The structural position of the Lolotoi Metamorphic Complex

Acknowledgements

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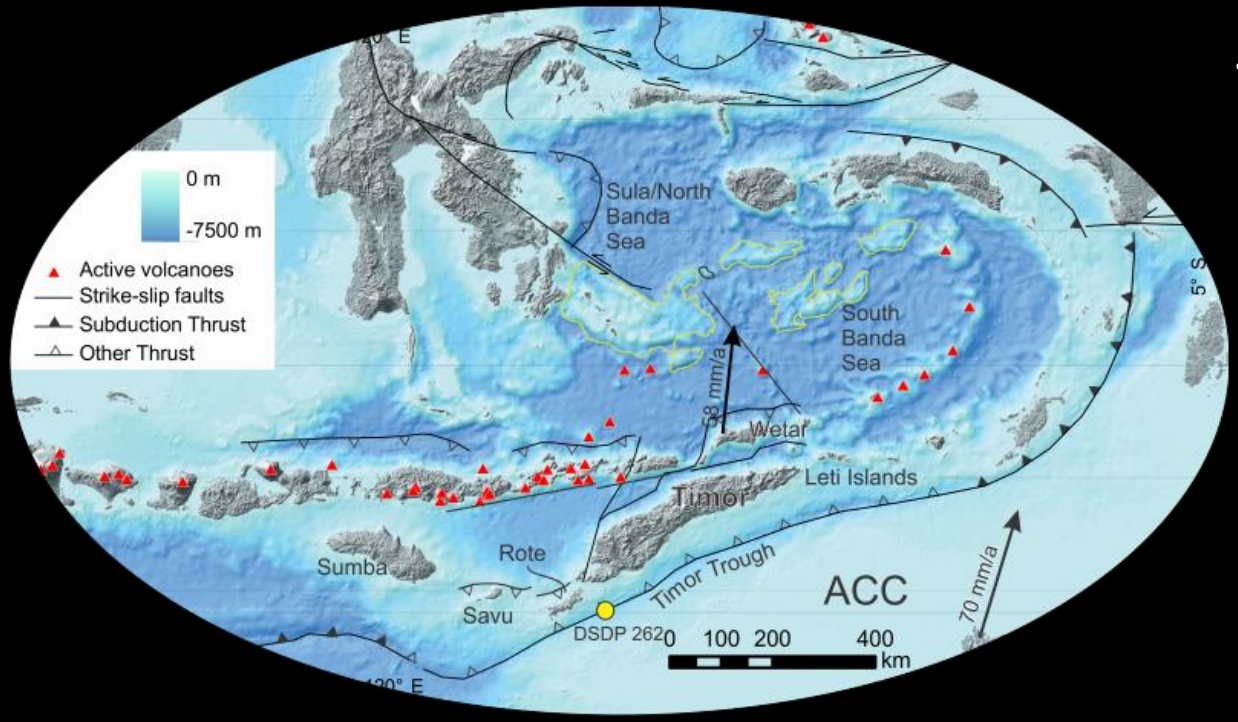
- University of Canterbury – Louise, Kari
- International – Ron Harris, Douwe van Hinsbergen
- Many others!

