GES GB NIGHT SCHOOL

Night School Recordings Outline

Non-Seismic Geophysical Methods for O&G Exploration and the Energy Transition: Jonathan Watson & Gary Barnes | 2022

Part 1 | Gravity and magnetics in exploration

General overview giving historical summary, overview of methods, data acquisition and processing considerations and basic concepts. A number of case studies will be used to look at data resolution, coming down from regional scale exploration to high-resolution applications. Will also cover integrated interpretation with seismic data and benefits to seismic planning.

Part 2 | Gravity Gradiometry – Introduction and case studies

Gravity gradiometry represents the highest resolution airborne datasets currently available. The session will cover the historical development of instrumentation, resolution, survey considerations. A number of case studies from different geological settings will be used to showcase the applications and integration with additional datasets.

Part 3 | Other non-seismic methods and applications in non-oil & gas exploration

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Play Fairway Analysis, Velocity analysis and depth conversion: Alan Foum | 2022

Session 1 | Basin Screening and Play Fairway Analysis

A workshop aimed at getting an understanding of play fairway analysis for basin screening and focussing exploration and new ventures efforts – this course covers:

- Why Screen Basins?
- Different Types of Hydrocarbon Contact
- Minimum Economic Volumes for Different Types of Oil and Gas Development
- What is PFE?
- Well Results Analysis
- Seals – The Cinderella of Petroleum Exploration
- Play Statistics
- Building Play Fairway Maps
- Common Segment Risking
- Yet to Find Estimation

Session 2 | Prospect Analysis in Exploration

A workshop aimed at gaining an understanding of exploration concepts. This course covers:

- Plays Prospects Leads and Concepts
- Estimating Chance of Success
- Biases - How to recognise them and try to deal with them
- Volumetric Estimation
- Introduction to Economics
- Introduction to Development Concepts

Session 3 | Appraisal – discoveries to Projects

A brief overview of appraisal geophysics to enable your geoscientists to have an awareness of appraisal concepts. What is field Appraisal – decision management systems, project classification and development concepts. A brief overview of Reserves, Resources and Economics – how does the geologist fit into this process? What are the main uncertainties in

field appraisal and what can we do to manage them? A brief overview of the value of information - using Bayes Theorem to polarise risk.

Session 4 | Depth Conversion and Velocity Modelling

A workshop aimed at getting an understanding of the issues involved in depth conversion and velocity modelling. Enables geologists and engineers to effectively understand and communicate with geophysicists – this course covers:

- Why Depth Convert
- Velocity Definitions
- Depth Conversion Methods
- Stochastic Depth Conversion
- Depth Domain Seismic
- Lateral Interpolation - making Maps and Models- Tying wells
- QC Tools

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Licence to Operate: Rosalie Constable, Rachel Gavey, Eric Bickel & Steve Pickering | 2022

Session 1 | ESG

- What is ESG, what is its value ?
- The changing role of ESG and key challenges in oil & gas companies .
- How to start defining an ESG strategy and roadmap ?
    - Why?
    - What is material?
    - What are the overall goals?
    - How do you break that into manageable tasks?
- How to implement a successful ESG strategy
    - Culture and common goals
    - Recording and reporting – accountability
    - Relevance and importance

Session 2 | Value of Information

- Influences on the Value of Information
- For tests for information; observability, relevance, materiality and cost
- Accuracy of measurement
- Decision tree analysis
- Bayesian revision
- Joint Probability

Session 3 | Project Management

- Failed projects
- Project bias
- Project management approach
- The project management triangle
- Project success criteria
- Managing risk
- Stage Gate Process
- Decision Quality Analysis
- Earned Value Analysis

- Operational Excellence

Session 4 | Stakeholder Analysis

- Why projects go wrong
- Who are the project stakeholders
- Stakeholders, partners and alliances
- Consequences and Challenges of Poor Stakeholder Engagement
- Stakeholder Engagement in the Project Lifecycle
- Analysing stakeholder influence and interest
- Stakeholder mapping exercise – Mozambique
- Managing Stakeholders

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Geomechanics: Vincenzo De Gennaro | 2022

Geomechanics for hydrocarbon and non-hydrocarbon energy Geomechanical analyses can be done before, after and while drilling; during production/development when pressure changes, during fluid injection (re-pressurization, storage, fracturing), when temperature and/or saturation change. Results helps identify hazards, de-risk decisions, reduce costs and improve asset performance by means of customized deliverables to support all phases of asset's lifecycle. This course will provide an overview of the geomechanical theory and solutions and their deployment from early field exploration to final abandonment. The course will also cover aspects related to storage integrity (Underground Gas Storage - UGS, Carbon Capture Storage - CCS) and non-hydrocarbon energy related topics (e.g. Geothermal, Wastes Disposals).

