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SEISMOTECTONIC MAPS IN THE VICINITY OF THE LOWER WABASH VALLEY, ILLINOIS, INDIANA, AND KENTUCKY — DIGITAL SPATIAL DATABASE

compiled by

Susan Rhea

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release and publication by the Director of the USGS. Although the
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   The database may be downloaded via 'anonymous ftp' from a USGS
data server named greenwood.cr.usgs.gov (136.177.21.122). The
files are located in a directory named /pub/open-file-reports/ofr-
97-681). The database manager is:

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This digital map database consists of the ESRI ARC/INFO Version
7.0.4 coverages used to generate the maps in the map series U.S.
Geological Survey Investigation Map — 2583 A to D (Rhea and
Wheeler, 1996, Rhea and others, 1996, Wheeler and others, 1997a
and b). Full description of the data, its sources, and its
characteristics are in the pamplets that accompany each map and in
the metadata for each dataset located on the U.S. Geological
Survey Digital Spatial Data Clearinghouse node located through
<http://fgdc.er.usgs.gov/cgi-bin/GEOgate>. Sources will not be
repeated in this open-file. The data were generated to help in
understanding the seismic hazards in the vicinity of the lower
Wabash Valley. These data complement similar data collected in the
vicinity of New Madrid, MO (Rhea, 1995; available via ftp on
<ftp://greenwood.cr.usgs.gov/pub/open-file-reports/ofr-95-0574>)

   Total database size is 9 Mb. Projections of published data are
in geographic coordinates, i.e., decimal degrees, although the
paper map series is published in Albers Equal Area projection.
Base data are from 1:100,000-scale Digital Line Graph (DLG) data
(roads, railroads, streams, water bodies, and state and county
boundaries). Brief descriptions of database content are in the
coverage entries below. Most coverages contain attribute
information beyond the usual ARC/INFO attributes (internal
numbers, length of arc, length of perimeter, area, for example),
and some coverages contain annotation subclasses.

Metadata for each coverage are available on the USGS Database Clearinghouse at <http://geo-nsdi.er.usgs.gov/>. Or, you can access the National Spatial Data Clearinghouse search engine at <http://fgdc.er.usgs.gov/cgi-bin/GEOgate>. Using the keywords 'Wabash' or 'seismotectonic' in the search engine, and specifying the U.S. Geological Survey Geoscience Data in the database field, you will find metadata for all the files in this database. Using additional keywords, such as faults, earthquakes, or gravity, will lead you to more specific metadata.

A brief description of each coverage follows. Descriptions are
organized into thematic groups:

BASE DATA
EARTHQUAKE AND GROUND MOTION DETECTION
FAULTS (SURFACE)
GEOLOGIC FEATURES
GEOPHYSICAL PROFILES AND INTERPRETATIONS
ISOSEISMALS
LIQUEFACTION FEATURES
REFLECTION, REFRACTION DATA

BASE DATA

hysel:
selected hydrography from 1:100,000 Digital Line Graph data
(abbreviated '100k DLG'). Lakes were selected because of their
value as a geographic reference and because each of the lakes is
dammed, and the impoundments are large enough that dam failure
during seismic shaking could be dangerous. Large streams were
chosen whose flood plains contain young, water-saturated materials
that might liquefy or amplify shaking during a large earthquake.

In Kentucky and Tennessee, streams with Holocene or Quaternary
alluvium mapped along their courses were selected. In Illinois,
streams with modern flood plain, channel, or alluvial fan deposits
of Wisconsinan to Holocene age, or with slack-water lake deposits
of Wisconsinan age in river valleys were selected. In Indiana,
streams with Holocene alluvium, or with valley-filling, lacustrine
clay, silt, and sand of Illinoian or Wisconsinan age were
selected.

feature classes arcs, polygons, anno.map, anno.fig
arc attributes acode:
      20 (shoreline)
      21 (manmade shoreline)
      47 (canal gate)
      52 (stream)
      54 (ditch or canal)
polygon attributes water
      yes (rivers, lakes)
      no (islands, land masses)

city:
cities with 1990 census populations of at least 10,000 or smaller
cities used by earth scientists as geographic references

feature classes point and anno.name
point attributes name

cnty:
county and state boundaries from 100k DLG data. Annotation added
for states and counties.

