

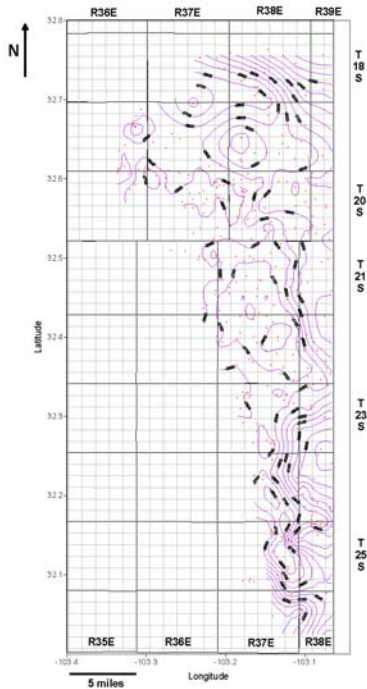
# Structure contours on Tubb sandstone member of Yeso Formation (Lower Permian), Central Basin Platform, southeastern New Mexico

*By*

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Central Basin Platform, New Mexico



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## INTRODUCTION

This open-file report contains a digital structure contour map of the upper surface of the Tubb sandstone member of the Yeso Formation (Lower Permian) on the Central Basin Platform, southeastern New Mexico (Figures 1, 2, 3). This project was undertaken at the request of the New Mexico State Land Office and was funded by the New Mexico State Land Office.

This open-file report has three parts:

1. This pdf document that discusses the report, the digital database of well data, well location methodology, correlation of the top of the Tubb sandstone, contouring methods, and the various methods available to view the structure contour map.
2. A digital database of 337 wells, including well locations, depth to the Tubb in each well, surface elevation of each well, and the subsea elevation of the Tubb in each well.
3. The structure contour map on the upper surface of the Tubb, which is presented in four different formats: a large pdf image with a 25 ft contour interval, a small pdf image with a 100 ft contour interval, an ArcReader project, and an ArcMap project.

The structure contour map of the top of the Tubb sandstone was constructed using the structural elevation of the upper surface of the Tubb in 337 wells that cover a 650 mi<sup>2</sup> area in southeastern New Mexico. Contours were made with a modern digital contouring program (*Surfer 8*, a product of Golden Software, Inc.). The database of wells and structural elevations is presented in this report in Microsoft Excel format so that the reader has the ability to plot the wells and structural data, and make contours on his/her own using different techniques and software than used for this project. The user also has the freedom to add additional well data to the database.

