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

January 2018

Kevin D. Crain and Jefferson C. Chang
Oklahoma Geological Survey

The University of Oklahoma
Norman, Oklahoma
2018

Oklahoma Geological Survey Open-File Report Disclaimer

OPEN-FILE REPORT 1-2018

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

Kevin D. Crain and Jefferson C. Chang

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 10-2018 through OF 16-2018, 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 at the NAD83 datum 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.

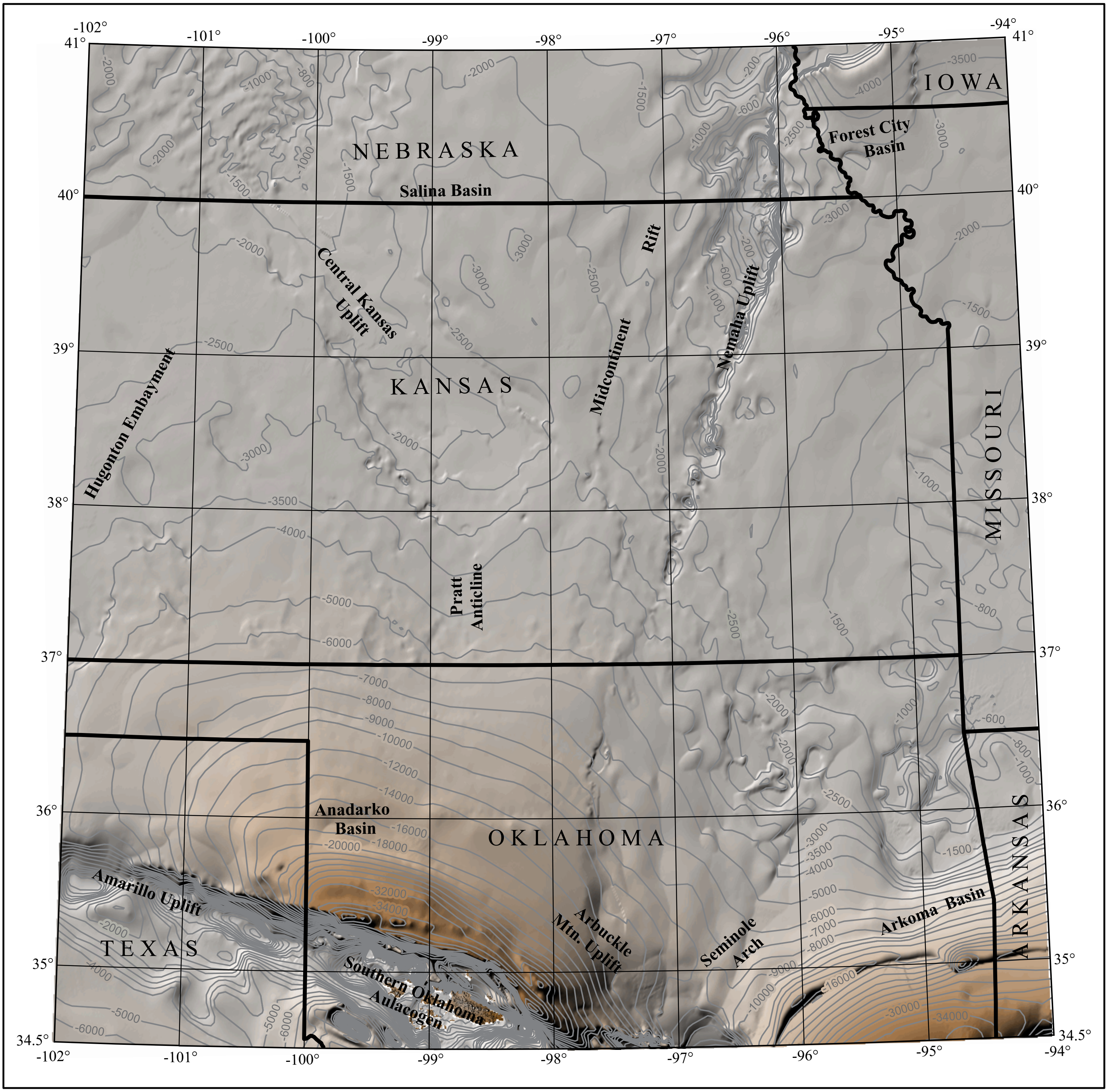
REFERENCES

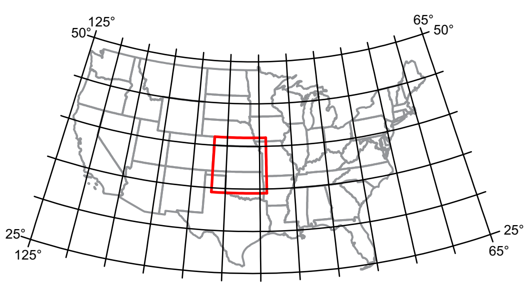
Rascoe, B., Jr., and Hyne, N.J., eds., 1988, Petroleum Geology of the Mid-Continent: Tulsa Geological Society Special Publication No. 3, 162 p.

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

Kevin D. Crain and Jefferson C. Chang

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