

How it's made: Subsurface structure of the Quarry Mountain foothills from seismic reflection imaging, Steamboat Springs, Colorado

Julia Berglind¹, Peyton Chandler¹, Renee Fischer¹, and Kadidia Mariko¹

¹Colorado School of Mines, Department of Geophysics.

Seismic imaging is a crucial tool for investigating the structural setting of basement formations and fault systems, offering insight into the Precambrian shear zone of Steamboat Springs, Colorado [1]. Geothermal activity in the region is indicative of weak, narrow shear zones with fractures [2]. Understanding the subsurface structure of these features is essential for reconstructing regional geologic history. In this study, we conducted seismic imaging surveys across Routt County Roads 42, 44, 33A, 43, and 45 to characterize subsurface structures and their relationship to known Precambrian shear zones.

Our imaging reveals westward-dipping layering, which we interpret as the Precambrian basement based on velocity models and how it aligns with surface exposure at the outcrop of Rabbit Ears Pass in Steamboat Springs, Colorado. Here we show that the identified fault at Routt County Road 43 corresponds to variations in dip across reflectors, suggesting deformation within the shear zone. Additionally, seismic reflections along County Road 45 confirm the presence of a major known fault, along with a secondary minor fault structure, further supporting evidence of regional faulting. The dipping basement layer demonstrates characteristics consistent with elastic deformation, likely due to thermal influences that preserved its igneous

composition and avoided metamorphic transformation.

These findings contribute to existing knowledge of the Precambrian shear zone in the Steamboat Springs, Colorado region, reinforcing surface observations of geologic history. By integrating seismic reflection data with known geologic structures, this study enhances our understanding of shear zone mechanics and their role in shaping the regional basement framework.

References:

- [1] K. R. Christopherson, "A Geophysical Study of the Steamboat Springs, Colorado Geothermal Systems," M.S. thesis, department of Geological Sciences, University of Colorado, Boulder, Colorado, 1979.
- [2] R. Zehner, "Analysis of Top 5 Colorado Targets," Flint Geothermal, LLC, Geothermal Data Repository, Mar. 16, 2012. [Online]. Available: <https://gdr.openei.org/files/338/ColoradoTargets2012March.pdf>