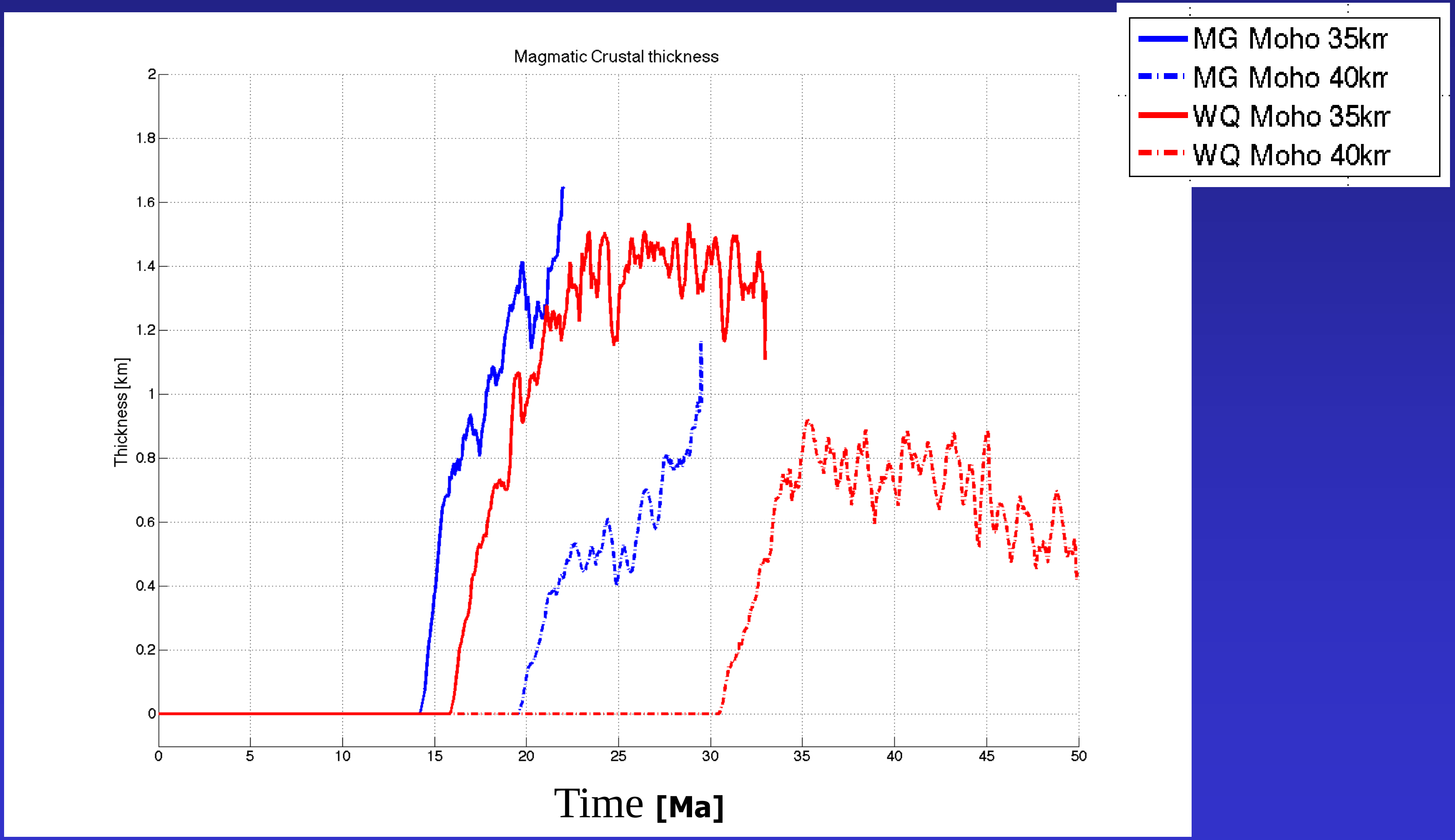
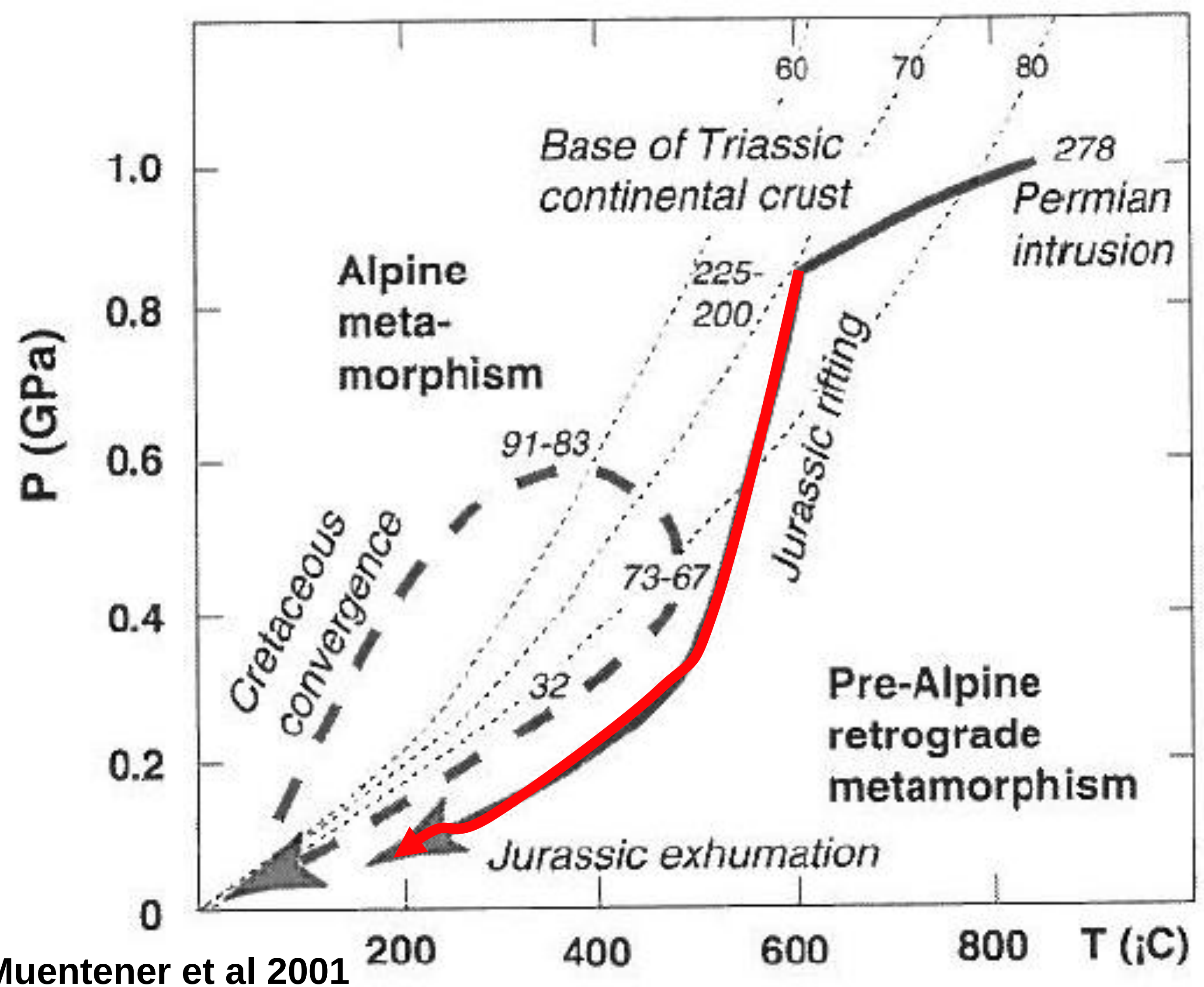
Preliminary results

