

New Basin Discovery

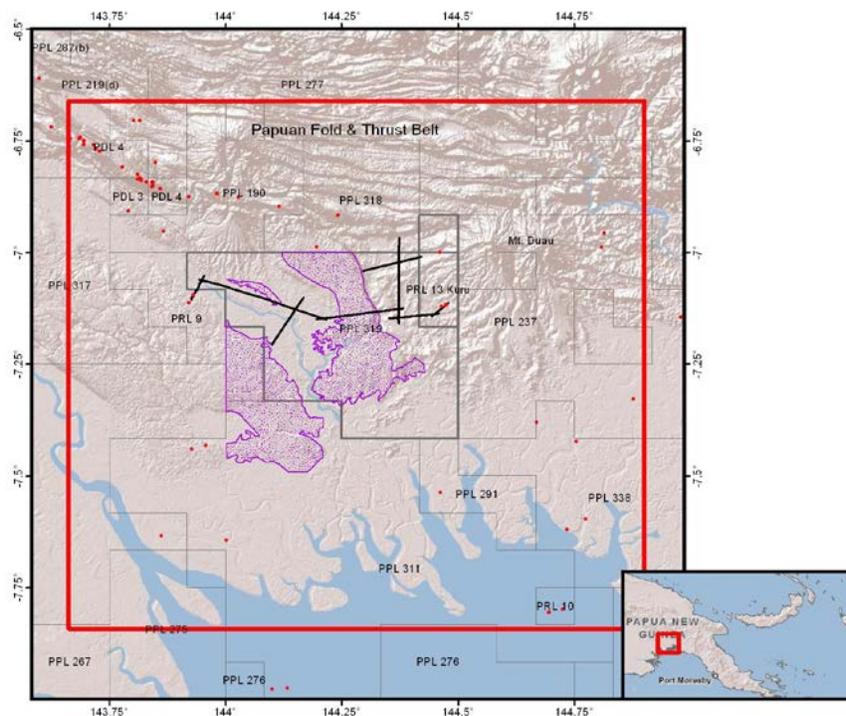
The search for new areas to explore should not be left only to the New Ventures department. New possibilities are often discovered as one works toward a different objective. As was with the Papua New Guinea project, the exploration objectives were reefs. Excitement had been generated by the 9 TCF reef discoveries at the InterOil Elk and Antelope fields in 2006-2009.

The complexity of the geology became evident as we reviewed the previous geophysical work done. Simply put, we had carbonates, but they were on the surface, covering 40% of the acreage. We also had thrust volcanoclastics to the north and igneous detritus to the south.

To determine prospective targets that would warrant further oil/gas exploration, we recommended an integration of multiple geosciences as the best approach to evaluating the more than 700,000 acres. Until the airborne gravity and aeromagnetic data surveys were acquired in 2010, no uniform data coverage existed. Only a sparse 1980's vintage 2D seismic survey (125 km) had been available.

The interpretation was based on these aeromagnetic and airborne gravity surveys acquired by Sander Geophysical, Ottawa, Ontario, Canada in April 2010. The seismic interpretation was based on the re-interpretation of eight 2D fold dynamite seismic lines acquired by Seiscom Delta in 1988; original processing was completed by Petty-Ray. In 2010, four of the lines were reprocessed by Kelman Technologies, Calgary, Alberta, Canada.

On the Project Index Map the GM geophysics survey outline is shown in red, and centered is the primary area of interest, block PPL 319. Dari carbonate outcrop is shaded purple. The background is the terrain reflecting the Papuan Fold & Thrust Belt and the volcanic Mt. Duau-Mt. Favenc complex. Well locations known in the area are posted as red dots; all are shallow Tertiary wells.



General Play Considerations

Tertiary

Even without access to seismic data it is clear that the carbonate play made famous by the giant InterOil discoveries to the east (Elk and Antelope) is not prospective over the majority of the PPL-319. Definitive outcrop or near-outcrop of that carbonate section is obvious on surface geology. As shown on the Index map the shaded purple relates to the carbonate (Dari) outcrop. The play fairway could exist only in the eastern part of the block where there is significant burial of the carbonate section.

