



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

NOV 09 1992

MEMORANDUM FOR: Ronald L. Ballard, Chief
Geology and Engineering Branch, HLWM

FROM: Keith I. McConnell, Section Leader
Geology/Geophysics Section
Geology and Engineering Branch, HLWM

SUBJECT: TRIP REPORT FOR MIDWAY VALLEY SITE VISIT - SEPTEMBER
17 & 18, 1992

On September 17 & 18, 1992, Division of High-Level Waste Management staff (John Trapp, Harold Lefevre, Rose Byrne, Charlotte Abrams, and Keith McConnell) attended a Department of Energy (DOE)-hosted site visit to the Yucca Mountain area, specifically the Midway Valley area, to view the progress resulting from on-going activities on Study Plan 8.3.1.17.4.2, "Evaluation of the Location and Recency of Faulting Near Prospective Surface Facilities." A detailed Itinerary for the Site Visit is presented as Enclosure 1. No specific handouts were provided for the site visit.

During the Site Visit, the staff visited trenches across, and outcrops of, the Paintbrush Canyon fault, the Bow Ridge fault, and the Ghost Dance fault. We also visited trenches and soil pits on the east side of Exile Hill in the vicinity of the proposed location for the repository surface facilities. Trenches visited on the east side of Exile Hill included T5, the 1100 foot long trench used by the DOE to demonstrate the presence or absence of faults near the proposed location of the surface facilities.

Following a short administrative briefing at the Field Operations Center, we visited recently cleared exposures on Busted Butte of the Paintbrush Canyon fault. John Whitney of the U.S. Geological Survey (USGS) stated that the latest mapping efforts on this fault indicate that there have been at least 4 episodes of faulting in the last 300,000 yrs. Based on this information, he is projecting a 70-100,000 yr. recurrence interval. A total of 1.8 meters of displacement resulted from the most recent two events and 2.5 meters of displacement occurred during the last three events. Whitney noted the possibility of temporal clustering of fault events along this fault within the past 400,000 yrs. Evidence from trenches (i.e., Trench 17) at a second stop along the Paintbrush Canyon fault to the north suggest that there were possibly 4 faulting events with the youngest event 120,000- 75,000 ya. The average slip per event was estimated to be .4 to .7 meters.

The next stop on the Site Visit was at Trench 14d along the Bow Ridge fault. Trench 14d is an "H-shaped" trench that the USGS investigator is using in an attempt to detect strike-slip movement. Mapping was preliminary, but it appears that the trenches were not constructed such that they will be able to tell if there is a significant strike-slip component. Apparently the trench does not get out of the main deformation zone. The preliminary information available at this time was that there appeared to be 4 events with a total

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displacement of approximately 45 cm.

The Site Visit continued with a stop in an unnamed wash on the east side of Yucca Mountain where the USGS (Rick Spengler) is conducting detailed mapping of the Ghost Dance fault. Spengler made a presentation at the Yucca Mountain Technical Project Officer meeting on September 11, 1992, detailing the results of the mapping effort along the Ghost Dance fault. This presentation is included as Enclosure 2 to this memorandum. Spengler's presentation outlines all pertinent information that was presented at the stop. His interpretation that the fault zone is approximately 700 feet wide may or may not be accurate. Exposures of the fault strands are intermittent and there may be multiple origins for the breccias interpreted to be indicative of faulting.

On September 18, the trip continued with a stop on the east side of Exile Hill at trenches and soil test pits near the location of prospective surface facilities. Exposures in T5 and a smaller trench to the south revealed a breccia zone in bedrock continuing upward into a fracture in the overlying Quaternary deposits. Geologists working for the DOE were interpreting the feature as a fracture resulting from settling along an erosional bench suggesting that the fracture was not tectonic in origin. However, most participants who voiced an opinion believed that the location of this fracture above a breccia zone in bedrock was suggestive of a tectonic feature. Other fractures in Quaternary deposits have been identified in Trench T5 further to the east, however, these fractures do not appear to have demonstrable vertical offset. The age for the development of these fractures is dependent on age interpretations for the various Quaternary deposits exposed in the trench. Some of the age assignments made for the deposits by geologists working for DOE appear to be subjective and may require further verification.

Also noted near this stop was the presence of a northwest-trending fault exposed in bedrock on the east side of Exile Hill. This fault zone is approximately 20 meters wide and has been estimated to have approximately 20 meters of vertical displacement. This feature has no apparent expression in Trench T5.

At the end of this stop, USGS investigators made an informal presentation on the geophysical tests in Midway Valley, making particular reference to the possible presence of the Midway Valley fault. Generally, existing geophysical data is not conclusive about whether or not a significant structural feature is present beneath Midway Valley as has been proposed by other USGS geologists. Prototype tests of other geophysical activities are being considered to assess their use, in association with the mapping in Midway Valley, in efforts to determine if a major structural feature(s) is present in Midway Valley.

The final part of the Site Visit occurred at the Field Operations Center, where a presentation was made regarding the June 29th earthquake in the vicinity of Little Skull Mountain. No new information was presented.

If you have any questions regarding this review, please contact me at 504-2532.

