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Mesozoic stretching and tectonic evolution of the Briançonnais (Western Alps)

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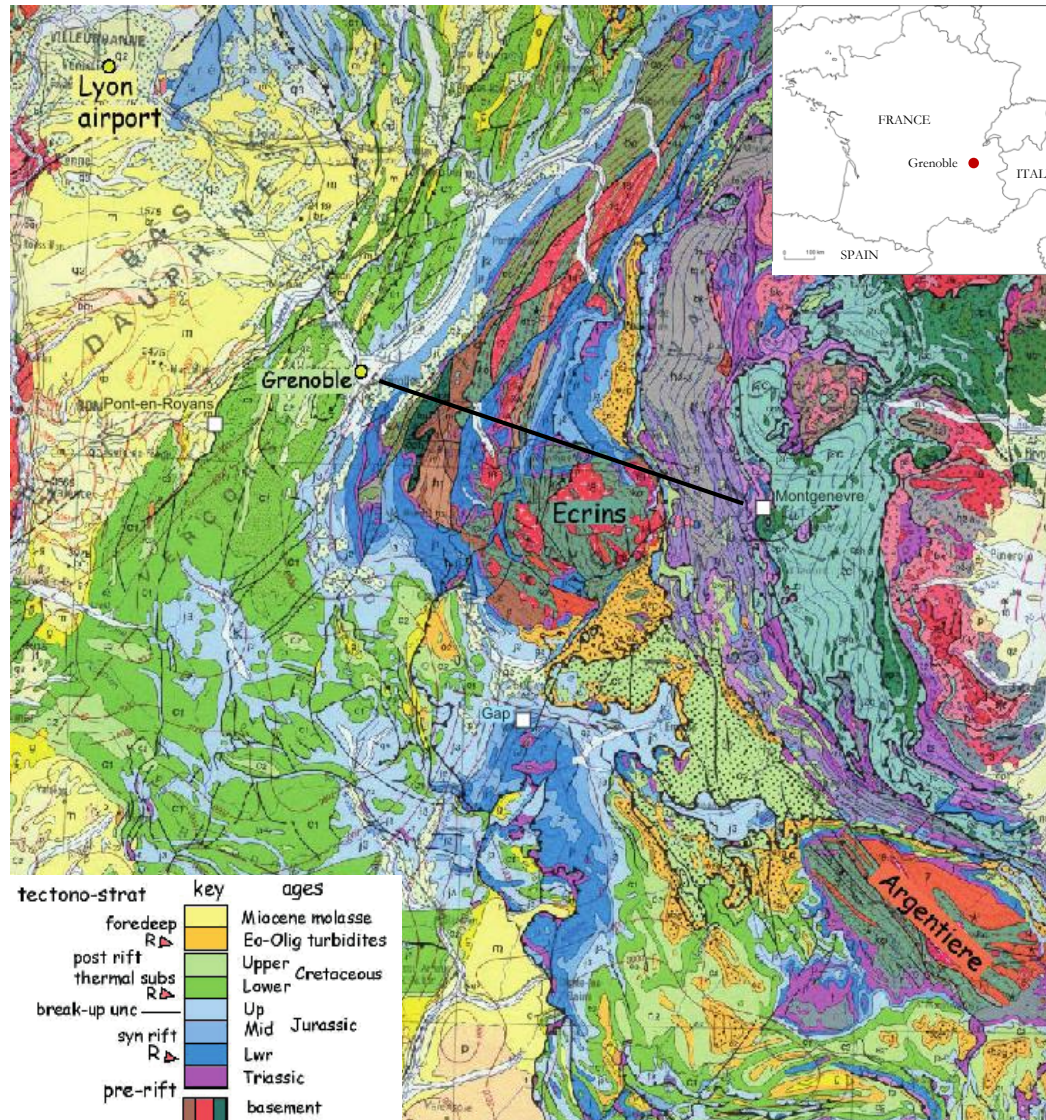
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Area of study



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The Alps are an orogenic system developed from the Cretaceous onwards by subduction of a Mesozoic ocean and subsequent collision between the Adriatic and European continental margins (Dal Piaz et al., 2003).

The stratigraphic sequence of Western Alps provides an exceptional record of divergent continental margins evolution.

The Briançonnais Block today mainly covers the internal areas of the Western Alps consisting of the eastern Dauphinois, Sub-Briançonnais, Briançonnais and the Piemontese units, coming from the European continental margin of Tethys (Costamagna, 2013).

