[PS]The Permian Basin Research Lab at the University of Texas at Dallas*

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Abstract

The Permian Basin is increasingly important to the Texas and New Mexico economies and US energy independence, but many geoscience faculty and students know little about it. The basin is densely drilled for hydrocarbons but there remains much that we do not know about its formation and evolution. In order to better understand the geologic history of this basin and to inform the next generation of geoscientists, we have established the Permian Basin Research Lab (PBRL) in the Geoscience Department at UTD. The Permian Basin Research Lab is committed to advancing our understanding of all geologic aspects of the Permian Basin. We emphasize teaching and making the results of our work open and available to all interested parties, from the general public to students at all levels to industry and government. Our efforts to date have included teaching a graduate course on the Permian Basin (Fall 2017), engaging graduate students in research about the Permian Basin, organizing workshops designed to stimulate collaborative research (April 2018), and making videos about the Permian Basin https://youtu.be/zksQ89aPigE. Our research is intended to be shared via presentations at scientific meetings and publications in the peer-reviewed literature. To better ensure that university and industrial geoscientists communicate and understand the expectations of limitations of their respective cultures, the PBRL is co-directed by a UTD professor (Stern) and an experienced industry geoscientist (Waite). We are in the early stages of developing the lab but are interested to recruit associates from industry, academia, and government. There are no fees or other restrictions to become involved, just a willingness to share information and data and an interest to help educate the next generation of geoscientists and inform our community. Please give us your suggestions.

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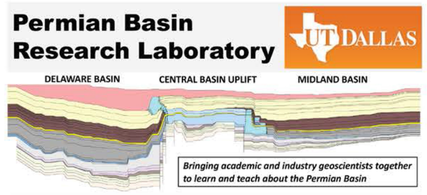
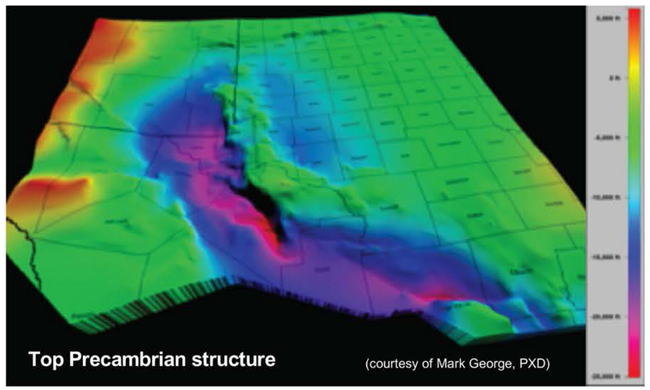


The Permian Basin Research Lab at the University of Texas at Dallas

Robert J. Stern (Geoscience Dept., U TX Dallas, Richardson TX USA); Lowell Waite (Geoscience Dept., U TX Dallas, Richardson TX USA)

ABSTRACT

The Permian Basin of west Texas and SE New Mexico is increasingly important to the economies of these states and to US energy independence but most university geoscience faculty and students know little about it. The Basin is densely drilled for hydrocarbons but there is much that we do not know about how it formed and evolved. In order to better understand the geologic evolution of this basin and to inform the next generation of geoscientists, we have established the Permian Basin Research Lab (PBRL) in the Geoscience Dept. at UTD. PBRL is committed to advancing our understanding of all aspects of Permian Basin geology. PBRL activities emphasize making the results of our work open and available to all interested parties, from the general public to students at all levels to industry and government agencies. Our efforts to date include teaching a graduate course on the Permian Basin (Fall 2017), organizing a workshop designed to stimulate collaborative research (April 2018), engaging graduate students in research about the Permian Basin, and making videos about the Permian Basin. PBRL research is intended to be shared via presentations at scientific meeting and publications in the peeer-reviewed literature. To better ensure that university and industrial geoscientists communicate and understnad the epectations and limitations of each other's cultures, the PBRL is co-directed by a UTD professor (Stern) and an experienced industry geoscientist (Waite). We are in the early stages of developing the lab but are interested to recruit associates from industry, academia, and government. Thre are no fees to become involved, just a willingness to share information and data and an interest to educate young geoscientists. Please give us your suggestions!



