

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



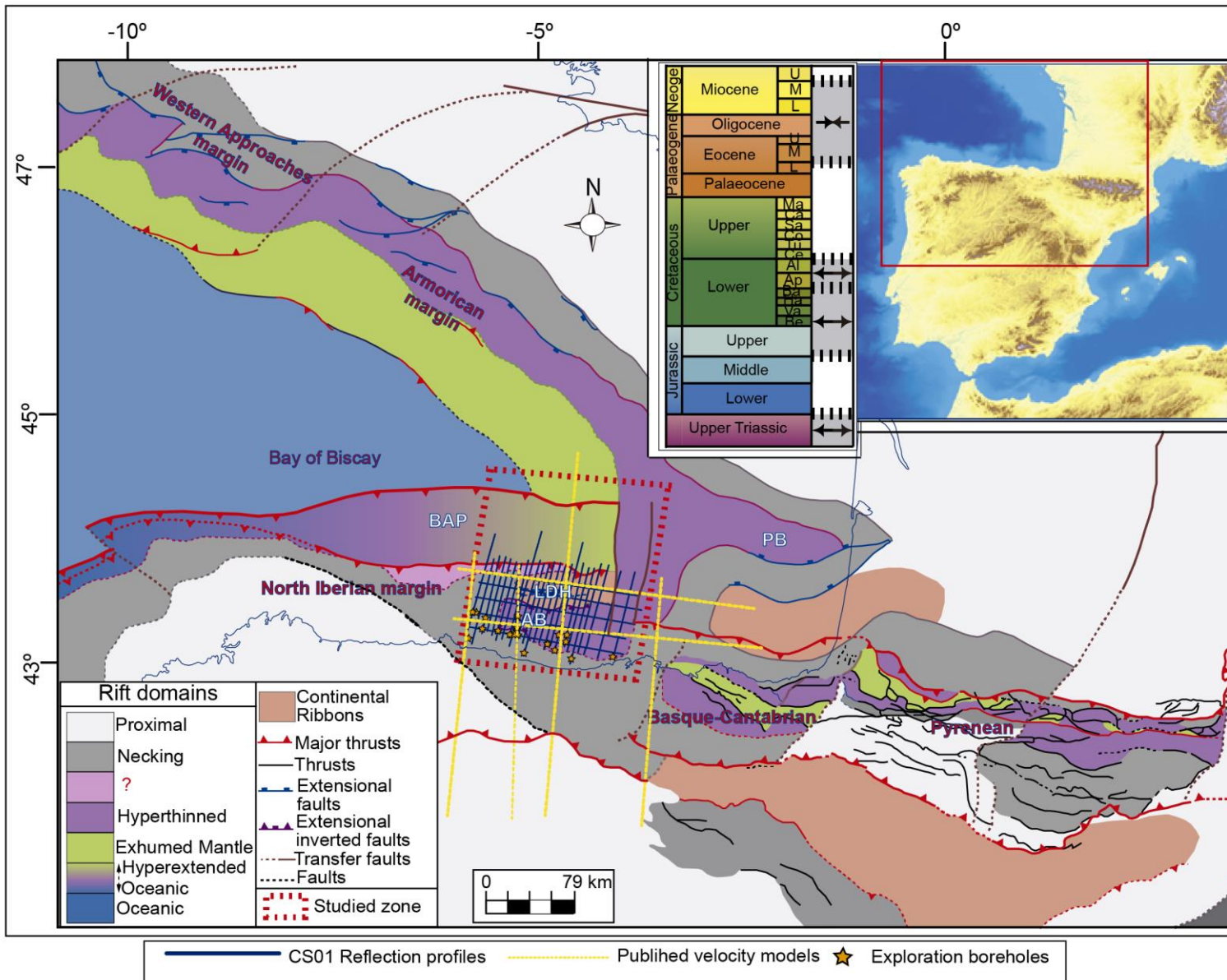
Universidad de Oviedo

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1:BCSI/ICM/CSIC, Barcelona; 2: CNRS/IPGS/EOST/Université de Strasbourg; 3 : University Oviedo

