Geologic and Geophysical maps of the Ozark, Illinois, Indiana, and Kentucky (OIINK) Region: DRAFT DATA PRODUCTS

Note: To use Esri layer packages, drag and drop the layer package from ArcCatalog into ArcMap. The source data will unzip and save to the default folder, usually "C:\Users\[username]\Documents\ArcGIS\Packages".

The 12 geologic and geophysical maps in this set span the four-state region of Missouri, Illinois, Indiana, and Kentucky. We have used existing local work to compile regional maps that provide a broader context for research on the tectonics of the Midcontinent. This map series was originally conceived as a means to provide visual context for discussions associated with an NSF EarthScope Workshop on *Tectonic Targets for EarthScope in the Midcontinent* (S. Marshak, lead convener) that was held on April 11-13, 2010 in Urbana, Illinois. The maps are currently under review for publication by the Illinois State Geological Survey. These Esri layer packages (ArcGIS v. 10.3) are being provided as interim data products and have not completed formal review or technical quality assurance procedures.

These maps were compiled from existing data and are presented in a standard four-state format. Most of the data were compiled from statewide data and merged into our larger four-state format. We made minimal efforts to match data across state lines, preferring instead to concentrate on the overall picture of the regional trends and then produce the most accurate state-to-state matching. In other instances, we clipped larger data sets to fit our regional map template.

Map 1—Land-Surface Topography
The elevation data were derived from National Elevation Dataset (NED) data, <http://ned.usgs.gov>, and show the terrain at a resolution of 100 meters. The NED is a raster product assembled by the U.S. Geological Survey, designed to provide national elevation data in a seamless form with a consistent datum, elevation unit, and projection. Data corrections made in the NED assembly process minimize artifacts, permit edge matching, and fill sliver areas of missing data. The NED is updated on a bi-monthly basis. This data set was derived from NED data released in October, 2012, http://ned.usgs.gov/downloads/documents/NED_Release_Notes_Oct12.pdf>.

Map 2—Bedrock Topography
This map was created in July 2009 with the Topo to Raster tool in ArcGIS by using the bedrock topographic contours of Missouri (Missouri Department of Natural Resources, 2006, ftp://msdis.missouri.edu/pub/state/st_top_rock_elev.zip), Illinois (Herzog et al. 1994, GIS Database ISDB_BEDGEO.IL_Bedrock_Topography_1994_Ln, http://www.isgs.illinois.edu/nsdihome/webdocs/st-geolb.html), and Indiana (Gray 2003, line shapefile BEDROCK_TOPOGRAPHY_MM36_IN, http://inmap.indiana.edu/dload_page/geology.html). A bedrock topography map was not available for Kentucky because in that state, bedrock is either at or very near the land surface. Therefore, surface elevations derived from the SRTM for Kentucky were merged into the Missouri-Illinois-Indiana grid.

A shaded relief map was then created by artificially illuminating the elevation surface from a light source located at 315 degrees azimuth and 45 degrees above the horizon. A 5× vertical exaggeration was applied to enhance the features of the bedrock surface.

Map 3—Surficial Geology with Shaded Relief
This map was created in March 2010 by extracting the four-state area from Fullerton et al. (2003, http://pubs.usgs.gov/imap/i-2789). The shaded relief map from Map 1 was included.

Map 4—Bedrock Geology with Bedrock Topography
This map was created in June 2009 by simplifying the more detailed statewide geologic maps from the Missouri Department of Natural Resources (1979, ftp://msdis.missouri.edu/pub/state/st_geol.e00.gz), McDowell et al. (1981, http://www.uky.edu/KGS/gis/geology.htm), Gray et al. (1987, http://inmap.indiana.edu/dload_page/geology.html, polygon shapefile BEDROCK_GEOL_MM48_IN), Noger (1988, http://www.uky.edu/KGS/gis/geology.htm), and Kolata (2005, GISDB_BEDGEO.IL_Bedrock_Geology_500K_2005, http://www.isgs.illinois.edu/nsdihome/webdocs/st-geolb.html). Only system-level geology was consistent across the four-state area. An additional boundary, the Pennsylvanian-aged Mattoon Formation (Kolata 2005, GISDB_BEDGEO.IL_Bedrock_Geology_500K_2005, http://www.isgs.illinois.edu/nsdihome/webdocs/st-geolb.html), was added in June 2009 to clarify the position of the Illinois Basin. The shaded relief map of the bedrock surface in Map 2 was included.

Map 5—Structure-Contour Map of the Pennsylvanian Springfield Coal
This map was created in two parts. A published raster surface of the Springfield Coal for the Illinois Basin (USGS Central Region Energy Resources Team 2002) was clipped to the extent of the Springfield Coal in Illinois, Indiana, and Kentucky. Because the Springfield Coal is not present in Missouri, we digitized a map of the surface of the Bevier Coal (Hinds and Greene 1915), which has an equivalent stratigraphic position in Missouri. Point locations were converted to an ArcGIS shapefile. A raster surface was then created with the Topo to Raster tool and clipped to the extent of the Bevier Coal. The raster for the Bevier Coal was then merged with the raster of the Springfield Coal in the Illinois Basin. Finally, a shaded relief map of the combined raster surface was created by artificially illuminating the elevation surface from a light source located at 315 degrees azimuth and 45 degrees above the horizon.

