LA-8687-PR

Progress Report

MASTER

Earthquake Catalog for Northern New Mexico

July—September 1980

University of California

LOS ALAMOS SCIENTIFIC LABORATORY
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Earthquake Catalog for Northern New Mexico

July—September 1980

D. J. Wechsler
D. J. Cash
K. H. Olsen
N. J. McFarland
J. J. Wolff

EARTHQUAKE CATALOG FOR NORTHERN NEW MEXICO

JULY 1980 - SEPTEMBER 1980

by

D. J. Wechsler, D. J. Cash, K. H. Olsen,
N. J. McFarland, and J. J. Wolff

ABSTRACT

This report is a summary of the earthquakes in northern New Mexico located by the Los Alamos National Laboratory seismic array. Data are presented in the form of tables and epicenter maps, with a brief explanatory text.

A seismic network capable of locating earthquakes has been maintained by the Los Alamos National Laboratory since September 1973. Summaries of recorded and earlier historical seismicity have been previously published (e.g., Slemmons, 1975; Newton et al., 1976; Northrop, 1976; Sanford et al., 1976; this catalog, 1st issue).

The present array configuration for the Los Alamos northern New Mexico seismograph stations is depicted in Fig. 1, and stations are listed along with pertinent information in Table I. Figure 1 includes some stations from the U.S. Geological Survey and Albuquerque Seismological Center seismic arrays, which are sometimes used in the computation of earthquake locations. Figure 2 is a map showing the more dense station distribution in the Jemez Mountains west of Los Alamos, around the Fenton Hill geothermal test site.

Earthquake locations have been determined using a version of HYPOINVERSE (Klein, 1978). Stations are assigned to one of three velocity models, given in Table II. Within the array (defined as an event with the largest azimuthal gap between recording stations $\leq 180°$) precision of epicentral locations is probably on the order of 1-5 km. Other locations can be determined to within

5-15 km at best. The detection threshold is variable over the area of array coverage as well, generally increasing as one moves away from the center of the array.

Estimates of depth precision are greater than for epicentral coordinates due to the nature of the hypocenter determination problem. Within the array, depths may be estimated to ± 2-10 km, depending on the distance to the closest station; outside the array, depth uncertainty may be ±40 km. The distribution of reliable depth estimates suggests, however, that most seismic activity in northern New Mexico is shallow focus (<20 km).

Magnitudes of events are listed as local magnitudes (M_L), computed using the relationship

$$M_L = 2.79 \log T - 3.63 \quad , \tag{1}$$

where T is the maximum event duration in seconds observed at all network stations. The duration is measured from the first P-phase arrival to the time when the coda dissappears into the background noise. The above equation was derived by comparison of log T to magnitude values determined by the ALQ Wood-Anderson seismograph. Magnitudes for near-regional events computed using this relationship have corresponded well to those given by the USGS.

For some areas where array coverage is best, as in the Jemez area after late 1979, events as small as $M_L = -1.5$ can be detected and located. Detection threshold is generally higher over most of the area of coverage, approximately $M_L = 0.5$.

Table III is the listing of located hypocenters for July through September 1980. A negative depth indicates that the depth was constrained to the absolute value of the number listed to obtain a reliable solution for the epicenter. The quality factor (A, B, C, or D) is determined by considering the values of the RMS travel time residual and the condition number of the partial derivative matrix. It is included to give an indication of the comparative quality of the solution. Quality factors may be loosely associated with estimates of epicenter precision as follows: A $\sim$ 1-3 km, B $\sim$ 3-5 km, C $\sim$ 5-15 km, and D $\sim$ greater than 15 km.

Figure 3 is the epicenter map for the three-month period. Figure 4 is a map depicting major geologic and tectonic features.

