

SUBSURFACE ALLIANCE

DATA DRIVEN | SCIENCE BASED | FIT-FOR-PURPOSE

We are a network of subsurface specialists using a Team-of-Teams approach to efficiently solve problems that have a direct business impact in today's fast-paced and evolving energy industry.



OUR SERVICES

We offer comprehensive subsurface services to help mitigate risks at every stage of a project. We use state-of-the-art geoscience and engineering tools together with specialized workflows to deliver world-class models and superior consulting and training services.

We don't merely look at the problem from a single angle. Our team evaluates each project from a multidisciplinary perspective to identify key drivers and propose the right course of action. By honoring data, we improve the reliability of our predictions while constraining uncertainty.



*We strive to provide
high quality
subsurface solutions
for the energy industry
by bridging the gap
between geoscience
and engineering*

GEOSCIENCE

Integrated multiscale characterization and modeling of reservoir architecture and distributed properties

GEOMECHANICS

Physics based modeling of subsurface forces to quantify the stress-strain behavior of geological materials

PETROPHYSICS

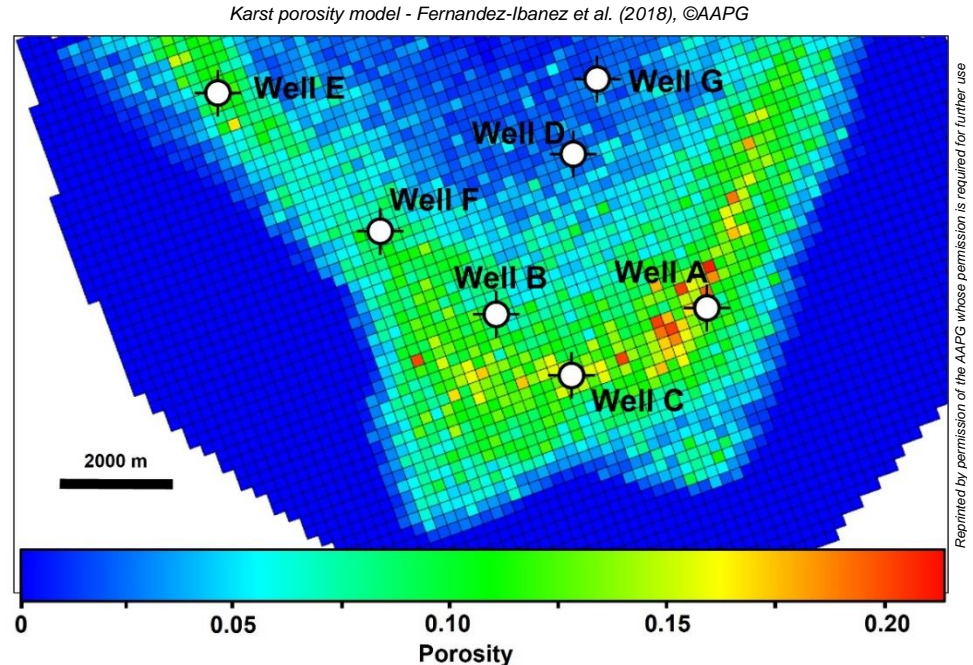
Pore typing, porosity, permeability and fluid composition from wells

RESERVOIR SIMULATION

Fluid flow simulation leveraging geological and geomechanical models to reduce uncertainty during field development and production

GEOSCIENCE

- ✓ Core Description
- ✓ Image Log Interpretation
- ✓ Integration of Core and Image Logs
- ✓ Cap Rock Integrity
- ✓ Fault Seal and Connectivity
- ✓ Fractures and Karst
- ✓ Analogs
- ✓ Petrophysics
- ✓ Rock Typing
- ✓ Geocellular Models
- ✓ DFN Models
- ✓ Well Test Integration
- ✓ Field Trips and Training



We use a process-based approach to develop geologic concepts. We integrate core, wireline, drilling, well tests, and production data to characterize and model permeability architecture in complex reservoirs