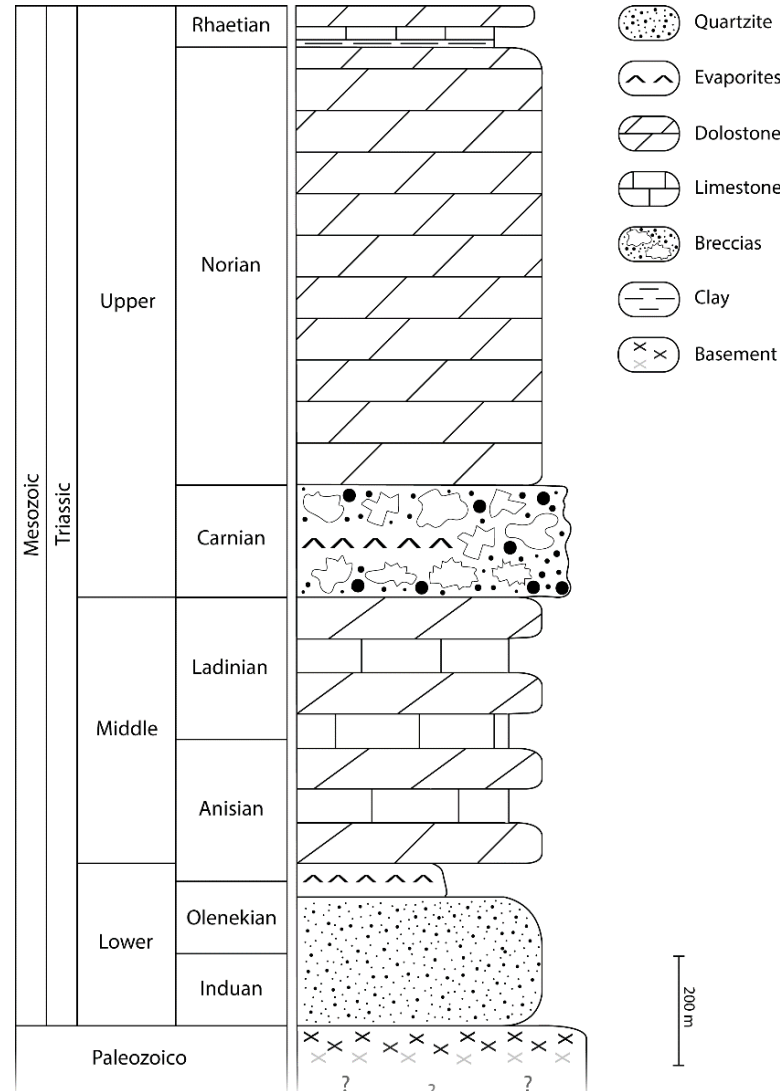
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Aim of work

The aim of this study is to backstrip the Mesozoic sedimentary succession of the Briançonnais domain in order to understand the tectonic driving forces responsible for the basin formation and subsidence.

The Briançonnais domain occupies a pivotal place for examining and testing various rifting models.