EGU 2020

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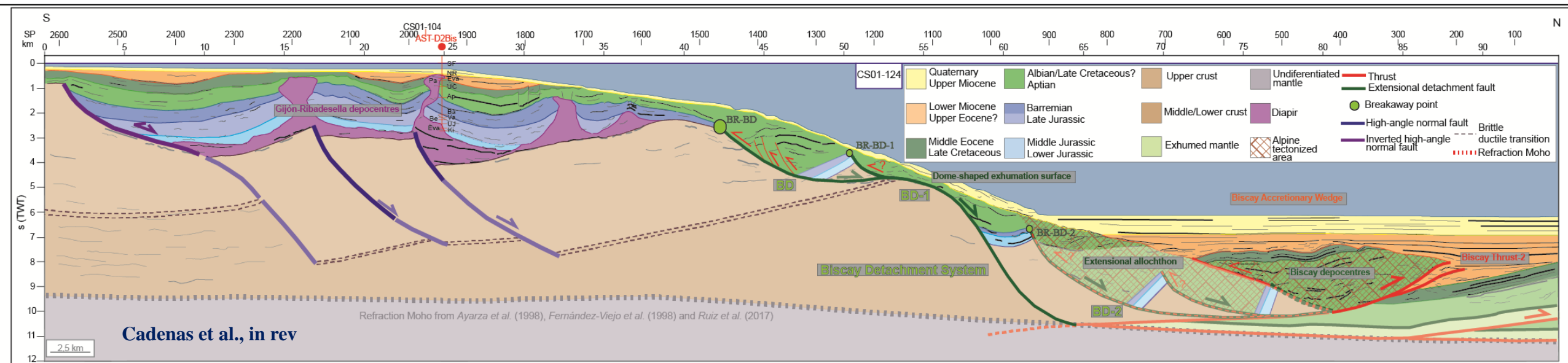
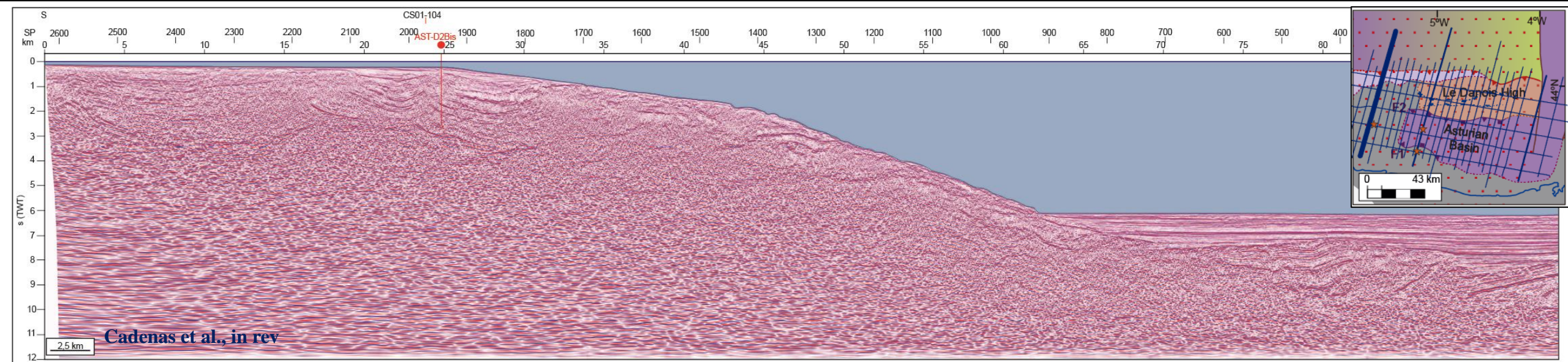


- **Research issue:** formation and reactivation of multi-stage rift systems. Multi-stage rifting
- **Natural laboratory:** the North Iberian margin (southern Bay of Biscay). Its structure resulted from a multi-stage rift evolution including three Mesozoic rift events and a subsequent Alpine reactivation.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

