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SUMMARY

LETTER FROM GENERAL CHAIR

Welcome to Rio de Janeiro, the Wonderful City! On behalf of the Organizing Committee, we welcome you to the 3rd Brazilian Petroleum Conference with the theme Deepwater Pre-Salt Carbonates & Turbidites in Brazil: From Exploration to Production and Beyond.

The Brazilian Petroleum Conference - BPC - takes place every 3 years 2015, 2018 and this 3rd edition was postponed to 2022 due to the pandemic and because we wanted an in presence event like the previous ones..

In its first edition, BPC brought the broad spectrum of exploration and production of carbonate rocks in Brazil and around the world. In the second edition, the focus was on the pre-salt from its discovery to early production and with a strong focus on reservoirs, petrophysics, diagenesis, seismic attributes, drilling and studies of analogous carbonates from various parts of the world.

In this 3rd edition, the pre-salt is a reality and already responsible for more than 70% of Brazil's petroleum production and presentations about the pre-salt giant and supergiant fields will show the knowledge consolidated until today and the challenges yet to be solved.

BPC will also bring the new exploratory frontiers in Brazil: The potential of Equatorial marginal basins and Eastern and Southern marginal basins, as well as a presentation of the discoveries from Guyana, Suriname and Namibia. The mature Campos Basin, E&P model in turbidites, its history of success, revitalization and decommissioning actions will also be presented.

The energy transition is underway, and society overall faces the challenge on how to make a transition to a low-carbon energy future with energy security to nations and the benefits of energy to the world population. BPC will bring the scenario of the energy transition and the decarbonization of our industry.

In this edition for the first time and thanks to our sponsors, 50 students and young professionals will participate in the event, will have special activities and will meet with the main leaders of our industry. They will also receive a one-day training on E&P activities, energy and soft skills.

The 3rd BPC brings a very attractive program and is meant to be very interactive having no parallel sessions allowing fruitful discussions during breaks and luncheons after 3 years of only online events.

Finally I would like to thank our sponsors, ABGP and SPE presidents and board of directors, the organizing committee, speakers, session chairs and all participants who will make one more successful Brazilian Petroleum Conference.

Enjoy the event, the city and the opportunity to interact with friends and colleagues. We can not take it for granted.

My best regards,

Sylvia Anjos

3rd BPC General Chair, BPC Organizing Committee

ORGANIZING COMMITTEE

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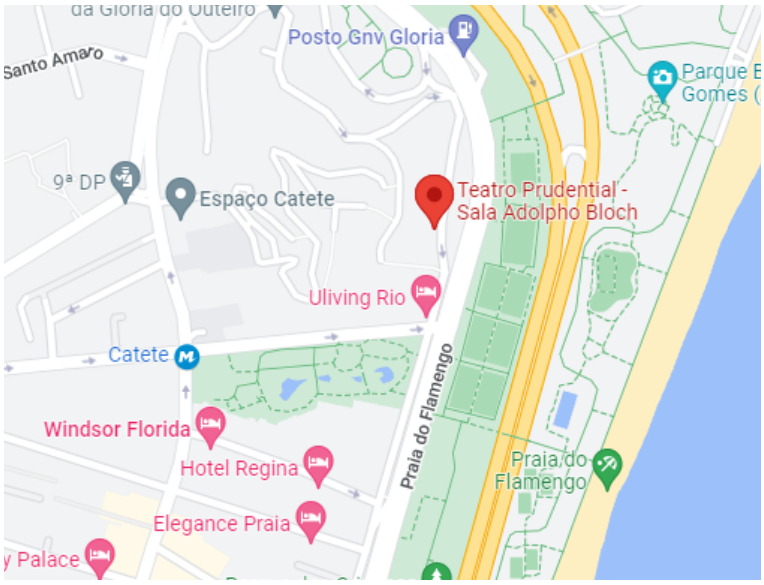
LOCATION

TEATRO Prudential

Rua do Russel, 804
Glória, Rio de Janeiro - RJ

(550m - 6min to the Catete Station)



RESTAURANTS NEARBY

BISTROGRO
Carne Suína
Praia do Flamengo, 2 - Flamengo
71m - 1min

BAR DO ZECA PAGODINHO
a la carte
Praia do Flamengo, 20 - Flamengo
150m - 2min

SUSHI GLÓRIA
Japanese food
Edifício Russel, R. do Russel, 450 - Glória
300m - 3min