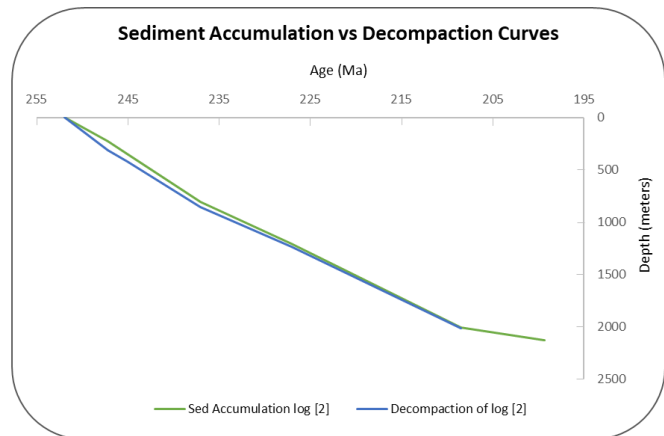
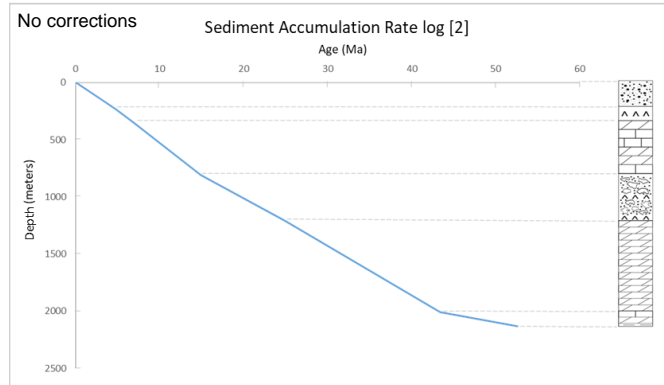
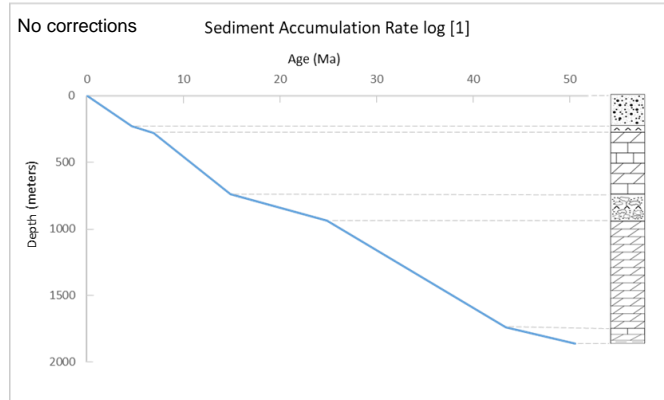
Its tectonic analysis develops understanding of upper-plate magma-poor rifted margins.



In the Triassic, no evidence of normal faults or onlap geometries have been identified anywhere to date (de Graciansky et al., 2010).

Sedimentation is homogeneous all over the Briançonnais domains with absence of facies variations (Lemoine et al., 1986).

Results



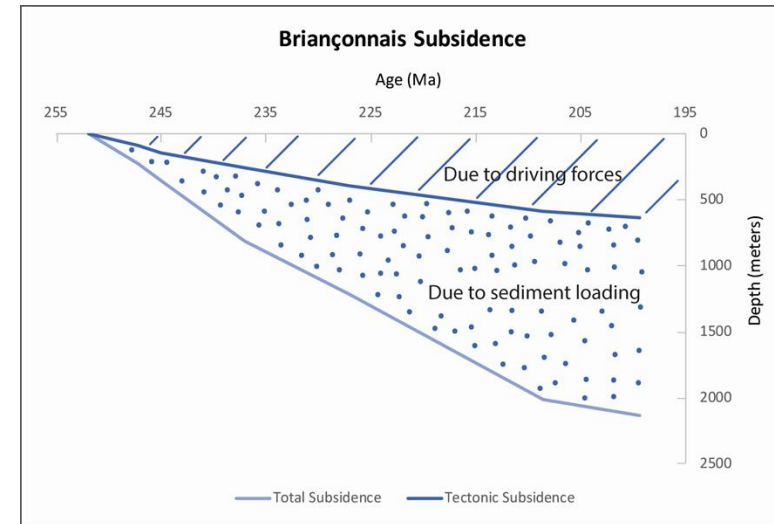
From Log [1] (shown to the left) the sediment accumulation rate curve has been calculated without applying any *Geohistory* corrections.

Because of salt dissolution and migration evidence, greater thicknesses of evaporites have been considered.

A new sediment accumulation rate curve has been computed.

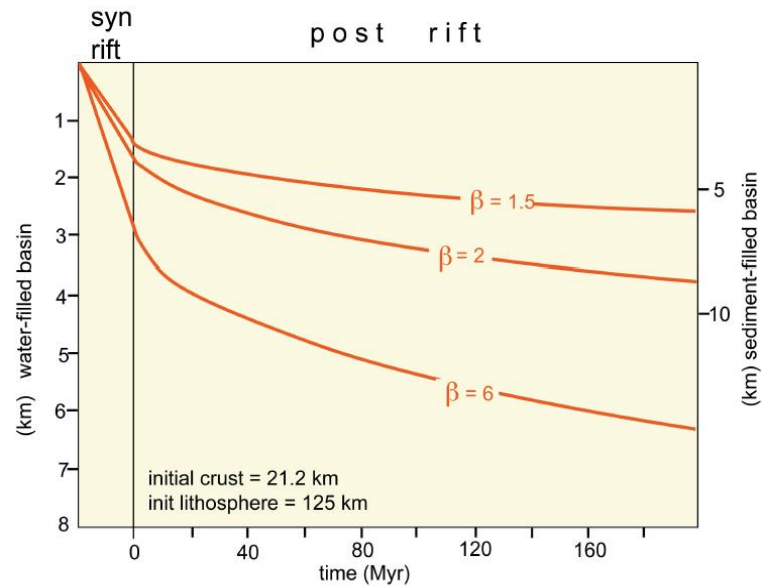
Although limestone, dolostone and evaporites are assumed not to be subject to compaction with increasing depth, a decompaction correction for Lower Triassic quartzite has been applied. This curve represents the basement depth at each time due to sediment accumulation.

