Concurrent growth of uplifts with dissimilar orientations in the southern Green River Basin, Wyoming: implications for Paleocene-Eocene patterns of foreland shortening

Philip Johnson, Cotton Shires & Associates, Los Gatos

The diverse orientations of Precambrian-cored and fault-bounded uplifts in the Rocky Mountain foreland region seem difficult to reconcile with the inferred Paleocene-Eocene shortening direction and plate convergence. Some have hypothesized that the shortening direction rotated as much as 90° over time, whereas others have hypothesized a relatively stable strain field involving concurrent oblique slip on faults with varied strikes.

The stratigraphic thicknesses of the synorogenic Paleocene through Eocene Fort Union, Wasatch, and Green River formations in the southern Green River Basin of Wyoming were used to define the pattern of basin subsidence and to interpret the timing of movement on two contractional structures with contrasting orientations. Isopachous maps and cross sections of three sequential time-stratigraphic intervals show thinning around the N-S oriented Rock Springs uplift and regional southward thickening of these three stratigraphic intervals. The southward thickening evidently resulted from flexural subsidence in response to loading from the adjacent E-W oriented Uinta uplift. Stratigraphic thinning in the vicinity of the Rock Springs uplift demonstrates that growth of the underlying blind thrust system produced an area of comparatively low accommodation space within the subsiding Green River basin.

The concurrent growth of the Rock Springs and Uinta uplifts does not support a rotation of shortening direction from E-W to N-S. The margin of a Neoproterozoic rift basin may have controlled the orientation of the thrust faults bounding the north flank of the Uinta uplift, and Late Cretaceous through Eocene compression caused oblique slip on these faults during structural inversion. A N-S-trending blind reverse fault underlies the west flank of the Rock Springs uplift, but Phanerozoic strata cover the Precambrian core of the uplift, so the structure within the Archean basement rocks is unknown. Despite contrasting strikes and different structural histories, the Uinta and Rock Springs uplifts responded concurrently to NE-SW- to ENE-WSW-directed shortening.

Biography: Phil Johnson received a BA in geology from San Francisco State University in 1987. After that, he studied sedimentary geology under David Andersen at San Jose State University where he completed his MS degree in 1990. Phil's MS thesis topic was the fluvial architecture of the Fort Union and Wasatch formations in the southern Green River Basin of Wyoming. Currently, Phil is a supervising geologist at Cotton, Shires and Associates in Los Gatos where he applies principles of geomorphology, sedimentology, and structural geology to problems of slope stability and seismic hazards. He has authored several full-length papers and abstracts on topics ranging from tectonics of the Rocky Mountain region to subsurface investigation of landslides.