Melbana Energy

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Research and Development into Predictive Geologic Models for the Structural Geology of Cuba Block 9 and Beyond.

Errol Johnstone, Dean Johnstone
Dr Rafael Tenreyro, Dr. Jose Prol Betancourt

Presentation Outline

1. Overview of Cuba Block 9
2. Tectonic and Structural Model developed by Melbana
3. Application to Zapato prospect
4. Ophiolite slab hypothesis
5. Forward modelling with Potential Fields data
6. Alternative scenarios and sensitivities
7. Conclusion
8. Implications for Santa Cruz Oil Field

Cuba Block 9 – An Overview

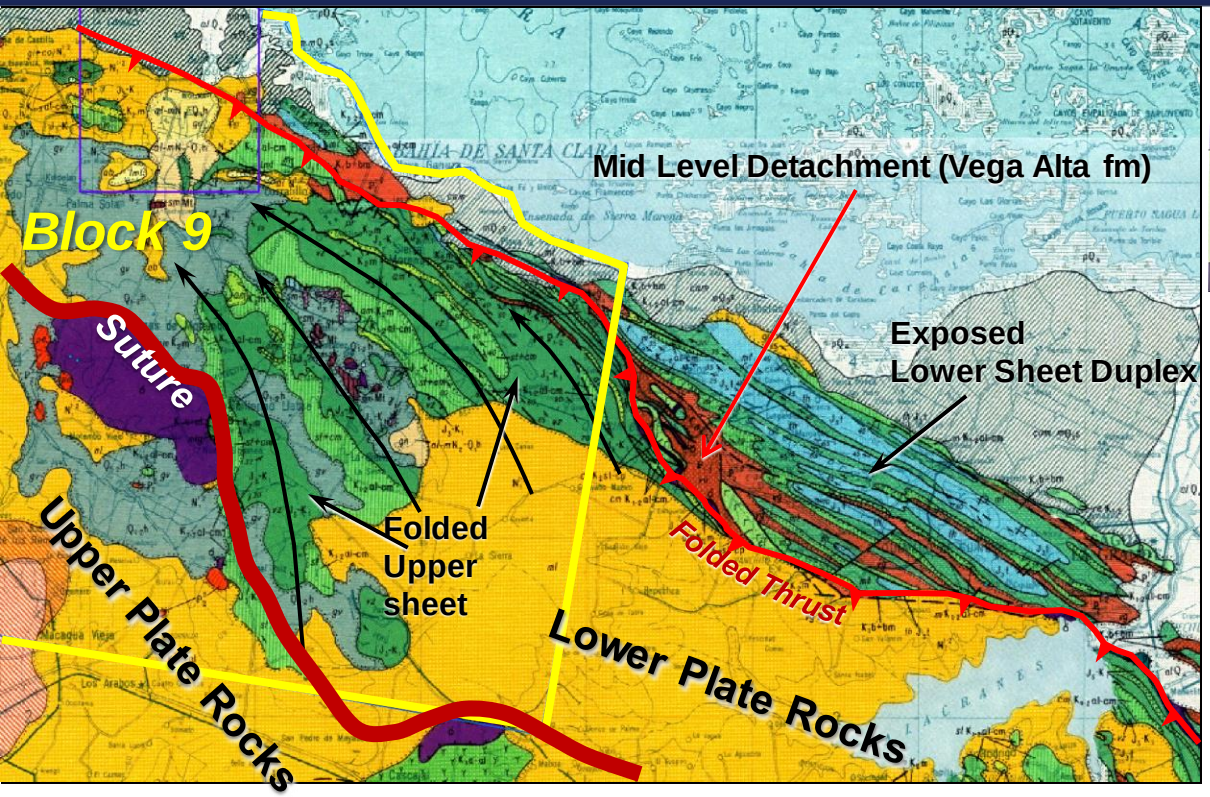
Block 9 Prospectivity

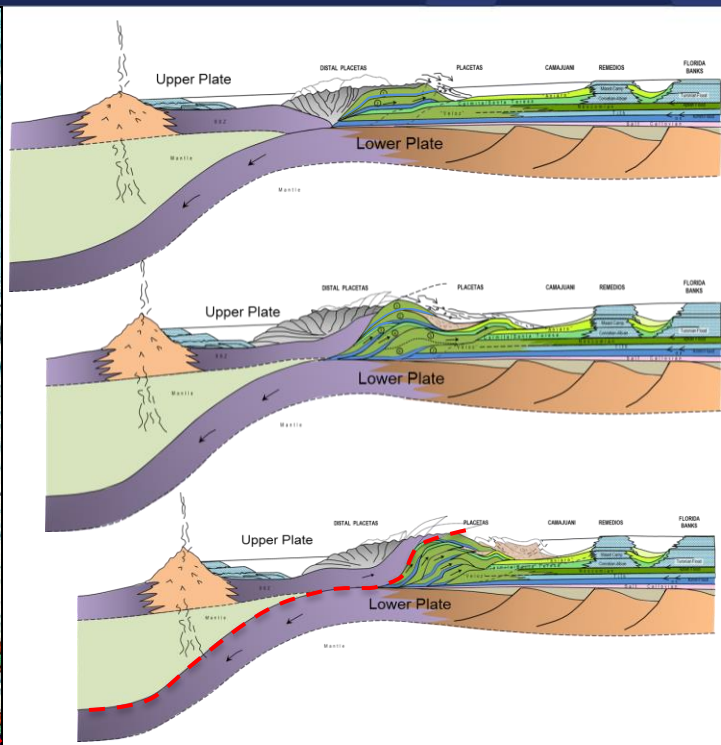
- 2,380km^2 or 588,000 acres located onshore in Cuba
- Lightly explored but contains natural oil seeps and has several small discoveries
- Multi-billion barrel potential
- Along trend from Varadero oil field (>11 billion barrels oil in place)
- Potential for Varadero type structures in Block 9

