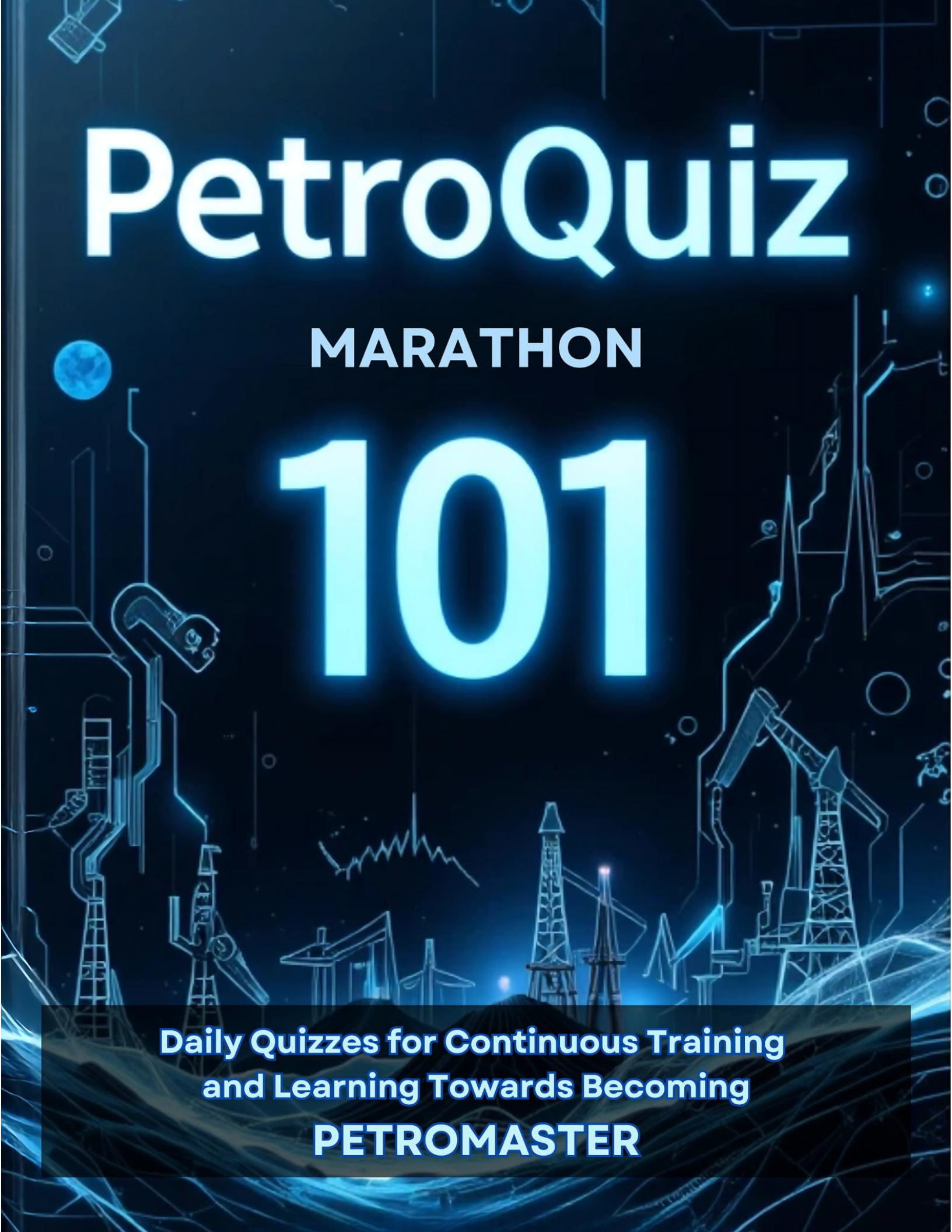
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TABLE OF CONTENTS

MEET THE EDITORS 6
SPONSORS 11
#PetroQuiz 001: Pickett Plot 17
#PetroQuiz 002: Mercury Injection Capillary Pressure 19
#PetroQuiz 003: Well Logs 21
#PetroQuiz 004: Vertical Resolutions 23
#PetroQuiz 005: Mud Filtrate Invasion 25
#PetroQuiz 006: Rock Sampling Method 27
#PetroQuiz 007: Lithology Porosity Estimation 29
#PetroQuiz 008: Acoustic Impedance 31
#PetroQuiz 009: Geothermal Assets 33
#PetroQuiz 010: Well Logs Digital Format 35
#PetroQuiz 011: Reservoir Technology 37
#PetroQuiz 012: Well Log Simulation 39
#PetroQuiz 013: Regression Algorithm 41
#PetroQuiz 014: Lithofacies 43
#PetroQuiz 015: Image Data 45
#PetroQuiz 016: Gen AI 47
#PetroQuiz 017: RW Determination 49
#PetroQuiz 018: Geological Facies Modeling 51
#PetroQuiz 019: Coalbed Methane 53
#PetroQuiz 020: Common Terminologies in Logs 55
#PetroQuiz 021: Hydrogen 57
#PetroQuiz 022: NMR Petrophysics 59
#PetroQuiz 023: Low-Resistivity-Low Contrast 61
#PetroQuiz 024: Thin Bed Pay 63
#PetroQuiz 025: Capillary Pressure 65
#PetroQuiz 026: High Pressure Mercury Injection Capillary Pressure Measurements 67
#PetroQuiz 027: Fluid Substitution for NMR 69
#PetroQuiz 028: Net Pay 71
#PetroQuiz 029: Cased Hole Logging 73

#PetroQuiz 030: Rock Pore Geometry 75

#PetroQuiz 031: NMR Petrophysics 77

#PetroQuiz 032: NMR Physics/Fundamentals 79

#PetroQuiz 033: Borehole Seismic 81

#PetroQuiz 034: Production Log Sensors 83

#PetroQuiz 035: Mud Pulse Telemetry 85

#PetroQuiz 036: Geosteering 87

#PetroQuiz 037: Exponent “m” of Fractured Rocks 89

#PetroQuiz 038: Clay Typing 91

#PetroQuiz 039: Klinkenberg Correction 93

#PetroQuiz 040: Total Organic Carbon 95

#PetroQuiz 041: Wettability on Logs 97

#PetroQuiz 042: Mud Logging 99

#PetroQuiz 043: Water Saturation 101

#PetroQuiz 044: The First Wireline Log 103

#PetroQuiz 045: Fracture Porosity 105

#PetroQuiz 046: Saturation Height 107

#PetroQuiz 047: Barite Effects on Logs 109

#PetroQuiz 048: Borehole Image Log 111

#PetroQuiz 049: PVT Test 113

#PetroQuiz 050: Fluid Substitution 115

#PetroQuiz 051: Overpressure Zone Identification 117

#PetroQuiz 052: C/O Cased Hole Log 119

#PetroQuiz 053: Mobility 121

#PetroQuiz 054: Logging Tool Frequency 123

#PetroQuiz 055: TOC From Well Logs 125

#PetroQuiz 056: Pore Pressure From Well Logs 127

#PetroQuiz 057: Cloud Computing and AI 129

#PetroQuiz 058: Clay CEC 131

#PetroQuiz 059: Shaly Sand Equations 133

#PetroQuiz 060: Operation Petrophysics 135

#PetroQuiz 061: Thomas-Stieber Plot 137

#PetroQuiz 062: Petrophysical Rock Typing 139

#PetroQuiz 063: Archie's "n" of Oil-Wetting Rocks 141

#PetroQuiz 064: Annulus Resistivity Profile 143

#PetroQuiz 065: Drilling Rig 145

#PetroQuiz 066: Bulk Density Log 147

#PetroQuiz 067: Capillary Pressure Hysteresis 149

#PetroQuiz 068: NMR Raw Echoes and Inversion 151

#PetroQuiz 069: Utah FORGE Geothermal 153

#PetroQuiz 070: Sonic Waveforms 155

#PetroQuiz 071: Cement Bond Log (CBL) 157

#PetroQuiz 072: Gamma Ray Log 159

#PetroQuiz 073: Knudsen Diffusion 161

#PetroQuiz 074: Darcy's Law 163

#PetroQuiz 075: Diagenesis 165

#PetroQuiz 076: Kerogen Type 167

#PetroQuiz 077: Well Depth Index 169

#PetroQuiz 078: Relative Permeability 171

#PetroQuiz 079: Saturation Dependency 173

#PetroQuiz 080: Formation Damage 175

#PetroQuiz 081: True Stratigraphic Thickness 177

#PetroQuiz 082: Reservoir Fluid Contacts 180

#PetroQuiz 083: Hydraulic Fracture Orientation 182

#PetroQuiz 084: Geothermal Gradient 184

#PetroQuiz 085: M-N Plot 187

#PetroQuiz 086: Borehole Imaging 189

#PetroQuiz 087: UCS from Logs 191

#PetroQuiz 088: Clay Types 193

#PetroQuiz 089: Polarization Horn Effect 196

#PetroQuiz 090: Wettability Test 198

#PetroQuiz 091: Pore Pressure Evaluation 200

#PetroQuiz 092: Fracture Gradient Estimation 202

#PetroQuiz 093: Routine Core Analysis (RCA) 204

#PetroQuiz 094: Refrac Candidates 206

#PetroQuiz 095: LWD Azimuthal Density Image 208

#PetroQuiz 096: Effective medium theory for averaging 210

#PetroQuiz 097: Cementation Bond Log 212

#PetroQuiz 098: Geothermal resources in USA 214

#PetroQuiz 099: Caprock Types 216

#PetroQuiz 100: Subsurface GR Radiation 218

#PetroQuiz 101: Carbon negative energy 220

MEET THE EDITORS



Leandro Melani (LinkedIn) is a petrophysicist and energy scientist specializing in subsurface characterization, well-log analysis, and low-carbon energy solutions. He holds a B.S. in Geology and an M.Sc. and Ph.D. in Petroleum Engineering with a focus on petrophysics. Since 2015, he has contributed to industry-sponsored research, advancing petrophysical characterization through well-log and image-log analysis, particularly in Brazil's pre-salt. Currently, he is a Petrophysicist Researcher at the Bureau of Economic Geology at UT Austin, developing strategic approaches to optimize the characterization of heterogeneous bedded salt formations in the Permian Basin for subsurface hydrogen storage. His work includes applying machine learning for basin-scale facies analysis to support the transition to low-carbon energy solutions.



Muhammad F. Ridzuan (LinkedIn) is an applied machine-learning scientist with a background that uniquely blends geoscience and healthcare. He holds a B.S. and M.S. in Geology and a Ph.D. in Machine Learning with a focus on medical applications for cancer prognosis. Prior to pursuing his Ph.D., he served as a geology domain champion, providing visualization and automation solutions to the energy industry. He has over 5 years of experience delivering impactful AI-driven solutions, leveraging his interdisciplinary background to bring fresh and innovative perspectives to solving complex challenges in energy and healthcare. His interests encompass deep learning, interpretability, survival analysis, and causality. His work has earned him several accolades for research, academic excellence, leadership, and community service.



Mauricio Buendía (LinkedIn**)** is a junior petrophysicist with a B.S. in Geophysical Engineering and soon-to-be M.Eng. in Resource Exploration. His research focuses on the application of data science and neural networks to effectively manage spatial data. Since 2021, he has been a lecturer in Petrophysics and Well Logging at the Faculty of Engineering, Universidad Nacional Autónoma de México. He has also worked as a contractor for Shell Mexico, where he edited and adapted data for the Hydrocarbons National Commission in Mexico City. Mauricio is actively involved in professional organizations, having served as the Coordinator of the Visiting Geoscientists Program for the North Region of AAPG, as well as in SEG, AMGE (as President of the Student Chapter), and AMGP. His professional interests include developing integrated, data-driven, and intelligent models in petrophysics and geosciences, with a focus on teamwork, leadership, and teaching.



Ning Hao (Linkedin) is a digital transformation expert with deep expertise in the petroleum industry, combining hands-on field experience with software innovation. Having worked as a field engineer, he understands the complexities of Field Development Planning, Well Construction, and Production. Over 20 years, he has led the design and development of cloud-based engineering solutions, optimizing workflows and enhancing decision-making for energy operations. He currently works in SLB Digital & Integration as a Product Analyst. With a Master's in Computer Science, Ning is dedicated to advancing digital solutions that transform the energy sector.



Joshua Christopher Bautista-Anguiano (LinkedIn**)** was born in Mexico City, Mexico, in 1990. He joined the top program in Geophysical Engineering at the National Autonomous University of Mexico (UNAM, from its Spanish acronym) in 2008, graduating in 2013. His academic successes continued with his Master's in Petroleum Engineering at The University of Texas at Austin (UT Austin). He heavily worked on well log analysis, simulation, interpretation, and integration to core data measurements. Continuing with his Ph.D., Joshua supported the Hildebrand Department of Petroleum Engineering at UT Austin for four years as a Teaching Assistant in well logging interpretation and petrophysics courses. Joshua completed his Ph.D. in March of 2021. In his work, Joshua continued developing new algorithms to simulate and verify the interpretation of spontaneous potential logs, for which he was awarded from the Society of Exploration Geophysicists the BEST PAPER award for 2020. From 2024, he has worked for AspenTech in Mexico, providing technical support and consulting work as a Senior Petrophysicist for Mexico and South America.



Julio C. Rojas Meza (LinkedIn) is an emerging petrophysicist and reservoir engineer. He earned dual B.Sc. degrees in Multidisciplinary Studies and Petroleum Engineering from the University of Oklahoma, where he is also pursuing a M.Sc. degree in Petroleum Engineering. His initial exposure to petrophysics occurred in the Reservoir Rock Properties course taught by the late Dr. Carl Sondergeld, an experience that sparked his enduring interest in the discipline. Julio has gained valuable industry experience through internships with Hunt Oil Company in Dallas and CARBO Ceramics Inc in Houston. In addition to his industry experience, he has enhanced his portfolio by serving as a teaching assistant in courses such as Rock Reservoir Properties, laboratory and lecture, Reservoir Fluid Mechanics, and Integrated Reservoir Management. His present work examines the transfer properties of oil well cements using non-destructive testing techniques. Additionally, he has played an active role in OU-SPE, serving as President of the student chapter and as captain of their PetroBowl team.



Chicheng Xu (LinkedIn) is the founder and chief scientist of OpenPetro AI, a company that leverages various open-source AI/ML technologies to solve energy industry problems. He joined the Aramco Houston Research Center in 2017 and worked as a research Petro physicist in the geology innovation and AI Technology teams. His research focused on petrophysics intelligence and automation using advanced computational techniques and data analytics for interpretation, classification, and modeling based on multiscale subsurface data integration. He earned his Ph.D. degree from the Petroleum & Geosystems Engineering Department of UT Austin in 2013 and worked as a Petro physicist/rock physicist for BP America and BHP Billiton from 2013 to 2017. He cofounded and chaired the SPWLA PDDA SIG and initialized a student scholarship for PDDA-related graduate research. He has also served as an associate editor for several international scholastic journals, including Petrophysics and SPE Reservoir Evaluation & Engineering. He was selected to receive the Regional Formation Evaluation Technical Award from the SPE – Gulf Coast in 2018, the SPWLA Meritorious Service Award in 2019, the SPE Outstanding Associate Editor Award in 2020, the SPWLA Meritorious Technical Award in 2021, and the Regional Data Science and Engineering Analytics Technical Award in 2022.

I borrowed the quiz idea from my Shifu Dr. Carlos Torres-Verdin (initially with SPWLA Newsletter bimonthly) and initiated the #PetroQuiz series on LinkedIn daily. The feedback has been amazingly positive so I extended the program to be a marathon series. It is such a fun learning & networking group event.

For complex work, try to accomplish it in a simple way.
If the work becomes simple, then try to do it every day.
For simple everyday work, still full attention you need to pay.

复杂的事情简单做，简单的事情重复做，重复的事情用心做

PETROQUIZ MARATHON AWARD PROGRAM

After initiation in October 2024, #PetroQuiz Marathon LinkedIn Program has attracted lots of engagement (average 150 votes, 3000+ impressions for each quiz). Three categories of awards are assigned weekly:

1. Diligent Co-host Award: for those who contribute quiz ideas that are adopted. Below is the list of co-hosts: Andy Brickell, Dr. Ron J.M. Bonnie, Dr. Behzad Ghanbarian, Craig Phillips, W. Sebastian Bayer Prince.

2. Best Insights Award: for those who share relevant technical insights in the comments.

3. Full Participation and Top Scorer Award: for those who work on the quizzes every day and achieve the highest score (full score mostly).

During the sponsoring week, Starbucks e-GiftCard or similar gift will be distributed to all award winners. Below is the list of sponsors:

SubsurfaceAI Inc - Dr. Renjun Wen

Kalpra Tech Solutions - Malleswar Yenugu, Ph.D.

SAGA Wisdom - John Thompson

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subsurfaceAI Inc. (formerly Geomodeling Technology Corp.) is an international geoscience software company based in Calgary, Alberta, Canada. Since our establishment in 1996, we have been at the forefront of developing innovative software solutions for the oil and gas exploration and production industry.

For over 27 years, subsurfaceAI has dedicated itself to pushing the boundaries of what is possible in subsurface software for the E&P industry. Our AI-powered software offers an integrated solution for multi-scale subsurface data interpretation, integration, and geomodeling. By harnessing the power of artificial intelligence, we enable our clients to significantly increase productivity, enhance consistency, and digitize their corporate knowledge.

One of the key strengths of our software lies in its ability to digitize and centralize the corporate knowledge of subsurface teams. Through a centralized database that stores AI labels and models, our clients gain access to a wealth of valuable information that can be utilized across multiple projects in different basins. This centralized approach fosters collaboration, efficiency, and seamless knowledge sharing, empowering organizations to make informed decisions and drive successful outcomes.

In addition to its application in oil and gas exploration and production, subsurfaceAI's innovative software can also be applied to select and characterize geological CO2 storage reservoirs. We recognize the importance of sustainable practices and are committed to providing tools that contribute to the effective management of carbon emissions and the transition to a more environmentally conscious future.

At subsurfaceAI, we have a team of dedicated professionals with extensive expertise in geoscience, data science, and software engineering. Our commitment to innovation and deep understanding of the industry allows us to consistently deliver software solutions that exceed our clients' expectations.

As we embark on this new chapter as subsurfaceAI, we are excited about the endless possibilities and opportunities that lie ahead. We invite you to explore our website and learn more about how our software can revolutionize your oil and gas exploration and production workflows. Join us as we continue to drive innovation, transform industries, and shape a sustainable future.

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In the rapidly evolving landscape of the oil and gas industry, the integration of advanced technologies has become imperative for enhancing efficiency, safety, and sustainability. Drake AI stands at the forefront of this transformation, offering cutting-edge artificial intelligence solutions tailored specifically for the unique challenges of the energy sector.

Company Overview

Drake AI is a pioneering technology firm dedicated to revolutionizing the oil and gas industry through innovative AI-driven tools and services. Drawing inspiration from Edwin Drake, the pioneer of the first producing oil well in the United States in 1859, the company embodies a spirit of innovation and progress. By leveraging state-of-the-art artificial intelligence and machine learning technologies, Drake AI aims to optimize operations, reduce risks, and drive sustainable practices within the energy sector.

Drake AI integrates advanced AI & machine learning to enhance well log analysis, seismic interpretation, and reservoir characterization—empowering geoscientists to make faster, data-driven decisions with ease.

🚀 **AI & Gen AI Modules in Drake for Geoscientists**

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🔹 **Drake GPT –** Your AI-powered geoscience assistant.

🔹 **Drake OCR –** Extracts critical insights from scanned geological documents.

Drake AI's Productive Intelligence Capabilities: AI and Generative AI in Oil & Gas

In the rapidly evolving oil and gas industry, artificial intelligence (AI) and generative AI (Gen AI) are reshaping how companies manage production efficiency, predictive maintenance, and asset reliability. Drake AI stands at the forefront of this transformation by integrating advanced AI-driven solutions designed to optimize operations, minimize downtime, and maximize production.

1. Production Optimization with AI and Generative AI

Efficient production management is critical for oil and gas operators seeking to improve recovery rates while reducing operational costs. Drake AI leverages AI-driven **Production Optimization** solutions to enhance real-time decision-making, automate workflows, and maximize hydrocarbon extraction efficiency.

Key Capabilities:

- **Real-Time Data Analysis**: AI models process large volumes of production data, analyzing pressure, temperature, flow rates, and equipment performance to provide actionable insights for operators.
- **Generative AI for Scenario Modeling**: By simulating various production scenarios, Gen AI can recommend optimal control strategies for well operations, enhancing recovery rates and reducing inefficiencies.
- **Automated Well Performance Monitoring**: AI algorithms continuously track well performance and detect underperforming wells, enabling proactive adjustments to enhance output.
- **AI-Driven Reservoir Insights**: Through machine learning, Drake AI models analyze historical production data to forecast potential decline rates and suggest interventions to sustain production levels.
- **Optimization of Artificial Lift Systems**: AI-powered adjustments help fine-tune artificial lift operations, ensuring maximum efficiency with minimal energy expenditure.

By applying these capabilities, Drake AI helps oil and gas companies maximize output while reducing operational uncertainties, ensuring optimal resource utilization.

2. Predictive Maintenance of Artificial Lifts

Artificial lift systems are vital for oil production but are prone to wear and tear, leading to costly failures and downtime. Drake AI's **Predictive Maintenance** solutions use AI and Gen AI to predict equipment failures before they occur, ensuring proactive maintenance and extending equipment life.

Key Capabilities:

- **AI-Based Failure Prediction**: Machine learning models analyze historical operational data and sensor readings to identify early warning signs of equipment degradation.
- **Generative AI for Failure Scenarios**: Gen AI simulates potential failure patterns under various conditions, enabling operators to prepare for different maintenance contingencies.
- **Automated Alerts and Recommendations**: AI-driven alerts notify operators of potential failures, providing recommended actions to mitigate risks.
- **Optimized Maintenance Schedules**: Predictive analytics enable data-driven maintenance scheduling, reducing unnecessary shutdowns and ensuring minimal disruption to operations.
- **Reduced Downtime and Cost Savings**: By preventing unplanned failures, AI-driven predictive maintenance significantly reduces repair costs and operational losses.

Drake AI's predictive maintenance capabilities ensure artificial lift systems operate at peak efficiency while minimizing unexpected failures, enabling oil and gas operators to maintain continuous and reliable production.

These tools exemplify Drake AI's commitment to reshaping geoscience and engineering practices, making them more efficient and data-driven.

For more information about Drake AI and its suite of services, please visit their official website: www.thedrake.ai.

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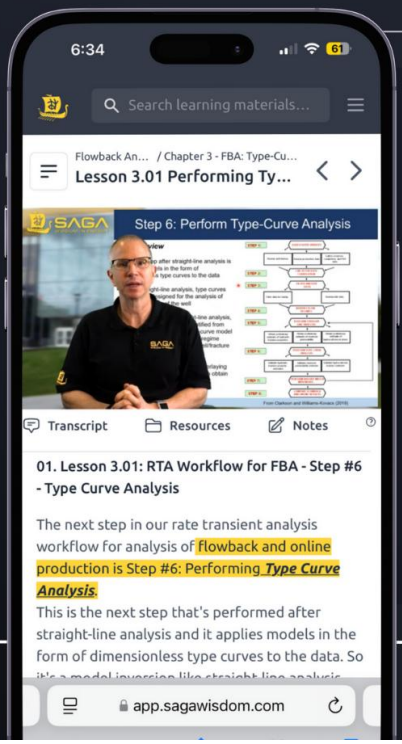

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#PETROQUIZ 001: PICKETT PLOT

Pickett plot is one of the classic tools for petrophysicists. Refer to the article below and answer the quiz question:

https://lnkd.in/gz2rYPxb

What reservoir property cannot be derived from the Pickett plot (porosity and resistivity on a double logarithmic scale)?

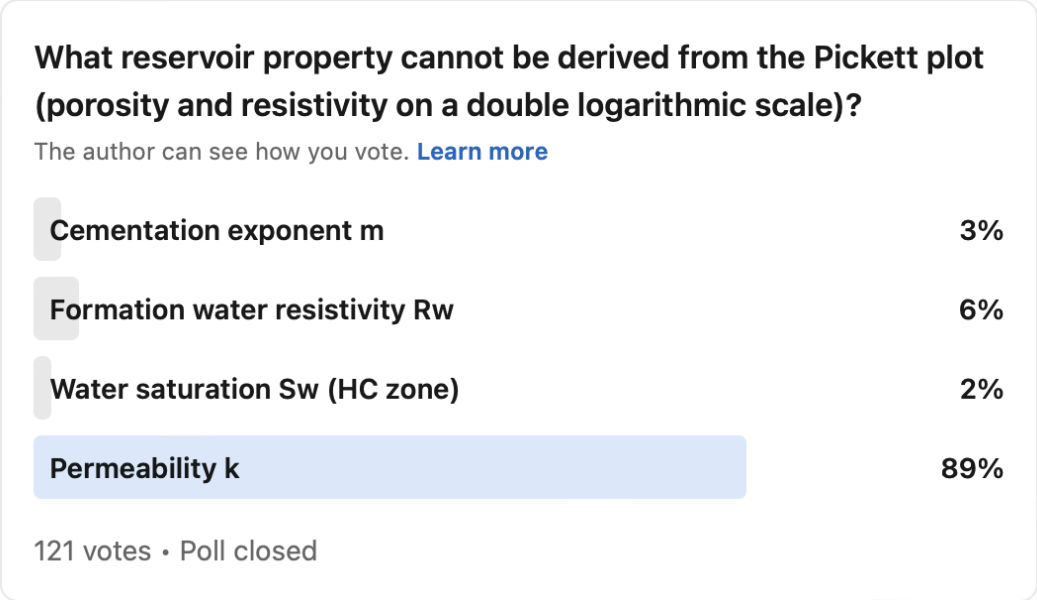
A. Cementation exponent **m**

B. Formation water resistivity **Rw**

C. Water saturation **Sw** (HC zone)

D. Permeability **k**

ANSWER



EXPLANATION

The Pickett plot applies to conventional reservoir types that have wells penetrating water zones with clean lithology and porosity variations. In this ideal scenario, porosity can be confidently estimated from neutron porosity and bulk density logs, and the simplest form of Archie's equation holds. Plotting deep resistivity and porosity logs on a log-log scale yields an obvious trend that can be fit by a straight line. The slope is **-m** or **-1/m** (cementation exponent), while the intercept relates to **Rw** (formation water resistivity).

Now, can we use the fitted Pickett plot to estimate water saturation in the hydrocarbon (HC) zones that are connected to the studied water zone? Graphically, we can move the plot up or down some units to reflect the impact of HC saturation on resistivity logs. However, some assumptions have to be made: (1) the basic Archie's equation still needs to hold (not much clay), and (2) the prior porosity estimation used in the plot is accurate (without knowing **Sw**! - HC density cannot be too light). If these conditions are met, the Pickett plot can provide a reasonable estimate of **Sw** in the HC zones as well.

The Pickett plot was not designed to estimate permeability, but capillarity in HC zones may help – this is another interesting topic.

#PETROQUIZ 002: MERCURY INJECTION CAPILLARY PRESSURE

Mercury injection capillary pressure (MICP) is a technique used to characterize the pore system of rock samples by measuring the volume of mercury that enters the sample's pores under increasing pressure. Refer to the article below to answer the quiz question:

https://lnkd.in/gHXMkb76

What rock property cannot be measured or derived from high pressure mercury injection capillary pressure test?

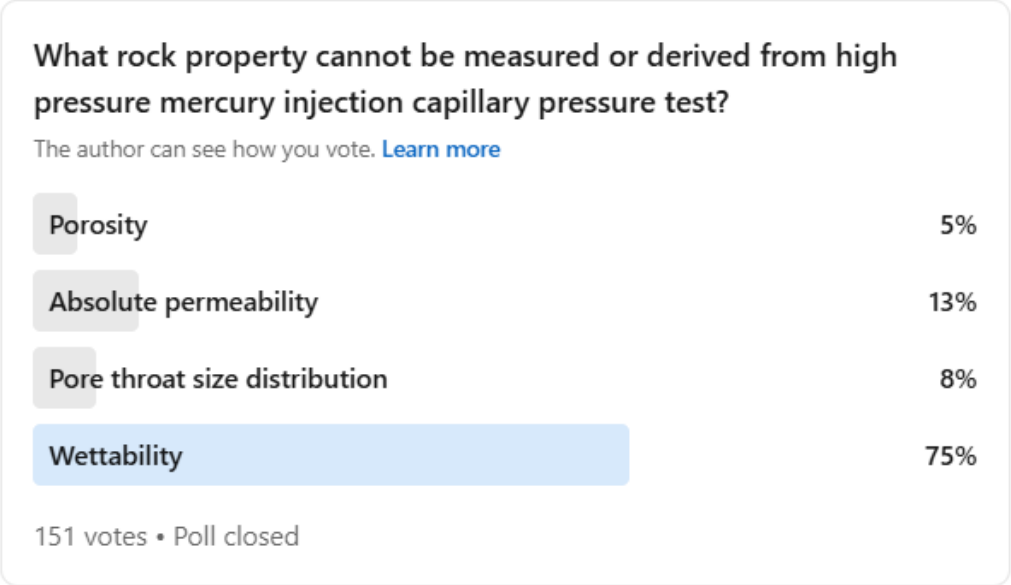
A. Porosity

B. Absolute permeability

C. Pore throat size distribution

D. Wettability

ANSWER



EXPLANATION

The test was initially called mercury porosimetry. Porosity is actually the immediate output although the typical MICP curve does not show porosity as it is normalized as Hg saturation in the plot. By using the derivative of Pc with Sw, pore throat size distribution can be calculated (normally very noisy pdf). Some classic models, such as Purcell's and Swanson's, can be applied to calculate absolute permeability with good accuracy. The only thing in the list that cannot be measured or derived from MICP is wettability, as samples are dried before the test.

#PETROQUIZ 003: WELL LOGS

Well logs are used to estimate reservoir properties such as lithology, porosity, water/HC saturation, and even permeability. Refer to the article below to pick your quiz answer:

https://lnkd.in/gsuwhkG6

Which of the well log(s) below cannot be used to estimate porosity?

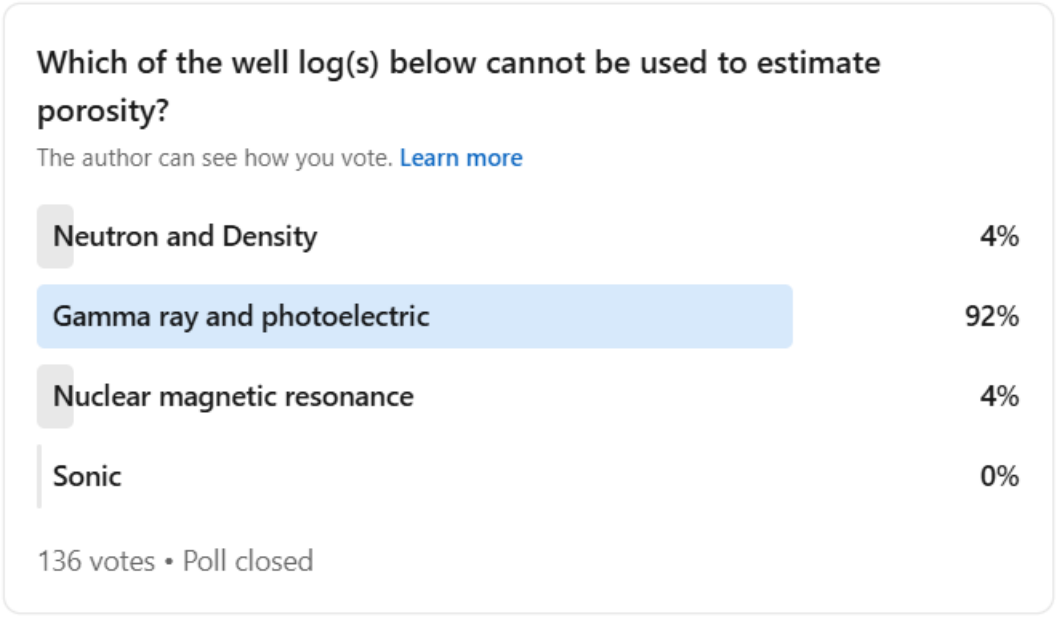
A. Neutron and density

B. Gamma ray and photoelectric

C. Nuclear magnetic resonance

D. Sonic

ANSWER



EXPLANATION

The answer should be GR/PEF logs, which are mostly sensing the matrix, not the pore fluid. They are good lithology indicators but cannot tell porosity directly. They can be included in multi-mineral solvers to reduce the uncertainty of grain density, which helps with porosity estimation.

#PETROQUIZ 004: VERTICAL RESOLUTIONS

Different logging tools have different physical sensor designs. Therefore, they also have different vertical resolutions. Refer to the table below to answer today's quiz:

https://lnkd.in/gpzktAwn

Which wireline log has the best vertical resolution?

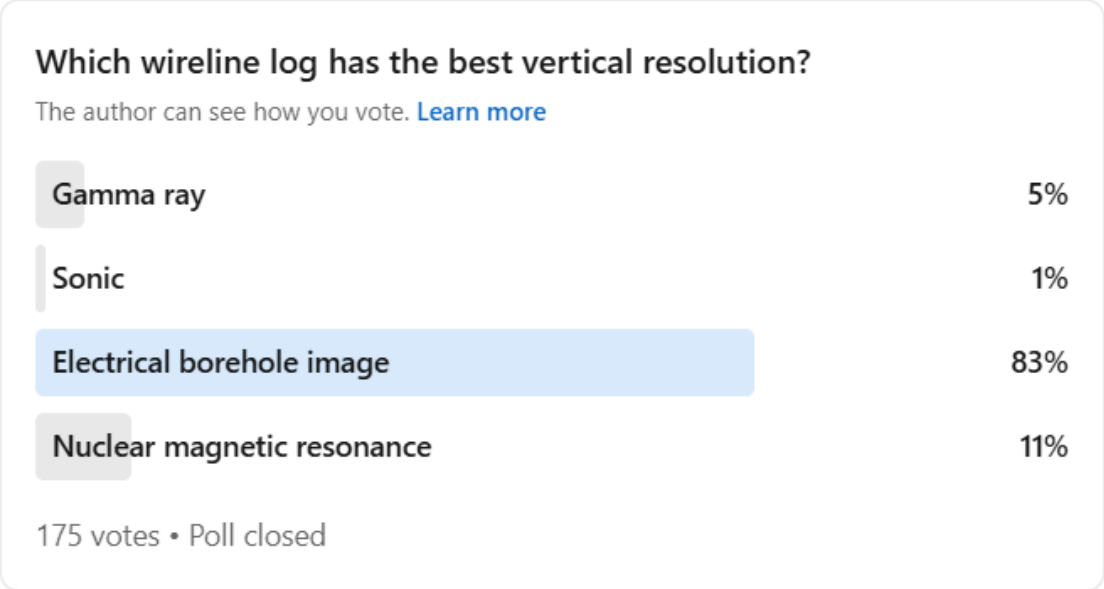
A. Gamma ray

B. Sonic

C. Electrical borehole image

D. Nuclear magnetic resonance

ANSWER



EXPLANATION

The electrical borehole image tool uses small button sensors of diameter ~0.2 inch (5 mm). It is often used to resolve very thin beds.

https://petrowiki.spe.org/Borehole_imaging

#PETROQUIZ 005: MUD FILTRATE INVASION

Mud filtrate invasion is the process by which the liquid component of drilling mud enters a permeable formation. This process can occur when the wellbore pressure is higher than the formation pressure, which is usually caused by excessive mud weights (overbalanced drilling). Refer to the chart (from the University of Texas at Austin Formation Evaluation & Petrophysics Group - Dr. Carlos Torres-Verdin) in the post below to answer today's quiz:

https://lnkd.in/g2Atazg7

Which wireline log is least impacted by mud filtrate invasion?

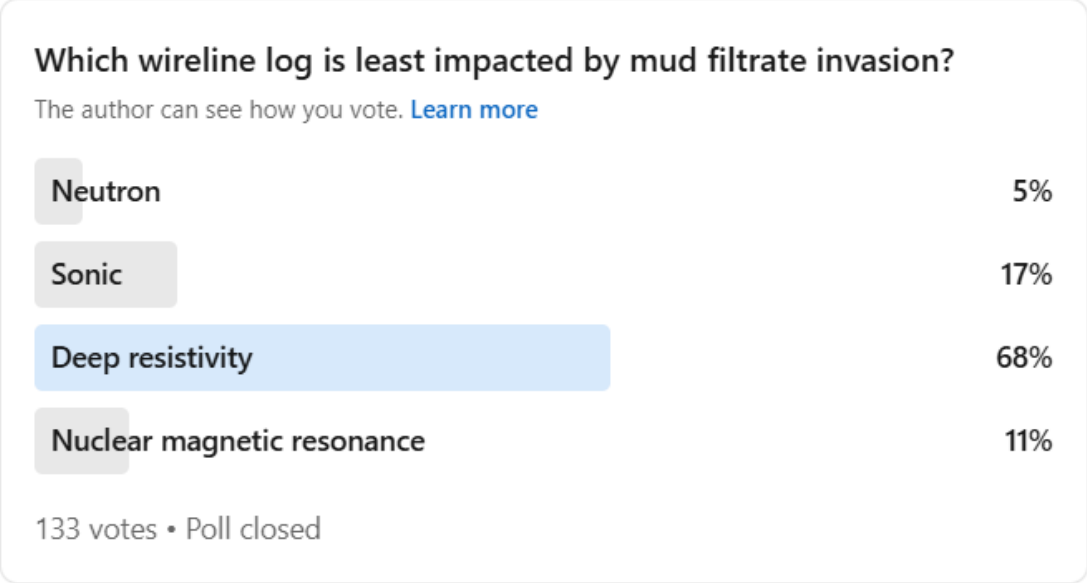
A. Neutron

B. Sonic

C. Deep resistivity

D. Nuclear magnetic resonance

ANSWER



EXPLANATION

In general, logging tools that have larger radial depths of investigation, and total sensing volume will be less impacted by mud filtrate invasion. If the mud filtrate of very different properties replaces the in-situ movable fluids (e.g., water-base mud invading gas zones), shallow reading logging tools will be sensing a complex fluid composition, and the effects of mud filtrate invasion has to be taken into account to give the best interpretation. In this list, the deep resistivity tool family can read almost 4-6 ft into the formation, which in most cases is beyond the invasion zone, so it is overall least impacted by invasion.

#PETROQUIZ 006: ROCK SAMPLING METHOD

Although well logs can be used to estimate various reservoir properties, direct lab measurements using rock samples are still necessary in the appraisal stage to validate/calibrate log interpretation models to reduce uncertainty. Refer to the article about rock sampling methods to answer today's quiz question:

https://lnkd.in/gGsWruK2

Which rock sampling method preserves the original reservoir properties the best?

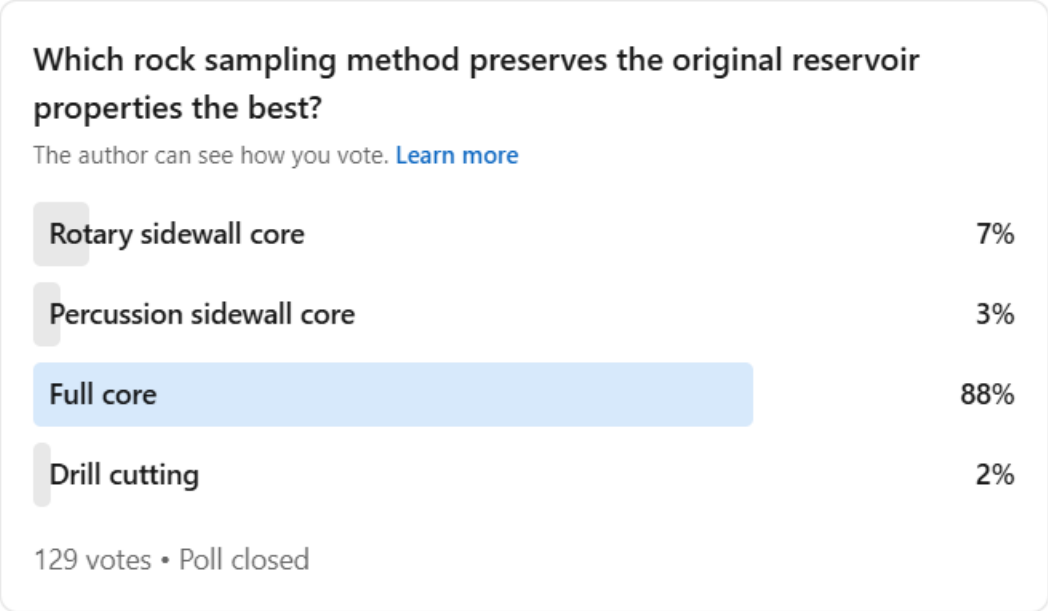
A. Rotary sidewall core

B. Percussion sidewall core

C. Full core

D. Drill cutting

ANSWER



EXPLANATION

The answer is full core, which is also the most expensive on the list. If full core is not available, rotary sidewall core could be the next option. Percussion sidewall core often damages the rock structure and could have a very low recovery rate in unconsolidated formations. It is still good for compositional studies such as XRD, grain size, etc. Drill cutting is available in all wells and does not cost extra money, but the samples are not protected and cannot preserve rock/fluid properties very well. Plus, the depth uncertainty is 5-10 ft.

