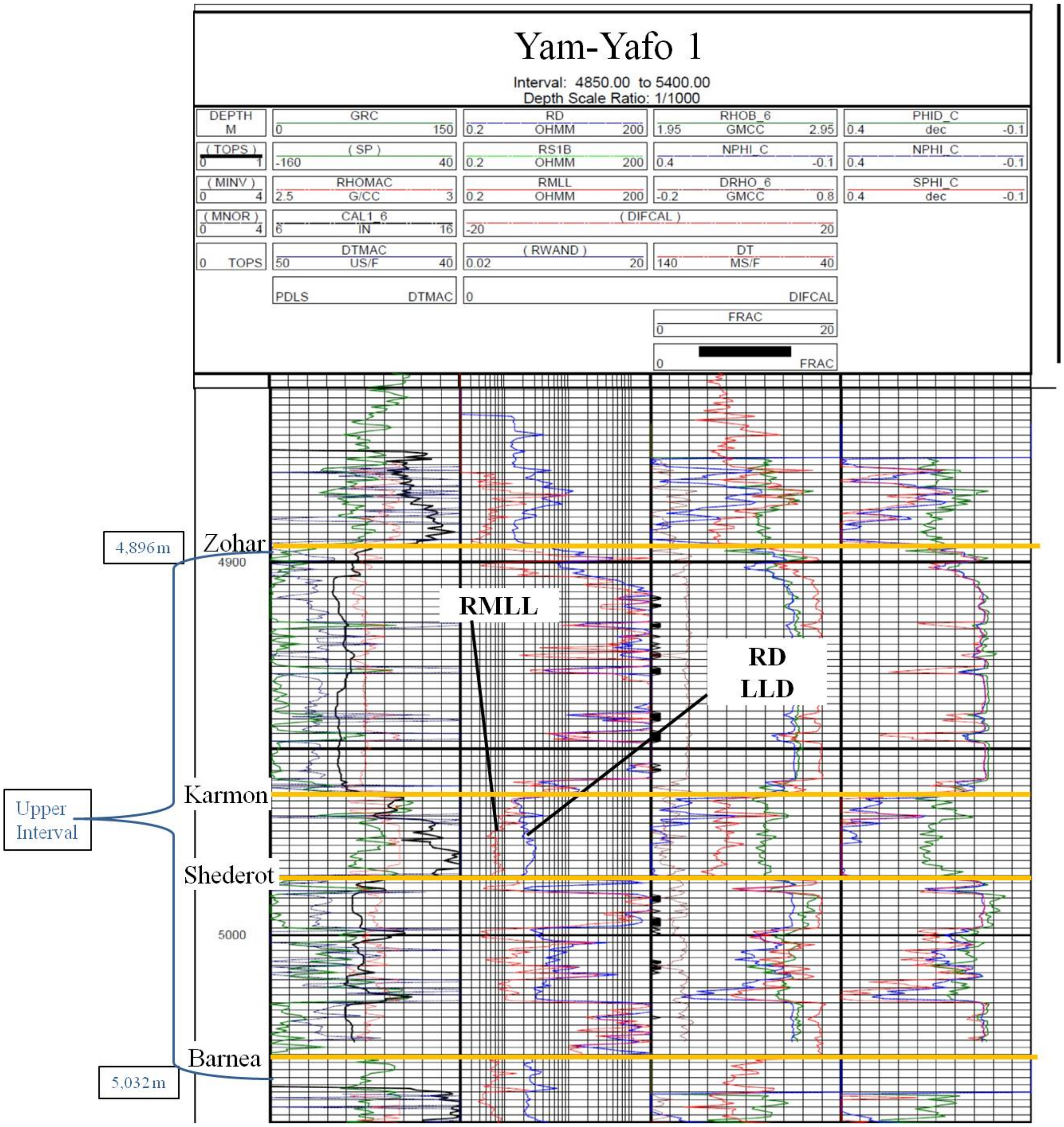

Figure 32 Yam-Yafo 1 Well Log Data Highlighting the Resistivity Data

1.26.2.4 Comparison of Total Porosity to the Corrected Sonic Porosity

Porosity data can also be helpful in the determination of potential fractures. In Yam-Yafo 1 well three porosity curves including density (Rhob), neutron, and sonic (DT) were recorded (Figure 33). These were processed in a complex mineral model to calculate corrected matrix values for each sample depth. The inputs for this processing were; Rhob, DT, and neutron porosity on a limestone matrix. The corrected matrix values for Rho matrix and DT matrix were used to calculate matrix corrected porosities for the density and sonic porosities. Total porosity was then computed from the corrected density porosity and the neutron porosity. Since, the total porosity includes matrix, vugs, oolites, and fracture porosity it can be compared to the sonic porosity, which represents only the matrix porosity, to indicate the presence of secondary porosity. In other words, when the total porosity is greater than the corrected sonic porosity this difference may be attributed to fractures, secondary porosity. This technique was helpful in this well, as the total and sonic porosities demonstrated some intervals of secondary porosity where total porosity was greater than the corrected sonic porosity.

1.26.3 Fracture Probability Analysis for the Yam-2

The interval analyzed for possible fractures in the Yam-2 well was in the limestone section from 5,278 meters to 5,339 meters which has a low matrix porosity of 3% with the exception of the interval, from 5,312 meters to 5,316 meters, where there is a thin interval of matrix pay 2.74 meters thick with 21% porosity and a Sw of 20%. The petrophysical results for the Yam-2 well are shown in Figure 34 with possible fracture zones depicted in red in the fluid track. Potential fractures in the Yam 2 well were identified using two indicators the Drho curve and the Resistivity Separation technique.

1.26.3.1 Density Correction Curve (Drho)

Although the interval from 5,278 to 5,339 meters lacked a caliper curve, the Rhob curve does not exhibit the characteristics of wash-outs such as spikes in the data (Figure 35). It was therefore assumed that the hole within this interval is in gauge. Since the invasion of drilling mud filtrate into fractures causes the Drho to deflect in a negative direction it can be used as an indicator of fractures in this well.

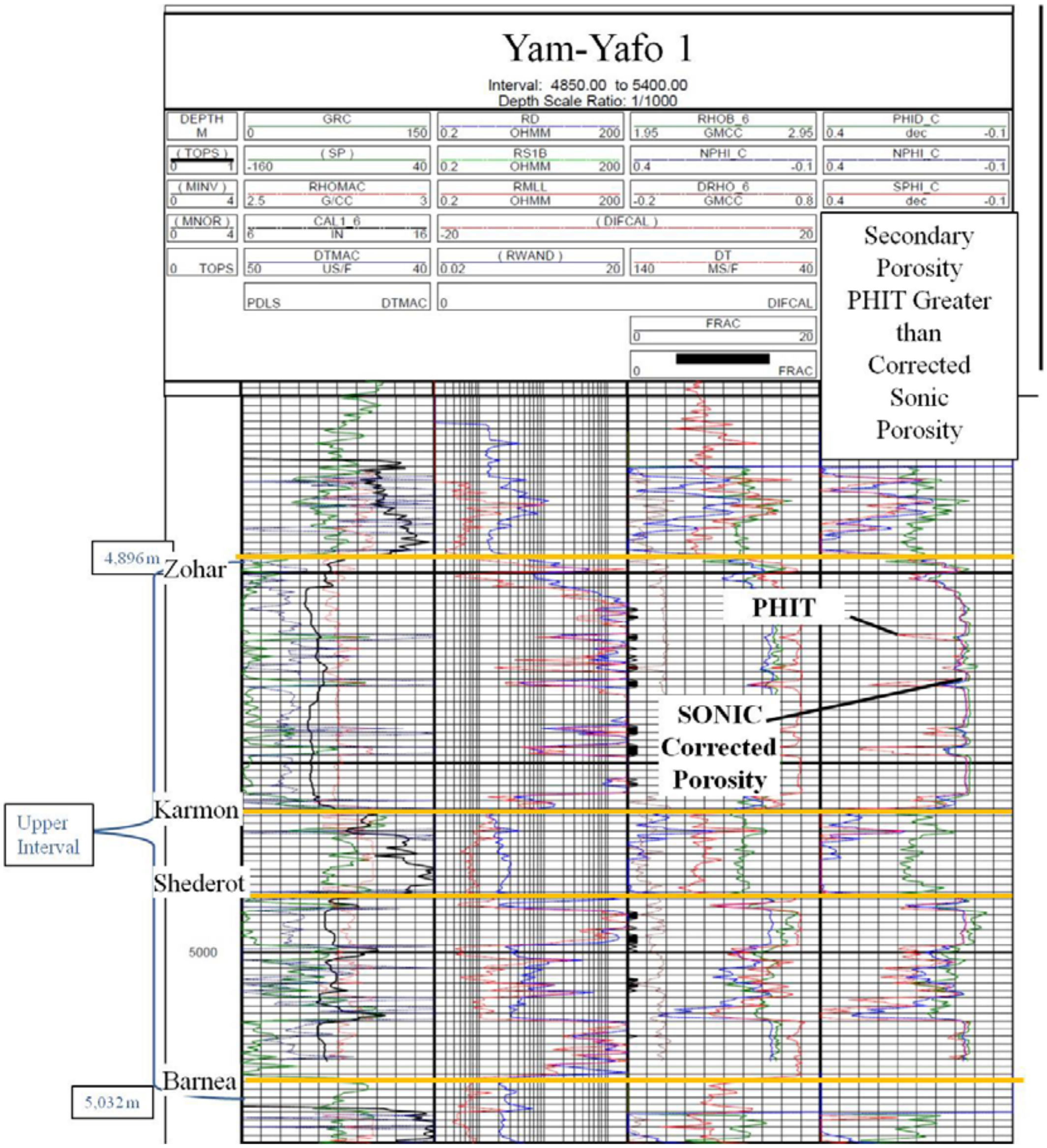

Figure 33 Yam-Yafo 1 Well Log Data Highlighting the Sonic Porosity Data

1.26.3.2 Resistivity Curve Response

The second fracture indicator used in this well was the separation of the LL3 and ILD resistivity curves (Figure 36). The separation between these curves which is caused by mud filtrate filling the open fractures, in very low porosity limestone, has often been correlated to fractures in core data. In the interval from 5,313 meters to 5,316 meters, if there are fractures they are hidden by the very good limestone matrix porosity of 20% in this zone. The log curves in this interval, resistivity and porosity are more representative of a conventional reservoir than a low porosity fractured limestone. The ILD and LL3 separation in the shale above at 5,255 meters appears to be an ILD calibration error caused by temperature effects. At the base of this interval below 5,380 meters the LL3 is affected by the higher resistivity limestone. This is probably a Groningen effect or where the return current electrode enters the higher resistivity bed this causes a distortion of the resistivity readings.

