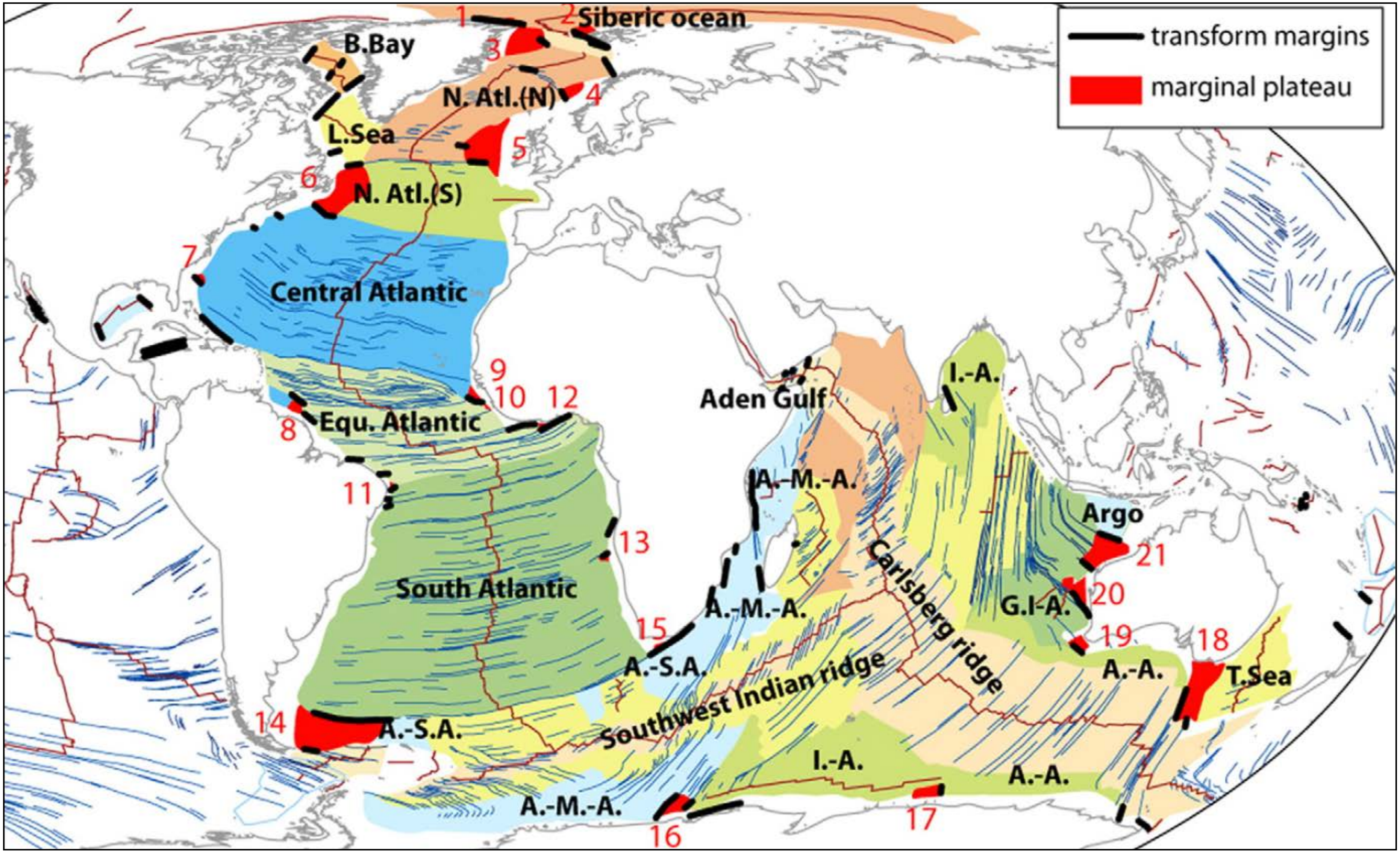
Christophe BASILE

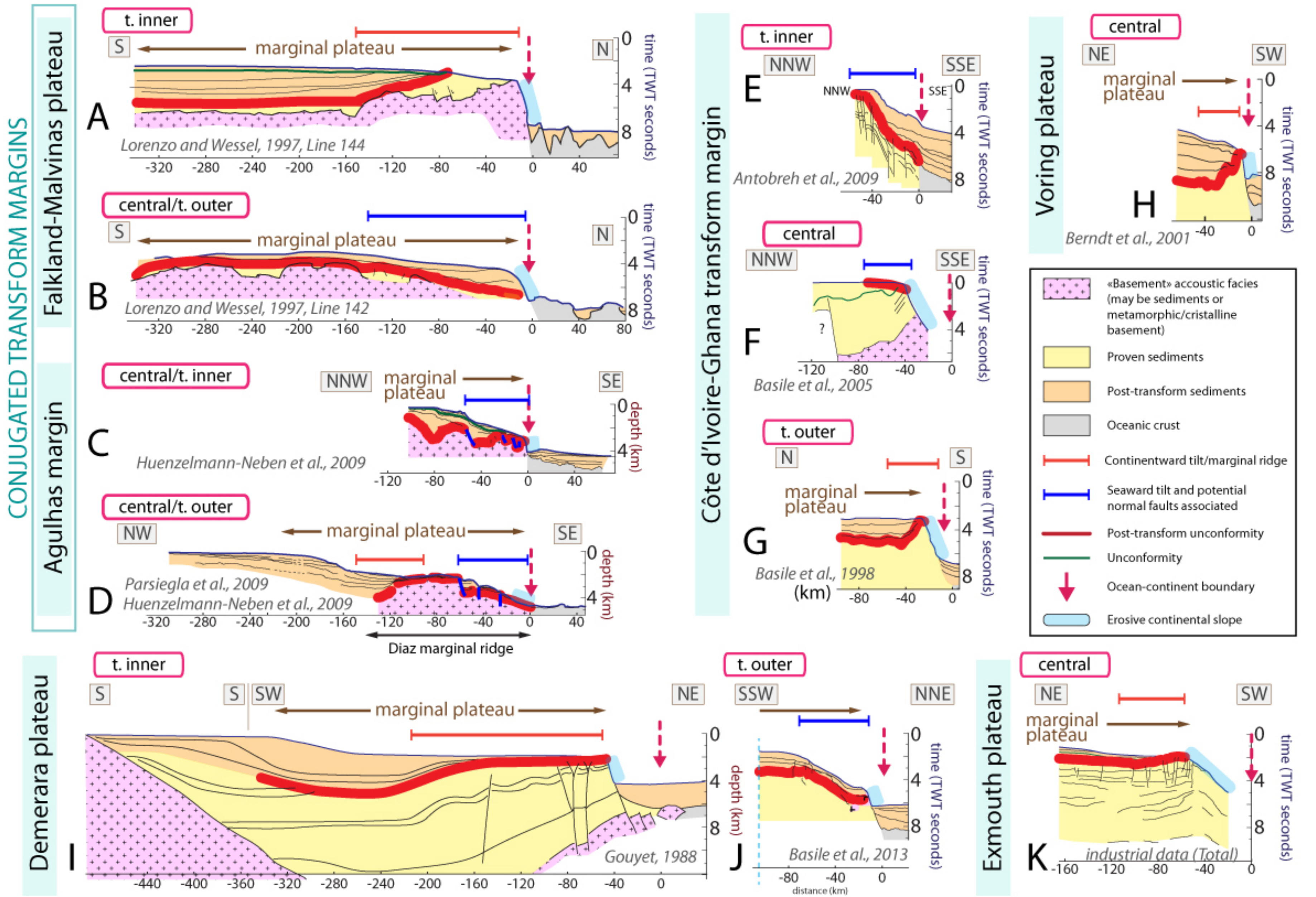
with Jean BRAUN, Lies LONCKE, Marion MERCIER DE LEPINAY, Walter ROEST

Transform margins along marginal plateaus

- Vertical motion
- Structural inheritance

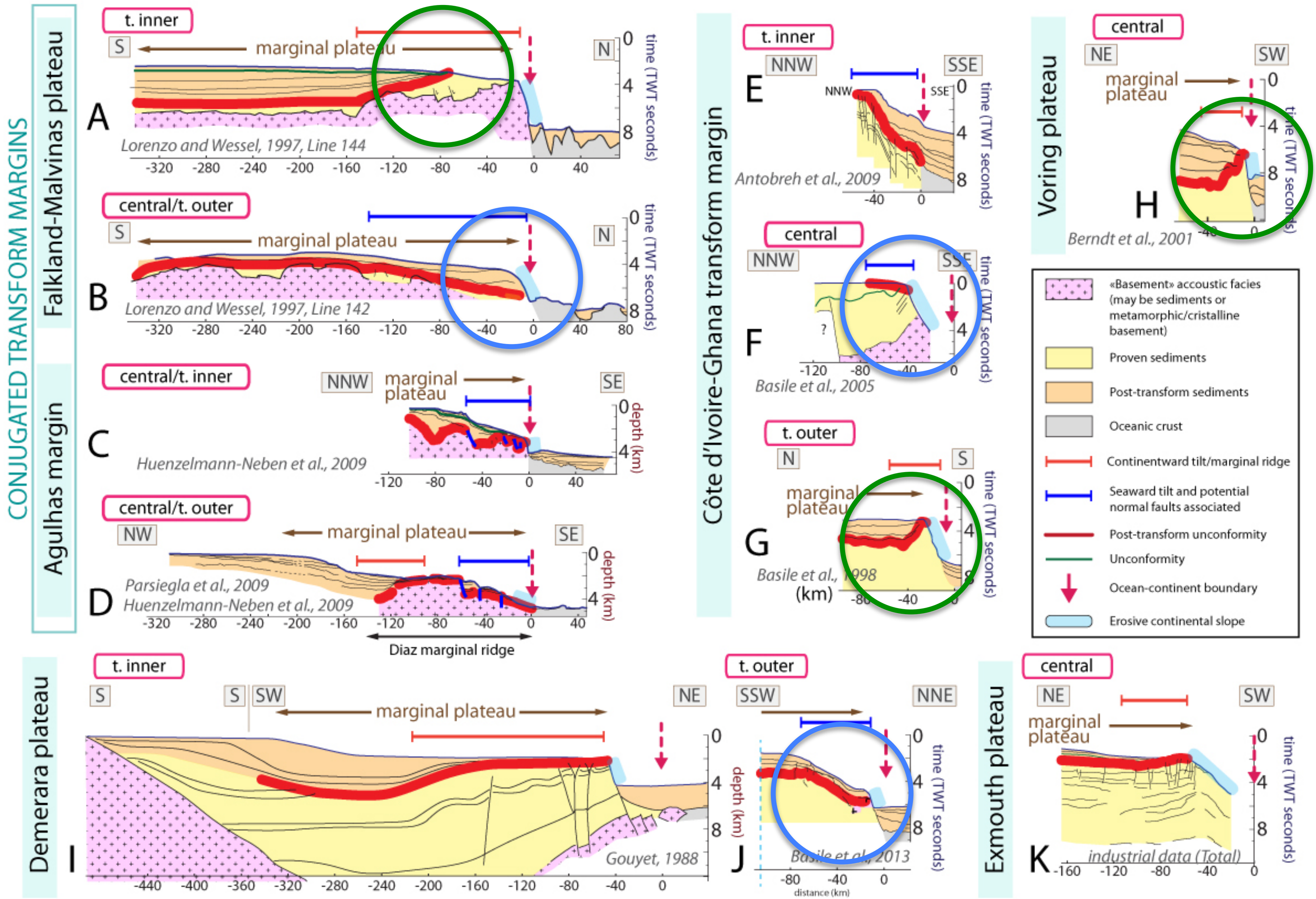


Mercier de Lépinay 2016



Mercier de Lépinay 2016

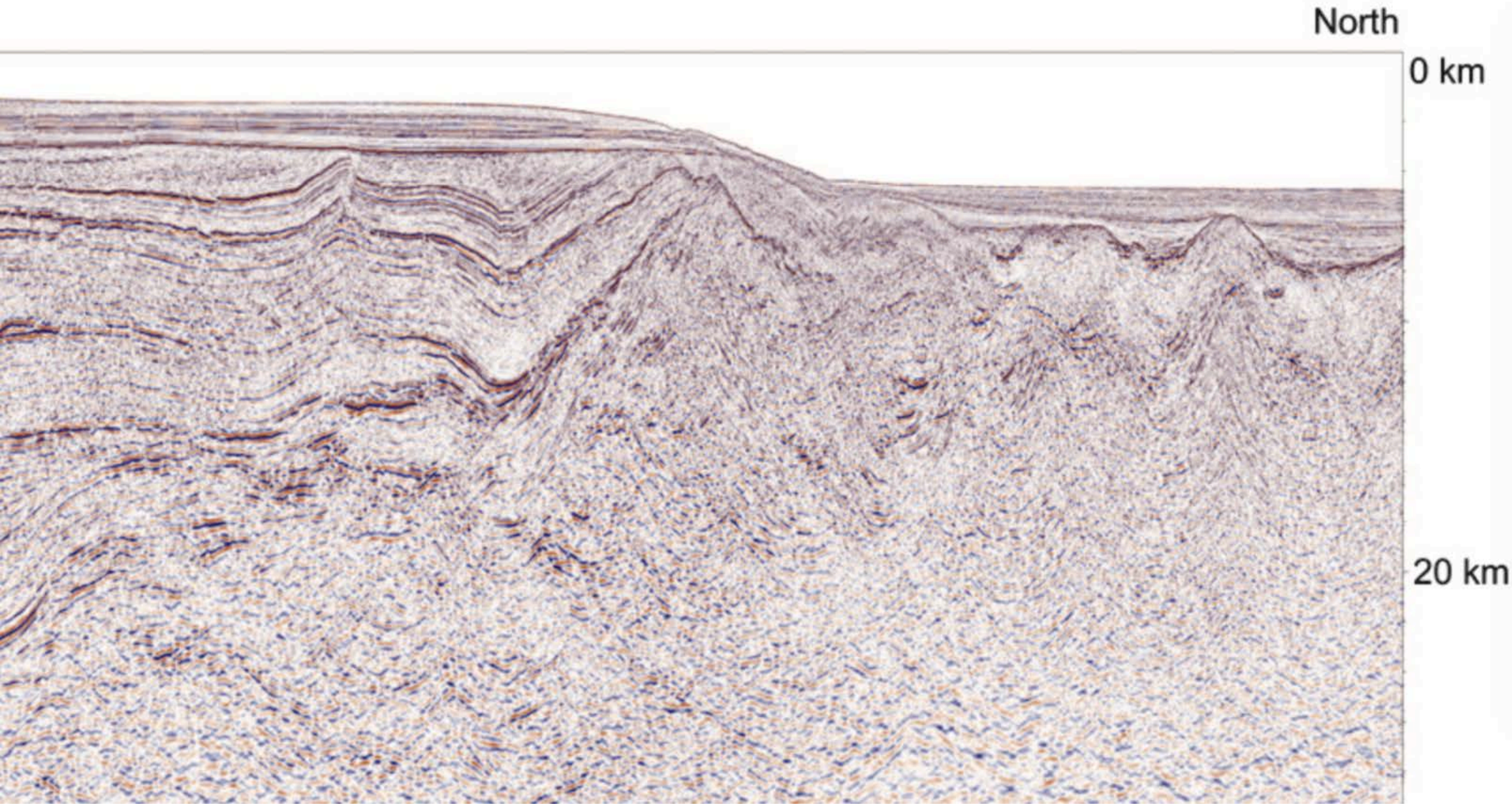
Upward flexure / Downward flexure



Deep marginal plateaus: space for sedimentation, no (?) erosion

Demerara marginal plateau

Oceanic crust

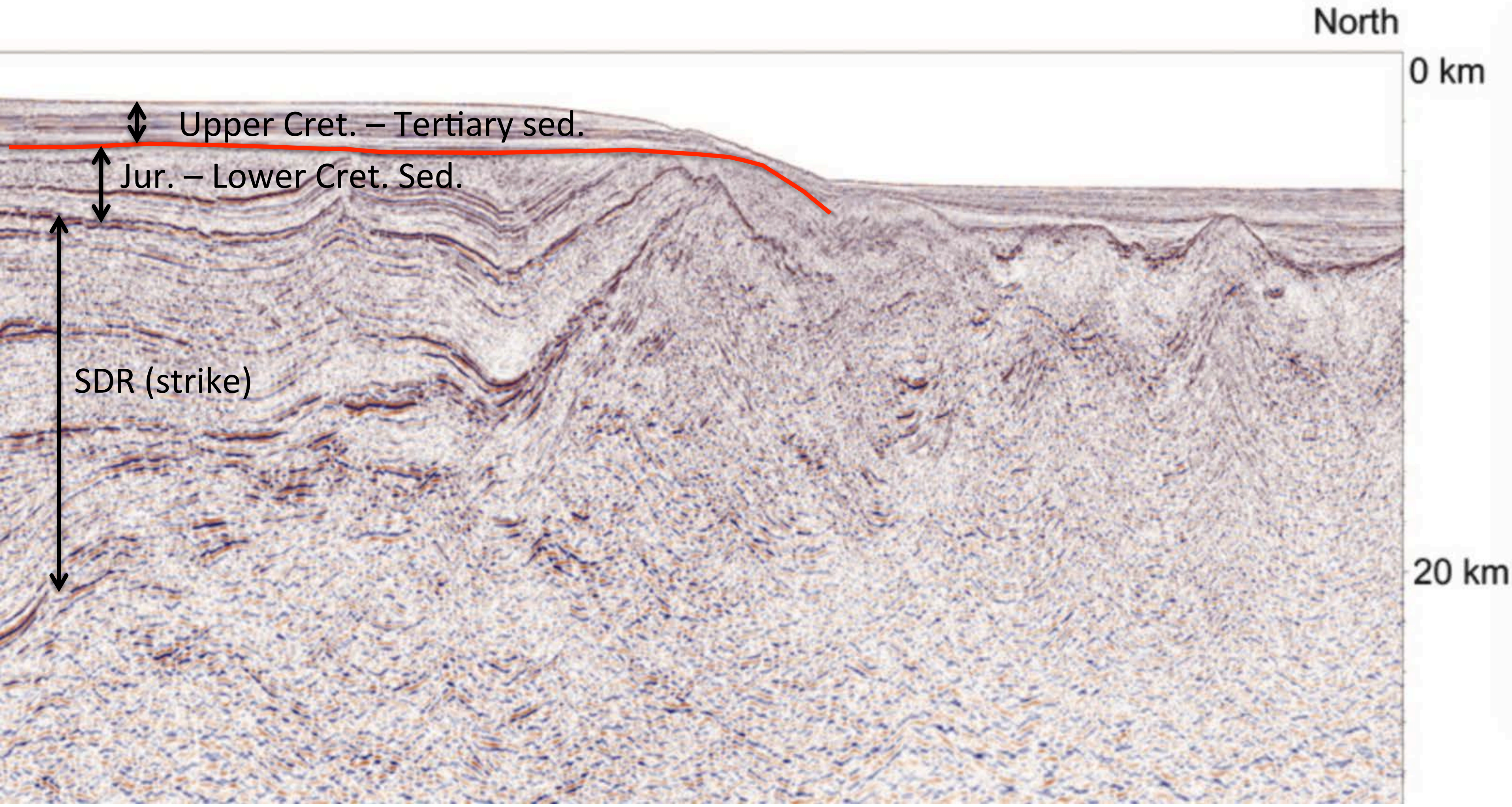


Vertical exageration ~ 3

Reuber 2016

Downward flexure post late Albian

Post-hot spot unconformity: late Albian = syn-transform

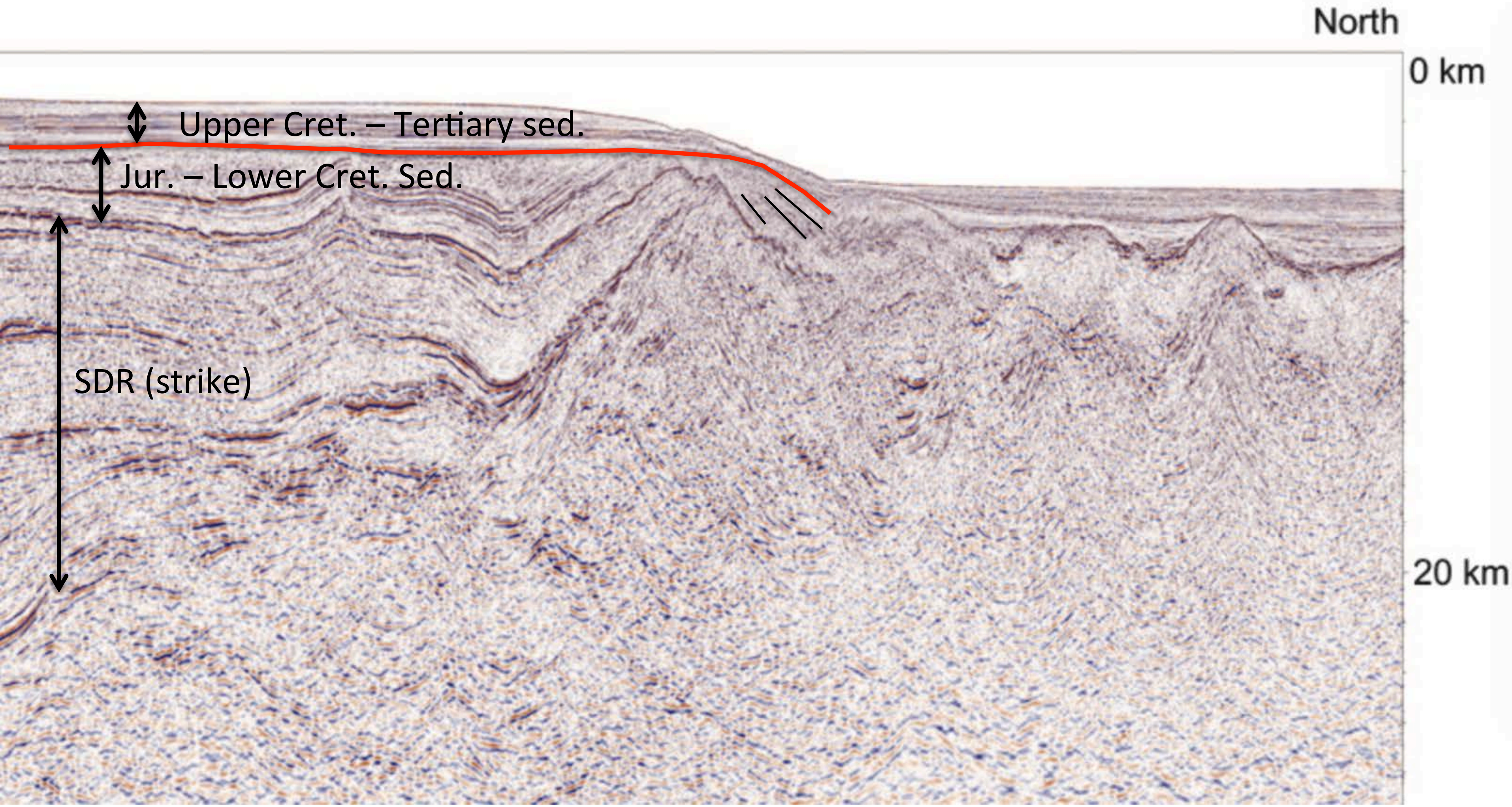


Reuber 2016

Downward flexure post late Albian

Post-hot spot unconformity: late Albian = syn-transform

subsidence along the transform (not dated, likely Aptian-Albian)



