Paleoaltimetry estimates suggest low surface elevations for the mid-Cretaceous Newark Canyon Formation within the Sevier hinterland

Anne Fetrow[1], Kathryn Snell[1], Russell Di Fiori[2], Sean Long[3], and Josh Bonde[4]

[1]University of Colorado Boulder
[2]Idaho Geological Survey
[3]Washington State University
[4]Las Vegas Natural History Museum

November 22, 2022

Abstract

The retroarc of the North American Cordilleran orogen in Nevada and Utah has been divided into the frontal Sevier fold-thrust belt in Utah, which accommodated shortening between ~145 and ~50 Ma, and a broad region of Nevada referred to as the 'Sevier hinterland'. The hinterland is hypothesized to have developed into a high-elevation orogenic plateau (or 'Nevadaplano') at some point between the Late Jurassic and the Paleogene. Recent paleoaltimetry utilizing clumped isotope temperature estimates suggests that at least some basins on the Nevadaplano were at an elevation of 2.2-3.1 km by the latest Cretaceous. However, it remains uncertain precisely when the Nevadaplano attained these high elevations and if surface uplift developed steadily along with protracted shortening in the Sevier fold-thrust belt or occurred rapidly and was decoupled from the shortening record. In order to extend the surface elevation history of the Nevadaplano further back in time, we have investigated the type-exposure of the mid-Cretaceous (~113-98 Ma) Newark Canyon Formation (Knc) in central Nevada. The Knc records synorogenic sedimentation in the Sevier hinterland during the early to middle stages of shortening in the Sevier thrust belt. We will present terrestrial surface temperature estimates from clumped isotope analyses derived from palustrine, lacustrine, and pedogenic carbonate-bearing facies. Contextualized by structural evidence and corrected for secular climate change, these data suggest that the studied Knc basin had not developed substantial surface elevation by the mid-Cretaceous. However, there was likely some considerable surface relief in this region associated with active fold-thrust structures in the upper crust. Preliminary temperature estimates range between 22 and 70°C. These temperatures reflect a range of facies-specific differences in primary carbonate formation, as well as, diagenetic overprinting of some samples. Consistently warm temperatures throughout the stratigraphic section suggest that there was no significant cooling due to elevation gain between ~113 and ~98 Ma. We will discuss the implications of these results for the style and timing of deformation and surface uplift within the Nevadaplano.

Hosted file

essoar.10504922.1.docx available at https://authorea.com/users/533316/articles/598161-paleoaltimetry-estimates-suggest-low-surface-elevations-for-the-mid-cretaceous-newark-canyon-formation-within-the-sevier-hinterland

AGU 2020 – Virtual Meeting

Session
Submit to EP003: Assessing paleotopography, relief, and elevation across spatio-temporal scales

Authors
Anne C. Fetrow
anne.fetrow@colorado.edu, 651-233-0027
University of Colorado Boulder, 2200 Colorado Ave, Boulder, CO, 80309, USA
Kathryn E. Snell
kathryn.snell@colorado.edu, 303-492-1461
University of Colorado Boulder, 2200 Colorado Ave, Boulder, CO, 80309, USA
Russell V. Di Fiori
russelld@uidaho.edu, 626-241-6154
Idaho Geological Survey, Morrill Hall, University of Idaho, Moscow, Idaho 83844, USA
Sean P. Long
sean.p.long@wsu.edu, 509-335-8868
Washington State University, 1228 Webster Hall, Pullman, WA, 99164, USA
Joshua W. Bonde
joshua.bonde@nvscicenter.org, 702-384-3466
Nevada Science Center, 702-468-2500, 331 South Water St. Unit D, Henderson, NV 89015, USA

Title
Paleoaltimetry estimates suggest low surface elevations for the mid-Cretaceous Newark Canyon Formation within the Sevier hinterland

Abstract
The retroarc of the North American Cordilleran orogen in Nevada and Utah has been divided into the frontal Sevier fold-thrust belt in Utah, which accommodated shortening between ~145 and ~50 Ma, and a broad region of Nevada referred to as the 'Sevier hinterland'. The hinterland is hypothesized to have developed into a high-elevation orogenic plateau (or 'Nevadaplano') at some point between the Late Jurassic and the Paleogene. Recent paleoaltimetry utilizing clumped isotope temperature estimates suggests that at least some basins on the Nevadaplano were at an elevation of 2.2-3.1 km by the latest Cretaceous. However, it remains uncertain precisely when the Nevadaplano attained these high elevations and if surface uplift developed steadily along with protracted shortening in the Sevier fold-thrust belt or occurred rapidly and was decoupled from the shortening record. In order to extend the surface elevation history of the Nevadaplano further back in time, we have investigated the type-exposure of the mid-Cretaceous (~113-98 Ma) Newark Canyon Formation (Knc) in central Nevada. The Knc records synorogenic sedimentation in the Sevier hinterland during the early to middle stages of shortening in the Sevier thrust belt.

We will present terrestrial surface temperature estimates from clumped isotope analyses derived from palustrine, lacustrine, and pedogenic carbonate-bearing facies. Contextualized by structural evidence and corrected for secular climate change, these data suggest that the studied Knc basin had not developed substantial surface elevation by the mid-Cretaceous. However, there was likely some considerable surface relief in this region associated with active fold-thrust structures in the upper crust. Preliminary temperature estimates range between 22 and 70°C. These temperatures reflect a range of facies-specific differences in primary carbonate formation, as well as, diagenetic overprinting of some samples. Consistently warm temperatures throughout the stratigraphic section suggest that there was no significant cooling due to elevation gain between ~113 and ~98 Ma. We will discuss the implications of these results for the style and timing of deformation and surface uplift within the Nevadaplano.