Map 6—Structure-Contour Map of the Mississippian-Devonian New Albany Shale Group
This map was created from preexisting digital contour data of Kentucky (Kentucky Geological Survey 1982) and the Illinois Basin (Morse et al. 2000) and from contours digitized from a scanned paper map of Missouri (Bohm and Palmer 1981). The paper map was scanned, and the resulting image was georeferenced in ArcGIS to the Universal Transverse Mercator (UTM) Zone 16 North American Datum (NAD) 1983 coordinate system. We then used the Topo to Raster tool in ArcGIS to create a raster surface for the four-state study area and created a shaded relief map by artificially illuminating the elevation surface from a light source located at 315 degrees azimuth and 45 degrees above the horizon. The surface and shaded relief rasters were then clipped to the extent of the unit.

Map 7—Structure-Contour Map of the Ordovician Trenton Group
This map was created from contour lines digitized from the regional paper map of the top of the Trenton Limestone or equivalents in June 2009 (Nelson 1995, http://www.isgs.uiuc.edu/nsdihome/browse/statewide/zips/IL_Struct_Feat_Clines_1995_Ln.zip). The map was scanned, and the resulting image was georeferenced in ArcGIS to the UTM Zone 16 NAD 1983 coordinate system. The Topo to Raster tool in ArcGIS was then used to create a raster surface for the four-state study area, and a shaded relief map was created by artificially illuminating the elevation surface from a light source located at 315 degrees azimuth and 45 degrees above the horizon. The surface and shaded relief rasters were then clipped to the extent of the unit.

Map 8—Structure-Contour Map of the Top of the Precambrian
This map was created from existing digital contour lines for Illinois and Indiana (Collison et al. 1988) and Kentucky (Solis et al. 2005) and from contour lines digitized from a paper map of Missouri (Kisvarsanyi 1984). The paper map was scanned, the resulting image was georeferenced in ArcGIS to the UTM Zone 16 NAD 1983 coordinate system, and contours and outcrop areas were digitized. Contours for all four states were used to create a raster surface for the four-state study area with the Topo to Raster tool in ArcGIS. A shaded relief map was created by artificially illuminating the elevation surface from a light source located at 315 degrees azimuth and 45 degrees above the horizon. The surface and shaded relief rasters were then clipped to the extent of the unit.

Map 9—Isostatic Gravity Anomaly
A raster (Esri grid) data set containing isostatic anomaly data for the conterminous United States was downloaded in May 2015 from the Mineral Resources On-Line Spatial Data of the USGS (Kucks 1999, http://mrdata.usgs.gov/geophysics/gravity.html). The data were originally published by Phillips et al. (1993, ftp://ftpext.usgs.gov/pub/cr/co/denver/musette/pub/GEOPHYSICAL_DATA/cdrom_DDS-9). The grid cell size is 4,000 × 4,000 meters. ArcGIS software was used to generate isostatic anomaly contours for the four-state study area at 5-milligal (mGal) intervals. A smoothed shaded relief overlay was created to better visualize the highs and lows in the data set. For this step, we used the ArcGIS Topo to Raster tool to generate a new raster surface from the contours. The new surface was then used to create the relief surface using the Hillshade tool.

Map 10—Magnetic Anomaly
Data for this map were downloaded in March 2010 from the source website (Bankey et al. 2002, http://mrdata.usgs.gov/geophysics/aeromag.html). ArcGIS was then used to clip the map to the four-state area.

Map 11—Fault and Fold Traces
Data for this map were downloaded in June 2009 from the various state GIS websites or the ISGS GIS database and compiled into a single map. Kentucky sources include the Kentucky Geological Survey (2008, http://www.uky.edu/KGS/gis/geology.htm), McDowell et al. (1981, http://www.uky.edu/KGS/gis/geology.htm), and Noger (1988, http://www.uky.edu/KGS/gis/geology.htm). Missouri fault and fold data were obtained from the Missouri Department of Natural Resources (2006, http://msdis.missouri.edu). The Illinois data

were drawn from Nelson (1995) in June 2009 (http://www.isgs.uiuc.edu/nsdihome/browse/statewide/zips/IL_Struct_Feat_Clines_1995_Ln.zip). The Indiana data were downloaded in June 2009 as a shapefile showing the locations of known structural features in Indiana (Indiana Geological Survey 1971, http://igs.indiana.edu/arcims/statewide/download.html, line shapefile STRUCTURAL_FEATURES_IN). This shapefile included only one fault trace.

Map 12—Earthquake Epicenters

Data for this map were obtained from two sources: (1) earthquakes before 1973 (Stover et al. 1984) and (2) the USGS's NEIC catalog of earthquakes from 1973 to present (USGS 1973–present, http://earthquake.usgs.gov/earthquakes/eqarchives/epic/epic_rect.php, data retrieved July 2009). These data sets were combined into a single shapefile and overlaid onto a base map.