Oklahoma Geological Survey
Jeremy Boak, *Director*

**Open-File Report 1-2018**

# Elevation Map of the Top of the Crystalline Basement in Oklahoma and Surrounding States

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**OPEN-FILE REPORT 1-2018**

# ELEVATION MAP OF THE TOP OF THE CRYSTALLINE BASEMENT IN OKLAHOMA AND SURROUNDING STATES

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## INTRODUCTION

This Open-File Report (OF) is the first in a series of 16 that shows shaded relief maps of the top and bottom digital elevation model (DEM) grids for stratigraphic units in Oklahoma, Kansas, and parts of Nebraska, Iowa, Missouri, Arkansas, and Texas. Isopach maps from which these DEM grids were derived are also included, along with lithofacies in some instances. Each map covers the area from 41.0 degrees to 34.5 degrees north-south, and -94.0 degrees to -102.0 degrees east-west. The Open-File Reports are published as layered PDFs that contain individual map pages with map layers that can be turned on or off, using Adobe Acrobat[1]. They are available in PDF and GIS-compatible formats.

In each of the 16 Open-File Reports, Plate 1 shows the top elevation of the unit; Plate 2 shows the bottom elevation of the unit; and Plate 3 shows the thickness of the unit. In OF 9-2018 through OF 15-2018, Plate 3 also shows the lithofacies of the unit. The lithofacies maps are taken from Rascoe and Hyne (1988) and use a simple four component carbonate-clastic binary phase diagram with vertical lithology boundaries. The colors represent the relative amount of clastics and carbonates in the rocks. Rocks with a high percentage of clastics are colored yellow, and rocks with a high percentage of carbonates are blue.

## DESCRIPTION

OF 1-2018 shows the shaded relief map of the digital elevation model (DEM) grid of the top of the crystalline basement in Oklahoma and surrounding states. Within the mapped area, the crystalline basement rocks deepen to the south in the Anadarko and Arkoma Basins.

## METHODS

Data used to create the shaded relief maps for the series of 16 Open-File Reports include:

- 16 isopach maps from *Petroleum Geology of the Mid-Continent* (PGM; Rascoe and Hyne, 1988), which depict the thicknesses of sedimentary strata from the topographic surface to the crystalline basement (Table 1), and

- National Elevation Dataset (NED) surface topography

[1] A free version of Adobe Acrobat Reader may be downloaded online at http://acrobat.adobe.com.

Each of the 16 PGM isopach maps were digitally scanned and georeferenced to geographic coordinates using the datum North American 1983 and later projected to the Albers Equal-Area Conic projection of the same datum. The contour lines of each isopach map were then digitized and attributed with their corresponding thickness values.

In some cases, the PGM isopach maps contain holes where no data are present. These discontinuities occur where (1) a unit pinches out to zero thickness or (2) a fault truncates a unit, resulting in a reduced thickness or disappearance of the unit. In these cases, the isopach used to create the DEMs was modified from the original PGM isopach to show the unit thickness as zero rather than the isopach map containing no data.

The digitized isopach thickness data were then gridded and co-registered with the National Elevation Dataset (NED) topography. Starting with the shallowest stratum (Triassic and Cretaceous Systems), the isopach thickness grid was subtracted from the NED topography to get the bottom elevation grid for that stratum; alluvium and terrace deposits were not factored into the model. By definition, the resultant bottom elevation grid is also the top elevation grid of the next lower stratum (Guadalupian Series). This workflow was repeated for each isopach thickness map in sequence until the top of the crystalline basement was reached. For example, the isopach thickness for the Guadalupian Series was subtracted from the top elevation grid of the Guadalupian Series to get the bottom elevation grid for the Guadalupian Series as well as the top elevation grid for the Leonardian Series. The subcrop grid is at a resolution of 30 arc-seconds.

**INTENTION**

These elevation models were originally produced to visualize 3D geology and aid in geophysical research. The tops and bottoms of each unit constrain the upper and lower bounds, respectively, of the density distribution within the sedimentary strata of a regional gravity model. The data presented here may also be useful for other subsurface investigations, such as geoengineering, petrophysical, or hydrogeologic applications. The data should be considered preliminary and may contain relative or absolute depth errors in stratigraphic unit elevations. The data may be revised in future iterations, when more subsurface information is made available to the authors.

**ACKNOWLEDGEMENTS**

We would like to thank Julie Chang and Jake Walter for their editorial assistance; Jim Anderson and Russell Standridge for their work preparing the PDF publication; and Randy Keller and RPSEA (Research Partnership to Secure Energy for America) for funding this endeavor.

