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Progress Report

Earthquake Catalog for Northern New Mexico

January 1980—March 1980

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LOS ALAMOS SCIENTIFIC LABORATORY

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D. J. Wechsler
D. J. Cash
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N. J. McFarland
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EARTHQUAKE CATALOG FOR NORTHERN NEW MEXICO

JANUARY 1980 - MARCH 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 Scientific 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 Scientific Laboratory (LASL) 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 LASL 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 $\leq 180^{\circ}$) 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

$$M_L = 2.79 \log T - 3.63 \quad , \qquad (1)$$

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 January through March 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 ≈ 1-3 km, B ≈ 3-5 km, C ≈ 5-15 km, and D ≈ 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.

ACKNOWLEDGMENT

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TABLE I

SEISMOGRAPH STATIONS

CODE NAME	GEOGRAPHIC LOCATION	COORDINATES LATITUDE	COORDINATES LONGITUDE	ELEVATION (METERS)	VELOCITY MODEL	SEISMOMETER	MAGNIFICATION*	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 Ford 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, LASL)	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

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 Data supplied by Carl A. Newton, Los Alamos Scientific Laboratory.

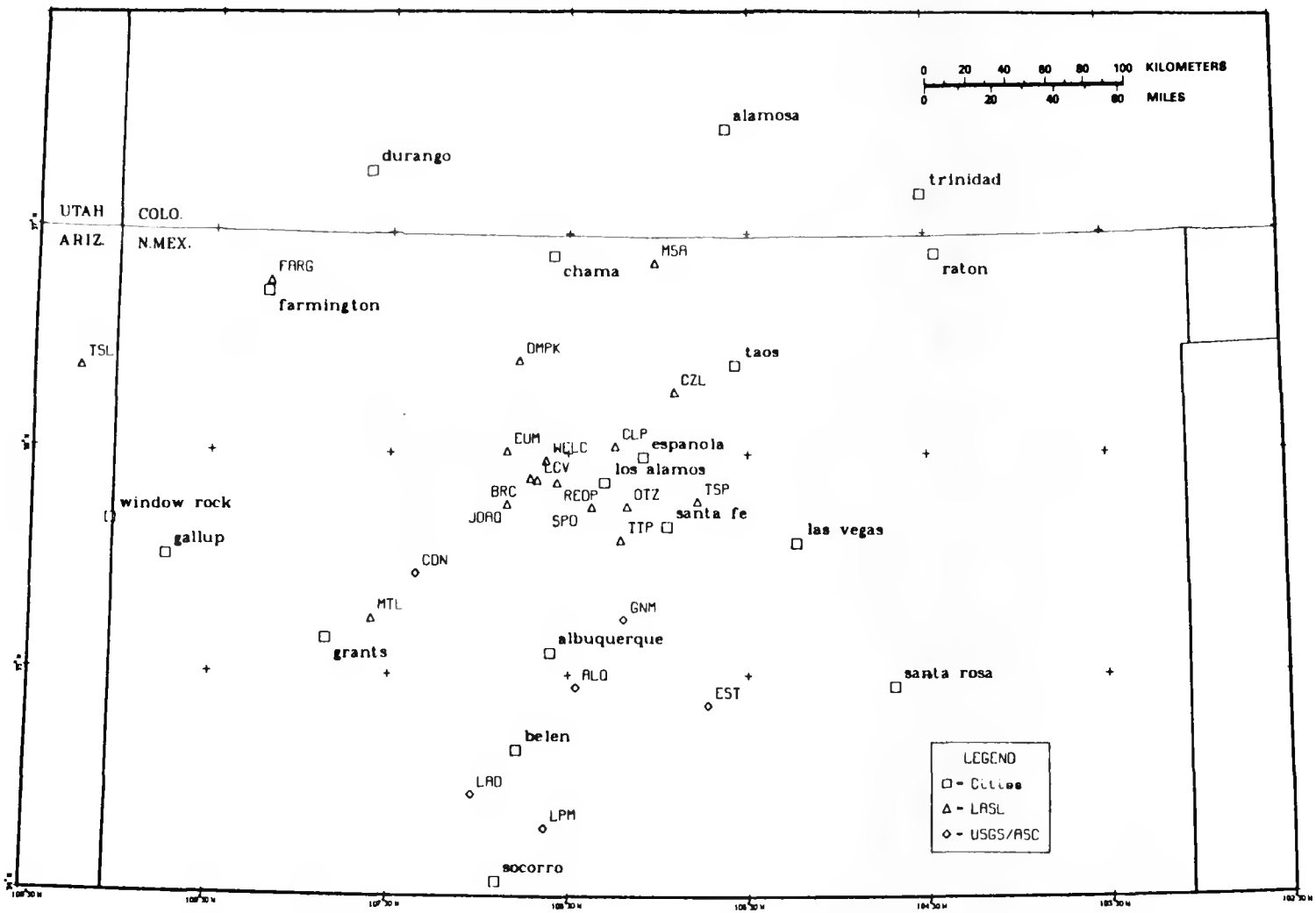

Fig. 1. Northern New Mexico seismograph stations.

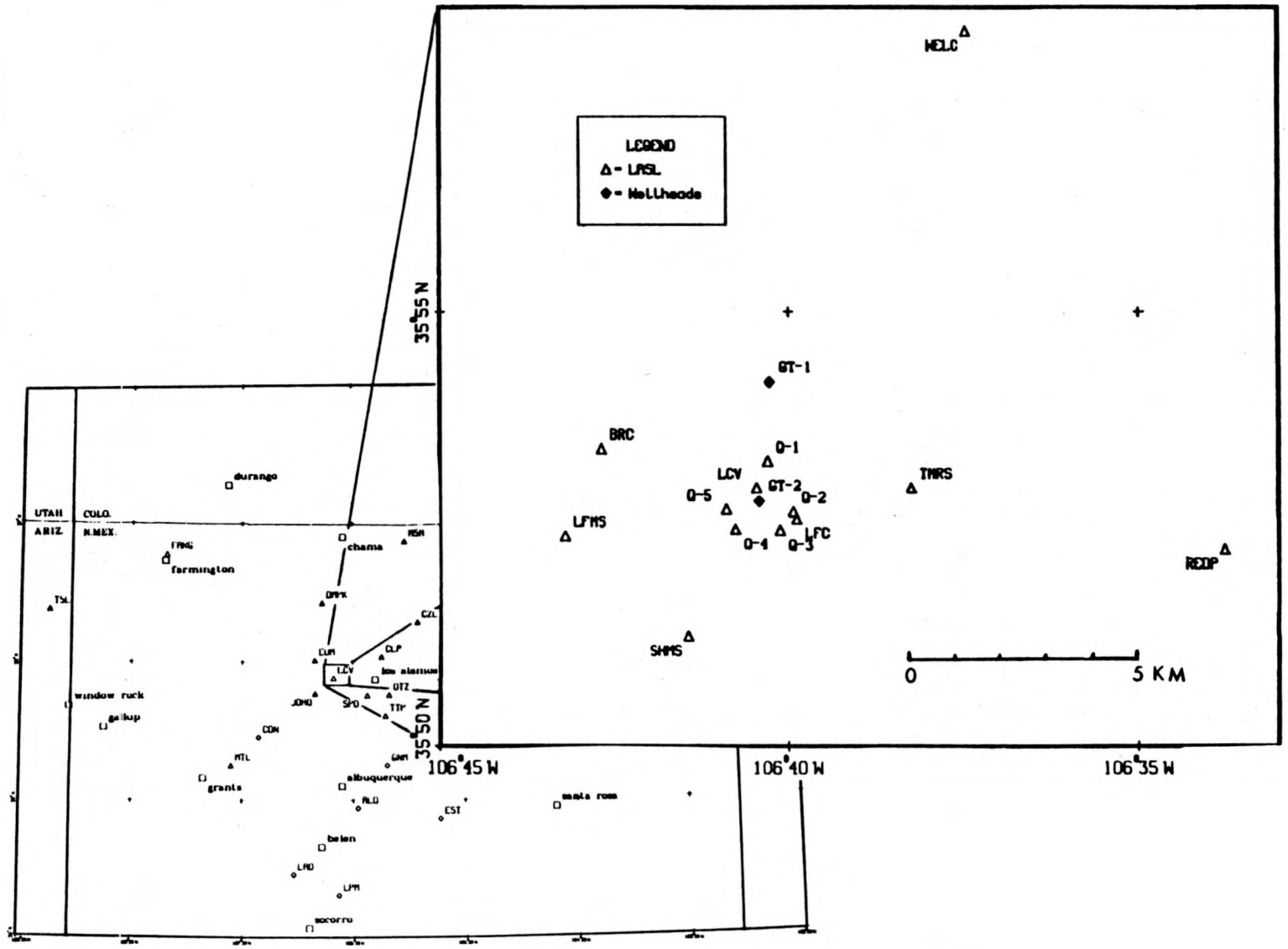

Fig. 2. Seismograph stations in the Fenton Hill, Jemez Mountains, area.

