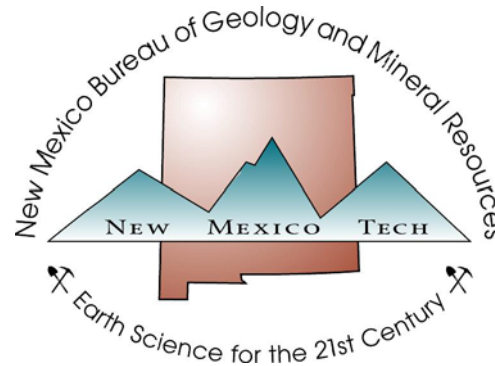


# **Oil & Natural Gas Activities**

## **New Mexico Bureau of Geology and Mineral Resources**

### **at New Mexico Tech**



**Ron Broadhead**  
**Principal Petroleum Geologist**

# Activities areas

## Data collections & archives (*unique resource, available to all*)

- Cores
- Drill cuttings
- Well records, incl. well logs
- Petroleum source rock information

## Industry & public service

- 625 data & information requests in FY 15-16

## Applied research projects

- Oil, natural gas, helium, carbon dioxide
- Goal is to understand resource base and geology of resources
- Funding drawn from state appropriation and DOE, State Land Office, Gas Technology Institute, other sources as available

## Educational activities

- Mentor NMT geology and petroleum engineering student groups
- NMT thesis committees, geology & petroleum engineering

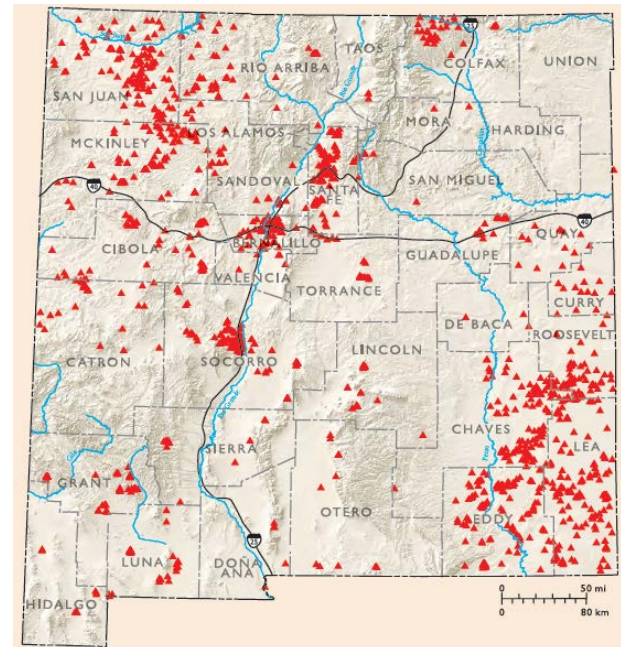
## Petroleum Staffing

- Petroleum geologist (38 years experience)
- Petroleum Information Coordinator (33 years)
- Geological Archives Coordinator – ¼ time (17 years)