Melting- Half extension velocity 3mm/yr

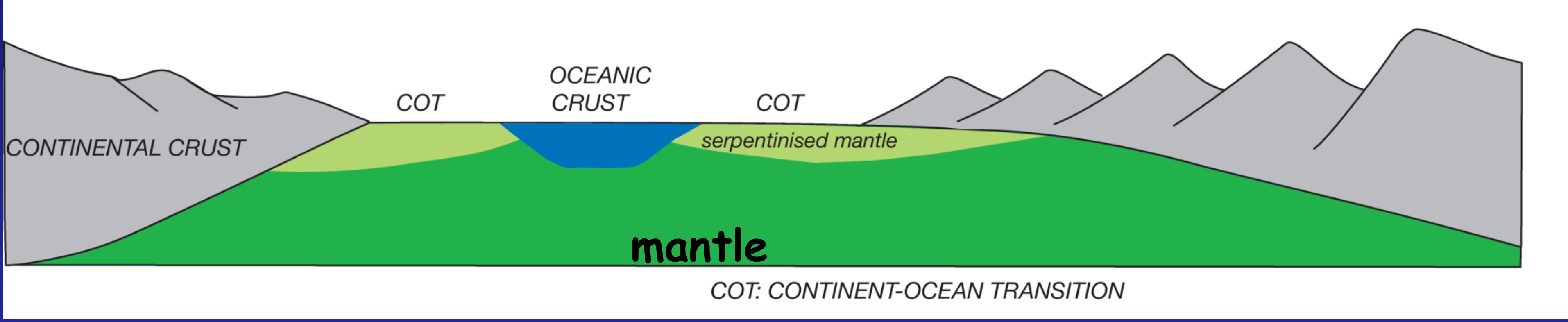


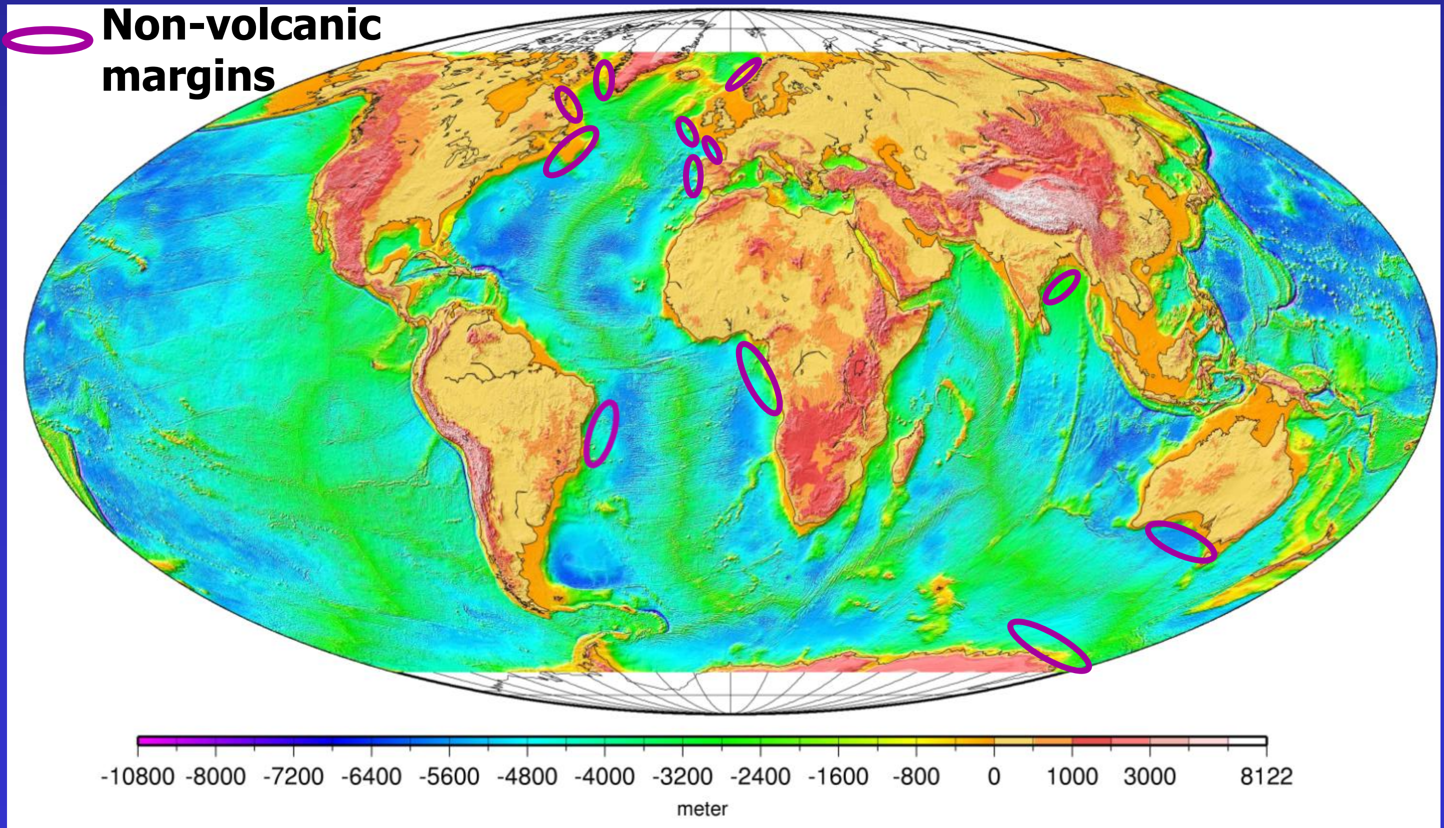
Rocks cool during extension



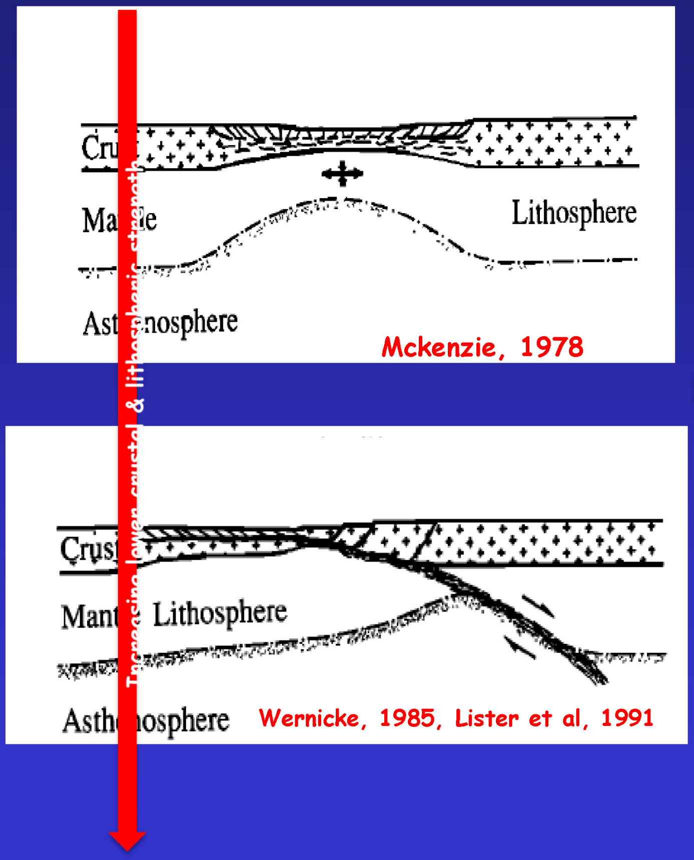
Muentener et al 2001

Magma-poor margins

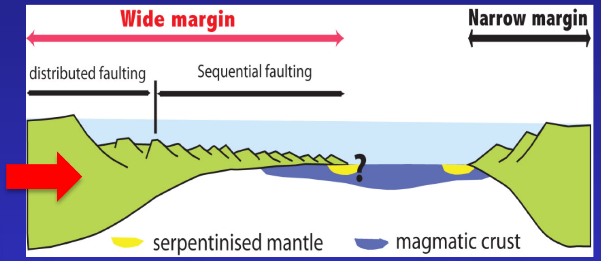




Modes of extension & oceanization



Sequential faulting mode



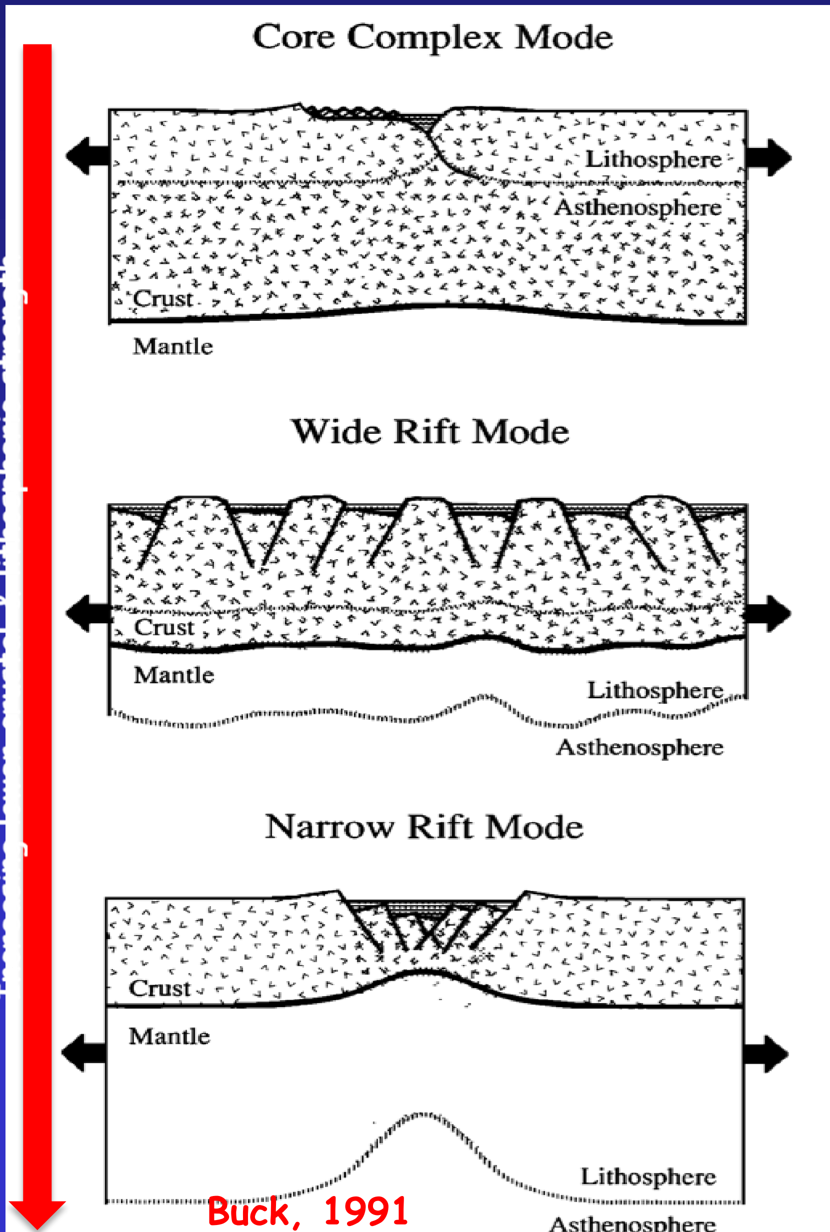
Ranero and Perez-Gussinye, 2010; Brune et al., 2014

Presenter's notes: In the 1970's and 80's two very different models were put forward in an attempt to explain architecture and symmetry of conjugate margins and basins. However, it was soon clear that these models were oversimplifications of reality and that they could not explain the richness in extensional styles observed in Nature. Roger Buck took a very important step by describing and classifying extensional styles into narrow, wide and core-complex modes and showing that the transition of one to the other would occur with increasing lower crustal viscosity. (Notes by presenter continued on next slide)

(Notes by presenter continued from previous slide)

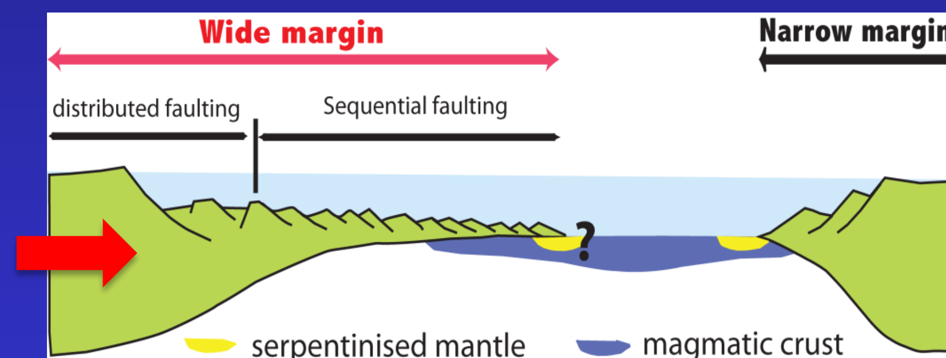
By looking at the richness of extensional styles along the South American margin, we have come to the conclusion that there is a fourth extensional mode, the sequential faulting mode, which when combined with the previous modes can well explain the wide variety of margin architectures that we see. We have also found that the predominance of one or the other modes during extension is intimately related to the width and nature of the continent-ocean transition zone.

