

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

SEISMOTECTONIC MAPS IN THE VICINITY OF NEW MADRID, MISSOURI —
DATABASE

digitally compiled by

Susan Rhea¹

Open-File Report 95-0574

This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards or with the North American Stratigraphic Code. Any use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

¹USGS, MS 966, Denver, CO, 80225

1995

Note for the Monthly List

Open File Report 95-574

SEISMOTECTONIC MAPS IN THE VICINITY OF NEW MADRID, MISSOURI —
DATABASE — digitally compiled by Susan Rhea

This digital map database consists of the ESRI ARC/INFO Version 7.0.3 *coverages* used to generate the maps in Map Series MF-2264 A to E (Rhea and Wheeler, 1994a,b, Rhea and others, 1994, Wheeler and Rhea, 1994, Wheeler and others, 1994) and I-2521 (Rhea and Wheeler, 1995). Total database size is 4.5Mb. The database may be downloaded via 'anonymous ftp' from a USGS data server named [greenwood.cr.usgs.gov](ftp://greenwood.cr.usgs.gov) (136.177.48.5). The files are located in a directory named [/pub/open-file-reports/ofr-95-0574](ftp://pub/open-file-reports/ofr-95-0574).

SEISMOTECTONIC MAPS IN THE VICINITY OF NEW MADRID, MISSOURI —
DATABASE

digitally compiled by

Susan Rhea

This database, identified as mf2264, has been approved for release and publication by the Director of the USGS. Although the database has been subjected to rigorous review and is substantially complete, the USGS reserves the right to revise the data pursuant to further analysis and review. Furthermore, it is released on condition that neither the USGS nor the United States Government may be held liable for any damages resulting from its authorized or unauthorized use.

The database may be downloaded via 'anonymous ftp' from a USGS data server named [greenwood.cr.usgs.gov](ftp://greenwood.cr.usgs.gov) (136.177.48.5). The files are located in a directory named [/pub/open-file-reports/ofr-95-0574](ftp://pub/open-file-reports/ofr-95-0574). The database manager is:

Susan Rhea
303/273-8639
rhea@gldvxa.cr.usgs.gov
U.S. Geological Survey
Box 25046, MS 966
Denver, CO 80225

This digital map database consists of the ESRI ARC/INFO Version 7.0.3 *coverages* used to generate the maps in Map Series **MF-2264 A to E** (Rhea and Wheeler, 1994a,b, Rhea and others, 1994, Wheeler and Rhea, 1994, Wheeler and others, 1994) and **I-2521** (Rhea and Wheeler, 1995). Total database size is 4.5Mb. Base-data are from 1:100,000-scale Digital Line Graph (DLG) data (roads, railroads, streams, water bodies, and state and county boundaries). Original source and scale for other data are described in the *coverage* entries below. All *coverages* contain attribute information beyond the usual ARC/INFO attributes, and some covers contain annotation subclasses. The ARC/INFO generated attributes include area and perimeter for polygon coverages, and internal control numbers and id numbers for point, arc, and polygon covers.

The projection used is Albers Equal-Area, with central meridian at 90°W, and standard parallels at 29°30' N and 45°30' N. Latitude of the projection's origin is at 23°N. The scale of the published (printed) Miscellaneous Field Maps and the Investigations Map is 1:250,000.

The EXPORT command was used to create the *data.e00* files, using full compression. The IMPORT command will generate the ARC/INFO coverages for your use. I recommend importing the coverages and using the DESCRIBE command to display information on available features for each coverage.

A brief description of each coverage follows (description of reflection and refraction coverages are grouped after descriptions of more general coverages):

- 2x2grat:* graticule for the map; 35-37°N, 89-91°W
arc attributes: NEATCODE = 1 for yes, 0 for no
 MJRULCODE at .5° intervals
 MNRULCODE at .125° intervals
polygon attributes: none
- 2x2grattic:* point cover of all the .125° interval tics in the 2x2grat area
point attribute: TICCODE for interior and exterior tics
- axgrav:* axial gravity anomaly (Langenheim, 1995)
arc attributes: CODE = plotting symbol
 GEO = type of data, i.e. psmag = pseudomag
polygon attributes: CODE = plotting symbol
 GEO = type of data, i.e. psmag = pseudomag
- basehyd:* selected hydrography, selected on the basis of significant ground-shaking or liquefaction potential.
arc attributes: DLG attributes
annotation subclass: anno.names (river and lake names)
- bhlin_24k:* Bootheel Lineament as observed on low-altitude photos and transferred to 1:24,000 scale topographic maps (Schweig and others 1992)
arc attribute: CODE = type of lineament; R1 and R2 are less prominent, B1 and B2 are more prominent, oldstm is not a tectonic feature
- bhlin_ls:* Bootheel Lineament as observed on landsat images.
- cities:* selected cities
point attributes: none
annotation subclass: anno.cities
- cnty:* state and county borders in the map area
arc attributes: BNDYTYPE = 1 for states and 2 for counties
annotation subclass: anno.map (state and county names in map units)
 anno.states (state names only)
- enrgcen:* locations of probable subsurface ruptures of the 1811-12 earthquakes, as defined by sandblow distribution (Obermeier, 1989). Obermeier describes the zones as 'energy centers' of those earthquakes, rather than the more spatially limited concept 'epicenter'
arc attributes: ID = date of earthquake assigned by Obermeier