Block 9 PSC

- 25 year term in total (awarded in 2015)
- 8.5 year exploration period divided into 4 sub periods
- Recent farmout to subsidiary of Anhui Guangda Mining Investment Co Ltd

Block 9: Outcrop Expression of Structural Elements

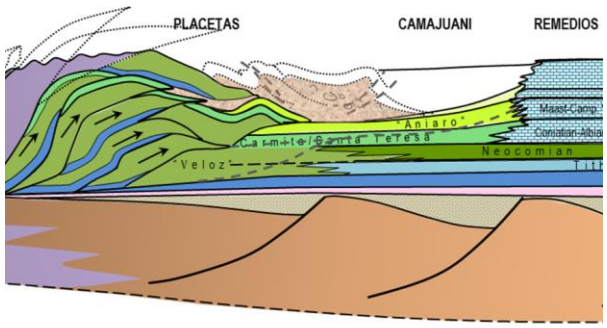




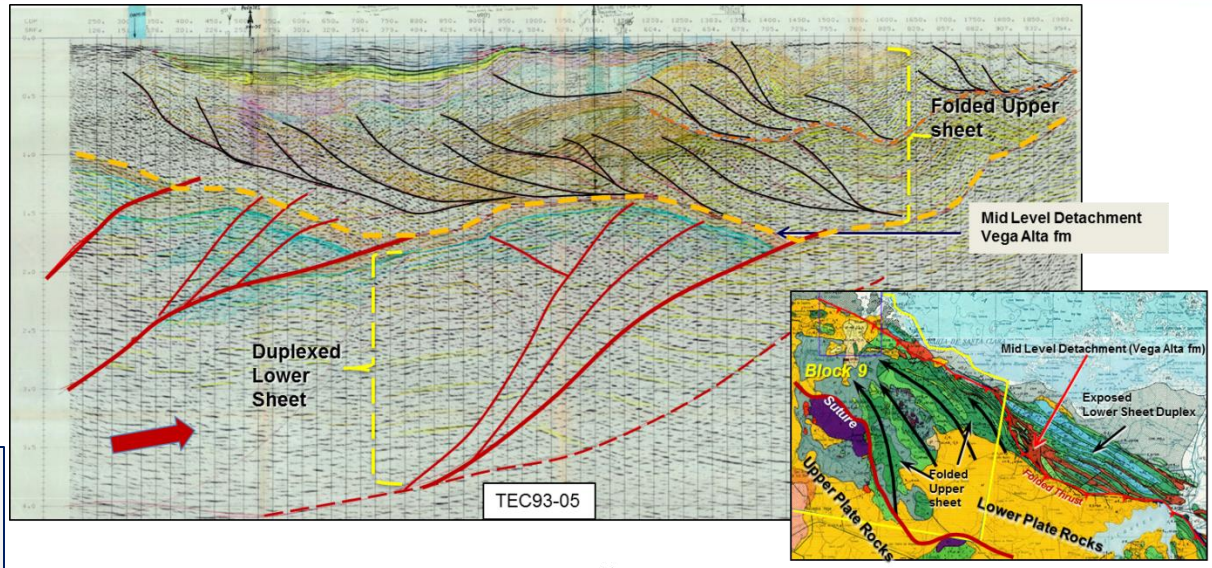
Melbana Structural work has concluded that the following observations can be made:

- Suture between Upper Plate rocks (Arc complex / Ophiolites) and the Lower Plate Remedios succession seen in outcrop
- Lower Plate composed of an Upper sheet (distal carbonates) folded by a duplexed Lower Sheet
- Thrusted contact between the Upper and Lower sheet defines the mid level detachment.
  - The Upper Sheet was emplaced on top of the Lower Sheet during early stages.
  - The Lower Sheet is an exhumed duplex involving proximal Jurassic to early Cretaceous
  - Later structuring of the Lower Sheet refolded the Upper Sheet and the thrusted contact

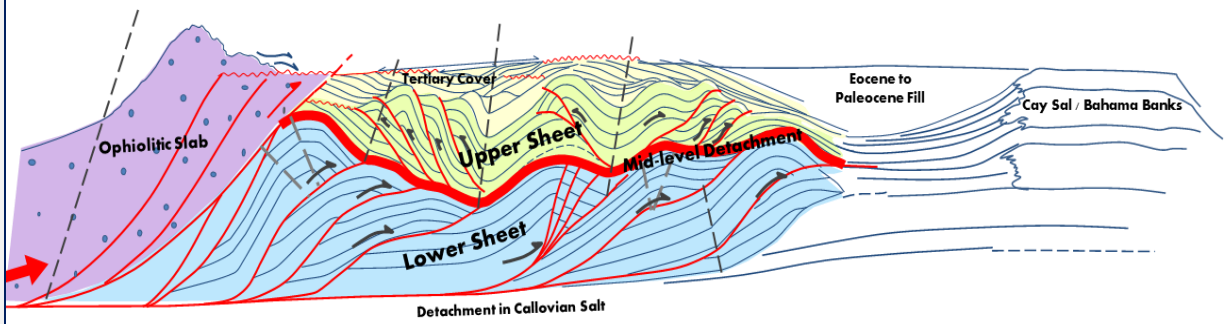
Block 9: Structural Model



- Upper Sheet, highly imbricated and back-thrusted trains of fault propagation folds composed of distal Placetas facies of Jurassic and Cretaceous age.
- composed of at least 2 component sheets
- Lower Sheet: A thicker sheet of more proximal carbonate facies. Simply deformed into large antiformal duplex stacks mappable on existing seismic.
- Mid level Detachment - Vega Alta Fm Olistostromic sea floor facies - topseal for the deeper sheet structures.



