Geophysical Research Abstracts,
Vol. 10, EGU2008-A-02401, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-02401
EGU General Assembly 2008

Very low angle thrusts: Problems and possible solutions

F. Ornelas Marques
University of Lisbon, Portugal (fomarques@fc.ul.pt)

Problems

1. Classical fault mechanics predicts low-angle thrust faults (ca. 27º) for common dry rocks in the brittle upper crust, but not sub-horizontal faults.

2. The rock boody in the hanging wall is transported over a long distance without significant internal strain. This implies low and homogeneously distributed internal stress levels. The transported rock must work as an efficient stress guide.

3. Push from the rear (overthrusting) works against gravity, which pulls the hangingwall down against the thrust plane and increases friction (basal resistence to frictional sliding). Rocks therefore fail earlier close to pushing “piston”, typically producing a tectonic wedge that thickens and propagates forward.

Possible solutions

1. Fluid overpressure on the thrust plane could carry part of the vertical load, thereby reducing the frictional resistance. Large amounts of fluids in the footwall may migrate upward until a capping impermeable rock in the hangingwall, which causes the upward flowing fluids to migrate along the fault plane and increase pressure, with this hovercraft effect producing the detachment.

2. Underthrusting at a low angle produces shear stresses that are distributed along the whole thrust plane, without significant increase in vertical load, in contrast to overthrusting.

3. Partitioning of strain between footwall and hanging wall, with flattening, folding and large volume reduction due to water loss in the former, and basal shear and rigid translation in the latter. This solves a great deal of the seemingly large displacement problem, and of the rigid, low stress, translation of the hanging wall block.

4. If the fault plane tilts towards horizontal during deformation, gravity is no longer a major problem in the presence of fluid overpressure. Tilting may occur by isostatic uplift in the root zone, which can result from variations in buttressing and/or climate/erosion. If tilting is such that the fault dip is inverted, then gravitational gliding can occur assisted by fluid overpressure on the fault plane. An original low angle thrust may become a flat normal fault with time.

5. If high topographic relief builds up in the root zone, this changes the stress orientation, with σ_1 becoming inclined toward the transport direction, thus leading to the initiation of thrusts at lower angle.

The classic Glarus fault in the Alps seems to encompass all these diagnostic features.