Reply to comment by S. H. Lamb on ‘Deformation of the NE Basin and Range Province: the response of the lithosphere to the Yellowstone plume?’ by R. Westaway

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Accepted 1990 November 27. Received 1990 November 27

The theory presented by Westaway (1989) contained some mistakes, which have been corrected by Westaway (1991). A copy of this correction was sent to Lamb in March 1990.

(i) Lamb’s (1991) first point is incorrect. Conditions exist whereby a single set of faults can take up distributed simple shear and extensional pure shear and where the strain rate tensor is uniaxial (see Westaway 1991). Whether faults in any set that satisfies these conditions take up pure normal slip or oblique slip simply depends on their orientation relative to the local extension direction.

(ii) Lamb (1991) correctly states that equation (2.19) of Westaway (1989) does not correctly describe slip sense on faults during uniaxial extension where vertical vorticity is non-zero. Westaway (1991) has indeed already shown this. Westaway (1991) has also developed appropriate new theory and has applied this theory to the NE Basin and Range Province.

(iii) Westaway’s (1989) result that rotation rate around a vertical axis, \( \omega \), of elongated blocks equals half the local vertical vorticity, \( \chi_z \), is correct for vorticity associated with concentric flow (an important special case) but is not correct in general. Lamb (1991) illustrates this point with two counterexamples that have already been noted by Westaway (1991). However, the orientation of active faults in the NE Basin and Range Province corresponds to neither of these counterexamples. Given this, \( \chi_z/2 \) remains a reasonable approximate estimate for \( \omega \) in the absence of any clear general method for obtaining a better estimate.

With the relevant theory corrected, Westaway’s (1989) principal conclusion remains tenable (see Westaway 1991): slip sense on active oblique normal faults in the NE Basin and Range Province is indeed consistent with what may be expected if the region is deforming in response to a sheared upwelling mantle plume beneath Yellowstone.

REFERENCES