TEC93-05 through central Block 9 - dip panel evidence for the forward vergent lower sheet duplexes under the back-thrusted upper sheet, separated by the Mid-level detachment layer - in outcrop as the Vega Alta fm.



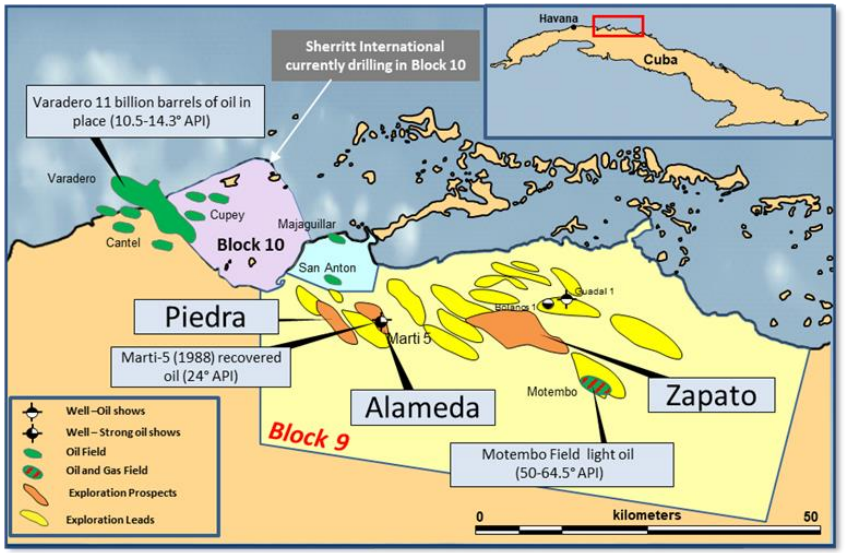
General Structural Model for Block 9 Exploration

Mapping the mid level detachment describes leads in the the lower sheet play

Cuba, Block 9 – Resource Assessment

McDaniel & Associates assess Prospective Resources up to 1.5 billion barrels

- Large footprint - 2,380km^2
- Lightly explored
- Along trend from Varadero oil field
- 3 prospects, 16 leads identified
- Potential for large Varadero type structures
- Cuba experts McDaniel & Associates Consultants[2] independently assessed resources per London Alternative Investment Market (AIM) listing standards:
  - Best estimate Oil-in-Place 15.7 billion barrels of oil[3]
  - Best estimate recoverable oil 718 million barrels of oil[3]



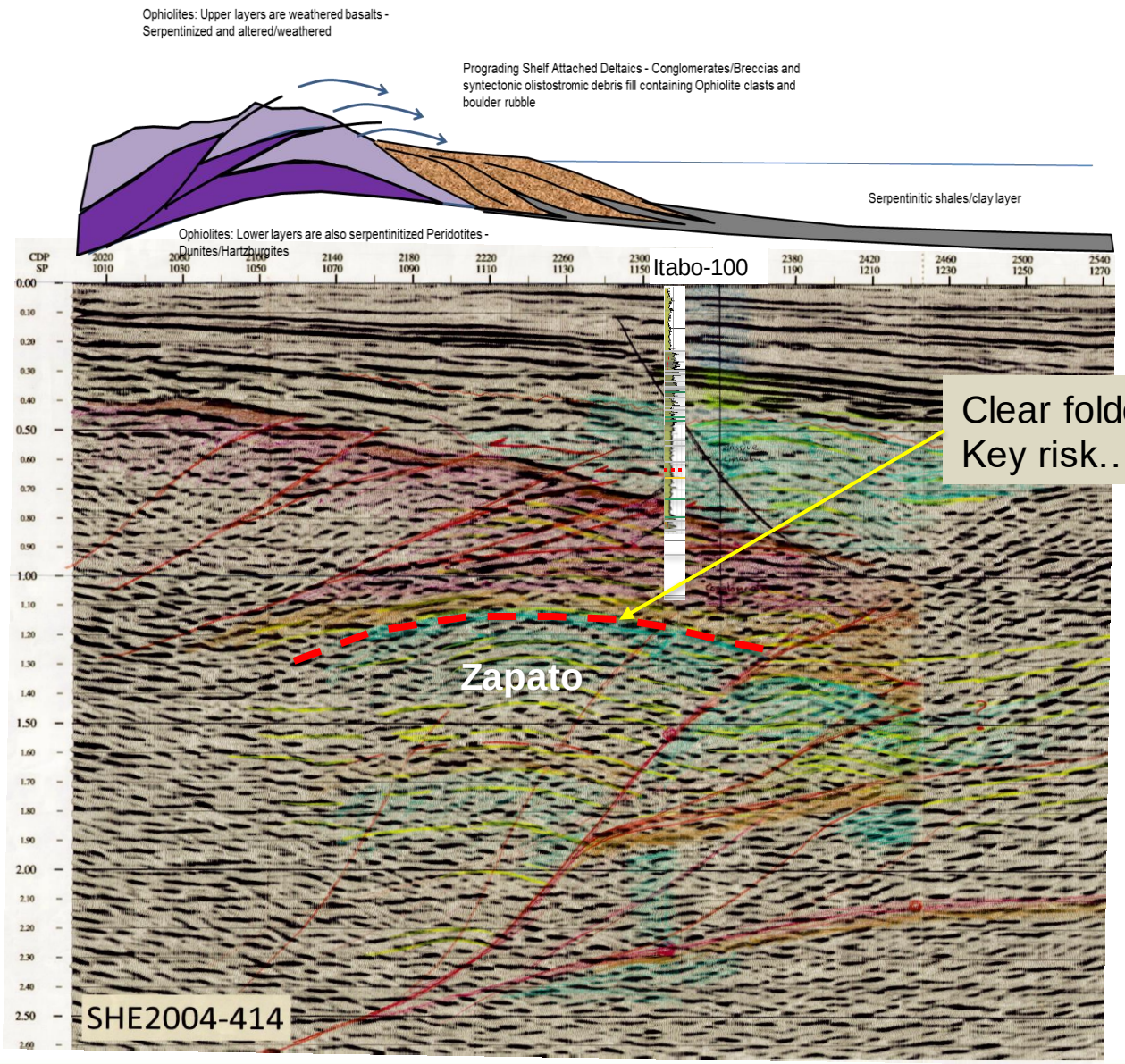
Block 9 Exploration Potential[3]	Low	Best	High	Mean
	MMstb	MMstb	MMstb	MMstb
Oil-in-Place	8,185	15,763	30,250	17,825
Prospective Resources (recoverable)	305	718	1,553	848

