

CURRENT STATUS OF GEOFRAMEWORK DATASETS AND 3D DATABASES AT THE KENTUCKY GEOLOGICAL SURVEY

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The Kentucky Geological Survey (KGS) at the University of Kentucky is working to formalize a digital 3D geologic framework. Building upon outcomes and processes of other 3D-active GSO's, as well as a legacy of geologic mapping, stratigraphic studies, digital geology, and public data delivery, KGS is compiling a database of 3D-compatible inputs. These include a three-dimensional fault model, stratigraphic contact surfaces from published contour data, a revised well-log stratigraphic tops dataset, and new surfaces interpolated from geophysical well logs and other subsurface data. These inputs are available for import into future 3D models that may be developed for numerous stakeholder applications related to energy, minerals, water, or hazards. To ensure transparency and aid future practitioners, KGS mappers are documenting standard workflows for each 3D product developed or migrated into the KGS 3D database. New web-based tools are being used for 3D data visualization and interrogation to make the results more accessible to KGS's diverse technical and public audiences.

As with any program of large datasets, data management and documentation are a challenge and priority for KGS. Kentucky currently has published paper statewide geologic maps at 1:1M, 1:500k, 1:350k, 1:250k, and statewide sets of 1:100k and 1:24k paper maps. KGS-specific assets include 2D digital geologic map products of 1:500k statewide general geology and faults, 1:24k statewide geology and faults, 1:24k

statewide bedrock geology, a general statewide raster model of surficial geology, and a general digital 2D map of basement faults and elevation surface. In the digital 3D database, KGS has a statewide fault model derived from the 1:24k 2D digital geologic map, 12 statewide 3D contact surfaces suitable for public visualization and display, and a total of at least 212 partial or regional 3D stratigraphic contact surfaces. Early uses of these data included a population of 3D visualization of features in the Illinois-Kentucky Mineral District (USGS-KGS cooperative Earth MRI critical mineral research) and online web tools for generating cross sections and general synthetic stratigraphic sections.

Active geoframework projects include tagging well logs for Devonian and deeper horizons in western Kentucky, generating 3D models of near-outcrop contact surfaces for clay shale units, and developing best-available stratigraphic surfaces for the Jackson Purchase (Gulf Coastal Plain) and Ohio River valley. Upcoming proposed work includes well tagging for 3D stratigraphic analysis for Upper Mississippian strata in western Kentucky.

Anticipated future applications of these 2D and 3D geoframework datasets include landslide research, water supply studies, geotechnical investigations, and supporting critical minerals research.