Geophysical Research Abstracts
Vol. 16, EGU2014-13826, 2014
EGU General Assembly 2014

Transtensional folding

Haakon Fossen (1), Christian Teyssier (2), and Donna L. Whitney (2)

(1) Department of Earth Science, Museum of Natural History, University of Bergen, N-5007 Bergen, Norway (haakon.fossen@geo.uib.no), (2) University of Minnesota, Minneapolis, MN 55455 United States (teyssier@umn.edu, dwhitney@umn.edu)

For now three decades transpression has dominated the concepts that underlie oblique tectonics, but in more recent years transtension has garnered much interest as a simple model that can be applied to shallow and deep crustal tectonics. One fundamental aspect that distinguishes transtension from transpression is that material lines in transtension rotate toward the direction of oblique divergence. Another point that may be less intuitive when thinking of transtension is that while transtensional strain involves shortening in the vertical direction, one of the horizontal axes is also a shortening axis, whatever the angle of divergence. It is the combination of these two shortening axes that leads to constrictional finite strain in transtension. The existence of a horizontal shortening strain axis implies that transtension offers the potential for folds of horizontal layers to form and then rotate toward the direction of oblique divergence.

An investigation of transtensional folding using 3D strain modeling reveals that folding is more likely for simple shear dominated transtension (large wrench component). Transtensional folds can only accumulate a fixed amount of horizontal shortening and tightness that are prescribed by the angle of oblique divergence, regardless of finite strain. Transtensional folds are characterized by hinge-parallel stretching that exceeds that expected from pure wrenching. In addition, the magnitude of hinge-parallel stretching always exceeds hinge-perpendicular shortening, causing constrictional fabrics and hinge-parallel boudinage to develop. Because the dominant vertical strain axis is shortening, transtensional fold growth is generally suppressed, but when folds do develop their limbs enter the field of shortening, resulting in possible fold interference patterns akin to cascading folds. Application of these transtensional folding principles to regions of oblique rifting (i.e. Gulf of California) or exhumation of deep crust (i.e. Western Gneiss Region, Norway) allows seemingly disparate structures to be integrate in a single tectonic setting of oblique divergence.