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Structural Geology and Tectonics: Susie Daniels, Richard Jones, John Howell, Jo Garland | 2021

Session 1 | Structural Complexity – Fractured basement reservoirs
Facilitator: Susie Daniels & Richard Jones

Recognising the complexity of naturally fractured reservoirs is critical to successful development. In basement plays, there is inherent complexity because of the extreme porosity and permeability contrast between the fracture network and the crystalline host rock. This virtual field trip will visit outcrops in NW Scotland that highlight recent work, and will include the following themes:

- Crystalline basement lithologies, and typical fracture network geometries;
- The importance of scaling relationships in fracture systems;
- Additional porosity related to sand-filled fissures;
- Basement-cover relationships, and the significance of weathering profiles;
- Beyond hydrocarbon – basement plays for geothermal energy and CCUS.

Session 2 | Structural Complexity in the 'Simply Folded Zone' of the Zagros
Facilitator: Richard Jones

The Zagros is classic area of hydrocarbon exploration that is renowned for its large four-way closing anticlines that form ideal structural traps. Although the geometry of folding looks simple at a regional scale, at outcrop to license block scales there is a wealth of structural complexity that can have a marked impact on prospectivity. This trip will visit key outcrops that illustrate the following themes:

- Typical examples of structural complexity and heterogeneity at outcrop to anticline scales – and the implications for exploration;
- The influence of mechanical stratigraphy on the hydrocarbon system; and why it creates a 'win-win-win' in the Zagros;
- Why an understanding of regional tectonics is so important – and how geology seen in outcrop confirms what we see in the recent GPS and earthquake data.

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Session 3 | Extensional and Salt Tectonics of Eastern Utah
Facilitator: John Howell

Eastern Utah contains spectacular examples of extensional and salt related tectonics. The goal of this virtual fieldtrip is to visit some of the classic examples around the town of Moab. The regional tectonics is dominated by a series of broadly parallel, N-S trending salt walls with well developed crestal collapse features, all of which well exposed. The trip will focus on the extensional tectonics associated with this crestal collapse

Trace the Moab along its length and study how deformation style changes with displacement. The fault has a maximum displacement of 900 m and dies out over 10 km.

- Damage zone nature and dimensions in the Bartlett Fault, a splay of the Moab Fault.
- Fault interaction at Courthouse fault where two splays join
- Relay ramp geometry and architecture at the Delicate Arch relay zone
- Crestal collapse on the top of the Salt Valley Anticline

All work is based on the authors studies on collaboration with various colleagues and students over the past 20 years, especially Haakon Fossen and Atle Rotevatn of UiB. The trip will be based on virtual outcrops and delivered via LIME, a dedicated VFT software developed by the trip leader and colleagues from NORCE.

Session 4 | Natural Fracture Systems in Carbonate Reservoirs
Facilitator: Jo Garland

Approximately 85% of all carbonate-reservoired oil and gas fields worldwide are naturally fractured (Lamarche et al. 2012). Whilst tectonic mechanisms are responsible for many of these fractured reservoirs, one should not underestimate the impact of other processes that create fractures, and thus permeability, in carbonate rocks.

Fracture related dolomite bodies (often defined as hydrothermal dolomites) occur where hot, Mg-rich fluids move upwards through fractures, dolomitising the surrounding host carbonates. These “hot” dolomites can add additional matrix porosity, or reversely destroy porosity, to what would traditionally may be considered a tectonically-fractured reservoir.

Karst processes result in stratigraphically-controlled, heterogeneous fracture systems which have typically been dissolution-enhanced. The resulting fracture network includes not only fracture propagation into roof and wall rocks, but also commonly results in thick breccia systems formed through cave collapse.

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Evaporite collapse breccias are formed where evaporites are dissolved, and the overlying continuous strata of carbonate rocks collapse, generating breccias composed of carbonate clasts. Fracture systems are inherent in the overlying, foundered, carbonates.

It is important to establish the mechanism responsible for creating fractures, since this will have a significant impact on the reservoir geometries and how the fractures are modelled. The only way to confidently unravel the complexity of fracture systems in carbonates is by careful diagenetic studies from core, and integrating well logs, seismic and analogues.

