

Near-Field, Subthrust and Deep Reservoir Tests of the Kutubu Oil and Gas Fields, Papua New Guinea*

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Abstract

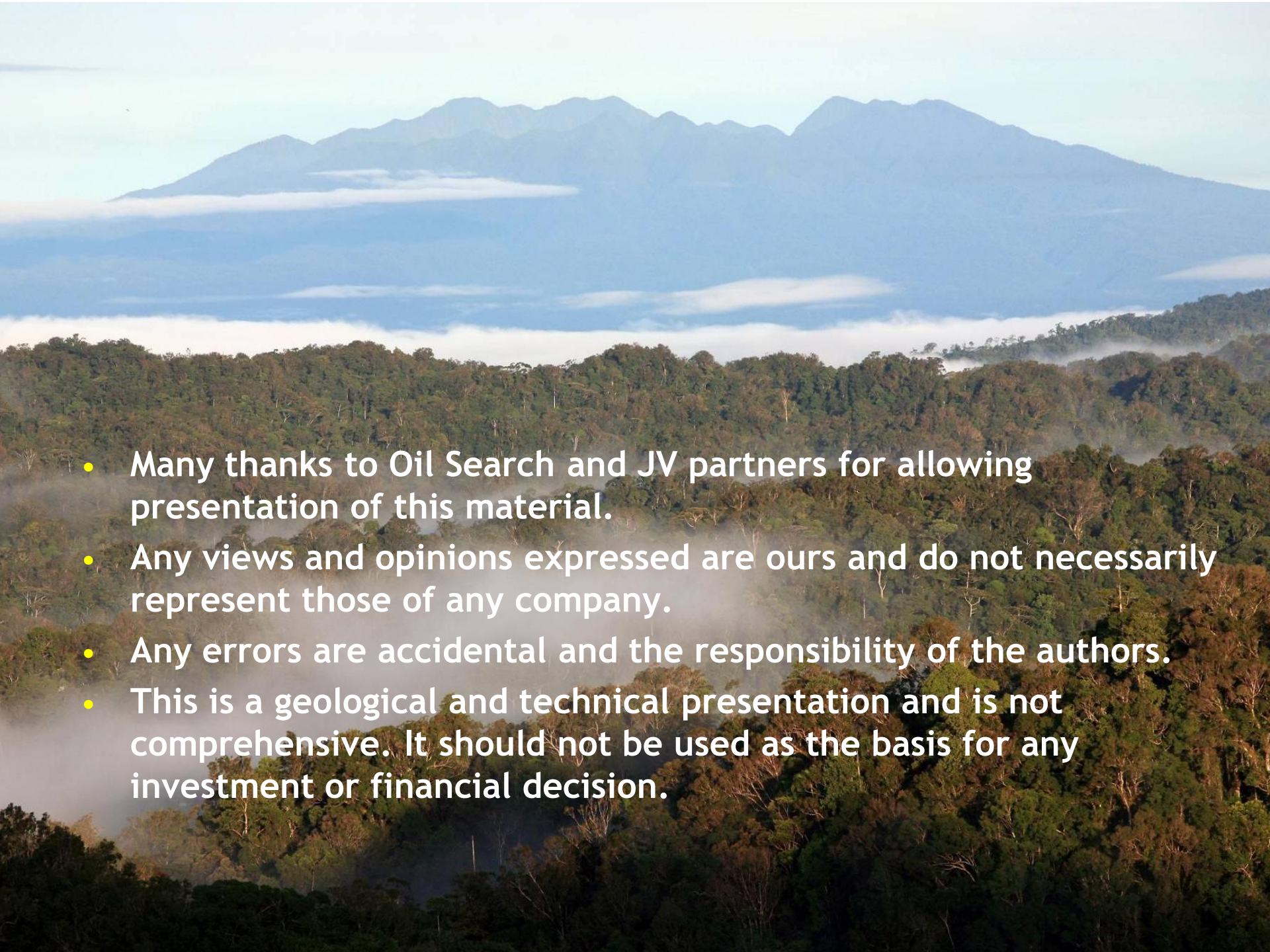
The Kutubu oilfield is a double-humped, thrust-faulted anticline in the Papuan Fold-Belt and is en echelon to the smaller Agogo oilfield. The structures were first drilled in the mid-80's and have since produced over 300mmBBL of oil from the lowermost Cretaceous Toro and Digimu sandstone reservoirs. It is estimated that 50mmBBL of oil and >1 TCF of gas remain to be produced. The reservoirs are overlain by ~1 km of Cretaceous shale and ~1 km of Miocene limestone which crops out in the mountains at surface. There, the limestone is highly karstified and covered in equatorial jungle, making acquisition of surface dips and seismic data difficult. In 2009, an Agogo well was sidetracked and deepened in order to test the Oxfordian Koi-Iange sandstone within the hangingwall. Instead, the well drilled through the main thrust and penetrated a 1-km sub-vertical limb of Toro and Digimu reservoirs that proved to be oil-bearing. The geological structure was re-evaluated and found to be a large asymmetric fold that was cut by a late, nearly-planar break-thrust that decapitated the crest. The break-thrust has ~2 km of offset and therefore separated and sealed the hangingwall and footwall reservoirs. The geometry seen at Agogo was applied to the Kutubu field, using thrust outcrop data and a handful of subsurface fault penetrations to define the geometry of the main thrust within a 3D structural model. The subthrust structure was drilled in 2011 with the fault being encountered close to prognosis, with ~2 km of offset. The Toro-Digimu reservoirs were overturned in the footwall and cut by small faults. The Toro was found to be oil-bearing, whereas the Digimu appears water-wet. Both the Agogo and Kutubu steep footwall limbs are on production with further appraisal wells planned. Meanwhile, another Koi-Iange test was attempted further back on the Kutubu field. After drilling through a backthrust with ~300m of offset and a fault with ~100m of normal offset, the interbedded sands and shales of the Koi-Iange Formation were encountered, extending previous interpretations of the sand fairway. These sands will be tested in 2012. Following an update of the 3D structural model, it is hoped that further near-field hydrocarbon discoveries will be made to augment production from these fields.



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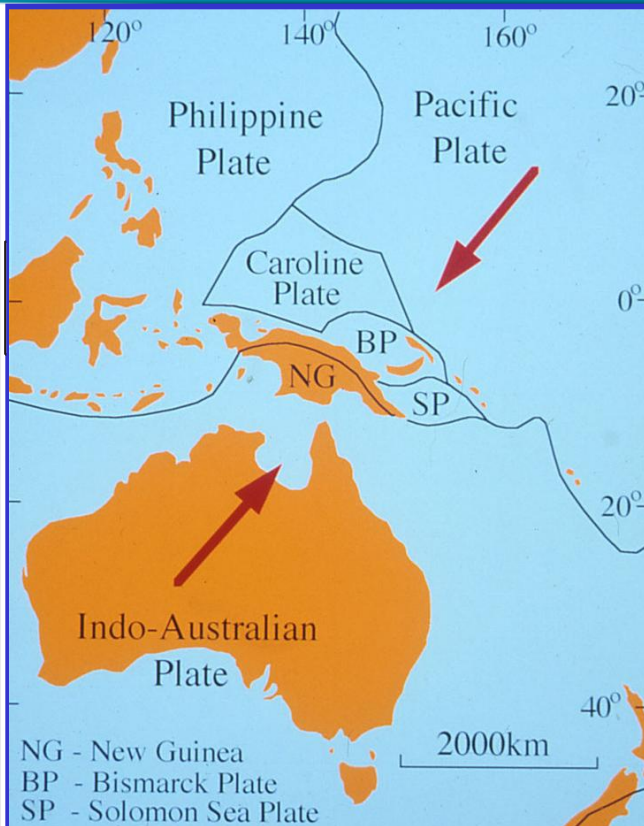


- Many thanks to Oil Search and JV partners for allowing presentation of this material.
- Any views and opinions expressed are ours and do not necessarily represent those of any company.
- Any errors are accidental and the responsibility of the authors.
- This is a geological and technical presentation and is not comprehensive. It should not be used as the basis for any investment or financial decision.