Prospective Resources Cautionary Statement - The estimated quantities of petroleum that may potentially be recovered by the application of a future development project(s) relate to undiscovered accumulations. These estimates have both an associated risk of discovery and a risk of development. Future exploration appraisal and evaluation is required to determine the existence of a significant quantity of potentially moveable hydrocarbons.

[2] See www.mcdan.com/experience

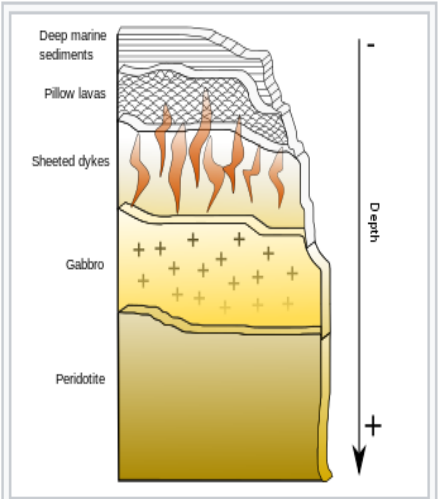
[3] per Independent Expert McDaniel & Associates Report

Zapato Prospect – What lies under the Ophiolite wedge??



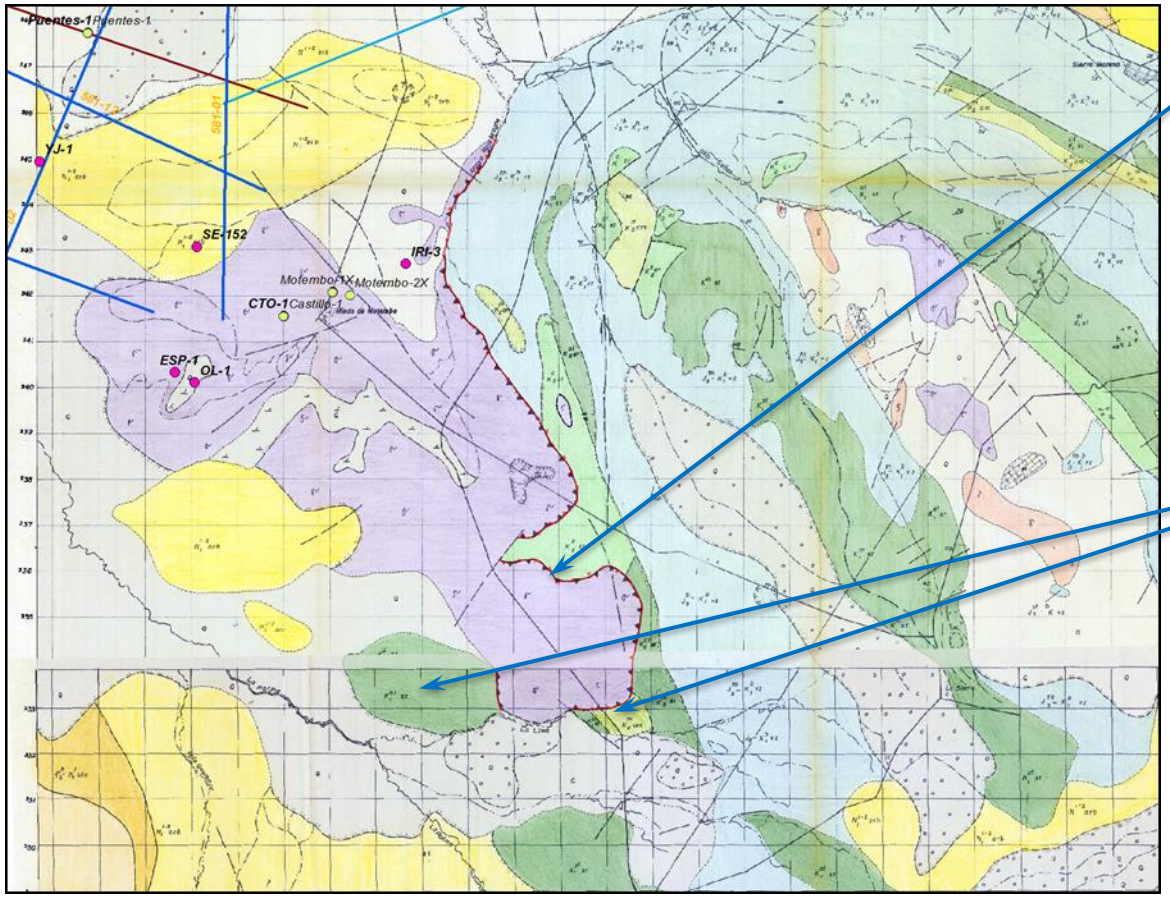
Ophiolite (Serpentinite) wedge tectonically emplaced and then weathered to produce a prograding foredeep clastic wedge