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TABLE I

SEISMOGRAPH STATIONS

CODE NAME	GEOGRAPHIC LOCATION	COORDINATES LATITUDE	COORDINATES LONGITUDE	ELEVATION (METERS)	VELOCITY MODEL +	SEISMOMETER	MAGNIFI-CATION*	TELEMETRY (FREQ.=MHz)	DATE INSTALLED
BRC	Barley Canyon	35.8903	106.7114	2261	2	L4-C	512 K	164.5/LL	20 Nov 75
CLP	Clara Peak	36.0358	106.2403	2591	2	SS-1	240 K	169.0	7 Oct 73
CZL	Cerro Azul	36.2833	105.9103	2128	3	S-13	672 K	410.35	24 Sep 76
DMPK	Dead Man's Peak	36.4264	106.7757	2664	1	S-13	144 K	416.35	22 Nov 76
EUM	Eureka Mesa	36.0131	106.8439	2914	1	L4-3D	216 K	M/226.7	13 Jan 76
FARG**	Farmington	36.7780	108.1870	1801	1	S-500	—		Oct 77
FCN**	Frijoles Canyon	35.7719	106.2503	1945	-	L4-3D	—	LL	7 May 73
JOAQ	Joaquin L.O.	35.7708	106.8411	2768	2	SS-1	720 K	410.35	9 Nov 79
LCV***	La Cueva	35.8828	106.6742	2652	2	L4-3D	456 K	LL	5 Sep 73
LFC	Lake Fork Canyon	35.8769	106.6647	2451	2	Lf-C	288 K	169.0/LL	4 Nov 75
LFMS	Lake Fork Mesa	35.8736	106.7200	2558	2	S-500	576 K	409.075	Nov 79
REDP	Redondo Peak	35.8711	106.5629	3417	2	SS-1	360 K	409.35	Oct 77
LOA**	Los Alamos (TA-49, LANL)	35.8247	106.2944	2144	-	L4-3D	—	LL	12 Jan 72
MSA	San Antonio Mountain	36.8692	106.0216	3322	3	L4-3D	128 K	M/226.7	9 Oct 75
MTL	Mt. Taylor	35.2519	107.5964	3335	1	L4-3D	272 K	M/226.7	15 Oct 75
OTZ	Ortiz Mountain	35.7603	106.1728	2091	3	L4-C	120 K	166.25	17 Sep 76
RIO**	Caja del Rio	35.7547	106.1756	2073	-	L4-C	—	166.25	21 Feb 75
SHMS	Schoolhouse Mesa	35.8544	106.6906	2561	2	S-500	288 K	409.025	Nov 79
SPD	St. Peter's Dome	35.7578	106.3694	2566	2	SS-1	688 K	164.75	18 Sep 73
TMRS	Thompson Ridge	35.8828	106.6375	2476	2	S-500	530 K	409.125	Nov 79
TSL	Navajo Community College	36.3722	109.2436	2012	1	SS-1	344 K	LL	22 May 75
TSP	Tesuque Peak	35.7853	105.7814	3664	2	SS-1	456 K	M/226.7	14 Oct 73
TTP	Tetilla Peak	35.6094	106.2064	2103	3	L4-C	114 K	164.50	18 Mar 75
WELC	Well C Fenton Hill	35.9704	106.6243	2000	2	S-500	512 K	409.	Nov 79
Q-1	Fenton Hill Area	35.8879	106.6716	2658	2	S-13	153 K	M/164.5	Jan 80
Q-2	Fenton Hill Area	35.8783	106.6655	2599	2	S-13	152 K	M/164.5	Jan 80
Q-3	Fenton Hill Area	35.8747	106.6686	2630	2	S-13	152 K	M/164.5	Jan 80
Q-4	Fenton Hill Area	35.8749	106.6793	2634	2	S-13	152 K	M/164.5	Jan 80
Q-5	Fenton Hill Area	35.8787	106.6815	2632	2	S-13	152 K	M/164.5	Jan 80

LL Land Line
M Microwave
* Peak Magnification at 10 Hz
** Closed
*** Fenton Hill site is 300 m south of LCV

S-500 Teledyne-Geotech
L4-C, L4-3D Mark Products
SS-1 Kinemetrics (Ranger)
S-13 Teledyne-Geotech
+ See Table II

TABLE II

VELOCITY MODELS

APPROXIMATE GEOGRAPHICAL AREA AND REFERENCE	VELOCITY (km/s)	DEPTH (km) TO TOP OF LAYER
1. Colorado Plateau (Roller, 1965)	3.0	0.0
	6.2	2.5
	6.8	27.0
	7.8	45.0
2a. Transition Zone (Toppozada and Sanford, 1976)	3.0	0.0
	6.15	1.0
	6.50	20.0
	7.9	41.0
2b. Jemez Local Seismicity[a]	2.2	0.0
	3.0	0.15
	4.0	0.42
	6.1	0.72
	6.5	5.0
	7.9	41.0
3. Rio Grande Rift (Olsen et al., 1979)	3.33	0.0
	6.0	3.2
	6.4	21.4
	7.6	33.7

a Model supplied by Carl A. Newton, Los Alamos National Laboratory.

