DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF-1388
SHEET 2 OF 2

INTRODUCTION

The earthquake data shown on this map and listed in table 1 are a list of earthquakes that were originally used in a study of seismic risk in the United States (Algermissen,1969). This data file has been recompiled and updated through 1979. Some revisions of epicenters and intensities in the original file have been made, and in addition intensities have been assigned to earthquakes that previously had none assigned. Only earthquakes located within the boundary of the State are listed in table 1 even though earthquakes with epicenters in bordering states or countries may have been felt or caused damage in the state. Intensity values were updated from new and additional data sources that were not available at the time of original compilation. Some epicenters were relocated on the basis of new information. The data shown in table 1 represents best estimates of the epicenter, magnitude, and intensity of each earthquake on the basis of historical and current information. Some of the aftershocks from large earthquakes are listed but aftershock data are incomplete in many instances, especially for ones that occurred before seismic instruments were in universal usage.

The data in table 1 were used to compile the seismicity map. To prepare the seismicity map the latitude and longitude of each epicenter were rounded to the nearest tenth of a degree and the number of events with identical locations were counted. The triangle on the map represent epicenters plotted to the nearest tenth of a degree. The number of earthquakes at each location is shown on the map by the number to the right of the triangle. A Roman numeral to the left of a triangle is the maximum Modified Mercalli intensity (Wood and Neumann, 1931) of all earthquakes located at that geographic position. The absence of an intensity value indicates that no intensities have been assigned to earthquakes at that location. The four digit number shown below each triangle refers the latest year for which the maximum intensity was recorded.

EXPLANATION OF THE TABLES

The data are listed chronologically in table 1 in the following categories: date, origin time, N. latitude, W. longitude, depth, hypocenter quality and referenced data sources, magnitude, and intensity (Modified Mercalli) and intensity source references. Table 1 has some basic limitations in terms of the size (magnitude or intensity) of the earthquakes listed. Prior to 1965 all recorded felt earthquakes are listed, after 1965 only felt earthquakes or those with magnitudes above the 2.5-3.0 range are listed; the lower magnitude levels apply mostly to the Eastern United States. If no magnitude was computed and the earthquake was felt it was included in the earthquake list. The low magnitude events located in recent years with dense seismograph networks have not been included.

Listed below is an explanation of the symbols and codes used in the tables:

1. Leaders (..) indicate information not available.
2. Latitude and longitude are listed to a hundredth of a degree if they have been published with that degree of accuracy, or greater; however, most historical events have been published only to the nearest degree or tenth of a degree and are therefore listed at this accuracy in table 1. An asterisk (*) to the right of the longitude indicates that the latitude and longitude were not given in the source reference, but were assigned by the compilers of the data file. An (x) to the right of the longitude indicates that the event is an explosion, a suspected explosion, rockburst, or a nontectonic event; these have not been plotted on the map.
3. The letter code in the HYPOCENTER, QUAL column is defined below:
   a. Determination of instrumental hypocenters are estimated to be accurate within the ranges of latitude and longitude listed below; each range is letter coded as indicated:
      - A 0.0°-0.1°
      - B 0.1°-0.2°
      - C 0.2°-0.5°
      - D 0.5°-1.0°
      - E 1.0° or larger

   b. Determination of noninstrumental epicenters from felt data are estimated to be accurate within the ranges of latitude and longitude listed below; each range is letter coded as indicated:
      - F 0.0°-0.5°
      - G 0.5°-1.0°
      - H 1.0°-2.0°
      - I 2.0° or larger
4. The reference identification numbers in the HYPOCENTER, REF and INTENSITY, REF columns indicate the sources of the hypocenter and intensity. They are listed in numerical order in table 2.
5. The magnitudes listed under "USGS" are mb values (Gutenberg and Richter, 1956) published in the Preliminary Determination of Epicenters (PDE) by the National Earthquake Information Service, U. S. Geological Survey and predecessor organizations. Associated with the magnitude values listed under "OTHER" are the source code and type. Type is defined by 1 = ML (Richter, 1958), 2 = mbLg (Nuttli, 1973), 3 = MS (Bath, 1966 or Gutenberg, 1945), 4 = mb (Gutenberg and Richter, 1956), and 5 = mbLg modified. The source codes are listed below:
   - GS - National Earthquake Information Service (and predecessor organizations), U. S. Geological Survey, Golden, Colo.
   - NMI - New Mexico Institute of Mining Technology, Socorro, N.M.
   - SLM - St. Louis University, St. Louis, Mo.
   - TUL - Oklahoma Geophysical Observatory, Oklahoma Geological Survey, Leonard, Okla.
6. An asterisk (*) in the INTENSITY, MM column indicates that the intensity was assigned by the compiler on the basis of the available data at the time the catalog was compiled.