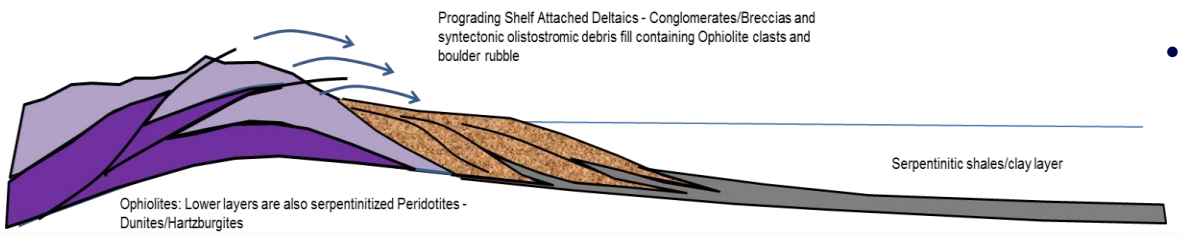
Clear folded antiform at depth
Key risk…what is the lithology??



Idealized stratigraphic sequence of an ophiolite.

Motembo Area – Ophiolite Outcrop





- Outcrop pattern of the fault is sinuous, relatively flat dips (vertical dips would present as a straight line)
- The southern end of the ophiolite shows the fault wrapping around the outcrop, revealing NW striking middle cretaceous rocks in the footwall and erosion of the fault on the backlimb causing windows.
- This outcrop pattern suggest the ophiolite is a deeply eroded, relatively flat lying hangingwall remnant above a relatively flat fault, - may have limited areal extent and thickness due to erosion
- Prospective Veloz fm Carbonates are expected as faulted antiformal duplexes beneath the ophiolite

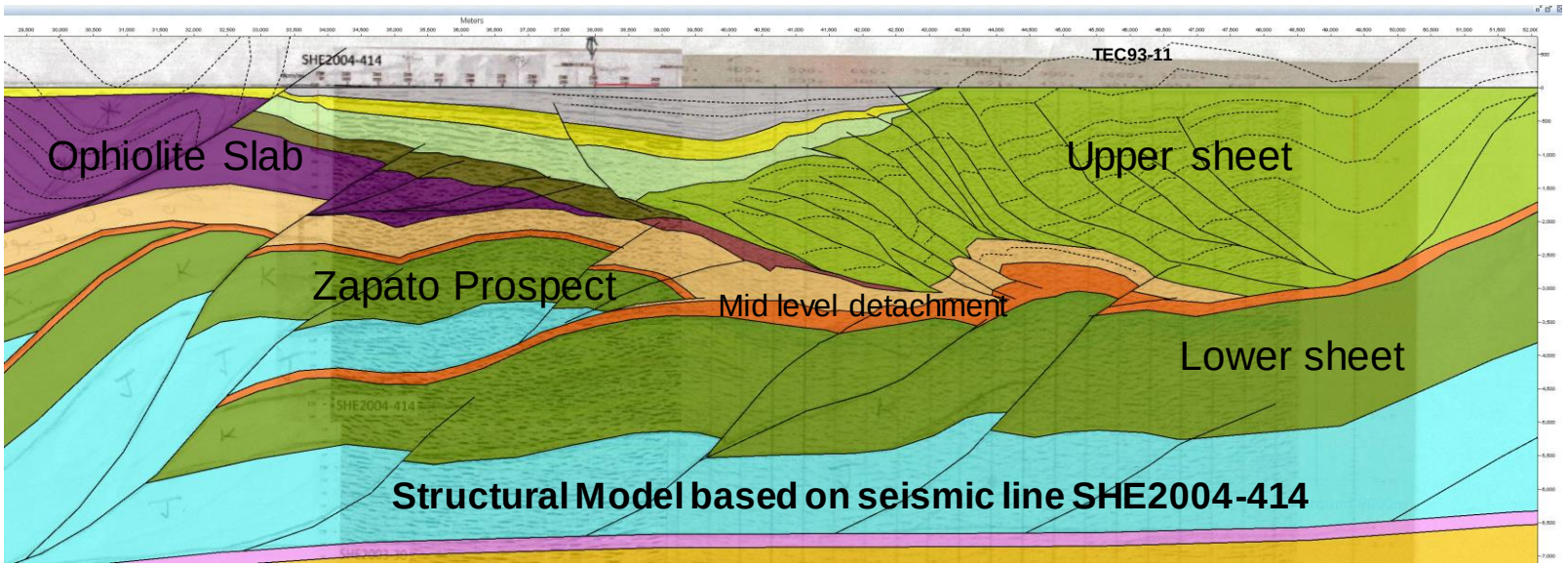
Objectives : Potential Fields Study

To establish the Gravity and Magnetic signatures of the Ophiolites seen in outcrop and model their extent and form at depth in the Zapato prospect setting

- Determine the Gravity and Magnetic signatures (densities and magnetic susceptibilities) of the Ophiolite Bodies seen in outcrop throughout the region – do they vary?
- What is the composition of the mapped intervals?
- Are the Ophiolite bodies actually erosional remnant synclines on a flat thrust? or are they constantly dipping bodies of significant thicknesses?
- Are some of these intervals under the leading edge Ophiolite actually syntectonic breccias of ophiolitic debris rather than carbonates?
- These differences are really important –Impacts prospectivity and well planning
- The best model will result from integrating all these data sets to define the ophiolite bodies attitudes/dimensions and geometry most correctly