#PETROQUIZ 007: LITHOLOGY POROSITY ESTIMATION

When using well logs to estimate porosity, we often need to know the matrix lithology (sandstone, limestone, dolomite, or mix). This is not always the case. Refer to the article below to answer today's quiz question:

https://lnkd.in/gCwCAdhE

Which well log provides "lithology-independent" porosity estimation?

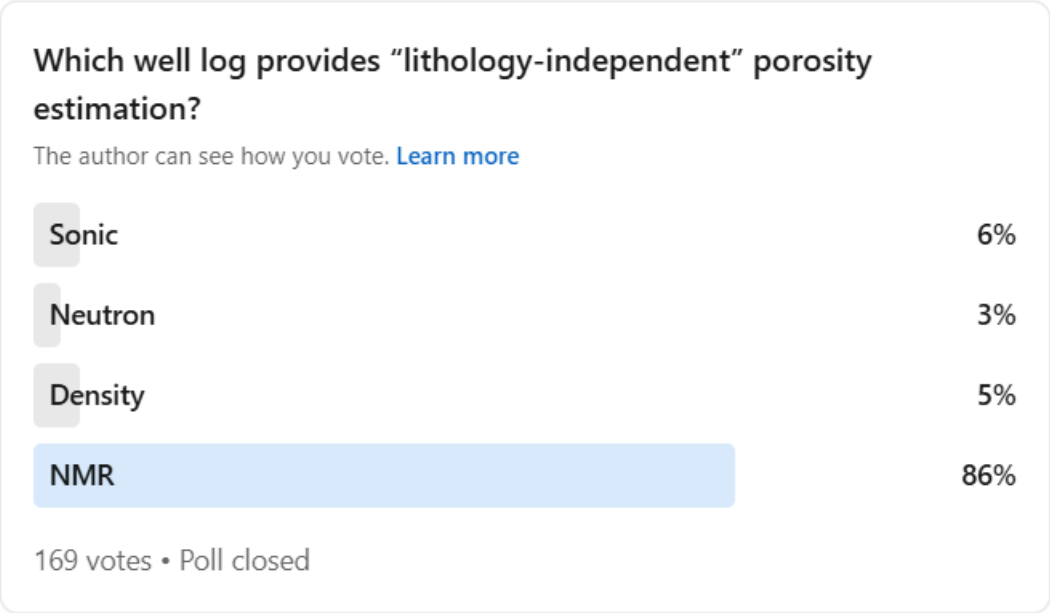
A. Sonic

B. Neutron

C. Density

D. NMR

ANSWER



EXPLANATION

NMR is considered "lithology independent" as it is mostly sensing pore fluids that have hydrogen atoms (H_2O/oil/gas). The other logs all need to know the lithology matrix to be able to estimate porosity accurately.

#PETROQUIZ 008: ACOUSTIC IMPEDANCE

Rock physics today. Acoustic impedance (AI) is a very important rock property for calculating wave reflection between rock layers. Synthetic seismic trace can be generated by convolving the reflection with wavelet functions. Refer to the article below to answer today's quiz question:

https://lnkd.in/gC8JV6-2

What log is not needed to calculate acoustic impedance for well-seismic tie?

A. Bulk density

B. Compressional slowness

C. Deep resistivity

ANSWER



EXPLANATION

Acoustic impedance is “bulk density x velocity”. Velocity can be calculated by taking the inverse of slowness. So the answer is deep resistivity. The Pickett plot was not designed to estimate permeability, but capillarity in HC zones may help – this is another interesting topic.

#PETROQUIZ 009: GEOTHERMAL ASSETS

Oct. 17 celebrates The World Geothermal Energy Day! Petrophysics still plays an important role in the energy transition including geothermal, CCUS, and natural hydrogen. Refer to the article below to answer today's quiz question:

https://lnkd.in/gDd3ZKdF

What can petrophysicists do for geothermal assets evaluation?

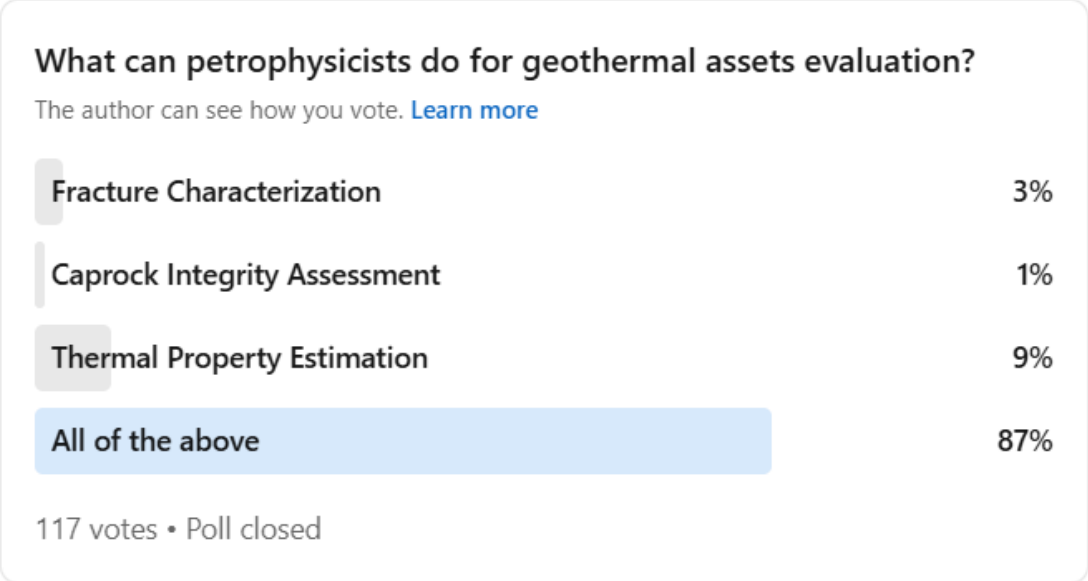
A. Fracture Characterization

B. Caprock Integrity Assessment

C. Thermal Property Estimation

D. All of the above

ANSWER



EXPLANATION

Petrophysicists are a group of smart people who can use various data sources such as core and well logs to help evaluate many subsurface properties, including fractures, caprock integrity, thermal properties, and more for geothermal resources. So the answer is all of the above.

#PETROQUIZ 010: WELL LOGS DIGITAL FORMAT

A bit about data today to prepare for digital transformation. Well logs are recorded in various digital formats - ASCII, binary, or image. Refer to the article below to answer today's quiz question:

https://lnkd.in/gSwsnsmF

Which data format is (was) not used in the oil and gas industry to record well logs?

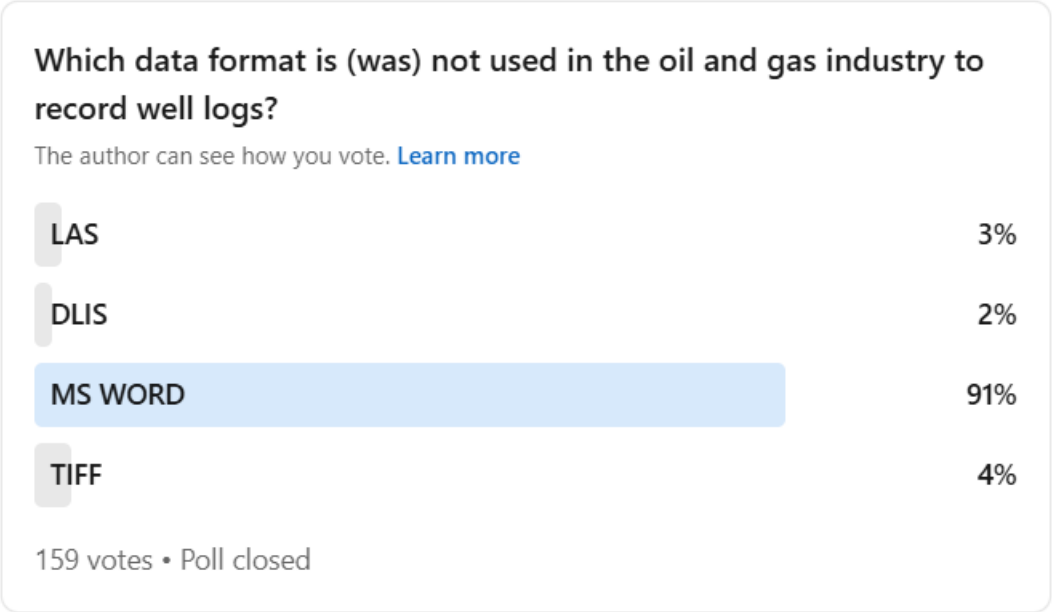
A. LAS

B. DLIS

C. MS Word

D. TIFF

ANSWER



EXPLANATION

LAS is ASCII, and DLIS is binary. Both are common deliverable formats for well logs. TIFF image format was also used to record well logs. MS Word has never been used to record well-log data.

The linked article by USGS introduced a well-log digitalization and QA/QC practice using LASIO by the Kentucky Geological Survey. It is worth reading for whoever is working on well logs-based digital transformation projects.

#PETROQUIZ 011: RESERVOIR TECHNOLOGY

Let's kick off the digital week with some fun quiz. For reservoir description, we do not always have high-quality, regular shaped full or whole core samples for laboratory testing. Sometimes we need to resort to new technologies to help. Refer to the article below to answer today's quiz question:

https://lnkd.in/gCNFiP7Q

What digital technology could be helpful if you want to know some reservoir properties of very small, irregular shaped rock samples?

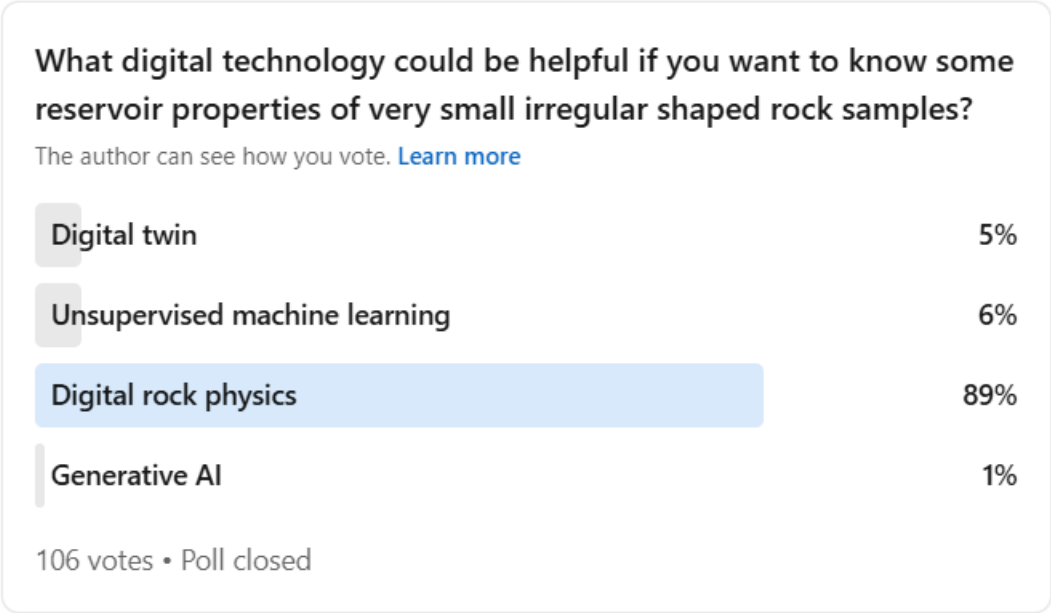
A. Digital twin

B. Unsupervised machine learning

C. Digital rock physics

D. Generative AI

ANSWER



EXPLANATION

The answer is digital rock physics which uses high-resolution 3D images of rock samples to analyze and calculate their physical properties, like porosity, permeability, and elastic moduli, by simulating fluid flow and stress conditions within the complex pore network structure of the rock, essentially allowing for a detailed understanding of a rock's behavior at the microscopic level, often used in the petroleum industry for reservoir characterization and fluid flow modeling; it involves creating a digital representation of a rock sample and then using computer algorithms to simulate its physical behavior based on its microstructure. In that sense, it is actually very close to the "digital twin."

#PETROQUIZ 012: WELL LOG SIMULATION

Physics is the key to validating well-log interpretation. If you have an earth model populated with rock and fluid properties, it is possible to utilize physics simulation to predict various log responses. Refer to the article below to answer today's quiz question:

https://lnkd.in/gAeUiazd

What is the process of simulating well-log responses from a multi-layered earth model filled with various rock & fluid properties?

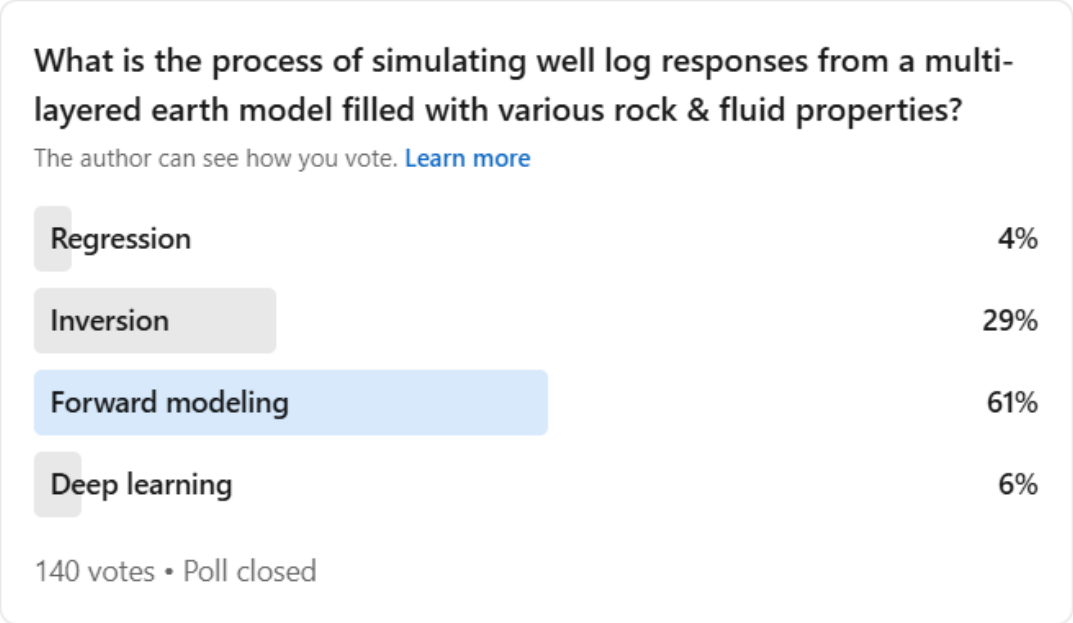
A. Regression

B. Inversion

C. Forward modeling

D. Deep learning

ANSWER



EXPLANATION

The answer is Forward Modeling. Given a general equation **m.X = D**, if we know the tool response functions **m** and the properties **X**, then we can calculate the expected log responses **D**. If we already have the measured log responses **D**, and we need to derive the properties **X** (assuming we know **m**), this process is called *inversion*. Forward modeling gives unique log responses while inversion has many possible solutions.

#PETROQUIZ 013: REGRESSION ALGORITHM

Wireline logs are typically run in vertical wells. Sometimes, "triple combo" (density/neutron porosity/resistivity) is acquired; sometimes, "quad combo" (density/neutron porosity/resistivity/sonic) is acquired. For wells without sonic logs, regression algorithms often need to be used to predict missing sonic logs to enable subsequent geophysical workflows. Refer to the article below to answer today's quiz question:

https://lnkd.in/gXfsBkwh

Which regression algorithm below is not tree-based?

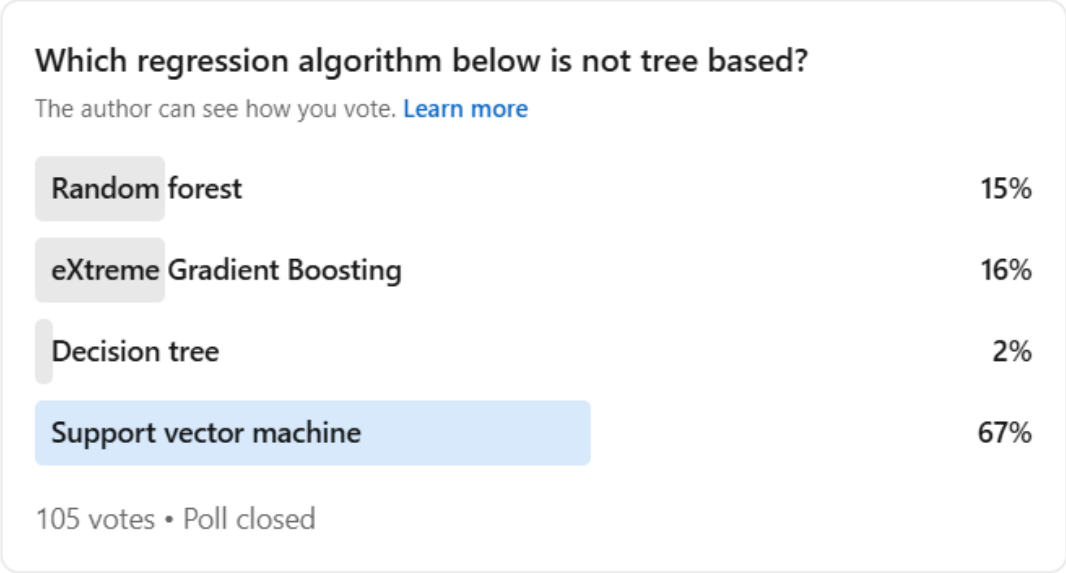
A. Random forest

B. eXtreme Gradient Boosting

C. Decision tree

D. Support vector machine

ANSWER



EXPLANATION

XGBoost is a scalable, open-source library that uses a tree-learning algorithm to solve classification, regression, and ranking problems. It can handle large datasets with many variables.

In contrast to tree-based methods, support vector machine (SVM) algorithms solve a regression or classification problem by finding the optimal hyperplane (of n-1 order) that separates the sample space of n input variables. A kernel function is used to construct non-linear hyperplanes.

(Contributed by Juan Pablo Gomez)

#PETROQUIZ 014: LITHOFACIES

Geologists often want to see lithofacies patterns from well logs to perform sedimentary and stratigraphic studies. If your geologist friend sent you some basic well logs from a few wells and asked you to help identify lithofacies types in these wells. No core description is available in these wells. Refer to the article below to answer today's quiz question:

https://lnkd.in/dr3RDJ5k

What classification algorithm would you use to perform lithofacies typing based on well logs without labelling data?

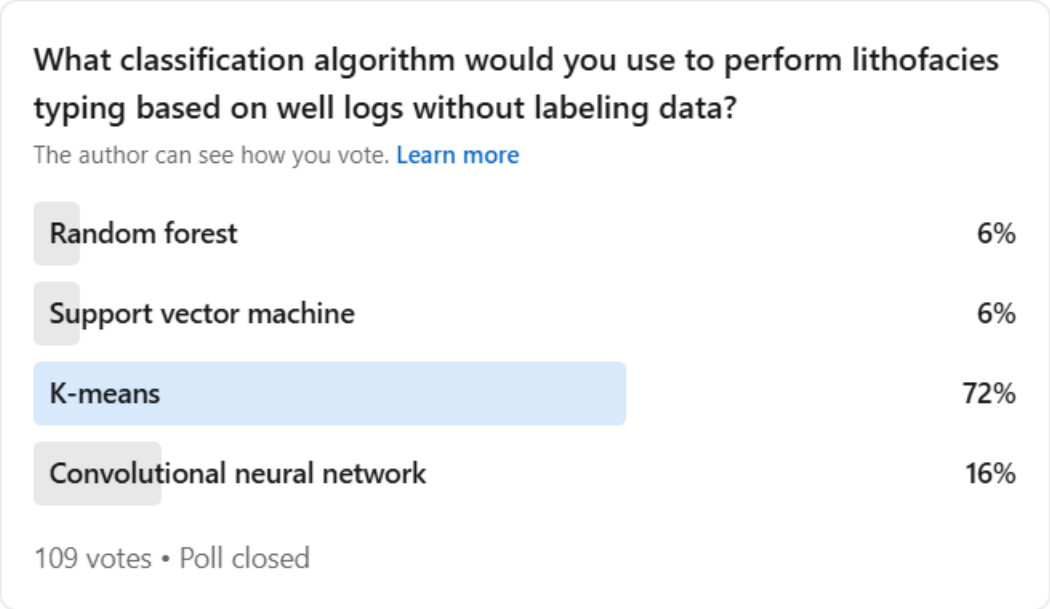
A. Random forest

B. Support vector machine

C. K-means

D. Convolutional neural network

ANSWER



EXPLANATION

The answer is the K-means clustering algorithm, which does not require labelled data. The other three algorithms require labelled data and are categorized as supervised classification.

#PETROQUIZ 015: IMAGE DATA

There are a lot of image types of data in petrophysicists' and geologists' data portfolios, such as core photo, thin section, SEM, hyperspectral scanning image, and borehole image. We need to be familiar with how image data is stored to be able to quantitatively use them. Refer to the article below to answer today's quiz question:

https://lnkd.in/d-y2RPix

What is the data shape or structure of an RGB color core photo of 500 pixels in height and 120 pixels in length?

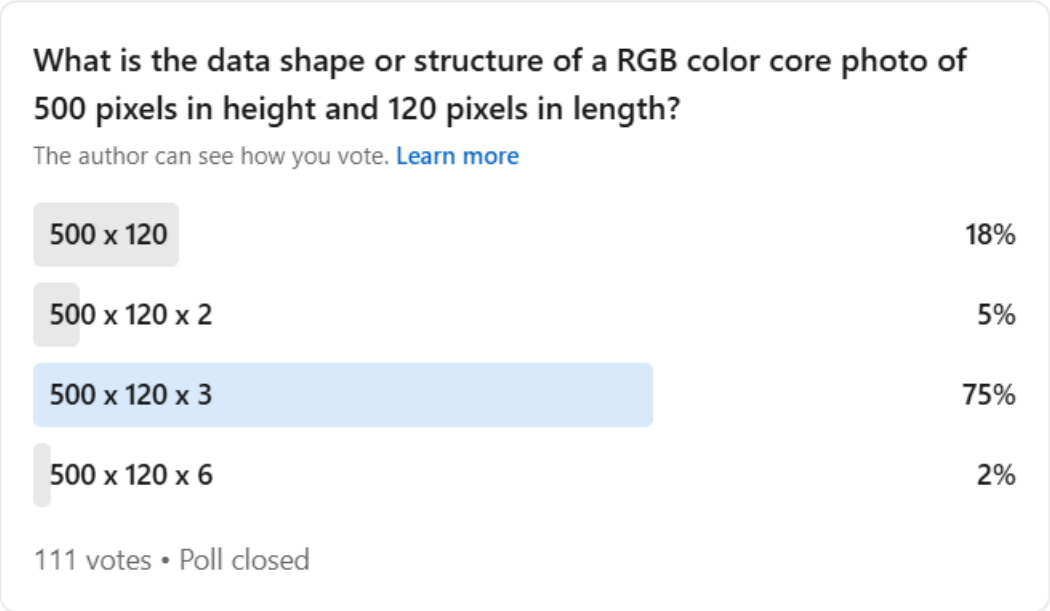
A. 500 x 120

B. 500 x 120 x 2

C. 500 x 120 x 3

D. 500 x 120 x 6

ANSWER



EXPLANATION

The answer is 500x120x3. The data structure for an RGB photo is an m-by-n-by-3 array, where each pixel is represented by a triplet of values for red (R), green (G), and blue (B).

#PETROQUIZ 016: GEN AI

Generative AI (GenAI) is a type of Artificial Intelligence that can create a wide variety of images, videos, and text. Therefore Generative AI can assist with many tasks for petrophysicists. Refer to the article below to answer today's quiz question:

https://lnkd.in/dbdgXC-c

Which task below cannot be handled by Gen AI or large language models (LLM)?

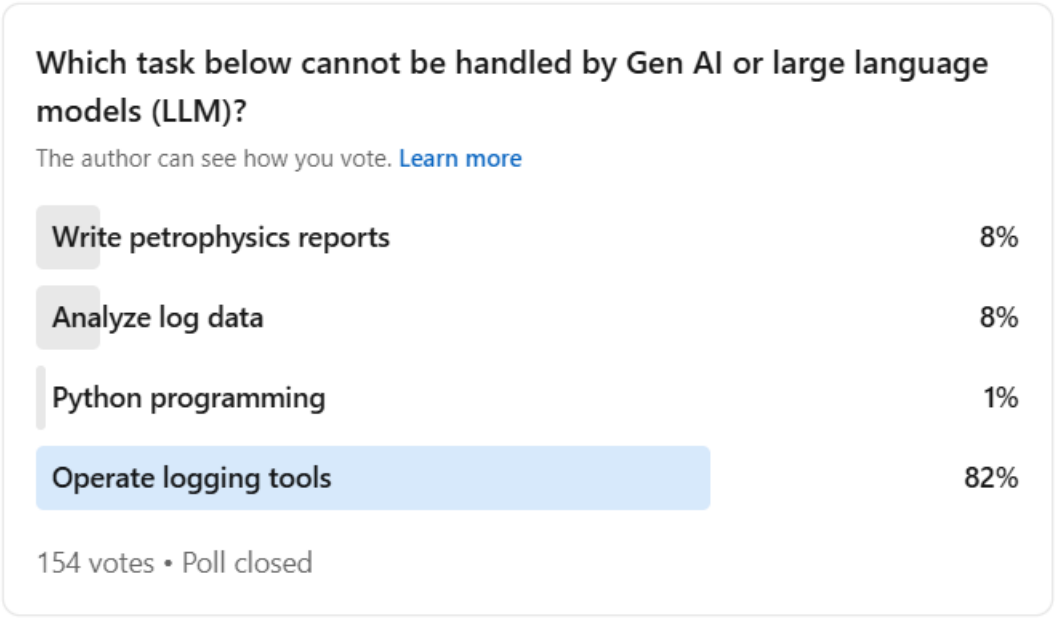
A. Write petrophysics reports

B. Analyze log data

C. Python programming

D. Operate logging tools

ANSWER



EXPLANATION

The answer is operating logging tools. Generative AI is capable of writing reports, analyzing data, and programming in many languages. However, it still lacks the capability of controlling logging tools either physically or by commands. Things might change with the advancement of robotics equipped with AI. Let's wait and see.

#PETROQUIZ 017: RW DETERMINATION

In 1942, G.E. Archie published his groundbreaking work (known as Archie's Equation) on using resistivity log to calculate reservoir water saturation. When using Archie's equation or its variations to calculate water saturation in HC zones, we need to know the formation water resistivity Rw. There are multiple ways of evaluating Rw using logs or fluid sample tests. Refer to the article below to answer today's quiz question:

https://lnkd.in/gQMuuZWN

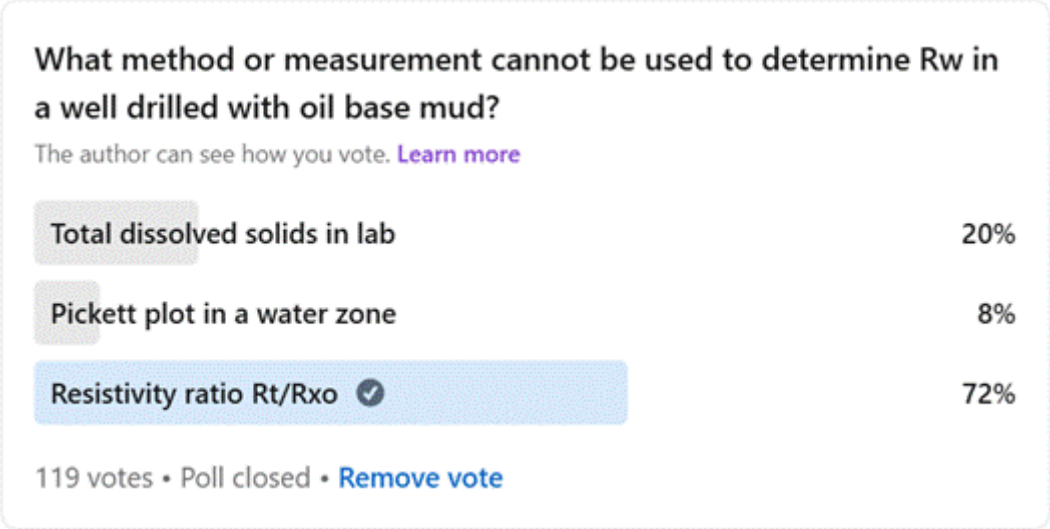
What method or measurement cannot be used to determine Rw in a well drilled with oil base mud?

A. Total dissolved solids in lab

B. Pickett plot in a water zone

C. Resistivity ratio Rt/Rxo

ANSWER



EXPLANATION

In wells drilled with OBM, resistivity contrast is mainly due to radial water saturation distribution instead of salinity contrast. So Rt/Rxo is not indicative of formation water salinity or Rw. Total dissolved solids can be tested with uncontaminated formation water sample and converts to equivalent water salinity to calculate Rw with measured reservoir temperature.

The Pickett plot is a visual representation of the Archie equation. It has its limitations (from its origins as an empirical equation) and requires adjustments for rock-fluid combinations such as pore geometries, conductive minerals and very fresh formation water. The advantage of this graphical tool is pattern recognition without major calibrations or assumptions, but it is highly dependent on the experience of the interpreter.

https://wiki.aapg.org/Pickett_plot_construction#Step_2:_plot_rw_point

https://wiki.aapg.org/Archie_equation

#PETROQUIZ 018: GEOLOGICAL FACIES MODELING

Geological facies modeling is a process that combines data from ancient and recent depositional environments to create models that help understand the nature of those environments. These models can be used to predict and interpret the distribution of geological facies in the subsurface. Multi-disciplinary data needs to be integrated for this purpose. Refer to the article below to answer today's quiz question:

https://lnkd.in/gF4t-N9d

What data is not typically integrated for geological facies modeling?

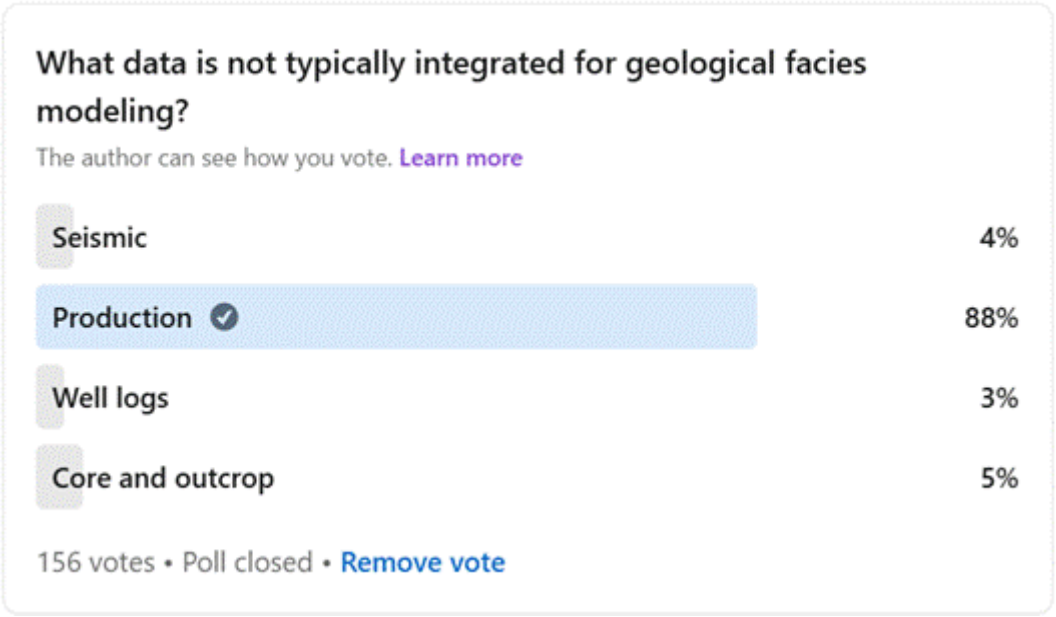
A. Seismic

B. Production

C. Well logs

D. Core and outcrop

ANSWER



EXPLANATION

The answer is production. Geological facies modeling is to build a static reservoir model towards reserve estimation. Seismic, well logs, core or even outcrop analog need to be integrated for this purpose. Production will be needed for dynamic reservoir modeling.

#PETROQUIZ 019: COALBED METHANE

Coalbed methane (CBM) is also categorized as unconventional resource. CBM is a natural gas that is extracted from coalbeds and is a significant source of energy in USA, where it accounts for about 5% of the country's natural gas production. Coalbeds usually have distinct well log responses. Refer to the article below to answer today's quiz question:

https://lnkd.in/gJQGvv46

Which log response below is not typical for coalbed methane?

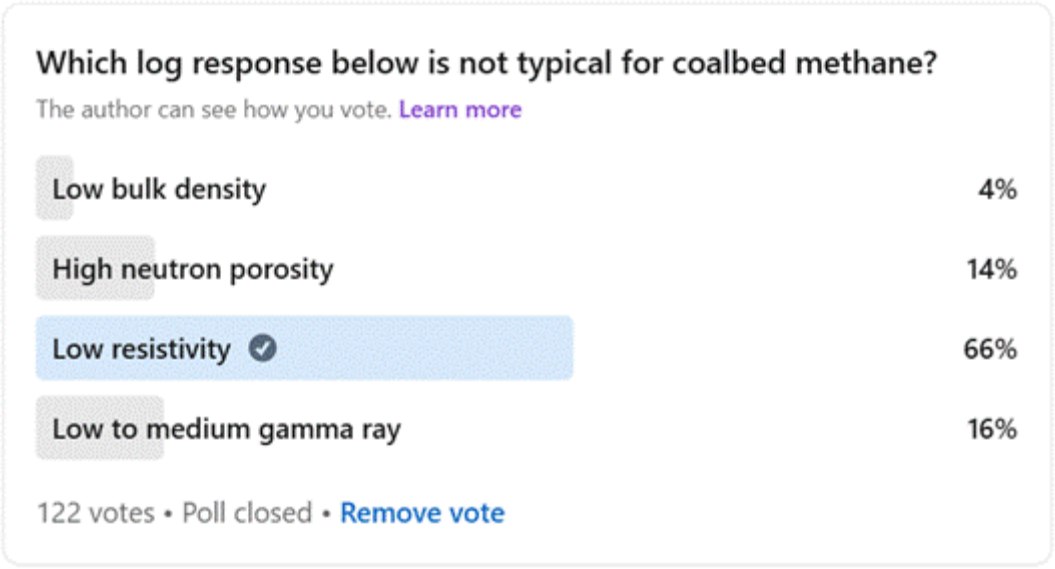
A. Low bulk density

B. High neutron porosity

C. Low resistivity

D. Low to medium gamma ray

ANSWER



EXPLANATION

The answer is low resistivity. CBM typically shows high resistivity, extremely low bulk density (<1.6 g/cc), high neutron porosity, low to medium gamma ray, and high slowness (low velocity).

Gas in coal is adsorbed on the internal surface of micropores and varies directly with pressure and inversely with temperature (Pal et. al., 2015). Electric current is sensitive to fluid storage, pore heterogeneity (internal structure) and pressure-temperature relationship, in CBM these factors increase the lecture of resistivity devices.

https://stimulationpetrophysics.com/project-view/coalbedcoalseam-methane-evaluation-log/

https://link.springer.com/chapter/10.1007/978-3-319-03119-4_6

#PETROQUIZ 020: COMMON TERMINOLOGIES IN LOGS

Well logs are very useful not only in calculating reservoir properties but also in geological studies. For example, geologists/geophysicists often use GR/Resistivity logs for well correlation to corroborate observed depositional trends. They created some interesting terminologies. Today's quiz question is an example. W. Sebastian Bayer Prince contributed to this fun quiz.

To correlate wells, geologists grab well logs floating from one well and stretch/squeeze to fit in another well. What are these logs called?

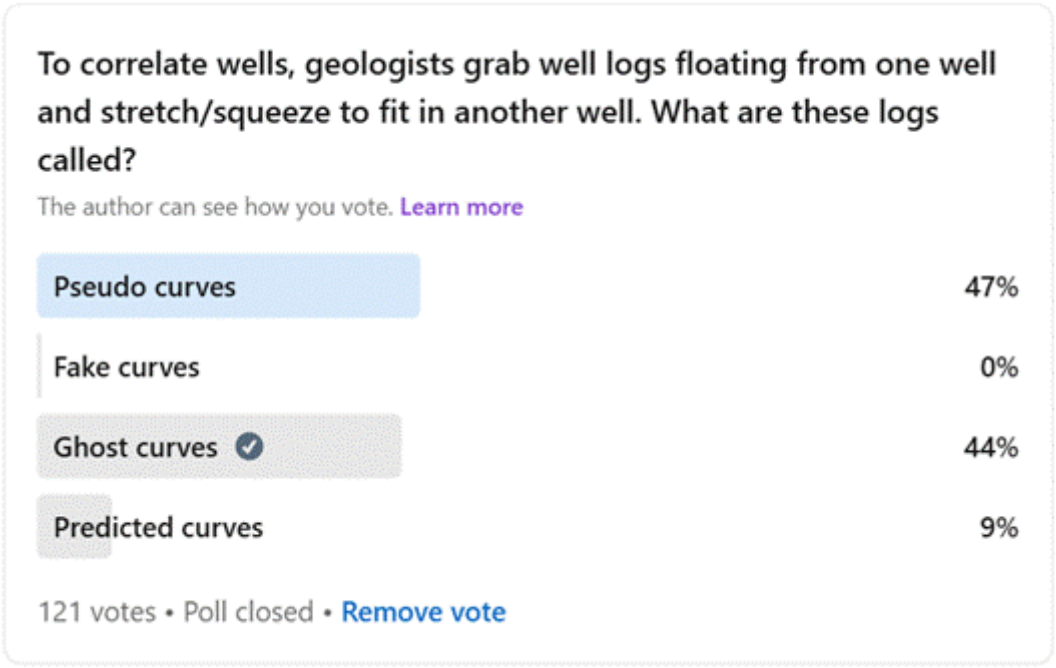
A. Pseudo curves

B. Fake curves

C. Ghost curves

D. Predicted curves

ANSWER



EXPLANATION

It is a "tricky" question for Halloween. As the curves are floating from one well to another, they look like ghost curves. It is actually a module in Petrel.

A predicted curve is the result of an algorithm such as inversion, machine learning (NN) or deep learning (RNN or CNN) from measured data. Pseudo-curve has been used as a synonym.

https://youtu.be/xYwKibD5NJw?feature=shared

https://doi.org/10.1016/j.energy.2022.125270

https://www.researchgate.net/publication/301434624_Well_Log_Editing_and_Pseudo_Well_Log_Generation_Workflow

#PETROQUIZ 021: HYDROGEN

Today is 11/1. So let's take a look at hydrogen - the No.1 element on the earth. Hydrogen atoms can be found in different forms in the reservoir: hydrocarbons, water, hydroxyl (OH) in clay minerals, or even natural hydrogen gas! Actually some logging tools are designed to be sensing hydrogen atoms. Refer to the article below to answer today's quiz question:

https://lnkd.in/gav3f9pZ

Which logging tool is the most sensitive to all forms of hydrogen atoms in the subsurface reservoirs (both rocks and fluids)?

