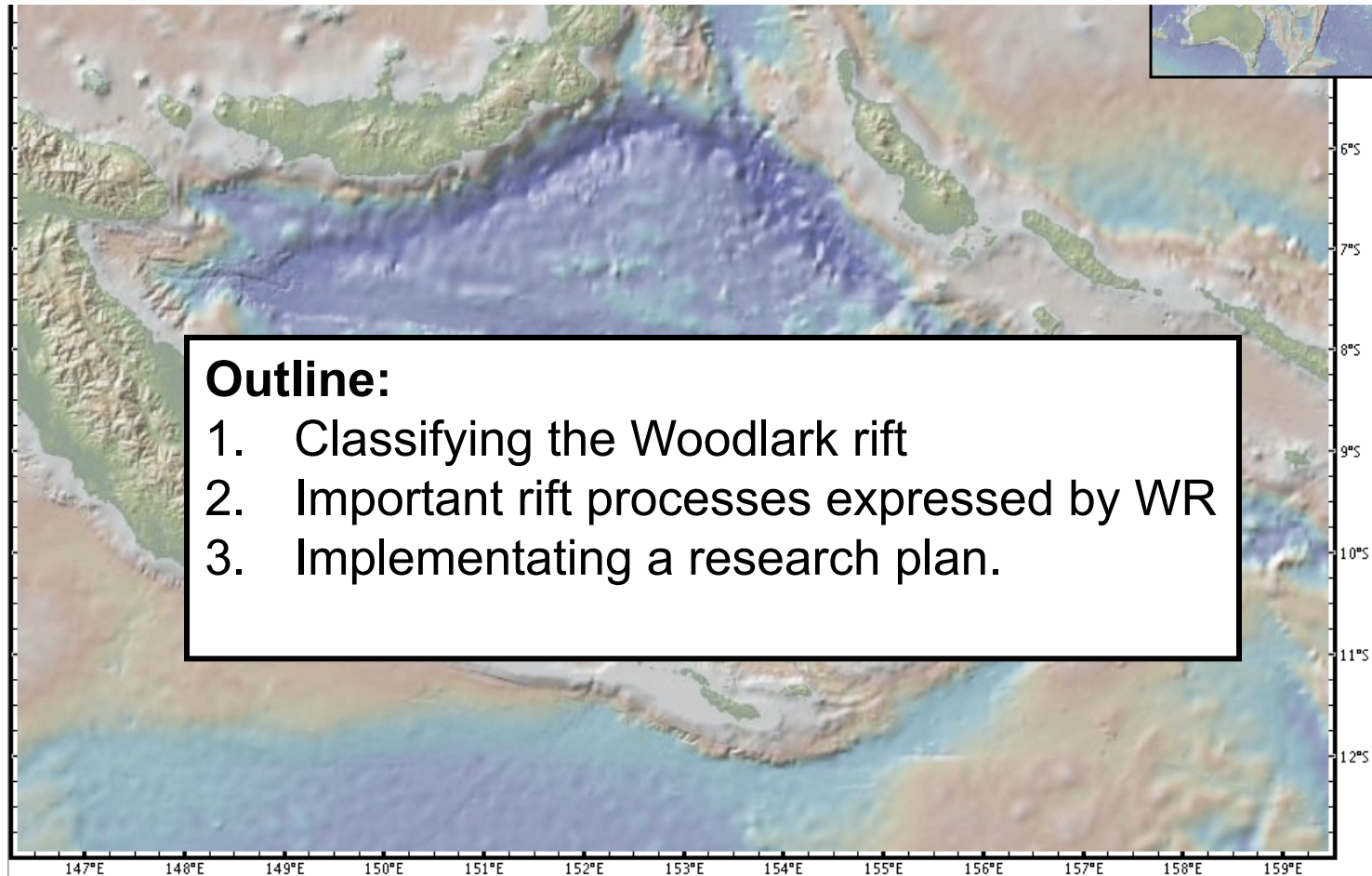


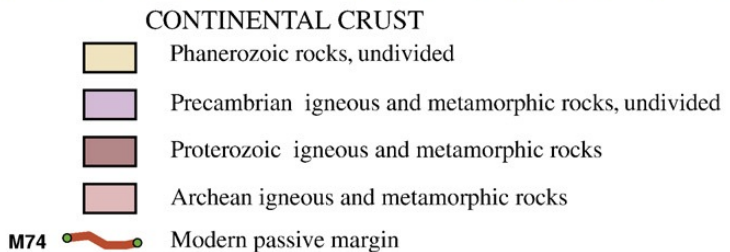
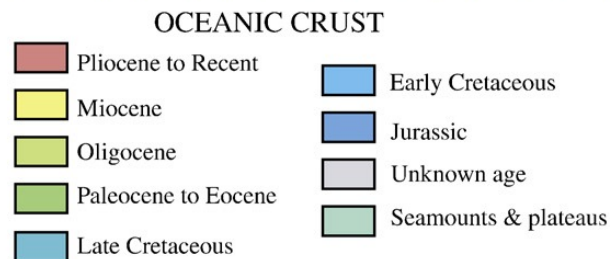
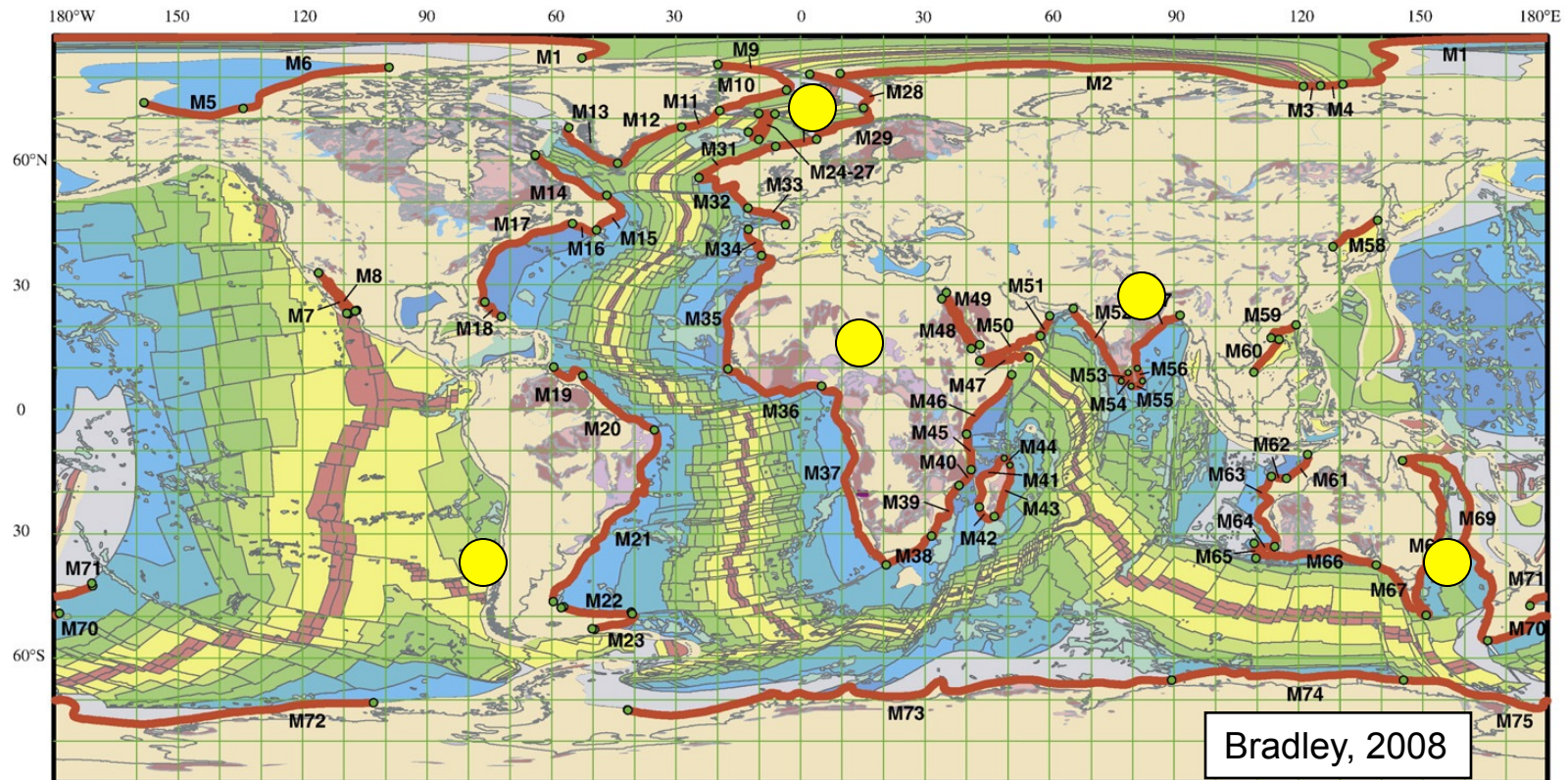
# Woodlark Rifting White Paper

