**Dave Barthelmy**

**From:** b.580.656255.224964358b585c0f@www.hgs.org on behalf of HGS <webmaster@hgs.org>
**Sent:** Thursday, October 24, 2013 7:52 PM
**To:** David Barthelmy
**Subject:** Shale Rock Physics, Fractures, and Stress Changes Due to Production

# Houston Geological Society

Join us November 4-5 for Geomechanics.  Presenters and attendees will represent a broad spectrum of industry professionals. Please note a correction to the previous mailing:  The keynote speaker, Mark Zoback, is from *Stanford University.*

## "Shale Rock Physics, Fractures, and Stress Changes Due to Production"

Colin Sayers, Ph.D.
Schlumberger, Houston, TX, USA

**Summary**

Shales comprise a large proportion of the rocks in most sedimentary basins and form the seal and source rocks for many hydrocarbon reservoirs. In unconventional shale plays, the shale acts as both the source rock and reservoir. Currently, there is great interest in organic-rich shales such as the Bakken, Barnett, Eagle Ford, Fayetteville, Haynesville, Marcellus and Woodford shales because these represent an enormous energy resource. Organic-rich shales are often strongly anisotropic because of layering, the partial alignment of clay minerals, and the bedding-parallel lamination ot organic material within the shale. Understanding shale anisotropy is of great importance for optimizing seismic exploration and exploitation of organic rich shales due to the effect of anisotropy on the geomechanical behavior of the reservoir and surrounding rocks. Because of their low permeability, economic production from unconventional reservoirs requires hydraulic fracturing of the reservoir. lt is important to have an estimate of the state of stress in the rock since this determines the downhole pressure required to propagate a hydraulic fracture and whether the fracture will be contained within the reservoir or will propagate into overlying or underlying formations. Changes in stress due to production are also important since these changes will determine how fluid flow within the stimulated zone will vary over the life of the well. These changes need to be understood to optimize the location, orientation, and stimulation of infill wells as Well as refracturing.

In addition to the intrinsic anisotropy of shales, anisotropy due to the presence of natural fractures and due to horizontal stress anisotropy plays an important role in determining the geometry of hydraulic fractures in unconventional reservoirs. Microseismic monitoring provides data that allows an assessment of the geometry and development of hydraulically-induced fracture systems. Such data sets have demonstrated that complex fracture networks can form in tight gas shales. Monitoring the fracture networks that result from stimulation helps optimize production in unconventional reservoirs as their low permeability requires the creation of an extremely large fracture surface area. In this talk, the use of sonic and seismic anisotropy to characterize unconventional reservoirs is introduced, the rock physics basis required to understand the anisotropy of shales is discussed, and the effect of anisotropy on the variation in stress due to production is explained. The

characterization of fracture networks resulting from hydraulic fracturing is discussed and related to the anisotropy of the in situ stress field as determined by sonic and seismic methods.

Register for Geomechanics on the hgs.org website.


HGS
14811 St.Marys Lane
Ste 250
Houston, 77079
United States