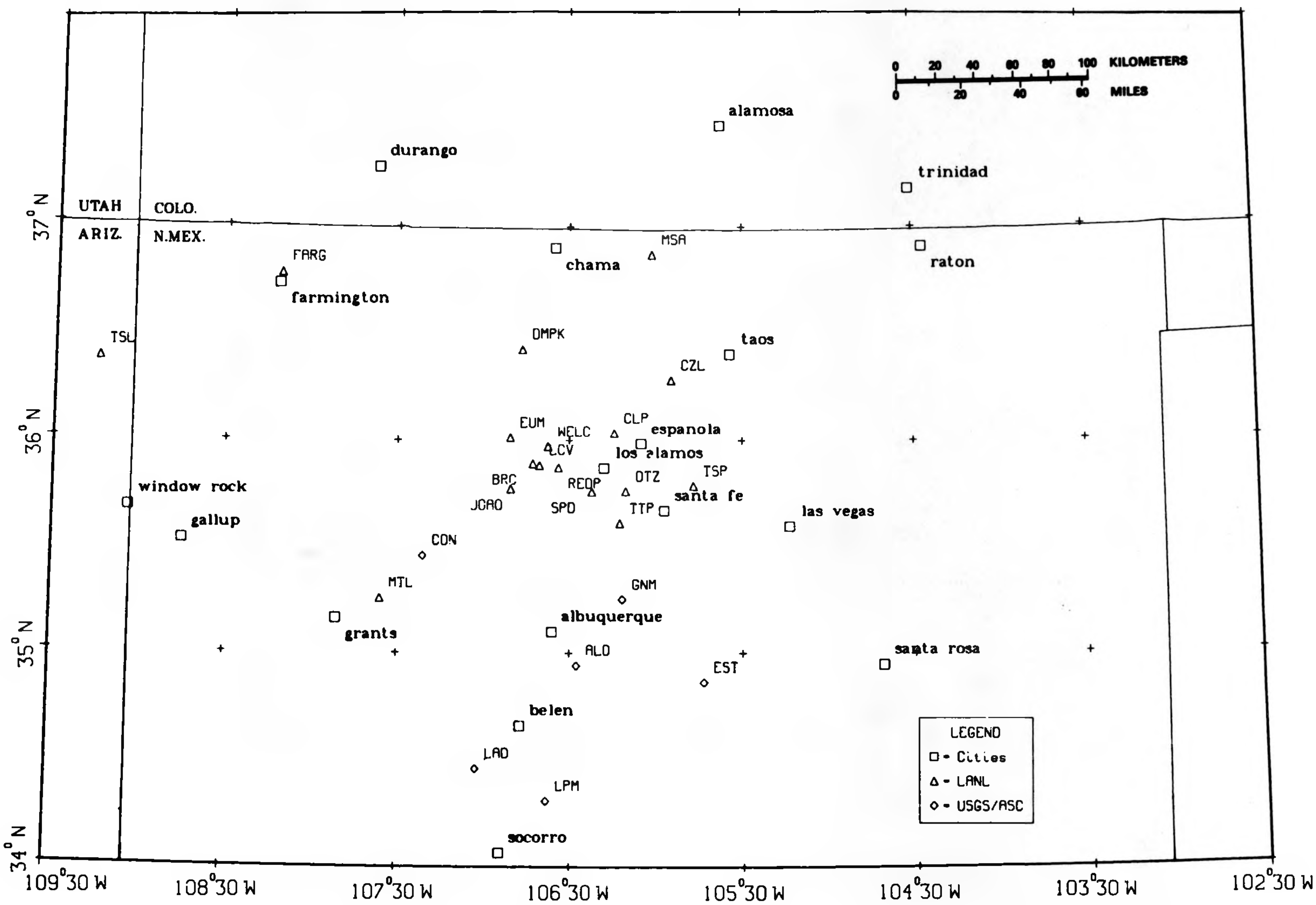

Fig. 1. Northern New Mexico seismograph stations.

