

Homework. Basin Analysis Report

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Permian Basin

1. Location of the Basin

There is in western Texas and southeastern New Mexico in the United States

2. Type of the Basin/Petroleum system/Trap

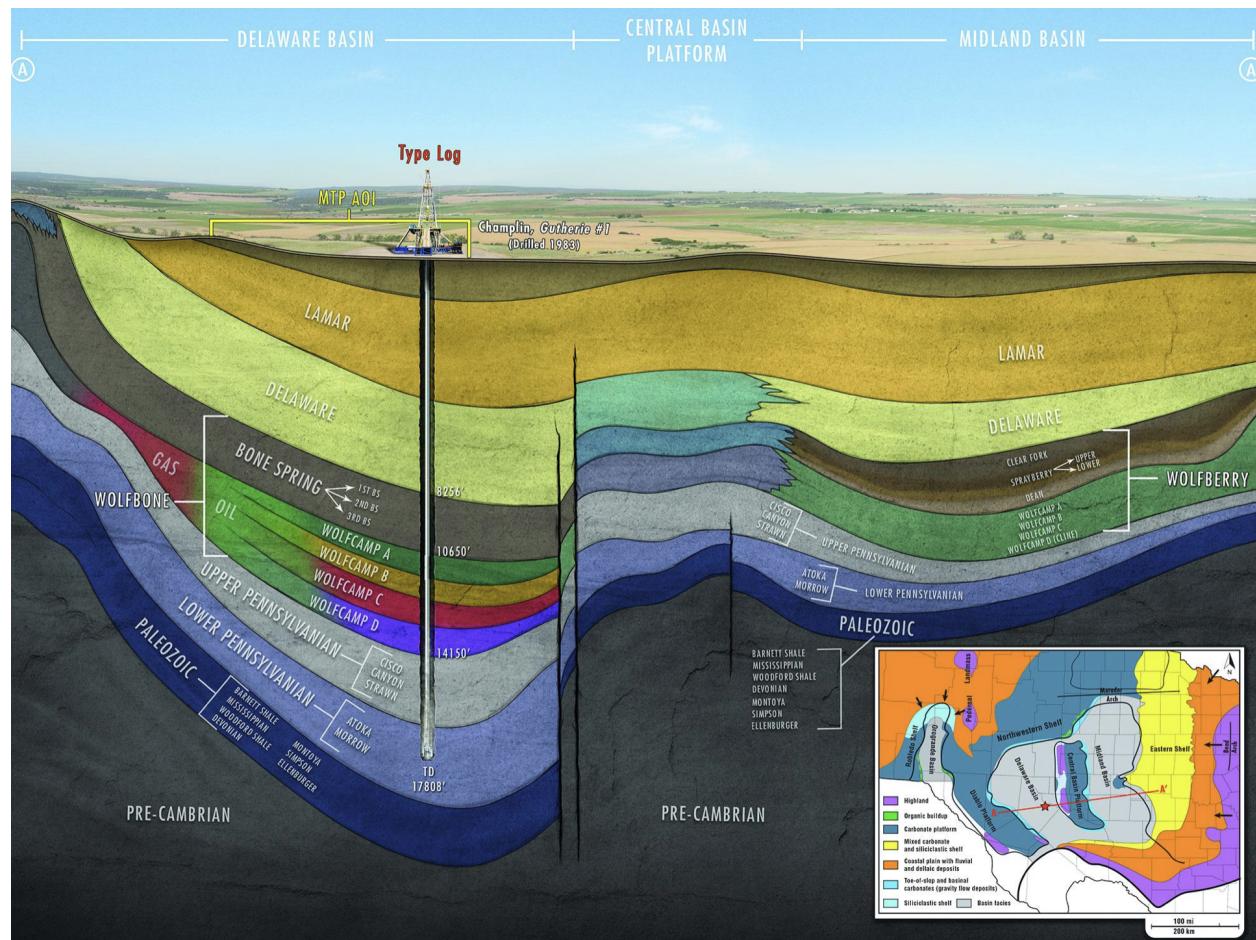


Fig 1 - Geological schematic slice of Permian Basin[1]

[1] https://wiki.seg.org/wiki/Permian_basin

The Permian Basin is an **asymmetrical**.

This is northwest- to southeast-trending sedimentary system bounded by the Marathon-Ouachita orogenic belt to the south, the Northwest shelf and Matador Arch to the north, the Diablo platform to the west, and the Eastern shelf to the east.

[2]https://www.eia.gov/maps/pdf/Wolfcamp_EIA_Report_Nov2018.pdf

3. Elements of the petroleum system

(brief description of rock types/lithology: cap rock, source rock, reservoir etc.)

Cap rock

The Cap Rocks of Permian Basin consists of **petrocalcic soils** containing **calcium carbonate** that have turned rock-hard and called "**caliche**"[3].

[3]https://geoinfo.nmt.edu/publications/periodicals/litegeology/47/lg_v47.pdf

Source rock

Associated organic-rich beds in the Devonian-Mississippian Woodford Shale are prolific source rocks. Generated hydrocarbons were trapped below the unconformity and migrated into nearby weathered reservoir rocks. Mineralogy of source rock is different.

Reservoir rock

The primary lithology of the reservoirs is **limestone** (40%), **dolomite** (29%), and **sandstone** (29%)[4]. Porosities average vary from 10 to 12 (rarely 25) percent and permeabilities from 6 to 60 mD. Drilling depths vary from 3,000 to 15,500 ft.

[4]<http://www.sepstrata.org/page.aspx?pageid=138>

Traps

Trapping is by a combination of both structural and stratigraphic mechanisms[5].

