

# AVAILABLE REPORTS

## → GABON

### **BLOCK-BY-BLOCK EVALUATION OF EXPLORATION ACREAGE IN GABON**

The purpose of this report is to help companies define their strategy in Gabon and provide them a **technical evaluation of all exploration blocks in Gabon**.

Exploration is only beginning in deep waters, and an important part of the onshore acreage remains only partially explored due to logistical difficulties in tropical rain forest. Various opportunities are therefore provided, from the development of small marginal fields under adapted contractual and technical conditions, to very deep-water frontier giant targets, requiring large high-technology investments.

Except for the ultra-deep offshore, almost all of the acreage is leased. However, possibilities of farm-in or other types of association are frequent, and relinquishment obligations also present many opportunities.

This report assesses these opportunities through a technical analysis of the hydrocarbon potential of **EACH BLOCK** and presents an evaluation of the risk involved.

The report is available on CD-ROM under an attractive interactive format (PDF files)

### **About the author**

The author of this report had an international career with Elf. He was Deputy District Manager for the Middle-East and Exploration Manager in West Africa. He spent the 1980s in staff positions at Elf headquarters working on worldwide activities, creating and managing the department of worldwide strategic studies (DES). He became coordinator for worldwide programs, studies and asset evaluation, and then counsel to the General Manager for Eastern Countries who reported directly to the President of the company.

He is now an independent consultant and provides studies based on his long experience in asset evaluation and exploration investments.

# **BLOCK-BY-BLOCK EVALUATION OF EXPLORATION ACREAGE IN GABON**

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- Reservoirs and Cap Rocks
- Sourcing
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## **BLOCK-BY-BLOCK EVALUATION OF EXPLORATION ACREAGE IN GABON**

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### **BLOCK-BY-BLOCK SECTION**

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12 Block Cards for Offshore Blocks

22 Block Cards for Deep-Water Blocks

Each Block Cards includes a location map and a discussion of the petroleum system and potential of the block.

19 Play Maps

9 Interpreted Seismic Sections

These are linked to Block Cards for blocks in which data are available

## BLOCK-BY-BLOCK EVALUATION OF EXPLORATION ACREAGE IN GABON

### Sample of Text in the General Section



#### GABON

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charge deep turbidites in the West, that is to say down dip the escarpment, and platform facies as Madiela limestones up dip the escarpment by lateral migration.

At the opposite, except the South Gabon, the pre-salt source rocks are too deeply buried down dip the escarpment and out of interest.

#### ■ Source Rocks

##### • Pre-Salt Source Rocks

Source rocks are abundant in the pre-salt sequence. Kissenda and Melania shales on the Plateau, together with the organic shale intercalations of the Dentale Formation in the trough, have a practical interest for future developments.

##### ► Plateau

Source rocks are abundant in the pre-salt succession of the margin of the rift. Two stratigraphic cycles have been described in the Neocomian - Barremian succession, both of which terminated with the deposition of organic shales:

- shales of the Kissenda Formation;
- shales of the Melania Formation.

Several hundred meters of these two source rocks occur along the margin of the basin from the Mayumba spur (Fig. 11) to the Sette Cama area in the uplift zone. They are in the oil window along the margin but pass rapidly into the gas generating zone in the adjoining low areas.

##### ► The Kissenda Formation

From Congo to South Gabon, there is evidence of source rocks, up to one hundred meters thick, in the Kissenda Formation. This formation is nevertheless little known, having been recognized only in a few wells.

It is in any case very difficult, if not impossible, to locate areas where the Kissenda source rock is within the oil window.

##### ► Melania Formation

The Melania Formation contains source rocks of very high quality. The source is, however, of potential interest only outside the Dental trough where it is over-mature.

##### ► Dentale Formation

There are numerous oil and gas shows (and a little pool at Tchibala) within the Dentale reservoirs. These hydrocarbons could not have been generated in the Melania source rock, which, if it occurs at all, is at very great depth, over-mature and also separated by thick under-compacted shales. For that reason, and in the absence of any specific analysis, the source is considered to be in the intra-Dentale brownish shales which are rich in lignitic and coal debris.

##### • Post-Salt Source Rocks

The main post-salt source rock of Gabon are the deep water shales of the Azilé Formation and of the Madiela deep sea facies. But the main drawback in South Gabon is their maturity. Normal burial depth in the absence of a thick Senonian and/or Miocene cover is insufficient for oil generation.

Their area of extension is west from the escarpment to the abyssal plain included. They are patchy and irregularly distributed but present in a lot of places, mainly where paleolows existed at the time of Albian to Senonian deposition

#### ■ Reservoirs and Cap Rocks



##### • Association between Principal Pre-Salt Reservoirs and Cap Rocks (Fig. 12)

In South Gabon, there are two different areas to be considered:


- the eastern rift plateau;
- the western Dentale trough.