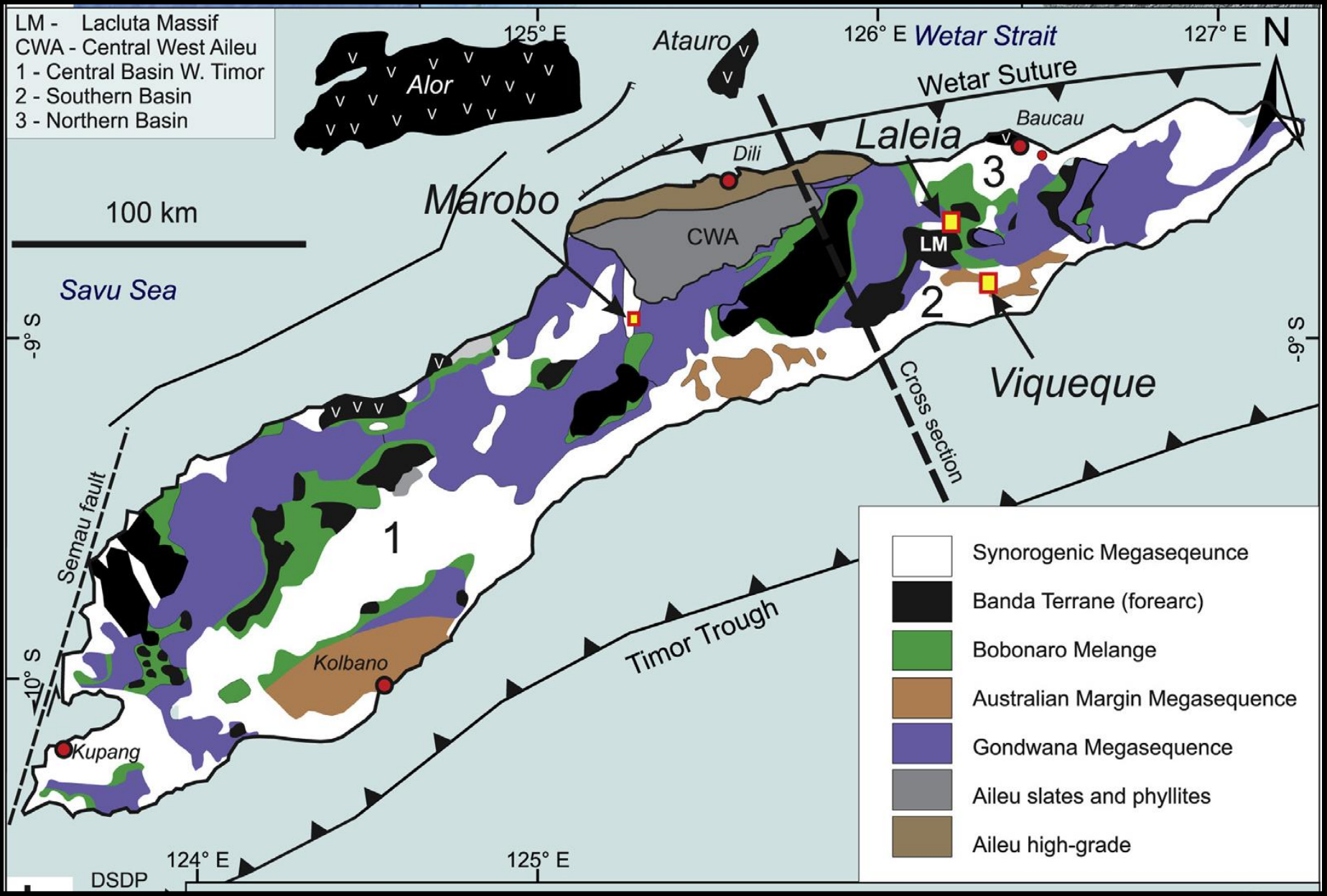
Rough outline

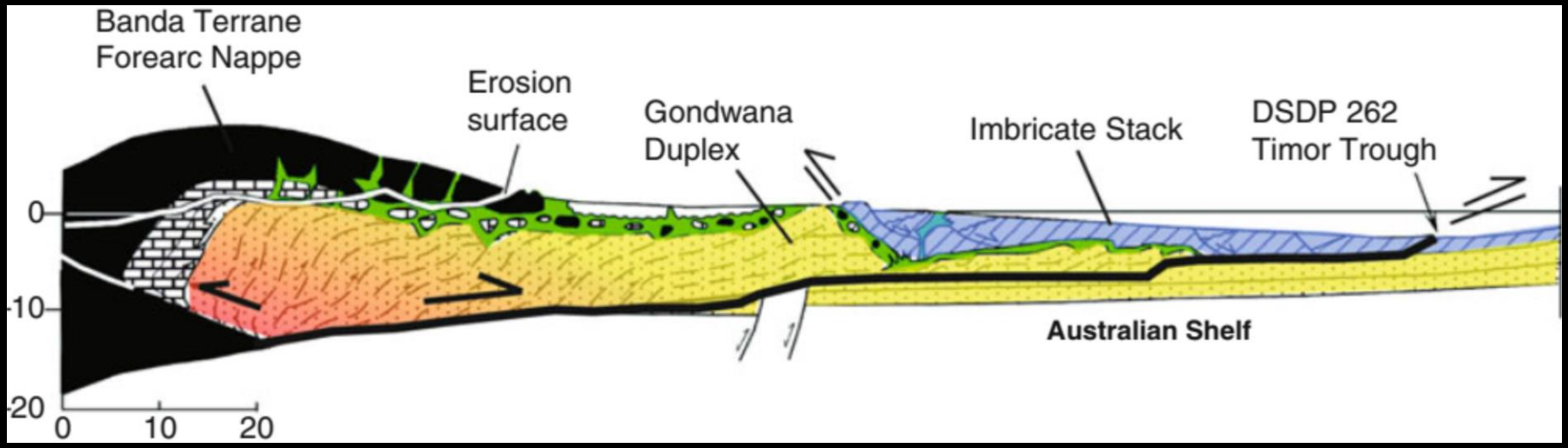
- Location and background
- Synorogenic rocks
- Source area of synorogenic rocks
- Structural style in the south of the country
- Ideas