Mesozoic

While there is no obvious clear cut limit to the Mesozoic Play as there is to the Tertiary, it is considered common knowledge that a reservoir will be a very high risk for all but the western most part of the block.

There is a wealth of published data showing both sand isolith data for various potential Mesozoic reservoirs and depositional environment variations. This suggests a clear-cut risk on finding significant thicknesses of reservoirs in this part of the section. This high-risk has been summarized by Ian Longley's analysis of the regional reservoir for Southern Papua New Guinea. His work was based on one well for this immediate area; however, it is a well that has since been recognized as misinterpreted. And there was no knowledge of the basement structure that indicates 8 kilometers of additional section (basin).

Basement Structure

The interpretation of the aeromagnetic survey revealed four major classes of structure-based anomalies:

- 1) elongate west-east short-wavelength anomalies identified with shallow sedimentary structures of the Papuan Fold & Thrust Belt;
- 2) high-amplitude short-wavelength anomalies sourced by shallow volcanic intrusives and extrusives of the Mt. Duau-Mt. Favenc complex;
- 3) alignments of medium-wavelength anomalies interpreted as moderately deep, fault-bounded basement anticlines;
- 4) broad anomalies interpreted as trends of deep basement high blocks with intervening subparallel trends of deep basement troughs.

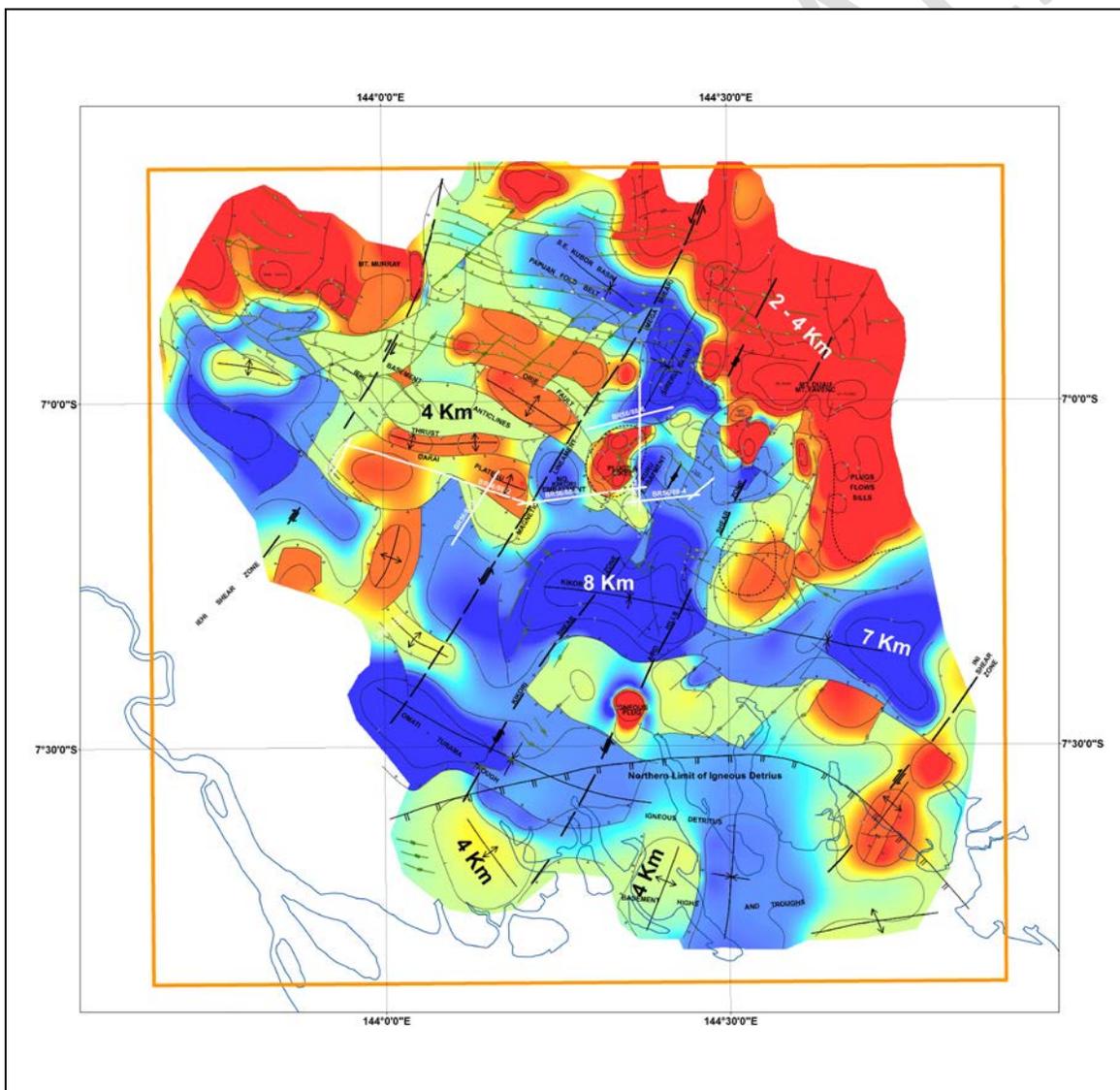
The elongate west-east near-surface anomalies immediately north of PPL 319 are interpreted as alignments of shallow folds and thrusts containing magnetized Tertiary sediments. High-amplitude anomalies of the main volcanic complex lie to the northeast of PPL 319, except for a local intrusive located in its northeast corner.