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Petroleum Resource Management System (PRMS): Tim Lines | 2021

This series of four two-hour lectures will describe how the SPE 2018 Petroleum Resources Management System ("PRMS") categorises the technical and commercial maturity of oil and gas deposits into reserves, contingent resources, prospective resources and unrecoverable. It will illustrate through worked examples how this popular and rigorous system underpins oil & gas company portfolio management (find, develop, produce, trade); asset debt capacity; and equity investment. At the end of the course, participants will be able to:

- Categorise hydrocarbon volumes into reserves, contingent resources, prospective resources and unrecoverable
- Reclassify resources through the field life cycle
- Define incremental projects
- Capture technical and commercial risk and uncertainty
- Apply the concept of economic producibility
- Calculate resource entitlement and recognition
- Report incremental and scenario volumes
- Compare deterministic vs probabilistic methods
- Aggregate resources
- Adjust resource volumes for fuel consumed in operations and other adjustments

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Time Lapse (4D) Seismic: Mehdi Padayesh | 2021

Session 1 | How 4D Seismic has changed the production recovery strategy (success case studies)

- Business value of 4D seismic
- 4D seismic application and success stories across the world
- How to do a quick 4D interpretation
- The outlook of 4D seismic technology

Session 2 | 4D rock physics bridging between petrophysics and geophysics

- Fluid substitution principals
- How to calibrate a 4D rock physics model
- AVO equations and their use
- Conventional seismic modelling and its pitfalls

Session 3 | 4D seismic integration with the reservoir engineering

- Review of reservoir engineering concepts in the 4D seismic context
- Pressure and saturation separation
- Hydraulic reservoir connectivity estimation from 4D seismic
- 4D seismic integration with the reservoir engineering measurements and models
- 4D seismic history matching

Session 4 | 4D Seismic modelling and inversion advanced topics

- Elastic properties of compositional fluid behaviour
- Anisotropic fluid substitution
- 4D seismic in the heavy oil reservoirs
- Going beyond 1D seismic convolution
- 4D depth domain inversion
- Use of Machine Learning in the 4D seismic studies

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Petroleum Geology of the Arabian Plate: Peter Webb | 2021

The Arabian Plate has been a major focus of petroleum exploration and production since the discovery of oil in Iran (Persia as it was then) in 1908. Since then, every nation on the plate has become an oil and gas producer to one extent or another and oil and gas are produced from pretty well every geological interval from Late Precambrian to Miocene. Current oil reserves are around 807 billion barrels and current production around 26.4 MMBOPD. Despite the growing initiative to move away from fossil fuels, it is likely that there will be continued oil and gas activity on the Arabian Plate for some time to come.

What You Will Learn

Over the four 2-hour sessions that comprise this course, the entire stratigraphic column from crystalline basement through to Recent is looked at. Above the basement, there are eight major tectonostratigraphic episodes. Each episode is explained in terms of the tectonic events that were taking place at the time and the sedimentary response to those events. The petroleum significance of each formation within those major episodes is described. You will learn what makes this region so special and why it still has so much to offer.

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Geomechanics: Vincenzo De Gennnaro | 2021

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Business Skills: Steve Pickering, Gavin Ward & Tim Gibbons | 2020

Part 1 | Cashflows:

In this session we will seek to understand how we can estimate the value of oil and gas projects and how to compare and rank projects with difference commodities, development schedules, cashflows. During the course we will discuss the impact of oil quality (or gas), taxation and time on value by calculating discounted cashflows (DCF), Net Present Value (NPV), Rate of Return (ROR), Expected Net Present Value (ENPV) and Expected Monetary Value (EMV). Various economic indicators will be discussed including Profit to Investment Ratio (aka Bang for the Buck), Discounted P/I ratio and Economic Limit. Lastly we will investigate hurdle rates and how to evaluate whether or not a project should be given a green light.

Part 2 |The differences between Economics and Accounting:

This course covers the fundamentals of oil and gas field Accounting and Finance in a down to earth manner, using plain English. In this session, the facilitator will introduce you to some of the simpler tools used to analyse an oil company, or service company annual report. You will be able to use the annual reports of two companies and examine the Balance Sheet and Profit & Loss statement to compare performance. The session draws on some principles in the PESGB Petroleum Prospect Economics session, like the source of the discount factor used in NPV and introduces the audience to several other methods of valuation used in acquisitions and management reporting. Attendees will find it useful to have a calculator on hand for a few short exercises but care has been taken to keep number crunching and mathematics to a minimum.

Part 3 | The basics of sales and marketing:

Product marketing, the basic sales process and the activities involved. It is designed more for people working in a technical role than for people who are currently working in a sales or marketing role. It will attempt to demystify the dark arts of sales and marketing such that attendees get an appreciation of the role that sales and marketing play in the oil and gas industry.

