

Surrounded by hydrocarbons

Only three years after Independence, East Timor is now ready to announce the first licensing round. With multiple oil and gas seeps onshore, several discoveries and four fields producing both oil and gas offshore, the Timorese have reason to expect significant interest from international oil companies.



Photo: Geir Yreland



The Democratic Republic of East Timor, also known officially as Timor-Leste, is the world's youngest nation. The country consists predominantly of the eastern half of the island of Timor. Also included in the territory are the nearby islands of Atauro and Jaco, and the small enclave Oecussi situated on the northwestern coast of Timor. The total land area is 14,600 km², while the population is approximately 1,000,000, of which 250,000 live in the capital of Dili. The local climate is tropical and generally hot and humid, characterised by distinct rainy and dry seasons.

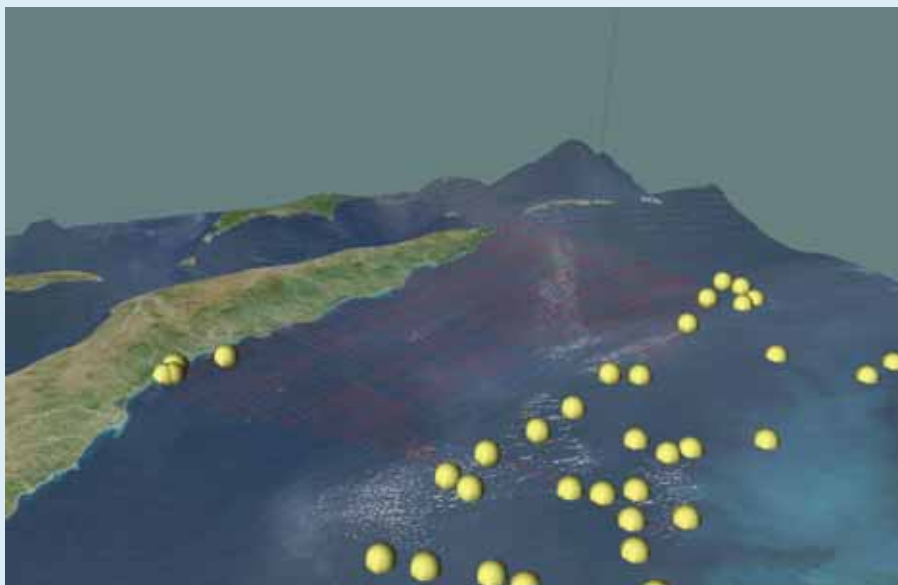
To the north and northwest of the island lie the Wetar Strait and Ombai Strait separating East Timor from some small Indonesian islands, to the south the Timor Sea separates the island from Australia, while to the west, on the same island, lies the Indonesian province of Nusa Tenggara Timur.

The Timor Trough, which runs through the area to be included in the first licensing round in East Timor, is a pronounced physiographic feature that was previously thought to represent the subduction zone where the Australian Plate collides with the Eurasian Plate. Today we know that this plate boundary is found to the north of the island.

Also shown are the oil and gas discoveries made in the Joint Petroleum Development Area (JPDA), including the small oil fields Elang/Kakatua and the gas/condensate field Bayu-Undan. The Timor Sea Treaty defines the JPDA, and the Timor Sea Designated Authority (TSDA), administers petroleum authorities therein. Development of the Sunrise Gas Project, including the Sunrise and Troubadour fields discovered in the mid 1970's, has been postponed due to the unresolved boundary dispute between East Timor and Australia.

The eastern part of Timor is rugged, with the mountains rising to 2,963 metres at Mount Tatamailau in the centre of a high plateau. Hilly areas are covered with sandalwood, while scrub and grass grow in the lowlands together with coconut palms and eucalyptus trees. Hot springs and numerous mountain streams are found throughout the island.