## *Important processes and implementation*

Paul Mann, Suzanne Baldwin, Paul Fitzgerald, Geoff Abers, Jim Gaherty,  
Laura Wallace, Guy Fitz, Nathan Daczko and others



“Dead rifts” front major ocean basins and are deeply buried by 75 modern passive margins (brown lines); intracratonic rifts are either failed rifts (aulacogens) or very slowly evolving ( $>10$  my) and can lack clear driving tectonic forces

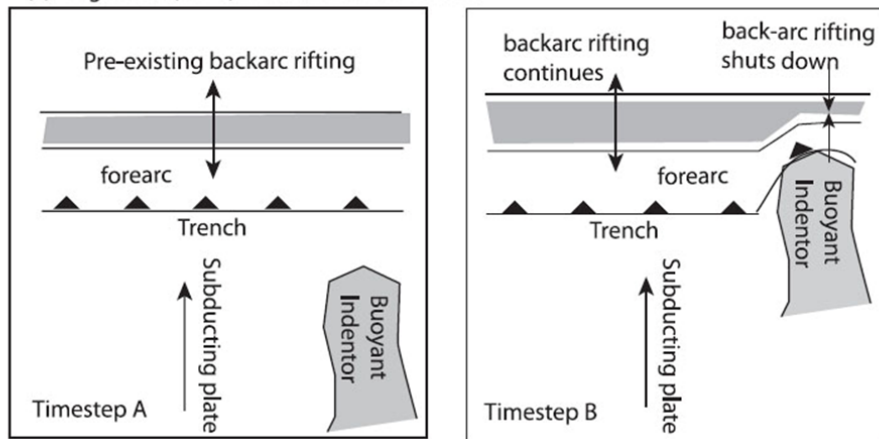




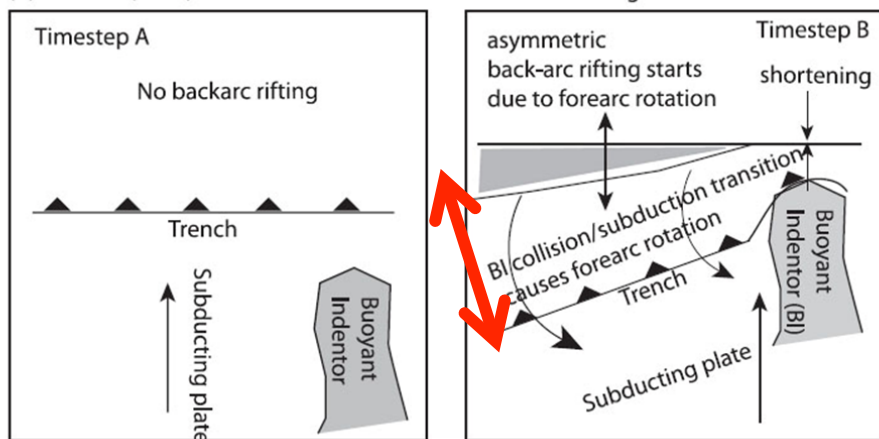
Rifts forming today on active plate margins at fast rates form by 3 processes: ***indent-related, rollback-related, or strike-slip-related***. All three types are more accessible than “dead rifts” beneath passive margins and evolve at faster plate boundary rates than intracratonic rifts

Laura Wallace papers:  
crustal-driven indent process

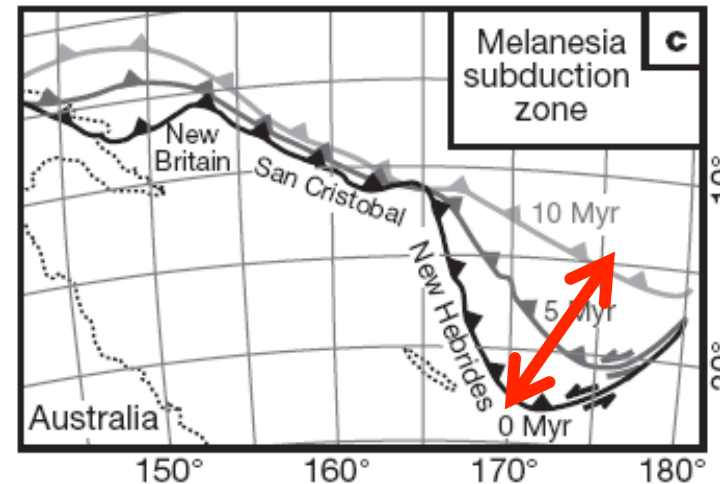
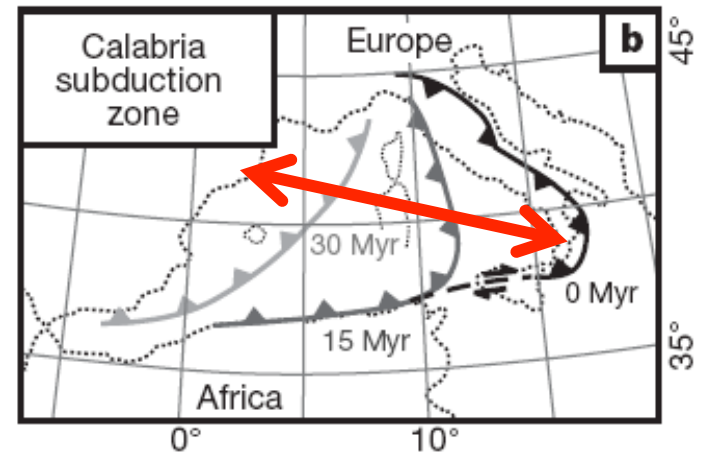
(a) Vogt et al. (1976) model for arc curvature:

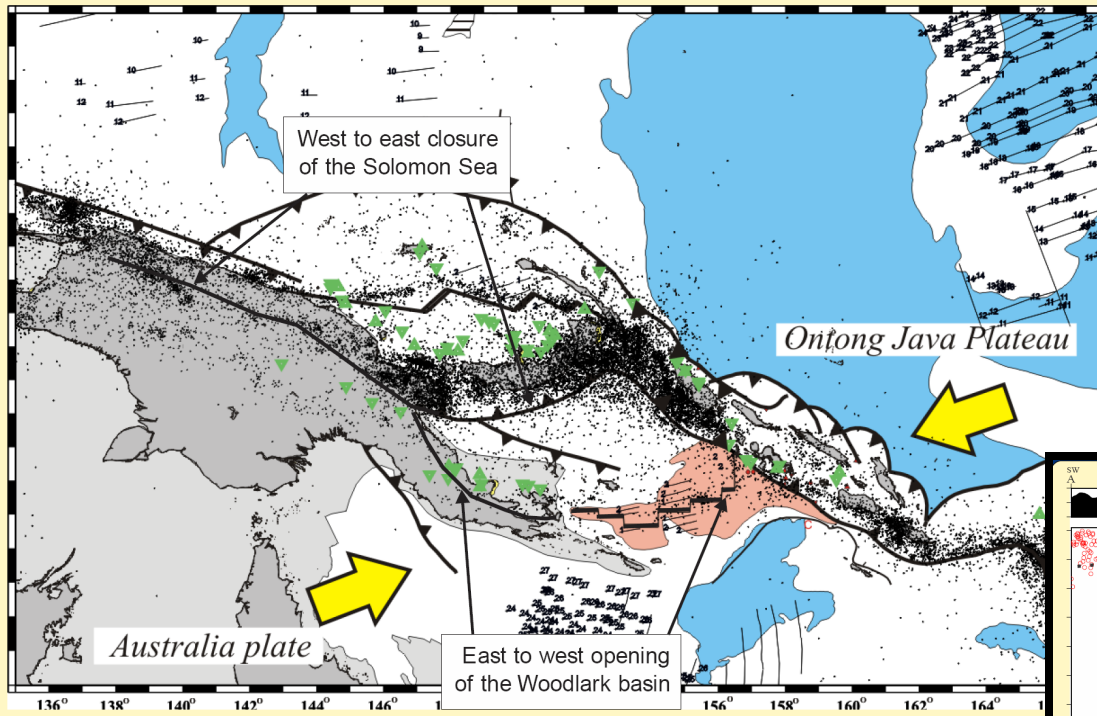


(b) McCabe (1984) model for arc curvature and back-arc rifting:

