Finding hidden giants

How analogue modelling will help to address polyphased deformation along margins

by

Thomas P-O. Mauduit
VU, Amsterdam
thomas@mauduit.org
06 275 805 71

Hundreds of seismic lines along passive margins display the same scenario: an extensional upslope domain, a transitional domain, and a compressional downslope domain (Fig. 1). The upslope extensional domain is characterised by huge depocentres, growth fault rollover/systems and associated rollers either on regional or counter regional faults, turtleback structure. The transitional domain consists in rafts and extensional diapirs and the compressional downslope domain is characterised by fold, thrusts and squeezed diapirs. The width of these deformed zones may vary greatly, depending on the basal slope and the width of the margin. As a result, the compressional zones can be very close or deep offshore. All gravity driven structures result from brittle/ductile coupling between the décollement layer (salt or shale) and the overburden. This is true in extensional settings as well as in compressional.

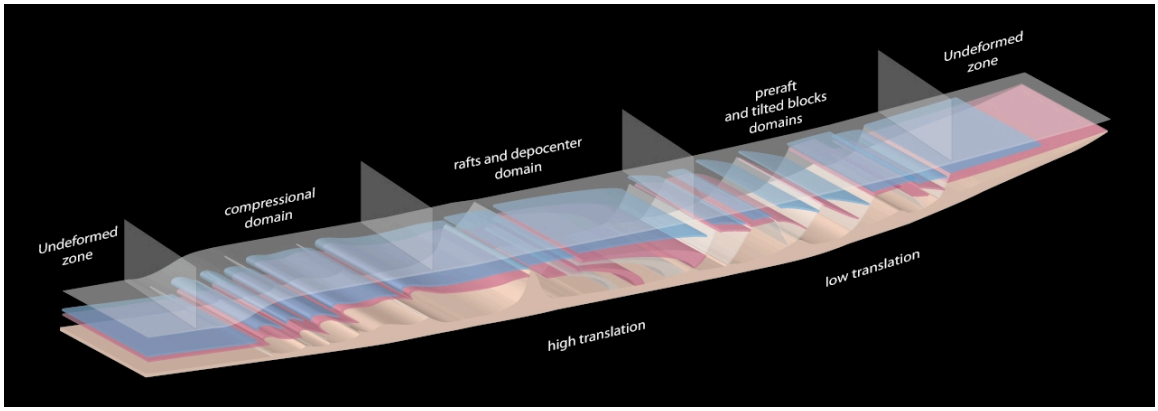

Fig. 1. Evolution of deformation along a passive margin (Mauduit, 1996)

The description of encountered structures has been fantastically illustrated by the oil industry. We present here recent results in analogue modelling which explained the kinematic and the mechanics of most of the main structures. We demonstrate for instance, that listric faults do not exist in salt tectonics.

Most deltas and margins present several sedimentation jumps toward the basin, meaning that the classical gravity driven scenario can be repeated at increasing orders of magnitude (Fig. 2).

Where it is the case many highly important questions remained unanswered:

- Does the wavelength of the first generation of structures control the following depobelts?
- What, if any, is the relationship between the types of early features and younger structures?
- What type of compressional structures could be found in the heart of recent depocentres?

The target of this research is twofold:

- Make the link between the structures we perfectly identify on seismic sections near the surface and the hidden deep compressional structure underneath. Does the size and shape of the younger structures have any relationship with the size and shape (i.e. prospect volume) of, for instance compressional structure?
- Reduce exploration hazards. In other words, which depocentres should oil companies focus on? Where should they drill wells? And what type of structures will they encounter?

Answering all these questions is academically, and industrially very challenging. The outcome of this work will have an impact in salt and shale tectonics, in every delta, and on any margin affected by gravity driven deformation.
It may leads to reinterpret and to reassess the potential economic values of prospect along margins.

We performed scaled analogue experiments in order to address polyphased deformation on margins. We present here the first results of a pilot project.

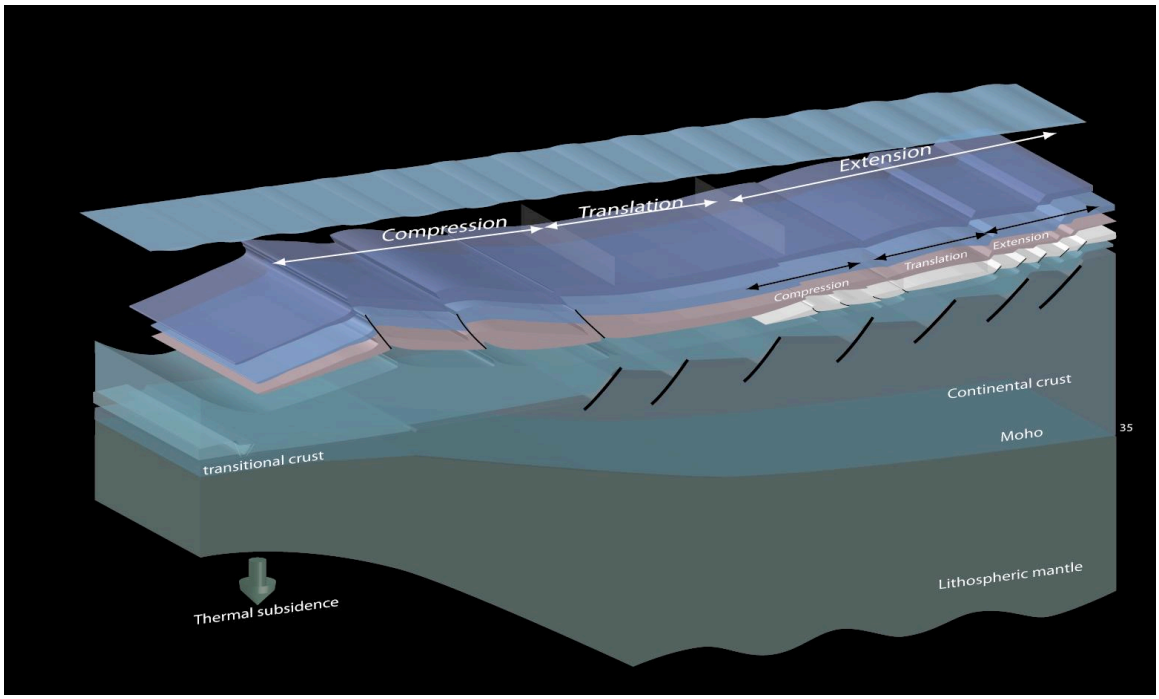

Fig. 2. Change in wavelength of gravity driven deformation along a passive margin.