- epri:* damaging earthquakes (moment magnitude ≥ 5.0) since 1811-12 as defined by EPRI (Johnston, 1994)
point attributes: YEAR, MONTH, DAY, and MAG (magnitude)
annotation subclass: anno.shta (year as printed on Map A)
anno.date (year of earthquakes as printed on Map E)
- eqk_slu:* earthquakes located by the St. Louis University from July 1974 to December 1992, Taylor and others (1991)
point attributes: all locational values and parameters as determined by the network operator and published in their annual reports including such items as latitude, longitude, and depth of epicenter, magnitude, RMS
- faults:* locations of faults identified by geologic observation
arc attributes: CODE = plotting symbol
REF = reference
annotation subclass: anno.zone (names of a few fault zones)
anno.name (named faults, direction of fault movement)
- gpspts:* locations of Global Positioning System monuments. There are three classes of monuments, one a permanent system, and two deployed by universities for graduate studies projects
point attributes: ID = identifying code
AGENCY = operator
LAT, LONG, HEIGHT = location
DECLIN = declination
COMMENTS = comments
PLOT = plot symbol
annotation subclass: anno.id (monument name/identifier)
- gravstr:* structures identified from gravity-field data (Langenheim, 1995)
arc attributes: CODE = plotting symbol
GEO = geological name
polygon attributes: CODE = plotting symbol
GEO = geological name
intended to be used with axgrav, intcom, and ma3str
- gwanom:* locations of ground-water anomalies (Brahana and Mesko, 1994)
- intcom:* intrusive complexes defined by aeromagnetic studies (Hildenbrand and Hendricks, 1995).
- hrvpdeep:* P-velocity contours for depths 5 - 14 km (Al-Shukri and Mitchell, 1987)
arc attributes: DEPTH = depth identifier, 14
VELOC = velocity
CODE = plotting symbol

- hrvpshal:* P-velocity contours for depths 0 - 5 km (Al-Shukri and Mitchell, 1987)
arc attributes: DEPTH = depth identifier, 5
 VELOC = velocity
 CODE = plotting symbol
- landslide:* landslides along the Chickasaw Bluffs, mapped by Jibson and Keefer (1987) at
 1:62,500 scale
polygon attributes: CODE = coded as in reference indicating probable cause of
 landslide and level of certainty
annotation subclass: anno.id (labels on selected features)
- magdep:* depth to magnetic basement (Hildenbrand and Hendricks, 1995)
arc attributes: DEPTH (km below sea level) to the nearest 1/2 km
 CODE = plotting symbol
polygon attributes: DEPTH (km below sea level) to the nearest 1/2 km labeled
 at 1/4 and 3/4 intervals
- misspoly:* polygon coverage of the Mississippi River extracted from *basehyd*
- miscenters:* Fischer and Schumm's (1995) locations of historical centerlines of the Mississippi
 River from 1765 to 1960
arc attributes: YEAR = year for which location was determined
annotation subclass: anno.year
- misshores:* Fischer and Schumm's (1995) locations of historical shorelines of the Mississippi
 River from 1765 to 1960
arc attributes: YEAR = year for which location was determined
annotation subclass: anno.year
- mtstr:* Reelfoot Graben structures interpreted from magnetotelluric data (Stanley and
 Rodriguez, 1992)
arc attributes: NAME = rift margin or arch trough
annotation subclass: anno.line (modelling lines in map units)
 anno.page (same, in map units for page-size printing)
- pzcon:* paleozoic surface depth contours from Dart (1995)
arc attributes: DEPTH
annotation subclass: anno.arch (label for the Lake County Arch)
 anno.label (labels on small contours)
- pzconpts:* control points for defining the paleozoic surface from Dart (1995)
- pzsub:* subcrop contacts on the paleozoic surface from Dart (1995)
arc attributes: none
annotation subclass: anno.name (subcrop formation names)
 anno.page (same, in map units for page-size printing)

