



AAPG

Geosciences Technology
Workshops 2022

7 - 9 JUNE 2022 • WINDHOEK, NAMIBIA

HYDROCARBON POTENTIAL IN NAMIBIA

WORKSHOP BROCHURE



WHAT TO EXPECT FROM THE AAPG EXPERIENCE

The American Association of Petroleum Geologists (AAPG) and our suppliers, venues and services partners are committed to providing a clean and safe environment and experience for all our event participants. We remain alert to COVID-19 risks and are closely following and adapting to all applicable health and safety guidelines. While conditions vary between countries, cities, municipalities, and facilities, safeguarding measures you may encounter at AAPG events include physical distancing and masking, readily available hand sanitizer, enhanced cleaning and disinfecting protocols, temperature health checks and screenings, minimized touchpoints and cashless payment options.

As personal safety is a shared responsibility, we ask that all participants ensure that they are feeling well and in good health, with no fever or other symptoms related to COVID-19, before showing up at an AAPG event. Any specific delegate obligations will be published in pre-event communications and clearly displayed on signage throughout our venues.

Given the ever-changing nature of the pandemic recovery, registrants will receive regular updates and instructions concerning the latest health and safety requirements.

TECHNICAL PROGRAM COMMITTEE

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WORKSHOP OUTLINE

This three-day workshop has the primary goal to share knowledge, case studies, techniques and workflows pertaining to the understanding of the petroleum potential of Namibia.

Namibia has a rich and varied prospective geology ranging from the Proterozoic to Recent in age in basins that vary from intracratonic, to fold belt, to passive margin in character. All the geological elements are present for a number of potential hydrocarbon provinces to be established. Even though no commercial production has been established to date, the presence of a large number of companies exploring Namibia is testament to its exciting potential.

Workshop Objectives

The workshop will have a rich program of oral presentations and posters covering a variety of aspects of a number of petroleum systems in Namibia, both offshore and onshore. It will present integration of data from seismic, remote sensing, petrophysical, geochemical, core/outcrop samples and seismic, to better understand the tectonics, stratigraphy, reservoirs, seals and source rocks and so describe the proven and potential petroleum systems. Participants are expected to leave with knowledge and exposure to the following:

- Tectono-sedimentary evolution
- Proven and possible petroleum systems of Namibia
- The source rocks: their distribution, characteristics, burial history, hydrocarbon products and their proven / possible migration routes
- The reservoirs: ranging in age from the Tertiary to the Proterozoic, their distribution, depositional architecture and the controls on reservoir quality
- The seals and traps: seal ages, architecture, sealing capacity and controls on their integrity, plus a review of traps drilled to date, analysis of successful and non-commercial exploration programs, together with predictions for the successful plays and traps of the future
- Prospectivity of syn-rift plays offshore Namibia

Benefits of Attending

The workshop is an opportunity for attendees to receive up-to-date knowledge about the petroleum systems and exploration plays in an exciting segment of the west African margin, exposure to regional case studies and to be introduced to workflows and techniques utilized for predicting the assessment of various components of the petroleum system. It is an opportunity to network and share experiences.

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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 display for presentation. If you are interested in participating, please send a short abstract to bwelch@aapg.org by 5 May 2022. 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. To avail the Member/Committee/Speaker rate you must be an active member of AAPG or a committee/speaker at the event. To register as a Young Professional you must be under the age of 35 with less than 10 years of work experience.

REGISTRATION TYPES & FEES

AAPG Member / Committee / Speaker: \$450.00
 AAPG Non-Member: \$650.00
 Join & Save: \$650.00
 YP & Academia: \$150.00
 Students (Masters): \$75.00

[To Register Click Here](#)

REGISTRATION DEADLINE

To guarantee your seat, please make sure to register by 26 May 2022.

WORKSHOP LOCATION

Windhoek, Namibia

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. The registrar will accept cancellation notices by telephone, but all such notices must be followed up by fax or e-mail. 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.

SESSION 1: TECTONO-SEDIMENTARY EVOLUTION AND STRUCTURAL HISTORY

All the offshore basins of Namibia have similar basement morphologies. However, sediment input from the South African Plateau has varied significantly into each basin through time such that the sequence isopach and morphology varies greatly both within and between basins. At the present time only three rivers are permanently connected to the South African Plateau: the Orange River in the south, and the Ugab and Kunene Rivers in the north. These rivers transported large amounts of sediment into the Atlantic.

