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The Size and Volume of the Remaining Hydrocarbon Potential are the Key of Future Exploration Drilling in Libya's Sedimentary Basins*

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Abstract

The early stage of exploration process in Libya is now over 60 years old. This exploration resulted in the discovery of about 58 billion barrels of recoverable oil and more than 60 trillion cubic feet of non-associated recoverable gas, which ranks Libya's sedimentary basins among the most prolific oil-bearing basins in the world. Libya's first oil discovery was made in 1957 in the western Ghadames Basin. The first commercial oil discovery was made in 1958 in Sirte Basin and by the end of the year 1961 eleven of the giant fields were already found. Giant fields were progressively brought on stream and exporting oil started in 1961. Production gradually increased to 3.38 million barrels per day in 1970, placing Libya amongst the top ten oil-producing countries. To date more than 142 billion barrels of oil in-place have been discovered in the onshore and offshore Sirte Basin of which 100 billion barrels (70%) are contained in the giant fields. Does exploration drilling level back to early stage again? Clearly this question has a wide range of answers as it depends on geosciences and investment on the technical side. It also depends on the size and volume of the reaming potential in Libya's basins. An intelligent approach to answering this question needs to consider all these elements. The remaining potential will play a significant role in the future of exploration drilling. To assess the goal of this research the available data combined with new drilling result provide a background information for the volume and distribution of remaining potential. The reserves of the giant fields in the Sirte Basin may be used statistically to assess the total hydrocarbon potential of the Sirte Basin and the remaining hydrocarbons to be discovered in the future. Although giant fields are generally discovered during the early stage of exploration because of their huge structural size, recent exploration and drillings in the deep area to the north of the Gialo Field indicate a major discovery. This recent discovery together with the large discoveries made in the deep Mar Trough area, show that the Sirte Basin has still a significant future potential, particularly deep trough areas. In general, Libya's onshore and offshore areas still are prospective for future exploration drilling and still contain remaining potential. Libya is looking forward to international companies coming back because they are in general more aggressive in their exploration.

Introduction

Exploration activities in Libya started more than 55 years ago. This exploration resulted in the discovery of about 58 billion barrels of recoverable oil and more than 60 trillion cubic feet of non-associated recoverable gas, which ranks Libya among the most prolific oil-bearing country in the world. The first commercial oil discovery in Libya was made in 1958 by the end of the year 1961 eleven of the giant fields were already found (Figure 1). Giant fields were progressively brought on stream and exporting oil started in 1961. Production gradually increased to 3.38 million barrels per day in 1970, placing Libya amongst the top ten oil-producing countries. The exploration drilling and production daily rate had a complex history. Various studies indicate that the discovered reserves are ~ 55-60% of the ultimately recoverable resource allowing for further exploration and reserves growth through improved reservoir management. Recent and previous geological, geochemical, and geophysical studies indicated Libya's sedimentary basins contain wide distribution of shale section organically rich source rocks with variable thickness and different maturity levels. The boundary of source section not well known with the possibility of existing a deep source not penetrated yet. That means Libya's sedimentary basins still have non-mature basins and still have remaining potential to be discovered. Recently new discoveries have been made in the offshore and onshore basins indicate that basins are still underexplored. The total estimated remaining reserves figure is about 60 billion barrel of oil and 120 trillion cubic feet of gas to be discovered from conventional and unconventional resources. Combination of geosciences and technology will grow the hydrocarbon potential reserves of Libya and encourage increase exploration drilling in offshore and onshore areas. Analysis of exploration potential indicates the richest yet to find is in the Ghadames, Sirte (onshore and offshore) basins. Murzuq Basin is also likely to be very prolific. The volume of the remaining hydrocarbon opportunity in Libya is world class. The effectiveness and efficiency of future exploitation of this resource depends critically on the new legal framework and executive institutions that Libya chooses to create. The technical risks and uncertainties are amenable to application of modern science and technology. The country also has obvious geographic advantage. Thus, together with the general high quality of Libya's crude, makes this opportunity technically very attractive indeed. Still an excellent opportunity of investment in Libya oil and gas sector exists both in downstream and upstream.

Objectives

The main objective of this project is to assess and estimate the total remaining hydrocarbon potential in Libya's sedimentary basins. Volume and size of the remaining potential will open new windows for future exploration investment in Libya and boost the country's reserves. This project will define new petroleum systems and determine the areas of future exploration drilling. It will determine the number of prospects that will be drilled in the future and where they will be drilled. New discoveries with expected potential that will be discovered in the future will change the country's reserve figures and increase the daily production rate of oil and gas. This project will open new windows of exploration investment in Libya. The purpose of the project is to assess the quantities of oil, gas, and natural gas liquids that have the potential to be added to reserves within the next years. An assessment unit is to define and map a part of a total petroleum system in which discovered and undiscovered fields exist. Also, to select methodology of resource assessment based on estimation of the number and sizes of undiscovered fields is applicable.

Methodology

Different methods have been used in this study to assess the main objective and estimate the total hydrocarbon remaining in Libya. It is extremely difficult to predict the total amount of hydrocarbons generated in Libya's basins from which reserves to be discovered in the future can be estimated. There are several methods to calculate the undiscovered reserves of the offshore and onshore sedimentary basins:

- **Statistical method** based on the worldwide information from the mature, depleted basins, the total reserves of all the giant fields comprise approximately 60-65 percent of the generated hydrocarbons. By using this information, it is possible to estimate the remaining reserves to be discovered in Libya's basins.
- **Volumetric method** one of the most reliable and realistic method is the volumetric calculation of source sediments. This method is applicable for the mature and well explored basins where the thickness and distributions of the source rocks are well known.
- **Undiscovered reserves** based on the geological and petroleum system. In this method all available geological information is used.

