Extension and Shortening Estimates: Funeral Mountains, Death Valley Region, California

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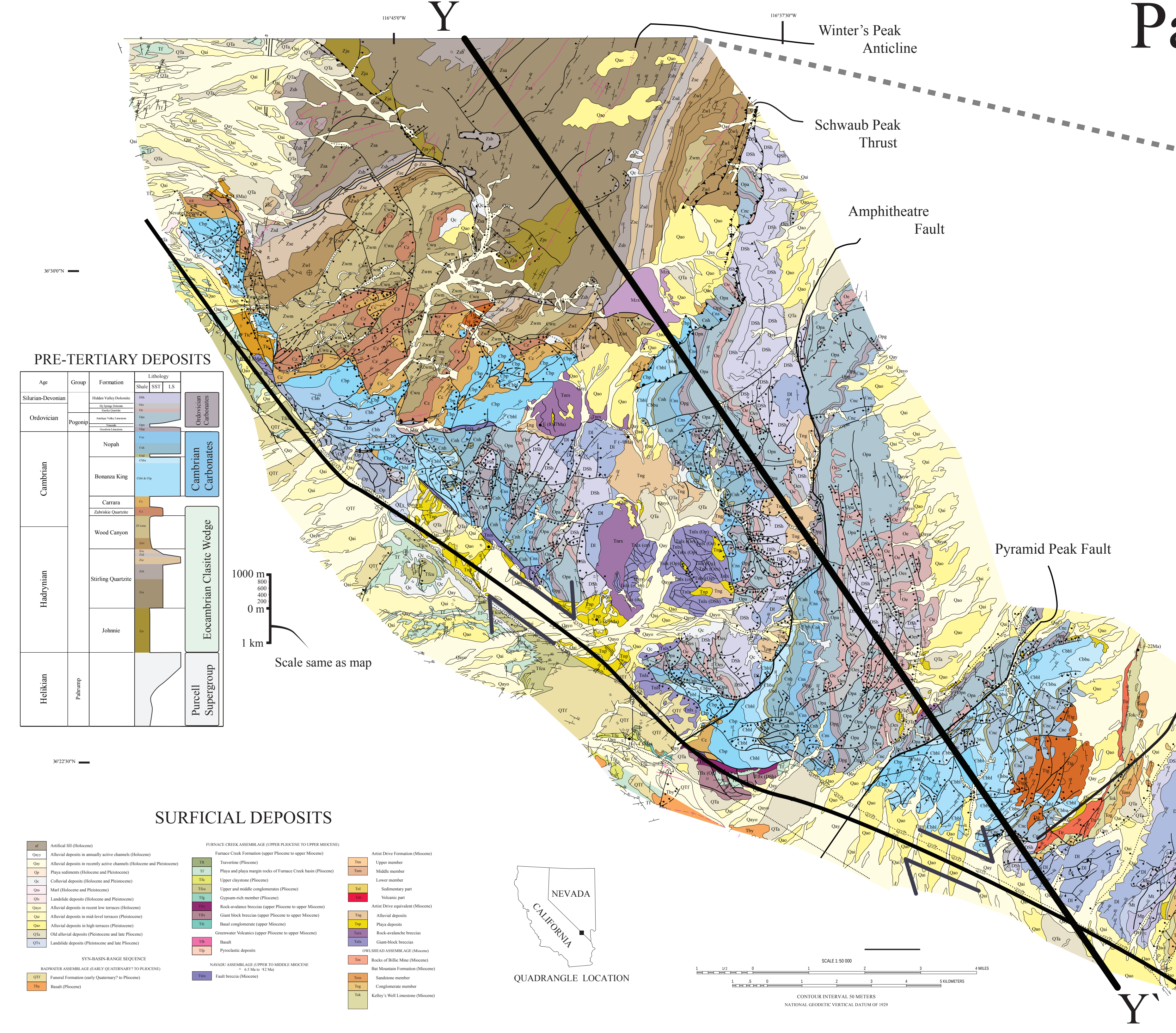
Problem

Pieces of a dismantled fold thrust belt are well exposed in the Funeral Mountains, California. Geometric elements of the structures that compose the belt are cornerstone to palinspastic reconstructions of Basin and Range extension in the Death Valley region. Explicitly, the spacing between an anticline (A) and two thrusts (T_1, T_2) in the Funeral (F) and Cottonwood (C) Mountains have lead previous workers (Snow and Wernicke, 1989) to conclude that the two range blocks were once adjoined. Extension *within* the Funeral Mountains range block has separated the thrusts, limiting their viability as pre-extensional markers.