BERBIGÃO
Seafood
R. do Catete, 150 - Catete
550m - 7min

BABUSKA
Buffet
Windsor Flórida, R. Ferreira Viana, 81
Flamengo
700m - 8min

GALETEANDO
Buffet, a la carte
R. do Russel, 32 B - Glória,
750m - 9min

FULL PROGRAM

SEPTEMBER 13, TUESDAY

8:00-9:00	**Welcome Coffee & Registration**
Opening Session	
9:00-9:10	Opening Ceremony - ABGP/ SPE Marcos Amaral, ABGP President | Carlos Pedroso, SPE Brazil President Sylvia Anjos, General Chair
9:10-9:40	**Special Opening Session** **Honorary Chair: Tiago Homem, Petrobras**
9:40-10:10 ***virtual***	**Keynote Lecture: Seeking an Energy Security and Carbon Emissions Balance** **Scott Tinker, Bureau of Economic Geology**
10:10-10:40	Petroleum Potential of the Equatorial and East Margin Basins - Where are we and where do we want to go? **Marina Abelha, ANP**
10:40-11:10	Pre-Salt as the game changer for offshore oil and gas production **Antonio Pinto, PPSA**
---- Refreshment Break ----	
Session 2 - Pre-Salt Exploration and Production **Chairs: Frances Abbots, Shell | Cristiano Sombra, UFF**	
11:30-12:00	Exploration Perspectives in Brazil: current activities and future opportunities **Diego Gracioso, Shell**
12:00-12:30	Geomechanical challenges to successful reach and drill pre-salt reservoirs **Vivian Marchesi, Baker Hughes**
---- Lunch ----	
Session 3 - Pre-salt Depositional Model Reservoir & Diagenesis Chairs: Adali Spadini, Ex Petrobras | Peter Homewood, Geosolutions TRD	
13:45-14:15	Modern Microbial Carbonates and Possible Correlations with Pre-Salt Microbialites of Santos Basin **Anelize Bahniuk, UFPR**
14:15-14:45	Diagenesis of the Pre-salt deposits of Alto de Tinguá on the offshore Cabo Frio High, Brazil **Monique Mettraux, Geosolution TRD**
14:45-15:15	Salta outcrops and similarities to Brazilian Pre-salt **Maria Mutti,University of Potsdam**
15:15-15:45	Use of machine learning for reservoir characterization **Lalitha Venkataramanan, Schlumberger**
---- Refreshment Break ----	
Session 4: Pre-Salt & Giant Fields Chairs: Bruno Moczydlower, Petrobras | Paulo Otávio, Ecopetrol	
16:15-16:45	Mero field: an overview of the Development Plan using New Tecnologies **Daniel Henrique Gonçalves, Petrobras**
16:45-17:15	The Giant Bacalhau Field **Lars Jetlund Hansen, Equinor**
17:15-17:45	Tupi 2.0 - A new Master Plan for the Pioneer Pre-Salt Super Giant **Luciana dos Santos Silva, Petrobras**
17:45-19:15	**Cocktail and** **Meet&Greet - Conections | ABGP and SPE with Student Chapters**

FULL PROGRAM

SEPTEMBER 14, WEDNESDAY

Session 5: Gas Management & Energy Transition Chairs: Priscila Moczydlower, Petrobras | Paulo Johann, Petrobras	
9:00 - 9:30	HISEP™ – A Subsea Rich CO_2 Gas Separation System do Debottleneck Plattaforms **Fabio Passarelli, Petrobras**
9:30-10:00	Operational update on WAG injection mechanism benefits in the Brazilian pre-salt carbonate context **Roland Bouchet , TotalEnergies**
10:00-10:30	What we've learned from the onshore revolution to unleash the energy transition in Brazil **Frederico Miranda, Eneva**
---- Refreshment Break ----	
Session 6: Decarbonization & Gas Management Chairs: Giovanna Carneiro, Schlumberger | Vinicius Machado, Petrobras	
10:50-11:20	COPPE Low Carbon Solutions Center **Angela Uller, COPPE/UFRJ**
11:20-11:50 ***virtual***	CO2 EOR as a means to geologically store CO2 and CCUS **Cesar Patiño, IEA**
11:50-12:20 ***virtual***	CCUS as a tool for sustainable development **Eduardo Falabella, UFRJ**
---- Lunch ----	
Session 7: Campos Basin - From Exploration to Increasing Recovery Chairs: Dimas Coelho, TotalEnergies | Carlos Abreu, UNB	
13:30-14:00	From Arcade to Contemporary, the rich history of the pre-salt in the Campos Basin **Cristiano Rancan, Petrobras**
14:00-14:30	Campos Basin post-salt exploration: 50 years of evolution in geoscientific knowledge **Ari Candido, Petrobras**
14:30-15:00	Mature Fields **Maria Clara Costa, Equinor**
15:00-15:30	Frade field: a Turnaround case **Luis Longhi - PRIO**
---- Refreshment Break ----	
Session 8: Campos Basin and Decommissioning Chairs: Eduardo Zacaron, Petrobras |Rogério Schiffer, Independent Consultant	
15:50-16:10	Technology Development, how it impact your P&A projects **Jørn Tore Giskemo, Halliburton**
16:10-16:40	Well Abandonment – Well Formation & Evaluation Workflow for Through Tubing Plug and Abandonment **Rafael G. Kenupp Pereira, Trident Energy**
16:40-17:10	The new mature era of the Campos basin: opportunities to increase the recovery factor **Rodrigo Amaral, Petrobras**