Exploration History

Sirte Basin, situated in the north-central part of Libya, is the largest oil producer in Africa. It was developed as a series of NW-SE trending horsts and grabens (platforms and troughs) by the collapse of the Sirte Arch in Lower Cretaceous time. Sirte Basin covers more than 500,000 square kilometers of north-central part of Libya with recoverable reserves of 48 billion barrels of oil and about 50 TCFG, considered as the most prolific basin in Libya (Figure 2). Exploration activities of Sirte Basin commenced during the late 1950s followed by the first commercial discovery in 1958 (Well A1-32). During the first half of the 1960s most of the giant fields were discovered bringing Sirte Basin among the most oil productive basins in the world. Exploration of the Sirte Basin started more than five decades ago. These exploration activities resulted in the discovery of about 42 billion barrels of recoverable oil and more than 33 trillion cubic feet of non-associated recoverable gas, which ranks the Sirte Basin among the most prolific oil-bearing basins in the world. The reserves comprise 19 giant oil fields with an average of about 1800 million barrels of recoverable oil per field; 25 large oil fields with an average of 300 million barrels of recoverable oil per field; and one giant gas field (Hateiba) with 12 trillion cubic feet and at least two more giant gas fields each containing over 3 trillion cubic feet of non-associated recoverable gas.

The first commercial oil discovery was made in 1958 in Bahi Field Concession 32-, and by the end of the year 1961 eleven of the giant fields were already found (Figure 1). Giant fields were progressively brought on stream and exporting oil started in 1961. Production gradually increased to 3.38 million barrels per day in 1970, placing Libya amongst the top ten oil-producing countries. Although giant fields are generally discovered during the early stage of exploration because of their huge structural size, recent exploration and drillings in the deep area to the north of Gialo Field (6J-59) indicate a major discovery in the Lower Cretaceous Nubian sandstones (Figure 2).

The exploration history in **Ghdames Basin** was quite different from Sirte Basin. The first commercial discovery in this basin was made in 1957. Approximately 300 exploration wells yielded 35 oil-field discoveries with an estimated 6.0 billion barrels of recoverable oil (Figure 2). The 80 wildcats drilled in the **Murzuq Basin** found 11 oil fields, including two giants, with reserves of approximately 4.0 billion barrels. Between 1984 and 1996 two elements have been made in this basin and were followed by new recent discoveries indicating more potential non-discovered (Figure 2). The exploration effort in the offshore **Tripolitania Basin** has been rewarding as well. Fourteen new oil and gas-condensate fields have been discovered as a result of the drilling of about 60 wildcats. Reserves there are an estimated 2.50 billion barrels of oil and 12.0 tcf of gas (Figure 2). These estimates refer to activities through 2010 and include some fields categorized as marginal.

A detailed review of the exploration history offers some interesting insights. The Sirte Basin is the most heavily explored. However, surprisingly, average technical success rates in Sirte are not that impressive (on average ~1:5) – industry appears to have been more successful in finding discoveries in Murzuq and Ghadames (in terms of fewer well failures but not in volumes). In spite of this Sirte has the highest volume of reserves. One could also argue that the relatively low rate of technical success in Sirte reflects the fact that most of the exploration wells here were drilled in the 1960s-1970s, when exploration science was not as advanced as today. This does imply that it is likely that considerable resources would have been missed during this early phase of exploration. Decreasing in the exploration activities and discoveries after 1970 was attributed to the different regime, lack of the application of advance technology, geosciences, and drop of the oil price. All these aspects increase the risk of drilling in the deep areas, to find deep targets, and deep plays. Obviously, the rate of giants decreases to the point that between the years 1970 to 1984 no giants were found. One could conclude that since the giant fields are generally discovered during the early stage of the exploration because huge structure size perhaps no more giants will be discovered in the basins. However, the discoveries in Mar Trough (Block NC98), in 1984 and recent discovery of North Gialo have demonstrated a significant potential in the graben (Figure 1). This success not only has been made in Sirte Basin but also has been made in Mourzu Basin were two giants were discovered. Recent discoveries also have been made in the Libya offshore area. Exploration history has been summarized in Table 1.

Estimation of Undiscovered Reserves

Hypothetical Assessments

Estimated discovered oil reserve figures for the Sirte Basin are in the order of 140 billion barrels in-place and 48 billion barrels recoverable, of which 100 billion barrels and 32 billion barrels are estimated for the giant fields respectively (Figure 3a and Figure 3b). Although these figures are estimated, they are still sufficiently reliable to demonstrate the importance of the Sirte Basin which contains more than 85% of the total oil reserves of Libya; and the role of the giant fields that they contain about 77% of the total discovered reserves of the Sirte Basin. It is extremely difficult to predict the total hydrocarbons generated in the Sirte Basin from which reserves to be discovered in the future can be estimated. There are several methods to calculate the undiscovered reserves of a basin.

Statistical Method

Based on the worldwide information from the mature, depleted basins, the total reserves of all the giant fields comprise approximately 60-65 percent of the generated hydrocarbons. By using this information, it is possible to estimate the remaining reserves to be discovered in the Sirte Basin statistically. Assuming that the total reserves of all the giant fields in the Sirte Basin comprise approximately 60 percent of the generated hydrocarbons, the total oil in-place and recoverable oil of the Sirte Basin would be in the order of about 185 billion barrels and 56 billion barrels respectively. Considering proved recoverable oil of about 48 billion, approximately 8 billion barrels recoverable oil (or about 35 billion barrels oil in-place) remain to be found in the Sirte Basin.

Volumetric Calculation of Source Rocks

One of the most reliable and realistic method is the volumetric calculation of source sediments. This method is applicable for the mature and well explored basins where the thickness and distributions of the source rocks are well known. Application of this method in the Sirte Basin and the other Libya prospective basins (Ghadames, Mourzq, and Offshore), may be far from reality due to the lack of information in the deep troughs. However, Table 2 shows the estimation of total hydrocarbons expelled in the Sirte Basin by different companies and authors.

Based on the recent regional studies of Sirte Basin, 2P has provided estimated un-risked and risked recoverable resources of Waha acreages by areas and horizons. The following map (Figure 4a) and graphs (Figure 4b, Figure 4c, and Figure 4d) represent 2P estimated undiscovered reserves of Waha Concessions.

As seen on the previous graphs and charts, the mean estimated reserves for Waha acreage from the USGS study are 1,765 MMBOE and from 2P analyses are 2,763 MMBOE with about one billion barrels difference. If this difference is applied for the total estimated un-discovered reserves of the Sirte Basin, the mean reserves of about 10 BBOE of USGS would be about 15.6 BBOE of 2P . USGS is considering that 230,000 km² of the Sirte Basin is prospective from which 10 BBOE undiscovered reserves are expected. On other hand and using the data available from petroleum system assuming the 600 Bbls was the total estimated hydrocarbon generation from the source kitchen in the Sirte Basin considering only 30% of this figure has been trapped then the total oil in-place is 80 Bbl. The total figure that was explored 160 Bbls volume to be explored 20 Bbls in-place expected 7 Bbls recoverable. Recent exploration and drillings in the deep area to the north of Gialo Field (6J-59) indicate a major discovery in the Lower Cretaceous Nubian sandstones. This recent discovery of North Gialo together with the large discoveries made in the deep Mar Trough area (Block NC-98), show that the Sirte Basin still has a significant future potential, particularly in the form of horst blocks and or tilted blocks in the deep trough areas. This exploration success is summarized in Figure 5a and Figure 5b.