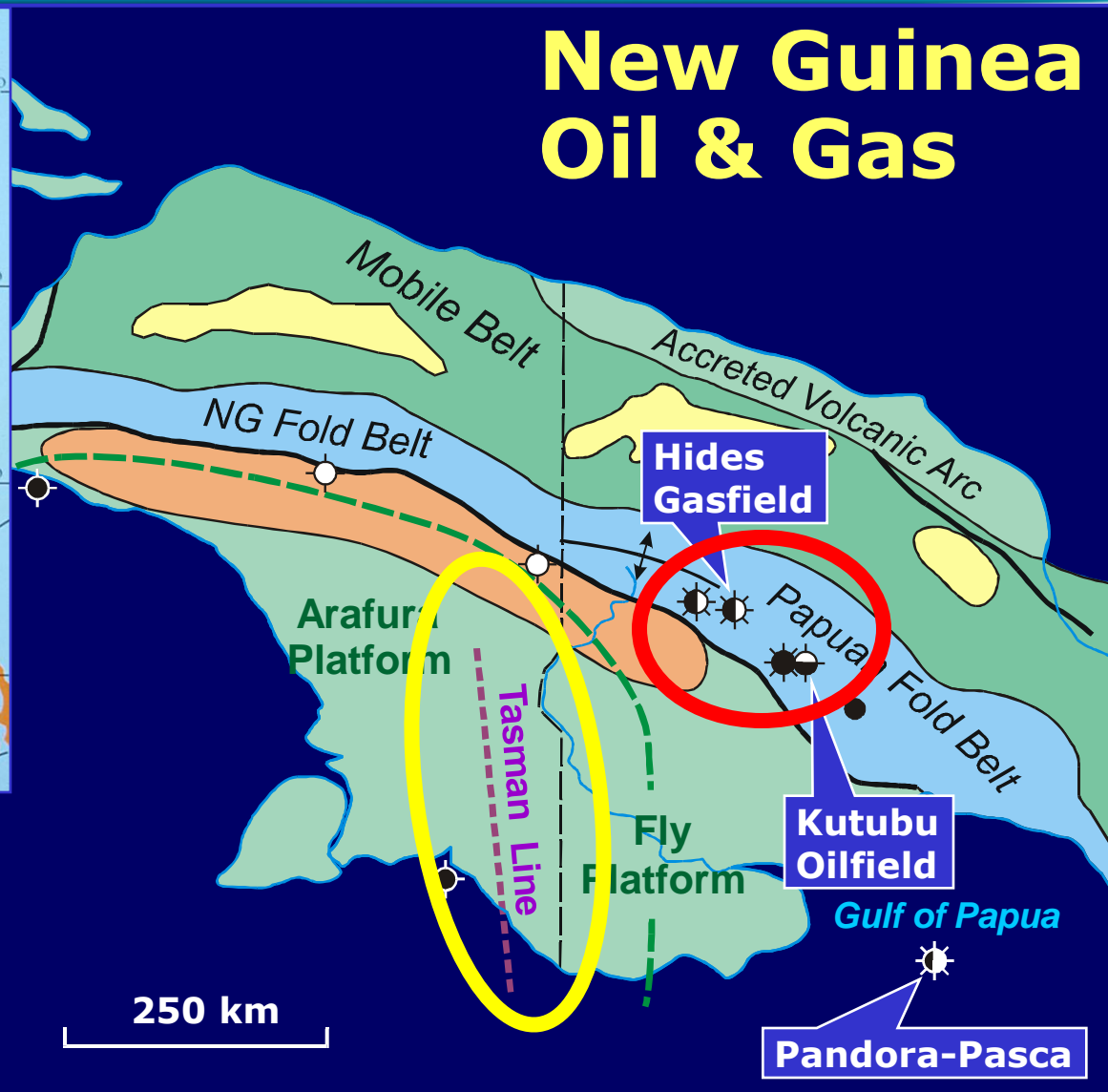


Tectonics and Hydrocarbons

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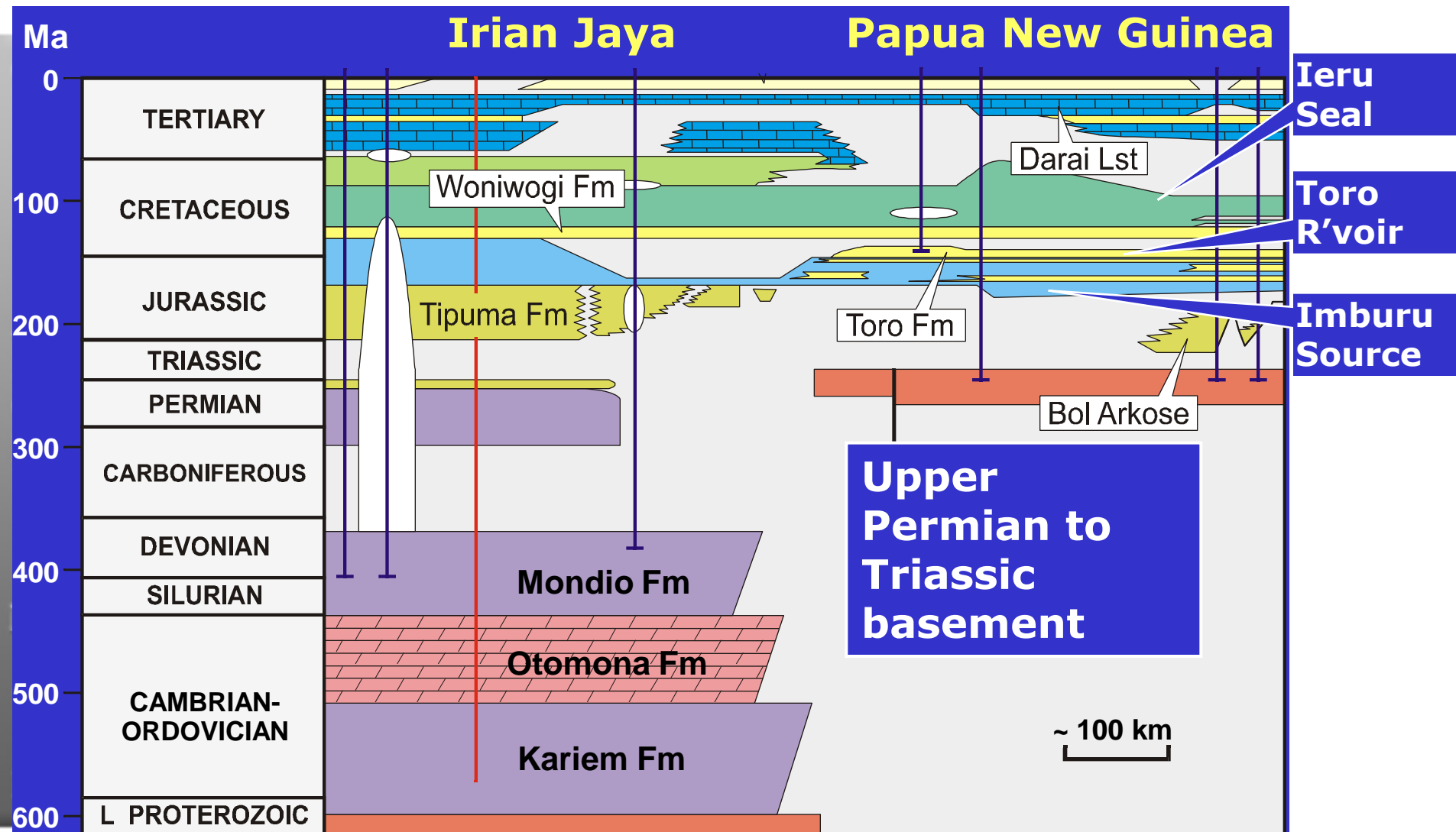


New Guinea Oil & Gas



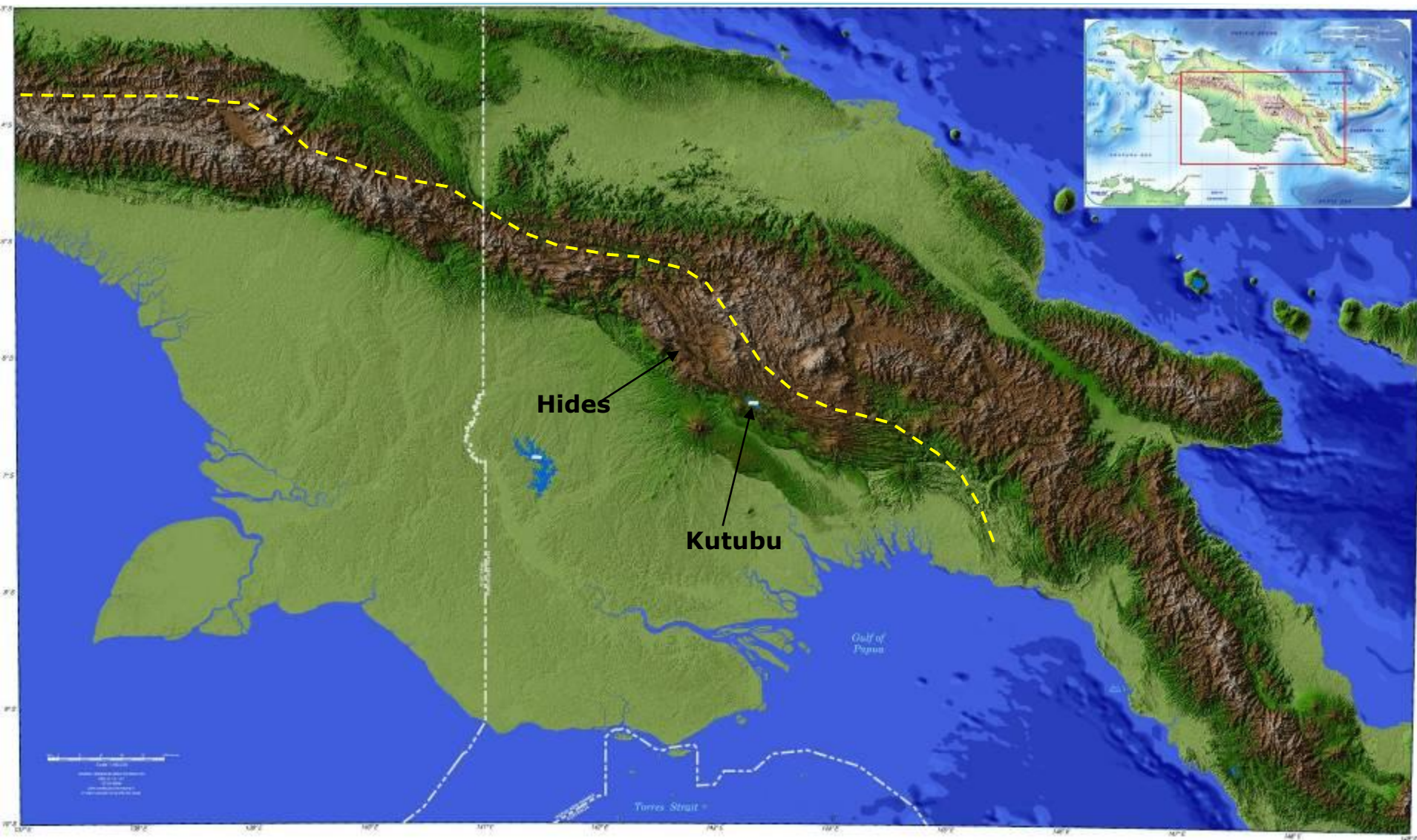


New Guinea stratigraphy - along the Fold Belt



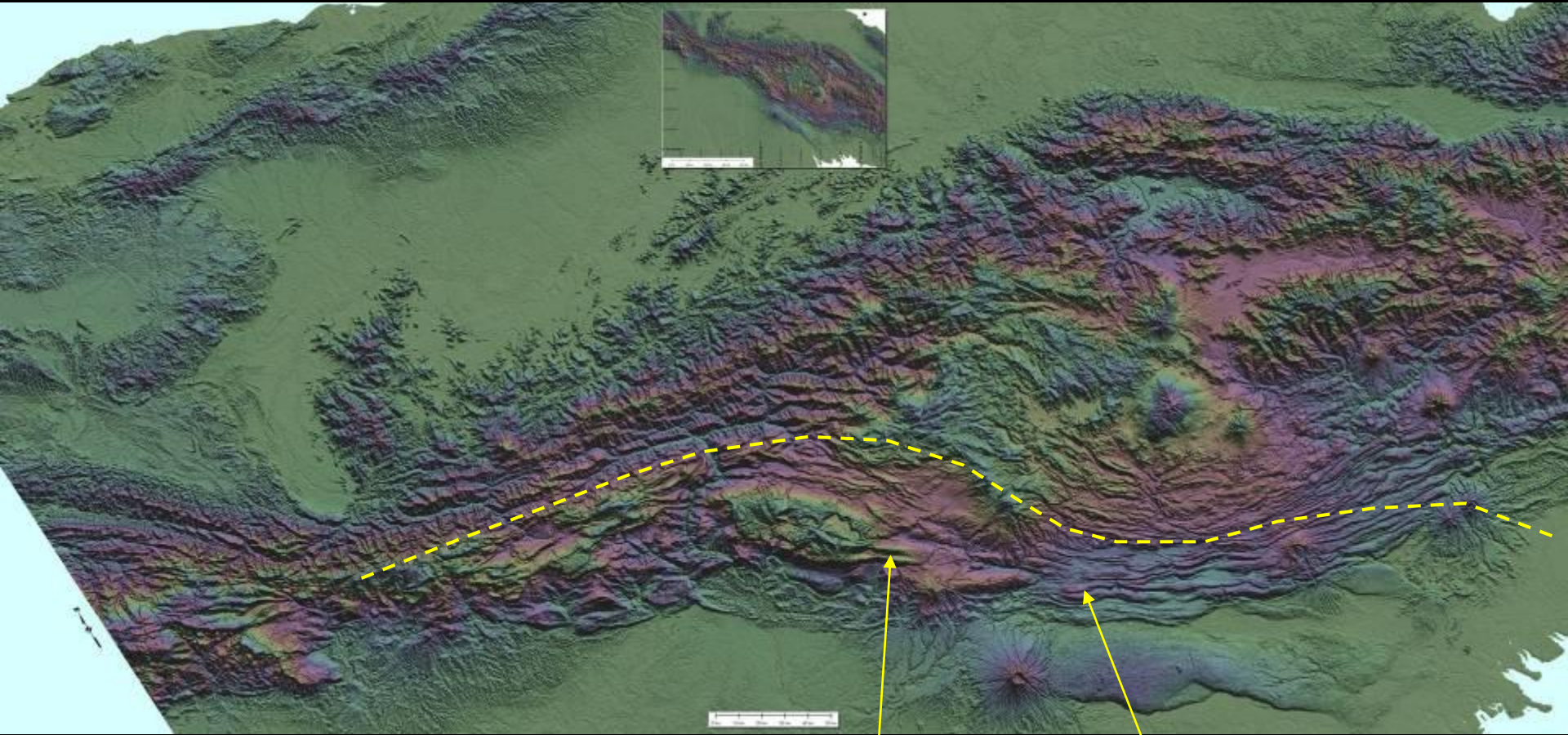


SRTM (synthetic radar topography model)





Foldbelt DEM (digital elevation model)