Keith I. McConnell, Section Leader
Geology/Geophysics Section
Geology and Engineering Branch, HLWM

Enclosures: As stated

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OFC	HLGE <i>[Signature]</i>				
NAME	KMcConnell:jlg				
DATE	11/09/92				

**ITINERARY
YUCCA MOUNTAIN TOUR
SEPTEMBER 17 AND 18, 1992
for
THE NUCLEAR REGULATORY COMMISSION**

**Thursday
September 17, 1992**

6:15am Depart the Valley Bank Center, 101 Convention Center Drive.
Guests meet in valet circle

6:15 - 8:00 Travel to Lathrop Wells / Gate 510 for badging

8:00 - 8:30 Badging

8:30 - 9:00 Travel to Field Operations Center / break

9:00 - 10:00 Opening Remarks - DOE, NRC, State of Nevada, and Counties
Discussion of Midway Valley Activities including progress of
Study Plan 8.3.1.17.4.2 and preliminary results and
near-term plans for future work

10:00 - 10:45 Travel to first field stop

10:45 - 5:30 Discussion at sites on stratigraphy, structure, and trench
logs. Field stops to include:
Busted Butte Pavements - Paint Brush Canyon Fault
Boulder Selection Sites - Erosion studies at the top of
Yucca Mountain / lunch
Trench 17 - Splay of Paint Brush Canyon Fault
Trench 14C - Bow Ridge Fault
Trench 14D - Bow Ridge Fault
Ghost Dance Fault at USW H4 Wash - Discussion of new
detailed mapping

5:30 - 6:00 Travel to Field Operations Center

6:00 - 6:15 Break

6:15 - 6:30 Travel to Gate 510

6:30 - 7:00 Travel to Beatty. Check in at Exchange Club Hotel

Friday
September 18, 1992

7:00am Depart Exchange Club in Beatty

7:00 - 7:30 Travel to Gate 510 for badge check.

7:30 - 7:45 Travel to the Field Operations Center

7:45 - 8:00 Break

8:00 - 8:30 Travel to field

8:30 - 12:00pm Field stops to include:
Exile Hill / Trench 5 & 6 - Prospective Surface Facilities
Soil Test Pits 2 - 10, Surface of Different Ages.
Presentation of Stratigraphy, Structure, and Trench Log
Review

12:00 - 12:30 Travel to Field Operations Center

12:30 - 1:00 Lunch

1:00 - 1:30 Little Skull Mountain Earthquake update

1:30 - 1:45 Closing remarks - DOE, NRC, State of Nevada, Counties

1:45 - 1:55 Travel to Gate 510 for badge collection

1:55 - 3:30pm Travel to Valley Bank Center in Las Vegas

RECENTLY ACQUIRED STRUCTURAL
INFORMATION ALONG THE GHOST
DANCE FAULT

ROCK CHARACTERISTICS SECTION
YUCCA MOUNTAIN PROJECT
U.S. GEOLOGICAL SURVEY

SEPTEMBER 11, 1992

ROCK CHARACTERISTICS SECTION

*THE COLLECTION, ANALYSIS, AND INTERPRETATION OF
GEOLOGIC, GEOPHYSICAL, AND GEOCHEMICAL DATA TO
SUPPORT EMERGING SITE MODELS*

- **Site Geologic Model**
 - **Site Structural, Tectonic, and Seismicity Models**
 - **Site-scale Unsaturated Zone Model**
 - **Transport Pathways within the Saturated Zone**
 - **Steeper Hydraulic Gradient in northern YM**
 - **Geochemical Model**
 - **Resource Assessment**
 - **Design and Performance Assessment of the Potential Repository Area**

**Mapping
Stratigraphic studies**

**Drilling
Geophysics**

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graph TD; A["Mapping  
Stratigraphic studies"] --> B["3-D GEOLOGIC MODEL"]; C["Drilling  
Geophysics"] --> B; B --> D["Underground geologic mapping"]
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3-D GEOLOGIC MODEL