The southern Banda Arc

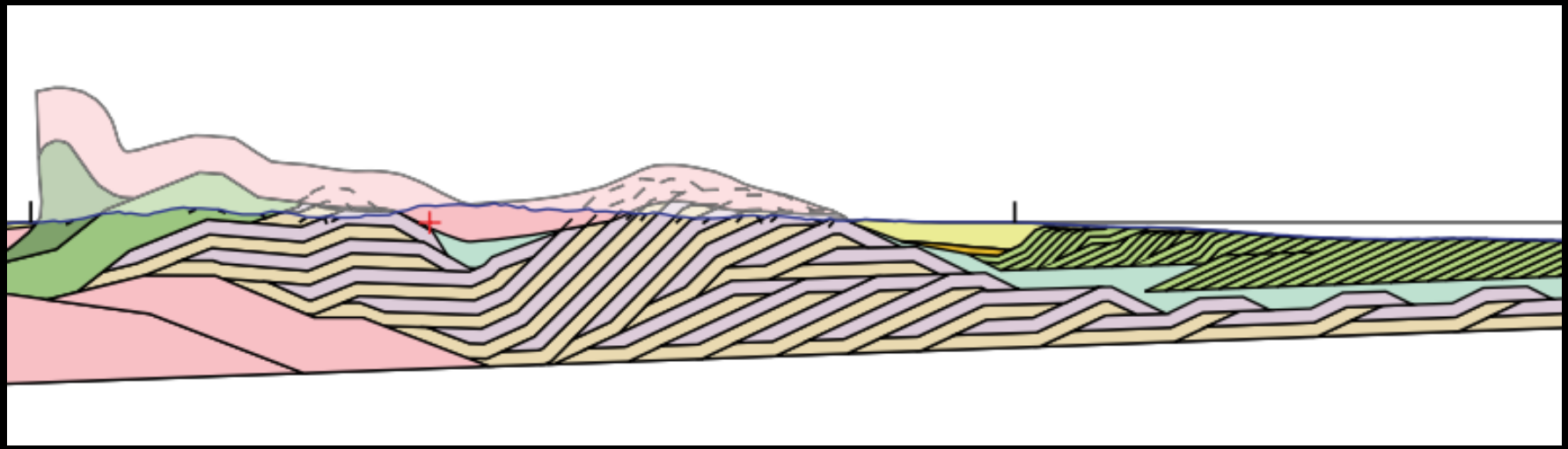


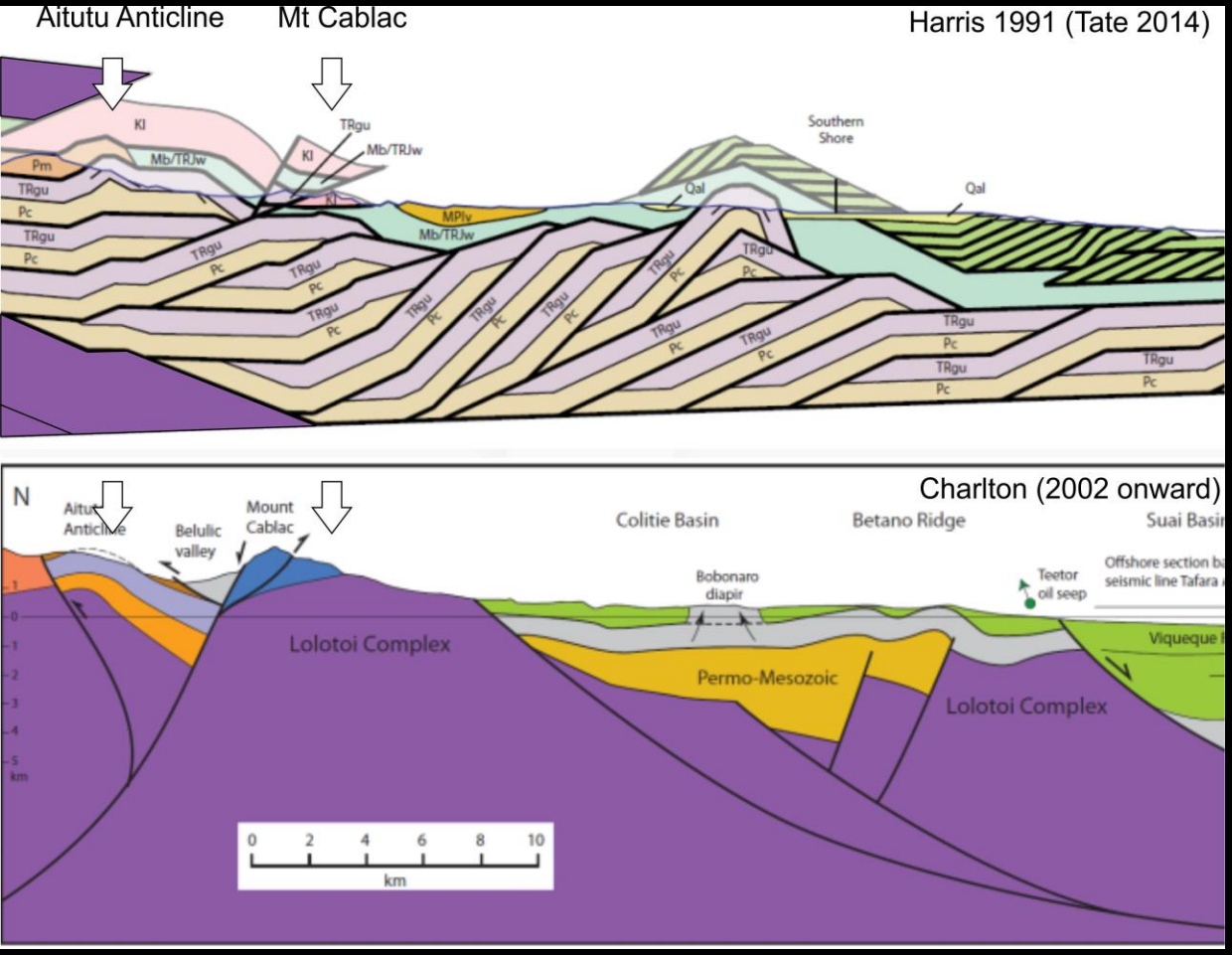
- Extinct arc north of Timor-Leste
- Extensively uplifted outer southern Banda Arc
- Uplifted forearc onshore Sumba, continental basement in the Savu Sea
- Uplifted Australian continental rocks onshore Savu-Rote-Timor
- Seismology and seismic reflection suggests incipient southward subduction


LM - Lacluta Massif
CWA - Central West Aileu
1 - Central Basin W. Timor
2 - Southern Basin
3 - Northern Basin
125° E
126° E
127° E
N
Wetar Strait
Wetar Suture
Atauro
Alor
Baucau
Laleia
Dili
Marobo
100 km
CWA
LM
3
2
1
Savu Sea
-9° S
-9° S
10° S
Viqueque
Cross section
Semau fault
Timor Trough
Kolbano
Kupang
124° E
125° E
DSDP
Synorogenic Megaseqeunce
Banda Terrane (forearc)
Bobonaro Melange
Australian Margin Megasequence
Gondwana Megasequence
Aileu slates and phyllites
Aileu high-grade



The increasingly accepted tectonic model





- Tate et al – A derivative of Harris' 1991 vintage model
  - Lolotoi is overthrust forearc basement
  - Section doesn't account for drilled Lolotoi
- Charlton – asks some important questions
  - Lolotoi = Australian basement
- What is on top and how did it get there?
- Critical for understanding hydrocarbon potential

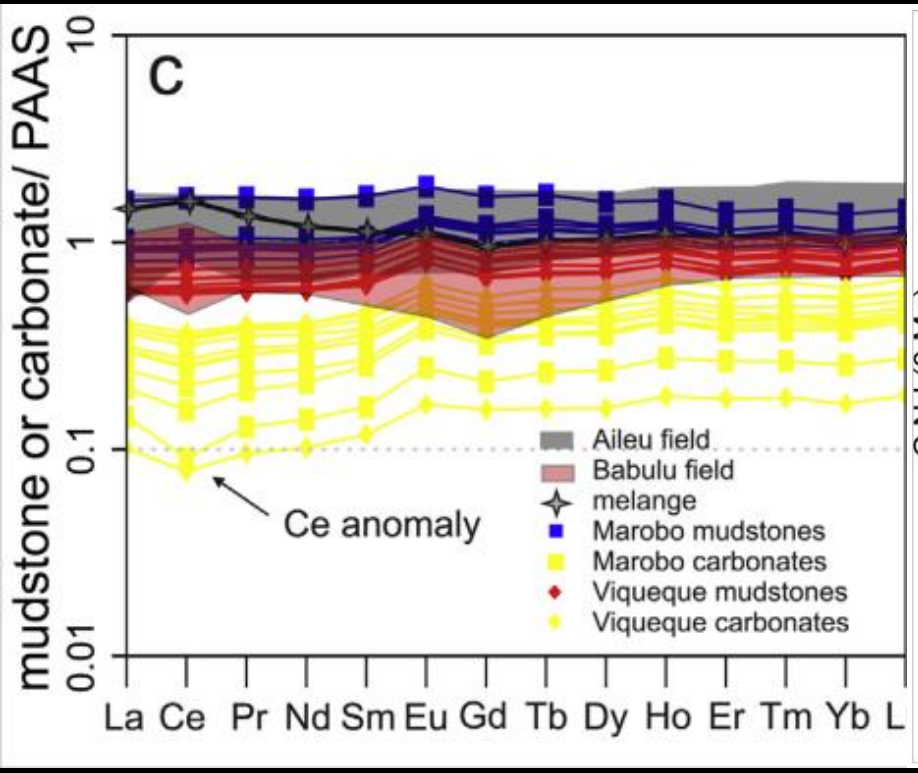
Is there an accepted tectonic model?

