QUATERNARY FAULTING CONCERNS AT YUCCA MOUNTAIN

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PRESENTATION TO
THE NUCLEAR WASTE TECHNICAL REVIEW BOARD
MAJOR CONCERNS

- Existence of Quaternary (potentially active) faults
- Paleoseismic history
- Regional analogues
- Coupled processes
- Interpretation of future events
EXISTENCE OF QUATERNARY
(POTENTIALLY ACTIVE) FAULTS

• Multiple potentially active faults

Surface displacements indicate moderate- to large magnitude events recurring on the same fault traces

• Faults may be difficult to detect

Lack of definition; small vertical offsets

• Unmapped faults have been identified

Low-sun-angle aerial photography highlights subtle features

• Other unrecognized faults likely

Additional aerial photography and ground investigation required
CURRENT DOE FAULT REPRESENTATION (Swadley and others, 1984)
QUATERNARY FAULTS AT YUCCA MOUNTAIN

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PALEOSEISMIC HISTORY

- Complex, distributive faulting
  Map and field evidence suggests faults are interconnected

- Recency of faulting
  Geologic evidence suggests recent activity

- Ages of faulted and faulted deposits
  Timing of Quaternary events is poorly constrained

- Magnitudes of paleoevents
  Magnitudes may be 7 or greater

- Strike-slip displacement
  Geologic and seismologic evidence suggests strike-slip component

- Synthesis of data
  Reasonable conservatism should be used to define paleoseismic history
FAULTS WITH YOUNG SCARPS

BLACK CONE
RED CONE
LITTLE CONES
LATHROP WELLS CONE

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FAULTED AND UNFAULTED DEPOSITS
FOCAL MECHANISMS IN THE NTS REGION (Rogers and others, 1987)
REGIONAL ANALOGUES

- 1932 Cedar Mountain earthquake should be used as a principal analogue
  - Walker Lane tectonic setting
  - Predominantly strike-slip event
  - Distributive fault pattern with small vertical displacements
1932 Cedah Mtn. Earthquake Ruptures

- 1932 ruptures, hachures on downthrown side
- Quaternary fault, ball on downthrown side
- Approximate 1932 epicenter

GABBS VALLEY

PARADISE RANGE

STEWARD VALLEY

CEDAR Mtns

MONTE CRISTO VALLEY

PILOT MOUNTAINS

WALKER LANE BELT

CM

YM

Mina
COUPLED PROCESSES

- Volcano-tectonic events
  Volcanic ash found in four faults
  Suggestive of simultaneous volcanic and faulting events

- Hydrologic effects
  Water level fluctuations
  Extensive fracturing associated with faulting
TRENCHES EXPOSING BASALTIC ASH IN FAULTS

Proposed Repository

CF1

CF2/3

WINDY WASH FAULT

HOT WASH FAULT

SOLITARIO CANYON FAULT

14

140 km

BOW RIDGE FAULT

PAINTBRUSH CANYON FAULT

BUSTED BUTTE

0 1 2 3 km

A. R. Ramelli
HYDROGRAPHS OF SELECTED WELLS IN FAIRVIEW VALLEY AFFECTED BY THE 1954 DIXIE VALLEY-FAIRVIEW PEAK EARTHQUAKES (Raney, 1988, for the N.R.C.)

<table>
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<th>Well 16</th>
<th>1955</th>
<th>1956</th>
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<td>D/W 9-6-50, 221.07&quot;</td>
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<td>D/W 12-11-61, 57.72&quot;</td>
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<th>1956</th>
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<td>D/W 12-11-61, 24.27&quot;</td>
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<th>Well 19</th>
<th>1955</th>
<th>1956</th>
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<td>D/W 1-60.27&quot; (Reported by driller)</td>
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Redrawn from Zones, 1957
QUATERNARY FAULTS AND FRACTURES IN ALLUVIUM IN THE VICINITY OF TRENCH CF-1
SUMMARY OF QUATERNARY FAULTING CONCERNS

• Distribution of Quaternary faults

• Style, age and magnitude of faulting
  • Regional analogues
  • Coupled processes