Approach

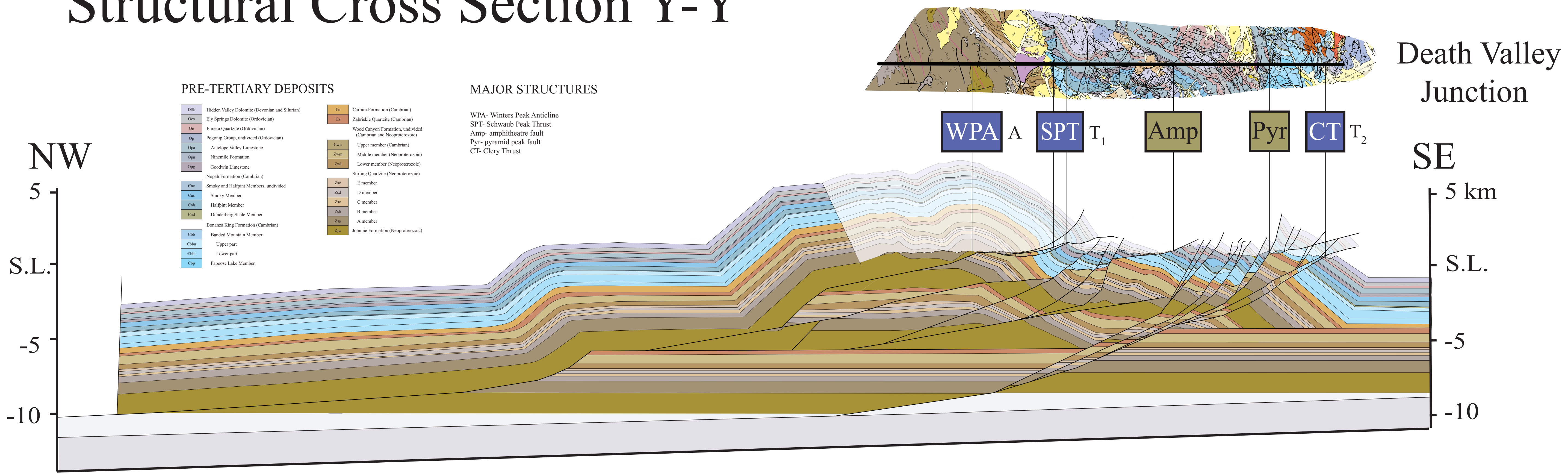
The magnitude of extension between the thrusts can be approximated through kinematic analysis. The balanced cross section Y-Y’ was validated through forward modeling in the software MOVE. Restoration of the normal faulting between the thrusts yields an estimate of their true pre-extensional spacing. If this pre-extensional spacing matches that of the structures in the Cottonwood Mountains, then previous palinspastic reconstructions are supported. If not, then the reconstructions need to be re-evaluated.