Reuber 2016

Downward flexure post late Albian

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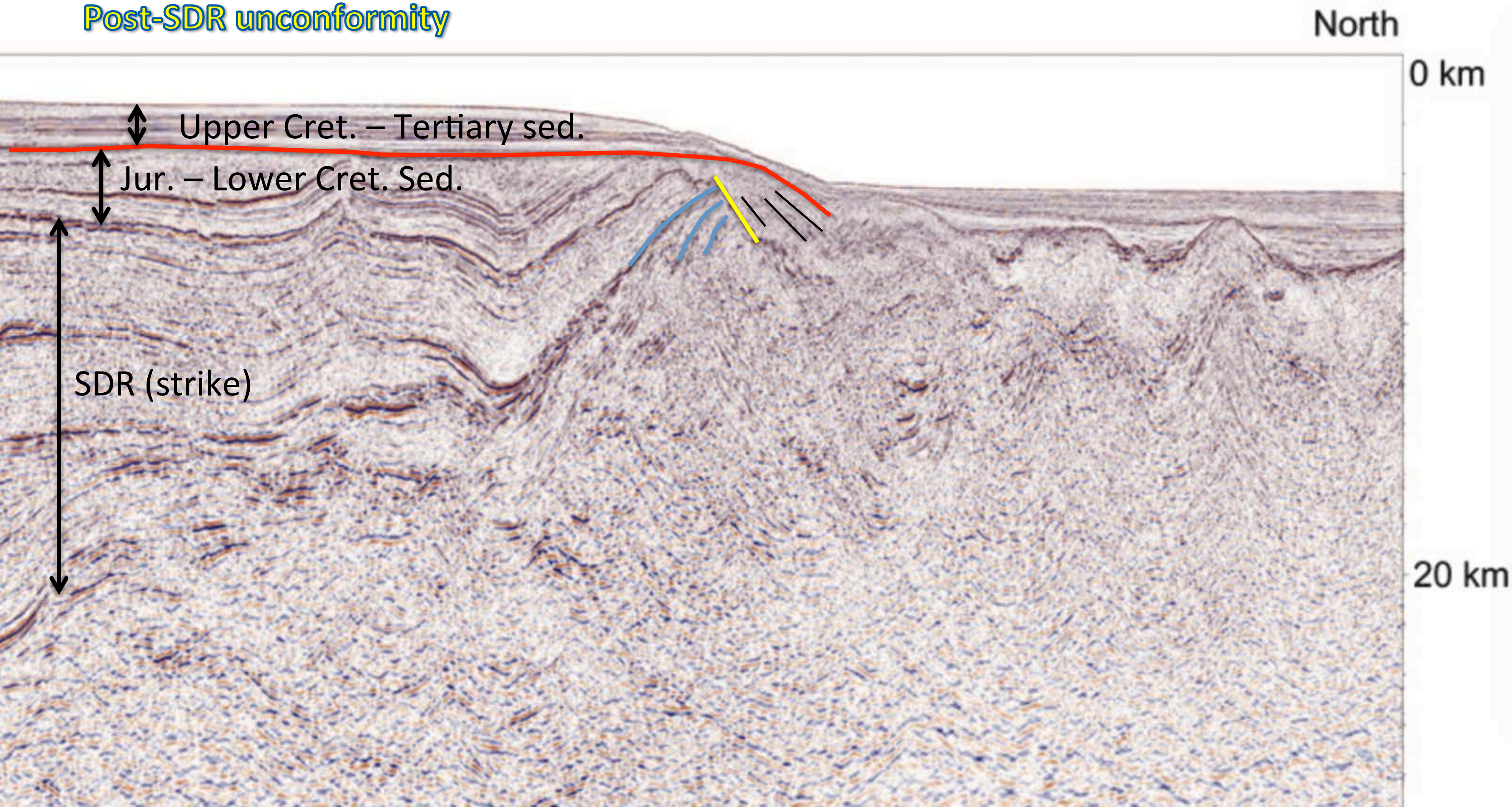
Post-SDR unconformity



Reuber 2016

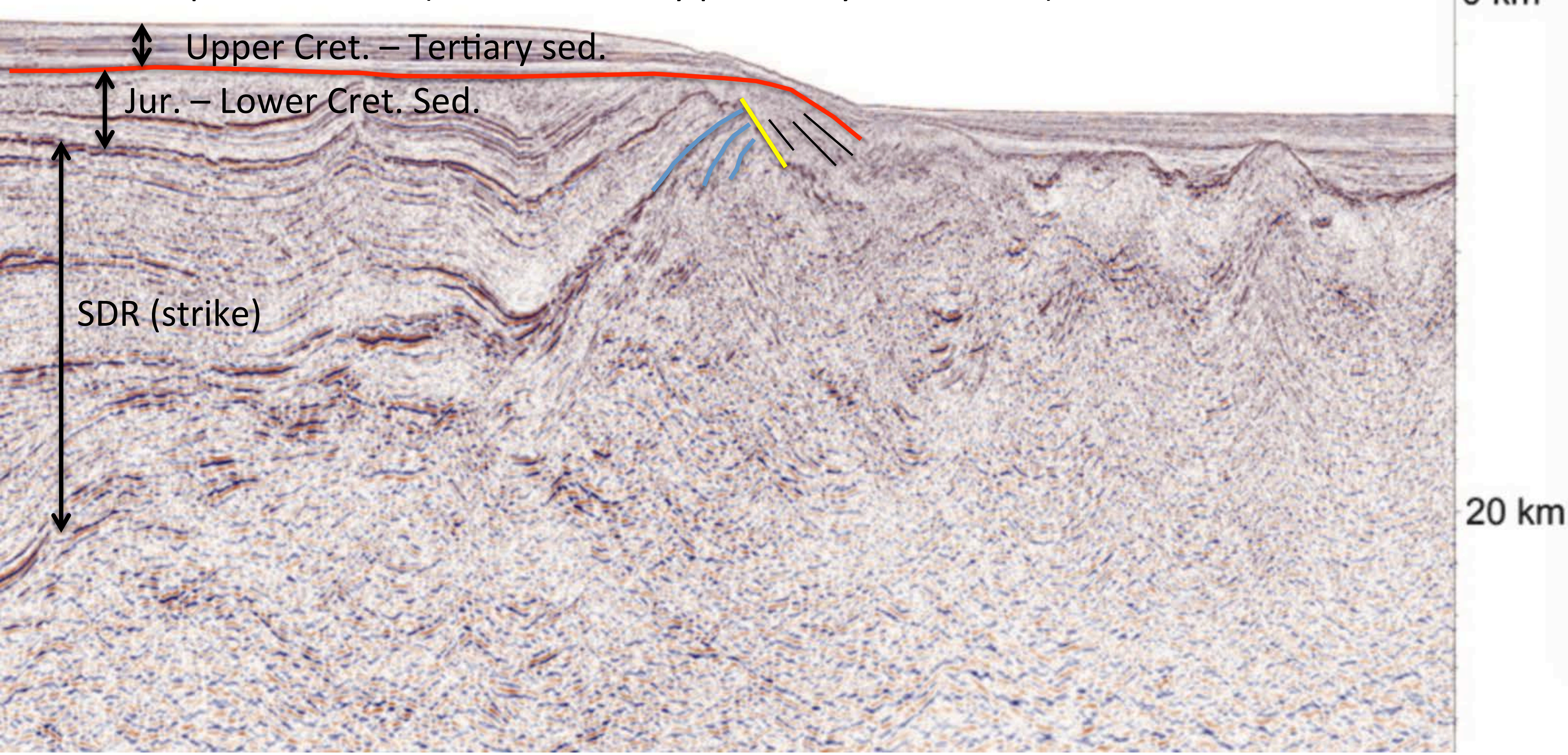
Downward flexure post late Albian

Post-hot spot unconformity: late Albian = syn-transform

subsidence along the transform (not dated, likely Aptian-Albian)

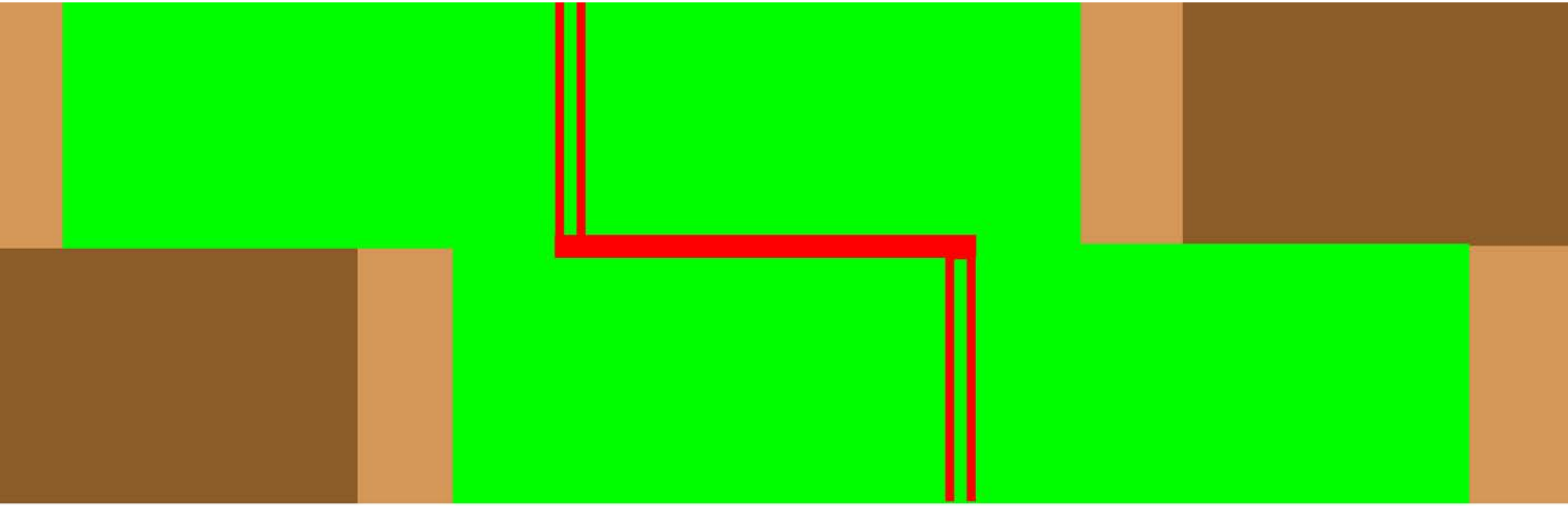
Post-SDR unconformity

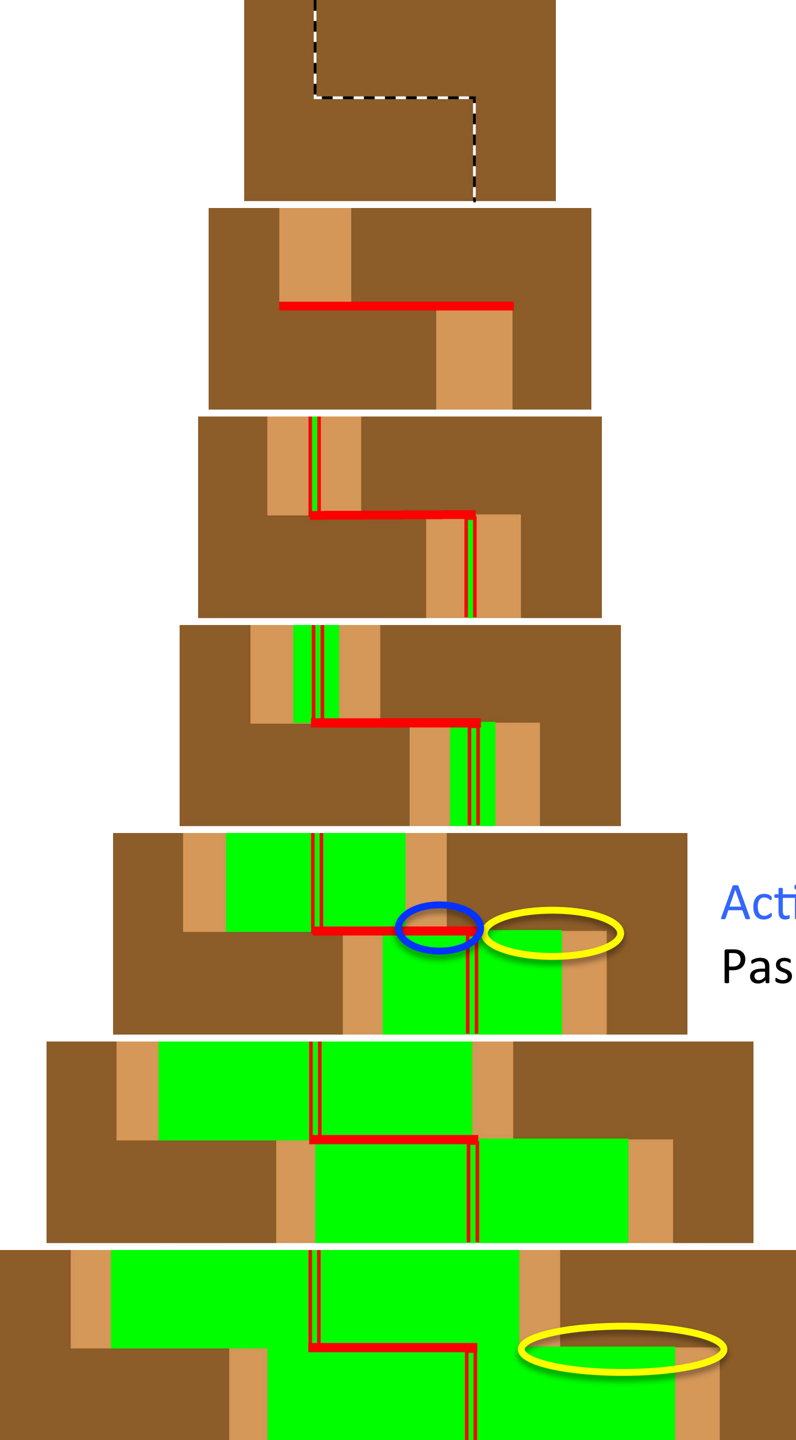
Upward flexure (not dated, likely post early Cretaceous)



Reuber 2016

Scrutton (1979)
Mascle & Blarez (1987)