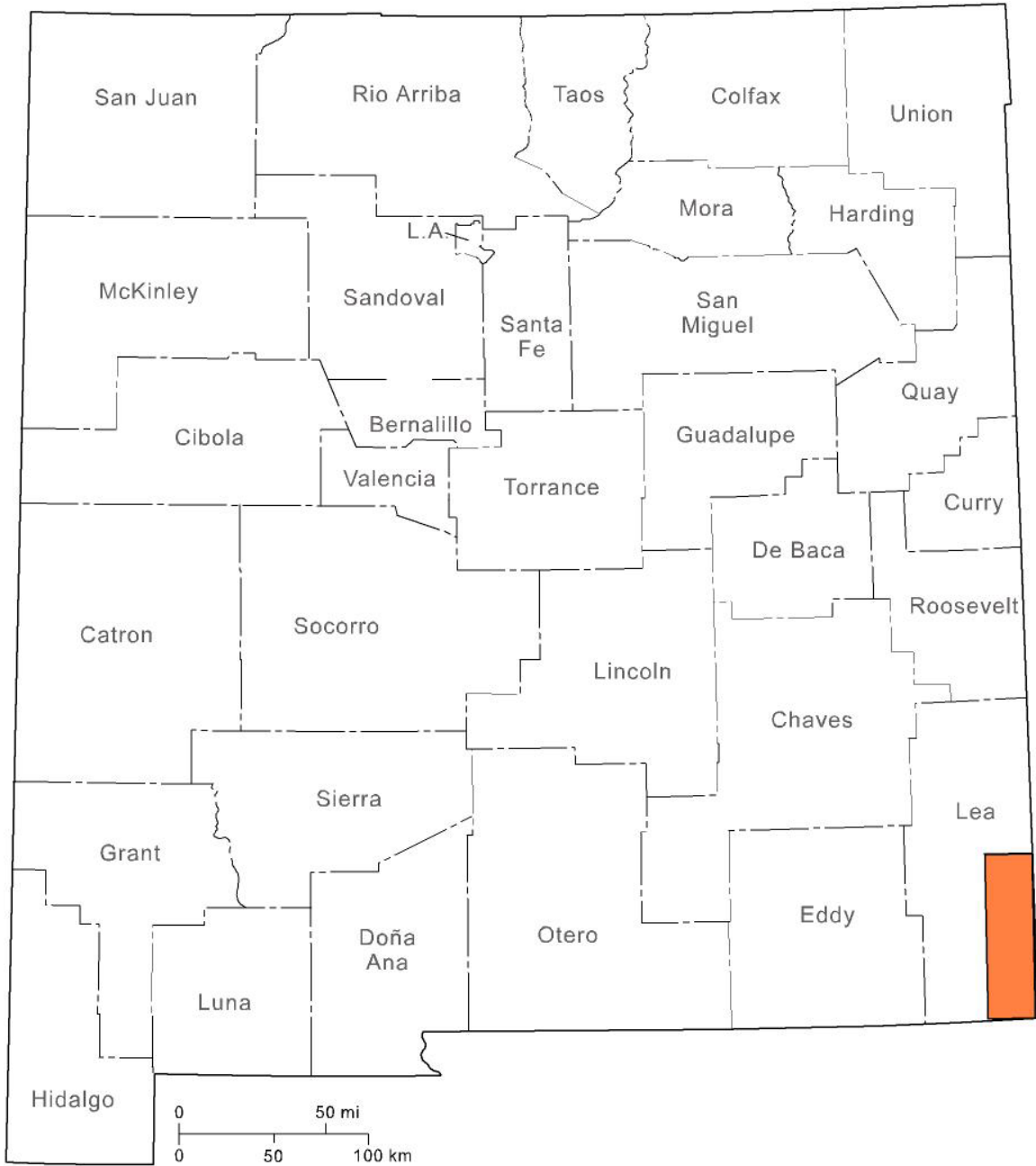


Figure 1. Location within New Mexico of Tubb sandstone structure contour map produced for this report.

| CENTRAL BASIN PLATFORM |                    |                                  |          |
|------------------------|--------------------|----------------------------------|----------|
|                        | Age                | Strata                           |          |
| <b>Triassic</b>        |                    | Chinle                           |          |
|                        |                    | Santa Rosa                       |          |
| <b>Permian</b>         | Ochoan             | Dewey Lake                       |          |
|                        |                    | Rustler                          |          |
|                        | Guadalupian        | Salado                           |          |
|                        |                    | Artesia Group                    | Tansill  |
|                        |                    |                                  | Yates    |
|                        |                    | Seven Rivers                     |          |
|                        |                    | Queen                            |          |
|                        |                    | Grayburg                         |          |
|                        | Leonardian         | San Andres                       |          |
|                        |                    | Yeso Formation                   | Glorieta |
| Paddock member         |                    |                                  |          |
| Blinebry member        |                    |                                  |          |
| Tubb sandstone member  |                    |                                  |          |
| Wolfcampian            | Drinkard member    |                                  |          |
|                        | Abo                |                                  |          |
|                        | Hueco ("Wolfcamp") |                                  |          |
| <b>Pennsylvanian</b>   | Virgilian          | Cisco                            |          |
|                        | Missourian         | Canyon                           |          |
|                        | Des Moinesian      | Strawn                           |          |
|                        | Atokan             | Atoka                            |          |
|                        | Morrowan           | Morrow                           |          |
| <b>Miss.</b>           |                    | undivided                        |          |
| <b>Dev.</b>            | Upper              | Woodford                         |          |
|                        | Middle             |                                  |          |
|                        | Lower              | Thirtyone                        |          |
| <b>Sil.</b>            | Upper              | Wristen                          |          |
|                        | Middle             |                                  |          |
|                        | Lower              | Fusselman                        |          |
| <b>Ord.</b>            | Upper              | Montoya                          |          |
|                        | Middle             | Simpson                          |          |
|                        | Lower              | Ellenburger                      |          |
| <b>Cambrian</b>        |                    | Bliss                            |          |
| <b>Precambrian</b>     |                    | igneous, metamorphics, volcanics |          |

Figure 2. Stratigraphic column of Phanerozoic sedimentary rocks on the Central Basin Platform. Tubb sandstone member of Yeso Formation shown in red.