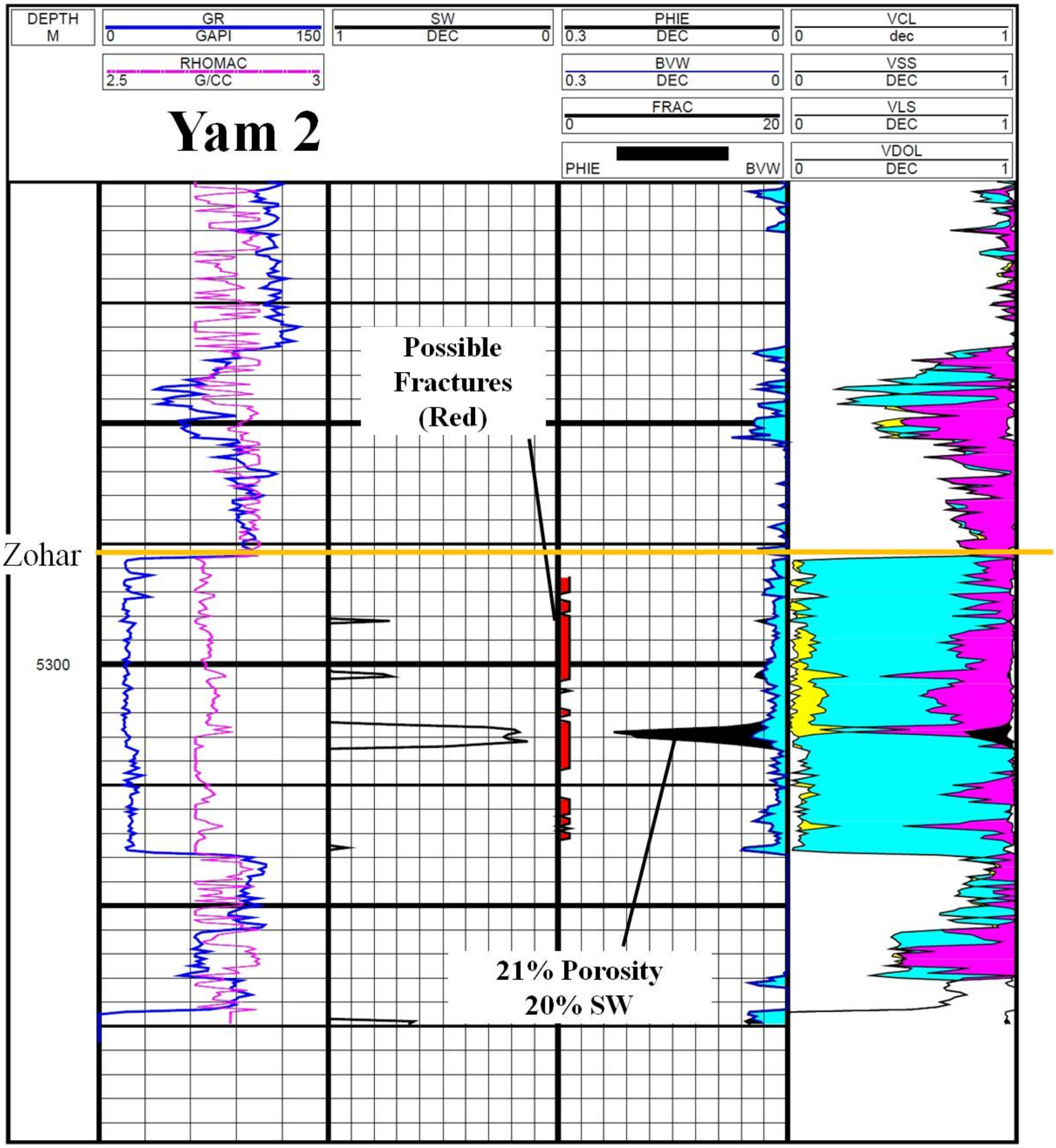

Figure 34 Yam 2 Well Petrophysical Evaluation Results

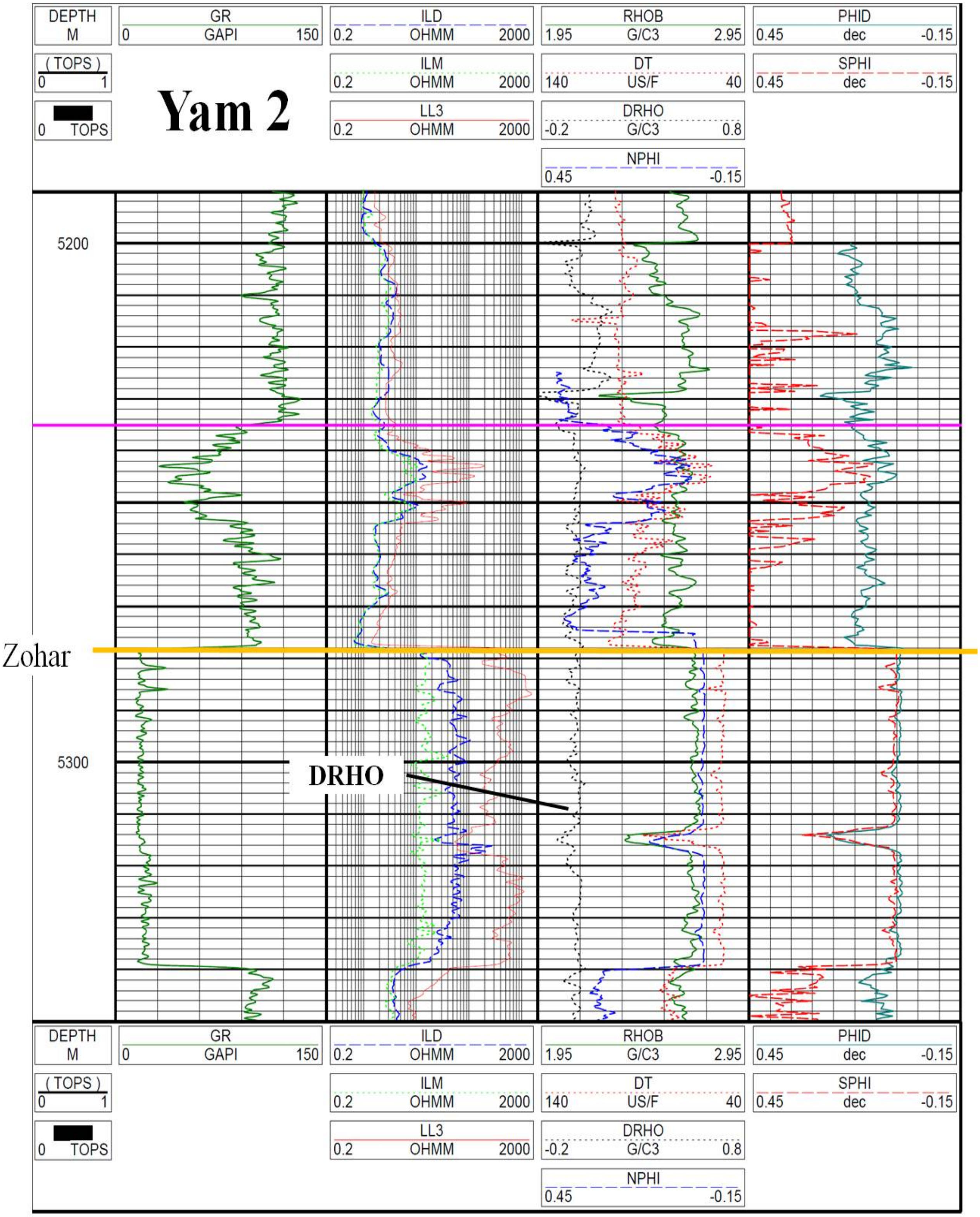

Figure 35 Yam 2 Well Log Data Highlighting the Drho or Density Porosity

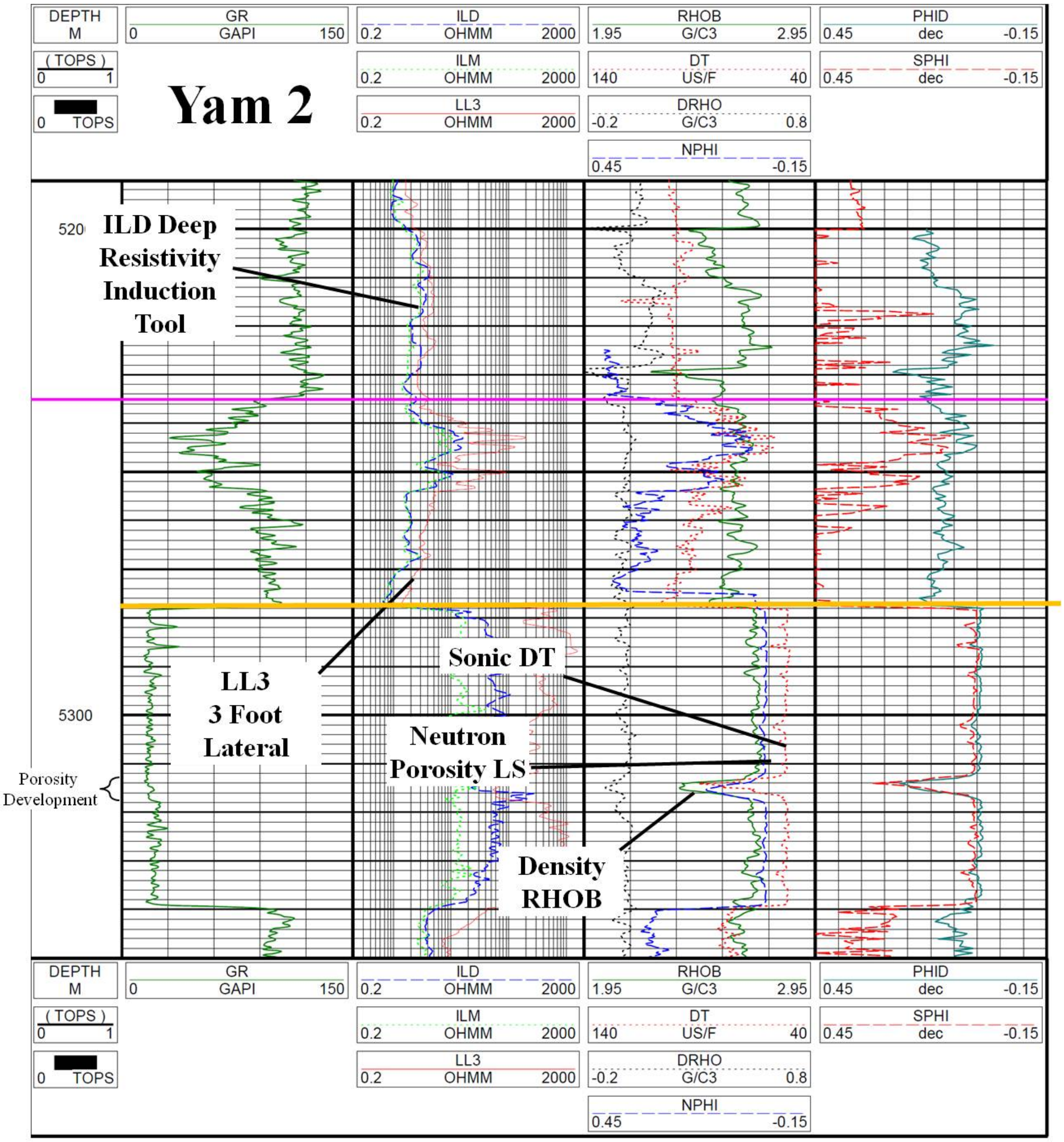

Figure 36 Yam 2 Well Log Data Highlighting the Resistivity and the Sonic, Neutron, and Density Porosity

1.26.4 Fracture Analysis Conclusions

Based on the fracture probability analysis of the Jurassic intervals seen in the Yam-Yafo 1 and the Yam 2 wells, the results show that both wells are fractured in the low porosity limestone intervals. In these two wells the higher porosity intervals may also have fractures but cannot be determined using these methods as the higher matrix porosity masks the fractures. A composite computer processed interpretation (CPI) was done on both wells over the Jurassic Limestone intervals. Possible fractures were determined from the indicators described above in each well and were summed and displayed as the FRAC curve colored in red (Figure 30 and Figure 34).

Four indicators were used in the Yam-Yafo 1 well to determine fracture probability including the caliper, Drho, resistivity and porosity curves. The Yam-Yafo 1 well has an upper limestone, from 4,995 meters to 5,032 meters and a lower limestone interval from 5,210 meters to 5,310 meters. These are separated by a shale section from 5,032 meters to 5,210 meters. Both the upper and the lower limestones are fractured. The upper limestone has a gross reservoir interval of 136 meters and the lower limestone has a gross reservoir interval of 121 meters.

The Yam 2 well has a gross reservoir interval of 61 meters where this interval in the Yam 2 Jurassic limestone correlates to the upper interval in the Yam-Yafo 1 well. The Yam 2 was not drilled deep enough to evaluate the lower limestone found in the Yam-Yafo 1 well.

