Grand Junction Geological Society

http://www.gjgs.org/

This Month's Presentation

Russell Davies
Structural Geology Consultant
Redlands Fault Geological Consulting LLC

will speak on

Fault Zone Architecture as a Dependence on Vertical Mechanical Heterogeneity

The speaker will present in person although we will also have Zoom available.

Guests Are Always Welcome

Abstract and Speaker's Bio Are on The Next Page

Meeting Time and Location

September 17, 2025

Joint meeting with the CMU Geology Students

6:30 p.m.

Saccomanno Lecture Hall (Room 141) in the Wubben Science Building at Colorado Mesa University

Zoom Details

Andres Aslan is inviting you to a scheduled Zoom meeting.

Topic: Sept GJGS meeting

Time: Sep 17, 2025 06:00 PM Mountain Time (US and Canada)

Join Zoom Meeting

https://coloradomesa.zoom.us/j/98057736852

Meeting ID: 980 5773 6852

Join instructions

https://coloradomesa.zoom.us/meetings/98057736852/invitations?signature=03MaYgM4E2QWz-nSfKIRaPcJPLCju__e6Z9cPpyPD30

Important Announcements

The Chenoweth Memorial Field Trip is scheduled for September 13.

Abstract

Fault Zone Architecture as a Dependence on Vertical Mechanical Heterogeneity

Russell Davies
Structural Geology Consultant
Redlands Fault Geological Consulting LLC

Faults are frequently described as single surfaces of offset or slip surfaces in a cataclastic gouge surrounded by a zone of damage of small offset faults or open mode joints. The damage zone is often modelled as a process zone at the tip of a propagating fault or associated with local areas of stress concentrated at bends in the fault. Our observations of mapped faults in rock volumes exposed in outcrop cutting a range of facies and sedimentary stacking sequences, however, demonstrate that the style and width of the damage zone is a function of the mechanical differences between the layers that we refer to as the vertical mechanical heterogeneity (VMH). Faults cutting layers with a higher VMH have a wider and more complex fault zone. This is true of both normal and reverse faults.

In our analysis of the development of these fault zones, we describe the deformation across a band or zone of shear. The idea is that faulting is a hereditary process with deformational steps that are irreversible and together contribute to a process that may ultimately fail with the development of a discontinuity in the rock volume. The width of the fault zone is defined by the limits of the deformed rock section sheared into the zone. In more brittle beds the shearing occurs by small offset across discrete faults; ductile lithologies such as normally consolidated mudstones smear into the zone.

The styles of deformation across the fault zone are controlled by the mechanical contrast between the layers but not necessarily the vertical stratigraphic heterogeneity. A stratigraphic section with high vertical mechanical heterogeneity, for example, will naturally have a high stratigraphic heterogeneity, however a low mechanical heterogeneity may also occur in beds with a high stratigraphic heterogeneity where the mechanical contrasts between the different lithologies is low. The VMH may, therefore, change in the same stratigraphic section for different subsurface conditions such as compaction, chemical diagenesis and fluid pressures.

Examples are shown of faults in outcrop included well-exposed areas along the Moab Fault.

Bio

Russell Davies has over 35 years' experience working in the oil and gas industry in exploration and development, and technology consulting services including research and development. He is a leading global expert in fault seal analysis where the concepts are applied to oil and gas but also in Carbon Capture and Containment. After a career with Shell and ARCO, Russell founded and managed the US subsidiary of Rock Deformation Research (RDR). Following RDRs acquisition by Schlumberger in 2014 Russell remained with SLB and was appointed global structural geology advisor where he worked on many oil and gas projects worldwide. Russell now works with clients on high-level structural geological challenges in trap and seal analysis, natural fracture characterization and structural modeling and offers training courses on these topics through his consultant company Redlands Fault Geological Consulting, LLC (redlandsfault.com).

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