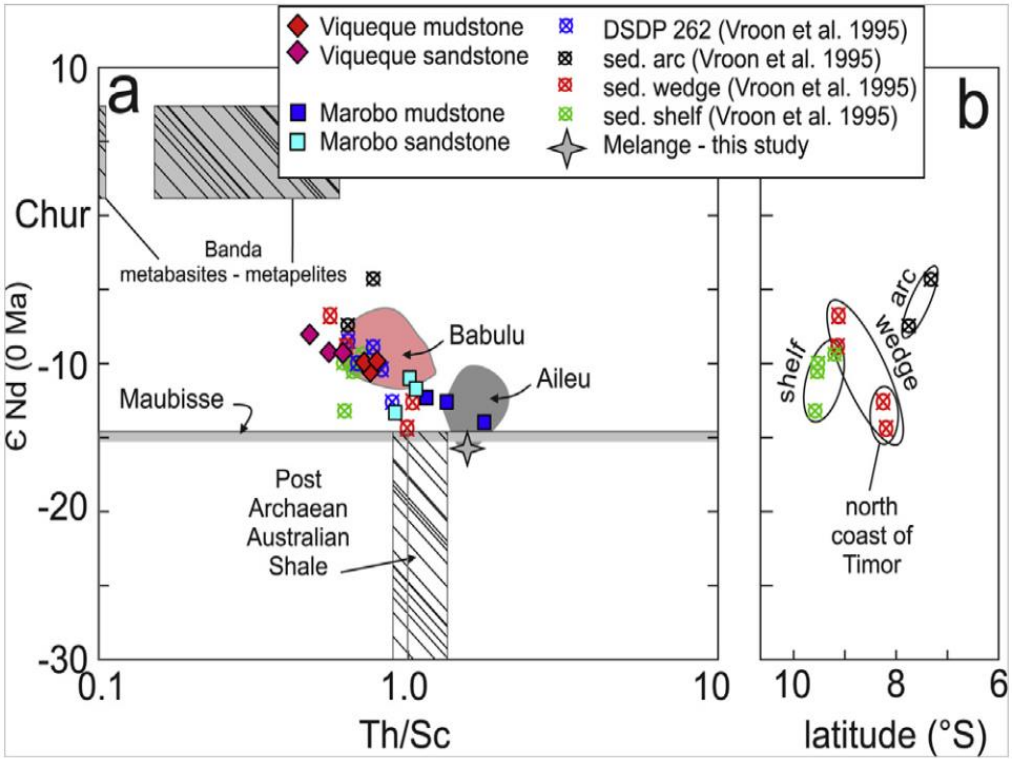
What about out-of-plane movement

- Lolotoi Metamorphic Complex has many features that are not consistent with the Australian Passive Margin – Fossils, igneous events, metamorphism, high and Low temperature thermochronology…

- So, bearing in mind strike slip movement, what is the structural position of the Lolotoi Metamorphic Complex