Underground geologic mapping

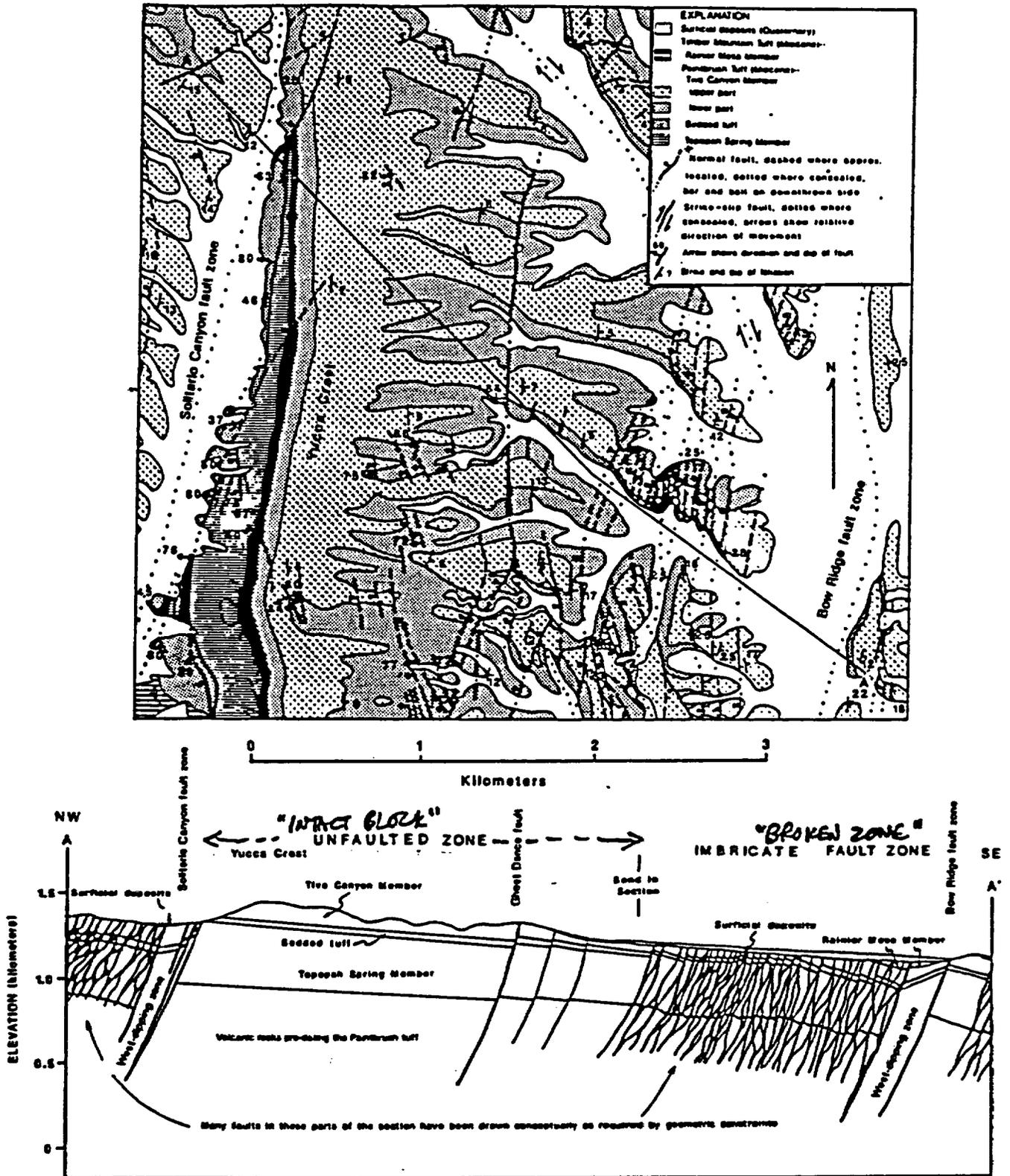


Figure 5. Geologic map and cross section of an area typical of the northern part of Yucca Mountain (Fig. 3). Geology from Scott and Bonk (1984). Line A-A' locates cross section. Note that only a few of the faults in the imbricate fault zone shown in the cross section can be correlated with mapped faults. The faults shown are a conceptualized projection from fragmental evidence seen in small exposures.

GHOST DANCE FAULT STUDY

OBJECTIVES:

- ◆ Combine techniques of surface fracture mapping and detailed geologic mapping to better characterize the Ghost Dance Fault.

- ◆ Utilize structural data primarily in the design of the unsaturated zone hydrologic model.

- ◆ Initiate and complete a discrete segment of work within the time frame of one fiscal year.

- ◆ Establish a grid system so that data that can be easily relocated, verified, and, augmented.