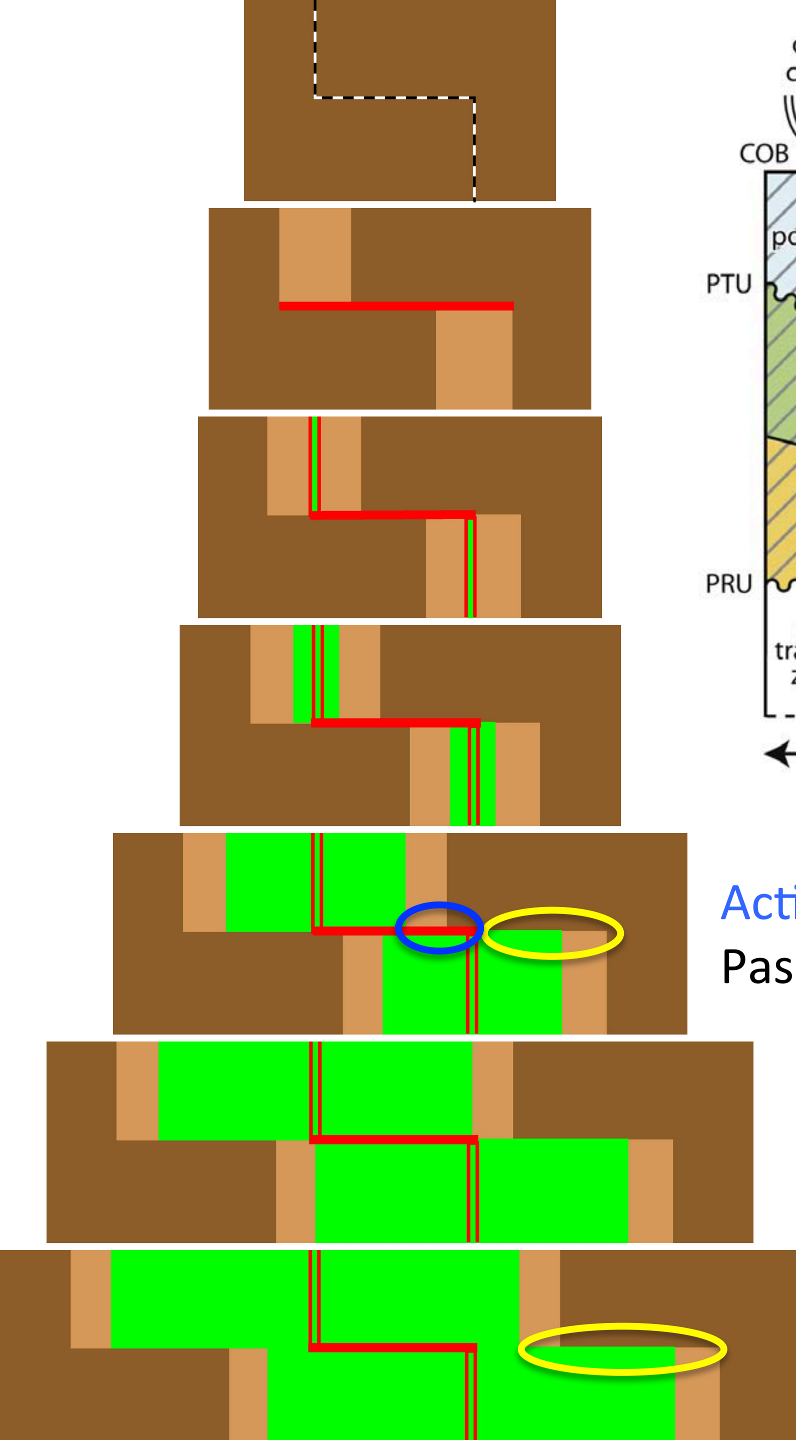


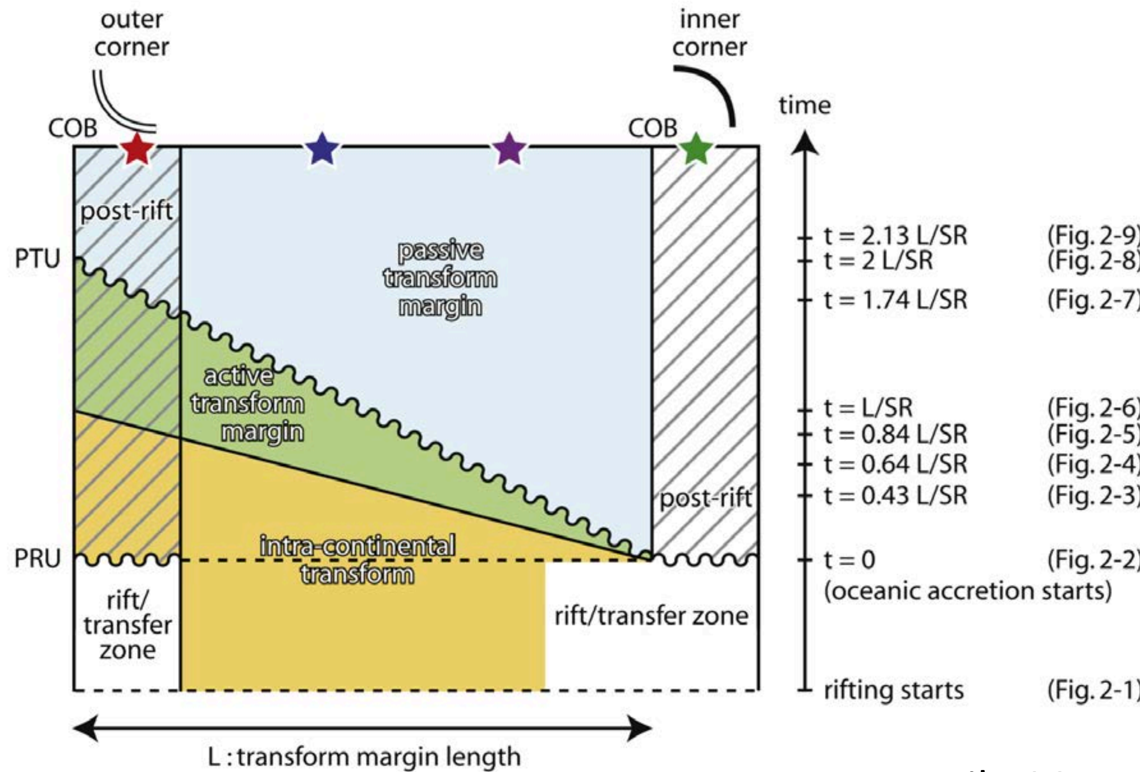


Active transform margin

Passive transform margin

Passive transform margin





Basile 2015

Active transform margin

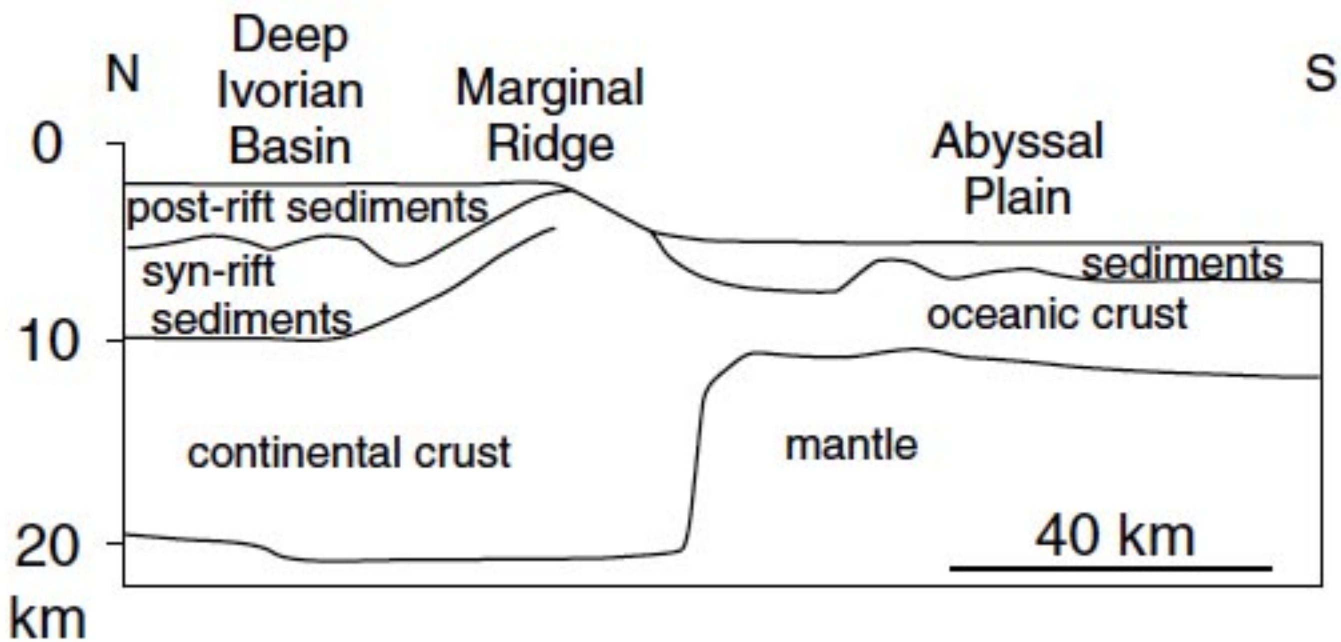
Passive transform margin

Post-rift ≠ Post-transform

Post-transform diachroneous

Passive transform margin

Côte d'Ivoire – Ghana transform margin



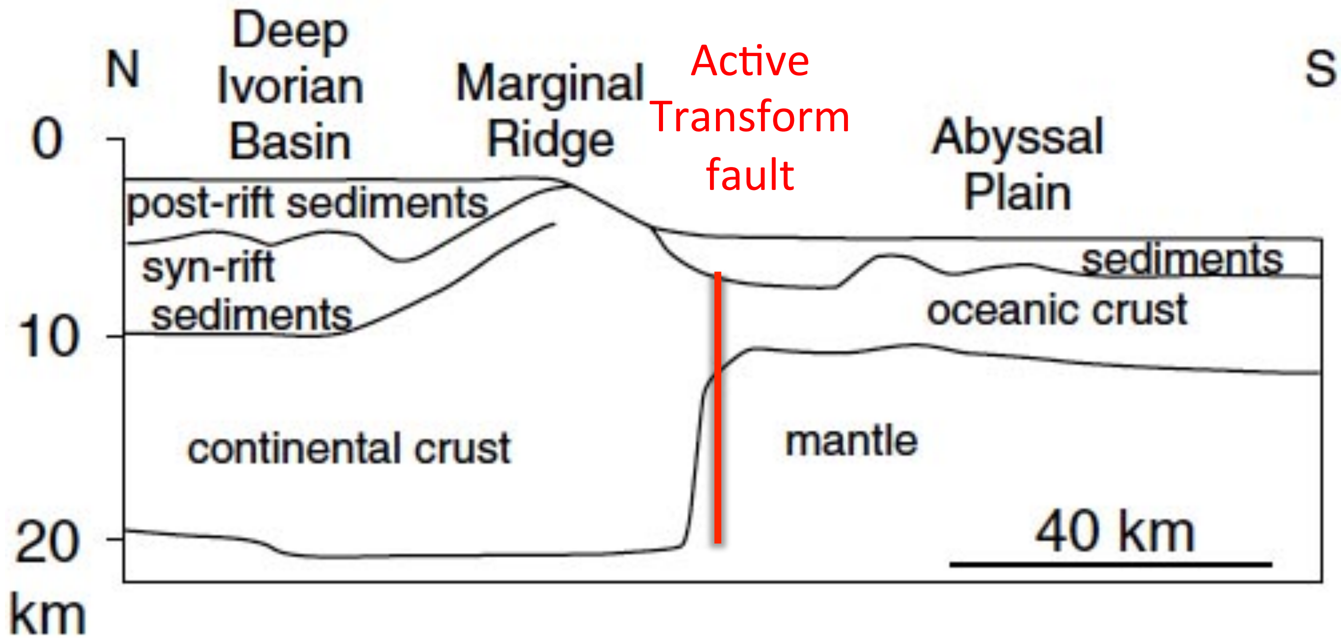
Basile 2005
from Sage 2000

Post-transform

The two lithospheres belong to the same plate: Coupling

Thermal subsidence of the oceanic lithosphere pulls down the edge of the continent:
Downward (oceanward) subsidence

Côte d'Ivoire – Ghana transform margin

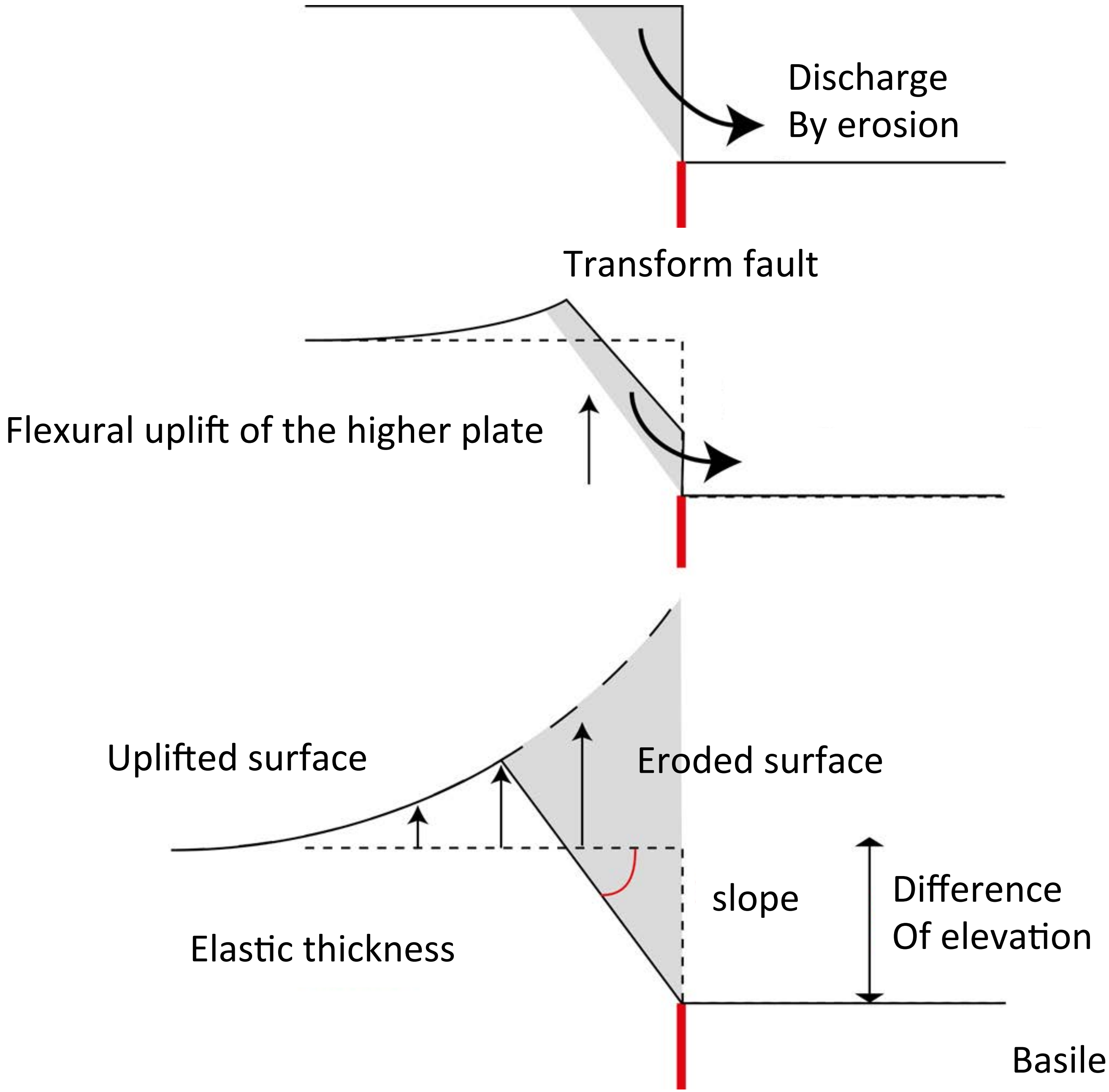


Basile 2005
from Sage 2000

Syn-transform

The two lithospheres belong to different plates: Uncoupling

Difference in elevation: Erosion of the higher plate



Basile 2002
Bigot-Cormier 2005

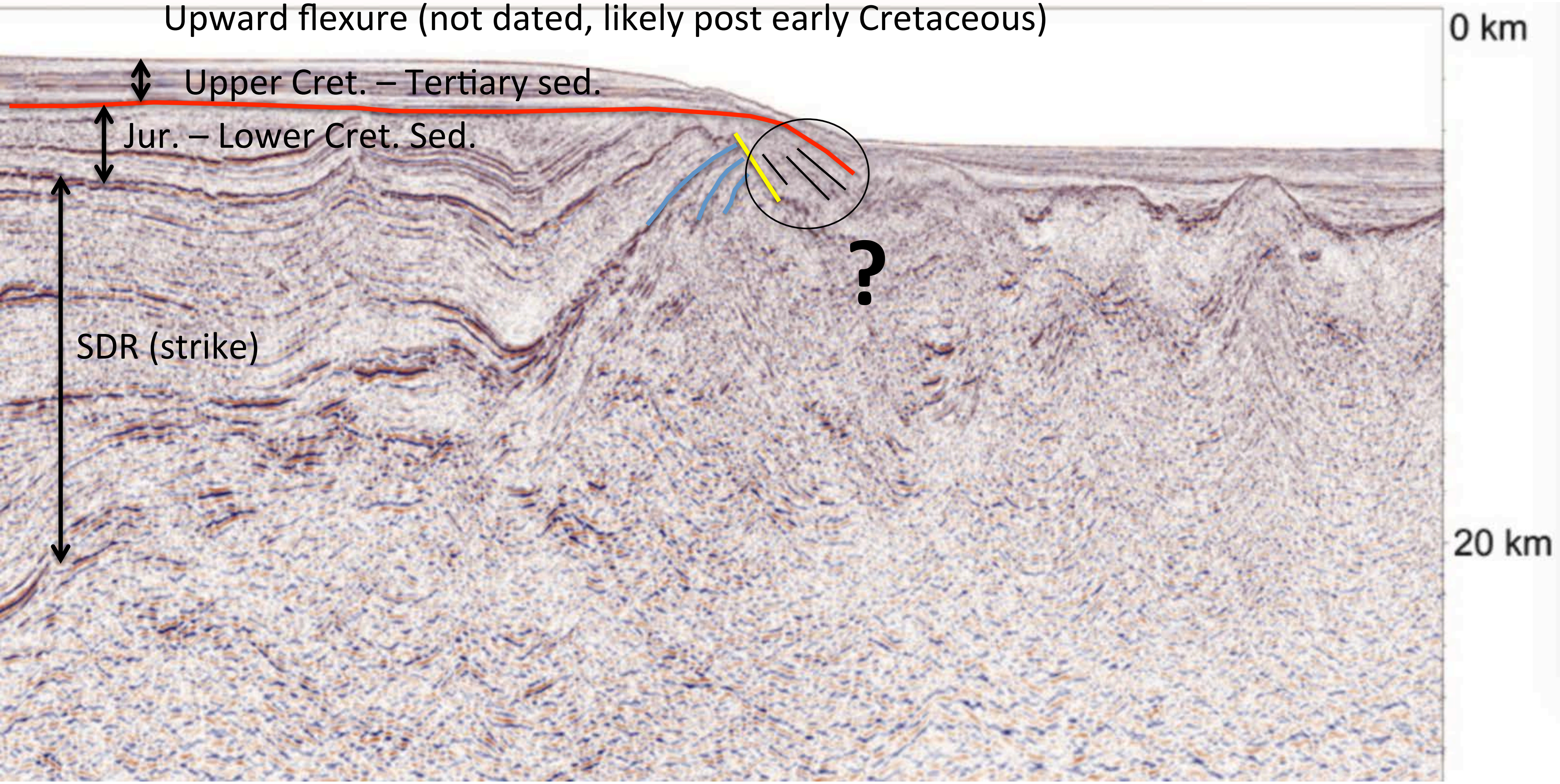
Downward flexure post late Albian | Thermal subsidence

Post-hot spot unconformity: late Albian = syn-transform

subsidence along the transform (not dated, likely Aptian-Albian) | ??

Post-SDR unconformity | Erosional uplift

Upward flexure (not dated, likely post early Cretaceous)



Reuber 2016

No. 4995 July 24, 1965 NATURE 343

A NEW CLASS OF FAULTS AND THEIR BEARING ON CONTINENTAL DRIFT

By Prof. J. TUZO WILSON, O.B.E.
Institute of Earth Sciences, University of Toronto

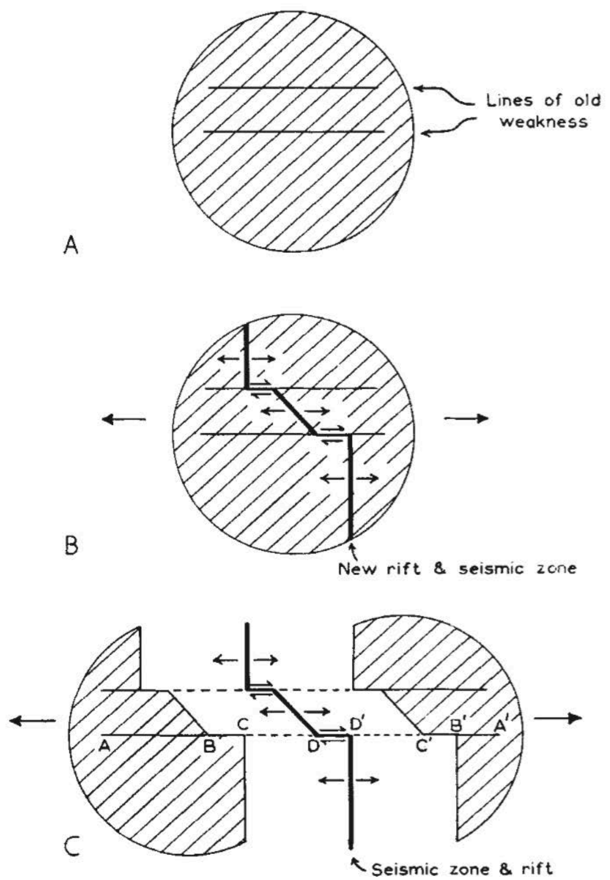


Fig. 6. Diagram illustrating three stages in the rifting of a continent into two parts (for example, South America and Africa). There will be seismic activity along the heavy lines only