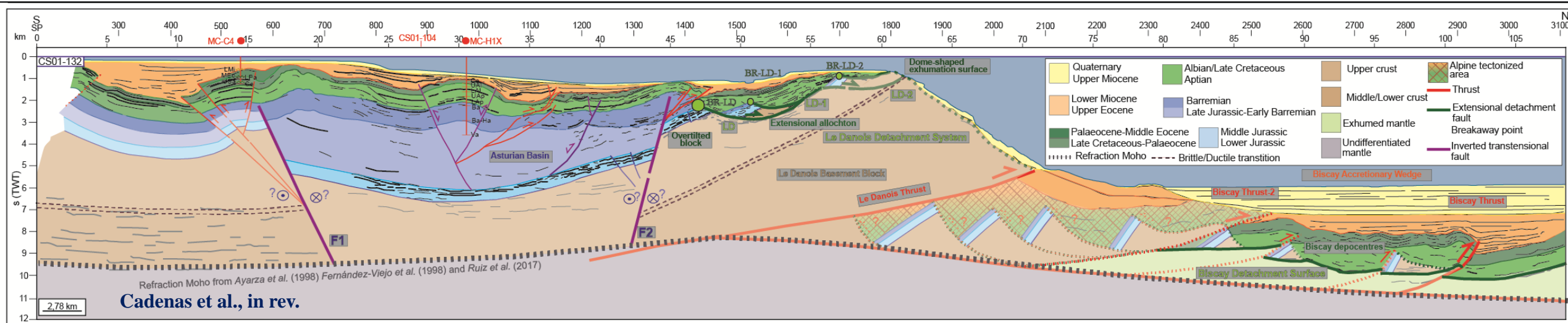
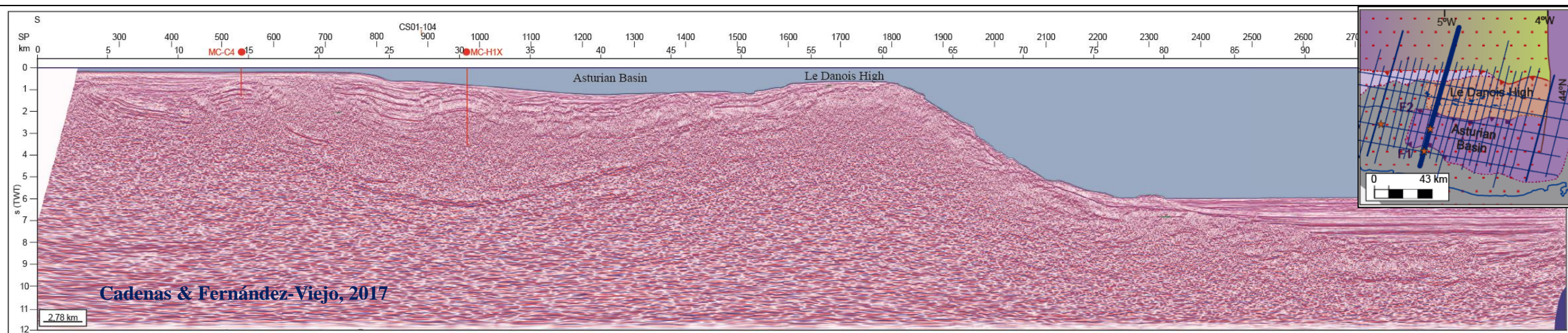
Mild inversion. Thin-skinned deformation. Diapirism and halokynes

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

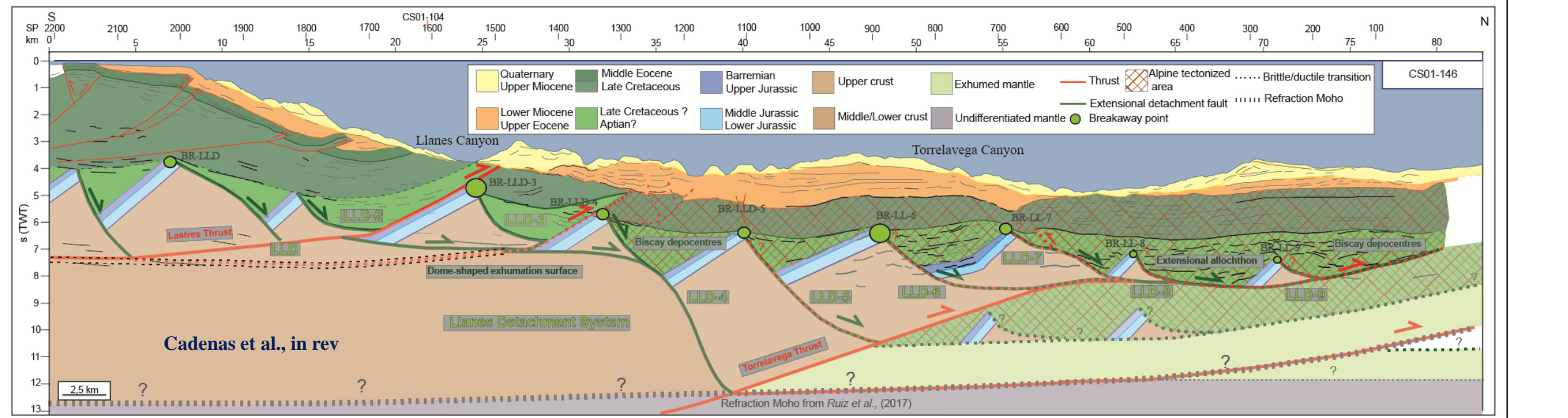
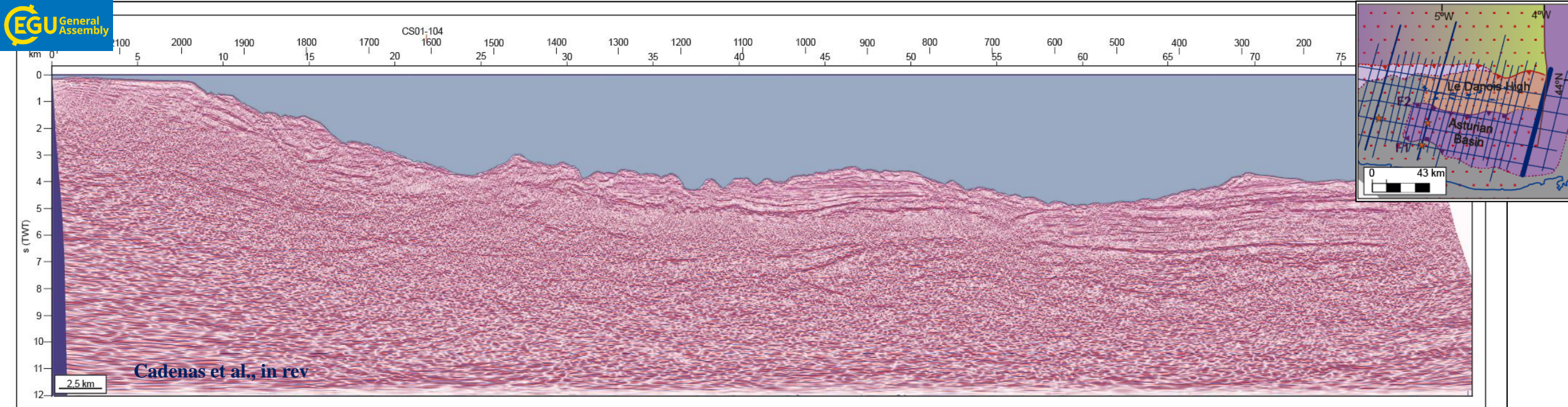
Le Danois Detachment System  
The Le Danois crustal block