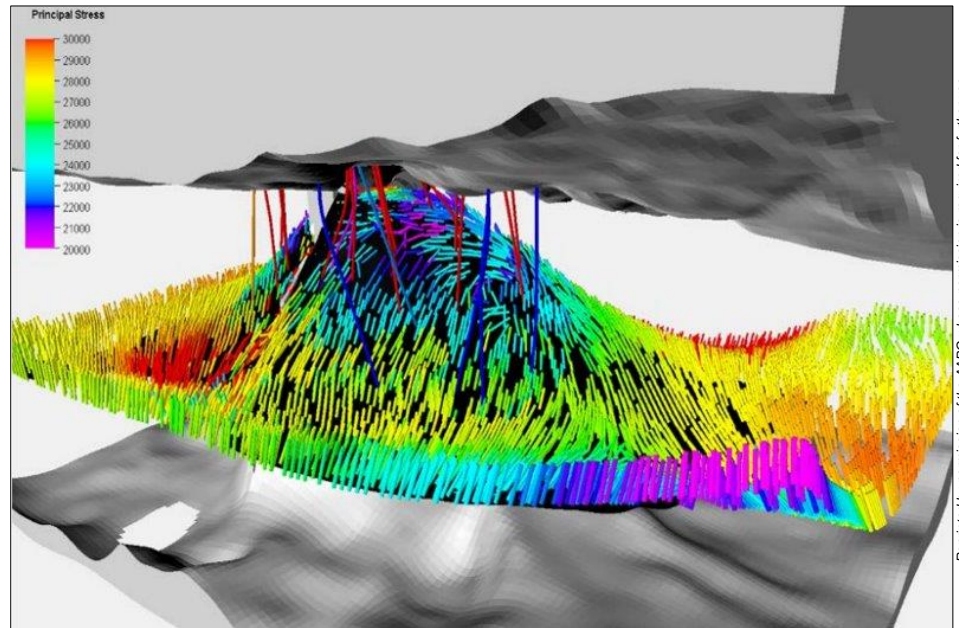
We specialize in characterization and modeling of complex reservoirs with dual porosity and permeability extremes. Our models help manage the risk associated to early breakthrough of undesired fluids and optimize field development programs.

All around the world, our solutions have saved millions of dollars by helping clients avoid over-investing in early drilling, under-investing in production facilities and maximizing the value of information.



GEOMECHANICS

- ✓ Pore Pressure & Fracture Gradient
- ✓ Wellbore Stability
- ✓ Solids Production Prediction
- ✓ Reservoir Compaction
- ✓ Fault Stability
- ✓ Subsidence
- ✓ Laboratory Tests Design & Interpretation
- ✓ Natural Fractures Connectivity
- ✓ Mechanical Skin Assessment
- ✓ Well Integrity Analysis

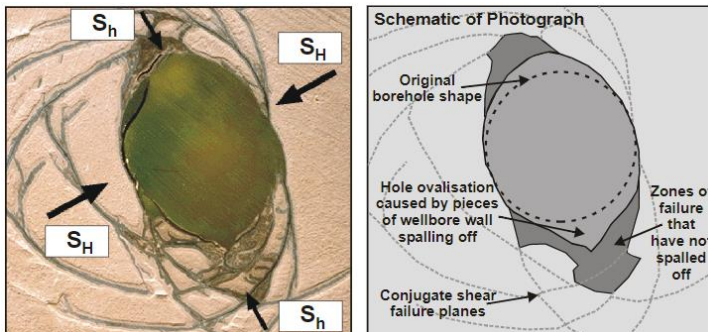


3D stress model around a salt dome - Alcalde & Araujo (2017) ©AAPG

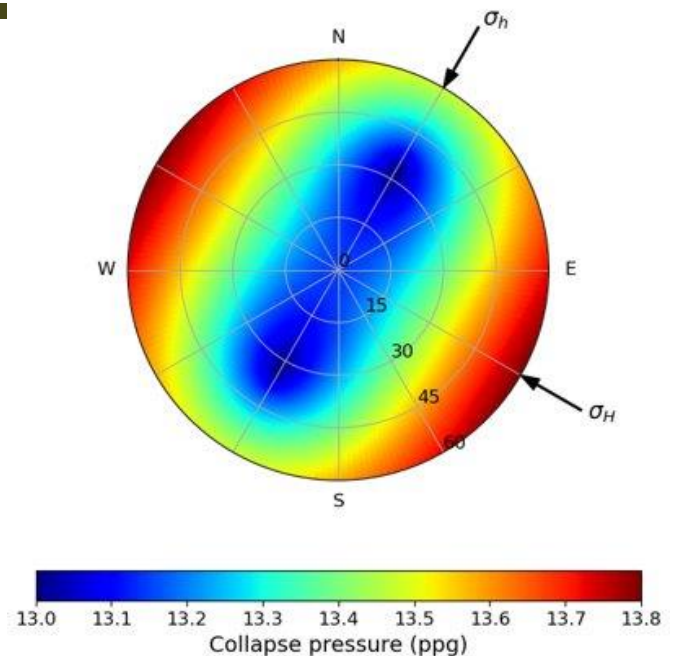
Our approach is robust and effective: we honor the data, select the best constitutive models, and apply scientific workflows to maximize the reliability of our rock mechanics predictions