Modes of extension & oceanization



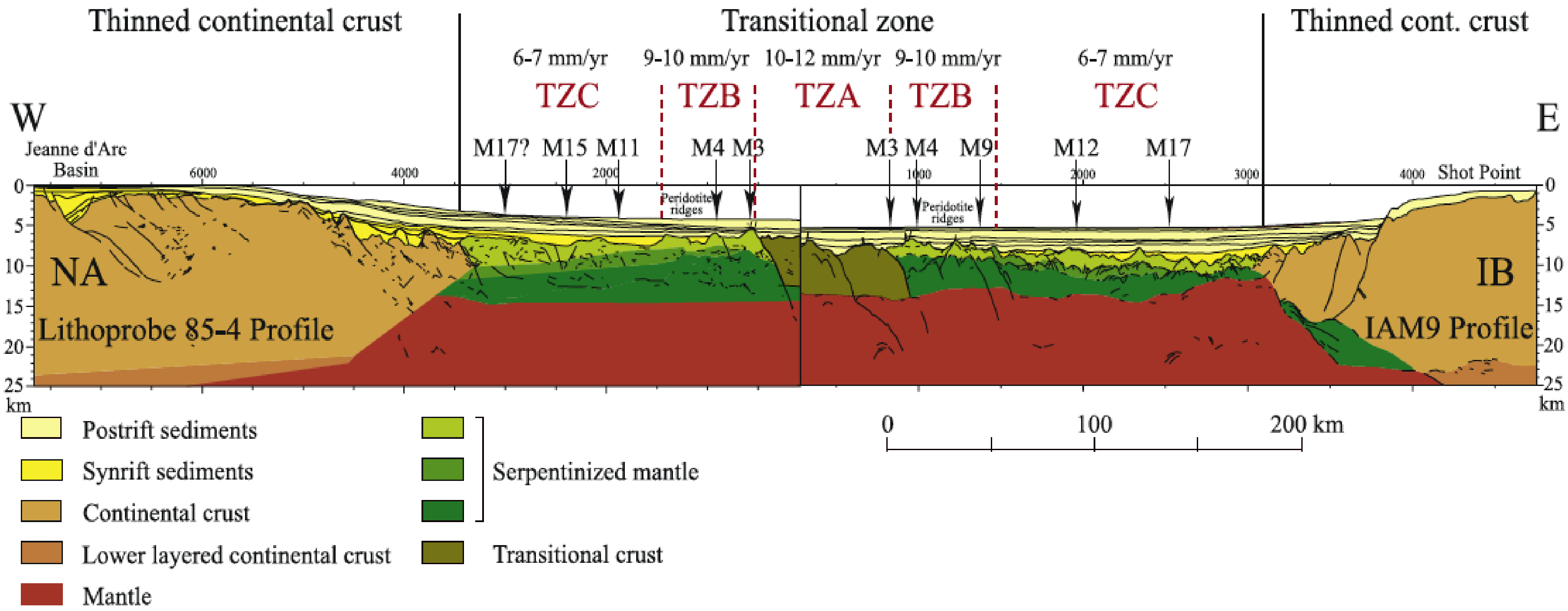
- Combination of 4 extensional modes can explain the wide variety of margins observed.
- The prevalence of any of these modes during extension also determines the style of oceanization (mantle exhumation vs abrupt transition to oceanic crust).

Sequential faulting mode



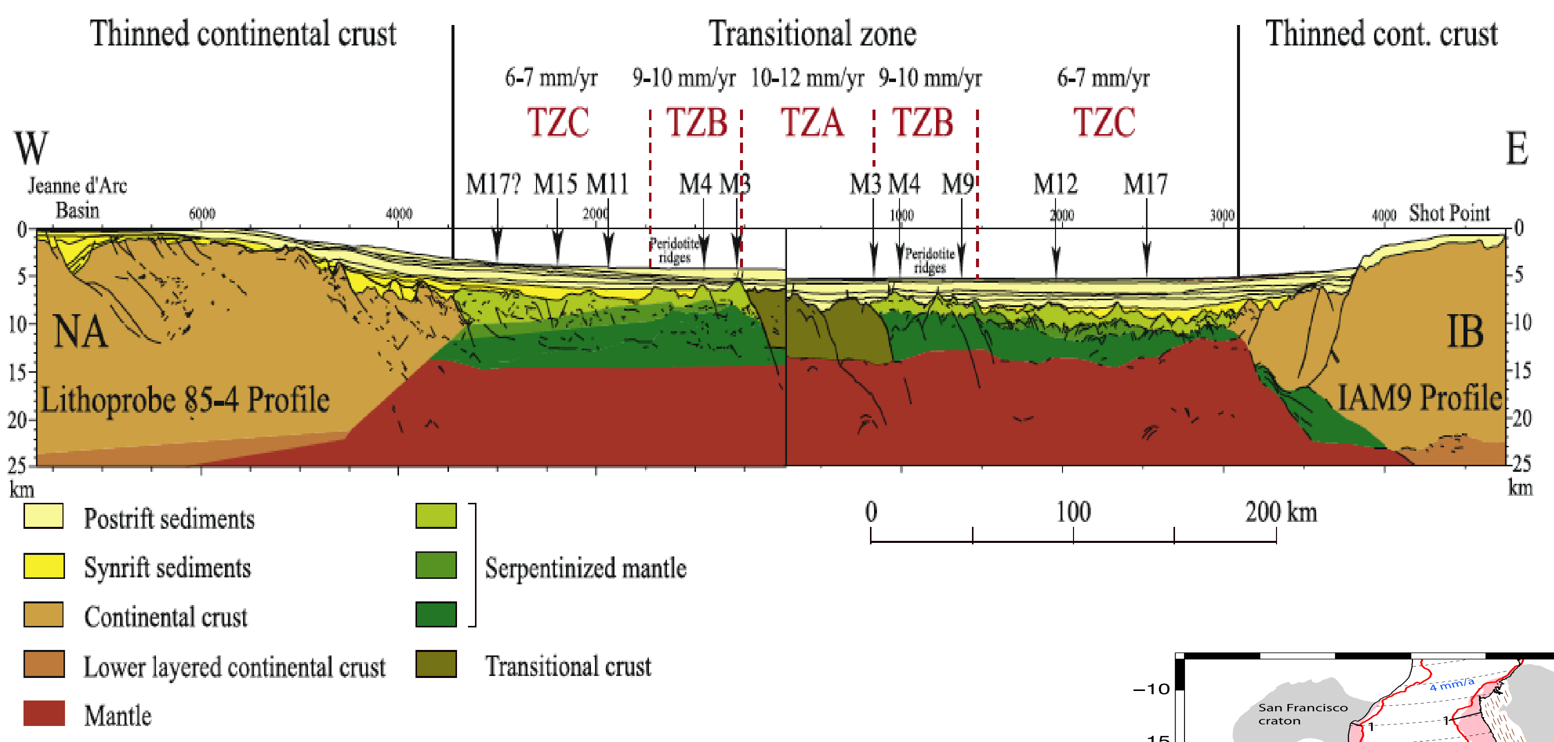
Ranero and Perez-Gussinye, 2010; Brune et al., 2014

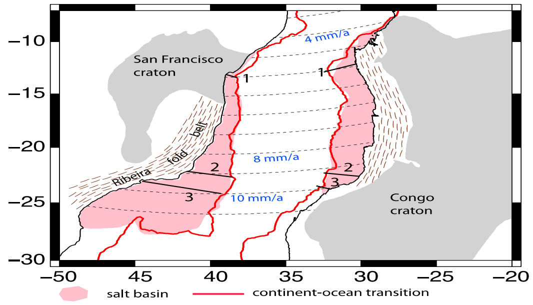
3. Transition to oceanic spreading



- Very little magmatism.
- Slow extension (ultra-slow end-member)
- Cool Moho (~450-600 C) at the start of rifting (P-T-t data).

3. Transition to oceanic spreading





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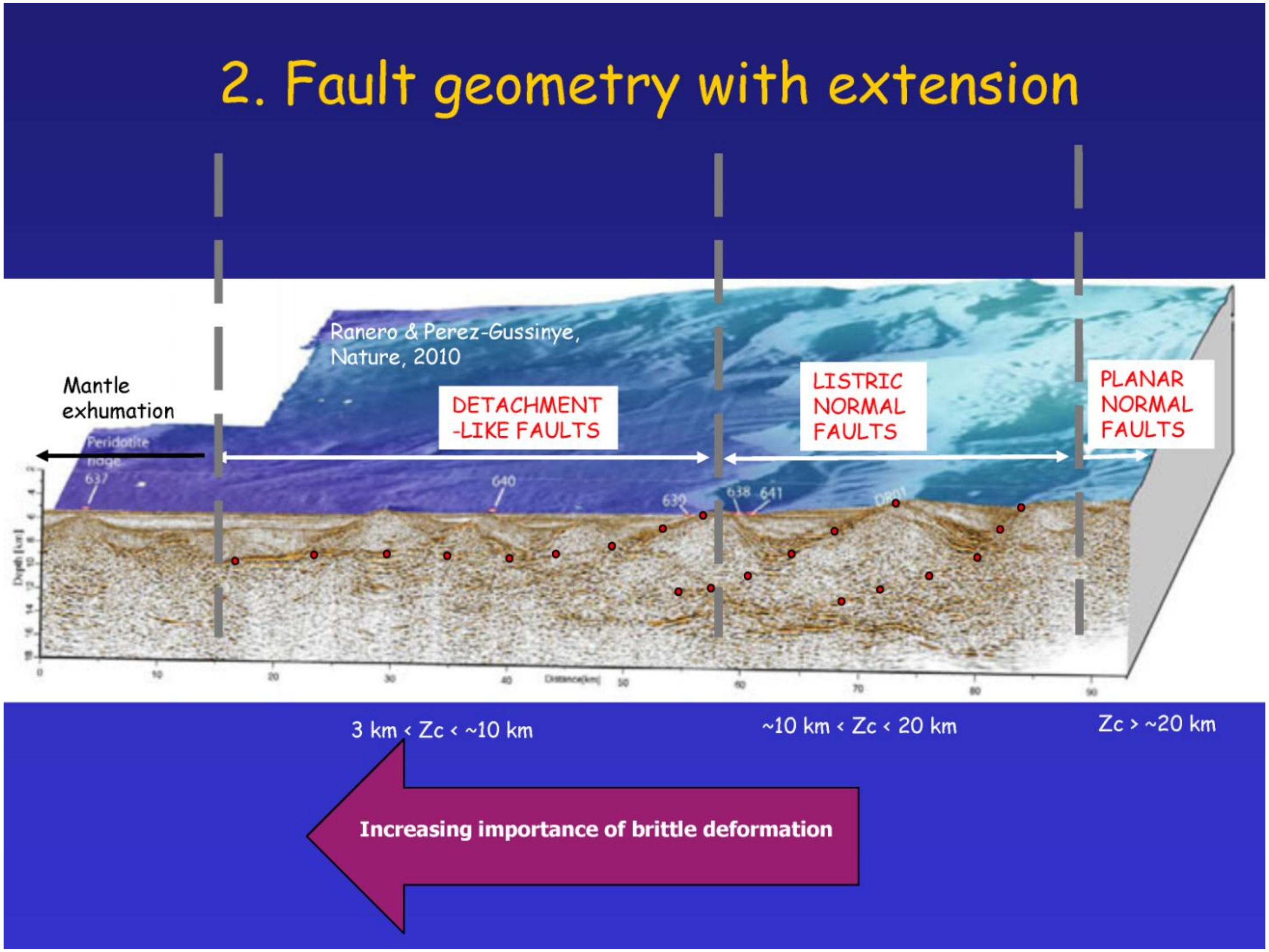
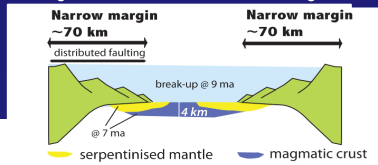


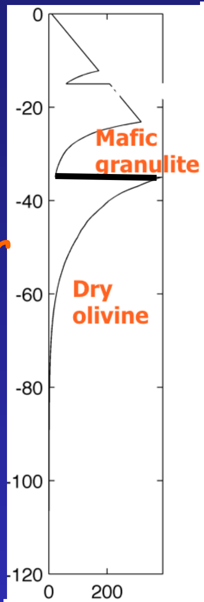
Presenter's notes: Finally we have been looking at (1) how the change in fault geometry from the little extended sectors, where faults are planar, to the more extended sectors where occurring faults appear listric--or detachment-like, (2) how is the related to the amount of differential thinning in the crust and (3) what are the implications of it for sedimentation, subsidence and heat-flow.

