EA It All Begins in The Field and Ends in The Field: How We Leverage Our 90-Year Legacy to Successfully Explore In PNG*

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Search and Discovery Article #42534 (2020)**
Posted May 25, 2020

*Adapted from extended abstract based on oral presentation given at 2020 1st AAPG/EAGE PNG Geoscience Conference & Exhibition, PNG's Oil and Gas Industry Maturing Through Exploration, Development and Production, Port Moresby, Papua New Guinea, February 25-27, 2020
 DOI:10.1306/42534Kidu2020

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Abstract

The PFB (Papuan Fold Belt) has been considered one of the most difficult areas to explore for hydrocarbons worldwide. Though the PFB shares the common challenges and risks of other fold belts, there are specific aspects to this geologic system that have required a fit for purpose toolkit to manage operations and to de-risk exploration targets. Aside from other surface challenges, the extensive exposure of thick carbonates hampers geological and geophysical work. The early (and larger) discoveries in the PFB were achieved on the back of the photo and satellite mapping, verified with large field campaigns in highly forested and rugged terrain, together with 2D seismic subsurface mapping. Unfortunately, some of the practices of the past, such as surface geological mapping, have lost favor and the geological maps constructed in the 70s- 90s have not had substantial updates.

Seismic data in the fold belt continues to deliver mixed results in subsurface imaging to enable interpreters to identify traps and narrow-down the spectrum of viable interpretations. To the latter, the common workflow to map prospects establishes a hierarchy of data to interpret seismic data: 1) surface geological data, dip data and carbonate depth derived from Strontium age data; 2) offset well tops, true stratigraphic thickness and well dips; and 3) seismic dip panels to define structural discontinuities. Given the shortcomings of subsurface imaging, seismic interpretation proceeds by honoring surface and well data, where available, which largely validate shallow seismic dip panels. The deeper dip panels, largely processing 'derived', are many times complex resulting from decoupling the deeper from the shallow structure.

Mapping updates can now be done more efficiently using modern remote sensing tools e.g. LIDAR which 'remove' the canopy and can be processed with illumination and slope enhancing algorithms. Mapping can be done efficiently on a workstation and targeted verification field campaigns can efficiently be designed. The ideal world would include multi-client regional LIDAR surveys for regional coverage. The benefits of the latter extend beyond geological objectives to seismic planning, engineering, logistics, geo-hazards etc.

In this presentation, we will illustrate via examples of how field-based campaigns could have provided insight or averted costly mistakes ahead of drilling and seismic acquisition. We present hindsight cases such as the Muruk-2 waterline transect (Figure 1) and the Karius 1 well (Figure 2). More generic forward-looking examples of LIDAR mapping illustrate structural character and disharmony between deeper and shallower structures (Figure 3). This detailed surface mapping optimizes seismic acquisition, characterizes subsurface targets structurally ahead of seismic acquisition and guides the subsurface interpreter when confronted with deeper poorly imaged targets. We believe that the cost effectiveness and technical benefits of the LIDAR-field-geological-validation approach should constitute a standard pre-drill-pre-seismic acquisition tool in de-risking Exploration program anywhere in the PFB.