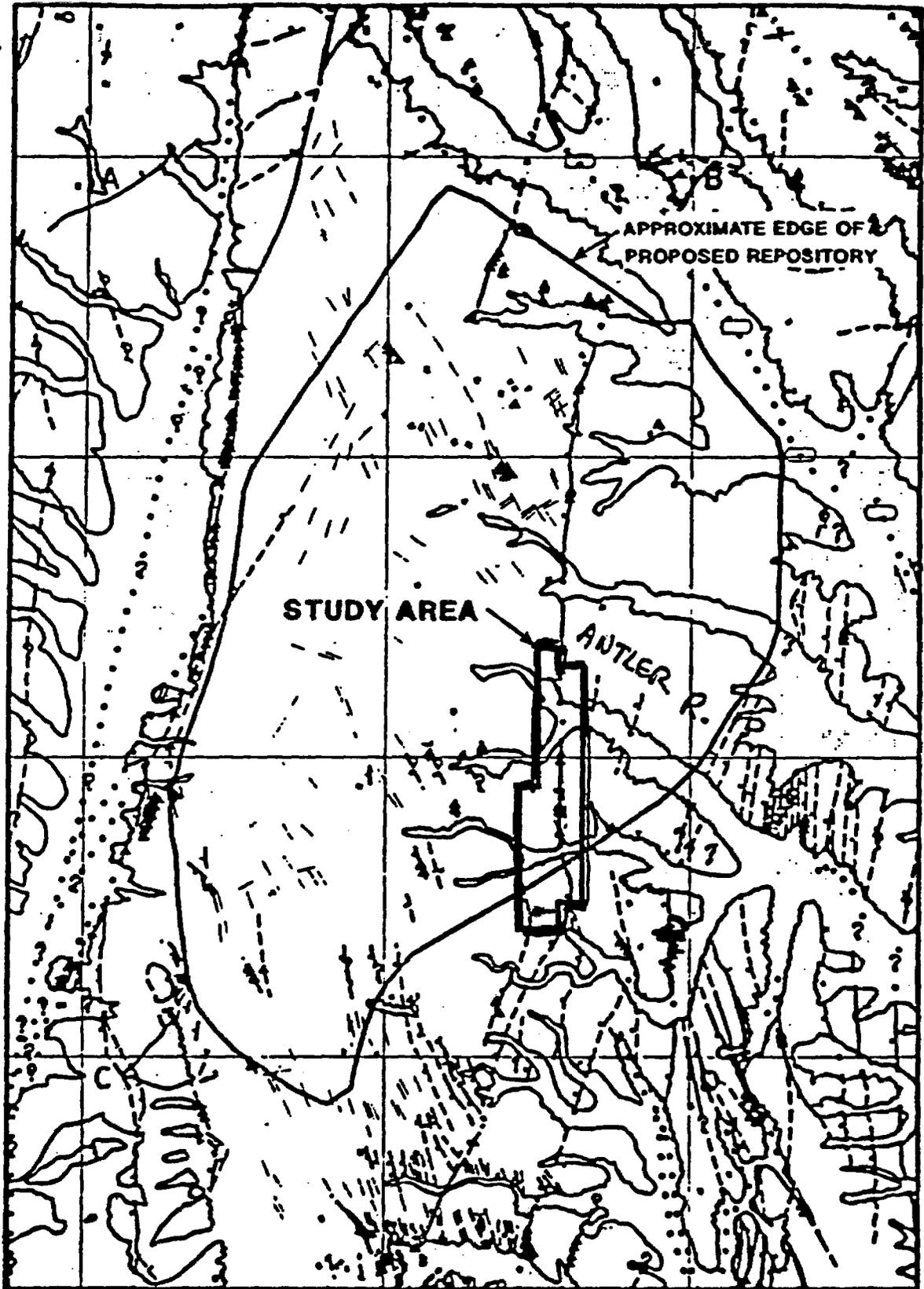


FIGURE 1. LOCATION OF STUDY AREA

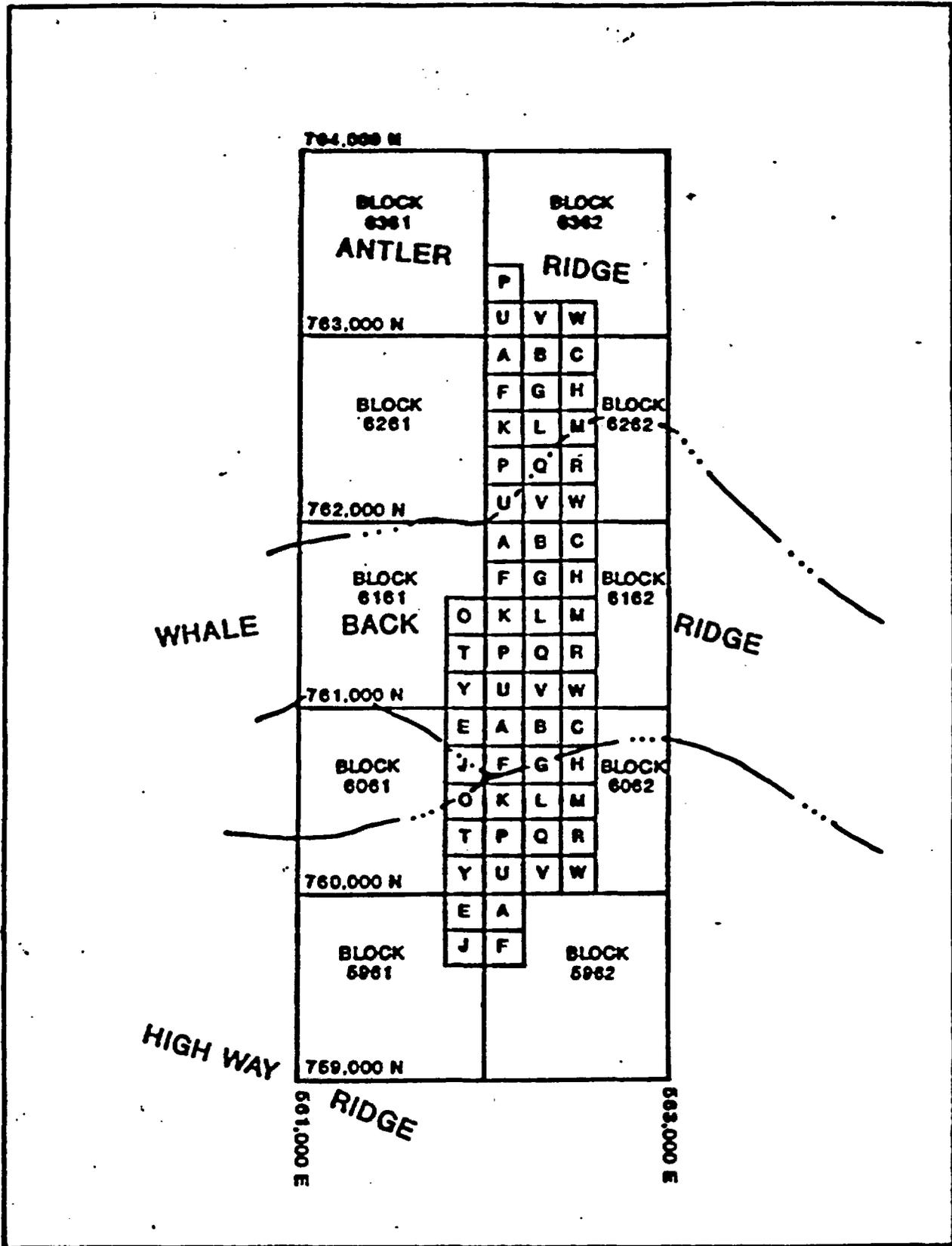
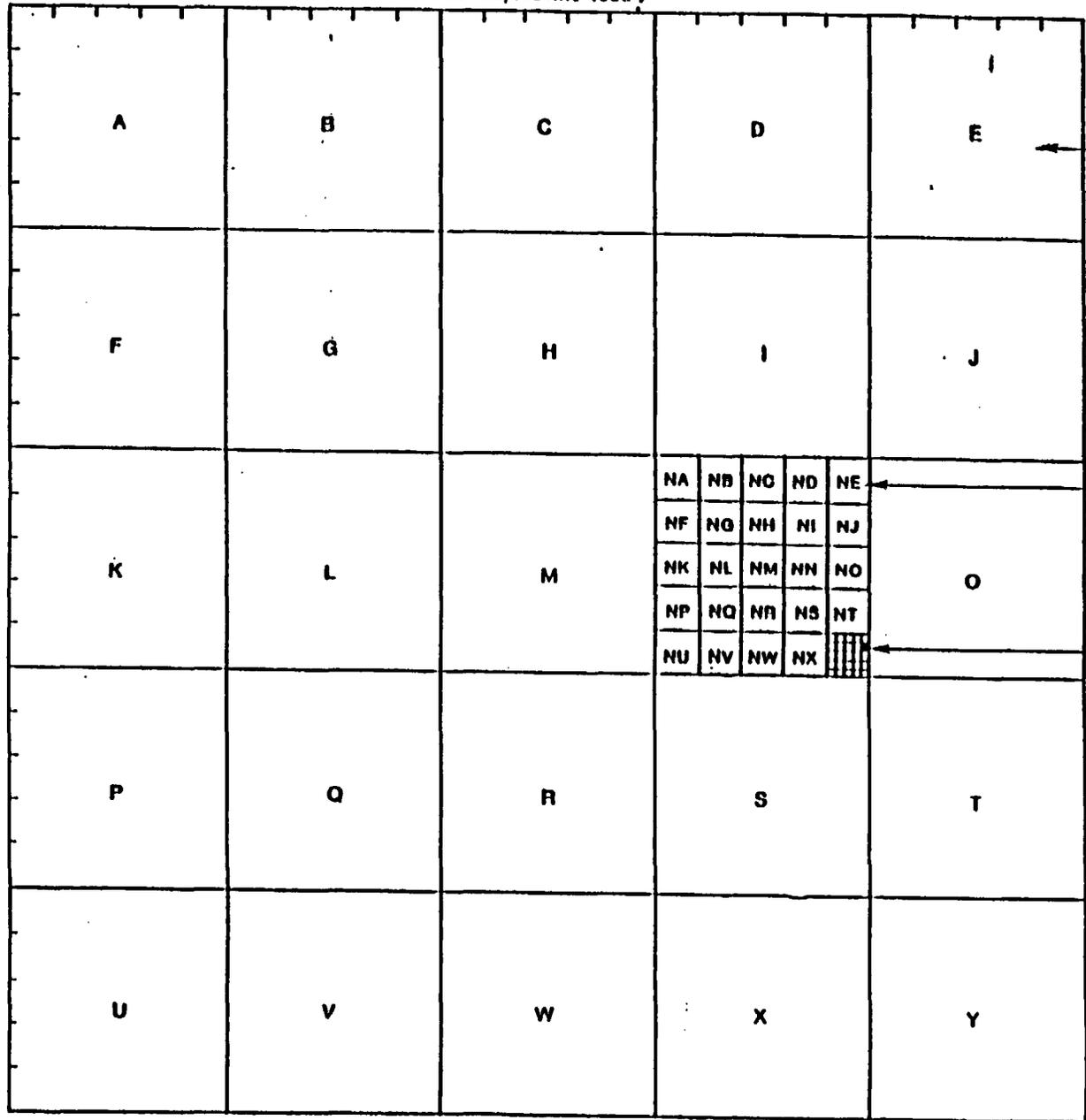


FIGURE 3. LOCATION OF GHOST DANCE FAULT GRID AND STUDY AREA.

Uses Nevada State Coordinate System

Block 5962 (1000' x 1000') Scale 1:1200 (i.e. 10" Represents 1000')



← This 200' x 200' Area Map is Designated 5962E
Scale 1:240

← This 40' x 40' Sub-Area Map is Designated: 5962NE
Scale 1:48

← This 8' x 8' Detail Map is Designated 5962NYJ
Scale 1:9.6

Note:
Since the letter Z is not normally used it will designate a non-standard map.
(e.g. 5962NYZ might indicate the location of a smaller mapping grid within the 5962NY Sub-Area)

Figure 2. Subdivision of Blocks
(reduced from 11"x17" to illustrate general system, but scale is distorted at this size)

**FAULT STUDIES LOCATION MAP
YUCCA MOUNTAIN PROJECT**

MAP AREA 8082C

200' x 200'

DATE COMPLETED IN FIELD 05/24/68

EXPLANATION

- ALLUVIUM (OUTCROP COVERED)
- COLLUVIUM (OUTCROP COVERED)
- PARTIAL COLLUVIUM WHERE FEATURES MAY BE SEEN THROUGH COVER
- LITHOLOGIC SECTION OF THE CANYON MEMBER OF THE PARIAN SHALE
- CAP ROCK
- UPPER CLIFF
- UPPER LITHOPHYSAZ ZONE
- COLUMNAR, ROUNDED TOP, MIDDLE LITHOPHYSAZ ZONE
- LOWER LITHOPHYSAZ ZONE
- HACKLY UNIT
- COLUMNAR UNIT

