

## **Kevin L. Woller**

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### **RESEARCH INTERESTS**

Applied geophysics and GIS analysis to near surface geology, cave systems, impact craters, and archeological sites. Filtering and analysis of gravity and magnetic field data to identify subtle geological features, both deep and shallow. Recording ground penetrating radar surveys to identify and map shallow features. Extracting geological features from 3D seismic data.

### **EDUCATION**

MS in Geographical Information Science, 2001, University of Texas, Dallas

MS in Geophysics, 1978, University of Oklahoma

BS in Physics, 1976, University of Oklahoma

### **PROFESSIONAL EXPERIENCE**

Geophysical Consultant, 2019-present

Geophysical Specialist, Pioneer Natural Resources, 2002-2019

Senior Analyst – GIS, American Airlines, 2000-2002

Senior Geophysical Advisor, Mobil Oil Company, 1978-2000. Held Supervisor and Team Lead positions during tenure at Mobil.

### **RESEARCH / FIELD WORK EXPERIENCE**

- Designed, executed, directed processing and interpreted many 3D seismic programs covering hundreds of square miles costing hundreds of millions of dollars in international and domestic US locations, onshore and offshore. Used Mesa software to design surveys, and ProMax/SeisSpace to analyze field tests and perform post-stack enhancements to 3D volumes. Recently consulted on 3D seismic program design and data processing flow for large program in Western Australia.
- Applied state-of-the-art seismic attributes and interpretation methods to 3D seismic surveys during interpretation projects, such as characterizing collapsed cave systems in the Ellenburger limestone. Details listed below.
- Conducted ground penetrating radar surveys for determining overburden to basement thickness in a sand mine and pipeline locations. Used off-the-shelf buggies for some work, but also used bistatic 50 and 100 MHz antennas for deeper penetration.
- Conducting controlled experiments with an engineering company to make an improved sonic pipeline detector. Proof-of-concept succeeded, but practical prototype not built.

- Co-designed and executed 3D and 4D borehole recordings using geophones and optical fibers. Processed zero-offset VSP data using ProMax/SeisSpace.
- Conducted regional gravity and magnetic data interpretation across Venezuela incorporating radar and satellite imagery. Applied spatial filters to bring out subtle anomalies on gravity and magnetic fields using LCT software. Have applied similar wavelength filtering techniques to data from the Appalachian fold belt, the Fort Worth Basin, the Permian Basin and the Raton Basin using 2D fast-Fourier transforms and filters in the Magmap extension to Oasis Montaj.
- Interpreted 2D and 3D seismic data and well log data from numerous basins around the world including Australia, China, Papua New Guinea, Argentina, Venezuela, Nigeria, Cameroon, The Netherlands, Trinidad, Viet Nam, Ecuador, Qatar, Oman, Bolivia, Algeria, Libya, Tunisia, South and West Texas. Experience with Landmark, Kingdom, Transform, Petrel, Paradigm, Hampson-Russell, and University of Oklahoma AASPI software for seismic interpretation and seismic attribute calculation.
- Team lead for rock properties group that included performing seismic inversions for acoustic impedance and amplitude-versus-angle analyses for determining fluid characteristics of targets. Used Mobil proprietary software and Hampson-Russell software.
- Supervised crew and operations for the *Mobil Search* seismic acquisition vessel. Vessel recorded 2D and 3D data around the world. Onboard geophysical staff processed data on ship-borne computer.

## **SELECTED RECENT PROJECTS**

### **NSF Grant Applications – Crustal imaging in Permian-Tobosa Basin**

Co-author of application for NSF funding for multifaceted study of the shallow and deep lithosphere and depth to Moho in the Permian-Tobosa Basin. Principally involved in organizing and pricing low frequency geophones, explosive and vibratory sources for deep imaging over 3 long lines. Goals are refraction and reflection imaging to provide scope to gravity and magnetic modeling, as well as magnetotelluric soundings. Project did not get funding for 2022. Group will resubmit for 2023 funding.

### **Ellenburger formation seismic interpretation – Midland Basin Texas**

Made well ties to 245 square mile 3D seismic volume within Kingdom software at several different levels to pinpoint the top and base of the Ordovician Ellenburger Limestone. Objective was to identify more permeable zones for possible waste-water disposal wells. Interpretation challenging due to erosional and transitional nature of the formation. Calculated seismic attributes of coherency/similarity/curvature within Kingdom, Paradigm and Petrel. This was to get a variety of attribute views and extractions at the top and within the Ellenburger formation. Made maps of concentrations of low coherency/similarity as leads to high permeability collapsed cave zones over three target areas within the Ellenburger. Calculated residual low

areas using the time structure map of the Top Ellenburger by using a combination of spatial filtering in Oasis Montaj and zonal calculation methods in ArcMap. These residual lows are interpreted as collapse areas within the Upper Ellenburger karstic environment.

### **Midland Basin Seismic Merge Project**

Directed the collection of data, project design and key decision points in merging over 2400 square miles of seismic data in the central Midland Basin, Texas. The input surveys are of various vintages, recording parameters and azimuths, but most are modern wide azimuth, high-fold 3D surveys, most of which were recorded and processed under my directions. The merge process requires many methods to improve quality, such as surface noise filtering, 5D interpolation and phase adjustment. Interim products such as post-stack time migrations have provided useful data and revealed large through-going faults that were not previously recognized due to lack of perspective. Interpretation of key seismic horizons in Kingdom and rendering their surfaces in 3D perspective views revealed through-going faults across the merged data set. Applying spatial filters and using real-time shaded relief showed subtle fault details when the shading came from different azimuths. Ultimately the project will yield post-stack and pre-stack time migrated azimuthal volumes and gathers over almost all of Pioneer's lease areas, greatly improving imaging in survey overlap areas, their understanding of the basin and the efficiency of seismic data interpretation by having a single volume rather than many separate and different seismic data sets.

