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U.S. Nuclear Regulatory Commission
ATTN: Mrs. Deborah A. DeMarco
Office of Nuclear Material Safety and Safeguards
Mail Stop 8 A23
Washington, DC 20555-0001

Subject: Programmatic Review of Abstract

Dear Mrs. DeMarco:

The attached abstract is being submitted for programmatic review. This abstract will be submitted for presentation at the American Geophysical Union 2002 Fall Meeting to be held December 6–10, 2002, in San Francisco, California. The title of the abstract is:

> "Fault Zone Characteristics and Deformation Mechanisms of the Bishop Tuff, Bishop, CA: Investigations of Critical Deformation Elements and Permeability within a Porous, Non-welded Tuff Sequence" by K. Bradbury, D. Ferrill, C. Dinwiddie, and R. Fedors

Please advise me of the results of your programmatic review. Your cooperation in this matter is appreciated.

Sincerely,

Budhi Sagar
Technical Director

rae

Attachments

cc: J. Linehan, W. Reamer, J. Schlueter, B. Leslie, D. Riffle, B. Meehan, J. Greeves, S. Wastler, K. Stablein, L. Campbell, T. Essig, P. Justus, J. Trapp, W. Patrick, CNWRA Dirs (ltr only), CNWRA EMs (ltr only), E. Pearcy, L. McKague, D. Ferrill, C. Dinwiddie, R. Fedors, K. Bradbury, T. Nagy (SwRI Contracts)

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Fault Zone Characteristics and Deformation Mechanisms of the Bishop Tuff, Bishop, CA: Investigations of Critical Deformation Elements and Permeability within a Porous, Non-welded Tuff Sequence

AGU Fall Meeting 2002, Tectonophysics Session T04: Fluids and Faulting: Cause and Effect

Kelly K. Bradbury (Utah State University, e-mail: kellykb@cc.usu.edu), David A. Ferrill, Cynthia L. Dinwiddie, and Randall W. Fedors [Center for Nuclear Waste Regulatory Analyses (CNWRA)].

Characterization of fault zone deformation elements and mechanisms are significant for understanding faults and fluid flow. Grain comminution within fault cores may contribute to porosity reduction and barrier formation that will disrupt lateral flow within the surrounding host rock; meanwhile, increased fracture intensity in the fault damage zone may locally increase permeability and enhance vertical flow.

We examine fault zone deformation features associated with two well-exposed moderate-offset {~8 m [26 ft]} normal faults within non- to poorly-welded lithologies of the rhyolitic Quaternary Bishop Tuff, Bishop, CA. Detailed fracture mapping was conducted along two transects oriented perpendicular to the main fault traces. The first transect intersects a northwest dipping fault that offsets a massive poorly welded ignimbrite sequence. The fault is characterized by a discrete polished surface with a 1-3 mm [$4\text{-}11 \times 10^{-2}$ in] thick fault core; it becomes curvilinear vertically upwards, forming a 1-m [3-ft] thick fault core with distributed slip surfaces at the upper extent, which produce an overall fan-shaped fault geometry. The hanging-wall damage zone is approximately 5 m [16 ft] thick and contains abundant, open, iron oxide-stained fractures with fracture intensities of 20-40/m [6-12/ft]. The footwall damage zone appears to be 0.05-1 m [0.2-3 ft] thick with fracture intensities ≤20/m [≤6/ft]. Microstructural and grain size analyses of the fault gouge reveal deformation mechanisms such as extensional fractures, grain comminution, and mineralization within the fault core.

The second fault is northeast dipping and offsets non-welded, finely laminated basal surge deposits. Structural data were collected along a 10.5-m [34-ft] transect extending perpendicular into the footwall. This fault is characterized by a discrete fracture surface; core thickness is 1.5-30 cm [0.6-12 in] and is composed of fine-grained gouge and/or adjacent beds offset by numerous cm-scale faults. Numerous small-displacement antithetic, synthetic and *en echelon* faults accommodate displacement in the ~6-m [~20-ft] thick footwall damage zone. Fracture networks are typically open, 1-5 mm [$4\text{-}20 \times 10^{-2}$ in] thick, and vertical to steeply dipping. Preliminary results suggest minimum fracture intensities of ~36/m [~11/ft] within the footwall damage zone and much greater within and adjacent to the fault surface. Mineralization surfaces up to several mm thick composed of calcite and/or silica are observed along the main fault and smaller faults within the damage zone. XRD analyses of host and fault rock reveal the primary constituents of the volcanic host rock include quartz, feldspar and glass. Calcite mineralization {≤1 cm [≤0.4 in] thick} occurs in veining within and parallel to the central portion of the fault core, whereas quartz is the primary mineral within the gouge core. Shear smear or normal fault drag deformation processes contribute to the well-developed gouge as some beds are dragged 1 m [3 ft] into the fault core.

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2. AUTHOR(s)

K. Bradbury, D. Ferrill, C. Dinwiddie, R. Fedors

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