The tectonics and structural history of the internal basins and the Atlantic margin play a fundamental role in controlling the deposition, burial and/or erosion and quality of the various elements of the petroleum system, as well as being the critical aspect of forming the hydrocarbon traps.

This session discusses the tectono-sedimentary history of the various Namibian basins through time, with emphasis on how this controls the supply of sediments, the distribution of source, reservoir and seal rocks, as well as the type of potential petroleum traps and their integrity through time.

SESSION 2: PETROLEUM SYSTEMS OF NAMIBIA

The petroleum system is a unifying concept that encompasses all the disparate elements and processes of petroleum geology. A petroleum system encompasses a pod of active source rock and all its genetically related oil and gas accumulations. It also includes all the geological elements (source, reservoir, seal and overburden rocks) and processes (trap formation, plus generation, expulsion, migration and accumulation of hydrocarbons) that are essential if an oil or gas accumulation is to exist. If all these elements are in place and the processes are understood to have occurred during the desired time and in the right space, with also a reasonable probability of an accumulation, then a petroleum system exists. There does not need to be a discovery.

Exploration wells drilled offshore Namibia demonstrate that all elements for a working petroleum system and hydrocarbon accumulations are present. Onshore, there are two vast Neoproterozoic/Early Cambrian Basins, the Owambo Basin in the country's northern part, and the Nama Basin in the south. Both basins cover an area of over 460,000 km². Complex foreland basin architectures in both basins are as a result of the prominent Damara and Gariiep Belts. Most of the drilled onshore exploration and stratigraphic wells were relatively shallow, and hardly tested the country's full onshore potential. Superimposed on the Precambrian basins are a group of late Paleozoic to early Mesozoic, Karoo-aged basins dominantly of extensional character whose potential is only recently begun to be realized. An active petroleum system has recently been verified in this setting in northeast Namibia.

This session will discuss Namibia's petroleum systems with a focus on how all the various components come together in both space and time to define both petroleum systems which are proven and those which may be possible.

SESSION 3: SOURCE ROCKS OF NAMIBIA

Source rocks are the most critical element of any petroleum system, and a rich source rock is needed to underpin any new hydrocarbon province. In Namibia to date, deep water marine source rocks have been sampled offshore in the Santonian-Cenomanian, but the only regionally proven source is the marine upper Barremian-Lower Aptian 'Kudu Shale'. Potential source rocks may also occur deeper in early Cretaceous syn-rift basins.

Onshore, predicted deep depocentres and several source and reservoir lithologies observed in core and outcrops have attracted explorers, from small independents to majors. Continental sediments prevail in the Namibian Karoo basins with marine influence only having been demonstrated in the uppermost Carboniferous. The Permian strata contains not only coal seams, but also extensive organic shales. With Mesosaurus as an index fossil the Namibian black shales correlate well with similar shales across Gondwana, known as the Whitehill Formation in South Africa and as the Irati Shales in South America.

Techniques for mapping out the distribution of source rocks, both traditional and more novel ones such as mapping on seismic data using inversion/AVO products, are important for defining the limits of a petroleum system. The behaviour of source rocks during maturation is driven by their compositional characteristics, so this will also be a subject of focus.

This session will discuss the proven and potential source rocks of Namibia, their characteristics, burial history, hydrocarbon products and their proven / possible migration routes.

SESSION 4: RESERVOIRS OF NAMIBIA

There is a rich suite of reservoir rocks in Namibia that range in age from the Proterozoic through to the Tertiary, varying from sandstones to carbonates and which were deposited from desert to deep water environments. Below are some specific challenges that this session will attempt to address.

Potential reservoir rock horizons include the Proterozoic Nosib, Otavi and Mulden Groups. The Nosib Group includes interbedded marine and continental clastics with minor carbonates. The Otavi Group is believed to be a self-sourcing carbonate system, and is primarily dominated by shallow marine carbonates, with lesser amounts of interbedded sandstones and shales. Potential in the Karoo section remains to be evaluated.