Backstripping



Considering deposition happened in a water depth of zero and eustatic sea-level variations are negligible, the backstripped curve Log [2] allows distinguishing the tectonic driving forces from the total subsidence of the basin.

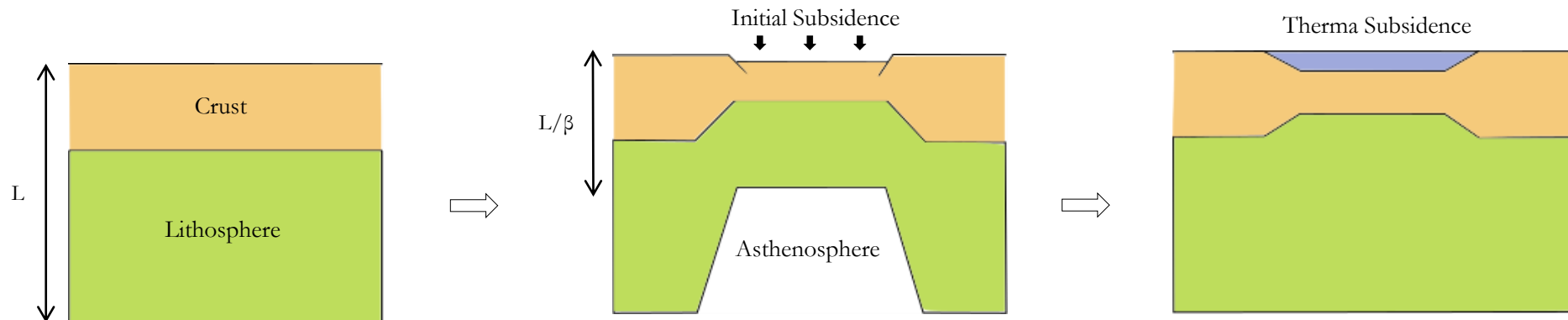
Does it reflect a thermal subsidence trend?



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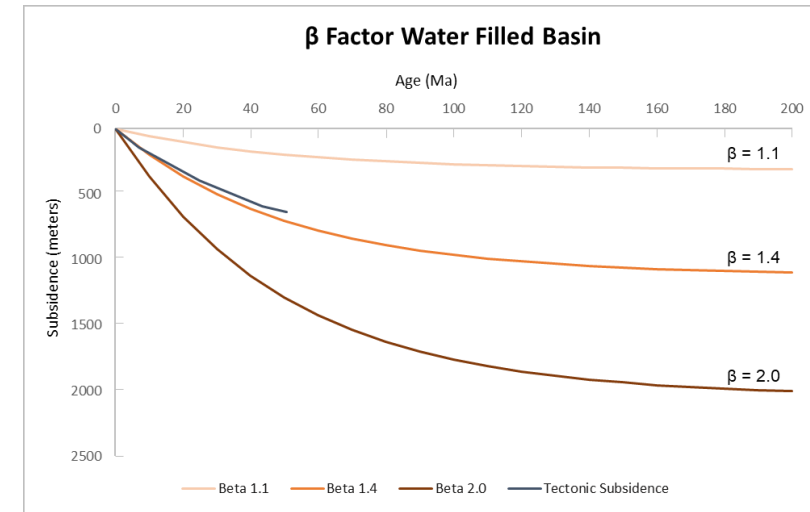
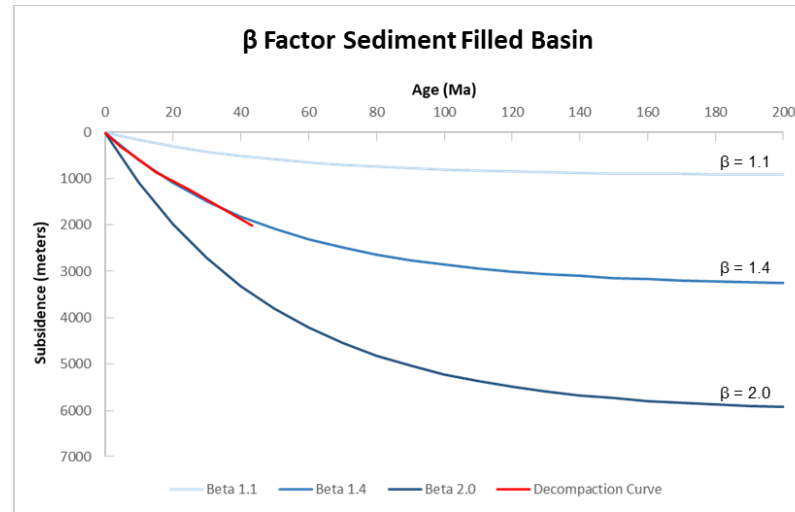
The numerical model of McKenzie (1978) considers an equal length-thickness block of lithosphere and crust stretched in two stages:

- Preliminary fault-controlled subsidence, strictly dependent on initial crustal thickness and β factor;
- A subsequent thermal subsidence, due to re-equilibration of lithospheric temperature and dropping of the isotherm, depending on β factor and the ratio of initial crustal over initial lithosphere thickness.



After McKenzie (1978) © Elsevier, all rights reserved

The stretching factor

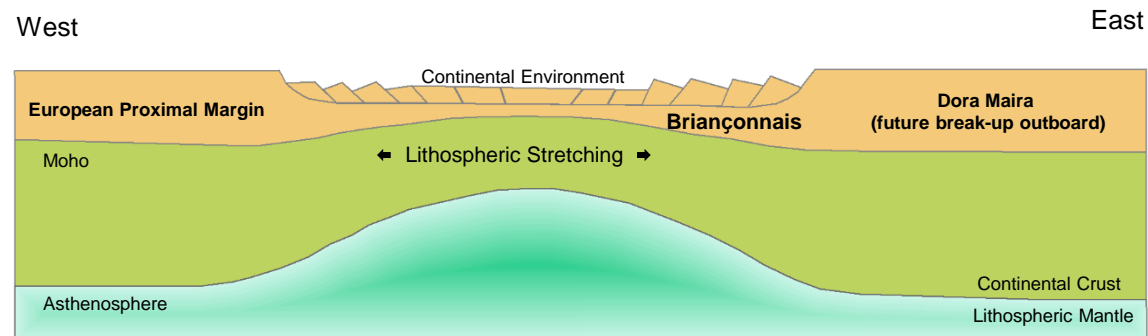


Applying the thermal subsidence equation of McKenzie (1978), theoretical and measured curves show a very good match with $\beta = 1.4$ for both the water-filled and sediment-filled basin.

How thick was the initial and the final crust?

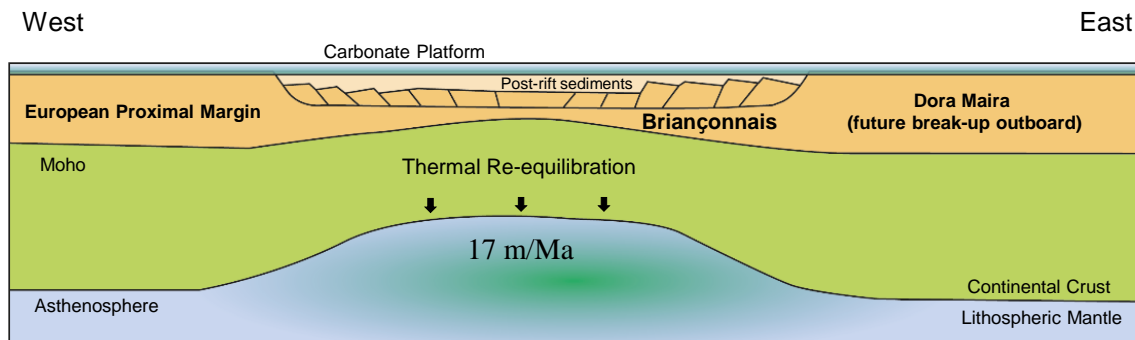
$Y_c = 33 \text{ km}$ (Pre-rift) \longrightarrow Before Permian