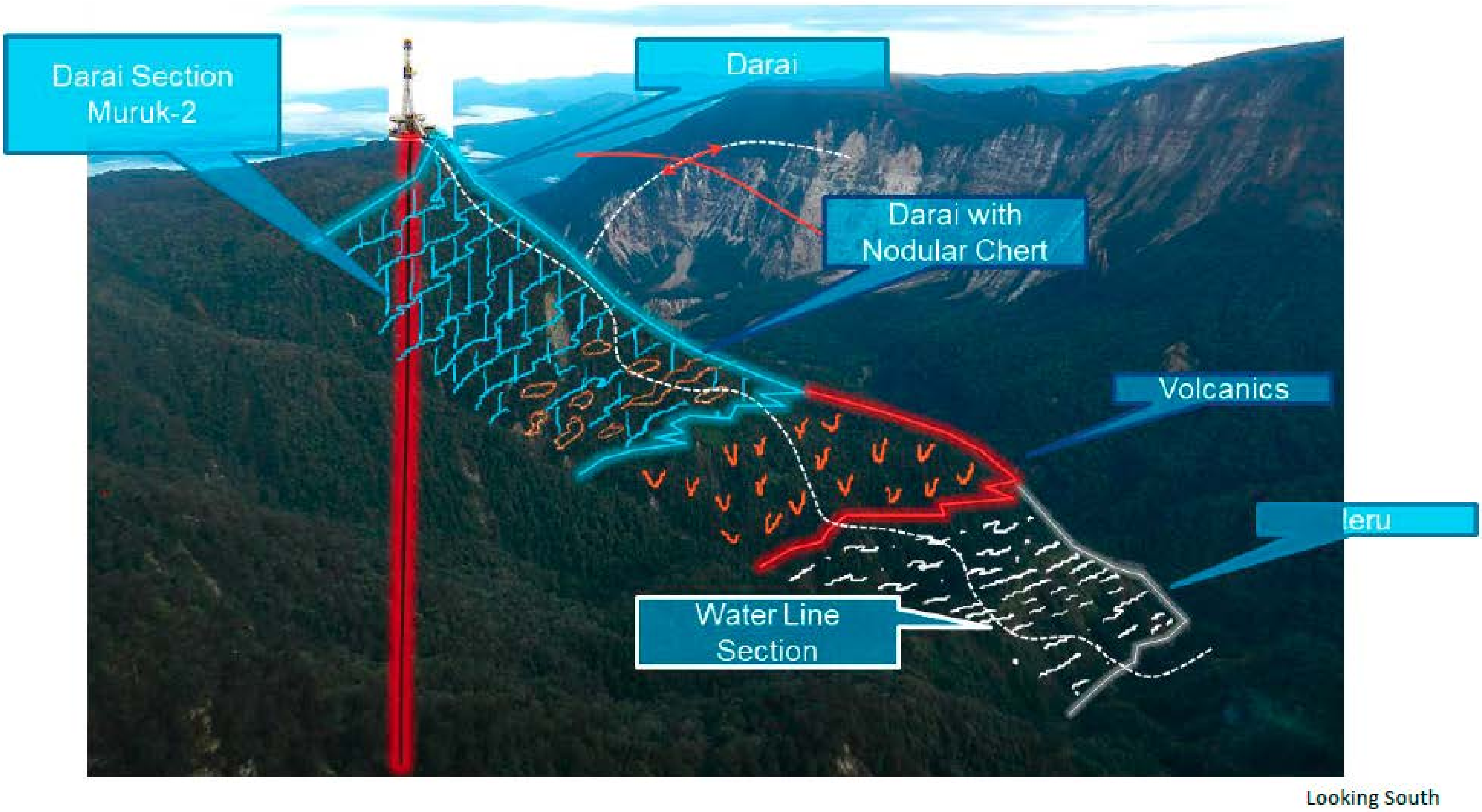

Figure 1. Schematic illustration of the Muruk-2 Waterline transect. Field observations of volcanics and thermally altered carbonates within the river valley indicated a heightened probability of intersecting similar lithologies within the Muruk 2 well.