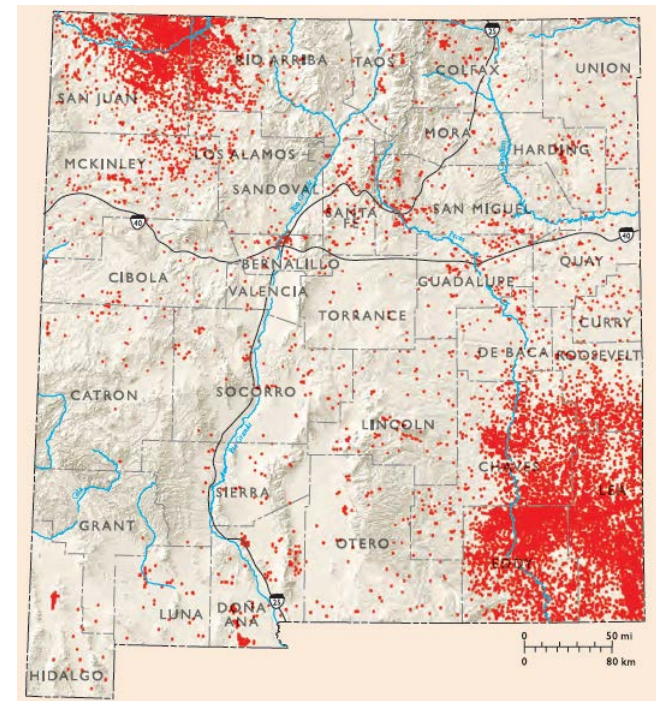
# Core Collection

- > 540,000 ft of core from 1,433 drill holes, stored in 6 buildings
- 3,300 sidewall cores from 120 drill holes
- Oil & gas cores, mineral cores, geothermal cores, other
- Digital data catalog
- Utilized by industry, researchers, students



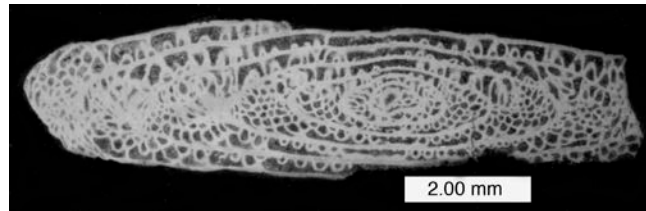
# Cuttings Collection

- 50,773 boxes of cuttings from 16,639 drill holes, representing 150 million ft of drill hole, enough to circle the earth 1.14 times
- Oil & gas cuttings, mining cuttings, water well cuttings
- Digital data catalog
- Utilized by industry, researchers, students



# Subsurface Library

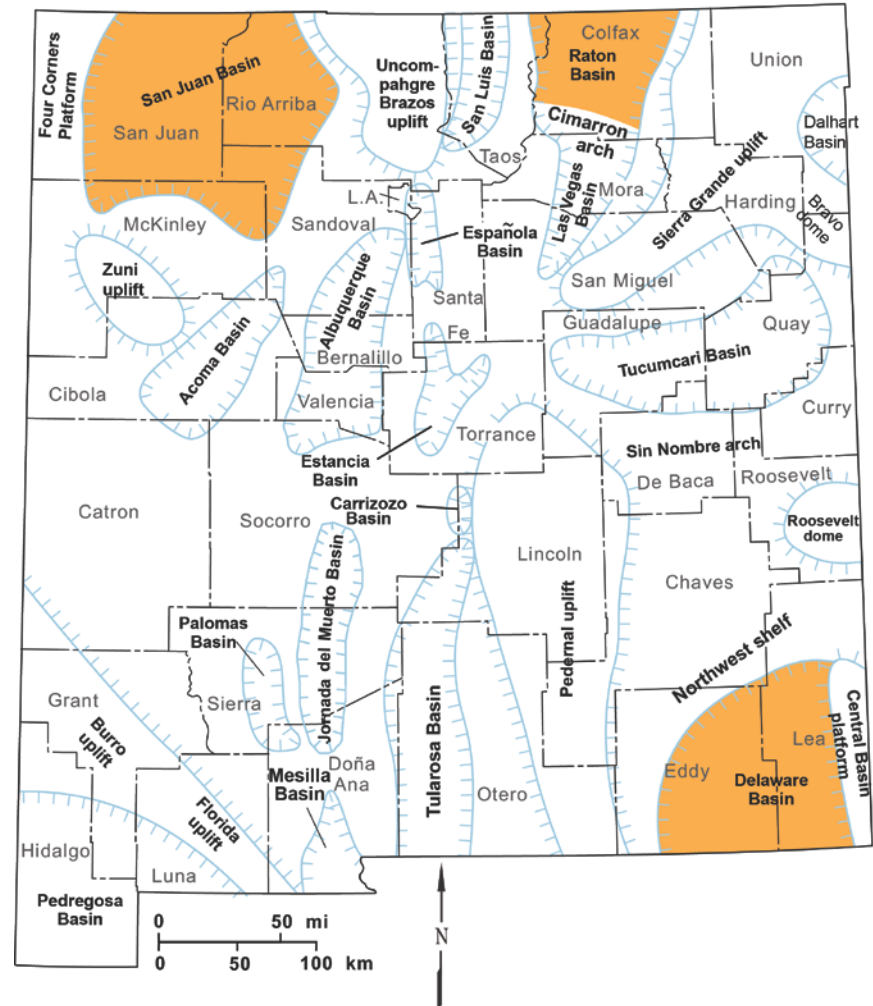
- Oil & gas well logs from 49,800 wells
- Uranium well logs from 14,210 uranium drill holes
- Deep water well logs, Albuquerque Basin
- Lithology logs of cuttings descriptions, 6,024 wells
- Well records from > 100,000 New Mexico wells
- One-of-a kind historic well records, several collections
- Oil & gas pool boundary maps
- Microfossil determinations made on drill cuttings