FULL PROGRAM

SEPTEMBER 15, THURSDAY

Session 9: Guiana and Equatorial Margin Basins Chairs: Lincoln Guardado, Independent Consultant | Renato Darros, Níon Energia	
9:00 - 9:30	Similarities in Selected Petroleum Systems Offshore Guayana, Suriname and Brazil **Sidney Rostirolla, 3R Petroleum**
9:30-10:00	The Petroleum Potential of the Equatorial Margin as seen in New Seismic Data **Pedro Victor Zálan, ZAG Consulting**
10:00-10:30	The Guiana Petroleum Systems and results **Victor Vega, Frontera Energy**
---- Refreshment Break ----	
Session 10: E&P Expectations, Eastern and Equatorial Margin Basins Chairs: Aloisio Pellon, Enauta | Paulo Ricardo, Independent Consultant	
10:50-11:20	***Petrobras Vision and E&P Expectations*** Vision an Expectations for the Future of Exploration and Production **Marta Vieira Abrão, Petrobras**
11:20-11:50	Petroleum Systems of the Brazilian Equatorial Margin: The Next Brazilian Exploration Frontier **Bruno David, TotalEnergies**
11:50-12:20	The eastern Margin Basins: a New vision for exploratory perspectives in Brazil **João Claudio Conceição, Findout Oil&Gas**
---- Lunch ----	
Session 11: SEAP, Eastern Margin Basins and Namibia Chairs: José Milton Mendes, Independent Consultant |Luciano Seixas, Independent Consultant	
13:30-14:00 ***virtual***	Turbidite Zones, impacts for exploration strategy and reservoir characteristics: examples from Santos, Campos and Espírito Santo Basins **Roberto Davila, Petrobras**
14:00-14:30	SEAP: a new frontier for O&G production in ultra deep water NE Brazil **Marcos Aurélio Lucas, Petrobras**
14:30-15:00	Regional Geomechanical Modeling in Pelotas Basin **Marcos Fetter, UFF**
15:00-15:30	Deep-Water Offshore Namibia: The Future Giant Oil and Gas Province of the Southern South Atlantic Basins **Marcio Rocha Mello, Brazil Petrostudies (BPS)**
---- Refreshment Break ----	
Session 12: Enablers Technologies: Wells & Seismic Chairs: Olivier E. Wambersie, Shell | Roberta Mendes, Petrobras	
15:50-16:10	Pre salt well engineering – Today and tomorrow **Danilo Gozzi, Petrobras**
16:10-16:40	Geophysical Technologies Innovation Applied to Campos, Santos and Equatorial Margin **Paulo Johann,Petrobras**
16:40-17:10	Towards autonomous seismic monitoring of pre-salt fields **Jorge Lopez, Shell**
17:10-17:40	**Special Closing Session** **Chairs: Sylvia Anjos, ABGP |Marcos Amaral, ABGP |Carlos Pedroso, SPE Brazil** Buzios Global Development Plan: Unlocking the potential of the world's largest ultra-deepwater oil field **Fabiano Omar - Petrobras**

18:00-20:00	**Leadership Meeting Program** **ABGP and SPE Closed Meeting With Student Chapters**

OPENING SESSION - PETROBRAS RECOGNITION AWARDS

Tiago Homem
PETROBRAS

Honorary Chair

Curriculum Vitae

Tiago Homem is the head of Petrobras Reservoir Division since 2019. Before that, he served as Pre-Salt Technical Competencies General Manager and as reservoir manager for Tupi, Iracema and Iara areas. Mr. Homem joined Petrobras in 2005. Before that, he worked as civil engineer in public sector.
He holds a BSc and a MSc in Civil Engineering from Federal University do Rio Grande do Sul, a post grad in Petroleum Engineering from Federal University of Bahia and a MBA in People Management from Getúlio Vargas Foundation.