• Interpretation of future events
PERSONAL

Born January 24, 1946, Berwyn, Illinois

Business address: Nevada Bureau of Mines and Geology
                 University of Nevada-Reno
                 Reno, NV 89557-0088

Business telephone: (702) 784-6691
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EDUCATION

B.A. Geology, Augustana College, 1968
M.S. Geology, Arizona State University, 1974

REGISTRATION

Registered Geologist, State of California

AREAS OF EXPERTISE

Quaternary geology; alluvial and soil stratigraphy
Neotectonics
Earthquake hazards
Engineering and urban geology

PROFESSIONAL WORK EXPERIENCE

A. Research Faculty, Nevada Bureau of Mines and Geology
   Mackay School of Mines, University of Nevada-Reno
   (1976-present)

   Assistant Engineering Geologist (1976-1979)
   Associate Engineering Geologist (1979-1988)
   Engineering Geologist (1988-present)
   Tenured 1981

   Responsible for basic and applied research in Quaternary and surficial
ground geology as related to engineering geology; specialized in neotectonics.

Conducted Quaternary and engineering geology studies for nuclear power plant sites in Arizona and California.


Conducted environmental geology research in the Fairbanks area, Alaska.


Conducted Quaternary geology study for proposed nuclear power/desalinization plant.


Surveyor; included service in Vietnam.

PROFESSIONAL SOCIETIES

Geological Society of America
Association of Engineering Geologists
International Association of Engineering Geologists
Seismological Society of America

HONOR SOCIETIES

Society of Sigma Xi
Peer-Reviewed Reports Published by Geological Surveys

Bell, J.W., and Bonham, H.F., Jr., 1987, Geologic map, Vista quadrangle: Nevada Bureau of Mines and Geology Map 4Hg.


Trexler, 1980, Earthquake hazards map, South Lake Tahoe quadrangle: Nevada Bureau of Mines and Geology Map 2Ai.

Trexler, D.T., and Bell, J.W., 1980, Earthquake hazards map, Carson City quadrangle: Nevada Bureau of Mines and Geology Map 1Ai.


Pewe, T.L., and Bell, J.W., 1975, Map showing foundation conditions in the Fairbanks D-1 SW quadrangle, Alaska: U.S. Geological Survey Map 671D.


Pewe, T.L., and Bell, J.W., 1975, Map showing ground water conditions in the Fairbanks D-1 SW quadrangle, Alaska: U.S. Geological Survey Map 671B.

Pewe, T.L., and Bell, J.W., 1975, Map showing distribution of permafrost in the Fairbanks D-1 SW quadrangle, Alaska: U.S. Geological Survey Map 671A.

Pewe, T.L., and Bell, J.W., 1975, Map showing foundation conditions in the Fairbanks D-2 SE quadrangle, Alaska: U.S. Geological Survey Map 669D.


Pewe, T.L., and Bell, J.W., 1975, Map showing ground water conditions in the Fairbanks D-2 SE quadrangle, Alaska: U.S. Geological Survey Map 669B.


Pewe, T.L., and Bell, J.W., 1975, Map showing foundation conditions in the Fairbanks D-2 NE quadrangle, Alaska: U.S. Geological Survey Map 670D.


Pewe, T.L., and Bell, J.W., 1975, Map showing ground water conditions in the Fairbanks D-2 NE quadrangle, Alaska: U.S. Geological Survey Map 670B.

Pewe, T.L., and Bell, J.W., 1975, Map showing foundation conditions in the Fairbanks D-2 NW quadrangle, Alaska: U.S. Geological Survey Map 668D.


Pewe, T.L., and Bell, J.W., 1975, Map showing ground water conditions in the Fairbanks D-2 NW quadrangle, Alaska: U.S. Geological Survey Map 668B.


Symposium Proceedings


Other Articles


Abstracts


Bell, J.W., and Lee, G.K., 1976, Description and age of pediment terraces along the lower Colorado River: America Quaternary Association, Abstracts of the fourth biennial meeting, p. 126.


Contract Reports and Unpublished Reports