Transform faults are inherited

Rifted (divergent) margins appear to connect the inherited transforms

Taylor et al. (2009) : Woodlark, Aden

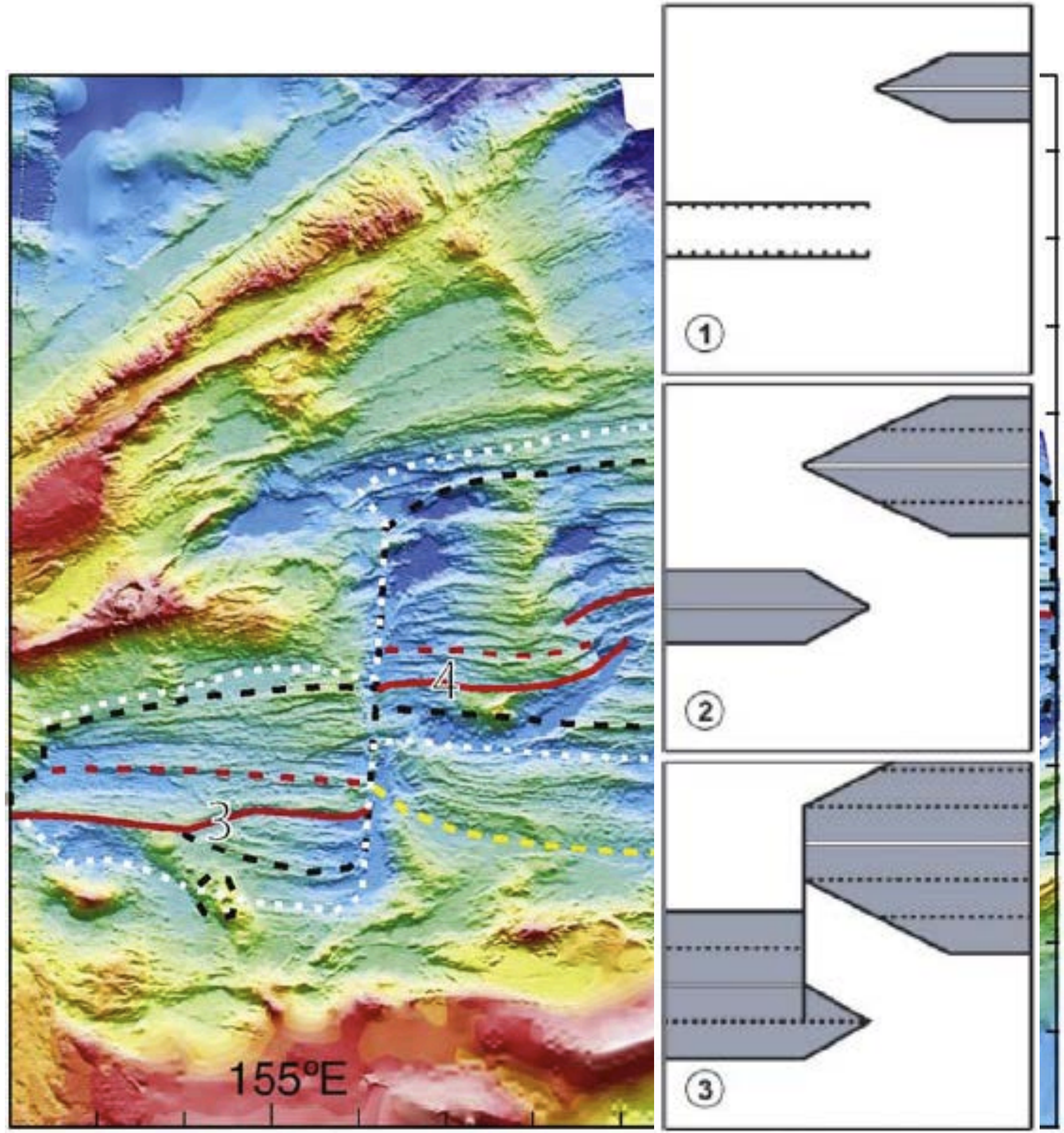
post-rift formation of transform

Transform faults connect oceanic spreading axis

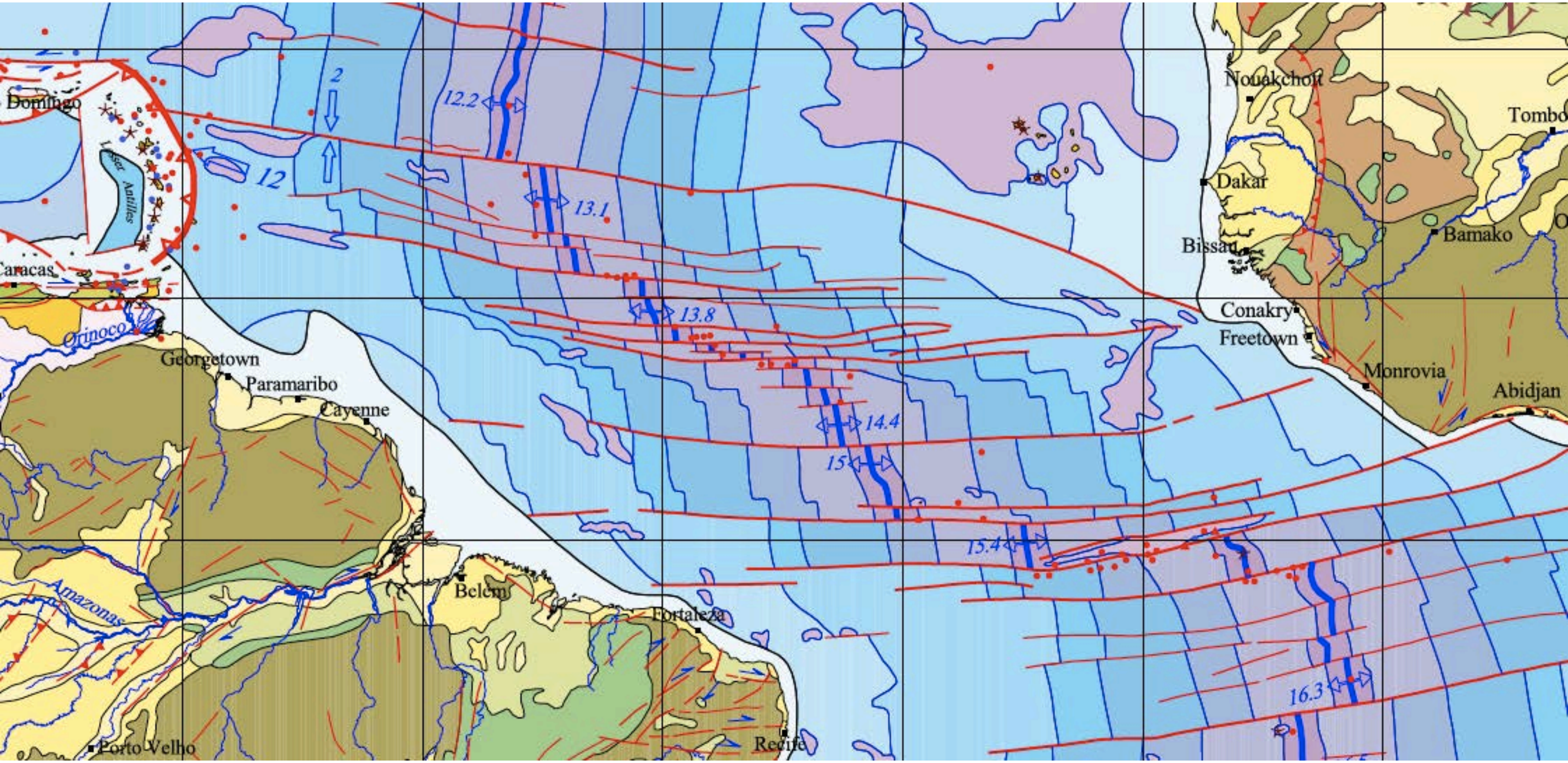
During rifting:

- No transform faults
(parallel to relative motion)

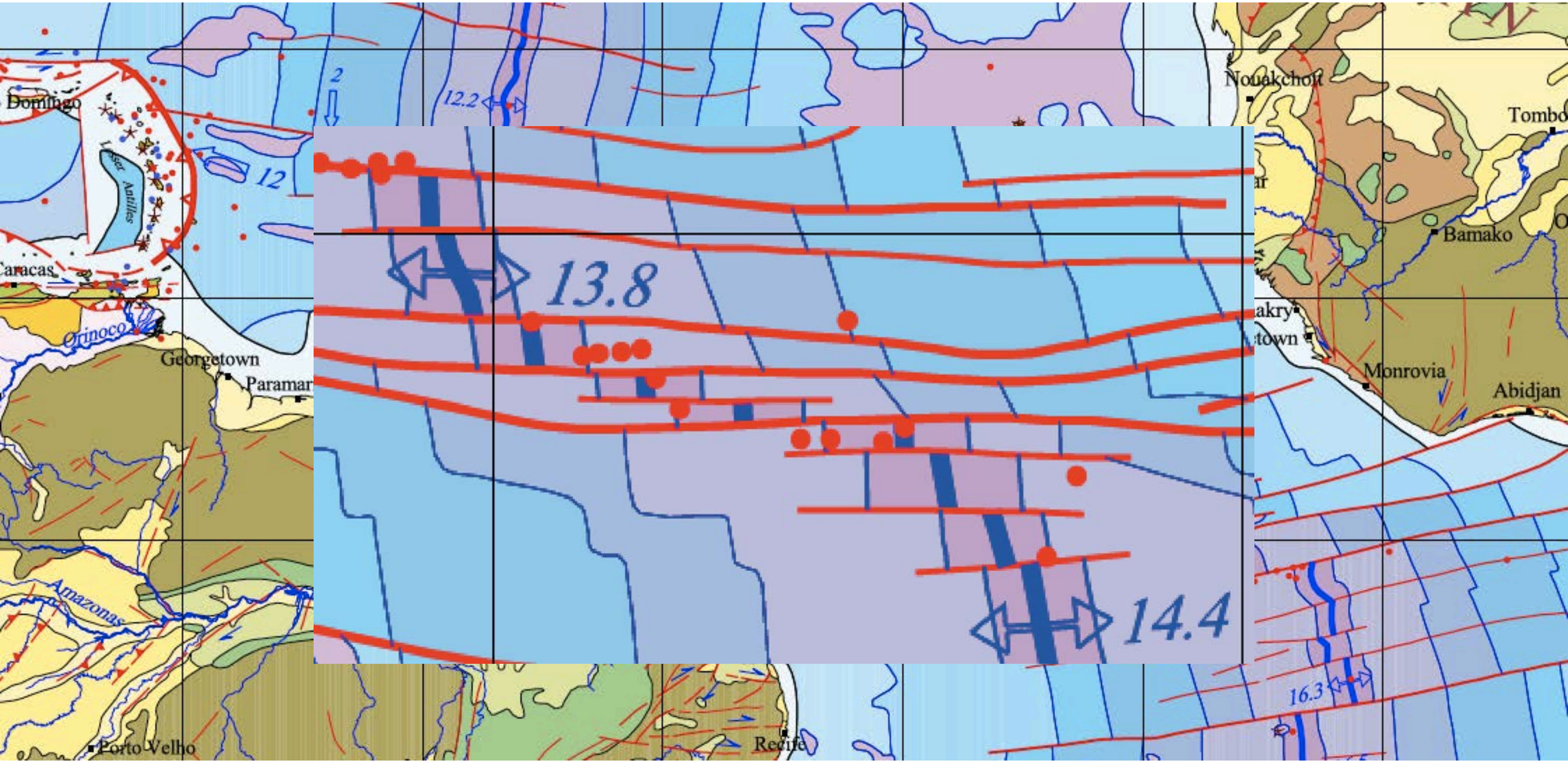
- But transfer zones
(not parallel to relative motion)



Divergent partitionning

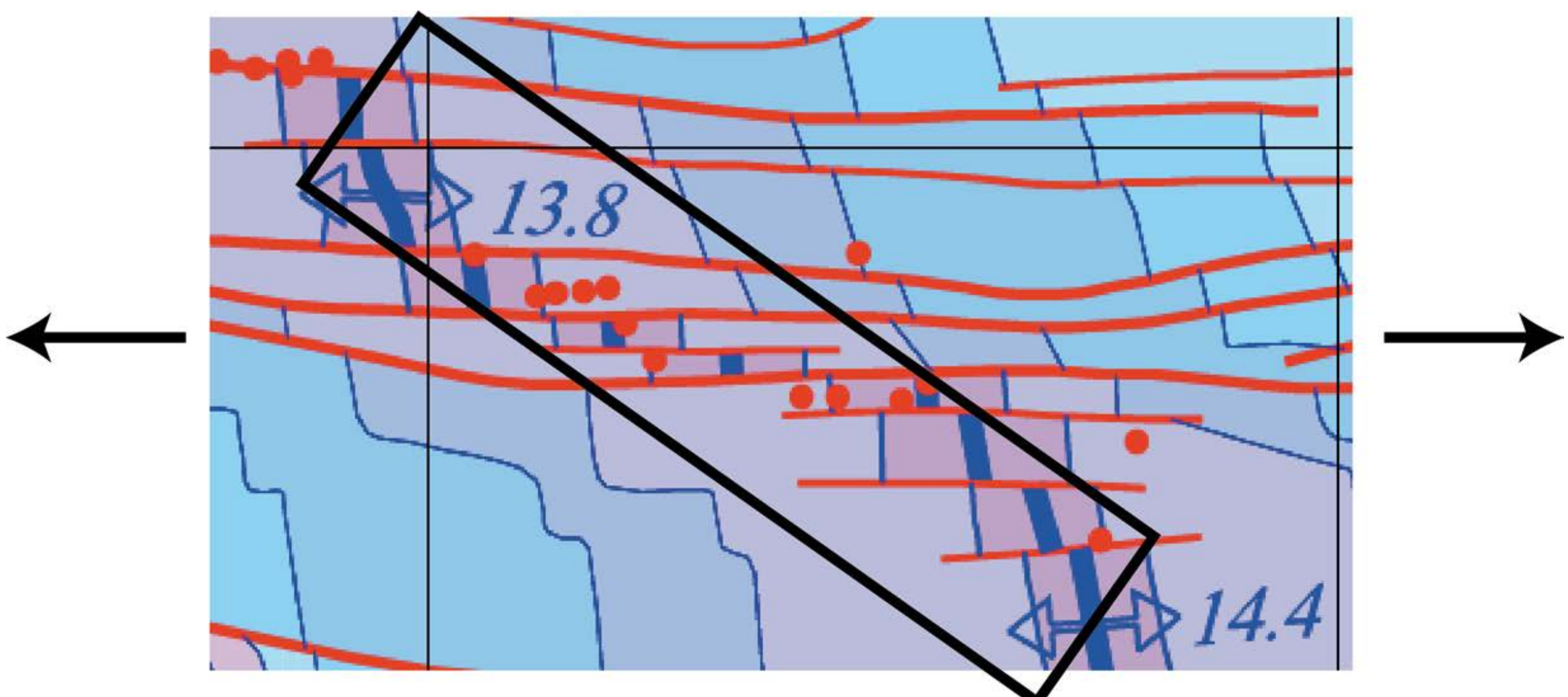


Divergent partitionning



Divergent partitionning

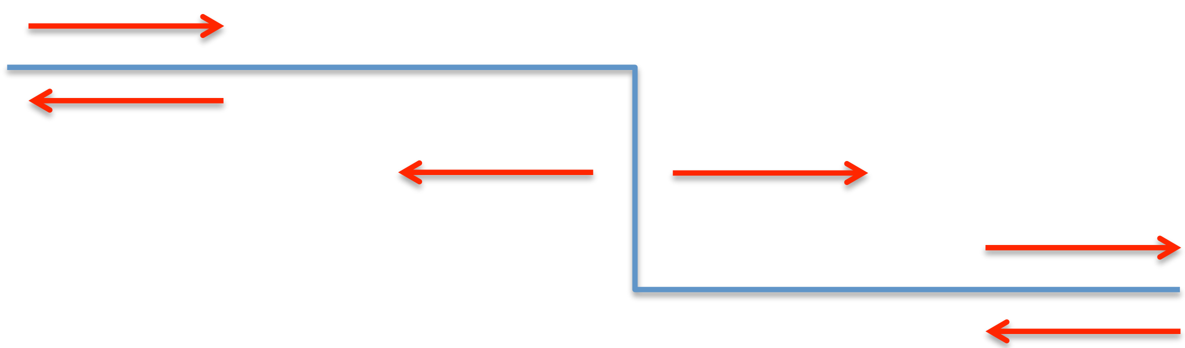
Obliquity between relative plate motion and regional trend of the plate boundary
solved by
spatial partionning between
- motion parallel plate boundaries (transform)
- motion perpendicular plate boundaries (spreading axis)



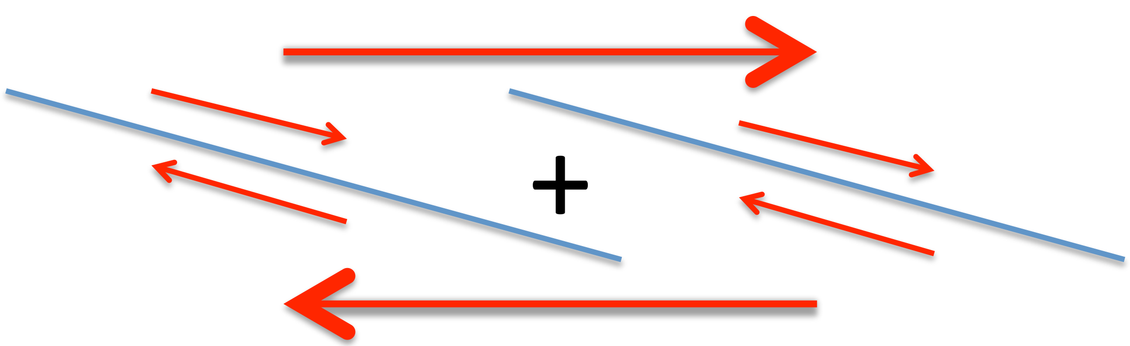
This is the case in oceanic lithosphere (drift), not in continental lithosphere (rift)

Two ways for divergent partitioning

inherited structures = inherited partitioning



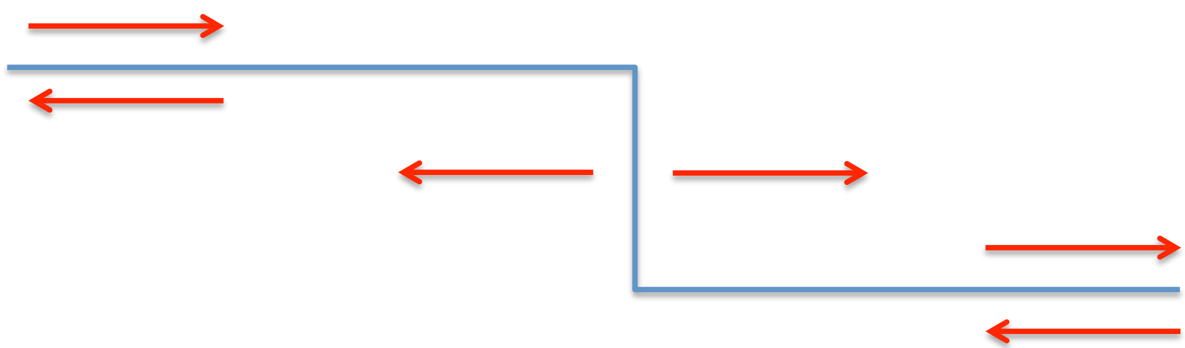
New strike slip faults: the pull-apart paradox