feature class arcs, anno.map, anno.statefig
arc attribute bndytype:
    1 (state boundaries)
    2 (county boundaries)

grat:
graticule for map area, 36.5-39 degrees N, 87-89 degrees W. Lines
are coded for line type, including NEATCODE for the outer
boundary, MJRULCODE (major rule code) for latitude/longitude
labeled intervals, and MNRULCODE (minor rule code) where
additional ticks occur. Major rules were placed at .5 degree
intervals, minor rules were place at .125 degree intervals. There
is polygon topology, with polygons corresponding to 7.5 minute
quadrangles.

feature classes include arcs, polygons, anno.fig, anno.map
arc attributes include neatcode, mjrulcode, mnrulcode with values
    1 (yes)
    0 (no)

grattic:
tick points corresponding to the graticule cover, grat. Points are
coded for location (corners, right, left, top and bottom margins,
and interior)

feature class points
point attribute TICCODE:
    1 - interior at major rule intersections (see grat)
    2 - left margin
    3 - right margin
    4 - bottom margin
    5 - top margin
    6 - bottom left corner
    7 - upper left corner
    8 - lower right corner
    9 - upper right corner
    0 - interior except for major rule intersections (see grat)

rd12:
road network selected from 100k DLG data

feature class arcs
arc attributes acode:
    11-14, 42-43 for primary roads (class 1)
    15-18 for secondary roads (class 2)

```
rail:
railroads from 100k DLG data

feature class arcs
arc attributes acode:
      21 for main routes
      28 for interchanges and spurs
      0 for 15 minute quad boundaries

states:
state boundaries from 100k DLG data. annotation added for states.

feature class arcs, anno.fig
arc attribute bndytype:
      1 (states)
```

EARTHQUAKE AND GROUND MOTION DETECTION

```
dameqk:
locations and magnitudes of earthquakes that have caused MMI 6 or
greater damage in the lower Wabash Valley.

feature classes points, anno.fig, anno.map
point attributes
      lat, lon, year, month, day, ht, min, mag, symbol

eqks:
instrumentally located earthquakes in the map area occurring
between July 1974 and December 1995

feature class points
point attributes
      date, type, hr, min, sec, lat, long, depth, deptag, mag,
      nsta, nphase, gap, dmin,
      rms, erh,sez, qh, qz, mod, dflag, mblg3

eqksta:
seismograph stations in the local seismograph network operating in
the map area between July 1974 and December 1995

feature classes points and anno.name
point attributes
      long, lat, sta (name),
      start (date; incomplete as supplied by SLU),
      stop (date; incomplete as supplied by SLU)

gps:
location and name of two Global Positioning System monuments of a
regional network that are located within the map area in western
Kentucky

feature class points
point attributes
      name, long, lat
```

tempsta:
location of temporary seismograph networks installed and operated
by Glenn Bear and others from Indiana University from Oct. 95
through June 96.

feature class points
point attributes
     lat, lon, sta (name)

strngmo:
locations of accelerometers operating within the map area

feature class points
point attributes
     name, owner, city, state

FAULTS (SURFACE)

ibcflt:
faults from Illinois Basin Consortium compilation. Erased with
boundary of padflt and kyflt since their data have higher
resolution than ibcflt.

feature classes are arcs, nodes
arc attributes (none other than arcinfo generated ones)
Note Drawn arcs appear to be attributed for faults type since
some have dip marks, some are dashed, and others are solid. The
arcs are not attributed; the dip marks and dashed lines were also
digitized as arcs.

kyflt:
faults appearing on the Geologic Map of Kentucky. Erased with
padflt since it has more reliable and accurate locations of faults
than kyflt.

