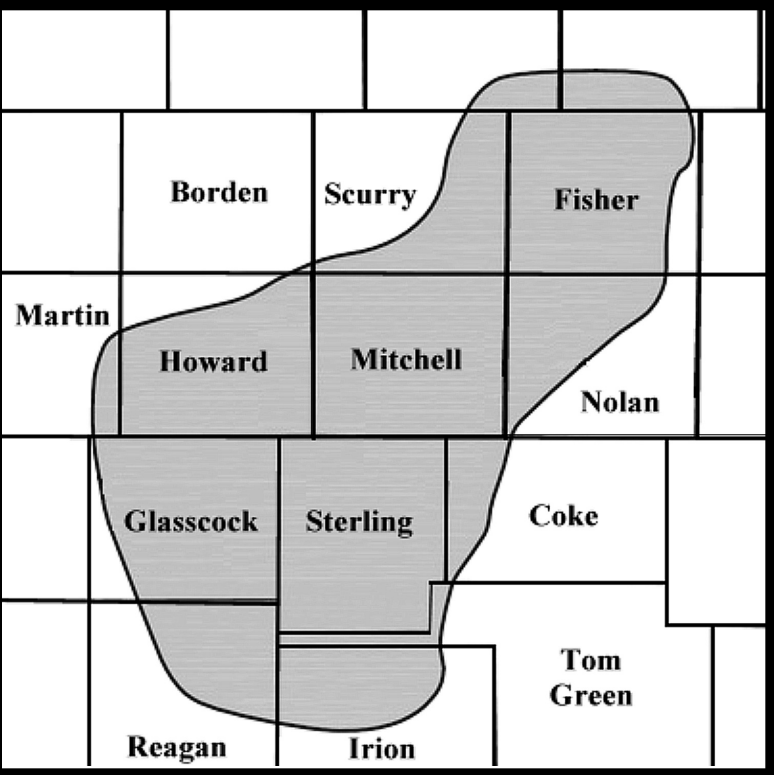


The Where & What of Shale Gas Formations

Source: NaturalGas.org  
Geologically, gas shales are fine grained, organic-rich, sedimentary rock formations that trap natural gas. Gas shale rock has characteristically small pores that are relatively impermeable to natural gas flow unless they are naturally or artificially fractured to create channels connecting the pores. Shale rock is considered so impermeable that geologists sometimes say it makes marble feel “spongy” in comparison. Shale gas is present across much of North America in basins of both extreme and moderate size.

Geologists have known of the presence of natural gas in shale rock for years, but until recently, could not cost-effectively extract it. Two factors came together in recent years to make shale gas production economically viable: (1) advances in horizontal drilling; and (2) advances in hydraulic fracturing. Together, these factors have transformed shale formations from marginal sources of natural gas to substantial contributors to the natural gas supply portfolio, ushering in a robust resurgence in domestic natural gas production.

With the onset of shale gas development, production has been diversified across the country, bringing supply closer to areas where it is consumed. New reserves are discovered so frequently that industry and



government authorities have trouble keeping maps up to date.

As a result, supply is less susceptible to weather disruptions in the Gulf of Mexico. The geographic diversity of U.S. shale gas resources and advances in technology help ensure a stable and deliverable natural gas supply.

The Cline Shale: A Brief Overview

Source: TheClineShale.com

The Cline Shale (also known as the Lower Wolfcamp) lies over a very large area on the eastern shelf of the Permian Basin. The “Cline” is a localized name for the Pennsylvanian aged shale that some recognize as the D bench of the Permian aged Wolfcamp.

