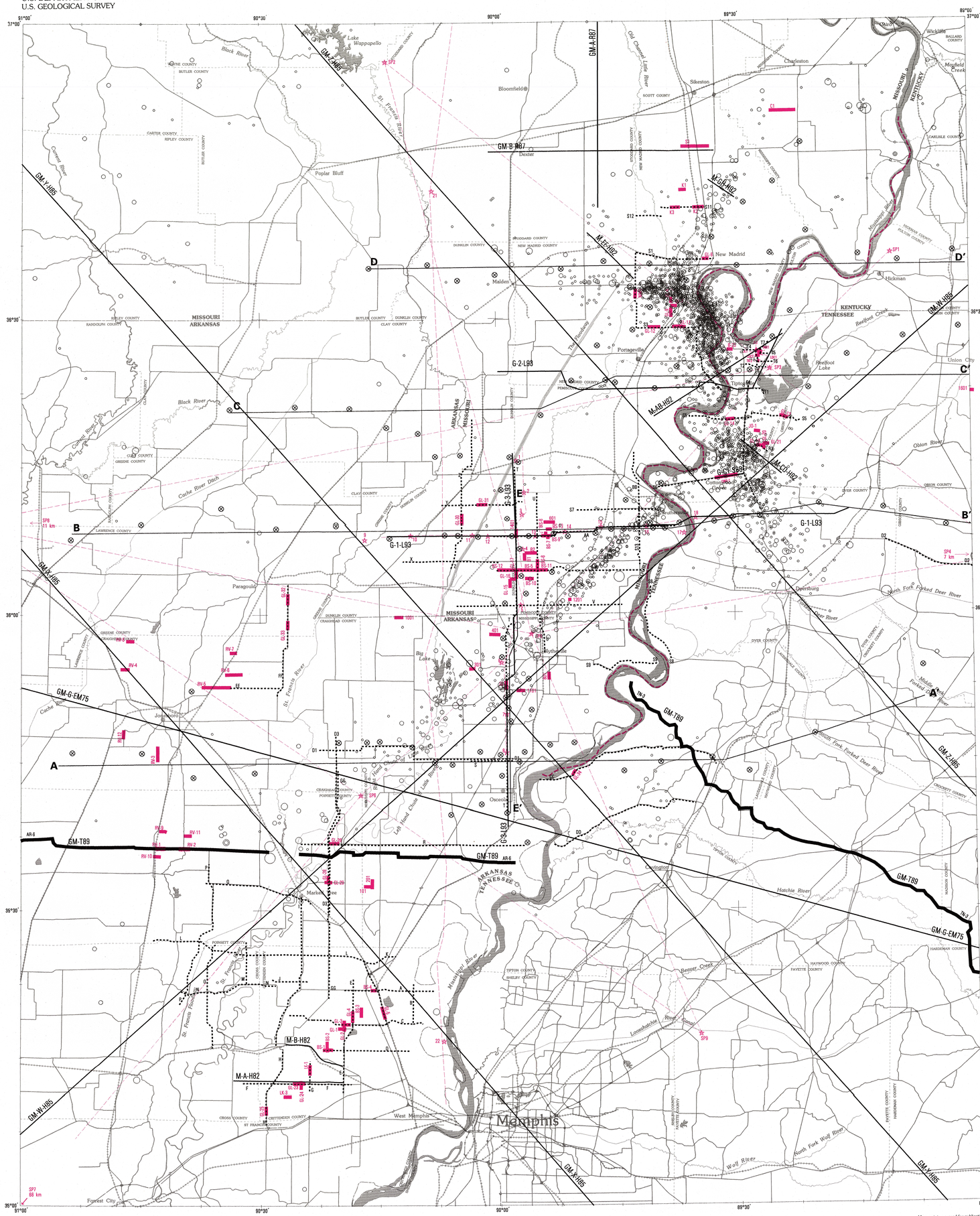
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF-2264-C

SEISMOTECTONIC MAP FOLIO IN THE VICINITY OF NEW MADRID, MISSOURI




# MAP SHOWING LOCATIONS OF GEOPHYSICAL SURVEY AND MODELING LINES IN THE VICINITY OF NEW MADRID, MISSOURI

By

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## DISCUSSION

This is one of a series of five seismotectonic maps of the seismically active New Madrid area in southeast Missouri and adjacent parts of Arkansas, Kentucky, and Tennessee (table 1). We cannot legibly show all the seismotectonic data on a single map, therefore each of the five maps in this series groups a different type of related information. Rhea and others (1994) summarized the background and purpose of the seismotectonic map folio.