Gravity/magnetic structural models demonstrate that except for areas of igneous intrusives, the gravity anomalies represent varying thicknesses or density of carbonates above basement

structure, and that the carbonate surfaces or thicknesses are not everywhere conformable with basement surface.

The southern area of the survey has a very different magnetic character: broad magnetic anomalies locally overridden by numerous short-wavelength anomalies. These short-wavelength anomalies are associated with shallow magnetic detritus. The broad anomalies are interpreted as two northwest-southeast trends of deep basement high blocks with intervening subparallel trends of deep basement troughs (6 to 8 kilometers). The northwest-southeast high block trends are crossed by secondary southwest-northeast trends of basement structures and faults.

Magnetic anomaly lateral offsets and/or truncations are the basis for IGC's interpretation of five major northeast-southwest lineaments or shear zones crossing the area. The central three are left-lateral and the outer two are right-lateral.



The basement structure based on the integration of aeromagnetics, gravity and the few seismic lines led to the development of several distinct exploration plays in addition to the Tertiary carbonate play expected. One new play was based on the possibility of deep-seated sands which were not expected or even hypothesized for the area before the newly interpreted discovery of the 8 kilometer (26,000 ft) structural deep – a basin.

The target areas chosen from the dense concentration of structural leads were derived from the several approaches taken. These approaches include magnetic depth analysis & mapping, residual gravity mapping, seismic, and (to a lesser degree) historical surface mapping. A possible target area based on only one of the tools but not indicated by another tool was not considered a high grade target area in this realization. This requirement to be target-rich with more than one tool is a first-order approach to integration of the tools. At this point, detailed coincidence of lead areas is not required, but rather the goal is to recognize a geographic clustering of leads from these multiple tools.

Take Aways

A new basin was identified, as were two major northwest-southeast high trends and two subparallel basement deeps, while in the process of targeting the reefal play.

The uniform and wide GM geophysical data coverage was cost-efficient for developing the possibility of new and different plays other than the reefs.

The basinal area would have ultimately been discovered in due time and after recording miles of 2D or 3D seismic surveys at prohibitive cost.

All the targets developed here are clearly structural in nature and the reservoirs of interest are sandstones. Further stratigraphic work needs to be completed before the target lead areas are determined to be drillable targets.

Several referenced papers emphasize the need to understand a basin's architecture and its control on hydrocarbon prospectivity. An integrated methodology provides a quantitatively mapped surface showing present-day configuration of the magnetic basement structure and its associated fault trends. I would think that our interpretation approach has merit in providing one component necessary for a more complete study of southern Papua New Guinea.

Those interested in additional description of the references should contact IGC.

Many thanks go to our client for their permission to present our work.

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