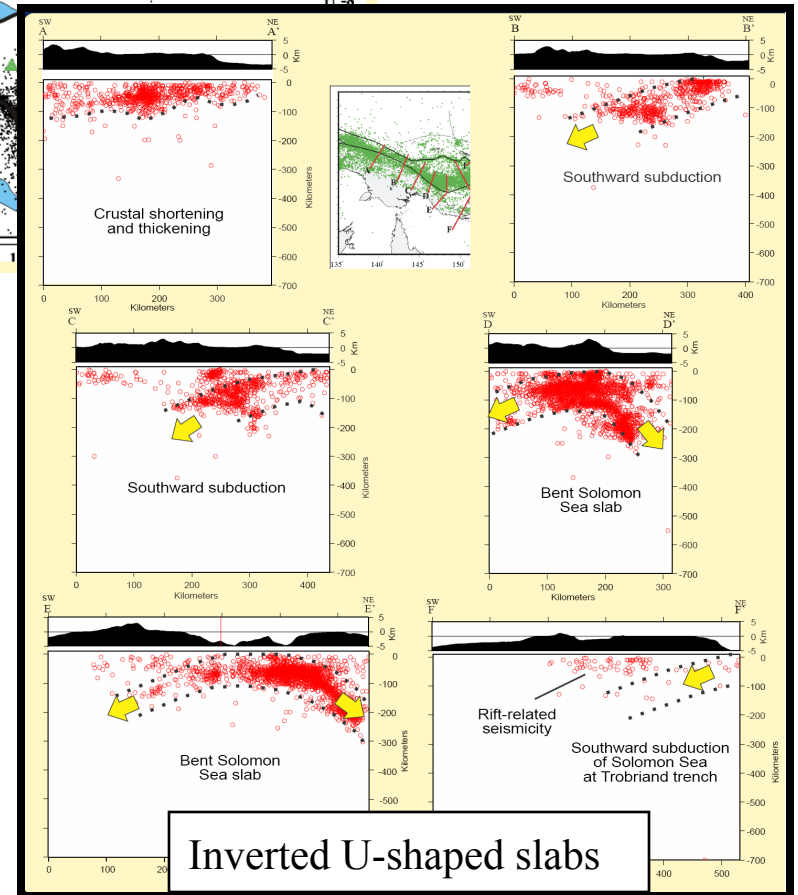


W.P. Schellart papers:  
mantle-based process



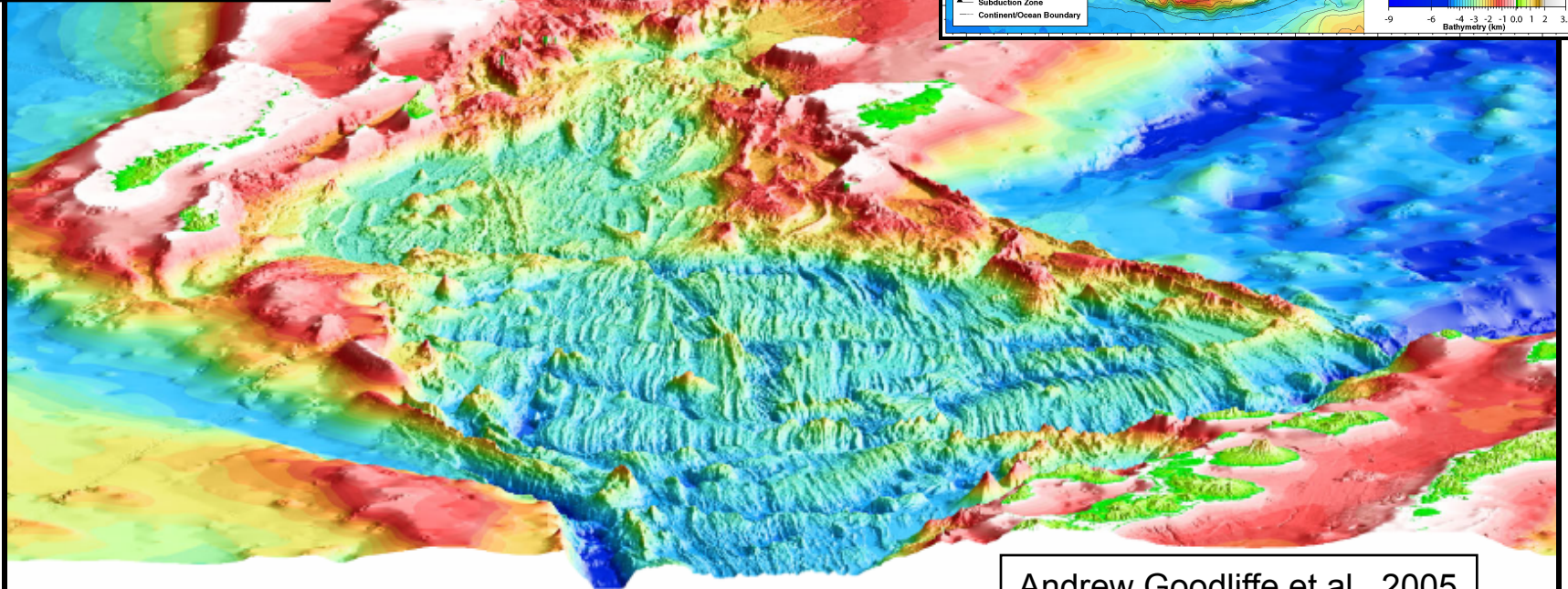
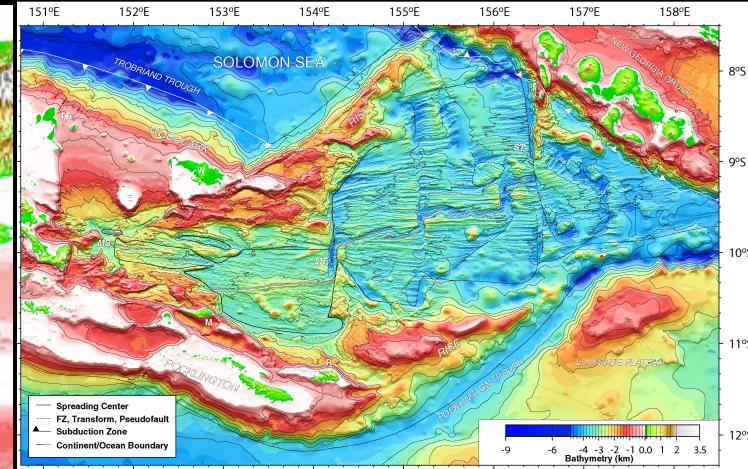
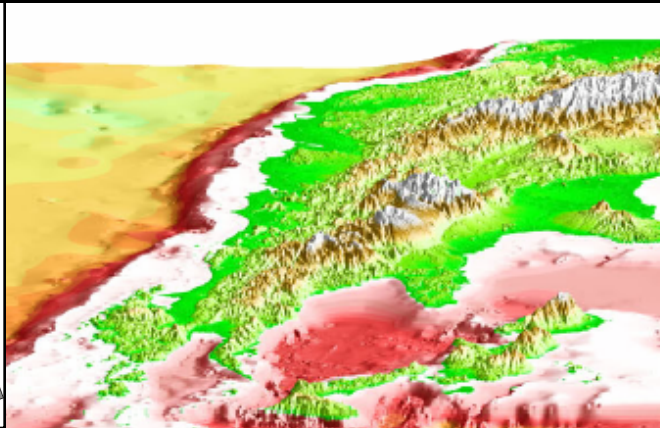
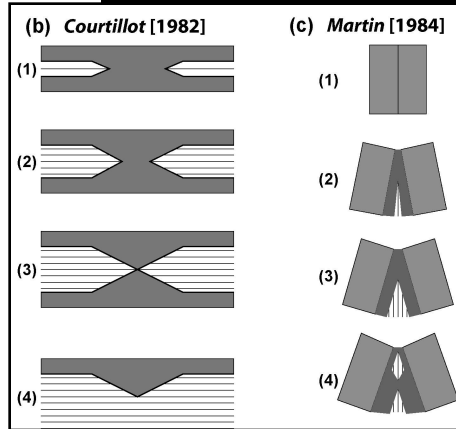


Rifting in Papua New Guinea area is either indent or rollback-related and very rapidly evolving (Australia began colliding with PNG about 30 Ma – middle Oligocene; OJP convergence and Woodlark basin started ~6 Ma, rate of westward propagation of rift tip is 140 km/my.