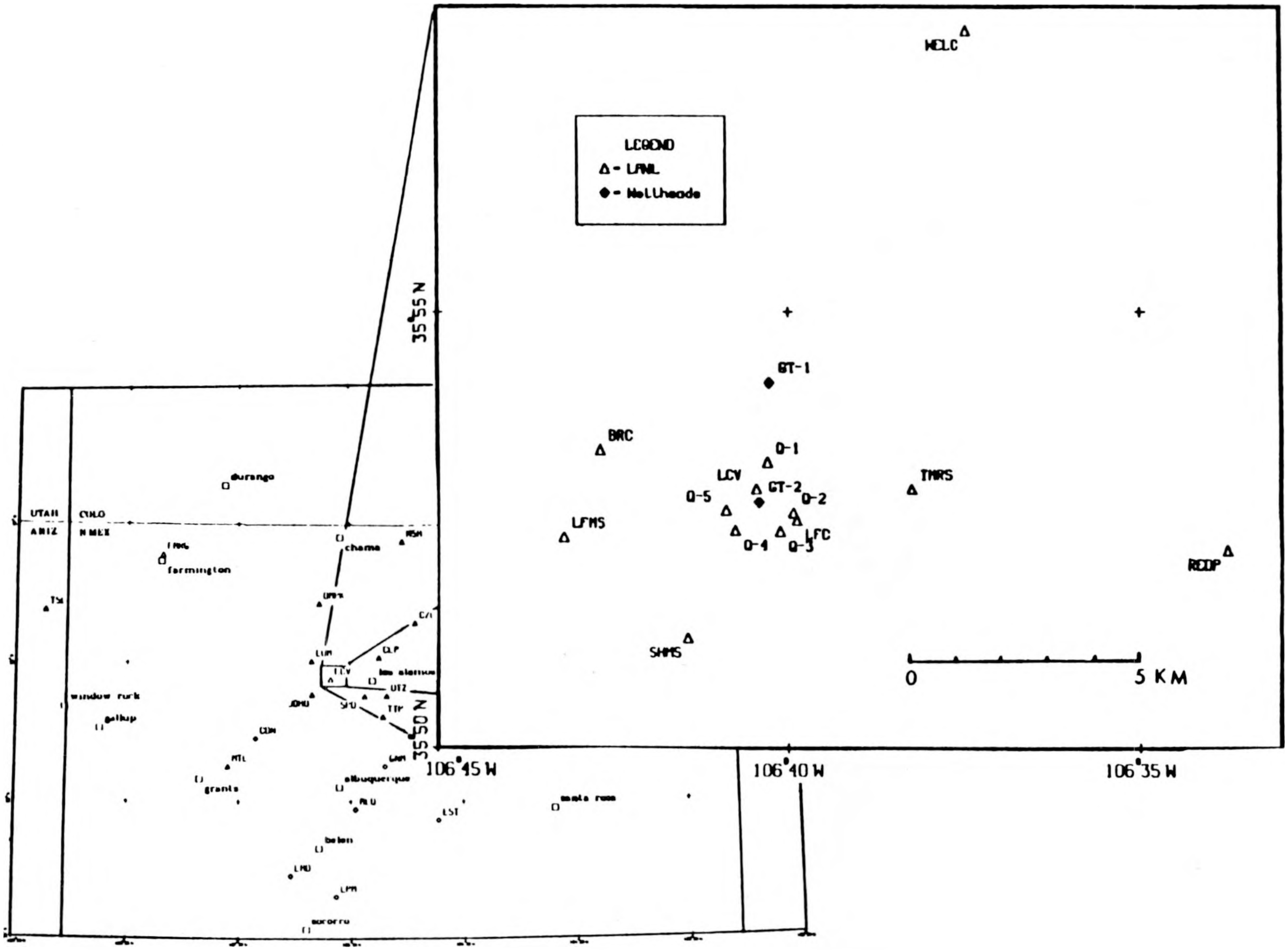

Fig. 2. Seismograph stations in the Fenton Hill, Jemez Mountains, area.

