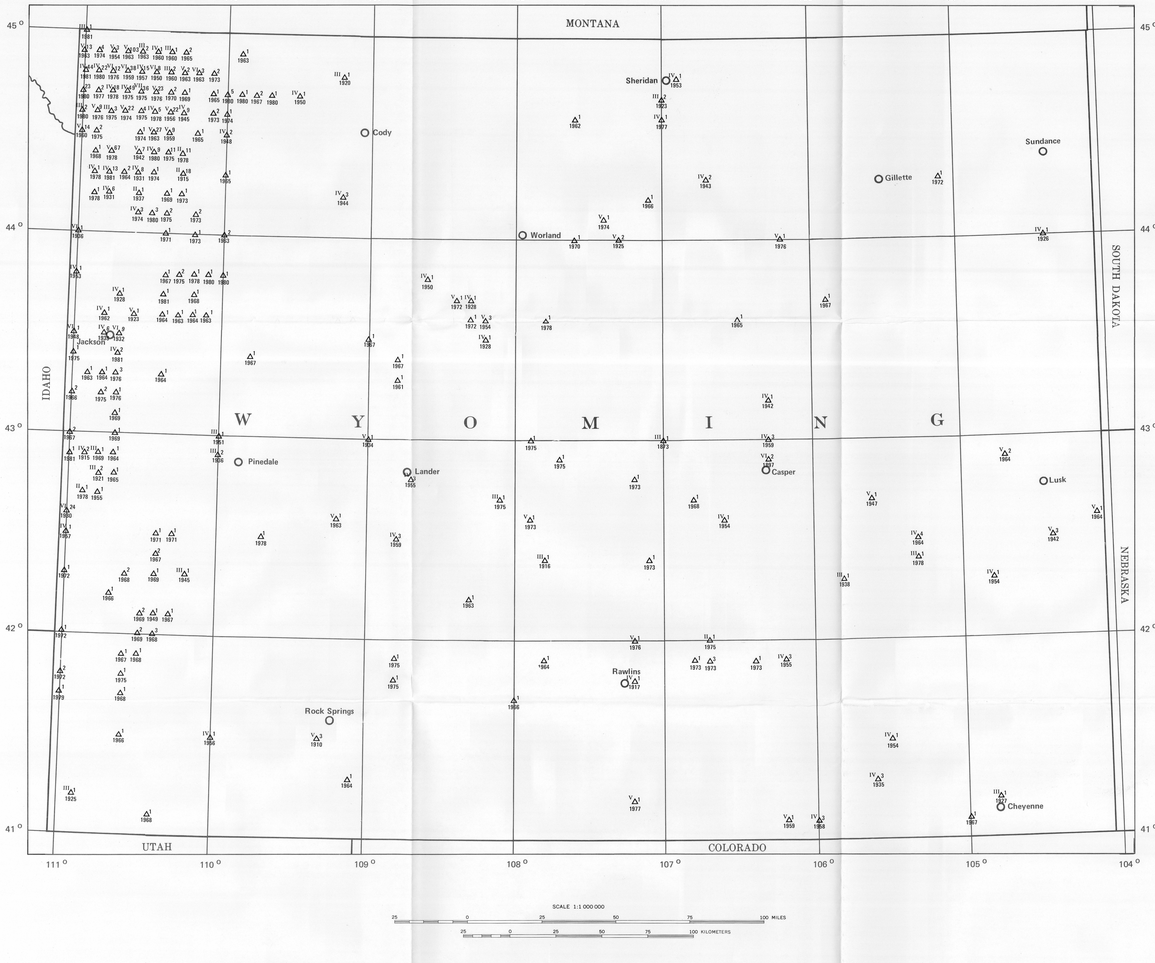

SCALE 1:1 000 000

SEISMICITY MAP OF THE STATE OF WYOMING

By

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INTRODUCTION

The data shown on this map and listed in table 1 are for earthquakes that were originally included in a study of seismic risk in the United States (Algermissen, 1969). This data file has been recompiled and updated through 1981. Some revisions of epicenters and intensities in the original file have been made, and intensities have been assigned to earthquakes that previously had none assigned. Only earthquakes that had epicenters within the boundary of the state are listed in table 1, even though earthquakes that had epicenters in bordering states or countries may have been felt or may have caused damage in the state. Intensity values were updated from data sources listed in table 2. Some of the epicenters and intensities in the original file were recalculated on the basis of new information. The data shown in table 1 represent 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 not all, especially for the earthquakes that occurred before seismic instruments were universally used.

The data in table 1 were used to compile the seismicity map. The latitude and longitude coordinates of each epicenter were rounded to the nearest tenth of a degree, and the number of earthquakes that occurred within each tenth-degree square was counted. 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 (MM) intensity (Wood and Neumann, 1931) of all earthquakes at that geographic location. 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 is 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 in Coordinated Universal Time (UTC), latitude, N. longitude, degrees, hypocenter quality and referenced data sources, magnitude, and intensity (Modified Mercalli) and intensity source reference. The letter F is recorded in the intensity column if an earthquake was felt but not enough information was available to assign an intensity. Table 1 has some basic limitations in terms of the size (magnitude or intensity) of the earthquakes listed. All felt earthquakes or those with computed magnitudes greater than or equal to 3.0 are considered to be completely listed. The quake was felt or an epicenter published it was included in the earthquake list. The low-magnitude events located in recent years with data from dense seismograph networks have not been included.