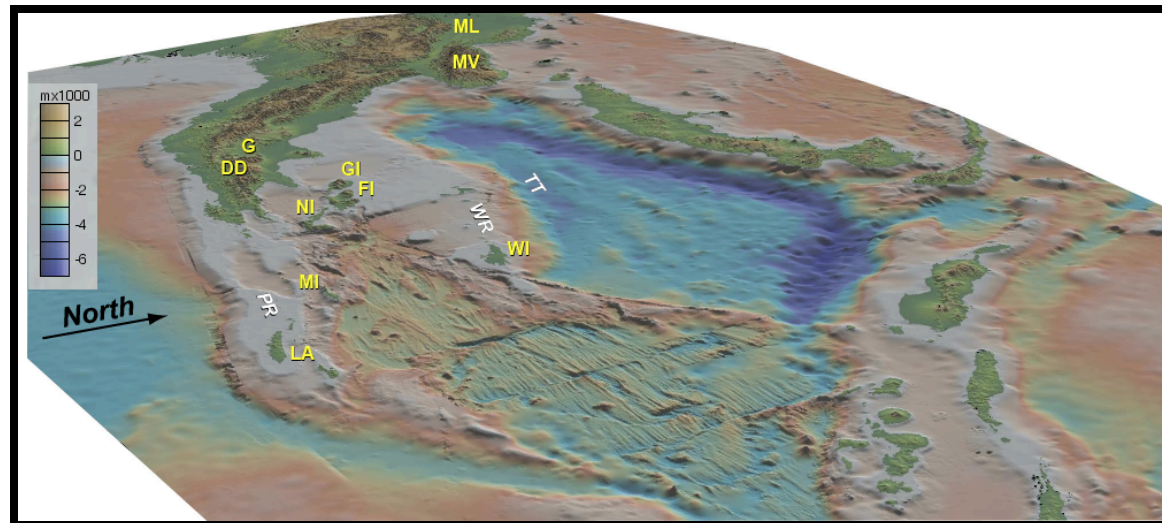
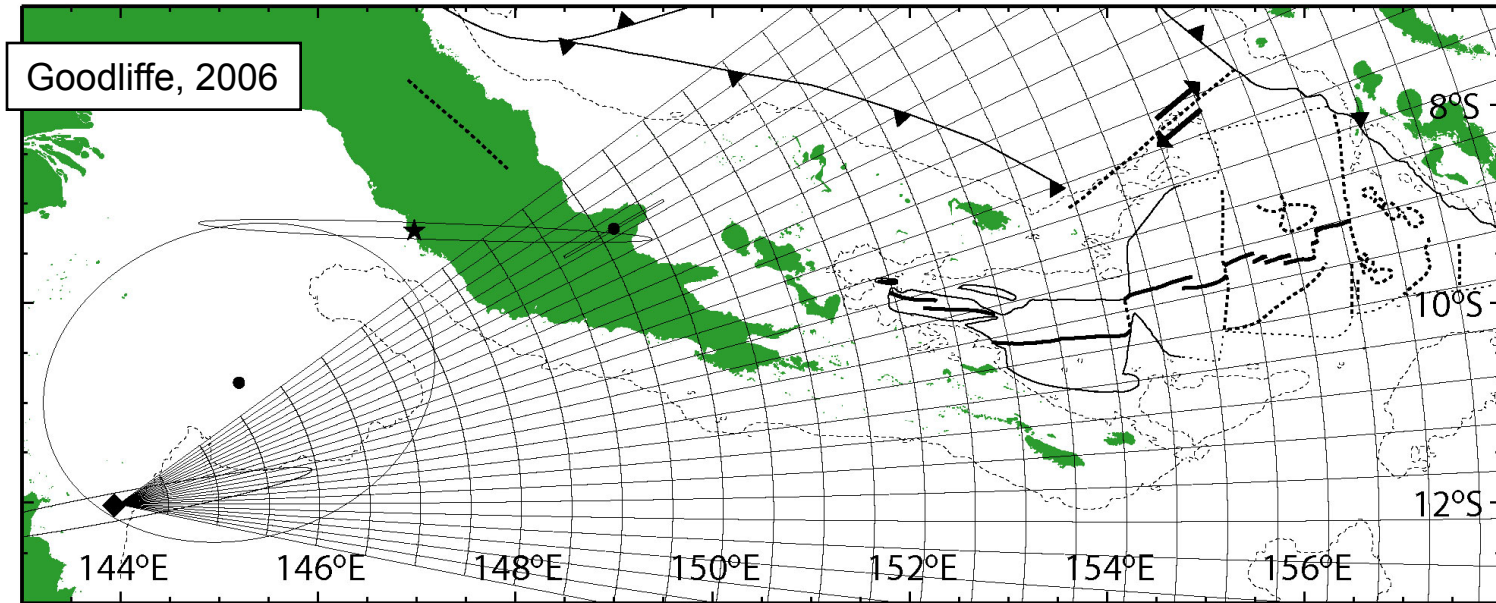
Active oceanic spreading centers propagating into continents are rare and present valuable analogs to the larger ocean basins because of their, diachronous time-space progression: Woodlark, Lena, Afar



Andrew Goodliffe et al., 2005

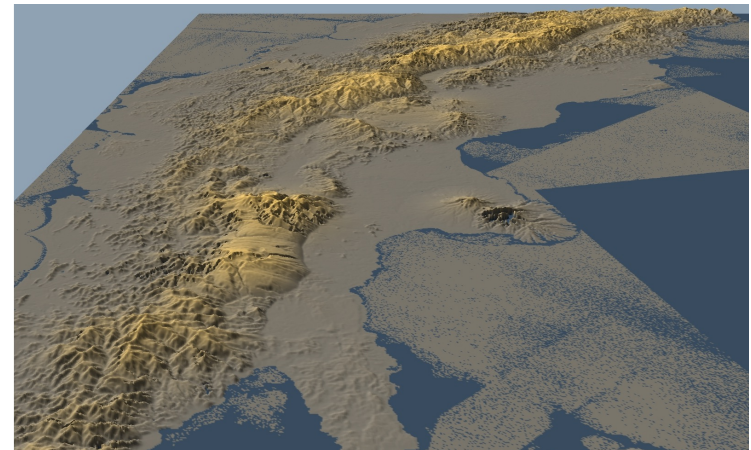
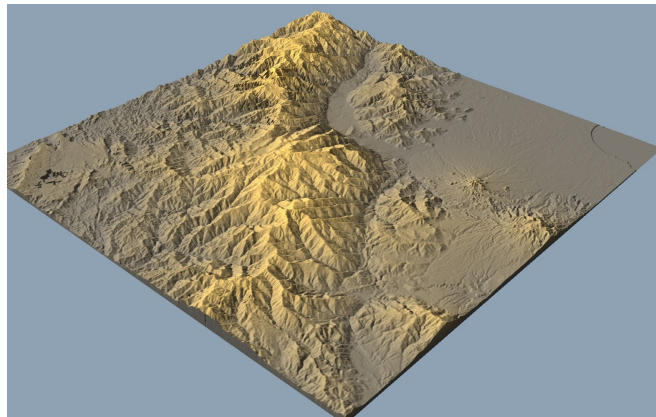
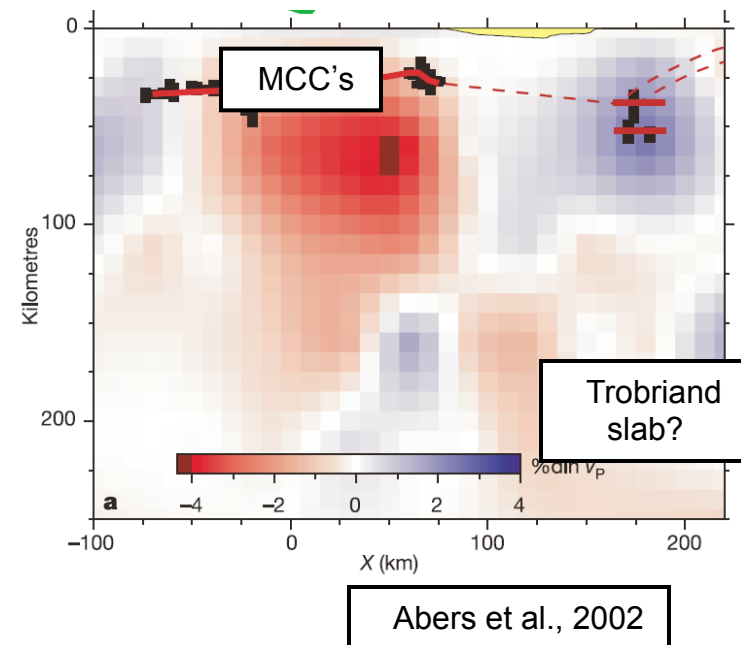
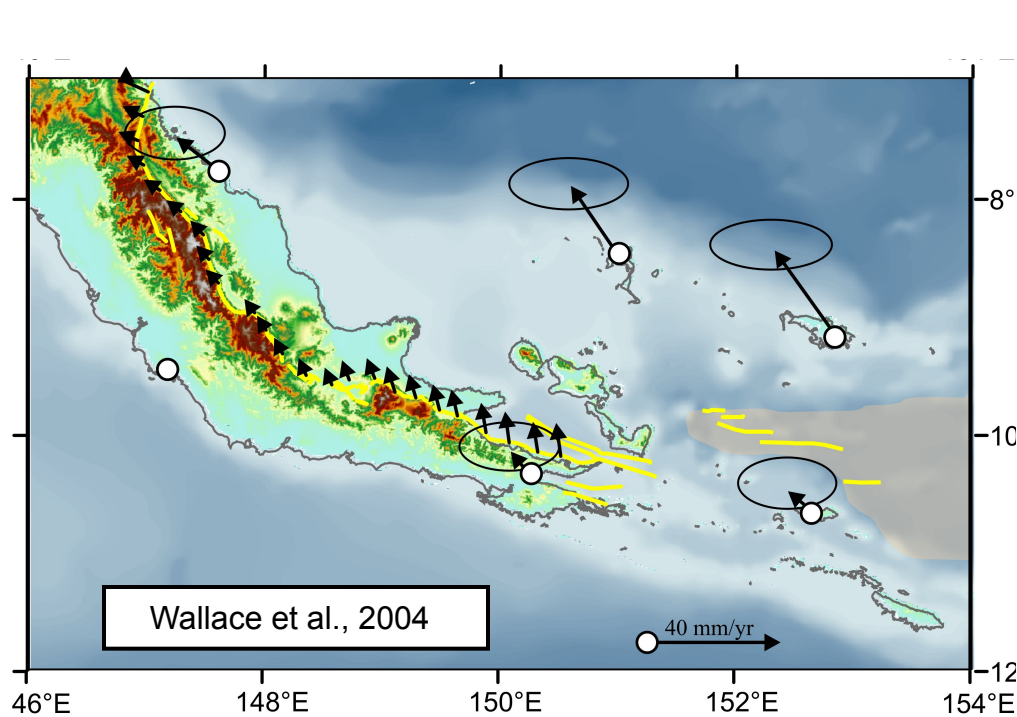