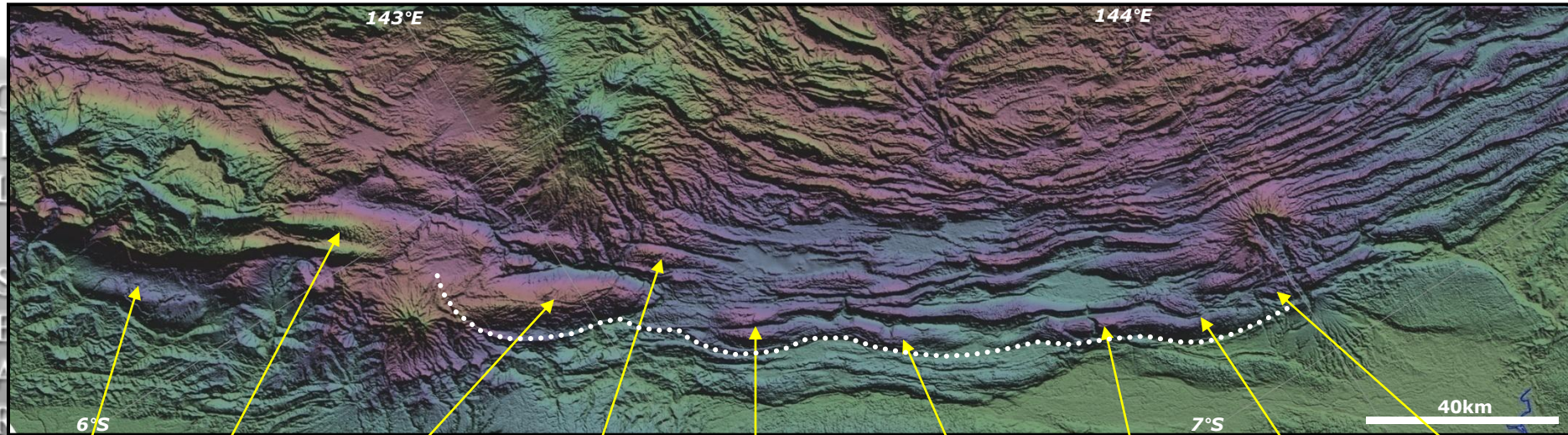


Hides

Kutubu



Regional Setting - Foldbelt DEM



Juha Hides Mananda Moran Kutubu SE Hedinia Gobe SE Gobe Cobra

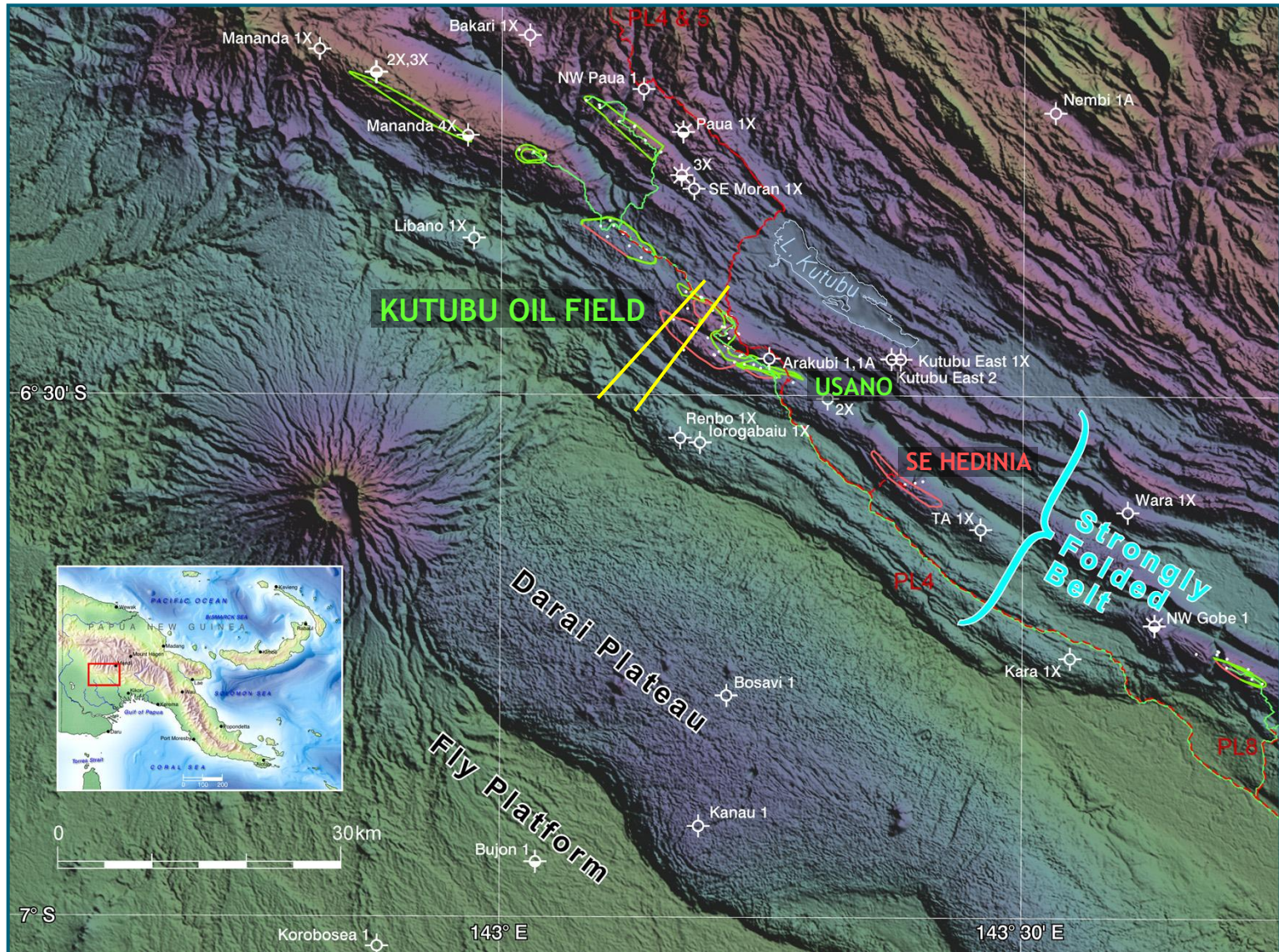
- Most of the successful wells drilled on the frontal trend
- They lie above Hedinia-Gobe thrust, 150 km long with 3-5 km offset

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Kutubu Oil & Gas Field on SAR

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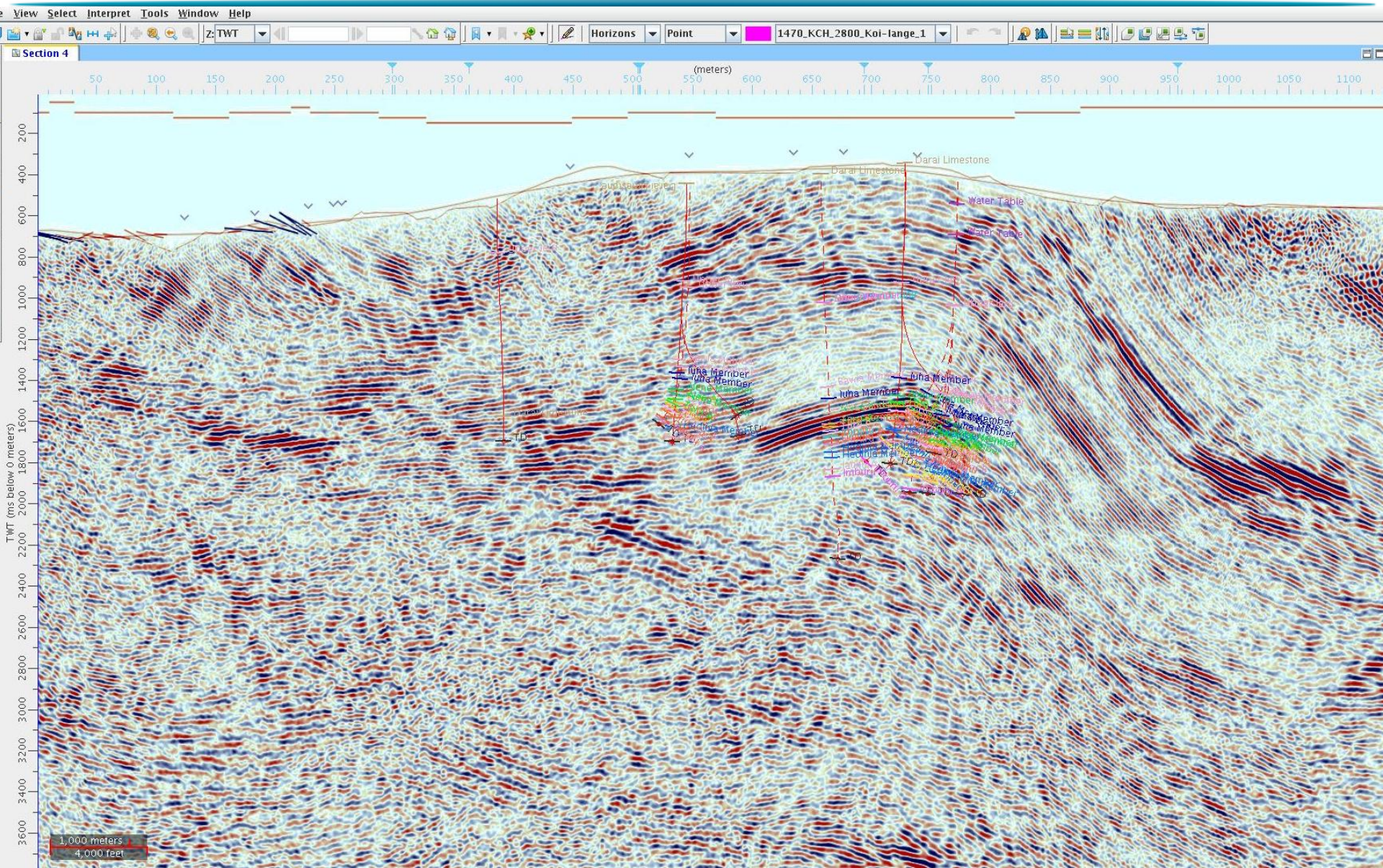


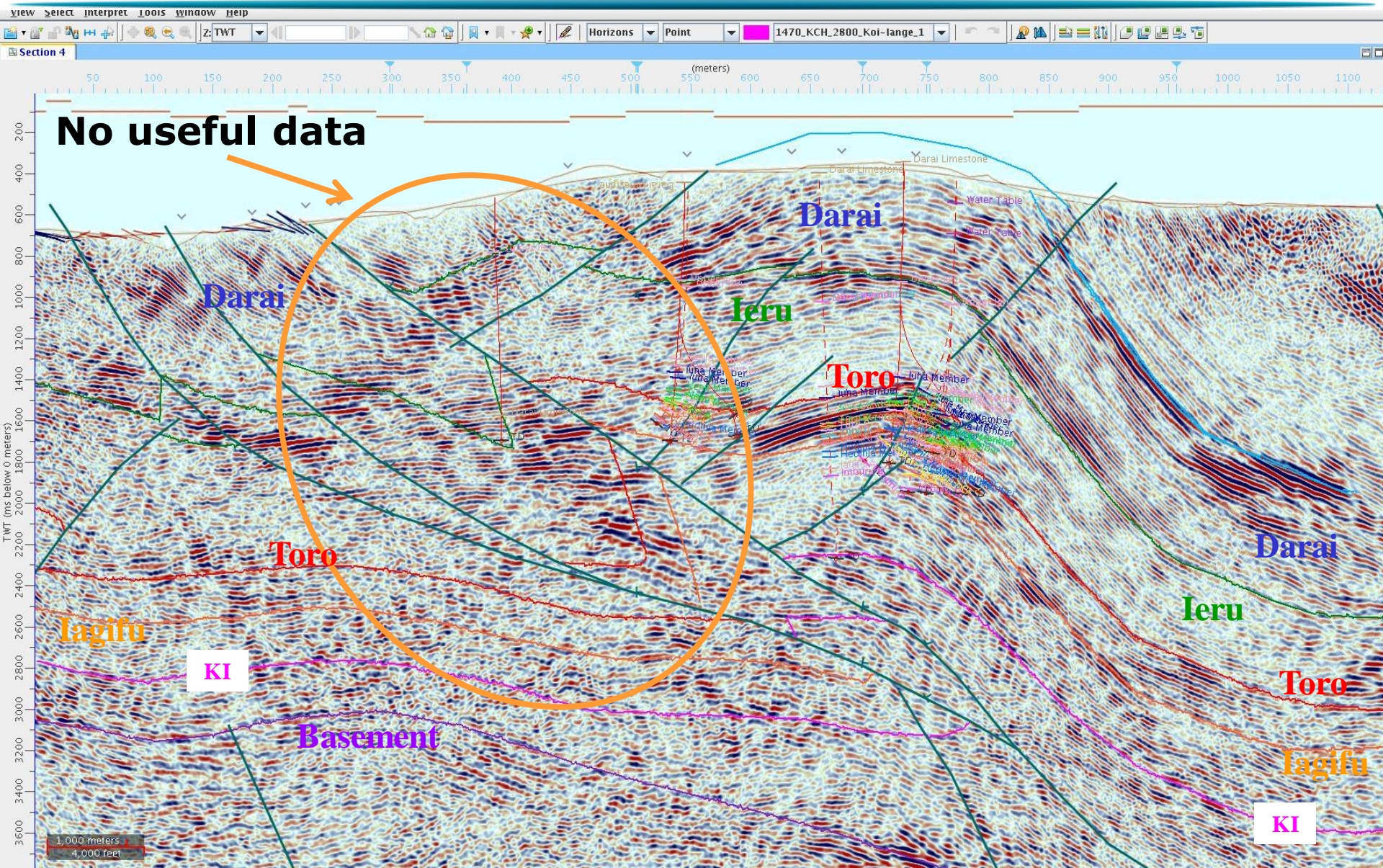


Seismic acquisition in the Foldbelt

- Extremely tough conditions for seismic
- Karst limestone, rainforest and highly rugose at surface
- Base carbonate usually imaged, reservoir very variable, especially on dip lines
- ~US\$160,000/km and increasing.