## BLOCK-BY-BLOCK EVALUATION OF EXPLORATION ACREAGE IN GABON

### Example of Block Card in the Block-by-Block Section


Kenguerie Marin


**SEISMIC SECTION - CAMARDO 101**



- ▶ OPERATOR**  
Shell
- ▶ PLAYS**  
Senonian turbidites of the salt dome province under screen of superficial salt glaciers; Cenomanian - Turonian shelfed slope turbidites (central eastern part)
- ▶ WILDCATS**  
17 (concentrated in the eastern part)
- ▶ EXPLORATION STATUS**  
Half of the block (north and west) is unexplored due to the high tech approach needed, the remainder of the block is only unexplored
- ▶ DISCOVERIES**  
1 (Iguaga N, 1997) - Iguaga North, 1998

**PETROLEUM GEOLOGY**

The block is located in the Libreville offshore sub-basin and is for its main part in the salt dome province up to the GBR fault which cuts the northeastern corner of the block. The western part of the block is in the slope area (WD up to 1000 m). Its structural framework resulted from the following history:

During the Aptian, transtensional faulting carved out the sub-basin. This generated blocks with differential subsidence during the late Aptian salt deposition, the thickness of which is important in the western part south of the GBR fault, and varies widely depending on the block involved.

This transcurrent fault system was reactivated during Senonian times, generating differential subsiding, induced halokinesis and some flower structures of which Koukwa and Pingouin are good examples. Cenomanian to Senonian shelfed turbidites controlled by halokinesis accumulated in subsiding panels.

During the Tertiary halokinesis reached a maximum and originated salt glaciers, large overhangs, etc., very similar to that of the deep offshore Gulf of Mexico. All these diapiric events were controlled by reactivated faults.

**RESERVOIR AND CAP ROCKS**

Reservoirs are provided by shelfed turbiditic sands, mainly of the Senonian but also probably of the Turonian and even the Cenomanian. These can be compared with the reservoirs of fields in the Port-Gentil area like the Anguille sands, the Pointe Clairette sands and the Batanga sands. Nevertheless, the type and distribution of turbidites are not exactly the same and remain poorly known. As a rule, sands distribution cannot be homogeneous and has been controlled by contemporaneous Senonian structural instability. When present, as demonstrated by the recent discovery, the sands (Cenomanian turbidites) exhibit excellent characteristics, but the importance and continuity of these sands remains to be established, and the risk consists in some areas being barren of sands.

As the turbiditic sands bodies are imbedded inside very thick shales or are pinching out against the salt, sealing is easily insured.

**CHARGE**

The African Cenomanian anoxic deep-sea shales are prolific source rocks. As the oil-prone ones are several hundred meters thick, a portion of them is always inside the oil window. This pattern is identical to that of the Port-Gentil fields area. Source rock efficiency is proven. Nevertheless, the turbiditic sands bodies are often isolated and migration from the underlying source rocks to the reservoir is dependent upon the existence of discontinuities such as minor faults or salt diapir fringes. As a result, not all the sands bodies are sourced, and in the Port Gentil area several isolated oil-bearing sands were encountered between wet-sand bodies.

**TRAPS**

Traps can only be subtle, and the comparison with the Gulf of Mexico has to be remembered. Possibilities for numerous traps are significant, some of them could be large even if the majority of them would be of limited size or compartmented. In fact, traps are related on one hand to complex and polyphased halokinetic or flower-structure closures, and on the other hand to discontinuous turbiditic sands often controlled by paleo-structuring. This is already known with a lesser extent in the fields of the Port-Gentil area such as for example, in the Turpile or the Opanedjo areas, but the difficulty of finding this type of traps in the Kenguerie block is accentuated by problems of seismic resolution. Traps are to be found under salt glaciers or other superficial salt-related seismic screens. Until now, seismic data has been unable to overcome this difficulty: it appears that at least partially, Shell has resolved the problem.

The major difficulty in the exploration of this block is to be able to define subtle traps under a salt screen.

**EXPECTED RESERVES**

With today's knowledge, one has to consider that an acceptable model for targets in the Kenguerie block is that of the fields in the Port-Gentil area, but with a noticeable uncertainty due to the amount and distribution of turbiditic sands being unknown. There are possibilities for a 200 MM bbls field and several lesser fields.

Target depth: 2000-2500 m.

**Risks**

The risk is high and due to three factors:

- the main factor is related to technology as it is very difficult to define subtle traps under a salt screen;
- a second factor is in locating turbiditic sands because they occur in specific areas that are difficult to define with seismic again due to the salt screen;
- the third risk factor is related to irregular charge.