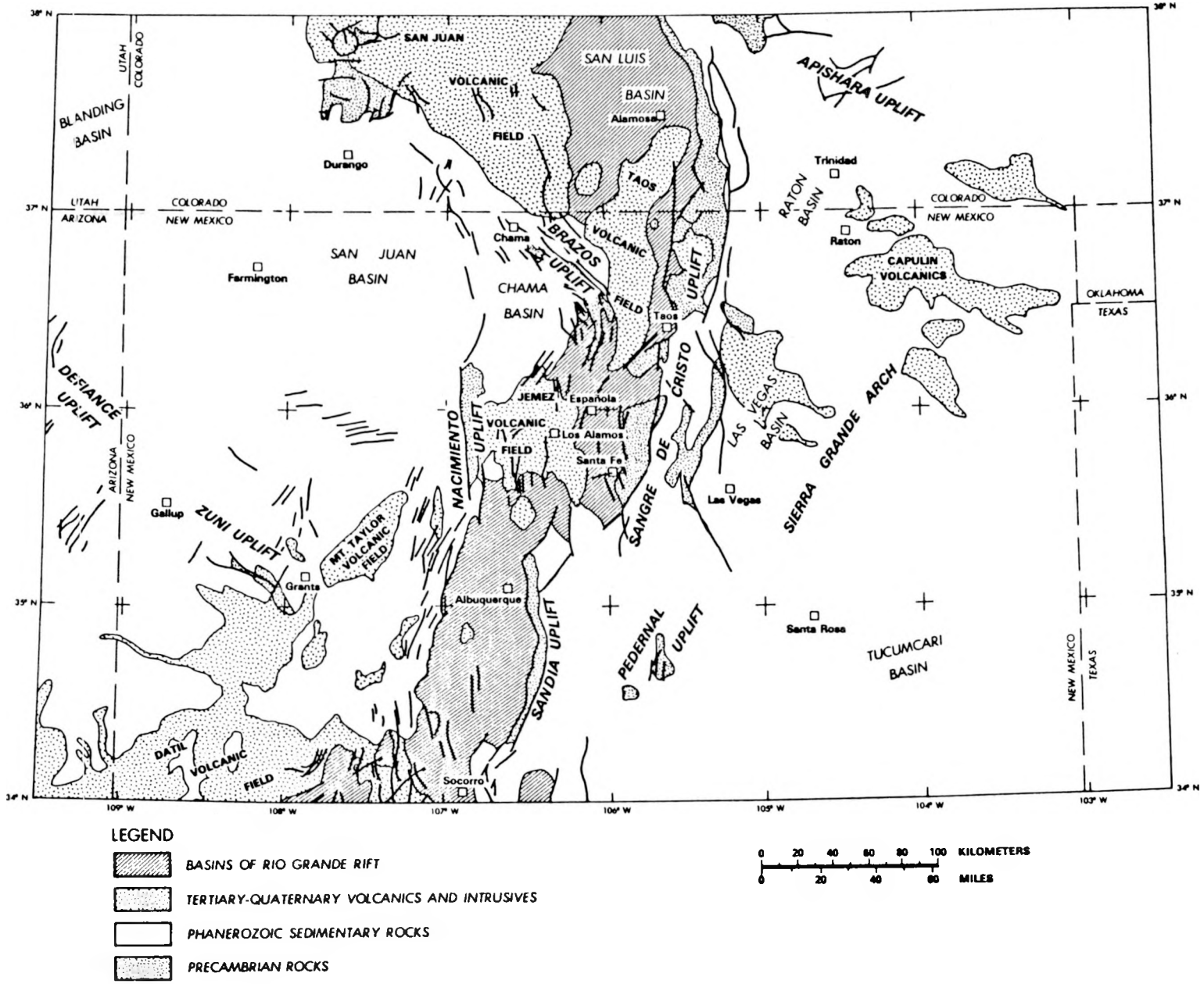

Fig. 4. Generalized geologic and tectonic map of northern New Mexico.