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CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

**TRIP REPORT**

**SUBJECT:** DOE Field Trip On Extreme Erosion Topical Report, Nye County Sponsored Field Excursion, and NRC/CNWRA Field Excursion

**DATE/PLACE:** January 31 - February 4, 1994, NRC/CNWRA Field Excursion, Yucca Mountain and Vicinity, Nevada Test Site, Mercury, NV and Death Valley, CA

February 1-2, 1994, DOE Extreme Erosion Field Trip, Yucca Mountain and Vicinity, Nevada Test Site, Mercury, NV

February 3, 1994, Nye County Field Excursion, Shoshone, CA vicinity and Las Vegas Valley, NV

**AUTHOR:** Michael P. Miklas, Jr., Brittain Hill, and H.L. McKague

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**AUTHOR:** Michael P. Miklas, Jr., Brittain Hill, and H.L. McKague

**PERSONS PRESENT:** Attachment 1 is a list of the attendees at the DOE-sponsored two-day field trip. Attachment 2 is a list of attendees at the Nye county-sponsored one-day field excursion. Attachment 3 is a list of attendees on the NRC/CNWRA-sponsored two-day field trip.

**BACKGROUND AND PURPOSE OF TRIP:** DOE, in response to questions and comments raised by the NRC and the CNWRA on the Extreme Erosion Topical Report, scheduled a 2-day trip to show the NRC/CNWRA the physical background of their report and to answer the questions and comments while viewing the data collection sites in the vicinity of Yucca Mountain, Nevada. Attachment 4 is the itinerary for the DOE-sponsored trip. In response to the DOE-sponsored trip, Nye county consultants proposed a one-day field excursion to view and discuss sites that the county consultants believed demonstrated the likelihood of extreme erosion and the development of varnish on much younger surficial deposits. Attachment 5 is the itinerary for the county-sponsored trip. The CNWRA and the NRC conducted a one-day fact finding trip on the Nevada Test Site prior to the DOE field excursion. The day after the county sponsored trip the NRC/CNWRA investigated evidence of extreme erosion in Death Valley and the occurrence of desert varnish on relatively young alluvial fans on the west side of Death Valley. Attachment 6 is the itinerary for the NRC/CNWRA two-day field excursion.

**SUMMARY OF PERTINENT POINTS:** DOE conducted a two-day trip in response to questions and comments generated by the NRC/CNWRA. The major points made by DOE included the following:

- Varnished boulder stripes on hillslopes blanket about 10% of the slopes in Yucca Mountain vicinity
- Ages of hill slope varnish are corroborated by buried calcrete soils of approximately 600 k years at the base of some apparently stable slopes
- Ongoing surficial mapping of Quaternary deposits adjacent to Yucca Mountain substantiates the lack of extreme erosion in area by identifying relatively small deposits of recent sediment

in Fortymile Wash

- Lack of alluvial fans on west side of Yucca Mountain indicates lack of erosion on the mountain
- Basis for varnish cation ratio dating method is being revised. Harrington now believes that only the upper 10 microns of the varnish is being analyzed and that an old age is "imprinted" in that uppermost 10 microns of varnish
- Fortymile Wash is an aggrading channel which is being filled with sediment from the Timber Mountain Caldera area, thus, erosion at Yucca Mountain is minimal and should be expected to lessen as the local base level is raised
- DOE investigators demonstrated that there are a number of sources of geomorphologic and paleoenvironmental information (e.g., age relationships of sand ramps and varnished boulder deposits on Fran Ridge and elsewhere) which are not contained currently in the topical report.

Nye county conducted a one-day field trip to establish some counterpoints to DOE slope stability arguments. The main points of the county trip were as follows:

- Sudden drainage and resulting erosion of the lakebed sediments in Lake Tecopa demonstrate that extreme erosion has occurred in recent time (within past 2 million years) in the Yucca Mountain vicinity
- Some colluvial deposits in the Las Vegas Valley have been lightly varnished within the past 10,000 years demonstrating that varnish can form rather quickly and that varnish developed at Yucca Mountain may not be assumed to be ancient simply because it is dark or thick

The NRC/CNWRA two-day field trip was intended to allow the staff to visit and evaluate some of the varnished boulder stripes in the Yucca Mountain vicinity prior to the DOE-led field trip and to allow staff to evaluate and develop alternate working hypotheses for erosion by visiting Death Valley and other nearby sites. The following are the main points of the NRC/CNWRA trip:

- Varnish on boulders does not easily dislodge even if boulders are forcibly rolled downslope per Harrington's conjecture
- Majority of hillslopes in the Yucca Mountain vicinity lack boulder stripes and have been eroded down to bedrock; this aspect of the landscape is not well-treated in the topical report
- Alluvial fans with Holocene deposition on the west side of Death valley emanate from valleys which have boulder stripes evident on the hillslopes
- Recent deposits on the late Pleistocene and Holocene fan surfaces in Death Valley exhibit varnish formation
- Yucca Mountain does not exhibit the formational characteristics of any of the nearby areas which have been extremely eroded

- DOE conclusion that climate change during the early Pleistocene is the only means to produce the large rock clasts on Yucca Mountain is not easily demonstrable

**SUMMARY OF ACTIVITIES:** NRC and CNWRA staff attended each of the three field trips and interacted with state, county, and DOE technical staffs on a variety of issues. Although no single issue was resolved, the presentation and discussion of the DOE viewpoint was extremely helpful in understanding their position.

**IMPRESSION/CONCLUSIONS:** DOE was extremely responsive in scheduling of the trip and inclusion of all items which the NRC/CNWRA wanted to discuss. All required DOE technical consultants were on hand to explain their hypotheses and to further update the attendees on recently developed pertinent data.

As presented by DOE, the cation-ratio dating method is not a rigorous procedure and its theoretical basis has not been well-established.

The trip sponsored by the county did not live up to initial billing of providing "new" information which "will blow your socks off." The visit to Lake Tecopa was interesting but not highly relevant to the current situation at Yucca Mountain. The varnish development on recent colluvial/alluvial deposits was not convincing of the inappropriateness of using cation-ratio dating to establish ancient ages on boulder mantled slopes on Yucca Mountain.

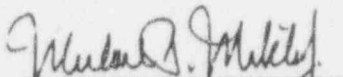
**PROBLEMS ENCOUNTERED:** None.

**PENDING ACTIONS:** None.


**RECOMMENDATIONS:** None.

**REFERENCES:** None.

**SIGNATURES:**

  
\_\_\_\_\_  
Michael P. Miklas, Jr.  
Sr. Research Scientist

03/04/97  
DATE

  
\_\_\_\_\_  
Brittain Hill  
Research Scientist

3/4/97  
DATE

CONCURRENCE SIGNATURES AND DATE:

H. L. McKague  
H.L. McKague  
Geologic Setting Manager

3/4/94  
DATE

Budhi Sagar  
Budhi Sagar  
Technical Director

3/4/94  
DATE

Attachment 1

DOE FIELD TRIP  
February 1 and 2, 1994

Michael P. Miklas, Jr.	CNWRA
Larry McKague	CNWRA
Brittain Hill	CNWRA
Andrew Watson	CNWRA (Consultant)
Harold Lefevre	NRC
John Trapp	NRC
John Bradbury	NRC
Phil Justus	NRC
Charlotte Abrams	NRC
John Whitney	USGS
John Stuckless	USGS
John Harrington	LANL
Stewart LeRoy	Duke Environmental
Tom Bjerstedt	DOE
David Tillson	State of Nevada (Consultant)
Carl Johnson	State of Nevada
Jay Quade	State of Nevada (Consultant)
Maury Morganstern	Nye County (Consultant)
Martin Mifflin	Nye County (Consultant)
Roger Morrison	Nye County (Consultant)
Engbrecht VonThiesenhausen	Clark County
William Heinz	ACNW
Lynn Deering	ACNW
Ken Foland	ACNW (Consultant)
Clarence Allen	NWTRB
Leon Reiter	NWTRB
And Others	

Attachment 2

NYE COUNTY FIELD TRIP  
February 3, 1994

Michael P. Miklas, Jr.	CNWRA
Larry McKague	CNWRA
Brittain Hill	CNWRA
Andrew Watson	CNWRA (Consultant)
Harold Lefevre	NRC
John Trapp	NRC
John Bradbury	NRC
Phil Justus	NRC
John Whitney	USGS
John Stuckless	USGS
John Harrington	Los Alamos
David Tillson	State of Nevada (Consultant)
Carl Johnson	State of Nevada
Jay Quade	State of Nevada (Consultant)
David Krinsley	State of Nevada (Consultant)
Maury Morganstern	Nye County (Consultant)
Martin Mifflin	Nye County (Consultant)
John Morrison	Nye County (Consultant)
Engebrecht VonThiesenhausen	Clark County
Ken Foland	ACNW (Consultant)
And Others	

Attachment 3

NRC/CNWRA FIELD TRIP  
January 31, and February 4, 1994

Michael P. Miklas, Jr.	CNWRA
Larry McKague	CNWRA
Brittain Hill	CNWRA
Andrew Watson	CNWRA (Consultant)
Harold Lefevre	NRC
John Trapp	NRC
John Bradbury	NRC
Phi. Justus (First day)	NRC (Site Representative)