A UTD Geosciences Class about the Permian Basin

Fall Semester 2017 Stern and Waite taught a graduate course "GEOS 5V08.506 Natural Resources" focused on the geology and resources of the Permian Basin. Five papers were assigned (Frenzel et al., 1988; Hills, 1972; Mazzullo, 1995; Ye et al., 1996; and Leary et al., 2017). Six lectures were given (Geologic Setting of the Permian Basin; Stratigraphic Framework of the Permian Basin (Pts. 1 and 2); Geophysical Setting of the Permian Basin; and Petroleum Geochemistry and 3-D Basin Modeling of the Permian Basin. A test on the readings was given. Students chose topics to research and present on 5 times over the rest of the course, then wrote and submitted a 10 page term paper. Student research topics were:

Basement of the Permian Basin
Capitan Reef
Castile Formation
Clear Fork Group
Central Basin Platform
Ellenburger Group
Horseshoe Atoll
San Andres Formation
Upper Wolfcamp and Lower Bone Springs, Delaware Bsn.
Wolfcamp Group
Woodford Shale

A Video about the Permian Basin

6 minutes
6600 views
on YouTube
as of April 2019

Graduate Student Research on Various Aspects of the Permian Basin

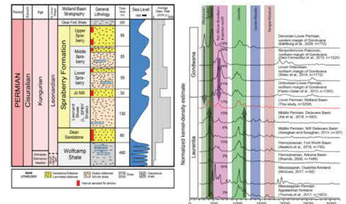
Graduate student research about the Permian Basin is a key aspect of the PBRL. We have three graduate student projects currently underway:
1) Shi Zheng "GIS of producing fields of the Eastern Shelf"
2) Eric Walker "The Glasscock Nose"
3) Katherine Sink "Composition of produced brines"
We seek more projects from industry and more UTD students to work on these.

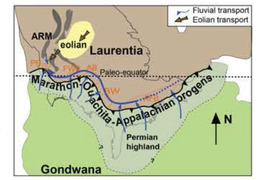
A Workshop about the Permian Basin

In Fall 2016 we held an open 1-day workshop at UTD to explore the possibility that a "Great Pennsylvanian River" once flowed into the Midland Basin. Geoscientists from LSU, TCU, WVU, TU Freiburg, GFZ Potsdam, U Ky, Ky Geol. Survey, OkSU, UAla, UTA, and Pioneer Natural Resources presented talks on a wide range of topics: "Overview of the Great Penn. River"; "Collisional Rivers"; "Mississippian Sediment transport in southern Laurentia"; "Overview of Penn. sediments - Alab. to Pennsylvania"; "Acadian-Variscan-Aleghenian orogen"; "Accuracy of detrital mineral provence methods"; "Penn. Rivers in the central App. and Illinois Basins"; "Westward migration of a giant synorogenic drainage system in Penn. time"; "Early Pennsylvanina Pottsville Fm. in Al. and Miss."; "Pennsylvanian seds/ of Arkoma Basin"; "Muenster-Wichita-Amarillo uplift'; Penn. subsidence and sed. dispersal in the Ft. Worth basin"; "Permian Basin overview"; and "Penn. sed. patterns and depocenters of the Midland Basin".
UTD students sat in, listened, and learned.

Research about the Permian Basin

We have research projects underway concerning the source of Spraberry mudstones. Our most mature project concerns the source of sediments that make up the early Permian Spraberry formation. Detrital zircons are an effective way to constrain sources of clastic sediments. We separated detrital zircons from 12 samples and obtained 3259 U-Pb ages and 357 Hf isotopic compositions on these.





The results reveal prominent groups of zircons derived from the Appalachian (500-270 Ma) and Grenville (1250-950 Ma) provinces in eastern Laurentia and the Peri-Gondwana terranes (800-500 Ma) incorporated in the Alleghenian-Ouachita-Marathon orogen. This drainage prograded westward and delivered sediments into the remnant oceanic embayment of the Permian Basin. Primary sediment delivery pathway was assisted by input from the Ancestral Rocky Mountains and wind deflation of fluvial sediments north and east of the basin. Slope failure associated with early Permian deposition in the southeastern margin of the Midland Basin triggered gravity flows leading to submarine fan deposition. This manuscript is being revised for Tectonics

The Future

We are just getting started building the PBRL. In Jan. 2019 we occuppied a lab space in the UTD Geosciences Dept. We know that there is a need for a research center like PBRL, where industry and univeristies can share research, where we can generate educational materials for undergraduate and graduate education, and which can host annual workshops on the Permian Basin. We recently submitted a proposal for 4 years of support ($676K) to the UTD Office of Research; if funded this will support 2-4 graduate students and 2 post-doctoral scholars. We are looking for partners and projects. We look forward to your comments and suggestions!