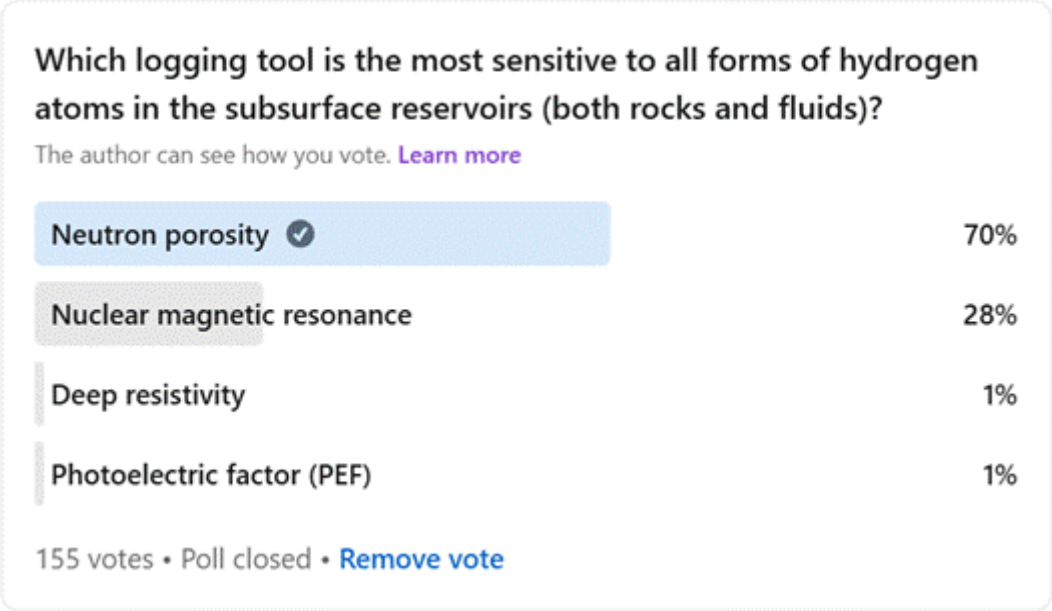
A. Neutron porosity

B. Nuclear magnetic resonance

C. Deep resistivity

D. Photoelectric factor (PEF)

ANSWER



EXPLANATION

Both neutron and NMR tools are sensitive to hydrogen atoms. However, NMR is not sensing the hydrogen atoms locked in hydroxyl of clay's lattice as there is no relaxation signal for those "fixed" hydrogen atoms. Neutron log is sensing the overall hydrogen index in all different forms.

Deep resistivity responds mainly to the ions dissolved in formation water and photoelectric factor responds to photoelectric absorption measured from the low energy of the scattered gamma ray spectrum.

#PETROQUIZ 022: NMR PETROPHYSICS

Today's quiz question is contributed by Prof. Behzad Ghanbarian at UT Arlington. Nuclear magnetic resonance (NMR) is a widely used physics approach to characterize rock pore properties at both core and log scales. NMR not only measures porosity but also can be used to estimate permeability from T2 relaxation time distribution. Refer to the article below to answer today's quiz question:

https://lnkd.in/g62ByD6Z

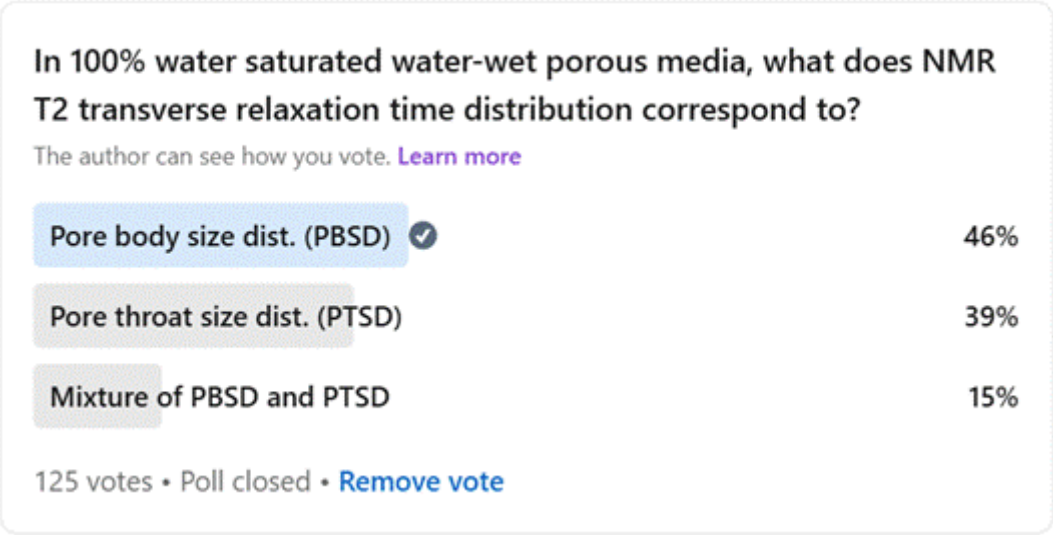
In 100% water saturated water-wet porous media, what does NMR T2 transverse relaxation time distribution correspond to?

A. Pore body size dist. (PBSD)

B. Pore throat size dist. (PTSD)

C. Mixture of PBSD and PTSD

ANSWER



EXPLANATION

As we know, NMR T2 relaxation corresponds to pore size distribution PSD in general. The term PSD is further separated into pore body and pore throat by the pore scale study community as both should contribute to relaxation. In conventional types of rocks, pore body effect should be dominant. In unconventional, it might be difficult to differentiate pore body with pore throat. The best answer is both or mixture. But no answer is really wrong :)

https://doi.org/10.1016/S0730-725X(98)00058-7

#PETROQUIZ 023: LOW-RESISTIVITY-LOW CONTRAST

Low-resistivity-low-contrast (LRLC) pay zones are areas in reservoirs where the resistivity of the pay zone is similar to the resistivity of the adjacent water zone. LRLC pay zones are difficult to identify using conventional log analysis. Refer to the article below to answer today's quiz question:

https://lnkd.in/gFSSxwhy

Which of the following is not likely to be the cause of low resistivity low contrast pay?

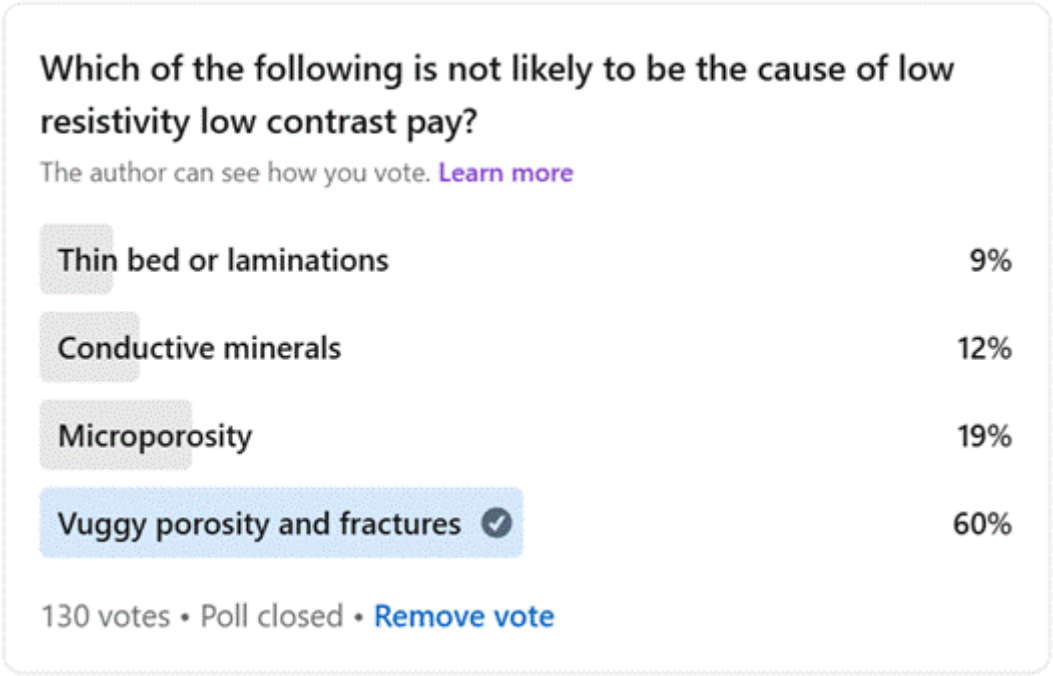
A. Thin bed or laminations

B. Conductive minerals

C. Microporosity

D. Vuggy porosity and fractures

ANSWER



EXPLANATION

The best answer is "vuggy porosity and fractures". If it is pay zone, secondary porosity created by vugs or fractures will be filled with hydrocarbon, which do not reduce resistivity significantly. Thin beds (laminations), conductive minerals, and microporosity (with bounded water) all contribute to reduce resistivity of pay zones.

https://petroshine.com/low-resistivity-and-low-contrast-pay/

#PETROQUIZ 024: THIN BED PAY

Thin bed pay (TBP) is the presence of oil and gas in porous and permeable beds that are much less than 30 centimeters (1 ft) thick, and are interbedded with impermeable beds of similar thickness. TBP is significant because it can occur in a variety of reservoirs, including conventional, unconventional, carbonate, and shale reservoirs. TBP is difficult to recognize and quantify because the beds are thinner than the vertical resolution of most logging devices. Refer to the articles below to answer today's quiz question:

https://lnkd.in/g-2Th7vG

https://lnkd.in/gEnTgXak

If you know the pay zone is thinly bedded or laminated sand, which log you would like to drop to make a logging program within budget?

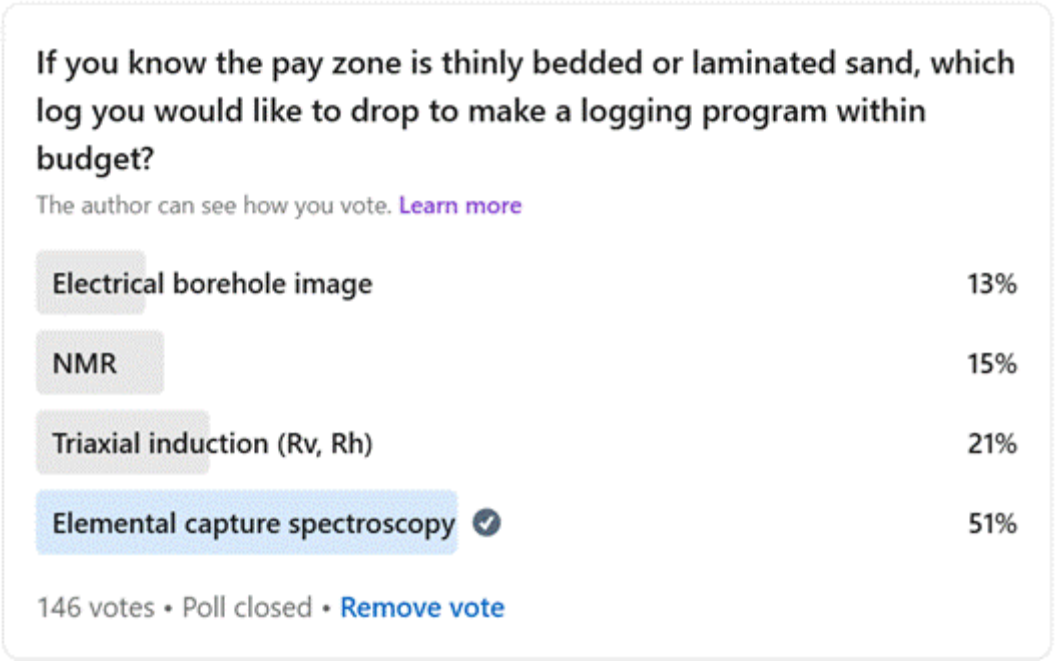
A. Electrical borehole image

B. NMR

C. Triaxial induction (Rv, Rh)

D. Elemental capture spectroscopy

ANSWER



EXPLANATION

The best answer is Elemental capture spectroscopy. Sand shale sequences do not exhibit very complex mineralogies so there is not much added value by running Elemental capture spectroscopy. Electrical borehole image log has high resolution to resolve thin beds. Triaxial induction Rv-Rh can evaluate anisotropy and true resistivity Rt. NMR can still effectively capture the big pore size (sand) and differentiate from small pore sizes (shale).

https://onepetro.org/SPEATCE/proceedings-abstract/92SPE/All-92SPE/53876

#PETROQUIZ 025: CAPILLARY PRESSURE

Evaluating capillary pressure of potential reservoir and seal rocks is important because capillarity controls the static distribution of fluids in the reservoir prior to production and remaining hydrocarbons after primary production. Refer to the article below to answer today's quiz question:

https://lnkd.in/gJgUD44a

Which method below is not used for measuring capillary pressure curves in the lab?

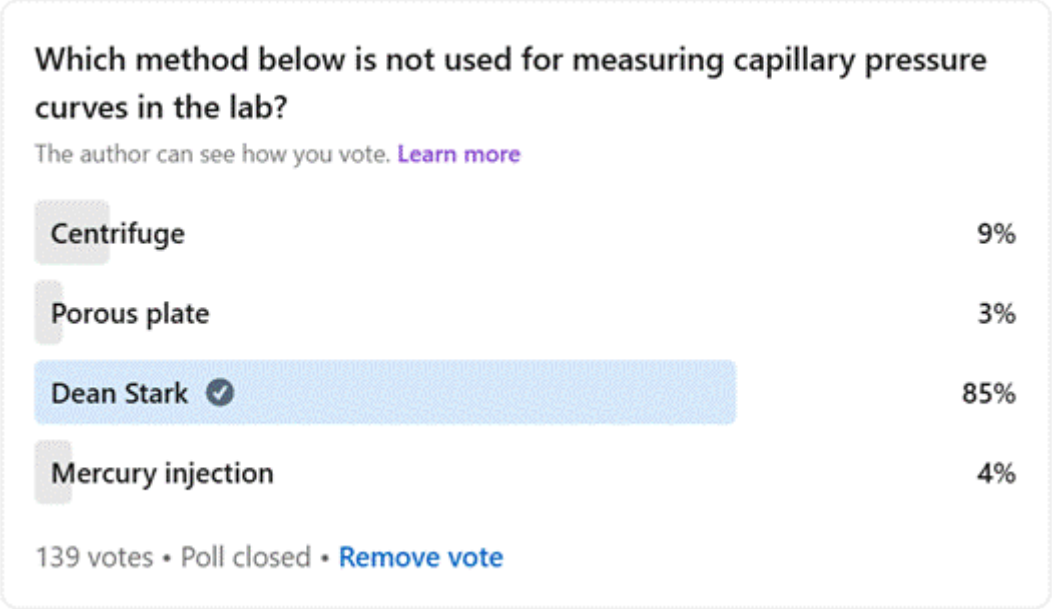
A. Centrifuge

B. Porous plate

C. Dean Stark

D. Mercury injection

ANSWER



EXPLANATION

Dean Stark is used to measure water/HC saturation only. The other three methods can all be used to measure capillary pressure curves.

In mercury injection, mercury enters into the sample increasing the pressure, is useful to investigate the structure of pores. In porous plate, it needs to saturate the sample with water, then the flat face is down against the chamber with gas, the method is depend on the displacement between gas and water the relationship is driven by the size of pores in the plates and the interfacial properties. Finally, centrifuge requires a sample saturated with oil, then the sample is spun and increase the rate of spin to force the oil to fall out of the pores, so the capillary pressure is a function of the spin rate. There are several variations of centrifugation methods.

https://petrowiki.spe.org/Measurement_of_capillary_pressure_and_relative_permeability

https://www.researchgate.net/publication/337953165_An_intelligent_data-driven_model_for_Dean-Stark_water_saturation_prediction_in_carbonate_rocks

#PETROQUIZ 026: HIGH PRESSURE MERCURY INJECTION CAPILLARY PRESSURE MEASUREMENTS

High pressure mercury injection capillary pressure measurements (MICP) can be used to quantitatively characterize rock's pore structure and estimate rock properties such as permeability (Purcell's model and Swanson's model). There were a lot of studies on using different analytical math functions to fit MICP curves or the derived pore throat size distribution. Refer to the linked article below to answer today's quiz question:

https://lnkd.in/ghWXAj47

https://lnkd.in/g4aMwFXs

Which function might not be good for fitting MICP curves or the derived pore throat size distribution?

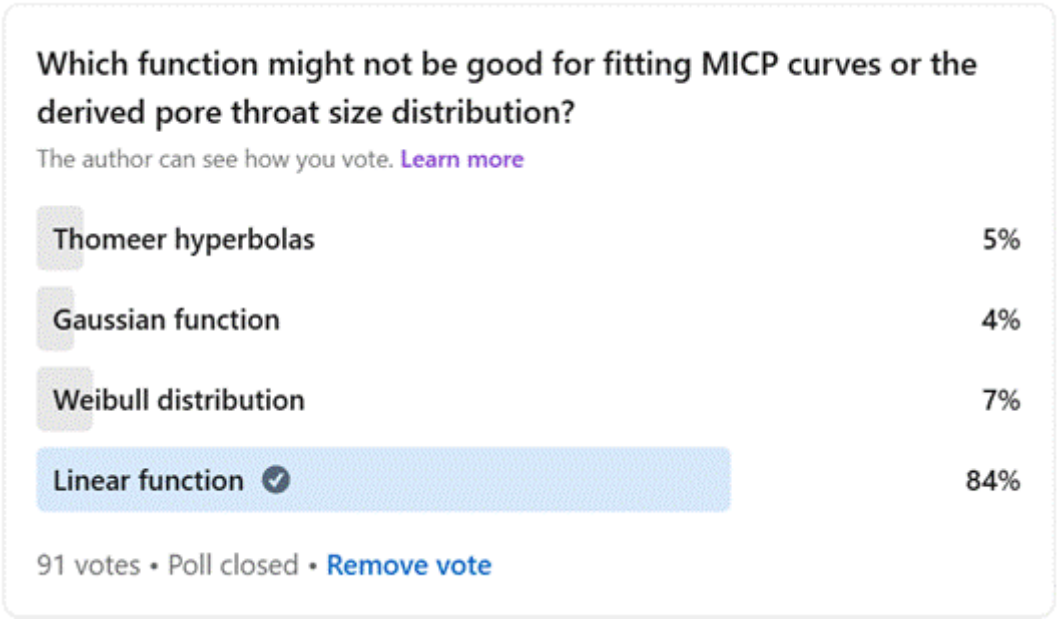
A. Thomeer hyperbolas

B. Gaussian function

C. Weibull distribution

D. Linear function

ANSWER



EXPLANATION

Both MICP and its derivative are extremely non-linear which cannot be well fit by linear functions. Thomeer/Gaussian/Weibull all have been used to model MICP or pore throat size distribution in the literature.

https://link.springer.com/article/10.1007/s11004-013-9473-2

#PETROQUIZ 027: FLUID SUBSTITUTION FOR NMR

The NMR T2-porosity relationship in which T2 is a function of pore size holds only for water-saturated rocks. The presence of hydrocarbons in water-wet rocks alters the T2 distribution, thus affecting the porosity interpretation. Refer to the article below to answer today's quiz question:

https://lnkd.in/g2ibQR4B

When the saturated water in larger pores is substituted with heavy oil, which direction the T2 spectrum from larger pores will move towards?

A. Left (smaller T2)

B. Right (larger T2)

C. No change

ANSWER

When the saturated water in larger pores is substituted with heavy oil, which direction the T2 spectrum from larger pores will move towards?

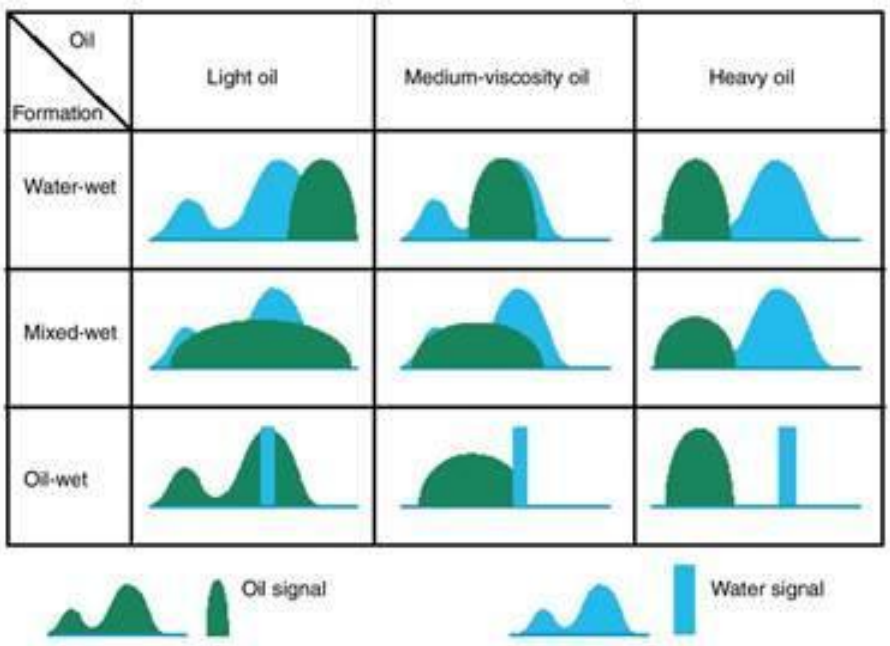
The author can see how you vote. Learn more

Left (smaller T2) ✓	86%
Right (larger T2)	14%
No change	0%

106 votes • Poll closed • Remove vote

EXPLANATION

Heavy oil has very fast bulk relaxation (small T2) less than 10 msec. Therefore if the water in big pores are substituted with heavy oil, T2 will shift to the left end.



#PETROQUIZ 028: NET PAY

Net pay is a key number to report in each well from petrophysics work. There a few terminologies that sound very close but actually different: net sand, net reservoir, and net pay. Refer to the article below to answer today's quiz question:

https://lnkd.in/gPZM2BAD

Which relation between thickness of net reservoir (NR), net sand (NS), and net pay (NP) is correct?

A. NS >= NP >= NR

B. NP >= NS >= NR

C. NR >= NS >= NP

D. NS >= NR >= NP

ANSWER

Which relation between thickness of net reservoir (NR), net sand (NS), and net pay (NP) is correct?

The author can see how you vote. Learn more

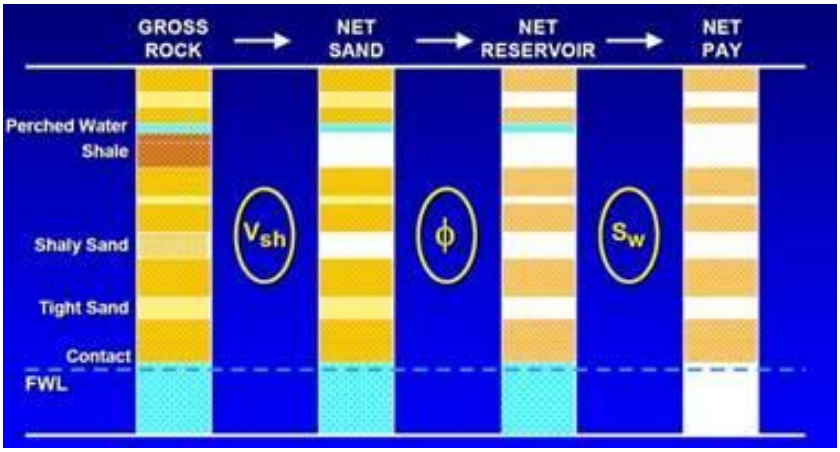
NS >= NP >= NR	2%
NP >= NS >= NR	3%
NR >= NS >= NP	24%
NS >= NR >= NP ✓	70%

122 votes • Poll closed • Remove vote

EXPLANATION

The answer should be NS>NR>NP.

In net sand, intervals correspond to lithology, in conventional reservoirs a "clean" interval (without shale) is sought. The net reservoir is concentrated in the best segment capable of storing fluids (is strongly influenced by the scale of analysis). Net pay is "The portion of the reservoir rock that will produce commercial quantities of hydrocarbons" (SPWLA), is determined by the presence of mudcake, Sxo > Sw indicates mobile hydrocarbons, mud losses formation pressure or production logs.



#PETROQUIZ 029: CASED HOLE LOGGING

Well logs can be acquired not only from open holes, but also from cased holes. Many physics are still relevant to measure the following behind casing:
Reservoir productivity
Well performance
Formation characteristics
Casing integrity
Cement condition
Refer to the following SPE Distinguished Lecture by James Hemingway to answer today's quiz question:

https://lnkd.in/gDB56iUE

Which physics below is not applicable to cased hole logging?

A. Nuclear

B. Resistivity

C. Sonic/Ultrasonic

D. NMR

ANSWER



EXPLANATION

The best answer is NMR log that is not applicable to cased hole as NMR is high frequency and reads shallow (not beyond casing and cement). Also, NMR tools have magnet that would not run in casing.

Sonic/ultrasonic tools are used to assess well integrity and cement bond. Nuclear tools such as Capture (Sigma) or Inelastic Spectroscopy (CO) can detect water-oil-gas contact, monitor the reservoir, identify gas zones and estimate mineralogy. Resistivity from electromagnetic devices can provide signals of corrosion and gradual thinning of the casing. There are other tools such as calipers, temperature sensors and flux leakage tools, all designed to monitor the life of the well during production.

http://petrowiki.spe.org/Cement_bond_logs

https://petrowiki.spe.org/Casing_inspection_logs

#PETROQUIZ 030: ROCK PORE GEOMETRY

"Rock pore geometry" refers to the shape, size, and interconnectedness of the empty spaces (pores) within a rock, essentially describing the "architecture" of the pore network within a rock which significantly impacts how fluids flow through it, and is a key factor in determining many important reservoir properties. Refer to the article below to answer today's quiz question:

https://lnkd.in/gcX9TDe9

Which rock property below is not much dependent on pore geometry?

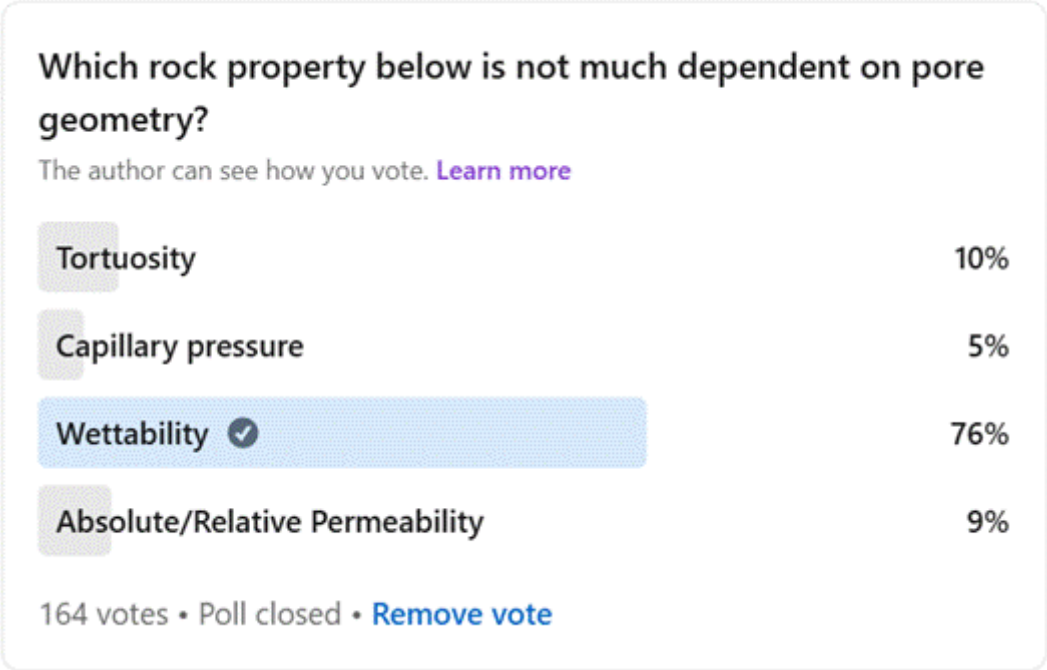
A. Tortuosity

B. Capillary pressure

C. Wettability

D. Absolute/Relative Permeability

ANSWER



EXPLANATION

The best answer is wettability which is more dependent on the rock mineral surface and fluid saturation history.

Tortuosity is defined as the conductivity pathways in the rock, capillary pressure is strongly influenced by throat pore size. And permeability, both absolute and relative, depends on the interconnection of the pores. All of these are directly related to pore geometry (micro-heterogeneity).

#PETROQUIZ 031: NMR PETROPHYSICS

Today's quiz is contributed by Dr. Ron J.M. Bonnie - NMR expert with 30+years of experience.

Traditionally, pore (throat) -size distributions in petrophysics have been obtained by / derived from (high pressure) Mercury Injection experiments (MICP). Laboratory NMR can offer to measure general pore size distributions at a significantly faster turn-around time without the complications and challenges of handling Mercury. Review the article below to answer today's quiz question:

https://lnkd.in/gUu4M2MY

Which lab test condition best relates rock pore-size distribution to NMR T2 distribution?

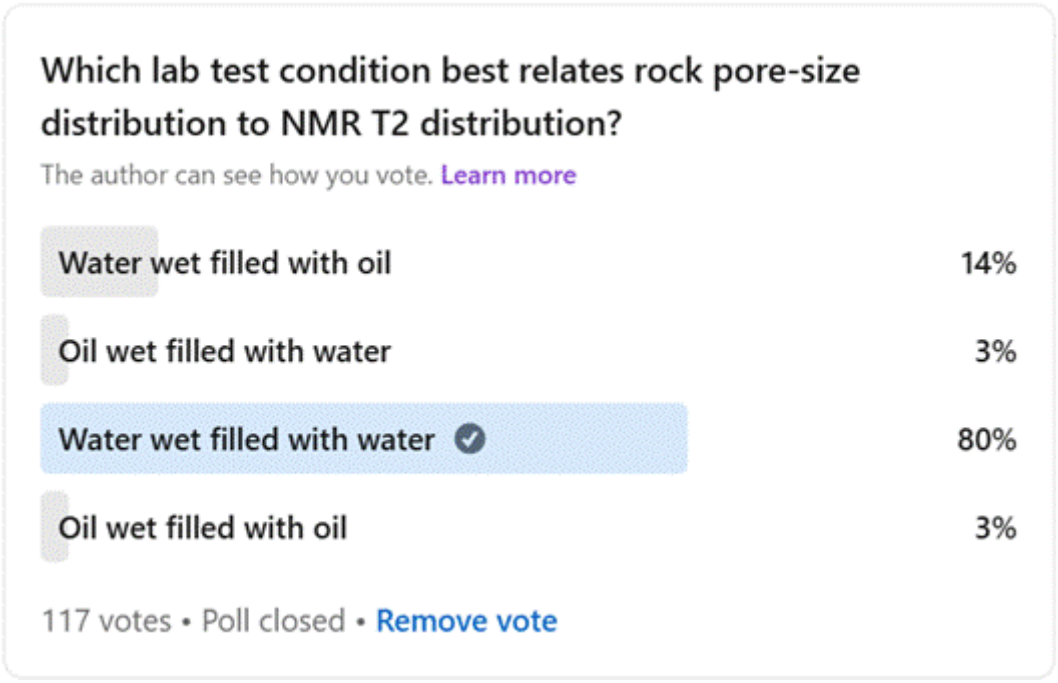
A. Water wet filled with oil

B. Oil wet filled with water

C. Water wet filled with water

D. Oil wet filled with oil

ANSWER



EXPLANATION

The most ideal condition would be water wet filled with 100% water. It might be easier for lab NMR. For NMR log, we need to be cautious with this assumption before we relate PSD to T2 distribution.

https://www.sciencedirect.com/science/article/abs/pii/S2949891023008138

#PETROQUIZ 032: NMR PHYSICS/FUNDAMENTALS

Dr. Ron J.M. Bonnie contributed to today's quiz question.

Understanding the fundamentals of NMR Physics is critical when designing any NMR logging- or laboratory-program and when interpreting the results from those programs. Longitudinal relaxation time T1, transverse relaxation time T2 and diffusion D are critical parameters for NMR-based fluid typing.
Refresh your memory on NMR fundamentals in the article below and then answer today's quiz question:

https://lnkd.in/gqamcvvk

For the same rock-fluid system, which of the following relation between T1 and T2 is not likely to happen?

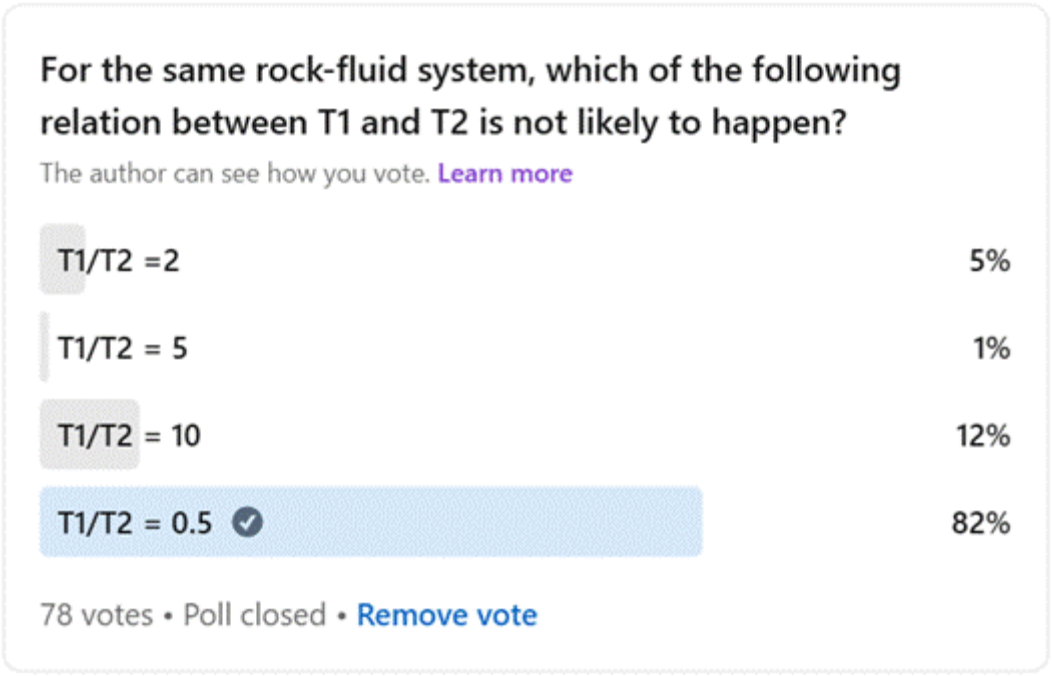
A. T1/T2 =2

B. T1/T2 = 5

C. T1/T2 = 10

D. T1/T2 = 0.5

ANSWER



EXPLANATION

In general, T1/T2 cannot be less than 1. So T1/T2 = 0.5 is not likely.
T1 relaxation is the result of energy transfer, T2 relaxation is also energy transfer and dephasing. So T2 is always faster than T1 (T2 ≤T1).

#PETROQUIZ 033: BOREHOLE SEISMIC

Borehole seismic data collected during and after the drilling of exploration and appraisal wells delivers valuable information for reservoir characterization. Combined with surface seismic data, borehole seismic surveys can help calibrate results and improve your predictions, as well as image specific reservoir features around the borehole. Refer to the article below to answer today's quiz question:

https://lnkd.in/g3SWNmCB

Which borehole seismic survey is recorded at much smaller spatial sampling intervals?

A. Checkshot

B. Vertical Seismic Profile

ANSWER



EXPLANATION

A vertical seismic profile (VSP) is essentially the same as a checkshot. However, a VSP, by definition, is intended to record travel times at smaller sampling intervals, generally within the interval of 50-100 ft.

#PETROQUIZ 034: PRODUCTION LOG SENSORS

Production logs are run in cased holes to allocate production on a zone by zone basis and also to diagnose production problems such as leaks or cross flow. Sensors to measure radial inflow rates are needed for production logging tools. Refer to the article below to answer today's quiz:

https://lnkd.in/gn_bXGPc

Which type of sensor is not applicable to measure downhole fluid flow rates as required by production logging?

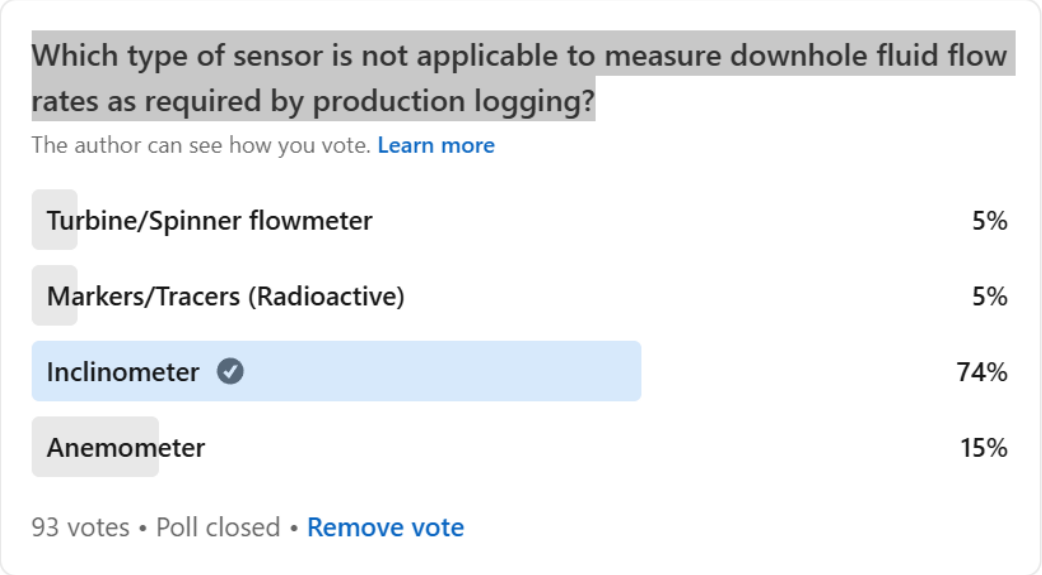
A. Turbine/Spinner Flowmeter

B. Markers/Tracers (Radioactive)

C. Inclinometer

D. Anemometer

ANSWER



EXPLANATION

Inclinometers have no relationship with any physical property that could directly indicate the flow of fluids and, hence, its application in production logging. The physical principle behind an inclinometer's operation is based on gravity. The device typically contains a sensor, such as an accelerometer or a gyroscope, that measures the angle of tilt by detecting the direction of gravity's pull. When the inclinometer is tilted, the sensor detects the change in orientation and converts this information into an angle measurement.

#PETROQUIZ 035: MUD PULSE TELEMETRY

Mud pulse telemetry (MPT) is a wireless communication technique that uses pressure pulses in drilling mud to transmit data from the bottom of a well to the surface. It's the most common method for transmitting data in deep boreholes for MWD/LWD/Geosteering. Refer to the articles below to answer today's quiz question:

https://lnkd.in/gvAN-CRg

https://lnkd.in/gA_GFrjSf

What is the typical range of mud pulse telemetry bandwidth in a very deep well (>30,000 ft)?

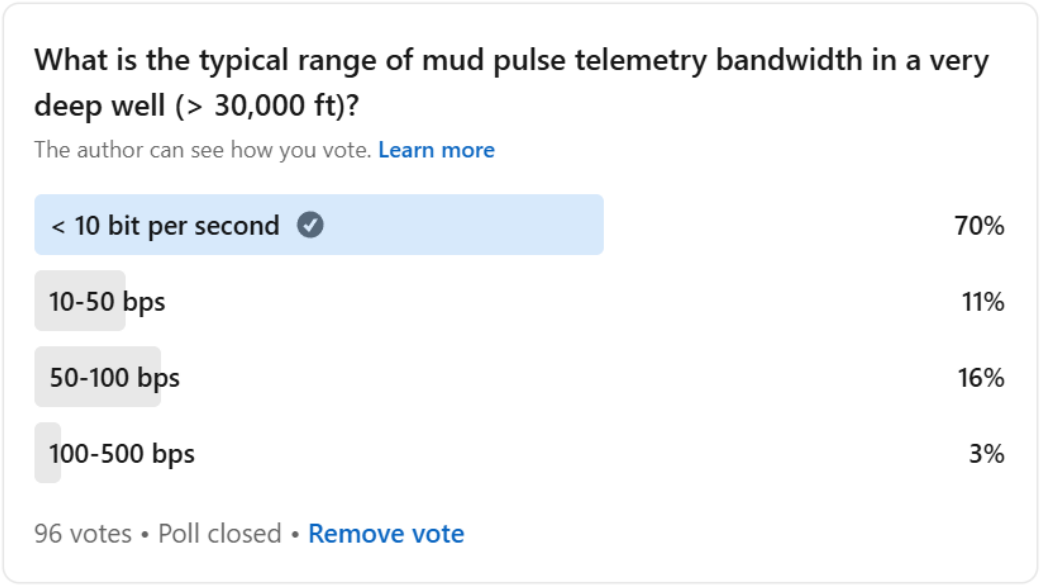
A. < 10 bit per second

B. 10-50 bps

C. 50-100 bps

D. 100-500 bps

ANSWER



EXPLANATION

In general, we could expect a nominal maximum bandwidth of 40 bps. As the borehole deepens, this bandwidth is expected to significantly decrease. For very deep wells (> 30,000 ft) this bandwidth can reach less than 1 bps.

The borehole environment can significantly impact the data bandwidth of mud pulse telemetry systems. Several factors contribute to this effect:

Mud Properties: The type and properties of the drilling mud, such as its density, viscosity, and composition, can influence the transmission of mud pulses. In the case of high-density or highly viscous muds can attenuate the signal, reducing the effective data bandwidth. This is a situation we could find in deep wells where heavier muds are needed to keep the well overbalanced and where higher temperatures of the formation and of the mud itself could compromise the correct operation of the telemetry equipment.