- County petroleum exploration maps
- Other data

# Research Areas

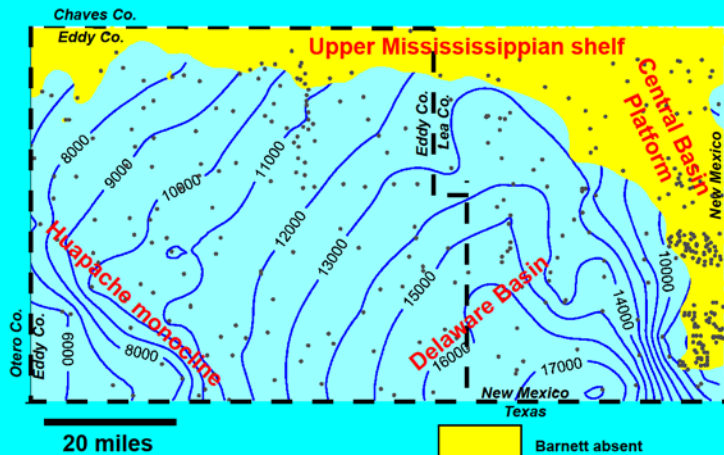
- Subsurface geology of New Mexico Basins
- Investigations into producing basins and frontier basins
- Oil & gas, including petroleum source rock studies
- Helium (study unique to NM)
- Carbon dioxide
- Results of research and analyses made public – much interaction with industry – economic development
- Several projects in conjunction with other entities (PRRC, NMT faculty/students, U of Texas, other state geological surveys)



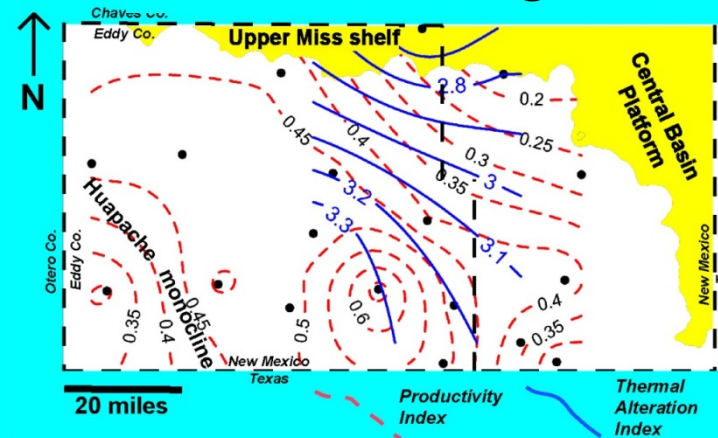
# Example: Permian Basin – Barnett Shale

- Results showed thermal maturity trends in direction not expected
- Trends confirmed by multiple geologic/analytic techniques
- Indication is favorable area different and perhaps larger than expected

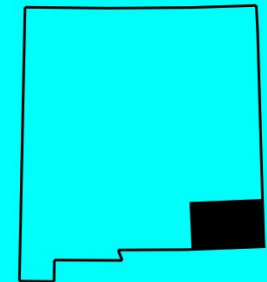
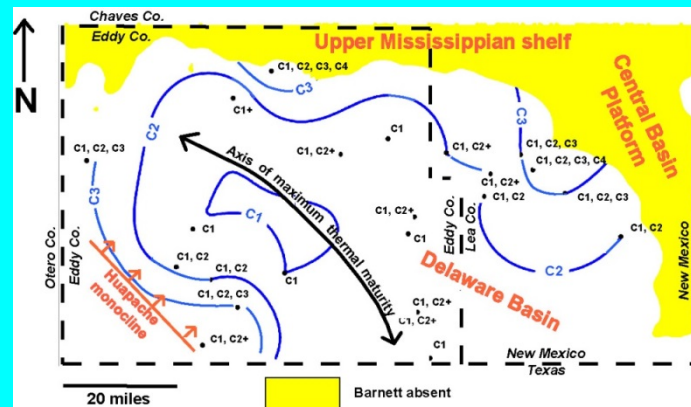
## Depth to Barnett