East Timor, whose economy is largely agricultural, was one of the world's poorest nations at Independence, and the economy, primarily made up of subsistence farming and fishing, is in shambles. Rice, coconuts, and coffee (the main export) are grown, and stretches of grassland support cattle. The majority of the country's infrastructure, including homes, irrigation systems, water supply systems, and schools, and nearly 100% of the country's electrical grid were destroyed by the Indonesians before Independence. The republic is one of only two majority Roman Catholic countries in Asia, the other being the Philippines.



The only modern seismic survey available offshore East Timor was acquired by partnership of Global Geo Services and the Chinese Geophysical contractor BGP just a few months ago. The survey totals 6674 km and covers an area of 30,000 km², the equivalent of five UK offshore quadrants. The data is compulsory for companies that want to bid in the first offshore licensing round. The yellow balls show the location of wells.

Halfdan Carstens

East Timor is ready for its first offshore licensing round ever. The announcement is expected to take place in 3rd quarter this year, upon which the Timorese authorities will present the geological framework and the licensing terms to the international oil community in "petroleum capitals" around the world.

Proven hydrocarbon province

Acreage to be announced encompasses an area off the southern coast in the Timor Sea that hitherto has seen virtually no exploration, the only exception being a 1500 km seismic survey in near coastal waters in 1974 and the drilling of one well in the 1975, Mola 1, operated by the Australian company Bocal. The well had oil and gas shows in the Pliocene section even if reservoir rocks were not encountered. The presumed structural closure was probably an artefact according to experts on the offshore geology.

Extensive exploration has been carried out since the 1970's further south, within what is now known as the Joint Petroleum Development Area (JPDA), and four fields, one giant and three small, have been put on production.

"Large gas and condensate fields have been discovered in the JPDA, and the ConocoPhillips-operated gas/condensate

field Bayu-Undan as well as the Kakatua/Kakatua North/Elang oil fields give revenues to this poor country. In addition, gas will start flowing from Bayu-Undan in 2006. Several more discoveries have been made in the undisputed Australian sector further south and west thereby proving that we are within an oil-rich province," says Geir Ytreland who is Project Manager for the Norwegian Petroleum Directorate's collaboration project with the petroleum administration on East Timor.

International assistance

A collaboration agreement was signed by the Norwegian Petroleum Directorate (NPD) with the Ministry of Development and the Environment in the East Timor capital of Dili in October 2003. This deal kicked off the latest in a series of projects involving the agency that have been funded by the Norwegian Directorate for Development Cooperation (Norad).

Over a six-year period, backed by USD 5 million, the NPD will help the East Timor authorities to develop a regulatory structure for managing their petroleum resources.

"The goal of the project is to provide assistance in building up and developing the petroleum administration in East Timor in such a way that the country will in the future be able to manage its petroleum resources on its own, with minimum assistance from foreign consultants and advi-

Unresolved boundary

Timor's offshore gas and oil reserves promised the only real hope for lifting it out of poverty, but a dispute with Australia over the rights to the oil reserves in the offshore region has currently thwarted those efforts.

The oil and gas fields lie much closer to East Timor than to Australia, but a 1989 deal between Indonesia and Australia set the maritime boundary along Australia's continental shelf, which gives it control of most of the oil. East Timor now wants the border redrawn in the middle of the 600 km of sea separating the two countries. They estimate that this would allow it to earn several billion dollars more over the next 30 years as opposed to previous borders. However, Australia wants the same boundary it set with Indonesia.

East Timor has so far refused to ratify a second revenue-sharing deal known as the International Unitization Agreement. Under this deal, 80% of Woodside's Sunrise gas field would fall within Australian waters and the remaining 20% in the JPDA.

In terms of a permanent boundary, East Timor wants a border in the middle of the 600 kilometres of ocean separating the two nations.



Within the Joint Petroleum Development Area (JPDA) revenues will be split 90/10 between East Timor and Australia.