Borehole Conditions: The geometry and condition of the borehole, including its diameter, roughness, and any obstructions, can affect the propagation of mud pulses. Irregularities in the borehole can cause signal reflections and scattering, leading to signal degradation and lower data rates. This aspect is related in part to the following variable: interference. e

Noise Interference: Drilling operations generate various types of noise, such as mechanical vibrations and fluid flow noise, which can interfere with the mud pulse signals.

#PETROQUIZ 036: GEOSTEERING

Geosteering is a drilling technique that involves adjusting a well's path in real time based on geological and geophysical data. The goal is to place a wellbore in the most optimal position to maximize reservoir exposure and production. Various types of logging sensors are typically used for geosteering purposes. Refer to the article below to answer today's quiz question:

https://lnkd.in/gCu8fg6b

Which logging tool is typically put at the closest to the drilling bit for geosteering?

A. Sonic

B. Resistivity

C. Gamma Ray

D. Density

ANSWER



EXPLANATION

A gamma-ray tool is the choice of preference in geosteering because of its simplicity, low costs and readily availability. It can also operate without significant issues in the complicated environment of the borehole and it can be correlated to other logs already available from nearby wells, helping in the guidance of the drill bit with most telemetry systems at hand these days.

#PETROQUIZ 037: EXPONENT "M" OF FRACTURED ROCKS

The cementation exponent m models how much the pore network increases the resistivity, as the rock itself is assumed to be non-conductive. If the pore network were to be modelled as a set of parallel capillary tubes, a cross-section area average of the rock's resistivity would yield porosity dependence equivalent to a cementation exponent of 1. However, the tortuosity of the rock increases this to a higher number than 1. Refer to the article below to answer today's quiz question:

https://lnkd.in/gy-DayEg

What is the most likely range of cementation exponent m (as in Archie's equation) for highly fractured carbonate rocks?

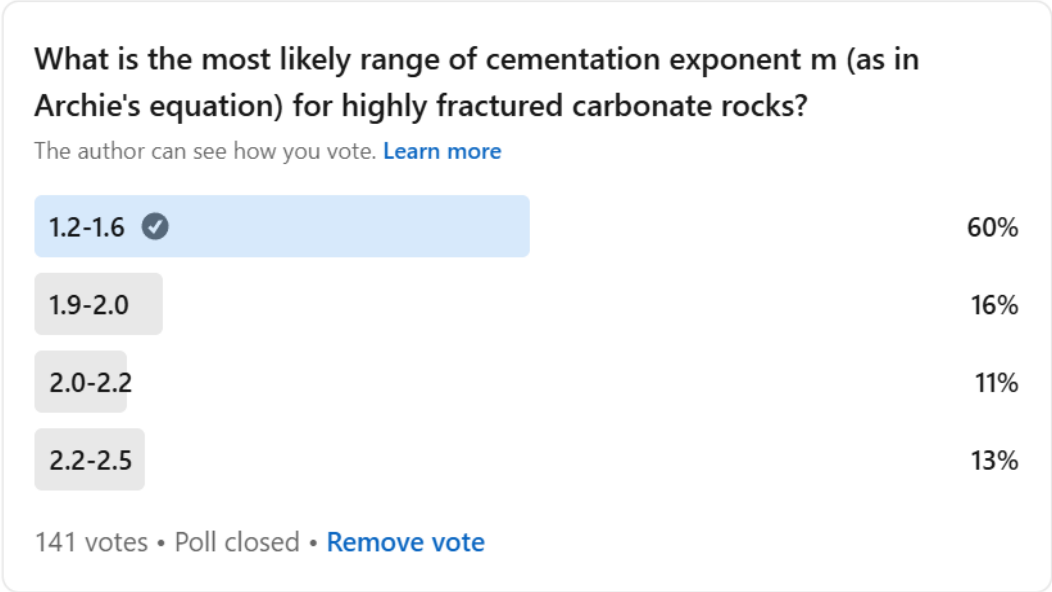
A. 1.2 - 1.6

B. 1.9 - 2.0

C. 2.0 - 2.2

D. 2.2 - 2.5

ANSWER



EXPLANATION

We can expect that the tortuosity of a highly fractured carbonate to be maximal if compared to siliciclastic (consolidated or unconsolidated). Hence, the most likely range (albeit only lab measurements will have the final word) for "m" is 2.2-2.5, the highest range from the ones provided as answers.

#PETROQUIZ 038: CLAY TYPING

“Clay typing" refers to the process of identifying the specific type of clay mineral present in a sample, which can be done by analyzing its physical and chemical properties to determine if the dominant clay mineral is kaolinite, illite, montmorillonite (smectite), chlorite, or another variety, each with distinct characteristics and behaviors depending on the geological environment where it formed. Refer to materials below to answer today’s quiz:

https://lnkd.in/gkGkvGcV

https://lnkd.in/g_iG5zEp

What technique cannot be used to find out clay types in the subsurface rock minerals?

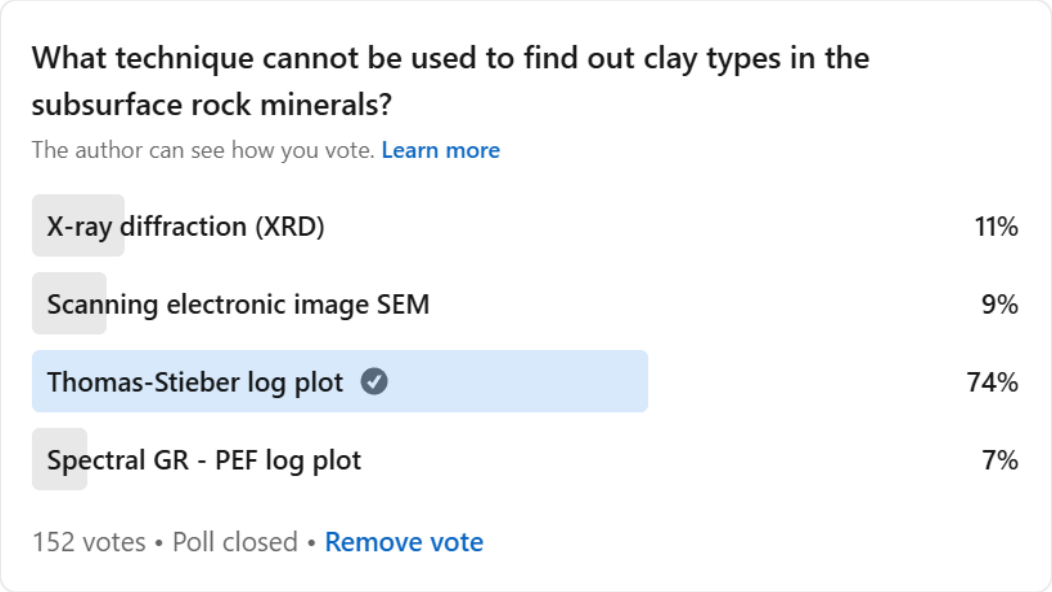
A. X-ray diffraction (XRD)

B. Scanning electronic image SEM

C. Thomas-Stieber log plot

D. Spectral GR - PEF log plot

ANSWER



EXPLANATION

The Thomas-Stieber log plot has data on GR and porosity as input. GR is an indirect measurement of V_{sh} , whereas porosity can be obtained from a bulk density or neutron log. None of this information is enough to identify or even clarify the type of clay present because both V_{sh} and porosity are very generic petrophysical properties.

#PETROQUIZ 039: KLINKENBERG CORRECTION

A "Klinkenberg correction" refers to a mathematical adjustment made to gas permeability measurements to account for the phenomenon of "gas slippage," where gas molecules "slip" along the walls of tiny pores in a rock, causing the measured permeability to appear higher than the actual permeability, especially at low pressures. Refer to the article below to answer today's quiz:

https://lnkd.in/gMi2ZvRN

For which rock type below gas slippage effect is more prominent so that Klinkenberg correction is critically important for getting K right?

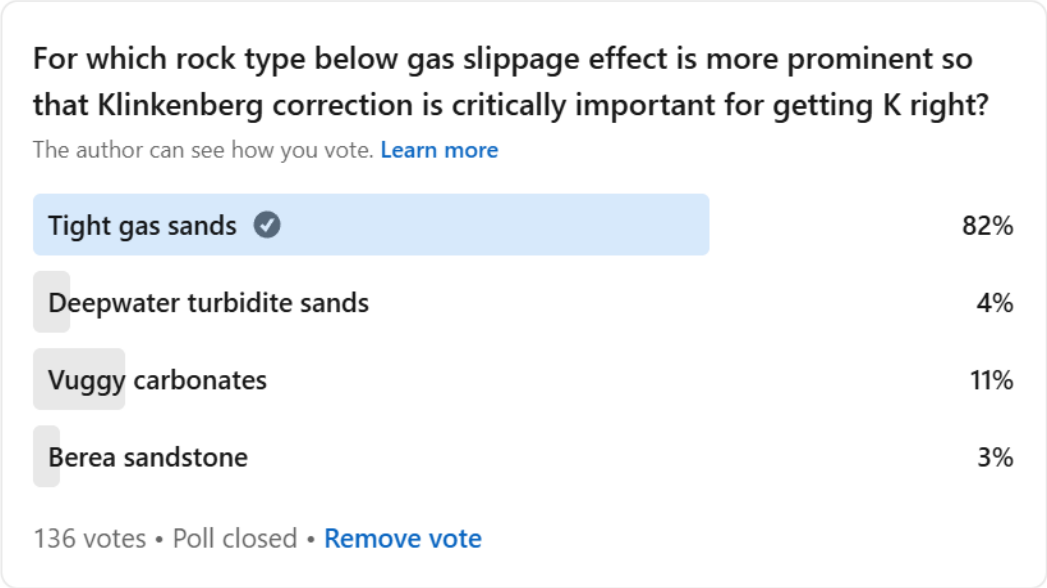
A. Tight gas sands

B. Deepwater turbidite sands

C. Vuggy carbonates

D. Berea Sandstone

ANSWER



EXPLANATION

Correction for the Klinkenberg effect will be relevant the most for tight gas sands, which by definition should have low porosity and permeability values. With low permeability values, we can expect the pore throat sizes to be in the order of the mean free path of air molecules (usually nitrogen) used to measure permeability, resulting in unquestionable gas slippage effect that will overestimate the permeability of our tight gas sand that could have terrible repercussion in later stages of production.

#PETROQUIZ 040: TOTAL ORGANIC CARBON

Total organic carbon (TOC) is a measure of the dry weight percent of organic carbon within hydrocarbon source rocks. Hydrocarbons, including natural gas (principally methane, ethane and propane), may be generated by the heating of organic carbon through burial over geological time. Weight percentage of TOC is an important property to rank source rock quality. Refer to the article below to answer today's quiz:

https://lnkd.in/gdpdYxbK

What wt % TOC in organic shales would be considered very good source rock?

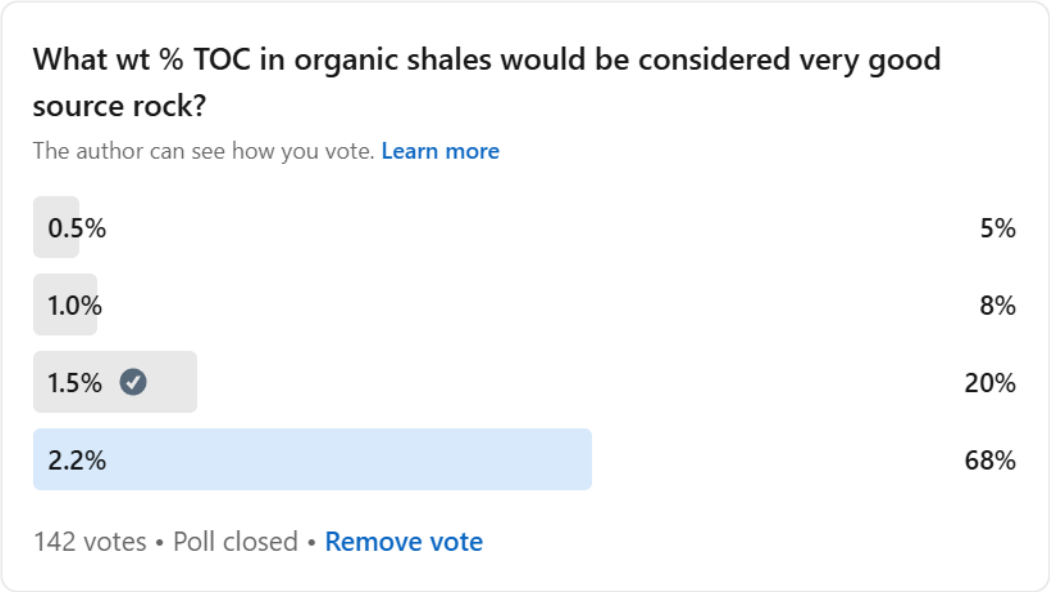
A. 0.5%

B. 1.0%

C. 1.5%

D. 2.2%

ANSWER



EXPLANATION

For a shale to be considered a good source rock, the larger the value of wt % TOC, the better. However, we can expect a shale to be a good candidate if its TOC values are above 1% and onward. An excellent shale would yield a 5% or more of TOC; a rare situation, yet plausible.

#PETROQUIZ 041: WETTABILITY ON LOGS

Wettability is a measure of the tendency of one fluid to spread on or adhere to a solid surface in the presence of other immiscible fluids. In a rock/oil/brine system, it is a measure of the preference that the rock has for either the oil or water. Wettability of rock is measured by a core analysis in a laboratory and typically a laboratory measures contact angle between the fluid and the rock. Refer to the article below to answer today's quiz:

https://lnkd.in/g88DJpTk

Which log below is not or the least sensitive to rock wettability?

A. NMR

B. Dielectric

C. Sonic

D. Resistivity

ANSWER



EXPLANATION

Sonic logs are not strongly dependent on the wettability of the rock because of the nature of the log itself, the operating frequency, and the inherent resolution of the tool. Whereas NMR, dielectric and resistivity logs are highly correlated to pore fluids and their topology in the pore network, sonic logs sample both the solid and fluid regions of a rock, with the largest component in the measurements coming from the solid components because of the general faster travel times.

#PETROQUIZ 042: MUD LOGGING

Mud logging is the creation of a detailed record (well log) of a borehole by examining the cuttings of rock brought to the surface by the circulating drilling medium (most commonly drilling mud). This provides well owners and producers with almost real time information about the reservoir while drilling. Refer to the article below to answer today's quiz:

https://lnkd.in/g3nM6gRf

Which information below cannot be found on mud logging?

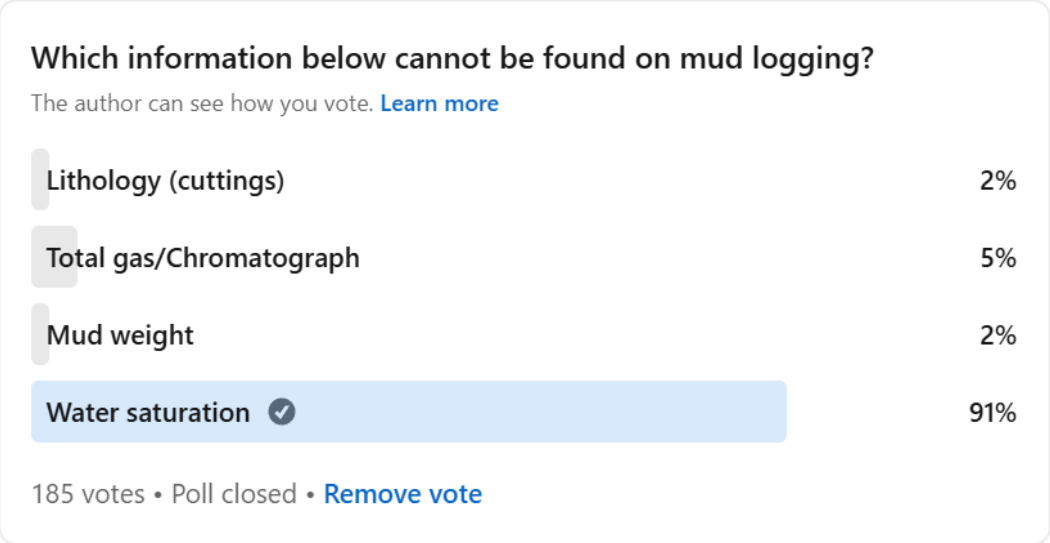
A. Lithology

B. Total gas/Chromatograph

C. Mud Weight

D. Water Saturation

ANSWER



EXPLANATION

Sadly, it is impossible to sample water saturation from mud logs because of the contamination all cuttings suffer in their trip to the surface in the drilling mud. While it could be possible to find cuttings wet with in-situ hydrocarbon, the contamination of the sample or the loss of original hydrocarbon from that cutting renders any attempt fruitless and of unquantifiable uncertainty.

#PETROQUIZ 043: WATER SATURATION

Water saturation is the fraction of a pore space that is occupied by water. There are several different water saturation terms in the petrophysicists' dictionary. Refer to the article below to answer today's quiz:

https://lnkd.in/gpZJv8wd

Which saturation term below is always the largest among all?

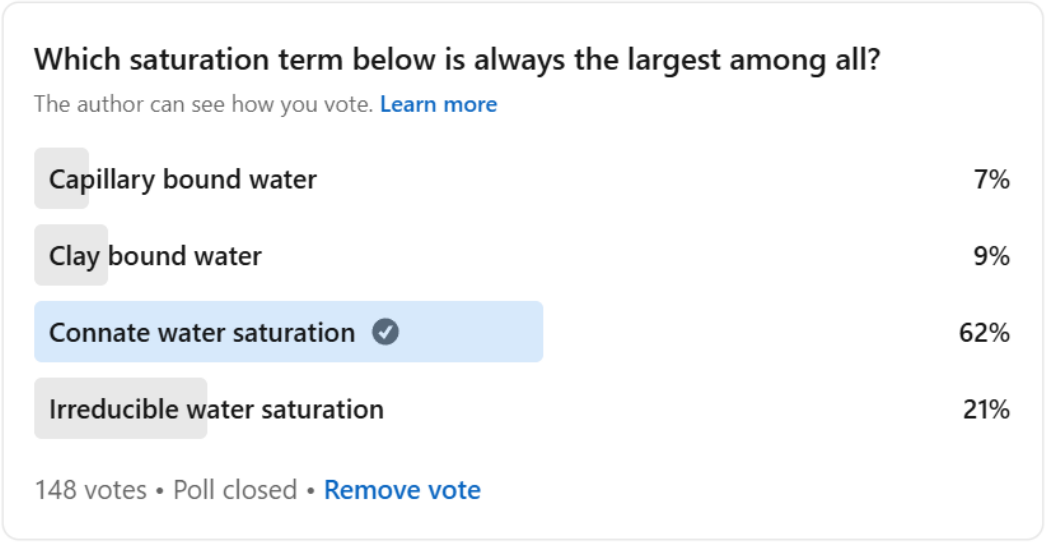
A. Capillary Bound Water

B. Clay Bound Water

C. Connate Water Saturation

D. Irreducible Water Saturation

ANSWER



EXPLANATION

Connate water saturation is always the largest term of all, as it represents the water that is in place in the rock since its deposition. Capillary bound water and clay bound water could be included as part of the irreducible water saturation. Irreducible water saturation is the minimum amount of water that a rock can hold as hydrocarbons or other immiscible fluid displaces the original water in place under reservoir conditions.

#PETROQUIZ 044: THE FIRST WIRELINE LOG

The first wireline log, or electrical resistivity well log, was recorded on September 5, 1927 in the Pechelbronn oil field in Alsace, France. Refer to the article below to answer today's quiz:

https://lnkd.in/gABzSscj

Who led the wireline crew to perform the first electrical log on Sep 5, 1927?

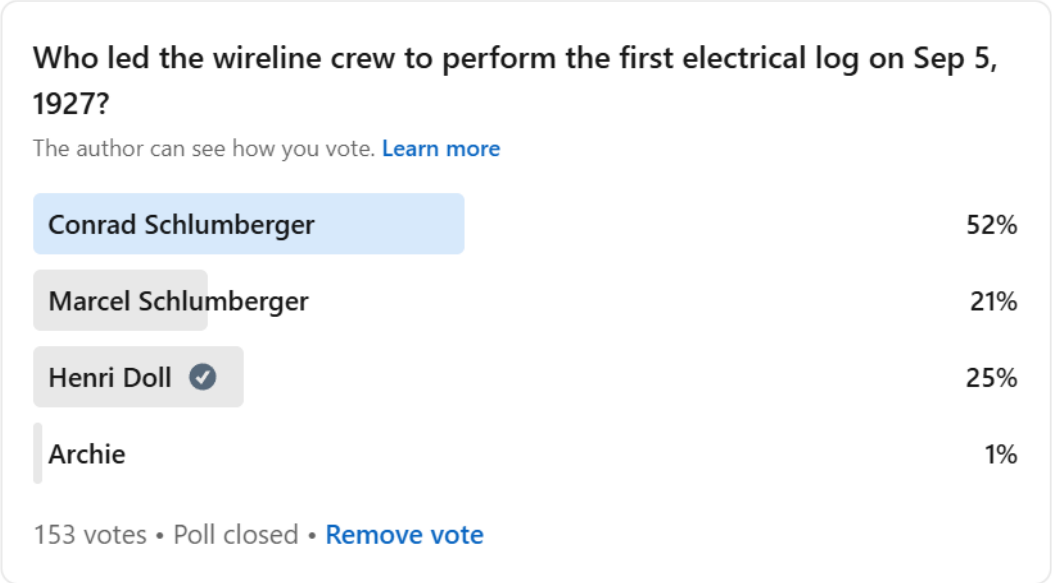
A. Conrad Schlumberger

B. Marcel Schlumberger

C. Henri Doll

D. Gustavus Archie

ANSWER



EXPLANATION

Contrary to what most professionals could think, the crew that performed the first electrical log was led by Henri Doll, an experimental physicist and one of the founding fathers of wireline logging as we know it today. The confusion could arise from the fact that Henri Doll and Conrad Schlumberger had not only a close work relationship, but they were also family: Henri Doll took Conrad Schlumberger's daughter as his first wife.

#PETROQUIZ 045: FRACTURE POROSITY

Secondary porosity is porosity formed within a reservoir after deposition. The major types of secondary porosity are fractures and vugs, which are common in carbonate reservoirs. Refer to the article below to answer today's quiz:

https://lnkd.in/dcdfT2pd

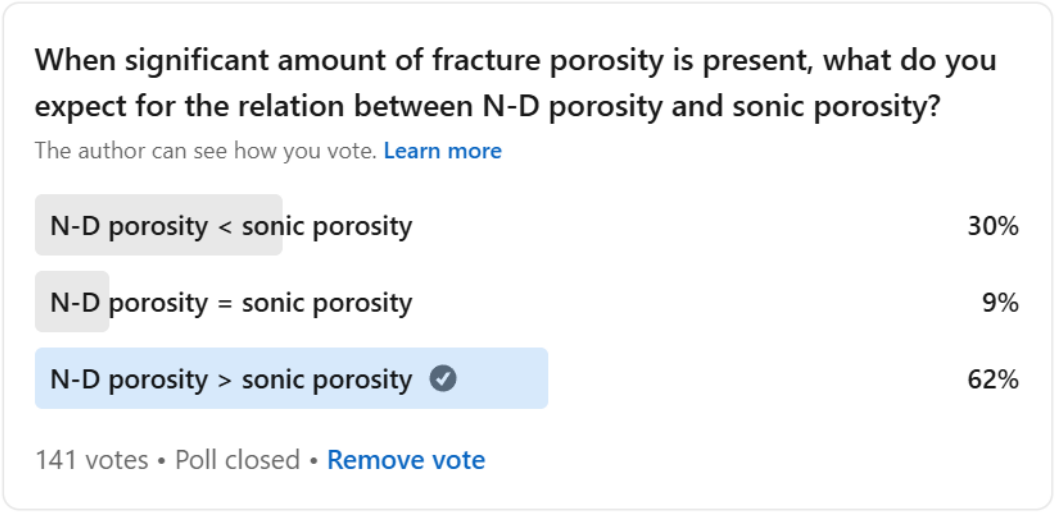
When a significant amount of fracture porosity is present, what do you expect for the relation between N-D porosity and sonic porosity?

A. N-D porosity < sonic porosity

B. N-D porosity = sonic porosity

C. N-D porosity > sonic porosity

ANSWER



EXPLANATION

Neutron-Density (N-D) tools are capable of sampling porosity as a whole, without distinction in its origin and distribution in a rock. On the other hand, sonic porosity is derived from the wave travel times that the sonic tool records. Only first arrivals are considered when processing a sonic log. As fractures offer a path of "more resistance", most first arrival times will include waves that "avoided" the fractures and traveled mostly along the offered faster traveling times. This situation is also known as Fermat's Principle. The result will be a sonic log that undersamples the fracture space and, hence, results in a lower apparent porosity than what N-D tools quantify.

#PETROQUIZ 046: SATURATION HEIGHT

Saturation Height Modelling is a well-established and traditionally used reservoir characterization methodology based on the analysis of capillary pressure data to predict the initial water saturation of a reservoir, a parameter that greatly affects the hydrocarbon in place calculations. Refer to the article below to answer today's quiz:

https://lnkd.in/gJgUD44a

For the same reservoir rock type (similar porosity-permeability or hydraulic radius), at which position it bears the least water saturation?

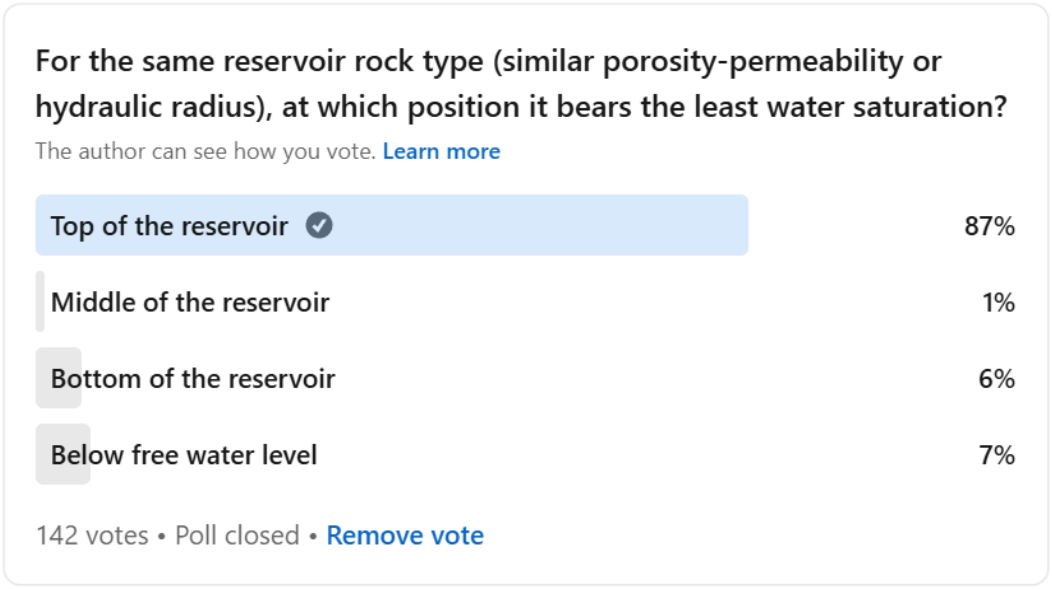
A. Top of the reservoir

B. Middle of the reservoir

C. Bottom of the reservoir

D. Below the free water level

ANSWER



EXPLANATION

For the same type of rock, we can expect that the lowest water saturation must be found at the top of the reservoir, where capillary pressure is the highest and possibly enough to reach irreducible water conditions.

#PETROQUIZ 047: BARITE EFFECTS ON LOGS

Barite is a mineral that's added to drilling fluids to increase their density and mud weight. Barite has a specific gravity of 4.2–4.6. Barite causes some issues for some types of logs. Refer to the article below to answer today's quiz:

https://lnkd.in/gW_JHvXA

When lots of barite is used to increase the mud weight, which log below cannot be used due to barite?

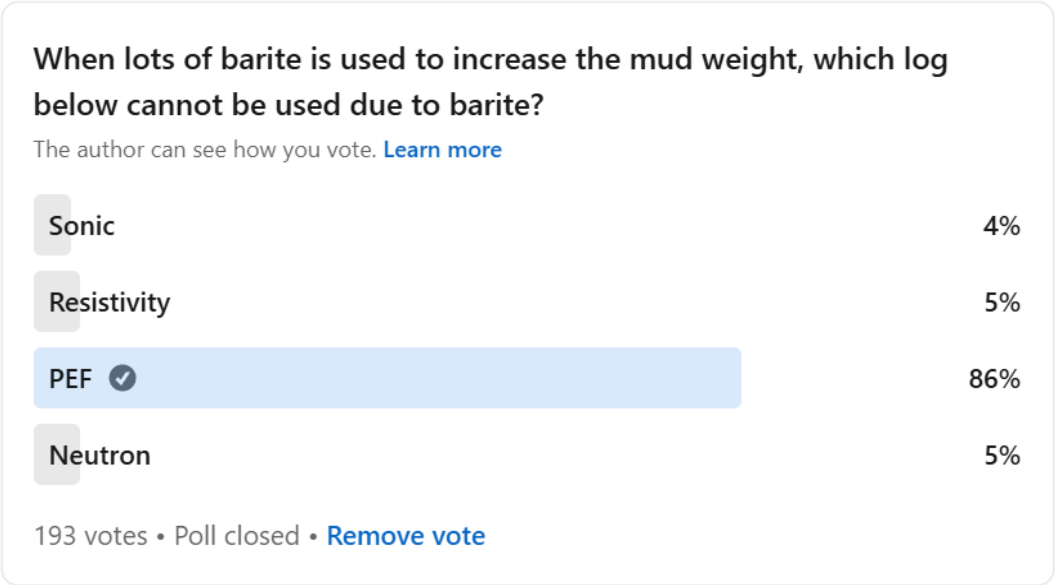
A. Sonic

B. Resistivity

C. PEF

D. Neutron

ANSWER



EXPLANATION

The reason behind the malfunctioning of PEF measurements when barite is present is the physical principle that the PEF tool uses for its operation: photoelectric absorption cross-section. While most reservoir rocks have values in the range of 1-5 barns/electron, barite possesses an overwhelming reading of ~267 barns/electron, masking any other signal that could come from the reservoir.

#PETROQUIZ 048: BOREHOLE IMAGE LOG

The term "borehole imaging" refers to those logging and data-processing methods that are used to produce centimeter-scale images of the borehole wall and the rocks that make it up. It can provide a lot of geological features. Refer to the article below to answer today's quiz:

https://lnkd.in/gevVdu67

Which feature below cannot be found from borehole image logs?

A. Fracture

B. Bed boundaries

C. Big vugs

D. Rock color

ANSWER



EXPLANATION

The label “imaging” could be misleading, but no borehole image log is capable of offering any information regarding rock color. The displays we usually observe utilize ad hoc color bars that enhance the visualization of the image.

#PETROQUIZ 049: PVT TEST

PVT tests are important in the oil and gas industry for the following:

- Understanding fluid behaviour during production: PVT analysis helps understand how oil, gas, and water behave under varying pressure and temperature conditions during production.
- Reservoir modelling: Accurate reservoir modelling requires PVT data to simulate fluid behaviour.
- Development planning: PVT analysis helps build production profiles associated with development plans.
- Characterization: PVT tests aid in characterizing oil populations.
- Phase behaviour: PVT tests study and quantify the phase behaviour of reservoir fluids at simulated recovery conditions.

Refer to the article below to answer this quiz:

https://lnkd.in/gwApXj6S

What does PVT stand for?

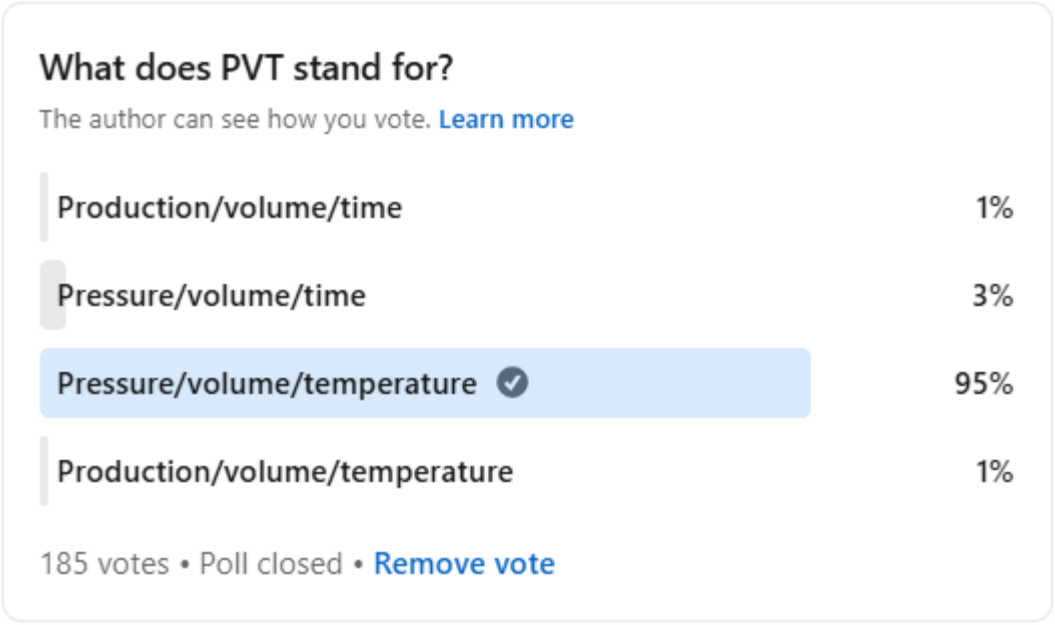
A. Production/volume/time

B. Pressure/volume/time

C. Pressure/volume/temperature

D. Production/volume/temperature

ANSWER



EXPLANATION

From article:

PVT tests are an essential part of the exploration and production process. The behaviors of reservoir fluids are nothing short of complex, but for oil and gas exploration projects to reach an optimal outcome, companies need to understand these unique behaviors so that they can make data-driven engineering decisions. A PVT (pressure, volume, temperature) analysis takes a deeper dive into the behaviors of a reservoir's fluids to collect this essential data that will advance your project to the next phase.

In essence, the PVT analysis looks at the way a specific reservoir's fluids behave under certain conditions. The results of the study serve to answer critical business questions, including

- *What is the volume of crude oil and gas in the reservoir?*
- *How can we optimize the liquid recovery process?*
- *What are the unique flow properties of this reservoir?*
- *What do we need to know to maintain the pressure?*

PVT Tests and Analysis are conducted by a professional petroleum service provider that can not only collect the essential data but also provide insight and guidance on next steps.

#PETROQUIZ 050: FLUID SUBSTITUTION

This quiz's question is contributed by Juan Berrizbeitia

Fluid substitution equations are an important part of any rock physics study, as they provide tools for modeling various fluid scenarios in the pore space to study the effect of fluid replacements in the elastic responses at both, log and seismic scales. Moreover, this technique is widely used to correct elastic logs (density, Vp, and Vs) for mud filtrate invasion. Probably the most common fluid substitution approach comes from the work of Gassmann in 1951. Refer to the article below to answer this quiz:

https://lnkd.in/gZj9p7QJ

Which of the following is NOT an assumption on which the Gassmann equations are based?

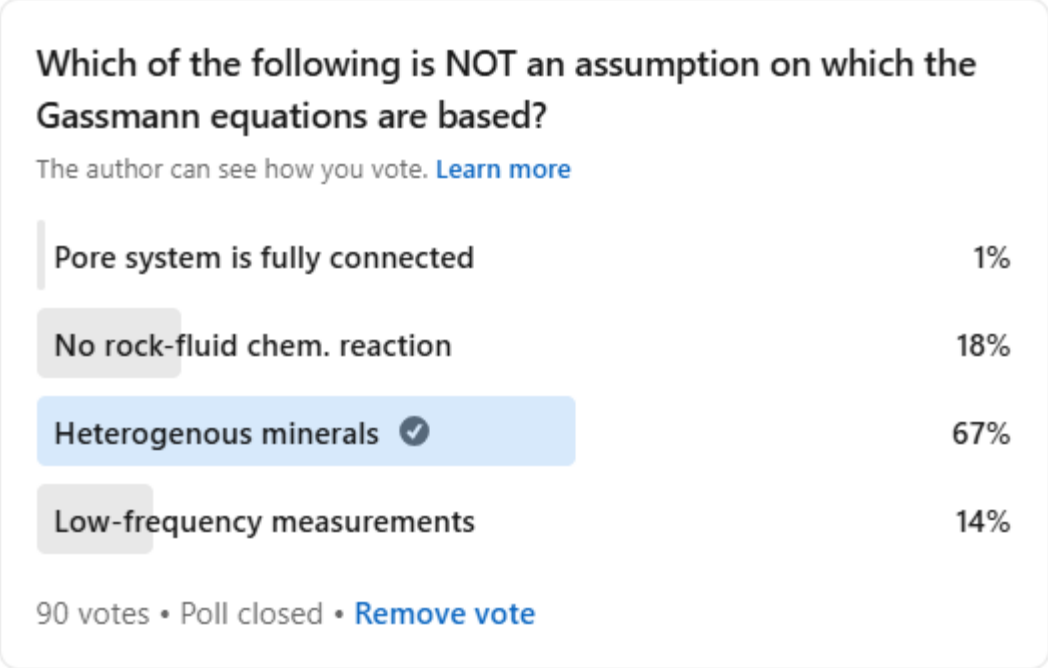
A. Pore system is fully connected

B. No rock-fluid chem. reaction

C. Heterogeneous minerals

D. Low-frequency measurements

ANSWER



EXPLANATION

From article:

Numerous assumptions are involved in the derivation of Gassmann's equation:

1. Porous material is isotropic, elastic, monomineralic, and homogeneous
2. Pore space is well connected and in pressure equilibrium (zero frequency limit)
3. Medium is a closed system with no pore fluid movement across boundaries
4. No chemical interaction between fluids and rock frame (shear modulus remains constant)

.

#PETROQUIZ 051: OVERPRESSURE ZONE IDENTIFICATION

Real-time sonic, resistivity, and density log data play a crucial role in identifying overpressure zones and estimating pore pressure. Further, d'exponent and sigma logs, which are based on drilling parameters, play a supporting role in detecting and estimating formation pressure in real-time. Refer to the article below to answer today's quiz:

https://lnkd.in/gN2uETGn

Which method can be used on the real-time sonic, resistivity, and density log to identify overpressure zones and estimating pore pressure?

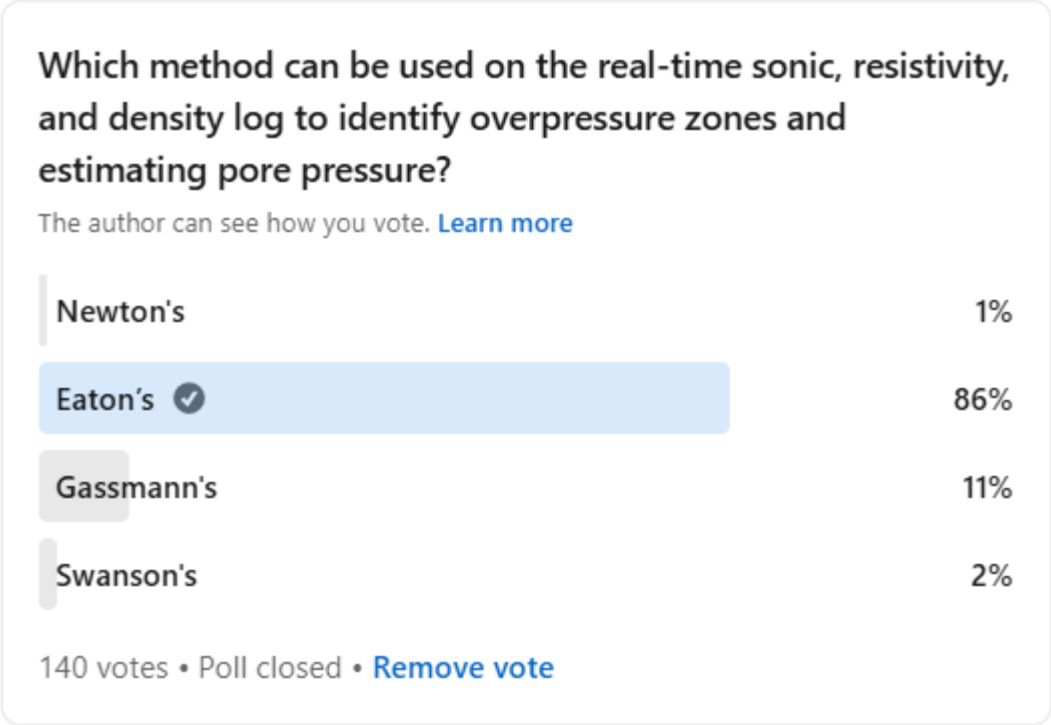
A. Newton's

B. Eaton's

C. Gassmann's

D. Swanson's

ANSWER



EXPLANATION

- Newton's Method:
  - Technique used in geoscience to solve equations by approximating solutions.
- Eaton's Method:
  - Combines the usage of real-time sonic, resistivity and density log data to identify over pressure zones and estimates pore pressure.
- Gassmann's Method:
  - Set of two equations describing isotropic elastic constants of an ensemble consisting of an isotropic, homogeneous porous medium with a fully connected pore space. This is saturated by a compressible fluid at the pressure equilibrium.
- Swanson's Method:
  - Geoscience technique that connects the shape of the MICP curve to permeability.