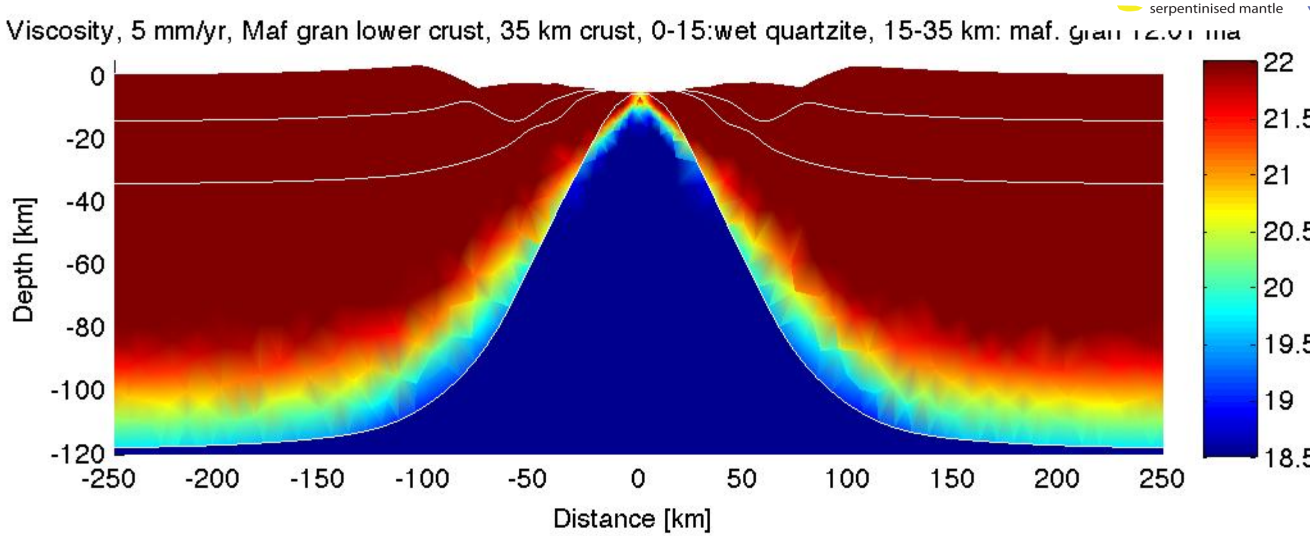
Effect of crustal thickness on margin width/symmetry

Strong mafic granulite

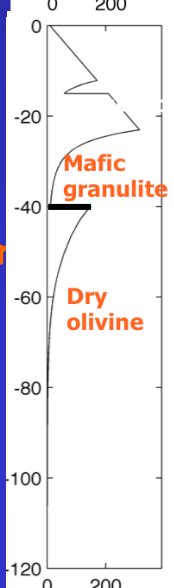


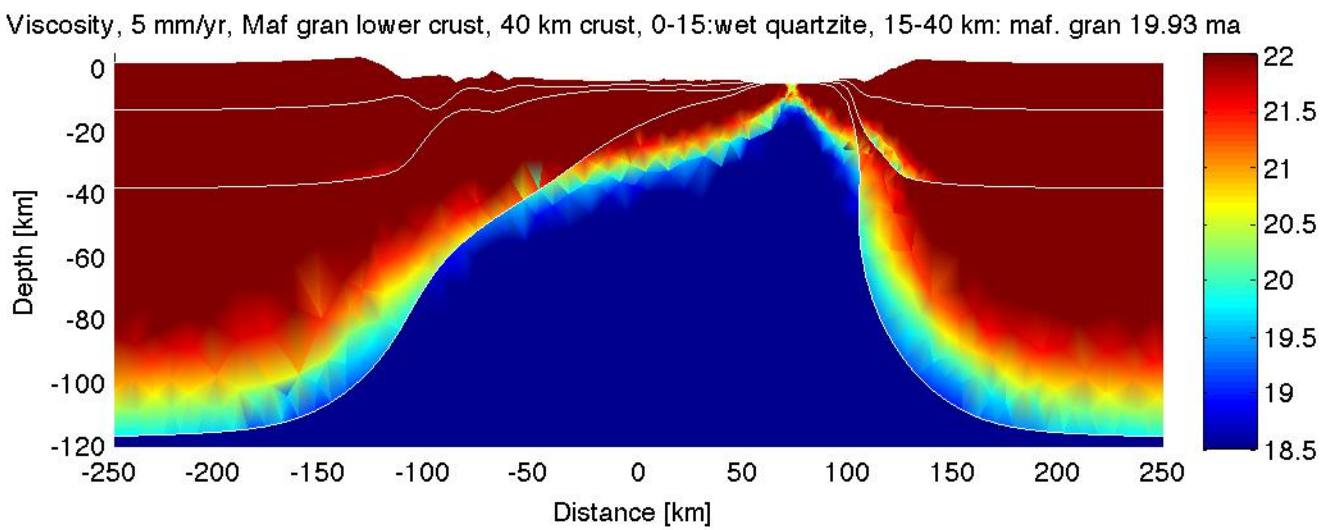
35 km crust – 5 km/Myr half ext





40 km crust – 5 km/Myr half ext

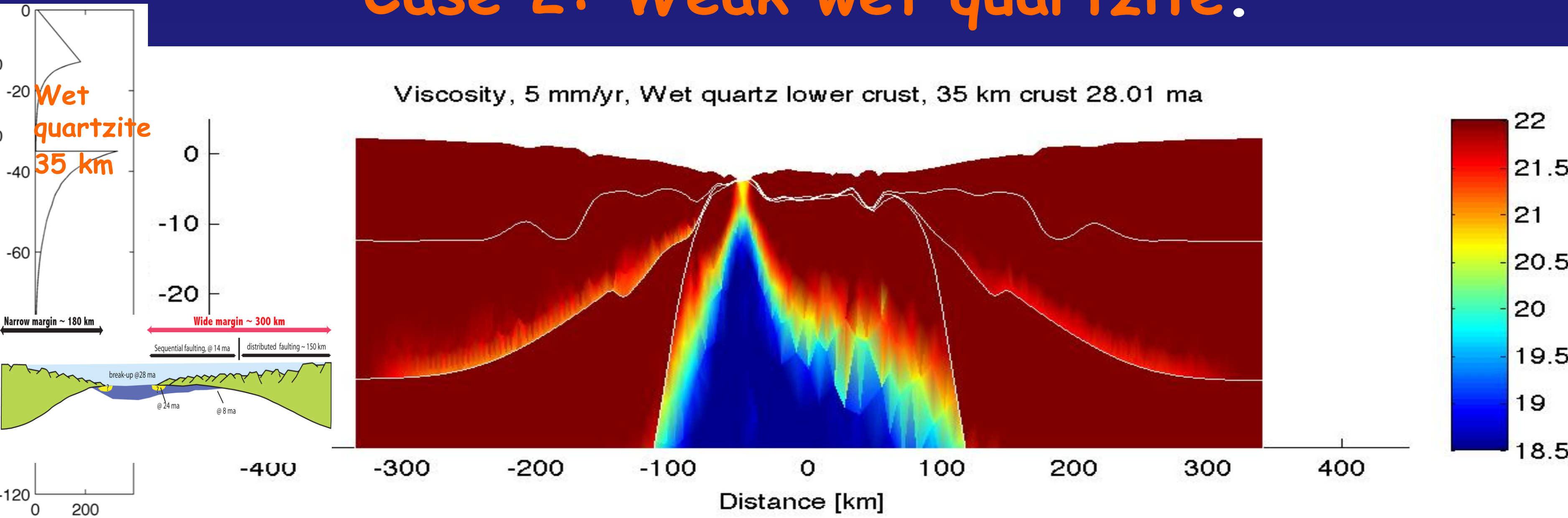


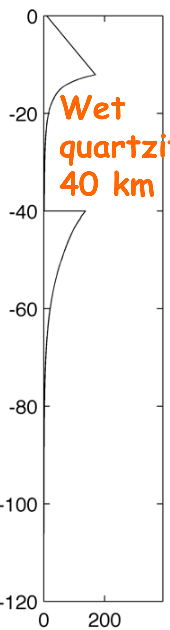


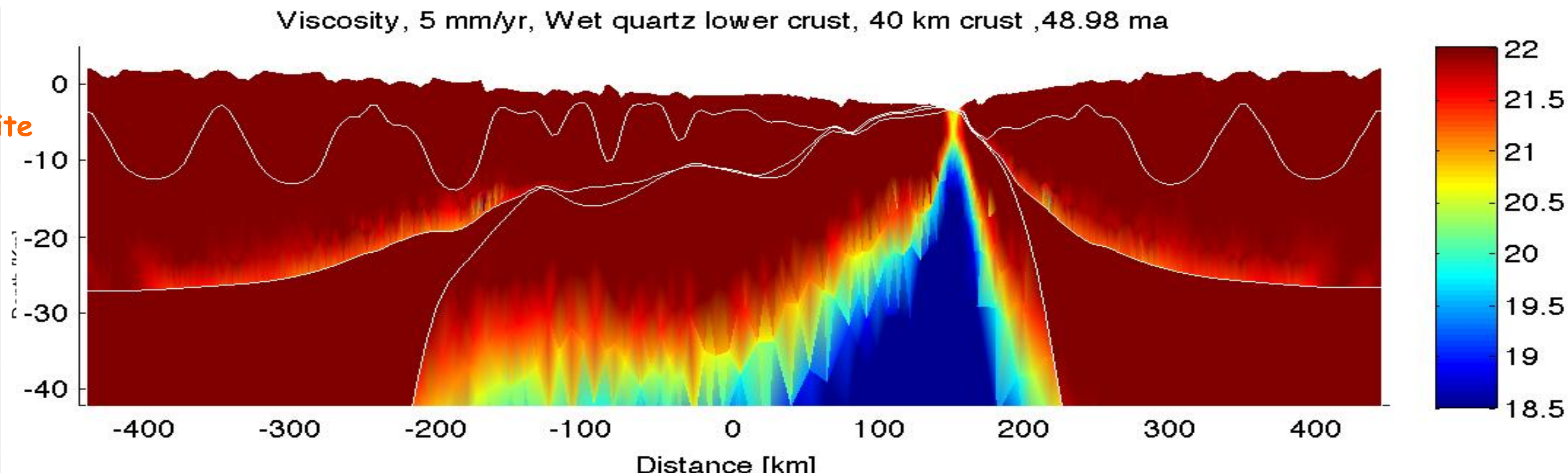
Effect of crustal thickness on margin width/symmetry

Wide

Case 2: Weak wet quartzite.