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Table 1.--Chronological listing of earthquakes for the State of Texas

DATE YEAR	MONTH	DAY	ORIGIN TIME(UTC) H M S	LAT. (N.)	LONG. (W.)	DEPTH (KM)	HYPOCENTER QUAL	HYPOCENTER REF	MAGNITUDE USGS	MAGNITUDE OTHER	INTENSITY MM	INTENSITY REF
1873	MAY	01	04 30 ..	30.2	97.7	..	G	105	..	.. ..	III*	105
1873	MAY	01	.. .. ..	30.2	97.7	..	G	105	..	.. ..	III*	105
1873	MAY	01	.. .. ..	30.2	97.7	..	G	105	..	.. ..	III*	105
1882	OCT	22	22 15 ..	33.6	95.6	..	H	105	..	.. ..	VII*	105
1891	JAN	08	06 00 ..	31.7	95.2	..	G	171	..	.. ..	VII	38
1891	JAN	08	.. .. ..	31.7	95.2	..	G	38	..	.. ..	III*	38
1907	APR	..	.. .. ..	35.3	101.2 *	..	F	123	..	.. ..	V*	123
1910	MAY	08	17 30 ..	30.1	96.0	..	G	105	..	.. ..	IV	105
1910	MAY	11	.. .. ..	30.1	96.0	..	H	105	..	.. ..	IV	105
1914	DEC	30	01	30.5	95.9 x	..	G	105	..	.. ..	V*	105
1917	JAN	28	19 56 ..	35.4	101.3	..	H	84	..	.. ..	II*	84
1917	MAR	24	19 30 ..	35.3	101.2 *	..	F	123	..	.. ..	VI*	123
1917	MAR	28	19 56 ..	35.3	101.3	..	G	105	..	.. ..	VI	105
1917	MAR	28	23 38 ..	35.3	101.3	..	G	105	..	.. ..	...	..
1923	MAR	07	05 03 ..	31.8	106.5	..	G	105	..	.. ..	IV*	105
1923	MAR	07	.. .. ..	31.8	106.5	..	G	105	..	.. ..	IV*	105
1925	JUL	29	11 30 ..	34.5	101.2	..	G	105	..	.. ..	IV	105
1925	JUL	30	08	34.5	100.3	..	G	173	..	.. ..	V	173
1925	JUL	30	12 17 ..	35.4	101.3	..	G	38	..	.. ..	V	38
1925	JUL	30	12 22 ..	35.4	101.3	..	G	38	..	.. ..	IV*	38
1925	JUL	30	12 27 ..	35.4	101.3	..	G	38	..	.. ..	IV*	38
1931	AUG	16	11 16 55	30.7	104.6 *	..	F	124	..	.. ..	...	..
1931	AUG	16	11 40 21.9	30.69	104.57	029	A	99	..	.. ..	VIII	4
1931	AUG	16	19 33 ..	30.7	104.6 *	..	F	4	..	.. ..	...	..
1931	AUG	18	09 42 ..	30.7	104.6 *	..	F	4	..	.. ..	...	..
1931	AUG	18	20 36 ..	30.7	104.6 *	..	F	4	..	.. ..	V	4
1931	AUG	19	01 36 ..	30.7	104.6 *	..	F	4	..	.. ..	III*	4
1931	AUG	26	.. .. ..	30.7	104.6 *	..	F	124	..	.. ..	III*	124
1931	OCT	02	.. .. ..	31.8	106.5 *	..	G	4	..	.. ..	II*	4
1931	NOV	03	15 50 ..	30.7	104.6 *	..	F	4	..	.. ..	III*	4
1932	APR	09	10 15 ..	31.7	96.4	..	G	38	..	.. ..	VI*	38
1934	APR	11	17 40 ..	33.8	95.5 *	..	G	105	..	.. ..	V	105
1934	APR	11	.. .. ..	33.8	95.5 *	..	G	7	..	.. ..	III*	7
1936	JUN	20	03 14 ..	35.8	101.3	..	C	9	..	.. ..	II*	9
