SINGLE VISCOUS LAYER FOLD INTERPLAY AND LINKAGE: A 3D-FEM MODELLING APPROACH

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Recent fieldwork observations and numerical experiments have demonstrated that large fold-belt systems do not necessarily grow uniformly in a cylindrical manner but arise from the lateral connection (parallel to the fold axis) of smaller embryonic folds (Bretis et al., 2011). The mechanical feasibility of the linkage of two isolated embryonic folds has already been studied (Grasemann and Schmalholz, 2012). In this context, the mechanical feasibility of the fork-linkage or more generally the triple-linkage (three isolated embryonic folds linking laterally together, Figure 1) is studied using the pTatin3d code[1] (May et al., 2013). To address this issue, a template for modelling the triple-linkage is introduced, which consists of a solitary embryonic fold opposite to a binary perturbation.

A new terminology stemming from the observed patterns is introduced and a phase diagram highlighting the various linkage structures as a function of the geometric parameters is presented.

The folding and linkage process is tackled considering the vorticity field

$$\omega = \frac{1}{2} \nabla \times u \,,$$

where u is the velocity field. It turns out to be a very interesting and fruitful framework that makes the linkage patterns and embryonic fold interplays simple to understand. Based on the 3D analytical solution for the finite amplitude folding of a single viscous layer embedded in a matrix (Fletcher, 1991), the planar-vorticity dominant wavelength (in the viscous layer plane) is computed numerically. This planar-vorticity dominant wavelength turns out to be distinct from the dominant amplification wavelength and it appears to be the characteristic length controlling the linkage process. In the light of these observations, a new interpretation and explanation is given for the simple-linkage previously studied and the perspectives for the general case are proposed.

1 . The pTatin3d code has been developed by D.A. May to model 3D-multiphase Stokes flows for geodynamical applications.

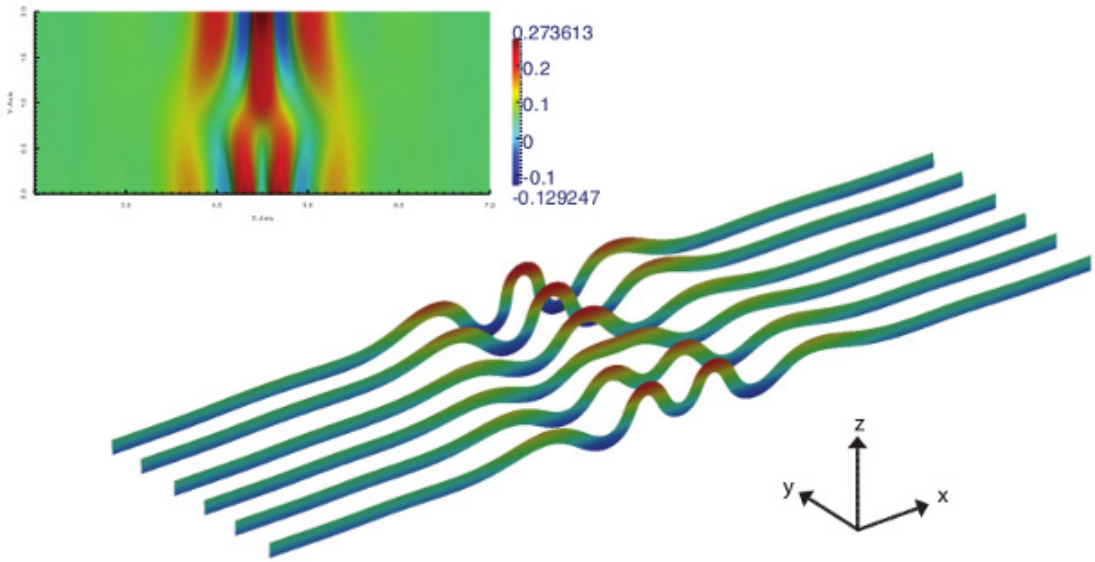

Figure 1: Triple-linkage: slices of a fork-structure. At the junction, we observe clearly a double hinge fold section with a flat topography. The colours indicate the relative topograpy.

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