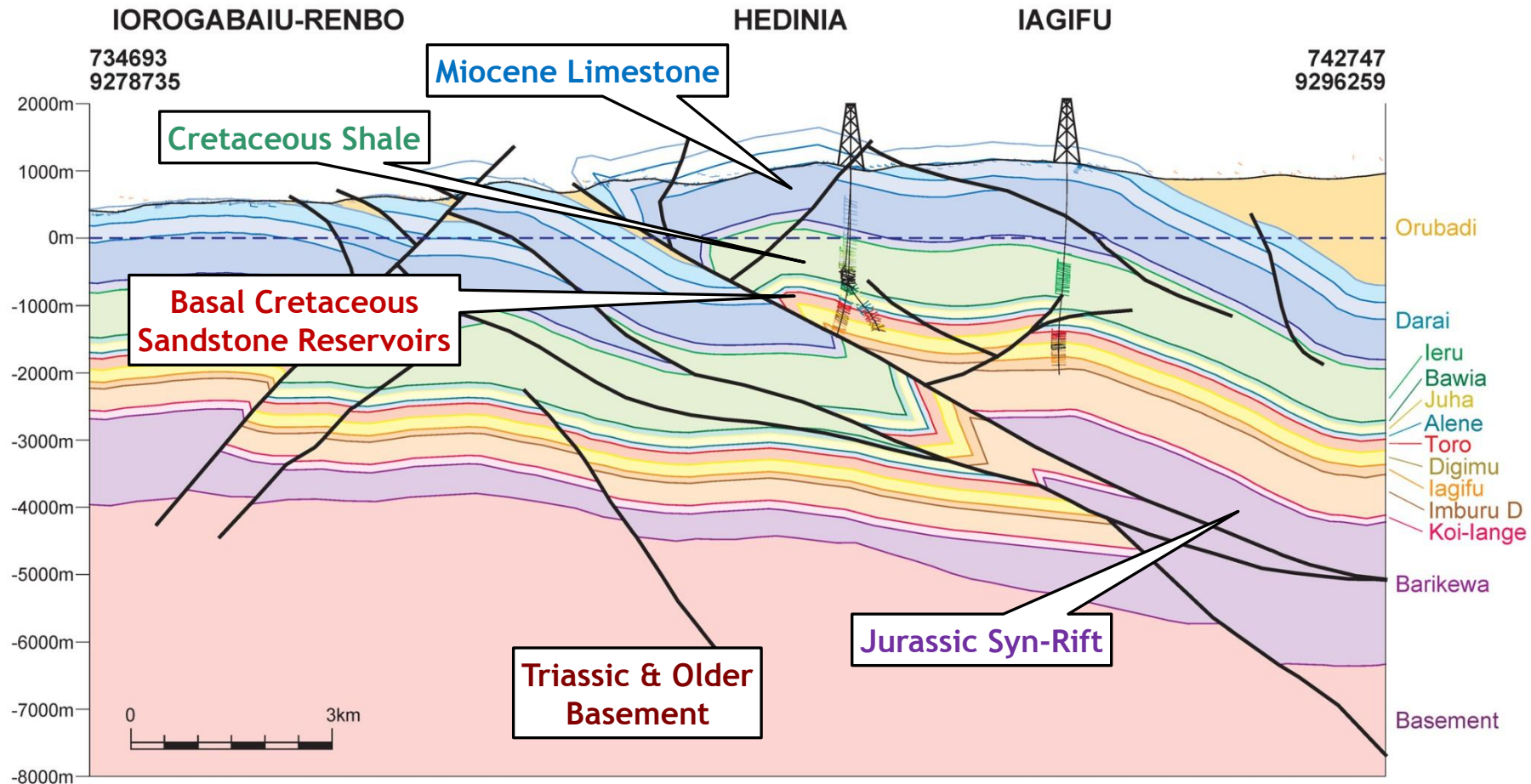






Kutubu Oil & Gas Field Structure

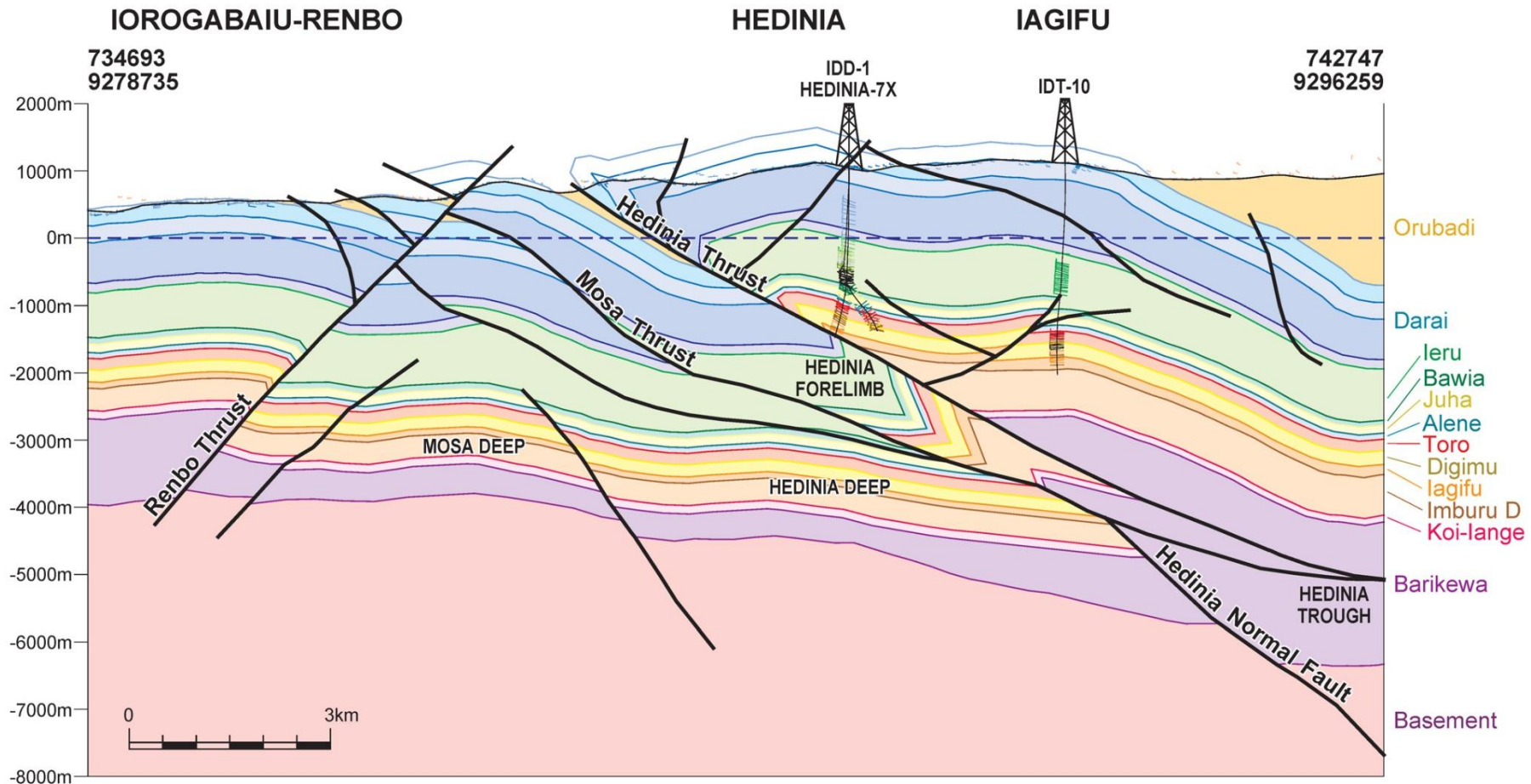
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Kutubu Oil & Gas Field Structure

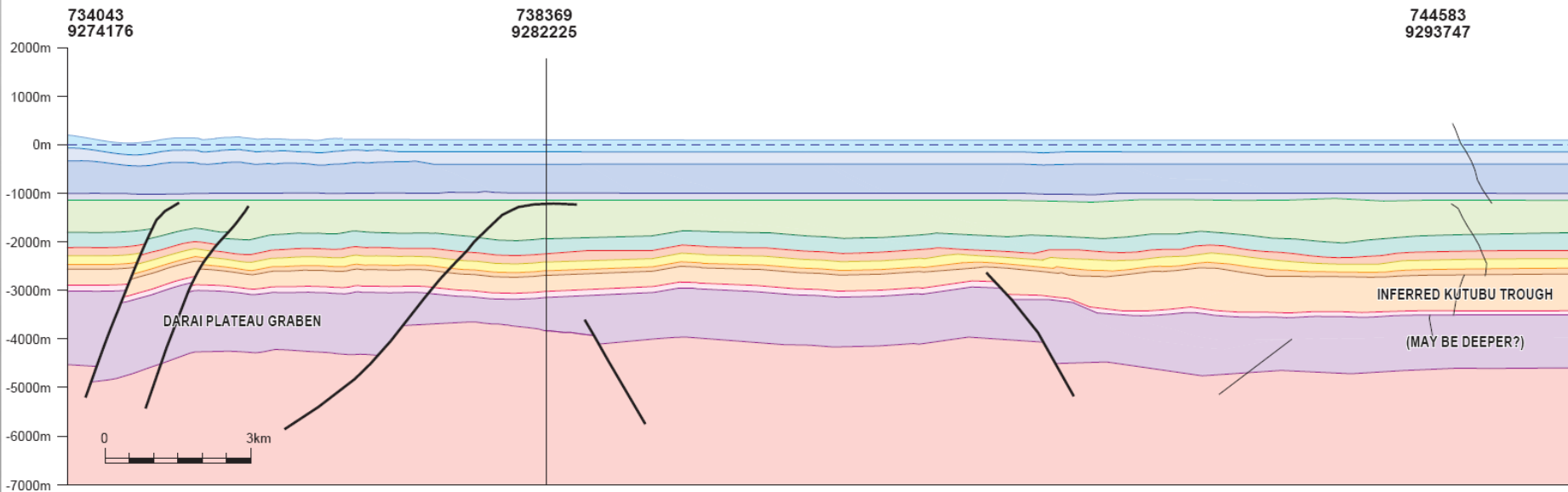
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Reconstruction: Stage 1

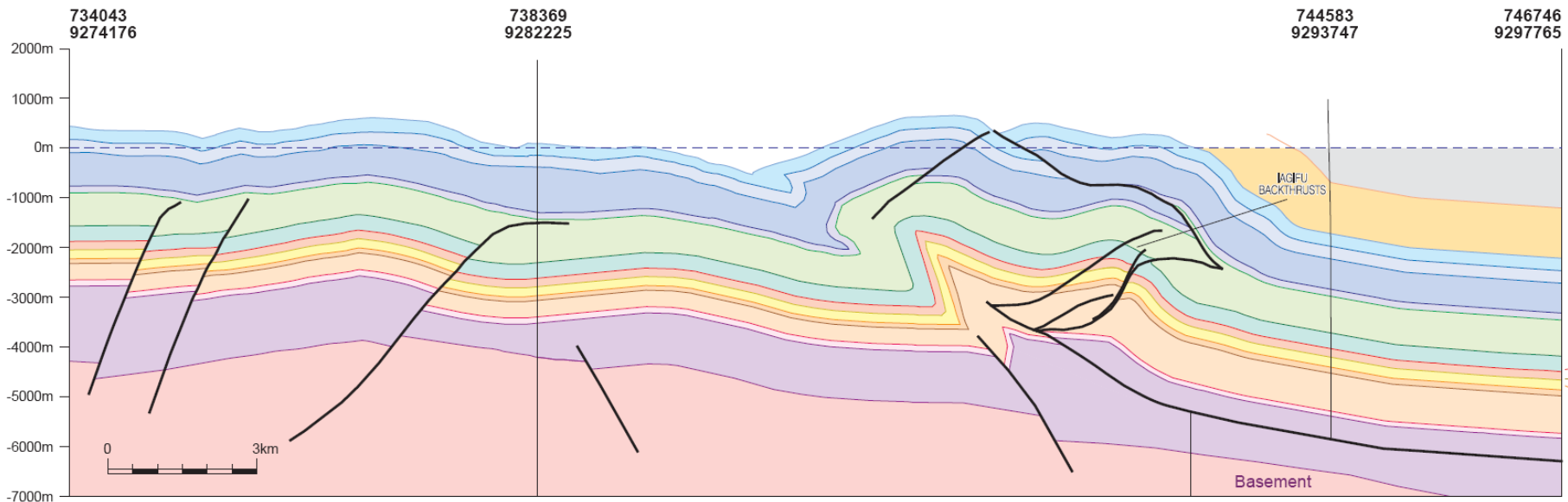
Initial state of the Hedinia (Kutubu) Trough





Reconstruction: Stage 2

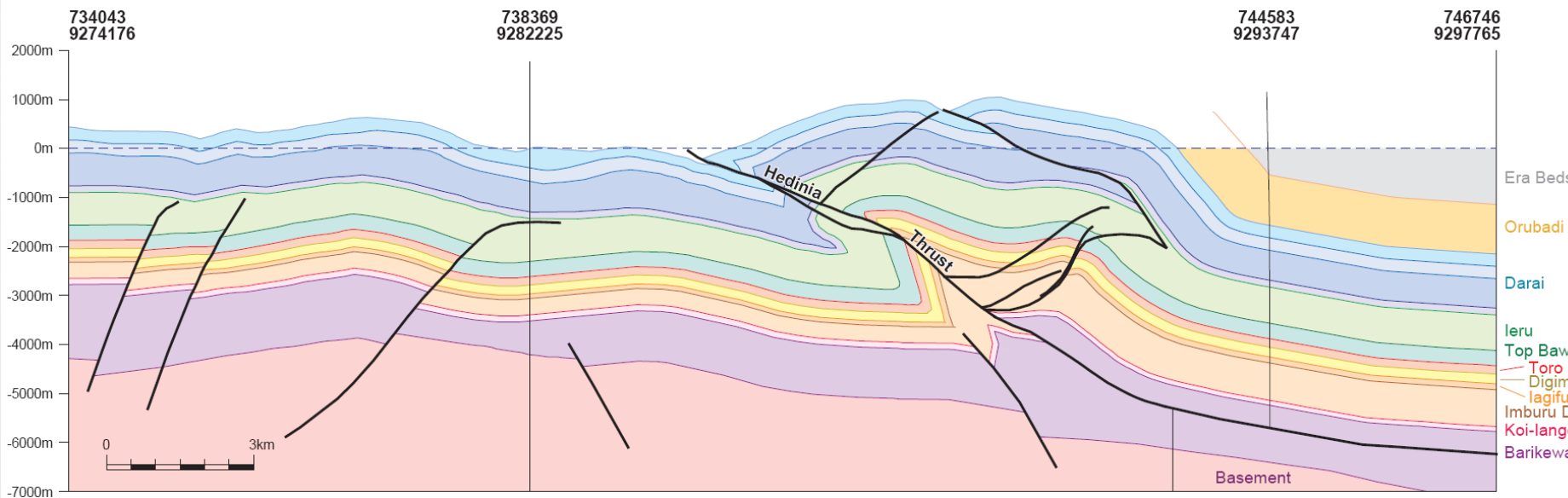
— Inversion and Folding with ~3km of shortening