Ghadames Basin

Ghadames Basin is one of the most important sedimentary basin for producing oil and gas in Libya. This basin is located in North West Libya and covers an area of more than 20,000 km². The basin extends across southern Tunisia and central Algeria. The Ghadames Basin with a total estimated recoverable oil of 6 billion barrel of oil, proven. Ghadames Basin will be one of the very prolific basins for future potential of hydrocarbon. The undiscovered potential in this basin is still high compared with the discovered potential. The remaining is estimated at more than 48 billion barrels of oil in place. The total estimated 752 billion barrels of hydrocarbon is generated from the western part of Libya. The amount of the expelled 462 billion barrels considers the expulsion efficiency 61%, with 10 Bbls recoverable, that means about 13% of the total amount has been expelled. On the other hand, to re-evaluate the amount of the generation according to the available data from the cited literature and other geochemical data considering the source rock volume of 2504 km^3, average potential yield 12 mg / gm rock, rock density 2.4 mg, transformation ratio 65% then the total hydrocarbon generation is 756 Bbls. Considering the expulsion efficiency is 60% then the expelled hydrocarbon is 451.2 Bbls. The accumulated hydrocarbon is 158 Bbls if considering the migration lost of 65 %. The total oil in place is 293 Bbls and the estimated recoverable if taking the recovery factor is 10% the recoverable is 15.8 Bbls and remains to be discovered is 9.80 Bbls.

The 80 wildcats drilled in the **Murzuq Basin** found 11 oil fields, including two giants, with reserves of approximately 4 Bbls. If considering this figure comprises 40% of total potential to be discovered the total estimated potential to be found in Murzuq Basin is 6 Bbls. The exploration effort in the **offshore Tripolitania Basin** has been rewarding as well. Fourteen new oil and gas-condensate fields have been discovered as a result of the drilling of about 60 wildcats. Reserves there are an estimated at 2.50 Bbls of oil and 12.0 tcf of gas. These estimates refer to activities through 2010 and include some fields categorized as marginal. Part of the offshore has been considered as a part of Sirte Basin reserve. On the other hand, the boundary of Sirte Basin could be extended to cover part of the offshore. The total expected remaining potential in the offshore area based on the statistical calculation is about 2 Bbls. Table 3 and Figure 6 summarizes the Libya's basins potential.

Prospective Areas

Although thousands of wells have been drilled in Sirte Basin, but the early exploration efforts were concentrated mainly on the platform areas and much of the deep graben and offshore areas have remained relatively unexplored. Only in recent years attention has turned towards the deep trough areas and drilling results in the Mar Trough and North Gialo have demonstrated the significance of the grabens. Of course, exploration and drilling in the deep trough areas are expensive and risky due to the poor seismic data, limited number of potential reservoirs, and the complicated structural relationships between the source and reservoirs. However, the discoveries of North Gialo; Bu Attifel Field and NC-98 “A” and “F” blocks in the Mar Trough; and Wadi Field in the Marada Trough all on fault controlled tilted tectonic blocks represent some examples of the high reward to risk ratio of drilling in the high potential, deep graben areas. Agedabia Trough is the largest, deepest, and the most important source kitchen in the Sirte Basin. Enormous amounts of oil and gas have been generated in the Agedabia Trough from which some has been trapped in the southern part of the trough, in the pinnacle reefs, but the large volumes of oil have migrated to the sides onto the Zelten Platform to the west, Rakb High to the east, and southwards to the Gialo-Sarir High. The northern deep part and offshore areas of the Agedabia Trough have remained unexplored. These deep areas are expected to be gas-prone for Upper Cretaceous source rocks, but Tertiary petroleum system may also exist to increase the chance of further potential of hydrocarbons. The remaining un-discovered reserves are expected to be more in and around the deep trough areas in the forms of horst blocks, tilted tectonic blocks, and up-dip stratigraphic traps.

Additional Exploration Discussion

It has been apparent for a number of years in Sirte Basin that petroleum exploration has graduated for the era of the discovery of giant fields to the stage in which smaller pools and more subtle traps are the main targets. This is not to say there are no elephants left. The volumes of oil estimated by the various methods to have been generated strongly suggest there are an opportunity for finding a giant field in the future. In order if taking in account the volume of hydrocarbons that have been explored compared with the volume that has been generated, difference is very big that means the volume of remaining hydrocarbon potential big and worthy.

Future Exploration Drilling Opportunity and Challenges

Based on the recent regional studies of Sirte Basin, 2P has provided estimated un-risked and risked recoverable resources of Waha acreages by areas and horizons. As pointed out previously, the estimated un-risked and mean risked reserves of Waha’s acreage calculated by 2P are being

13,030 MMBOE and 2,763 MMBOE respectively, therefore about 2,077 MMBOE risked reserves remain to be discovered as additional prospects by Waha Oil Company. Considering Waha's present portfolios of prospects and leads and assuming that all leads will be eventually upgraded to drillable prospects, the number of exploration wells to be drilled in the future would be 130. The total estimated reserves of all these 130 prospects are 9,968 MMBOE and 3,233 MMBOE in-place and recoverable respectively. If we use the same risk factor of 2P (13,030 MMBOE un-risked reserves being 2,763 MMBOE risked reserve), the total estimated risked reserves of all prospects and leads of Waha's present portfolios would be only 685.5 MMBOE. Again, if used the same risked factor of both 2P and UUSG for all prospective areas in Sirte Basin the number of exploration wells to drilled in the near future would be exceeding 500 wells. It is expected to map and drill about 500 wildcat prospects in Sirte Basin; two outposts will be drilled to delineate the successful wildcats. Assuming 20% success ratio, 200 outposts have to be drilled which will make the total wells to be drilled to about 700 wells. This would be the same number that will be drilled in the other three basins Ghdamas, Murzouq, and Offshore.