The production test peak flow rate of 821 barrels of oil per day was produced from a 122.5 meter interval that may have had formation damage. It is expected that a fractured undamaged formation would produce at higher rates.

1.27 PROSPECTS

The Yitzhak block has the potential for shallower gas prospects in the Cretaceous and a deep Jurassic prospect. The outline of the Cretaceous and Jurassic Zohar oil prospects and where they occur within the block area is depicted in Figure 37.

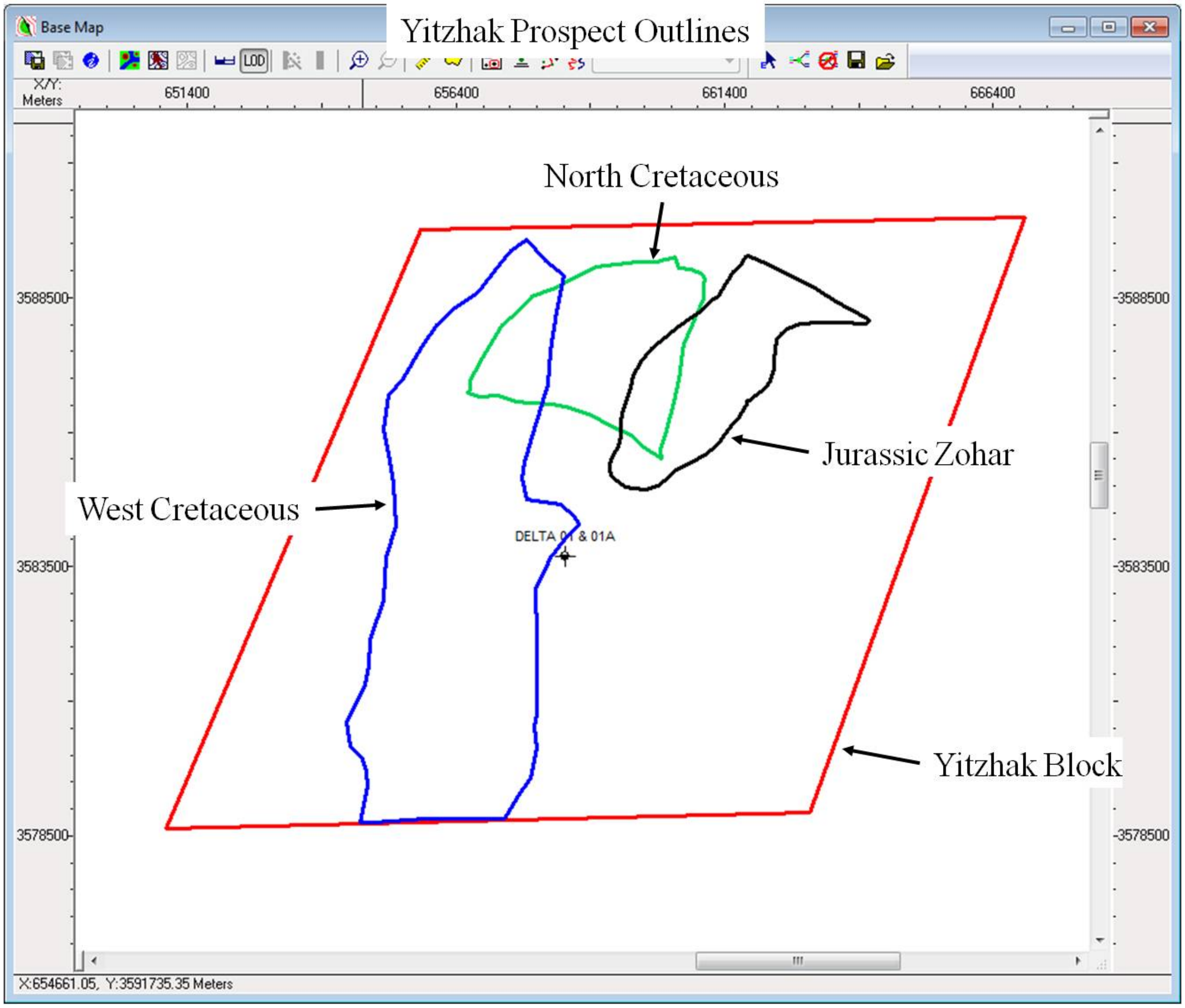

Figure 37 Outline of the Prospects on the License

1.27.1 <u>Jurassic Zohar</u>

In order to estimate the Probabilistic Contingent Resources for these prospects, areal and vertical closures were determined and are depicted for the Zohar level in Figure 38. A P_{10} or maximum size of approximately 8.5 square kilometers of areal closure has been calculated with an indicated vertical closure of approximately 168 meters to the 4,200 meter contour. A P_{90} or minimum size of 1.0 square kilometers with approximately 28 meters of vertical closure has been calculated using the 4,060 meter closure. Finally, for the P_{50}, using the 4,130 meter contour gives an approximate areal extent of 3.5 square kilometers and a vertical closure of about 98 meters. After reviewing numerous time-slices, the northwest-southeast trending “red” fault may be extended approximately 1 kilometer to the northwest to intersect the 4,200 meter contour. This interpretation is used for the P_{10} case.

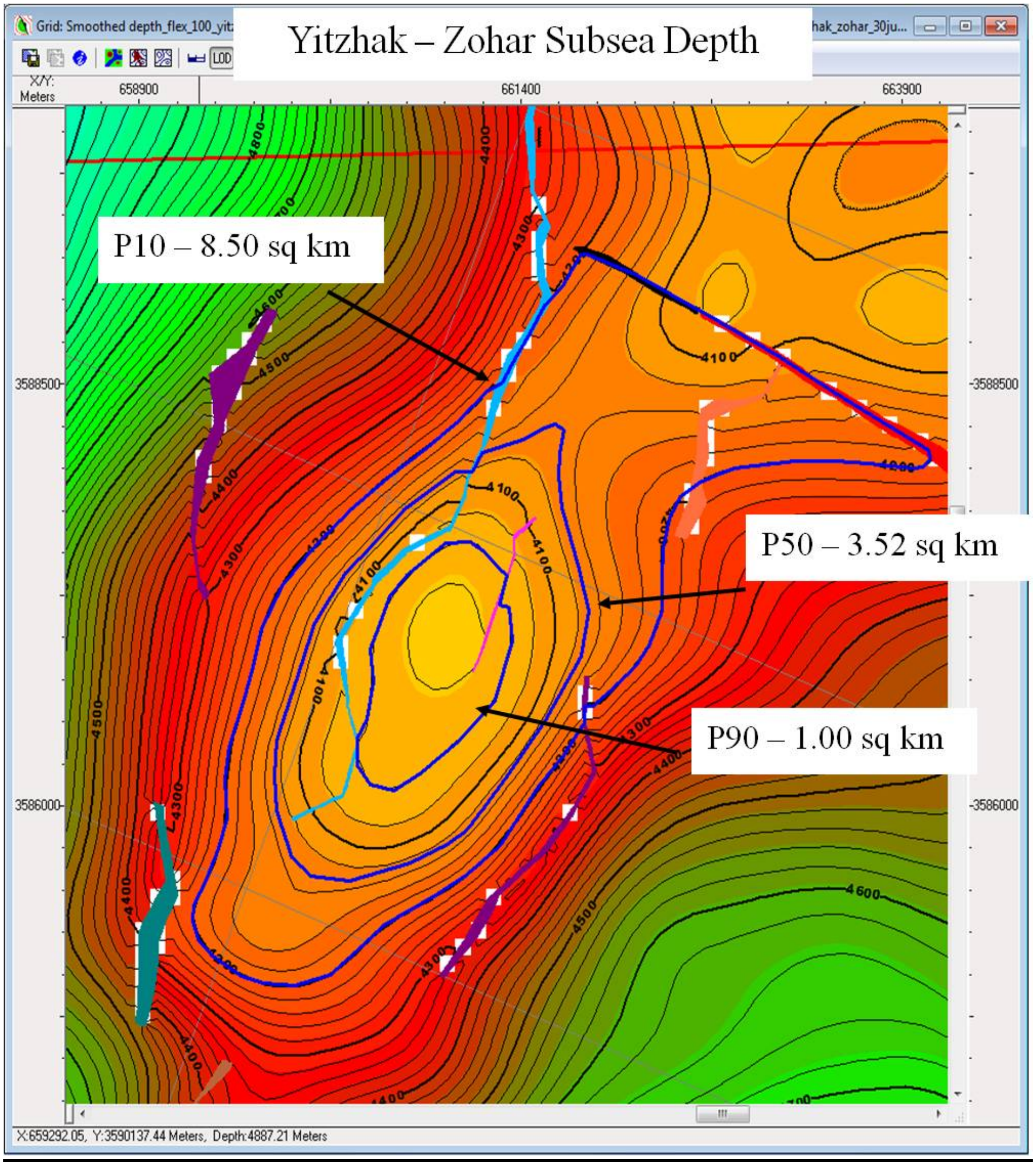

Figure 38 Zohar Depth Map with Areas of Closure Used in the Probabilistic Contingent Resource Estimate for Yitzhak

The Gross thickness used in the Probabilistic calculations includes only the Gross carbonate intervals seen in the Yam 2 and Yam-Yafo 1 wells. Since the matrix porosity is so low, the presence of reservoir quality rock is dependent on fractures or fracture porosity. Therefore, the

Net to Gross for the Jurassic is assumed to be 1:1 and the dual porosity of matrix and fractures accounts for the Gross reservoir volume in the carbonate. This thickness and dual porosity system is assumed to be averaged over the areas used in the Probabilistic estimates.