Reconstruction: Stage 3

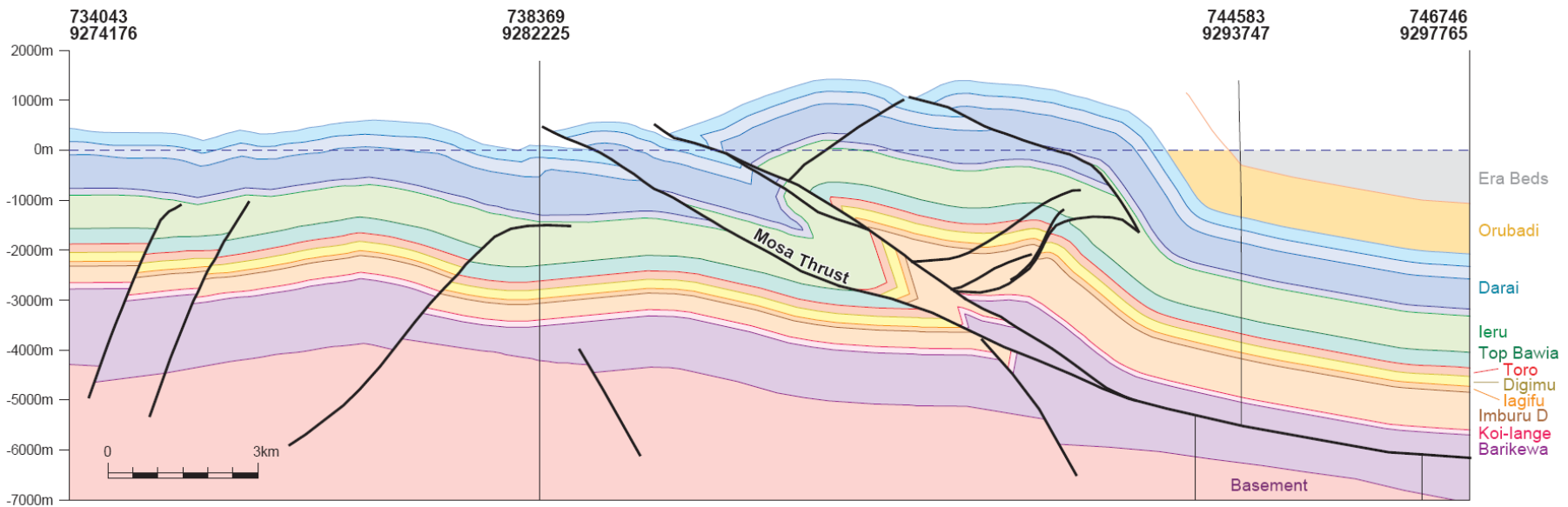
- Hedinia Thrust is formed with $>1\text{km}$ of offset





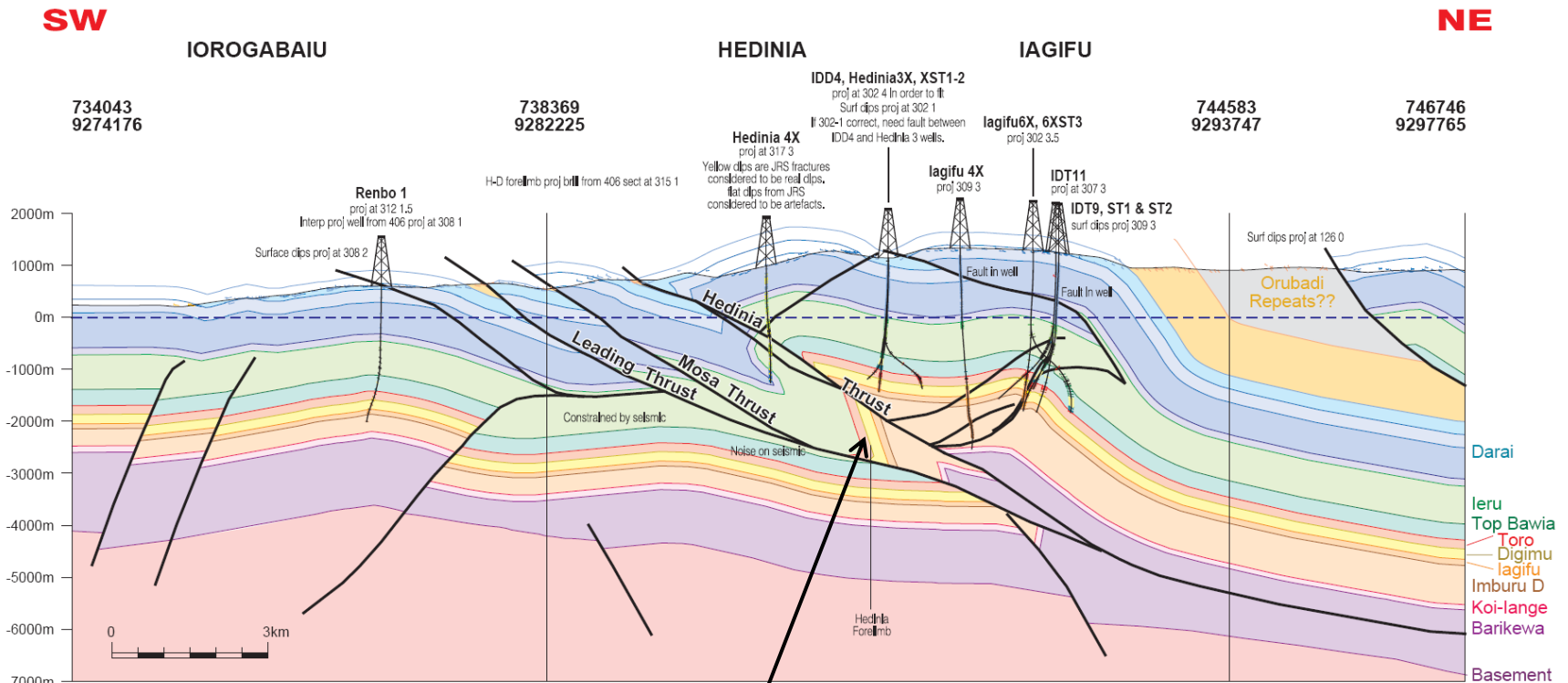
Reconstruction: Stage 4

- Mosa Thrust is formed with ~1km of offset





Iorogabaiu-Hedinia-Iagifu XSection

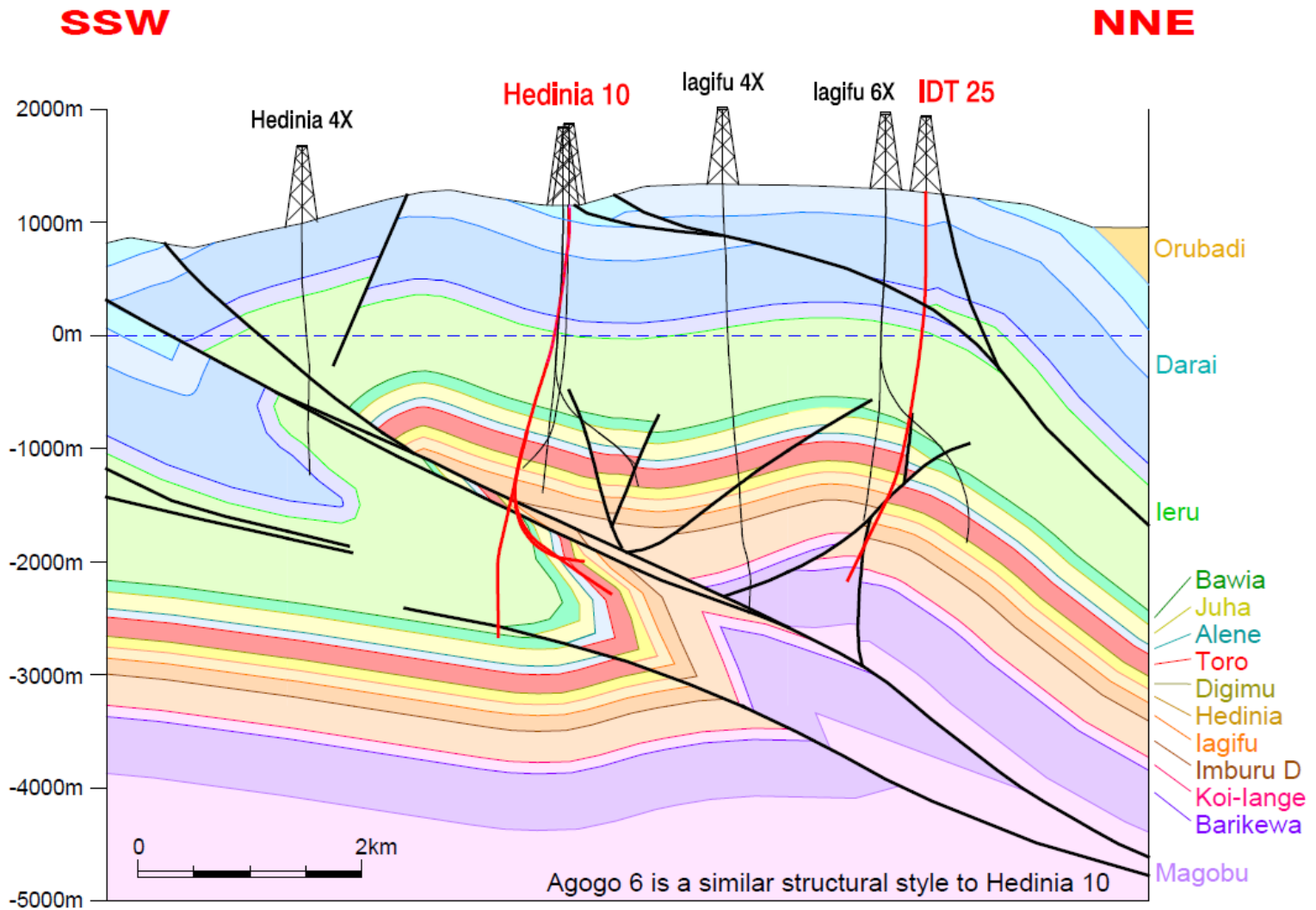


So, what happened when we drilled to test the forelimb play?



Kutubu Oilfield (Iagifu-Hedinia)

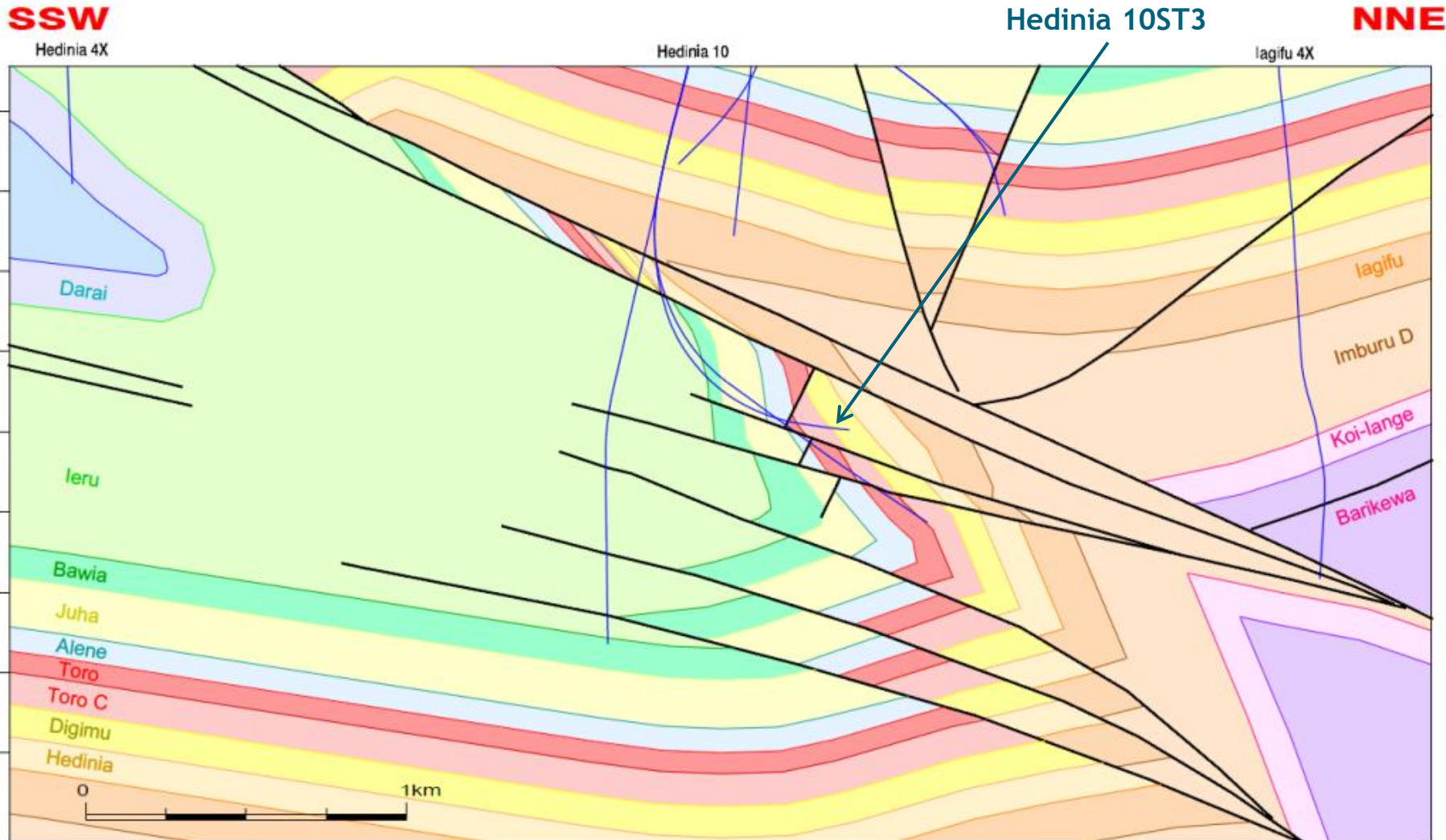
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Hedinia 10ST3 Update

