2

This is an informal report intended primarily for internal or limited external distribution. (The opinions and conclusions stated are those of the author and may or may not be those of the laboratory.) This report is not to be given additional external distribution or cited in external documents without the consent of the author or LLL Technical Information Department.

UCID - 16390

RECEIVED BY TIC DEC 11 1973

LAWRENCE LIVERMORE LABORATORY

University of California/Livermore, California

**STRAIN SEISMOMETER DATA
FROM THE ALMENDRO EVENT AT NTS**

Clifford W. Olsen

November, 1973

NOTICE

This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Atomic Energy Commission, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights.

MASTER

Prepared for U. S. Atomic Energy Commission under contract no. W-7405-Eng-48

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

Page

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

The ALMENDRO event was conducted on Pahute Mesa at NTS, and was announced as an intermediate yield event (200-1000 kt). Strainmeter records were obtained at three locations in Yucca Flat. One recording site was a triaxial station; the other two were two component stations. Table I summarizes the station parameters. The pertinent data relating to ALMENDRO are summarized in Table II.

TABLE I

Station Parameters

<u>Station</u>	<u>Tie-Point Location</u>	<u>Component</u>	<u>Rod Length and Type</u>	<u>Rod Azimuth</u>
A9	37°07'44.74"N	NS	241.00" Invar	N 00°07'W
(Area 9)	116°02'16.24"W	EW	240.12" Invar	S 89°58'E
NTS	N 866,570.77	NE/SW	241.00" Invar	S 45°17'W
Coord's.	E 683,312.62			
A2E	37°08'20.50"N	NS	240.38" Invar	N 03°53'W
(Area 2)	116°05'51.74"W	EW	238.74" Invar	N 85°50'E
	N 870,077.33			
	E 665,840.27			
A2W	37°08'19.34"N	NS	247.60" Invar	N 04°28'W
(Area 2)	110°06'16.39"W	EW	240.10" Invar	N 84°20'E
	N 869,948.31			
	E 663,845.33			

TABLE II

Summary of Recording Stations for Almendro

<u>Station</u>	<u>Distance to Ground Zero</u>	<u>Azimuth to Ground Zero</u>
A9 (triaxial)	99,205 ft	N 65°09'W
	30.238 km	
A2E (NS & EW)	81,986 ft	N 62°16'W
	24.989 km	
A2W (NS & EW)	80,289 ft	N 61°39'W
	24.472 km	

In addition to the strainmeters a vertical geophone is installed at the tie-point pier of the A2E station. The geophone is a 2.00 ± 0.15 hz unit with 46% damping. The output as a function of driving frequency is shown in Figure 1. The plots of geophone data are uncalibrated. The ordinate is digital bits from the digitizing hardware, hence the geophone data, without further processing, are useful only for timing information. Information on relative amplitude can be obtained, but some care must be exercised due to the frequency dependent calibration (Figure 1).

The data from the triaxial station (Area 9) are given in Figures 2-16 for each component (identified as 9NS, 9EW, and 9SW) for time periods from 4 to 10 sec, from before zero time to 28, 60 and 100 secs, and to 50 min after zero time. Figures 17-24 show the data from the Area 2-West station for the NS and EW components (designated W-NS and W-EW). Figures 25-32 show the data from the Area 2-East station for the NS and EW components (designated E-NS and E-EW). The time periods covered by Figures 17-32 are the same as those for Figures 2-16 without the 100 sec plot. Figures 33-35 show the Area 2-East geophone data for periods of +4 to +10 sec and to +28 and + 100 sec, respectively.

On all the strainmeter plots the ordinate is in units of 10^{-6} strain with compression positive. As mentioned previously the geophone data are uncalibrated, but the positive ordinate corresponds to upward vertical motion.

Data analysis is not complete, but two features of the data are of interest. First is the clear indication of vertical motion at the A2E station on the geophone beginning at 4.75 sec, but no detectable strain changes were observed until after 4.9 sec. The other feature of interest is the marked difference between the records from the Area 2 stations and the Area 9 station. The major dynamic strain at the Area 2 stations occurs from about 5-8 secs during the P-wave arrivals, while at the Area 9 station major dynamic strains were observed to last for 30 sec or more with the peaks considerably later than the P-wave portion of the record. The difference between the stations is probably due to the subsurface structure (which is discussed by E. N. Hinrichs in GSA Memoir 110, "Nevada Test Site", pages 239-246), and will be the subject of further analysis of the data.

The swing on the Area 9 records between about 18 and 30 min may be a real strain variation ($\sim 3-7 \times 10^{-8}$) or a small disturbance in the recording system. Any interpretation of these features should be done with due caution. All data presented are available in digital form.

