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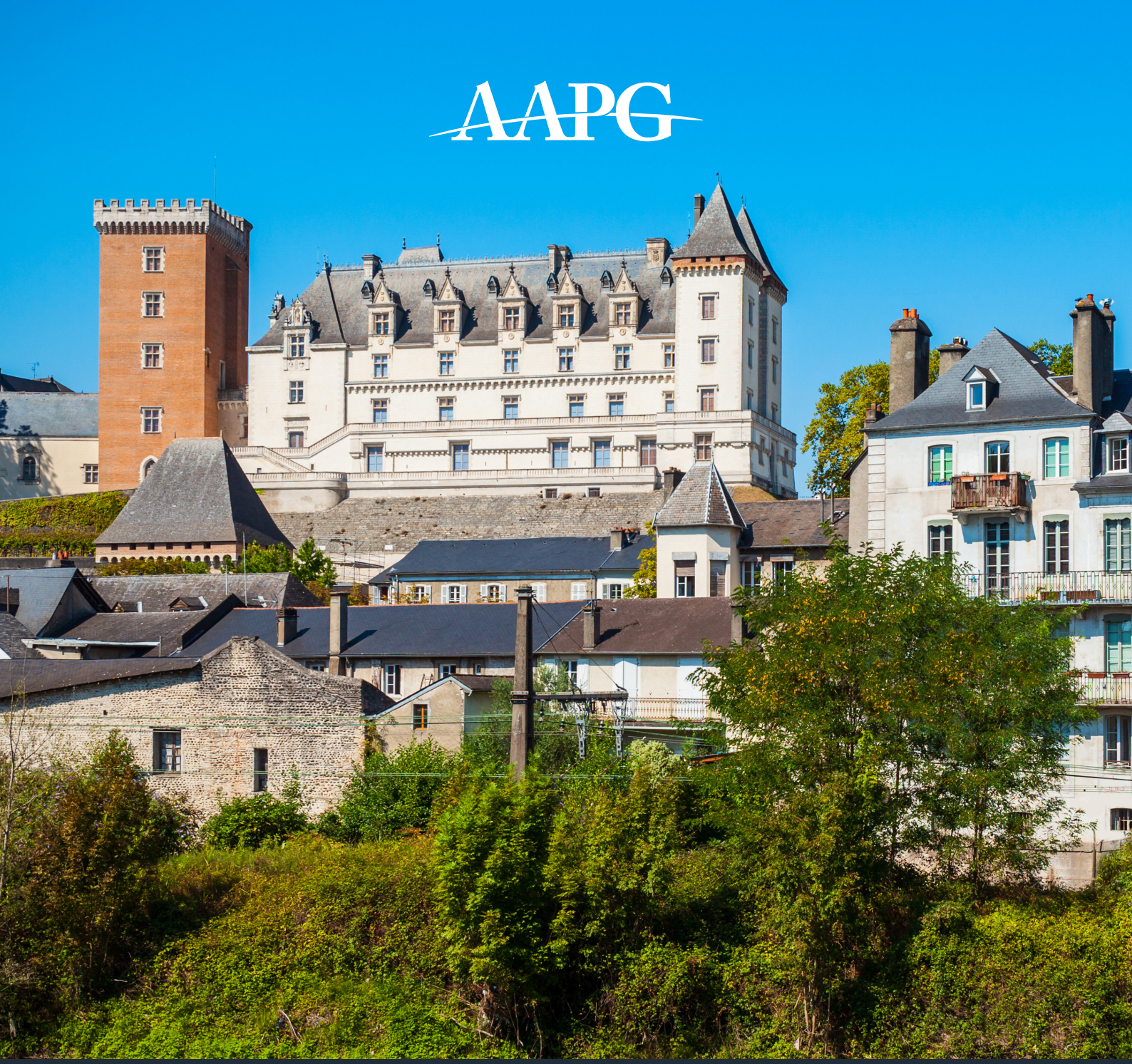

3RD EDITION:

# GEOLOGICAL PROCESS-BASED FORWARD MODELING GTW

10-12 MAY 2027 | PALAIS BEAUMONT, PAU, FRANCE

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# WORKSHOP OUTLINE

## WORKSHOP OVERVIEW

Process-Based Geological Modeling is steadily moving from R&D specialist groups into broader asset team workflows. We are not fully "integrated" yet—the seamless link between stratigraphy, geomechanics, diagenesis and petroleum systems modeling is still a work in progress—but the gaps are closing.