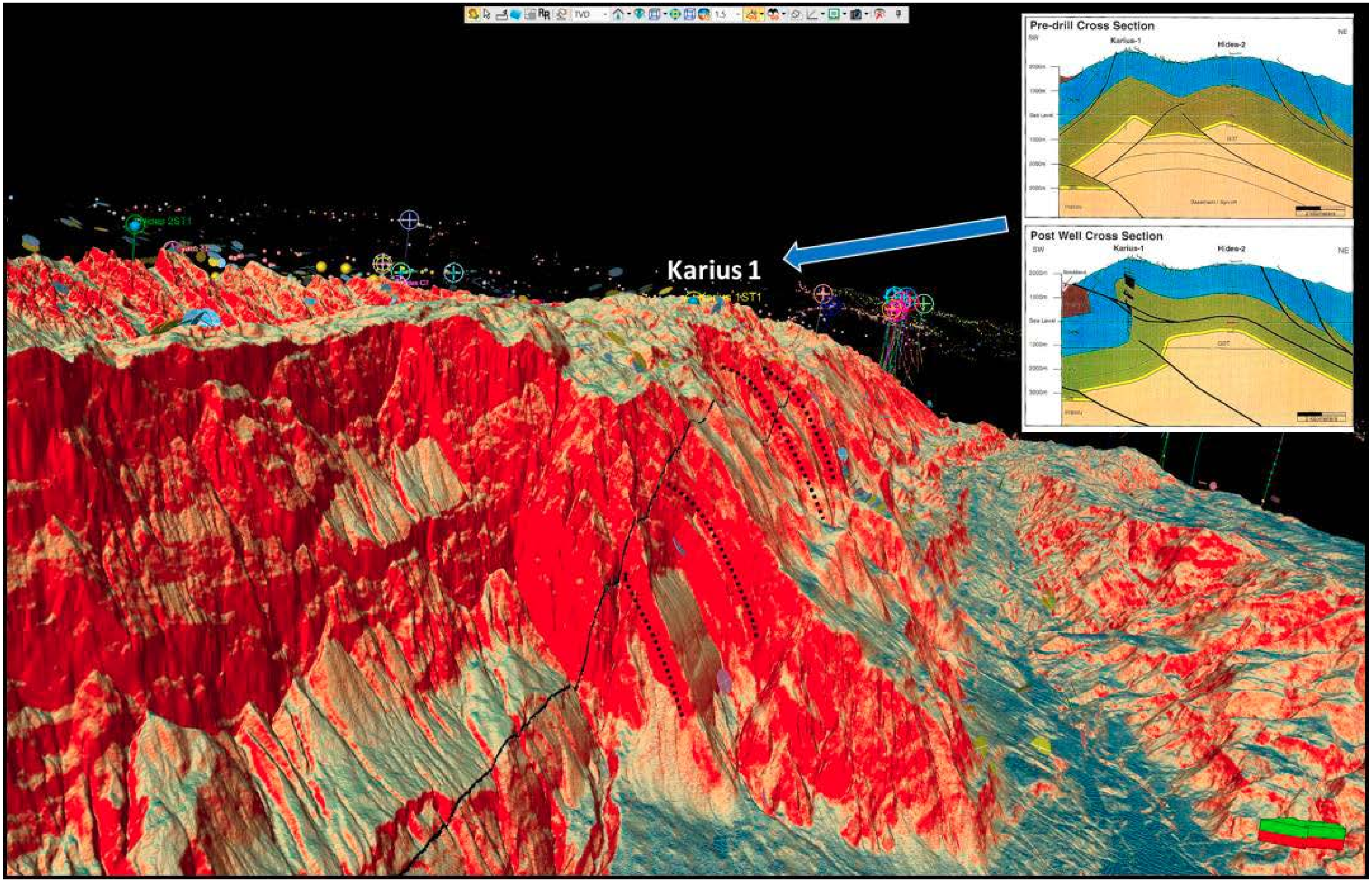

Figure 2. Karius-1 well drilled a long section of Darai Limestone. Lidar clearly shows the vertical forelimb drilled which in hindsight could have been averted.

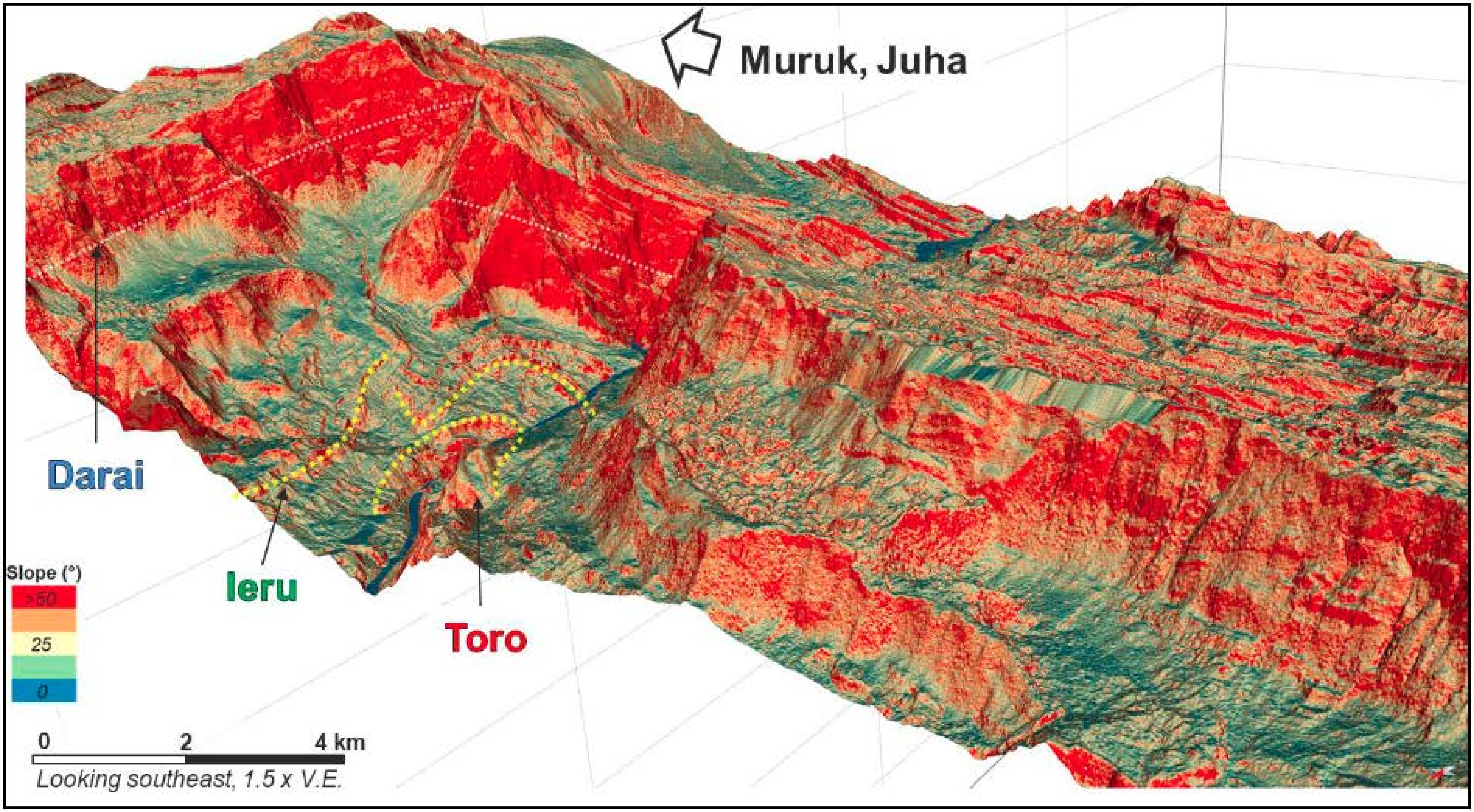

Figure 3. Structural decoupling below Darai Limestone and underlying stratigraphy.