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GEOLOGIC STRUCTURE MAPPING DATABASE SPENT FUEL TEST--CLIMAX NEVADA TEST SITE

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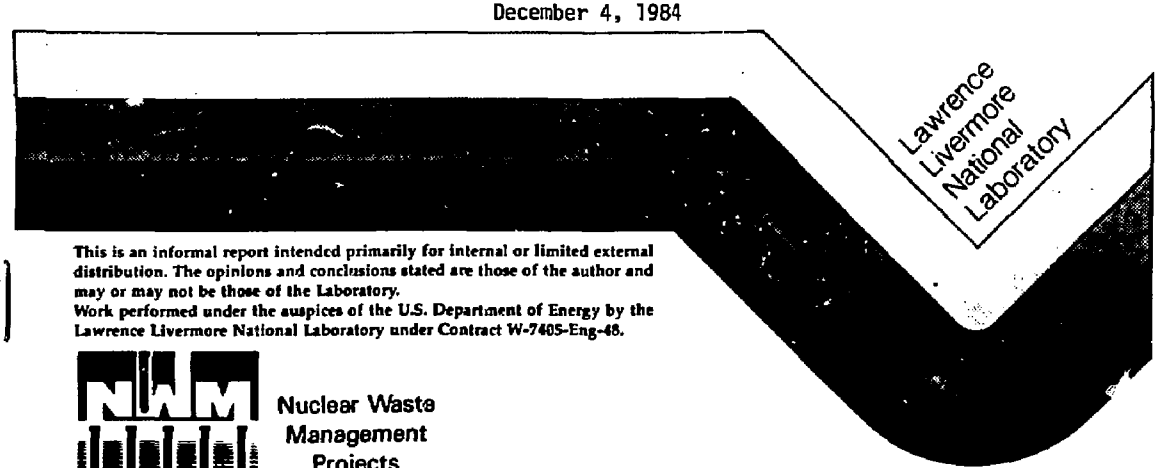
December 4, 1984



Nuclear Waste
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INTRODUCTION

The Spent Fuel Test--Climax (SFT-C) is a test of deep geologic storage and retrieval of commercial spent nuclear fuel assemblies (Ramspott et al., 1979). The test is conducted under the technical direction of the Lawrence Livermore National Laboratory (LLNL) as part of the Nevada Nuclear Waste Storage Investigations, which are administered by the Department of Energy's Nevada Operations Office.

During the early stages of the project extensive geologic mapping was carried out in the drifts of the SFT-C. The primary objective of this mapping effort was to characterize the geologic structure of the rock mass at the SFT-C facility for use in safety and design considerations, instrument siting, and interpretation of test results. The resulting geologic discontinuity data were entered into a database file on an LLNL computer system for subsequent analysis.

The purpose of this report is to document the SFT-C geologic structure mapping database and to make it available for use by researchers outside of LLNL. Sketch maps from the field notes have been published previously (Wilder and Yow, 1981), and an analysis and interpretation of the structural data and overview of the geologic setting of the SFT-C are also separately reported (Wilder and Yow, 1984). Core logging data from site investigation and instrumentation boreholes have been documented (Wilder et al., 1982, and Thorpe, 1984); a report on post-test core logging and a core logging database are in preparation at this writing.

SFT-C MAPPING

The SFT-C is sited at the Nevada Test Site at a depth of about 1378 ft (420 m) within the Climax granitic stock (Fig. 1). Construction of the SFT-C facility was described by Patrick and Mayr (1981); Fig. 2 illustrates the layout and stationing of the SFT-C drifts. The three parallel drifts (one canister drift and two heater drifts) are each over 200 ft (61 m) long, and extend N61W from the Rail Car Room to the Receiving Room. The central canister drift is about 15 ft wide x 20 ft high (4.6 m x 6 m), and the two