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Part 4 | How to sell anything:

Even if they do not have a formal sales role, geoscientists are frequently required to "sell". This may be a farm-in opportunity to another company or an infill well to management or partners etc. In order to sell, we need to construct a narrative that persuades our audience to accept our proposal. This session will explain the most effective way of doing this and provide a structure for participants to use whatever they are required to sell.

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Depth conversion: Alan Atkinson | 2020

This is a practical course for geoscientists tasked with creating depth maps for volumetrics and well planning, with an emphasis on understanding and modelling the geological controls on velocity. Velocity analysis techniques designed to extract full value from velocity data will be taught, along with velocity modelling methods including powerful 'Vok' linear functions and seismic velocity calibrated to wells. The theory and practice of tying maps to wells will be covered, as well as highlighting common pitfalls in the depth conversion process. Spreadsheet exercises to illustrate concepts and techniques will be demonstrated and provided to attendees. A wide range of experience will be catered for in the course. Attendees will leave with an awareness of techniques necessary to undertake defendable depth conversions.

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Migration and Velocity Model Building: Ian Jones | 2020

The course will commence with an overview of different migration schemes, and cover the motivations for building detailed velocity models, and briefly discuss the inherent limitations on our ability to build a detailed model. Current-day practice will be covered, exemplified via many case-studies, and we will briefly discuss the less well known and emerging techniques. The approach will mostly be non-mathematical, and will rather try to concentrate on an intuitive understanding of the principles, and demonstrate them via case histories. The bias in this course is towards those techniques that have seen widespread industrial use over the past 30 years. Unfortunately, some topics will not be covered, in-part due to the time constraints: these omissions will include consideration of VSP and multi-component data, and Marchenko imaging.

Prerequisites (Knowledge/Experience/Education Required)

The course is designed to be followed by anyone with a broad geoscience background: no specific detailed foreknowledge is required, although a familiarity with geophysical terminology will be useful.

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Basin Analysis and Modelling: Duncan MacGregor | 2020

This course will cover an analytical workflow that should be followed to predict petroleum system elements and hydrocarbon generation based on the tectonic setting and history of the basin concerned. It commences by considering the fundamentals of the formation of different types of basin, which is critical in predicting source rock development and assessing thermal history. It then moves onto a consideration of workflows, particularly the inputs necessary to building a petroleum systems model. Discussions will be initiated on key uncertainties such as the critical prediction of hydrocarbon phase and why we are finding so much gas rather than oil in frontier exploration. Case studies of different basin types will be included from around the world ranging from the simple models applicable to the North Sea and SE Asia to very complex ones in North Africa.

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Geopressure: Peter Webb | 2020

The aim of this course is to understand what geopressure is and why it is so important during the exploration, appraisal and development phases of the petroleum project life cycle. It looks at overburden pressure, formation pressure, fracture pressure, and the concept of the drilling pressure window. It also covers pressure measurement and prediction ahead of the drill bit.

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Building the Portfolio: Gavin Ward & Stuart Harker | 2020

There is the myth that you don't find oil in nice locations using examples like the cold hostile waters of the North Sea plus hot and arid areas of the Middle East. This lecture demonstrates that this is untrue and examples are given from California and Greece – two popular tourist destinations and thus considered to be "nice places". Both areas have production from Mio-Pliocene structures and are earthquake prone. However, California has vast and long established production from both on and offshore, whereas Greece has only small offshore production from the Prinos Basin. Potential for new oil and gas discoveries in California is very good and lies in deeper targets and unconventionals. The upside for Greece lies largely in deep water areas and is as yet unproven.

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Petrophysics: Steve Cannon | 2020

There are two questions you should be asking yourself before signing up for this course:

- What is petrophysics?
- Why build reservoir models?

This course will show you that petrophysics is central to the evaluation and development of oil and gas resources and nowhere is this more important than providing the correct input for static and dynamic reservoir modelling. Whether it is sonic data for depth conversion, density data for seismic attribute analysis, composite logs for correlation or the relevant rock and fluid properties for distributing in the model, the petrophysicist does it all. BUT, if the petrophysical input is not constrained by geology, the subsequent models will not have the necessary "real world" characteristics needed to successfully estimate in-place volumes, likely rates of production or ultimate recovery.

And why do we build reservoir models? Because we have incomplete information about the dimensions, architecture and variability of the reservoir at all relevant scales, but a model can integrate data from all the disciplines in a convenient, repeatable and highly visual representation of the surface at the scales we require. Seismic data, especially time slices or attributes provides much of the inter-well modelling information, and dynamic well-test data, the proximity to boundaries, but it is the geologist who describes the conceptual model of the reservoir and guides the construction or, better still, builds it themselves.

Never forget, "all models are wrong, some are useful" (Box, 1979)

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