## Thermal maturity indicators - kerogens

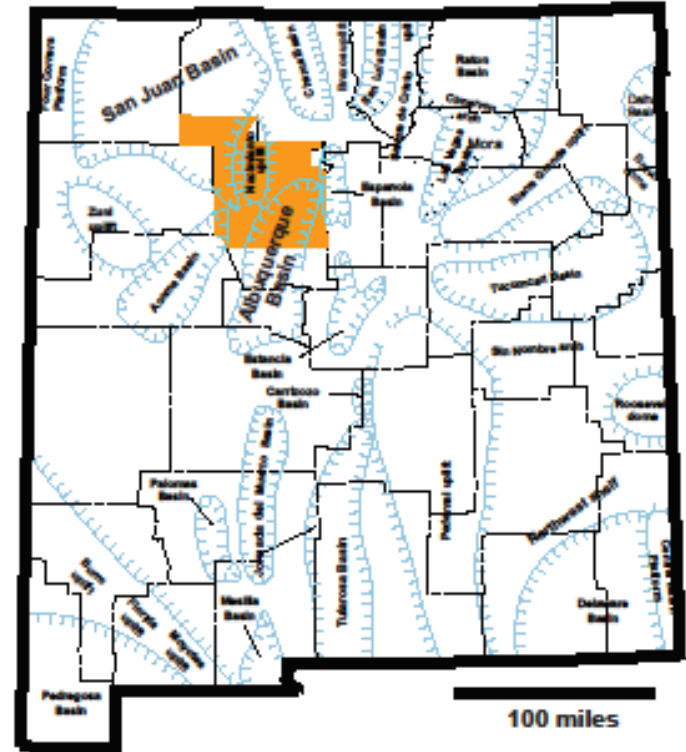


## Barnett gas composition from mudlogs



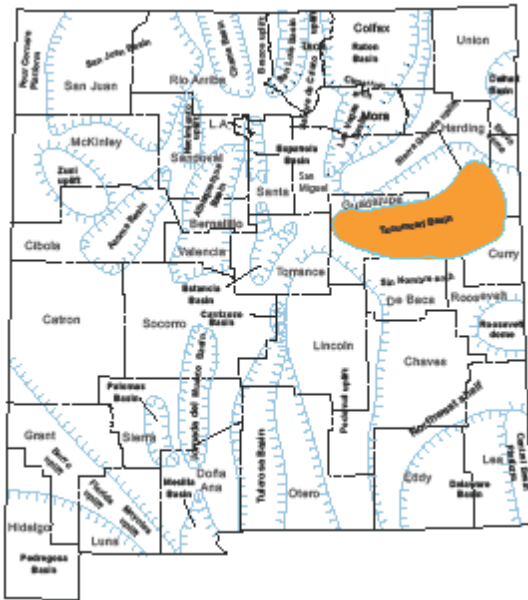
# Current project: Sandoval County

- Study at request of county in response to efforts to drill an exploratory well near Rio Rancho.
- Funded by Sandoval County.
- Assess oil & natural gas potential of the county.
- Relate potential oil & gas reservoirs to aquifers across the county.
- Describe modern drilling techniques and effects on oil & gas production and on aquifers in the Sandoval County setting.
- Project is in its beginning stages; project report is due at end of May 2018.