Uplift+ tilting

Hyperextended crust + Biscay Detachment Surface  
wide Biscay depocentres

Underthrusting+ accretion. Thrusts decoupled in the crust/mantle boundary





Extensional allochthons + Llanes Detachment System + wide Biscay depocentres

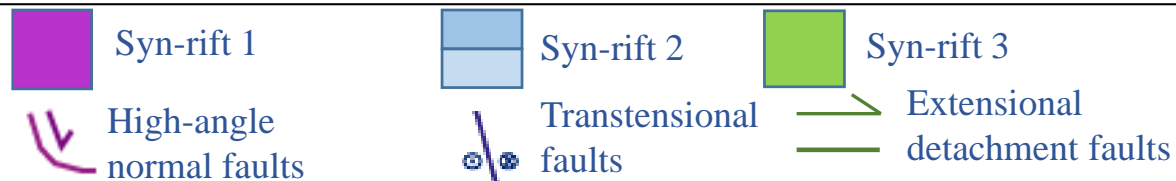
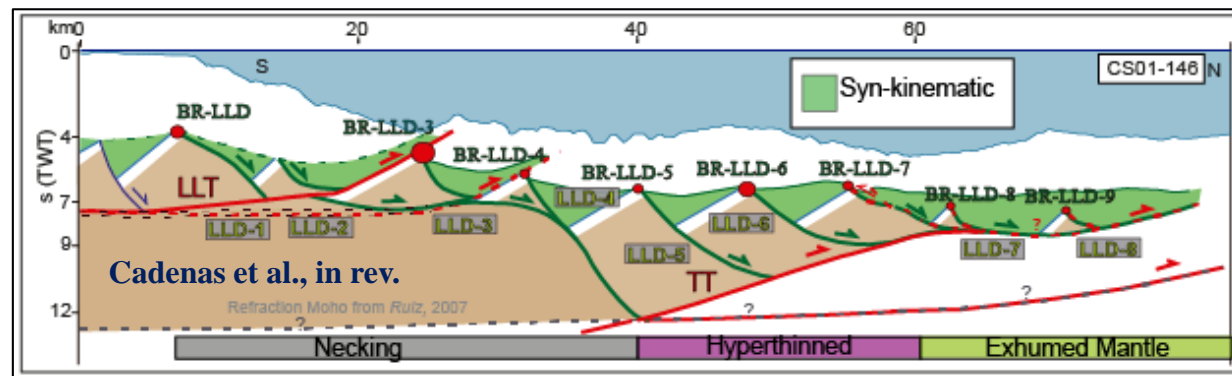
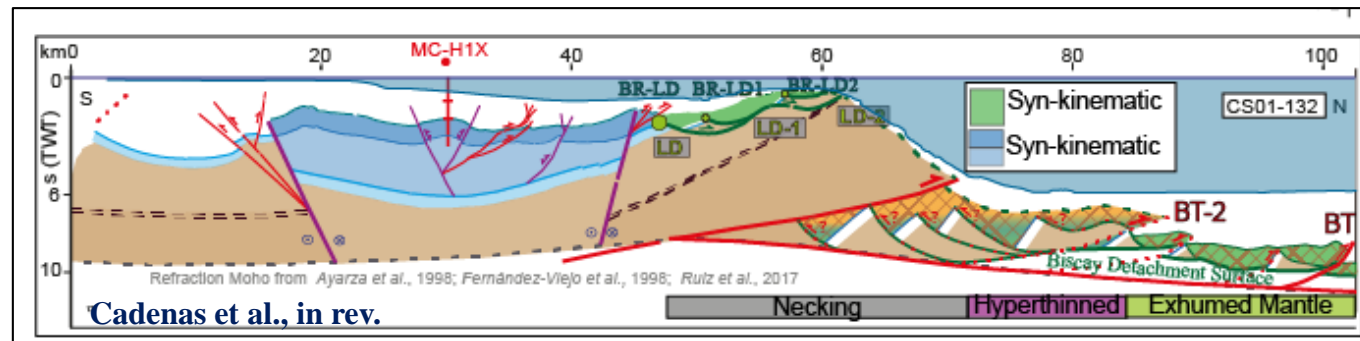
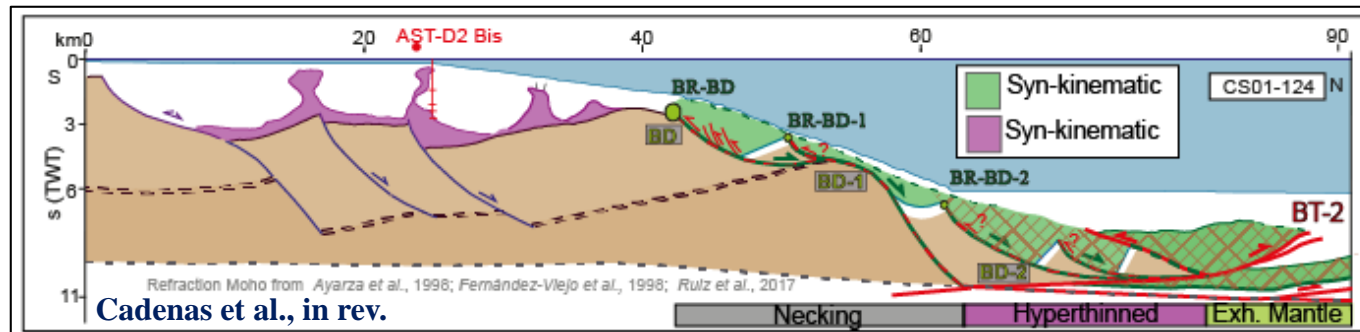
Thrusting. Thrust decoupled in the brittle/ductile transition