CONTACT (DASHED WHERE COVERED)

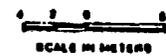
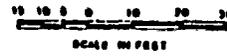
STRIKE AND DIP OF FRACTURE (END BAR SHOWS THAT END OF FRACTURE WAS LOCATED, LENGTH OF FRACTURE REPRESENTS ACTUAL MEASURED LENGTH)

STRIKE AND DIP OF FOLIATION

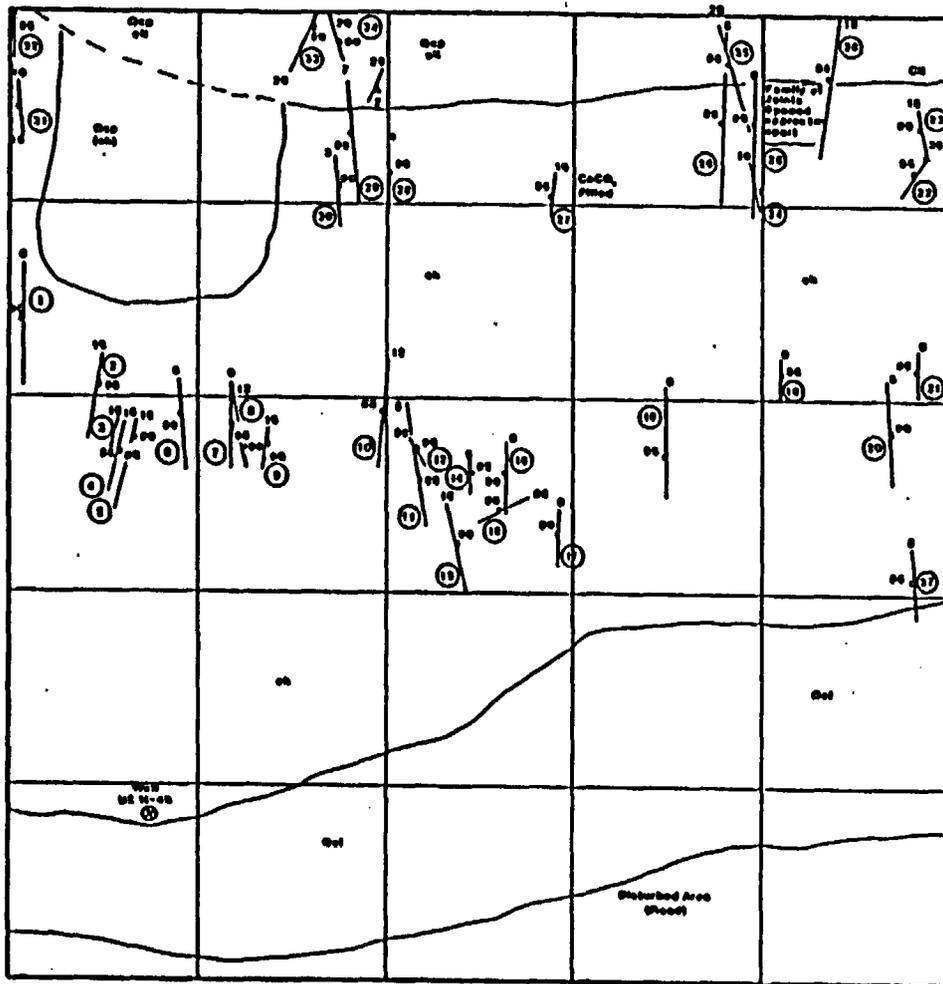
STRIKE, DIP AND RELATIVE MOVEMENT OF A FAULT

1 INCH EQUALS 20 FEET

1 INCH EQUALS 61 METERS



NOTE: SEE BASE MAP (FIGURE 1) FOR LOCATION OF AREA



FRACTURE MAPPING

Map at a scale of 1 inch = 20 feet (1:240).

Map fractures greater than 6 feet in length

Record fracture attributes

*MINIMUM -
Selected due to
time constraint
(one year) -
but can rev.*

FAULT MAPPING

Map at 1 inch = 20 feet (1:240)

Map location, nature, and continuity of breccia zones, offsets of subunits of the Tiva Canyon, abrupt changes in dip of subunits

Compile maps at 1 inch = 50 feet (1:600)

FRACTURES

Mapped 745 Fractures

Tiva Canyon Member

Upper Cliff Unit	82
Upper Lithophysal Unit	237
Clinkstone Unit	254
Lower Lithophysal Unit	53
Hackly Unit	119