feature classes arcs, anno.map, anno,shtd
arc attributes none (other than arcinfo generated ones)
Note Drawn arcs appear to be attributed for faults type since
some have dip marks, some are dashed, and others are solid. The
arcs are not attributed; the dip marks and dashed lines were also
digitized as arcs.

padflt:
faults appearing on Paducah Quadrangle.

feature classes arcs, nodes, anno.map, anno.shtd

arc attributes
     symcode (30, 130)
     fltexp (exposed, concealed, inferred)

GEOLOGIC FEATURES

bcontours:
contours of depth to Cambrian-Precambrian unconformity.
Contributed from James Drahovzal (Kentucky Geological Survey) and
Glenn Bear (Indiana University). Units are in thousands of feet
below sea level

feature classes arcs, point, anno.number

point attributes
        symbol (120, 123 - anticline, 2nd symbol smaller,
              121, 124 - syncline)
arc attributes
      depth (in thousands of feet below sea level)
      symbol (202 - depression hachures
              203 - solid lines)

bcontours_all:
same as bcontours, except region extends beyond the map area.

bfaults:
basement faults as interpreted by James Drahovzal and Glenn Bear

feature classes arcs and points

arc attributes
      linetype (dashed (uncertain), solid (certain))
      symbol (198 - dashed, no dip
              199 - solid, no dip
              200 - dashed, with dip
              201 - solid, with dip)

point attributes
      symbol (122, 125 - right lateral arrow
              126 - Reverse fault)

embay:
Mississippi Embayment boundary contact between Paleozoic rocks and
younger sedimentary rocks above, generalized from state geologic
maps. Inliers and outliers not included.

feature classes arc, anno.map

arc attribute code (1)

lampdike:
small lamprophyre and mica peridotite intrusions thought to be
evidence of Permian extensional reactivation of pre-existing
faults

feature classes arcs and points (many of the points duplicate arcs
that are too small to be seen at published map scale)

```
arc attributes
     name (quadrangle name and relative location)
     symbol (plotting symbol number, map C)
     dsymbol (plotting symbol number, map D)
```

point attribute name

neotect:
locations of possibly young faulting or liquefaction, or of field
investigations of such features

feature classes are points, anno.trenchid

```
point attributes
     name (map code, used in Table 3 of sheet D)
```

well:
locations of wells used to constrain depth to basement, stress
orientations, or rifting history

feature classes include point, anno.id, anno.sym7 (for plotting
map C)

```
point attributes
     name, class, lat, long, topo_elev
     unit depths and depth tags
```

GEOPHYSICAL PROFILES AND INTERPRETATIONS

gravmag:
locations of gravity and magnetic profiles

```
feature classes arc, anno.map
arc attributes
     name, ref(erence)
```

lineament: (clipped from lineament_all to map boundary)
locations of Paducah gravity lineament, Commerce geophysical
lineament, and South-Central magnetic lineament from Tom
Hildenbrand, May 1997.

```
feature classes arc, poly, anno.lineid
arc attributes name
polygon attributes name
```

lineament_all:
same as lineament except boundaries extend beyond map area

magdike:
Mafic dikes as interpreted from aeromagnetic anomalies.
Contributed from Tom Hildenbrand and Vicki Langenheim

```
feature class arc
arc attributes - none other than arcinfo ones
```

magtell: (clipped from magtell_all to map area)
locations of magnetotelluric sounding points. Contributed from Dal
Stanley, Sept. 1995

feature classes points, anno.profile, anno.map
point attributes
      x-coord, y-coord, profile, station

magtell_all:
same as magtell except boundaries extend beyond map area

magdep:
depth to magnetic rock, usually metamorphic or igneous basement.
Contributed from Tom Hildenbrand, July 1992. Edited and clipped to
map area Sept. 1994

feature classes arc, polygon
arc attributes
      code, depth
polygon attributes
      depth