Opportunity and Challenges

Libya has an excellent opportunity to add new potential through the new exploration drilling to discover the remaining hydrocarbon potential. Despite this great exploration effort, the four producing basins are in the emerging stage of exploration maturity. Two aspects in particular are indicative of vast undiscovered resources in Libya and the exploration opportunities to access those resources: (1) numerous potential areas, proximal to oil-field trends where well density is extremely low; and (2) extensive areas, mostly basin centers, where valid deep objectives were reached by only a few wells. Based on the volume of remaining hydrocarbon potential in Libya and the number of prospects that would be drilled in the future in Libya's basins. This huge number of prospects requires 3D seismic survey, geological studies, data interpretation to complete all of the requirements of the portfolio. This will open doors for the exploration companies to invest their potential in Libya to discover the remaining potential. This is an excellent opportunity for investment in Libya. Although to achieve and drill this number of prospects we need manpower, number of rigs, and advance technology to drill the wells and to get that potential from the ground. The target of future investment not only for the NOC Libya, but also for the operators and service companies national and international. Any chance of success and opportunity of investment is usually associated by many challenges. One of these challenges facing the NOC is the interest of the companies to resume their activities and developing technology. Technology challenges to explore and develop the oil fields and renew the infrastructure. Pollution and environmental impactions are also big challenges. As well-known there is no doubt Libya still has huge potential to be discovered. Libya has a tremendous future in the oil industry. In the absence of strong government and unstable condition of the country create state of unsafe and unsecure in the oil fields. This is due to the direct effect in the daily production rate as well-known part of the revenue goes to maintain oil fields, re-new the infrastructure, and for geosciences technology. All of the mentioned challenges act as a barrier facing the future exploration program and effect on the rate of country production.

Conclusion

The size and volume of the remaining hydrocarbon opportunity in Libya is world class. It will open doors for future investment in exploration and production. This size and volume of non-discovered potential are strongly indicated and proven from various studies in the past and recent. This significant kind of investment will help to discover and add new reserve via exploration and reservoir management. The effectiveness and efficiency of future exploitation of this resource depends critically on the new legal framework and executive institutions that Libya chooses to create. The remaining un-discovered reserves are expected to be more in and around the deep trough areas in the forms of horst blocks, tilted tectonic blocks, and up-dip stratigraphic traps. In spite of the long years of exploration in Libya, many large areas with established hydrocarbon play elements such as reservoir, source, seal, trap and timing, are remarkably under-explored, particularly in the deeper parts of the productive basins. The recent giant discoveries together with large discovers have been made in Libyan basins, (Sirte and Mourzq), show that the four major prospective basins in Libya still have a significant future potential, However, there is still plenty of room to search in Libya, and renewed interest by the international industry could yield new giants. Exploration for the subtle traps are in fact, more work intensive and more risky than was the case with early Sirte giants. Finding subtle traps requires more precision in both geology and geophysics. The rate of giants was gradually decreased to the point that between the years 1971 to 1984 no giants were found in the major interest Libya basins. One could conclude that since the giants are generally discovered during the early stage of the exploration because of their huge structure size. However, the discoveries of Block NC98 in the deep Mar Trough in 1984 and recent discovery of North Gialo have demonstrated a significant potential in the graben. New discovers have been made recently from year 2010 to 2015 in Libya's basins was strongly evidence these basins still have potential and indication for new reserves have been added. This result holds good news for future investment and the opportunity to discover new giants in the near future and future exploration process focused on subtle traps.

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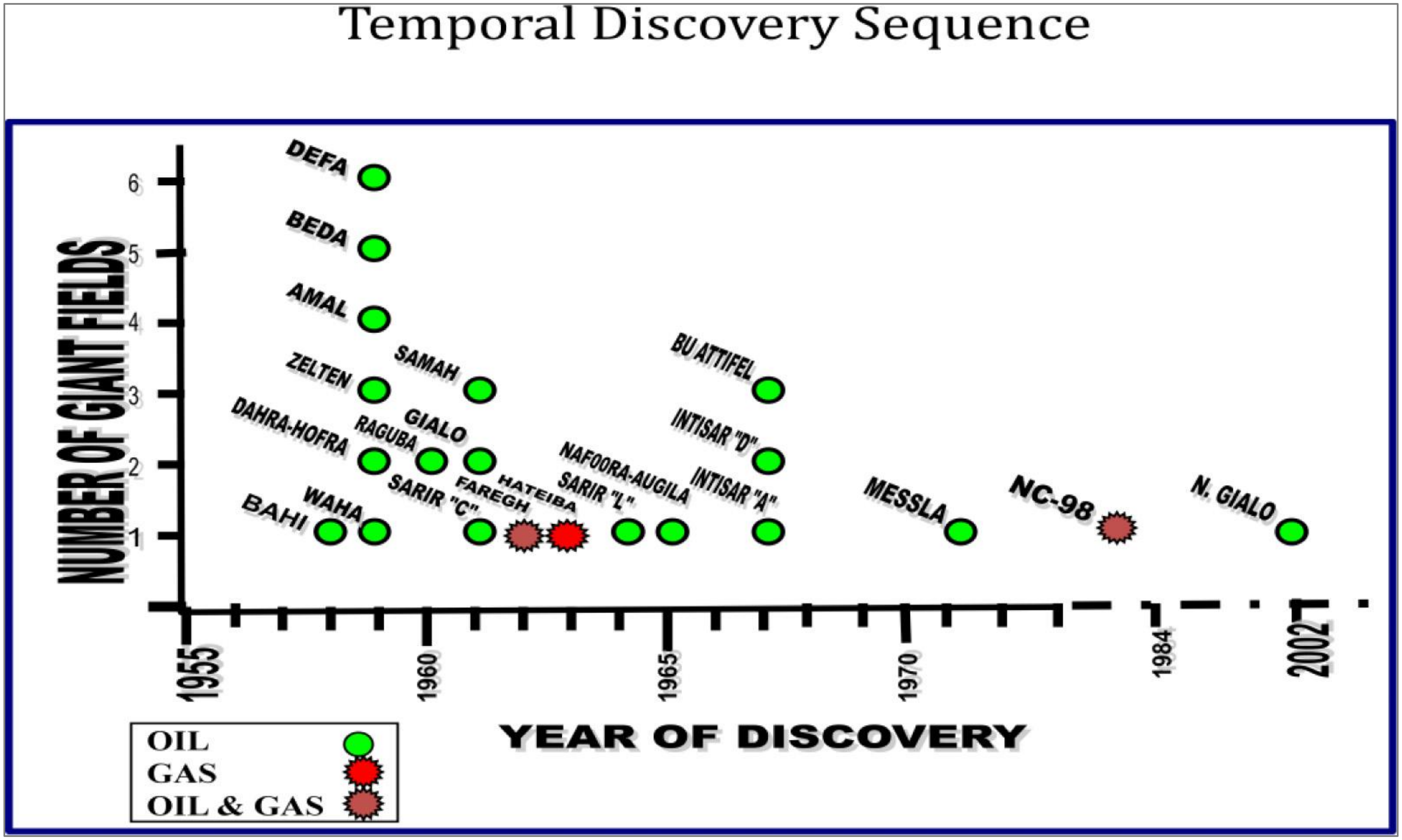