- qd24k:* polygons of the 1:24000 scale topographic maps in the area
polygon attributes: LONG, LAT at center of quad
 NAME
 STATE
- railrds:* railroads on the 100k DLG's
arc attributes: defined by National Mapping Division
- rds:* class 1 and 2 roads (major 4-lane and principle 2-lane roads)
arc attributes: defined by National Mapping Division
- reflstr:* structures identified in seismic reflection research; NOTE: one fault, unnamed, trending southwest-northeast approximately 10km northwest of New Madrid (Zoback and others, 1980), was left off MF-2264-D and I-2521 but is included in this database
polygon attributes: NAME = Blytheville arch (this is the only polygon)
arc attributes: GEO = arch or 6 letters of fault name
 CODE = plotting symbol
 REF = reference of publication showing feature
annotation subclass: anno.fault (named faults, in map units)
 anno.line (Blytheville Arch, in map units)
 anno.page (same, in units for page-size prining)
- rivanom:* river anomalies throughout the New Madrid region identified by Fischer and Schumm (1995)
arc attributes: DRAW = plotting index
polygon attributes: INSIDE = plotting index
annotation subclass: anno.code (index to table on MF-2264-E)
 anno.orange (same as code, symbol for orange text)
- sblows:* outlines of Obermeier's (1989) definitions of areas covered by greater than 1% and greater than 25% sandblows from the 1811-12 earthquakes
polygon attributes: CODE = 1 or 25 to correspond with respective areas
- selwell:* selected wells from Dart (1992)
point attributes: described in Dart (1992) and include, for example, location, owner, id, depth to various formations, and thickness of various formations
annotation subclass: anno.id (four character well id)
- sfcstr:* significant structures visible at the surface in the vicinity of New Madrid
polygon attributes: NAME = Lake County uplift, Crowleys Ridge, F idgely Ridge, Sikeston Ridge, and Tiptonville Dome
annotation subclass: anno.names (same as polygon names)
 anno.embay (Mississippi Embayment text only)

- seissta:* locations of seismograph stations that have operated in the New Madrid region since July 1974
point attributes: location coordinates, station name, start date, and stop date if available.
- states:* arcs from *cnty* with *bndytype* = 1; see *cnty* for description
annotation subclass: anno.states (state names)
- stresspts:* stress orientations either from borehole breakouts or earthquake focal mechanism solutions updated in Ellis (1994)
point attributes: \$ANGLE = 360° - stress direction; needed for plotting the stress symbol in the correct direction
 DIRECTION
 TYPE = b for borehole, e = earthquake
 QUALITY = Zoback and Zoback (1989) rating
 MARK = plotting symbol
 LAT, LONG = location
 FOCMECH = plotting symbol
- strmot:* strong motion seismometers
point attributes: NAME, OWNER, CITY (nearest), and STATE
- trench:* trenches examined for prehistoric earthquakes and a report has been published
point attributes: ID = identifying code
 REF = reference abbreviation
annotation subclass: anno.id
- well:* wells from Dart (1992) in the map area. See *selwell* for wells used in MF-2264
point attributes: described in Dart (1992) and include, for example, location, owner, id, depth to various formations, and thickness of various formations
- Discussion of reflection and refraction coverages (see MF-2264-C for references and locations of surveys):
- 2x2cocorp:* COCORP lines in map area
arc attributes: LINE = line number or name
annotation subclass: anno.line
- cocorp:* same as 2x2cocorp, except ends of lines extend outside New Madrid area
- rivrefl:* airgun survey of Mississippi River from north of Hickman to south of Osceola
point attributes: MILE = river mile number
 SHPT = shotpoint number
 SHPT500 = code for every 500th shpt
 WRITE = plotting code

