

# Oil Exploration in Sri Lanka in Retrospection

## Abstract

The exploration for hydrocarbons (oil and gas) in Sri Lanka dates back to the late 1950s when geological and geophysical surveys were carried out in the northwest and northern parts of the country underlain by sedimentary rocks. These rocks are known to contain marine organisms that have decomposed and converted to hydrocarbons. The accumulation of such deposits is in pervious sandstones that form reservoirs or traps. The base of such structures is impervious rock such as shales or limestone, etc. There is also a cap rock like a salt dome at the top of the reservoir that contains the oil or gas.

This study attempts to trace the history of oil exploration for the past 45 years and analyse various geological factors, specially land that were not attractive to accumulation of commercially exploitable oil and gas deposits.

Exploration for oil and gas was not pursued for over 20 years since 1984. However in 2001, such activity was revived after the Asian Development Bank funded the implementation of a new fiscal and legal framework to assess the upstream off shore oil and gas exploration, targeting the Mannar basin. To this end, a Petroleum Resources Act was formulated, and a technical review of the petroleum resources in the off shore areas was undertaken. A Petroleum Resources Development Secretariat (PRDS) and a Petroleum Resources Development Committee (PRDC) were also established under the new Act. Further in 2005, a Ministry of Petroleum Resources Development was created, and Sri Lanka pursued an aggressive exploration programme. However, lack of coordination with other state agencies and universities, and recruitment and training of technical staff to fill vacancies in the PRDS were major impediments to rapid assessment of commercially exploitable oil and gas resources.

Suggestions are made to look for new target areas and overcome some serious deficiencies in the technical and legal framework in the quest for oil and gas deposits.

## Introduction

This study attempts to analyse past exploration activities and developments in the search for oil and gas on land, shallow and deep water off shore areas within the Mannar basin as well as the area north of Mannar island falling within the southwest extension of the Cauvery basin which extends from the eastern seaboard of India. Such

activities were also accelerated after the discovery of oil and gas north of the Indo Sri Lanka maritime boundary in the early 1980s. The advancement of knowledge on the geology of the off shore Mannar and Cauvery basins on both sides of the boundary also contributed to the acceleration of exploration projects.

In 2001, the Asian Development Bank approved a project to provide technical assistance to Sri Lanka for promotion of private sector involvement in oil and gas exploration and reviving such activity after a period of nearly 20 years.

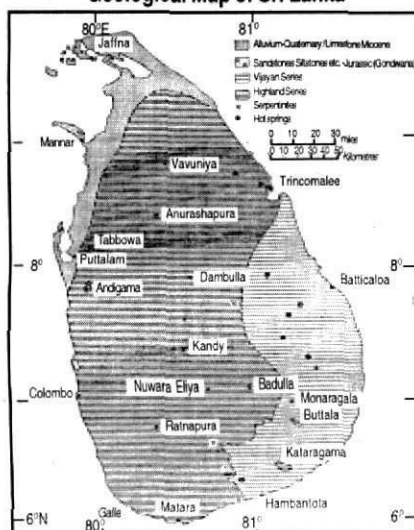
Accordingly, there were two major phases in the quest for oil and gas, namely (a) the period from 1958 to 1984 and (b) from 2001 to present.

This study highlights attempts made by designated state entities, invariably with foreign collaboration, to actively pursue exploration activities during the above periods. Suggestions are also made as to how certain deficiencies within the designated agency, namely the PRDS, could be overcome and an effective exploration programme could be affected.

## Geology of Sri Lanka

The Island of Sri Lanka covers a surface area of 65,525 square kilometres and consists mainly of crystalline rocks of Precambrian age formed 2,500–545 million years ago. There are also sedimentary rocks of Miocene age of 24 million years (limestone stretching from Puttalam to Jaffna) as well as Jurassic age of 205 million years (shales and sandstones at Andigama and Pallama). These sedimentary rocks are overlain by rocks of recent age such as lagoonal and estuarine clays, corals, etc. of less than 1.8 million years (Fig 1) (Cooray, 1987).

