

# Dipole Sonic Log Calibration for Mechanical Properties



**The problem:** Dipole sonic logs are often found to be inaccurate for predicting the mechanical properties of rocks in many reservoirs. These inaccuracies cause engineering failures including poor fracture designs and unreliable sand prediction analyses.

**The solution:** Static lab data matching reservoir conditions are required for reliable calibrations of dipole sonic logs.

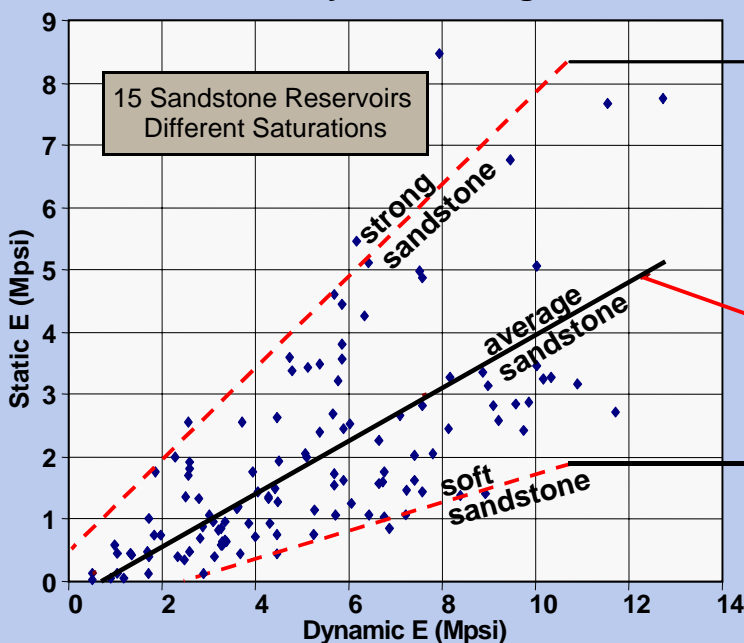
**The results:** These calibrations are successful in hundreds of wells worldwide and many different types of reservoirs.

- Enhance well completion options with lab data
- Improve well stimulation (hydraulic fracture design and selective perforation)
- Optimize horizontal well placement
- Predict reliable maximum drawdown pressure to maintain perforation hole stability and avoid sand production
- Calibrate logs with new data such as angle of internal friction and poroelastic variability



Core Lab provides vital calibration data and engineering analyses for dipole sonic logs with a full-service geomechanics laboratory.

## Static Versus Dynamic Young's Modulus



### REALITY CHECK:

How reliable is your log-derived data?

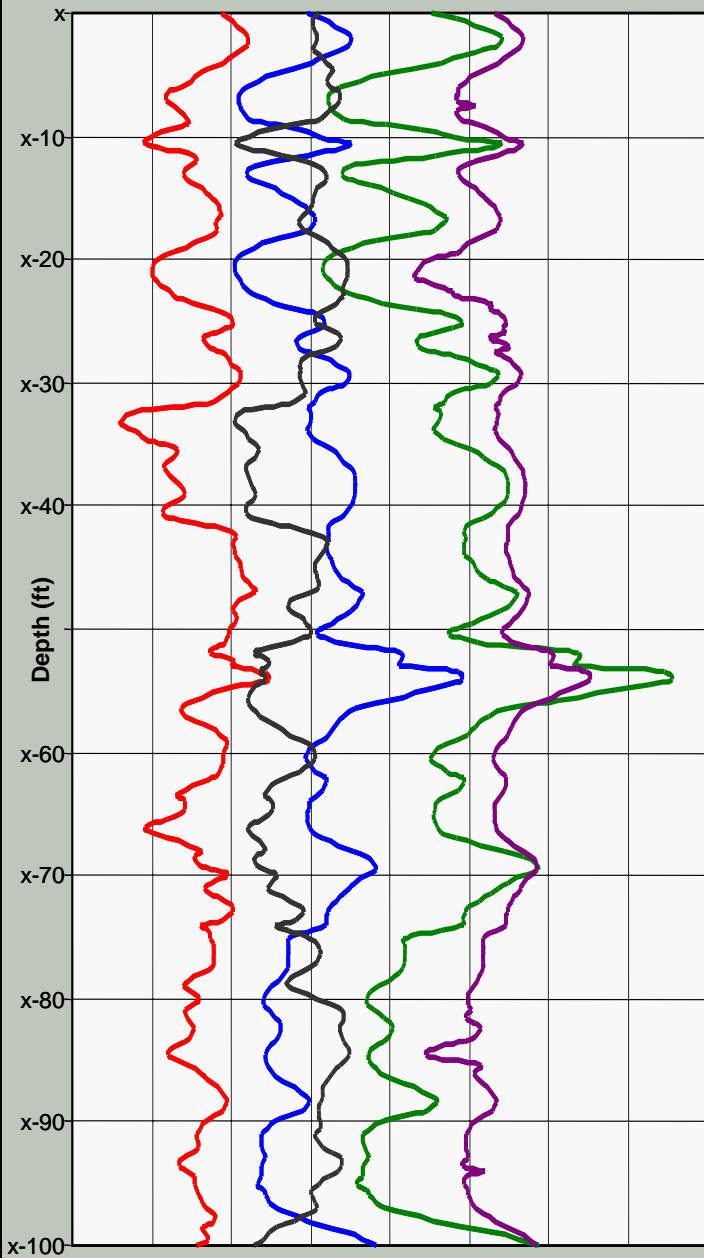
— wide variability for real-world reservoirs

This line represents ideal cases—average rock for which accurate estimations of strength properties are possible from dipole sonic logs alone. The wide scatter (which is not due to statistical error) of the data points indicates that the correlations between static lab data and dynamic log data are different for each reservoir.

To estimate mechanical properties of reservoirs using only dynamic log data, assumptions must be made that the current reservoir contains "average reservoir rock". This is seldom an accurate assumption to make because *mechanical properties are reservoir-specific*. Static laboratory data from triaxial rock testing give realistic appraisals of formation mechanical properties under a variety of conditions.

## Calibrated Dipole Sonic Log

- 0 unconfined compressive strength (psi) 8000
- 0 max drawdown at initial pore press (psi) 8000
- 0 max drawdown at reduced pore press (psi) 8000
- 0 dynamic Young's modulus (Kpsi) 8000
- 0 dynamic Poisson's ratio 0.5



Calibration of a dipole sonic log to laboratory data:

- Improves accuracy and reliability of predictions of mechanical properties at reservoir conditions.
- Provides new engineering data on formation strength (i.e., shear strength, angle of internal friction) that control drawdown pressure predictions.
- Calibrates to different failure modes such as thick-wall cylinder (TWC) test results.
- Corrects for artifacts in the log created by mud filtrate invasion and mechanical damage to the wellbore.



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