

**U.S. DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT**

**NUCLEAR WASTE TECHNICAL REVIEW BOARD
FULL BOARD MEETING**

**SUBJECT: PROGRESS REPORT ON THE
 DETAILED GEOLOGIC MAPPING
 OF THE GHOST DANCE FAULT**

PRESENTER: RICHARD W. SPENGLER

**PRESENTER'S TITLE
AND ORGANIZATION: CHIEF, ROCK CHARACTERISTICS SECTION
 U.S. GEOLOGICAL SURVEY
 DENVER, COLORADO**

**PRESENTER'S
TELEPHONE NUMBER: (303) 236-1266**

**PLAZA SUITE HOTEL • LAS VEGAS, NEVADA
OCTOBER 14 - 16, 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 Yucca Mountain**
 - **Geochemical model**
 - **Resource assessment**
 - **Design and performance assessment of the potential repository area**

**Mapping
Stratigraphic Studies**

**Drilling
Geophysics**

3-D Geologic Model

**Underground
Geologic Mapping**

Summary of Ghost Dance Fault Stop of the NWTRB's Yucca Mountain Site Tour on June 28, 1989

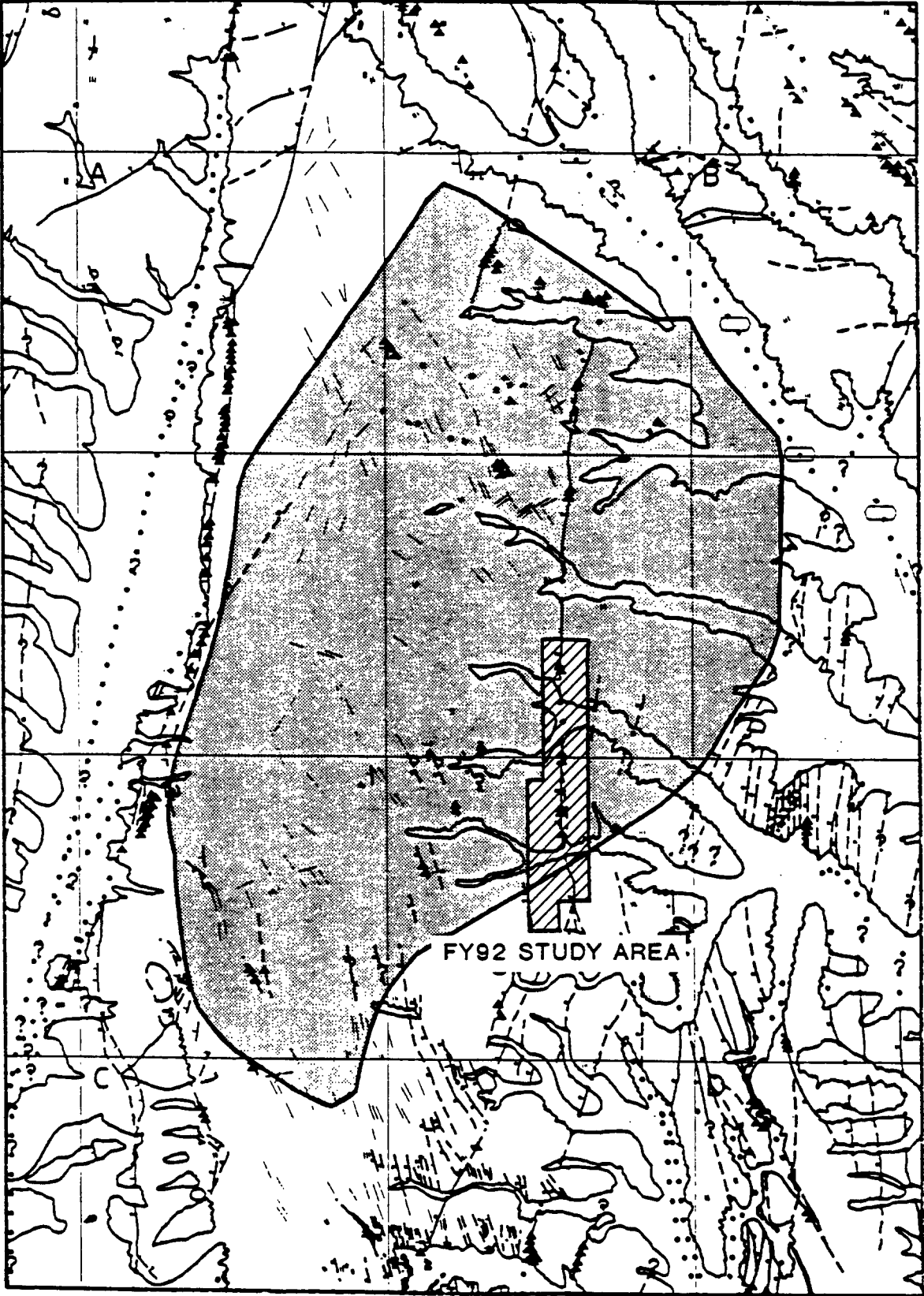
- **High-angle down-to-the-west normal fault**
- **Offsets 12.7-million-year-old Tiva Canyon Member by 100+ ft in south, dies out into fractured strata in north (Scott and Bonk, 1984)**
- **No Quaternary offset found (Swadley, Hoover, and Rosholt, 1984)**
- **Expressed at surface by offset of strata, breccia, slickensides, positive topographic relief on upthrown side**
- **Dips from 79° to 90° at the surface**
- **Character at depth unknown; may be single fracture or fracture zone; may be listric**
- **Other faults and fracture zones occur in the vicinity; major faults unlikely; minor faults and fractures are probably numerous**

