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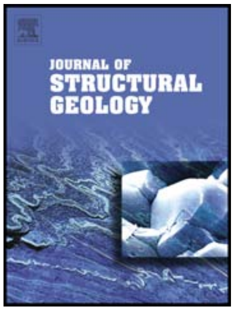

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Transtensional folding

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Abstract

Strain modeling shows that folds can form in transtension, particularly in simple shear-dominated transtension. Folds that develop in transtension do not rotate toward the shear zone boundary, as they do in transpression; instead they rotate toward the divergence vector, a useful feature for determining past relative plate motions. Transtension 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. Hinge-parallel stretching of transtensional folds always exceeds hinge-perpendicular shortening, causing constrictional fabrics and hinge-parallel boudinage to develop.

These theoretical results are applied to structures that developed during oblique continental rifting in the upper crust (seismic/brittle) and the ductile crust. Examples include (1) oblique opening of the Gulf of California, where folds and normal faults developed simultaneously in syn-divergence basins; (2) incipient continental break-up in the Eastern California-Walker Lane shear zone, where earthquake focal mechanisms reflect bulk constrictional strain; and (3) exhumation of the ultrahigh-pressure terrain in SW Norway in which transtensional folds and large magnitude stretching developed in the footwall of detachment shear zones, consistent with constrictional strain. More generally,