According to an announcement made in early May following the ongoing negotiations between the two countries, East Timor will also receive USD 3.9 billion on top of the 90 per cent share of revenue. In return, East Timor has agreed to postpone for some time final resolution of the sea boundary. The areas coloured red, Red Zone West and Red Zone East, are still under negotiation.

sors," says NPD's Project Coordinator Principal Engineer Erling Kvadsheim to the quarterly magazine *Norwegian Petroleum Diary* published by NPD (www.npd.no).

The Norwegian Petroleum Directorate's main collaborating partner on East Timor is the Ministry of Development & Environment (MDE). Daily cooperation takes place with the Energy and Mineral Resources Directorate (EMRD), which is one of the units in the Ministry. The EMRD is divided into two divisions, one for mineral resources and one for petroleum.

"The level of knowledge within the petroleum administration has increased, and key parts of the framework are now in place, or are being completed. The cooperation between the various parts of the petroleum administration has also been strengthened," says Kvadsheim.

"High unemployment and widespread poverty characterise the East Timor today. A number of challenges have to be overcome, such as filling the continued need for increased technical and academic expertise in key petroleum disciplines. In addition, fundamental social and economic structures must be set into place. The lack of health care services, general poverty, high prices, and limited access to electricity (the power supply is extremely unreliable for the 20% who have it), are key challenges for East Timor, and for the Norwegian collaboration project."

"Good governance"

The need for direct technical assistance to the Timorese people has been consider-

able. Moreover, there has proven to be a great need for increased administrative support and development of the education programme for the petroleum sector in the country.

Geir Ytreland is project manager for NPD's collaborative project with the petroleum administration on East Timor. Geir, who currently lives in the capital of Dili, is a geologist by profession with more than 30 years experience in international petroleum exploration and production. Postings include Norway, Saudi Arabia, USA, Venezuela, Indonesia, UK, Egypt and Togo.

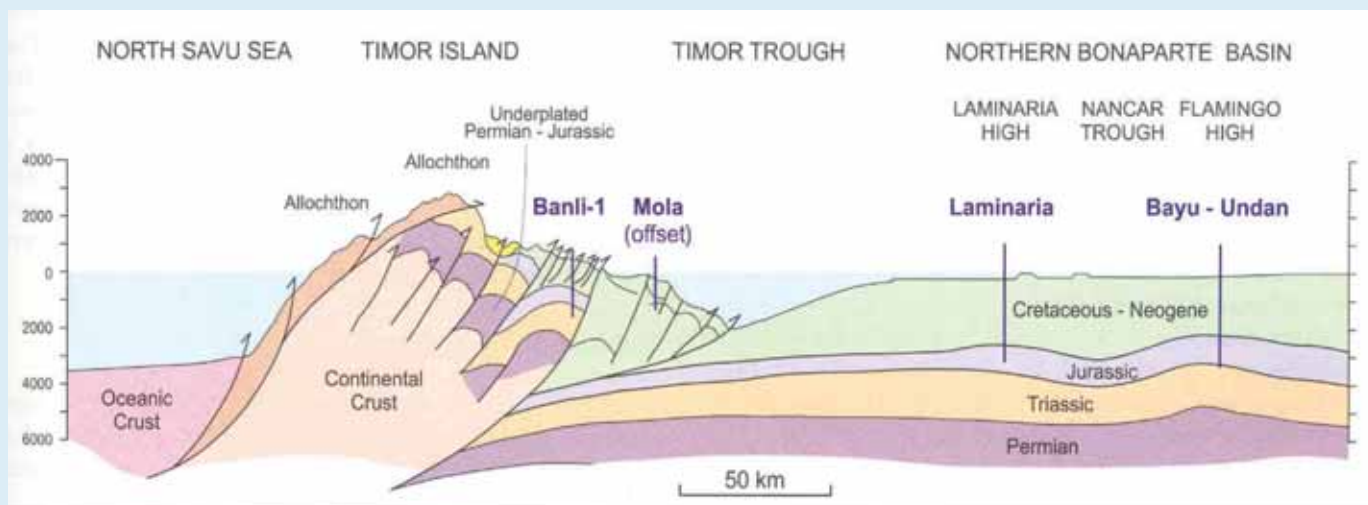


Photo: Halldan Carstens

able. Moreover, there has proven to be a great need for increased administrative support and development of the education programme for the petroleum sector in the country.

