Segmentation and structural style evolution during continental breakup:
observations from the Northern Bay of Biscay passive margin (offshore France)

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**Introduction**

**Morpho-structural variations at rifted margins**

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**Northern Bay of Biscay segmentation**

**Western Approach margin**

- Trévélyan Structure
- Méridzech Terrace
- Western Approach basin

*Figures and captions by Tugend et al. 2014*

**Armorican margin**

- Armorican basin

*Figures and captions by Tugend 2013*

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**Significant morpho-structural changes are described along the Northern Bay of Biscay rifted margins** *(Thinon et al., 2003)*

- Where and how does it occur?
- Origin of this change?
What is the impact of oblique rifting on the structural style?
What is the structural style related to continental breakup?

TUGEND ET AL., 2015b

OCT

Onset of oceanic accretion

Bay of Biscay

After Tugend et al., 2014
TECTONIC CONTEXT

Bay of Biscay

Pyrenean compression

Crétacé Sup. (~80Ma) Tugend et al., 2015b

After Tugend et al., 2014
Previous works by Guennoc 1978; Barbier 1986; Deregnaucourt 1981; Thinon 1999

Shipboard Scientific Party (1979a,b,c)
• Necking domain: faults root on an intra-basement decoupling interface (*top lower crust*?).
• Hyperthinned domain: fault root at the Moho or deeper.

**Evolution of the nature and depth of the fault rooting level**

![Diagram showing seismic interpretations with Colorbar: 'Hyperthinned Domain' and 'Necking Domain' with labels for base post-rift, top pre-rift, top basement, Syn-rift sediments, Pre-rift sediments, basement, and acoustic basement. A line labeled 'Line 1' is shown with a 'S-reflection' in Le Pichon & Barbier 1987. A plot shows two-way travel time (sec) with a scale of 25 km.](image-url)
- Mantle seems to be exhumed locally forming the ocean-continent-transition (Thinon et al., 2003, Tugend et al., 2014)
A change in structural style occurs in the distal margin. Normal faults dip mainly continentward.
Structural style variations

- Loose segment transition
- Progressive change in structural style in the distal margin (*hyperthinned domain*) and OCT (*Exhumed mantle domain*).
How is accommodated this segment transition?

- Progressive change in structural style likely to be related a different accommodation of extensional deformation across the transfer zone.
Isobath of the fault rooting level

Tugend et al., in prep.

Rift domain map

Two-way travel time

Tugend et al., in prep.

Necking Domain

Hyperthinned Domain

ESE

WNW

25 km

Tugend et al., in prep.

Line 9
STRUCTURAL STYLE VARIATION

Isobath of the fault rooting level

Exhumed Mantle D.  Hyperthinned Domain  Necking Domain

Segment transition

Tugend et al., in prep.

Tugend et al., in prep.
CONCLUSIONS

1. Morpho-structural variations across a loose transfer zone.

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2. Horse-tail structures

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**CONCLUSIONS**

1. Morpho-structural variations across a loose transfer zone.
2. Horse-tail structures rooting on a lower crustal dome

Analogue to core-complexe formed in transtension?

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Le Pourhiet et al., 2012

Tugend et al., in prep.
CONCLUSIONS

1. Morpho-structural variations across a loose transfer zone.
2. Horse-tail structures rooting on a lower crustal dome (impact of oblique rifting?)

Tugend et al., in prep.
1. Morpho-structural variations across a loose transfer zone.
2. Horse-tail structures rooting on a lower crustal dome (impact of oblique rifting?)
3. Role of structural inheritance?

CONCLUSIONS

Tugend et al., in prep.

- Permo-Carboniferous structures versus Western Approaches B.structures

Fault rooting level

Ocean

Western Approach Segment

Armorican Segment

Tugend et al., in prep.