Listed below is an explanation of the symbols and codes used in table 1:

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 assigned locations based on felt or damage information and are listed in table 1 only to the nearest degree or tenth of a degree. 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, a rockburst, or a nontectonic event; these have not been plotted on the map. A question mark (?) to the right of the longitude indicates that published descriptions of the event are inconclusive and it may or may not be an earthquake.
3. The letter D in the DEPTH (KM) column indicates a deep event.
4. Determinations 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	0.2°–0.4°
C	0.5°–0.7°
D	0.8°–1.0°
E	1.0° or larger

4. The reference identification numbers in the HYPOCENTER, REF and INTENSITY, REF columns indicate the sources of the hypocenters and intensity data. They are listed in numerical order in table 2.
5. The magnitudes listed under USGS are wh values (Gutenberg and Richter, 1956) published in "Preliminary Determination of Epicenters" 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 $l = \log(\text{Wiechert}, 1908)$, $z = \text{wlg}$ (Nuttli, 1973), $b = \text{mb}$ (Bath, 1966 or Gutenberg, 1945), $s = \text{mb}$ (Gutenberg and Richter, 1956), $3 = \text{mlg}$ (Richter, 1958), $w = \text{Mw}$ (Kanamori, 1977), and $g = \text{Ms}$ (Richter, 1958). Magnitudes based on areas or attenuation of intensities (Bakun and Lindh, 1977) computed solely from epicentral intensity have not been included. The source codes are listed below:

BRK	Seismograph Station, University of California, Berkeley, Calif.
ERD	Department of Energy (formerly U.S. Energy Research and Development Administration and Atomic Energy Commission).
GS	National Earthquake Information Service (and predecessor organizations), U. S. Geological Survey, Golden, Colo.
MWT	Mackin, Woodward, Tibbetts, Seismology and Technology, Butte, Mt.
NSO	University of Nevada, Mina, Nev.
PAS	Seismological Laboratory, California Institute of Technology, Pasadena, Calif.
USG	U. S. Geological Survey, Menlo Park, Calif.
UU	University of Utah, Salt Lake City, Utah.

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.

MODIFIED MERCALLI INTENSITY SCALE OF 1931

Adapted from Sieberg's Mercalli-Cancani scale,
modified and condensed (Wood and Neumann, 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–very rarely, very slightly.