Zapato Prospect: Seismic Interpretation to Structural Modelling

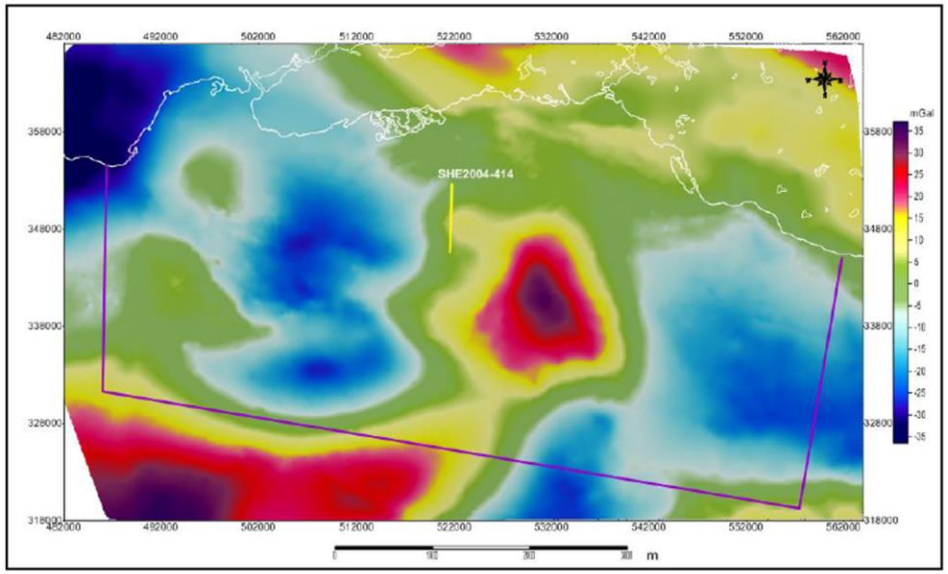
Structural interpretation based on interpreted seismic using dip panel geometries provides the input model



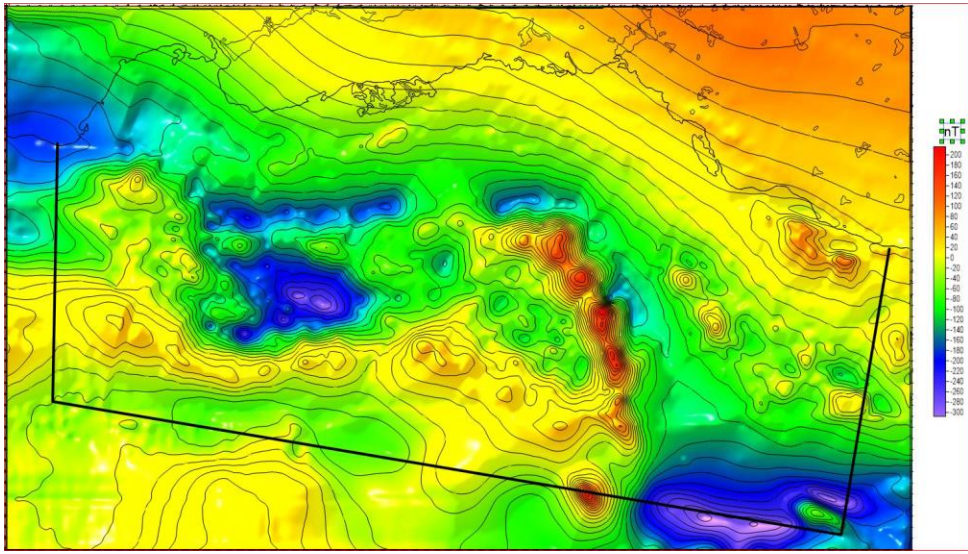
Interpretación interválica litológica / Interval lithological interpretation

Block 9 Potential fields data sets

- Block 9 is covered by numerous potential fields data sets
- Gravity
- Magnetics
- Both airborne and land surveys
- The various surveys have been reprocessed by Ceinpet and merged to provide continuous, high density coverage for both gravity and magnetics response across Block 9



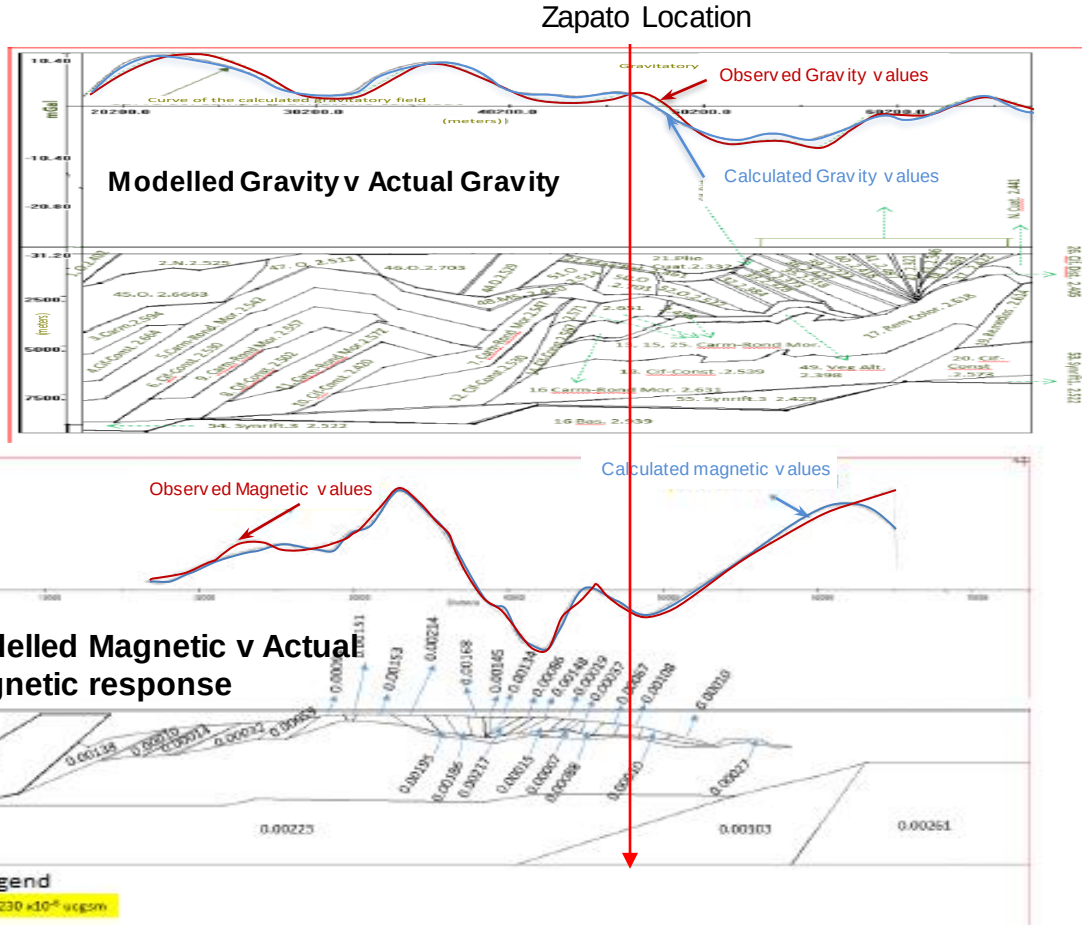
Bouger Gravity map: Results of reprocessing and merging of all existing gravity data for Block 9