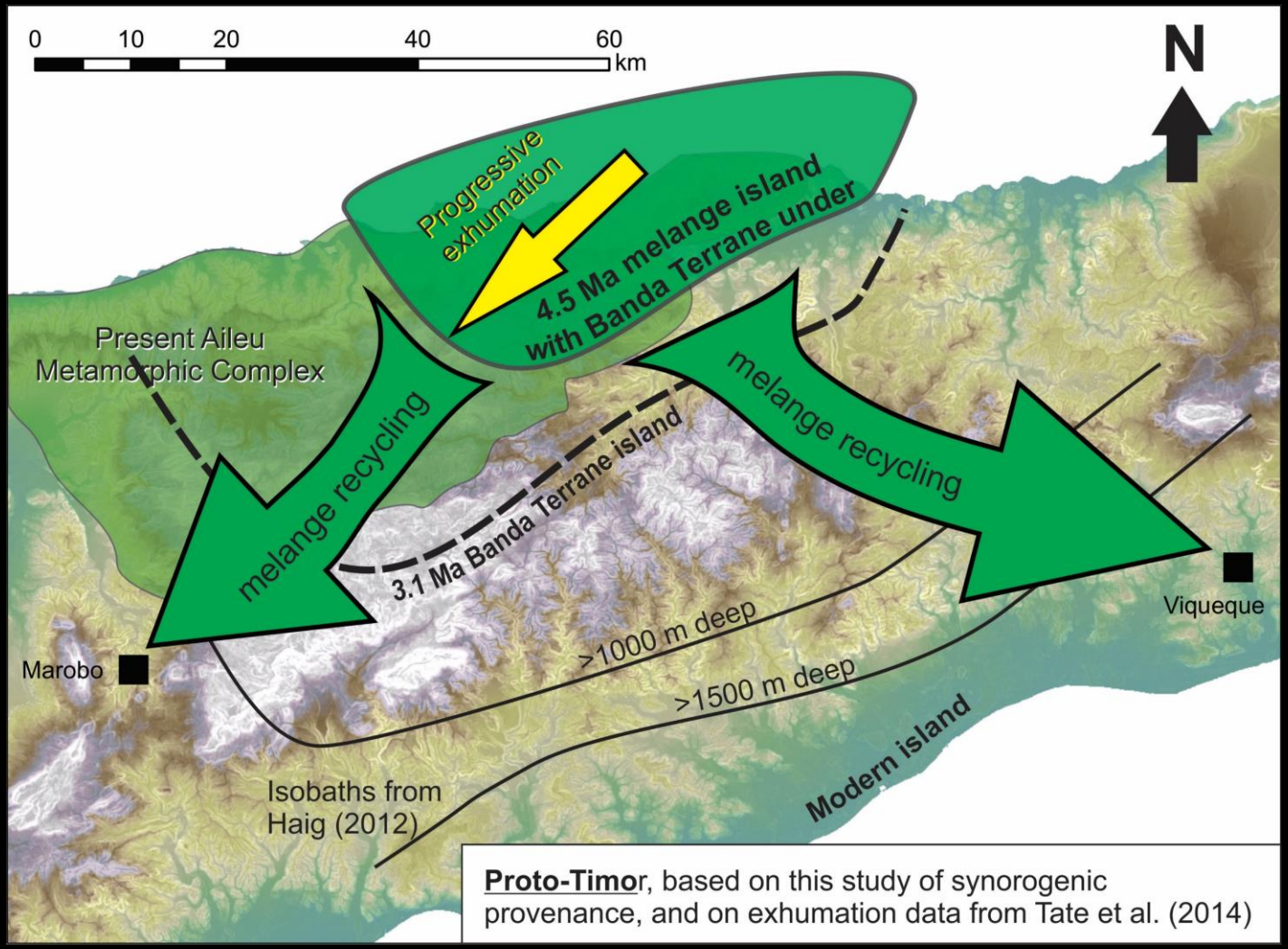
Post Archaean Australian Shale – REE





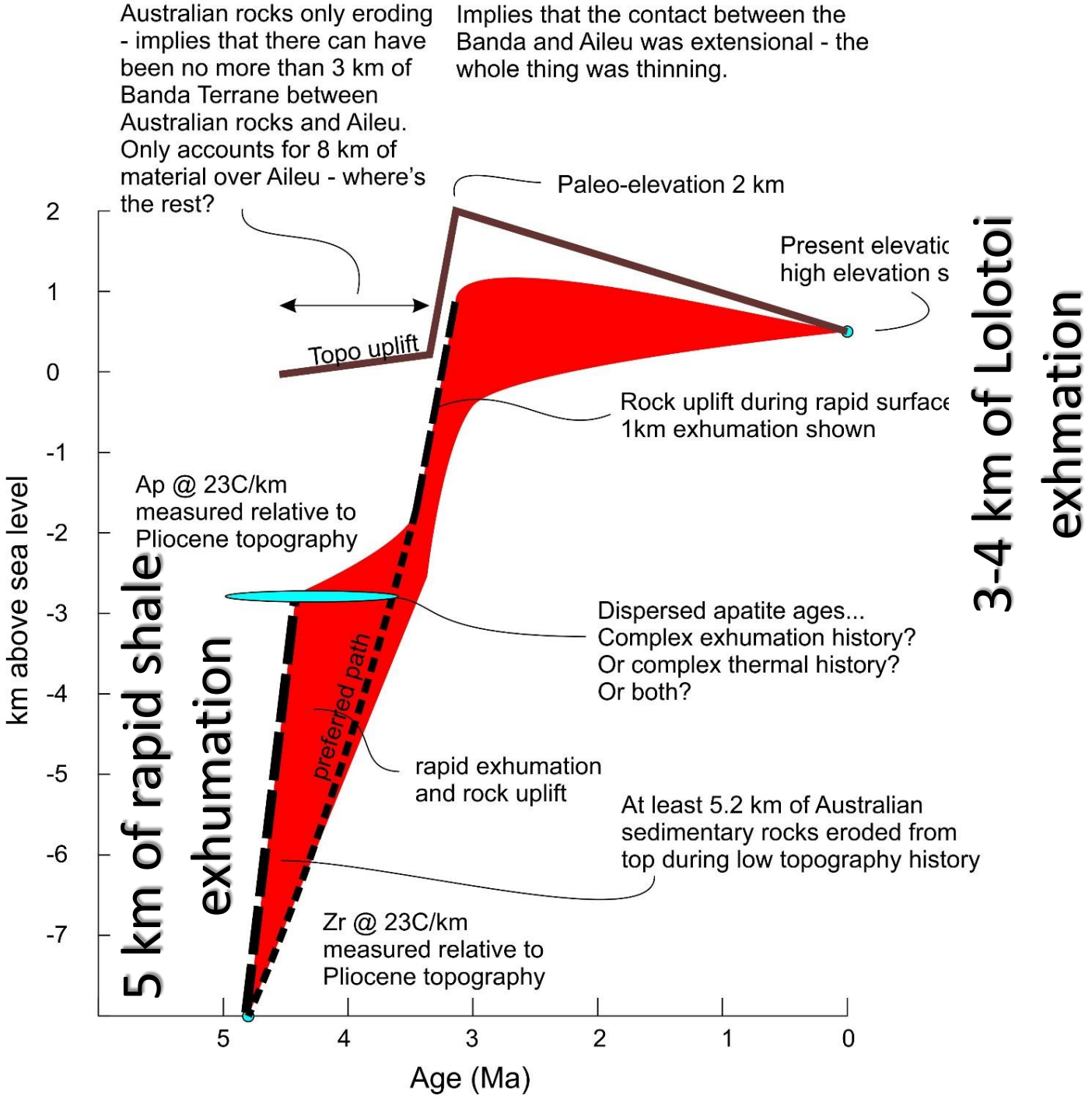
- Early sediment shed into the marly component of the Batu Putih was geochemically similar to Australian shales, not Lolotoi Metamorphics
- REE profiles flat relative to PAAS
- Epsilon Nd trends towards Lolotoi, from shale starting point

Where were the synorogenic sediments coming from



Duffy et al. 2017

What happened in the source area

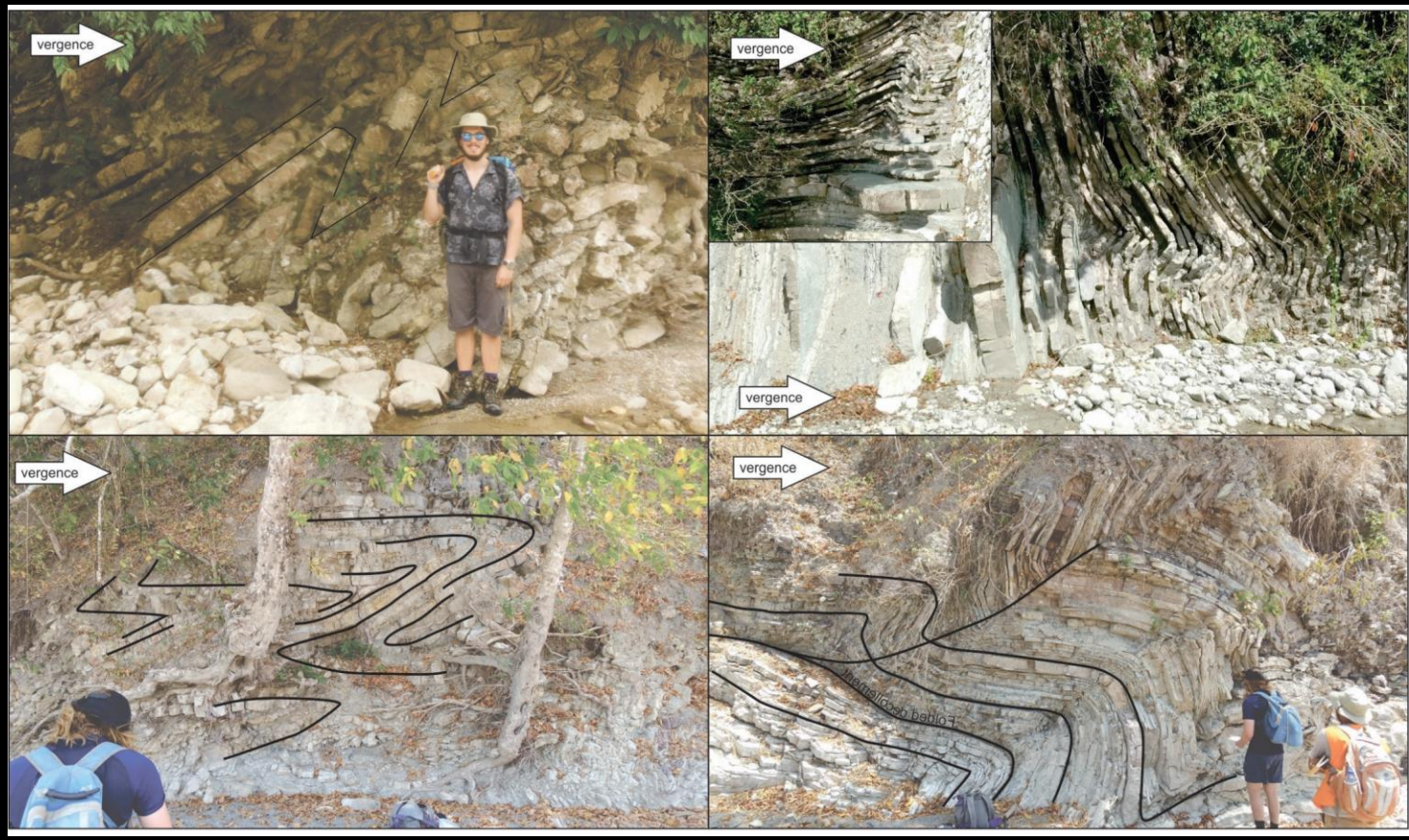


So we all pretty much agree that there are Gondwanan rocks over the top of Lolotoi Metamorphics