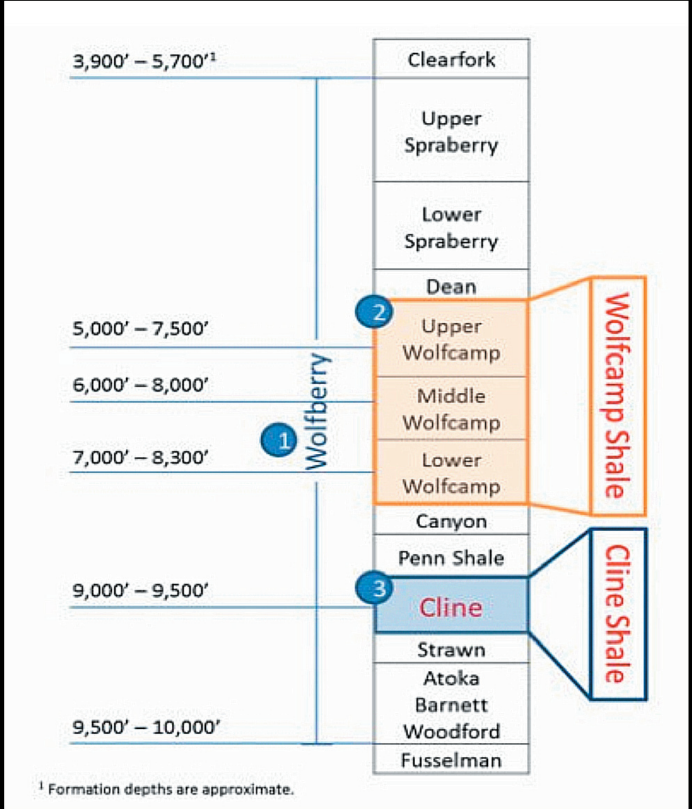
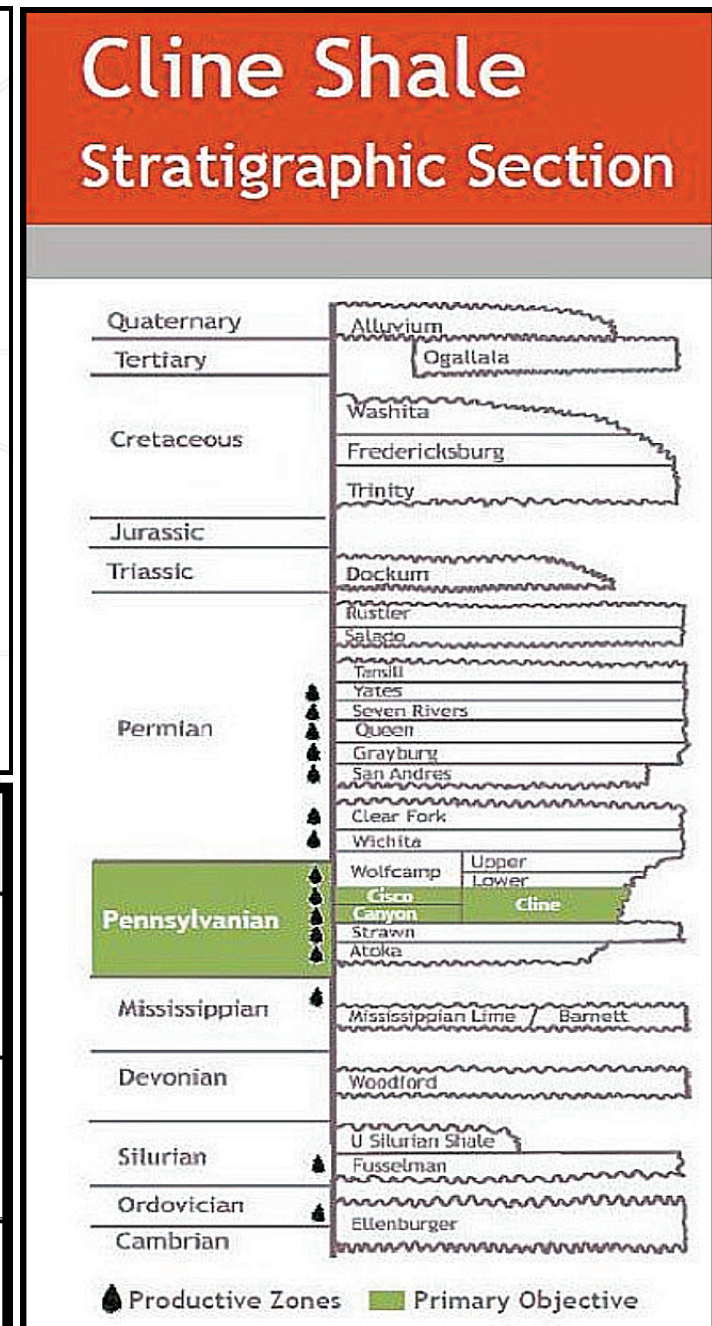
Starting at the Wolfcamp A bench down to the bottom, Wolfcamp C bench, the rock has less carbonates. However, the underlying shale is interbedded with

sand and silt, indicative of its depositional environment.

The Cline source rock lies on a broad flat shelf, with very little relief. Total Organic Carbon (TOC), porosity, permeability, and OOIIP are all fairly comparable in both the Wolfcamp and the Cline. Even though the Wolfcamp is thicker, which can be a driver for production in shale plays, it is the pressure and thermal maturity of the Cline that set it apart.

The pressure gradient is around 0.55-0.65 psi/ft with an Ro value (Vitrinite reflectance) of 0.85-1.1%. Along with natural gas liquids (NGLs), this allows for a nice, light crude with an API gravity of 38-42 degrees, which some say is comparable to the Eagle Ford.

The industry type curve for the Cline Shale is quoted at 420 Mboe (1,000 barrels of oil equivalent) EUR (estimated ultimate recovery)/well with 60% oil



Source above maps: TheClineShale.com  
and a 30 day IP of 575 Boe/d (barrels of oil equivalent per day) with 75% oil.  
In short, the Cline is an organic rich shale, with Total Organic Content (TOC) of 1-8%, with silt and sand beds mixed in. It lies in a broad shelf, with minimal relief and has nice light oil of 38-42 gravity with excellent porosity of 6-12% in thickness varying 200 to 550 feet thick.  
Active players in the shale include Devon Energy, Chesapeake, Firewheel Energy, Apache Energy, Laredo Petroleum, Exco, Callon Petroleum, Pioneer Resources and others.  
Counties included in the shale are Fisher, Nolan, Sterling, Coke, Glasscock, Tom Green, Howard, Mitchell, Borden and Scurry.

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