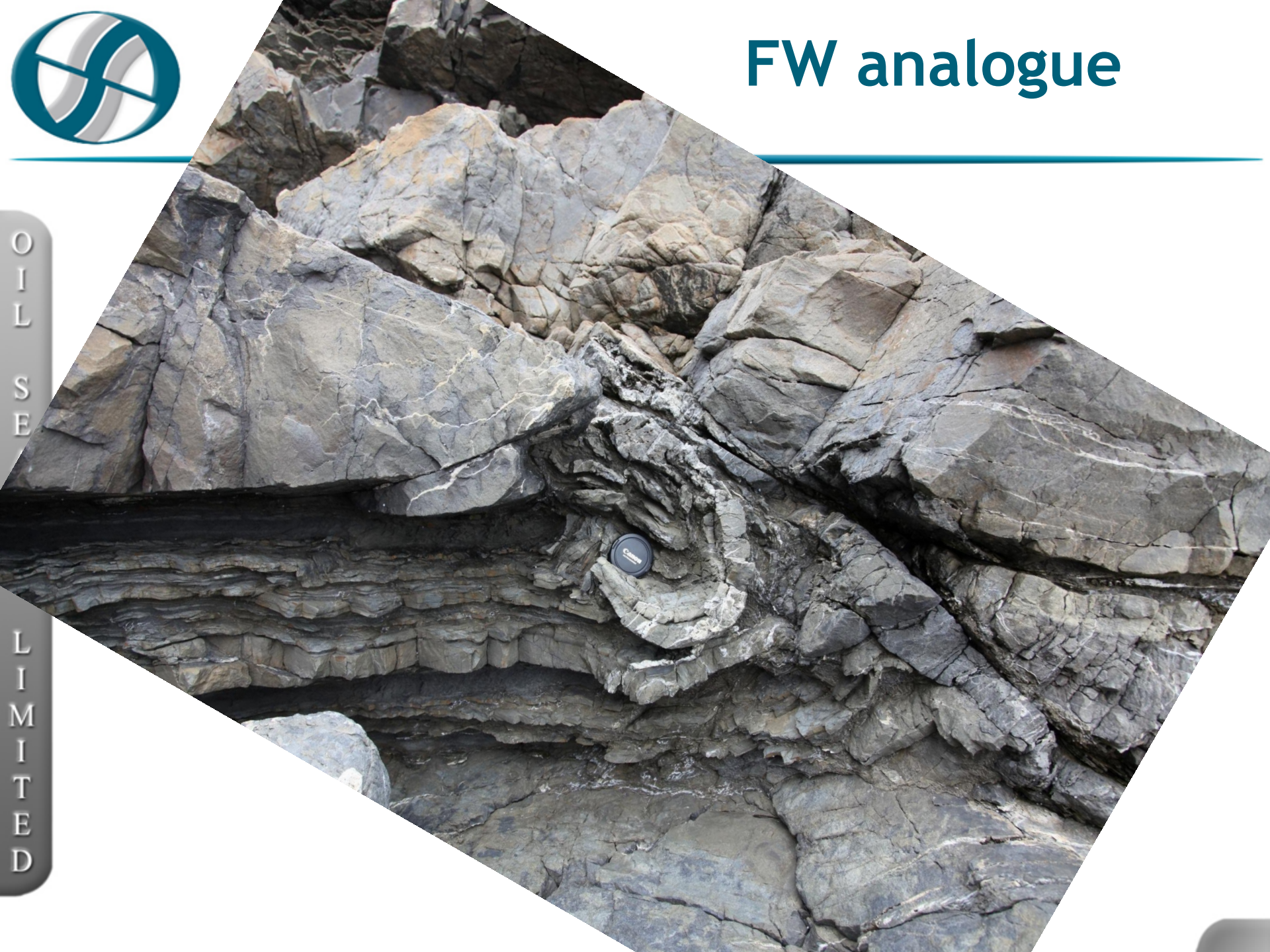
- Producing from Toro; 1200+ stbopd; nil water cut