The 3rd edition of the workshop will build on the 2nd edition that was held on 27-29 May 2024 in Abu Dhabi, United Arab Emirates. A major shift in the last three years has been the arrival of AI solutions that specifically target the "inverse problem." We are moving past the hype to see AI for what it is in this domain: a computational accelerator. It is helping us condition physics-based models to hard data and run uncertainty loops that were previously lengthy if not infinite process, finally paving the way for these tools to sit alongside or integrated with traditional geostatistics in the decision-making process. Unlike previous editions, this one will also include petroleum systems modeling as part of the program.

Currently, most predictions often rely on stochastic geostatistical approaches. While powerful, these statistical models do not fully capitalize on the geological laws that govern sedimentation and rock mechanics, often struggling to predict heterogeneity in data-poor areas. Geological Process-Based Modeling offers the critical alternative: a deterministic, physics-driven approach that simulates the actual evolution of the subsurface. By respecting the laws of physics, process-based modeling provides the only way to test geological concepts quantitatively and predict rock properties in areas where well data is non-existent. The workshop aims to assess advancements, identify remaining gaps in the integrated workflow, and chart the path forward for practical implementation.

## PERSISTENT CHALLENGES

Despite its clear value, the industry has only recently started to utilize process-based modeling due to several persistent challenges that this workshop aims to address:

- **Parameter Calibration:** Calibrating numerical input parameters for the geological past (e.g., paleo-climate, ancient wave energy) remains difficult and often relies on empirical estimates.
- **Non-Uniqueness (Equifinality):** Different combinations of input parameters can produce similar results, creating significant uncertainty that is computationally expensive to quantify.
- **Scale Discrepancy:** Bridging the gap between basin-scale depositional trends and the fine-scale resolution required for reservoir simulation remains a major hurdle.
- **Integration:** Truly coupling depositional models with diagenetic (chemical) and geomechanical (stress) models is still a developing frontier.

The workshop will bring together invited experts and researchers to tackle these challenges head-on. We will concentrate on applications of geological process-based forward modeling with a focus on integration of sedimentation, geochemistry, and geomechanics.

## TARGET AUDIENCE

- Exploration geoscientists
- Basin/PSM modelers
- Reservoir modelers, stratigraphers, diagenesis & evaporite specialists
- Geomechanics experts
- CCS teams
- Data scientists (incl. physics-based ML)
- Technical leaders.

## REASONS TO ATTEND

- **Break the Discipline Silos:** Stop treating stratigraphy, geomechanics, and geochemistry as separate tasks. Discover how to build coupled models where sedimentation history directly informs pore pressure prediction and fracture gradients.
- **Understand the Scale Challenge:** Walk away with an understanding of how modeling at different scale can successfully translate coarse basin-scale process models into fine-scale, drillable reservoir properties.
- **Network with the Experts:** Join a focused community of academic researchers, industry specialists, and software innovators to debate the future of subsurface characterization in an interactive, workshop setting.
- **Learn about Hybrid Workflows:** Move beyond the buzzwords and understand how AI and Machine Learning are finally solving the "inverse problem," making physics-based models faster and easier to condition to well data.
- **De-Risk the Energy Transition:** Gain critical skills for the new energy landscape. Learn the specific physics-driven workflows for CCS seal integrity, Lithium brine exploration, and Geothermal heat flow that statistical models cannot provide.

## WORKSHOP PURPOSE & GOALS

The aim of this workshop is to push beyond the theoretical and look at how we practically couple these disciplines. We want to move away from treating Stratigraphic Forward Modeling (FSM), Petroleum Systems (PSM), Diagenetic Reactive Transport Modeling (RTM) and Forward Geomechanical Modeling as isolated tasks and explore the workflows that actually link them and practically implement them for subsurface applications.

