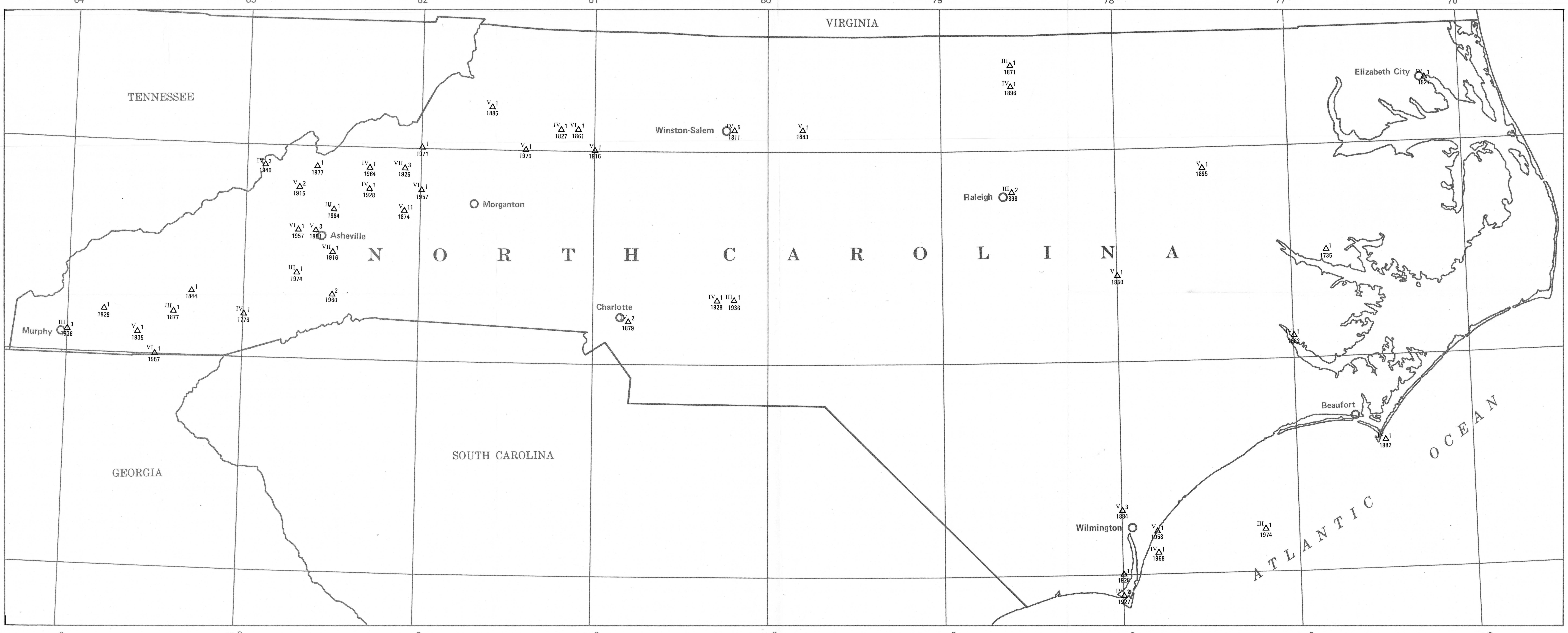

SCALE 1:1 000 000

25 0 25 50 75 100 MILES

25 0 25 50 75 100 KILOMETERS

INTRODUCTION

The earthquake data shown on this map and listed in table 1 are a list of earthquakes that were originally used in preparing the Seismic Risk Studies in the United States (Algermissen, 1969) which have been recompiled and updated through 1977. These data have been reexamined which resulted in some revisions of epicenters and intensities as well as assignment of intensities to earthquakes that previously had none assigned. 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 are estimates of the most accurate 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 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. The latitude and longitude were rounded to the nearest tenth of a degree and sorted so that all identical locations were grouped together and counted. A triangle represents the epicenter plotted to a 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. A year shown below a 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, 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), 4 = mb (Gutenberg and Richter, 1956), and 5 = mbLg modified. The source codes are listed below:
   - BLA - Virginia Polytechnic Institute and State University, Blacksburg, Va.
   - GB - Bollinger, 1979, Seismological Society of America Bulletin, v. 69, no. 1, p. 45-63.
   - JLM - Jones, Long, and McKee, 1977, Seismological Society of America Bulletin, v. 67, no. 6, p. 1503-1513.
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 North Carolina