### **Salado Gas Pocket Detection and Mapping**

Having been made aware of the existence of nitrogen-filled gas pockets within the Salado formation, I undertook finding and mapping them within Pioneer's seismic database. The pockets manifest as larger than background amplitudes in seismic data and can be identified. Working through all of our data sets I have mapped a few hundred potential gas pockets that are hazards to drilling. Working through an intern, I have developed improved formation understanding and developed theories on how the pockets were formed and filled with nitrogen. Post-stack and pre-stack inversion using Hampson-Russell software has better defined the probable low velocity and density zones that are the gas pockets. Submitted article on Salado gas pockets to The Leading Edge in October, 2021.

## **PUBLICATIONS AND PRESENTATIONS**

1. Seismic Expressions of Salado Gas Pockets, Oral presentation, SEG Technical Program Expanded Abstracts, 2019.
2. Monitoring horizontal well stimulations and geomechanical deformation processes in the unconventional shales of the Midland Basin using fiber-based time-lapse VSPs, microseismic and strain data, Robert Hull, Robert Meek, Hector Bello, Kevin Woller and Jed Wagner, The Leading Edge, Volume 38, Issue 2, February 2019.

3. Gravity and Magnetic Modeling of the Southern Permian Basin, W. Texas, Mickus, Kevin L., Dept. of Geography, Geology, and Planning, Missouri State University, Springfield, MO 65897, Stern, Robert, Geosciences, Univ. Texas - Dallas Dept. Geosciences- MS ROC-21, PO Box 830688, Richardson, TX 75083-0688, George, Mark, Pioneer Natural Resources, Irving, TX 75039 and Woller, Kevin (Presenter), Pioneer Natural Resources, 5205 N. O'Connor Blvd., Suite 200, Irving, TX 75080, Geological Society of America South-Central Section, 2017.
4. Time-Lapse imaging of a hydraulic stimulation using 4D Vertical Seismic profiles and fiber optics in the Midland Basin, Robert Meek, Kevin Woller, Mark George, Robert Hull, Hector Bello and Jed Wagner, Unconventional Resources Technology Conference, , Austin, Texas, 24-26 July 2017.
5. Comparing seismic data recorded with three-geophone and six-geophone groups, Woller, Kevin, SEG Technical Program Expanded Abstracts, 2016.
6. Integration and Visualization of Subsurface, Surface and Satellite Data in Southern Tunisia, K.L. Woller, R.S. Garrick and E. Caamano, 1st EAGE North African/Mediterranean Petroleum & Geosciences Conference & Exhibition, 2003.
7. High Frequency Shallow Reflection Seismic as a Substitute for Upholes, M. Dablain, E. Caamano, D. Nelson and K. Woller, 1st EAGE North African/Mediterranean Petroleum & Geosciences Conference & Exhibition, 2003.
8. Modeling Urban Population Growth from Remotely Sensed Imagery and TIGER GIS Road Data, Qiu, Fang; Woller, Kevin L.; Briggs, Ronald, Photogrammetric Engineering & Remote Sensing, Number 9 / September 2003, pp. 1031-1042(12).
9. Integrating Multiple Data Types in Search for Subtle Silurian Acacus Structural Traps, Southern Tunisia, R.S. Garrick, K.L. Woller, M.A. Dablain and E. Caamano, 1st EAGE North African/Mediterranean Petroleum & Geosciences Conference & Exhibition, 2003.
10. Cerro Negro Field, Venezuela: Geological Images from a High Resolution 3-D Survey, Kevin Woller, 6th International Congress of the Brazilian Geophysical Society, 1999.
11. Sierra Chata Field, Argentina: Geophysical Discovery and Development of a Stratigraphic Trap, Kevin L. Woller and William T. Louder, 6th International Congress of the Brazilian Geophysical Society, 1999.
12. Sierra Chata Field, Argentina, The Mapping of a Stratigraphic Trap, Louder, William and Woller, Kevin, SEG Technical Program Expanded Abstracts, 1999.

## **HONORS / AWARDS**

Best Paper, European Association of Geoscientists and Engineers (EAGE), North Africa Meeting, 2003

Innovation Award, Pioneer Natural Resources, 2016, 2017, 2018

## **MEMBERSHIPS / AFFILIATIONS / SERVICE**

Society of Exploration Geophysicists (1972-present, co-chair for Annual Meeting and Exhibition, 2019, Special Session co-chair 2020, 2021), Abstract reviewer 2019-2021.

European Association of Geoscientists and Engineers (2002-present)

Science Advisory Committee member for the Center for Integrated Seismicity Research at the Bureau of Economic Geology, Texas (2017-19)

Pioneer Natural Resources representative to Attribute Assisted Processing and Interpretation (AASPI) consortium at the University of Oklahoma and the Geophysical Consortium at the University of Oklahoma at Dallas (2014-2019)

Served on Consortium Review Committee at Pioneer Natural Resources (2017-2019)

Served on campus recruiting, intern assessment and intern mentoring teams

## **LECTURES**

Introduction to Exploration Geophysics, Applied Science Education Program (ASEP) session for high school students, SEG Annual Meeting 2019

Geophysical Lecture Series, Internal to Pioneer Natural Resources

Intern Field Trip lectures and crew visits, Internal to Pioneer Natural Resources

Permian Basin Geophysics, University of Texas at Dallas, 2017, 2018.

Exploration Geophysics, University of Kentucky, 2011

Chinese National Oil Company, Korla, China, 1993

## **CONTINUING EDUCATION**

Drone Geophysics Workshop, November 2021

Society of Exploration Geophysicists Annual Meetings: 2019, 2020, 2021