# Structure contours on Tubb sandstone (Lower Permian) Central Basin Platform, New Mexico

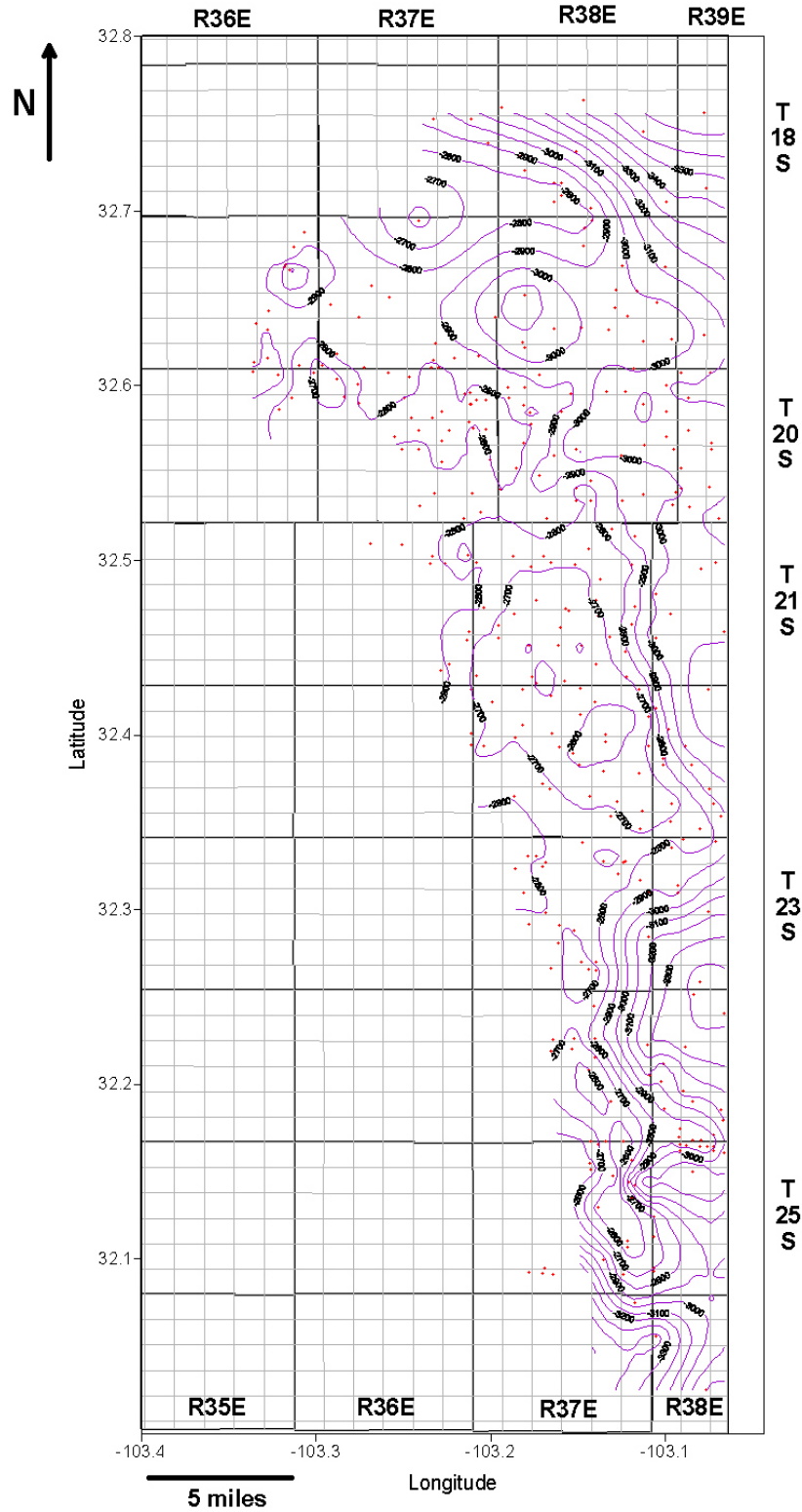


Figure 3. Structure contours on upper surface of Tubb sandstone, Central Basin Platform, southeastern New Mexico.

## THE TUBB STRUCTURE DATABASE

The Tubb structure database (*Tubb structure data.xls*) is presented on this CD in Microsoft Excel format. For each of the 337 wells in the database, there are 16 data fields that pertain to the description of each well, its location, and the subsea (or structural) elevation of the upper surface of the Tubb sandstone in each well. The data fields are described below.

**Operator:** The name of the company that drilled the well.

**Lease name:** The name of the lease the well was drilled on.

**Well number:** The number of the well in the lease.

**API number:** The unique API well number, if present in the well files of the New Mexico Bureau of Geology and Mineral Resources.

**Township (south):** The township, south of the regional base line, in which the well is located.

**Range (east):** The range, east of the New Mexico Principal Meridian, in which the well is located.

**Section:** The section within the township and range, specified above, in which the well is located.

**Loc in section:** The location of the well within the section, in feet from the boundary lines of the section.

**Longitude:** The longitude of the well, in decimal degrees. See section on *Well locations* in this report to find out how longitude was calculated.

**Latitude:** The latitude of the well, in decimal degrees. See section on *Well locations* in this report to find out how latitude was calculated.

**Elevation:** The surface elevation of the well in feet above sea level.

**Datum:** The datum that the surface elevation is measured from. KB = Kelly bushing; DF = derrick floor; GR = ground level.

**Total depth:** Total depth of the well, in feet.

**Tubb top (ft):** Depth to the top of the Tubb sandstone, in feet.

**Tubb subsea elevation (ft):** The subsea (or structural) elevation of the upper surface of the Tubb sandstone was calculated by subtracting the depth to the top of the Tubb sandstone from the surface elevation of the well.

**Source Tubb top:**

*Scout ticket* = the depth to the top of the Tubb sandstone was obtained from well records on file at the New Mexico Bureau of Geology and Mineral Resources.