Ghost Dance Fault Study

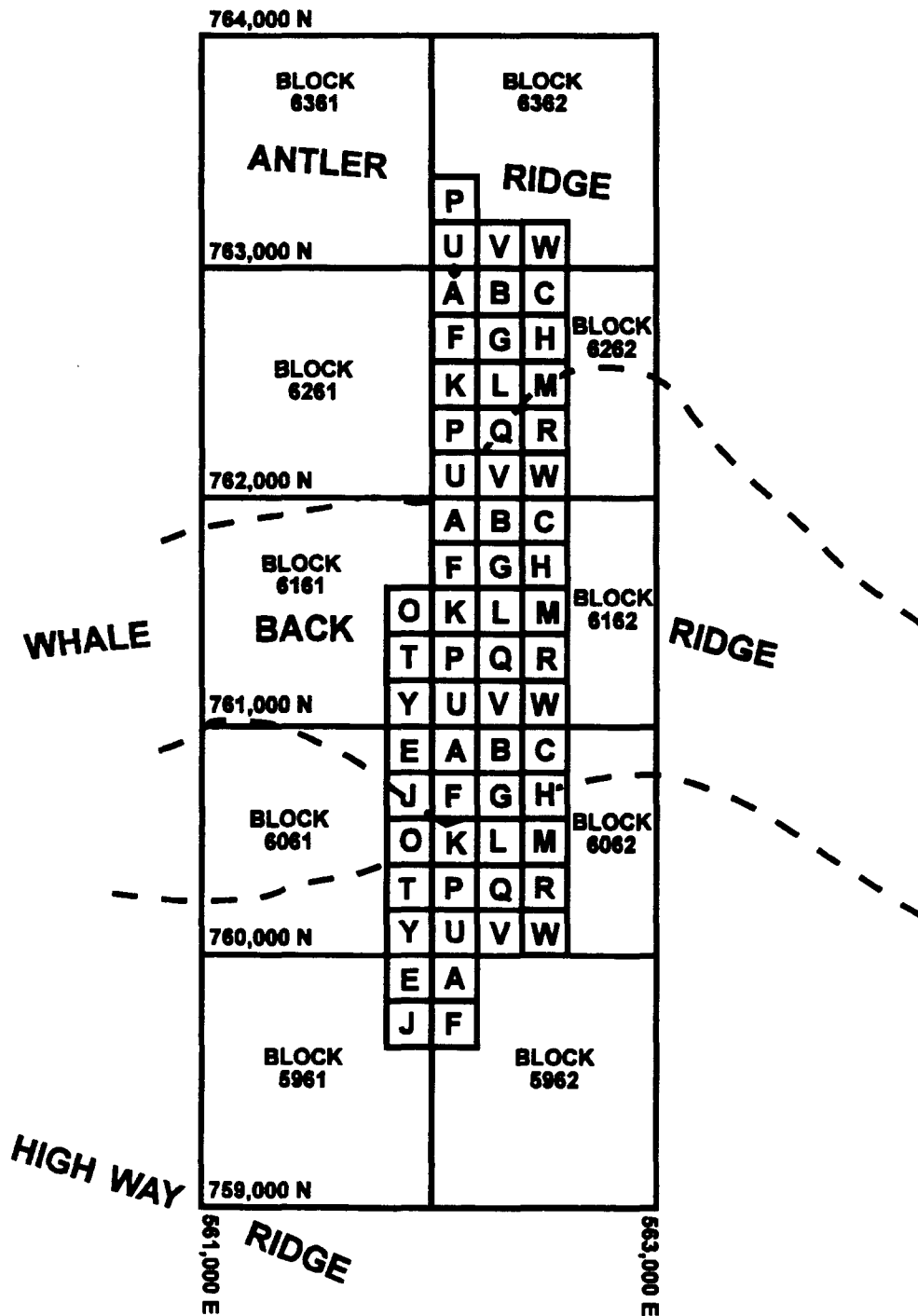
Objectives:

- **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 can be easily relocated, verified, and augmented**

Mapping of Ghost Dance Fault (FY92)



Location of Ghost Dance Fault Grid and Study Area



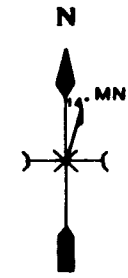
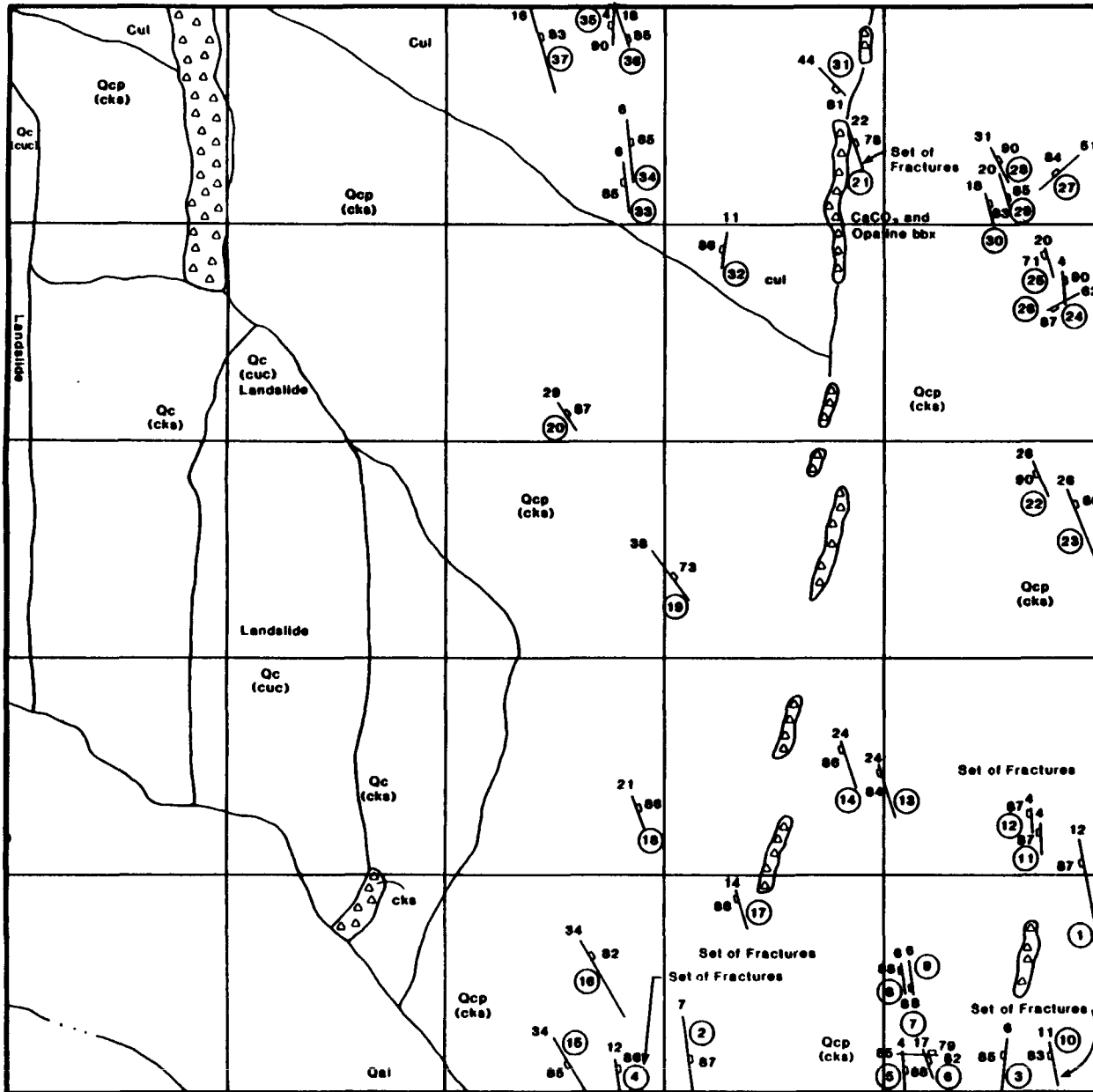
Explanation