## CALL FOR ABSTRACTS

We invite abstracts to be considered for posters in the following categories:

→ Current Status & AI-Augmented Challenges

→ Coupled FSM-PSM Workflows & Stratigraphic Trap Prediction

→ Downscaling to Prospect/Field Scale, Static Model Conditioning & applied Geomechanics)

→ Advanced Diagenetic Modeling & Evaporite Systems

→ Stratigraphic Framework Refinement & Chronostratigraphic Calibration

→ Seismic Forward Modeling & Multi-Data Validation

→ Geothermal System Modeling (Heat & Flow)

→ Critical Mineral Systems Simulations

→ Subsurface Storage (CCS, H2) & Seal Integrity

# SESSIONS' DESCRIPTIONS

## 1 CURRENT STATUS, CHALLENGES, AND EMERGING FRONTIERS

**Theme:** Where are we now, and how are new technologies solving old problems? This session sets the baseline. We will assess the current maturity of process-based modeling across the industry—what works, what does not, and where the critical gaps remain. We then pivot to emerging technologies, specifically looking at how AI and hybrid workflows are addressing persistent challenges like the "Inverse Problem." As well as the paths toward integration of various processes.

### Topics of Interest

- **Status Report:** A critical review of current physics engines (FSM, RTM, PSM)—strengths, weaknesses, appropriate applications, limitations and integration across disciplines.
- **The "Grand Challenges":** Addressing the persistent bottlenecks of Equifinality (non-uniqueness), Stationarity (integration with geostatistics), and Scale (basin vs. reservoir).
- **AI Utilization:** Moving beyond hype—practical applications of Machine Learning surrogates to accelerate physics solvers and enable rapid uncertainty analysis.

## 2 MODEL CALIBRATION AND VALIDATION: THE MULTI-PHYSICS CONSTRAINT

**Theme:** How do we know our models are right? Strategies for rigorous calibration. A critical session dedicated to the validation of process-based models against observational data. We welcome studies demonstrating novel calibration workflows using diverse datasets.

### Topics of Interest

- **Seismic Integration:** Workflows for comparing model outputs with seismic data—ranging from synthetic seismogram generation to constraining models with seismic inversion volumes.
- **Chronostratigraphic Constraints:** Utilizing biostratigraphy and orbital tuning to validate time-steps and sedimentation rates.
- **Multi-Domain Validation:** Integrating chemostratigraphy, well logs, and core data to constrain uncertainty and reduce non-uniqueness.
- **Validation & QC:** Methodologies for blind-testing downscaled models, quantifying uncertainty propagation, and calibrating results against core, logs, seismic, and production data.

## 3 COUPLING BASIN DYNAMICS: INTEGRATING FSM WITH PETROLEUM SYSTEMS

**Theme:** Linking architecture to charge, a workflow for de-risking stratigraphic plays. This session delivers on the promise of including PSM. We focus on the practical integration of Forward Stratigraphic Modeling (FSM) with Petroleum Systems Modeling (PSM) to quantitatively predict and risk stratigraphic and stratigraphic-diagenetic traps. The goal is to define workflows where depositional architecture and facies heterogeneity directly constrain charge timing and migration pathways.

### Topics of Interest

- **Workflow Design:** Sequentially linking FSM outputs (architecture, facies) → property assignment → PSM (burial, thermal, charge) → trap screening & risking.
- **Target Generation:** Predicting subtle pinch-outs, diagenetic barriers/enhancements, and combined structural-stratigraphic traps.
- **Sweet Spot Analysis:** Using coupled model sensitivity analysis to identify optimal charge windows and reservoir quality sweet spots.
- **Case Studies:** Examples of successful integration and frank discussions of remaining technical gaps.

## 4 FROM BASIN TO BOREHOLE: PRACTICAL APPLICATIONS FOR EXPLORATION AND FIELD DEVELOPMENT

**Theme:** Applied workflows and real-world success stories for translating process models into drillable decisions. This session bridges the critical gap between basin-scale simulations and the fine-scale detail required for exploration and development. We showcase integrated case studies where process-based modeling was successfully downscaled to inform static property models, predict geomechanical behavior, and solve specific subsurface problems. The focus is on practical workflows, lessons learned, and the tangible value delivered from basin-scale concepts to prospect- and well-scale decisions.