1.27.2 Talme Yafe Cretaceous

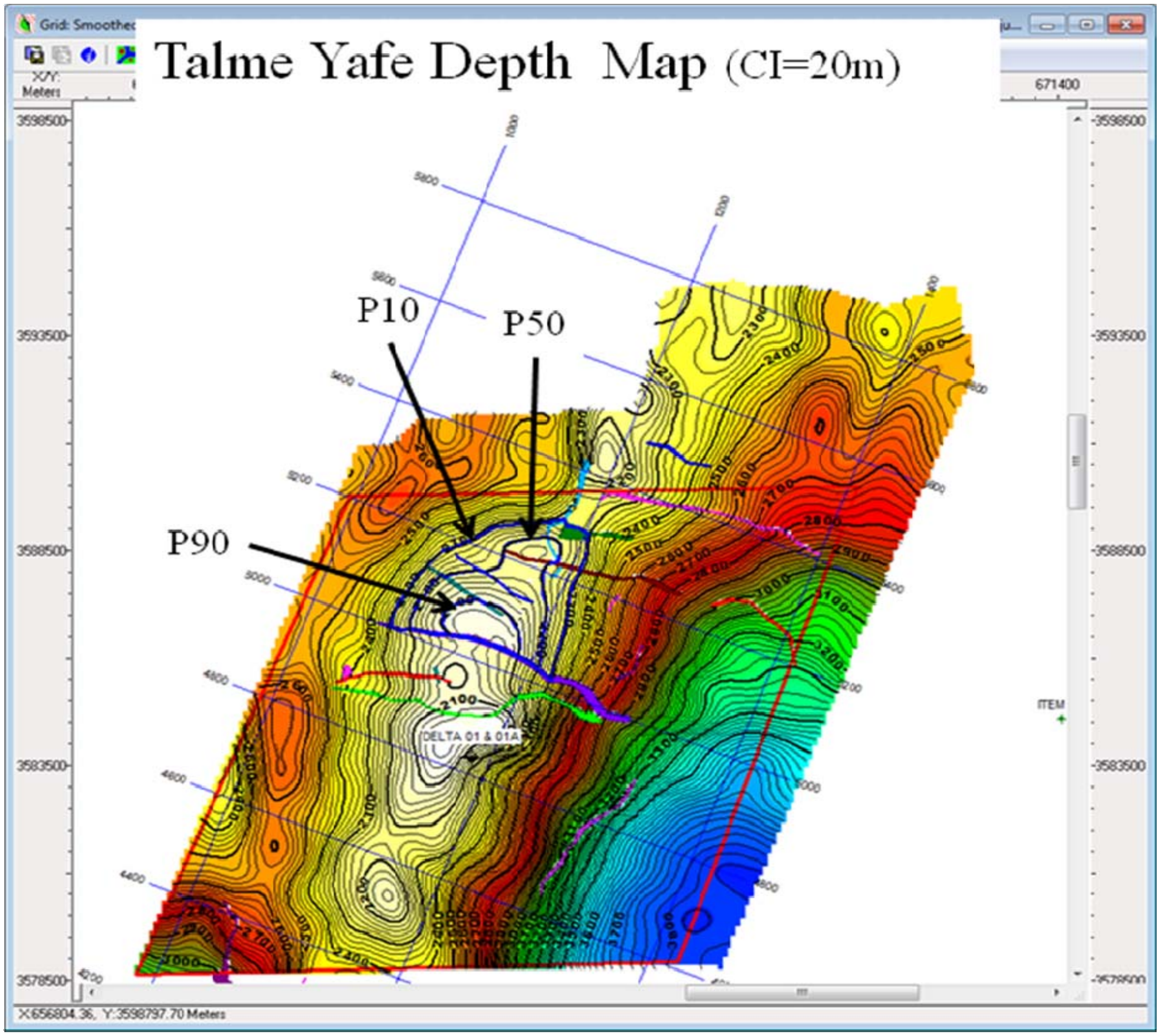

Figure 39 Depth map of the Talme Yafe Cretaceous Prospect on Yitzhak

The Cretaceous Talma Yafe horizon has a three-way dipping structure with a fault closure (Figure 39) as well as high amplitude events that may indicate a sequence not encountered at the Delta 1 well. An isopach and a flattened time section indicate that the Talme Yafe to Zohar section thickens to the west.

For the Cretaceous Talma Yafe horizon, a P_{10} or maximum size of approximately 9.5 square kilometers of areal closure has been calculated with an indicated vertical closure of approximately 230 meters to the 2,290 meter contour. A P_{90} or minimum size of 1.4 square kilometers with approximately 40 meters of vertical closure has been calculated using the 2,100 meter closure. Finally, for the P_{50}, using the 2,200 meter contour gives an approximate areal extent of 5.4 square kilometers and a vertical closure of about 140 meters.

1.27.3 West Cretaceous

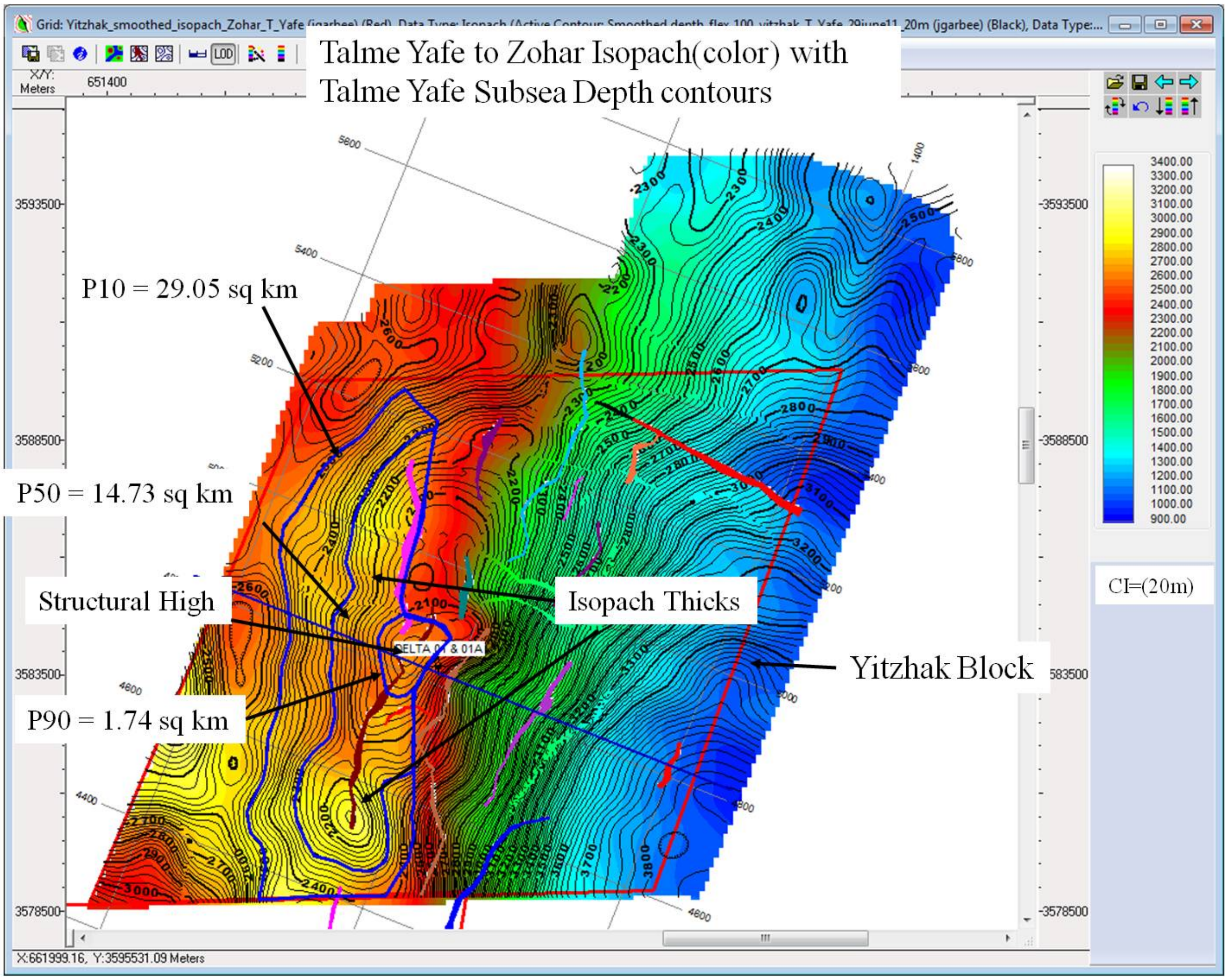

Figure 40 West Cretaceous Prospect

The West Cretaceous Prospect on the Yitzhak block, Figure 40, is an Isopach thick on an inversion structure feature. The isopach from the Talme Yafe to Zohar shows sediments over

3,000 meters thick that occur on a structure. Although the Delta well did not encounter porous sands in this interval the sediments thicken to the west and the potential for reservoir quality rocks would be higher. The eastern boundary of the West Cretaceous prospect is a stratigraphic thinning just west of the Delta well. The Talme Yafe to Zohar Isopach areas of greater thickness would have a greater potential for sand development and where there are present day structural highs caused by inversion there is the potential for hydrocarbon accumulation.

For the West Cretaceous Prospect, a P_{10} or maximum size of approximately 29.0 square kilometers of areal closure has been calculated with an indicated vertical closure of approximately 460 meters to the 2,600 meter contour. A P_{90} or minimum size of 1.7 square kilometers with approximately 60 meters of vertical closure has been calculated using the 2,000 meter closure. Finally, for the P_{50}, using the 2,200 meter contour gives an approximate areal extent of 14.7 square kilometers and a vertical closure of about 260 meters.

1.28 SOURCE

The probable hydrocarbon source rocks for the Zohar Jurassic oil accumulation would be deeper Jurassic and Triassic sediments. It is generally accepted that the geothermal gradient is low and that maturity was attained recently, following post-Tertiary deep burial to about 3,700 meters depth, in order to account for the observed maturation levels. There are at least two possibilities for oil generation sources since the current reservoir temperatures in the Jurassic (>300°F) suggest that oil generation started fairly recently: 1.) perhaps in Pliocene time from the early Jurassic or Triassic sediments or 2.) the hydrocarbon source would be within an early Jurassic to Permian sequence where hydrocarbons probably migrated along Triassic-Jurassic tensional fault complexes to reach Upper Jurassic reservoirs in Cretaceous or Early Tertiary times. In either case there is oil in the Jurassic and gas in the younger sediments.

1.29 SOURCE ROCKS AND PETROLEUM SYSTEM

The data in the area of the Yitzhak block supports the existence of two types of petroleum systems, a biogenic source and a thermogenic source. Onshore producing fields such as Heletz, and Ashdod fields, along with oil tests or shows in offshore boreholes in the Jurassic such as the Yam 2, Yam West 1, and Yam-Yafo 1 indicate that a thermogenic source exists. Onshore producing fields such as Shiqma and Sadot, and offshore producing fields such as Mari B, Noa and Gaza Marine and hydrocarbon shows in the same offshore wells along with the Dalit, Tamar and Leviathan discoveries support the existence of a biogenic source. The younger sediments are the source of the biogenic natural gas while the deeper rocks are the source of the thermogenic oil and gas.

1.29.1 Biogenic

Plio-Pleistocene, Oligocene and Eocene rocks in the region were found to have biogenic gas potential. Organic rich shales of Oligo-Miocene and Plio-Miocene sediments are considered as source rocks for the onshore Sadot and Shiqma gas fields (Oligo-Miocene). The natural gas found in Noa, Mari, and Gaza Marine fields is considered to be of Miocene-Pliocene origin. The gas found at Mari B is dry and was probably generated fairly recently from Miocene sediments. The gas seen at Tamar is reported by Noble to be biogenic in nature.

1.29.2 Thermogenic

1.29.2.1 Upper Cretaceous

The organic rich marl of the Mount Scopus Group is considered to be a regional prime source rock for some onshore discoveries and shows. Thermal maturity modeling shows that upper Cretaceous sediments reach maturation within the Levant Basin at depths greater than four kilometers[18]. Hence, the Senonian Mount Scopus Group rocks can be considered as a potential for oil and thermogenic gas in the deeper parts of the basin.

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[18] Gardosh, 2002

1.29.2.2 Lower Cretaceous

Gevram shales have a high Total Organic Content (TOC) and are considered to be potential source rocks for oil and thermogenic gas in places where maturity is reached.

1.29.2.3 Middle Jurassic

The Barnea Formation, a fine grained basinal limestone, is rich in organic matter and is considered as the source for the Heletz oil. The Barnea is known from the southern coastal plain wells and its extension into the Levant basin offshore makes it a potential source for oil generation.

1.29.2.4 Lower Jurassic & Triassic

Lower Jurassic and Triassic rocks were found to present source rock properties in various onshore boreholes[19]. High grade oil shows found in the middle Jurassic carbonates in the Yam 2 and Yam-Yafo 1 wells are probably related to these source rocks. Gardosh (2002) estimated that Triassic rocks reached their maturity window in the late Jurassic to mid-Cretaceous. This assumption suggests that the primary migration may have taken place prior to the Syrian Arc folding phase and potential traps can be found in the Early Mesozoic fault blocks and stratigraphic traps.

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[19] Bein et al 1984

8. ENGINEERING

The Delta 1A well was the only well drilled on the Yitzhak block. The Delta 1 and 1A wells were drilled by Belpetco Israel Ltd in 1970. The Delta 1 well was drilled to 4,171 meters where the hole was abandoned. The Delta 1A was drilled as a sidetrack out of the Delta 1 well and drilled to a Total Depth of 4,423 meters. The well encountered minor oil shows in several Cretaceous zones and was Plugged and Abandoned. The well did reach the Jurassic but did not drill deep enough to see the Jurassic Zohar interval that was seen in the Yam 2 and Yam-Yafo 1 wells. Based upon well control and seismic interpretation, drilling was stopped in the Delta formation only 200 to 300 meters above the potential reservoir. The stratigraphic section in the Delta 1A well is quite similar to the Yam-Yafo 1 well. Therefore, it is assumed that a similar reservoir could exist in Delta 1A approximately 200 to 300 meters below the Total Depth of the well.