Underthrusting + accretion. Thrusts decoupled in the crust/mantle boundary

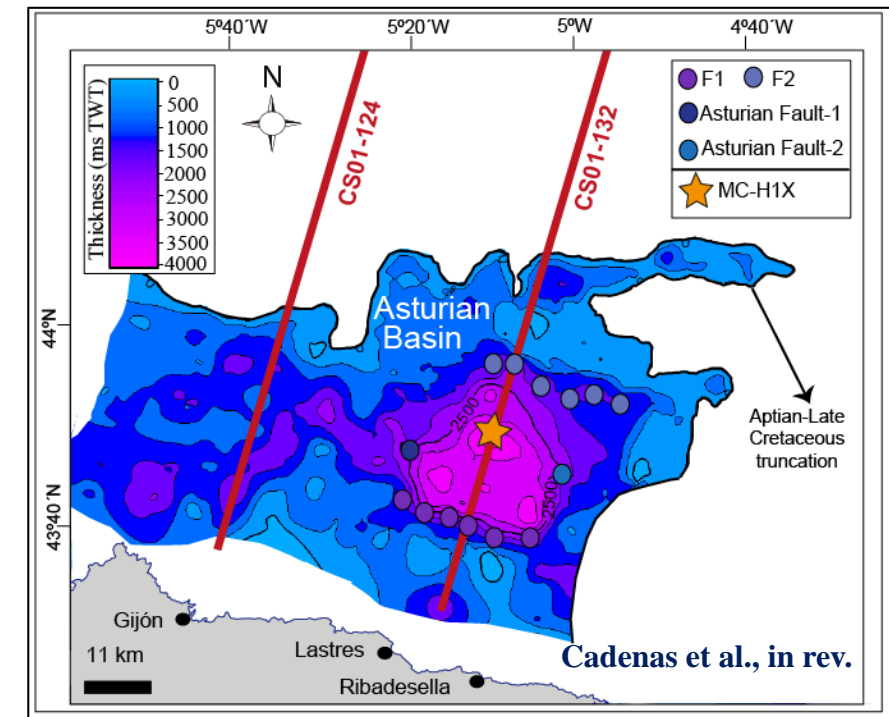


## 2) Syn-rift units and rift basins in the central North Iberian margin

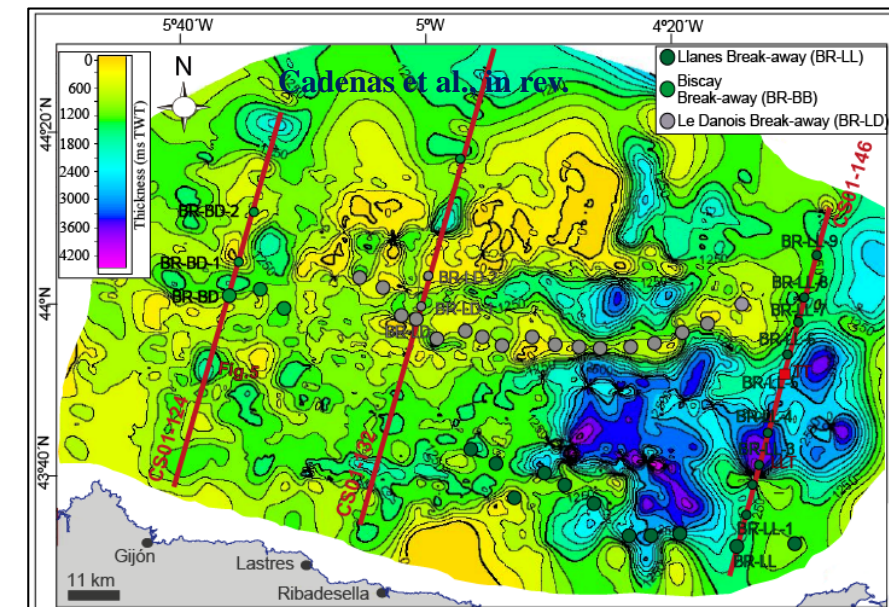
### Interpretation of syn-kinematic units along three N-S profiles