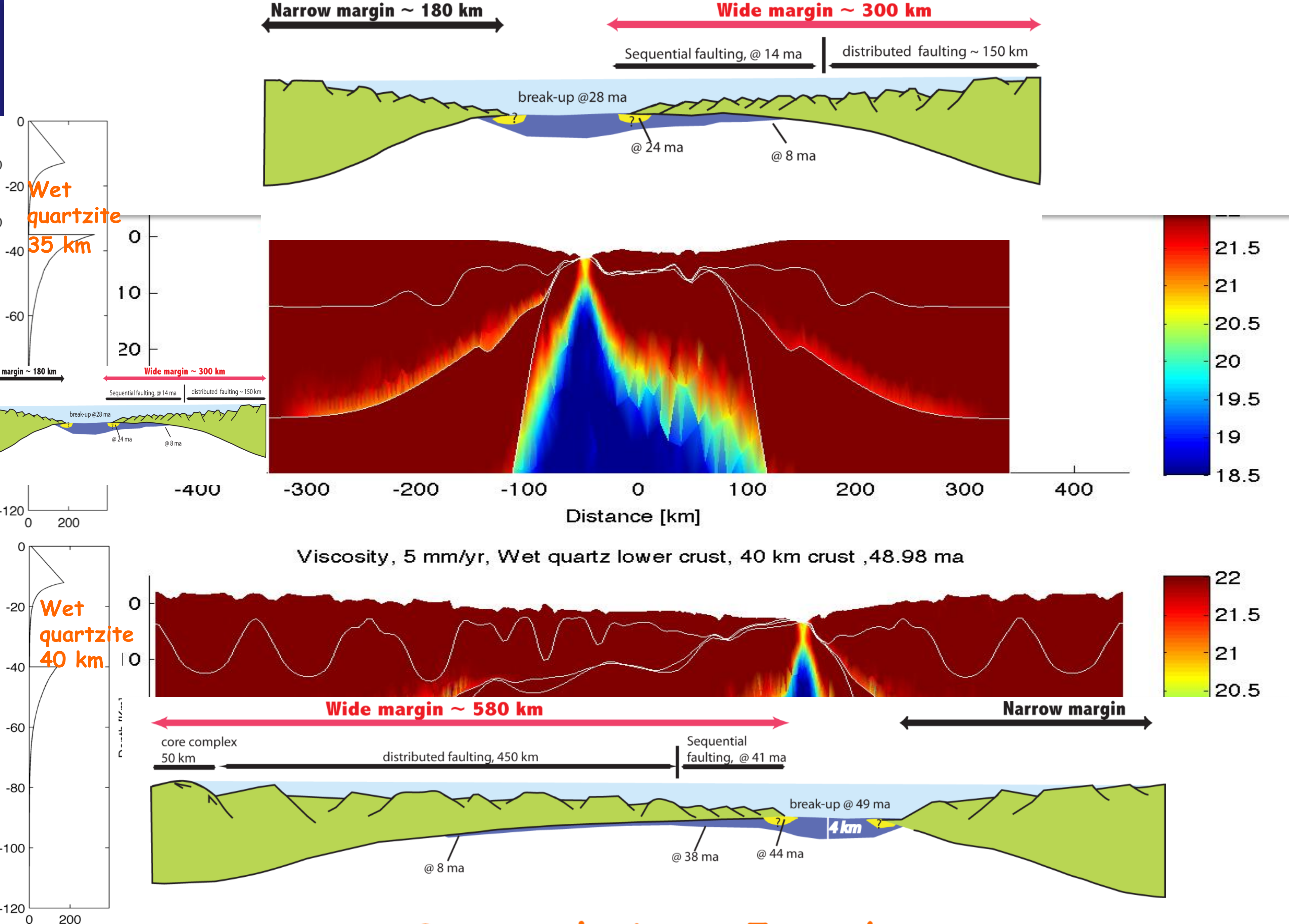




little subsidence for a long period in rift history, extremely wide margin

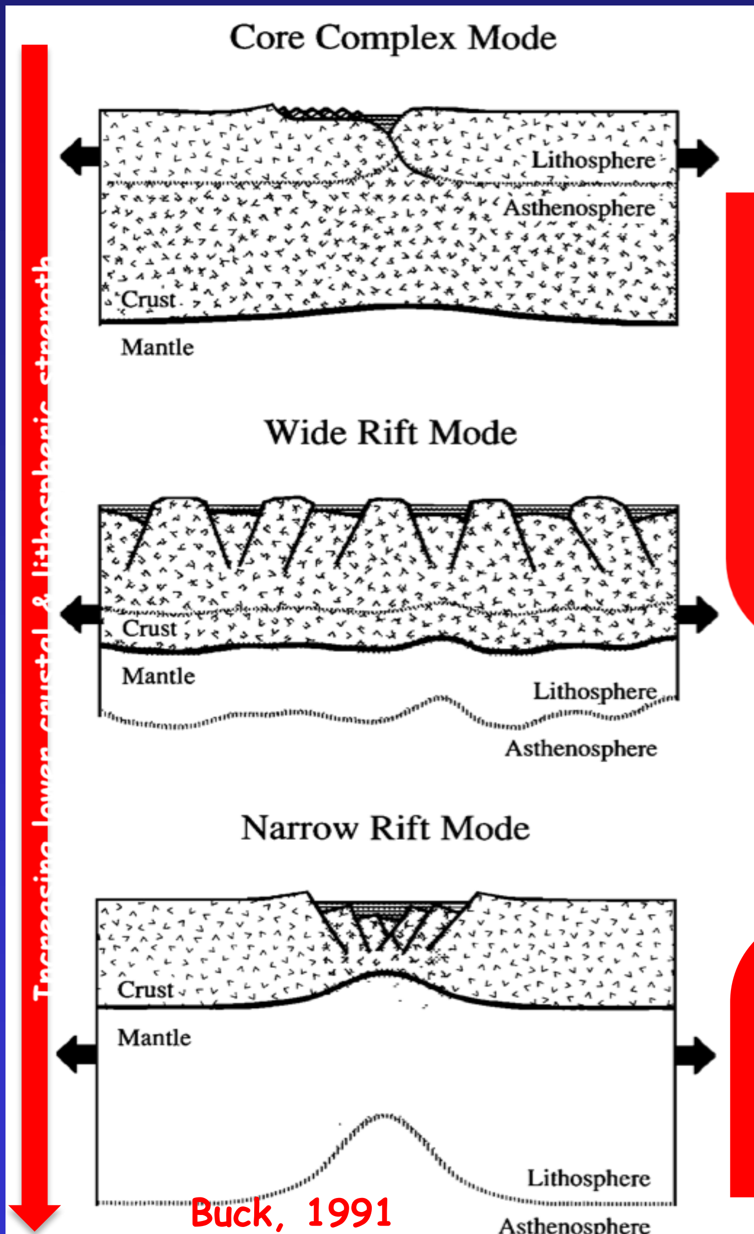
Same velocity = 5 mm/yr

Same velocity = 5 mm/yr



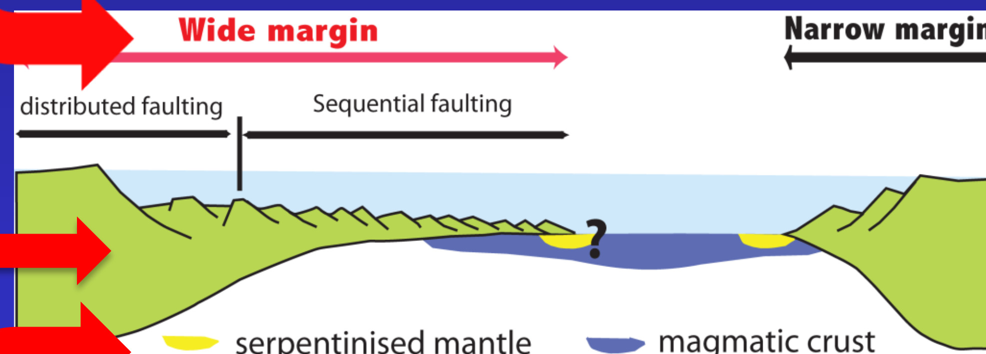
Same velocity = 5 mm/yr

Modes of extension & oceanization



Cooling

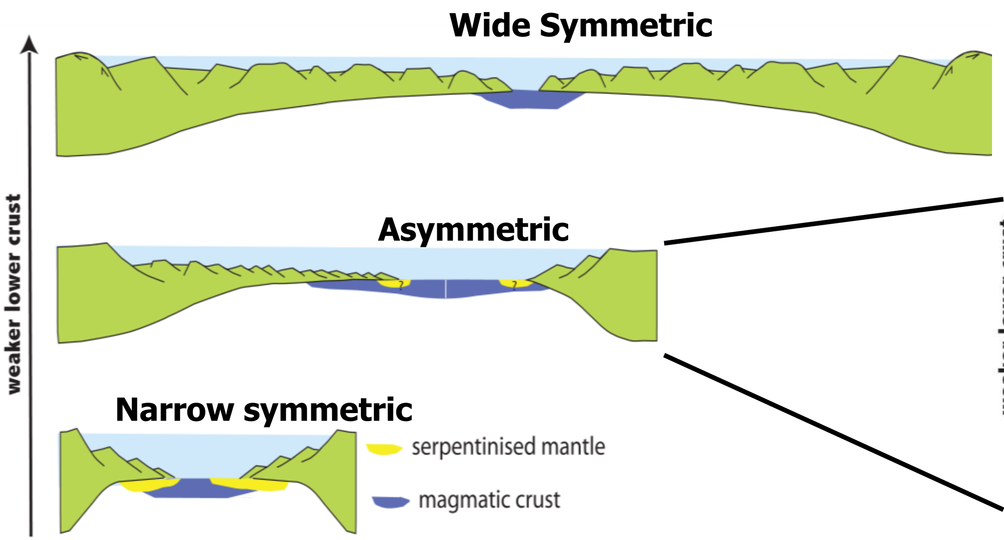