Isramco and partners drilled the Yam-Yafo 1 well on their Med Tel Aviv License (now Gabriella) in 1994. The well was drilled to a total depth of 5,785.5 meters and tested oil from the interval from 4,894 meters to 5,034 meters. The well was plugged and suspended on 5 November 1994[20] and subsequently Isramco relinquished the area. From that point in time until Adira was awarded the Yitzhak License in October of 2009, the only activity was the acquisition of speculative seismic data.

1.30 YAM YAFO-1 WELL

1.30.1 Well History

The Yam-Yafo 1 well was spud on 24 Jan 1994 using the Ross Offshore/Transocean semi-submersible drillship “Benreoch”. The well was drilled and logged to a total depth of 5,785.5 meters in 200 days. Electric wireline logs were taken from 816.6 meters to 1,004.4 meters and from 1,414.2 meters to total depth. Two zones of interest were seen from 4,894.0 meters to 5,034.0 meters and from 5,195.0 meters to 5,332.5 meters. These limestone formations were

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[20] Final Well Report, Yam-Yafo-1, 1994

overpressured and required a mud weight of 16.1 ppg to maintain well control while drilling the 8-3/8 inch hole section. Consequently these intervals were not cored. Both of the zones were tested in a cased hole with a 7 inch production liner that tied back to the surface.

1.30.1.1 Yam-Yafo 1 - Well Test #1

After displacing the well with 11.3 ppg Calcium Chloride brine and perforating using tubing conveyed perforating (TCP) guns over the interval 5,195.0 to 5,322.5 meters (a net interval of 121.5 meters), the lower zone was tested. This test produced only 39.6 barrels of brine water at a flowing pressure of 27 psi on a 16/64 inch choke. Subsequent acid stimulation using 172 barrels of 15% HCl acid failed to improve the flow and did not result in the recovery of hydrocarbons. After a 17 hour test period the zone was abandoned with a notation in the test report that no reservoir fluids were recovered.

1.30.1.2 Yam-Yafo 1 - Well Test #2

The upper zone was perforated using TCP with an underbalanced column of 11.3 ppg CaCl brine. A net interval of 122.5 meters between 4,894 and 5,034 meters was perforated and after a clean-up flow period, the well produced 468.2 barrels of liquids in 9.85 hours. This volume consisted of 189.7 barrels of oil (40.5% of the Total Fluid) and 278.5 barrels of water. The final flowing tubing pressure was 1,361 psi on a 16/64” choke. Total production during the entire test was 1,351 barrels of 44° API oil at rates up to 821 barrels of oil per day; 3,892 barrels of 4,200 ppm chlorides (brackish) water, and approximately 1,050 Mcf of 0.948 gravity associated gas.

1.30.1.3 Yam-Yafo 1 - Well Test 2A

In an attempt to isolate the water producing zones within the upper interval, the existing perforations were squeezed with cement and the well was plugged back to 4,955 meters. The interval from 4,894 to 4,955 meters was re-perforated but the production from the next test remained water cut. The measured production from the well was 139.6 barrels of water and 101.9 barrels of oil (42.2% of the Total Fluid) and 200 MCF of gas. Average production from test 2A was 395 barrels of oil per day and 489 barrels of water per day on a 12/64 inch choke with a flowing tubing pressure of 2,730 psi.

The well testing lasted for a total of 77 days and the Yam-Yafo 1 was abandoned as a non-economic discovery by setting one mechanical and four cement plugs in the 7 inch casing.

1.31 YAM-YAFO 1 AND YAM 2 WELL TEST SUMMARY

The Yam 2 had a Kelly Bushing of 13.2 meters and was drilled to a Total Depth of 5,377 meters. The mud weight at 5,300 meters was 14.2 pounds per gallon with an equivalent bottom-hole pressure of 12,840 psi.

A drill stem test (DST) was conducted in the Jurassic zone @ 5,309 – 5,317 meters. The extrapolated initial shut-in bottom-hole pressure (ISIBHP) is equal to 13,558 psi @ -5,290.8 meters subsea depth. The resulting pressure gradient (Pgr) is equivalent to 2.56 psi/meter or 0.781 psi/foot which would be considered a highly over-pressured reservoir. The bottom hole temperature of 340°F yields a temperature gradient (Tgr) of 0.0153°F/ft, which is also very high. The DST recovered approximately 152.2 barrels of oil and 26.1 barrels of water in about four and a half hours, or 800 barrels of oil per day. The produced water is most likely mud filtrate from mud losses during drilling. Water analysis information from this test is not available. The PVT Analysis for the Yam 2 oil that was recovered from the test is depicted in Figure 41.

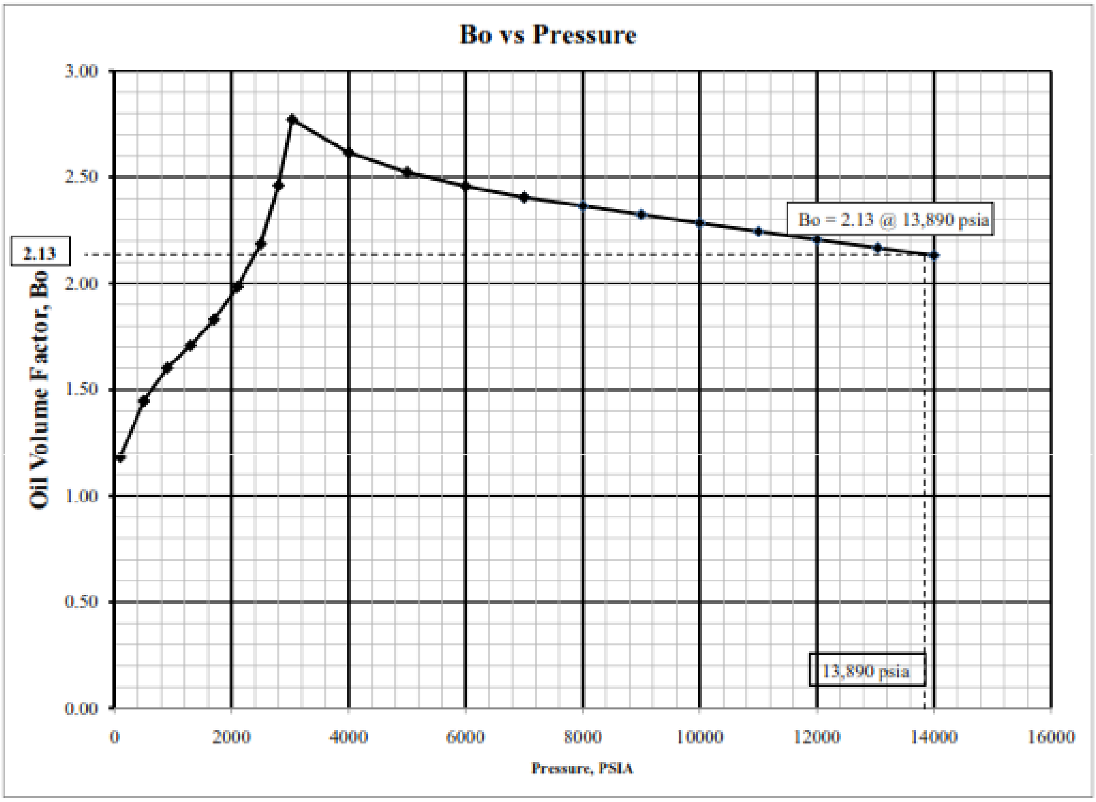

Figure 41 Graph of B_o vs. Pressure from the PVT Analysis, Yam 2

The Yam-Yafo 1 tested Jurassic section is found at a measured depth of 4,894 to 5,332.5 meters. The Pgr derived from DST data ranges from 2.79 to 2.878 psi/meter or 0.851 to 0.877 psi/foot. Based on this, the estimated Initial Shut In Bottom Hole Pressure range is from 13,681 to 14,098 psi at 4,900 meters. These pressures are based on an equivalent circulating density estimate of 16.4 to 16.9 ppg because of large drilling induced fractures observed on the well log data. Based on the PVT analysis of the oil from the Yam 2 well and an average BHP of 13,890 psia for the Yam-Yafo 1 well the B_o[21] would be approximately 2.13 (Figure 41).

The tests from both wells included water that was most likely mud filtrate from mud losses during drilling, based on drilling records and water analysis data. The Yam 2 and the Yam Yafo 1 were both tested in the Jurassic. The Yam 2 drilling report synopsis states that 25 barrels of mud were lost into the interval from 5,307.5 meters to 5,310.0 meters during the drilling of the

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[21] oil formation volume factor

section and another 25 barrels later. This overlaps the interval from 5,309.0 meters to 5,317.0 meters, which was tested in DST 1. Further losses at the rate of 20 barrels per hour occurred in this section until LCM was pumped into the well. Therefore, at least 50 barrels of mud and probably over 100 barrels were lost into the tested interval during drilling operations. This mud loss indicates good permeability of the limestone which must have fracture porosity in order to take this much mud at this high a rate. DST 1 tested oil, water and gas over the six hour test. The rates[22] ranged from 517 to 752 barrels of oil per day, 128 to 89 barrels of water per day and 587 to 532 MCF of gas per day. The rates are measured each hour and these values were used to estimate the total recovery of fluids which would be 152.2 barrels of oil and 26.1 barrels of water. The recovered water was most likely filtrate from the mud that was lost during drilling and this would represent only a fraction of the mud lost. The water production rate was also decreasing over time which would occur if the water source was the mud filtrate. In the summary section from the Final Well Report for Yam-Yafo 1 (Geological Section, Isramco, December 1994), it notes that drilling induced fractures occurred from 4,985 meters to 5,020 meters where an estimated 400 barrels of mud was lost. An additional 1,395 barrels of mud were lost from 4,894 to 4,925 for a total of 1,795 barrels. During DST 2A from the interval 4,894 to 4,955 meters a total of 101.9 barrels of oil and 139.6 barrels of water were recovered. These data would also suggest that the water that was produced in the tests was from mud filtrate and not formation water.

1.32 INFRASTRUCTURE

The local offshore infrastructure is very limited. For example the newly discovered Leviathan, Tamar and Dalit fields are located approximately 107, 90, and 45 kilometers from shore respectively and will take at least 2 years to get on line. Currently the Tamar gas would have to be transported in a new pipeline about 135 Kilometers (84 miles) south to the Mari B platform in order to get the gas to market. This gas pipeline crosses the Shemen block to the south of Gabriella and Yitzhak and makes landfall in Ashdod (Figure 42) and transports gas from the Mari B field. If gas is found on Yitzhak it will be available for sale before Tamar is ready to be produced with the construction of a pipeline that ties into the line to the south. An oil pipeline

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[22] Page 6 Final Well Report Yam 2, Isramco

could be constructed along the same path or if permitted could be built directly to shore to the Tel Aviv area.