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

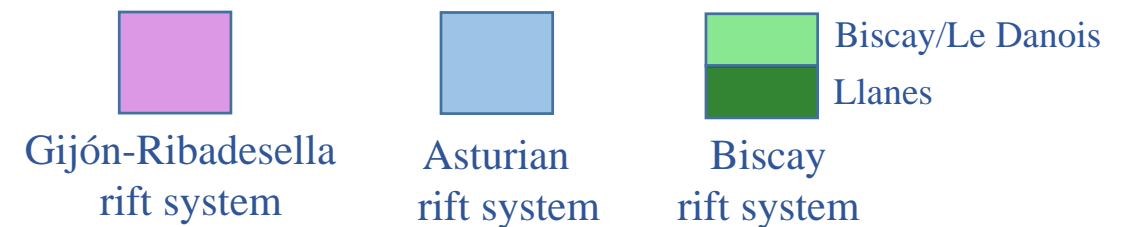
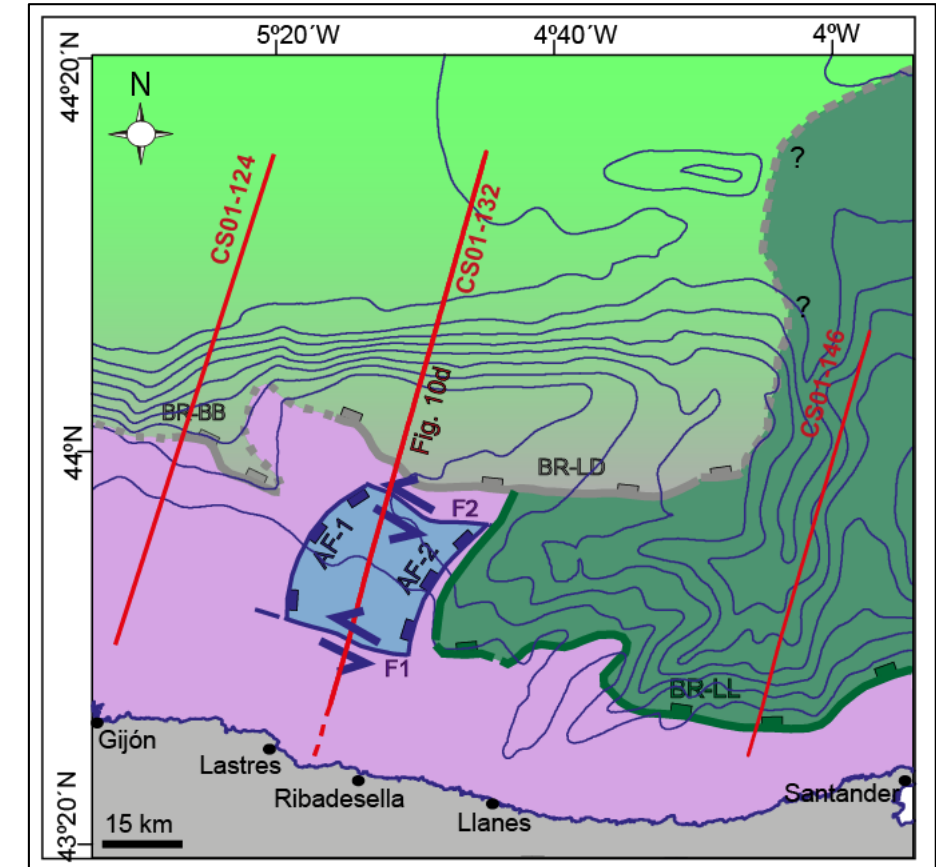