Discrepancy of oceanic spreading vs. continental extension about the pole of opening: where is it taken up? MCC's? Lower crust? Other unknown processes?

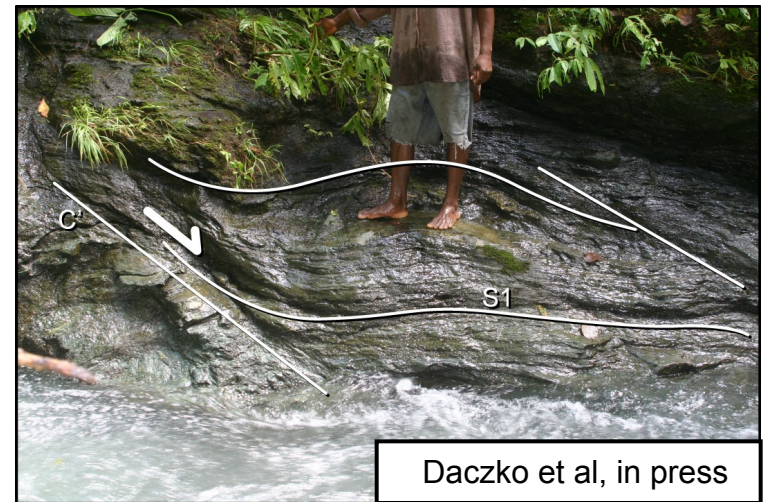
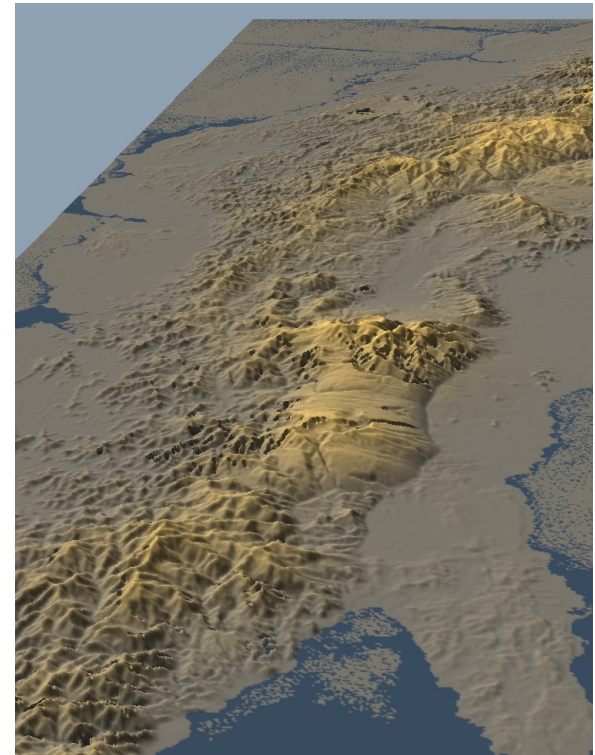
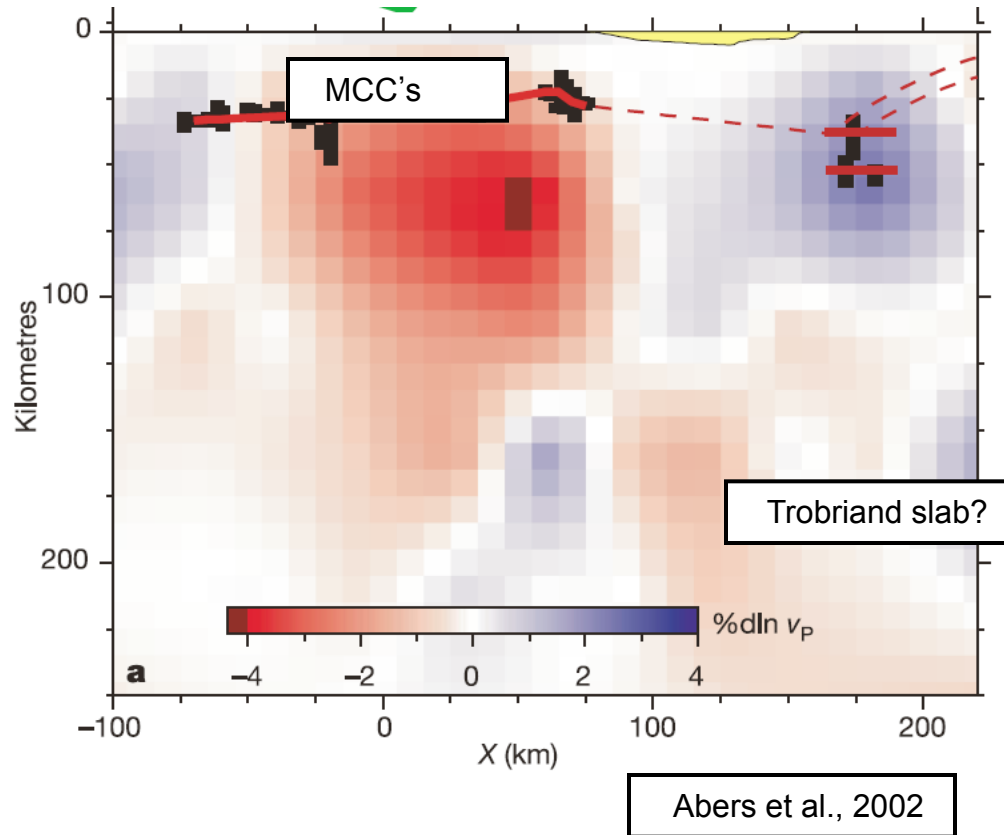




“Forcing parameters” of active plate boundary rifts can be inferred from GPS measurements (crustal) or tomography (mantle). Studies that show links between deformation and magmatism require combining data types from all depths.