"There is little administrative experience among government employees. Their

experience largely stems from the period of Indonesian government, which gave precisely the practices that the country wants to get rid of. Petroleum is the country's most important industrial sector. If we can succeed in building up a good governance culture here, this will create spillover



A schematic cross-section through Timor Island to the northern Bonaparte Basin illustrates oceanic crust to the north, how continental crust underlies both the island and the deep Timor Trough and the general belief that Mesozoic rocks continue with the same facies as the Australian equivalents below the young sedimentary wedge. Modified from Norvick (1997), *Journal of Petroleum Geology*.

Struggle for independence



The Timorese people have been under foreign rule for almost 500 years following the first Portuguese settlements in 1520. Only in 2002 did East Timor become a sovereign state with international recognition.

Formerly Portuguese Timor, East Timor became a province of Indonesia on July 1976. After the UN-sponsored second referendum on 30 August 1999, Indonesia relinquished control of the territory, which achieved full independence on May 20, 2002. The planned licensing of offshore and onshore acreage thus comes after only 3 years of independence.

The Portuguese were the first Europeans to arrive in the area in 1520. They established an isolated presence on the island of Timor, while the surrounding islands came under Dutch control.

The process of decolonisation began in 1974 when, owing to political instability and more pressing concerns with decolonisation in Angola and Mozambique, Lisbon effectively abandoned East Timor. One of the political parties – Fretilin – had gained control of much of the territory, and on November 28, 1975 the movement unilaterally declared itself independent as the Democratic republic of East Timor. Nine days later, however, the country was invaded and occupied by Indonesian forces. Indonesian rule in East Timor was marked by extreme violence and brutality. During the invasion and 27-year occupation, an estimated 100,000 to 250,000 people were killed, either because they resisted occupation or because of famine and disease, compared with a population of about 600,000 at the time of the invasion.

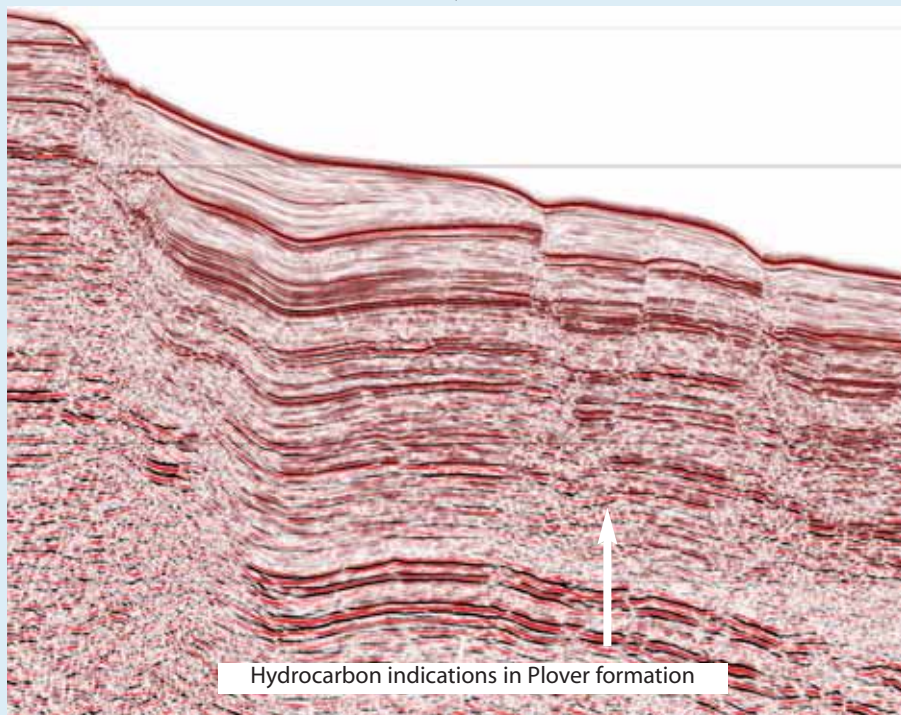
effects for other sectors in state administration," says Kvadsheim.