Sequential faulting mode

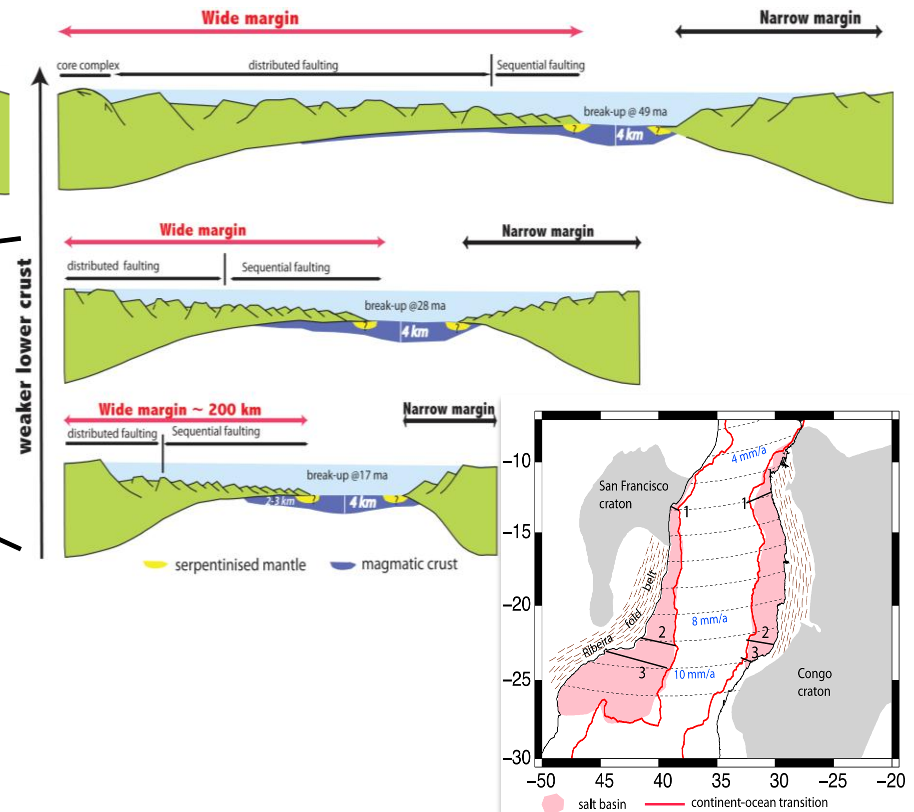


Deep reservoirs of weak lower crust

Modes of extension & oceanization

Type II

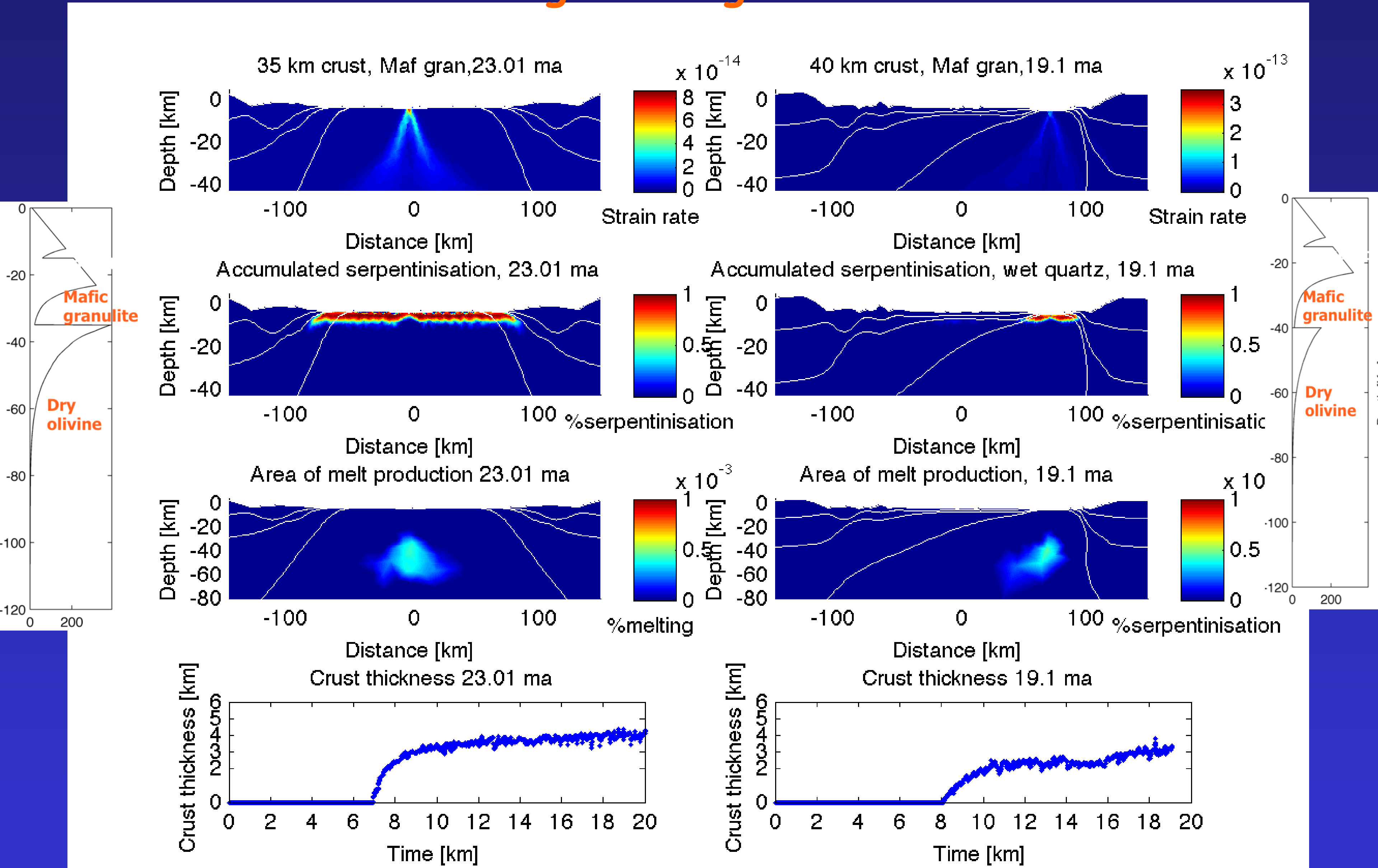




Type I (Huismans and Beaumont, 2011)

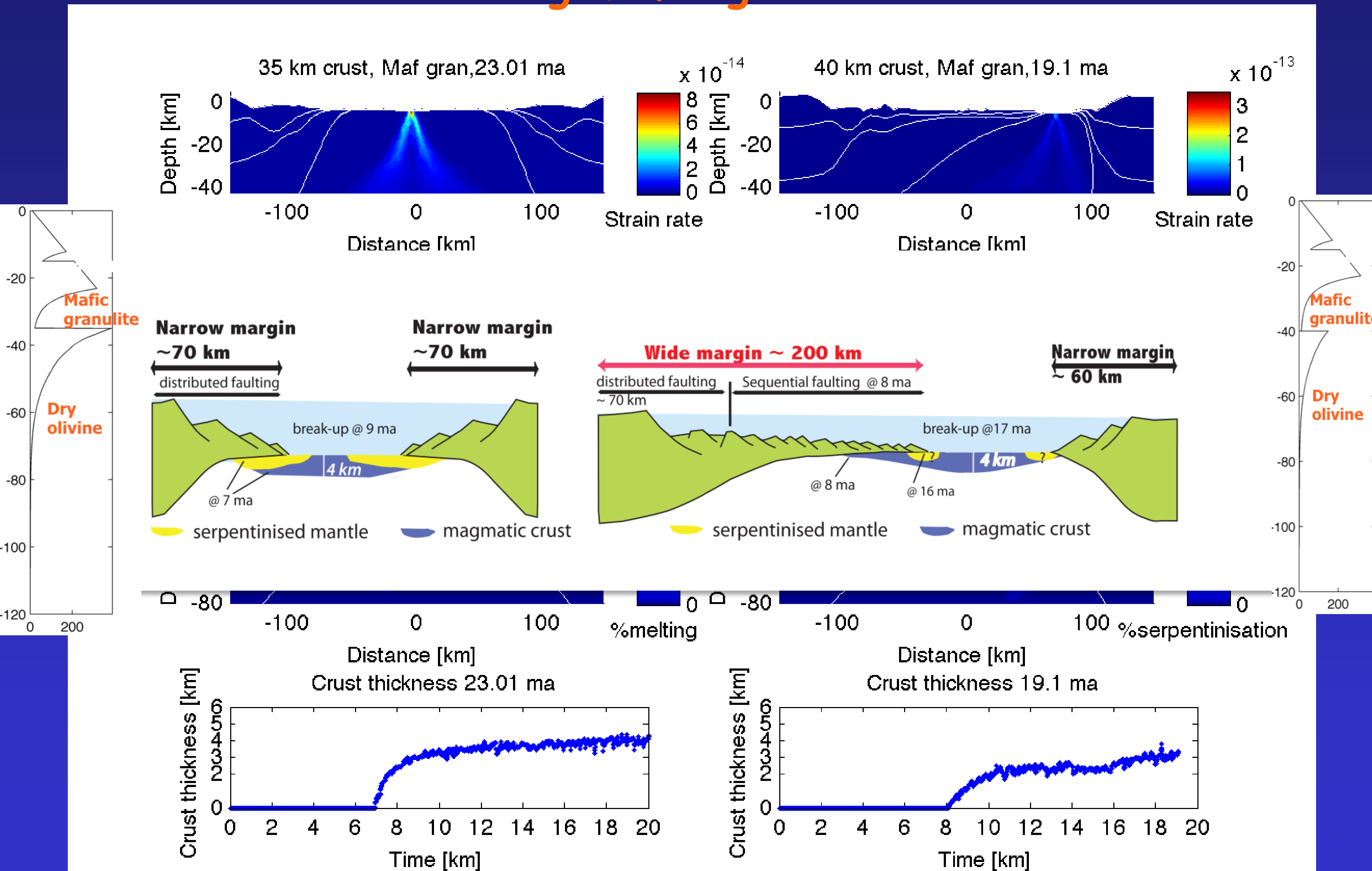
Effect of crustal thickness on serpentinisation/melting.