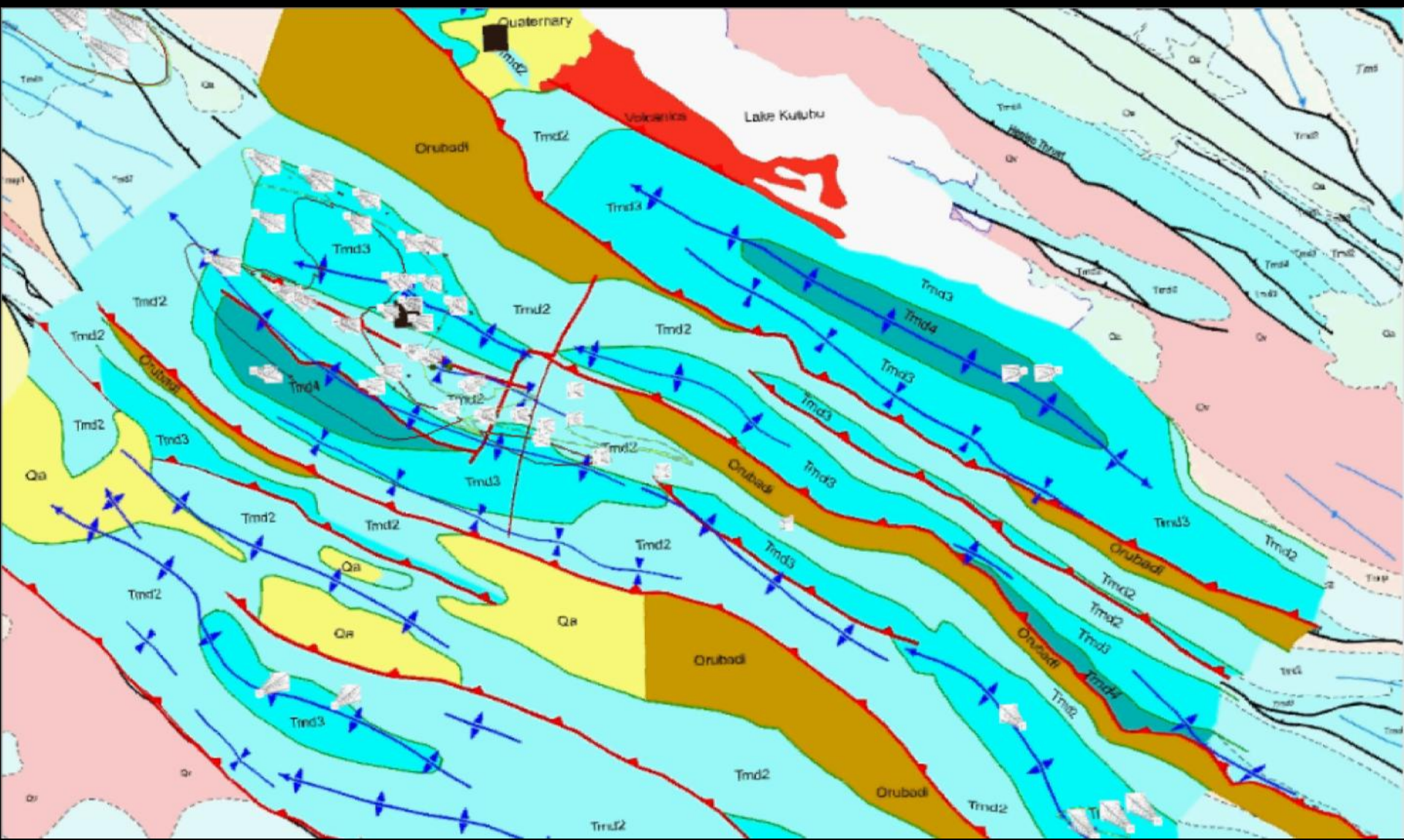


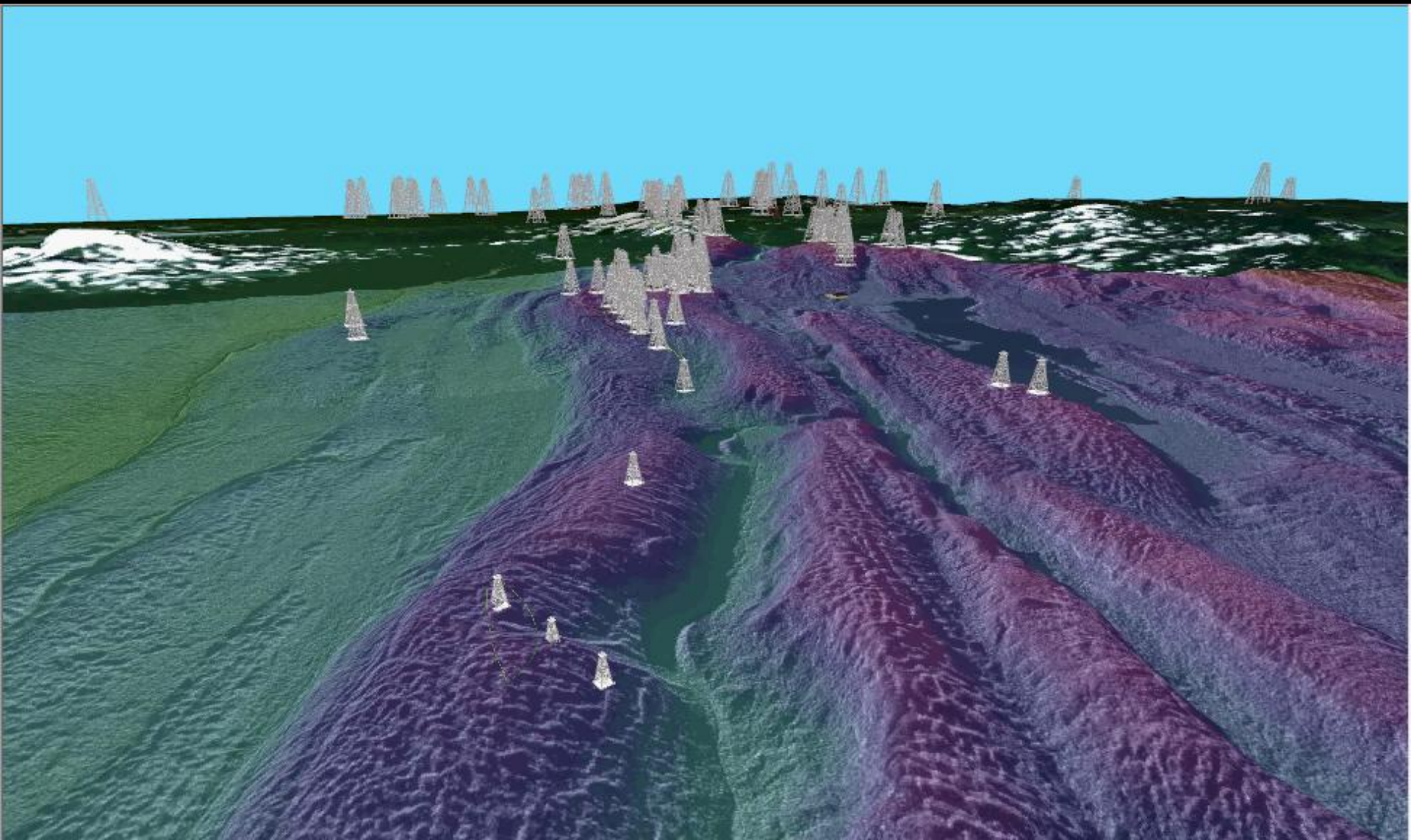


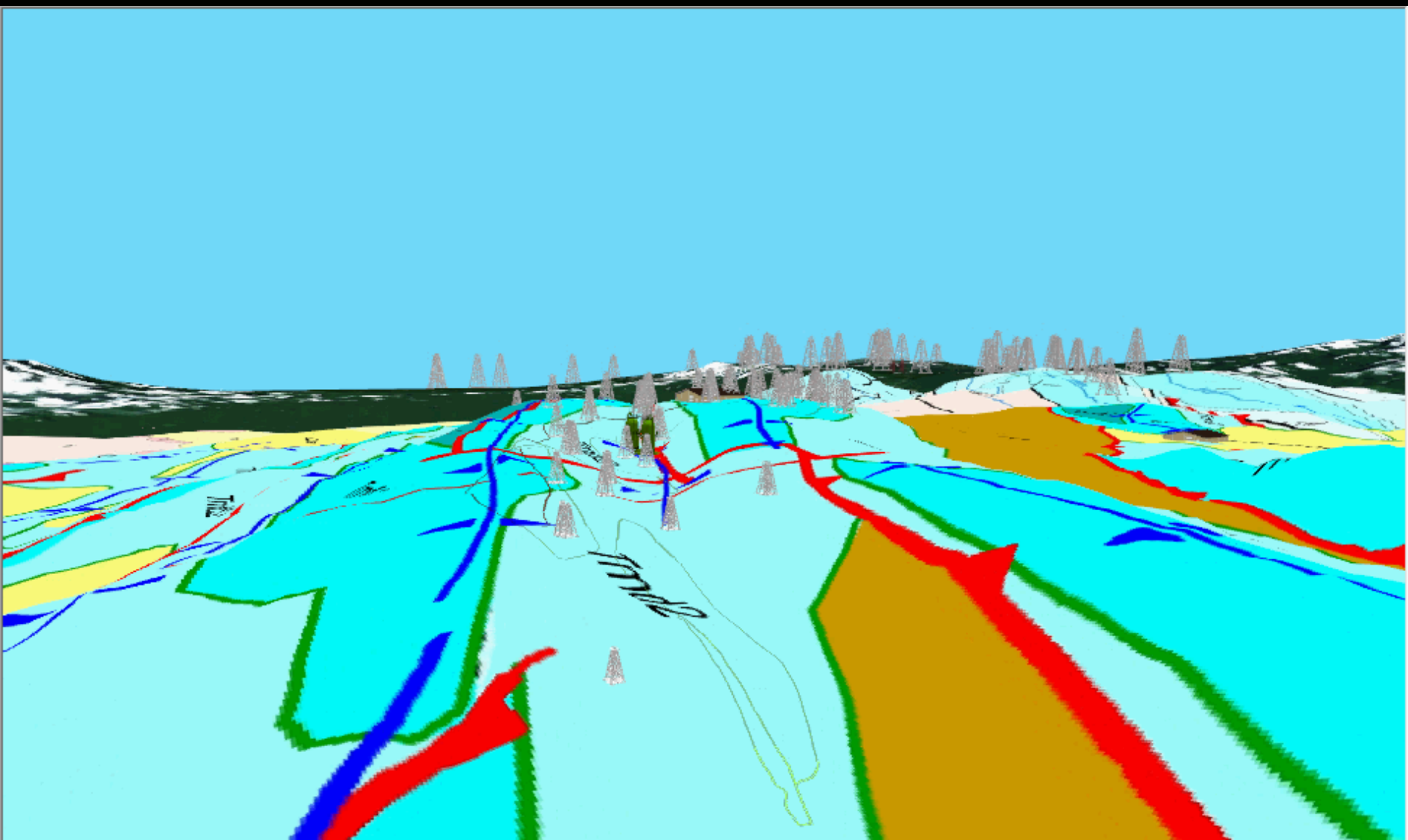
FW analogue

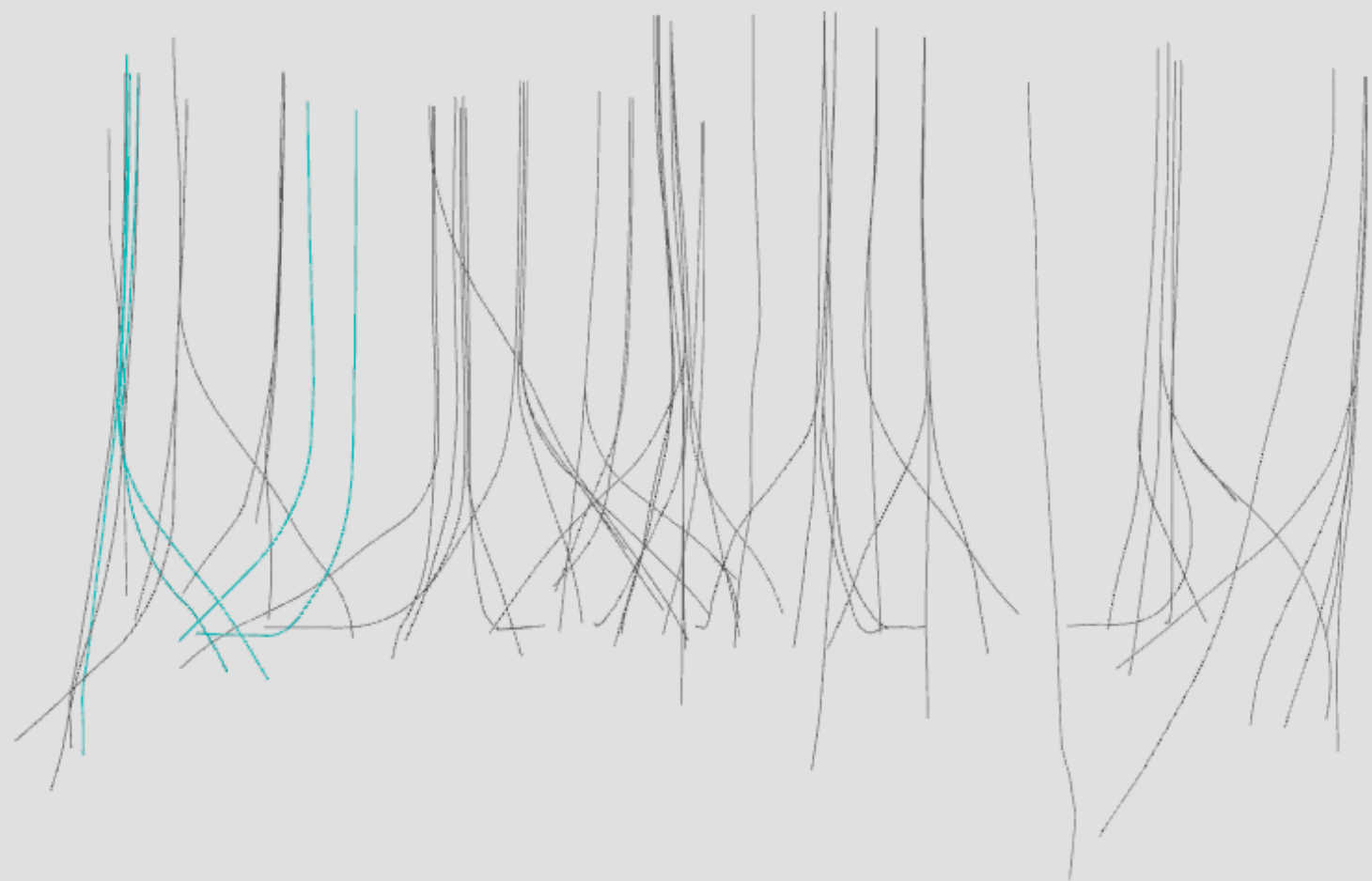
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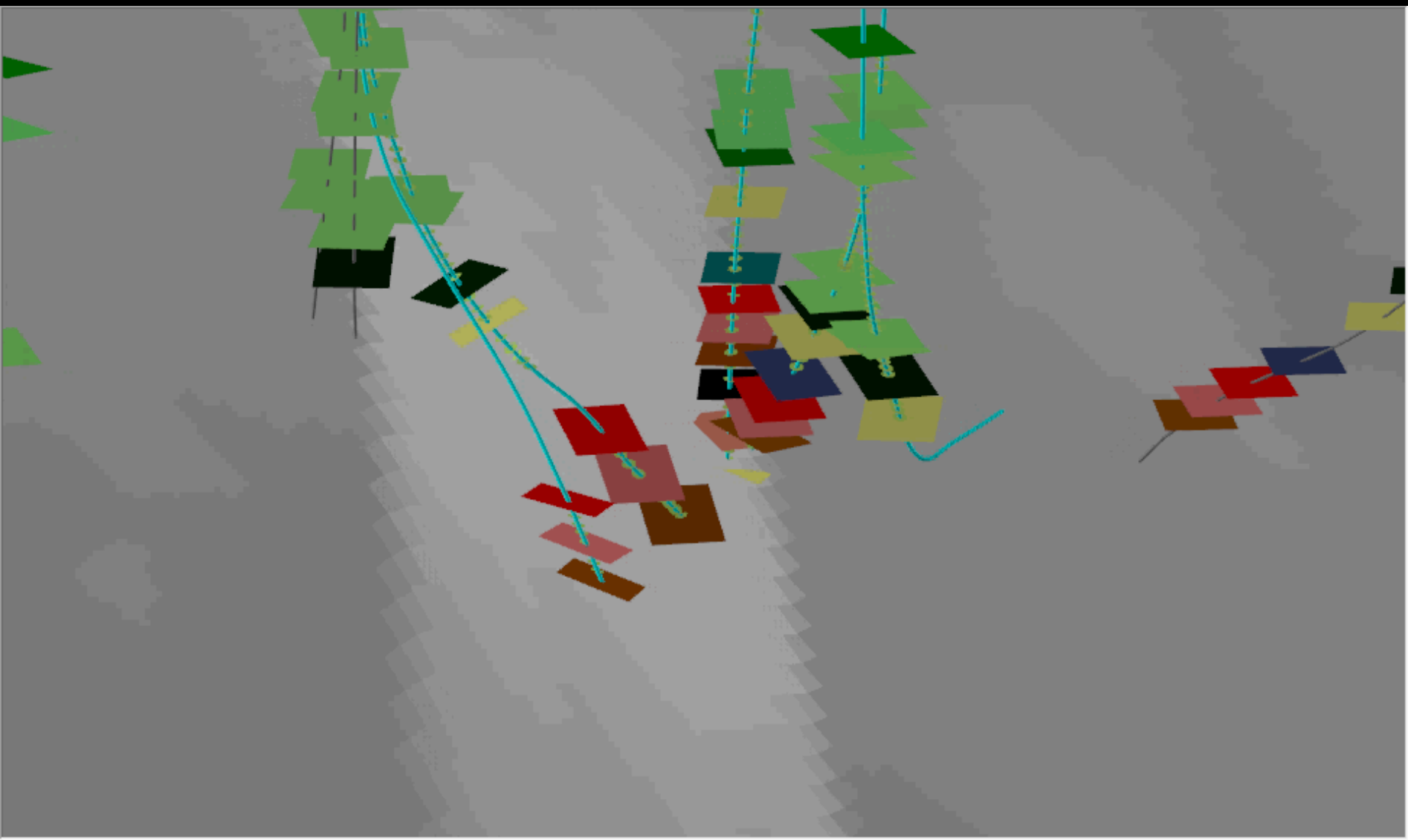