II. Felt indoors by few, especially on upper floors, or by sensitive, or nervous persons. Also, when delicately suspended: 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 few, unless apprehensive from previous experience. Vibration like that due to passing of heavy or loaded trucks. Sensation like heavy body striking building or falling of heavy object inside. Rattling of dishes, windows, doors; glassware and crockery clink and clash. Creaking of walls, suddenly conspicuous, especially in the upper range of this grade. Hanging objects swing, in numerous instances. Disturbed liquids in open vessels slightly shaken. Standing motor cars rocked 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. Decidedly disturbed in the earthquake zone. The broke dishes, glassware, to some extent. Cracked windows–in some cases, but not generally. Overturned vases, small or medium 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 changed rate. Pictures knocked askew. Small furnishings or ornaments unstable in slight extent. Spilled liquids in small amounts from well-filled 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 moderately to strongly, noticeably so in a suspected set in strong motion. Small bells rang–church, chapel, school, etc. Damage slight in poorly built buildings. Fall of plaster in small amounts. Cracked plaster–numerous especially fine cracks–occurs 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–big waves. Water turbid from mud. Shock felt, perceptible extent of area of great stress beaks. 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 bricks, stones, tiles, also cornices (also unbraced parapets and architectural ornaments). Fall of cornices from towers and buildings. Cracked boilers, fire walls, bricks and stones. Overturned heavy furniture, with damage from breaking. Damage considerable in cheap structures.

VIII. Fright general–alarm approaches panic. Disturbed persons driving motor cars. Trees shaken strongly–branches, trunks, broken off, especially palm trees. Sand and mud ejected in small amounts. Changes in well-water, persons: of flow of springs and wells; dry wells renewed flow; temporary, permanent, or change in flow. Waves on ponds, lakes, and running water–big waves, following ripples. Water turbid from mud. Shock felt, perceptible extent of area of great stress. Slight alarm ringing 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 bricks, stones, tiles, also cornices (also unbraced parapets and architectural ornaments). Fall of cornices from towers and buildings. Cracked boilers, fire walls, bricks and stones. Disturbed brick chimneys. Overturned heavy furniture, with damage from breaking. Damage considerable in cheap structures.

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 1 yard in width ejected on 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. Best railroad rails slightly. Torn apart, or crushed endwise, pipe lines buried in earth. Open cracks and broad slides 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. Put railroad lines completely out of service. 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. Lakes dammed, waterfalls formed, rivers deflected, 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.