1936	JUN	20	03 18 ..	35.8	101.3	..	C	9	..	.. ..	III*	9
1936	JUN	20	03 24 ..	35.8	101.3	..	G	38	..	.. ..	V	38
1936	AUG	08	01 40 ..	31.8	106.5 *	..	G	9	..	.. ..	II*	9
1936	OCT	15	17	31.8	106.5 *	..	G	9	..	.. ..	II*	9
1937	MAR	31	23 45 ..	31.8	106.5 *	..	G	10	..	.. ..	III*	10
1948	MAR	12	04 29 00	36.0	102.5	..	B	21	..	.. ..	VI	21
1950	MAR	20	13 23 ..	33.3	97.1 *	..	G	23	..	.. ..	IV*	23
1951	JUN	20	19 37 10	35.5	103.0	..	B	24	..	.. ..	VI	24
1952	OCT	17	15 48 ..	30.1	93.8 *	..	G	25	..	.. ..	IV	25
1955	JAN	27	00 37 ..	30.6	104.5 *	..	G	28	..	.. ..	IV	28
1956	JAN	07	.. .. ..	29.3	94.8 *	..	G	29	..	.. ..	IV	29
1957	MAR	19	16 37 38	32.0	95.0 *	..	G	30	..	.. ..	V	30
1957	MAR	19	17 41 17	32.0	95.0 *	..	G	30	..	.. ..	III*	30
1957	MAR	19	22 36 ..	32.0	95.0 *	..	G	30	..	.. ..	III*	30
1957	MAR	19	22 45 ..	32.0	95.0 *	..	G	30	..	.. ..	III*	30
1959	FEB	10	20 05 ..	35.5	100.9	..	G	105	..	.. ..	V	105
1964	APR	24	01 20 55	31.5	93.8	..	B	37	3.7	4.0SLM 2	V	37
1964	APR	24	03 36 18.0	31.3	93.8	..	C	178	..	2.6SLM 2	...	..
1964	APR	24	07 47 18.0	31.3	93.8	..	C	178	..	3.2SLM 2	...	..
1964	APR	24	07 50 56.0	31.3	93.8	..	C	178	..	2.6SLM 2	...	..
1964	APR	24	12 07 07.0	31.3	93.8	..	C	178	..	3.2SLM 2	...	..
1964	APR	24	12 54 17.0	31.3	93.8	..	C	178	..	2.9SLM 2	...	..
1964	APR	24	17 22 13.0	31.3	93.8	..	C	178	..	2.8SLM 2	...	..
1964	APR	24	23 03 50.0	31.3	93.8	..	C	178	..	2.6SLM 2	...	..
1964	APR	25	03 23 08.0	31.3	93.8	..	C	178	..	2.6SLM 2	...	..
1964	APR	25	06 02 33.0	31.3	93.8	..	C	178	..	2.9SLM 2	...	..
1964	APR	26	02 35 24.0	31.3	93.8	..	C	178	..	2.7SLM 2	...	..
1964	APR	26	03 24 50.0	31.3	93.8	..	C	178	..	3.3SLM 2	...	..
1964	APR	27	21 50 27.0	31.3	93.8	..	C	178	..	3.2SLM 2	...	..
1964	APR	28	00 24 07.0	31.3	93.8	..	C	178	..	3.1SLM 2	...	..
1964	APR	28	00 30 45.6	31.5	93.8	..	B	37	3.4	4.3SLM 2	V	37
1964	APR	30	20 30 ..	31.5	93.8 *	..	G	37	..	.. ..	III*	37
1964	MAY	02	06 34 54.0	31.3	93.8	..	C	178	..	3.3SLM 2	...	..
1964	MAY	03	03 24 12.0	31.3	93.8	..	C	178	..	3.0SLM 2	...	..
1964	MAY	07	20 10 ..	31.5	93.8 *	..	G	37	..	3.2SLM 2	III*	37
1964	JUN	02	23 00 ..	31.3	94.0 *	..	G	37	..	.. ..	II*	37
1964	JUN	03	01 30 ..	31.3	94.0 *	..	G	37	4.2	.. ..	IV*	37
1964	JUN	03	02 27 24.2	31.3	94.0	..	B	37	..	3.1SLM 2	IV	37
1964	AUG	16	11 36 ..	31.3	94.0 *	..	G	37	..	2.9SLM 2	V	37