DATE YEAR	MONTH	DAY	ORIGIN TIME(UTC) H	M	S	LAT. (N.)	LONG. (W.)	DEPTH (KM)	HYPOCENTER QUAL	REF	MAGNITUDE USGS	OTHER	INTENSITY MM	REF
1735	MAR	08	..	..	..	35.5	76.8 *	..	G	165	..	.. ..	...	..
1776	NOV	05	..	..	..	35.2	83.0 *	..	G	71	..	.. ..	IV*	71
1787	NOV	09	..	..	..	36.1	80.2 *	..	G	71	..	.. ..	III*	71
1792	AUG	12	02	..	..	36.1	80.2 x	..	I	71	..	.. ..	...	..
1808	DEC	13	10	30	..	35.8	78.6 *	..	G	156	..	.. ..	III*	156
1811	NOV	27	08	..	..	36.1	80.2 *	..	G	71	..	.. ..	IV*	71
1823	AUG	23	..	..	..	36.1	80.2 *	..	G	71	..	.. ..	III*	71
1826	NOV	11	..	..	..	36.1	80.2 *	..	G	71	..	.. ..	III*	71
1827	MAY	11	..	..	..	36.1	81.2 *	..	G	156	..	.. ..	IV*	156
1829	...	..	..	..	..	35.2	83.8	..	G	71	..	.. ..	...	..
1834	NOV	29	..	..	..	36.1	80.2 *	..	G	71	..	.. ..	III*	71
1844	JUN	..	..	..	..	35.3	83.3 *	..	G	71	..	.. ..	...	..
1848	...	..	..	..	..	35.7	82.1 *	..	G	165	..	.. ..	...	..
1850	MAR	30	15	..	..	35.4	78.0 *	..	G	156	..	.. ..	V*	156
1851	AUG	11	01	55	..	35.6	82.6 *	..	G	156	..	.. ..	V*	156
1861	AUG	31	10	22	..	36.1	81.1 *	..	G	55	..	.. ..	VI	38
1871	APR	16	05	..	..	34.3	78.0 *	..	G	156	..	.. ..	V*	156
1871	APR	21	02	..	..	36.4	78.6 *	..	G	156	..	.. ..	III*	156
1874	FEB	10	..	..	..	35.7	82.1	..	G	71	..	.. ..	V	38
1874	FEB	22	..	..	..	35.7	82.1	..	G	71	..	.. ..	IV*	71
1874	MAR	17	..	..	..	35.7	82.1	..	G	71	..	.. ..	IV*	71
1874	MAR	26	..	..	..	35.7	82.1	..	G	71	..	.. ..	IV*	71
1874	APR	14	..	..	..	35.7	82.1	..	G	71	..	.. ..	IV*	71
1874	APR	17	..	..	..	35.7	82.1	..	G	71	..	.. ..	IV*	71
1876	JAN	23	..	..	..	35.7	82.1 *	..	G	165	..	.. ..	...	..
1877	APR	26	22	00	..	35.2	83.4	..	G	103	..	.. ..	III*	71
1877	OCT	09	01	..	..	35.0	82.7 x	..	G	156	..	.. ..	...	..
1878	NOV	23	15	00	..	35.1	84.0 *	..	G	71	..	.. ..	III*	71
1879	DEC	13	00	..	..	35.2	80.8 *	..	G	71	..	.. ..	III*	71
1879	DEC	13	07	..	..	35.2	80.8 *	..	G	71	..	.. ..	IV*	71
1880	JAN	28	..	..	..	35.7	82.1 *	..	G	71	..	.. ..	III*	71
1880	JAN	29	..	..	..	35.7	82.1 *	..	G	71	..	.. ..	III*	71
1880	FEB	10	..	..	..	35.7	82.1 *	..	G	71	..	.. ..	III*	71
1882	JAN	08	22	10	..	34.6	76.5	..	G	103	..	.. ..	IV*	71
1882	OCT	15	17	30	..	35.1	84.0	..	G	103	..	.. ..	III*	71
1882	OCT	23	12	00	..	35.1	77.0 *	..	G	71	..	.. ..	IV*	71
1883	SEP	21	11	45	..	36.1	79.8	..	G	103	..	.. ..	V*	71
1884	JAN	18	13	..	..	34.3	78.0	..	G	103	..	.. ..	V	103
1884	JAN	18	13	02	..	34.3	78.0	..	G	71	..	.. ..	V*	71
1884	APR	30	11	46	..	35.1	84.1 x	..	G	71	..	.. ..	I*	66
1884	JUL	..	..	..	..	35.7	82.5	..	G	71	..	.. ..	III*	71
1885	AUG	06	13	00	..	36.2	81.6	..	G	71	..	.. ..	V*	71