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SEISMICITY TABLE

Table 1.—Chronological listing of earthquakes for the State of Wyoming

DATE YEAR	MONTH	DAY	ORIGIN TIME(UTC) H	M	S	LAT.	LONG.	DEPTH (KM)	HYPOCENTER QUAL.	HYPOCENTER REF	MAGNITUDE USGS	MAGNITUDE OTHER	INTENSITY MM	INTENSITY REF
1871	...	...	...	...	...	44.5	N. 110.5 W.	..	E	249	..	..	..	F 249
1873	DEC	10	...	...	...	43.0	N. 107.0 W.	*	E	84	..	..	III*	133
1896	JUN	14	...	...	...	43.5	N. 106.3 W.	*	E	38	..	..	..	38
1897	NOV	14	...	...	...	43.5	N. 106.3 W.	*	E	38	..	..	..	38
1898	JAN	13	...	...	...	41.3	N. 105.6 W.	*	E	285	..	..	III*	285
1906	OCT	06	00	20	...	43.5	N. 110.8 W.	*	G	84	..	..	IV	84
1909	JUL	30	07	30	...	42.9	N. 106.3 W.	*	G	272	..	..	III*	272
1915	MAR	31	18	30	...	42.9	N. 106.9 W.	*	G	272	..	..	III*	272
1915	MAY	08	16	10	...	44.9	N. 110.7 W.	*	G	38	..	..	V	38
1915	OCT	02	03	00	...	43.5	N. 110.8 W.	*	G	272	..	..	III*	272
1916	AUG	12	04	...	...	42.4	N. 107.8 W.	..	G	272	..	..	III*	272
1917	MAR	31	04	...	...	41.8	N. 106.2 W.	..	G	272	..	..	III*	272
1920	FEB	02	00	45	...	44.8	N. 109.2 W.	..	G	272	..	..	III*	272
1921	DEC	26	21	30	...	44.8	N. 110.8 W.	..	G	272	..	..	III*	272
1922	OCT	23	02	30	...	44.3	N. 106.7 W.	..	G	272	..	..	II*	272
1922	NOV	29	13	15	...	43.0	N. 106.3 W.	..	G	272	..	..	III*	272
1923	JAN	17	20	02	...	44.7	N. 107.0 W.	..	G	272	..	..	III*	272
1923	JAN	30	09	18	...	44.7	N. 107.0 W.	..	G	272	..	..	III*	272
1923	MAR	02	08	30	...	44.4	N. 110.8 W.	..	G	38	..	..	IV	38
1923	DEC	12	17	55	...	42.5	N. 108.8 W.	..	G	272	..	..	IV*	272
1924	JUL	20	14	15	...	44.5	N. 110.5 W.	*	G	218	..	..	..	218
1924	SEP	30	10	45	...	44.5	N. 110.5 W.	*	G	218	..	..	III*	218
1925	OCT	30	10	45	...	44.5	N. 110.5 W.	*	G	218	..	..	III*	218
1925	NOV	06	16	16	...	44.5	N. 110.5 W.	*	G	218	..	..	III*	218
1925	NOV	18	01	45	...	44.5	N. 107.3 W.	*	G	280	..	..	III*	218
1925	NOV	18	23	...	...	44.0	N. 107.3 W.	*	F	218	..	..	F	218
1925	DEC	01	08	04	...	44.5	N. 110.9 W.	*	F	218	..	..	III*	218
1926	MAY	01	...	...	...	44.0	N. 104.4 W.	..	G	105	..	..	IV	105
1926	DEC	31	23	30	...	44.0	N. 110.0 W.	..	G	218	..	..	III*	218
1927	MAR	24	21	10	...	41.2	N. 104.8 W.	..	G	105	..	..	III*	105
1928	FEB	13	12	00	...	44.0	N. 110.0 W.	..	G	218	..	..	III*	218
1928	MAR	31	15	16	...	43.7	N. 110.7 W.	..	G	1	..	..	IV*	1
1929	JUN	12	09	03	...	43.7	N. 110.7 W.	..	G	1	..	..	IV*	1
1930	JUN	12	09	03	...	43.7	N. 110.7 W.	..	G	3	..	..	IV*	3
1930	JUN	12	09	25	...	42.6	N. 111.0 W.	..	G	3	..	..	IV*	3
1930	JUN	12	09	40	...	42.6	N. 111.0 W.	..	G	3	..	..	IV*	3