- Qal** Alluvium (outcrop covered)
- Qc** Colluvium (outcrop covered)
- Qcp** Partial Colluvium (large features may be seen through cover)

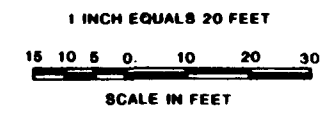
Lithologic section of Tiva Canyon

- ccr** Cap Rock
- cuc** Upper Cliff
- cul** Upper Lithophysal zone
- cks** Clinkstone, Rounded Step, Middle Lithophysal zone
- cli** Lower Lithophysal zone
- ch** Hackly Unit
- cc** Columnar Unit

Map Area: 6262B



-  CONTACT (DASHED WHERE COVERED)
-  STRIKE AND DIP OF FRACTURES (END BAR SIGNIFIES 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



Fracture Mapping

- **Map at a scale of 1 inch = 20 ft (1:240)**
- **Map fractures greater than 6 ft in length**
- **Fracture attributes include location, length, elevation, lithology, attitude, spacing, roughness coefficient, fracture mineralogy**

Fault Mapping

- **Initial mapping at 1 in. = 20 ft (1:240)**
- **Map location, nature, and continuity of breccia zones, offsets of zonations within the Tiva Canyon Member, abrupt changes in attitude of zonations**
- **Zonal Variations Include:**
 - **Groundmass devitrification, degree of welding, shape of eroded slopes, texture of weathered surfaces, lithophysae cavity abundance, lithic fragment abundance, phenocryst ratios**
- **Compile maps at 1 in. = 50 ft (1:600)**

Fracture Mapping in FY 92

Mapped 745 fractures

Tiva Canyon Member

Upper Cliff Unit
Upper Lithophysal Unit
Clinkstone Unit
Lower Lithophysal Unit
Hackly Unit