Figure 1  
Geological Map of Sri Lanka



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The areas that are of importance for oil and gas exploration are the sedimentary basins forming the limestone belt that extends off shore as well as the two Jurassic faulted block depressions consisting of carbonaceous shales, siltstones and sandstones.

For the occurrence of oil and gas, the above sedimentary rocks should have formed in a marine environment where the low forms of micro-organisms have decomposed to generate the hydrocarbons. Further, an oil or gas reservoir or trap has to be in pervious rock such as sandstone with a cap rock like a salt dome and an impervious rock such as shale, etc. at its base. The heat required for the above conversion is derived from igneous activity of deep-seated origin and moving along faults.

Geophysical surveys such as seismic, gravity, magnetic and other related surveys can unravel the sub surface strata, and indicate oil-bearing structures which are further probed by subsurface drilling operations both on land and off shore.

## Exploration Activities for Oil and Gas between 1958 and 1984

The Geological Survey Department (presently Geological Survey and Mines Bureau GSMB) in 1958 initiated an air-borne magnetic survey to cover the Island. Hunting Survey of Canada carried out this survey on a technical assistance programme under the Colombo Plan. The special lines flown covering Jaffna and Mannar areas indicated that the sedimentary basin slopes towards the Bay of Bengal and the Gulf of Mannar (unpublished maps held by Geographical Survey and Mines Bureau).

In 1968, La Compagnie Generale de Geophysique (CGG) of France carried out seismic profiles in the Jaffna, Mannar, Puttalam, Andigama and Tabbowa areas on behalf of the Ceylon Petroleum Corporation (CPC) in its attempts to locate targets for exploration.

Further in 1970, the Geological Survey Department initiated a gravity survey of the Island including the sedimentary basins with the assistance of the Geological Survey of New Zealand. The results of

this survey indicated that the Tertiary sediments of Miocene age most probably underlain by Jurassic sediments are over 5,000 metres in thickness in the centre of Jaffna Peninsula. The Jurassic sediments at Andigama and Tabbowa were over 500 metres in thickness. Exploratory drilling did not follow up these results.

Since the results of surveys carried out by land did not give promising results, the Government sought the assistance of the Former Soviet Union (Russian Federation) in exploring the Mannar Island, and also the shallow waters of the Mannar basin in the late 1960s and early 1970. Further, during the period 1960 and 1984, Soviet as well as western companies principally focused on exploration within the shallow off shore areas of Mannar as well as the Cauvery basin located off shore from Jaffna.

During the above periods, nearly 18,000 kilometres of seismic data were recorded, and seven wells were drilled, of which, four were structural wells. All wells were plugged and abandoned without encountering hydrocarbons. However, three wells drilled by the Soviets (Pesalai 1, 2, and 3) were reported to have encountered wet gas at several levels. In the Palk Strait region of the Cauvery basin, Marathon of the United States of America (USA) drilled Palk Bay 1 and Delft 1 wells, and Cities Services USA drilled Pedro 1 and also Pearl 1 on the eastern flank of the Gulf of Mannar basin located to the south of Adam's Bridge high which separates the two basins.

The target areas that Marathon and Cities were looking for were in Cretaceous sands across horsts (down faulted earth's crust) and tilted fault blocks in the Palk Strait region. Identification of such targets was based on discovery of oil in Cretaceous sands 30 kilometres to the north of Pedro 1 structure within the Indian waters of the Cauvery basin, and this test well yielded 1,488 barrels of oil per day.

In 1984, Petro Canada also examined the seismic data as well as well logs and did not pursue further exploratory work.

#### Exploration from 2001 to Present

The Asian Development Bank (ADB) technical assistance programme for the promotion of private sector involvement in oil and gas exploration commenced in 2001. The total project cost was US\$ 388,000, of which the local component was US\$ 80,000. The main objectives of the project were: (a) review exploration prospects and potential for oil and gas development; (b) define acceptable financial and legal terms for exploration service agreements

satisfactory to the Government and to the international exploration investors and (c) promote exploration by international oil companies of Sri Lanka's sedimentary basins, in particular the Sri Lanka side of the Cauvery basin and the deep off shore area.