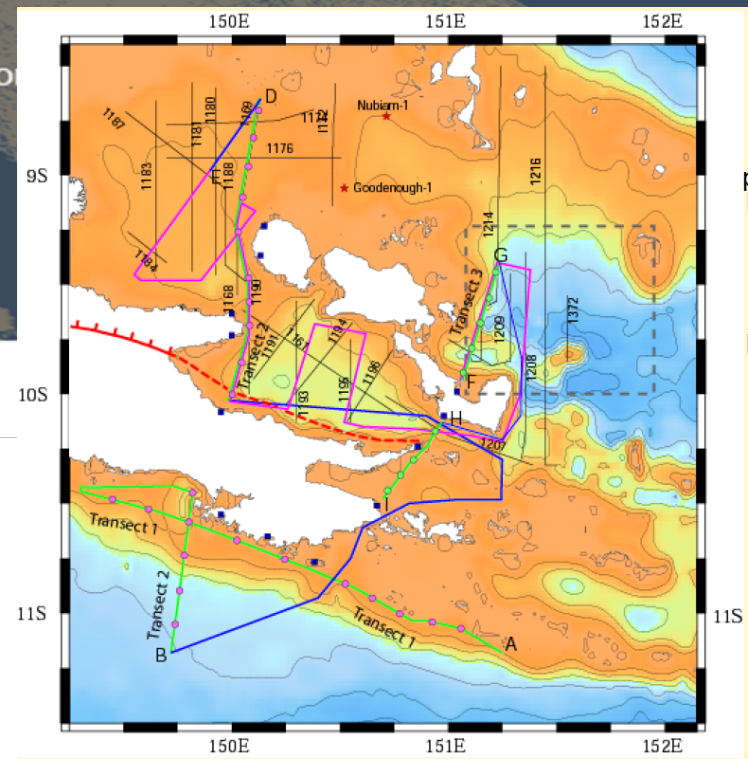
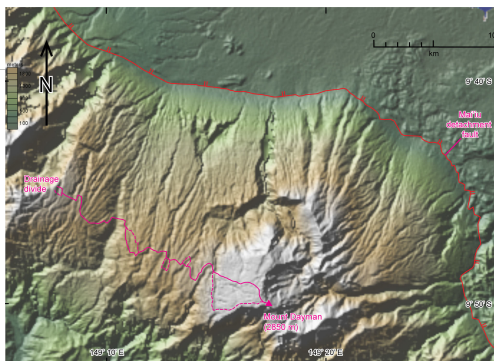
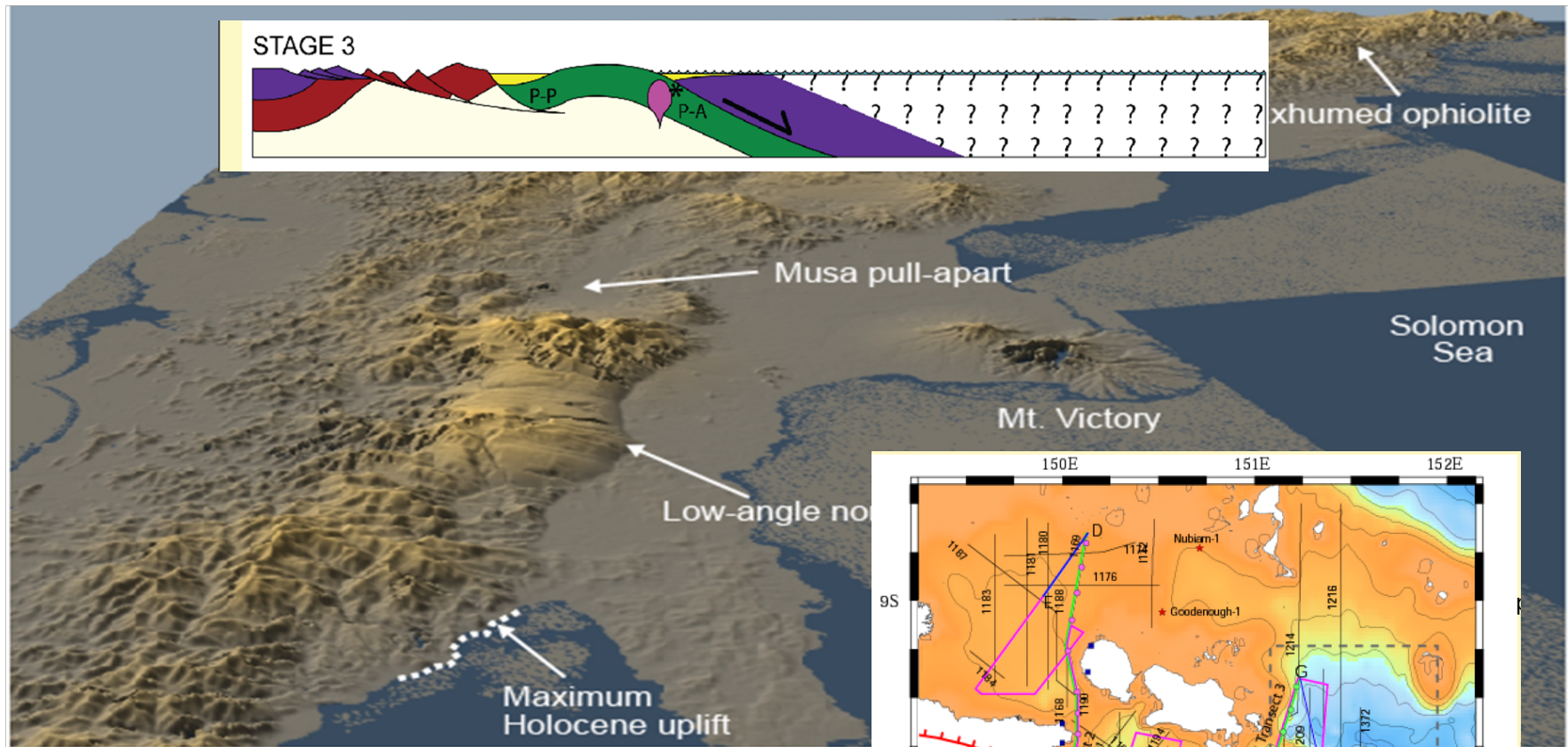
*"Few examples of low-angle detachments associated with continental breakup have been described".  
Luc Lavier quoting ??.*





# What controls locations of rifts?

Sites of former arcs or collisional zones? Inherited thrust surfaces?



# Fast rates from basement rocks: Ferguson MCC uplifting at average rate of 12-17 mm/yr

➤ (U)HP rocks have been exhumed from beneath km-scale shear zones at plate tectonic rates ( $> 1$  cm/yr)

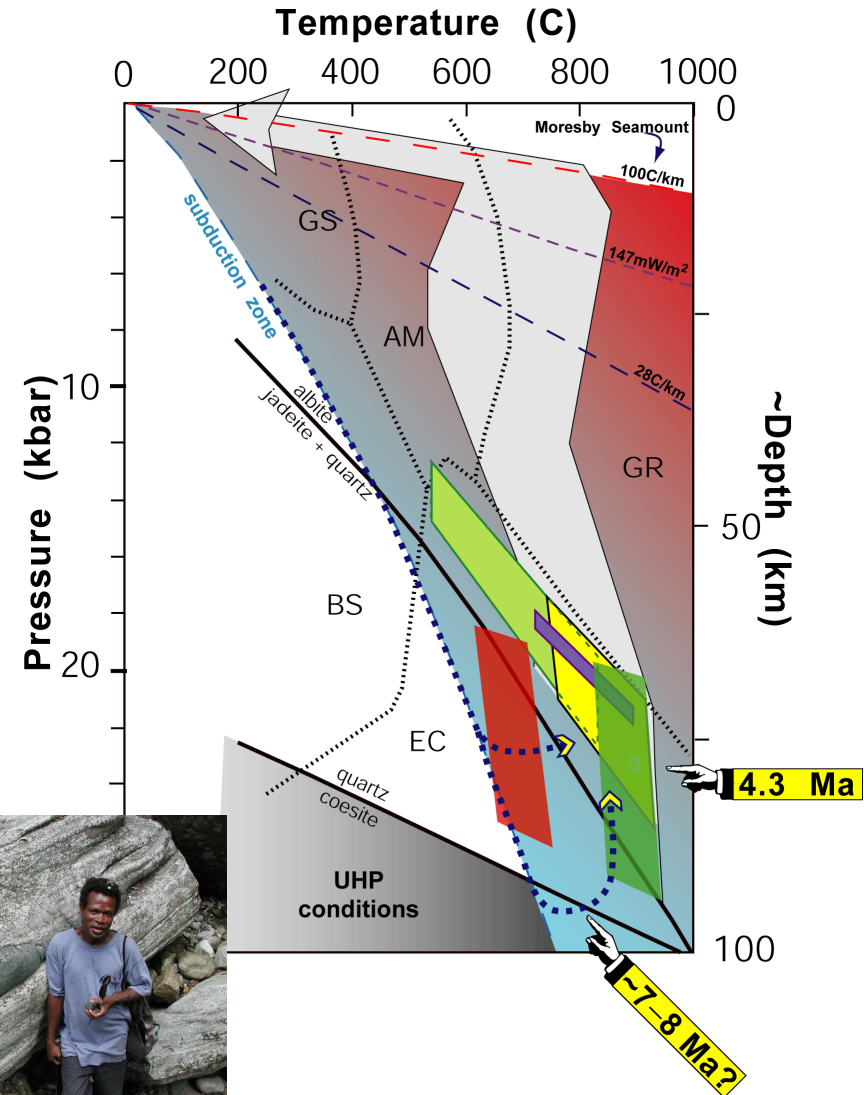
➤ Average minimum vertical exhumation rates ( $\sim 12$ - $17$  mm/yr)