- sexton80:* 1978 - 1986 shallow seismic reflection surveys by Sexton; lines included are: AM1, JL1, JL2, LDC1, LDC2, T6-2, CWG-1
point attributes: LINE = line name or number
ORIENT = orientation for line labeling, 90 for vertical labels on east-west lines, 0 for horizontal labels on north-south lines
annotation subclass: anno.line
anno.page (pagesize annotation, larger than 'line')
anno.black (black text symbol instead of red)
- sexton90:* 1990 shallow seismic reflection surveys by Sexton; lines included are: C1, S1, K1, K2, K3, NM1, B1, B2, B3
point attributes: LINE = line name or number
ORIENT = orientation for line labeling, 90 for vertical labels on east-west lines, 0 for horizontal labels on north-south lines
annotation subclass: anno.line
anno.page (pagesize annotation, larger than 'line')
anno.black (black text symbol instead of red)
- sosie82:* 1982 shallow seismic reflection surveys by USGS; lines included are: 101, 201, 301, 401, 601, 801, 1001, 1101, 1201, 1401, 1601
arc attributes: LINE = line number
annotation subclass: anno.line
anno.black (black text symbol instead of red)
- sosie90:* 1990 shallow seismic reflection surveys by USGS ; lines included are: BS-1 thru 9, GL-1 thru 9 and 11 thru 17
point attributes: LINE = line name or number
SOSIE90-ID = shotpoint number
arc attributes: LINE = line name or number
annotation subclass: anno.line
anno.black (black text symbol instead of red)
- sosie91:* 1991 shallow seismic reflection surveys by USGS ; lines included are: JC -1, B-25, LK-1, LK-3, BS-10,11,12,13, RV-1 thru 12, GL-19,20,21,23,24,25,26,28 thru 34
point attributes: LINE = line name or number
SOSIE90-ID = shotpoint number
arc attributes: LINE = line name or number
annotation subclass: anno.line
anno.black (black text symbol instead of red)
- usgs83:* 1983 refraction survey
arc attributes: REF = reference
point attributes: LONG, LAT, STA = endpoints of modeling lines

- usgs83_2x2*: clip of *usgs83*
annotation subclass: anno.shpt
 anno.black (black text symbol instead of red)
- usgs91*: 1991 refraction survey
arc attributes: REF = reference
point attributes: LONG, LAT, SHPT, ELEV = endpoints of modeling lines
 LINE = modelling line identifier
- usgs91_2x2*: clip of *usgs91*
annotation subclass: anno.shpt
 anno.black (black text symbol instead of red)
- usgs91rec*: 1991 refraction survey receiver locations
point attributes: SHPT = shotpoint number
 LINE = line number
 X-COORD, Y-COORD = long, lat of shotpoint
- vib76*: 1976 vibroseis surveys by USGS; lines included are: T1, T2, T3, T4, T5, T6, T7, R1
point attributes: LINE = line number
 VIB76-ID = shotpoint number
arc attributes: LINE = line number
annotation subclass: anno.id (line number, bold symbol)
 anno.small (same, size for page-size printing)
 anno.line (same, regular text symbol)
- vib78*: 1976 vibroseis survey by USGS; lines included are: D1, D2, D3, S1 thru S13
point attributes: LINE = line label
 SHPT = shotpoint number
 ORIENT = line orientation; east-west or north-south
arc attributes: LINE = line label
annotation subclass: anno.line
- vib78_2x2*: clip of *vib78*
- vib83pub*: 1983 purchase of industry vibroseis lines by USGS; lines included are: K, L, M, O, Q, R, S, T, U, V, W, AA, BB, CC, DD, GG
point attributes: LINECODE = line label
 SHPT = shotpoint number
 ORIENT = line orientation; east-west or north-south
arc attributes: LINECODE = line label
annotation subclass: anno.coded

- vib90pub*: 1990 purchase of industry vibroseis lines by USGS; lines included are: A, B, C, D, E, F, G, H, X, Y, Z, EE, FF
- point attributes: LINECODE = line label
SHPT = shotpoint number
ORIENT= line orientation; east-west or north-south
- arc attributes: LINECODE = line label
- annotation subclass: anno.coded
-
- vib91pub*: 1991 purchase of industry vibroseis lines by USGS; lines included are: I, J, N, P
- point attributes: LINECODE = line label
SHPT = shotpoint number
ORIENT= line orientation; east-west or north-south
- arc attributes: LINECODE = line label
- annotation subclass: anno.coded