## Attachment 4

### ITINERARY FOR DOE-NRC SITE VISIT FOR EROSION TOPICAL REPORT TOPICS NEVADA TEST SITE (NTS) AND ENVIRONS FEBRUARY 1-2, 1994

FEBRUARY 1, 1994

- 6:00 Depart Beatty
- 6:35 Arrive at Steve's Pass for overview of visit
  - Introduction of trip organizers and opening remarks
- 7:00 Depart for Solitario Canyon through Crater Flat
- 7:45 Solitario Canyon to visit and discuss
  - Oldest dated boulder deposit on west slope of Yucca Mountain (YMW-3); Reference Figure 4 of Topical Report (TR) [requires 1 to 1.5 hour hike from vehicles to deposit and back; moderately strenuous]
- 10:45 Drive to Trench through Solitario Canyon Fault (SCFT-2)
- 11:05 Discuss thick carbonate deposits and pediment surface at SCFT-1 (also carbonate deposits and pediment surface; if time allows)
- 11:45 Drive to Trench CF-1
- 11:55 Discuss exposure of alluvium at CF-1
- 12:15 Drive to NTS Gate 510, via Steve's Pass [LUNCH will be during drive to Gate 510 or as opportunity allows]
- 1:00 Badging at NTS Gate 510
- 1:15 Drive to Field Operations Center (FOC)
- 1:30 Break at FOC
- 1:45 Drive to Yucca Mountain
- 2:15 East Flank of Yucca Mountain to visit and discuss:
  - Hillslope boulder deposits on Boundary Ridge (YME-2); Reference Figure 5 of TR
- 2:50 Hillslope boulder deposit at head of Abandon Wash (YME-1); Reference Figures 3 and 5 of TR;  
1 hour hike to deposit and back
- 4:15 Discussion of Sand Ramp history in area
- 4:30 Return to Beatty (or Mercury, as required)

Attachment 4 (continued)

ITINERARY FOR DOE-NRC SITE VISIT FOR EROSION TOPICAL REPORT TOPICS  
NEVADA TEST SITE (NTS) AND ENVIRONS  
FEBRUARY 1-2, 1994

FEBRUARY 2, 1994

- 5:45 AM Leave Beatty, NV for Skull Mountain via Gate 510
- 7:00 Skull Mountain SKM-1 and SKM-3 overview of varnish deposits from road; Reference Figure 6 in TR
- 7:30 Drive to Little Skull Mountain
- 7:40 Little Skull Mountain Pass to visit and discuss cross-section of hillslope colluvial boulder deposit (LSM-1); Reference Figure 5 of TR
- 8:20 Drive to Fortymile Wash vista
- 8:40 Fortymile Wash to discuss Tertiary and Quaternary geologic history
- 8:55 Drive to Fortymile Wash rim
- 9:05 Fortymile Wash to discuss Tertiary and Quaternary geologic history [10 minute walk]; Reference Figure 13 in TR
- 9:50 Drive to Coyote Wash
- 10:00 Coyote Wash to visit and discuss canyon cutting and Holocene geologic history
- 10:50 Drive to Jake Ridge
- 11:15 Jake Ridge to visit and discuss 1984 erosion event and role of infrequent erosion events on landscape
- 11:45 Drive to Buckboard Mesa [Lunch will be eaten during drive to Buckboard Mesa or as opportunity allows]
- 1:20 PM Buckboard Mesa to visit and discuss oldest dated hillslope colluvial boulder deposits in Yucca Mountain area (BM-1) and upper Fortymile Canyon history (1 hour hike to deposit and back); Reference Figures 5 and 10 from TR
- 3:20 Depart for wrap-up session in Mercury
- 4:10 Wrap-up session in Mercury cafeteria
- NRC provide discussion/overview of their comments from review of TR
  - Questions and comments from state and affected counties
  - DOE closing remarks
- 5:10 Depart for Mercury Gate 100; return NTS badges, return to Las Vegas or Beatty, NV

## ITINERARY

### Regional Evidence for Age of Landforms, Cyclic Erosion February 3, 1994

(Detailed handouts on stops are separate)

Overnight February 2 in Pahrump, Nevada (Saddles West)