In the pre-break up section of the Atlantic Margin predicting the presence of sandstone and carbonates reservoirs in a section dominated by volcanics.

The distribution of the Lower Aptian to Lower Albian carbonates and where good reservoir quality is likely to be found.

The facies and distribution of deep-water sandstone reservoirs, often beautifully imaged by 3D seismic data, but can reservoir quality and hydrocarbon fill be predicted? The effects of bottom currents and contourite deposits on the reservoirs.

This session will discuss and focus in on some of the critical aspects of these reservoirs and their depositional systems to help predict where they are deposited and how good the reservoir quality will be.

SESSION 5: SEALS AND TRAPS OF NAMIBIA

Seals are key elements of any petroleum system. Their importance is usually overlooked during the evaluation of the potential hydrocarbon accumulation. The effectiveness of seals depends on several factors. The most important is the thickness, continuity, and high capillary entry pressure. The typical lithology of seals in Namibia includes shale, silt, salt, and anhydrite formations. In terms of their architecture, they can be created by vertical lithological stratifications and lateral lithological variation or porosity degradation. Additionally, faults and fractures can act as seals by impeding fluid flow. In the Arabian Peninsula, potential seals include deformation bands, and hydrodynamically-aided stratigraphic and fault rocks.

Assessment of seals using a rigorous strategy is vital in the appraisal phase. However, production and injection-related activities might alter seals hydrocarbon retention characteristics, and therefore, must be incorporated in all stages of the field development plans.

Over 50 years of exploration offshore Namibia and more onshore, has yielded one gas discovery at Kudu, recovery of an encouraging light, sweet oil sample using a wireline tool at Wingat-1 and encouraging hydrocarbon shows in the recent drilling campaign onshore. Despite this, large and small companies continue to believe that Namibia holds all the ingredients to become a successful oil and gas production province, as the previous sessions have demonstrated. Examples of different trapping styles will be presented, with an emphasis on learning lessons from failures in the past and predicting the potential successes of the future.

This session discusses challenges confronted in the evaluation of seal capacity and best practices for the assessment of seal quality in Namibia with emphasis on case studies from different reservoir rock types. It will also re-visit previous exploration campaigns and examine the reasons for no commercial production being established to date and then will predict which current and future campaigns will lead to commercial success and a bright future for Namibia.

SESSION 6: PROSPECTIVITY OF SYN-RIFT PLAYS OFFSHORE NAMIBIA

Rift basins are well-known as prolific hydrocarbon-bearing provinces worldwide. Structural development plays a huge role in the occurrence and distribution of hydrocarbons within rifts, including the character of the basin fill.

Syn-rift plays stem from a complex interplay between tectonics and sedimentation rate. Tectonically derived topography is the primary control on the sedimentary processes which result in facies and stratigraphic distribution of source rocks, reservoir rocks and seals in syn-rift successions.

Commonly, the seismic expression of different syn-rift units gives an indication about the different stages of rift evolution and associated depositional systems. The stratigraphy of many continental rift basins show a vertical transition from an early fluvial, shallow lake or shallow marine succession to a deep lake or deep marine succession, when the rate of fault displacement is relatively low and sedimentation keeps pace with subsidence. As rifting continues, the rate of fault displacement increases markedly and sedimentation cannot keep pace with subsidence, this is known as the rift climax stage. On seismic section, the rift climax system is characterized by an increased amount of aggradations, together with the development of divergent forms related to continued tilting of the hanging wall during deposition. During the late syn-rift phase, the sediment supply is outpaced the rate of tectonic/fault-controlled subsidence, resulting into the deposition of well sorted coarser clastics which would act as good reservoir.

This session will discuss the prospectivity of the syn-rift succession offshore Namibia's margin, which has not yet been penetrated by any exploration wells, however similarities can be seen in structural architecture and seismic facies with some of the typical rift basin success cases, such as the AJ graben in the Orange Basin, South Africa, where oil was discovered in 1988. By comparing them to different field analogues from various sedimentary basins this will aid in better understanding their impact on exploration.