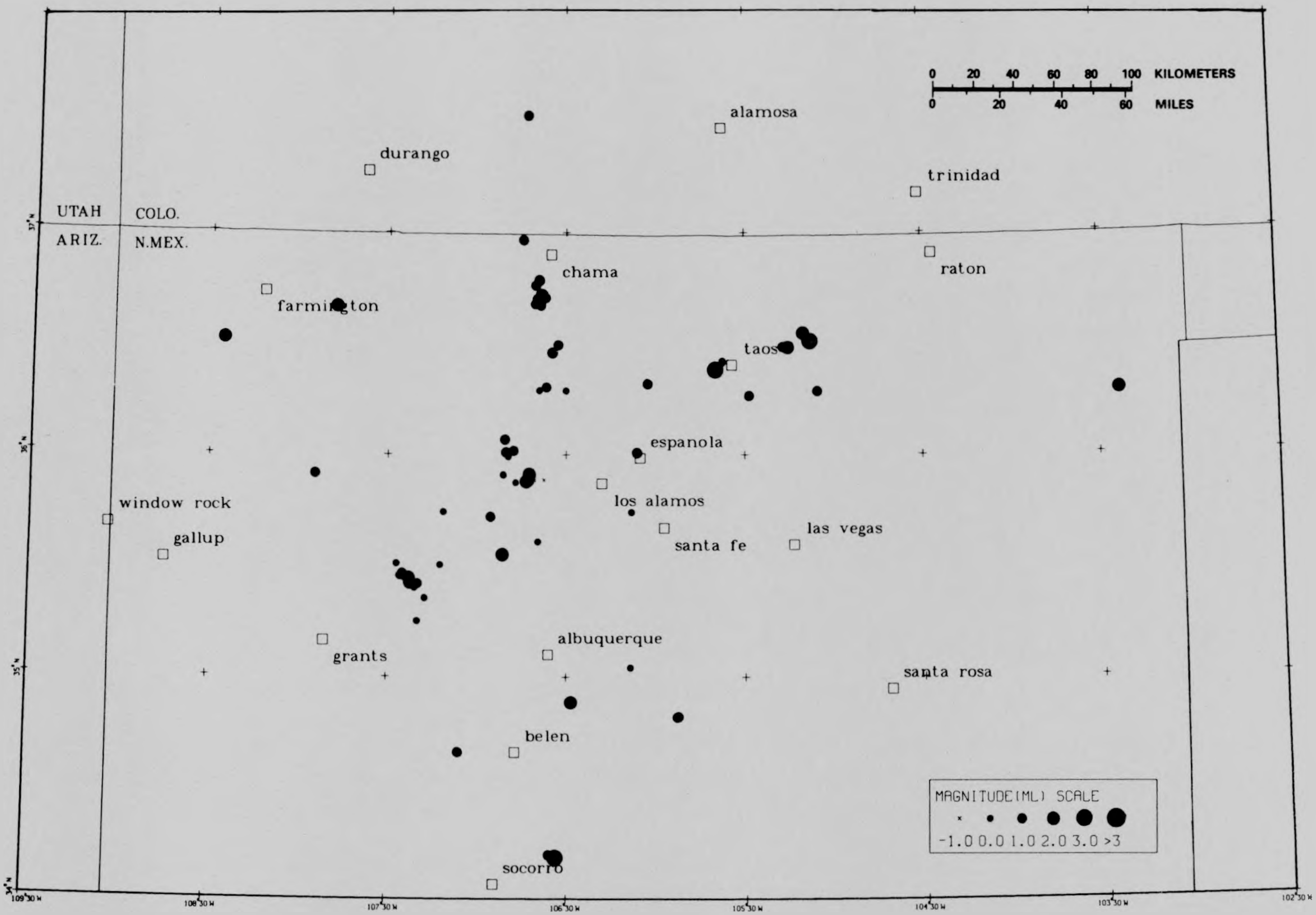

Fig. 3. Northern New Mexico earthquakes, Jul. 1980 - Sept. 1980.