ISOSEISMALS

The coverages listed below with an 'iyearmo' designation contain
Modified Mercalli Intensity isoseismal contours for earthquakes
that caused damage in the map area from December 1811 through June
1987 (there have been no damaging earthquakes since June 1987).
The coverage isopts contains the point data used to generate the
isoseismal contours

feature classes arcs and polygons.
arc attributes none (except the arcinfo ones)
polygon attributes
        intensity

i181112a:
contours for earthquake on December 16, 1811 at 0815 GMT; mag 8.1

i181112b:
contours for earthquake on December 16, 1811 at 1415 GMT; mag 7.2

i181201:
contours for earthquake on January 23, 1812 at 1500 GMT; mag 7.8

i181202:
contours for earthquake on February 7, 1812 at 0945 GMT; mag 8.0

i182707:
contours for earthquake on July 5, 1827 at 1130 GMT; mag 4.8

i183806:
contours for earthquake on June 9, 1838 at 1445 GMT; mag 5.1

i184301:
contours for earthquake on January 5, 1843 at 0245 GMT; mag 6.5

i185710:
contours for earthquake on October 8, 1857 at 1000 GMT; mag 5.1

i187609:
contours for earthquakes on September 25, 1876 at 0600 GMT; mag 4.5, and 0615 GMT; mag 4.8

i188301:
contours for earthquake on January 11, 1883 at 0712 GMT; mag 4.6

i188702:
contours for earthquake on February 6, 1887 at 2215 GMT; mag 4.6

i188708:
contours for earthquake on August 2, 1887 at 1836 GMT; mag 4.9

i189107:
contours for earthquake on July 27, 1891 at 0228 GMT; mag 4.1

i189109:
contours for earthquake on September 27, 1891 at 0455 GMT; mag 5.5

i189510:
contours for earthquake on October 31, 1895 at 1008 GMT; mag 6.8

i189904:
contours for earthquake on April 30, 1899 at 0205 GMT; mag 4.3

i190302:
contours for earthquake on February 9, 1903 at 0021 GMT; mag 4.9

i192211:
contours for earthquake on November 27, 1922 at 0331 GMT; mag 4.4

i192504:
contours for earthquake on April 27, 1925 at 0405 GMT; mag 4.9

i192509:
contours for earthquake on September 2, 1925 at 1156 GMT; mag 4.6

i193408:
contours for earthquake on August 20, 1934 at 0047 GMT; mag 4.7

i195811:
contours for earthquake on November 8, 1958 at 0241 GMT; mag 4.4

i196811:
contours for earthquake on November 9, 1968 at 1701 GMT; mag 5.4

i197404:
contours for earthquake on April 3, 1974 at 2305 GMT; mag 4.3

i198406:
contours for earthquake on June 29, 1984 at 0758 GMT; mag 4.1

i198706:
contours for earthquake on June 10, 1987 at 2348 GMT; mag 5.0

isopts:
This cover contains all the data points used to determine the
intensity contours for the earthquakes that caused damage in the
map area

feature class points, anno.year
point attributes
      long (longitude)
      lat (latitude)
      mmi (Modified Mercalli Intensity value)
      st (state)
      city (nearest city)
      year (year of earthquake occurrence
          a or b attached if two earthquakes occurred in one year)
      mo (month of earthquake occurrence)
      day (day of earthquake occurrence)
      hr (hour of earthquake occurrence)
      min (minute of earthquake occurrence)

LIQUEFACTION FEATURES
The northern part of the map area and large adjacent regions have
been severely shaken by one or more moderate to large prehistoric
earthquakes. The evidence of these takes the form of
paleoliquefaction features, including shaking-induced dikes and
sandblows that feed them.

The most widespread paleoliquefaction is attributed to a mid-
Holocene earthquake near what is now Vicennes, IN, with an
estimated moment-magnitude of about 7.5. Stratigraphic,
geomorphological, pedological, archeological, and geochronologic
evidence indicates that probably some of the paleoliquefaction was
caused by several additional, smaller earthquakes during the
Holocene and late Pleistocene.

Collectively, the following coverages contain results through the
end of the 1995 field season from all workers.

liqmunpts:
Cheryl and Pat Munson's locations of paleoliquefaction, mostly in
Indiana

feature class points
point attributes
      long, lat, dikeclass, site

liqmunsurv:
areas Munsons searched for evidence of paleoliquefaction, mostly
in Indiana

feature class polygon
polygon attribute inside

liq94pts: (clipped from liq94pts_all)
Jim Oliver's compiled locations of paleoliquefaction from various
field workers, mostly in Illinois.