➤ 25-51 mm/yr assuming exhumation from beneath 20-30° NNE dipping shear zones

➤ Compare with:

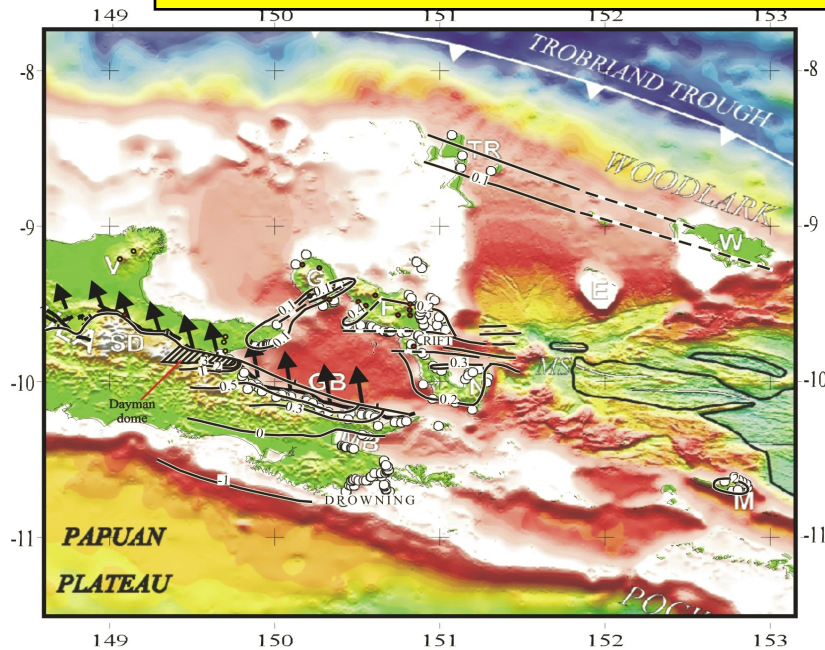
➤ 25-40 mm/yr extension rates near rift tip (Abers, 2001)

➤ 12-40 mm/yr half-spreading rates from magnetic anomalies (Benes et al., 1994) and GPS crustal motion studies (Tregoning et al., 1998)

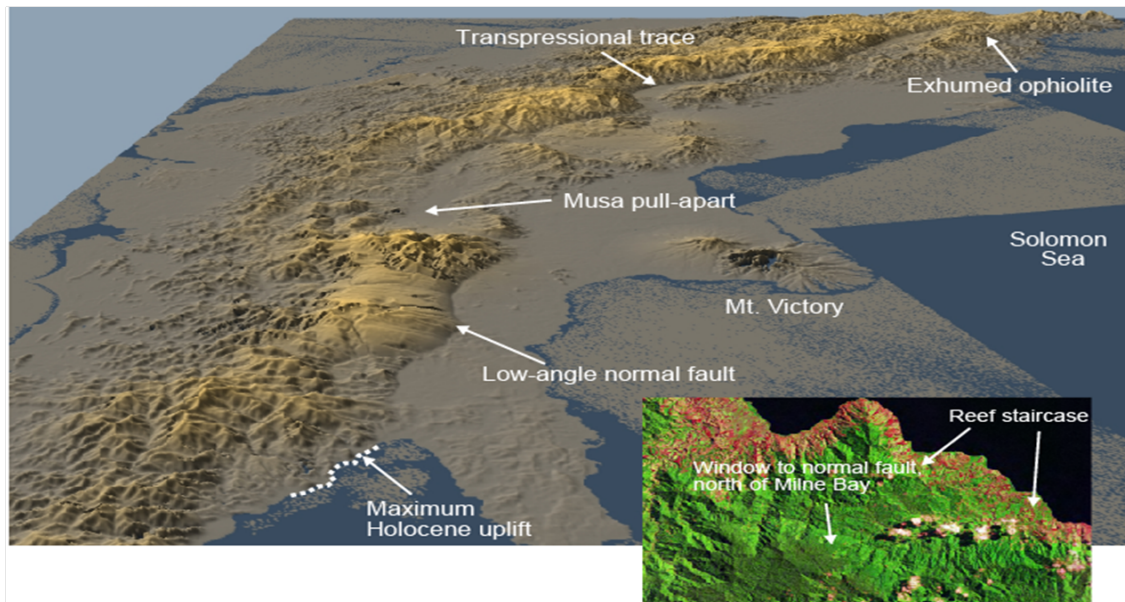




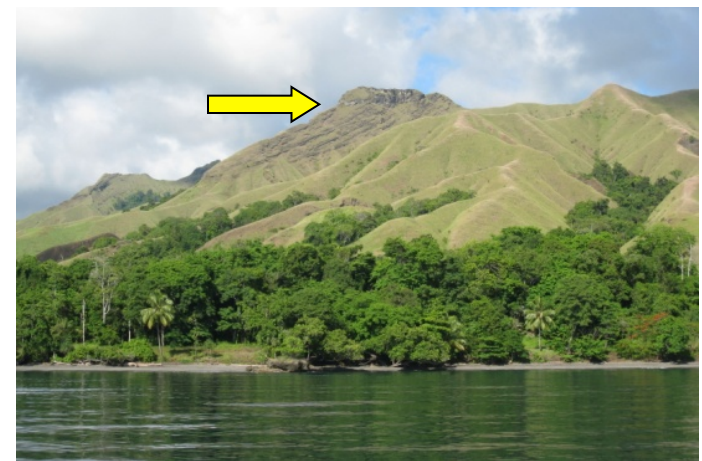
# Fast rates from coral reefs: OSFZ footwall block uplifting at 4 mm/yr



322 m high surface was at sea level ~127 ka

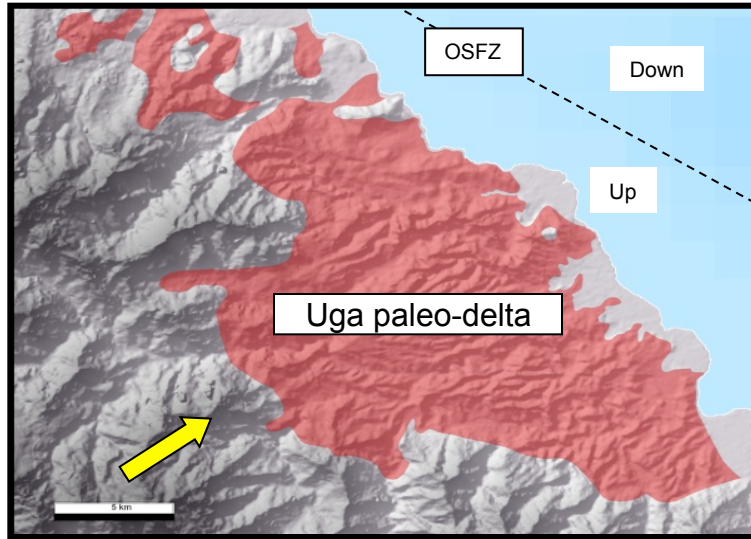


127 Ma coral unconformable on  
Folded, Pleistocene deltaic sediments

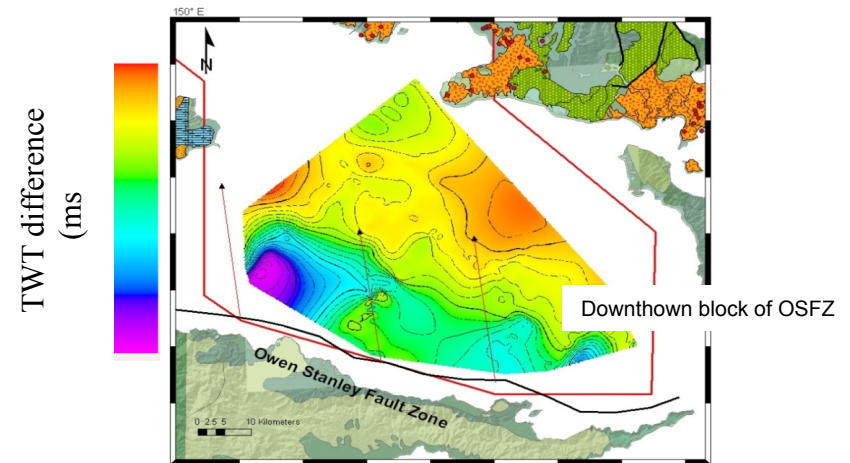




# Sediment flux into the rift: Pliocene-Pleistocene Uga delta uplifted on footwall of Owen-Stanley normal fault; thick seen on seismic data on hanging wall block