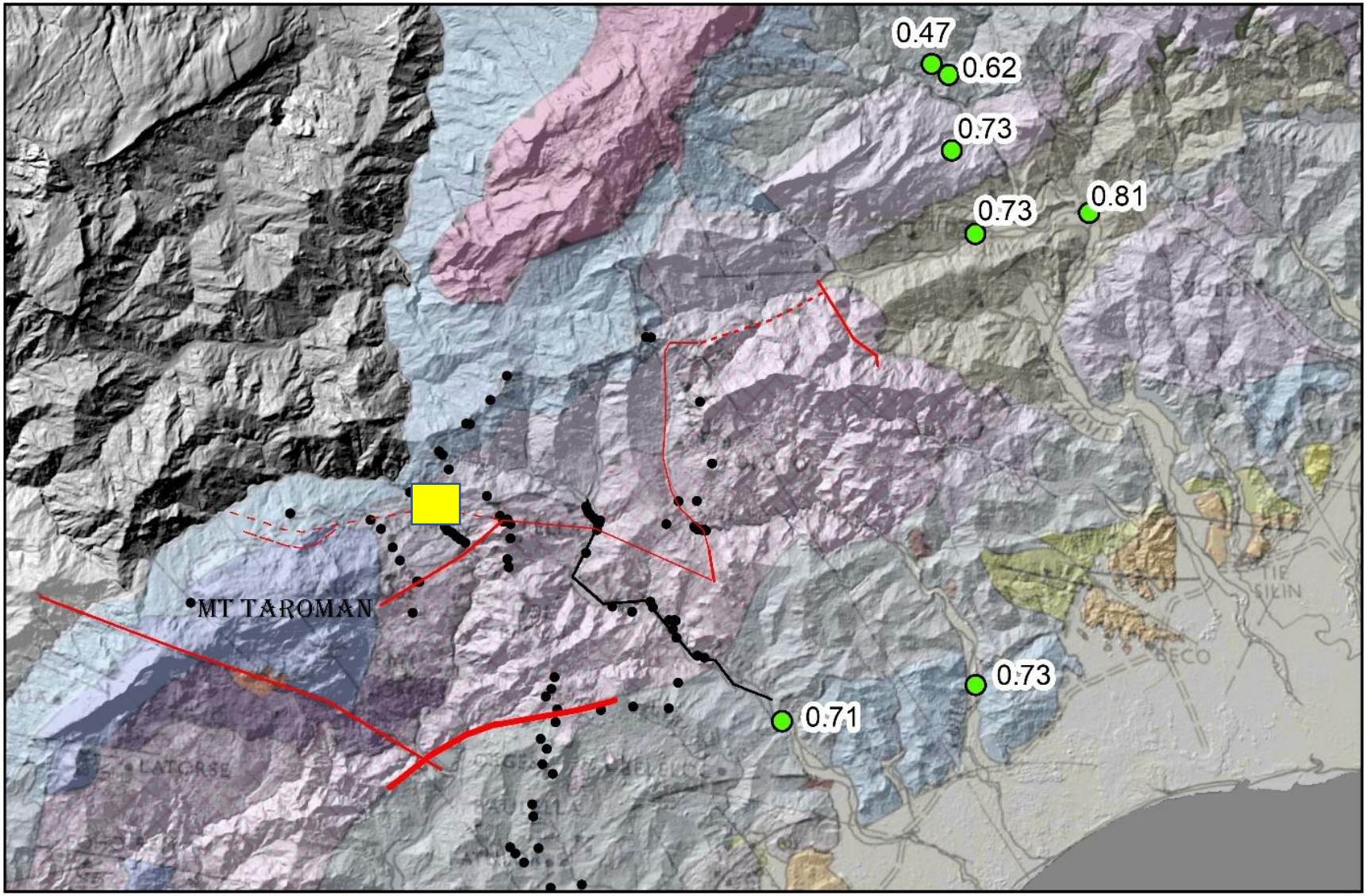
But if that was the case in Laclo, what bits are overthrust?

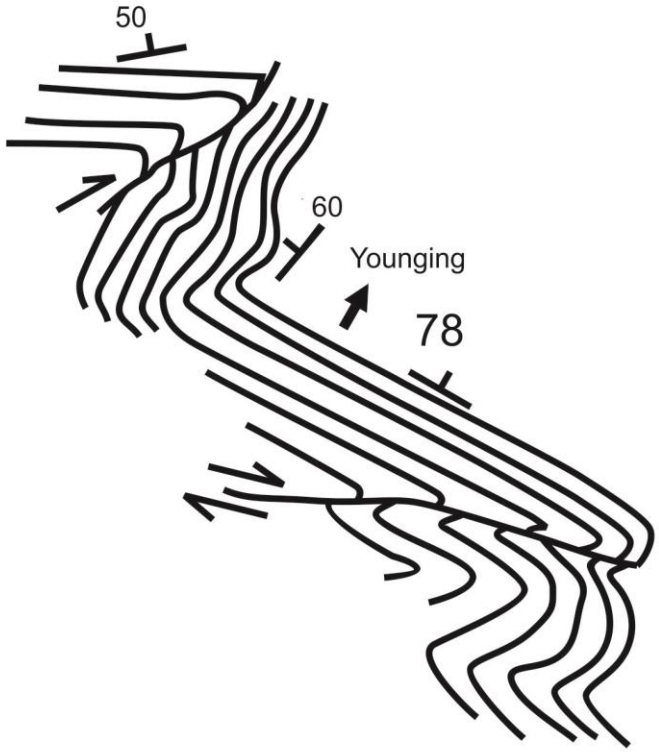
Looking at the Gondwanan rocks that overlie the Lolotoi rocks

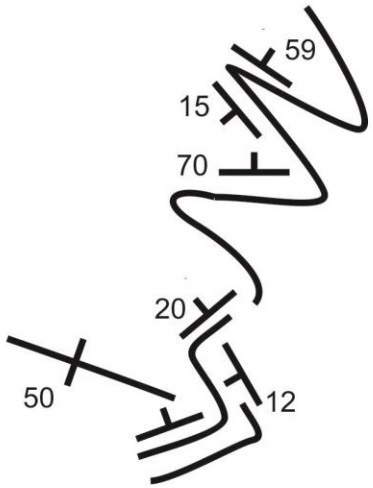
- Lots of north-vergent structure
- At least 2 phases of folding
- 2nd phase is thicker skinned, accentuates some and unfolds others