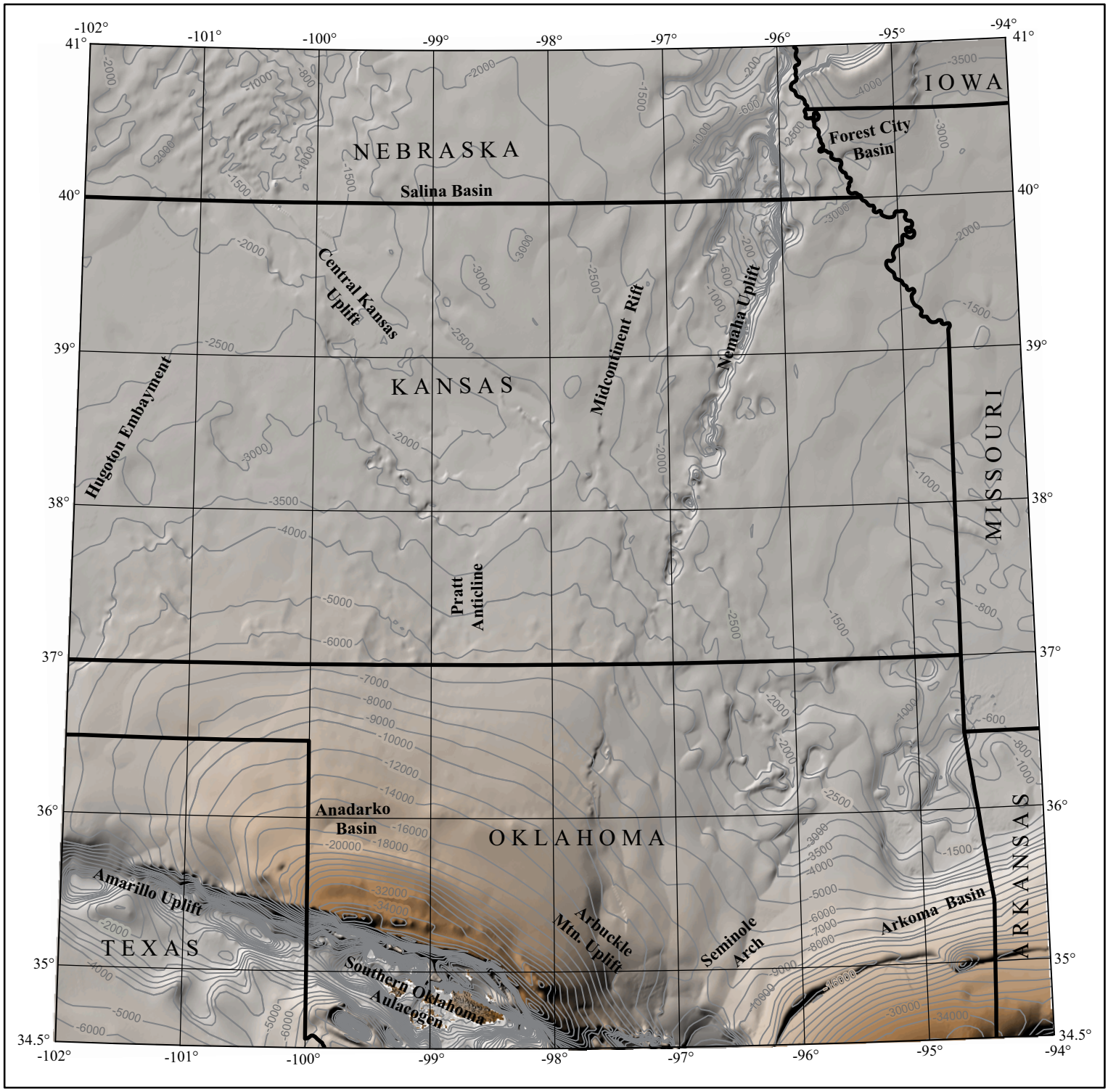
**REFERENCES**

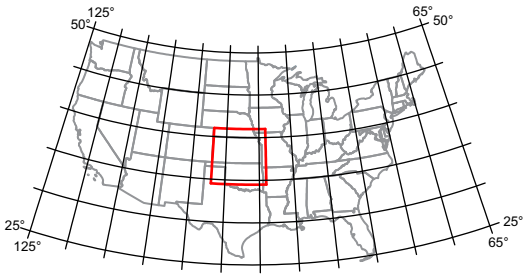
Rascoe, B., Jr., and Hyne, N.J., eds., 1988, Petroleum Geology of the Mid-Continent: Tulsa Geological Society Special Publication No. 3, 162 p.

Table 1. Open-File Report number (OF No.) and corresponding PGM isopach maps for units listed stratigraphically from oldest to youngest.

| OF No. | Unit | Series Age | PGM Plate No. | Page |
|---|---|---|---|---|
| OF 1-2018* | Precambrian Basement | Precambrian | 2 | 5 |
| OF 2-2018 | Arbuckle Group | Ordovician | 8 | 35 |
| OF 3-2018 | Simpson Group | Ordovician | 9 | 39 |
| OF 4-2018 | Viola Limestone | Ordovician | 10 | 47 |
| OF 5-2018 | Sylvan Shale | Ordovician | 11 | 49 |
| OF 6-2018 | Hunton Group | Silurian | 12 | 53 |
| OF 7-2018 | Woodford Shale | Devonian | 14 | 67 |
| OF 8-2018 | Pre-Chesterian Mississippian Rocks | Mississippian | 15 | 74 |
| OF 9-2018 | Chesterian Series | Mississippian | 16 | 80 |
| OF 10-2018 | Morrowan Series | Pennsylvanian | 18 | 94 |
| OF 11-2018 | Atokan and Desmoinesian Series | Pennsylvanian | 19 | 107 |
| OF 12-2018 | Missourian and Virgilian Series | Pennsylvanian | 20 | 113 |
| OF 13-2018 | Wolfcampian Series | Permian | 21 | 119 |
| OF 14-2018 | Leonardian Series | Permian | 22 | 128 |
| OF 15-2018 | Guadalupian Series | Permian | 23 | 129 |
| OF 16-2018 | Triassic and Cretaceous Systems | Triassic and Cretaceous | 24 | 130 |

* This publication




Index map showing outline of study area

Albers Equal-Area Conic projection; NAD 83 datum
Contour: Elevation in feet

N

0 25 50 75 100 Miles

0 30 60 90 120 Kilometers

# OF 1-2018, PLATE 1
# Elevation of Precambrian Basement

by
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After Petroleum Geology of the Mid-Continent, Plate 02, p. 5