#PETROQUIZ 052: C/O CASED HOLE LOG

Pulsed neutron (PN) Carbon oxygen ratio (C/O) log is routinely run for reservoir saturation monitoring and fluid contact movement during field development, for monitoring reservoir performance, identifying by-passed oil for recompletion or evaluating sweep efficiency for feasibilities of enhanced oil recovery projects. Refer to the article below to answer today's quiz:

https://lnkd.in/g-hbS2w6

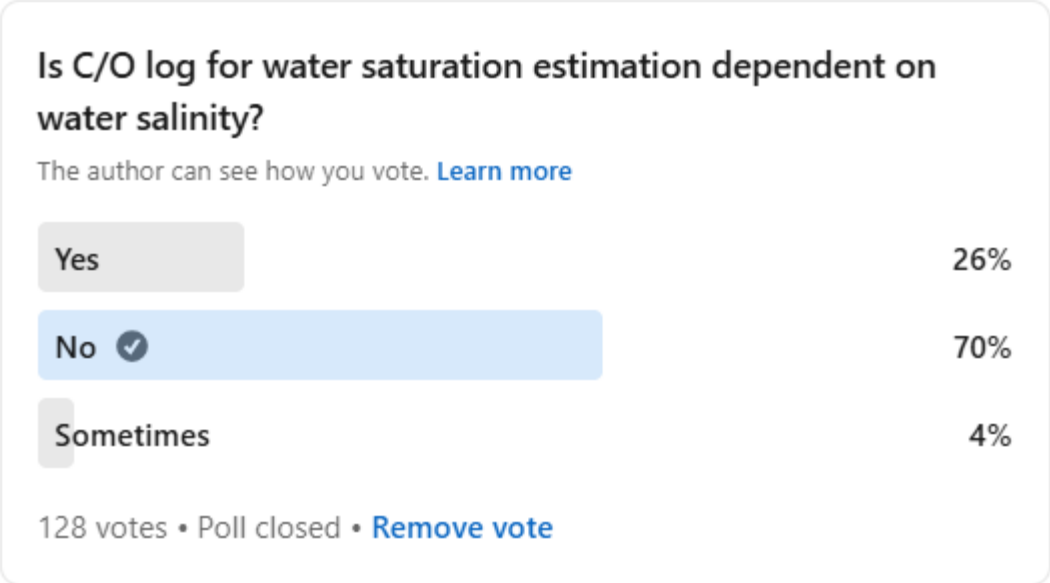
Is C/O log for water saturation estimation dependent on water salinity?

A. Yes

B. No

C. Sometimes

ANSWER



EXPLANATION

It is independent of water salinity because the C/O log depends on elemental composition (carbon to oxygen ratio) and not the resistivity of the water, if the dissolved salt is predominantly NaCL or KCl.

#PETROQUIZ 053: MOBILITY

Fluid mobility is important because it directly impacts how easily a fluid can flow through a porous medium, like rock in an oil reservoir, making it a crucial factor in determining the efficiency of extracting fluids like oil or gas. Refer to the article below to answer today's quiz:

https://lnkd.in/g28Haciq

Which two properties determine fluid mobility in a porous medium?

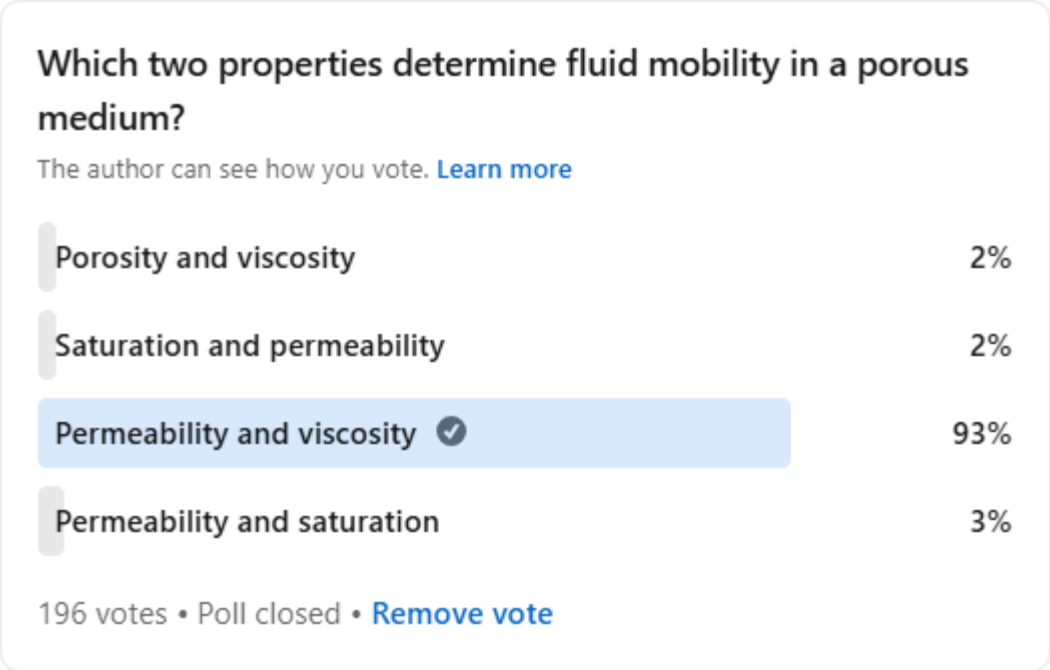
A. Porosity and viscosity

B. Saturation and permeability

C. Permeability and viscosity

D. Permeability and saturation

ANSWER



EXPLANATION

Mobility of a fluid equation:

$$M = \frac{K_i}{\mu_i}$$

$$K: effective\ permeability\ of\ the\ rock\ to\ fluid$$

$$\mu: viscosity$$

#PETROQUIZ 054: LOGGING TOOL FREQUENCY

Logging tools based on different physics have different frequencies for transmitter and receiver. Use your physics understanding to answer today's quiz :)

Which logging tools have the highest frequency?

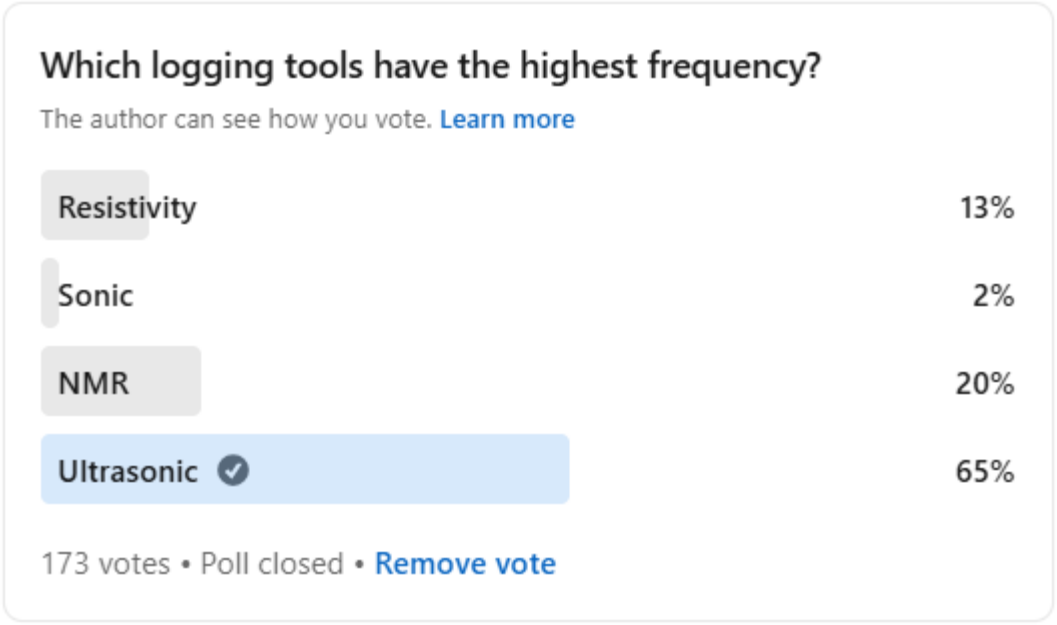
A. Resistivity

B. Sonic

C. NMR

D. Ultrasonic

ANSWER



EXPLANATION

- NMR:
  - Typically, below 2 MHz
- Resistivity:
  - 100 kHz – 10 GHz
- Ultrasonic:
  - 15 – 900 kHz
- Sonic:
  - 10 – 20 kHz

#PETROQUIZ 055: TOC FROM WELL LOGS

Total organic carbon (TOC) is an important parameter in the evaluation of kerogen-rich unconventional reservoirs. Refer to the article below to answer today's quiz:

https://lnkd.in/g4A_EH5f

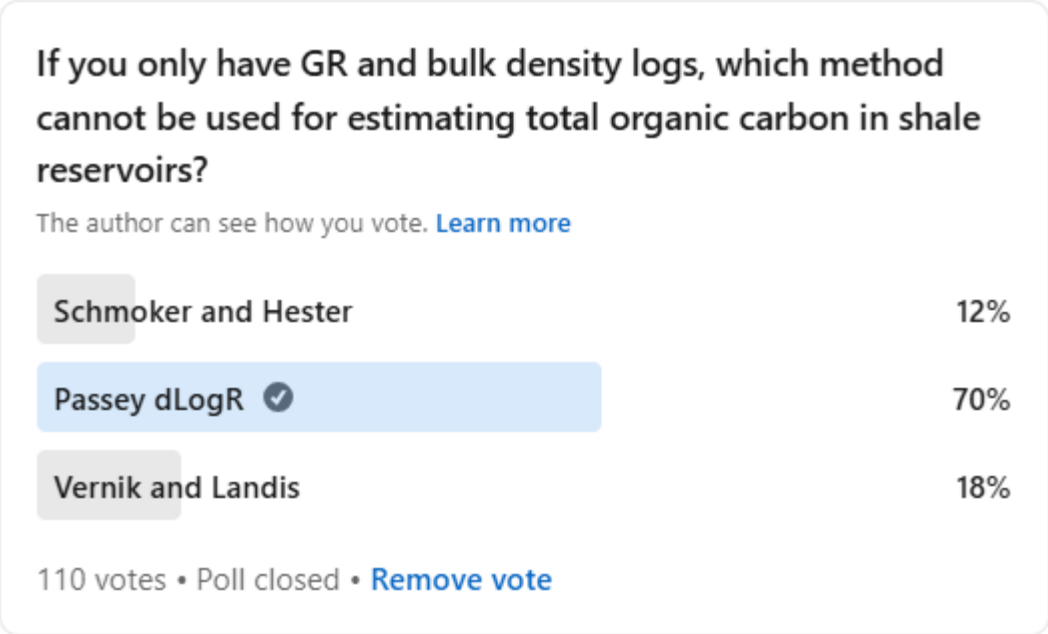
If you only have GR and bulk density logs, which method cannot be used for estimating total organic carbon in shale reservoirs?

A. Schmoker and Hester

B. Passey dLogR

C. Vernik and Landis

ANSWER



EXPLANATION

- Passey dLogR:
  - $TOC(wt\%) = \Delta logR * 10^{(2.297-0.1688\times LOM)}$
- Vernik and Landis:
  - $TOC(wt\%) = 67 \times \frac{RHO_K(RHO_S-RHOB)}{RHOB(RHO_S-RHO_k)}$
- Schmoker and Hester:
  - $TOC(wt\%) = \frac{154.497}{\rho} - 57.261$

#PETROQUIZ 056: PORE PRESSURE FROM WELL LOGS

Pore pressure prediction is an integral process in the well planning procedure as well as the geological evaluation of a potential trap. Predictions are based mainly on a combination of remote data, such as seismic and basin modelling, and/or by analysis of nearby (offset) wells. Well logs are commonly used for predicting pore pressure. Refer to the article below to answer this quiz:

https://lnkd.in/gYKqggpU

Which log below is the least important for predicting pore pressure?

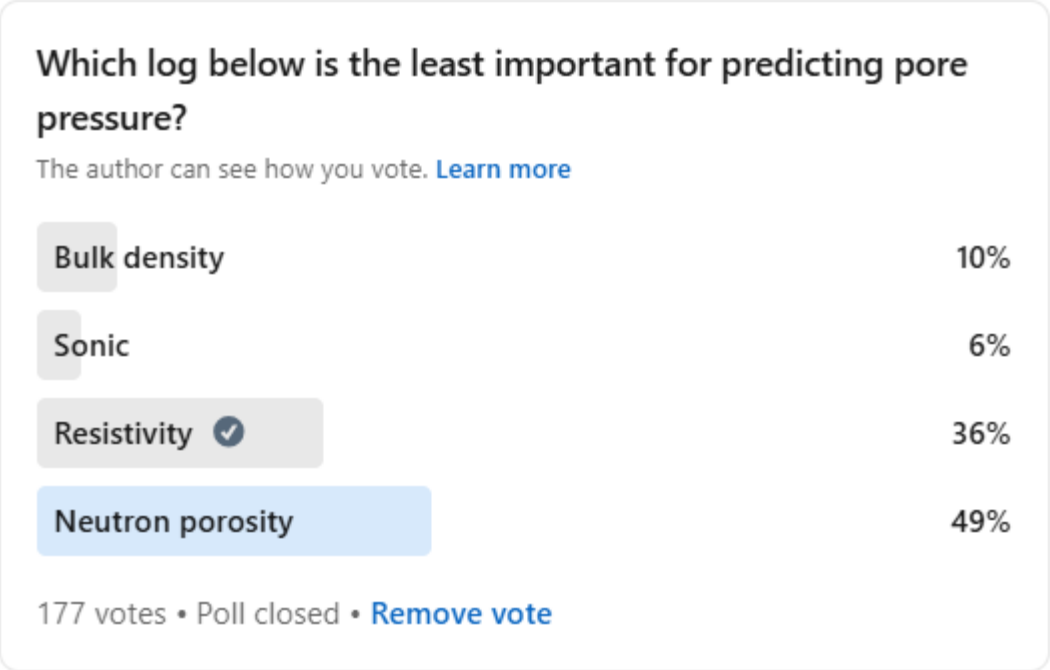
A. Bulk density

B. Sonic

C. Resistivity

D. Neutron porosity

ANSWER



EXPLANATION

For predicting pore pressure, Eaton's resistivity and sonic methods are most commonly used. Overburden pressure gradients can be obtained with the bulk density log.

Eaton's Sonic:

$$P_p = OB_P - (OB_P - N_p) \times \left(\frac{\Delta T_{NCTL}}{\Delta T_{Log}}\right)^{3.0}$$

Eaton's Resistivity:

$$P_p = OB_P - (OB_P - N_P) \times \left(\frac{R_{Log}}{R_{NCTL}}\right)^{1.2}$$

$$P_p: Pore\ Pressure\ (gradient)$$

$$OB_P: Overburden\ Pressure\ (gradient)$$

$$N_p: Normal\ (hydrostatic)\ pressure\ (gradient)$$

$$\Delta T_{Log}\ \&\ \Delta T_{NCTL}: slowness\ from\ log\ \&\ normal\ compaction\ trend\ line$$

$$R_{Log}\ \&\ R_{NCTL}: resistivity\ from\ log\ log\ \&\ normal\ compaction\ trend\ ine$$

#PETROQUIZ 057: CLOUD COMPUTING AND AI

The O&G industry initiated an open-source, standards-based, technology-agnostic data platform. The goal is to liberate the data from the applications and focus on the business value and innovation rather than on the common data interoperability and basic data management challenges. Refer to the articles below to answer today's quiz:

https://lnkd.in/g5-PxaDh

https://lnkd.in/g_tfgJFh

What is the name of the open-source data platform initiated by the oil and gas industry to facilitate cloud computing and AI applications?

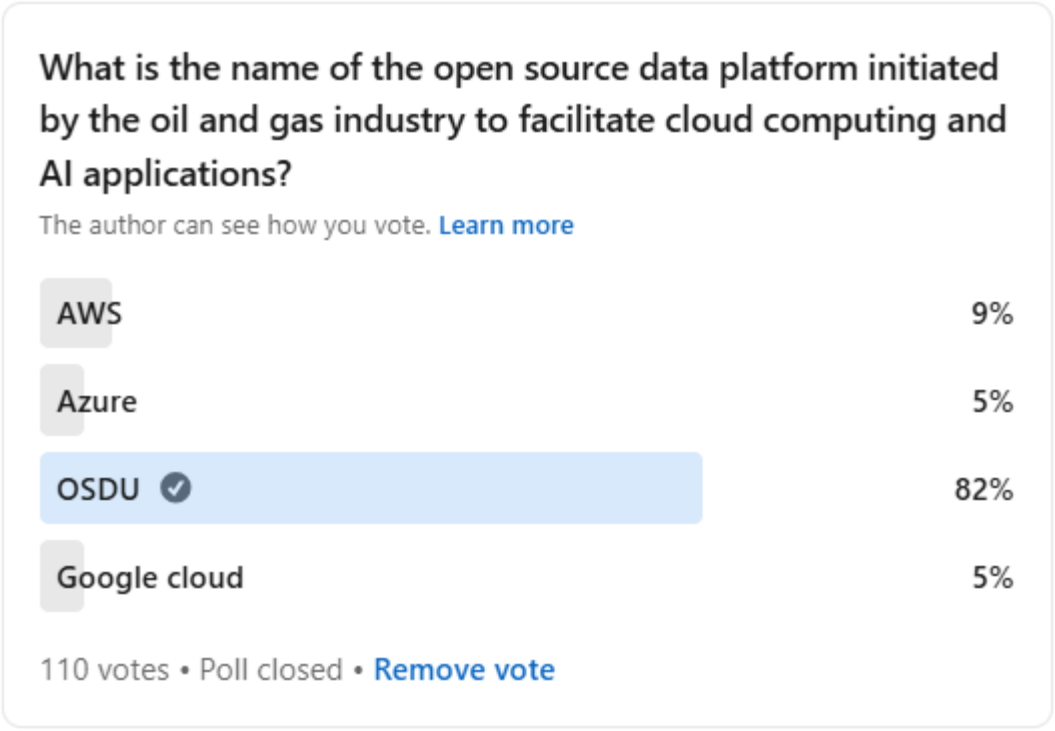
A. AWS

B. Azure

C. OSDU

D. Google cloud

ANSWER



EXPLANATION

- From articles:
  - OSDU – Open Subsurface Data Universe

#PETROQUIZ 058: CLAY CEC

The cation exchange capacity (CEC) of clay is the amount of positively charged ions, or cations, that the clay can store. CEC is measured in milliequivalents per 100 grams of soil (meq/100 g). The CEC of clay varies depending on the type of clay and can range from 10 meq/100 g to 100 meq/100 g or even higher. Refer to the article below to answer today's quiz:

https://lnkd.in/gwXcJ3Kb

Which type of clay has the highest CEC among the list in general?

A. Smectite

B. Kaolinite

C. Illite

D. Chlorite

ANSWER



EXPLANATION

- Smectite:
  - ~80 – ~210 ($cmol_c/kg$)
- Kaolinite:
  - ~5 – ~20 ($cmol_c/kg$)
- Illite:
  - ~15 – ~50 ($cmol_c/kg$)
- Chlorite:
  - ~15 – ~50 ($cmol_c/kg$)

#PETROQUIZ 059: SHALY SAND EQUATIONS

Archie's equation needs to be adapted to some variations in formations of high clay content. Refer to the article below to answer today's quiz:

https://lnkd.in/g5zcRDKz

Which shaly sand equation uses PHIE to calculate water saturation?

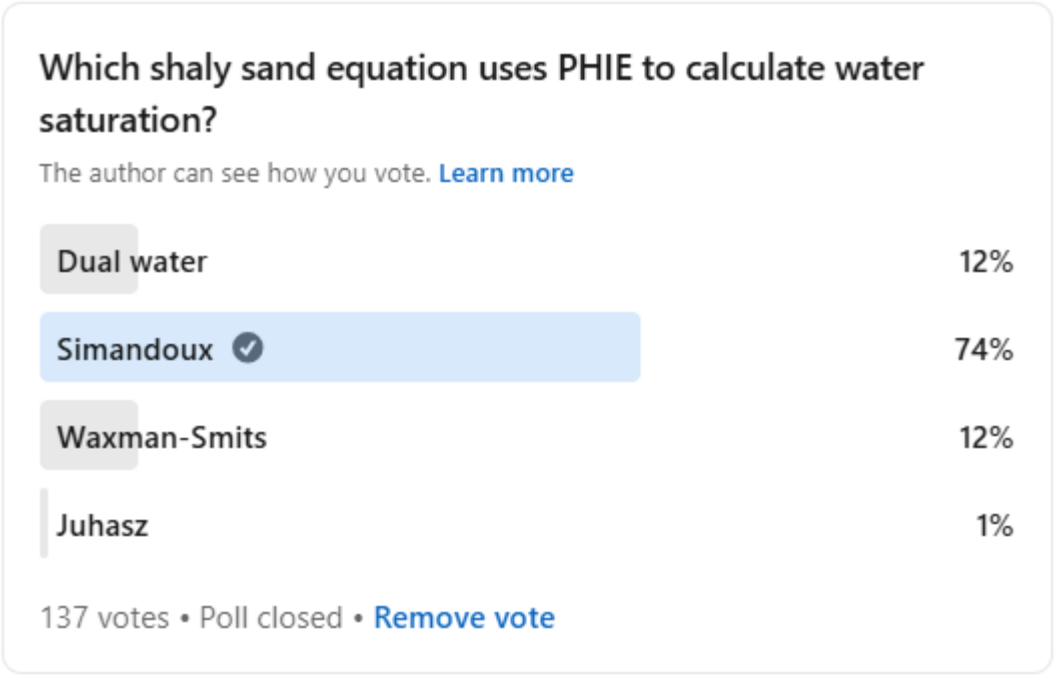
A. Dual water

B. Simandoux

C. Waxman-Smits

D. Juhasz

ANSWER



EXPLANATION

From article:

- PHIT:
  - Waxman – Smits
  - Juhasz
  - Dual Water

- PHIE:
  - Indonesia
  - Simandoux

- Both PHIT and PHIE:
  - Bespoke Equation

#PETROQUIZ 060: OPERATION PETROPHYSICS

Wireline logging has the risk of getting tool stuck or dropping tool in the borehole. If it happens, the tools must be removed to save the well. Refer to the article below to answer today's quiz:

https://lnkd.in/gGWhYWHz

What is the operation procedure to recover equipment that has fallen into a wellbore or is stuck in it?

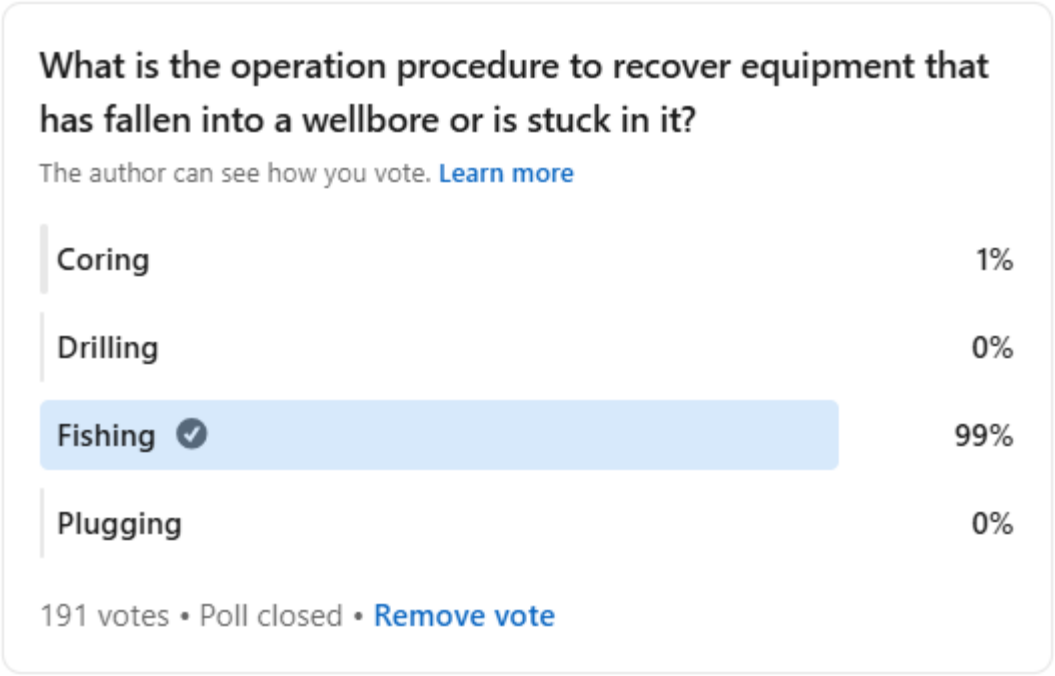
A. Coring

B. Drilling

C. Fishing

D. Plugging

ANSWER



EXPLANATION

The process of retrieving a lost or stuck object from the inside of a wellbore is called “fishing”. The objects of retrieval interest are called “fish”.

#PETROQUIZ 061: THOMAS-STIEBER PLOT

Thomas-Stieber plot by is a classic and useful tool for evaluating many properties of shaly sand reservoirs based on basic well logs. Refer to the videos below to answer today's quiz:

https://lnkd.in/gzEsK7dr

https://lnkd.in/gqGvgfbk

Which of the following cannot be derived from Thomas-Stieber plot in a typical shaly sand reservoir?

A. Shale distribution

B. Shale volume

C. Clay type

D. Net to gross ratio

ANSWER

Which of the following cannot be derived from Thomas-Stieber plot in a typical shaly sand reservoir?

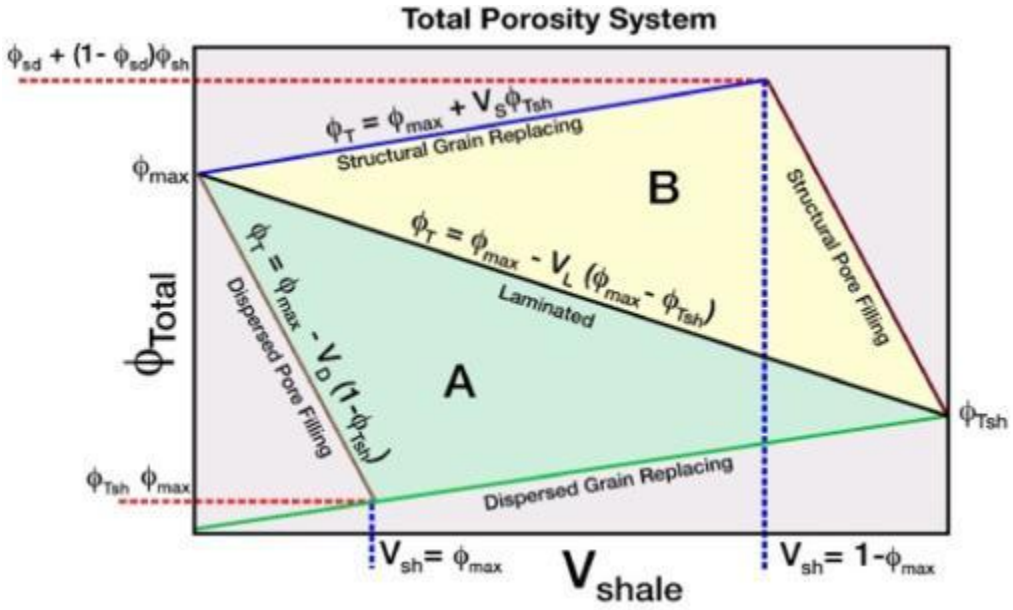
The author can see how you vote. Learn more

Shale distribution	5%
Shale volume	4%
Clay type ✓	57%
Net to gross ratio	35%

130 votes • Poll closed • Remove vote

EXPLANATION

A typical Thomas-Stieber plot below:



Evaluation of Laminated Shaly Sand Sequences in Ahwaz Oil Field Using Thomas Stieber method and Conventional Petrophysical Logs (Parvizi et al. 2017, modified from Juhasz 1986)

#PETROQUIZ 062: PETROPHYSICAL ROCK TYPING

Petrophysical rock typing methods refer to the process of classifying reservoir rock formations based on their physical properties, like porosity, permeability, and water saturation, allowing geologists and reservoir engineers to identify distinct rock types within a reservoir and predict their fluid flow behaviour, typically used in the oil and gas industry to optimize production strategies. Refer to the articles below to answer this quiz:

https://lnkd.in/gevViZfG

https://lnkd.in/g6ihv46v

Which method below is not used for petrophysical rock typing?

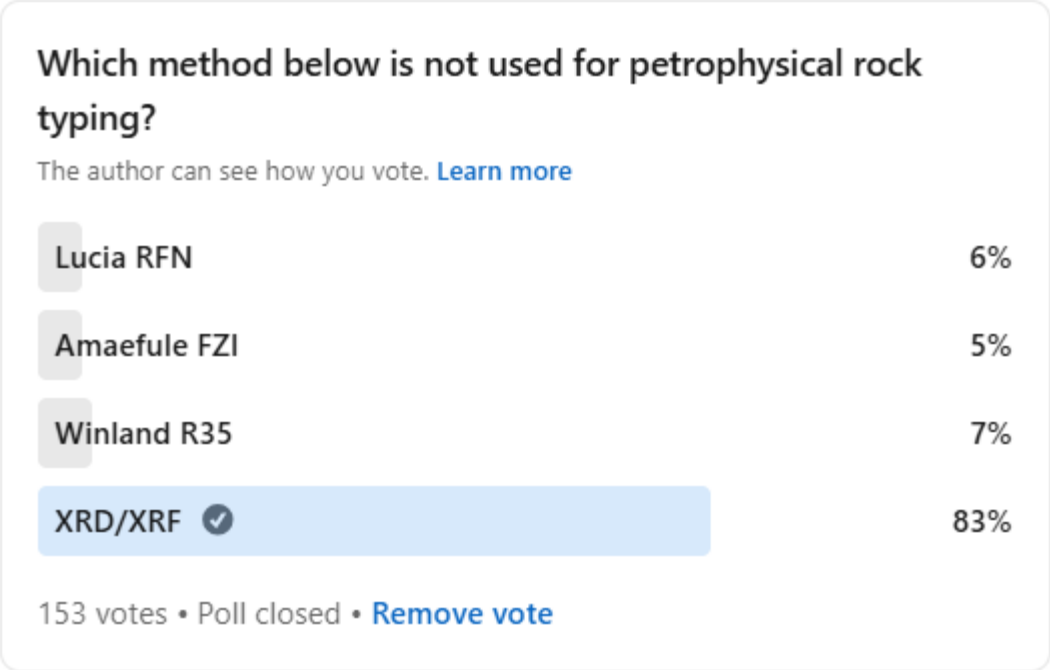
A. Lucia RFN

B. Amaefule FZI

C. Winland R35

D. XRD/XRF

ANSWER



EXPLANATION

While XRD/XRF can be used for rock typing, they are not explicitly used for that purpose.

#PETROQUIZ 063: ARCHIE'S "N" OF OIL-WETTING ROCKS

Archie's equation was derived from sandstones which were water-wetting. The saturation exponent 'n' was close to 2.0. However, oil-wetting rocks are common (refers to the preference of a solid to be in contact with an oil phase rather than water phase). The fluid distribution is different from water-wetting rocks. Refer to the article below to answer today's quiz:

https://lnkd.in/gy-DayEg

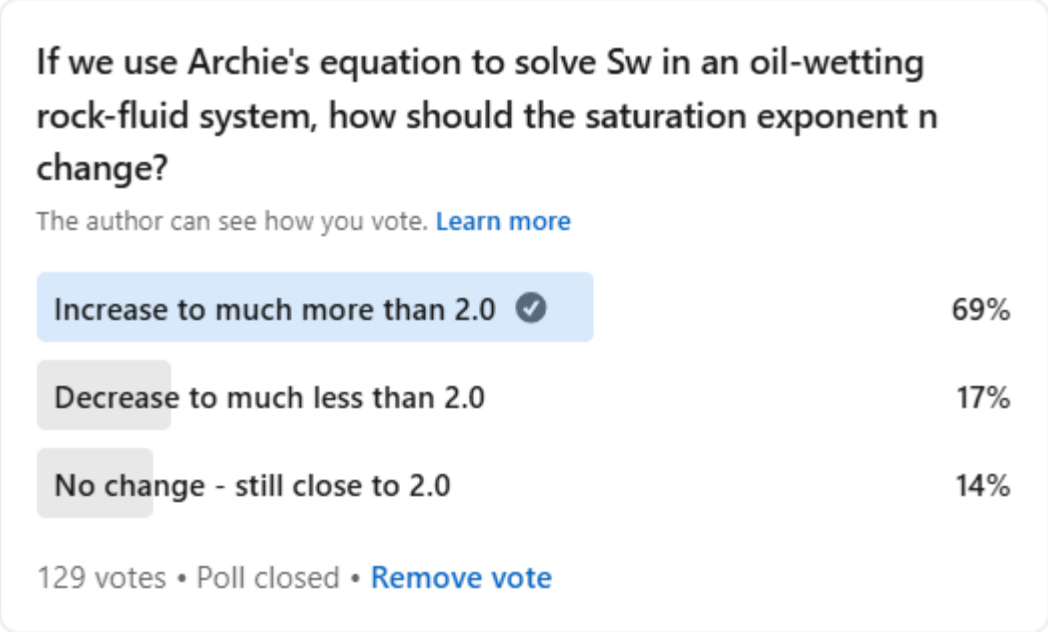
If we use Archies's equation to solve Sw in an oil-wetting rock-fluid system, how should the saturation exponent 'n' change?

A. Increase to much more than 2.0

B. Decrease to much less than 2.0

C. No change – still close to 2.0

ANSWER



EXPLANATION

The in-situ electrical conductivity of a fluid saturated porous rock is:

$$C_t = \frac{1}{a} C_w \phi^m S_w^n$$

When dealing with water-wet systems, the saturation exponent is typically close to 2. Electrical conductance is reduced/absent when dealing with oil/wet systems, therefore the water saturation (S_w) decreases and the saturation exponent increases in order to lower the electrical conductance.

#PETROQUIZ 064: ANNULUS RESISTIVITY PROFILE

Annulus resistivity profile is very important to a formation evaluation specialist, because the profile can only occur in zones that bear hydrocarbons. As the mud filtrate invades the hydrocarbon-bearing zone, the hydrocarbons are moved out first. Next, formation water is pushed out in front of the mud filtrate, forming an annular (circular) ring at the edge of the invaded zone. Refer to the article below to answer today's quiz:

https://lnkd.in/gHGVpJgE

When is an annulus profile on resistivity log likely to be seen? (Long post drill means running log long time after drilling)

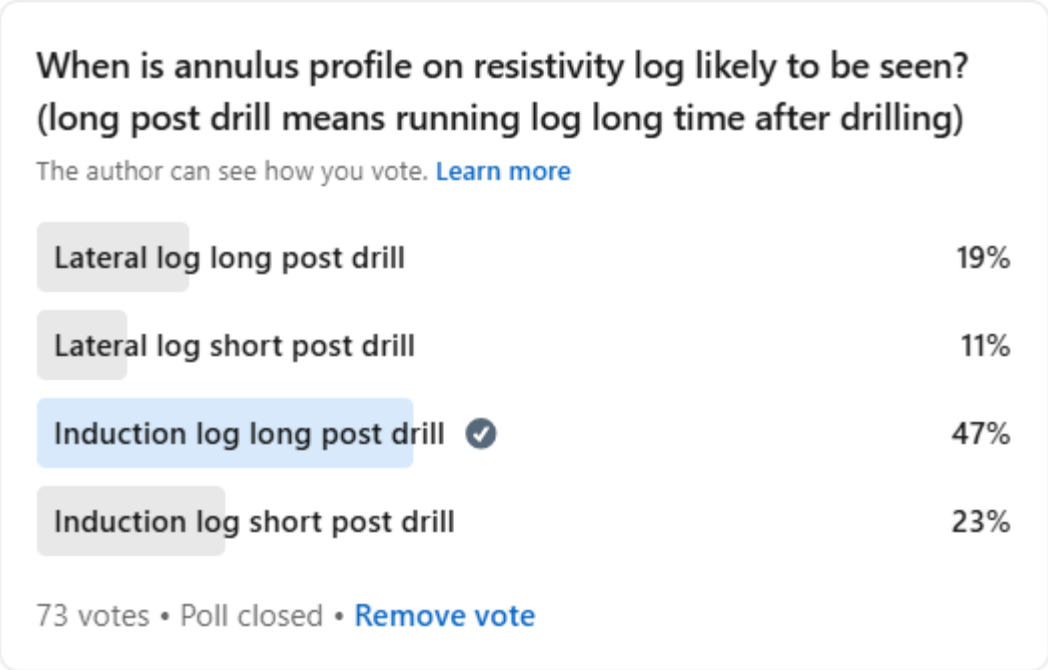
A. Lateral log long post drill

B. Lateral log short post drill

C. Induction log long post drill

D. Induction log short post drill

ANSWER



EXPLANATION

From the article:

- "The annulus effect is detected by a higher resistivity reading on a deep induction log than by one on a medium or short induction log."

#PETROQUIZ 065: DRILLING RIG

A drilling rig is crucial because it provides the necessary machinery to access and extract valuable resources like oil and natural gas from deep within the Earth's crust, essentially acting as the central hub for exploration, drilling, and production of these hydrocarbons, making it a vital component of the energy industry; it can also be used to sample subsurface minerals, test rock properties, and install underground infrastructure like wells and utilities. Refer to the article below to answer today's quiz:

https://lnkd.in/guHUBFuk

Which of these is not a part of a drilling rig?

A. Monkey board

B. Cat walk

C. Dog house

D. Giraffe neck

ANSWER



EXPLANATION

Giraffe neck is not a part of a drilling rig. Drilling rigs have specific components with unique names, often derived from their function or resemblance to other objects:

- Monkey board: A platform where the derrickman works while "tripping" pipe.
- Catwalk: An elongated platform where drill pipe and other tools are laid out before being hoisted into the derrick.
- Dog house: A small cabin on the rig that serves as a control center where the driller and other crew members can operate the equipment and monitor drilling parameters.

#PETROQUIZ 066: BULK DENSITY LOG

A "bulk density log" is a method of measuring the bulk density of a formation in a borehole by detecting the amount of gamma radiation scattered back from the formation, where the primary scattering mechanism is well known; essentially, the more gamma rays scattered, the higher the bulk density of the formation. Refer to the article below to answer today's quiz:

https://lnkd.in/gt7gRytn

What physical process is the basis for bulk density well logging?

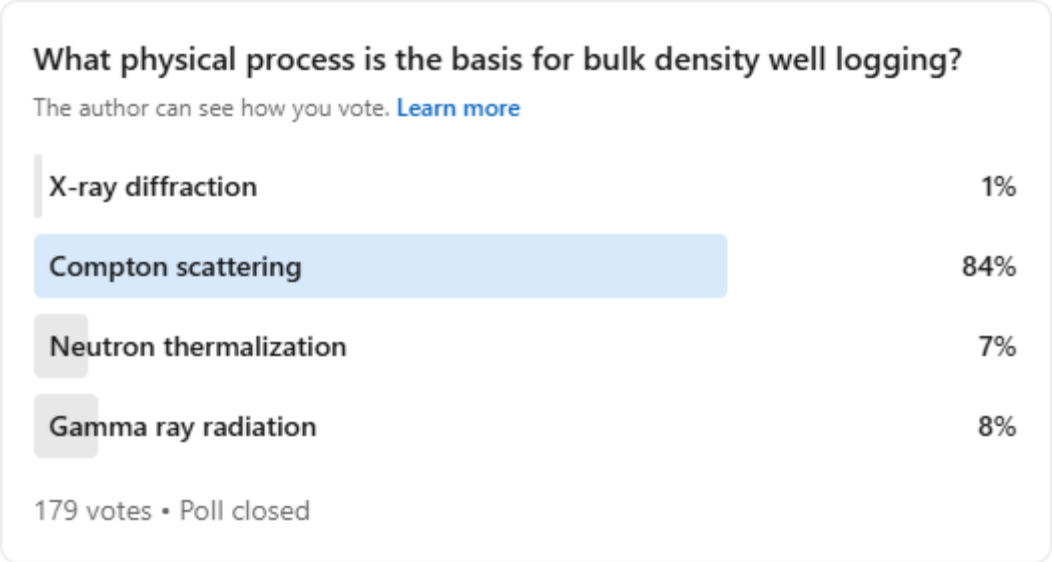
A. X-ray diffraction

B. Compton scattering

C. Neutron thermalization

D. Gamma ray radiation

ANSWER



EXPLANATION

Compton scattering is the primary physical process behind bulk density logging. Density logging uses an active nuclear tool with a radioactive source, typically Cesium-137, which emits medium-energy gamma rays into the formation. These gamma rays interact with electrons in the formation and are scattered in an interaction known as Compton scattering, where gamma rays lose energy upon colliding with electrons. The number of scattered gamma rays that reach the detector is proportional to the electron density (ρ_e) of the material, which is directly related to the bulk density of the formation.