The scope will include: (a) review the available geological and geophysical data; (b) assess the prospects for exploration activity that may lead to commercial oil and gas production; (c) review and formulate improvements in petroleum legislation compatible with Sri Lanka's petroleum potential; (d) prepare a model Production Sharing Contract (PSC) based on best market practice; (e) map out Government's framework for a campaign to attract international oil and gas exploration and devising a strategy of awarding licenses and (f) assist in promotional campaign to attract bids for exploration licences.

The above work scope has been divided into three main groups: (a) report on prospective petroleum resources; (b) a model PSC that meets the Government's approval and (c) advice on petroleum license marketing internationally.

The School of Petroleum Engineering of the University of New South Wales (UNSW) was selected as the executing agency of the project, and the Ceylon Petroleum Corporation (CPC) under the Ministry of Power and Energy was the implementing agency.

#### Prospective Petroleum Resources

As an integral part of the ADB project, a Non Exclusive Seismic data Agreement was signed between TGS NOPEC Geophysical Company of Norway and the Ceylon Petroleum Corporation (CPC) to acquire 2D and 3D seismic data within the territorial waters of Sri Lanka. The total cost of Phase 1 for a 2D seismic survey of 1,100 kms covering the Gulf of Mannar and the deep water area and the deep water area along the south west coast was US \$ 1,737,330 and was borne by TGS NOPEC which was given the exclusive right to sell the data, and after cost recovery, the revenue generated after recovery of 150 per cent of costs was to be split equally between TGS NOPEC and CPC.

Since the TGS NOPEC Agreement was detrimental to Sri Lanka, the government annulled it and agreed to pay US\$ 8.5 million as compensation. A detailed analysis of the TGS NOPEC Agreement indicated that the company was in default (Jayawardena, 2007).

It was also reported that TGS NOPEC carried out additional 2D seismic surveys in the Gulf of Mannar under Phase 2 of the project in 2002.

CPC together with the ADB consultants presented the results of this survey at the Southeast Asia Petroleum Exploration Society (SEAPEX) Conference in December 2001 held in Singapore, and attracted the attention of international oil companies.

The reinterpretation of the earlier and newly-acquired seismic data as well as the study of the well logs indicated that the Gulf of Mannar basin represents a new deep-water frontier region that has indications of hosting significant hydrocarbon accumulations (Shaw, 2002).

#### Petroleum Resources Act No. 26 of 2003

The Act provides for the exploration and recovery of petroleum resources in Sri Lanka and for regulation of the same. Certain provisions of the Petroleum Corporation Act No.28 of 1961 were repealed to exclude the above functions and bring them under the new Act.

The Act consists of the following:

Part I Ownership of Petroleum Resources vested in the State.

Part II Petroleum Resources Development Committee (PRDC) assisted by a Petroleum Resources Development Secretariat (PRDS) headed by a Director General to assist the PRDC. The powers and functions of the PRDC are indicated in Article 6 and include formulation of policies to promote development of petroleum resources, calling for bids for exploration and preparation of model Petroleum Resources Agreements (PRAs) similar to Production Sharing Contracts (PSCs) among others.

Part III Elaborates issues related to PRAs, exploration blocks and issuance of development licenses after discovery of commercially exploitable oil or gas deposit. This Part consists of 13 Articles from 7 to 19.

Part IV Defines the functions of the Secretariat (PRDS) and consists of 2 Articles 20 and 21. Attention is drawn to Article 21(2) where there is provision for PRDC to assign wide powers to the Director General for him to act independently.