1930	JUN	12	10	00	...	42.6	N. 111.0 W.	..	G	3	..	..	IV*	3
1930	JUN	12	17	45	...	42.6	N. 111.0 W.	..	G	3	..	..	IV*	3
1930	JUN	12	17	45	...	42.6	N. 111.0 W.	..	G	3	..	..	IV*	3
1930	JUN	13	12	30	...	42.6	N. 111.0 W.	..	G	3	..	..	III*	3
1930	JUN	13	14	17	...	42.6	N. 111.0 W.	..	G	3	..	..	III*	3
1930	JUN	14	07	00	...	42.6	N. 111.0 W.	..	G	3	..	..	III*	3
1930	JUN	15	04	45	...	42.6	N. 111.0 W.	..	G	3	..	..	III*	3
1930	JUN	16	08	50	...	42.6	N. 111.0 W.	*	G	3	..	..	III*	3
1930	JUN	16	11	00	...	42.6	N. 111.0 W.	*	G	3	..	..	III*	3
1930	JUN	16	11	40	...	42.6	N. 111.0 W.	*	G	3	..	..	III*	3
1930	JUN	16	19	33	...	42.6	N. 111.0 W.	*	G	3	..	..	III*	3
1930	AUG	23	02	40	...	44.5	N. 110.5 W.	..	G	3	..	..	V*	36
1930	AUG	25	14	45	...	44.5	N. 110.6 W.	*	G	3	..	..	II	249
1930	AUG	26	11	00	...	44.5	N. 110.8 W.	*	G	3	..	..	III	249
1930	AUG	27	11	45	...	44.3	N. 110.6 W.	*	G	4	..	..	III	249
1930	AUG	28	00	00	...	44.4	N. 110.8 W.	*	G	3	..	..	III*	3
1930	SEP	07	03	30	...	42.9	N. 110.7 W.	*	G	3	..	..	III*	3
1930	SEP	16	03	10	...	44.8	N. 110.7 W.	*	G	3	..	..	III*	3
1930	SEP	20	11	00	...	42.6	N. 111.0 W.	*	G	3	..	..	III*	3
1930	SEP	21	...	...	...	42.6	N. 111.0 W.	*	G	3	..	..	III*	3
1930	SEP	21	21	00	...	42.6	N. 111.0 W.	*	G	3	..	..	III*	3
1930	NOV	16	...	...	...	42.6	N. 111.0 W.	*	G	3	..	..	III*	3
1930	DEC	22	16	13	...	44.4	N. 110.8 W.	*	G	3	..	..	IV*	3
1931	AUG	25	02	40	...	44.2	N. 110.8 W.	*	G	4	..	..	IV*	4
1931	AUG	26	11	00	...	44.3	N. 110.8 W.	*	G	4	..	..	IV*	4
1931	AUG	27	11	45	...	44.3	N. 110.6 W.	*	G	4	..	..	III	249
1931	SEP	21	05	15	...	41.3	N. 105.8 W.	*	G	279	..	..	IV*	279
1931	SEP	21	05	30	...	41.3	N. 105.8 W.	*	G	279	..	..	IV*	279
1931	SEP	22	13	13	...	41.3	N. 105.7 W.	*	G	279	..	..	III*	279
1932	JAN	27	08	00	...	43.5	N. 110.7 W.	*	F	5	..	..	III*	5
1932	JAN	28	01	00	...	43.5	N. 110.7 W.	*	F	279	..	..	III*	279
1932	JAN	28	08	...	...	43.5	N. 110.7 W.	*	F	279	..	..	III*	279
1932	JAN	28	21	30	...	43.5	N. 110.7 W.	*	F	279	..	..	III*	279
1932	JAN	29	01	...	...	43.5	N. 110.7 W.	*	F	279	..	..	IV*	279
1932	JUN	08	21	30	...	44.5	N. 110.5 W.	*	G	7	..	..	IV	7
1934	MAR	13	09	13	...	44.5	N. 110.5 W.	*	G	7	..	..	IV	7
1934	AUG	23	03	30	...	44.5	N. 110.5 W.	*	G	7	..	..	IV	7
1935	NOV	11	03	42	...	41.3	N. 105.6 W.	*	G	8	..	..	IV*	8
1936	JAN	15	06	40	...	44.0	N. 111.0 W.	*	G	38	..	..	VI	38
1936	JUN	28	04	27	...	44.6	N. 110.4 W.	*	G	10	..	..	IV*	10
1936	OCT	03	21	34	...	44.4	N. 110.8 W.	*	G	10	..	..	III*	9
1937	APR	27	22	34	...	44.4	N. 110.8 W.	*	G	10	..	..	III*	10
1937	AUG	10	07	30	...	44.4	N. 110.8 W.	*	G	10	..	..	III*	10
1937	SEP	16	04