Riedel faults
always form
compressive relays

Two ways for divergent partitioning

inherited structures = inherited partitioning



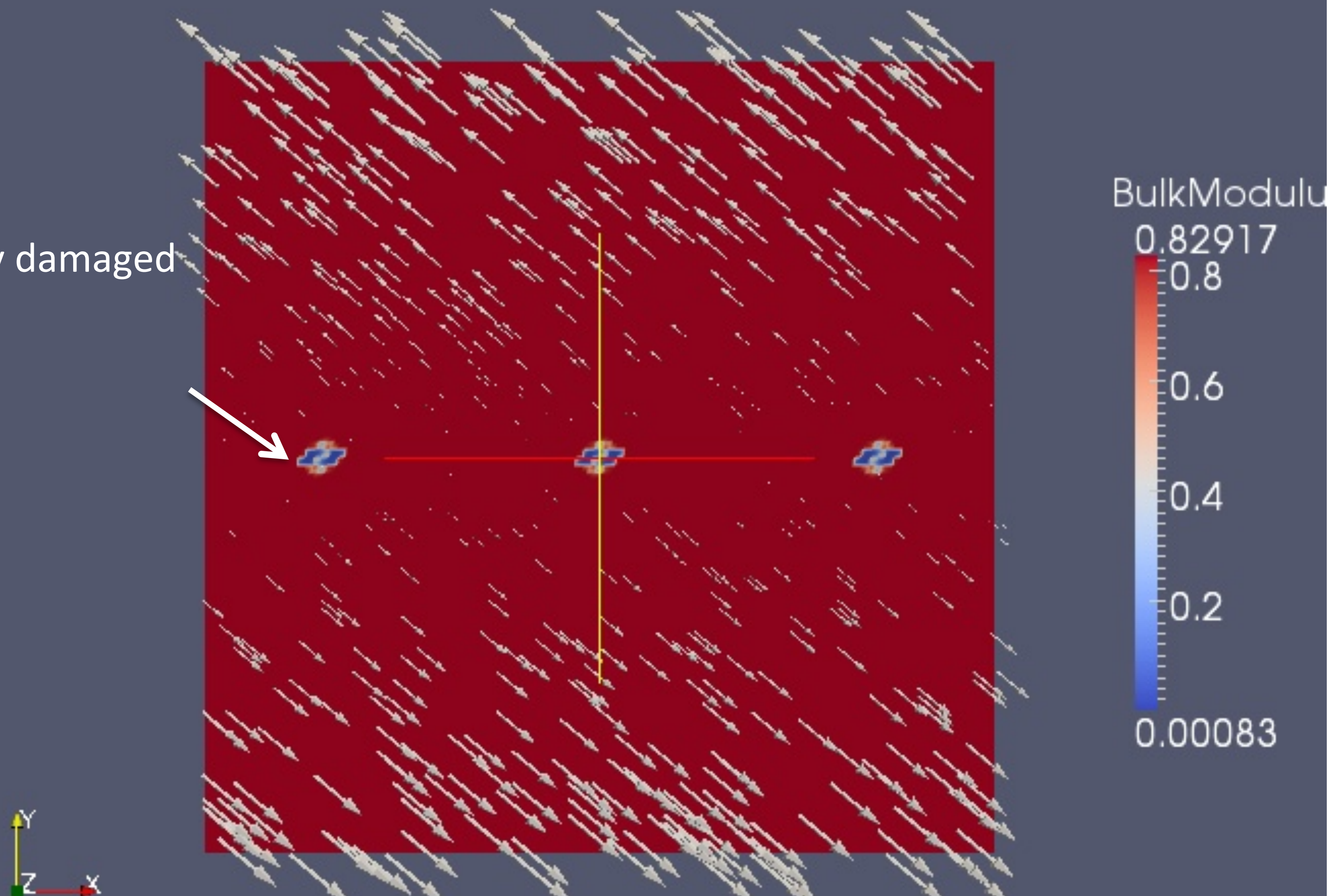
Third way for divergent partitioning

Transform faults appear to connect the divergent basins

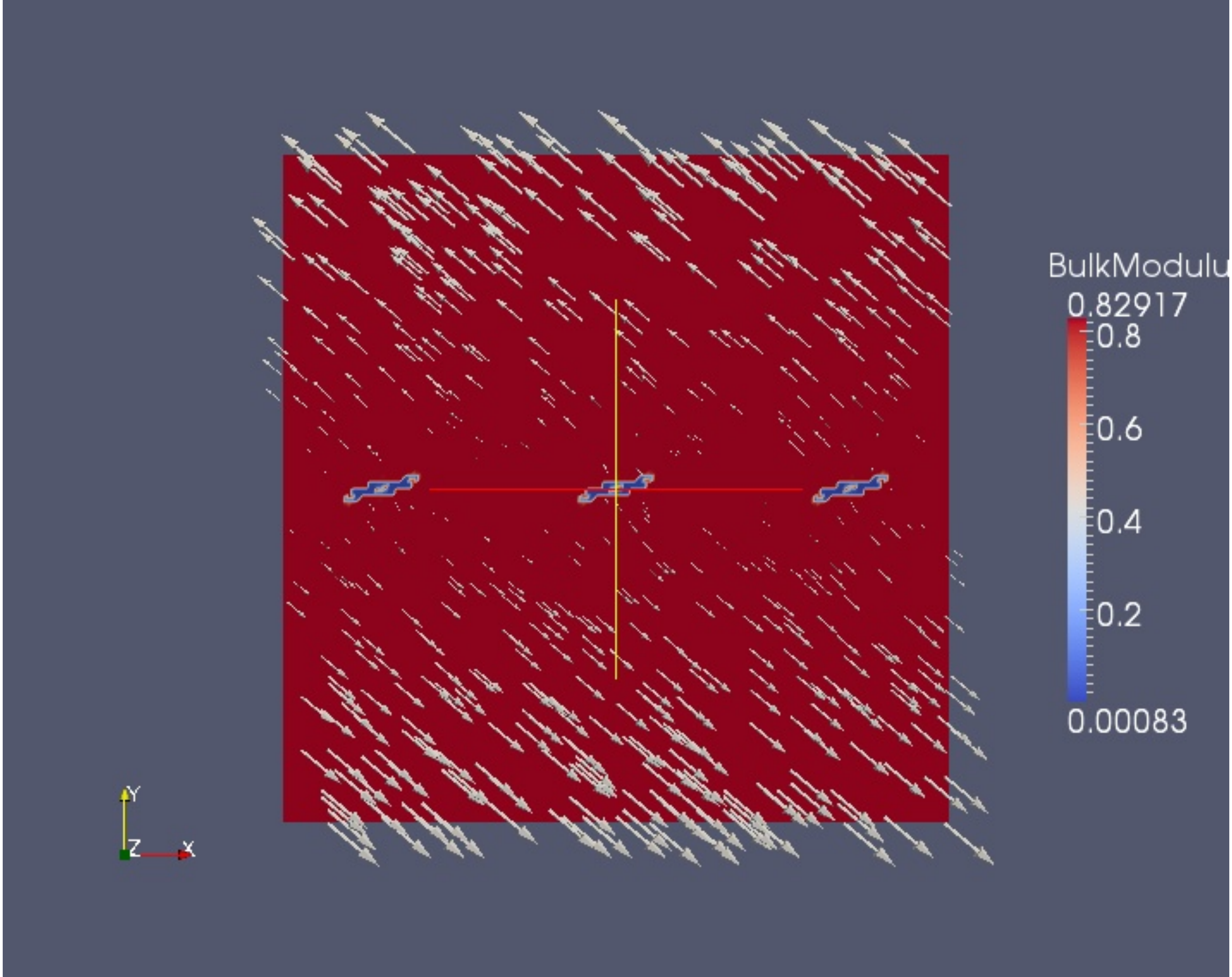
Based on elastic plate behavior (Basile & Braun 2016)

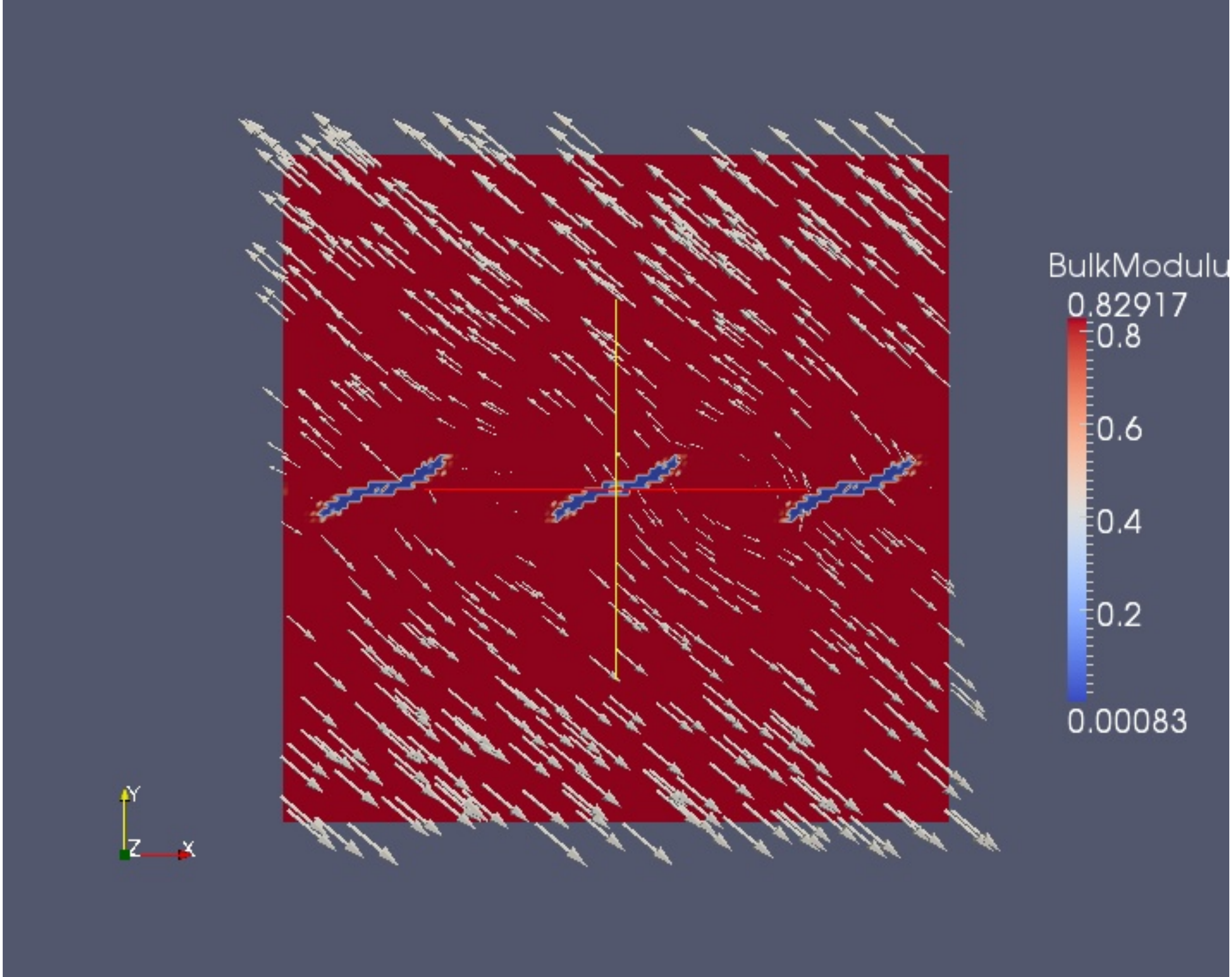
Obliquity
40°

Initialy damaged
zones



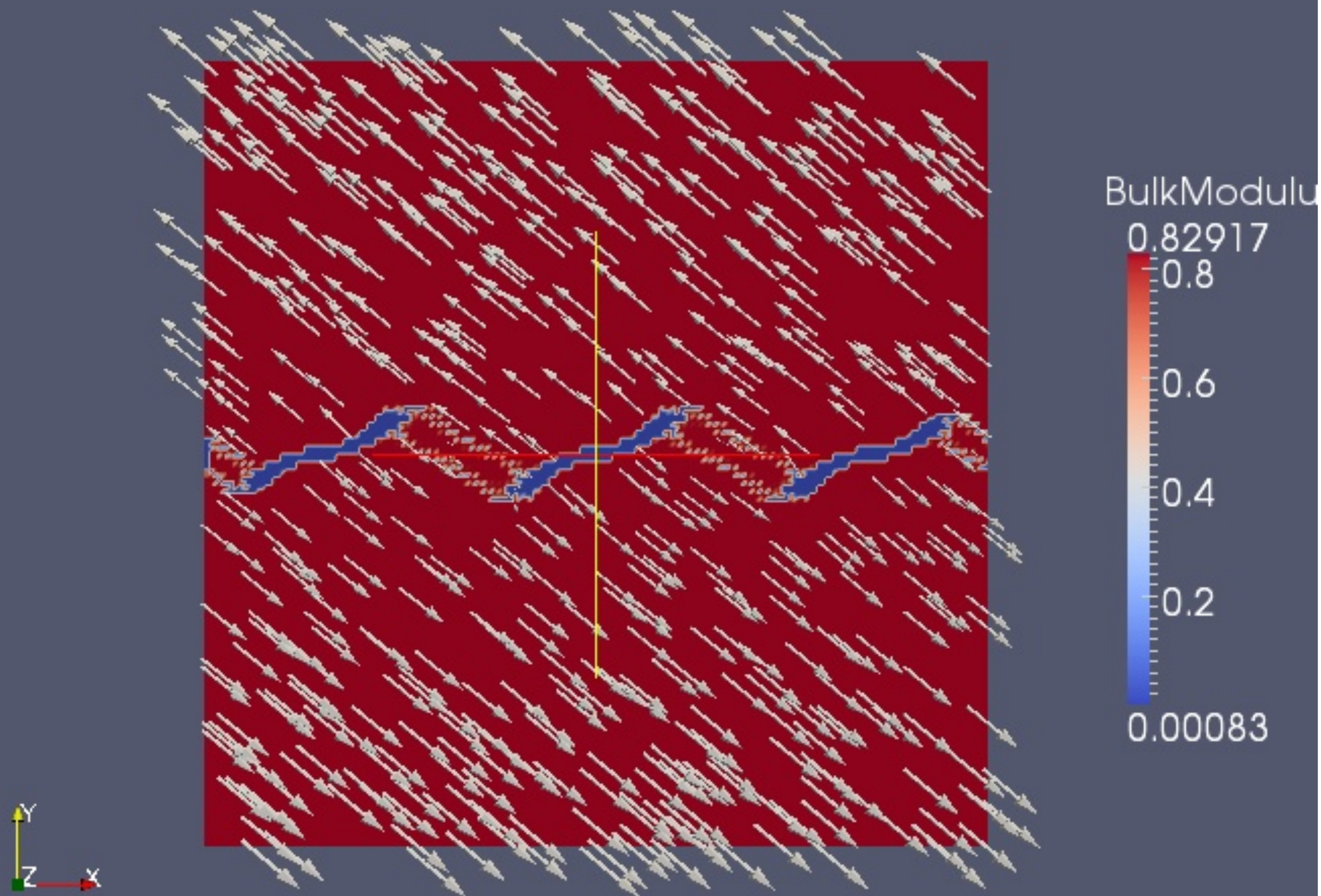
Damages increase with traction (bulk modulus)
and shear (shear modulus)

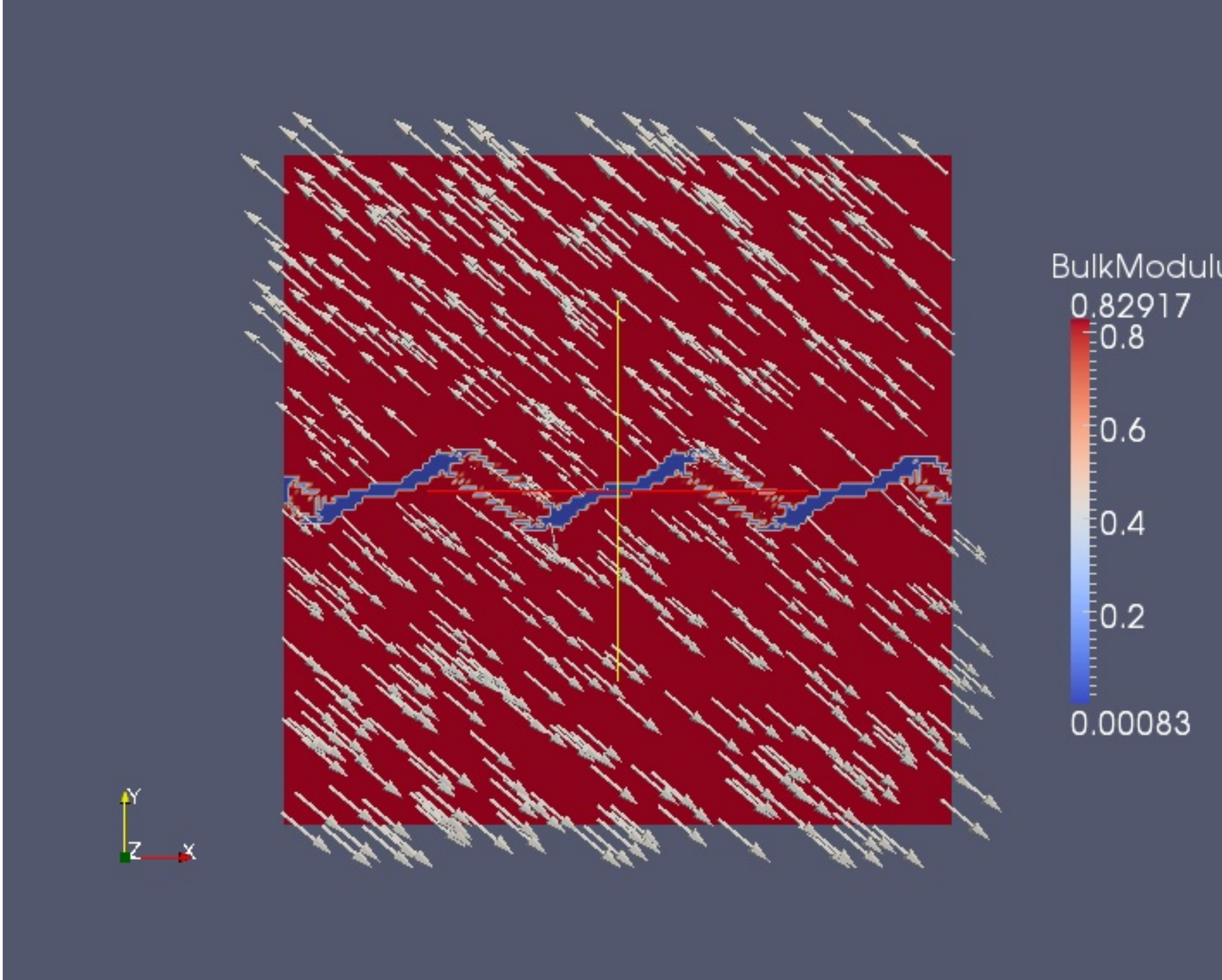

BulkModulu
0.82917
0.8
0.6
0.4
0.2
0.00083
Y
Z
X



BulkModulu
0.82917
0.8
0.6
0.4
0.2
0.00083
Y
Z
X

Partitioned plate boundary; late transform faults parallel to displacement





BulkModulu
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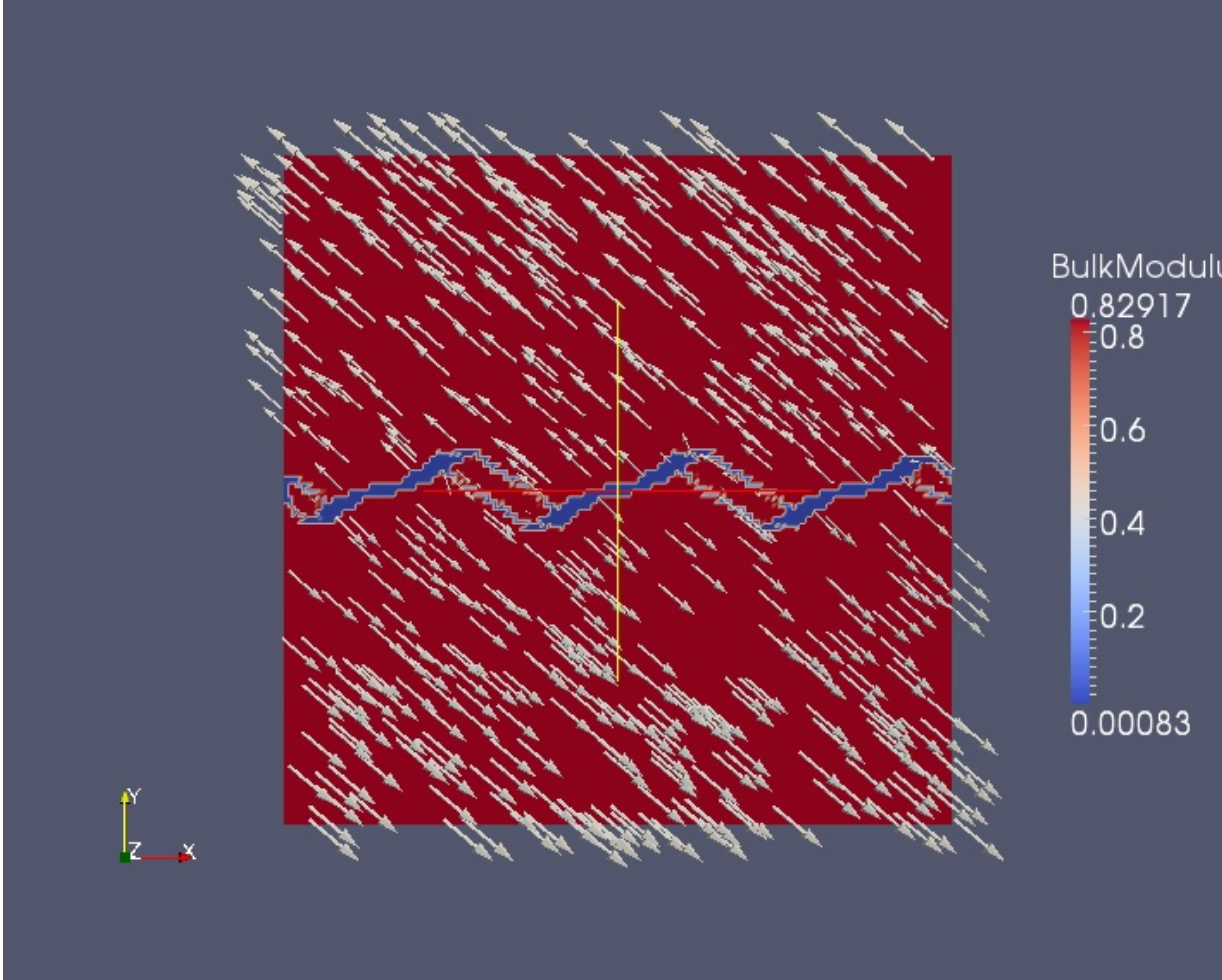
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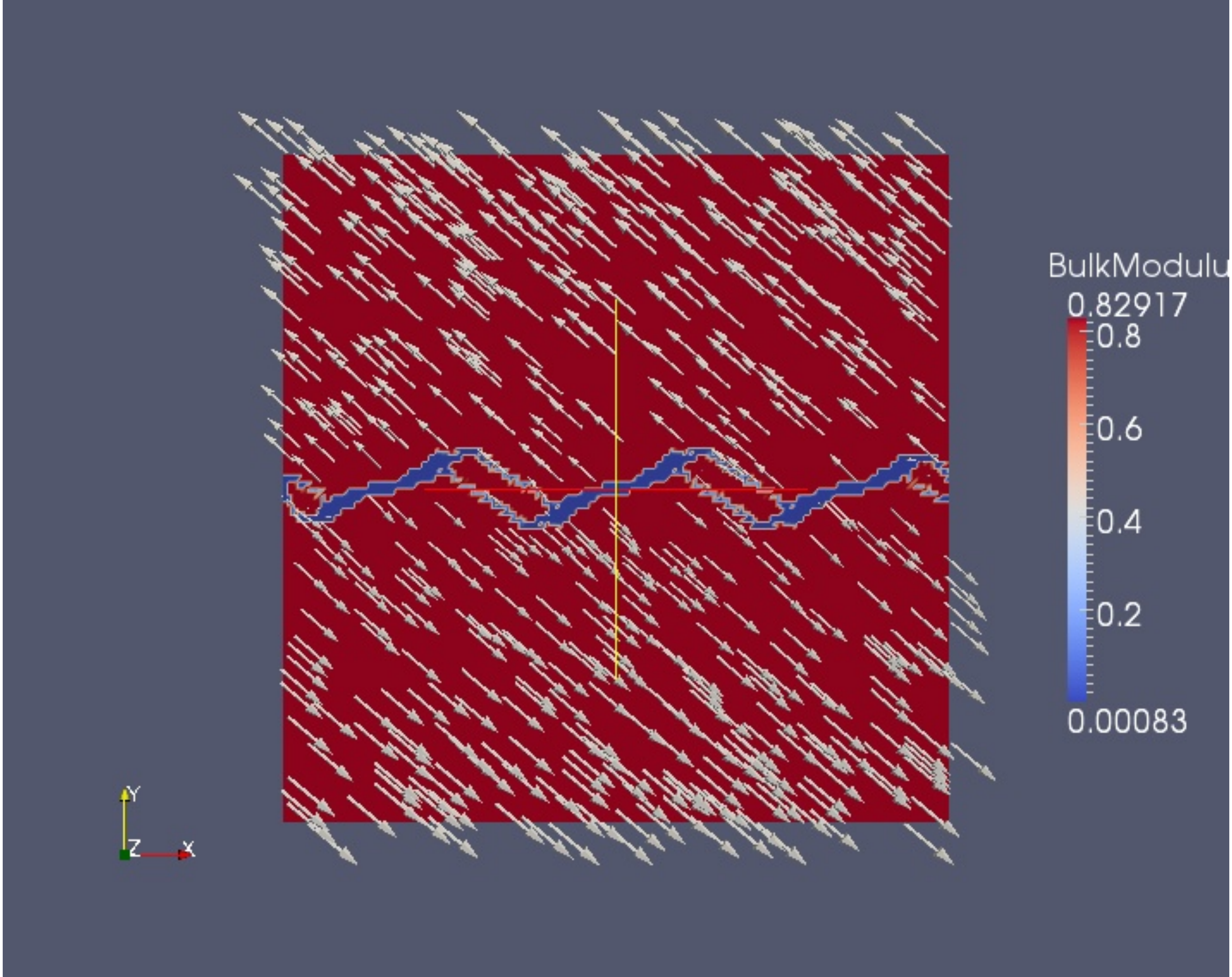