By applying state-of-the-art numerical methods and workflows we can tackle geomechanics-related issues at any scale, from well-centered to full-field models.

With a second to none track record, our solutions have added millions of dollars to the value chain of subsurface projects, from exploration to appraisal, drilling and completions, development, and abandonment.

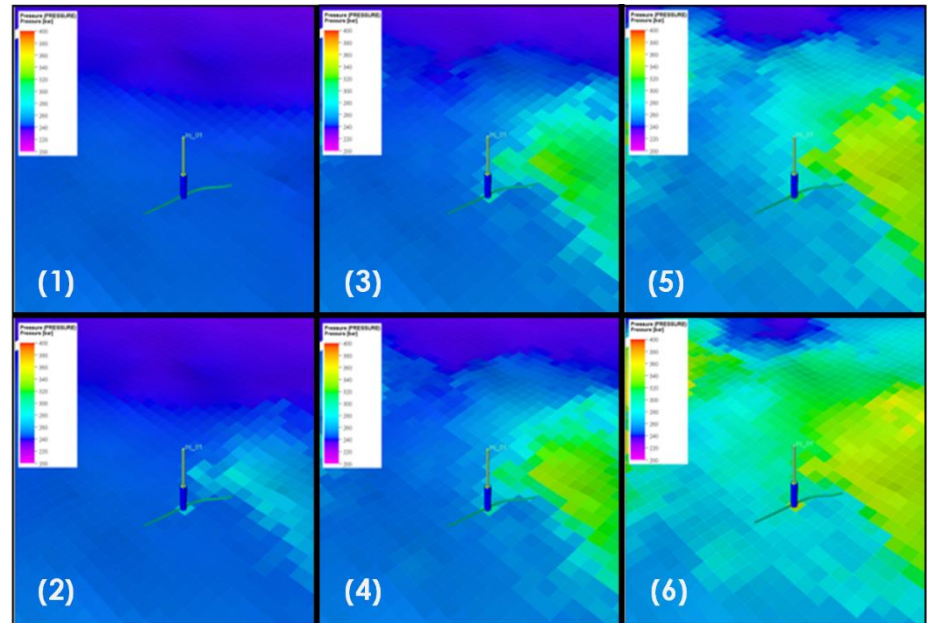


(After Reinecker et al., 2003)



RESERVOIR ENGINEERING

- ✓ Black Oil/Compositional
- ✓ Dual Porosity
- ✓ Coupled Geomechanics
- ✓ Rock-Fluid Interactions
- ✓ Thermal / Chemical EOR
- ✓ CCUS and Geothermal
- ✓ Hydraulic Fracturing
- ✓ Flexibility and Integration
- ✓ Uncertainty Analysis
- ✓ Optimization Workflows
- ✓ Streamlines
- ✓ Exploration-to-Production Simulation
- ✓ Experience with Main 3D Numerical Simulators



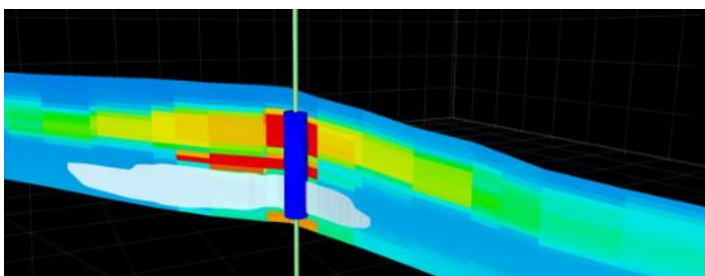
Pressure distribution over time in a fractured water injection well - Fischer et al. (2017) SPE-185590

We use state-of-the-art fully integrated black-oil/compositional, geomechanics and hydraulic fracturing reservoir simulators to assess plausible scenarios that can result in project under-performance

