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Deciphering the influence of the thermal processes on the early passive margins formation

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Many large-scale dynamic processes, from continental rifting to plate subduction, are intimately linked to metamorphic reactions. This close relation between geodynamic processes and metamorphic reactions is, in spite of appearances, yet poorly understood. For example, during extension processes, rocks will be exposed to important temperature, pressures and stress changes. Meanwhile less attention has been paid to other important aspects of the metamorphic processes. When reacting rocks expand and contract, density and volume changes will set up in the surrounding material.
While several tectonic models are proposed to explain the formation of extensive basins and passive margins (simple shear detachment mantle exhumation ....) a single thermal model (McKenzie , 1978), as a dogma, is used to understanding and modeling the formation and evolution of sedimentary basins . This model is based on the assumption that the extension is only by pure shear and it is instantaneous. Under this approach, the sedimentary deposits occur in two stages. i) A short step , 1 to 10 Ma , controlled by tectonics. ii) A longer step , at least 50 Ma as a result of the thermal evolution of the lithosphere.
However, most stratigraphic data indicate that less thermal model can account for documented vertical movements. The study of the thermal evolution , coupled with other tectonic models , and its consequences have never been studied in detail , although the differences may be significant and it is clear that the petrological changes associated with changes in temperature conditions , influence changes reliefs.
In addition, it seems that the relationship between basin formation and thermal evolution is not always the same:
- Sometimes the temperature rise above 50 to 100 Ma tectonic extension. In the Alps, a significant rise in geothermal gradient Permo -Triassic followed by a "cold" extension , leading to the opening of the Ligurian- Piedmont ocean, from the Middle Jurassic .
- Other examples show that temperature changes are synchronous with basin formation . For example, extensive ponds Cretaceous North Pyrenean clearly indicate that the "cooking" of contemporary sediment deposit.
In the light of new models, we discuss the consequences of the formation of LP-granulites during rifting on deformation and the subsidence processes.