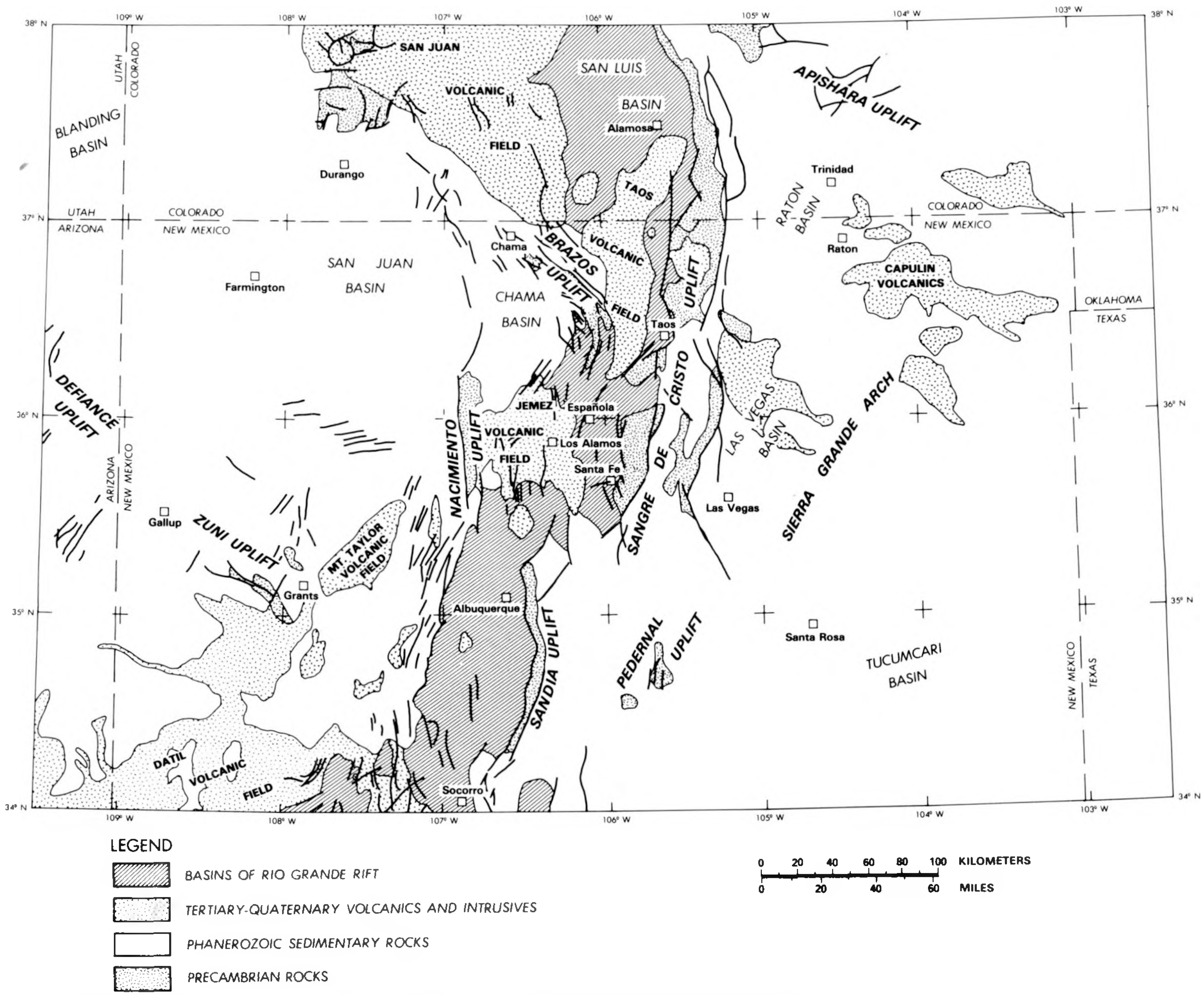

Fig. 4. Generalized geologic and tectonic map of northern New Mexico

TABLE III

NORTHERN NEW MEXICO EARTHQUAKES, JUL.-SEPT. 1980

IDN	DATE	TIME	LAT	LONG	DEPTH	MAG	QUAL
1	800705	1024 5.73	36.3206	106.0411	-5.00	.4	A
2	800706	202943.85	35.2516	107.3300	-5.00	-.8	C
3	800707	18 235.39	35.3554	107.2898	-5.00	-.2	C
4	800708	330 8.27	36.2874	105.0881	-5.00	.5	C
5	800710	11945.25	37.5264	106.7168	-5.00	.4	B
6	800710	91147.12	35.0420	106.1399	-5.00	-.3	B
7	800713	41419.01	36.7189	106.6397	-5.00	1.2	C
8	800713	42723.82	36.7858	106.6522	-5.00	.5	C
9	800713	51653.07	35.7414	106.1304	-5.00	0.0	C
10	800713	64458.68	36.6988	106.6407	-5.00	1.3	B
11	800713	64918.88	36.6767	106.6482	4.90	.2	C
12	800714	124519.74	36.4950	106.5452	-5.00	.4	A
13	800718	111544.84	35.4187	107.3358	-5.00	.4	B
14	800808	10 518.53	35.6097	106.6574	-5.00	-.1	B
15	800813	132420.43	36.2875	103.3882	-5.00	1.4	D
16	800813	183329.41	36.0157	106.7971	7.20	.7	B
17	800814	21 912.96	35.4349	107.3773	-5.00	-.2	D
18	800814	231920.11	35.4234	107.3689	-5.00	1.7	B
19	800814	232623.30	35.4512	107.4066	-5.00	0.0	D
20	800814	232655.43	35.4056	107.3471	-5.00	0.0	D
21	800815	0 8 4.39	35.4266	107.3708	-5.00	0.0	D
22	800815	185910.21	35.4197	107.3586	-5.00	.7	B
23	800820	25248.93	34.6593	107.0972	-5.00	.5	B
24	800822	114438.77	35.4564	107.4252	-5.00	-.1	C
25	800822	133311.84	35.7413	107.1855	-5.00	-.4	D
26	800823	172137.73	36.4606	106.5774	-5.00	.3	A
27	800830	81944.18	36.7664	106.6675	-5.00	.1	D
28	800901	119 .96	36.9664	106.7410	-5.00	.3	C
29	800902	2232 4.55	36.0074	106.1003	-5.00	.5	A
30	800906	125537.78	36.2890	106.5034	-5.00	-.3	A
31	800907	54124.69	34.8199	105.8717	-5.00	.5	B
32	800908	15831.53	35.5105	107.4432	-5.00	-.6	D
33	800908	33333.34	34.1982	106.5938	-5.00	1.0	B