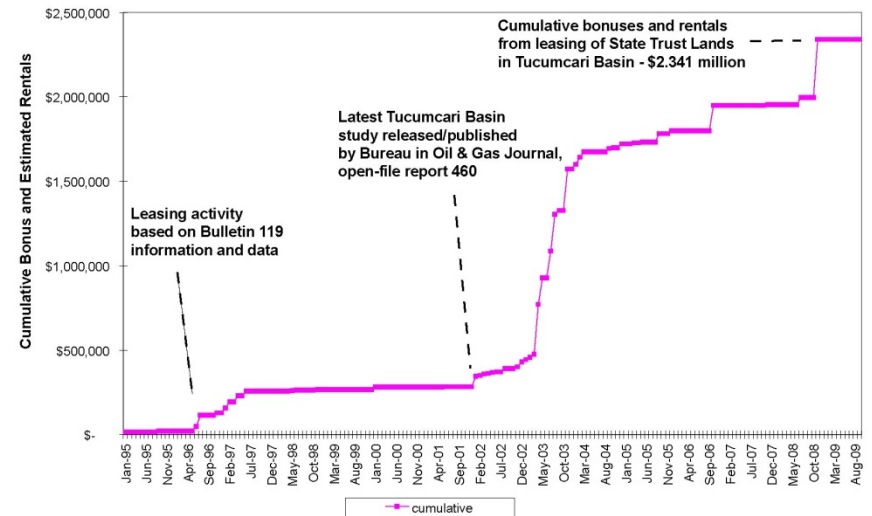
# Example: Tucumcari Basin



- Tucumcari Basin studied in phases
- Basic geology of subsurface mapped
- Oil & gas related aspects in subsurface of basin analyzed and mapped
- Work funded by NM Bureau of Geology and State Land Office
- Publications and presentations followed each stage

- After each phase of work, significant lease activity followed
- Significant gas discovery was made, but gas prices fell so gas became “stranded”
- However some of the gas contained helium, which may carry the next phase of exploration. Recent renewed interest.

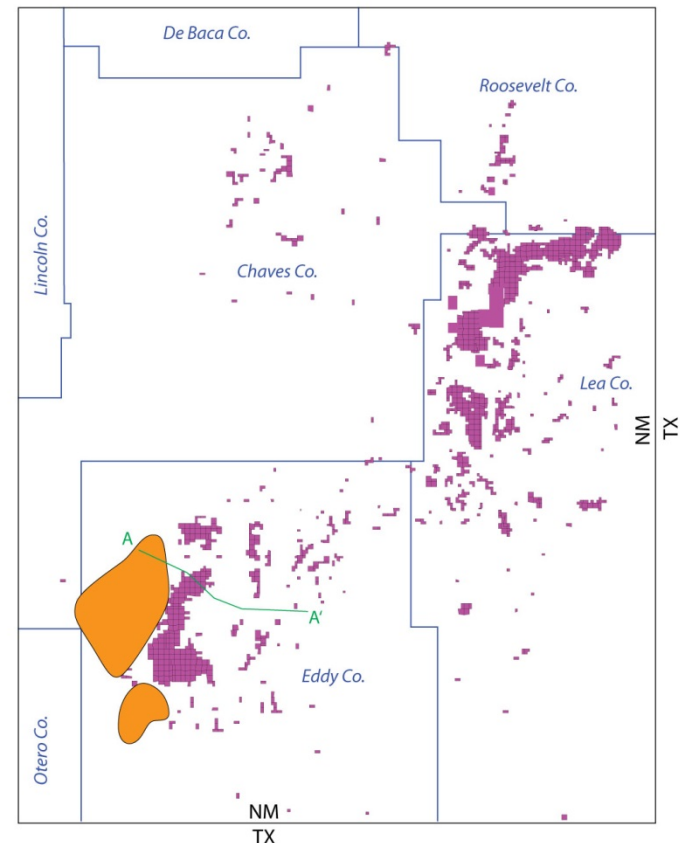
Tucumcari Basin Leasing and Revenue History from January 1995 to September 2009  
New Mexico State Trust Lands only



# Research areas: Environmental and societal concerns of petroleum production

- **Induced seismicity and oil & gas production** – possible focus areas in New Mexico, in conjunction with NMT Geoscience faculty
- **Hydraulic fracturing** – description of process; water use associated with hydraulic fracturing; brackish water (10,000 ppm TDS) can now be used – decreases need for fresh water

Upper Pennsylvanian Reservoirs and 2005-2009 Earthquakes



20 mi

# Information for the general public

## Lite Geology

NEW OIL AND GAS TECHNOLOGIES

SPRING 2014  
ISSUE 35



Horizontal drilling and advanced hydraulic fracturing techniques have opened up new underground reservoirs for oil and natural gas development that have increased production in New Mexico and across the country. Amid environmental concerns, the trend is gaining strength. Illustration by Leo Gabalton.