[5]<https://certmapper.cr.usgs.gov/data/noga95/prov44/text/prov44.pdf>

4. Kerogen type

We can say that the **second type of kerogen** in the Permian Basin for two reasons:

- oil and gas production in the Permian basin (I type of kerogen means that kerogen produced only oil, II type - oil. and gas, III - gas, IV - produces nothing)
- according to article [6], there is a two type of kerogen, **II** and **IIIs**(with high sulfur concentration)
- according to paleo-geology, Permian Basin was a complex reef system in Permian Period, that means we can assume the kerogen type can be a **Planktonic(II)** - [7]

[6]https://www.searchanddiscovery.com/pdfz/documents/2017/10950xia/ndx_xia.pdf.html

[7]https://en.wikipedia.org/wiki/Kerogen#Type_II:_Planktonic

5. Reserves of the Basin/petroleum system

(oil, gas, how much)

Oil

Reservoirs in the Permian Basin of Texas are estimated to have contained a total of **105.7 billion barrels** (bbl) of oil at discovery[8].

[8]<https://www.beg.utexas.edu/publications/oil-and-gas-resources-remaining-permian-basin-targets-additional-hydrocarbon-recovery>

Gas

The basin's proven, technically recoverable reserves in the Wolfcamp and Bone Spring Play formations alone are estimated nearly **300 trillion cubic feet** of natural gas [9].

[9]<https://www.enverus.com/permian-basin/>

6. Perspectivity of the Basin for further production or exploration

Permian Basin is very economic important. Owing to it, Permian basin is well-studied geological structure.

Although named for the Permian Period (299 million to 251 million years ago) of geologic time, the origins of the basin can be traced back much earlier to Precambrian tectonic

events occurring from about 1.3 billion to 850 million years ago.

During the early Paleozoic Era, the basin was covered by a shallow seaway. During late Paleozoic times, more structural deformation occurred during the Alleghenian, Ouachita, and Marathon orogenies (mountain-building events) which formed the complex structures and basins that are collectively known as the Permian Basin.

The Permian Basin is made up of three component parts: the eastern Midland Basin, the Central Basin Platform, and the western Delaware Basin. [10]

[10]<https://www.britannica.com/place/Permian-Basin>

In 1917, J.A. Udden, a University of Texas geology professor, speculated that the Marathon Fold, associated with the Marathon Mountains, may extend northward. This fold theory was further elaborated on in 1918 by geologists R.A. Liddle and J.W. Beede. The potential structure was thought to be a potential oil trap. Based on this Marathon Fold theory, and known oil seeps, test drilling commenced in the eastern Permian Basin [1].

According to USGS report (2021) [5], Permian Basin have potential for additional discoveries in this play is limited by extensive previous drilling.

The carbonate and shale intervals between the sands are more recently being assessed and proven out for their economic resource potential.

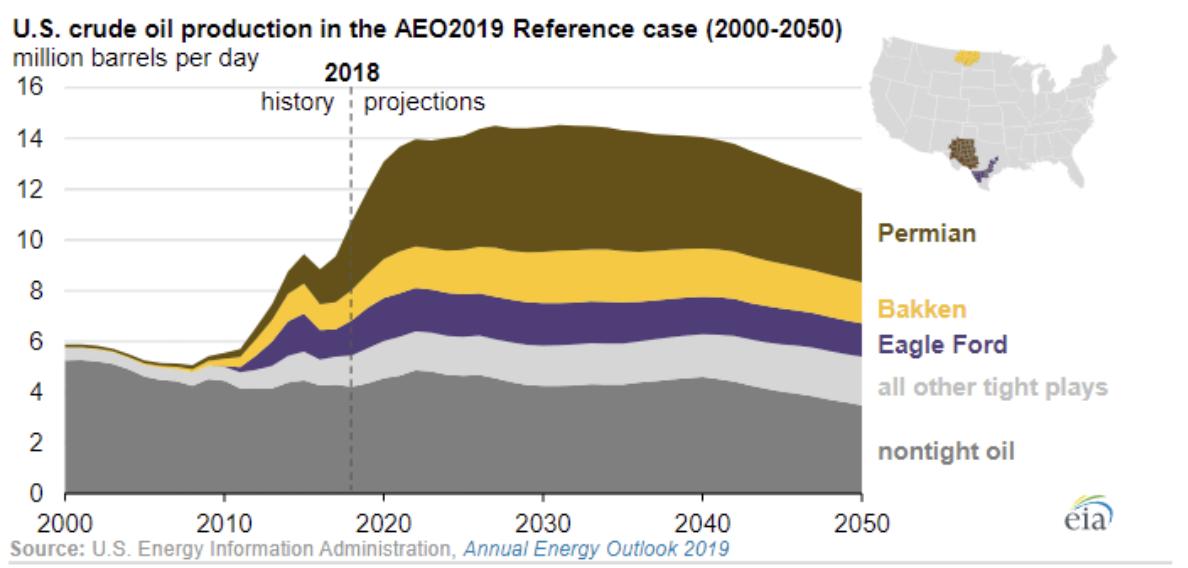


Fig 2 - Forecast of oil production in the Permian basin until 2050 [11]

[10]<https://seekingalpha.com/article/4491400-oil-and-gas-blues-peaking-permian-basin>

According to EIA report, there is high potential to produce tight oil in Permian Basin and **60% Permian Basin oil production growth by 2030[11]**.

[11]<https://www.freightwaves.com/news/2018/2/12/eia-60-permian-basin-oil-production-growth-by-2030>