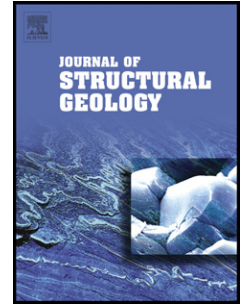


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Area balancing as a test of models for the deep structure of mountain belts, with specific reference to the Alps

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9 ABSTRACT

10 Basic concepts of structural restoration are applied to crustal cross-sections
11 through mountain belts to explore large-scale tectonic models and deep
12 structure. However, restored sections should account for variations in pre-
13 orogenic crustal thicknesses. Crustal balancing approaches are reviewed and
14 applied to two Alpine sections, coinciding with deep seismic experiments: NRP-
15 20 East (Central Alps) and ECORS-CROP (Western Alps). Existing studies assume
16 large (>300km) orogenic contraction and only moderately thinned pre-orogenic
17 crust. The resulting restored sections contain more crust than is imaged beneath
18 the present-day Alps, the missing crust generally assumed to be subducted. Two
19 kinematic modifications reduce the requirement for subduction: thinning and
20 buoyancy-driven return flow of ultra-high pressure metamorphic rocks during
21 orogenesis; and pre-orogenic hyperextension. Using large stretching factors for
22 the pre-orogenic crust negates crustal subduction on both Alpine transects. If the
23 lower crust was approximately rigid, restorations of the Central Alps require
24 strongly depth-heterogeneous stretching of upper and lower crust during
25 Mesozoic rifting. Relaxing this requirement allows uniform lithospheric
26 stretching, a corollary consistent with published subsidence estimates.
27 Restorations make implicit statements on the form of pre-orogenic basins and
28 the structure of continental margins incorporated into mountain belts that can in
29 turn provide tests of tectonic models.

30

31 Highlights:

32 Workflows and methods are presented for crustal balancing through orogens.

33

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