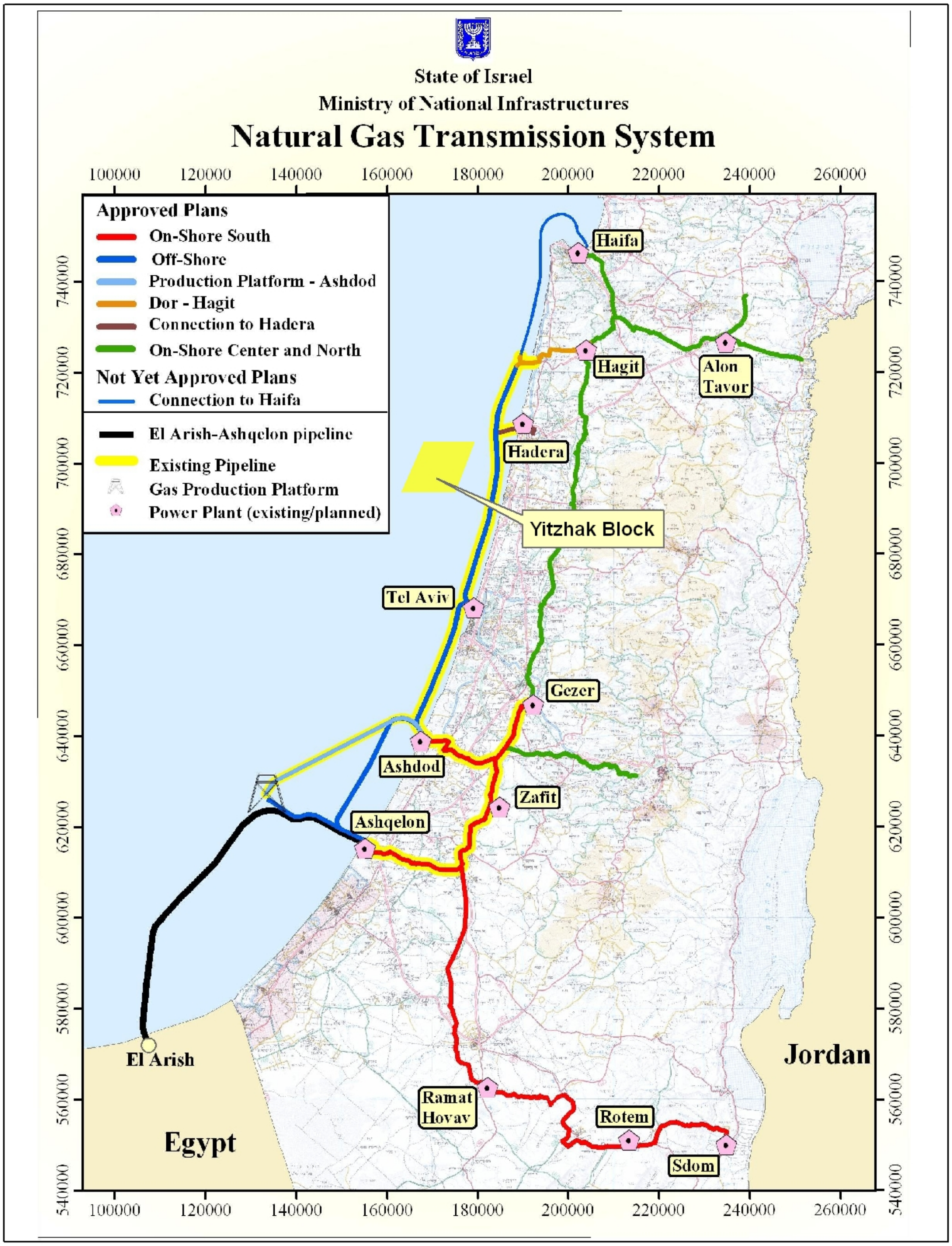

Figure 42 Map of Existing Offshore Gas Pipeline Infrastructure in Israel

9. PROBABILISTIC RESOURCE ANALYSIS

1.33 GENERAL

A probabilistic resource analysis is most applicable for projects such as evaluating the potential resources of the subject area, where some limited information exists regarding the reservoir parameters. The range of values in the reservoir data is quantified by probability distributions, and an iterative approach yields an expected probability distribution for the resources. This approach allows consideration of most likely resources for planning purposes and what potential upside there may be for the project.

The analysis for this project was carried out considering the range of values for all parameters in the volumetric equations. Therefore, triangular probability distributions, with input of minimum, maximum, and most likely values, were used.

The prospects on this block have not been tested; therefore, they contain Prospective Resources. Prospective Resources are defined as "those quantities of petroleum estimated, as of a given date, to be potentially recoverable from undiscovered accumulations by application of future development projects. Prospective Resources have both an associated chance of discovery and a chance of development. Prospective Resources are further subdivided in accordance with the level of certainty associated with recoverable estimates assuming their discovery and development and may be sub-classified based on project maturity."[23] There is no certainty that any portion of the Prospective Resources will be discovered. If discovered, there is no certainty that it will be commercially viable to produce any portion of the resources.

The fairly wide spacing of values between the low and high estimated resources reflects the level of uncertainty in this analysis. In general, the high probability resource estimates at the left side of these distributions represents downside risk, while the low probability estimates on the right side of the distributions represent upside potential.

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[23] Society of Petroleum Evaluation Engineers, (Calgary Chapter): Canadian Oil and Gas Evaluation Handbook, Second Edition, Volume 1, September 1, 2007, pg 5-7.

1.34 INPUT PARAMETERS

The parameters for these input distributions were selected based on a review of all available data, for this and nearby analogous areas. Note that these parameters represent average parameters over the entire prospect and formation. So, for example, the porosity ranges do not represent the range of what porosity might be in a particular well or a particular interval, but rather the reasonable range of the average porosity for the whole reservoir.

Note that triangular distributions were used for all the input parameters. In general, the P_{90}, Mode, and P_{10} points were specified for the distributions. For drainage area and gross thickness, the probability for the low end estimates was reduced as far as necessary in order to avoid results less than zero. These values were set between zero and ten.

For the purposes of estimating resources, it was assumed that a well drilled on the Delta Zohar structure would encounter multiple (up to three) carbonate sections as seen in the Yam-Yafo 1 well. The gross thickness used in the Probabilistic estimate was based on the accommodation space provided by the difference between the top and base of the structure for the area used in the P_{10}, P_{50} and P_{90} cases and includes only the gross carbonate intervals seen in the Yam 2 and Yam-Yafo 1 wells. Since the matrix porosity is so low, the presence of reservoir quality rock is dependent on fractures or fracture porosity. Therefore, the Net to Gross for the Jurassic is assumed to be 1:1 and the prospective Jurassic reservoir is expected, based on analysis of the Yam – Yafo 1 well, to have a dual porosity system, with the flow dominated by a natural fracture system, supported by some storage and influx of hydrocarbons from the low-porosity carbonate matrix. This was modeled as two different systems, with the distribution for porosity, initial water saturation, and recovery factor used for both the matrix and the fracture system being an estimate of the net volume of rock that has fractured porosity, initial water saturation, and recovery factor and assumed to be representative of the average over the prospective area. Note that based on the structural analysis, the fracture systems are not expected to collapse as oil is withdrawn from the reservoir. Therefore, higher recovery of hydrocarbon fluids is anticipated.

The parameters of the input distributions are shown in Table 6 and Table 7. The oil and gas formation volume factor was estimated based on typical oil field data. In addition to the data tabulated below, a shape factor of 0.8 was used to account for the likely geometry of the reservoirs.

Table 6 Summary of Input Parameters -- Jurassic

Parameters	P_{90}	P_{50}	P_{10}
Area (Sq Km)	1.0	3.5	8.5
Gross Thickness (m)	28	98	168
Net to Gross, %	100%		
Porosity, Matrix, %	2.0%	3.0%	4.0%
Porosity, Fracture, %	3.0%	5.0%	7.0%
Water Saturation, Matrix, %	40%	50%	60%
Water Saturation, Fracture, %	10%	20%	30%
Recovery Factor, Matrix, %	5.0%	10.0%	15.0%
Recovery Factor, Fracture, %	40.0%	50.0%	60.0%
B_o, res. Bbl/STB	1.97	2.24	2.81

Table 7 Summary of Input Parameters -- Cretaceous

Parameters	P_{90}	P_{50}	P_{10}
Common to All Prospects			
Net to Gross, %	25.0%	35.0%	45.0%
Porosity, %	20.0%	22.0%	25.0%
Water Saturation, %	30.0%	50.0%	55.0%
Recovery Factor, %	60%	65%	70%
Gas Gravity, relative to air	0.590	0.600	0.610
Temperature Gradient, °F/ft	0.014	0.015	0.016
Pressure Gradient, psi/ft	0.465	0.500	0.565
Cond/Gas Ratio, Bbl/MM	100	150	200
Talme Yafe Prospect			
Depth m	2,075	2,188	2,300
Area (Sq Km)	1.4	5.4	9.5
Gross Thickness (m)	40	140	230
West Prospect			
Depth m	2,000	2,200	2,400
Area (Sq Km)	1.7	14.7	29.0
Gross Thickness (m)	60	260	460

In a probabilistic analysis, dependent relationships can be established between parameters if appropriate. For example, portions of a reservoir with the lowest effective porosity generally may be expected to have the highest connate water saturation, whereas higher porosity sections have lower water saturation. In such a case, it is appropriate to establish an inverse relationship between porosity and water saturation, such that if a high porosity is randomly estimated in a given iteration, corresponding low water saturation is estimated. The degree of such a correlation can be controlled to be very strong or weak. This type of dependency, with a medium strength of -0.7, was used in this study for porosity with water saturation and with net/gross ratio. Similarly, the low end of the gross thickness distributions for this prospective accumulation would generally be expected to occur when the productive area is small; therefore, a positive correlation of 0.7 was assigned to gross thickness and productive area.

1.35 PROBABILISTIC SIMULATION

Probabilistic resource analysis was performed using the Monte Carlo simulation software called "@ Risk." This software allows for input of a variety of probability distributions for any parameter. Then the program performs a large number of iterations, either a large number specified by the user, or until a specified level of stability is achieved in the output. The results include a probability distribution for the output, sampled probability for the inputs, and sensitivity analysis showing which input parameters have the most effect on each output parameter.

After distributions and relationships between input parameters were defined, a series of simulations were run wherein points from the distributions were randomly selected and used to calculate a single iteration of estimated potential resources. The iterations were repeated until stable statistics (mean and standard deviation) result from the resulting output distribution, after 5,000 iterations.

1.36 RESULTS

The output distributions were then used to characterize the Prospective Resources. Key points, summarized below in Table 8 and Table 9, from the contingent resource distribution include the 50 percent point (Best Estimate or P_{50}) the 90 percent point (Low Estimate or P_{90}) and 10 percent point (High Estimate or P_{10}). Graphs of cumulative probability versus resources were constructed. The resulting distribution curves are presented in Figure 43 through 47. Note that these estimates do not take into account any risk of failure. It should be noted that an economic evaluation has not been performed as part of this study.

Table 8 Summary of Gross Prospective Oil Resources, Jurassic Oil Prospects

	Low Estimate	Best Estimate	High Estimate
OOIP, MMBO	12.2	54.7	165.3
Oil Resources, MMBO	4.5	20.4	64.4

Table 9 Summary of Gross Prospective Resource Estimates, Cretaceous Gas Prospects

		Prospective Gas Resources, BCF, Estimate			Prospective Condensate Resources, MMB, Estimate		
Prospect	**Reservoir**	**Low**	**Best**	**High**	**Low**	**Best**	**High**
Talme Yafe	Cretaceous	34.6	147.3	382.5	4.8	20.9	58.9
West	Cretaceous	198.5	842.2	2,254.7	27.2	123.5	346.5
Total		**233.1**	**989.5**	**2,637.2**	**32**	**144.4**	**405.4**