There are observations outside the map area, and there are
observations that duplicate the Munsons' observations. These
locations were removed in this cover but are retained in
'liq94pts_all'.

feature class point
point attributes
      dikeclass (size class)
      quality (qualitative value assigned by Obermeier's group)

liq94pts_all:
all locations of paleoliquefaction evidence reported from Oliver,
including those outside the map area and those that overlap
Munsons' data

feature class points
point attributes
      tillpeatno
      dikeclass (size classification)
      nmq (researcher's code of earthquake associated with dike)
      nmqpre (researcher's code of related prehistoric earthquake)
      long, lat

liq94surv:
areas searched for evidence of paleoliquefaction by field workers
contributing to Oliver's compilation, mostly in Illinois

feature class polygon
polygon attributes
      inside

liqsurv:
areas searched for evidence of paleoliquefaction by all field
workers (combination of munsurv, liq94surv, and liq95surv)

feature class polygon
polygon attributes
      inside

liq95pts:
locations of paleoliquefaction from Obermeier's and Tuttle's 1995
field season

feature class points
point attributes
        long, lat, dikeclass, site

liq95surv:
areas Obermeier and Tuttle searched for evidence of
paleoliquefaction in the 1995 field season

REFLECTION, REFRACTION DATA

reflec: (clipped from reflec_all)
locations of seismic reflection lines with publically available
interpretations that can constrain subsurface structures

feature classes lines, points, anno.line, anno.point

arc attributes
        line (name), ref(erence)
point attributes
        line, ref(erence)

reflec_all:
same as reflec, lines may extend beyond map area

refrac: (clipped from refrac_all)
locations of seismic refraction lines with publically available
interpretations that can constrain subsurface structures

feature classes arcs, anno.map
arc attributes
        name, ref (abbreviated reference)

refrac_all:
same as refrac, lines may extend beyond map area

cocorp:
locations of Ilinois and Indiana COCORP lines that cross the map
area

features classes arcs, anno.line, anno.point

arc attributes
        line (name), ref(erence)

REFERENCES

Rhea, Susan, 1995, Seismotectonic maps in the vicinity of New Madrid, Missouri - Database, U.S. Geological Survey Open File Report, OFR 95-0574, 13 p., available at <URL:ftp://greenwood.cr.usgs.gov/pub/open-file-reports/ofr-95-0574>

Rhea, Susan, and Wheeler, R.L., 1996, Map showing seismicity in the vicinity of the Lower Wabash Valley, Illinois, Indiana, and Kentucky, U.S. Geological Survey Geologic Investigations Map I-2583-A, 1 sheet, scale 1:250,000, 14 p.

Rhea, Susan, Wheeler, R.L., and Hopper, M.G., 1996, Map showing earthquake intensities in the vicinity of the Lower Wabash Valley, Illinois, Indiana, and Kentucky, U.S. Geological Survey Geologic Investigations Map I-2583-B, 1 sheet, scale 1:250,000, 6p.

Wheeler, R.L., Diehl, S.F., Rhea, Susan, Sargent, M.L., and Bear, G.W., 1997, Map showing selected wells and geophysical survey and modeling lines in the vicinity of the lower Wabash Valley, Illinois, Indiana, and Kentucky, U.S. Geological Survey Geologic Investigations Map I-2583-C, 1 sheet, scale 1:250,000, 16p.

Wheeler, R.L., Rhea, Susan, Diehl, S.F., Drahovzal, J.A., Bear, G.W., and Sargent, M.L., 1997, Map showing faults, igneous rocks, and geophysical and neotectonic features in the vicinity of the lower Wabash Valley, Illinois, Indiana, and Kentucky, U.S. Geological Survey Geologic Investigations Map I-2583-D, 1 sheet, scale 1:250,000, 15p.