The relationship between electron density and bulk density is expressed as:

$$\rho_e = 2\rho_{bulk}\frac{Z}{A}$$

where **Z** is the atomic number and **A** is the molecular weight of the compound. For most elements, **Z / A** is approximately 0.5 (except for hydrogen, where this ratio is 1). The electron density (ρ_e) in g/cm^3 determines the response of the density tool.

#PETROQUIZ 067: CAPILLARY PRESSURE HYSTERESIS

Capillary pressure hysteresis refers to the phenomenon where the magnitude of capillary pressure depends on the saturation and the direction of saturation change. Refer to the article below to answer today's quiz:

https://lnkd.in/gdw-YmAx

In a capillary pressure test, if we gradually increase the wetting phase, what is the procedure called?

A. Drainage

B. Imbibition

C. Hysteresis

D. Adsorption

ANSWER

In a capillary pressure test, if we gradually increase the wetting phase, what is the procedure called?

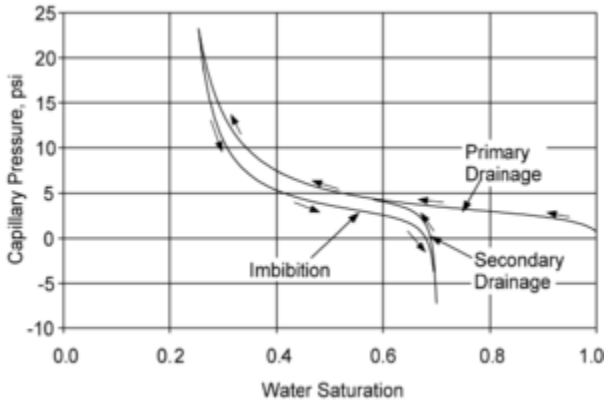
The author can see how you vote. Learn more

Drainage	9%
Imbibition	88%
Hysteresis	2%
Adsorption	2%

162 votes • Poll closed

EXPLANATION

Capillary pressure, Pc, is defined as the difference in pressure across the interface between two immiscible fluids, for example, oil and water in the reservoir. Imbibition describes the process of gradually increasing the saturation of the wetting phase in a capillary pressure test. This process occurs when the non-wetting phase (e.g., oil or gas, CO_2) is displaced by the wetting phase. Imbibition plays a significant role in processes such as water flooding and enhanced oil recovery.



#PETROQUIZ 068: NMR RAW ECHOES AND INVERSION

NMR logging is not only a powerful tool but also a fascinating process to study and replicate. The ability to process raw echo trains, apply phase rotation, stack the data, and invert for T2 distributions opens a window into the reservoir. Refer to the post below to answer today's quiz:

https://lnkd.in/gqnEhHhs

What reservoir properties can be derived from NMR raw echoes measured on fully water saturated rock without inverting to T2 distribution?

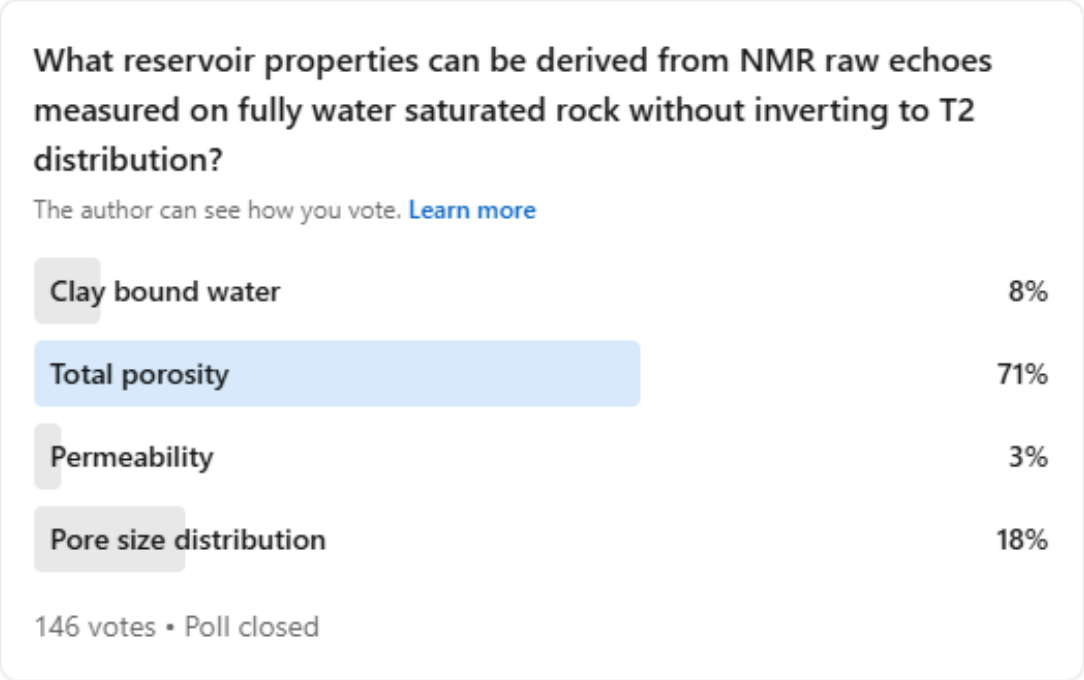
A. Clay bound water

B. Total porosity

C. Permeability

D. Pore size distribution

ANSWER



EXPLANATION

Total porosity can be directly derived from NMR raw echoes measured on fully water-saturated rocks without the need to invert to the T_2 distribution. This is because, in fully water-saturated rocks, the total signal amplitude of the raw echoes is directly proportional to the total hydrogen content in the pore space, which corresponds to the total porosity of the rock.

#PETROQUIZ 069: UTAH FORGE GEOTHERMAL

The Utah FORGE project is an international field laboratory that is managed by the Energy & Geoscience Institute at the University of Utah, and sponsored by the Department of Energy. It has been designed to develop, test and optimize the methods and techniques required to create, sustain and monitor enhanced geothermal systems resources. The aim is to establish rigorous, reproducible solutions that make geothermal energy possible anywhere in the world. Refer to the website below to answer today's quiz:

https://lnkd.in/grys9f6E

What is the main lithology of the geothermal zones in Utah FORGE field?

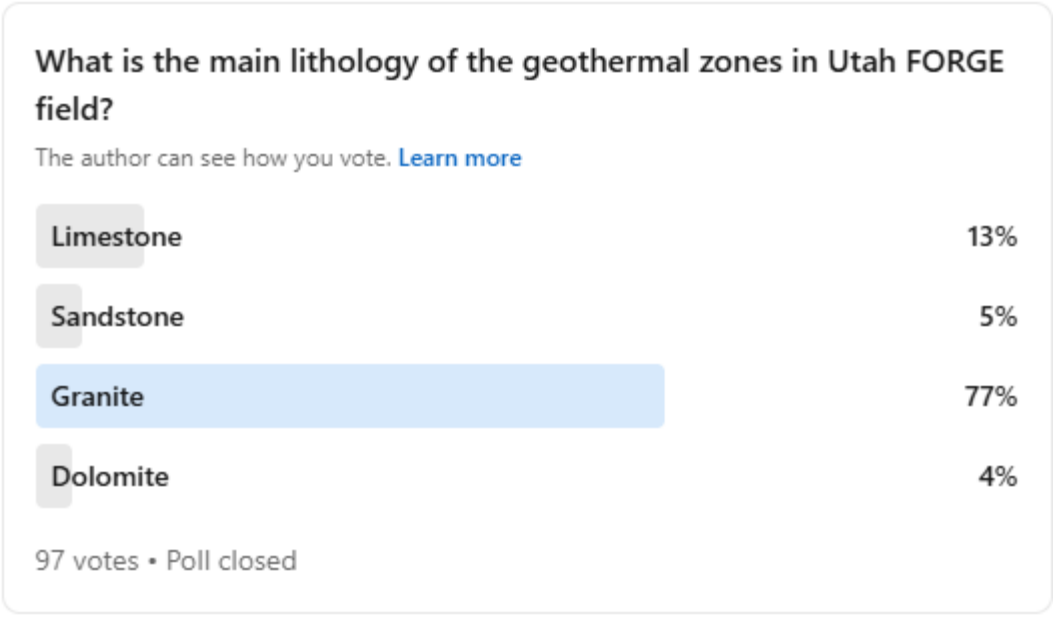
A. Limestone

B. Sandstone

C. Granite

D. Dolomite

ANSWER



EXPLANATION

The geothermal zones in the Utah FORGE field are primarily associated with granite formations. Granite is an ideal host rock for enhanced geothermal systems (EGS) because of its high heat retention capacity, which is essential for geothermal energy production. The heat extraction processes are optimized through hydraulic stimulation and reservoir engineering.

#PETROQUIZ 070: SONIC WAVEFORMS

Full waveform acoustic logs provide information about the seismic and lithologic properties of a formation. There are three wave arrivals that can easily be identified in a full waveform acoustic log, namely the P wave packet, the S wave packet, and the Stoneley wave. Refer to the article below to answer today's quiz:

https://lnkd.in/gDHnjHwJ

What is the order of arrival of different types of waves recorded in a full waveform acoustic log?

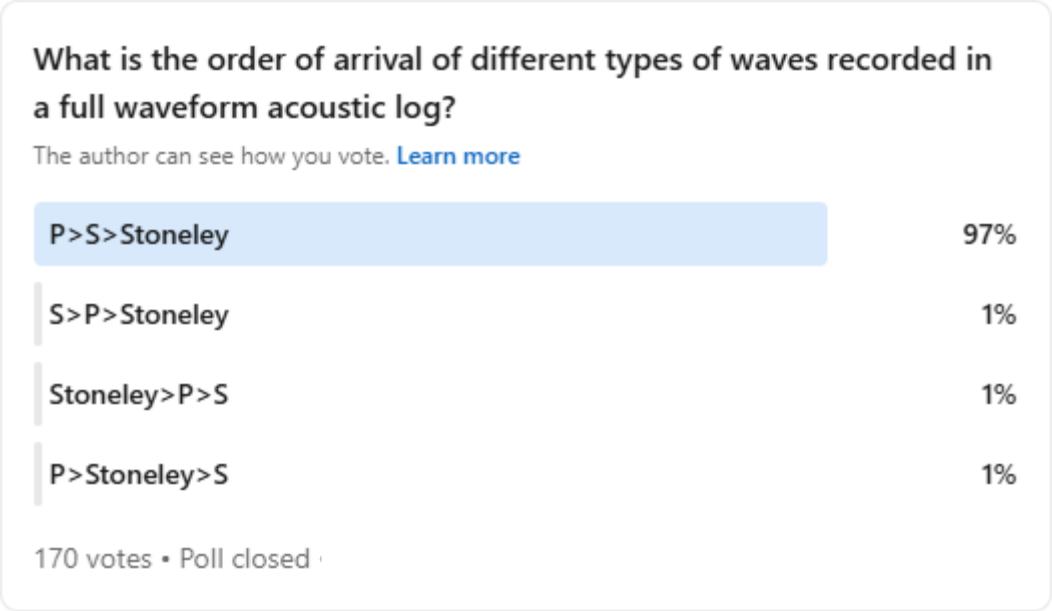
A. P>S>Stoneley

B. S>P>Stoneley

C. Stoneley>P>S

D. P>Stoneley>S

ANSWER



EXPLANATION

In a full waveform acoustic log, the waves arrive in a specific order due to their varying propagation speeds in the formation. In order of arrival time, they are the P wave, the S wave, and the Stoneley wave.

- P-wave (Primary or compressional wave): This is the fastest wave and arrives first. It propagates through the formation as a compression and expansion of particles in the direction of wave travel.
- S-wave (Shear wave): This wave arrives second and moves slower than the P-wave through the formation by moving particles perpendicular to the direction of propagation.
- Stoneley wave: This is a type of surface wave that typically arrives last, propagating along the borehole-formation interface at a slower velocity compared to the body waves (P and S).

#PETROQUIZ 071: CEMENT BOND LOG (CBL)

Cement evaluation assesses the annular barrier and the bond between the casing and cement placed in the wellbore annulus between casing and wellbore. Acoustic or ultrasonic logs provide the primary means for evaluating the mechanical integrity and quality of the cement bond. Refer to the articles below to answer today's quiz:

https://lnkd.in/gwFpp2BY

https://lnkd.in/geGJwf4s

Which of the following is not typically recorded on cement bond log?

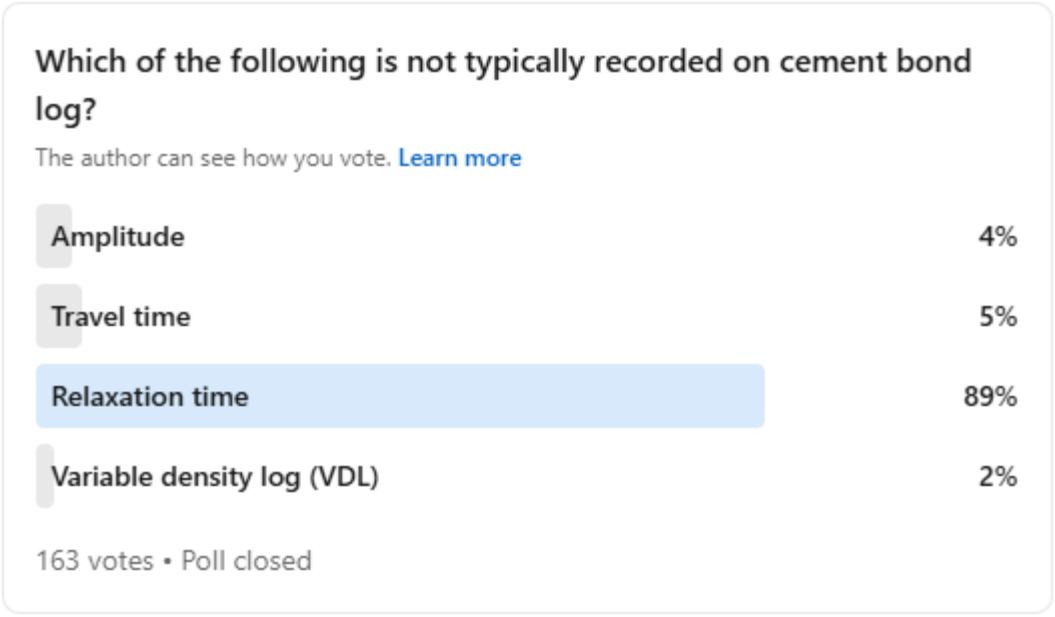
A. Amplitude

B. Travel time

C. Relaxation time

D. Variable density log (VDL)

ANSWER



EXPLANATION

Relaxation time is typically associated with NMR logs, not recorded in standard cement bond logs. It refers to the time required for the relaxation of magnetization in rock samples, which is useful for evaluating fluid characteristics and porosity in NMR studies. Cement bond logs (CBL) are used to assess the quality of the cement bond between the casing and the formation. Amplitude, travel time, and variable density log (VDL) are measurements recorded on a CBL.

#PETROQUIZ 072: GAMMA RAY LOG

Gamma ray logging is a method of measuring naturally occurring gamma radiation to characterize the rock or sediment in a borehole or drill hole. It is a wireline logging method used in mining, mineral exploration, water-well drilling, for formation evaluation in oil and gas well drilling and for other related purposes. Refer to the article below to answer today's quiz:

https://lnkd.in/gfPZzNUw

Where does the radiation measured by gamma-ray logs come from?

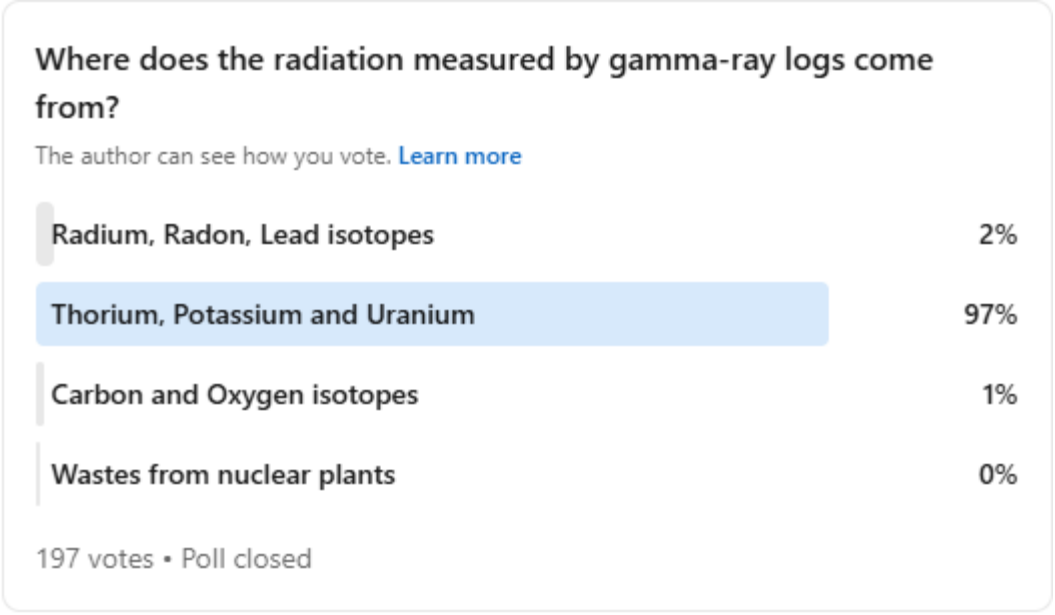
A. Radium, Radon, Lead isotopes

B. Thorium, Potassium and Uranium

C. Carbon and Oxygen isotopes

D. Wastes from nuclear plants

ANSWER



EXPLANATION

Gamma ray logs measure the naturally occurring gamma radiation emitted by trace amounts of radioactive isotopes present in the formation. These isotopes, primarily thorium (Th), potassium (K), and uranium (U), decay over time, emitting gamma rays in the process. The intensity of the gamma rays recorded by the tool can help identify lithology and estimate shale content in the formation. A common gamma-ray log records the total radiation and cannot distinguish between the radioactive elements, while a spectral gamma ray log can. Spectral gamma ray logging measures the concentrations of specific radioactive isotopes, including potassium, uranium, and thorium, by analyzing the energy spectrum of the gamma radiation. This provides more detailed information about the rock formation compared to traditional gamma ray logs.

#PETROQUIZ 073: KNUDSEN DIFFUSION

Knudsen diffusion, named after Martin Knudsen, is a means of diffusion that occurs when the scale length of a system is comparable to or smaller than the mean free path of the particles involved. An example of this is in a long pore with a narrow diameter (2–50 nm) because molecules frequently collide with the pore wall. Refer to the article below to answer today's quiz:

https://lnkd.in/gtaxBFt9

Which of the following reservoir type or field need to take into account of Knudsen diffusion to estimate fluid flow capacity?

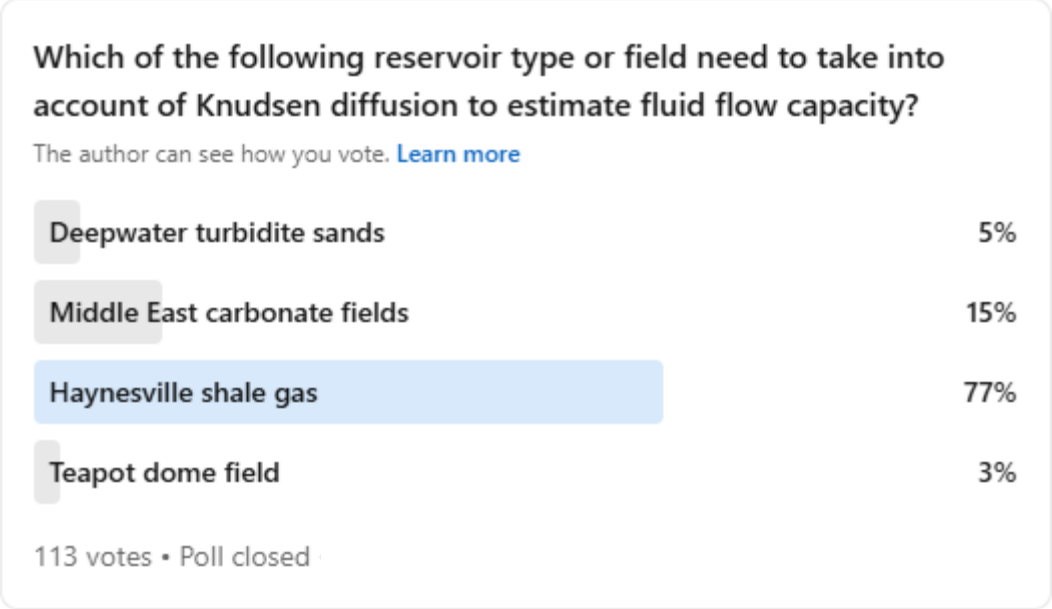
A. Deepwater turbidite sands

B. Middle East carbonate field

C. Haynesville shale gas

D. Teapot dome field

ANSWER



EXPLANATION

Knudsen diffusion becomes significant in reservoir systems with small pore sizes, a common condition in shale reservoirs like the Haynesville shale gas field. This process occurs when the pore size is comparable to or smaller than the mean free path of the gas molecules (typically 2–50 nm). The mean free path increases at low pressures, leading to molecular collisions with pore walls to dominate the diffusion process. Consequently, Knudsen diffusion is particularly relevant in tight reservoirs operating under low-pressure conditions.

#PETROQUIZ 074: DARCY'S LAW

Darcy's law is an equation that describes the flow of a fluid through a porous medium and through a Hele-Shaw cell. The law was formulated by Henry Darcy based on results of experiments on the flow of water through beds of sand, forming the basis of hydrogeology, a branch of earth sciences. Refer to the article below to answer today's quiz:

https://lnkd.in/gnaJbXFw

https://lnkd.in/gFv_RwVr

Which of the following law is the best analogous law to Darcy's law in a different physics?

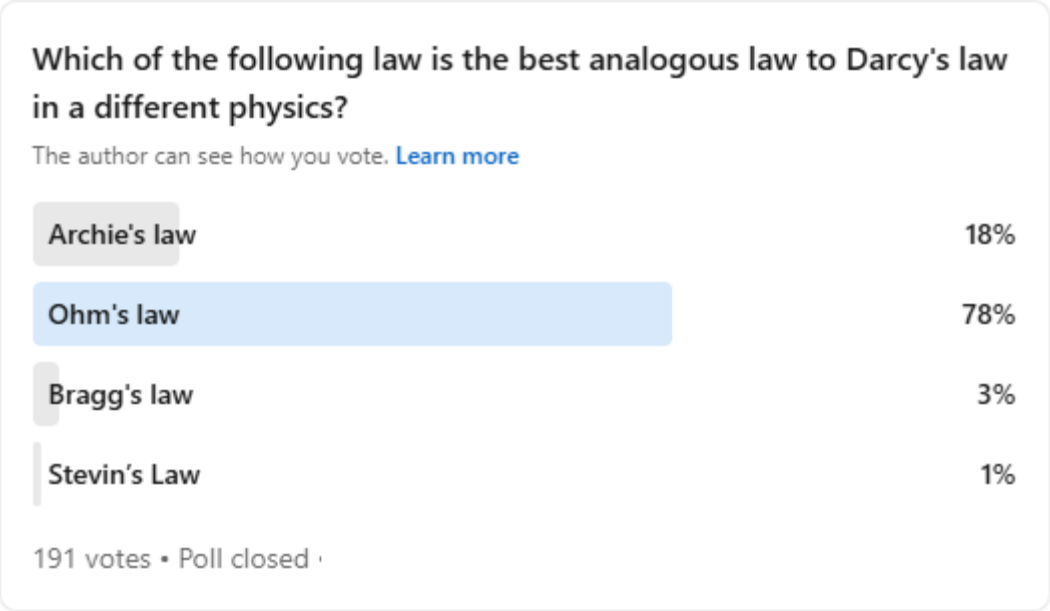
A. Archie's law

B. Ohm's law

C. Bragg's law

D. Stevin's Law

ANSWER



EXPLANATION

Darcy's law, describing fluid flow through porous media, is conceptually similar to Ohm's law, which explains electrical current flow in a circuit. Both laws establish a relationship between a driving force and a response:

- Darcy's law relates fluid flow rate to the pressure gradient in porous media.
- Ohm's law relates electrical current to the voltage difference in a conductor.

While the physical phenomena differ, both describe how the "flow rate" (fluid for Darcy, electrical current for Ohm) depends on the driving force (pressure gradient for Darcy, voltage difference for Ohm) and the medium's resistance (permeability in porous media, electrical resistance in circuits).

#PETROQUIZ 075: DIAGENESIS

'Diagenesis' refers to the physical and chemical processes that affect sedimentary materials after deposition and before metamorphism and between deposition and weathering. The effects of diagenetic processes on rock properties such as porosity and the degree of lithification are progressive. Refer to the article below to answer today's quiz:

https://lnkd.in/gZJqRYmp

Which of the following is not a diagenesis effect?

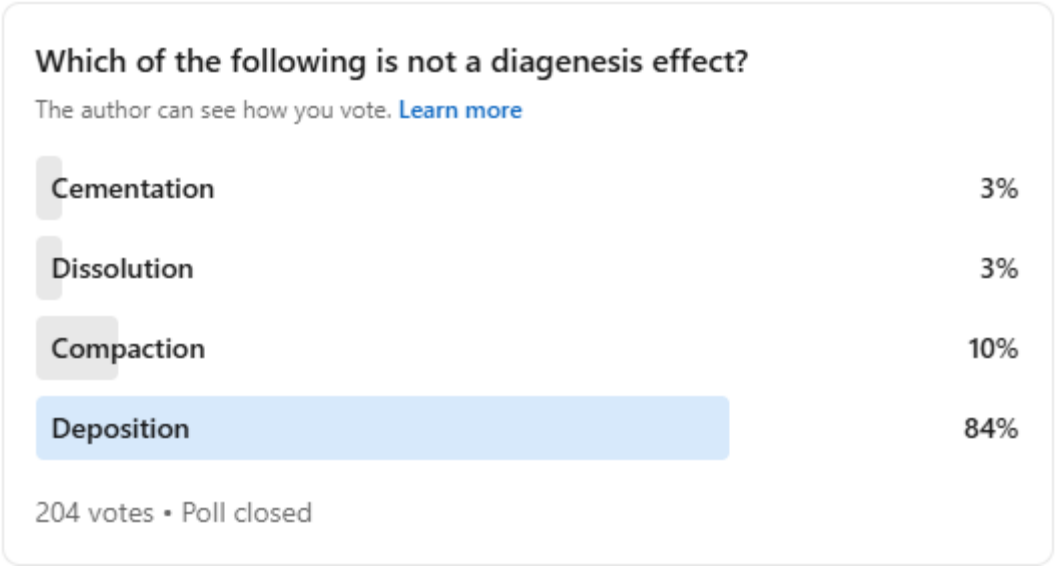
A. Cementation

B. Dissolution

C. Compaction

D. Deposition

ANSWER



EXPLANATION

Deposition refers to the process of sediment accumulation in a depositional environment. It occurs before diagenesis begins and is part of sedimentary rock formation, not a diagenetic process. Diagenesis is post-depositional and modifies the sediment into rock through physical, chemical, and biological processes such as cementation, dissolution, and compaction, which alter the original properties of the sediment.

#PETROQUIZ 076: KEROGEN TYPE

Geochemists define kerogen as the fraction of sedimentary organic constituents of sedimentary rocks that is insoluble in the usual organic solvents. Kerogens are composed of a variety of organic materials, including algae, pollen, wood, vitrinite, and structureless material. The types of kerogens present in a rock largely control the type of hydrocarbons generated in that rock. Refer to the article below to answer today's quiz:

https://lnkd.in/gYBV6KTj

Which type of kerogen is gas prone only and deposited in terrestrial environments?

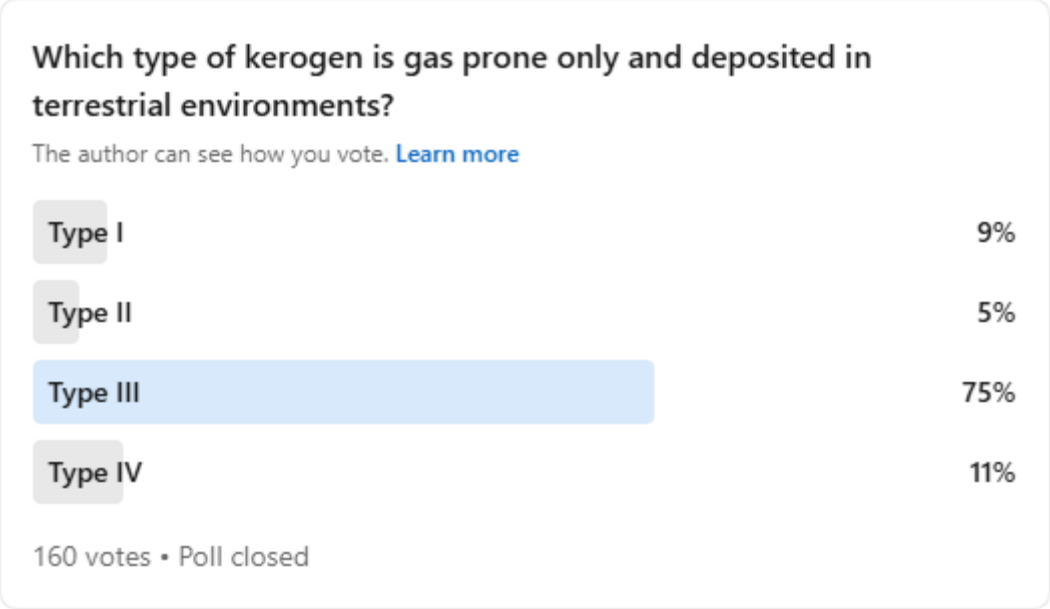
A. Type I

B. Type II

C. Type III

D. Type IV

ANSWER



EXPLANATION

Type III kerogen is the primary contributor to natural gas in terrestrial sedimentary basins. Type III kerogen is derived primarily from terrestrial plant material, such as woody and fibrous organic matter. It is deposited in terrestrial environments, like deltas and floodplains, and is predominantly gas-prone. During thermal maturation, Type III kerogen generates methane and other gaseous hydrocarbons rather than oil.

#PETROQUIZ 077: WELL DEPTH INDEX

In the oil and gas industry, depth in a well is the distance along a well between a point of interest and a reference point or surface. It is the most common method of reference for locations in the well, and therefore, in oil industry speech, "depth" also refers to the location itself. However, multiple depth terms are used for indexing a well. Refer to the article below to answer today's quiz:

https://lnkd.in/gHMkWYJY

Which of the following relations is always correct?

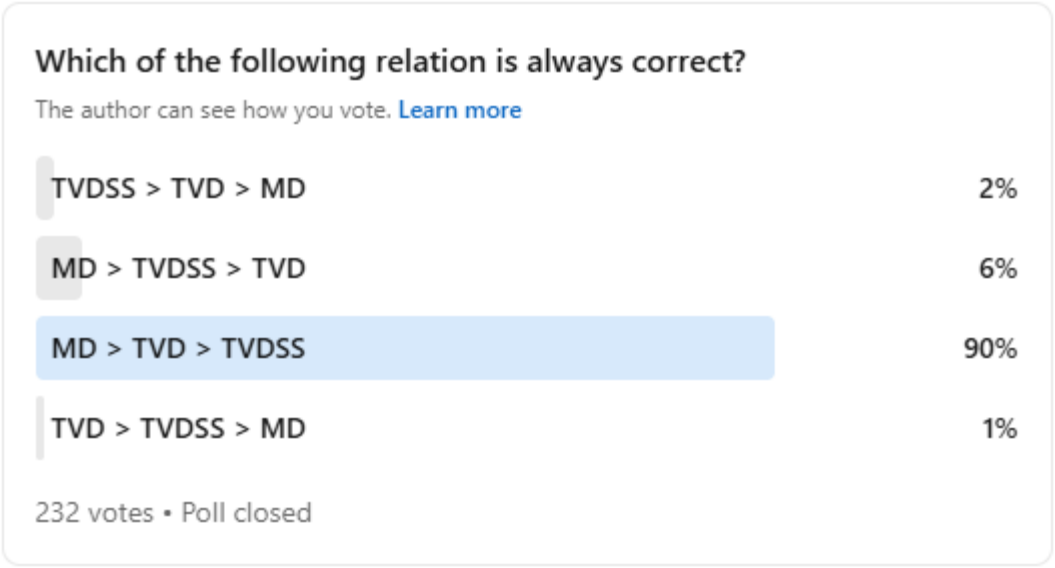
A. TVDSS > TVD > MD

B. MD > TVDSS > TVD

C. MD > TVD > TVDSS

D. TVD > TVDSS > MD

ANSWER



EXPLANATION

The general relationship is **MD > TVD > TVDSS**, based on the following definitions of the depth terms:

- Measured Depth (**MD**): The total length of the wellbore measured along its trajectory. It is always the largest because it accounts for the well's curvature in horizontal or deviated wells.
- True Vertical Depth (**TVD**): The vertical distance from a reference point (e.g., the surface) to a point of interest. It is always less than or equal to MD since it measures in a straight vertical line.
- True Vertical Depth Subsea (**TVDSS**): The TVD adjusted for the elevation of the surface reference point relative to sea level. When the surface elevation is above sea level, TVDSS will be less than TVD.

However, if the elevation is negative (e.g., the ground level is below MSL), **MD** remains the longest measurement, but **TVDSS** can be greater than **TVD**, as it reflects the depth relative to MSL. In this case, the relationship becomes MD > TVDSS > TVD.

In summary, the relationship **MD > TVD > TVDSS** applies in typical scenarios. That said, the absolute values and relationships depend on the reference point, especially in cases where the elevation is below MSL.

#PETROQUIZ 078: RELATIVE PERMEABILITY

To calculate relative permeability, you divide the effective permeability of a specific phase in a porous medium by the absolute permeability of that medium; essentially, it's the ratio of how easily a particular fluid can flow through a porous material compared to how easily a single fluid could flow through the same material. Refer to the article below to answer today's quiz:

https://lnkd.in/gBk3j_bC

What is the unit of relative permeability?

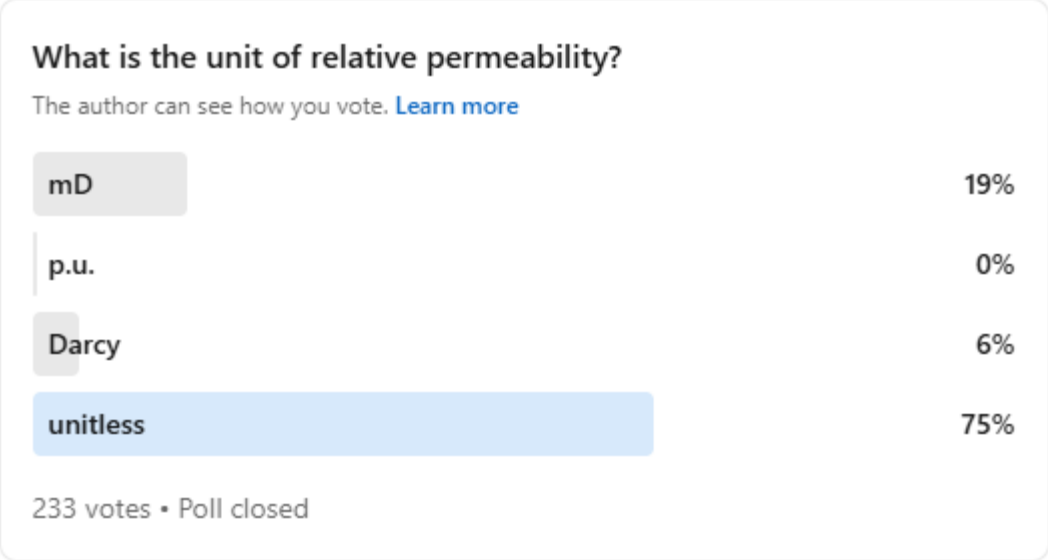
A. mD

B. p.u.

C. Darcy

D. unitless

ANSWER



EXPLANATION

Relative permeability is dimensionless because it is the ratio of the effective permeability of a particular fluid phase to the absolute permeability of the rock or porous medium.

#PETROQUIZ 079: SATURATION DEPENDENCY

"Water saturation" in a reservoir refers to the proportion of the pore space within a rock formation that is filled with water, expressed as a fraction of the total pore volume, and is a key factor in determining the amount of recoverable hydrocarbons within a reservoir; essentially, it tells you how much of the rock is occupied by water compared to oil or gas. Refer to the article below to answer today's quiz:

https://lnkd.in/gg-Xkhii

What property below is not saturation dependent?

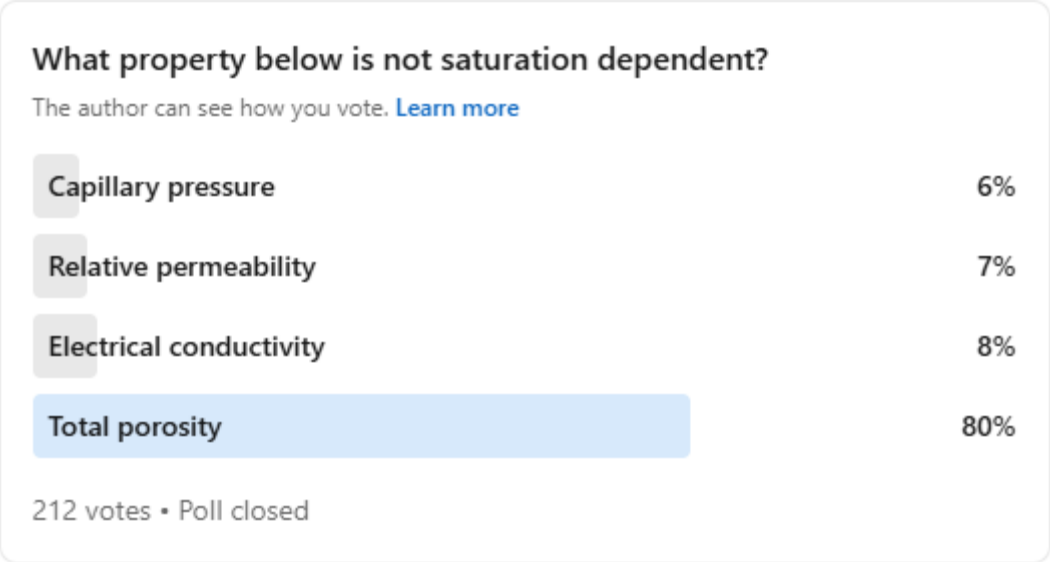
A. Capillary pressure

B. Relative permeability

C. Electrical conductivity

D. Total porosity

ANSWER



EXPLANATION

Total porosity is the measure of the total pore space in a rock, regardless of the type of fluid occupying the pores. It is not directly dependent on the saturation of the reservoir, as it considers both water, oil, and gas within the pore spaces. The total porosity is a fixed property of the rock material and is determined by its structure and composition. The other options are all saturation-dependent.

#PETROQUIZ 080: FORMATION DAMAGE

Formation damage is a condition that impairs the permeability of reservoir rocks, thereby reducing the natural productivity of reservoirs. It is most commonly caused by wellbore fluids used during drilling, completion, and workover operations. Formation damage can negatively impact oil and gas recovery. The damage may be caused by different mechanisms. Refer to the article below to answer today's quiz:

https://lnkd.in/gb5zvnz7

Which of the following is not a commonly seen mechanism of formation damage?