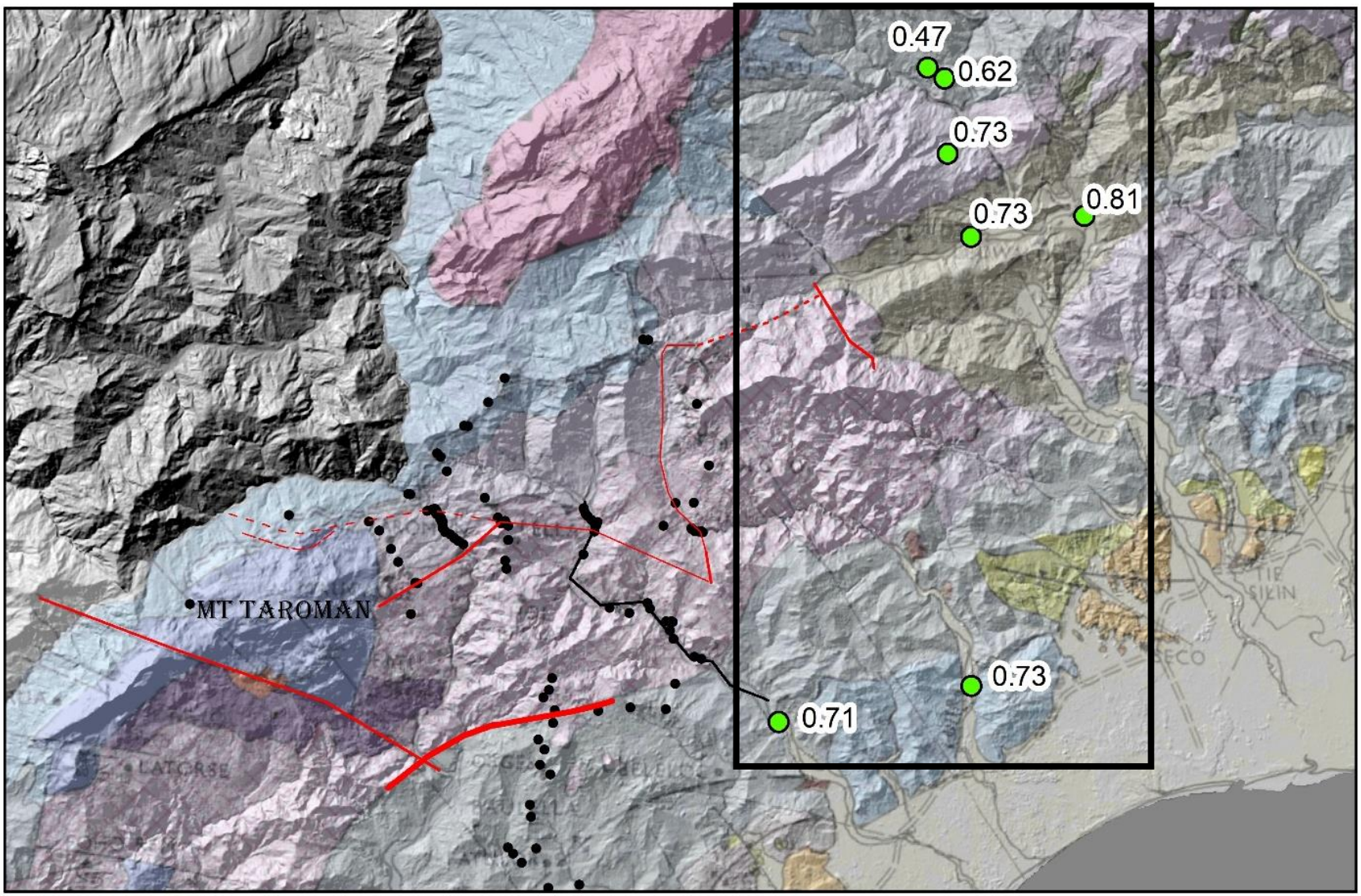
Vitrinite reflectance patterns




50
60
Younging
78

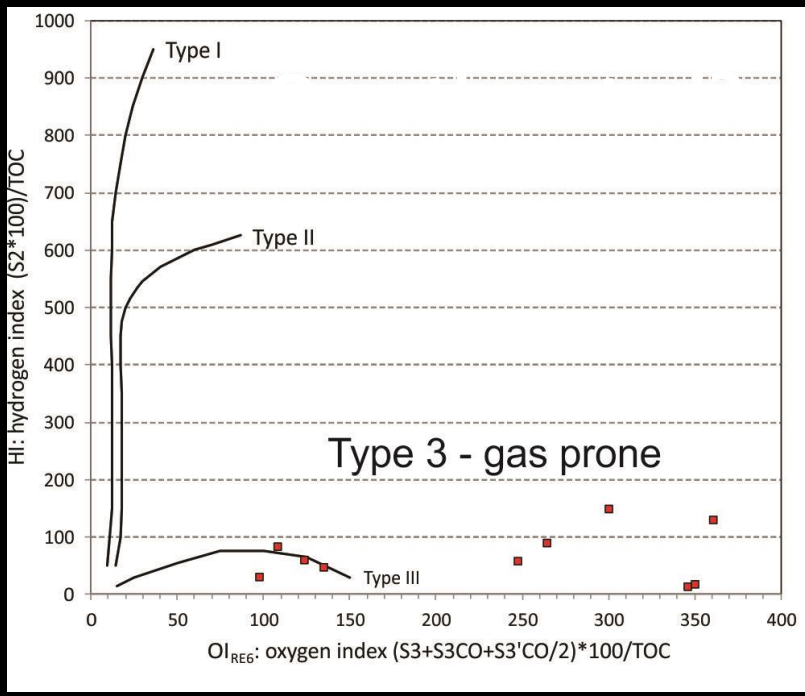

59
15
70
20
50
12

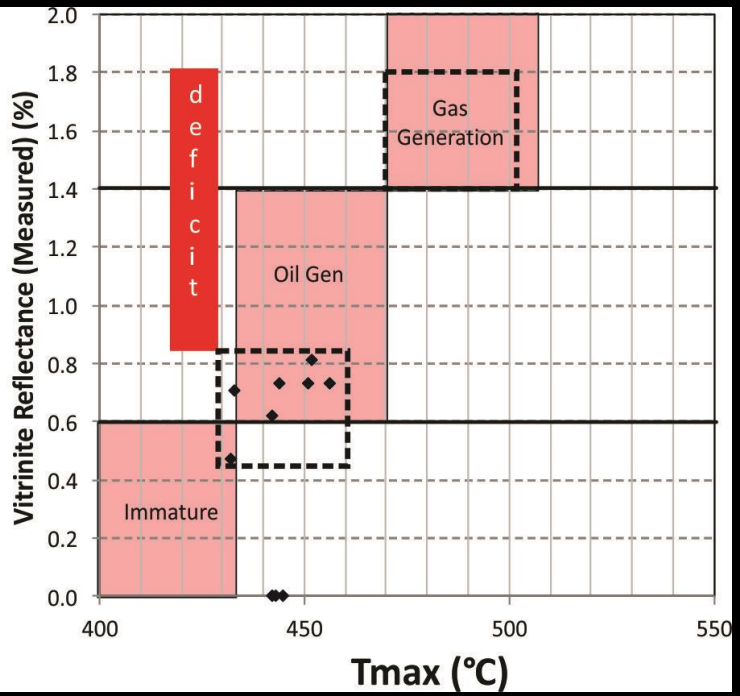
Vitrinite reflectance patterns



Burial of Gondwanan sedimentary rocks

Most rocks are barely lithified, barely in the oil window – and yet there are seeps…