- 7:00 a.m. Meet in front of Saddles West.
- 7:10 a.m. Leave, travel west towards Shoshone, California, on Nevada Highway 372 which turns into California Highway 178.
- 7:30 a.m. Turnoff for Stop 1 (to Chappo Spring). #1 geomorphic surface and  $160 \pm 10$  ka ash.
- 9:00 a.m. Return to Highway 178, west to Stop 2. View of Lava Creek B and Bishop tephra along the way.
- 9:15 a.m. Stop 2, Shoshone Town Dump. #1 geomorphic surface, dates on BK soil horizon.
- 9:45 a.m. Back to Highway 178, south on Highway 127 to Stop 3.
- 10:30 a.m. Stop 3, 2/3 mile traverse by foot to #2 geomorphic surface, fault zones, geomorphic surface #1, coarse gravels of this surface.
- 12:30 p.m. Lunch at this site (will carry makings/beverages).
- 1:00 p.m. Leave to travel north on Highway 127 to Death Valley Junction, continue north to turnoff near Stateline to Fairbanks Spring (northernmost spring of Ash Meadows group).
- 2:00 p.m. Stop at Fairbanks Spring. Discuss age relationships, compare landforms and apparent histories of Tecopa basin and Amargosa Desert.
- 2:30 p.m. Leave, continue east to Crystal, then to U.S. 95 and on to the Indian Springs area.
- 3:30 p.m. Stop briefly to review desert varnish on gravels near Indian Springs (stop optional depending on time).
- 4:00 p.m. Continue southeast to Corn Creek badlands stop. Relationship of terrace gravels inset into well dated 7-9 ka paleodischarge deposits with well developed varnish on the desert payments of the gravel terrace. This is a key locality where available time for varnish formation is constrained to less than 9,000 years.
- 6:30 p.m. Arrive in Las Vegas.

Attachment 6

Day One NRC Field Trip  
January 31 (Monday), 1994

- 6:00 AM Eat breakfast in Beatty, NV
- 7:00 Leave Beatty, NV for gate 510 at NTS
- 7:35 Arrive at Gate 510 for badging
- 8:00 Depart Gate 510 for Little Skull Mountain
- 8:20 Arrive at pass between Little Skull Mountain and Skull Mountain. Stop to investigate varnished deposits north and south of Jackass Flat Highway.
- 11:00 Leave Little Skull Mountain
- 11:10 Arrive Rock Valley. Stop for discussion at east side of Rock Valley along Jackass Flat Highway.
- 11:30 Depart Rock Valley for Lunch in Mercury
- 11:45 Lunch in Mercury
- 12:30 PM Arrive U.S.G.S. Core Library in Mercury for discussion of geology at overview map.
- 1:00 Leave Mercury for 40 Mile Wash
- 1:30 Arrive 40 Mile Wash. Stop in Wash just north of junction with Yucca Crest Highway for evaluation of alluvial and colluvial deposits.
- 2:30 Leave 40 Mile Wash for Fran Ridge Overview
- 2:45 Fran Ridge. Stop for overview of erosion.
- 3:00 Arrive at Yucca Mountain stone stripes and investigate.
- 4:45 Leave for Yucca Crest
- 5:20 Leave Yucca Crest for egress from Gate 510.
- 6:40 Return to Exchange Club in Beatty, NV

Attachment 6 (Continued)

Day Two NRC Field Trip  
February 4 (Friday), 1994

- 6:00 AM Breakfast in Beatty, NV
- 7:15 Depart Beatty for Big Dune
- 8:00 Arrive Big Dune stop. Evaluate aeolian activity
- 8:30 Leave Big Dune for Funeral Formation stop near Death Valley National Monument boundary
- 9:30 Arrive Funeral Formation stop for erosion/geology evaluation
- 10:00 Leave Funeral Formation stop for Zabriskie Point stop
- 10:30 Arrive Zabriskie Point. Discussion of extreme erosion in Furnace Creek formation as a result of diversion of Furnace Creek in early 20th century.
- 11:00 Leave Zabriskie Point for stop at Death Valley National Monument headquarters and proceed to west side road
- 12:00 PM Travel to west side alluvial fans in Death Valley. Journey up Hanaupah Canyon fan and stop for lunch. Evaluate Dorn's work on dating alluvial fans on west side of Death Valley.
- 1:00 Leave Hanaupah Canyon fan for trip to east side of valley to Badwater
- 2:00 Arrive Badwater. Stop for overview discussion.
- 3:30 Leave Badwater for drive south through Death Valley to Las Vegas, NV with possible stops as time permits
- Stop at faulted alluvial fan of choice
  - Stop at Shoreline Butte
  - Discuss faulted cinder cone
  - Erosion features near Jubilee Pass, CA
- 4:00 Leave Death Valley for Las Vegas, NV
- 5:30 Arrive St. Tropez Hotel in Las Vegas