Permian-Triassic
251.9 Ma

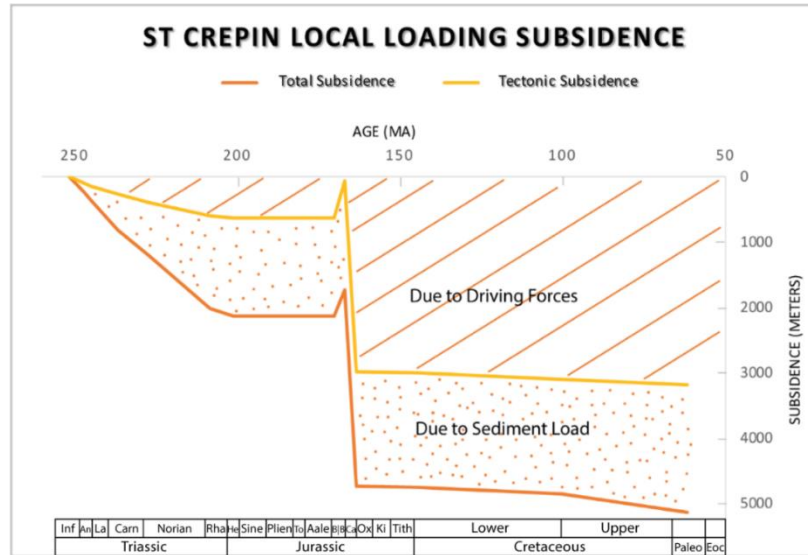


$$\beta = \frac{t_0}{t_f} \longrightarrow t_f = 23.6 \text{ km}$$

Triassic- Jurassic
201.3 Ma

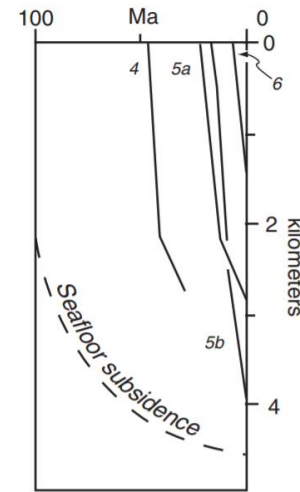


What happened in the Jurassic?

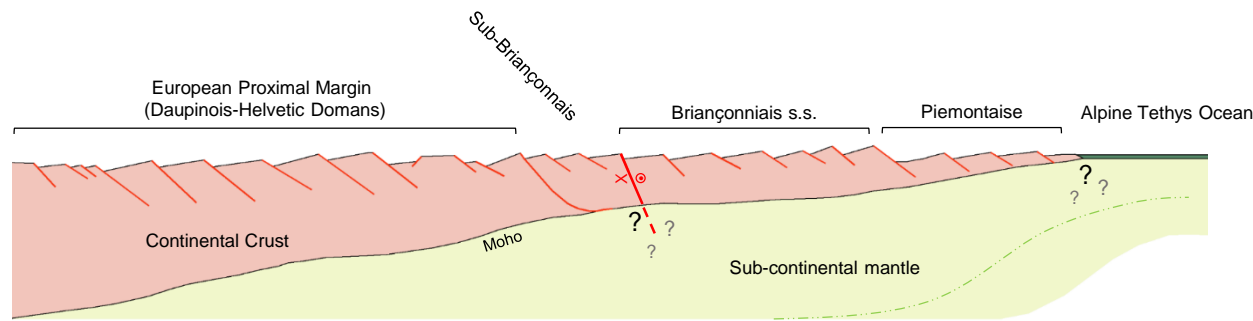


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STRIKE-SLIP BASINS



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In contrast to Triassic evolution of the Briançonnais, rapid and opposing Jurassic tectonic movements cannot be explained with the uniform stretching model of McKenzie (1978). On the contrary, a quantitative non-uniform model should be applied. Although this aspect has not been developed in this work, we hypothesize the sharp Bathonian/Callovian subsidence of the Briançonnais s.s. is due to the development of a pull-apart type basin rapidly deepening under the CCD in Late Jurassic times to the north of the Briançonnais domain. Many transform movements, in fact, have been registered between the main plates since the Jurassic (Lemoine et al., 1986; de Graciansky et al., 2010; Stampfli et al., 2002).

Thank you for your attention