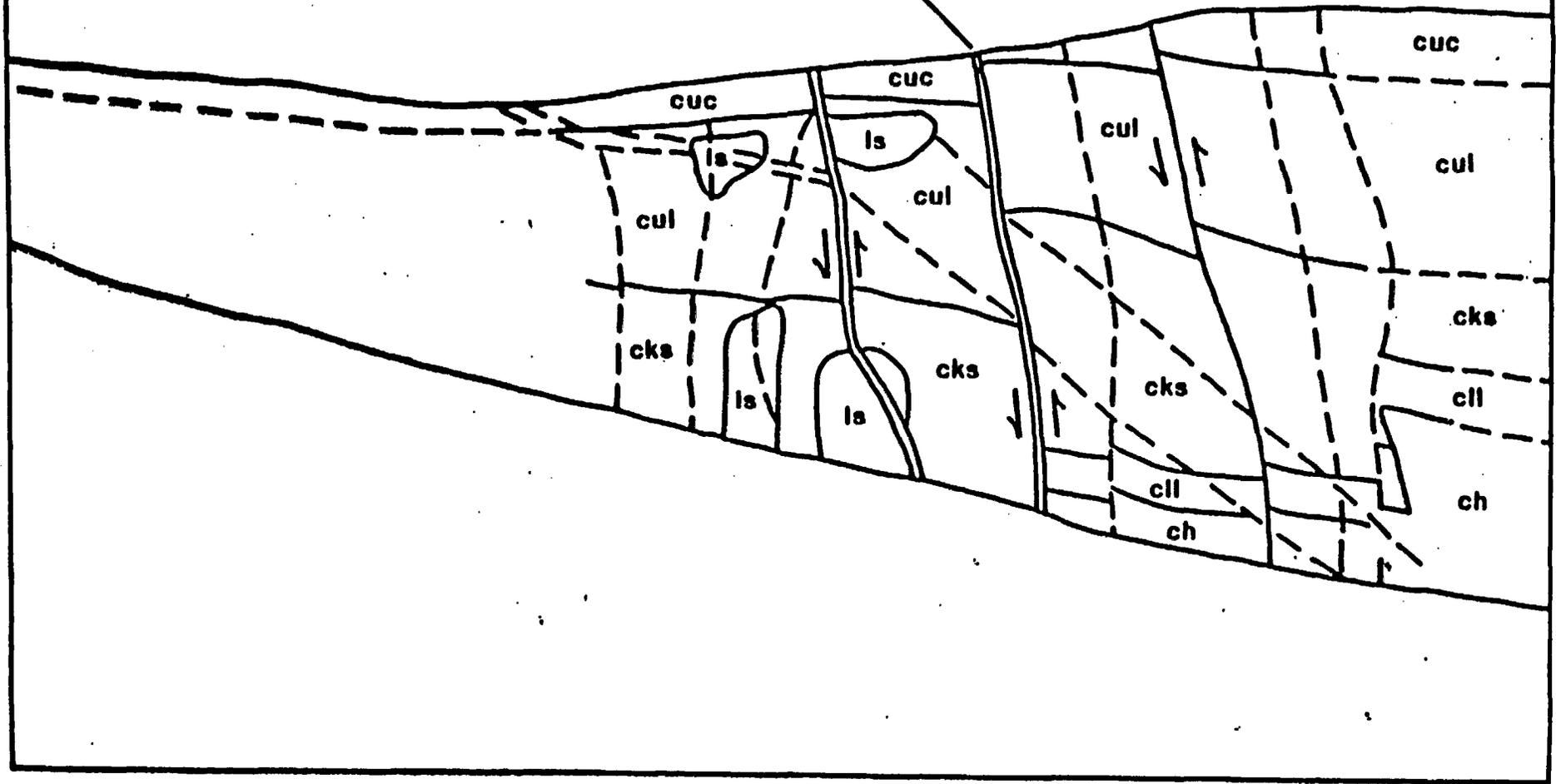
Fracture lengths range from 6 to 85 feet

Southern exposure Antler Ridge
view is North thru Christ Dome (GD)
250' of section