Figure 1. Shows number of giant fields and year of discovery.

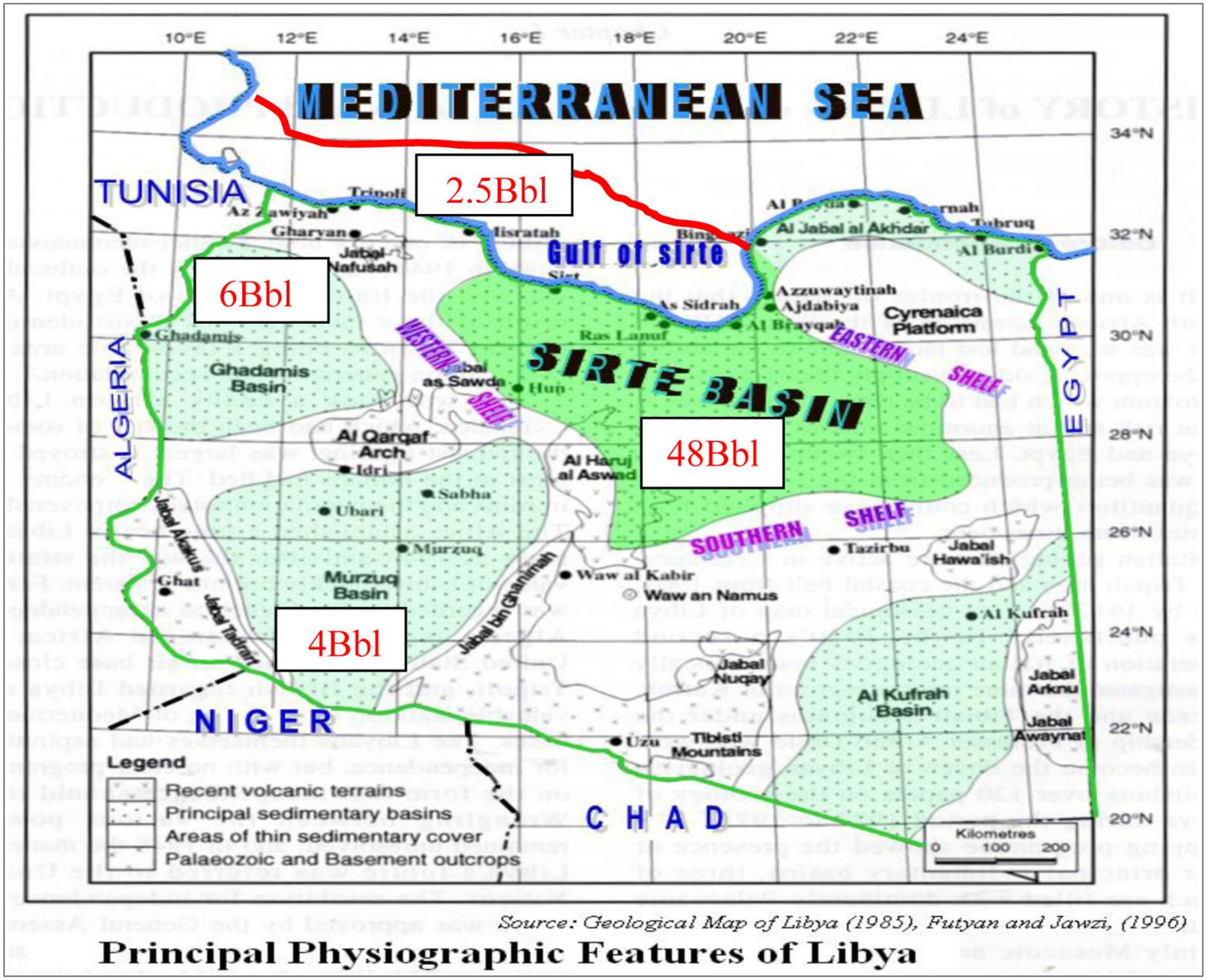

Figure 2. Map shows the location of prospective sedimentary basins in Libya.