BulkModulu
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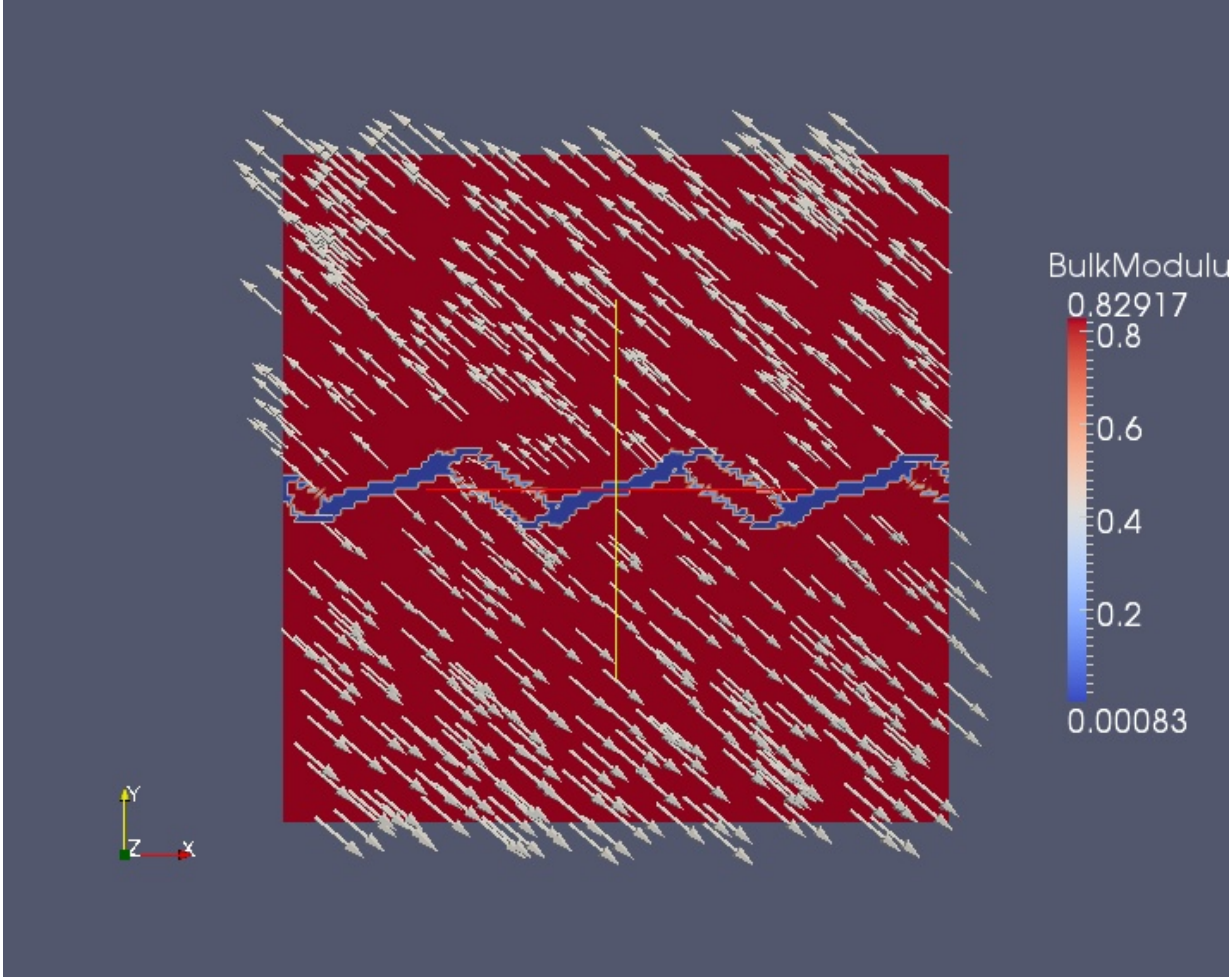

BulkModulu
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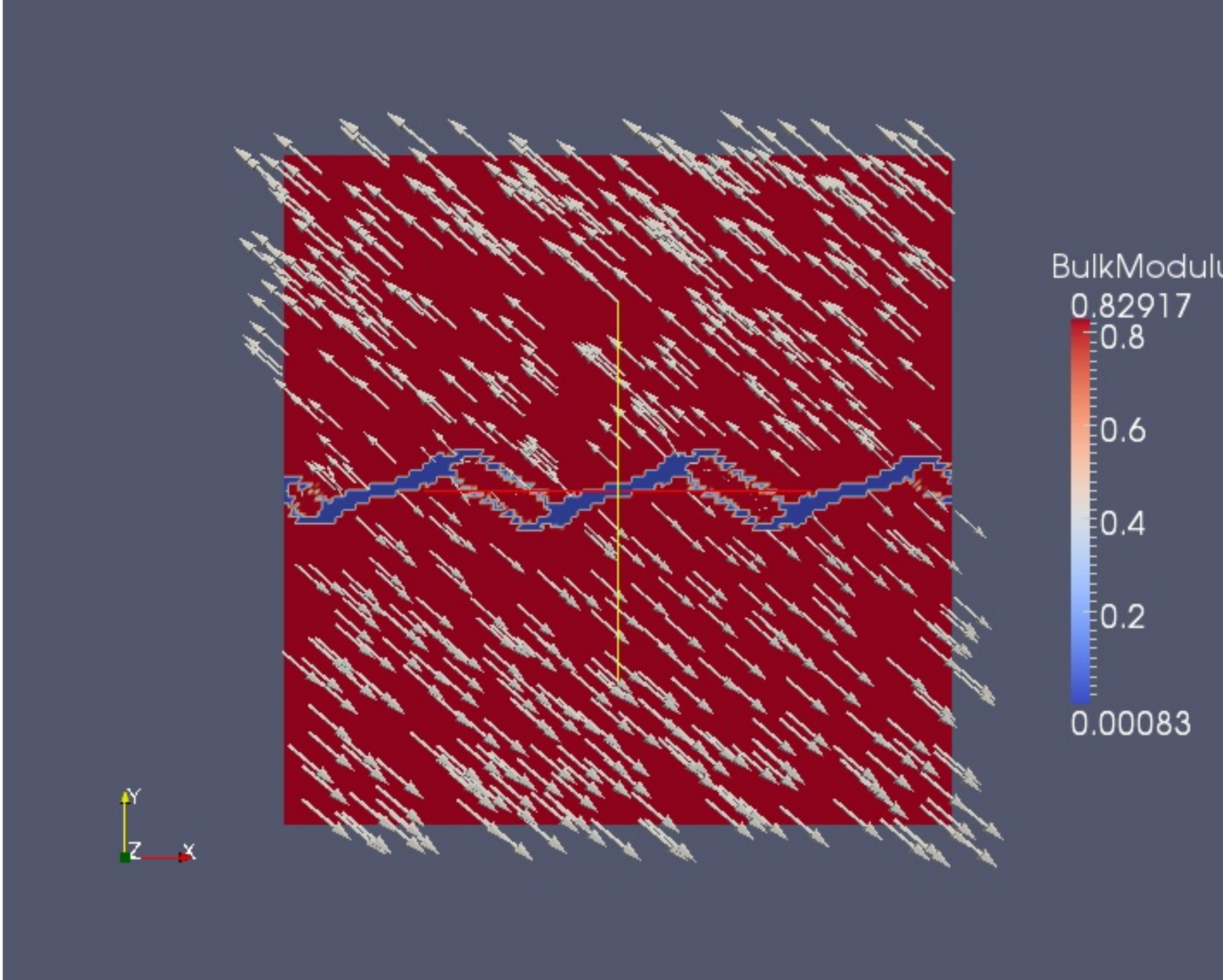
0.6
0.4
0.2
0.00083
Y
Z
X


BulkModulu
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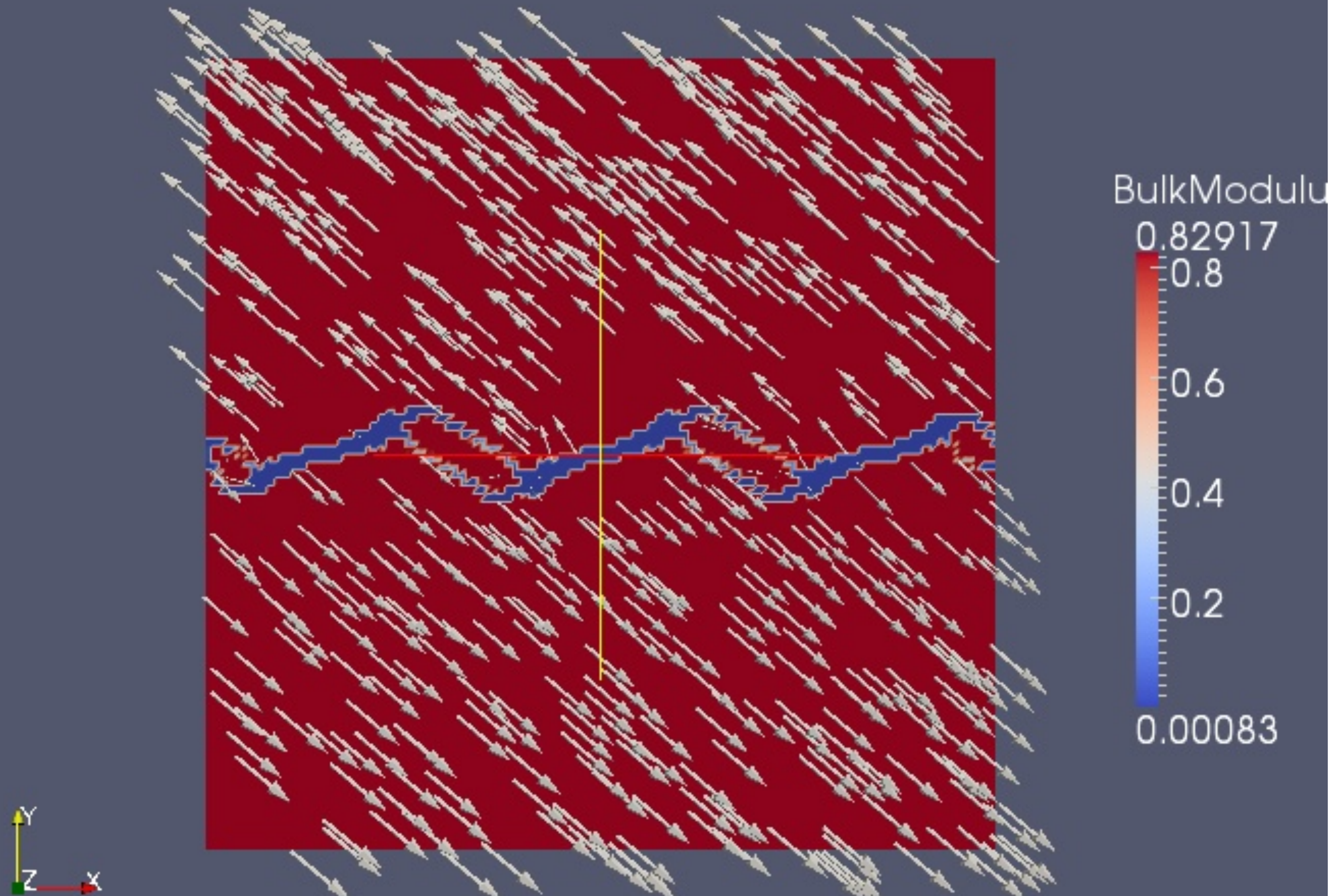
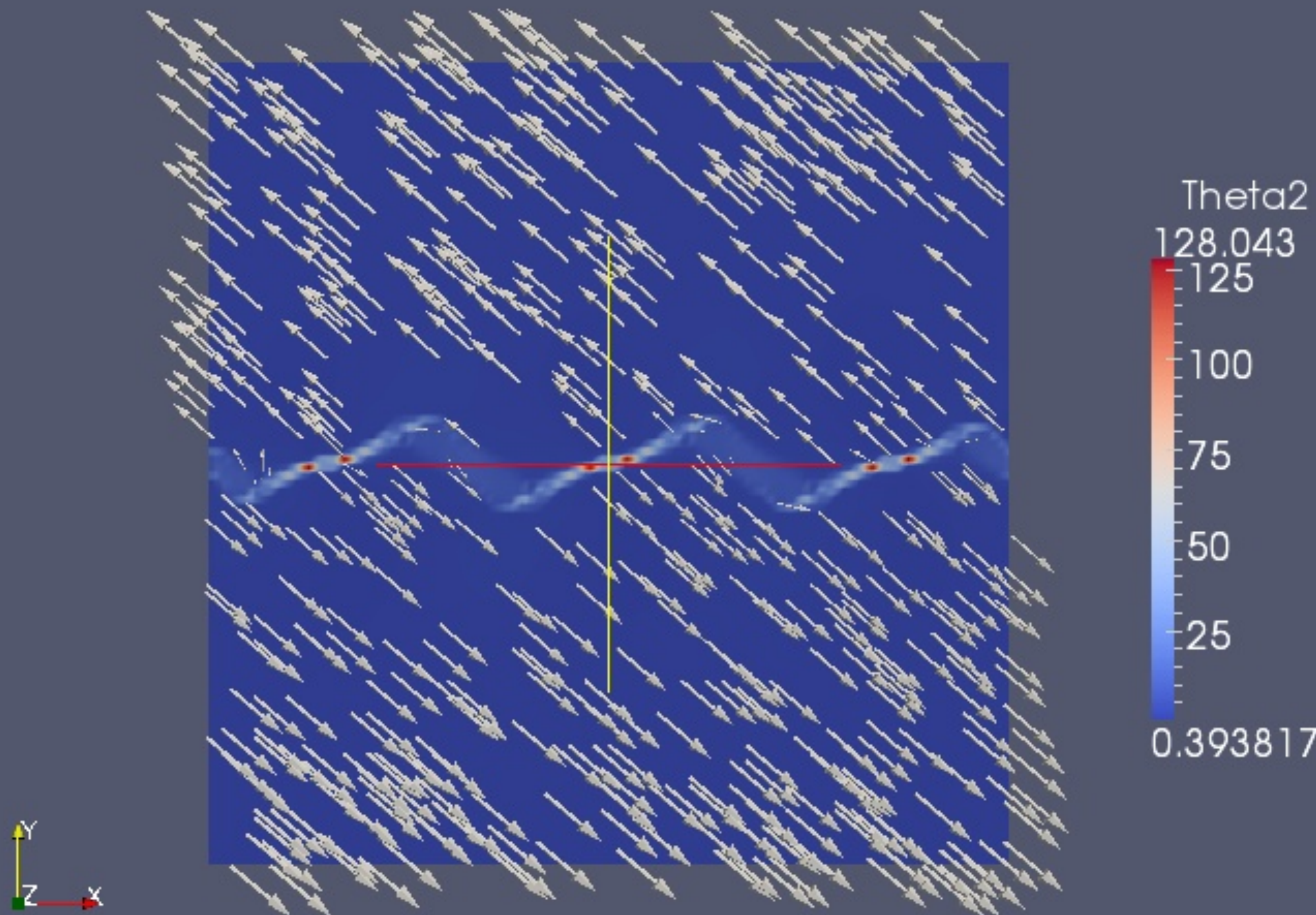
0.8
0.6
0.4
0.2
0.00083
Y
Z
X