SPEAKERS

OPENING SESSION

SEEKING AN ENERGY SECURITY AND CARBON EMISSIONS BALANCE

Scott Tinker

BUREAU OF ECONOMIC GEOLOGY

Keynote Lecture

Curriculum Vitae

Scott Tinker works to bring industry, government, academia, and nongovernmental organizations together to address major societal challenges in energy, the environment, and the economy. Dr. Tinker is Director of the 250-person Bureau of Economic Geology, the State Geologist of Texas, and a professor holding the Allday Endowed Chair in the Jackson School of Geosciences at The University of Texas at Austin. With Director Harry Lynch, Tinker coproduced and is featured in the award-winning energy documentary films Switch and Switch On, which have been screened in over 50 countries and used on thousands of campuses worldwide. Dr. Tinker formed, and serves as Chairman of, the nonprofit Switch Energy Alliance, whose materials appear from schools to board rooms globally. Tinker is the voice of EarthDate, which is featured weekly on over 425 public radio stations in all 50 United States. In his visits to some 60 countries, Scott has given nearly 1000 keynote and invited lectures. In 2022, Dr. Tinker presented a TEDx talk on The Dual Challenge: Energy and Environment. He is an AGI Campbell Medalist, AAPG Halbouty Medalist, GCAGS Boyd Medalist, American Institute of Professional Geologists (AIPG) Parker Medalist, and a Geological Society of America (GSA) Fellow.

PETROLEUM POTENTIAL OF THE EQUATORIAL AND EAST MARGIN BASINS - WHERE ARE WE AND WHERE DO WE WANT TO GO?

Marina Abelha

ANP

Curriculum Vitae

Marina Abelha is graduated in Geology from the Federal University of Rio de Janeiro (UFRJ) in 2008. Completed her Masters in Geology at the same university in 2010, focusing on sedimentology and stratigraphy. Currently pursuing a PhD in Public Policy. At the beginning of her career, she was Substitute Professor of Sedimentology at UFRJ. She joined the National Agency of Petroleum, Natural Gas and Biofuels (ANP) in 2008. She worked as a Geologist and as Deputy Superintendent of Block Definition, as Advisor to the Board of Directors, as Deputy Superintendent of Exploration as Superintendent of Exploration and served as a Substitute Director. Currently she acts as Exploration Superintendent.

PRE-SALT AS THE GAME CHANGER FOR OFFSHORE OIL AND GAS PRODUCTION

Antônio Carlos Capeleiro Pinto

PPSA

Curriculum Vitae

Mr. Antonio Pinto holds a Master 's Degree in Petroleum Engineering from UNICAMP. He has 39 years of experience in offshore field development and management. In Petrobras, he headed, for almost 10 years, the design and development of the Santos Basin Pre-Salt fields. In 2018-2019, Antonio was the Reservoir Executive Manager at Petrobras. Currently, at PPSA, he is the Executive Manager for the PSC of Buzios. In 2015 Antonio received the OTC Brazil award, for his individual contribution for the development of deep water fields. In 2021, he was elected a member of the Brazilian Academy of Engineering. He is a SPE Distinguished Lecturer 2022-23.

EXPLORATION PERSPECTIVES IN BRAZIL: CURRENT ACTIVITIES AND FUTURE OPPORTUNITIES."

Diego Gracioso
SHELL

Shell is an international energy company with expertise in the exploration, production, refining and marketing of oil and natural gas, and the manufacturing and marketing of chemicals that aims to meet the world's growing need for more and cleaner energy solutions in ways that are economically, environmentally and socially responsible.

Powering Progress sets out our strategy to accelerate the transition of our business to net-zero emissions, in step with society. It is designed to deliver value for our shareholders, for our customers and for wider society. Powering Progress serves four main goals: generating shareholder value, achieving net-zero emissions, powering lives and respecting nature.

Our operations are divided into our businesses: Upstream, Integrated Gas and Renewables and Energy Solutions (formerly New Energies), and Downstream. Exploration is a key part of Shell's integrated global energy business. It delivers valuable resources in support of the company's strategic objectives for Conventional Oil and Gas, in Deep water and for the Integrated Gas business. This is how we fuel the Shell engine.

With 109 years in Brazil, Shell is present in several businesses such as Exploration, Production, Trading, Research & Development, Wind, Solar and in the energy trading market. Our production in Deep Waters is around 400 thousand barrels of oil equivalente (May, 2022), being the largest international company in country.