This map shows locations of geophysical studies that resulted in interpreted cross sections that are or soon will be available (table 2). Four kinds of seismic-reflection surveys and their survey lines are represented: COCORP (Continental Consortium for Reflection Profiling), Vibrosis, and Mini-Sosie and similar surveys on land, and an airgun survey along part of the Mississippi River. Seismic-refraction surveys are represented as shot point locations, connected by lines to approximate the lines along which crustal velocity models were calculated. Lines representing gravity and magnetic modeling studies are located where cross-sectional models were calculated. The map shows locations of magnetotelluric soundings and the lines along which authors calculated crustal resistivity models.

Some lines have been the subject of more than one type of survey or model. Such lines have two or more labels on the map, indicating opportunities for constructing cross sections with multiple geophysical constraints. Examples are (1) an east-west line south of Caruthersville, Mo., along parts of which magnetotelluric, gravity, refraction, Vibrosis, and Mini-Sosie surveys have been conducted; (2) a north-south line west of Blytheville, Ark., along parts of which the same five kinds of surveys have been done; (3) the COCORP line, along parts of which gravity and magnetic modeling and Mini-Sosie surveys have been conducted; and (4) a north-trending line that crosses COCORP line AR-6 in eastern Poinsett County, Ark., along which Vibrosis surveys D3 and GG coincide almost exactly except about 5 km south of the boundary between Poinsett and Craighead Counties, Ark.

This study excludes three types of geophysical surveys. First, we excluded most of the many hundreds of kilometers of seismic-reflection surveys performed by the petroleum industry (Howe and Thompson, 1984; Howe, 1985) because details of their interpretations are proprietary. Second, we excluded surveys where gravity maps were combined with shallow resistivity measurements to infer shallow faults, because it is difficult to distinguish faults from monoclines using this technique (Stearns, 1954; Stearns, Haselton, and Tsau 1986; Stearns and others, 1984; Stearns and Wilson, 1986; Stearns, Wilson, and Nava, 1986). Third, we excluded some very high resolution seismic-reflection surveys that typically produce short, shallow profiles, interpretations of which are usually published together with results of longer surveys. Most examples in the map area use shotgun sources along parts of Mini-Sosie surveys. Williams and Catchings (1992) described another example that used buried explosives southwest of Caruthersville, Mo.

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**Table 1.** *Maps in the U.S. Geological Survey seismotectonic folio of the New Madrid, Mo., area*

| Map | Theme: features shown | Reference |
|---|---|---|
| Map MF-2264-A | Seismicity: earthquake epicenters, focal mechanisms, seismic velocities, instrument locations, and aspects of liquefaction | Rhea and others (1994) |
| Map MF-2264-B | Crustal structure: epicenters; large structures inferred from gravity, aeromagnetic, seismic reflection, seismic refraction, and magnetotelluric data | Rhea and Wheeler (1994) |
| Map MF-2264-C | Geophysical surveys: epicenters; lines of gravity, aeromagnetic, magnetotelluric, seismic reflection, and seismic refraction surveys and models | This map |
| Map MF-2264-D | Bedrock geology: epicenters; geologic and subcrop contacts; structure contours; radon concentrations; selected wells; selected faults; and arches, troughs, and faulted boundaries of the Mississippi Valley graben | Wheeler and others (1994) |
| Map MF-2264-E | Surficial and hydrologic features: epicenters; aspects of liquefaction; trench sites; earthquake-induced landslides; courses of the Mississippi River since 1765; fluvial and hydrologic anomalies; selected topographic features; Bootheel lineament; and geodetic monuments | Wheeler and Rhea (1994) |