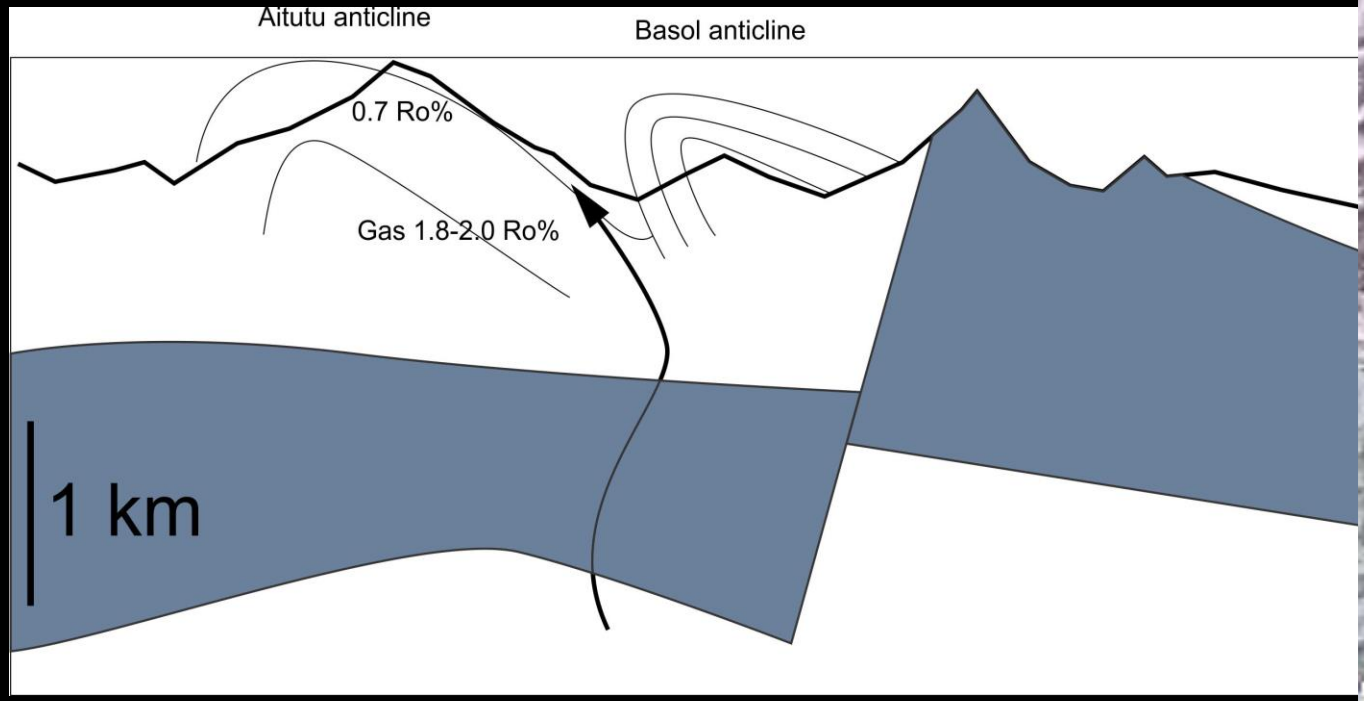


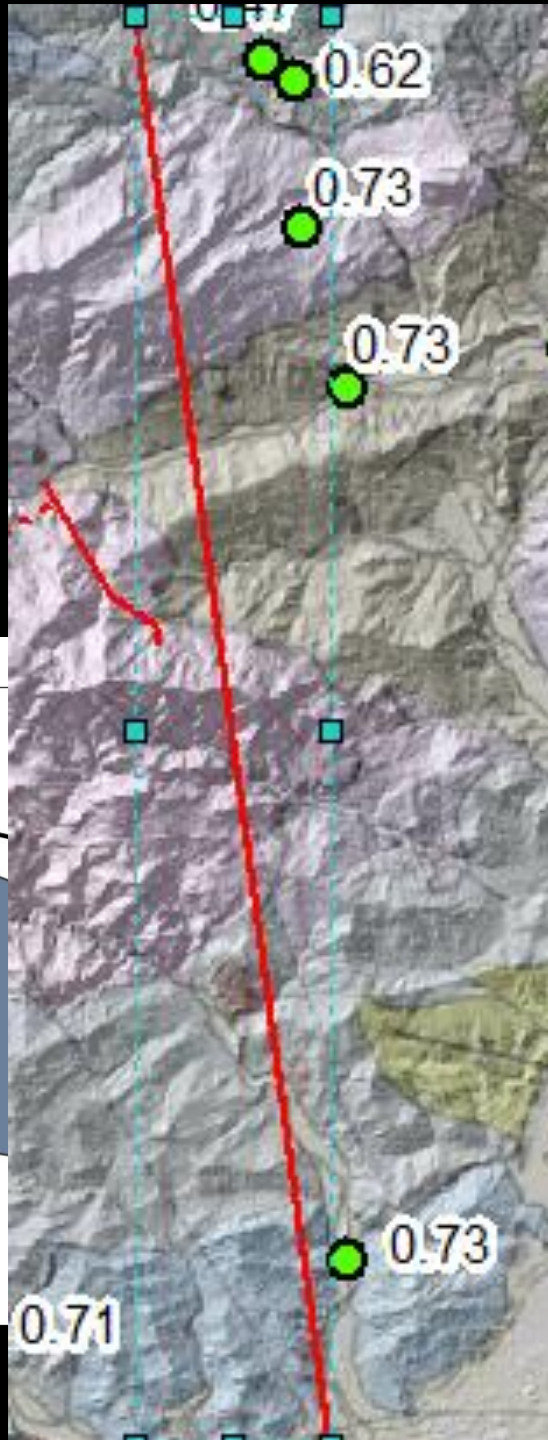


I think this is little more than burial by passive margin and synorogenic sediments

The gas clue

1.8-2 Ro% gas located with 0.4-0.7Ro% outcrop – gas migrating from >4 km depth?





Conclusions

- Vast expanse of Gondwanan rocks that have not had Lolotoi thrust sheet over the top of them
- Extends all the way to north coast….
- Gas is presumably coming from several km depth
- Is it possible that much of the immature sediment is part of the upper plate?
- Possibility for petroleum systems further north?
- Seismic in the Maliana graben, Manatuto?