The architecture and the multi-stage evolution of the North Iberian margin (Bay of Biscay)

Patricia Cadenas Martínez 1,2, Gianreto Manatschal2, Gabriela Fernández-Viejo3
1: BCSI/ICM/CSIC, Barcelona; 2: CNRS/IPGS/EOST/Université de Strasbourg; 3: University Oviedo

EGU 2020
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• **Research issue:** formation and reactivation of multi-stage rift systems. Muti-stage rifting

• **Natural laboratory:** the North Iberian margin (southern Bay of Biscay). Its structure resulted from a multi-stage rift evolution including three Mesozoic rift events and a subsequent Alpine reactivation.

• **Methodology:** tectono-stratigraphic approach

• **Data:** 2d seismic data+boreholes+published velocity models

• **Results:**
  - Crustal structure
  - Rift-related basins and bounding structures
  - Major compressional structures
  - Rift systems (map+2D sections)
1) Crustal structure and basin architecture in the central North Iberian margin

Crustal blocks + High-angle normal faults + Gijón-Ribadesella half-graben-type basins

Mild inversion. Thin-skinned deformation. Diapirism and halokynesis

Extensional allochthons + Biscay Detachment System + Biscay depocentres

Underthrusting + accretion
1) Crustal structure and basin architecture in the central North Iberian margin

Steep and planar transtensional faults
Narrow and deep Asturian Basin
Mild inversion

Le Danois Detachment System
The Le Danois crustal block
Uplift + tilting

Hyperextended crust + Biscay Detachment Surface
wide Biscay depocentres
Underthrusting + accretion. Thrusts decoupled in the crust/mantle boundary

Cadenas & Fernández-Viejo, 2017
Cadenas et al., in rev.
Thrusts decoupled in the brittle/ductile transition

Underthrusting + accretion. Thrusts decoupled in the crust/mantle boundary
2) Syn-rift units and rift basins in the central North Iberian margin

Interpretation of syn-kinematic units along three N-S profiles

Thickness map (ms TWT) of the syn-rift unit 2

Cadenas et al., in rev.

Thickness map (ms TWT) of the syn-rift unit 3

Cadenas et al., in rev.
3) Rift systems in the North Iberian margin

Cadenas et al., in rev.

Gijón-Ribadesella rift system
Asturian rift system
Biscay/Llanes

Biscay/Le Danois

High-angle normal faults
Transtensional faults
Extensional detachment faults

Syn-rift 1
Syn-rift 2
Syn-rift 3
4) Conclusions and discussion

- The **North Iberian margin** resulted from multi-stage rather than poly-phase rifting processes.

- **Multi-stage rifting** includes out of sequence rift events with different kinematic frameworks and of different age.

- We distinguished **three rift systems**: 1) a diffuse rift system of a Triassic age; 2) a laterally confined Late Jurassic to Barremian *transitional* rift system; 3) a wide Aptian to Late Cretaceous (Cenomanian?) **hyperextended** rift system, including two domains.

- **Spatial distribution + overprint** of the three rift systems resulted in a complex 3D template.

- **Inherited rift templates** guide subsequent rift events.

- Different interplay of the **Alpine compression** with each rift system.

- Reactivation amplified the inherited structural variability.

- **To discuss:**
  - Multi-stage Mesozoic rift systems along the IB/EU plate boundary: structure and kinematics.
  - Reactivation of multi-stage rift systems. Inherited multi-stage rift templates: the key to understand variations in the architecture of the Pyrenean-Cantabrian orogen.

Work under review…
Contact email:pcadenas@geol.uniovi.es
The Early Career Scientists (ECS) team of the EGU Tectonics and Structural Geology (TS) Division is launching a **new initiative** - a community-wide paper discussion forum!

In this initiative, **TS “Must-read” papers** will be selected and discussed by the TS community. Papers covering any TS subject are welcome, from fundamental, seminal papers to just-published ground-breaking articles. We suggest you try to answer the question “if I could only suggest a handful of articles to a starting TS researcher, which ones would they be?” and then go vote here: [https://tinyurl.com/yc7vwm2m](https://tinyurl.com/yc7vwm2m)

We’ll then promote the **most voted contributions** (total number to be decided depending on input) and moderate their discussion on a public forum (Reddit).

Aside from the discussion, each paper will lead to **two main outputs** that we also hope will be useful for all of us TS ECS, and hopefully for other TS researchers too! A **summary post in the EGU TS Blog** will summarize the content of each article as highlighted by discussion participants. A **preprint** compiling all posts together will be the final output of the action.

Voting will take just 3 minutes of your time, so we hope to get your opinion soon!

Thank you very much in advance,
The ECS “TS Must Read” working group