SOUTHERN NAMIBIA FIELD TRIP

THE NAMA AND KAROO IN SOUTHERN NAMIBIA: TWO SUPERIMPOSED BASINS WITH BITS AND PIECES OF AN ANCIENT PETROLEUM SYSTEM

Field Trip Leaders
Ansgar Wanke
Reconnaissance Energy Namibia
Raydel Toirac
Pioneer Oil & Gas Consulting
Location: Namibia
Start / Return: Windhoek

Dates: 3rd – 6th June 2022
Fee: \$1380 for 3 nights / 4 days
(including transport, meals and lodge accommodation)
Registration Deadline: 28th April 2022

[Register online via the website](#)

ITINERARY

3rd June

- Depart from Windhoek to Hardap (ca 300km)
- Overnight Hardap Resort (Namibia Wildlife Resorts)
- Geology: Weissrand and Hardap Karoo

4th June

- Drive to Fish River at Ganigobis and M98 Bridge (ca 190km)
- Drive to Maltahöhe (ca 260km)
- Overnight Maltahöhe Hotel
- Geology: Lower Karoo Outcrops along Fish River; Nama Fish River Subgroup and bitumen shows

5th June

- Drive to Sesriem and Sossusvlei (ca 230km)
- Drive to Zebra River Lodge (ca 145km)
- Overnight Zebra River Lodge
- Geology: Sossusvlei Star Dunes and Vlei, Lower Nama Group Omkyk Member Reefs and Grainstones – Sequence Strat

6th June

- Drive to Windhoek (ca 330km)
- Geology: Driedoornvlagte Reef Complex (Nama Group)

The lower Nama Group (Kuibus subgroup) exposed in the Zebra River area



View from the Tsauchab River to the Naukluft front



OVERVIEW

Fieldtrip Objectives:

The objectives of the fieldtrip are the following:

- Introduction to the Upper Carboniferous - Permian lower Karoo sequence (Dwyka and Ecca Groups) of southern Namibia with emphasis on the glacial – to post-glacial transition and associated source rock deposition.
- Observe a sequence of basaltic flows (Kalkrand floodbasalts - Drakensberg Group) interbedded with siliciclastics as onshore analogues to reservoirs offshore Namibia. Relate outcrop to seismic scales of observation.
- Give an overview to the Ediacaran – Early Cambrian Nama Basin. Demonstrate the sequence architecture of the Kuibus subgroup using excellent exposures in the Zaris sub-basin along the Zebra River and at the Driedoornvlagte Ridge. Relate outcrop to seismic scales of observation.
- Show the magnificent star dunes at Sossusvlei as an effective barrier to the present-day Tsauchab River. Discuss the Cretaceous Tsauchab River as a main sediment source for the Lüderitz basin offshore Namibia

Terms and Conditions:

- Travel dates to consider – arrival one day prior to the field trip (2nd June)
- Fees include meals and transportation from 3rd – 6th of June. Water will be provided during drives. Snacks are not included.
- Fees include accommodation for the nights of 3rd, 4th, and 5th of June
- Cancellations received on or before the 27th April 2022 will be charged \$100.
- Cancellations received after the 27th April will be charged the full amount.

The giant dunes at the Sossusvlei



Upper Carboniferous black shales of the last deglaciation stage exposed at the banks of the Fish River



RIFTED MARGINS INTERACTIVE SEISMIC WORKSHOP

Workshop Leader
Paul Bellingham, Ion Geophysical

Date: 8th June
Time: 11am – 1pm

DESCRIPTION

A hands-on seismic workshop during which you will use conjugate seismic data from the South Atlantic as the basis to investigate the basin architecture and tectonostratigraphic development. We will investigate the Namibian Atlantic margin in the context of its South American conjugate. The first pair of sections will be from the Orange basin across to Uruguay and the second pair will be from the Walvis basin to the Pelotas basin in Brasil. Using these example lines from ION's deep, mega-regional Basin SPAN seismic data you will be able to directly interpret the full crustal structure and the stratigraphy from shelf to the distal setting.

After an initial presentation, attendees will split into small working groups and spend time interpreting some of the key features on a set of sections and will then convene to discuss as a group what can be inferred about the structure, development, environments of deposition and implications for the petroleum system in the areas. We will also put these discussions in the context of the exploration results in the different areas.

*This workshop is only open to registered workshop participants.