34	800911	2 710.08	35.7219	106.9226	2.80	.6	A
35	800911	957 8.34	35.8840	106.6784	2.00	-1.2	A
36	800911	161653.23	36.4844	105.2573	-5.00	1.1	B
37	800911	18 9 7.46	35.4420	107.3737	-5.00	2.0	C
38	800911	181148.55	35.4497	107.4040	-5.00	.2	C
39	800911	182515.55	35.4407	107.3929	-5.00	.1	C
40	800911	225242.96	35.4650	107.4141	-5.00	.2	C
41	800912	192218.12	36.3862	105.6560	-5.00	2.7	D
42	800912	192720.48	36.3039	106.6104	-5.00	.1	B
43	800912	194440.33	36.5471	105.1666	-5.00	1.2	C
44	800912	213733.72	36.5113	105.1279	-5.00	2.8	C
45	800912	223820.86	36.2906	106.6530	-5.00	-.2	B
46	800912	224036.14	36.4852	105.2811	-5.00	.7	C
47	800913	02256.67	36.4139	105.6177	-5.00	0.0	D
48	800913	3 453.64	35.5033	107.2054	-5.00	-.5	B
49	800915	74713.86	35.8858	106.6257	6.60	-1.0	C
50	800915	91416.08	35.9066	106.8533	-5.00	-.6	A
51	800918	93954.30	34.8848	106.4720	-5.00	1.1	B
52	800918	113947.66	34.1835	106.5579	-5.00	2.3	C
53	800918	154222.73	35.9934	106.8259	.40	0.0	B
54	800920	211444.12	36.2647	105.4752	-5.00	.4	D
55	800922	104437.01	36.5196	108.4245	-5.00	1.1	D
56	800923	55756.20	36.0098	106.8329	6.10	.6	B
57	800924	31428.57	38.2296	105.9188	-5.00	1.1	D
58	800924	181444.94	35.5497	106.8552	-5.00	1.1	B
59	800925	75517.31	35.9135	107.9053	-5.00	.4	B
60	800925	173833.71	35.9092	106.7023	.60	1.2	A

TABLE III (cont)

IDN	DATE	TIME	LAT	LONG	DEPTH	MAG	QUAL
61	800925	1831 9.46	35.8823	106.7012	.20	.9	B
62	800925	19 125.80	35.8821	106.7370	.60	.9	B
63	800925	104019.29	36.0656	106.8451	-5.00	.6	C
64	800925	2053 .36	35.8818	106.7222	.50	1.1	A
65	800925	22 731.09	35.8759	106.7800	.80	-.2	D
66	800929	91748.67	36.6802	106.6720	-5.00	.4	B
67	800929	115853.37	36.6970	106.6639	-5.00	.7	B
68	800929	22 030.99	36.7060	106.6144	-5.00	.3	D
69	800930	192032.08	36.6664	107.7955	-5.00	1.3	B

TOTAL NO. OF EPICENTERS = 69