# Barriers to using land seismic in unconventional reservoir characterization

One of the big challenges remaining in the field of geophysics is establishing the limits of information that can be gained from seismic data in appraisal and development of unconventional resources. Decades of seismic methods have focused on assessing the likelihood of finding hydrocarbons and the height of the hydrocarbon column. Hence, seismic data is invaluable in exploration and in HCIIP assessment of conventional reservoirs. Under favorable circumstances, even changes in oil saturation and pressure can be detected, making time-lapse, or 4D, seismic a tool for reservoir monitoring. Unfortunately, none of this is applicable to resource plays.

Nowadays, geophysicists are working together with petrophysicists and stimulation engineers to come up with reliable methods to predict production rate, and ultimate-recovery before a production pad location is chosen and the wells are drilled. The focus in these multi-disciplinary projects is on geomechanical aspects, because there is a reasonable expectation that those rock properties can be derived from seismic. Presently, barriers to vertical frac growth are at best qualitatively identified. It is disappointing that industry has not routinely moved beyond this level.

In my opinion, one of the reasons for this lack of progress is that we, as an industry, have continued to acquire, or buy, severely compromised seismic data in an effort to save costs. This self-defeating focus on costs rather than value has also lead to the demise of nearly all globally operating land seismic acquisition contractors. The few that are remaining struggle to invest in new seismic acquisition technology such as wireless recording using nodes and Compressive Sensing.

This situation is mirrored on the land seismic processing side: risk-adverse operators select those contractors that execute established processing flows quickly and cheaply. With few exceptions, the processing contractors themselves cannot afford to innovate on their own dime, because returns on investment are low. This has hampered uptake of advances in acquisition, such as simultaneous recording and Compressive Sensing sampling, which require high-quality deblending and wavefield reconstruction in processing.

Our colleagues on the engineering side are guilty of the same focus on short-term costs rather than long-term value. Clear evidence for this if e.g. the lack of horizontal boreholes equipped with fiber optic. With only surface measurements of proppant pumped and hydrocarbon produced, everyone is left guessing about lateral variability. The few wells that are properly instrumented show that lateral changes are commonly significant.

We cannot hope to establish reliable predictions of production rate and ultimate-recovery if we do not improve our data collection.