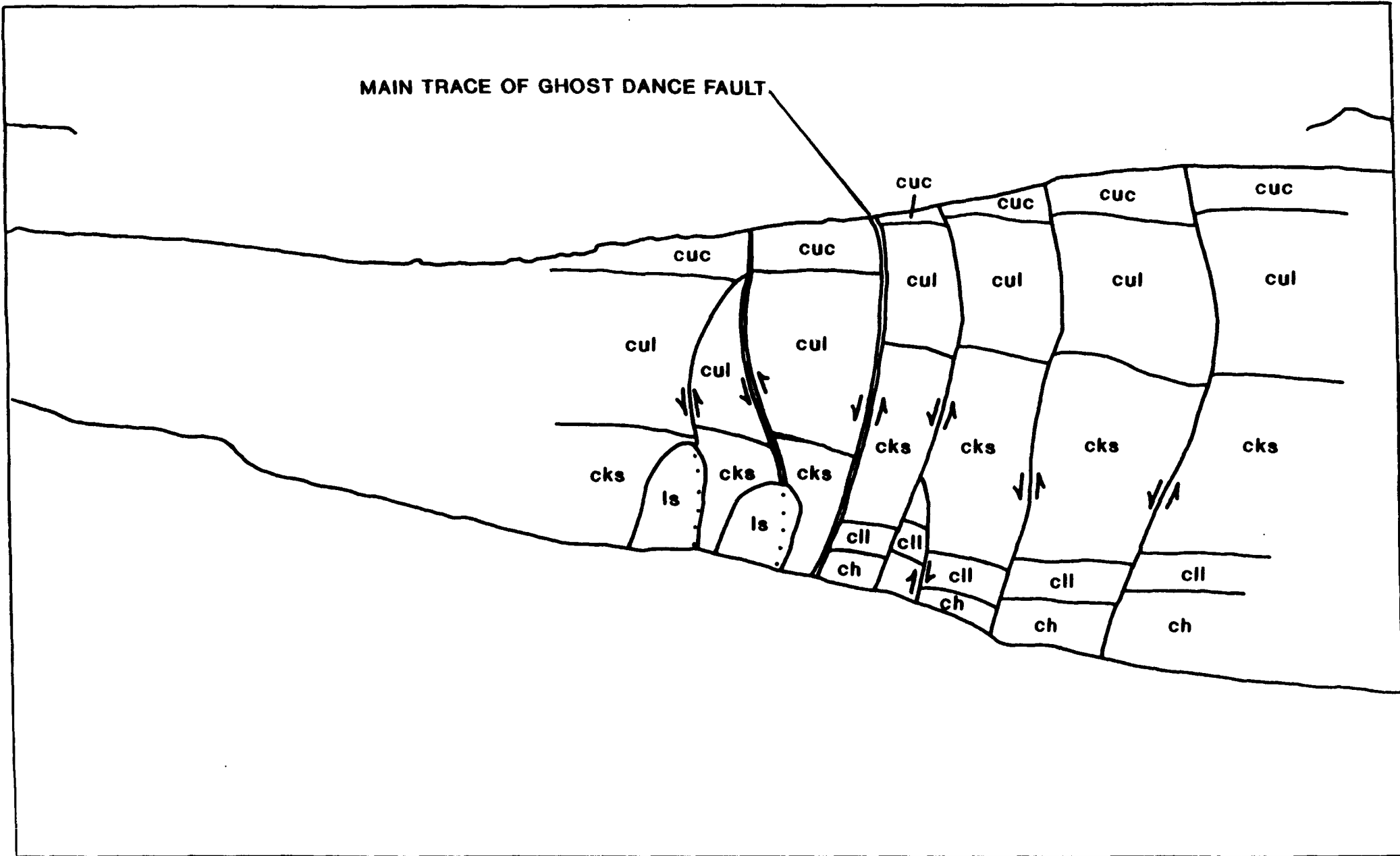
**Number of
Fractures**

82
237
254
53
119

Fracture lengths range from 6 to 85 ft

View Looking North toward Antler Ridge Illustrating Ghost Dance Fault Zone

MAIN TRACE OF GHOST DANCE FAULT



Preliminary Findings

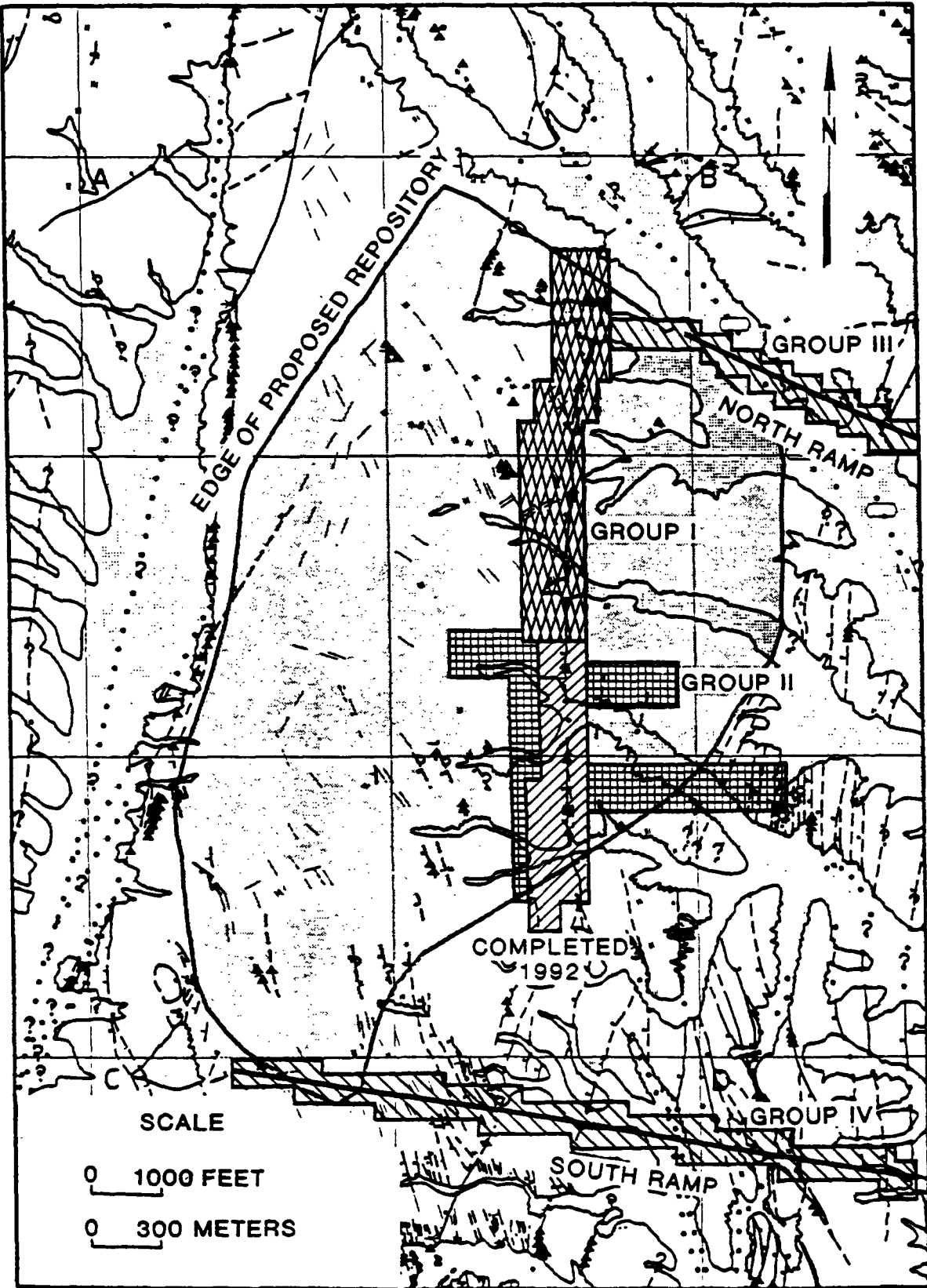
October 15, 1992

- **Fracture mapping indicates a dominance of high-angle north-to-northwest trends. Fracture trends appear consistent between subunits of the Tiva Canyon**
- **The Ghost Dance Fault consists of an anastomosing to subparallel network of north-trending faults**
- **Faults showing minor displacement occur on either side of the Ghost Dance Fault to a lateral extent of about 700 ft**

Proposed Studies in FY 93

- **Extend detailed mapping to the north along the main trace of the Ghost Dance Fault**
- **Use the grid-attribute technique to map a broader but selective area within the potential repository area but away from known faults**
- **Map selected areas along north and south ramp alignments using the grid-attribute technique**
- **Augment the detailed mapping by exposing lowermost flanks of east-west ridges within the fault zone**

Proposed Field Mapping for FY 93



Conclusions

- **Data are preliminary, and field work is incomplete**
- **At the same time, any interpretation must be considered preliminary and subject to potential change following colleague review**
- **To date, mapping has not provided information on last movement on or associated with Ghost Dance Fault and consequent potential impact to waste isolation**
- **Results to date support need for continued surface and underground mapping**