**CONCLUSION**

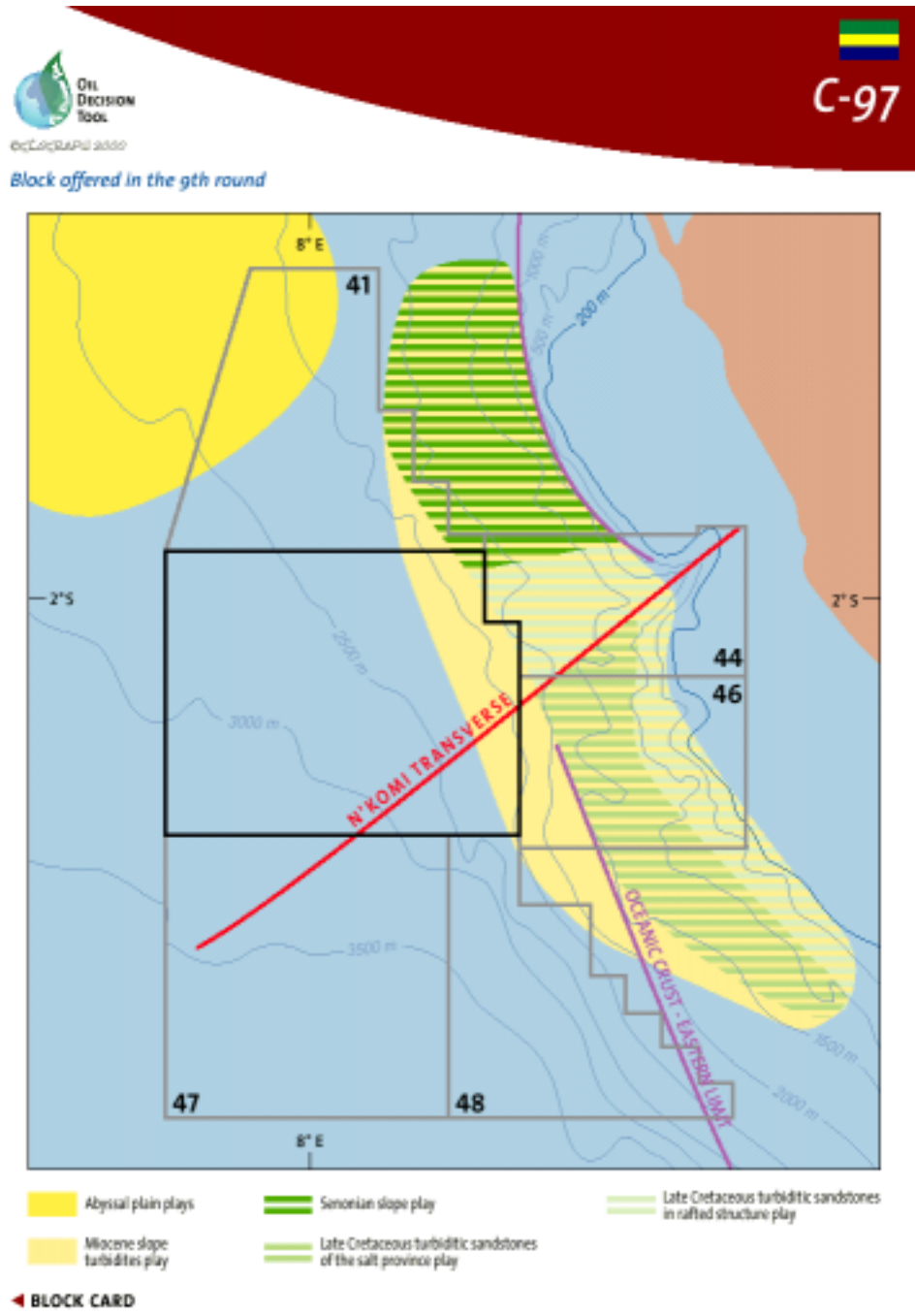
The Kenguerie block is by far the most attractive block of the shelf and is the less than 1000 m WD areas in Gabon, even if it is associated with a high risk. It can be classified as an high reward-high risk block.

Its interest has been emphasized by the recent Iguaga discovery, and for the time being it would appear very improbable that Shell will accept to share its assets. But the renewal of the block is underway. As its exploration is very difficult, the portions chosen by Shell for relinquishment, could still be of interest.

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## BLOCK-BY-BLOCK EVALUATION OF EXPLORATION ACREAGE IN GABON

### Example of Play Map in the Block-by-Block Section



## **BLOCK-BY-BLOCK EVALUATION OF EXPLORATION ACREAGE IN GABON**

### **Example of Interpreted Seismic Data in the Block-by-Block Section**