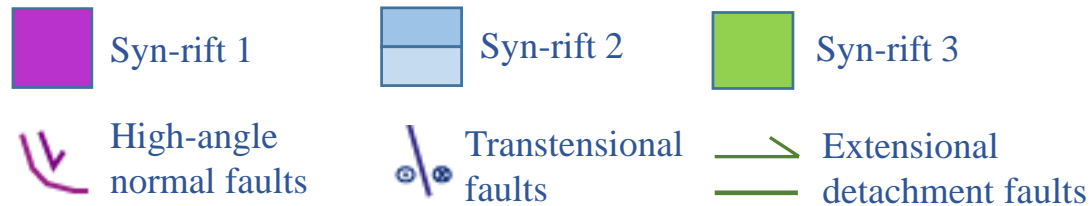
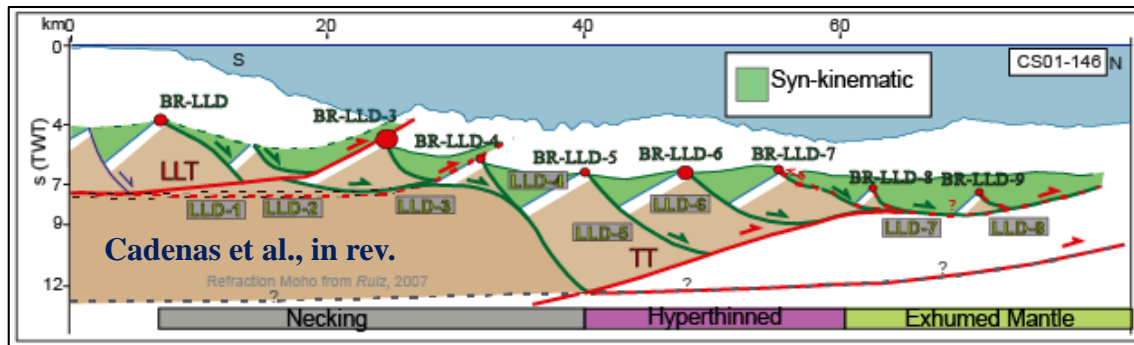
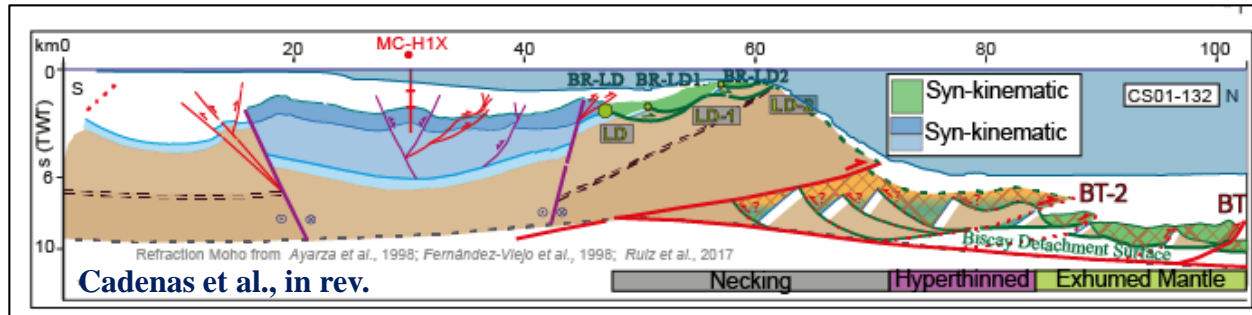
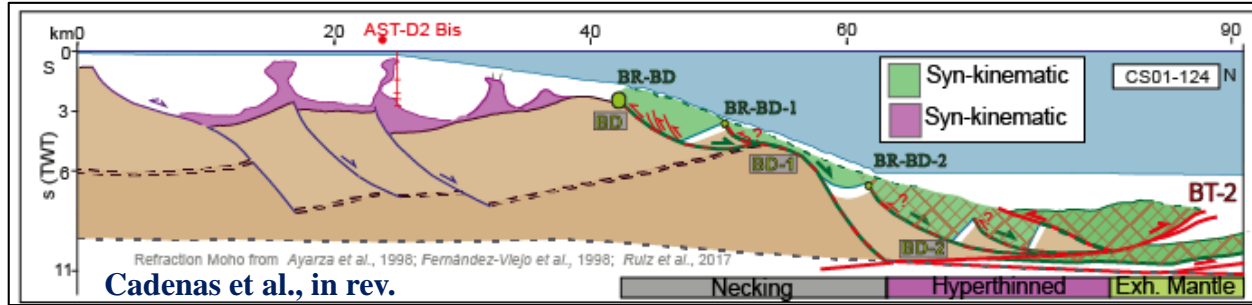