Geologic Map

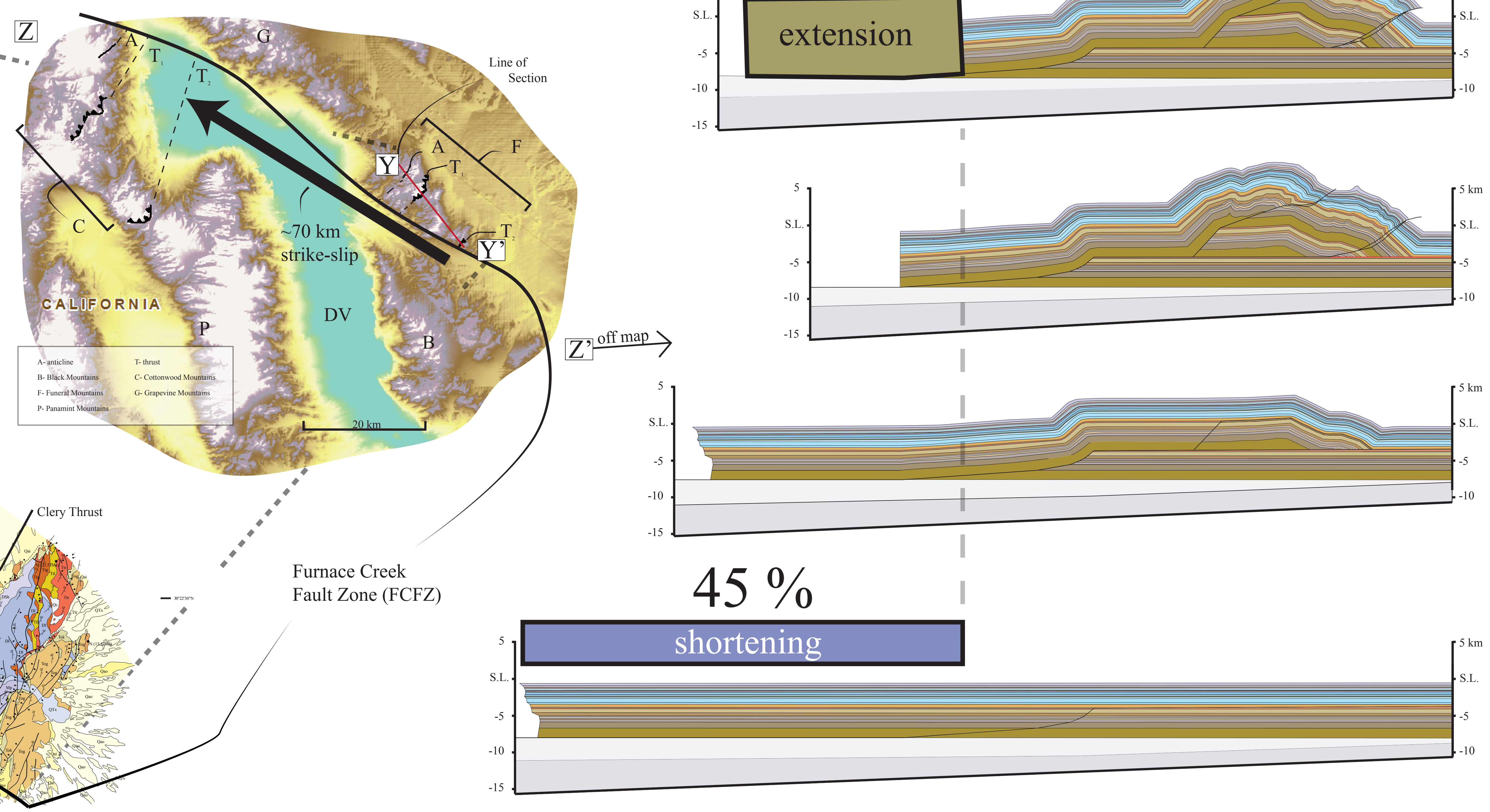


Fridrich et al., 2008

Structural Cross Section Y-Y’