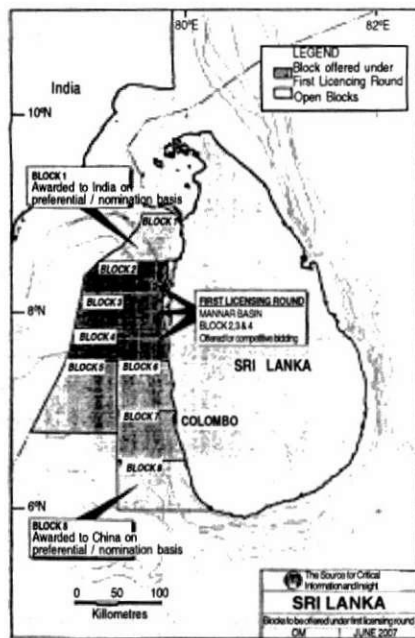
Part V Consists of Fiscal Provisions and consists of 5 Articles (22 to 26)

Part VI Has General Provisions with definitions in Article 34

## Exploration Blocks in the Mannar Basin and Offshore South West Sri Lanka

In pursuance to the TGS NOPEC off shore seismic survey, 8 exploration blocks comprising a total of 33,714 square kilometres (nearly half the surface area of Sri Lanka) were demarcated from north to south. Block 1 (3,501 sq.kms) and Block 8 (4,995 sq.kms) were reserved for India and China respectively to be awarded on a nomination basis (Fig 2).

**Figure 2**  
**Offshore Exploration Blocks**



The Ministry of Petroleum and Petroleum Resources Development (MPPRD) formally announced the launch of the country's First Licensing Round at an Off Shore Technology Conference (OTC) in Huston on 1 May 2007. The Blocks on offer were as follows:

Block 2	3,338 sq.kms
Block 3	3,572 sq.kms
Block 4	4,126 sq.kms

The western margin of the above blocks is along the Indo-Sri Lanka Maritime Boundary under the Maritime Zones Law No.22 of 1976, and the legal implications of such demarcation will be dealt with later.

### Appointment of Consultants of Mannar Bidding Round

On 15 May, MPPRD signed a contract with Fugro Data Solutions (FDS) for the following assignment:

1. Developing a Model Petroleum Resources Agreement (MPRA) and a computer model.

2. Marketing bid round and assisting in evaluation of bids.
3. Assist in negotiations involving award of exploration blocks to India and China.

It was later revealed that the MPRA was identical to the Production Sharing Contract (PSC) of India under the New Exploration Licensing Policy (NELP V1).

Fugro was not involved in evaluation of bids received under the 1st bidding round. The total contract value was Pounds Sterling 500,000 (Jayawardena, 2008)

### Model Petroleum Resources Agreement (MPRA)

The above Agreement was analysed in detail, and the various Articles that were copied from the PSC under NELP V1 have been highlighted (Jayawardena, 2008). There are 37 Articles and 8 appendices in both these model agreements (MPRA).

### Mannar Bidding Round

In response to the three Road Shows in London (August 2007), Houston (27 August 2007) and Kula Lumpur (September 2007), only 6 bids were received. Cairn India bid for Block 2 and 3, Oil and Natural Gas Corporation (ONGC). Videsh for Block 2 and Niko Resources of Cyprus for Blocks 2, 3 and 4.

The Cabinet of ministers appointed a Technical Evaluation Committee (TEC) and a Negotiating Committee (NC) to evaluate the offers and recommend to the government the awards. However the Government subsequently decided to evaluate offers received from all three companies for Block 2, and to defer the evaluation of the other two blocks for a later date. The final award of the Block No. SL 2007-01-01 was made to Cairn India Limited (CIL), a company listed in the Bombay Stock Exchange and the National Stock Exchange and 65 percent of CIL is owned by Cairn Energy PLC of United Kingdom and 12.7 per cent by Petronas of Malaysia.

### Petroleum Resources Agreement

This Agreement for the exploration and production of oil and gas in Block SL 2007-01-01 was signed on 7 September 2008 by the Minister of Petroleum and Petroleum Resources Development with a Director of Cairn Sri Lanka, a wholly owned subsidiary of Cairn India.