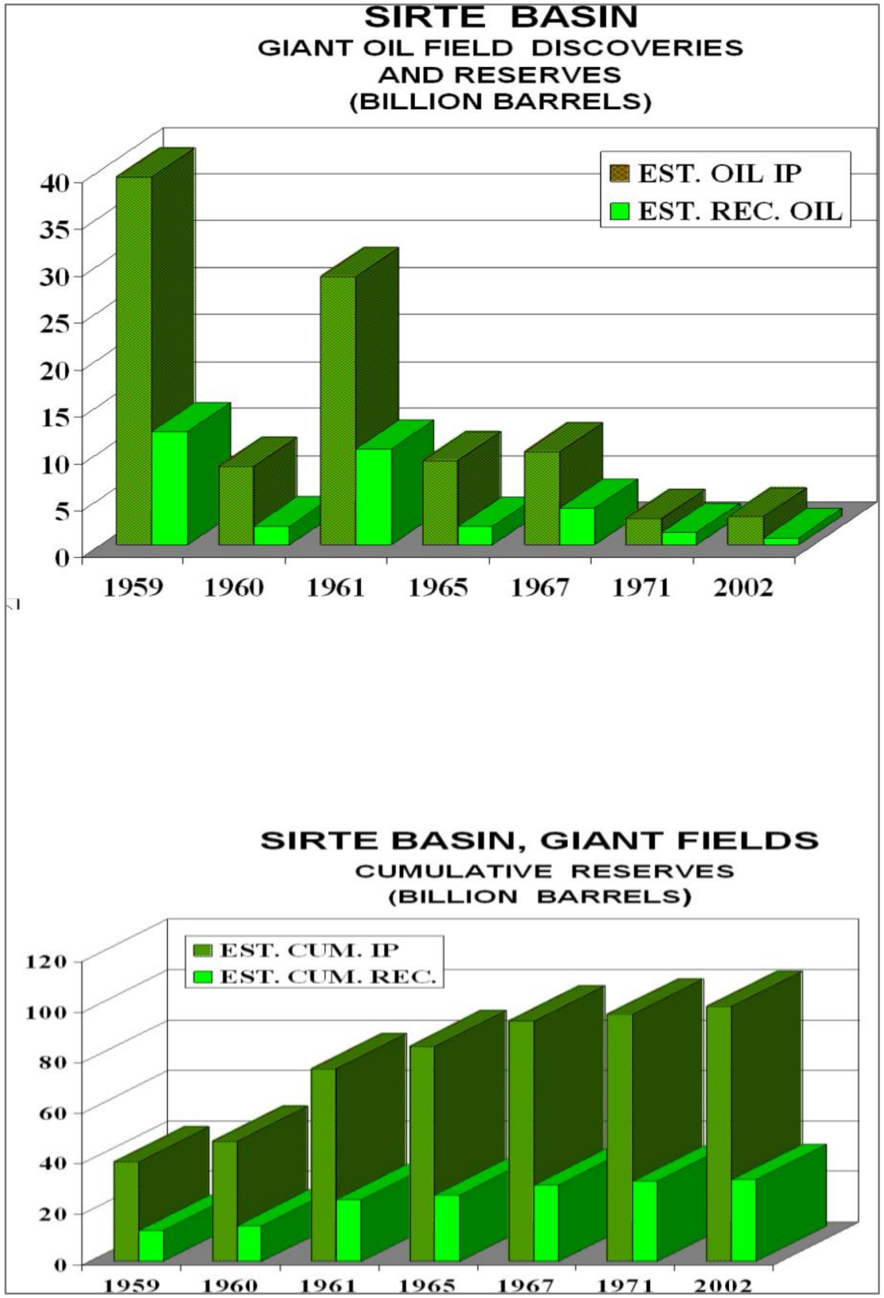

Figure 3. Chart a and b shows the Sirte Basin giant fields discoveries and reserves.

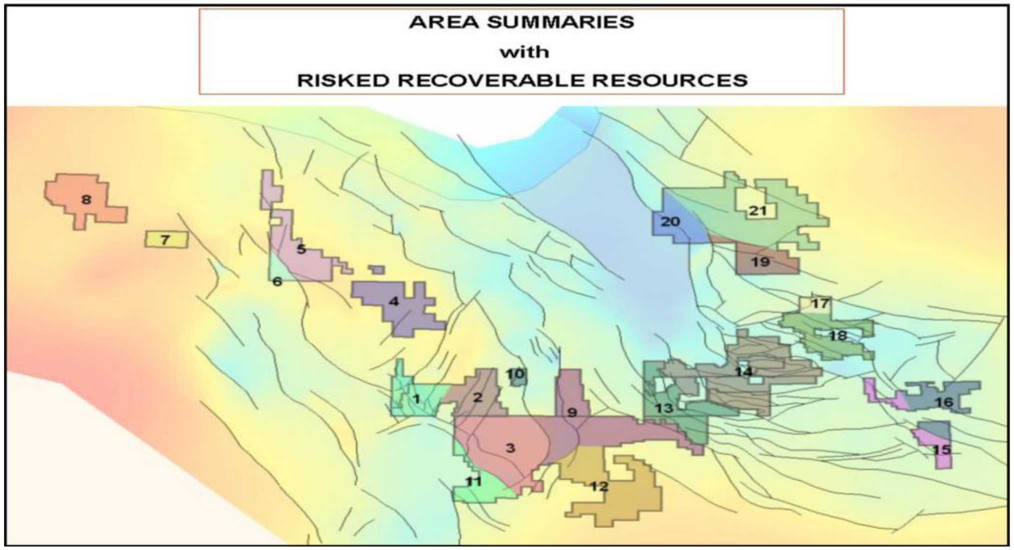

Figure 4a. Map shows Waha Oil Company concessions.

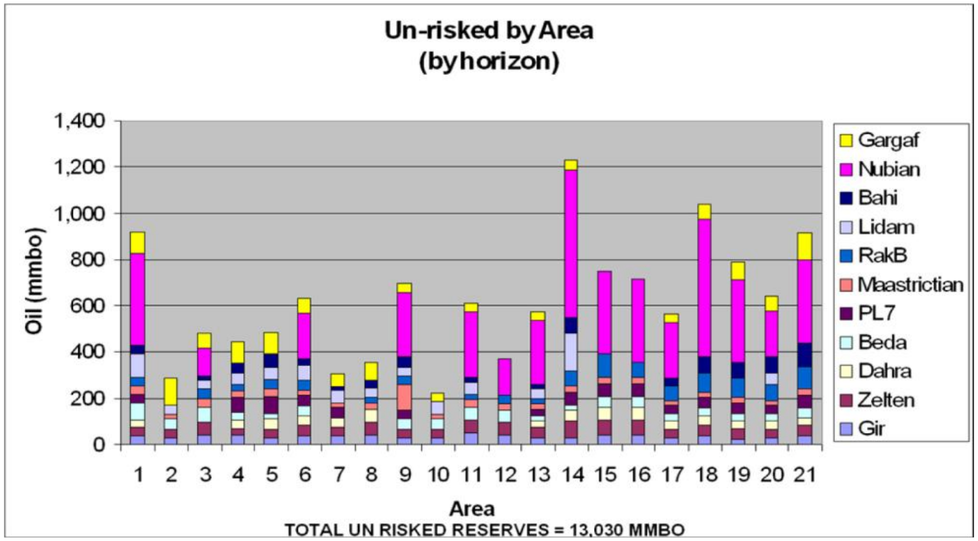

Figure 4b. Volume of un-risked reserves by horizon.