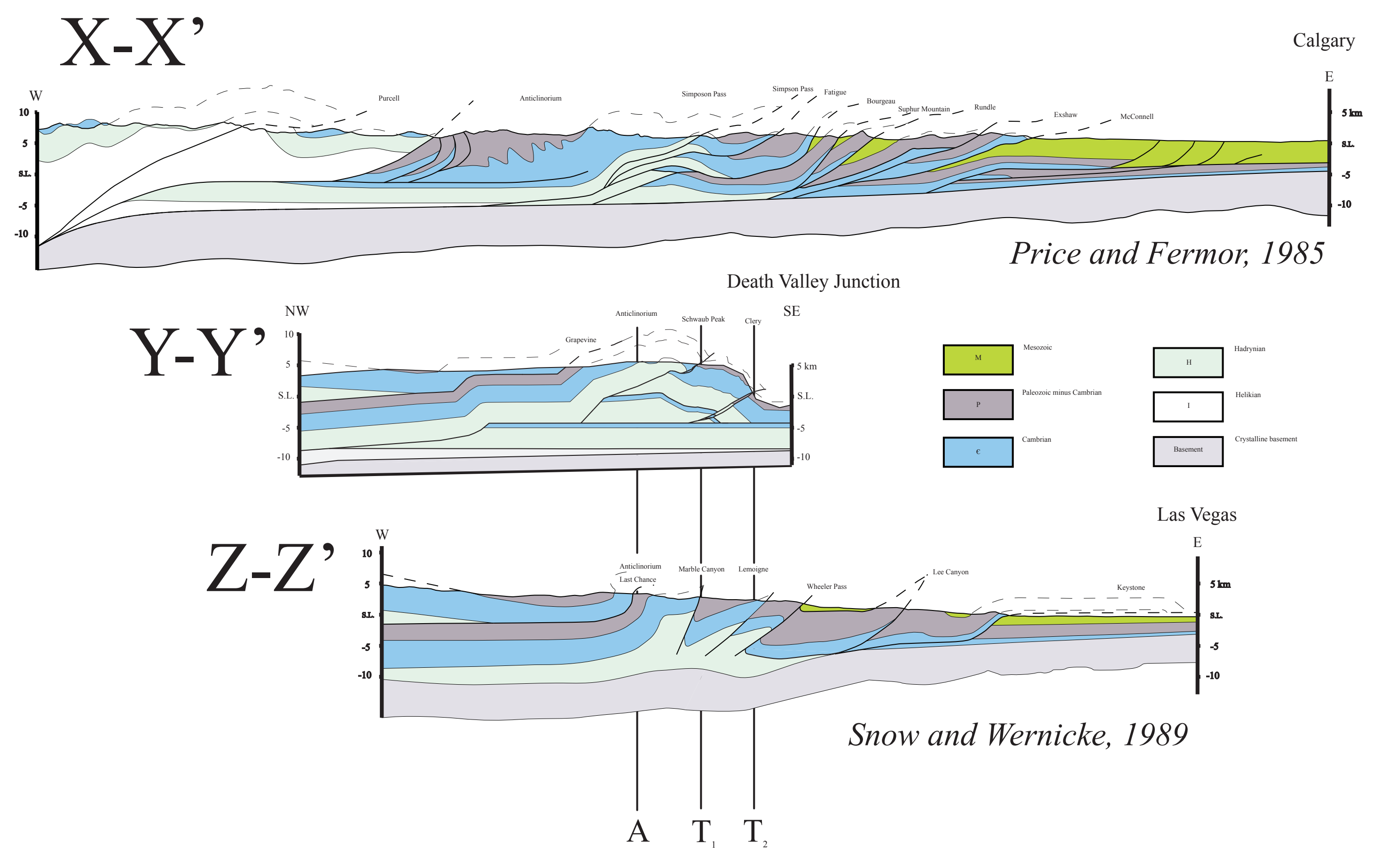


Palinspastic Reconstructions



Regional Correlations

Restoration of intra-block extension indicates that Funeral Mountains thrusts (Y-Y’) have a similar pre-extensional spacing to those in the Cottonwoods (Z-Z’). This structural geometry is corresponds to patterns observed in the Cordilleran fold-thrust belt near Alberta, Canada (X-X’). A west-vergent anticlinorium resulting from imbrication of the Eocambrian clastic wedge (Snow and Wernicke, 1989) is present in all three sections. The anticlinorium is a regional feature that marks the trailing end of the Sevier fold-thrust belt from Southeastern California to British Columbia (Decelles, 2004).



Discussion & Conclusions

The Funeral and Cottonwood Mountains are interpreted here-in to be correlative range blocks. Thus, previous estimates of strike-slip along the Furnace Creek Fault Zone are supported by this work.

The kinematic model indicates that the magnitudes of extension and shortening *within* the Funeral Mountains range block are approximately 25% and 45%, respectively. The structural geometry and values of extension/shortening are consistent with previous studies of range blocks and fold-thrust belts in the Cordillera (see below).

Range Blocks			Fold-thrust Belts		
Study	Location	Total Extension	Study	Location	Total Shortening
Snow, 1990	Cottonwood Mountains, CA	32%	Baby et al., 1992	Andes Mountains, Bolivia	42%
Çemen and Wright 1990	Funeral Mountains, CA	25%			
G. Michel-Noel et al., 1990	Rainbow Canyon, NV	10-20 %	Gotberg et al., 2012	Andes Mountains, Peru	40%
Lutz &Çemen, (this study)	Funeral Mountains, CA	25%	Lutz & Çemen, (this study)	Funeral Mountains, CA	45%

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