Total Magnetic Intensity : The existing Geoterrex aeromag survey has been reprocessed and merged with the Soviet regional north Cuba dataset – now continuous coverage

Regional Potential Fields Modelling – Good Initial Match between Observed and Calculated

- Ceinpet generated modelled gravity and magnetic responses from Melbana's structural model, using known density and susceptibility data from wells and outcrop
- Result was a very good match between observed and calculated response



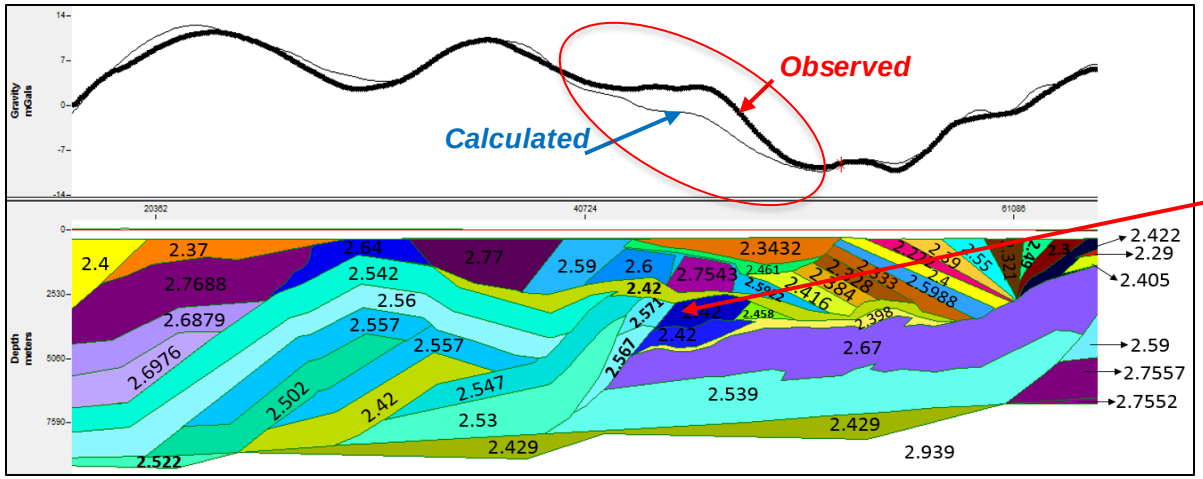
Laboratory Experiment: Sensitivity Tests

Alternative Interpretations for the Zapato Structure

- Numerous alternative scenarios were modelled but none provided a closer match between modelled and actual potential fields response.

Example of sensitivity test: replace Zapato target lithology (carbonate) with ophiolitic debris

- Results in a significant mismatch between observed and calculated gravity

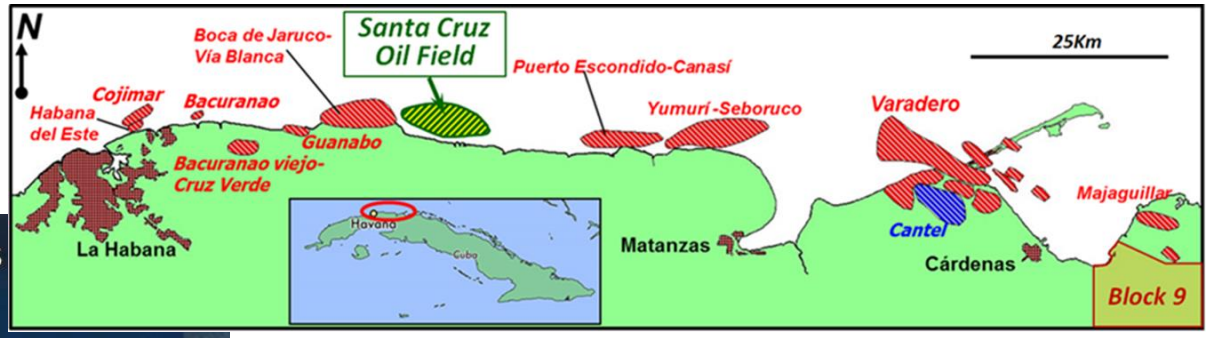


Sensitivity test: change Zapato target from carbonate to ophiolitic debris

These tests increase the confidence in the base case interpretation hypotheses.