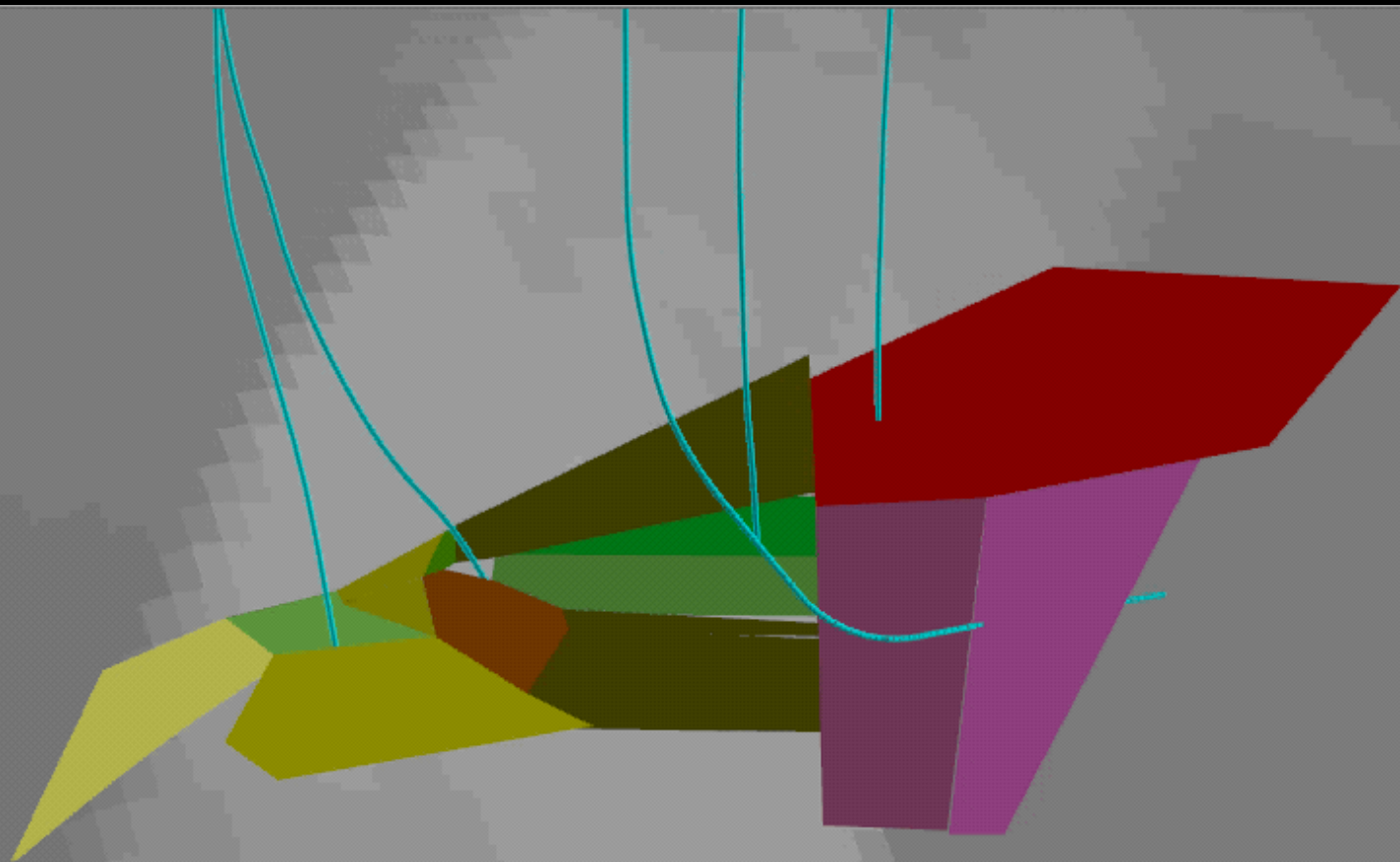


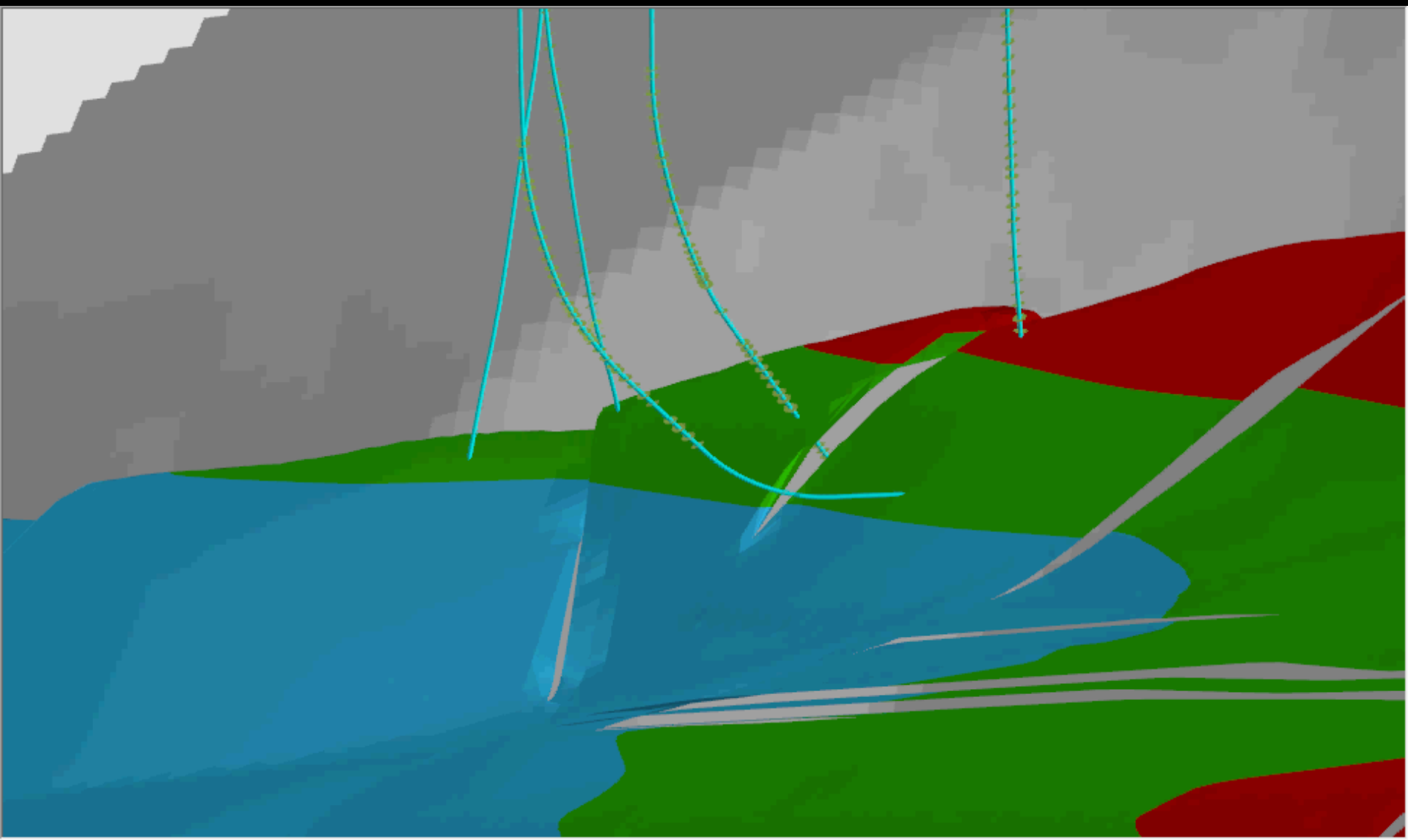


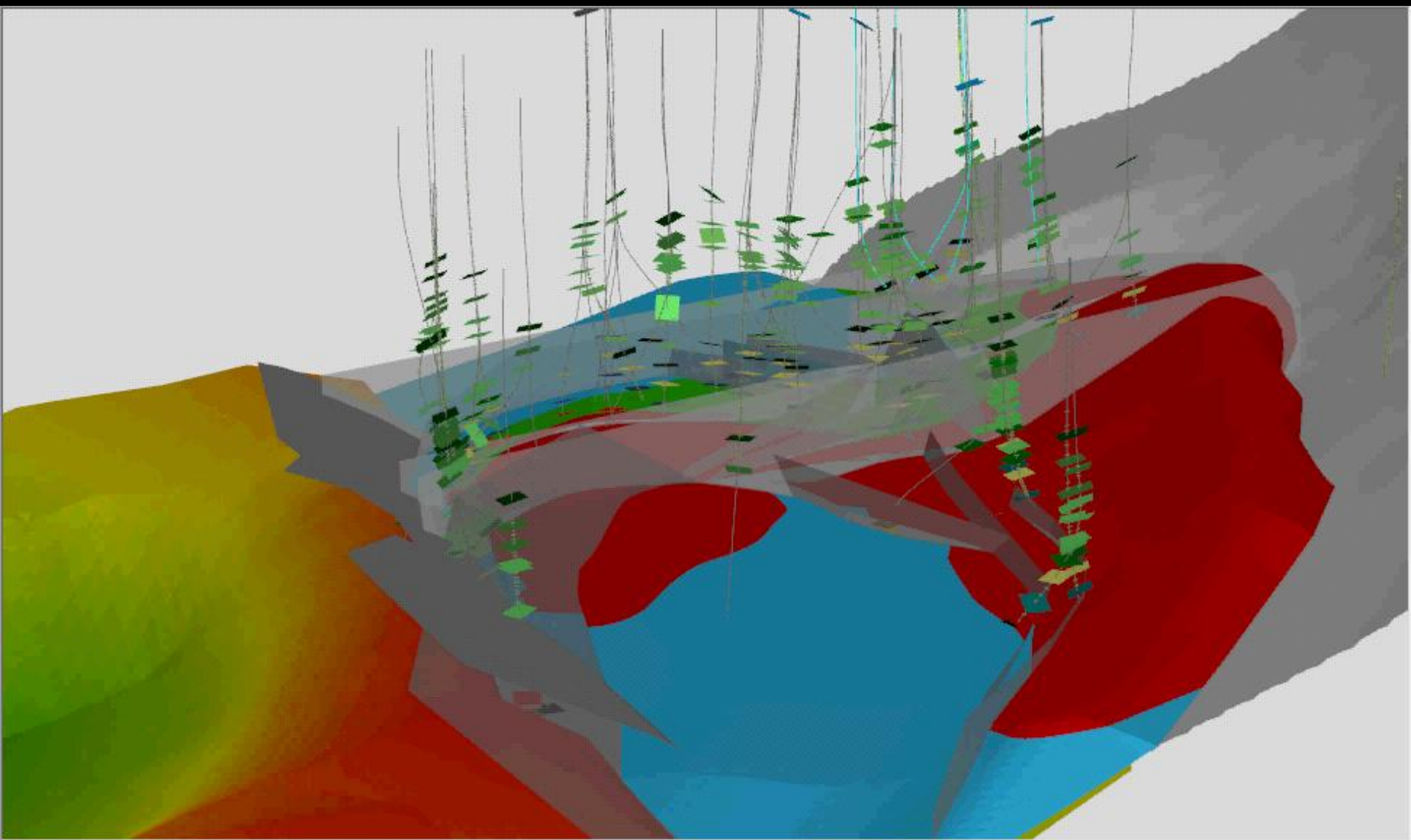


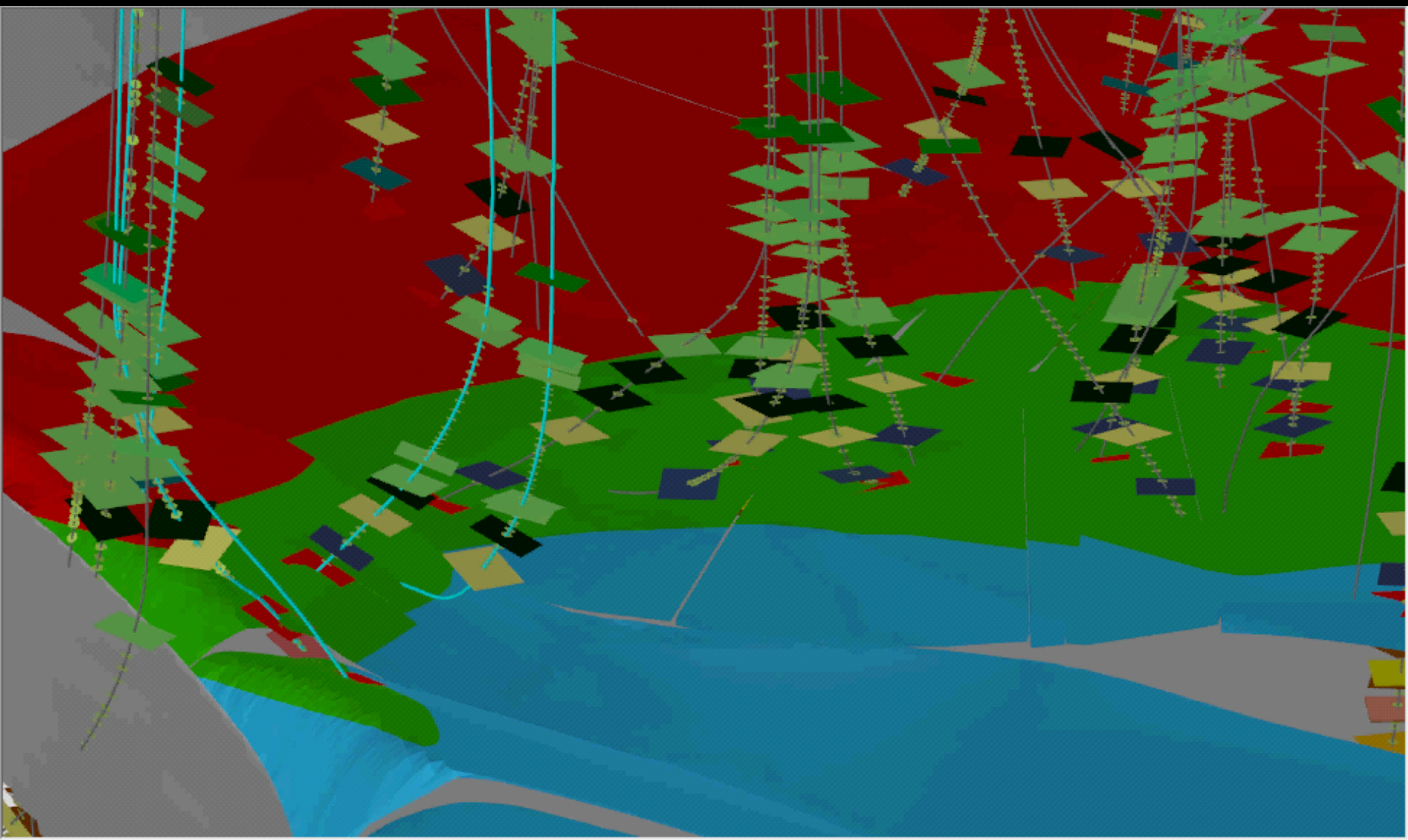














Conclusions

- Most of the hangingwall anticlines drilled, with success
- Now drilling subthrust, overturned forelimbs with large oil columns
- Seismic expensive and of little use
- Require 3D models, built directly in 3D in areas of dense data
- Built from closely spaced sections where data are sparse
- Utilize all datasets



The End

Questions