PHOTOGRAPH

w/overlay

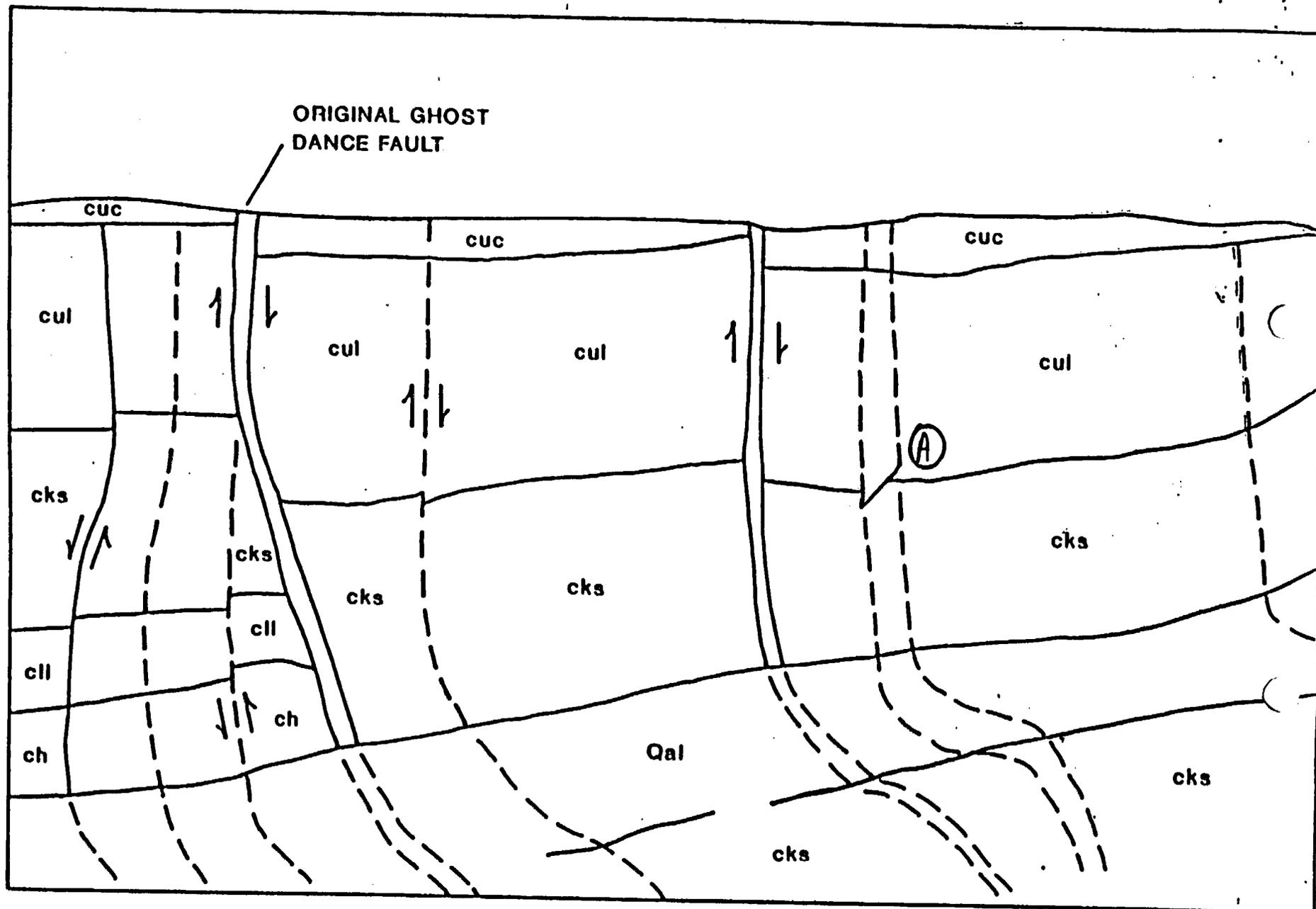
ORIGINAL GHOST
DANCE FAULT



VIEW NORTH OF ANTLER RIDGE
SHOWING GHOST DANCE FAULT ZONE
(OVERLAY)

PHOTOGRAPH

View to South
WTZ pad area
200' of Section



Interpretation By C. Braun

SOUTHERN VIEW OF BROKEN LIMB RIDGE

Breached Zones

Ⓐ ≡ abrupt change in dip

PRELIMINARY FINDINGS

QA on-going at this time.

◆ Mapping indicates a dominance of high-angle north-to-northwesterly trends. Fracture trends appear consistent between subunits of the Tiva Canyon.

ZONE
◆ The Ghost Dance Fault consists of an anastomosing to subparallel network of 3 to 6 north-trending brecciated faults.

ZONES
◆ The zone of brecciated faults commonly occurs over a width of 220 and 400 feet.

◆ Spacing between individual faults commonly ranges between 100 and 150 feet.

◆ Total displacement within the zone of brecciated west-side-down faults ranges between 80 and 160 feet.

◆ Individual brecciated faults show offsets between 5 and 120 feet.

PRELIMINARY FINDINGS

ZONE

- ◆ A zone of breakage also occurs east and west of the zone of brecciated faults. This zone, which contains 1) discontinuous north-trending offsets commonly spaced between 50 and 100 feet apart, 2) long north-trending fracture swarms, 3) and abrupt changes in dip of subunits (suggestive of faulting).
- ◆ If discontinuous faults are included, then the total width of the Ghost Dance Fault Zone may be as wide as 700 feet.

RECOMMENDATIONS

Increase level of effort and funding to extend detailed mapping to the north along the main trace of the Ghost Dance Fault, as well as west and east of the Zone.

Use the technique to map a much broader area within the potential repository area but away from known faults prior to underground construction.

In the short term, consider augmenting the detailed mapping with the construction of "road cuts" along lowermost flanks of east-west ridges.

NOV 09 1992

Dr. Budhi Sagar, Geologic Setting Program Manager
Center for Nuclear Waste Regulatory Analyses
6220 Culebra Road
San Antonio, Texas, 78228-0510

SUBJECT: COMPLETION OF INTERMEDIATE MILESTONE 3702-002-100-008 (COMPLIANCE DETERMINATION STRATEGY FOR RR2012 POTENTIALLY ADVERSE CONDITION-STRUCTURAL DEFORMATION)

Dear Dr. Sagar:

The Nuclear Regulatory Commission staff has completed it's review of the subject document transmitted by cover letter, dated October 30, 1992. I have discussed the review with the NRC lead staff (Dr. John S. Trapp) and found the subject document is an acceptable deliverable. In addition, as required by Section 7.2 of the Center's TOP-001-11 (Revision 0, Change 0), the subject Compliance Determination Strategy is approved by the NRC staff.

If you have any questions, please contact me at (301) 504-2532.

Keith I. McConnell, Geology/Geophysics
NRC-GS Program Element Manager
Division of High-Level Waste Management

cc: M. Knapp, PMDA
S. Mearse, CAB1

DISTRIBUTION: CNWRA Ticket# 92-253

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OFC	HLPD	HLGE <i>for</i>	HLGE <i>for</i>		
NAME	MLee <i>MP</i>	KMcConnell	RBallard		
DATE	11/05/92	11/05/92	11/05/92		

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