The project involves many aspects of petroleum administration. Says Kvadsheim: "In addition to developing a division of the ministry that is responsible for administration of the petroleum sector, the project has supported the authorities in their work on ocean border negotiations with Australia, it has provided advice regarding how to handle the petroleum revenues, it has participated in shaping the country's new petroleum legislation, it has participated in discussions regarding the East Timor Petro-

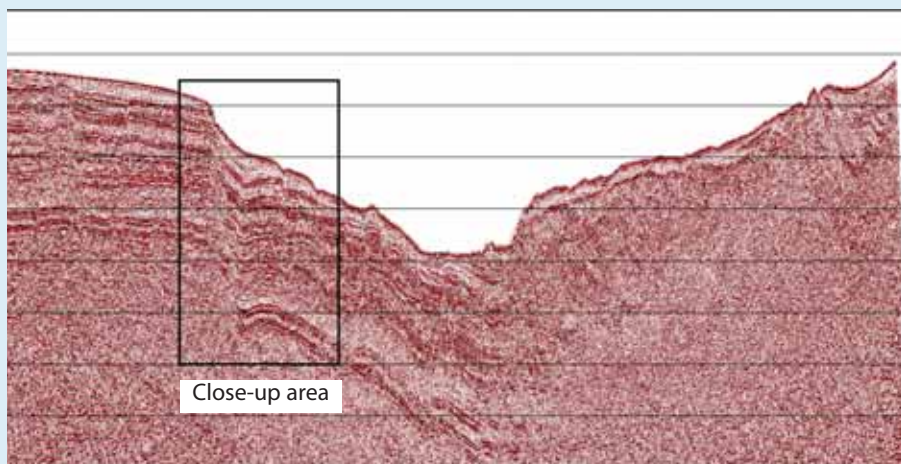
leum Fund, and it has participated in discussions concerning State involvement in the petroleum activities."

Geology

"Onshore data, drilling in the JPDA and on the Australian continental shelf, combined with interpretation of regional seismic data, prove that there is a full stratigraphic sequence from the Permian through to the Tertiary within the offshore acreage that is to be offered this year," says Geir Ytreland.



A segment of the seismic line below that shows a large roll-over structure with hydrocarbon indications assumed to be in the Jurassic Plover formation. The Plover formation is a producing reservoir in the JPDA to the south of this structure.



Seismic line across the Timor Trough shows fault blocks and rollover structures in the thick Mesozoic sequence on the southern margin. North of the trough, a thick Tertiary wedge is overlying the Mesozoic succession that steps up towards the Timor island

Proven oil and gas

Petroleum is already the cornerstone of the East Timor's economy, and it will most certainly also remain so in the future.

In the Joint Petroleum Development Area (JPDA), three small oil discoveries were made in the 1990's – Kakatua, Kakatua North and Elang – that together have produced approximately 28 million barrels of light, low sulphur crude oil since 1998. Initial combined production rate exceeded 30,000 bopd, but they are currently produ-

cing less than 5,000 bopd and may be shut down next year.

The Bayu-Undan gas/condensate field, operated by ConocoPhillips, was discovered in 1995, when the Bayu-1 well intersected a 155m column of gas/condensate at a depth of 897m. In July 1995, Undan was discovered 10km northwest of Bayu.