1964	AUG	19	23 58 55.0	31.3	93.8	..	C	178	..	2.7SLM 2	...	..
1964	NOV	08	09 26 00	31.9	103.0	..	B	169	..	2.7NMI 1	...	..
1964	NOV	21	11 21 24	31.9	103.0	..	B	169	..	2.5NMI 1	...	..
1965	FEB	03	19 59 32	31.9	103.0	..	B	169	..	3.0NMI 1	...	..
1965	AUG	30	05 17 30	31.9	103.0	..	B	169	3.5	2.6NMI 1	IV	173
1966	MAR	24	23 45 ..	30.0	94.0 x	..	G	105	..	.. ..	...	..
1966	MAR	24	.. .. ..	30.0	94.0 x	..	G	105	..	.. ..	...	..
1966	JUL	20	09 04 58.2	35.7	101.2	033	B	81	3.9	3.8SLM 2	V	81
1966	AUG	14	15 25 47	31.9	103.0	..	B	169	3.4	2.8NMI 1	VI	81
1966	NOV	26	20 05 41	30.9	105.4	..	B	169	..	2.6NMI 1	...	..
1969	FEB	02	12 49 32.0	33.3	95.8	..	C	178	..	2.8SLM 2	...	..
1969	MAY	12	08 26 18.7	31.80	106.40	019	B	42	..	3.4GS 1	VI	42
1969	MAY	12	08 49 16.3	31.82	106.40	019	B	42	4.3	3.3GS 1	...	..
1969	MAY	12	08 51 ..	31.8	106.4 *	..	G	42	..	.. ..	...	..
1969	MAY	12	10 39 ..	31.8	106.4 *	..	G	42	..	.. ..	...	..
1971	JUL	30	01 45 50.6	31.72	103.00	010	C	74	3.0	3.1NMI 1	III	173
1971	JUL	31	14 53 49.0	31.70	103.06	010	C	74	3.4	3.2NMI 1	IV	173
1971	SEP	24	01 01 54	31.6	103.2	..	B	169	..	3.0NMI 1	...	..
1972	DEC	09	05 58 44.3	31.8	106.5 *	..	G	45	..	.. ..	III*	45
1973	DEC	25	02 46 ..	29.0	98.0 *	..	H	46	..	.. ..	IV	46
1974	FEB	15	13 33 49.2	36.50	100.69	024	A	107	4.5	4.6SLM 2	V	107
1974	DEC	30	08 05 27.1	30.92	103.11	005	B	108	..	3.7GS 1	...	..
1975	AUG	01	07 27 57.3	31.42	104.01	005	B	89	4.8	3.0TUL 2	II	89
1976	JAN	19	04 03 30.5	31.90	103.08	001	A	91	..	3.3GS 1	IV	91
1976	JAN	22	07 21 57.0	31.90	103.07	001	A	91	..	2.8GS 1	III	91
1976	JAN	25	04 48 27.9	31.90	103.08	002	A	91	..	4.1GS 1	V	91
1976	AUG	05	18 53 09	31.57	103.02	..	B	170	..	3.0NMI 1	...	..
1977	APR	26	09 03 07.3	31.90	103.08	004	A	94	..	3.3GS 1	V	94
1977	JUN	07	23 01 20.4	33.06	100.75	005	A	94	..	4.0GS 1	...	..
1977	JUN	17	03 37 05.7	32.35	100.40	005	C	239	..	2.5TUL 2	...	..
1977	SEP	12	02 36 30.1	33.95	95.24	005	C	239	..	2.5TUL 2	...	..
1977	NOV	28	01 40 50.5	32.95	100.84	005	A	92	..	3.5GS 1	...	..
1978	MAR	02	10 04 52.7	31.56	102.51	011	C	240	..	3.5GS 1	III	240
1978	JUN	16	11 46 54.2	33.03	100.77	010	B	240	4.4	4.6SLM 2	V	240
1978	JUN	16	11 53 33.2	33.07	101.19	005	C	239	..	3.4TUL 2	...	..
1979	JUL	05	01 05 01.0	32.95	100.90	004	C	233	..	2.7TUL 2	...	..