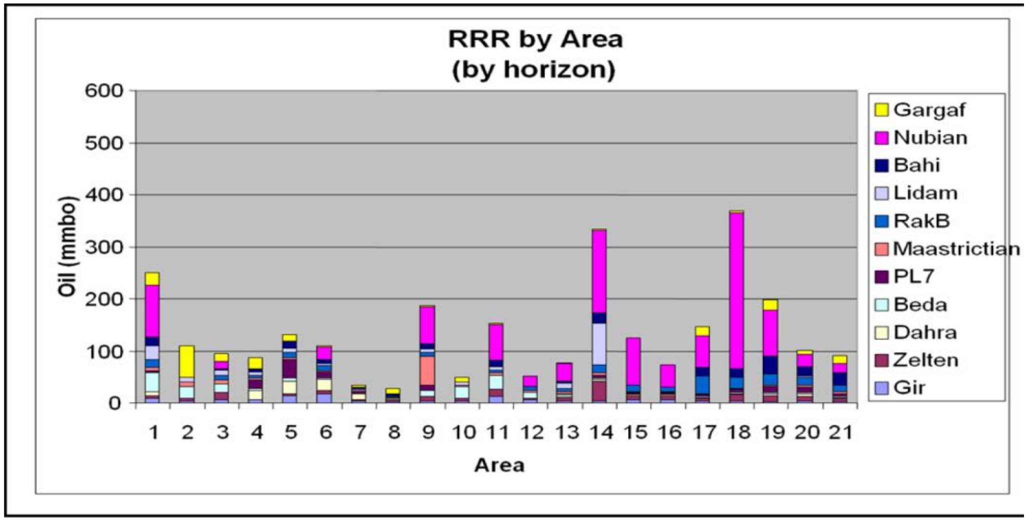

Figure 4c. Volume of recoverable risked reserves by horizon.

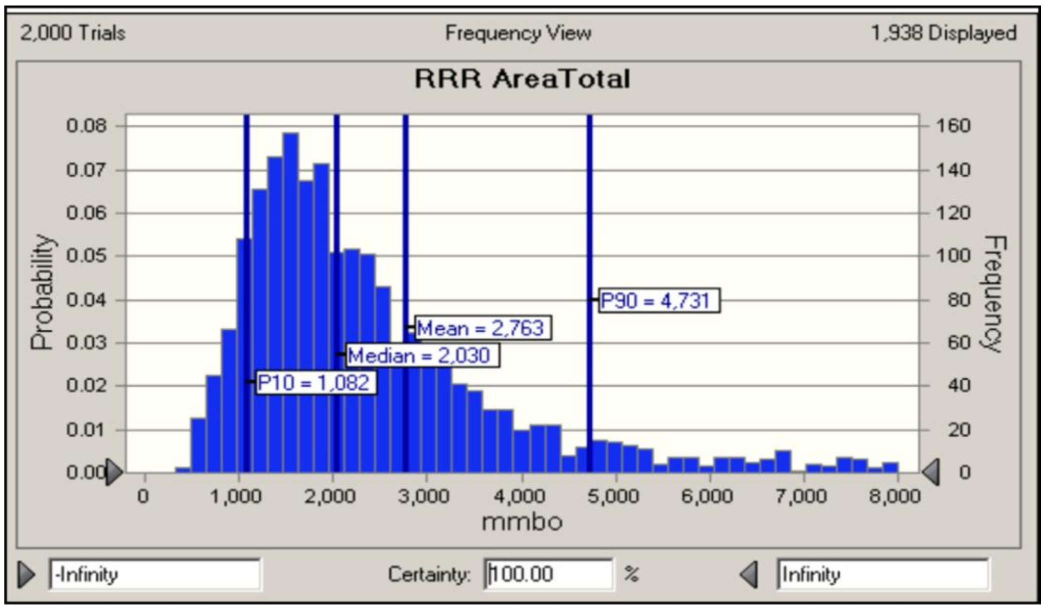

Figure 4d. Area of total recoverable risked reserves.

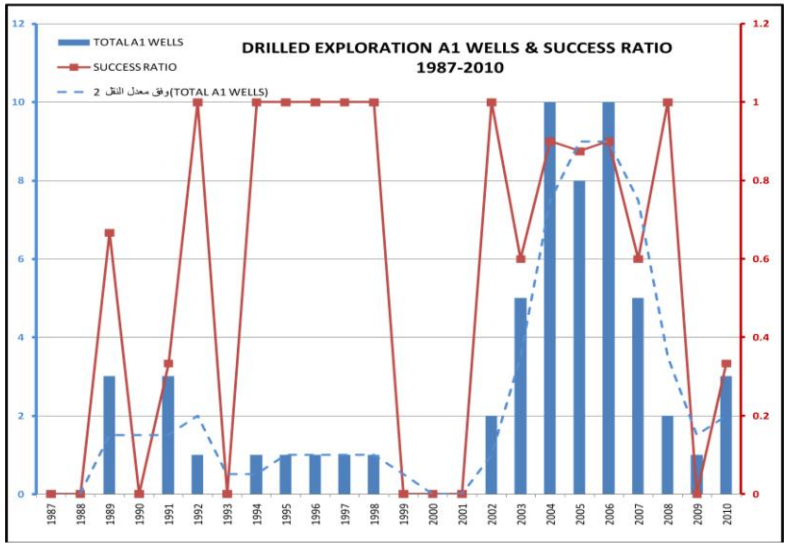

Figure 5a. Chart shows drilling exploration A1 wells and success ratio year 1987 – 2010.

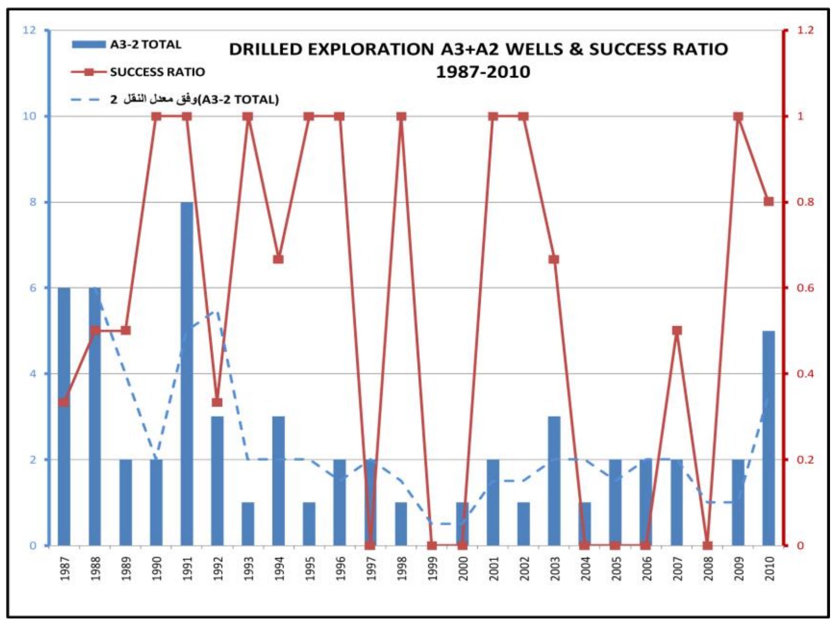

Figure 5b. Chart shows drilling exploration A3 plus A2 wells and success ratio year 1987 – 2010.