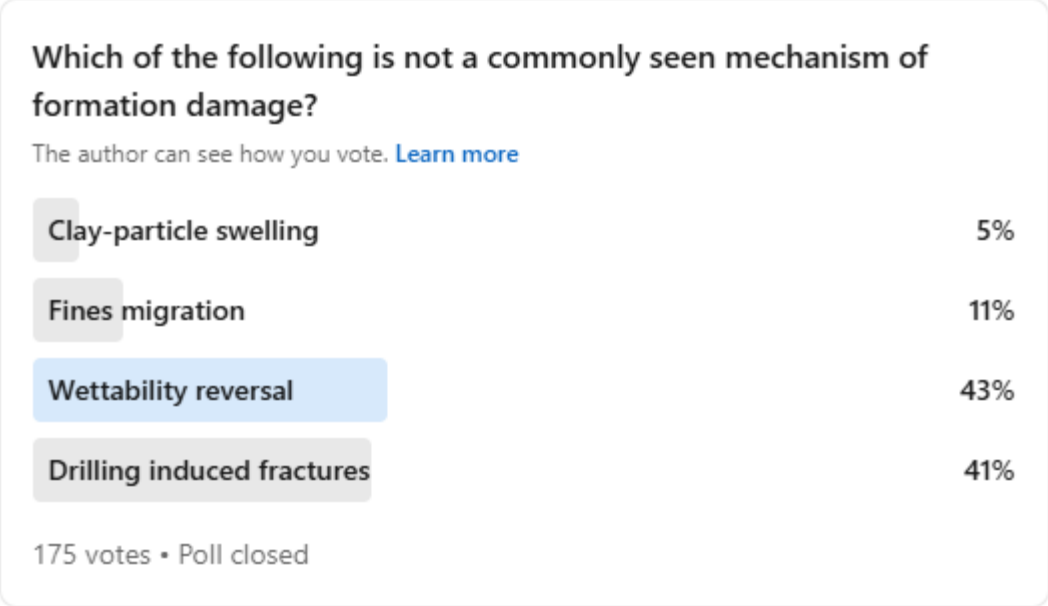
A. Clay-particle swelling

B. Fines migration

C. Wettability reversal

D. Drilling induced fractures

ANSWER



EXPLANATION

Wettability reversal refers to a change in the rock's preference for water or oil to wet its surface, typically caused by chemical treatments, such as acidizing or the introduction of surfactants. While wettability changes can affect flow properties in the reservoir, wettability reversal is generally considered a secondary or more specialized effect, rather than a common mechanism of formation damage in the same way as clay-particle swelling and fines migration.

Drilling induced fractures alter the formation but they are not classified as a typical formation damage in the traditional sense because they are typically considered a result of wellbore stress rather than a damaging process that impairs the natural permeability of the formation.

#PETROQUIZ 081: TRUE STRATIGRAPHIC THICKNESS

True stratigraphic thickness (TST) is the thickness of a stratigraphic unit measured in the direction perpendicular to the bedding planes of the unit. It is a critical measure for understanding both the structural and stratigraphic development of a field. The true stratigraphic thickness calculation needs more information than MD/TVD. Refer to the article below to answer this quiz:

https://lnkd.in/gVMaD5uu

What information do you need to calculate the true stratigraphic thickness?

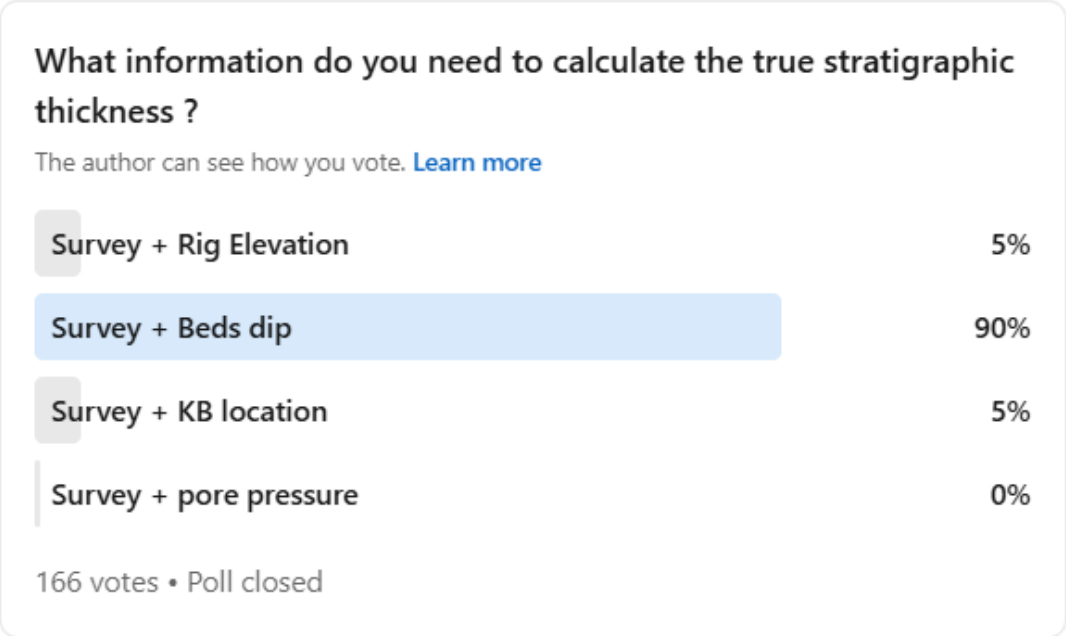
A. Survey + rig elevation

B. Survey + beds dip

C. Survey + KB location

D. Survey + pore pressure

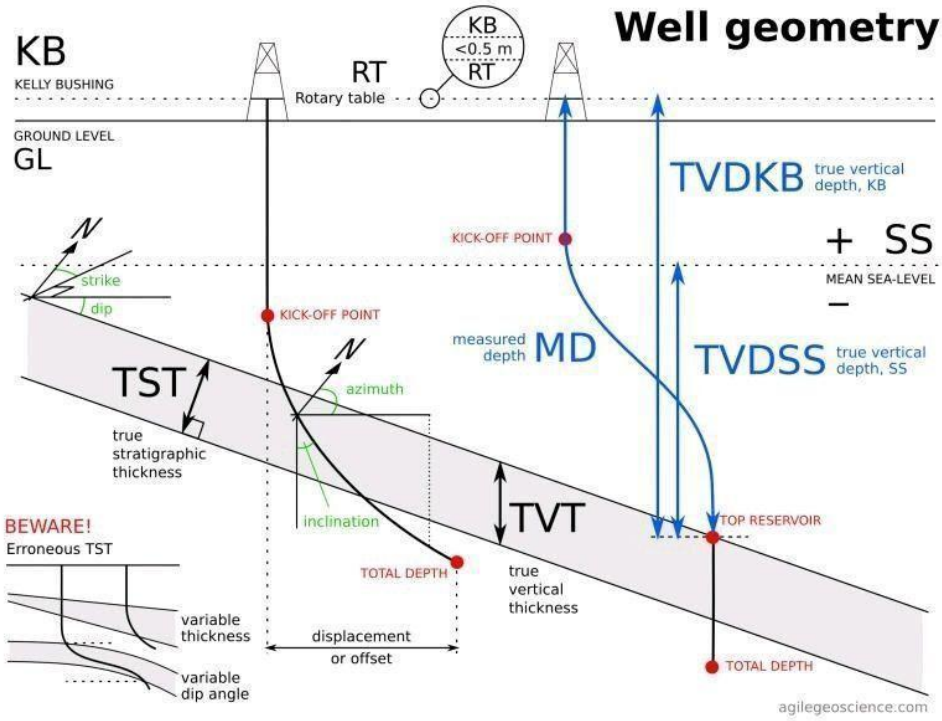
ANSWER



EXPLANATION

We need the beds' dip to calculate TST.

Editor's comment: The following diagram illustrates the differences between TST, TVT, TVDKB, TVDSS, and MD.


Well geometry
KB
KELLY BUSHING
RT
Rotary table
KB
<0.5 m
RT
GROUND LEVEL
GL
TVDKB true vertical depth, KB
+ SS
MEAN SEA-LEVEL
−
KICK-OFF POINT
strike
dip
KICK-OFF POINT
measured depth MD
TVDSS true vertical depth, SS
azimuth
TST
true stratigraphic thickness
inclination
TVT
true vertical thickness
TOP RESERVOIR
TOTAL DEPTH
BEWARE!
Erroneous TST
variable thickness
variable dip angle
displacement or offset
TOTAL DEPTH
agilegeoscience.com

#PETROQUIZ 082: RESERVOIR FLUID CONTACTS

This quiz idea was contributed by Mr. Yuan C. C.

Definitions of fluid contacts are based on comparison to capillary pressure curves. The free water level (FWL) is the highest elevation at which the pressure of the hydrocarbon phase is the same as that of water. The hydrocarbon-water (oil-water or gas-water) contact (HWC) is the lowest elevation at which mobile hydrocarbons occur. The transition zone is the elevation range in which water is coproduced with hydrocarbons. Refer to the article below to answer this quiz:

https://lnkd.in/gbBdk-vR

Which of the following relations is possibly found in a thick oil reservoir?

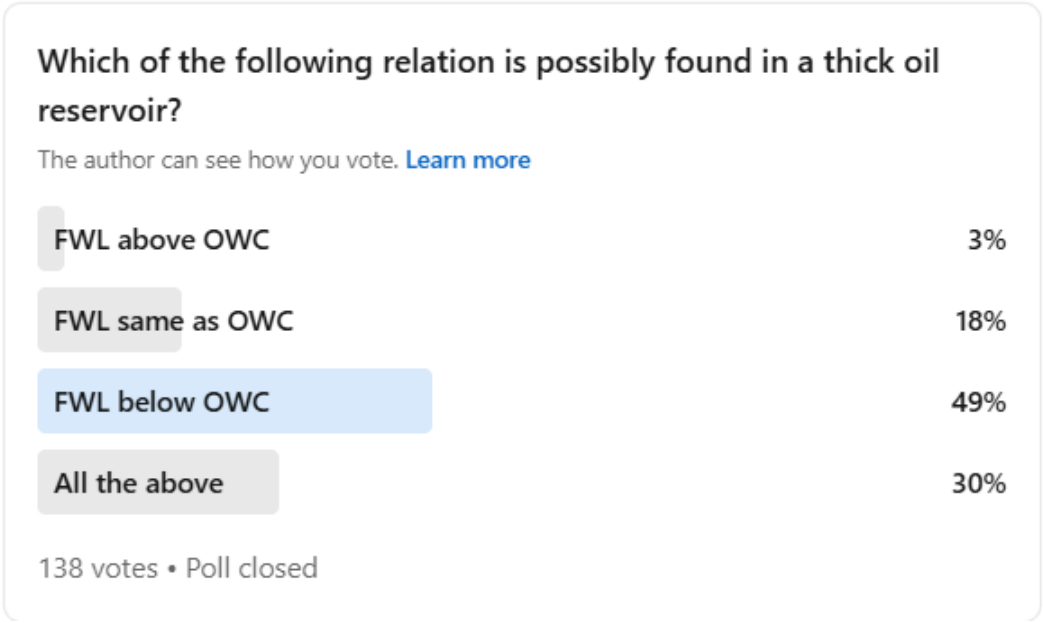
A. FWL above OWC

B. FWL same as OWC

C. FWL below OWC

D. All of the above

ANSWER



EXPLANATION

All are possible. Some are rare.

#PETROQUIZ 083: HYDRAULIC FRACTURE ORIENTATION

Hydraulic fracture orientation is determined by the local stress state. The stresses can be divided into three principal stresses:

- σ1 is the vertical stress
- σ2 is the minimum horizontal stress
- σ3 is the maximum horizontal stress

Refer to the articles below to answer this quiz:

https://lnkd.in/ghHV-45U
https://lnkd.in/g_Z2JqHV

What is the orientation of a hydraulic fracture propagation?
p-stress = principal stress

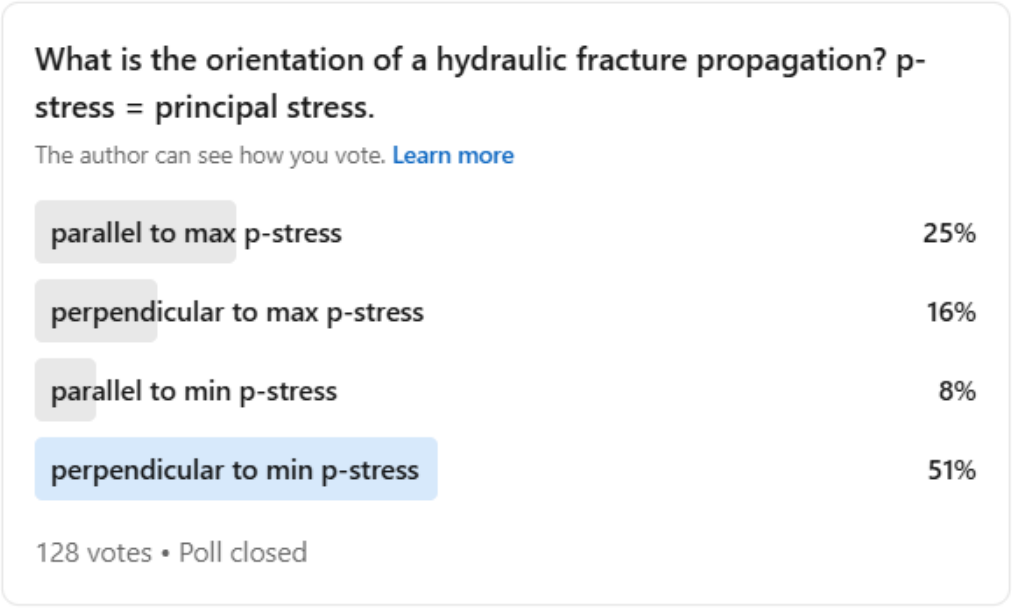
A. Parallel to max p-stress

B. Perpendicular to max p-stress

C. Parallel to min p-stress

D. Perpendicular to min p-stress

ANSWER



EXPLANATION

The best answer is "perpendicular to min p-stress". In some cases, this might be the same as "parallel to max p-stress".

#PETROQUIZ 084: GEOTHERMAL GRADIENT

Geothermal gradient is the rate of change in temperature with respect to increasing depth in Earth's interior. As a general rule, the crust temperature rises with depth due to the heat flow from the much hotter mantle. Geothermal gradient is typically used to estimate the formation temperature for many purposes such as *Rw* calculation. Refer to the article below to answer this quiz:

https://lnkd.in/g8dnj7Bp

In normal continental crust, what is a typical geothermal gradient within the first 3 to 5 kilometers (2 or 3 miles) of Earth's surface?

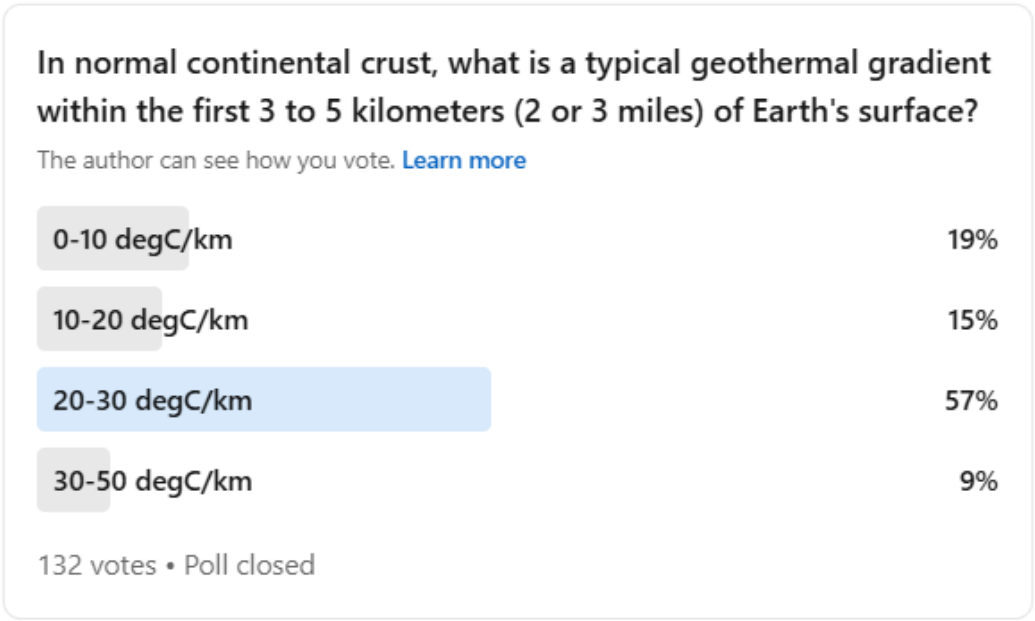
A. 0-10 degC/km

B. 10-20 degC/km

C. 20-30 degC/km

D. 30-50 degC/km

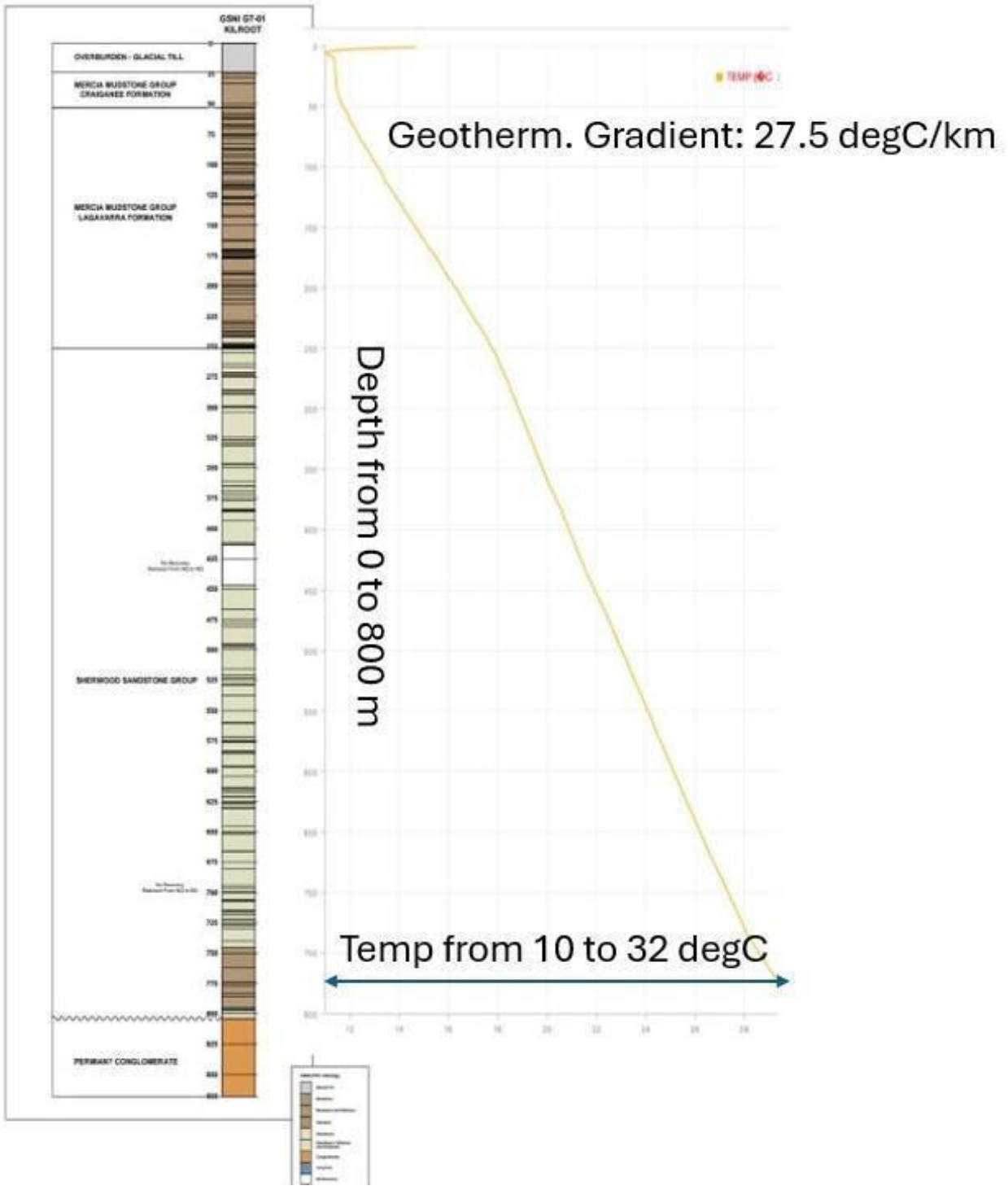
ANSWER



EXPLANATION

20-30 degC/km is the answer.

Check out some nice data for geothermal gradient (27.5degC/km at this location): https://www.linkedin.com/posts/simontodd64_geothermal-borehole-temperature-activity-7290376719905996800-FBz9/


GSNI G7-01
KILROOT
OVERBURDEN - GLACIAL TILL
MERCIA MUDSTONE GROUP
CRAIGAHEE FORMATION
MERCIA MUDSTONE GROUP
LAGAVARRA FORMATION
SHERWOOD SANDSTONE GROUP
PERMIAN CONGLOMERATE
TEMP (°C)
Geotherm. Gradient: 27.5 degC/km
Depth from 0 to 800 m
Temp from 10 to 32 degC

#PETROQUIZ 085: M-N PLOT

Lithology or mineralogy composition can sometimes be determined graphically. Two crossplot techniques are commonly used to identify the occurrence of mineralogies: (1) the M-N crossplot and (2) the MID crossplot. Refer to the article below to answer this quiz:

https://lnkd.in/gSMWh9DZ

Which of the following logs is not used in constructing an M-N plot?

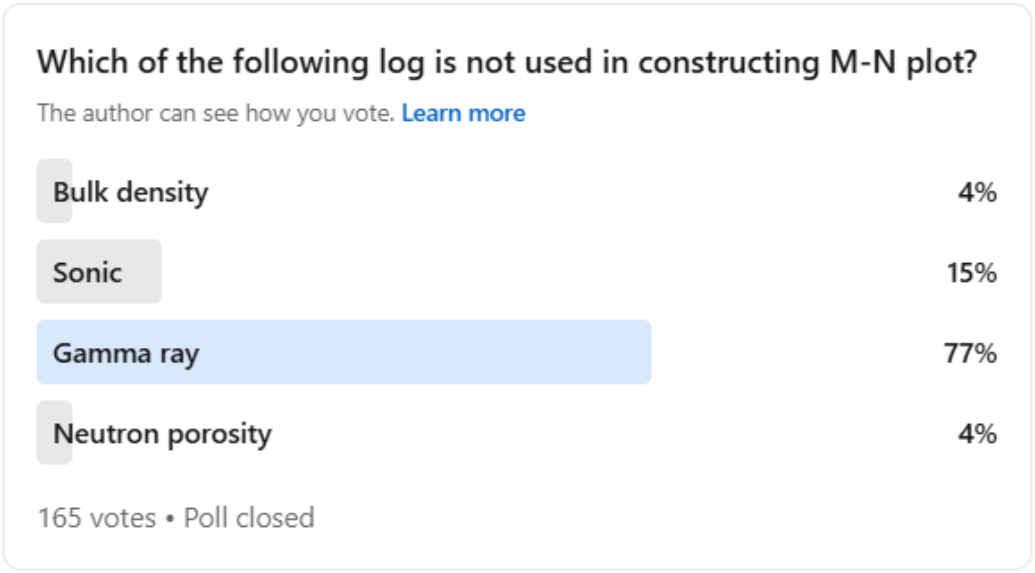
A. Bulk density

B. Sonic

C. Gamma ray

D. Neutron porosity

ANSWER



EXPLANATION

Bulk density (ρ_b), neutron porosity (Φ_N), and sonic slowness (Δt) are used in calculating **M** and **N**. **GR** is not used.

$$M = \frac{\Delta t_{fl} - \Delta t_{log}}{\rho_b - \rho_{fl}} \times 0.01$$

$$N = \frac{\phi_{Nfl} - \phi_{N\,log}}{\rho_b - \rho_{fl}}$$

#PETROQUIZ 086: BOREHOLE IMAGING

The term "borehole imaging" refers to those logging and data-processing methods that are used to produce centimeter-scale images of the borehole wall and the rocks that make it up. Borehole imaging has wide applications and has been one of the most rapidly advancing technologies in wireline well logging. Refer to the article below to answer this quiz:

https://lnkd.in/gkzCaHTx

Which of the following features cannot be seen from borehole imaging?

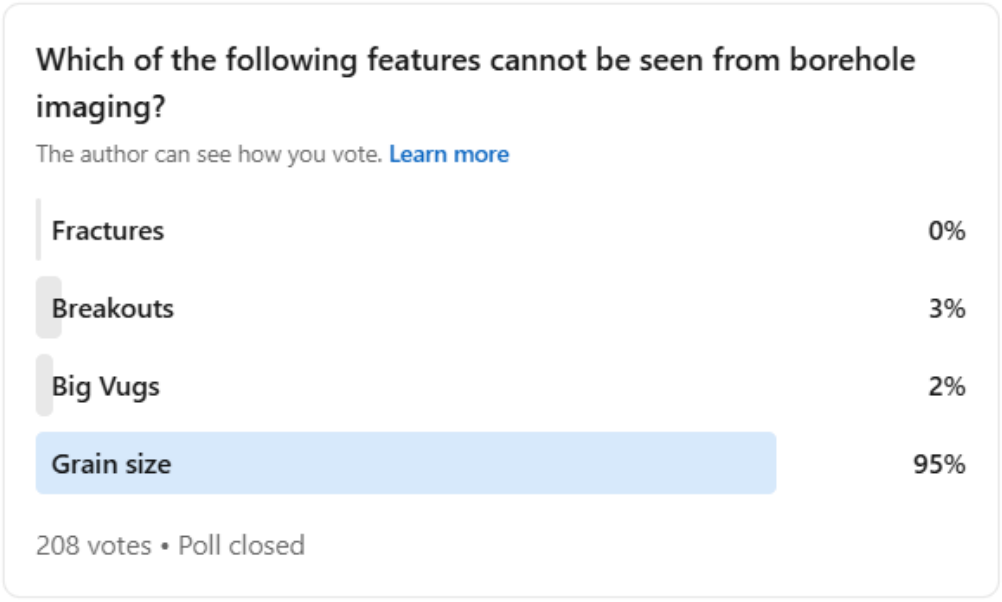
A. Fractures

B. Breakouts

C. Big Vugs

D. Grain size

ANSWER



EXPLANATION

Grain size is not easy to see directly from BHI for most sedimentary rocks unless there are breccias and conglomerates.

#PETROQUIZ 087: UCS FROM LOGS

Uniaxial compressive strength (UCS) is a geotechnical engineering parameter that measures the maximum amount of axial compressive stress a rock can withstand. It's a key factor in determining the mechanical properties and failure characteristics of rocks. Refer to the article below to answer this quiz:

https://lnkd.in/gSgMB5NJ

Which log or reservoir property is not needed for calculating UCS using Coates' model?

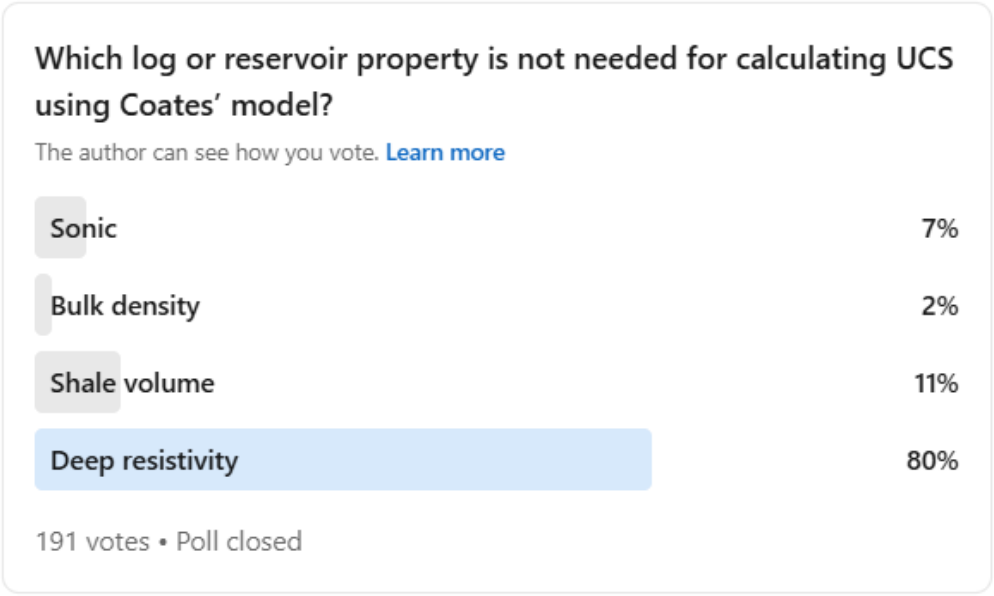
A. Sonic

B. Bulk density

C. Shale volume

D. Deep resistivity

ANSWER



EXPLANATION

Based on the following, sonic ($\mathbf{t_c}$, $\mathbf{t_s}$), bulk density (ρ_b), and shale volume ($\mathbf{V_{sh}}$) are needed. Deep resistivity is not needed.

$$\nu_{\text{poisson}} = \frac{0.5\,(t_s/t_c)^2 - 1}{(t_s/t_c)^2 - 1}$$

$$G_{\text{shear}} = a\,.\,\rho_b/t_s^2$$

$$E_{\text{young}} = 2\,G_{\text{shear}}(1 + \nu_{\text{poisson}})$$

$$K_{\text{bulk}} = a\,.\rho_b\left(\frac{1}{t_c^2} - \frac{4}{3t_s^2}\right)$$

$$SPI \cong G_{\text{shear}}^2\left[(t_s/t_c)^2 - 4/3\right]$$

$$UCS_{\text{coates}} \cong 0.087 \times 10^{-6}\,E\,.\,K\left[0.008\,V_{\text{sh}} + 0.0054\,(1 - V_{\text{sh}})\right]$$

#PETROQUIZ 088: CLAY TYPES

Clay minerals play an important role in reservoir development. They can change the permeability of rocks by swelling and reducing pore space available for flow. They are involved in the formation of kerogen and the migration of crude oil. Understanding clay mineral surface chemistry is critical for controlling reservoir rock wettability. Refer to the article link below to answer this quiz:

https://lnkd.in/gpxcG6vK

Which type of clay has the simplest lattice structure and is also the least detrimental to permeability?

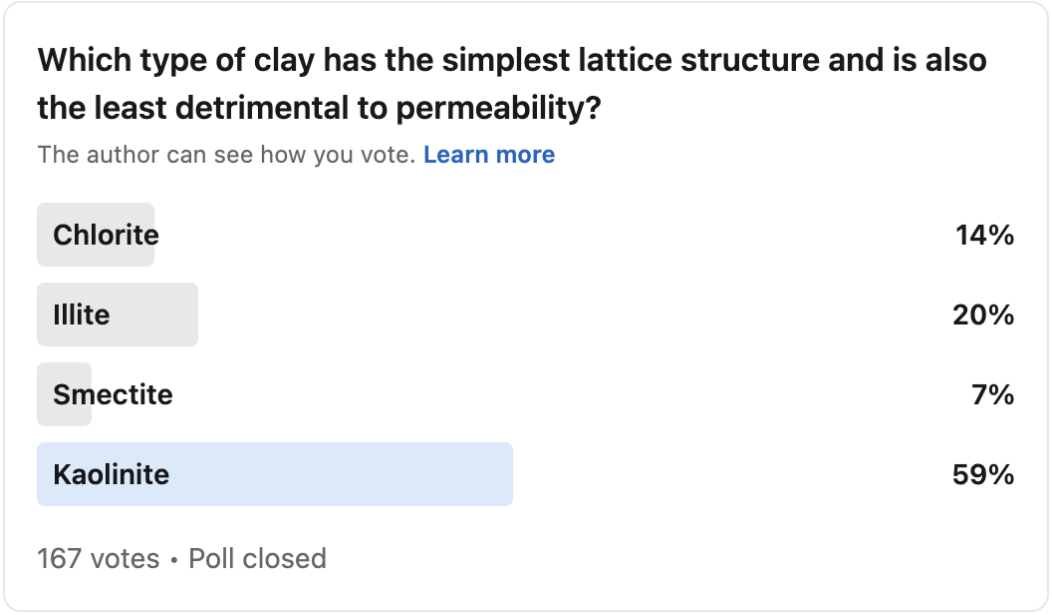
A. Chlorite

B. Illite

C. Smectite

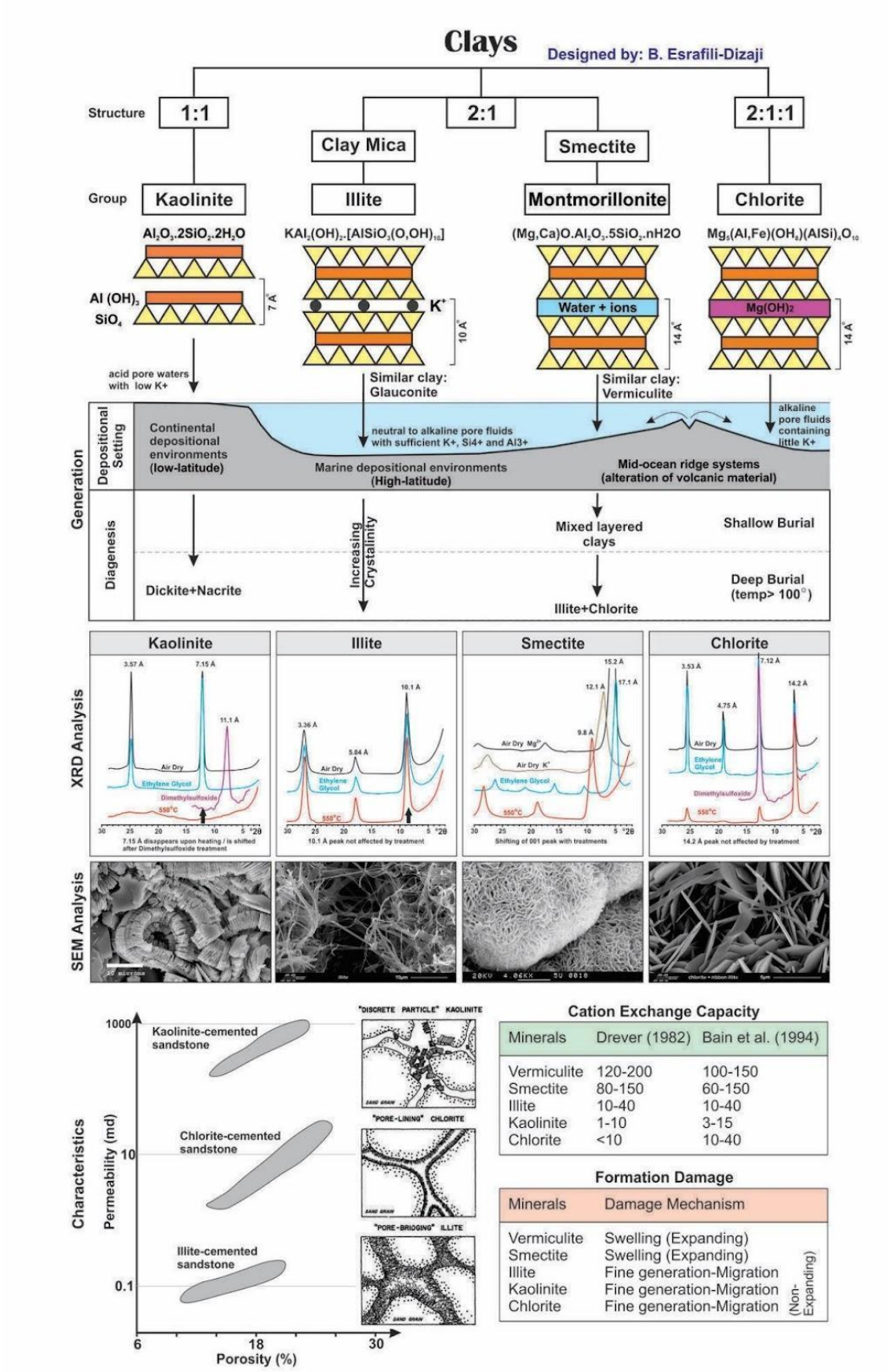
D. Kaolinite

ANSWER



EXPLANATION

Kaolinite. The answer is clear in the following graph:



Cation Exchange Capacity

Minerals	Drever (1982)	Bain et al. (1994)
Vermiculite	120-200	100-150
Smectite	80-150	60-150
Illite	10-40	10-40
Kaolinite	1-10	3-15
Chlorite	<10	10-40

Formation Damage

Minerals	Damage Mechanism
Vermiculite	Swelling (Expanding)
Smectite	Swelling (Expanding)
Illite	Fine generation-Migration
Kaolinite	Fine generation-Migration
Chlorite	Fine generation-Migration

(Non-Expanding)

#PETROQUIZ 089: POLARIZATION HORN EFFECT

The polarization horn effect is a phenomenon that occurs when a logging tool passes through the boundary of two layers with different electrical conductivities. The effect is caused by charge buildup at the boundary between layers. The charge buildup acts like a secondary transmitter, increasing the measured resistivity. The spike in resistivity increases with the contrast between the layers. Refer to the article below to answer this quiz:

https://lnkd.in/g3wnMsNc

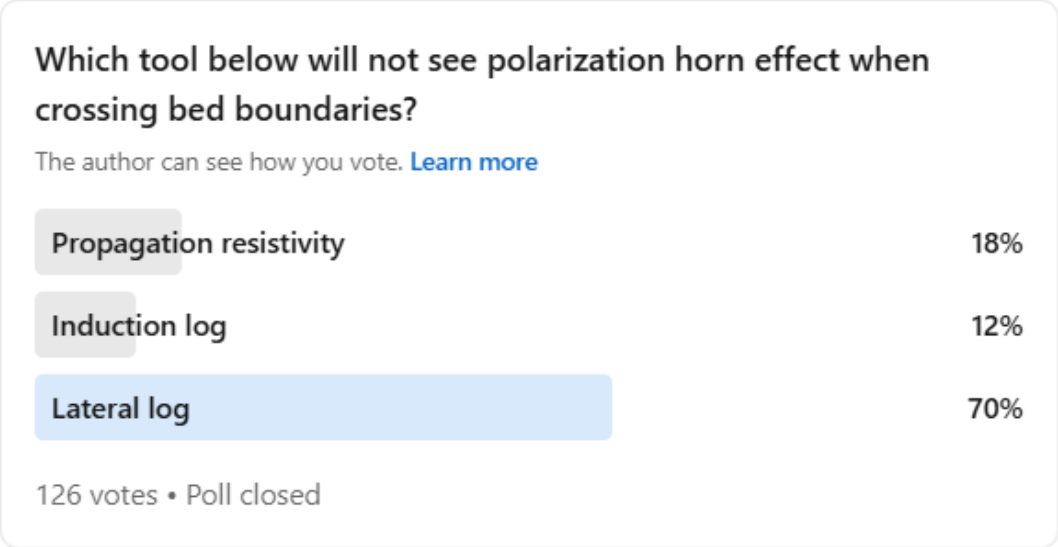
Which tool below will not see a polarization horn effect when crossing bed boundaries?

A. Propagation resistivity

B. Induction log

C. Lateral log

ANSWER



EXPLANATION

Polarization horn is the effect on a *propagation resistivity* or *induction log* of charge buildup at the boundary between two formation layers with different dielectric properties. Lateral log will not see a polarization horn effect.

#PETROQUIZ 090: WETTABILITY TEST

Wettability significantly affects a variety of measurements critical to describing oil reservoirs, from residual saturations to resistivity indices. In spite of the importance attributed to wettability, no standardized technique exists that completely and adequately characterizes the phenomenon. Refer to the article below to answer this quiz:

https://lnkd.in/gh_uDv9E

Which of the following methods is not used for wettability tests in the lab?

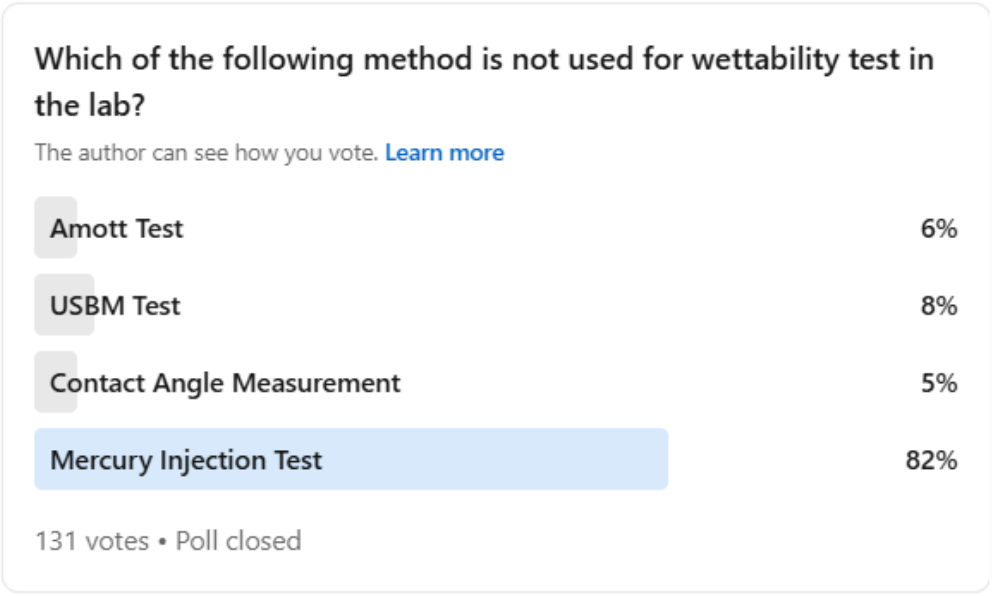
A. Amott test

B. USBM test

C. Contact angle measurement

D. Mercury injection test

ANSWER



EXPLANATION

Amott test, USBM test, and contact angle measurement are all techniques used to determine wettability.

