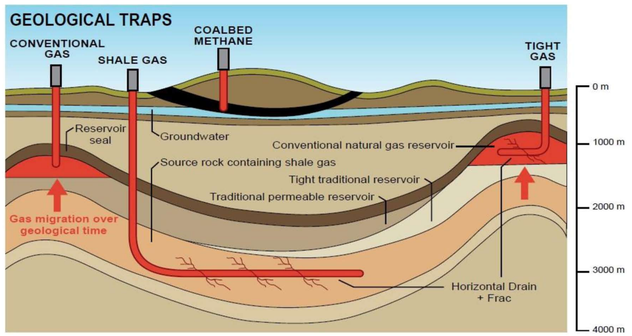
THE NATURE OF SHALE PLAYS: WHY MONITOR EVERY FRAC

Cherie Telker, Geology Team Leader
Mike Mueller, VP Technology Development

UNCONVENTIONAL PLAYS ARE DIFFERENT FROM CONVENTIONAL PLAYS

Shale plays have changed the world we work in. Today the shale source rock is the reservoir, and we're not looking for traps. The shale plays have been enabled via the technologies of horizontal drilling and high volume hydraulic fracturing which transform the shale 'source rocks' into unconventional 'reservoir rocks'.

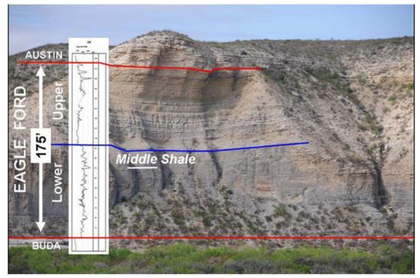


Furthermore, multiple shales blanket our sedimentary basins. While traditional, conventional reservoirs with trapped oil and gas occur in discrete 'fields', the shales are everywhere and are conceivably developable everywhere the shale exists.

However, there's a lot of variability involved in the unconventional plays. And this variability exists at the trend, county, outcrop, pad, well, core and microscopic scales.

SHALES ARE VARIABLE

Consider the variability in the Eagle Ford "shale" at the **outcrop scale**: The lower member is debrites; the middle member has varying amounts of calcareous shales with limestone stringers; the upper member consists of thick limestone beds.



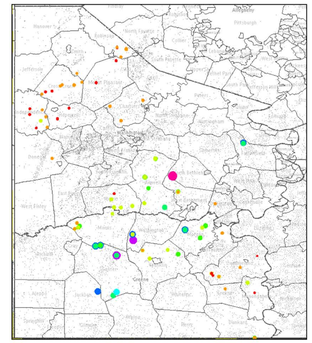
Now, variability at the **core scale**. There is variability from the fine scale layering in the shale, and some areas of lateral heterogeneity. There's even variability at the microscopic scale where we can see organic rich intervals in the dark layers.

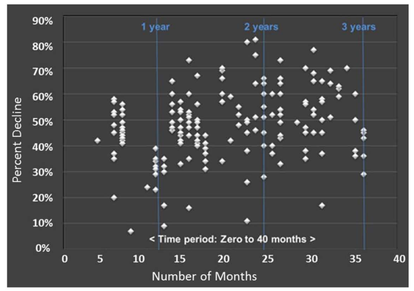
We must plan carefully where to land the lateral, how far the lateral will be drilled, and how many stages can be profitably stimulated.

Fig. 2. Slabbed Eagle Ford core from the Robinson-Troell #1 well. Yard-stick to the far right shows the scale.

PRODUCTION IS VARIABLE

This map shows cumulative Marcellus production in 2 counties in southwest Pennsylvania. The wells are colored and sized by cumulative production for wells with first production in 2012. There are high producers near low producers.

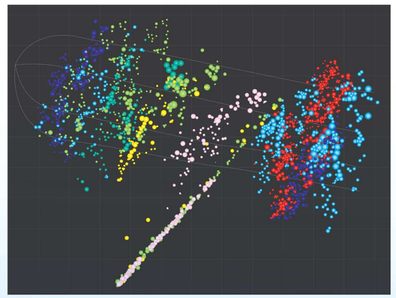




For 190 wells drilled and completed in the Marcellus production declines range from less than 10% to more than 80% with no trend up to 40 months.

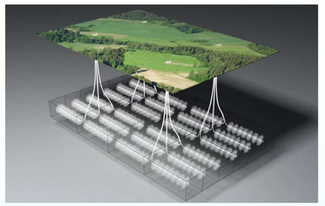
STIMULATION RESPONSE IS VARIABLE

Here microseismic resolution capability is illustrated and reveals unexpected variability - a fault below active seismic resolution.



MONITOR EVERY FRAC TO ELIMINATE THE STATISTICAL APPROACH AND CREATE THE DATA DRIVEN APPROACH

BuriedArray™ acquisition using a permanently installed grid enables long term monitoring up to life of field that scales to any size. This means monitoring 100s to 1000s of laterals and pads is available on demand and provides monitoring costs below a few thousand dollars per stage.



The ability to predict production from a **monitor every frac** approach means data driven resource progression, deterministic reserves bookings with MSI's Completions Evaluation Services including Productive-SRV. This replaces modeled bookings reducing the chance of write-downs and increasing shareholder value.

MicroSeismic
Passive Monitoring, *Active Listening*

© 2014 MicroSeismic, Inc | All Rights Reserved