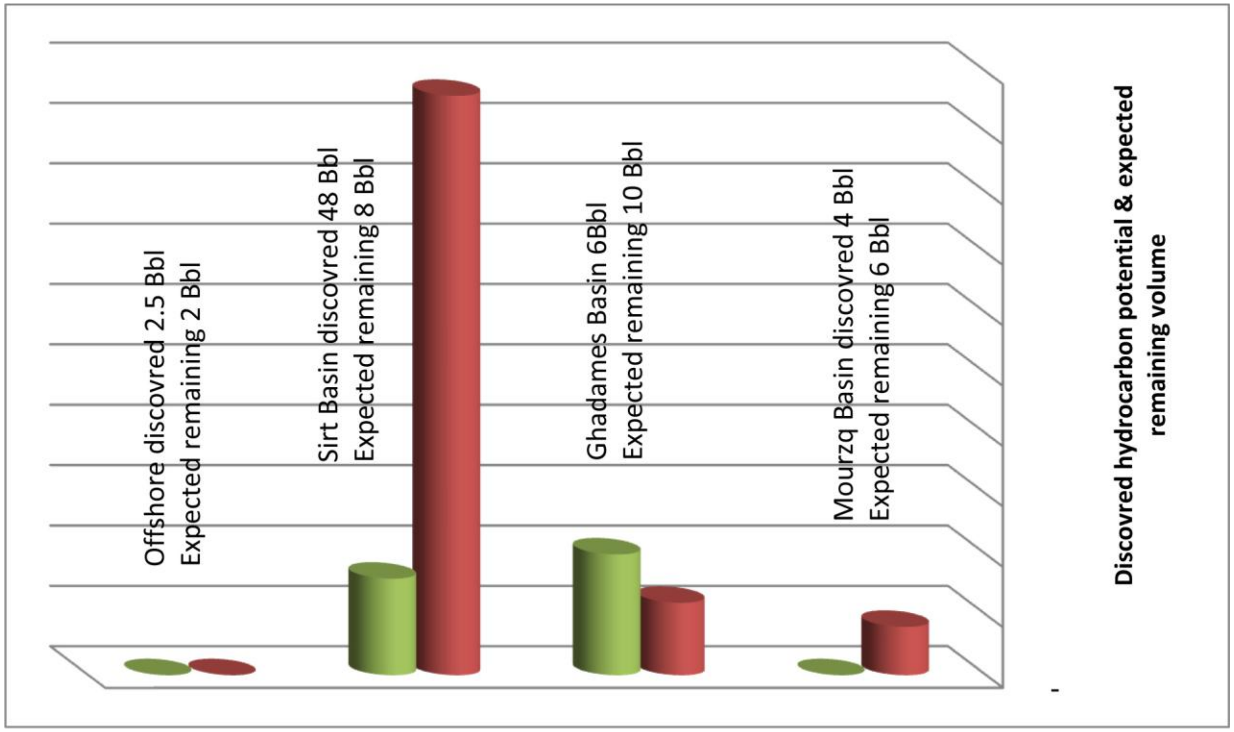

Figure 6. Chart shows the discovered and the expected undiscovered potential reserves in Libya's Basins

Period	Milestone	Remarks
1955	First Concession offered	
1957	First commercial discovery has been made	
1957 - 1971	19 giant fields have been discovered	Comprise 75% of total reserves
1971 - 1984	Decrease exploration activity	No giant fields discovered only subtle plays, due to politic policy of oil ,lack of technology,
1984 - 2002	Four giants discovered	Sirt Basin deep area, N-Gialo NC98 Mar trough, two giants in Mourzq Basin.
2002 - 2015	New discoveries have been made	In the four prospective Basins (onshore and offshore)

Table 1. Summarize the exploration history and phases of discoveries.

Idris A Belkhir Geology of South Libya ESSL - 2012	Total **Expelled 203BB** entire Sirt Basin, considering 20% of migration lost **Accumulated 163BB**	Accumulated **163BB**, Explored **120BB** To be discover 43 in-place, considering Recovery factor 30% Recoverable Approximately **13BB**
Fugro, 2005	Marada Tr. 147.2BB Gerad Tr. 3.4BB Zella Tr. 7.5 Bu Tamayo Tr. 1.9BB Total HC Expelled Only Western Part of the **Sirte Basin 160BB**	Hydrocarbon Expelled Based on Volumetric calculation of Source Rocks
M. Abuhajar, A. El-Sogher & others, 2002	**Total HC Expelled 381BB**	Hydrocarbon Expelled Based on Volumetric calculation
Geochem, 1990	Marada Tr. 76BB Agedabia Tr. 56 Gerad Tr. 1 **Total HC Expelled 133BB**	Hydrocarbon Expelled Based on Volumetric calculation of Source Rocks

Table 2. Shows the amount of hydrocarbon generation and expelled in Sirte Basin.

Basin Name	Potential Explored	Oil proven	Gas Proven	Potential to be found	Remarks
Sirt	160BB in-place	48Bbl Recoverable	50Tcf	8Bb & 20Tcf Gas	Part of the figure include offshore
Ghadames	48BB in-place	6Bbl		9.8Bb & 15Tcf Gas	
Mourzq		4Bbl	6Tcf	6Bb & >12Tcf Gas	
Offshore		2.5Bbl	4Tcf	2Bb & 8Tcf Gas	
Kufra	0	0			Has potential need more work for evaluation
Total		60 Bbl	60 Tcf	25.8Bb & 65 Tcf Gas	

Table 3. Shows the proven discovered potential and expected remaining potential.