1895	OCT	07	04	30	..	35.9	77.5 *	..	G	156	..	.. ..	V*	156
1896	FEB	11	01	45	..	36.3	78.6 *	..	G	71	..	.. ..	IV*	71
1898	FEB	11	04	30	..	35.8	78.6 *	..	G	71	..	.. ..	III*	71
1915	OCT	29	05	23	..	35.8	82.7	..	G	71	..	.. ..	IV*	71
1915	OCT	29	05	25	..	35.8	82.7	..	G	71	..	.. ..	V	67
1916	FEB	21	22	39	..	35.5	82.5	..	G	71	..	.. ..	VII	67
1916	AUG	26	19	36	..	36.0	81.0	..	G	71	..	.. ..	V	71
1920	JAN	22	..	..	..	36.4	80.3 x	..	G	71	..	.. ..	...	..
1923	OCT	18	19	30	..	35.3	82.5	..	G	128	..	.. ..	...	..
1926	JUL	08	09	50	..	35.9	82.1	..	G	71	..	.. ..	VII	68
1927	OCT	27	..	..	..	36.3	76.2 *	..	G	71	..	.. ..	IV*	71
1927	NOV	23	00	50	..	33.9	78.0 *	..	G	71	..	.. ..	IV*	71
1928	NOV	20	03	45	..	35.8	82.3	..	F	1	..	.. ..	IV	68
1928	NOV	22	..	..	..	34.0	78.0	..	G	71	..	.. ..	...	..
1928	DEC	23	02	30	..	35.3	80.3	..	G	71	..	.. ..	IV*	71
1935	JAN	01	08	15	..	35.1	83.6	..	C	38	..	.. ..	V	68
1936	JAN	01	08	..	..	35.1	84.0 *	..	G	71	..	.. ..	III	71
1936	SEP	06	..	..	..	35.3	80.2 *	..	G	71	..	.. ..	III*	71
1940	DEC	25	01	30	..	35.9	82.9	..	G	103	..	.. ..	III	13
1940	DEC	25	06	50	..	35.9	82.9	..	H	103	..	.. ..	IV	105
1940	DEC	26	..	..	..	35.9	82.9	..	H	103	..	.. ..	III	103
1941	MAY	10	11	12	..	35.6	82.6	..	G	103	..	.. ..	IV*	71
1957	MAY	13	14	24	58	35.8	82.0	018	G	30	..	.. ..	VI	132
1957	JUL	02	09	33	01	35.6	82.7	007	G	155	..	.. ..	VI	132
1957	NOV	24	20	06	17	35.0	83.5	..	C	30	..	.. ..	VI	132
1958	MAR	05	11	53	43	34.2	77.8	..	G	103	..	.. ..	V	103
1958	MAY	16	22	30	..	35.6	82.6	..	G	103	..	.. ..	IV	132
1960	JAN	03	07	30	..	35.9	82.1 *	..	G	132	..	.. ..	IV	132
1960	JAN	04	..	..	..	35.9	82.1 *	..	G	132	..	.. ..	II*	132
1960	FEB	09	14	00	06.0	35.3	82.5	..	G	103	..	.. ..	...	..
1964	JAN	20	13	37	52.0	35.9	82.3 *	..	G	37	..	.. ..	IV	132
1968	NOV	26	01	..	..	34.1	77.8 *	..	G	41	..	.. ..	IV	41
1970	SEP	10	01	41	05.2	36.02	81.42	001	A	201	..	3.1GB 2	V	132
1971	MAY	29	21	21	..	36.0	82.0	..	D	203	..	2.9JLM 5	...	..
1974	...	..	..	..	..	33.9	78.0 *	..	H	47	..	.. ..	II*	47
1974	MAY	16	..	..	..	35.4	82.7 *	..	G	47	..	.. ..	III*	47
1974	DEC	09	18	40	..	34.2	77.2 *	..	F	47	..	.. ..	III*	47
1977	SEP	25	06	22	39.0	35.95	82.63	005	A	161	..	2.5BLA 2	...	..

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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 NORTH CAROLINA

By

B. G. Reagor, C. W. Stover, and S. T. Algermissen

1980

INTERIOR—GEOLOGICAL SURVEY, RESTON, VA.—1980

For sale by Branch of Distribution, U.S. Geological Survey, 1200 South Eads Street, Arlington, VA 22202