### Topics of Interest

- **Downscaling in Action:** Case studies demonstrating methodologies for translating coarse FSM outputs into high-resolution, prospect- and field-scale static models with depositional controls.
- **Property Prediction & Conditioning:** Examples of populating reservoir grids with FSM-derived facies, RTM-derived properties, porosity, permeability, and rock types, calibrated to well and seismic data.
- **Applied Geomechanics from Depositional Fabric:** Field examples where depositional history and stratigraphic architecture were used to predict mechanical stratigraphy, fracture corridors, borehole stability, and frac-barriers.
- **Pore Pressure Prediction in Practice:** Real-world examples of coupling sedimentation rates with burial history to predict overpressure ramps and narrow drilling margins.
- **Diagenesis and Key Properties:** Studies that highlight effect of diagenetic overprint in controlling the spatial distribution of key properties (e.g., porosity, permeability, strength...etc.)
- **Characterization at Scale:** Integrated case studies highlighting the end-to-end workflow from basin-scale process modeling to field-scale reservoir simulation and geomechanical assessment.
- **Reactive Transport Modeling:** Upscaling pore-scale chemical processes to basin-scale porosity and permeability evolution.

## 5 FUTURE RESOURCES: STORAGE, GEOTHERMAL, AND CRITICAL MINERALS

**Theme:** Physics-driven de-risking for the Energy Transition and Critical Minerals. This session broadens the scope to the extraction of new energy resources, subsurface storage, energy transition, critical minerals, and environmental applications. We seek papers demonstrating how coupled process models can de-risk extraction (minerals, heat) and containment (carbon, hydrogen).

### Topics of Interest

- **Critical Minerals & Brines:** Modeling the stratigraphic controls on brine concentration (e.g., Lithium) and the physics of in-situ recovery/solution mining.
- **Geothermal Systems:** Modeling fracture network evolution, heat flow, and hydrothermal alteration in fractured basements and sedimentary aquifers.
- **Subsurface Storage (CCS/H2):** 4D modeling of seal integrity, plume migration, and fault stability during injection cycles.
- **Environmental Applications:** applying process-based modeling on modern environments for prevention, management, and assessment of various geohazards. (e.g., slope instabilities, erosion, subsidence..etc)

To register, click or scan the QR code

# WORKSHOP GUIDELINES

## FORMAT

The workshop will be **3 days**, consisting of oral presentations, poster presentations and breakout sessions where participants can discuss and investigate a specific theme that is of mutual interest. The first day will feature an inaugural keynote speech by a high-profile professional from the industry.

## ATTENDANCE

Registrations are invited from all relevant disciplines with experience and/or knowledge of the subject areas being addressed in the workshop. Registrations will be accepted on a first-come, first-served basis.

## CALL FOR POSTERS

You are invited to prepare a poster for presentation at the workshop. If you are interested in participating, please send a short abstract to **cnavarro@aapg.org** by **14 April 2027**. All posters will be produced as pull-up banners and delivered by AAPG. There will not be any other format available for poster display.

## REGISTRATION TYPES & FEES

Fees are inclusive of onsite documentation, coffee breaks and luncheons.

### EARLY BIRD PRICING

| | |
|---|---|
| $1,250 | Non Member |
| $1,050 | Member |
| $950 | Committee/Presenter |
| $500 | Academia |
| $350 | Student |

*To avail the Member rate, you must be an active member of AAPG, DGS, GSO or KGS.

Early Bird ends on 10 March 2027

## REGISTRATION DEADLINE

To guarantee your seat, please make sure to register by **3 May 2027.**

## CANCELLATION POLICY

AAPG will refund the tuition, less a $100 processing fee, if the request is received no later than 30 days prior to the workshop. Cancellations must be made in writing via email. No refund will be made for cancellations received less than 30 days prior to a workshop being given. Nonpayment of tuition does not constitute automatic cancellation. If no cancellation notice is received by 30 days prior to a workshop, participants are liable for full tuition. AAPG reserves the right to cancel a workshop if enrollment is insufficient to ensure proper effectiveness. Substitutions for individuals can be made at any time. A paid enrollment may be transferred one time to a future workshop if the request is received prior to the 30-day cut-off date.