

The permeability architecture of faults in carbonate rocks is of fundamental importance to hydrocarbon reservoir performance, but remains poorly understood. Southwest Research Institute® (SwRI®) formed a consortium in summer 2007, with a two-year initial phase leading to improved understanding of fault architecture.

### Initial Phase (2 Years)

The objectives of the initial phase are to:

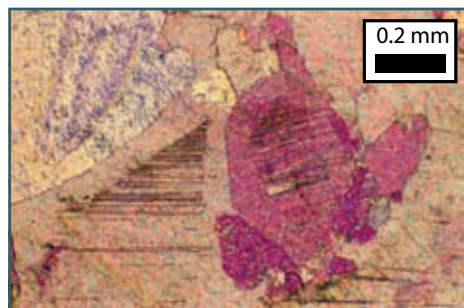
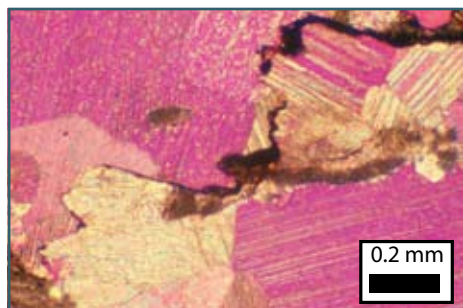
- ❑ Characterize deformation features that develop in faulted carbonate rocks
- ❑ Integrate structural analysis with lithologic and hydrologic characterization
- ❑ Generate a quantitative data set of normal fault characteristics in carbonate strata and their effects on permeability

Detailed work will be conducted over a two-year period in south central Texas on the recently exhumed Hidden Valley Fault. This fault, which cuts the Cretaceous Glen Rose Formation, is representative of a common class of structure. This unique site permits study of the interplay between structure, rock type, and fault-zone hydraulic properties.

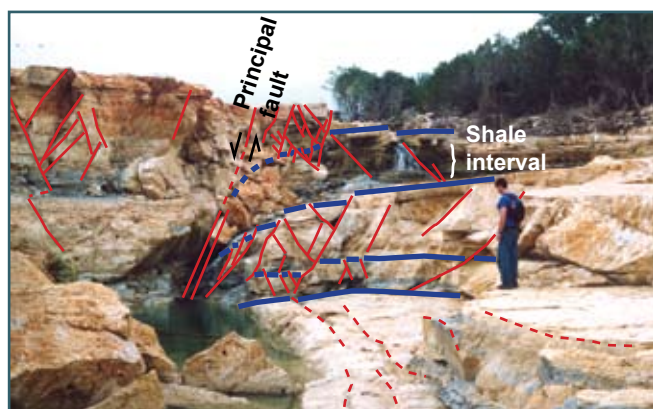
Additional work on faults within the Cretaceous strata of south central and west Texas will provide a context for interpreting and applying the detailed work in the Hidden Valley Fault.

### Stratigraphic and Lithologic Characterization (Year 1)

- ❑ Develop detailed measured sections of hanging wall and footwall
- ❑ Obtain natural gamma ray log
- ❑ Characterize textures and quantify clay content of host lithologies



Photomicrographs of fault rock in limestone illustrating stylolites, vein fill, and twinning of vein calcite.



Profile view of Hidden Valley Fault zone at waterfall looking WSW, showing synthetic dip in footwall damage zone, and conjugate normal faulting in both footwall and hanging wall.

### Structural Analysis (Years 1 & 2)

- ❑ Analyze mechanical stratigraphy
- ❑ Map outcrop scale structural elements
- ❑ Conduct microstructural analysis
- ❑ Develop a digital geologic framework model from field mapping

### Well Infrastructure (Year 1)

- ❑ Drill, core, log, and complete two wells
- ❑ Install multi-level piezometers in the hanging wall and footwall of the Hidden Valley Fault