Table 2.--List of data sources

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MODIFIED MERCALLI INTENSITY SCALE OF 1931

I. Not felt - or, except rarely under especially favorable circumstances. Under certain conditions, at and outside the boundary of the area in which a great shock is felt: sometimes birds, animals, reported uneasy or disturbed; sometimes dizziness or nausea experienced; sometimes trees, structures, liquids, bodies of water, may sway--doors may swing, very slowly.

II. Felt indoors by few, especially on upper floors, or by sensitive, or nervous persons. Also, as in grade I, but often more noticeably: sometimes hanging objects may swing, especially when delicately suspended; sometimes trees, structures, liquids, bodies of water, may sway, doors may swing, very slowly; sometimes birds, animals, reported uneasy or disturbed; sometimes dizziness or nausea experienced.

III. Felt indoors by several, motion usually rapid vibration. Sometimes not recognized to be an earthquake at first. Duration estimated in some cases. Vibration like that due to passing of light, or lightly loaded trucks, or heavy trucks some distance away. Hanging objects may swing slightly. Movements may be appreciable on upper levels of tall structures. Rocked standing motor cars slightly.

IV. Felt indoors by many, outdoors by few. Awakened few, especially light sleepers. Frightened no one, unless apprehensive from previous experience. Vibration like that due to passing of heavy or heavily loaded trucks. Sensation like heavy body striking building or falling of heavy objects inside. Rattling of dishes, windows, doors; glassware and crockery clink and clash. Creaking of walls, frame, especially in the upper range of this grade. Hanging objects swung, in numerous instances. Disturbed liquids in open vessels slightly. Rocked standing motor cars noticeably.

V. Felt indoors by practically all, outdoors by many or most: outdoors direction estimated. Awakened many, or most. Frightened few--slight excitement, a few ran outdoors. Buildings trembled throughout. Broke dishes, glassware, to some extent. Cracked windows--in some cases, but not generally. Overturned vases, small or unstable objects, in many instances, with occasional fall. Hanging objects, doors, swing generally or considerably. Knocked pictures against walls, or swung them out of place. Opened, or closed, doors, shutters, abruptly. Pendulum clocks stopped, started or ran fast, or slow. Moved small objects, furnishings, the latter to slight extent. Spilled liquids in small amounts from well-filled open containers. Trees, bushes, shaken slightly.

VI. Felt by all, indoors and outdoors. Frightened many, excitement general, some alarm, many ran outdoors. Awakened all. Persons made to move unsteadily. Trees, bushes, shaken slightly to moderately. Liquid set in strong motion. Small bells rang--church, chapel, school, etc. Damage slight in poorly built buildings. Fall of plaster in small amount. Cracked plaster somewhat, especially fine cracks chimneys in some instances. Broke dishes, glassware, in considerable quantity, also some windows. Fall of knick-knacks, books, pictures. Overturned furniture in many instances. Moved furnishings of moderately heavy kind.