Strong mafic granulite

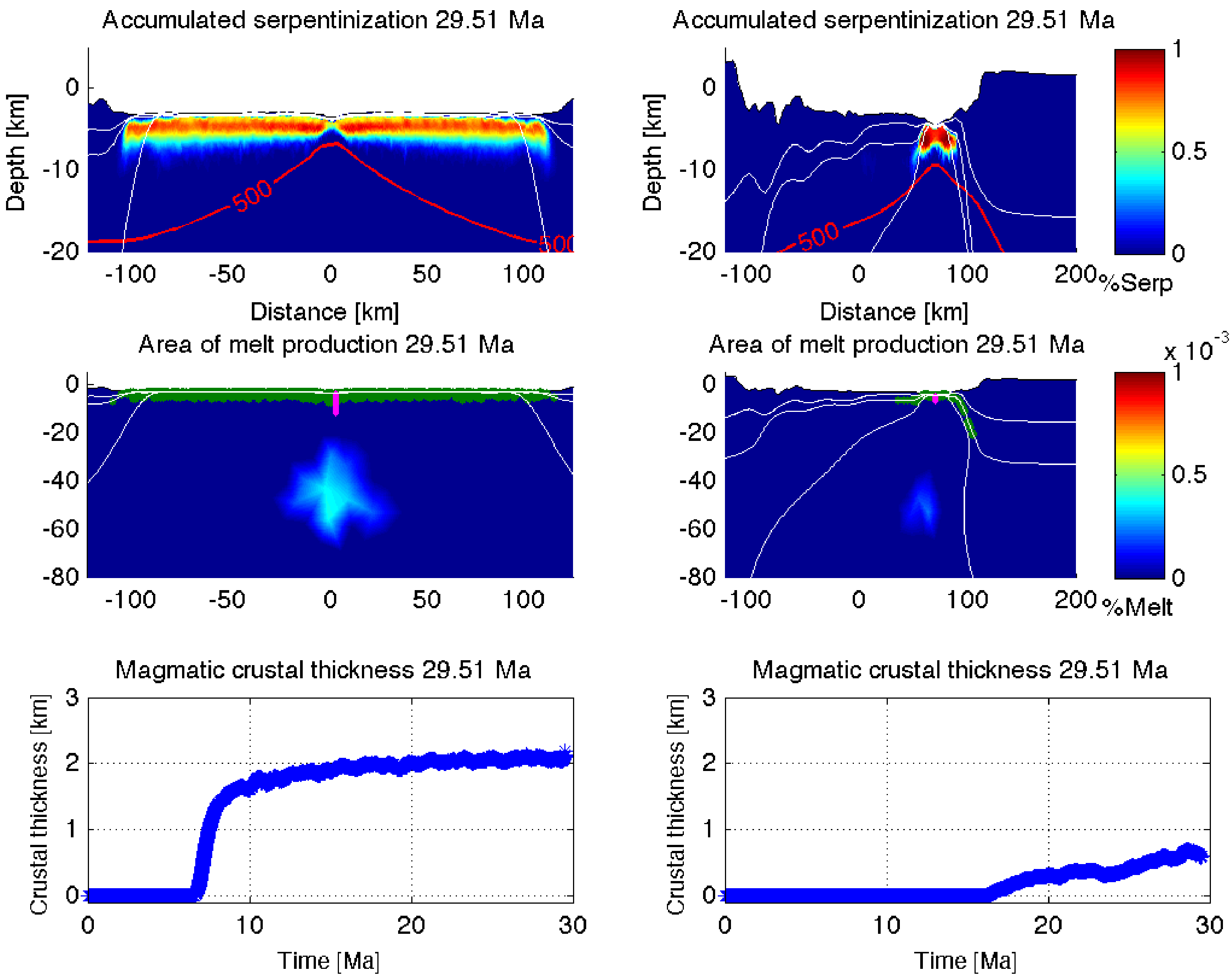


Same velocity = 5 mm/yr

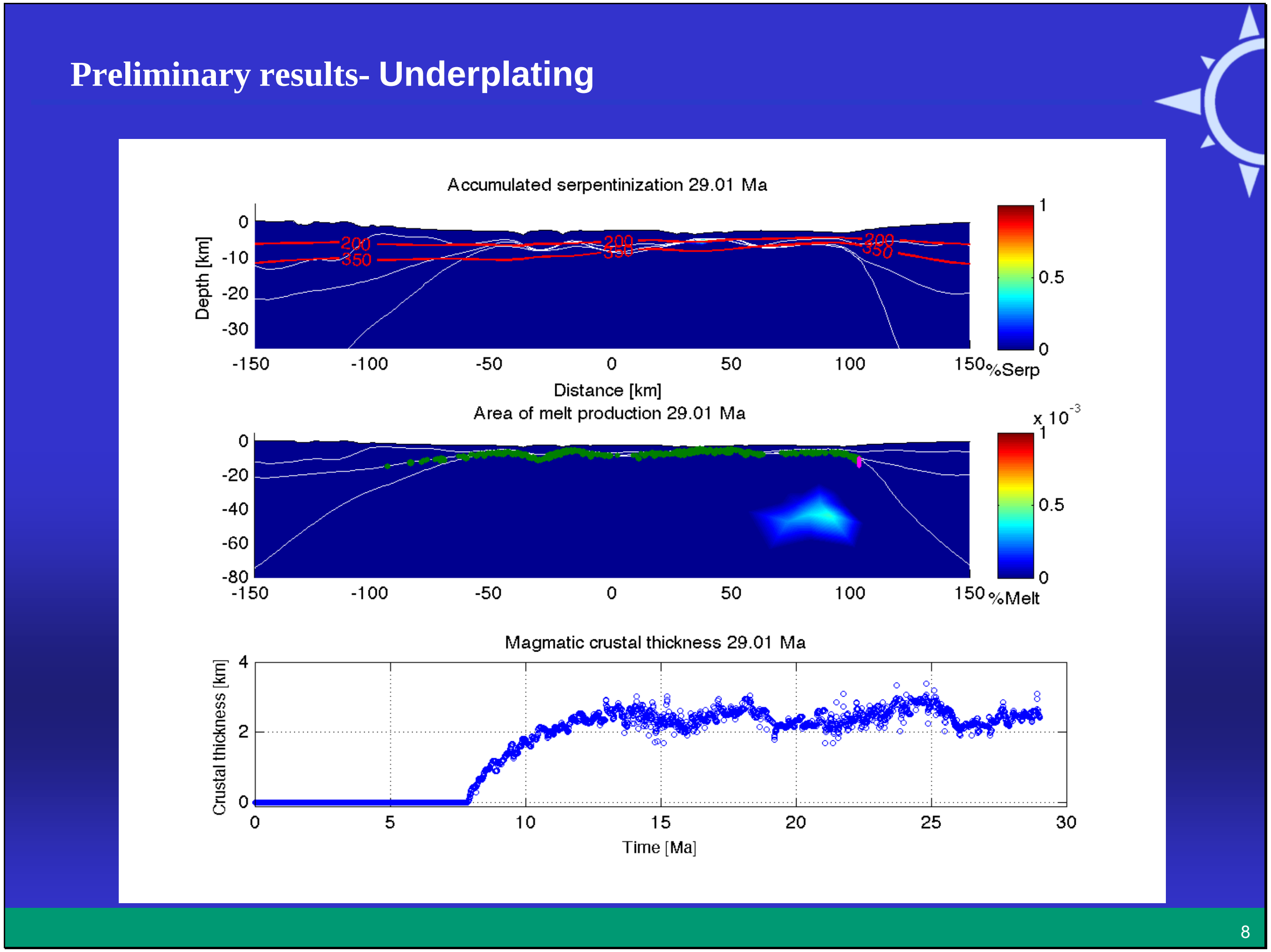
Effect of crustal thickness on serpentinisation/melting.
Strong mafic granulite



Same velocity = 5 mm/yr

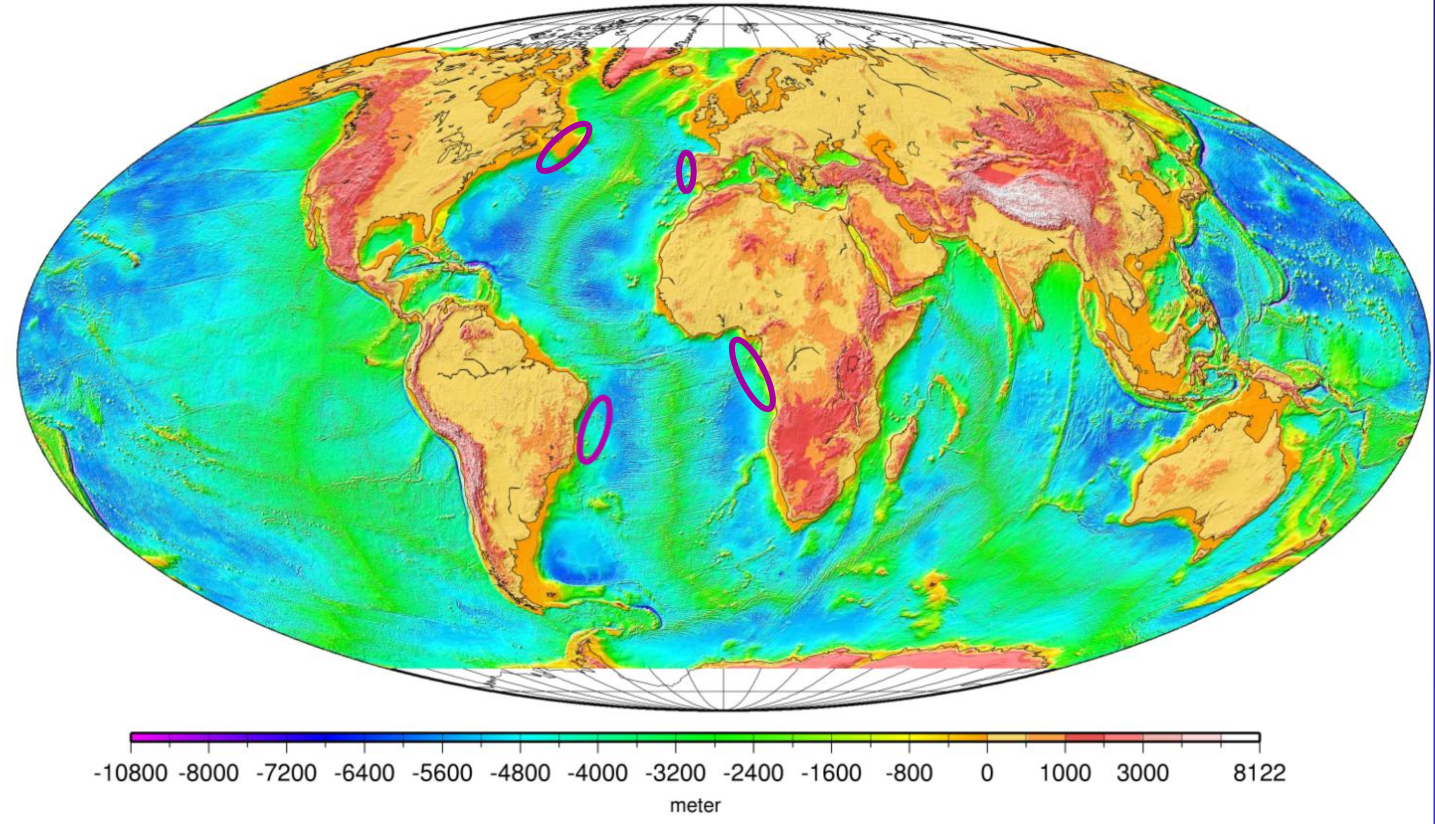


Accumulated serpentinization 29.51 Ma
Depth [km]
Distance [km]
500
Accumulated serpentinization 29.51 Ma
%Serp
Area of melt production 29.51 Ma
Area of melt production 29.51 Ma
x 10^-3
%Melt
Magmatic crustal thickness 29.51 Ma
Crustal thickness [km]
Time [Ma]
Magmatic crustal thickness 29.51 Ma



Presenter's notes: Shown here is an example of the evolution of a rift with underplating from dikes. Top and bottom plots show degree of serpentinization and magmatic crustal thickness over time. The middle plot shows the formation of a dike at each time step (in pink color) and the resulting underplating and the thickness of the underplated melt over time (in green color). A remarkable result is that we can find very highly thinned and hyperextended margins which are not floored by serpentinite, but rather by melt. Work continues on implementing how the melt is distributed in space for the sill approximation.