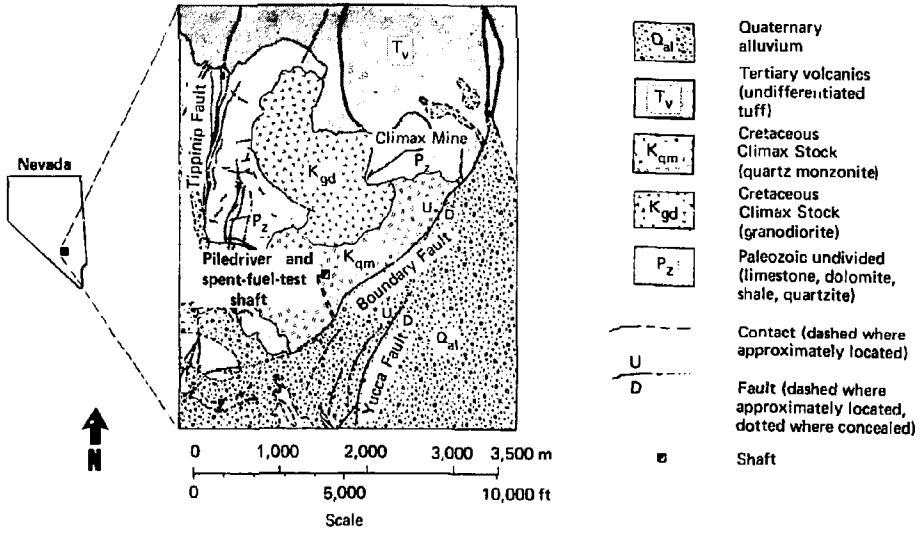

Figure 1. Geologic setting of the Spent Fuel Test-Climax.

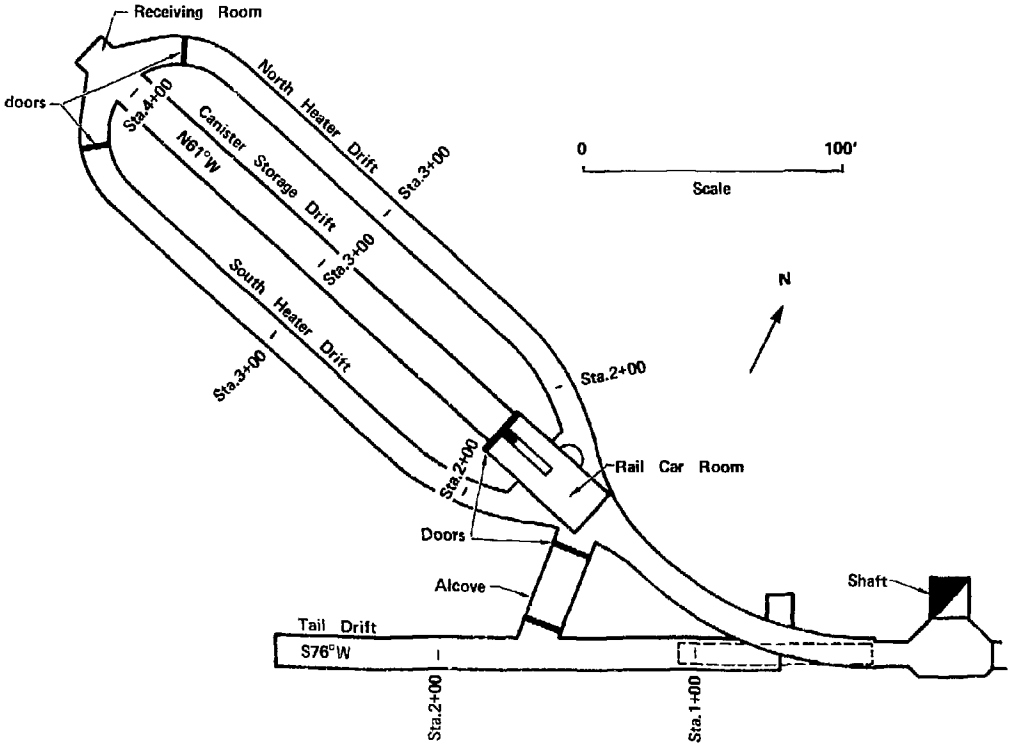

Figure 2. Layout of SFT-C Drifts.

adjoining heater drifts are each about 11 ft wide x 11 ft high (3.4 m x 3.4 m). A 12 ft wide x 12 ft high (3.7 m x 3.7 m) tail drift extends S76W from the facility access drift, and a 15 ft wide x 10 ft high (4.6 m x 3 m) alcove runs 408E from the tail drift to the Rail Car Room.

Mapping of geologic discontinuities at the SFT-C proceeded in stages and at differing levels of detail. Several people were involved in the mapping effort, and mapping was necessarily affected by the construction activities (Wilder and Yow, 1981). Nevertheless, over 2500 discontinuities including joints, shears, and faults were mapped in the SFT-C drifts. After the mapping had been completed the data was coded from the field notes for entry into the database using a format described below. Prior to use of the database for any analyses, the data files were printed and each line was read and compared with the field notes. Errors in the data files were marked on the printed copies and then crossed off when corrected so that the proofreading could be verified.