**Table 2.** *Geophysical surveys and models in the vicinity of New Madrid, Mo. used in this study*

| Label on map | Locations[1], references |
|---|---|
| **COCORP seismic-reflection survey** | |
| AR-6 and TN-3 | Spans Mississippi Valley graben (Rhea and Wheeler, 1994; Wheeler and others, 1994; table 1) and its seismicity (Rhea and others, 1994). Thomas (1989), Nelson and Zhang (1991). |
| **Vibrosis seismic-reflection surveys** | |
| A to H | Southwest quadrant of map area, northwest of Memphis, Tenn., over Crittenden County fault zone (Wheeler and others, 1994). Crone (1992). |
| I to W and AA, BB, and GG[2] | Scattered between Caruthersville, Mo., and southwest of Marked Tree, Ark., over an alignment of epicenters (Rhea and others, 1994) and the Blytheville arch (Rhea and Wheeler, 1994; Wheeler and others, 1994). Crone and others (1985), Hamilton and McKeown (1988), Hamilton and Mooney (1990), McKeown and others (1990). |
| X to Z and EE and FF[2] | Between Jonesboro, Ark., and Portageville, Mo., over a fault zone that forms the northwest margin of the Mississippi Valley graben (Rhea and Wheeler, 1994; Wheeler and others, 1994). |
| CC and DD[2] | Southeast quadrant of map area, east of Mississippi River, north of Covington, Tenn. |
| D1 to D3[2] | West of Osceola, Ark., and east of Dyersburg, Tenn. Zoback and others (1980), Hamilton and Zoback (1982), Crone and others (1985), Hamilton and McKeown (1988). |
| R1 | Northeast quadrant of map area, south of Reelfoot Lake, Tenn., over Ridgely lineament (lineament is not shown on any map in this folio). Zoback (1979). |
| S1 to S13 | Scattered on both sides of Mississippi River from east of Blytheville, Ark., to north of New Madrid, Mo. Zoback and others (1980), Hamilton and Zoback (1982). |
| T1 to T7 | Northeast quadrant of map area, northwest of Reelfoot Lake, Tenn., over Reelfoot scarp (Wheeler and Rhea, 1994). Zoback (1979), Sexton and Jones (1986, 1988). |
| **Mini-Sosie seismic-reflection surveys** | |
| GL-1 to GL-5, GL-23 to GL-25, BS-1 to BS-4, LK-1, LK-3[2] | Southwest quadrant of map area, northwest of Memphis, Tenn., over Crittenden County fault zone (Wheeler and others, 1994). Luzietti and others (1992, 1994), Nicholas and others (1992), Williams and others (1993). |
| GL-6 to GL-9, GL-11, GL-12[2] | Northeast quadrant of map area, between Portageville and New Madrid, Mo., over northwest boundary of Mississippi Valley graben (Rhea and Wheeler, 1994; Wheeler and others, 1994) and possible deformation from 1812 earthquake. Odum and others (1994). |
| GL-13, GL-14, GL-19 to GL-21, JO-1[2] | Northeast quadrant of map area, south of Reelfoot Lake, Tenn., over Cottonwood Grove fault (Wheeler and others, 1994) and Ridgely lineament (lineament not shown on any map in this folio). |
| GL-15 to GL-17, BS-5 to BS-13[2] | Near center of map area, north-northwest of Blytheville, Ark., over Bootheel lineament (Wheeler and Rhea, 1994). Schweig and others (1992). |
| GL-26, GL-28, GL-29[2] | Southwest quadrant of map area, southwest of Osceola, Ark., over Blytheville arch (Rhea and Wheeler, 1994; Wheeler and others, 1994). |
| GL-30 to GL-33[2] | Southeast and northeast of Paragould, Ark., over northern boundary of Mississippi Valley graben (Rhea and Wheeler, 1994; Wheeler and others, 1994). |
| GL-34[2] | Southeast quadrant of map area, northeast of Osceola, Ark., over possible northeast extension of Crittenden County fault zone (Wheeler and others, 1994). |
| 101, 201, 301, 401, 601, 801, 1001, 1101, 1201, 1401, 1601 | Various locations, over air photo lineaments suspected to be fault traces (lineaments not shown on any map in this folio). Luzietti and Harding (1991). |
| RV-1 to RV-12[2] | Southwest quadrant of map area, near Jonesboro, Ark., over possibly faulted edges of Crowleys Ridge (Wheeler and Rhea, 1994). VanArsdale, Schweig, and others (1992), VanArsdale, Williams, and others (1992, 1994), VanArsdale and others (1993). |
| B1 to B3, K1 to K3, NM1, S1, C1[2] | Near Blytheville, Ark., and between Portageville and Charleston, Mo., over Bootheel lineament (Wheeler and Rhea, 1994), Blytheville arch (Rhea and Wheeler, 1994; Wheeler and others, 1994), and Sikeston ridge (Wheeler and Rhea, 1994). Sexton and others (1992), J.L. Sexton and others, 1993, written commun. |