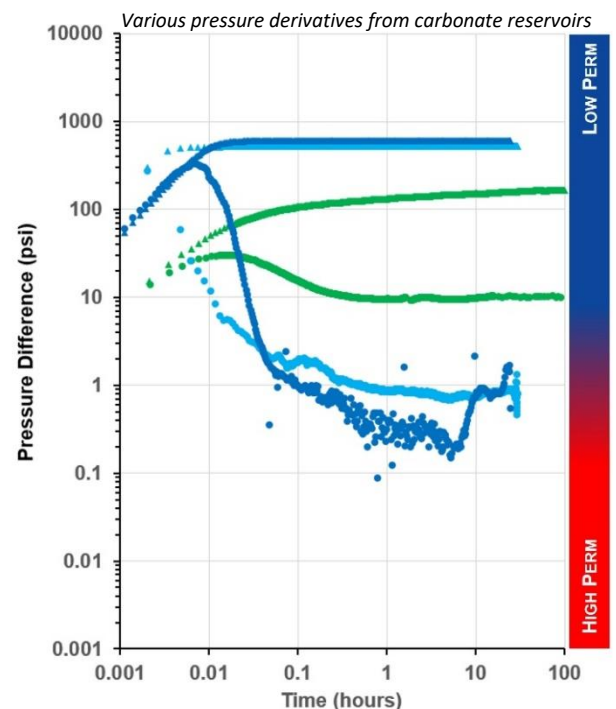
We manage the most relevant physics required for conventional and unconventional reservoirs, while maintaining flexibility and enabling fast decision making.

We leverage on the newest computer programming technologies and open-source resources to create dynamic solutions with short innovation cycles.

We can use output flow streams to develop deterministic and probabilistic economic analyses for energy projects under different tax regimes.



Pressure profile in a polymer-fractured well - Fischer et al. (2017) SPE-185590



GLOBAL EXPERIENCE



We have 100+ years of combined experience in different basins and plays around the world: from conventional reservoirs to unconventional, CCS or geothermal; carbonates, clastics or fractured reservoirs.

Our experts bring a broad range of international experience working a variety of world-class projects for major independent operators, always bridging the gap between geoscience and engineering.

OUR PARTNERS AND COLLABORATORS

Together with our partners and collaborators we have adopted a Team-of-Teams model to promote effective communications, set higher performance standards and deliver superior customer-oriented products.



OUR PEOPLE



Ewerton Araujo, PhD - Geomechanics specialist with 20 years in the oil and gas industry. Ewerton started as an R&D engineer before joining GeoMechanics International, where he worked on projects in the Americas, Middle East, and Africa. After that, he joined Equinor as the SME for geomechanics of USA and Canada assets, and following that, was hired by BHP to implement and develop the geomechanics discipline in the Petroleum business. His expertise covers all geomechanics-related aspects of wells planning, drilling, completions, operation, and abandonment, in addition to reservoir geomechanics during exploration, appraisal, and production

Jorge Pastor, PhD - Geomechanics specialist with 25+ years of experience in the oil and gas industry. Jorge started his career as R&D engineer developing geomechanical simulators for Petrobras. In 2004, he joined Schlumberger where he was directly involved in 1D and 3D projects for Brazil, Mexico, Colombia, and USA. Later, he joined BHP in Houston where he led the development of coupled 3D projects for multiple Gulf of Mexico fields. He used these models for wellbore stability, sanding, compaction/subsidence, cap/casing integrity and fault reactivation analyses. His expertise also includes design, interpretation, and QC of laboratory rock mechanics tests as well as software development.



Eduardo Viro - Petrophysicist with 40+ years of oil & gas industry experience working for Schlumberger where he achieved the Principal Petrophysicist role. Proficient in developing petrophysical models for reservoir characterization. Experienced in integrating routine and special core analyses with capillary data to describe pore geometries, develop saturation height models, validate and forecast water saturation. Passionate about mentoring and training. Schlumberger's NEXT instructor with extensive hands-on/personalized training for NOCs (e.g., Ecopetrol, PDVSA or PEMEX). Worked both carbonate and clastic reservoirs all around the world (e.g. Angola, Argentina, Bolivia, Brazil, México or Saudi Arabia).