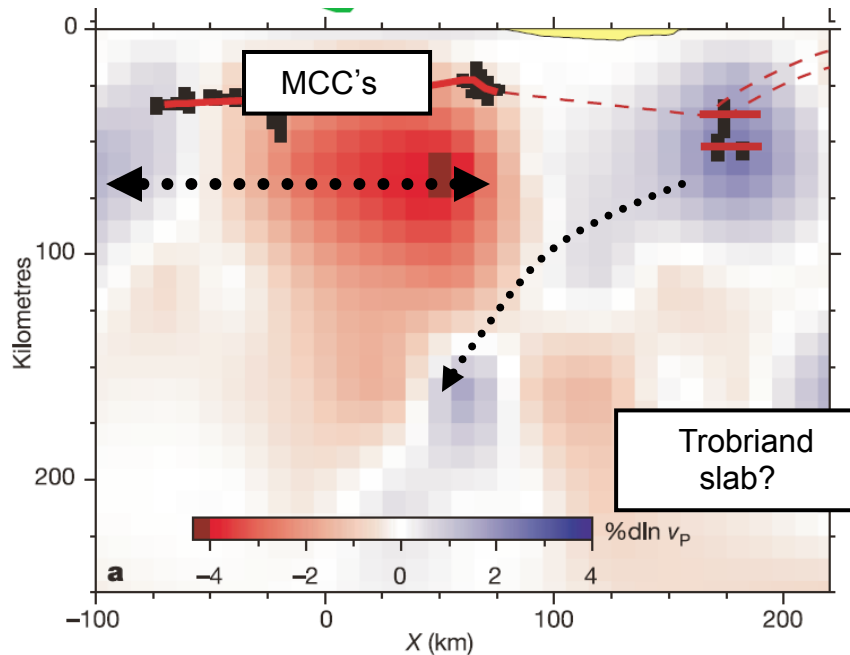
Pliocene to Plio-Pleistocene Isochron map of Goodenough basin from Fitz, in prep.





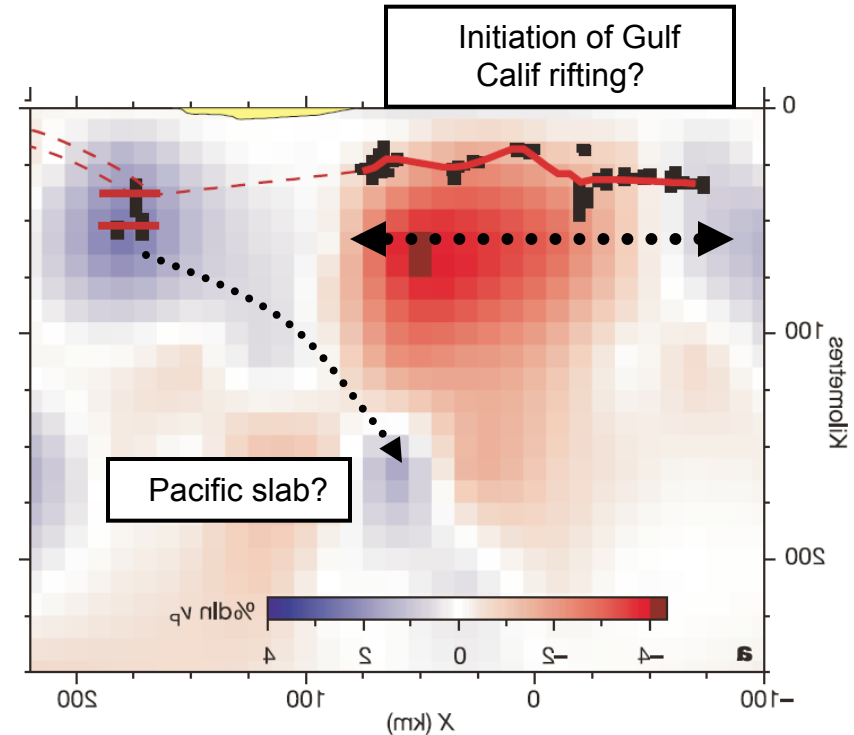
How is lower crust, mantle and deeply subducted slabs return to the surface during the rifting process? Is orogenic collapse triggered by rollback the answer?

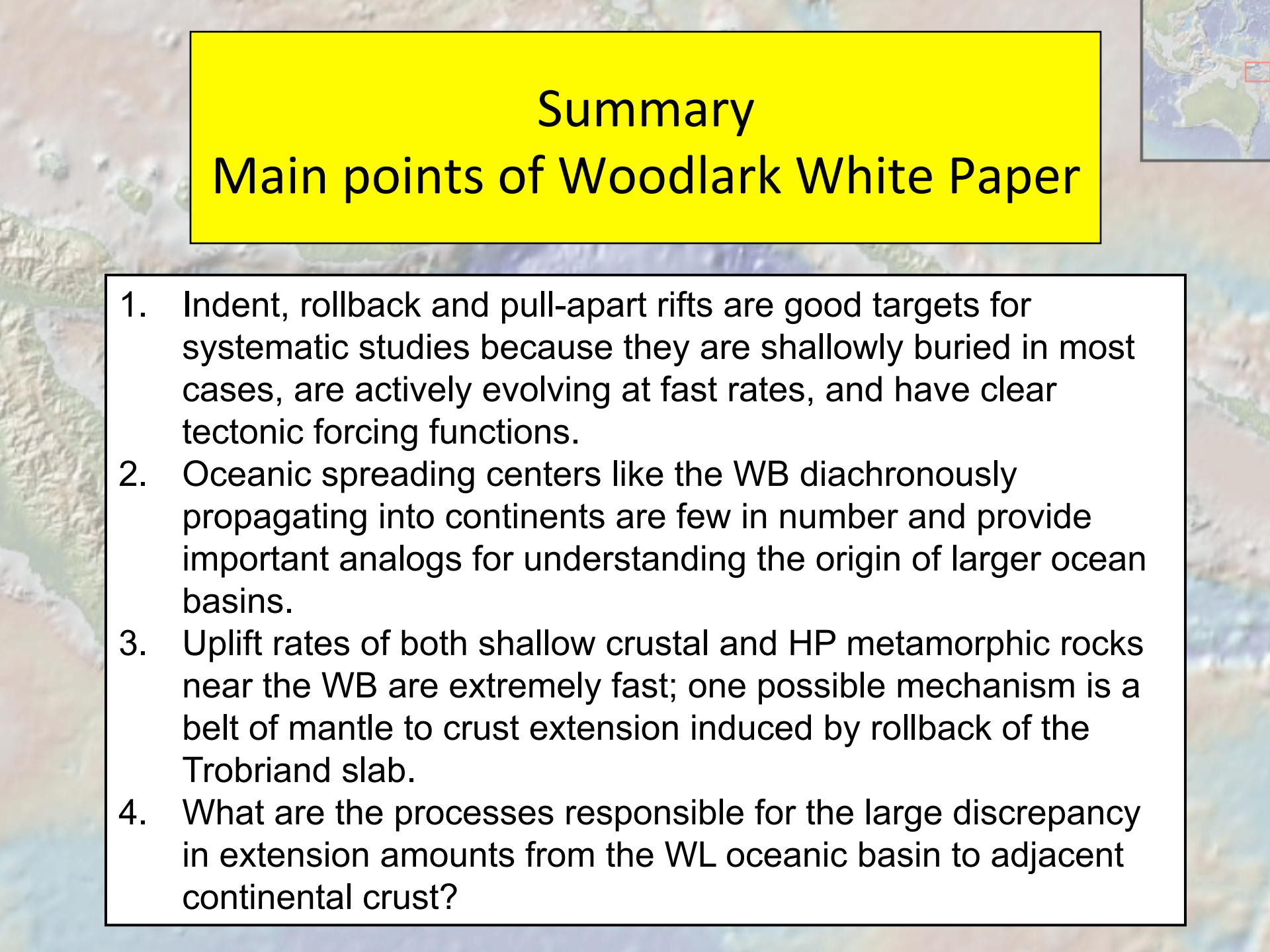
### Papua New Guinea



Abers et al., 2002

### Baja-Gulf of California analog





# Summary

## Main points of Woodlark White Paper

1. Indent, rollback and pull-apart rifts are good targets for systematic studies because they are shallowly buried in most cases, are actively evolving at fast rates, and have clear tectonic forcing functions.
2. Oceanic spreading centers like the WB diachronously propagating into continents are few in number and provide important analogs for understanding the origin of larger ocean basins.
3. Uplift rates of both shallow crustal and HP metamorphic rocks near the WB are extremely fast; one possible mechanism is a belt of mantle to crust extension induced by rollback of the Trobriand slab.
4. What are the processes responsible for the large discrepancy in extension amounts from the WL oceanic basin to adjacent continental crust?