### In This Issue...

New Technologies in the Oil and Gas Industry

Economic Benefits and the Future of Oil and Gas in New Mexico

Global Impacts of the Shale Oil and Gas Boom • Coalbed Methane—Natural Gas from Coal

Water Use in the San Juan Basin • Crossword Puzzle

New Mexico's Most Wanted Minerals—Anhydrite

New Mexico's Enchanting Geology

Classroom Activity: The Removal of Copper from a Carbonate

Through the Hand Lens • Earth Briefs • Short Items of Interest

NEW MEXICO BUREAU OF GEOLOGY & MINERAL RESOURCES A DIVISION OF NEW MEXICO TECH

<http://geoinfo.nmt.edu/publications/periodicals/litegeology/current.html>



## New Mexico's Natural Gas Resources

New Mexico is an energy-producing state, which means that we produce more energy than we consume, and we export a significant amount of energy (in the form of oil, gas, and electricity) to surrounding states. This is a result primarily of New Mexico's rich natural resources, particularly oil and gas. Natural gas is likely to play an important role in our state-wide energy mix down the line, thanks both to new discoveries in frontier gas provinces as well as expanding technologies for the development of existing resources. Furthermore, power companies are now investing in gas-generated power plants, which are seen as cleaner than the traditional coal-burning plants. Finally, for companies looking to invest in wind and solar, natural gas offers the promise of backup, allowing those industries to provide continuous power to the grid.

Natural gas production in New Mexico dates from 1921 with the discovery of the Aztec field of the San Juan Basin in the northwestern corner of the state. Natural gas was discovered while drilling for oil in the Upper Cretaceous Farmington Sandstone at a depth of 890 feet. In the 1920s there was little demand for natural gas in northwestern New Mexico or anywhere in the American Southwest, so the gas was piped to the nearby community of Aztec where it was used for home heating and cooking. Oil was discovered in the San Juan Basin in 1922 and in the Permian Basin in 1924. Massive exploration, drilling, and



Basins and uplifts in New Mexico.

development programs followed, and soon many large oil reservoirs were discovered, mostly in the Permian Basin and to a much lesser extent in the San Juan Basin. Crude oil was refined principally into motor fuel and other products such as heating oil and lubricants. Most of the oil fields in New Mexico produced substantial volumes of natural gas along with the oil. As no widespread markets existed for natural gas in those early days, much of the gas was flared (burned) at the wellhead. Exploration for and development of natural gas resources remained limited until years later, when the San Juan Basin was revealed to be a major natural gas province.

### Conventional Gas

After World War II the demand for natural gas as an energy source soared. Exploratory vertical drilling in the 1950s and 1960s in the San Juan Basin resulted in new discoveries of major natural gas reservoirs. Some of these were conventional reservoirs, as the gas was produced from discrete accumulations in permeable rock. However, many were widespread, less permeable ("tight gas"), blanket-type accumulations in Upper Cretaceous sandstones. This new gas not only filled the needs of New Mexicans, it was exported through interstate pipelines to California. Production boomed. Reservoirs filled with natural gas were now sought after rather than avoided. Additional drilling provided data that helped to define the extent and nature of natural gas reservoirs both in the San Juan and Permian Basins. Even as conventional gas has declined, discovery of substantial new and previously unrecognized gas reservoirs continues to this day.

### Coalbed Methane

Underground coal miners have long known that coal beds are associated with natural gas that, if not properly vented, will result in large and often tragic explosions within the coal mines. In the 1980s it was found that coalbed methane (the term used for natural gas in coals) could be produced economically from the Upper Cretaceous Fruitland formation of the San Juan Basin. The Fruitland coals were quickly

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# Summary

- Petroleum activities at New Mexico Bureau of Geology are highly diversified
- Data repository contains cores and cuttings on thousands of New Mexico wells and also well records, logs, lithology descriptions, and unique collections of data. Mostly donated.
- Collections are extensively utilized by industry.
- Applied research aimed at analyzing and assessing geology and resources in both producing and frontier basins. *Economic development.*
- Research is also focused on environmental and societal concerns.