Bayu-Undan is being developed in two phases. The first is a gas recycle project, where gas liquids are extracted and the dry gas is reinjected into the reservoir. The second phase, an LNG project, is expected to be completed in 2006. A gas pipeline is being built from the field to an LNG facility near Darwin, Australia. Production from the first phase began in 2004. Daily exports from the floating production facility currently exceed 75,000 barrels per day.

The total recoverable reserves of Bayu-Undan are estimated to 350-400 million barrels of hydrocarbon liquids and 3.4 TCF of gas, according to the operator. The field is expected to yield USD 5 billion in taxes to East Timor over the next 20 years.

The Greater Sunrise field, operated by Woodside, is the largest known petroleum resource in the Timor Sea. The field may contain as much as 300 million barrels of condensate (light oil) and LPG, and about 8 TCF gas. The Greater Sunrise field straddles the eastern perimeter of the Joint Petroleum Development Area (JPDA) established under



Gas seep in Aliambata on the southeastern part of the island put on fire. Instead of being wasted, it will soon be used to produce electricity for the local communities.



Because this was just before the Indonesian invasion it was never put into production.

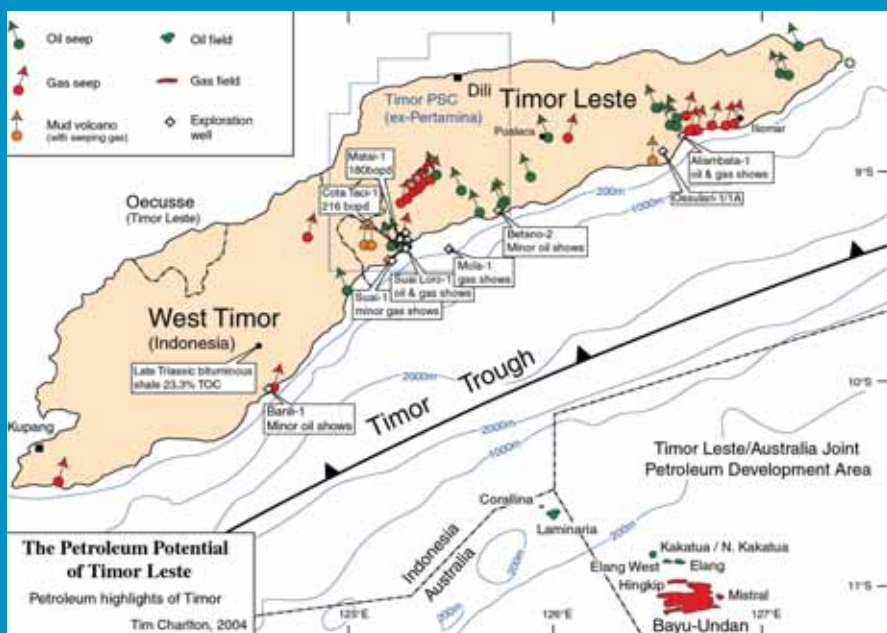
the Timor Sea Treaty. The field lies fully within an area that would likely belong to Timor-Leste under a maritime boundary agreement consistent with international law.

Petroleum is not just found offshore. There is a long history in East Timor of using seeping oil in local communities, and the oil industry already started to show their interest in the 1890's.

"Oil-seeps, i.e. oil that has seeped up to the surface from mature source rocks, are found in many locations in East Timor. During World War I a well was drilled to 800m producing oil for a steam boiler. During World War II, the Japanese mined approximately 100 barrels of light oil per day from open pits on the southern coast of East Timor", says Geir Ytrelund.

In the early 1970's a 1500 km seismic survey was acquired onshore and in the near coastal waters. One offshore well was subsequently drilled; Mola 1, and gas shows were encountered in the Pliocene section. In the 1960's and the early 1970's, Timor Oil drilled a number of onshore wells on the southern coast. Oil shows were reported from several of the wells, but commercial production was not established. All onshore operations were halted after the Indonesian invasion in 1975.