GEOLOGIC MAPPING DATABASE

The entire database of geologic structure data from the SFT-C mapping is reproduced on the two microfiche that accompany this report. Each discontinuity recorded in the field notes is represented by four lines of information in the database, using the format shown in Table 1. Abbreviations used in the database are listed in Table 2, while the conventions and definitions used in preparing the database are explained in the following paragraphs. A sample page from the database is shown in Figure 5.

ft, rib (wall), and survey stationing on the first line of each discontinuity listing are self-explanatory. The height refers to the elevation of the feature in feet above the drift invert (floor) at the station at which the feature was mapped. All features are referenced to drift stationing as shown in Figure 2 and in the sketch maps published by Wilder and Yow (1981). The discontinuity numbers do not follow any facility-wide scheme because the mapping was done in drift segments, each ordinarily 50 feet or more in length. Since the discontinuity numbers are not unique, they should be used carefully and in conjunction with drift, rib, and station identifiers, particularly where they indicate relationships between features.

TABLE 1. FORMAT OF DATABASE DISCONTINUITY ENTRIES

DATA ITEM	UNITS	LINE	COLUMNS
drift name	--	1	1-5
rib identifier	--		6-10
station at which mapped	feet	1	11-15
height at which mapped	feet	1	16-20
joint number	--	1	21-25
strike azimuth	degrees	1	26-30
dip	degrees	1	31-35
dip azimuth	degrees	1	36-40
apparent dip direction 1*	degrees	1	41-45
apparent dip 1*	degrees	1	46-50
reference plane 1 strike	degrees	1	51-55
reference plane 1 dip	degrees	1	56-60
apparent dip direction 2*	degrees	1	61-65
apparent dip 2*	degrees	1	66-70
reference plane 2 strike	degrees	1	71-75
reference plane 2 dip	degrees	1	76-80
apparent joint length	feet	2	1-5
joint thickness	feet	2	6-10
number of joints in group	--	2	11-15
width of group	feet	2	16-20
splay locations and lengths	feet	2	21-40
joint morphology	--	2	41-60
relation to other joints	--	2	61-80
joint surface texture	--	3	1-20
description of filling	--	3	21-50
description of alteration	--	3	51-80
remarks/comments	--	4	1-80

