Geophysical Research Abstracts
Vol. 16, EGU2014-3926, 2014
EGU General Assembly 2014

Meteoric water circulation and rolling-hinge detachment faulting: Example of the Northern Snake Range core complex, Nevada

Aude Gébelin (1), Christian Teyssier (), Matthew T. Heizler (), and Mulch Andreas ()

(1) Biodiversity and Climate Research Centre (BiK-F) and Senckenberg, Frankfurt/Main, Germany (aude.gebelin@senckenberg.de), (2) Earth Sciences, University of Minnesota, Minneapolis, USA (teyssier@umn.edu), (3) Bureau of Geology and Mineral Ressources, Socorro, USA (matt@nmt.edu), (4) Biodiversity and Climate Research Centre (BiK-F) and Senckenberg, Frankfurt/Main, Germany (andreas.mulch@senckenberg.de)

The Northern Snake Range metamorphic core complex developed as a consequence of Oligo-Miocene extension of the Basin and Range Province and is bounded by an arched detachment that separates the cold, brittle upper crust from the ductile middle crust. On the western and eastern limbs of the arch, the detachment footwall displays continuous sections of muscovite-bearing quartzite and schist from which we report new microfabrics, δD values, and 40Ar/39Ar ages. Results indicate that the two limbs record distinct stages of the metamorphic and kinematic Cenozoic events, including Eocene collapse of previously overthickned crust in the west, and one main Oligo-Miocene extensional event in the east.

Quartzite from the western part of the range preserves Eocene fabrics ($\sim$49-45 Ma) that developed during coaxial deformation in the presence of metamorphic fluids. In contrast, those from the east reveal a large component of non coaxial strain, Oligo-Miocene ages (27-21 Ma) and contain recrystallized muscovite grains indicating that meteoric fluids sourced at high elevation (low-δD) infiltrated the brittle-ductile transition zone during deformation. Percolation of meteoric fluids down to the mylonitic detachment footwall was made possible by the development of an east-dipping rolling-hinge detachment system that controlled the timing and location of active faulting in the brittle upper crust and therefore the pathway of fluids from the surface to the brittle-ductile transition. Oligo-Miocene upper crustal extension was accommodated by a fan-shaped fault pattern that generated shear and tension fractures and channelized surface fluids, while top-to-the-east ductile shearing and advection of hot material in the lower plate allowed the system to be progressively exhumed. As extension proceeded, brittle normal faults active in the wedge of the hanging wall gradually rotated and translated above the detachment fault where, became inactive and precluded the circulation of fluids from the surface to the lower plate. The Eocene section observed on the western limb represents an example of such a tilted block that was rotated and exhumed in the first stages of the rolling-hinge detachment activity.