FIGURE 1

7/16/73/1400

FILE 4 CHANNEL 2

11/01/73

9 NS

AL

-5-

BITS X 4.52E-03

m

FIGURE 2

7/16/73/1400

FILE 4 CHANNEL 4

11/01/73

9EW

AL

-9-

BITS X 7.09E-03

FIGURE 3

7/16/73/1400

FILE CHANNEL 6

11/01/73

95W

AL

FIGURE 4

30-327E-03

-7-

7/16/73/1400

FILE 4 CHANNEL 2

11/01/73

9 NS

AL

-8-

BITS X 4.52E-03

m

FIGURE 5

TIME

7/16/73/1400

FILE 4 CHANNEL 3

11/01/73

9EW

AL

-6-

BITS X 1.49E-02

FIGURE 6

7/16/73/1400

FILE 4 CHANNEL 6

11/01/73

95W

AL

-01-

BITS X 6.77E-03

E 1

FIGURE 7

3

TIME

7/16/73/1400

FILE 6 CHANNEL 2

11/05/73

9 NS

AL

-||-

BITS X 4.52E-03

F

1 3 FIGURE 8

TIME

7/16/73/1488

FILE 6 CHANNEL 4

11/85/73

9EW

AL

-12-

00-360.2 X BITS

FIGURE 9

7/16/73/1400

FILE 6 CHANNEL 6

11/05/73

95W

AL

-13-

BITS X 6.77E-03

FIGURE 10

7/16/73/1400

FILE 6 CHANNEL 2

11/05/73

9 NS

AL

-14-

30-325.4 X SLTB

FIGURE 11

7/16/73 1400

FILE 6 CHANNEL 4

11/05/73

9EW

AL

-15-

BITS X 7.09E-03

FIGURE 12

7/16/73/1400

FILE G CHANNEL 6

11/05/73

9 SW

AL

-16-

BITS X 6.77E-03

FIGURE 13

7/16/73-1430

FILE 6 CHANNEL 2

11/05/73

9 NS

AL

-1-

BITS X 4.52E-03

FIGURE 14

-81-

BITS X 7.09E-03

FIGURE 15

7/16/78/1400

FILE 6 CHANNEL 6

11/85/73

950

AL

FIGURE 16

7/16/73/1400

FILE 1 CHANNEL 3

11/01/73

W. EW

AL

FIGURE 18

7/16/73/1400

FILE 1 CHANNEL 4

11/01/73

W-NS

AL

1 3 FIGURE 19

7/16/73/1400

FILE 1 CHANNEL 3

11/01/73

W-EW

AL

FIGURE 20

20-327.2 X SL19

7/16/73/1400

FILE 3 CHANNEL 4

11/01/73

W-NS

AL

FIGURE 21

BITS X 2.91E-02

-24-

7/16/73/1400

FILE 3 CHANNEL 3

11/01/73

W-EW

AL

FIGURE 22

20-327.2 X SL18

7/16/73/1400

FILE 3 CHANNEL 4

11/01/73

W - NS

AL

1 3 FIGURE 23

20-31E-02

-92-

7/16/73/1400

FILE 3 CHANNEL 3

11/01/73

W-EW

AL

FIGURE 24

7/16/73/1400

FILE 1 CHANNEL 2

11/01/73

E-US

AL

FIGURE 25

7/16/73/1400

FILE 1 CHANNEL 1

11/01/73

E-EW

AL

FIGURE 26

7/16/73-1400

FILE 1 CHANNEL 2

11/01/73

E-NS

AL

-30-

BITS X 2.19E-02

E

1 3

FIGURE 27

TIME

7/16/73/1400

FILE 1 CHANNEL 1

11/01/73

E-EW

AL

-31-

20-31E-02
BITS X 2.01E-02

FIGURE 28

7/16/73/1400

FILE 3 CHANNEL 2

11/01/73

E - NS

AL

-32-

20-361.2 X SLIB

1 3 FIGURE 29

-33-

BITS X 2.01E-02

FIGURE 30

7/16/73/1400

FILE 3 CHANNEL 2

11/01/73

E-NS

AL

-34-

BITS X 2.19E-02

1 3 FIGURE 31

7/16/73/1400

FILE 3 CHANNEL 1

11/01/73

E-EW

AL

-35-

20-31E-02

FIGURE 32

7/16/73/1400

FILE 1 CHANNEL 5

11/01/73

E-GP

AL

-36-

00 300.1 X 5118

FIGURE 33

7/16/73/1400

FILE 1 CIBELL 5

11/01/73

E-GP

AL

FIGURE 34

7/16/73/1400

FILE 3 CHANNEL 5

11/01/73

E-GP

AL

-83-

00 500.1 X SLR

1 3 FIGURE 35

Distribution:

M. W. Major, Colorado School of Mines, Golden, Colo. 80401

D. Tocher, U. S. Geological Survey, 345 Middlefield Road, Menlo Park, CA 94025

L. S. Germain, L-7

C. W. Olsen (3), L-48

T. I. D. (10)

NOTICE

"This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Atomic Energy Commission, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately-owned rights."