West Iberia- Newfoundland margins
Brazil-African margins



Past and Current Research

Future Research

Continental margin formation and oceanization

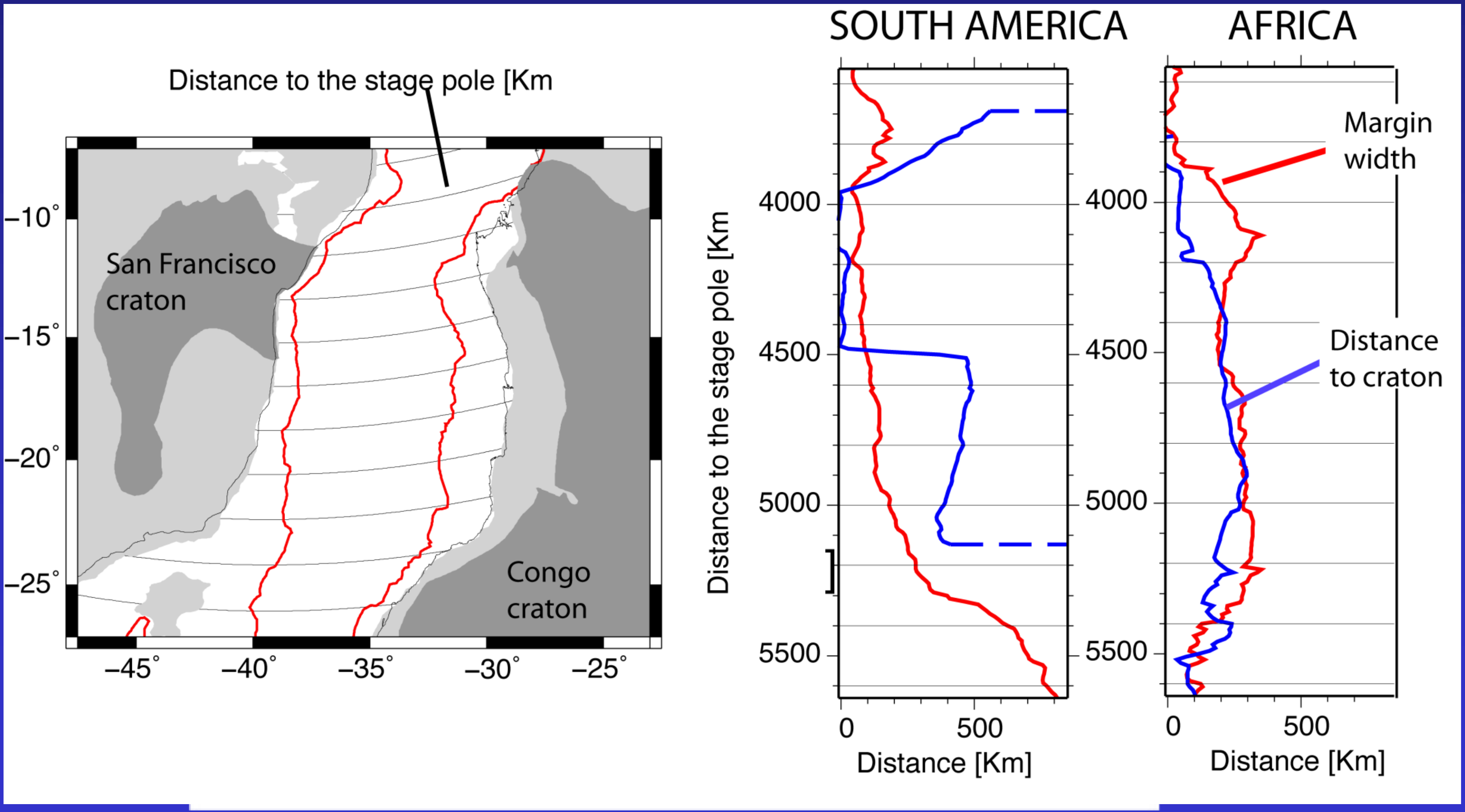
1. Key controls on margin formation.

2. Interplay between deformation and sedimentation.

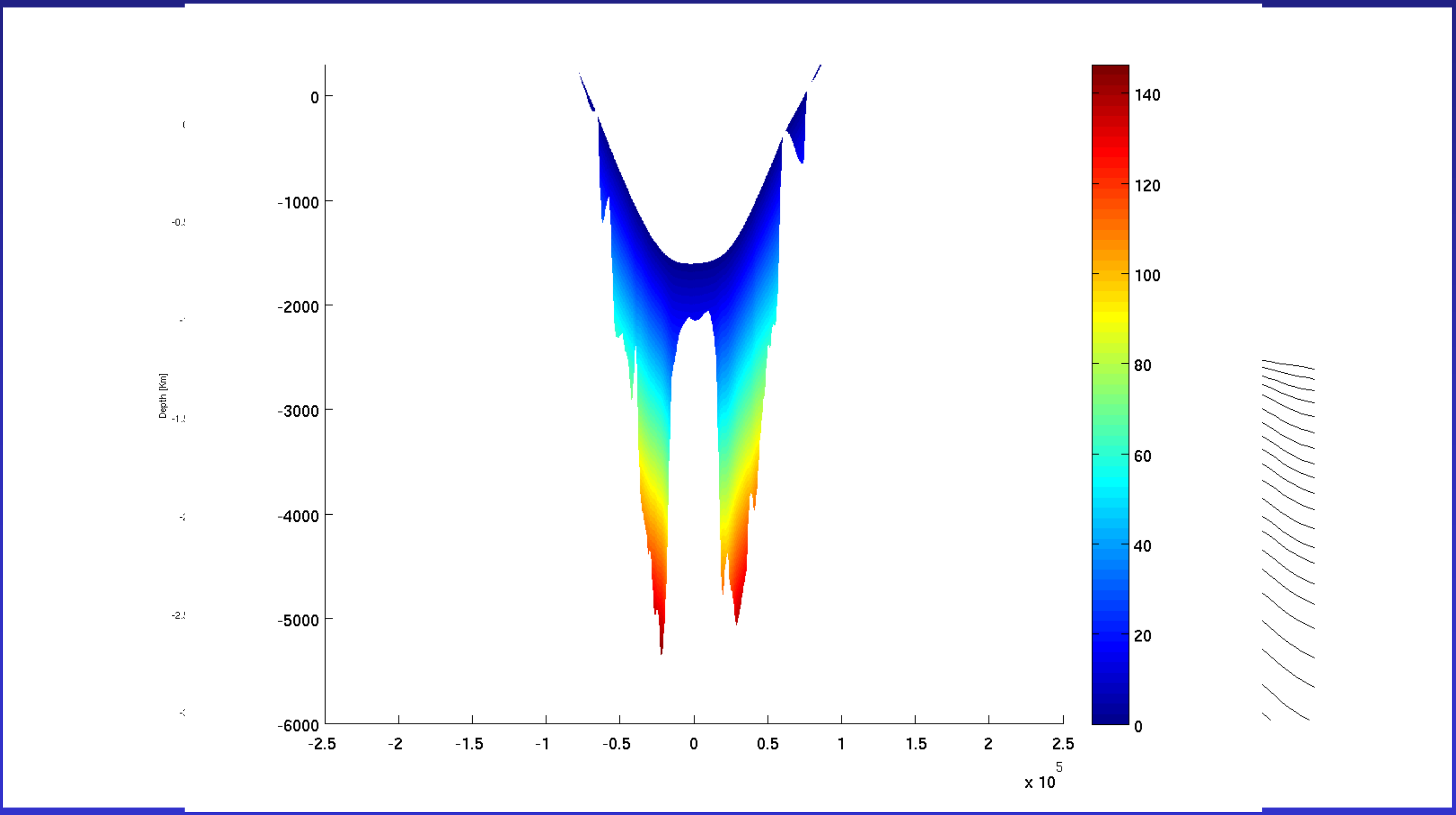
3. Margin formation, uplift, sediment transport and accumulation.

1. Key controls on margin formation.

Combined offshore/onshore experiments

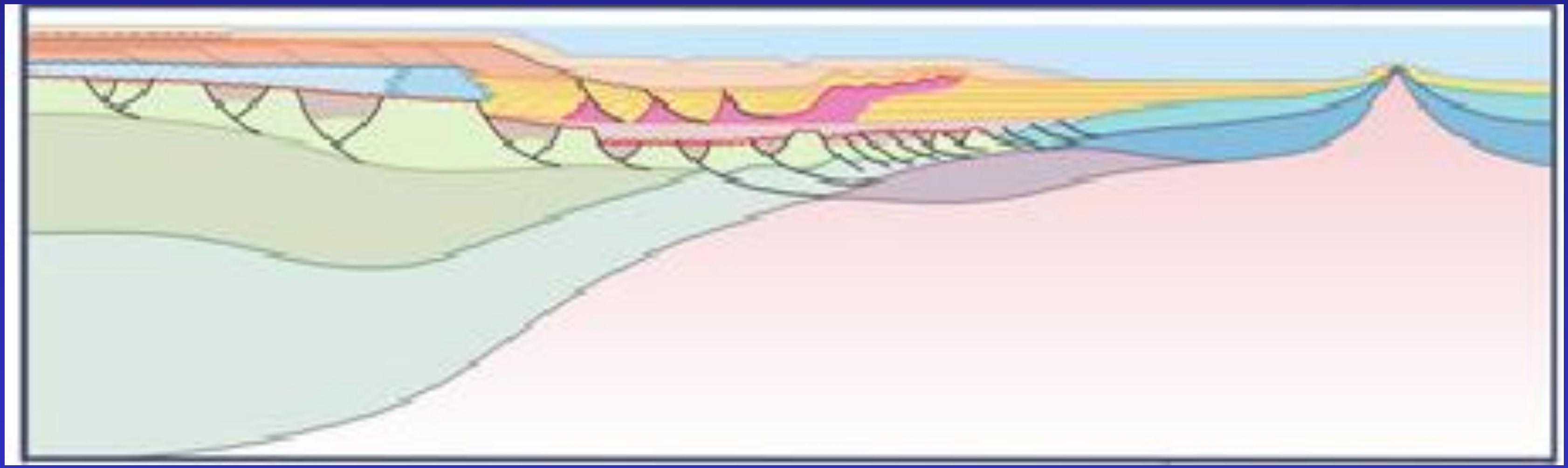


2.Interplay between continental margin deformation and sedimentation.



Miguel Andres Martinez, PhD candidate

3.Interplay between margin formation, offshore uplift and consequences for sediment transport and accumulation.



Thank you!

Part 5 (additional slides)