*Log correlation* = the depth to the top of the Tubb sandstone was determined by correlating geophysical borehole logs and/or sample logs on file at the New Mexico Bureau of Geology and Mineral Resources.

## WELL LOCATIONS

Well locations in the Tubb structure database are provided in both section-township-range format and in latitude-longitude format. Section-township-range format is the legal surveyed well location and is provided with every well record; this is the location used in every well permit. A location in latitude-longitude format is necessary to plot wells on a map using a computer and to perform contouring with a computer.

Latitude and longitude were calculated from the section-township-range coordinates at the New Mexico Bureau of Geology and Mineral Resources using the Geographix Exploration Program (a product of Landmark Graphics) and the Whitestar Corporation digital land grid of New Mexico (1997 version). This method allows translation of section-township-range coordinates into latitude-longitude coordinates based on the 1927 North American datum. In general, wells located with our version of the Whitestar land grid appear to plot within 250 feet of the surveyed locations on a 1:24,000 topographic map. In general, these locations will be accurate to at least the nearest quarter-quarter-quarter section. This is sufficient accuracy to produce a valid structure contour map on a basinal scale with a maximum well density of one well per section.

## DETERMINATION OF DEPTH TO TOP OF TUBB SANDSTONE MEMBER OF THE YESO FORMATION

The database contains values for depth to the upper surface (“top”) of the Tubb sandstone for 337 wells. Of these, tops for 316 wells were obtained from well records on file at the New Mexico Bureau of Geology and Mineral Resources. Tops for 21 well were obtained by correlating geophysical borehole logs and/or sample logs. Therefore 6% of the Tubb tops were the result of correlations made with well logs. The Tubb has also

been referred to as the Fullerton sandstone by some workers and is listed as the Fullerton sandstone in many well records. In general, Tubb tops listed in well records appear consistent and demark the highest sandstone bed within that part of the Yeso section correlative with the Tubb. The Tubb was calculated from well logs and/or sample logs only in wells where records at the NMBGMR do not list the top of the Tubb and in those areas where well density is low.