There is no question that the onshore acreage is also underexplored leaving a potential for small to medium fields. Says Ytrelund: "This is why there is also interest in exploring for oil and gas on the island itself, and several oil companies have already approached the authorities on this possibility. We will therefore look at offering acreage also onshore this year."



It is not a question of if there is oil in East Timor. It is a question of how much. Onshore, numerous oil and gas seeps have been discovered, and oil has been produced from several wells in the past. Offshore, both oil and gas is so far proven in the Joint Petroleum Development Area (JPDA), while the acreage to the north towards the coast remains to be explored.

"Middle Jurassic sandstones and Permian carbonates may constitute reservoir rocks, while good source rocks are expected to be found within the Triassic shales."

Geir Ytreland is fully aware that some of the fields in the JPDA are not filled to spill-point, thereby suggesting that oil is leaking from the reservoirs. "Further north, however, there is a thick Pliocene wedge of largely clays and mudstones that may have protected the reservoirs from leaking. This wedge may also contain reservoir rocks," he says.

Ytreland adds that fault blocks and roll-over anticlines are the primary structural targets. Stratigraphic traps are nevertheless not dismissed.

Favourable terms

"The licensing round will be announced 3rd quarter this year when the Petroleum Law, the Petroleum Tax Law and a model Production Sharing Contract have been approved by the government," says Geir Ytreland.

The seismic data acquired is now being processed and will be available in June 2005. The Energy and Mineral Resources Directorate (EMRD) in cooperation with the Norwegian Petroleum Directorate and Global Geo Services, will subsequently run a "road show". Cities to be visited include Houston, Singapore and London. EMRD will arrange a technical conference for prospective bidders in the 4th quarter, while deadline for bidders is expected to be in the 1st quarter of next year with bid awards 2nd quarter 2006.

"The acreage to be offered offshore East Timor is likely to be both oil and gas prone. Major discoveries can be expected. We base our conclusions on geological correlations that include both onshore and offshore findings," says Geir Ytreland. With worldwide experience, including many years in Indonesia, he is definitely in a position to judge.

"The terms offered by the Timorese government also appear to be favourable. There will be no signature bonuses; rather, the government will put emphasis on work programmes, local content and geological knowledge," Geir Ytreland says.



The vessel had a crew of 36 and 3 Timorese trainees.

New data available

A major step towards the forthcoming licensing round was taken upon completion of a non-exclusive seismic survey, named ET-05, offshore East Timor in February. Almost 6700km was acquired in an area of 30,000 km² with the seismic vessel Zephyr 1 following a multi-client seismic contract awarded to a partnership of GGS and the Chinese Geophysical contractor BGP. The partnership was selected after a competitive bidding round.

The data will be available during May and June in due time before the round will be announced. The seismic, gravity and bathymetric data to be collected will be mandatory data for the first licensing round in East Timor, planned for 2005.

The grid is very open with 6 km between every dip line and 12 or 30 km between strike lines. Ties are made to discoveries in the Joint Petroleum Development Area and the Australian sector, including the discoveries The Greater Sunrise, Laminaria, Barnacle, Thornton, Squilla and Thornton.



Preliminary processing was carried out onboard using a Promax. The Timor Trough stands out as a prominent physiographic feature of the sea bottom. The trough was previously thought to represent a subduction zone, as demonstrated in several scientific publications, but this has now been disproved. Instead, it represents a prominent geological boundary where the Mesozoic of the Australian shelf dips below a Tertiary wedge shed from Timor Island.



The seismic survey ET-05 was carried out with the Russian vessel Zephyr 1 operated by the Chinese seismic contractor BGP and the Norwegian company Global Geo Services (GGS) through December of last year and January and February of this year. It used an 8000 m streamer thereby facilitating good quality deep data down to 10 seconds 2-way-time.



Before survey start-up Prime Minister Mari Alkatiri was given a tour of the ship.