Fermin Fernandez-Ibañez, PhD - Geoscientist with 15+ years of experience in Development, Production, and Research & Technology. Structural geology and geomechanics expert. He worked as geomechanics consultant for GeoMechanics International before joining ExxonMobil where he became corporate SME for fractured reservoirs. He also has experience in geothermal and CCS projects. Fermin has worked assets around the world, including SE Asia (PNG, Vietnam, Indonesia, Australia-NZ, Malaysia), South America (Colombia, Argentina, Mexico, Brazil pre-salt), Europe/Caspian (Kazakhstan, West Med), Kurdistan, Gulf of Mexico, and Canada (SAGD).



Flavio Ferreira - Reservoir Engineer with 30+ years of industry experience, including reservoir engineering, IT consulting and management. As a reservoir engineer, he worked in operations and research for Petrobras and Schlumberger. His expertise includes dynamic reservoir characterization, reservoir geomechanics, field development planning, EOR/IOR methods, reservoir management, surveillance and monitoring. He has experience with black oil, gas, thermal and compositional reservoir simulation. Flavio is always pursuing new career challenges, which led him to take on many international assignments (Angola, Norway, Equator, Mexico, Brazil).

RELEVANT PUBLICATIONS

[Excess Permeability in the Brazil Pre-Salt: Non-matrix Types, Concepts, Diagnostic Indicators, and Reservoir Implications](#), 2022: AAPG Bulletin 106 (4).

[Geomechanical Impacts and Characterization of Collapse Breccia Pipes in Brine Injection Operations](#), 2021: 55th U.S. Rock Mechanics/Geomechanics Symposium, ARMA-2021-2056.

[Borehole Stability in Shale: Beyond Mud Weight](#), 2020: IADC/SPE International Drilling Conference and Exhibition, SPE-199596-MS.

[Optimizing Drawdown Program for a Miocene Field by Applying Geomechanical Modelling to Quantify Casing Integrity Risk](#), 2019: 53rd U.S. Rock Mechanics/Geomechanics Symposium, ARMA-2019-1793.

[Integrating Borehole Image Logs with Core: A Method to Enhance Subsurface Fracture Characterization](#), 2018: AAPG Bulletin, v. 102.

[Assessment of Creep Potential of Gearle Formation for Griffin Field PP&A Planning](#), 2018: 52nd U.S. Rock Mechanics/Geomechanics Symposium, ARMA-2018-502.

[Risk Mitigation on Deepwater Drilling Based on 3D Geomechanics and Fit-for-Purpose Data Acquisition](#), 2017: Offshore Technology Conference, OTC-28160-MS.

[Reducing Fault Reactivation Risk on Deepwater Drilling](#), 2017: SPE Latin America & Caribbean Petroleum Engineering Conference, SPE-185619-MS.

[Integrated Modelling of Formation Damage and Multiple Induced Hydraulic Fractures during Produced Water Reinjection](#), 2017: SPE Latin America & Caribbean Pet. Engineering Conference, SPE-185590-MS.

[Geological and Geomechanical Modeling of the Haynesville Shale: A Full Loop for Unconventional Fractured Reservoirs](#), 2016: Unconventional Resources Technology Conference, URTEC-2460295-MS.

[Using Integrated Geomechanical Study To Resolve Expensive Wellbore Instability Problems While Drilling Through Zubair Shale/Sand Sequence of Kuwait: A Case Study](#), 2011: SPE/IADC Middle East Drilling Technology Conference and Exhibition, SPE-148049-MS.

[Drilling Optimization Using 3D Geomechanical Modeling in the Llanos Orientales Basin, Colombia](#), 2010: SPE Latin American and Caribbean Petroleum Engineering Conference, SPE-138752-MS.

TRAINING

At SA we believe that educating clients is the foundation for a long-term relationship, thus, knowledge sharing is always our number one priority. Our training courses are designed to develop skills and capabilities within organizations. We offer a variety of expert-led training opportunities including traditional in-classroom courses, hands-on experience, field trips, or customized sessions that fits your needs. Some of our most popular classes are **Geomechanics 101**, **Advanced Geomechanics**, **Excess Permeability in Carbonates** or **Fractured Reservoirs**.

Please reach out to learn more about our training opportunities. We will find the formula that works best for you!

CONTACT US

Get in touch to get the ball rolling!

info@subsurfacealliance.com

Email us with any questions or inquiries. We would be happy to answer any questions, or even better, set up an initial consultation to frame a problem and see how we can help.



www.subsurfacealliance.com