### Thickness map (ms TWT) of the syn-rift unit 3



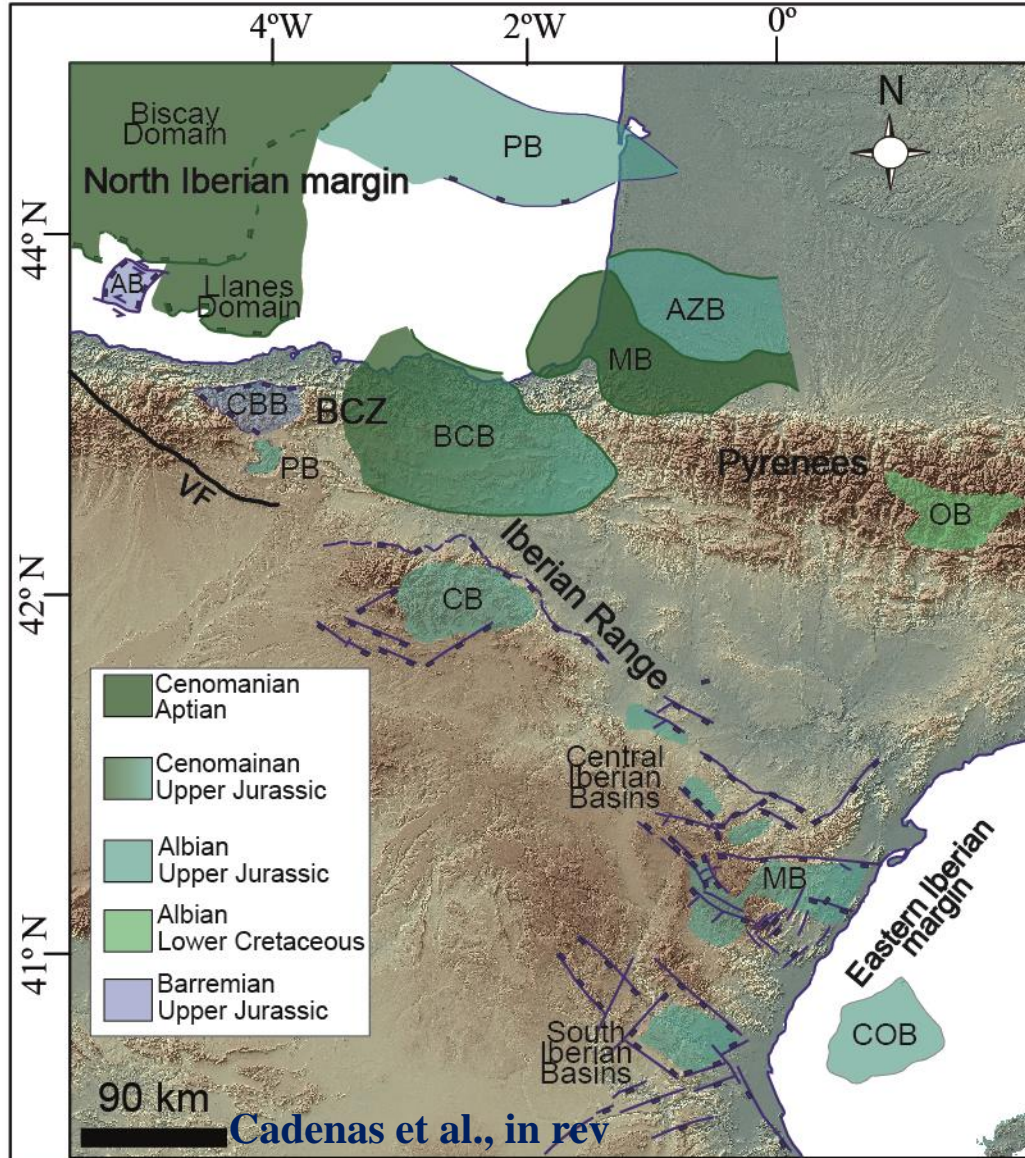
### 3) Rift systems in the North Iberian margin

Cadenas et al., in rev





## 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 **transtensional** 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.**

Cabuérniga Basin (CBB) and Polientes Basin (PB) from Ábalos (2016) and Espina (1997). Basque-Cantabrian Basin (BCB), Mauleón Basin (MB), and Arzac Basin (AZB) from Masini et al., 2014 and Lescoutre (2019). Organyà Basin (OB) from Tavani et al. (2018). Cameros Basin (CB), Central Iberian Basins, South Iberian Basins, and Maestrazgo Basin (MB) from Martín-Chivelet et al. (2019). Columbrets Basin (COB) from Etheve et al. (2018) and Roma et al. (2018). VF: Ventaniella Fault.

**Work under review...**  
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Small advertisement...



*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>*

*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*