VII. Frightened all--general alarm, all ran outdoors. Some, or many, found it difficult to stand. Noticed by persons driving motor cars. Trees and bushes shaken moderately to strongly. Waves on ponds, lakes, and running water. Water turbid from mud stirred up. Incaving to some extent of sand or gravel stream banks. Rang large church bells, etc. Suspended objects made to quiver. Damage negligible in buildings of good design and construction, slight to moderate in well-built ordinary buildings, considerable in poorly built or badly designed buildings, adobe houses, old walls (especially where laid up without mortar), spires, etc. Cracked chimneys to considerable extent, walls to some extent. Fall of plaster in considerable to large amount, also some stucco. Broke numerous windows, furniture to some extent. Shook down loosened brickwork and tiles. Broke weak chimneys at the roof-line (sometimes damaging roofs). Fall of cornices from towers and high buildings. Dislodged bricks and stones. Overturned heavy furniture, with damage from breaking. Damage considerable to concrete irrigation ditches.

VIII. Fright general--alarm approaches panic. Disturbed persons driving motor cars. Trees shaken strongly--branches, trunks, broken off, especially palm trees. Ejected sand and mud in small amounts. Changes: temporary, permanent; in flow of springs and wells; dry wells renewed flow; in temperature of spring and well waters. Damage slight in structures (brick) built especially to withstand earthquakes. Considerable in ordinary substantial buildings, partial collapse: racked, tumbled down, wooden houses in some cases; threw out panel walls in frame structures, broke off decayed piling. Fall of walls. Cracked, broke, solid stone walls seriously. Wet ground to some extent, also ground on steep slopes. Twisting, fall, of chimneys, columns, monuments, also factory stacks, towers. Moved conspicuously, overturned, very heavy furniture.

IX. Panic general. Cracked ground conspicuously. Damage considerable in (masonry) structures built especially to withstand earthquakes: Threw out of plumb some wood-frame houses built especially to withstand earthquakes; great in substantial (masonry) buildings, some collapse in large part; or wholly shifted frame buildings off foundations, racked frames; serious to reservoirs; underground pipes sometimes broken.

X. Cracked ground, especially when loose and wet, up to widths of several inches; fissures up to a yard in width ran parallel to canal and stream banks. Landslides considerable from river banks and steep coasts. Shifted sand and mud horizontally on beaches and flat land. Changed level of water in wells. Threw water on banks of canals, lakes, rivers, etc. Damage serious to dams, dikes, embankments. Severe to well-built wooden structures and bridges, some destroyed. Developed dangerous cracks in excellent brick walls. Destroyed most masonry and frame structures, also their foundations. Bent railroad rails slightly. Tore apart, or crushed endwise, pipe lines buried in earth. Open cracks and broad wavy folds in cement pavements and asphalt road surfaces.

XI. Disturbances in ground many and widespread, varying with ground material. Broad fissures, earth slumps, and land slips in soft, wet ground. Ejected water in large amounts charged with sand and mud. Caused sea-waves ("tidal" waves) of significant magnitude. Damage severe to wood-frame structures, especially near shock centers. Great to dams, dikes, embankments often for long distances. Few, if any (masonry) structures remained standing. Destroyed large well-built bridges by the wrecking of supporting piers, or pillars. Affected yielding wooden bridges less. Bent railroad rails greatly, and thrust them endwise. Put pipe lines buried in earth completely out of service.

XII. Damage total--practically all works of construction damaged greatly or destroyed. Disturbances in ground great and varied, numerous shearing cracks. Landslides, falls of rock of significant character, slumping of river banks, etc., numerous and extensive. Wrenched loose, tore off, large rock masses. Fault slips in firm rock, with notable horizontal and vertical offset displacements. Water channels, surface and underground, disturbed and modified greatly. Dammed lakes, produced waterfalls, deflected rivers, etc. Waves seen on ground surfaces (actually seen, probably, in some cases). Distorted lines of sight and level. Threw objects upward into the air.

SEISMICITY MAP OF THE STATE OF TEXAS

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