

Faulting, Fracturing and Mechanical Stratigraphy Field Seminar, San Antonio, Texas (G022)



Tutor(s)

[David Ferrill](#): Institute Scientist, Space Science and Engineering Division, Southwest Research Institute.

[Kevin Smart](#): Manager, Earth Science Section, Space Science and Engineering Division, Southwest Research Institute.

Overview

Superb exposures of Paleozoic and Mesozoic rocks in central and west Texas provide the opportunity to examine factors that influence the style and intensity of faulting, folding and fracture development, as well as the relationship between fracture spacing and mechanical layering. The outcrops offer analogs for deformation in both carbonate reservoirs and shale resource plays worldwide. The exposures range from map to fault block scale and provide the opportunity to explore the range of depositional facies and diverse tectonic regimes that influence the style and intensity of faulting, folding and fracture networks.

Duration and Logistics

A 7-day field course, comprising a mix of classroom lectures (5%), field lectures (65%) and field exercises (30%). The course begins and ends in San Antonio, Texas. A printed manual will be provided for each participant.

Level and Audience

Advanced. This course is intended for geoscientists, reservoir and production engineers, and petrophysicists who work with layered faulted and fractured reservoirs. It should be of particular interest to individuals working in unconventional or self-sourced plays (e.g. Eagle Ford, Austin Chalk). Basic familiarity with structural geology is expected of all participants.

Exertion Level

This class requires a **MODERATE** exertion level. Fieldwork is in the Hill Country near San Antonio where conditions are typically warm-hot and humid – the daily temperature range in fall is 15–30°C (60–85°F) – and in west Texas, where the climate is warm-hot and dry – the daily temperature range in fall is 7–27°C (45–80°F). Participants will be taking short to moderate hikes (less than 3.2km/2 miles) over flat to hilly terrain with a maximum elevation change of 200m (660 ft). Transport is by SUVs and most driving is on black-top roads. Some outcrops are reached via well-marked dirt roads.

Objectives

You will learn to:

1. Perform structural interpretations using the basic concepts of faulting, fracturing and mechanical stratigraphy.
2. Assess the role of mechanical stratigraphy and stress conditions on fracture and fault formation in sedimentary strata.

3. Evaluate deformation mechanisms that operate in fault zones and the relationship between faulting and associated folding.
4. Determine how complex structures control hydrocarbon migration and trapping in carbonate petroleum provinces.
5. Effectively interpret many of the fault system features they will encounter on seismic and well data.
6. Determine the controls on regional tectonic setting, stratigraphy and development in the areas they work.
7. Assess local structural styles and relate deformation features to mechanical stratigraphy and structural position.

Course Content

Day 1: Arrive in San Antonio

Travel to San Antonio, Texas.

Classroom:

- Course introduction and safety briefing.

Overnight San Antonio.

Day 1: Faulting, fracturing and mechanical stratigraphy

Classroom:

- Morning lectures on regional geology and basic concepts of faulting, fracturing and mechanical stratigraphy

Fieldwork:

- Examine outcrops of Cretaceous carbonate and shale strata (including the Eagle Ford Formation) in the Balcones fault system

Overnight in San Antonio.

Day 2: Fault zone deformation

Fieldwork:

- Visit Canyon Lake Gorge to study the Hidden Valley fault, a seismic-scale normal fault with world-class exposure of subseismic-scale fault zone deformation features

Overnight in San Antonio.

Day 3: Marathon fold-thrust belt

Drive to Marathon, Texas, with field stops enroute.

Fieldwork:

- Examine structural style in different facies and mechanical units in outcrops of the Eagle Ford
- Formation and equivalent Boquillas Formation and underlying Buda Formation and overlying Austin Chalk
- Contractional folding west of Del Rio in outcrops of the Eagle Ford/Boquillas formations and overlying and underlying units and relationship of fracturing to regional structural setting, stress field and mechanical stratigraphy
- Marathon fold-thrust belt – intensely folded and thrustured Paleozoic strata exposed as a window through the Cretaceous cover west of Sanderson

Overnight in Marathon.

Day 4: Relay Ramps

Drive to Big Bend National Park, Texas, with field stops en route.

Fieldwork:

- Examine Marathon fold-thrust belt structures (Simpson Springs/East Bourland Mountain anticlinorium/synclinorium pair)
- Visit Black Gap Wildlife Management area to study the Big Brushy Canyon monocline, Heath Canyon relay ramp and Stillwell Canyon relay ramp developed in the Cretaceous carbonate and shale section
- View contractional folding at Persimmon Gap

Overnight in Big Bend National Park.

Day 5: Extensional systems

Fieldwork:

- Study contractional folding, thrust faulting, extensional faulting and extensional fracturing in the Eagle Ford equivalent Boquillas Formation at Ernst Tinaja
- Study normal fault relay ramp development at Cuesta Carlota, and strike-slip and normal faulting in Cretaceous limestones at Boquillas Canyon

Overnight in Big Bend National Park.

Day 6: Extensional systems

Fieldwork:

- Santa Elena Canyon normal fault zone and footwall analysis in Big Bend National Park.

Overnight in San Antonio.

Day 7: Departure

Departure and travel home.