The Agreement is valid for 30 years, and the exploration period is 8 years under 3 phases of 3, 2 and 3 years respectively. During the first exploratory phase, a total of US\$ 112.1 million will be spent. The work programme involves seismic, gravity and magnetic surveys and exploratory drilling of 3 wells. The second and third phases will involve an expenditure of US\$ 25 million and US\$ 35 million respectively. Each phase has a minimum work programme and minimum expenditure levels for which the company has to give a bank guarantee for 25 per cent of the exploration costs under each phase. Further 30 per cent of the contract area has to be relinquished after 8 years. The company has the option to terminate exploration at the end of each phase and withdraw from the project.

If the exploration is successful, the company will enter into a development phase after obtaining a license from the PRDC. All exploration and development costs will be recovered from petroleum and, subsequently, profit from petroleum will be divided between the Government and the company on an agreed formula.

A signature bonus of US\$ 1 million was paid by Cairn to the government at the time the Agreement was signed.

Cairn Sri Lanka has now registered under the Board of Investments (BOI), and will enjoy concessions like tax holidays under section 17 of the Greater Colombo Economic Commission (GCEC) Law.

### Maritime Boundary Issue

Attention is drawn to the western boundary of Block 2 which is contiguous with the Indo-Sri Lanka Maritime boundary. The Governments of India and Sri Lanka have signed Maritime Boundary Agreements for the Gulf of Mannar and the Bay of Bengal, and ratifications were exchanged on 10 May 1976.

Attention is drawn to Article V11 of the Agreement which states "If any geological petroleum or natural gas structure or field, or any single geological structure of field of any mineral deposit including sand or gravel extends across boundary referred to in Articles 1 and 11 and the part of such structure or field which is situated on one side of the boundary is exploited in whole or in part, from the other side of the boundary, the two countries shall seek to reach agreement as to the manner in which the structure or field shall be most effectively exploited and the manner in which the proceeds deriving there from shall be apportioned".

It is clear that the Petroleum Resources Agreement, which the Government of Sri Lanka signed, ignored the above agreement, and it would be prudent to initiate diplomatic and legal consultations with the Government of India even at this later stage.

## Conclusions

An attempt was made to trace the long history of oil exploration in Sri Lanka and summarise the activities at various stages from 1958 to present day. The responsibility for oil and gas exploration is with the Ministry of Petroleum Resources Development. The major drawback is the serious lack of coordination by the PRDS with the Universities and other relevant agencies such as the GSMB, National Aquatic Resources Agency (NARA), Marine Pollution Prevention Authority and the Central Environmental Authority. It is suggested that PRDS work closely with these agencies so that there will be no conflicts in the future. All technical data of a non-proprietary nature should be made available to the other agencies so that researchers can contribute to the advancement of our knowledge on hydrocarbon accumulations.

The off shore area north of the Gulf of Mannar falling within the southern Cauvery basin is known to be more promising for hydrocarbons, particularly gas as some significant deposits have been discovered in the Krishna Godavari basin as well as the Mahanadi basin along the eastern coast of India. PRDS should actively pursue licensing of exploration blocks in this off shore area.

It is also disappointing to note that although the PRDS was established about 3 years ago, it still has to recruit technical personnel such as geophysicists, petroleum geologists, etc. and fill its cadre. There is only one expatriate presently at PRDS who is experienced in oil and gas exploration, and this situation should be rectified as a matter of priority.

Attention is drawn to the legal implications that will emerge over the maritime boundary with India, and immediate action should be taken to resolve this issue.

It is learnt that the various regulations under the Petroleum Act have not been legislated, and this matter should be expedited to enforce an effective legal regime.

Finally, serious thought should be given as to why only 6 bids were received for the first bidding round for the blocks in the Mannar basin. It is suggested that the PRDS write to all the international exploration companies who attended the Road Shows, and get a feed back to refine the Petroleum Resources Agreement to make it more competitive and attractive to the foreign investors.

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## Footnotes

<sup>1</sup> TIGSS - NOPEC Geophysical Company ASA of the Netherlands