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## The New Ireland Basin – A Mountain of Gold Floating on a Sea of Gas Condensate

Papua New Guinea has often been spoken of metaphorically as “a mountain of gold floating on a sea of oil”. This seems to hold true in the New Ireland Basin, where PEAK Oil (PNG) Pty Ltd (PEAK) is proving up a large petroleum-bearing structure, located 15 km from the world-class gold mine on Lihir Island. In scale, the Exotica North anticlinal structure (32 x 9 km) rivals the anticlinal structure (Hides Gas Field: 30 x 5 km) that underpins the PNG LNG project. The delineation of the Exotica North Gas prospect is a potential game changer for petroleum exploration in Papua New Guinea because it showcases the untapped potential for hydrocarbons in the country’s frontier basins.

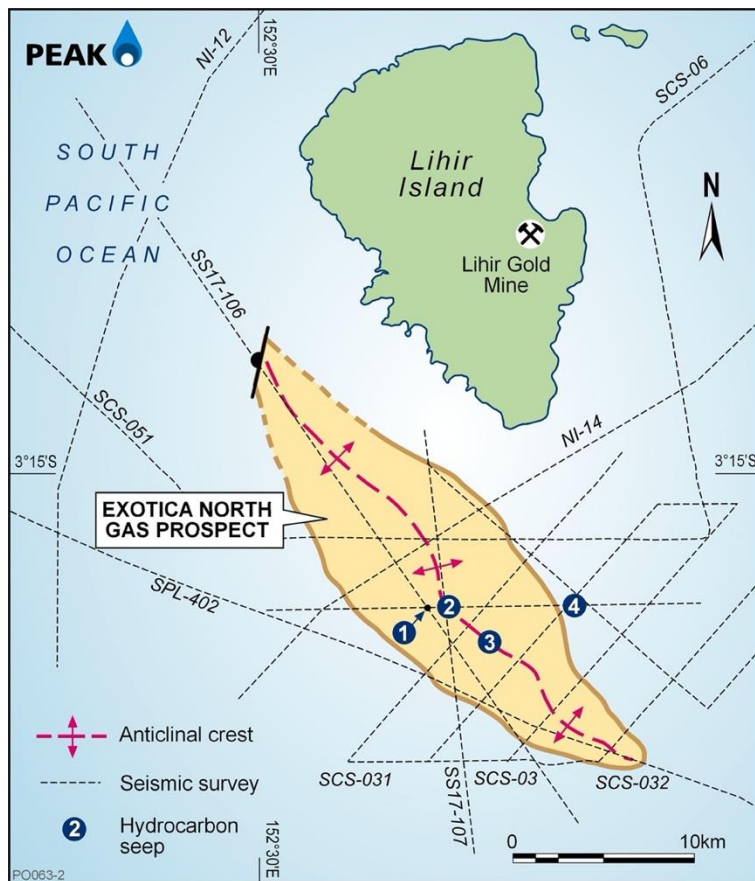


Figure 1: Outline map of Exotica North anticlinal structure along with the locations of hydrocarbon seeps and 2D seismic survey lines. The boundary of the anticline in this diagram is defined by the 3 second TWT isopach. Four confirmed hydrocarbon seeps were surveyed: Edison (1), Mussel Cliff (2) Paleo (3) and Karambusel (4).

PEAK was attracted to the area following scientific reports of hydrocarbon seeps emitting thermogenic hydrocarbons south of Lihir Island. In 2023 a team of international scientists (Project DYNAMET – SO299) undertook marine surveys including multi-beam seafloor mapping, heat flow, gravity, magnetotelluric and passive seismic arrays. The DYNAMET team investigated four hydrocarbon seepage areas (Edison, Mussel Cliff, Paleo and Karambusel) south of Lihir using the KIEL6000 ROV, identifying features common to submarine hydrocarbon seeps associated with oil and gas fields in the Gulf of Mexico and the North Sea. The methane seeping from the New Ireland Basin sites is a nutrient source for highly specialised bacteria which form white, mat-like colonies on the sea floor. Other evidence for gas seepage includes gas pockmarks, authigenic carbonate pavements and chemosynthetic colonies of clams, mussels, gastropods, tubeworms and crabs. Gas samples and

sediment extracts from these locations returned high concentrations of C1-C5 hydrocarbons with C1/(C2+C3) averaging 18. Liquid extracts contain aromatic and polycyclic aromatic hydrocarbons indicative of the presence of light crude oil.

