Open-File Report 11-2018

Elevation, Thickness, and Lithofacies of the Pennsylvanian Atokan and Desmoinesian Series Rocks in Oklahoma and Surrounding States

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OPEN-FILE REPORT 11-2018

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Kevin D. Crain and Jefferson C. Chang

INTRODUCTION

This Open-File Report (OF) is the eleventh 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. They are available in PDF and GIS 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 11-2018 shows the shaded relief map of the top (Plate 1) and bottom (Plate 2) digital elevation model (DEM) grids of the Pennsylvanian Atokan and Desmoinesian Series rocks, as well as the unit's lithofacies and thickness (Plate 3), in Oklahoma and surrounding states.

METHODS

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

- sixteen 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

Each of the sixteen 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 is 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 the shallowest stratum (Triassic and Cretaceous Systems); 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. Due to the map scale, there are no elevation contours for the outcrop topography. The subcrop grid is at a scale of 30 arcseconds.

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.

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.

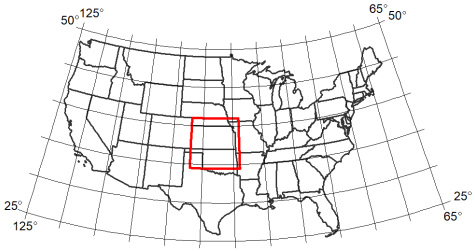
ACKNOWLEDGEMENTS

I would like to thank Julie Chang and Jake Walter for their editorial assistance; David Morris and Russell Standridge for their work preparing the PDF publication; and Randy Keller and RPSEA for funding this endeavor.

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

Top Elevation of Atokan and Desmoinesian Series

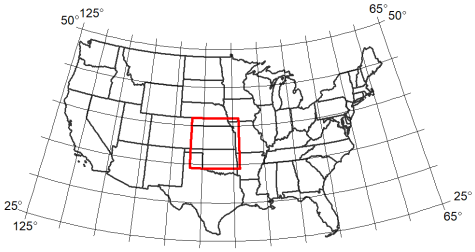
by

Kevin D. Crain and Jefferson C. Chang

OF 11-2018, PLATE 1

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. Plate 19, p. 107



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

Bottom Elevation of Atokan and Desmoinesian Series

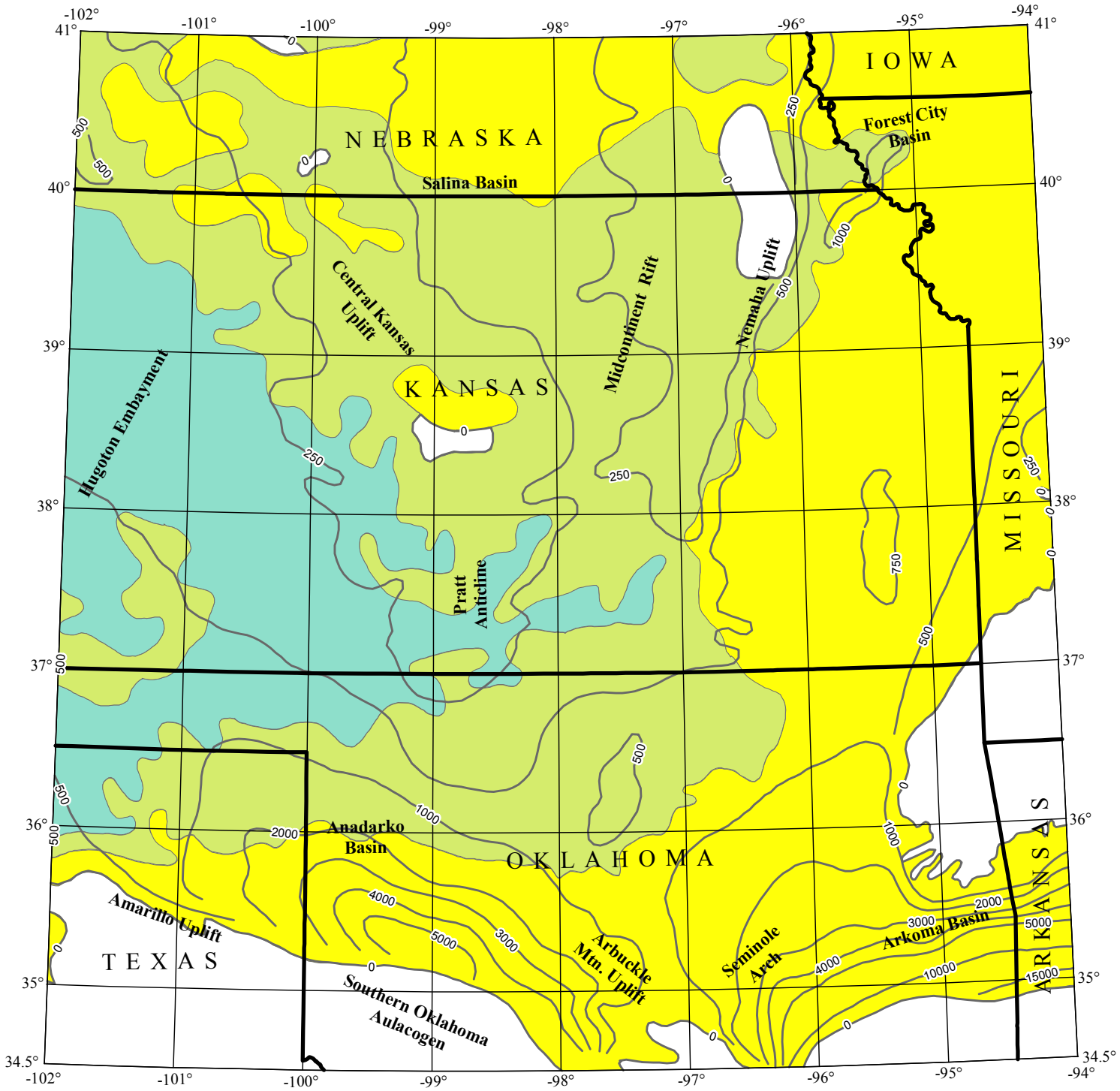
by

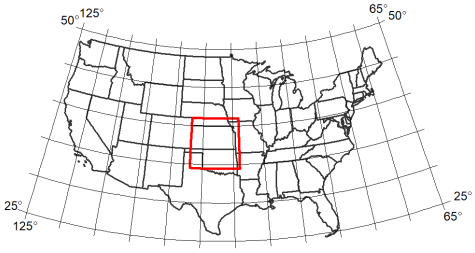
Kevin D. Crain and Jefferson C. Chang

OF 11-2018, PLATE 2

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. Plate 19, p. 107





Index map showing outline of study area

Albers Equal Area Conic Projection; NAD 83 Datum
Contour: Elevation in feet

PERCENTAGE OF CARBONATES
0 20 50 80 100
100 80 50 20 0
PERCENTAGE OF CLASTICS

N

0 25 50 75 100 Miles
0 30 60 90 120 Kilometers

Lithofacies and Thickness of Atokan and Desmoinesian Series

by

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OF 11-2018, PLATE 3

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. Plate 19, p. 107