#PETROQUIZ 091: PORE PRESSURE EVALUATION

The field of pore pressure analysis is the study of how pressures within rock pores vary with depth inside the subsurface. In the field of exploration, pore pressure holds particular significance for drilling and discovery purposes. Modern drilling teams often need a subsurface pore pressure map in order to drill safely and efficiently. Anomalous pressures, especially overpressures, can pose a large threat to both life and the drilling prospect. Hazards like well blowouts, pressure kicks, and fluid influx are dangerous risks which can be avoided by studying pore pressure geometries prior to drilling.

Refer to the article below to answer today's quiz:

https://lnkd.in/gwqe__46

Which of the following is not typically used in Eaton's method (logs or seismic) to evaluate pore pressure?

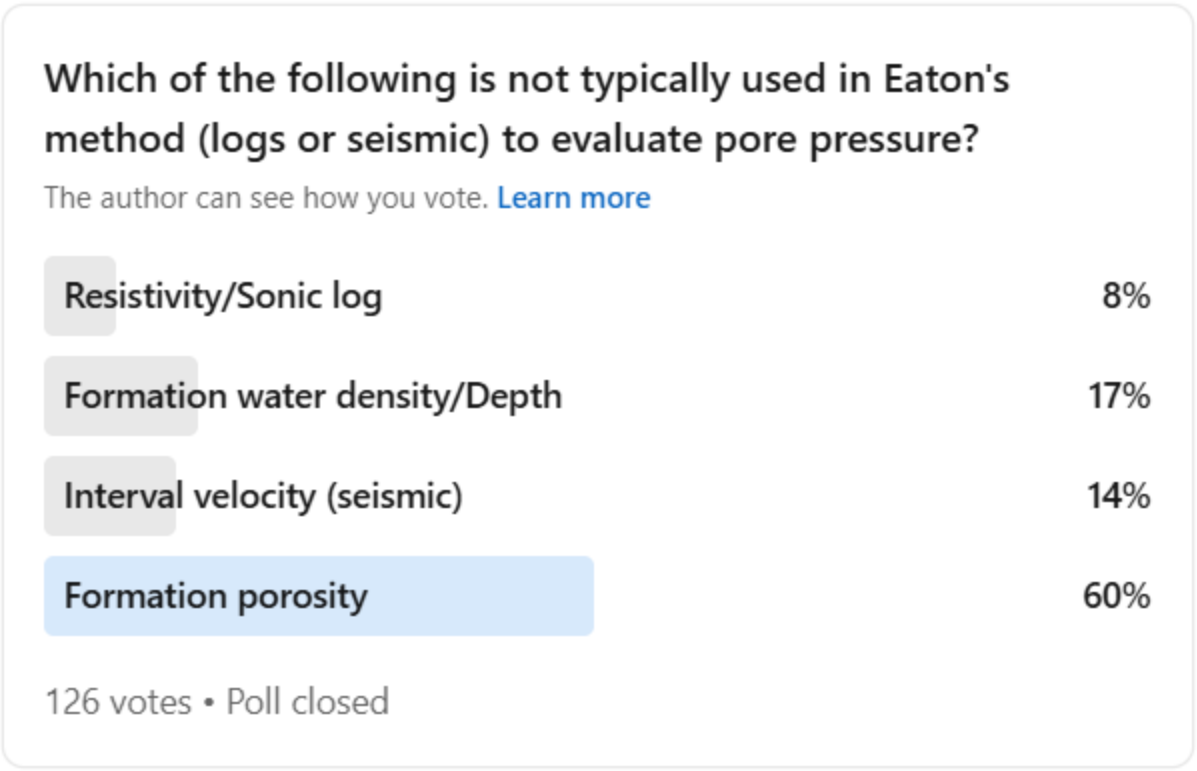
A. Resistivity/Soni Log

B. Formation water density/Depth

C. Interval velocity (seismic)

D. Formation porosity

ANSWER



EXPLANATION

“Formation porosity” is the best answer.

Formation porosity is typically not a primary input in Eaton’s method for pore pressure prediction. Instead, Eaton’s method relies on resistivity logs, sonic logs, and interval velocity (from seismic data) to estimate deviations from the normal compaction trend. While formation water density can play a role in defining the normal pressure gradient, formation porosity is generally not a key parameter in Eaton’s approach.

Methods to determine pore pressure - PetroWiki

#PETROQUIZ 092: FRACTURE GRADIENT ESTIMATION

Fracture gradient is the pressure at which a formation breaks. It's a key parameter in drilling operations and mud weight design.

Refer to the article below to answer today's quiz:

https://lnkd.in/gqsv-KUY

Which rock property below is the most critical for fracture gradient estimation?

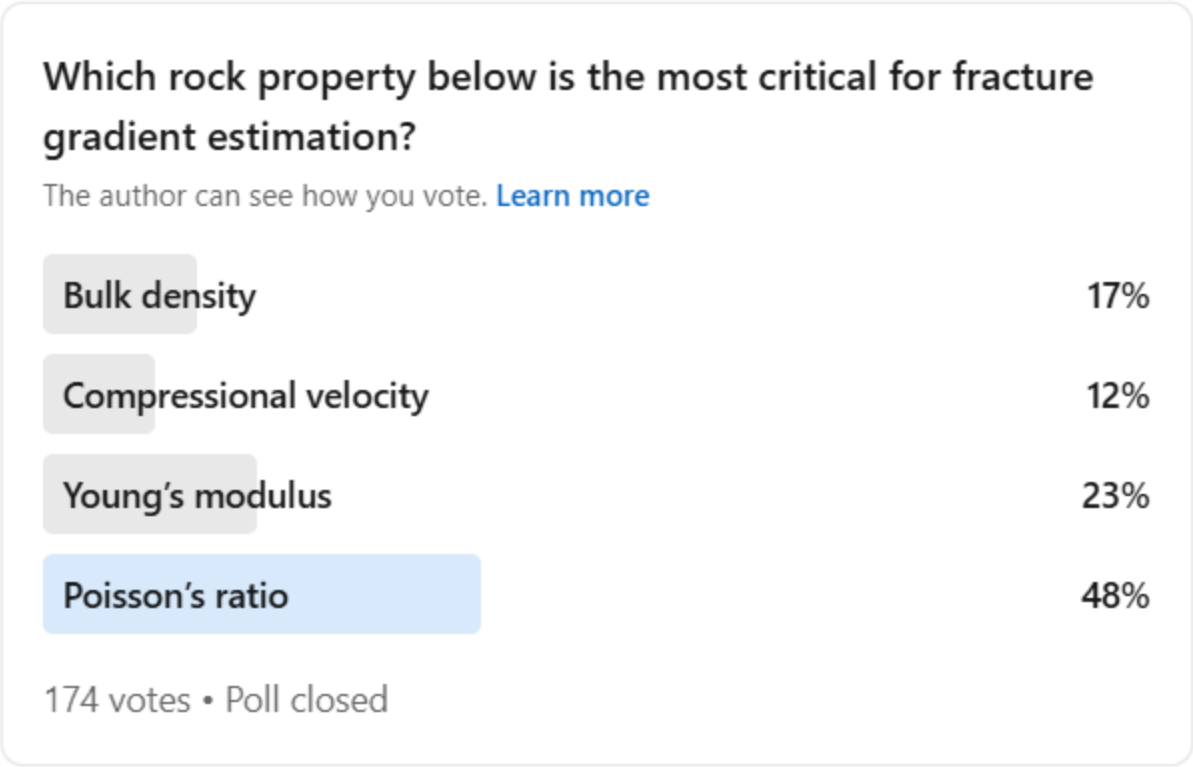
A. Bulk density

B. Compressional velocity

C. Young's modulus

D. Poisson's ratio

ANSWER



EXPLANATION

"Poisson's ratio" is the best answer.

Poisson's ratio measures the ratio of lateral strain to axial strain in a material subjected to uniaxial stress. It reflects the material's ability to deform in directions perpendicular to the applied load. In the context of fracture gradient prediction, Poisson's ratio is integral to understanding how a rock formation will respond to stress conditions during drilling.

While other properties like bulk density and compressional velocity are important in geomechanical analyses, Poisson's ratio directly influences the calculation of fracture gradients, thereby playing a pivotal role in safe and effective drilling operations.

#PETROQUIZ 093: ROUTINE CORE ANALYSIS (RCA)

Routine core analysis (RCA) is a set of measurements normally carried out on core plugs or whole core. RCA is the determination of generally, non-dynamic petrophysical properties that may be performed in a well completion time frame depending on the type and volume of analysis.

Refer to the article below to answer today's quiz:

https://lnkd.in/gPyhbVP7

Which of the following is not considered as part of routine core analysis (RCA) program?

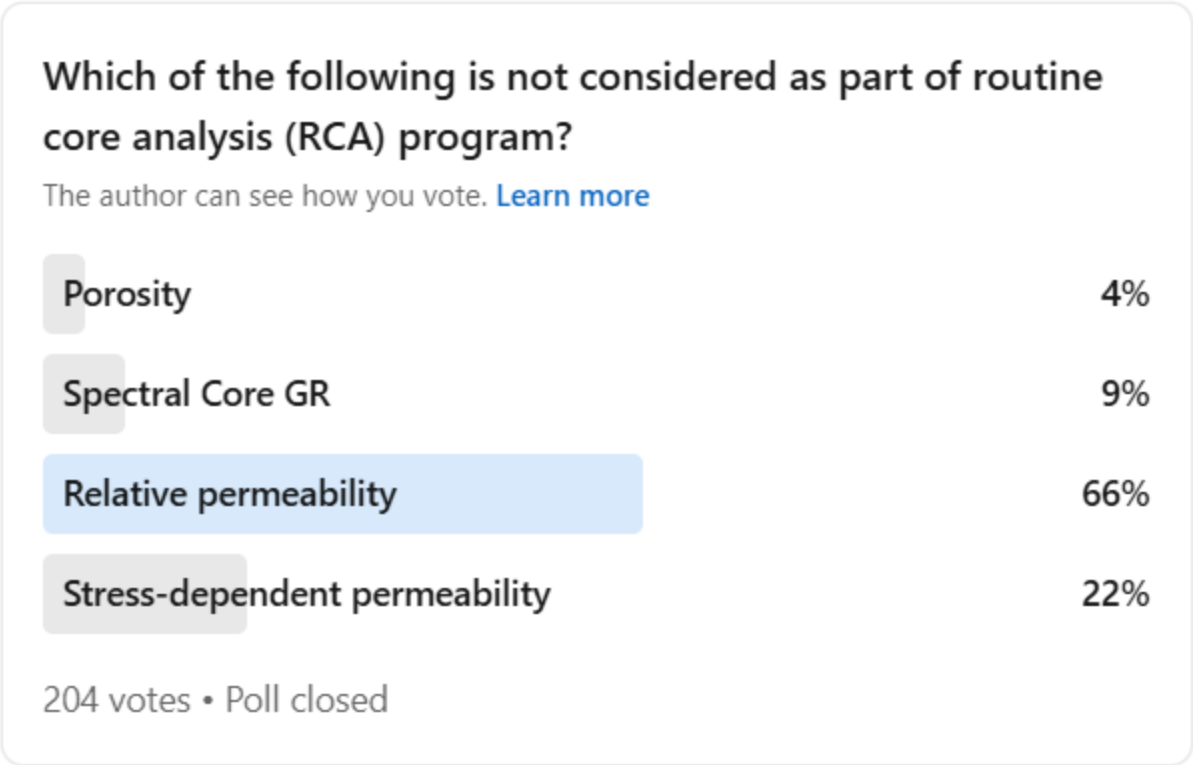
A. Porosity

B. Spectral Core GR

C. Relative permeability

D. Stress-dependent permeability

ANSWER



EXPLANATION

"Relative permeability" is the correct answer.

Routine Core Analysis (RCA) involves the measurement of fundamental rock properties to assess reservoir characteristics. Relative permeability is not part of Routine Core Analysis (RCA) because it is a dynamic measurement that requires fluid flow experiments under reservoir conditions, making it a Special Core Analysis (SCAL) parameter.

#PETROQUIZ 094: REFRAC CANDIDATES

Refracturing a well is an operation to restimulate a well after an initial period of production. It aims to bypass near-wellbore damage, reestablish good connectivity with the reservoir, and tap portions of the reservoir with higher pore pressure1. Refracturing increases reservoir contact, improves production of infill wells, and protects the parent well's future production.

Refer to the article below to answer today's quiz:

https://lnkd.in/gt9BMKWc

Which condition is not necessarily good for making a well a good refracing candidate?

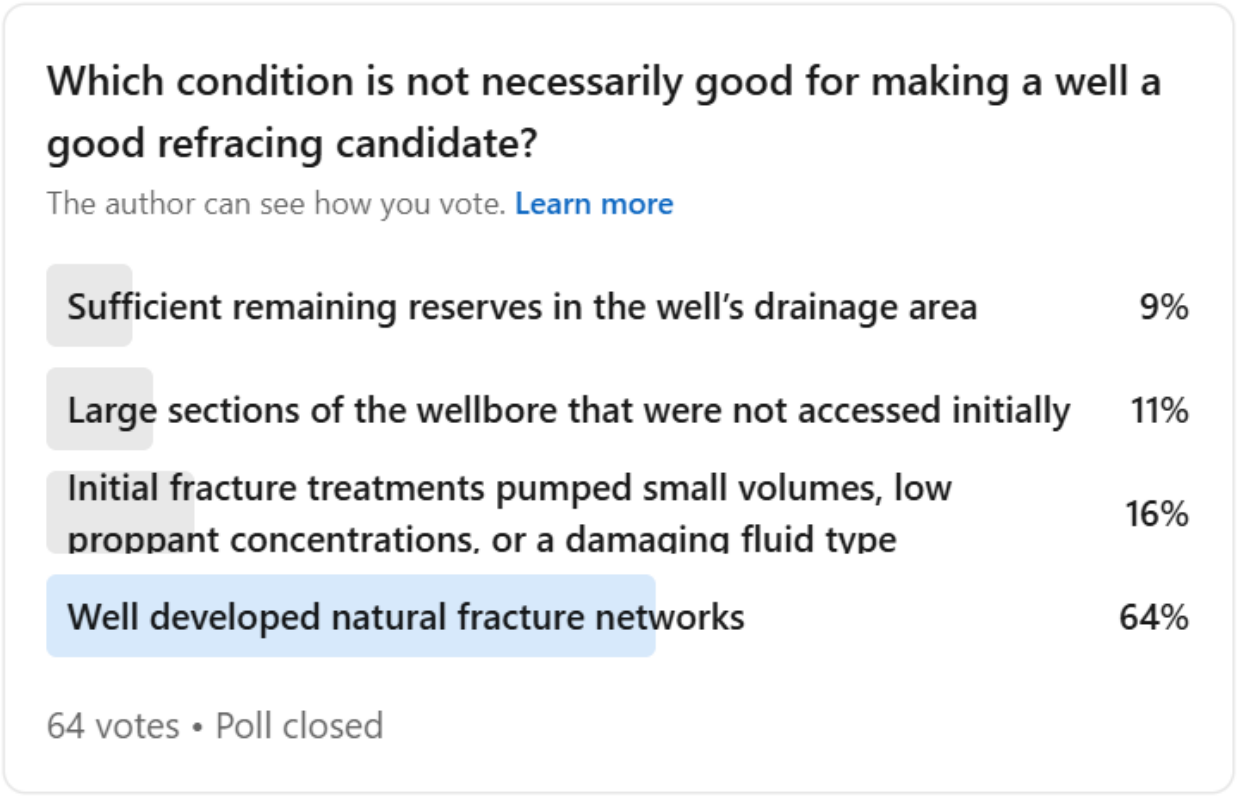
A. Sufficient remaining reserves in the well's drainage area

B. Large sections of the wellbore that were not accessed initially

C. Initial fracture treatments pumped small volumes, low proppant concentrations, or a damaging fluid type

D. Well developed natural fracture networks

ANSWER



EXPLANATION

The correct answer is "Well developed natural fracture networks".

Existing natural fractures can control the fluid flow, causing an uneven distribution of fracturing fluid and proppant. This may lead to inefficient stimulation and minimal enhancement in well performance. Additionally, if the natural fracture network is already well-developed, the reservoir drainage could be sufficient, meaning refracturing might not provide a significant production increase.

#PETROQUIZ 095: LWD AZIMUTHAL DENSITY IMAGE

LWD (Logging While Drilling) azimuthal density image is a tool used in the oil and gas industry to provide real-time measurements of formation density around the borehole while drilling. It uses gamma-ray technology to measure the density of the surrounding rock formations at different azimuthal (directional) angles, creating a detailed image of the borehole wall. This helps geologists and engineers assess formation properties, identify lithology, detect fractures, and evaluate reservoir characteristics. The azimuthal density image is particularly useful for understanding formation heterogeneity and optimizing well placement.

https://lnkd.in/g3JuQ5fg

What geological feature is best identified using LWD azimuthal density images?

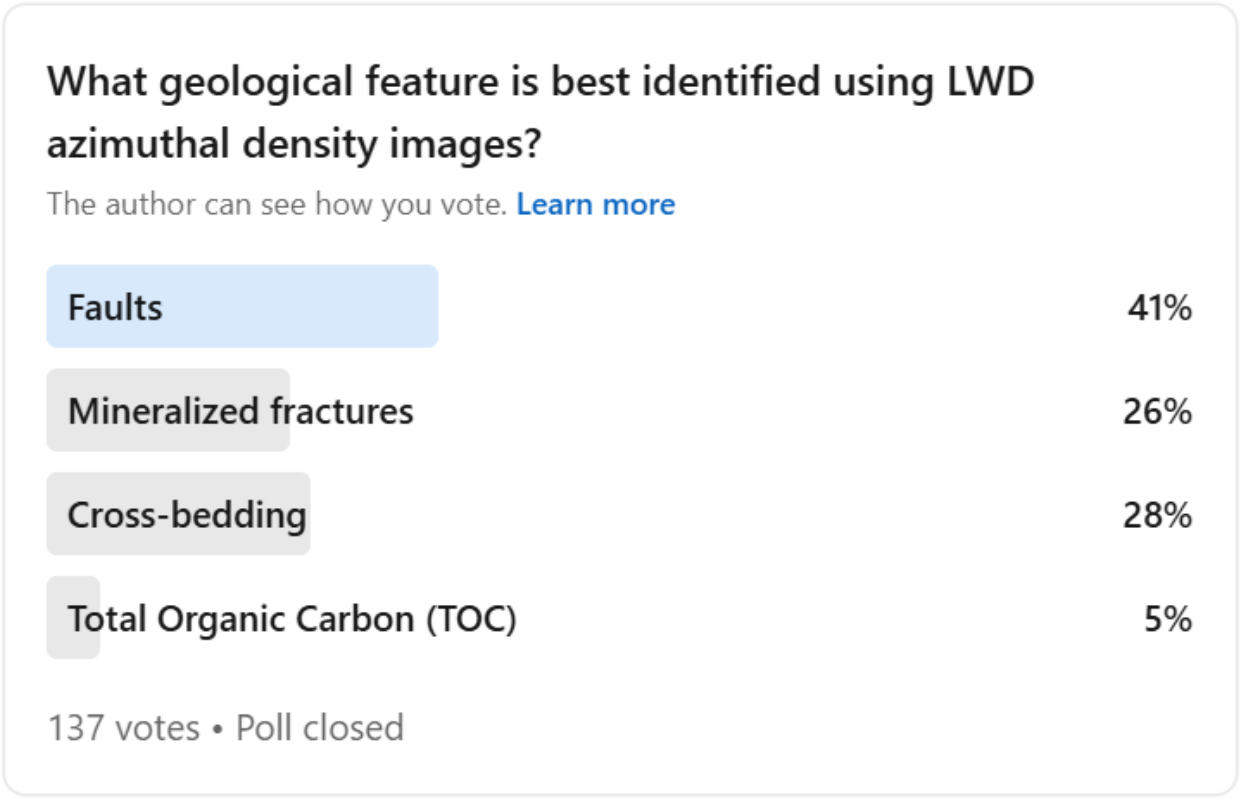
A. Faults

B. Mineralized fractures

C. Cross-bedding

D. Total Organic Carbon (TOC)

ANSWER



EXPLANATION

The best answer is “Cross-bedding”.

Cross-bedding refers to the internal layering within sedimentary rocks that are inclined relative to the main bedding plane. These structures are indicative of depositional environments such as river channels, deltas, and aeolian settings. LWD azimuthal density images capture high-resolution, 360-degree views of the borehole wall, allowing geologists to observe the angular relationships and repetitive patterns characteristic of cross-bedding.

#PETROQUIZ 096: EFFECTIVE MEDIUM THEORY FOR AVERAGING

Effective-medium theory is often used to upscale density & sonic-log data for synthetic seismogram generation. Averaging methods need to be applied to find the anisotropic elastic parameters that characterize seismic-wave propagation at low frequencies in a layered medium.

Refer to the article link below to answer today's quiz:
https://lnkd.in/gSvVmfBf

Which of the following averaging method is typically used to smooth well logs to tie with seismic?

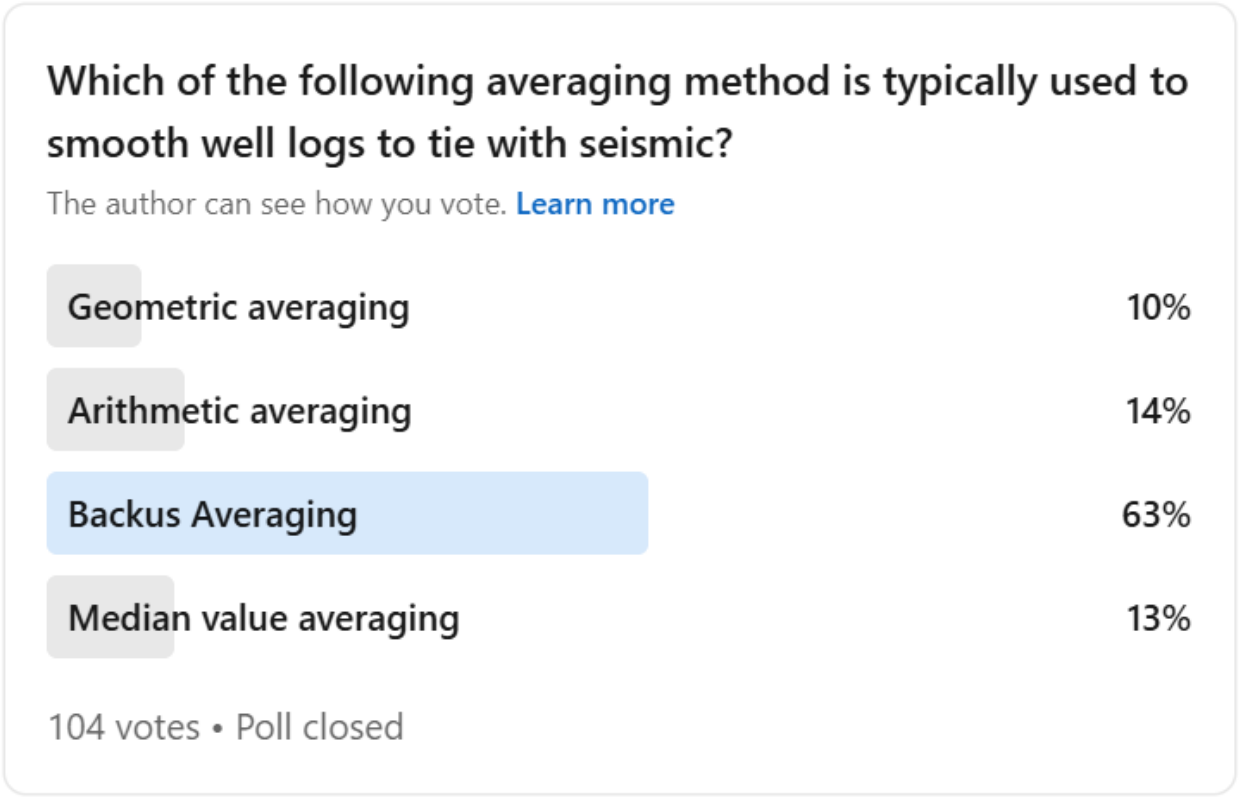
A. Geometric averaging

B. Arithmetic averaging

C. Backus Averaging

D. Median value averaging

ANSWER



EXPLANATION

“Backus Average” is the best answer.

In geophysical applications, particularly when integrating well log data with seismic data, it's essential to upscale high-resolution well logs to match the lower resolution of seismic measurements. This process ensures consistency between the datasets and facilitates accurate seismic interpretation.

Among the averaging methods listed, Backus averaging is specifically designed for this purpose. It provides a means to compute the effective anisotropic elastic properties of a finely layered medium over long wavelengths, which is crucial for generating synthetic seismograms and tying well logs to seismic data.

#PETROQUIZ 097: CEMENTATION BOND LOG

A chevron pattern (also called a "herringbone" or "V-pattern") on a cementation bond log (typically observed in a Variable Density Log (VDL) or ultrasonic imaging tool is often observed.

Refer to the article below to answer today's quiz:

https://lnkd.in/gwFpp2BY

Which condition below is not indicated by a chevron pattern observed on a cementation bond log (VDL)?

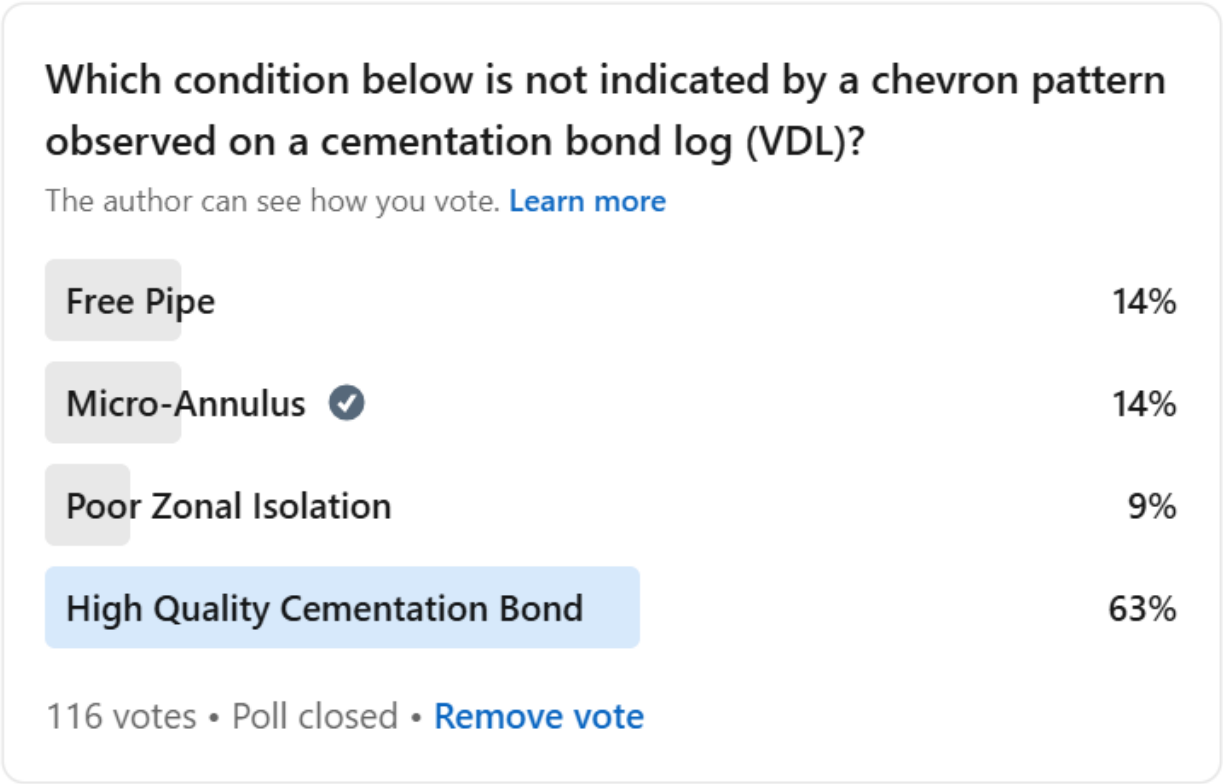
A. Free Pipe

B. Micro-Annulus

C. Poor Zonal Isolation

D. High Quality Cementation Bond

ANSWER



EXPLANATION

“High Quality Cementation Bond” is the best answer.

A high-quality cement bond is characterized by strong attenuation of the acoustic signal, resulting in low amplitude readings and the absence of chevron patterns on the VDL. Instead, the VDL would display more randomized, wavy patterns indicative of good bonding to both the casing and formation.

#PETROQUIZ 098: GEOTHERMAL RESOURCES IN USA

Geothermal reservoirs are naturally occurring areas of hydrothermal resources. These reservoirs are deep underground and are largely undetectable above ground.

Refer to the article link below to answer today's quiz:

https://lnkd.in/gZE_suSr

Which state has the highest geothermal temperature underground in general?

A. Texas

B. Florida

C. California

D. Pennsylvania

ANSWER

Which state has the highest geothermal temperature underground in general?

The author can see how you vote. Learn more

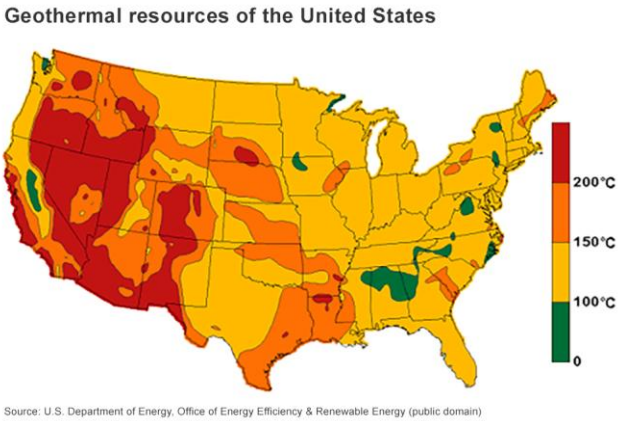
Texas	14%
Florida	4%
California	76%
Pennsylvania	6%

116 votes • Poll closed

EXPLANATION

The best answer is “California”.

Most geothermal resources are found near the Earth's tectonic plate boundaries. In the United States, geothermal power plants are primarily located in the western states and Hawaii, where heat from the Earth's interior is more readily accessible.



#PETROQUIZ 099: CAPROCK TYPES

A caprock sits above a reservoir rock and acts as a barrier, preventing fluids like oil and gas from escaping upwards.

Refer to the article link below to answer today's quiz:

https://lnkd.in/gqZYYh2G

Which rock type below is not good for serving as the caprock in a CCUS project?

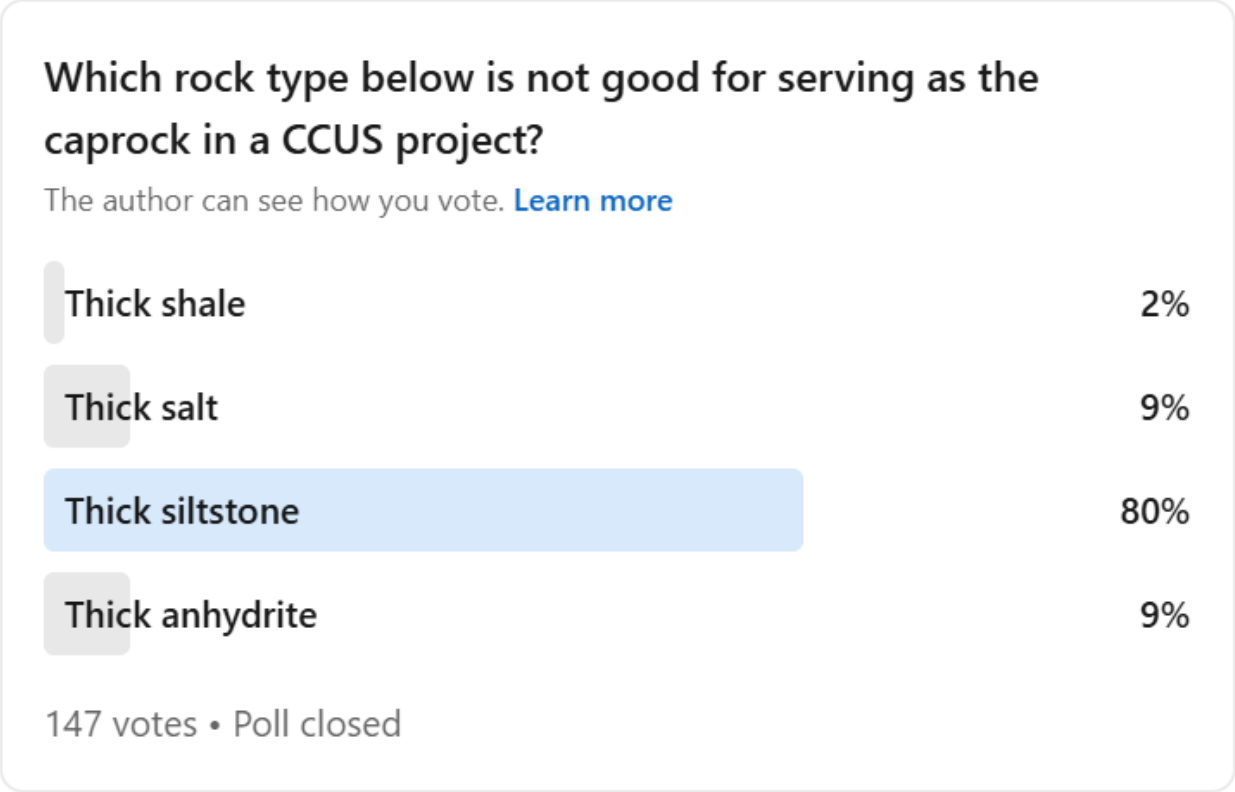
A. Thick shale

B. Thick salt

C. Thick siltstone

D. Thick anhydrite

ANSWER



EXPLANATION

The best answer is "Thick siltstone".

Thick siltstone is not ideal for serving as the caprock in a CCUS project due to its relatively higher permeability, which may not provide the necessary sealing capacity to prevent CO_2 migration.

#PETROQUIZ 100: SUBSURFACE GR RADIATION

Radioactive zones are typically considered as non-reservoir rocks. However, in a clastic reservoir, both mud log and formation testing confirm that a highly radioactive zone is rich in oil. Well testing further proves that this radioactive zone produces light oil at a very high rate.

Refer to the article below to answer today's quiz:

https://lnkd.in/gHBa7g3A

https://lnkd.in/gSMws_Zt

Which of the following is not a plausible explanation for high oil production from a highly radioactive zone in a clastic reservoir?

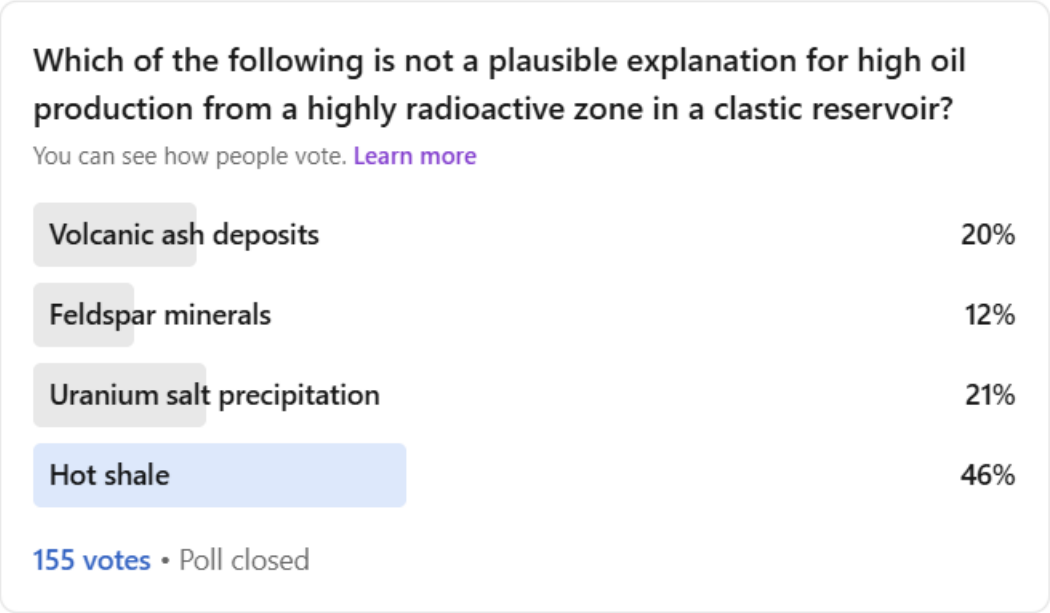
A. Volcanic ash deposits

B. Feldspar minerals

C. Uranium salt precipitation

D. Hot shale

ANSWER



The best answer is “Hot shale”.

EXPLANATION

The best answer is “Hot shale”.

Hot shale, despite being an organic-rich source rock with high gamma-ray (GR) readings, typically does not produce oil at high flow rates unless it is exceptionally fractured. Even then, its permeability is usually quite low, making sustained high-rate production unlikely in a conventional clastic reservoir. On the other hand, Volcanic ash deposits, k-feldspar, and uranium salt all can elevate GR readings without negatively impacting oil production in a clastic reservoir.

#PETROQUIZ 101: CARBON NEGATIVE ENERGY

Carbon negative energy is energy that removes more carbon from the atmosphere than it emits. This is achieved through various natural processes and innovative technologies.

Refer to the article link below to answer today's quiz:

https://lnkd.in/giNsr8cG

Which of the following can generate carbon negative energy?

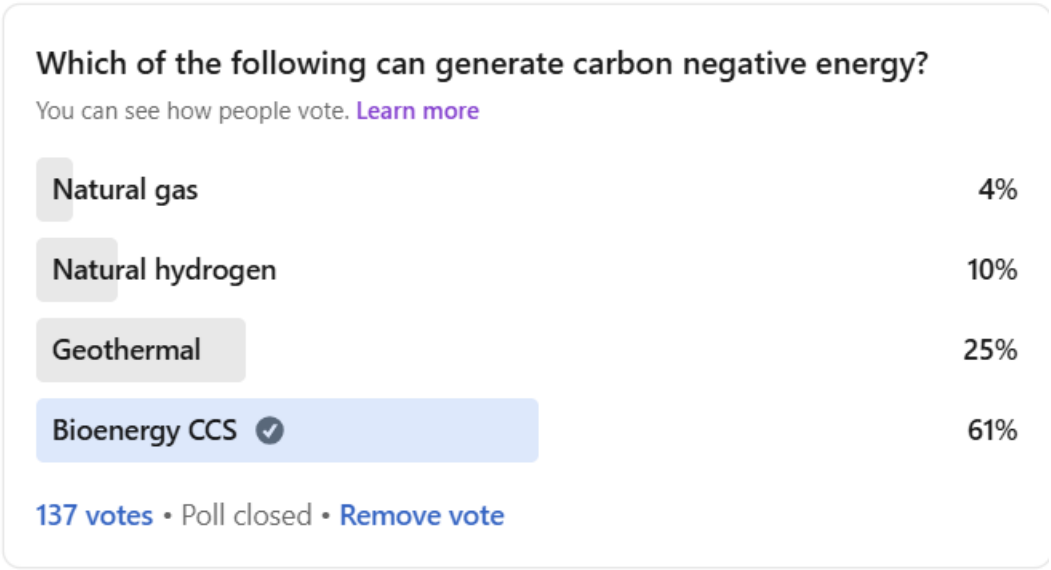
A. Natural gas

B. Natural hydrogen

C. Geothermal

D. Bioenergy CCS

ANSWER



The best answer is “Bioenergy CCS”.

EXPLANATION

The best answer is “Bioenergy CCS”.

According to the linked article, Bioenergy with Carbon Capture and Storage (BECCS) is the only option among the choices that can generate carbon negative energy.