Engineering - Hydrologic Engineering; Study Results from University of Texas Austin Update Understanding of Hydrologic Engineering (Effects of Overpressure On Mechanical Properties of Unconventional Shale Reservoirs Through Novel Use of a Sonic Overpressure Indicator)

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2022 MAR 25 (VerticalNews) -- By a News Reporter-Staff News Editor at Energy Weekly News -- Researchers detail new data in Engineering - Hydrologic Engineering. According to news reporting out of Austin, Texas, by VerticalNews editors, research stated, "Overpressure is a common feature among productive unconventional shale reservoirs, such as the Bone Spring (BSPG) and Wolfcamp (WFMP) Formations of the Delaware Basin (DB) of west Texas and southeastern New Mexico, and is thought to be a strong driver of well productivity. Compared with conventional reservoirs and shales in normal pressured conditions, the effects of overpressure on the mechanical properties of shales is not well understood."

Funders for this research include Tight Oil Resource Assessment program at the **Bureau of Economic Geology**, State of Texas Advanced Resource Recovery program at the **Bureau of Economic Geology**.

Our news journalists obtained a quote from the research from the University of Texas Austin, "Here we present an analysis of overpressure in clay-bearing siliciclastic facies of the BSPG and WFMP Formations of the DB and implications for mechanical properties of the reservoir. Estimation of the effects of overpressure on mechanical properties of unconventional shale reservoirs is determined through use of the sonic overpressure indicator (SOPI). The method requires log model results that accurately characterize variations in lithology and porosity for the formations of interest. The SOPI (Delta T/Delta T-N)(2), where Delta T is the measured compressional sonic transit time, and Delta T-N is the forward-modeled result for normally pressured conditions, can be used with elastic moduli and their interrelationships to compare estimates of mechanical properties including Poisson's ratio nu, the Biot or effective stress coefficient alpha, and Young's modulus E, in normal and overpressured conditions. Results presented here are broadly applicable to overpressured unconventional reservoirs that contain significant clay volume (>0.1 v/v) and exhibit low porosity (<0.08 v/v), comparable to that of siliciclastic-rich facies of the WFMP Formation. To account for increased V-P/V-S ratio, we regard overpressurization of shaly facies as an irreversible thermodynamic process that transforms a normally pressured siliciclastic system. At stress below the yield point, which is taken as the limit of normal pressure, the system responds elastically to stress; beyond this point, during overpressurization, the system responds as an elastic/plastic medium with strain hardening. We regard elastic moduli as descriptive of mechanical energy stored in this system. This perspective enables Poisson's ratio for the overpressured system nu(OP) to be computed from an estimate of the normally pressured system nu(N) using (Delta(T)/Delta T-N)(2). Overpressure also results in a limited increase of the Biot or effective stress coefficient alpha. Moreover, recognition that overpressure results in a decrease of Young's modulus, that is, E-OP/E-N < 1, provides a means of estimating the amount of strain energy stored by the formation due to overpressurization. We believe that when exposed to lower pressures by wellbore construction, this strain energy stored in overpressured unconventional reservoirs drives creep, which affects interpretations made using geomechanical models. We have developed and tested computational models based on biaxial or plane strain for vertical wells and uniaxial strain for horizontal wells that describe how creep likely affects estimation of minimum horizontal stress S-hmin and pore pressure from instantaneous shut-in-pressure (ISIP) measurements."

According to the news editors, the research concluded: "Thus, for overpressured unconventional reservoirs, ISIP determinations differ from tectonic S-hmin by an amount related to nu and E-OP/E-N."

This research has been peer-reviewed.

For more information on this research see: Effects of Overpressure On Mechanical Properties of Unconventional Shale Reservoirs Through Novel Use of a Sonic Overpressure Indicator. SPE Reservoir Evaluation & Engineering, 2022;25(1):1-9. SPE Reservoir Evaluation & Engineering can be contacted at: Soc Petroleum Eng, 222 Palisades Creek Dr, Richardson, TX 75080, USA.

Our news journalists report that additional information may be obtained by contacting K. M. Smye, University of Texas Austin, Austin, TX 78712, United States.

Keywords for this news article include: Austin, Texas, United States, North and Central America, Hydrologic Engineering, Engineering, University of Texas Austin.

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