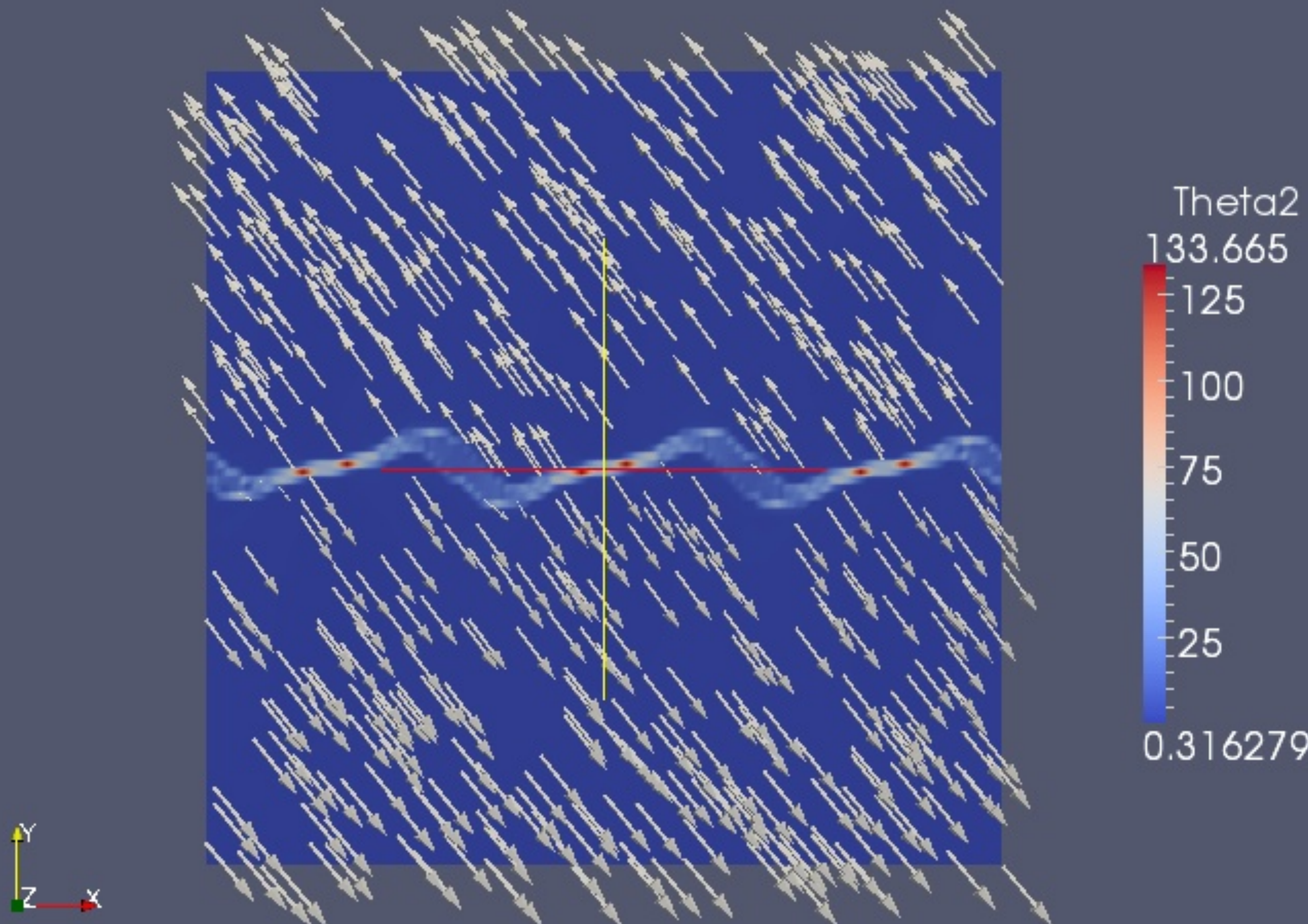
stable plate boundary



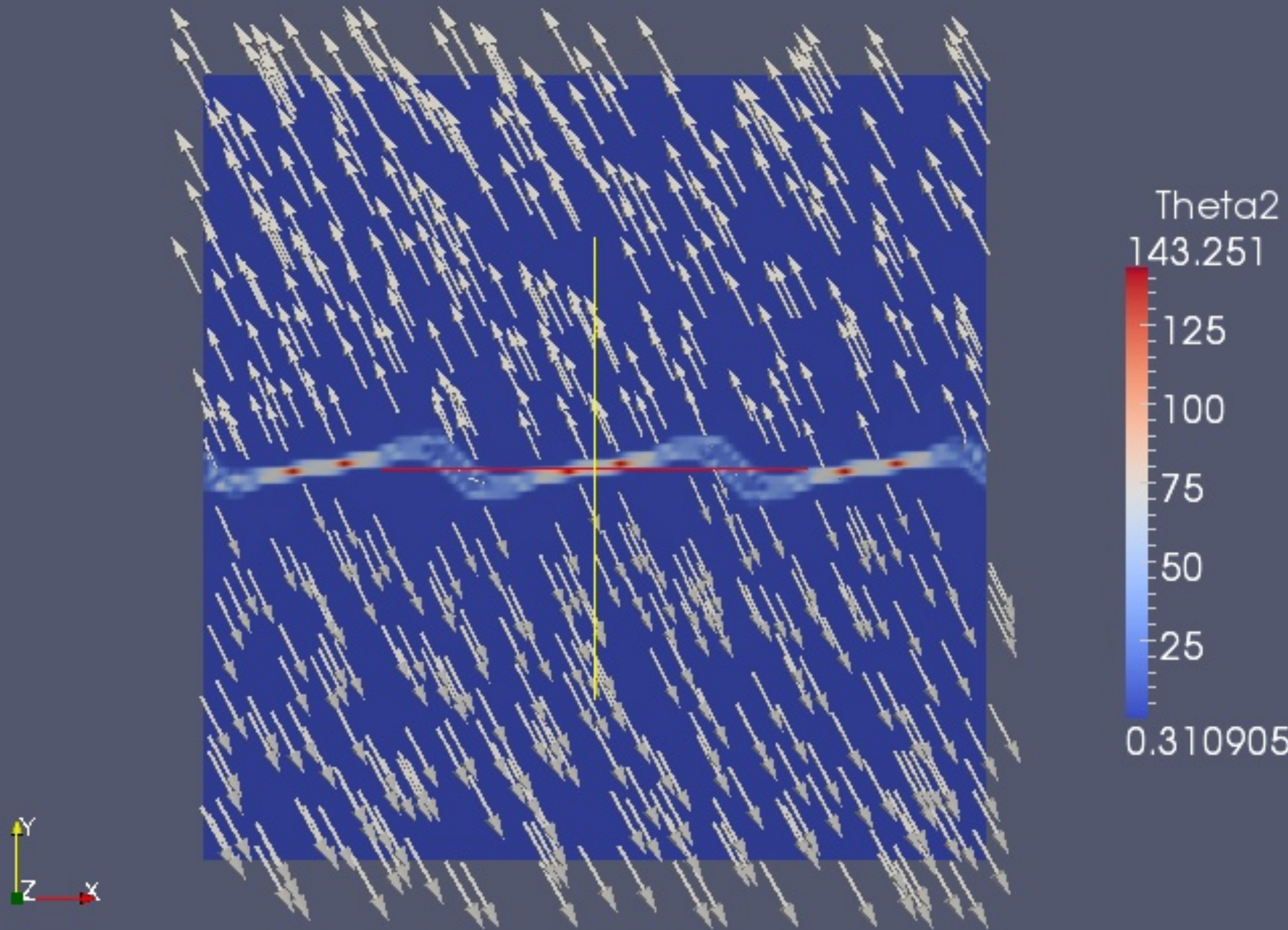
Effects of obliquity: 40°



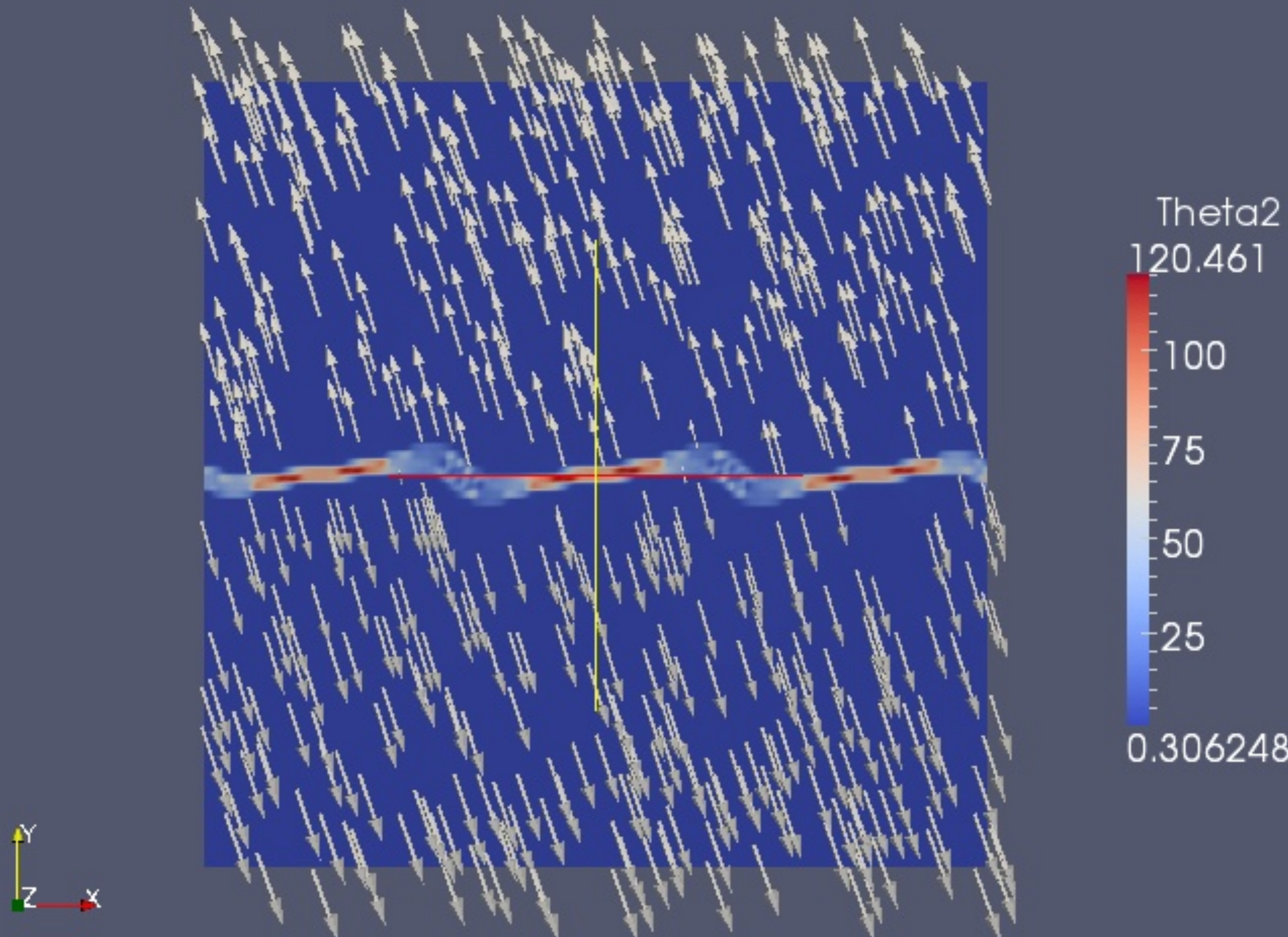
Effects of obliquity: 50°



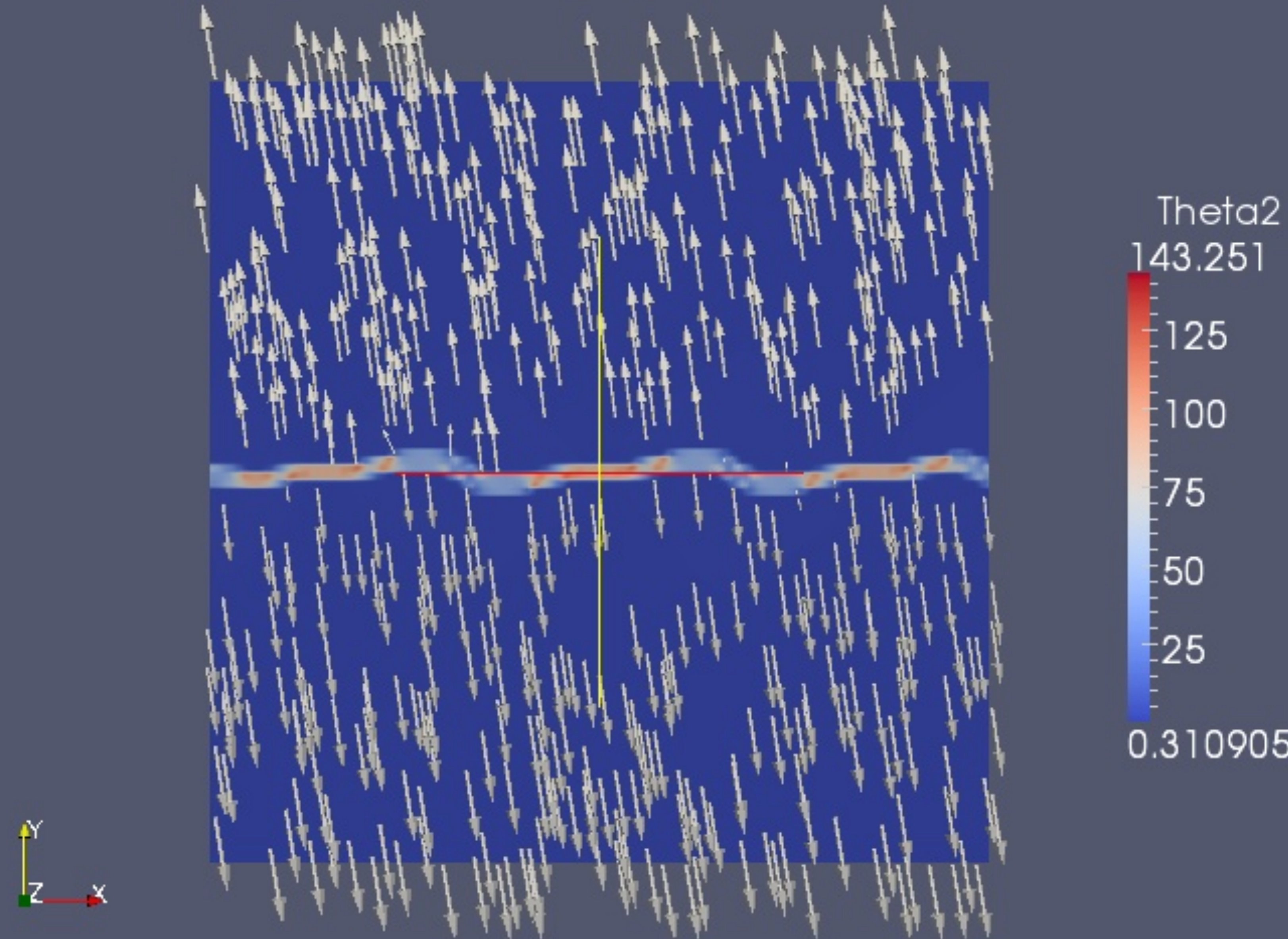
Effects of obliquity: 60° no more transform faults, but transtensional boundaries



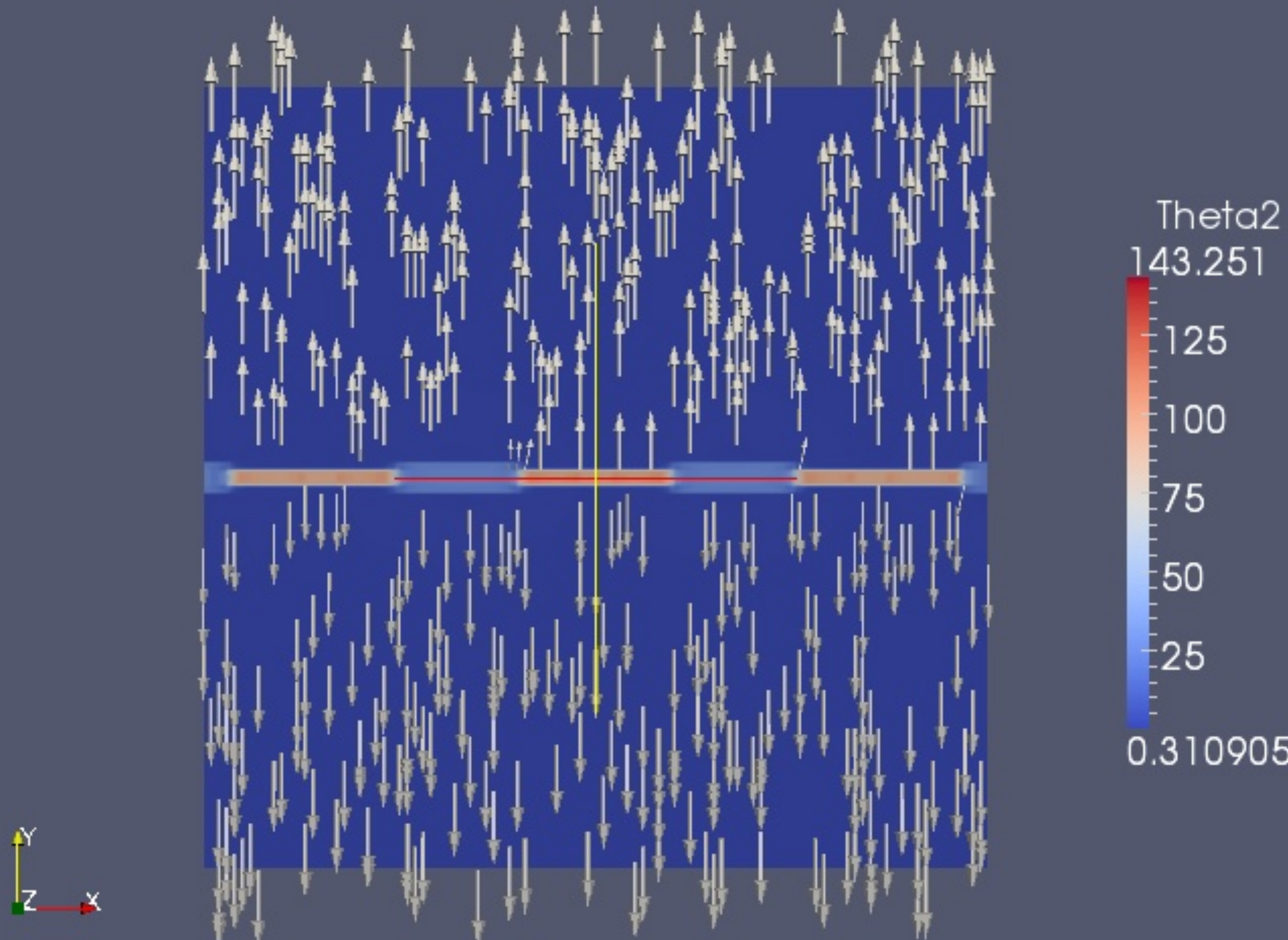
Effects of obliquity: 70° no more transform faults, but transtensional boundaries

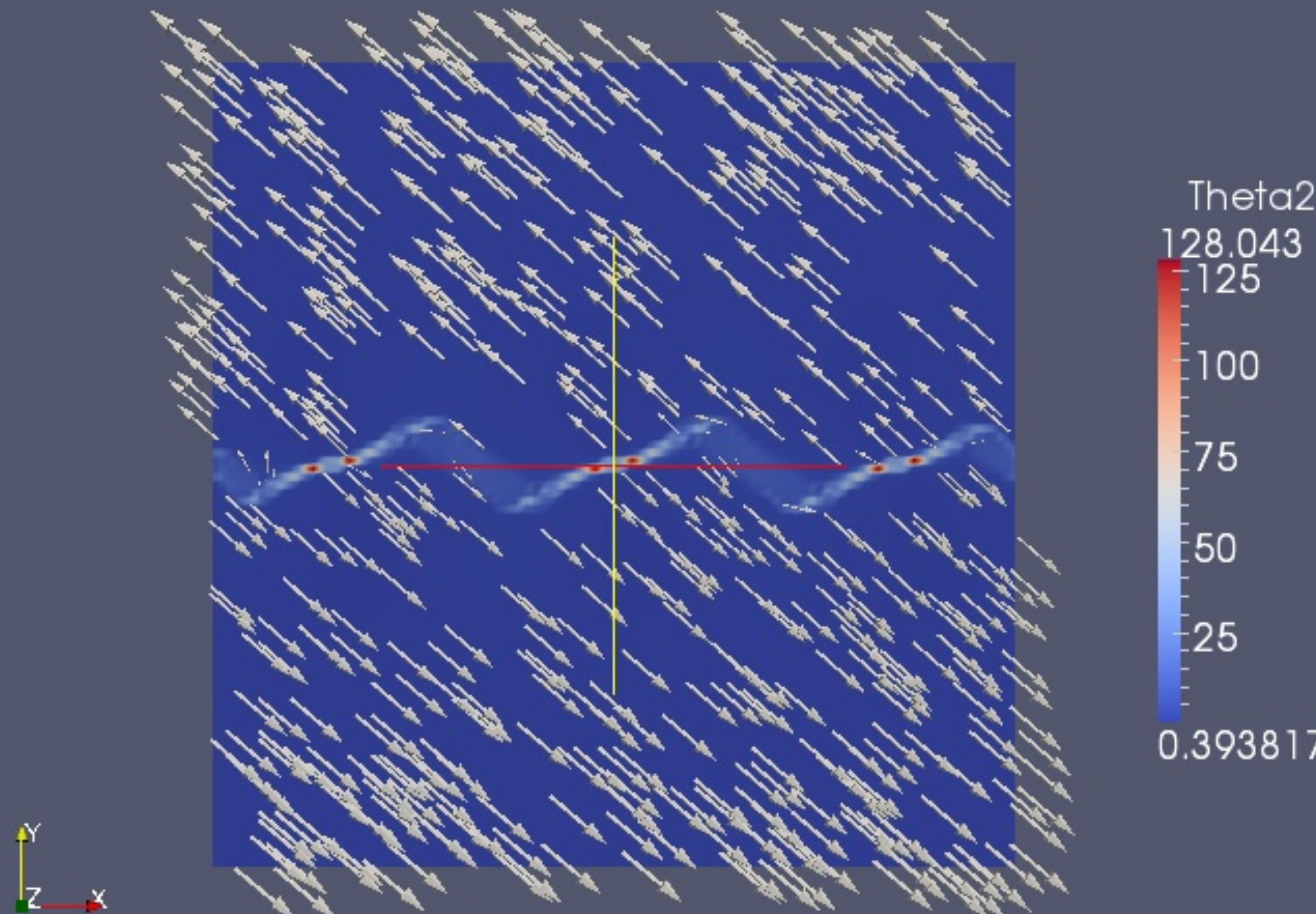


Effects of obliquity: 80° strike-slip component decreases in transtensional boundaries