| T5-2, LDC-2, JL-2 | Northeast quadrant of map area, northwest of Reelfoot Lake, Tenn., on Reelfoot scarp (Wheeler and Rhea, 1994). Sexton and Jones (1986). |
| CWG-1 | Southeast quadrant of map area, northeast of Caruthersville, Mo., over Cottonwood Grove fault (Wheeler and others, 1994). Sexton (1988), Sexton and Jones (1988). |
| **Seismic-reflection surveys similar to Mini-Sosie surveys** | |
| B-25 | Northeast quadrant of map area, northwest of Reelfoot Lake, Tenn., on Lake County uplift (Wheeler and Rhea, 1994). Mullins and others (1992), Woolery and others (1992, 1993), Harris and others (1994). |
| AM-1, JL-1, LDC-1 | Description and significance of the gravity field in the Reelfoot Lake region of northwest Tennessee: U.S. Nuclear Regulatory Commission Report NUREG/CR-3769, 40 p. Northeast quadrant of map area, north of Reelfoot Lake, Tenn., on Reelfoot scarp (Wheeler and Rhea, 1994). Sexton and others (1982). |
| **Airgun seismic-reflection survey** | |
| unlabeled[3] | Along Mississippi River from Hickman, Ky., to Osceola, Ark. Shedlock and Harding (1982), Crone and others (1986), Shedlock and others (1988). |
| **Seismic-refraction surveys** | |
| SP1, SP2, SP3, SP5, SP6, SP9[3] | Spans the map area, over Mississippi Valley graben (Rhea and Wheeler, 1994; Wheeler and others, 1994). Mooney and others (1983), Ginzburg and others (1983), Mooney and Andrews (1984). |
| 1 to 18 and 21 and 22[4] | In center of map area and along its north-south axis. Braile and others (1992), Mooney and others (1993), R.D. Catchings and W.M. Kohler (written commun., 1993). |
| **Gravity models** | |
| G-C1-S88 | Northeast quadrant of map area, northeast of Caruthersville, Mo., over Cottonwood Grove fault (Wheeler and others, 1994). Sexton and Jones (1988). |
| G-1-L93 to G-3-L93 | Trend north-south and east-west between Portageville, Mo., and Big Lake, Ark. Langenheim (1994). |
| **Magnetic models** | |
| M-A-H82 and M-B-H82 | Southwest quadrant of map area, west-northwest of Memphis, Tenn., over faulted southeast margin of Mississippi Valley grabens (Rhea and Wheeler, 1994; Wheeler and others, 1994). Hildenbrand (1982). |
| M-AB-H92, M-CD-H92, M-EF-H92, M-GH-H92 | Northeast quadrant of map area, scattered between Dyersburg, Tenn., and Sikeston, Mo. Hildenbrand and others (1992). |
| **Models using both gravity and magnetic data** | |
| GM-W-H85, GM-X-H85, GM-Y-H85, GM-Z-H85 | Trend northwest and northeast across the map area. Hildenbrand (1985). |
| GM-A-R87 and GM-B-R87 | Northeast quadrant of map area, west of Sikeston, Mo., over Bloomfield pluton (Rhea and Wheeler, 1994). Ravat and others (1987). |
| GM-G-EM75 | Trends west-northwest across the map area. Ervin and McGinnis (1975), Austin and Keller (1982), Thomas (1984). |
| GM-T89[3] | Coincides with COCORP line across Mississippi Valley graben (Rhea and Wheeler, 1994; Wheeler and others, 1994) and its seismicity (Rhea and others, 1994). Thomas (1989), Thomas and Kanter (1989). |
| **Magnetotelluric surveys** | |
| A-A' to E-E' | Trend north-south and east-west across most of the map area. Stanley and Rodriguez (1992), B.D. Rodriguez and W.D. Stanley (1993, written commun.). |

[1] This map does not show the geologic features that are named in some entries of this column. However, the reader can refer maps in this folio that show the features (table 1).

[2] Part of this survey or group of surveys is not yet analyzed.

[3] Shot points SP4, SP7, and SP8 are outside the map area. Dashed lines between shot points are straight and they approximate the locations of strings of geophones. Dashed line extending southwest from SP6 toward SP7 ends in map area at location of southwestmost geophone.

[4] Shot point 20 is north of the map area. There was no shot point 19. Broken dashed lines between shot points follow locations of geophones.

[5] Gravity and magnetic data were collected along the entire length of the COCORP line and beyond its western end (Thomas, 1989).



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