REFERENCES

- Al-Shukri, H.J., and Mitchell, B.J., 1987, Three-dimensional velocity variations and their relation to the structure and tectonic evolution of the New Madrid seismic zone: *Journal of Geophysical Research*, v. 92, no. B7, p. 6377-6390.
- Brahana, J.V., and Mesko, T.O., 1994, Hydrology of the McNairy-Nacatoch and adjacent aquifers in the northern Mississippi embayment: U.S. Geological Survey Professional Paper 1416-K, in press.
- Dart, R.L., 1992, Catalog of pre-Cretaceous geologic drill-hole data from the upper Mississippi embayment--A revision and update of Open-File Report 90-260: U.S. Geological Survey Open-File Report 92-685, 253 p.
- _____, 1995, Maps of Paleozoic and Pre-Cambrian rocks of the Mississippi embayment: U.S. Geological Survey Miscellaneous Field Studies Map MF 95-2284, scale 1:500,000, in press.
- Ellis, W.L., 1994, Summary and discussion of crustal stress data in the region of the New Madrid seismic zone: Chap. B of Shedlock, K.M., and Johnston, A.C., eds., *Investigations of the New Madrid Seismic Zone*: U.S. Geological Survey Professional Paper 1538-B, 13 p.
- Fischer, K.J., and Schumm, S.A., 1995, Geomorphic evidence of deformation in the northern part of the New Madrid seismic zone: Chap. R of Shedlock, K.M., and Johnston, A.C., eds., *Investigations of the New Madrid Seismic Zone*: U.S. Geological Survey Professional Paper 1538-R, in press.
- Hildenbrand, T.C., and Hendricks, J.D., 1995 Geophysical setting of the Reelfoot rift and relations between rift structures and the New Madrid seismic zone, Chap. E of Shedlock, K.M., and Johnston, A.C., eds., *Investigations of the New Madrid Seismic Zone*: U.S. Geological Survey Professional Paper 1538-E.
- Jibson, R.W., and Keefer, D.K., 1988, Landslides triggered by earthquakes in the central Mississippi valley, Tennessee and Kentucky: U.S. Geological Survey Professional Paper 1336-C, 24 p., 1 folded plate, scale 1:62,500.
- Johnston, A.C., 1994, Summary tables, SCR seismology database, in Johnston, A.C., Coppersmith, K.J., Kanter, L.R., and Cornell, C.A., eds., *The earthquakes of stable continental regions, V. 2, appendices A to E*: Palo Alto, California, Electric Power Research Institute, C1 - C46.
- Langenheim, V.E., 1995, Gravity study of the New Madrid seismic zone, Chap. L of Shedlock, K.M., and Johnston, A.C., eds., *Investigations of the New Madrid Seismic Zone*: U.S. Geological Survey Professional Paper 1538-L.
- Obermeier, S.F., 1989, The New Madrid earthquakes: An engineering-geologic interpretation of relict liquefaction features: U.S. Geological Survey Professional Paper 1336-B, 114 p., 11 plates.
- Rhea, Susan, and Wheeler, R.L., 1994a, Map showing large structures interpreted from geophysical data in the vicinity of New Madrid, Missouri: U.S. Geological Survey Miscellaneous Field Studies Map MF-2264-B, 1 sheet, scale 1:250,000.
- _____, 1994b, Map showing locations of geophysical survey and modeling lines in the vicinity of

New Madrid, Missouri: U.S. Geological Survey Miscellaneous Field Studies Map MF-2264-C, 1 sheet, scale 1:250,000.

_____. 1995, Map showing synopsis of seismotectonic features in the vicinity of New Madrid, Missouri, U.S. Geological Survey Investigations Map I-2521, 1 sheet, scale 1:250,000.

Rhea, Susan, Wheeler, R.L., and Tarr, A.C., 1994, Map showing seismicity and sand blows in the vicinity of New Madrid, Missouri: U.S. Geological Survey Miscellaneous Field Studies Map MF-2264-A, 1 sheet, scale 1:250,000.

Schweig, E.S., Marple, R.T., and Li, Yong, 1992, An update of studies of the Bootheel lineament in the New Madrid seismic zone, southeastern Missouri and northeastern Arkansas: *Seismological Research Letters*, v. 63, no. 3, p. 193-208.

Stanley, W.D., and Rodriguez, B.D., 1992, Structure of the Reelfoot rift as interpreted from 2-D magnetotelluric models: *Seismological Research Letters*, v. 63, no. 3, p. 223-232.

Taylor, K., Stauder, W., and Herrmann, R., 1991, A comprehensive, unified data set for the New Madrid seismic array [abs.]: *Seismological Research Letters*, v. 62, p. 187.

Wheeler, R.L., and Rhea, Susan, 1994, Map showing surficial and hydrologic features in the vicinity of New Madrid, Missouri: U.S. Geological Survey Miscellaneous Field Studies Map MF-2264-E, 1 sheet, scale 1:250,000.

Wheeler, R.L., and Rhea, Susan, and Dart, R.L., 1994, Map showing structure of the Mississippi Valley graben in the vicinity of New Madrid, Missouri: U.S. Geological Survey Miscellaneous Field Studies Map MF-2264-D, 1 sheet, scale 1:250,000.

Zoback, M.D., Hamilton, R.M., Crone, A.J., Russ, D.P., McKeown, F.A., and Brockman, S.R., 1980, Recurrent intraplate tectonism in the New Madrid seismic zone, *Science*, V. 209, no. 4460, p.971-976.