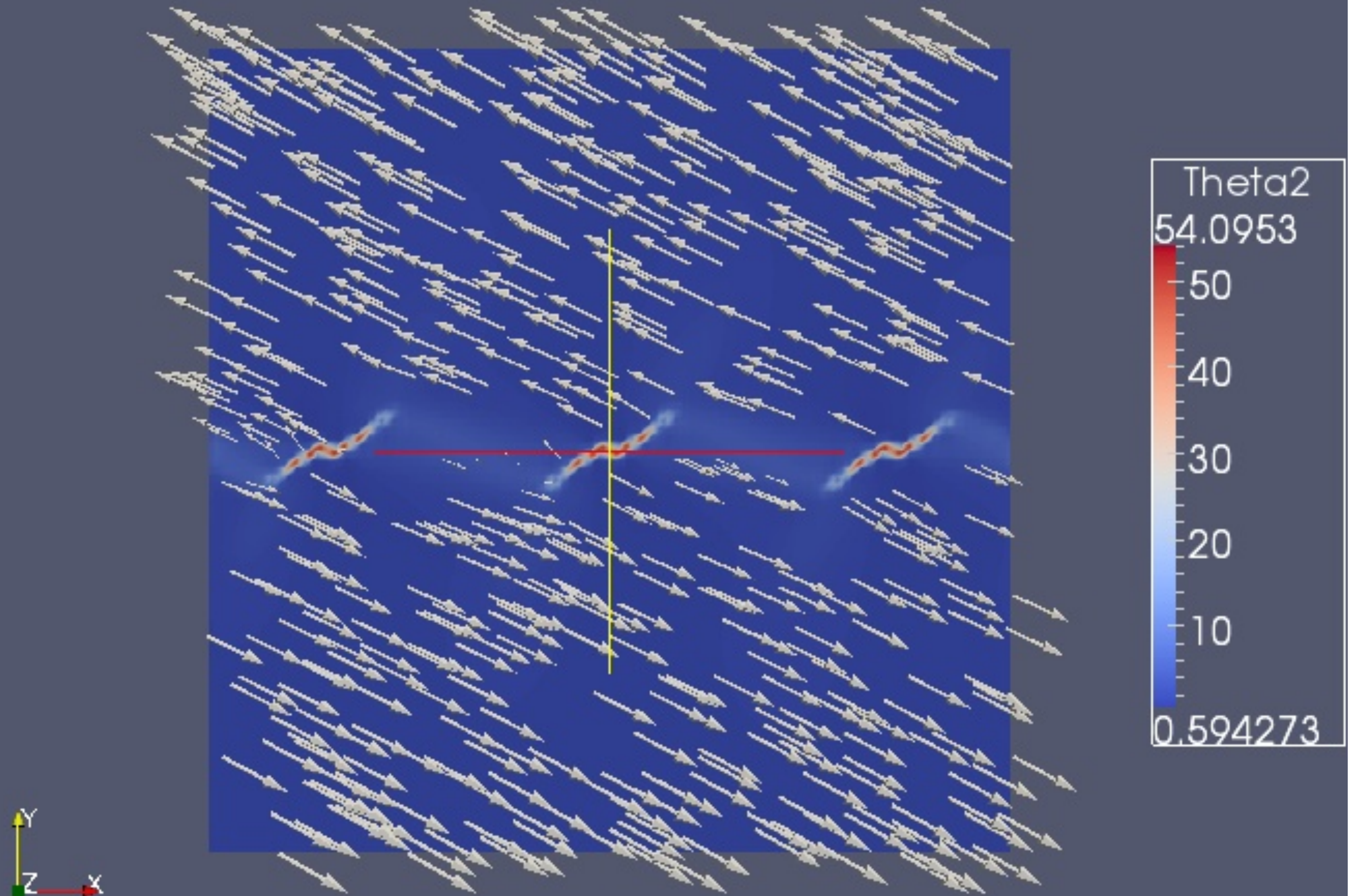


Effects of obliquity: 90°   purely divergent

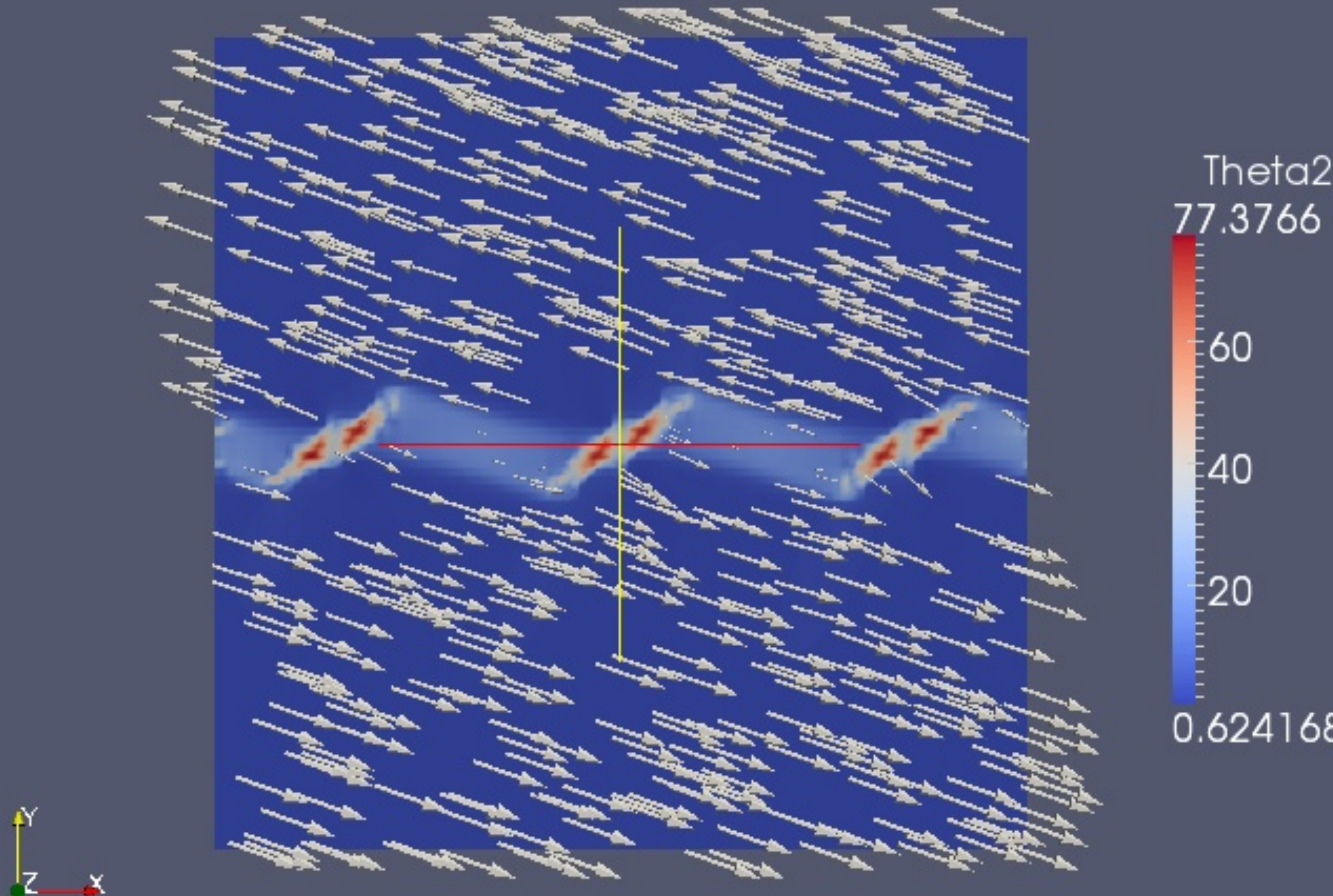




Effects of obliquity: 40°

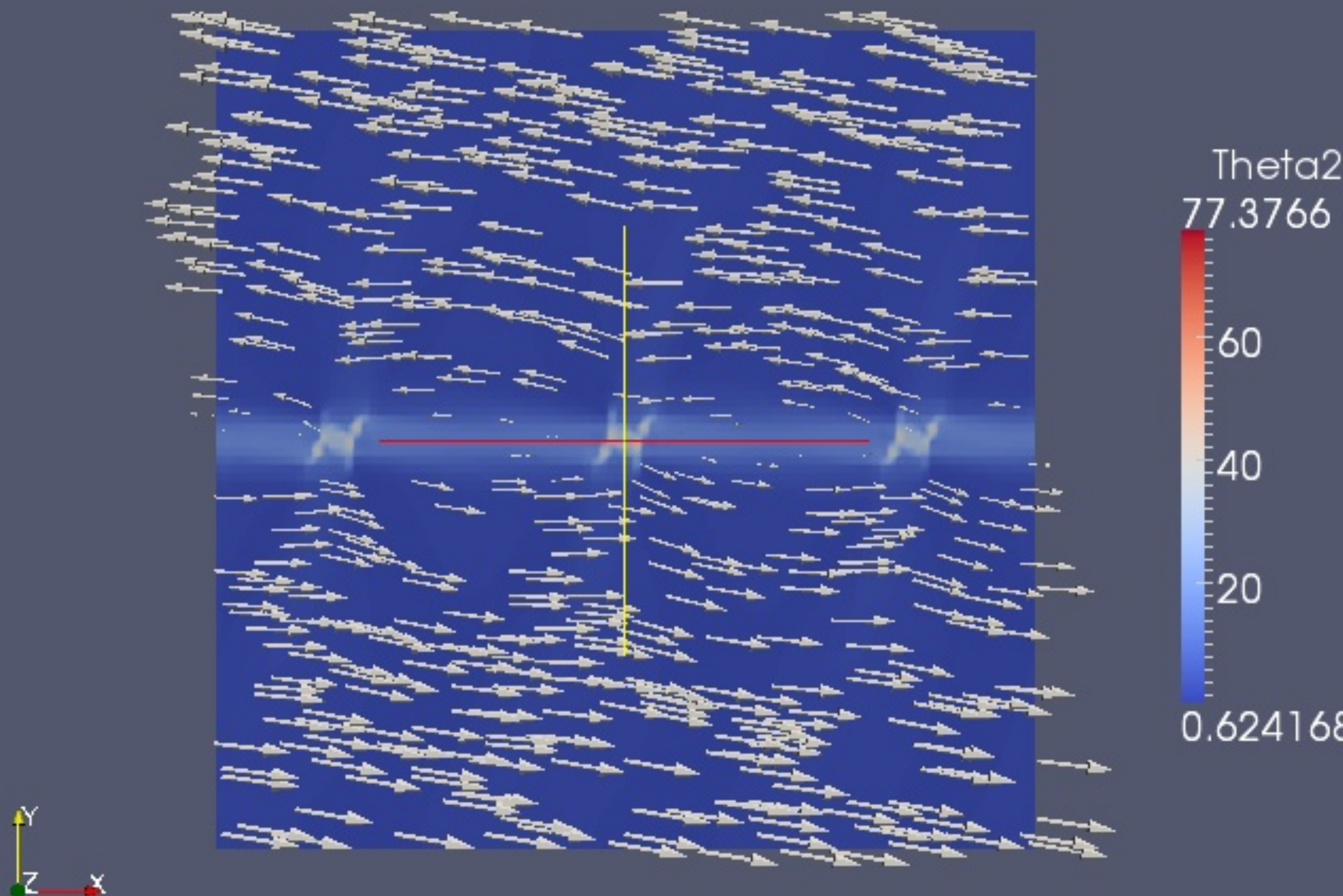


Effects of obliquity: 30° divergent segments become oblique



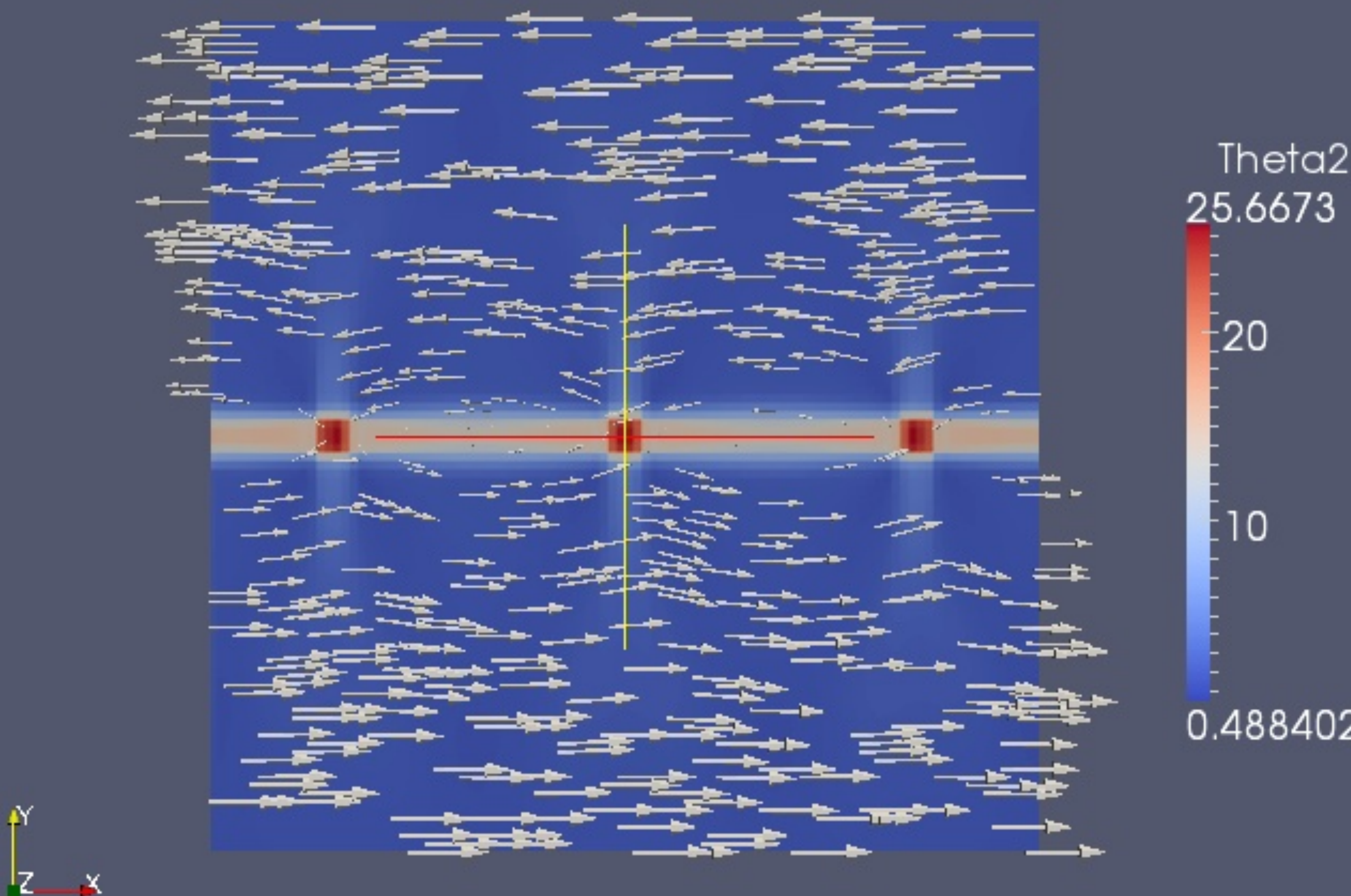
Effects of obliquity: 20° oblique divergent segments

The connexion requires higher traction rate to form transform faults



Effects of obliquity: 10°

no more divergent segments, but unstable single transform fault



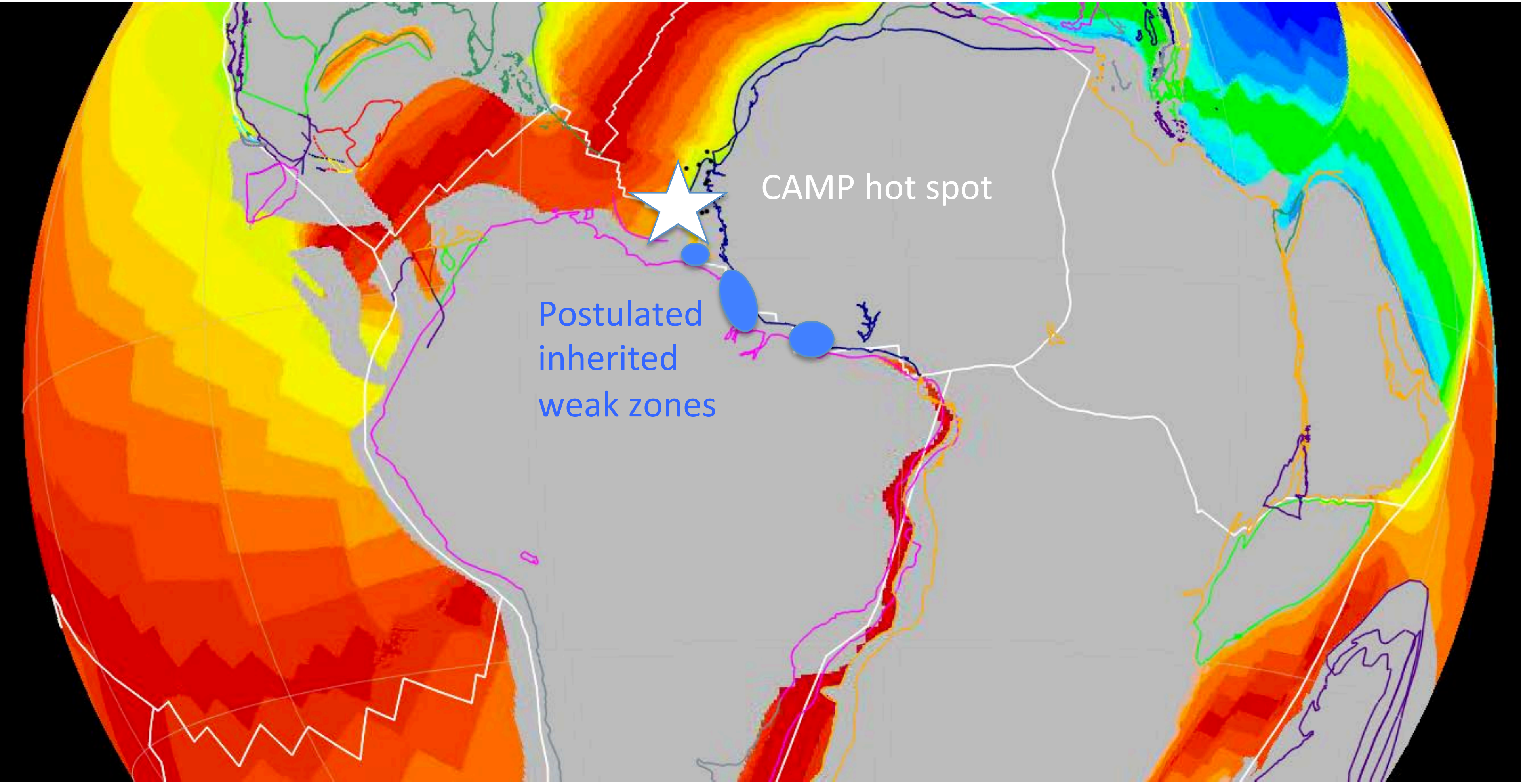
Effects of obliquity: 0°   unstable transform faults

Plate boundary geometry is controled by lithospheric weakness zones where divergence localizes

Transform faults appear to connect divergent segments, depending on the obliquity

Obliquity 0-10°: strike-slip only
20-50°: alternating transform and rift
60-80°: alternating transtension and rift
90°: rift only

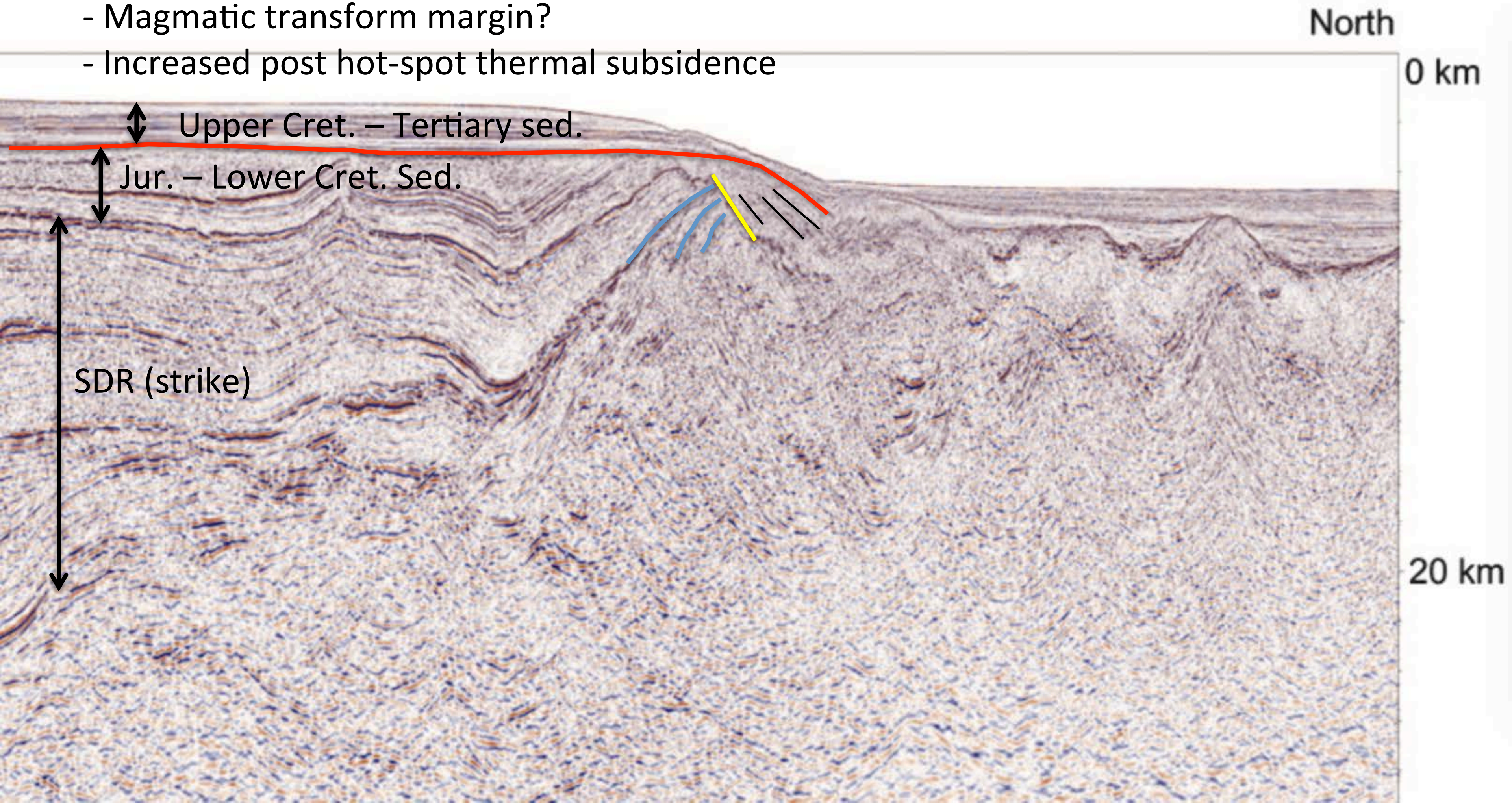
115 Ma



Gplates – Seton 2012

Demerara:

- SDR thin northward
- The transform fault appeared on the side of SDR (stronger 50 My after their formation?)
- Magmatic transform margin?
- Increased post hot-spot thermal subsidence



Reuber 2016