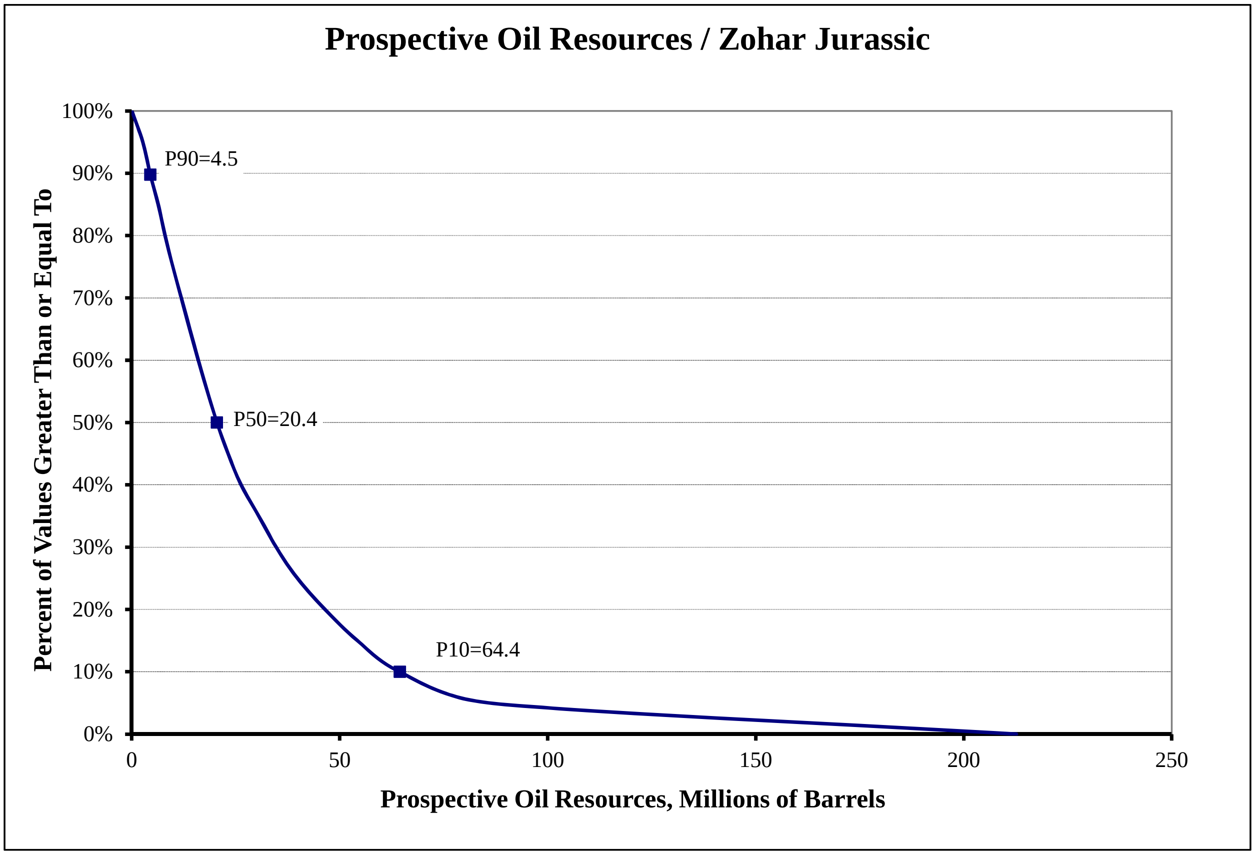

Figure 43 Distribution of Prospective Oil Resources

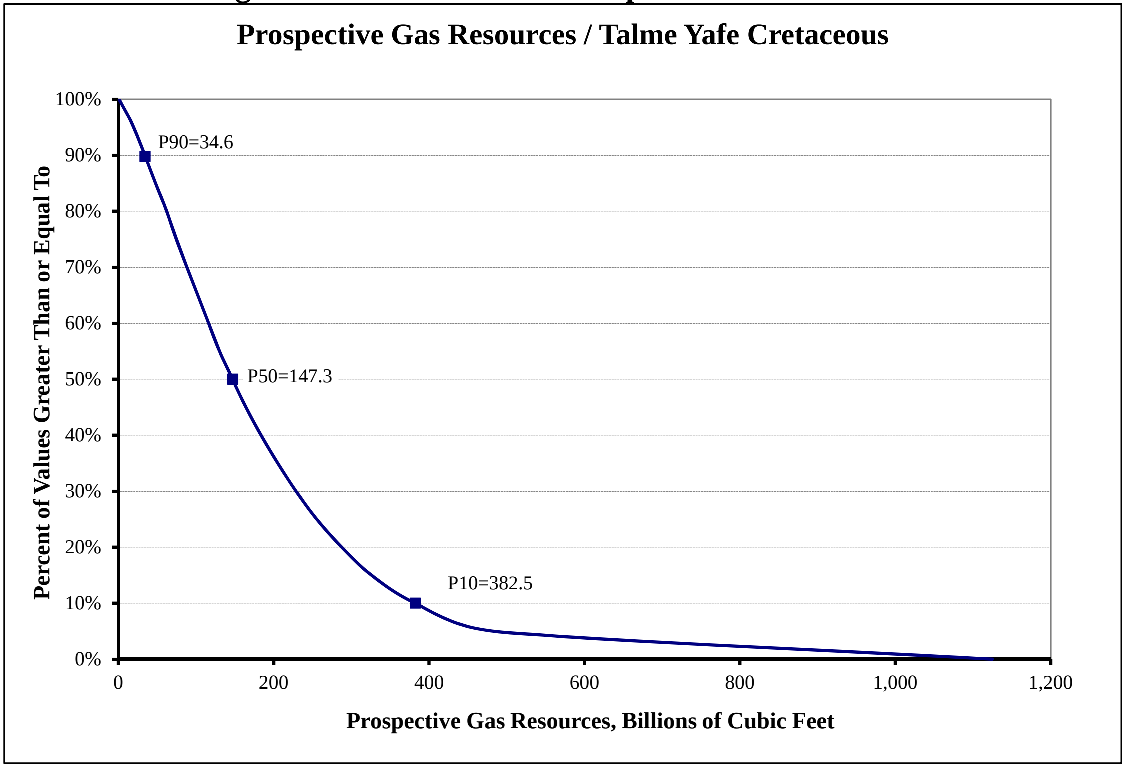

Figure 44 Distribution of Prospective Gas Resources, Talme Yafe Cretaceous

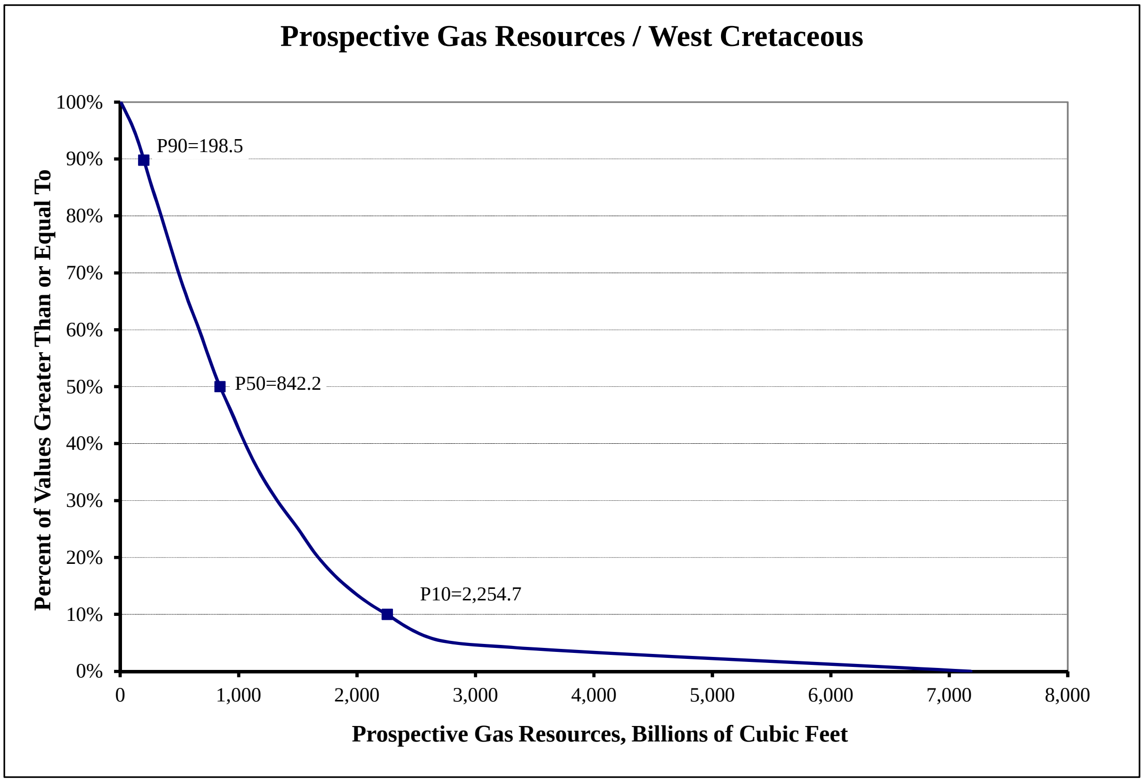

Figure 45 Distribution of Prospective Gas Resources, West Cretaceous

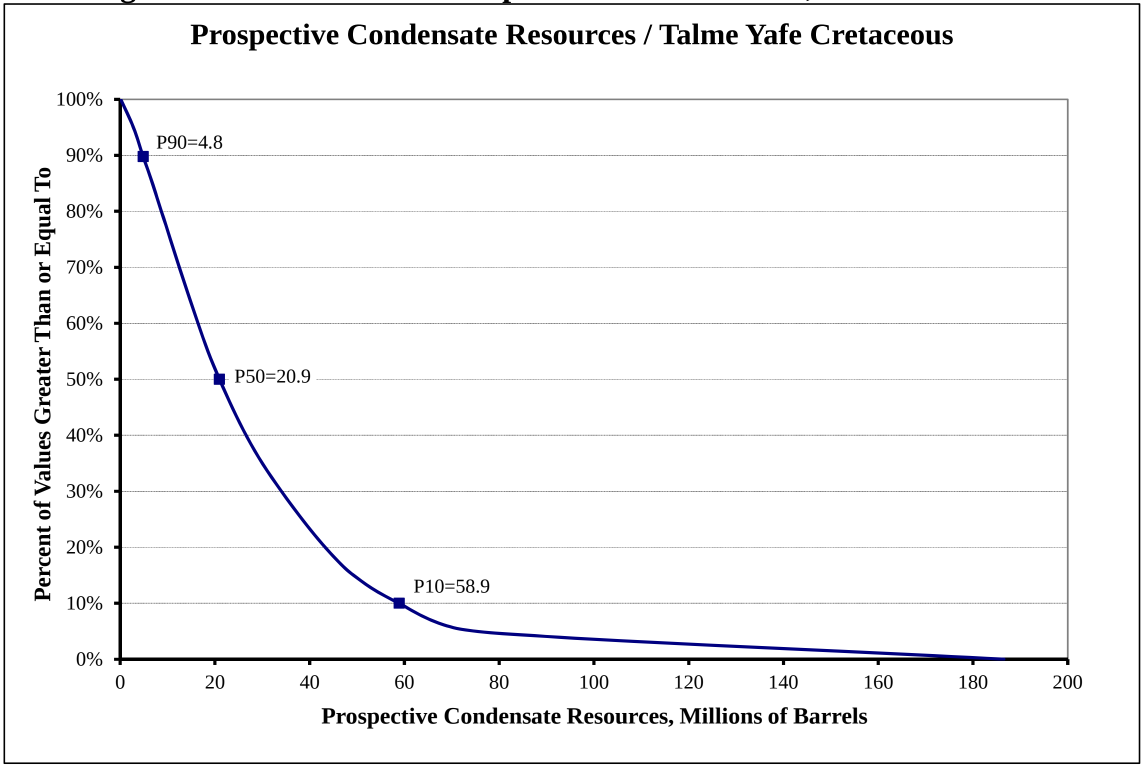

Figure 46 Distribution of Prospective Condensate Resources, Talme Yafe Cretaceous