The Lihir seepage area is covered by four generations of closely spaced 2D seismic data which indicate that the seeps are all associated with a giant anticlinal structure, 32 km long and 9 km wide. Three of the 4 hydrocarbon seeps (Edison, Mussel Cliff and Paleo) plot along the hinge line of this structure. The basal sediments within the anticline are interpreted to be Miocene to Late Pliocene polycyclic pelagic carbonate and turbiditic sediments sourced from the erosion of the New Ireland carbonate platform, and overlain by Pleistocene to Recent sediments (tuffs, turbidites and debrites) sourced from alkaline volcanic centres on Lihir Island.



Figure 2: Retrieval of ROV KIEL 6000 after a survey over the Exotica North Gas Prospect with Lihir Island in the background. Photo used with permission of Dr Philipp Brandl, SO299 Chief Scientist (DYNAMET Project).

The Exotica Formation, a 200- to 400-metre thick debris flow unit of regional extent, can be traced within the anticline and is the most likely reservoir unit. It was deposited about 6 Myr ago when tectonic activity caused the catastrophic collapse of New Ireland carbonate reefs into the deeper parts of the basin. This formation consists of broken reef sediments and constitute a “deep-water resedimented slope carbonate play”. Resedimented slope carbonate deposits are a new petroleum play type in Papua New Guinea but are known to be prolific hydrocarbon reservoirs in SE Asia, Kazakhstan and the Gulf of Mexico.

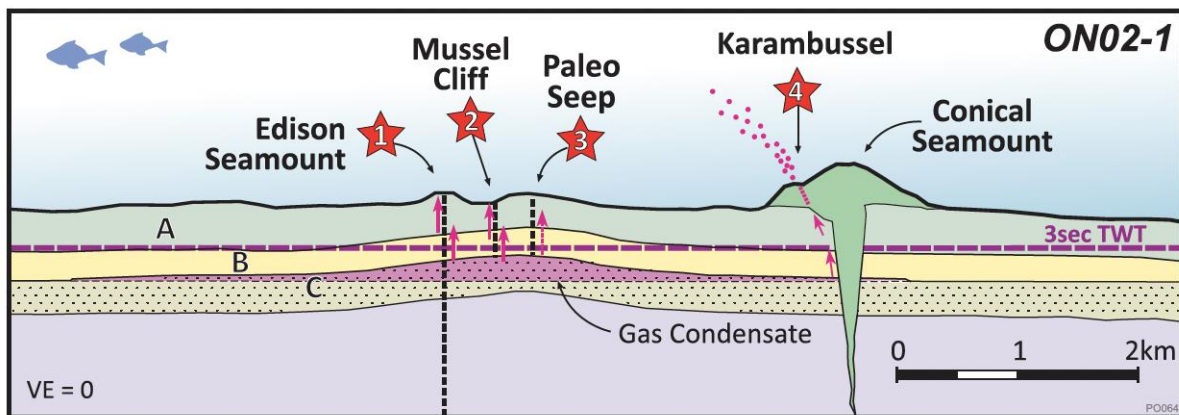


Figure 3. A genetic model for hydrocarbon seeps south of Lihir Island and their connection to an underlying gas-condensate field. The delineation of Group A and B strata is based on SO94 Line 1 interpretation of Gennerich (2019), while Group C is interpolated from Searcher Seismic (2018) data. Hydrocarbon accumulation at the top of Group C is postulated. Structural and volcanic piercements of the anticline are conduits for the migration of hydrocarbons to the seafloor from an overpressured gas reservoir. The minimum height of the gas column is 250 m.

Our interpretation is that the Exotica North anticline is a structural trap similar in scale to the Hides Gas Field, and that the wet gas seepage results from an overpressured gas condensate reservoir. The location of the NNW closure of the Exotica North gas condensate prospect has not yet been defined by seismic, with additional surveys, possibly 3D, needed to delineate the full extent of the anticlinal structure. Nonetheless, a risked resource estimate for the area containing the highest density 2D seismic coverage is:

- 3.6 TCF of natural gas and 160 MM barrels of light crude oil (P<sub>90</sub>)
- 7.8 TCF of natural gas and 400 MM barrels of light crude oil (P<sub>50</sub>).



The Exotica North gas condensate prospect is shaping up to be a world-class project, rivalling the top-tier petroleum assets in Papua New Guinea. The scale of the resource justifies an onshore LNG plant, potentially located on nearby Lihir Island or New Ireland. A gas liquefaction plant located in New Ireland Province would cut LNG transport times to key Asian markets such as Japan, Korea and China by 25% to 40% relative to other LNG plants in the Australia-PNG region (e.g., Caution Bay, Darwin, Gladstone, Ichthys and Prelude). Preliminary studies indicate that siting this plant on New Ireland, with its deepwater access, international airport and sealed highway logistics, combined with the reduced transport costs to Asian markets, could easily shift LNG production costs into the lowest quartile of global producers.