1. that the Zapato prospective target is composed of carbonates.
2. that the ophiolite slab has a flat faulted base and is a finite thickness

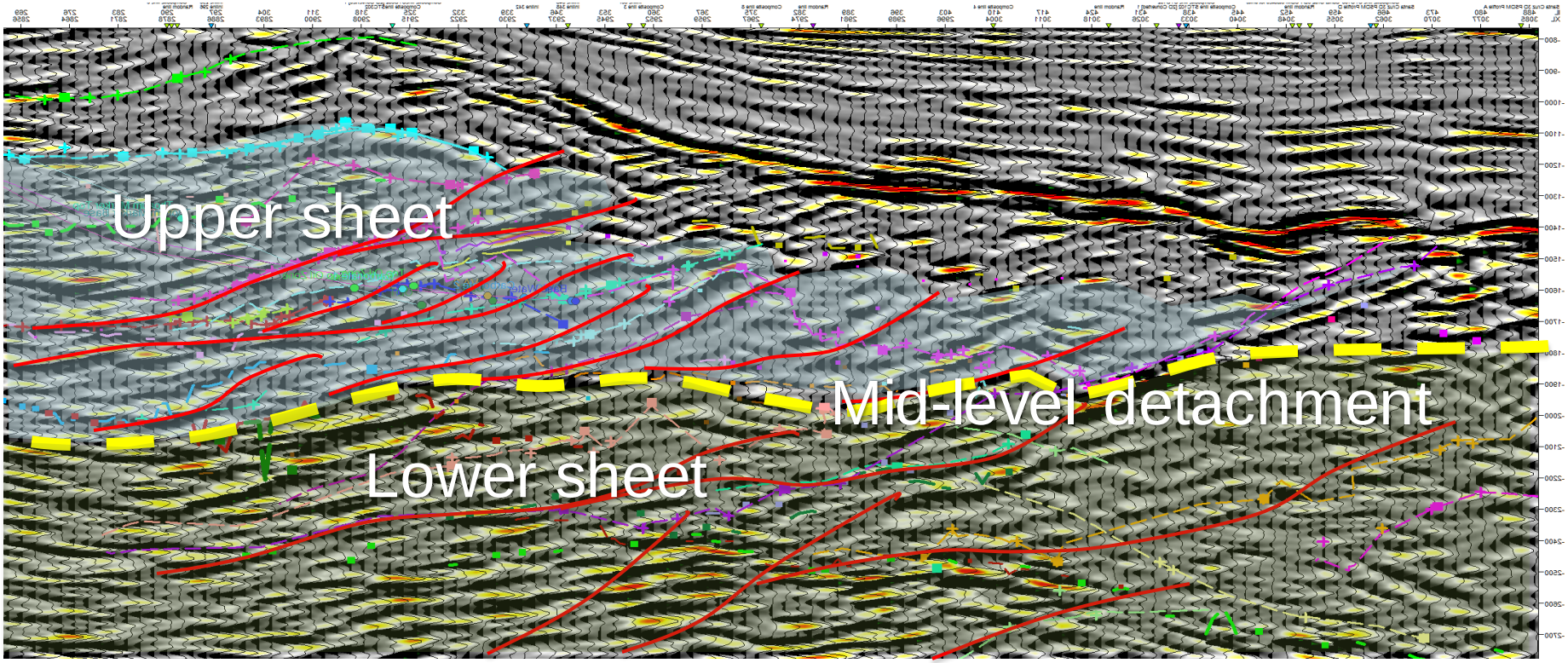
Cuba, Santa Cruz – Incremental Oil Contract



- Part of Cuba's northern fold belt which continues into Block 9
- Discovered in 2004; initially tested at 1,250 barrels per day, oil quality 10 – 22° API
- Initial estimates 100 million barrels of recoverable oil
- By 2012, production rate 1,600bpd, total production 7.4 million barrels from 18 wells
- CubaPetroleo recently announced significant discovery of lighter than typical oil at Bacuranao
- Melbana and CubaPetroleo Incremental Oil Recovery (IOR) contract finalised (subject to Cuban regulatory approvals)
  - Multiple phases, initial study period then optional implementation phase
- Melbana project team formed, structural integration, facilities review and initial reservoir engineering study completed

Santa Cruz 3D and wells : a blind test of the Block 9 structural hypothesis – confirmation of the model

- Block 9 structural model now used as a blind test at Santa Cruz field
- Santa Cruz is an independent dataset where 3D seismic exists in a different region from where the structural hypotheses was created
- Main elements are observed to be present at Santa Cruz:
  - upper and lower duplex sheets with internal thrusting
  - A mid level detachment separates the sheets and can be seen clearly
- This is encouraging for the ultimate resource potential in the Santa Cruz field and vicinity



Conclusions

- The Tectonic and Structural Model developed by Melbana in 2017 has been tested by forward modelling and comparing to recorded potential fields data and by application to a independent dataset at Santa Cruz
- Thus the initial structural model is a plausible solution to the complex structural problem seen at Block 9
- Zapato prospect – a fault bend fold proposed under the leading edge of an Ophiolite slab, when forward modelled provides the best match with potential fields data as a deep sheet carbonate duplex under a relatively thin body of ophiolite and associated debris.
- Several alternative scenarios and sensitivities were considered and tested
- Conclusion - the initial structural model best matched the field data
- The structural model was then applied at Santa Cruz where 3D seismic and multiple wells provided a blind test of the structural concepts and the initial results suggest the model provides a good explanation of the observations on the dataset