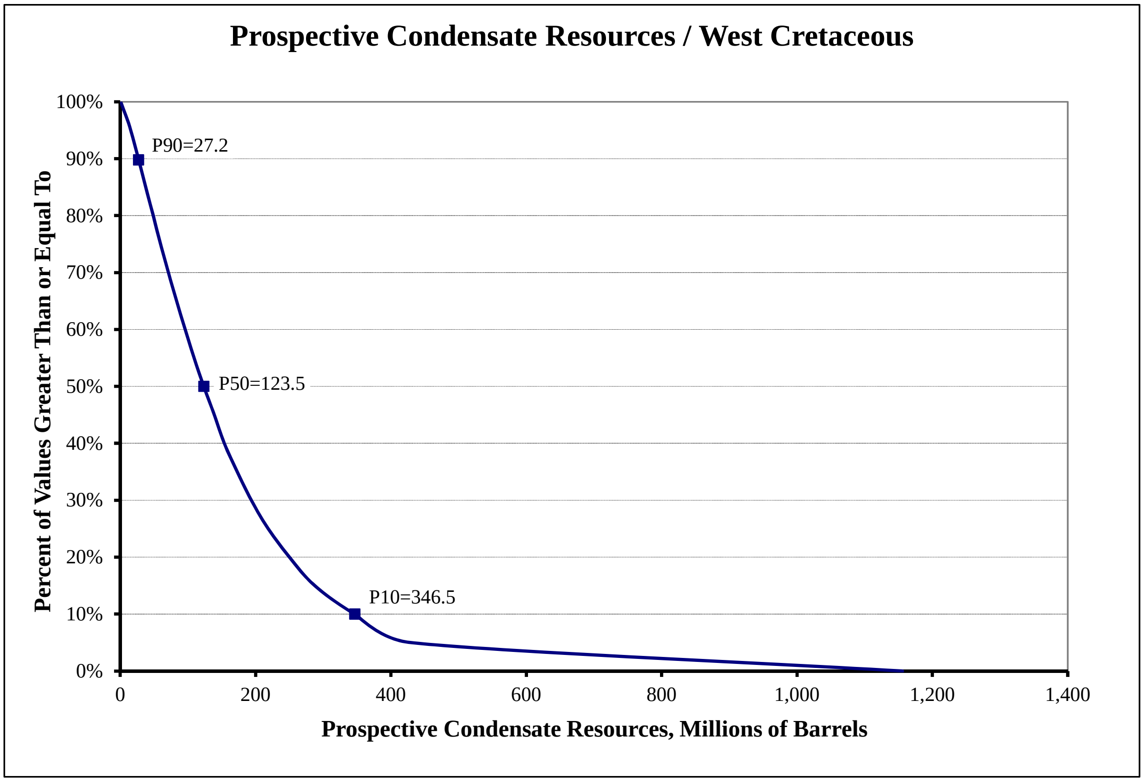

Figure 47 Distribution of Prospective Condensate Resources, West Cretaceous

10. REFERENCES

Adira Energy, Interim Report for License #378/"Gabriella" Offshore Israel. July 2010.

Adira Energy, Interim Report for License #380/"Yitzhak" Offshore Israel. October 2010.

Bravo 1, Drilling and Completion Report, 1970, Belpecto Israel Ltd. Internal Report.

Conway, B. H., 1981; Dinoflagellate age sequence and thermal maturity of Delta 1 well offshore Natanya, Israel: GSI paleontology div. report # P/1/81.

Conway, B. H., 2002; The oil window in the offshore Yam West 1 borehole as detected by thermal alteration indices (TAI's), GSI report #16/2002.

Final Well Report Yam Yafo 1 Offshore Israel Drilling Section , Isramco Inc., Internal Report, 1995.

Final Well Report - Yam 2 Offshore Ashdod Israel, 1995; By Technical Oil Field Services.

Gardosh, Michael A., Druckman, Yehezkel and Buchbinder, Binyamin, 2009, The Late Tertiary Deep-Water Siliciclastic System of the Levant Margin-An emerging Play Offshore Israel: Search and Discovery #10211, adapted from oral presentation at AAPG 2009, http://www.searchanddiscovery.com/documents/2009/10211gardosh/ndx_gardosh.pdf.

Gardosh, M., Druckman, Y., Buchbinder, B., and Calvo, R., 2008, The Oligo-Miocene deepwater system of the Levant Basin: Geophysical Institute of Israel Report 446/426/08 and Geological Survey of Israel Report GSI/33/2008, 73 p.

Gardosh, M., Druckman, Y., Buchbinder, B., and Rybakov, M., 2006, The Levant Basin offshore Israel: stratigraphy, structure, tectonic evolution and implications for hydrocarbon exploration: Geophysical Institute of Israel Report 429/218/06 and Geological Survey of Israel Report GSI/14/2006, 119 p.

Geochemical Evaluation of Samples from the Yam Yafo 1 and Bessor 1 Wells, Geochem Group Limited, 1995, Report #95/9630/9361/001.

Gill, D., Conway, B.H., Eshet, F., Lipson, S., Peri, M, Grossowicz-Perlis, H., Rosenfeld, A., Siman-Tov, R., 1995; The Stratigraphy of Yam West 1, Borehole: GSI Report #13/95.

Gvirtzman, Z., Zilberman, E., and Folkman, Y., 2008, Reactivation of the Levant passive margin during the late Tertiary and formation of the Jaffa Basic offshore central Israel: Journal of the Geological Society, March 2008, 165, p. 563.

Hollingsworth, R. V., 1971; PaleoLab report: Belpetco Israel Ltd internal report.

Isramco INC., Israel branch, 1994. Final Well Report Yam Yafo-1 Offshore Israel Geological Section.

Isramco, Inc, Well Test Report - Production Test #2a, 22nd October – 29th October 1994.

Isramco, Inc, Well Test Report - Production Test #1, 28th August - 21st September 1994.

Isramco, Inc, Israel Branch, Drilling Program Yam Yafo #1 Well Med Tel-Aviv License Jan 1994.

Maquilken, J., 2000; Gal Permits Petroleum Geochemistry & Basin Modeling, BG Group Internal Report.

Moore, D., 1995; A Geochemical Evaluation of Twenty Six Rock Samples from the Interval 3150-5151 meters in the Yam West 1 Well: Report #95/9725/001/01 Prepared by Geochem Group Limited for Isramco Inc.

Petroleum Resources Management System, from the Society of Petroleum Engineers, 2007, World Petroleum Congress, American Association of Petroleum Geologists, and Society of Petroleum Evaluation Engineers.

Roberts. G., Peace, D., 2007; Hydrocarbon plays and prospectivity of the Levantine Basin offshore Lebanon and Syria from modern seismic data: GeoAfrica, Vol. 12, No. 3.

Rohbauer, C., Helfman, J. A., 1989; Drilling Program Yam 2 Well Offshore Israel, Isramco Inc., Internal Report.

Sanderson, C. and Oates, M., 2000, Petroleum Potential of Shiqma Yam License, Offshore Israel, September 2000.

Wennberg, O. P., Azizzadeh, M., Aqrawi, A. A. M., Blanc, E., Brockbank, P., Lyslo, K. B., Pickard, N., Salem, L. D., and Svånå, T., 2007, The Khaviz Anticline: an outcrop analogue to giant fractured Asmari Formation reservoirs in SW Iran: Geological Society, London, Special Publications; v. 270; p. 23-42.

Yam Yafo 1 Well Test Report - Production Test #2, Isramco Inc Internal Report , 1994.

11. CONSENT LETTER

Gustavson Associates LLC hereby consents to the use of all or any part of this Resource Evaluation Report for the Yitzhak Concession Block, as of August 31, 2011, in any document filed with any Canadian Securities Commission by Adira Energy.

Letha C. Lencioni
Vice-President, Petroleum Engineering
Gustavson Associates LLC

12. CERTIFICATE OF QUALIFICATION

I, Letha Chapman Lencioni, Professional Engineer of 5757 Central Avenue, Suite D, Boulder, Colorado, 80301, USA, hereby certify:

1. I am an employee of Gustavson Associates, which prepared a detailed analysis of the oil and gas properties of Adira Energy Ltd. The effective date of this evaluation is August 31, 2011.
2. I do not have, nor do I expect to receive, any direct or indirect interest in the securities of Santos Ltd or its affiliated companies, nor any interest in the subject property.
3. I attended the University of Tulsa and I graduated with a Bachelor of Science Degree in Petroleum Engineering in 1980; I am a Registered Professional Engineer in the State of Colorado, and I have in excess of 30 years' experience in the conduct of evaluation and engineering studies relating to oil and gas fields.
4. A personal field inspection of the properties was not made; however, such an inspection was not considered necessary in view of information available from public information and records, and the files of Adira Energy Ltd.

LETHA CHAPMAN LENCIONI
29506

Letha Chapman Lencioni
Chief Reservoir Engineer/
Vice-President, Petroleum Engineering
Gustavson Associates, LLC
Colorado Registered Engineer #29506

APPENDIX

PETROPHYSICAL SUMMATIONS

Well Name **YAM-YAFO 1**

Curve Name	Pay Cutoff	Cutoff
PHIE_E	yes	0.08
SW	yes	0.6
VCL	no	0.5

Zone Name	Top Depth (MD)	Bot Depth (MD)	Top Pay (MD)	Bot Pay (MD)	Gross Interval	Net Pay Int (TVD)	Avg Phi (Pay)	Avg Net Sw (Pay)	Avg VClay (Pay)	Pay/Gross Ratio	HPVH (Pay)	PHIH (Pay)	Avg Phi (Res)	Avg VClay (Res)	Res/Gross (Res)	PHIH (Res)
TLM YAFE	2,670.0	3,077.0	-	-	407.0	0.0	0.000	1.000	0.000	0.000	0.000	0.000	0.122	0.413	0.011	0.561
GVARAM	3,078.0	4,189.0	-	-	1,111.0	0.0	0.000	1.000	0.000	0.000	0.000	0.000	0.110	0.288	0.004	0.442
YAM	4,190.0	4,409.0	-	-	219.0	0.0	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
DELTA	4,410.0	4,894.0	-	-	484.0	0.0	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ZOHAR	4,895.0	4,962.0	4,896.9	4,897.7	67.0	0.9	0.139	0.367	0.108	0.013	0.079	0.125	0.121	0.146	0.022	0.182
KARMON	4,963.0	4,984.0	-	-	21.0	0.0	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SHEDEROT	4,985.0	5,032.0	5,008.6	5,008.9	47.0	0.4	0.131	0.484	0.136	0.009	0.027	0.052	0.122	0.219	0.017	0.098
BARNEA	5,033.0	5,350.0	5,201.0	5,292.3	317.0	2.9	0.136	0.265	0.179	0.009	0.291	0.395	0.118	0.273	0.019	0.721
INMARU	5,351.0	5,681.0	-	-	330.0	0.0	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
QEREN	5,682.0	5,780.0	-	-	98.0	0.0	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total					3,101.0	4.2					0.397	0.572				2.004

Well Name **YAM 2**

Curve Name	Pay Cutoff	Cutoff
PHIE	no	0.08
SW	yes	0.6
VCL	no	0.5

Zone Name	Top Depth (MD)	Bot Depth (MD)	Top Pay (MD)	Bot Pay (MD)	Gross Interval	Net Pay Int (TVD)	Avg Phi (Pay)	Avg Net Sw (Pay)	Avg VClay (Pay)	Pay/Gross Ratio	HPVH (Pay)	PHIH (Pay)	Avg Phi (Res)	Avg VClay (Res)	Res/Gross (Res)	PHIH (Res)
GVARAM	3,130.0	4,433.0	-	-	1,303.0	0.0	0.000	1.000	0.000	0.000	0.000	0.000	0.098	0.378	0.002	0.255
YAM	4,433.9	4,764.0	-	-	330.1	0.0	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
DELTA	4,764.9	5,234.0	-	-	469.1	0.0	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ZOHAR	5,234.9	5,350.0	5,313.6	5,316.3	115.1	2.7	0.145	0.335	0.000	0.025	0.280	0.421	0.145	0.000	0.025	0.421
Total					2,217.3	2.7					0.280	0.421				0.676

APPENDIX OF ABBREVIATIONS

Gr	Gamma Ray
Cali	Calipier
Rhoma	Corrected Density Matrix
Dtmac	Corrected DT Sonic Matrix
Sw	Water Saturation
PHIE	Effective Porosity
PHIT	Total Porosity
BVW	Bulk Volume Water
FRAC	Fracture Flag
VCL	Volume of clay (shale)
VSS	Volume of Sandstone
VLS	Volume of Limestone
VDOL	Volume of Dolomite