## **CONTOURING METHODS**

The structure on top of the Tubb sandstone was contoured digitally using *Surfer 8*, a modern digital contouring program (*Surfer 8* is a registered trademark of Golden Software, Inc.). Gridding of the well data, provided in the Excel spreadsheet on this CD, was done in Surfer using the point kriging method with default parameters. The gridded data were then contoured at 25 ft and at 100 ft contour intervals. For both the 25 ft and 100 ft contour-interval maps, the contours were smoothed with the high smoothing option in order to remove the straight-line aspects of contours that are made without the smoothing option. Although smoothing results in contours are more rounded and look more natural, this option can locally cause contour lines to cross over each other in areas where contour spacing is very close. Once the contours were made in Surfer, they were exported to ArcMap for use in the GIS projects.

One of the drawbacks to the kriging method in the gridding of data is that the method can extrapolate structural elevation values beyond the known range of values, thereby producing a map that in places may have unrealistically high or unrealistically low contours. However, kriging generally minimizes this effect compared to other gridding techniques and generally results in contours that more closely approximate a good hand-contoured map than other gridding techniques. Kriging also attempts to minimize bulls eye patterns in the data and will attempt to connect isolated high points along ridgelines, thereby expressing trends among data points (Golden Software, Inc., 2002).

## **ACCESSING THE MAPS**

The structure contour map of the upper surface of the Tubb sandstone is presented in three formats for your use.



1. **Pdf format.** This format may be viewed on any computer that has Adobe Acrobat Reader installed and is a fixed map that cannot be modified or overlain on other maps. Two versions of the pdf map are give, one with 100 ft structure contour intervals (*Tubb structure 100 ft contours.pdf*) and one with 25 ft contour intervals (*Tubb structure 25 ft contours.pdf*). The 25 ft contour interval map has greater resolution than the 100 ft contour interval map and therefore will produce a larger map when plotted on paper, but will also require more computer memory and processing power to produce the map in a timely manner. Users that have older computers with limited memory and processing power may wish to use the map with the 100 ft contour intervals. Both maps were exported directly from Surfer 8. The pdf format is easy to use and a paper map may be easily plotted using a large format plotter. The pdf maps show contours and their values, a section-township-range grid, and well locations. If you do not have Adobe Acrobat Reader installed on your computer, a free copy is included on this CD in the file “*Acrobat Reader*” and may be downloaded and used in accordance with the license agreement provided with the software.
2. **ArcMap format.** ArcMap is a Geographic Information System (GIS) product of ESRI Corp. With this map, you can plot well locations, well data, contours, and other geologic and geographic data in a system of digital maps that may be spatially related to other geologic and geographic data that the user chooses to import from other sources. The user must have ArcMap v 8.2 from ESRI in order to view and use the contour map in ArcMap format. The files for the ArcMap version of the Abo structure contour map are located in the folder “*ArcMap*”. The structure contours in the ArcMap format were first created in Surfer 8 and then exported to ArcMap.
3. **ArcReader format.** ArcReader, a product of ESRI Corp., is a free viewer that allows the user to view the GIS version of the contour map, but not modify or change it. This format is located on this CD in the folder “*ArcReader map*”. If Arc Reader is not installed on your computer, you may download it from this CD by opening the folder “*ArcReader program*” and then by double clicking on the “license agreement” icon and accepting the terms of the license agreement. You may then double click on the “*setup*” icon in order to install ArcReader. After installation is complete, you may view the Tubb structure map by clicking on the *Tubb\_structure\_map ArcReader project*.

## **REFERENCE**

Golden Software, Inc., 2002, Surfer 8 users guide: Golden Software, Inc., Golden, CO.,  
640 p.