* as seen on the indicated reference plane

TABLE 2. GEOLOGIC STRUCTURE DATABASE ABBREVIATIONS

AB	albite alteration
ALC	alcove
BL	bleaching
CAL	calcite
CAN	canister drift
CHL	chlorite
CLA	clay
DIS	disseminated
ER	east rib
FE or FE OX	iron oxide stains
FEL	feldspar
FL	floor or invert
H	height of splay above floor
L	apparent length of splay
MO	molybdenite
NA or NAD	outer rib of heater drifts, west of doors (see Fig. 2)
NF	northwest end of Receiving Room
NHD	north heater drift
NR	north rib
PYT	pyrite
QTZ	quartz
REC	receiving room
SAU	sausserite
SER	sericite
SHD	south heater drift
SP	splays
SR	south rib
ST	station of splay occurrence
TD	tail drift
WR	west rib

```
   TD   NR   0.   8.   117  72.  45. 342.    0.   0.   8.   0.   0.   0.   0.   0.
    0.        0.   8.                    UNDULATING
ROUGH                  PYT QTZ                              BL .5
CONT THRU ZONE. DOES NOT CURVE.
   TD   NR 178.  6.0  107 285.  25.  15.    0.   0.   8.   0.   0.   0.   0.   0.
  16.5.0001    0.   0.                    UNDULATING
SMOOTH                 PYT CAL                          FSP BL .25

   TD   NR 179.  9.0  110   0.   0.   0.    0.  33.   0.   0.   0.   0.   0.   0.
  10.0  .06    8.   0.                    PLANAR
SMOOTH                 PYT CAL                              BL .75
APP DIP DIR N. // TO 111
   TD   NR 181. 11.0  101 320.  75.  50.    0.   0.   0.   0.   0.   0.   0.   0.
  10.0.0001    0.   0.
SMOOTH WAVY
POSSIBLY THIN CLAY COATING
   TD   NR 182.  5.5  105 263.  20. 353.    0.   0.   0.   0.   0.   0.   0.   0.
   3.0  .03    0.   0.                    PLANAR
SMOOTH                 PYT CAL
INTERSECTS 103. DISCONTINUOUS
   TD   NR 183.  8.5  106 218.  80. 128.    0.   0.   0.   0.   0.   0.   0.   0.
   7.0.0001    0.   0.                    UNDULATING
SMOOTH                 CAL
SRIKE AND DIP APPROXIMATE
   TD   NR 183. 10.5  102   0.   0.   0.    0.  45.   0.   0.   0.   0.   0.   0.
   8.0.0001    0.   0.
SMOOTH WAVY
APP DIP DIR SE. SUB // TO 101
   TD   NR 183.  4.5  114   0.   0.   0.    0.  44.   0.   0.   0.   0.   0.   0.
   6.0.0001    0.   0.
SMOOTH WAVY
APP DIP DIR E
   TD   NR 184.  6.0  109 222.  45. 312.    0.   0.   0.   0.   0.   0.   0.   0.
   1.0         0.   0.                    PLANAR
SMOOTH                 PYT CAL
ABUNDANT PYT
   TD   NR 186.  7.5  104 327.  38.  57.    0.   0.   0.   0.   0.   0.   0.   0.
   8.0  .06    0.   0.                    UNDULATING
ROUGH                  PYT QTZ CAL
.0001
   TD   NR 186.  6.0  111  42.  32. 312.    0.   0.   0.   0.   0.   0.   0.   0.
   6.0  .13    0.   0.                    PLANAR
SMOOTH                 PYT CAL CHL
// TO 110. QUESTIONABLE STRIKE
   TD   NR 186.  8.5  103   0.   0.   0.    0.  20.   0.   0.   0.   0.   0.   0.
  15.0  .25    8.   0.                    PLANAR
                       QTZ PYT CAL                          BL .5
APP DIP DIR E. SOME LIMONITE
   TD   NR 186.  2.5  115   0.   0.   0.    0.  17.   0.   0.   0.   0.   0.   0.
   4.0.0001    0.   0.
ROUGH                  PYT QTZ MOLY
APP DIP DIR E. HEALED. APPEARS TO TERMINATE ON JT 1
   TD   NR 186.  1.5  116  60.  24. 330.    0.   0.   0.   0.   0.   0.   0.   0.
  13.0.0001    0.   0.
ROUGH WAVY             QTZ PYT
CONT THRU ZONE. DOES NOT CURVE.
   TD   NR 188.  6.5  113   0.   0.   0.    0.  31.   0.   0.   0.   0.   0.   0.
  17.0.0001    8.   0.                    PLANAR
SMOOTH
APP DIP DIR N. APPEARS TO TERMINATE ON HIGH ANGLE SHEAR
```

Figure 3. Sample Listing from Geologic Structure Mapping Database

Strike and dip direction are both given in degrees as an azimuth measured clockwise from true north. Complete orientations were recorded for over 1800 of the discontinuities. For the remainder of the data set, however, actual orientations could not be mapped because of poor exposure. Where possible, the apparent dip directions and dips of such features and the orientations of two surfaces upon which they appeared were recorded. These variables were then used to calculate true orientations if adequate measurements were available.

The length of each feature in the database is that given in feet by the field personnel when such information was recorded. However, in most cases the lengths of mapped features were partially sketched rather than measured and noted. Discontinuity lengths were therefore scaled from the mapping sketches for database entry, and may not be at all representative of actual trace lengths on the drift ribs. Thicknesses recorded in the mapping data refer to apparent thicknesses of features, in feet, including any filling materials or mineralization.

In cases where field notes indicated a group of two or more parallel fractures that were too close together to expeditiously map or sketch individually, the database entries are duplicated to represent the number of discontinuities (number in group) actually forming the feature mapped. The corresponding group width is given in feet. Splays, morphology, relations, surface texture, filling description, and wall rock alteration are all to be understood with reference to the list of abbreviations in Table 2.

The fourth line of information for each discontinuity is for miscellaneous notes or remarks recorded in the field notes. These often include apparent structural relationships, and field assessments of shears and faults. Shears in this context are major, continuous features that evidence mineral crushing or clay filling, but without obvious offsetting of other discontinuities. Faults are features which offset other discontinuities, and which often contain quantities of gouge materials (Wilder and Yow, 1981).

CONCLUSIONS AND ACKNOWLEDGMENTS

Information on over 2500 discontinuities mapped at the SFT-C is contained in the enclosed geologic structure mapping database. Over 1800 of these features include complete descriptions of their orientations. This database is now available for use by other researchers.

Dale Wilder planned and supervised the mapping efforts that acquired this data set. James Springer helped with data entry for construction of the database, and Debra Tatman assisted with proofreading and corrections.

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GEOLOGIC STRUCTURE MAPPING DATABASE
SPENT FUEL TEST--CLIMAX
NEVADA TEST SITE

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December 4, 1984