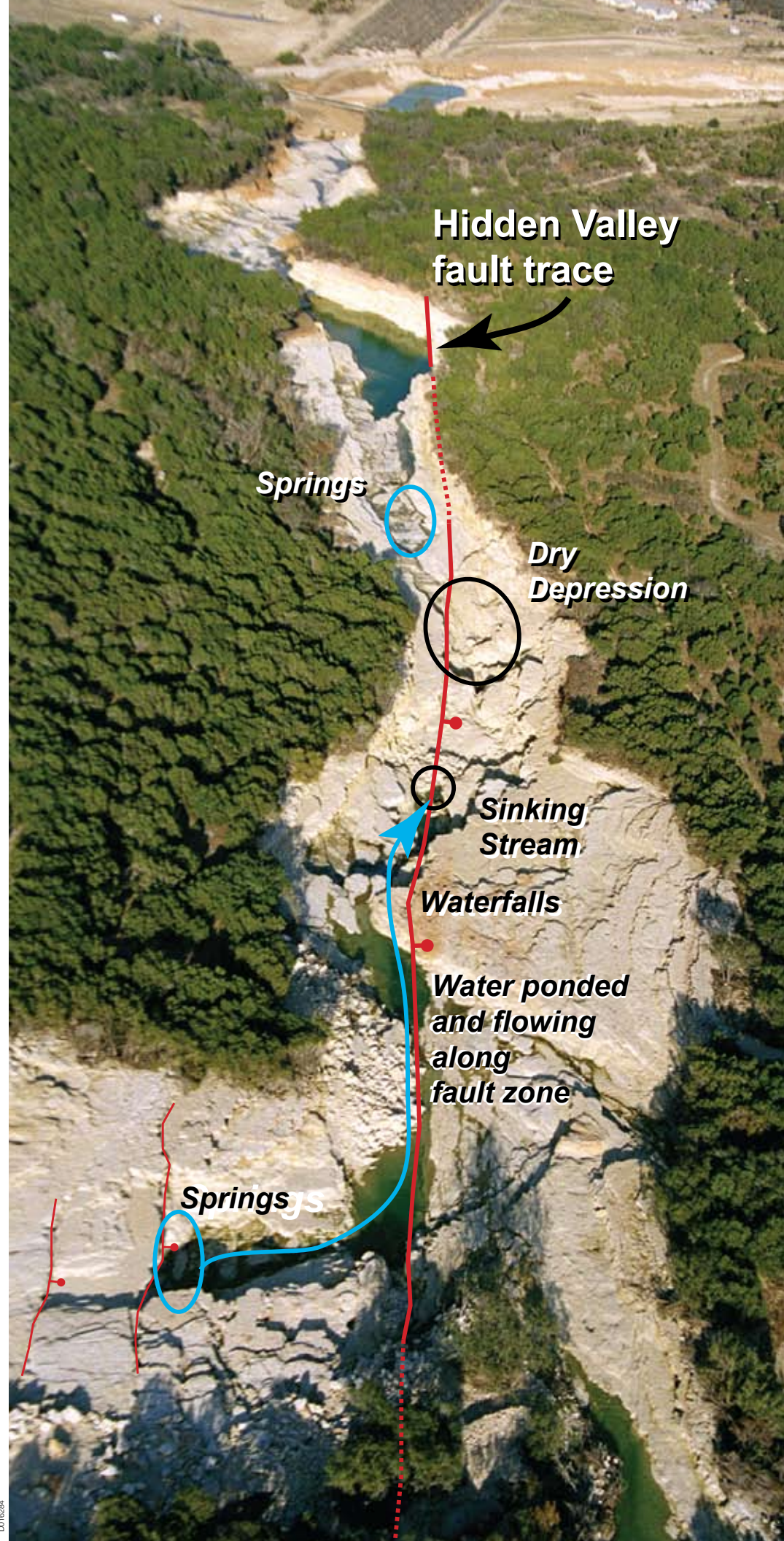
### Hydrologic Characterization (Years 3 & 4)

- ❑ Assemble water level data for Canyon Lake and local water wells
- ❑ Monitor springs, seeps and influent/effluent surface water bodies
- ❑ Measure water flow rates within Canyon Lake Gorge
- ❑ Monitor water pressures at multiple intervals in monitoring wells

### Geomechanical Characterization (Years 3 & 4)

- ❑ Characterize geomechanical properties of representative lithologies from the Hidden Valley Fault exposure
- ❑ Use finite element and distinct element methods to simulate deformation associated with the Hidden Valley Fault

Low-altitude aerial photograph of Canyon Lake Gorge showing traces of faults and locations of springs, pools, and infiltration points in channel. View is ENE along strike of Hidden Valley Fault.





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# Carbonate Fault Project

A Consortium for  
Integrated Structural  
Geologic, Hydrologic,  
and Geomechanical  
Investigations