With over 25 blocks (concessions and PSCs), our Exploration Portfolio is focused on Deep-Water spanning from North to South of Brazil in Barreirinhas, Potiguar, Campos and Santos. By continuously de-risking and re-building our portfolio in Brazil we continue to demonstrate our commitment to growing our production in country and our strong belief in the value deep-water resources brings to our shareholders.

Curriculum Vitae

Diego Gracioso is a geologist by background with +10 years experience with BSc and Msc in Geology from Rio de Janeiro University. Diego is currently the Team Leader for Portfolio Maturation Brazil in Shell based in Rio de Janeiro, responsible for the maturation of exploration projects in Campos and Santos basins. Has worked with Shell since 2011 on a variety of roles in the Exploration business such as regional evaluation, prospect maturation, well operations and portfolio management with assignments in Rio, Houston and London.

GEOMECHANICAL CHALLENGES TO SUCCESSFUL REACH AND DRILL PRE-SALT RESERVOIRS

Vivian Marchesi, Thiago Figueiredo Polari Pessoa, Olga Carvajal Garcia
BAKER HUGHES

The geomechanical challenges to successfully reach and drill pre-salt reservoirs are numerous and diverse, directly leading to high costs due to non-productive time (NPT). Considering global drilling numbers, the cost of NPT is estimated as 25% of total drilling costs, with geomechanical related incidents responsible for 37% of this value. Reducing these costs is the main goal of geomechanical studies. Specific challenges are faced during drilling post-salt, salt, and pre-salt sections. Post salt issues can include rock fluid interaction along shales, with time dependent behavior; thin intercalation between rocks with different rigidity (such as marls and claystones); presence of unconsolidated sandstones (turbidites); and presence of faults and fractured carbonates in the vicinity of salt top due to salt tectonism. Along salt section, expected risks include salt creep behavior (the higher the temperatures, the faster is the expected wellbore closure); potential kick zones when igneous inclusions are present (usually highly fractured and presenting abnormally high pore pressure); and possible fractured anhydrites placed on bottom of salt section, adjacent to pre-salt carbonates, that can represent a thief zone. Looking specifically to the pre-salt section, the main problem is the risk of severe losses. Pre-salt carbonates are frequently fractured and can present vugs and caverns resulting from diagenetic processes. When these secondary porosity features are interconnected with natural fractures, they represent the most critical scenario. Experience shows volumes higher than 10.000 bbl of losses on pre-salt carbonates. These severe losses can lead to additional problems such as stuck pipe due to differential pressure, pack-off and a poor cementing job. Due to the uncertainty in pore pressure, fluid inflow can also be expected, given the high permeability of interconnected pores and fractures. Multidisciplinary teams, composed by geophysicists, geologists and geomechanical specialists can predict in advance these features and propose best well schematic, mud weight and mud composition and drilling practices to successfully drill in these areas. Another typical issue in pre-salt drilling is related to low rate of penetration (ROP), fast bit wear and consequent tight hole due to the presence of hard carbonates, with high unconfined compressive strength (UCS). An optimization of ROP can also be achieved with multidisciplinary work, studying formation mineralogy, and proposing optimized fluid and bit programs. When igneous rocks are present on pre-salt section, they can lead to a combination of the problems presented before, such as low ROP, severe losses to fractures and even pack-offs when the annular is excessively charged due to wellbore instability. The aim of this presentation is to show how the geomechanical approach can optimize pre-salt drilling projects, and consequently save drilling costs by delivering efficient drilling campaigns from seabed to and into pre-salt reservoirs.

KEYWORDS: PRE-SALT, WELLBORE STABILITY, GEOMECHANICS
SUPPORT: BAKER HUGHES

Curriculum Vitae

Vivian Marchesi has 14 years' experience in geomechanics. She is Senior Geomechanics Specialist at Baker Hughes and currently the President of Brazilian Committee of Rock Mechanics (National Group for ISRM), 2021-2022.
She has a PhD. in Civil Engineering/Geotechnics, with emphasis in Petroleum Geomechanics (PUC-Rio), a Civil Engineer degree from UFES (2005) and graduate degree in Petroleum Engineering from PUC-Rio (2010).
Her experience includes several consultant studies on geomechanical modeling and wellbore stability analysis in Latin America, 3D geological/geomechanical modeling for drilling purposes in pre-salt Brazilian basins, and development of a real time wellbore stability software for Petrobras.

MODERN MICROBIAL CARBONATES AND POSSIBLE CORRELATIONS WITH PRE-SALT MICROBIALITES OF SANTOS BASINS

A. Bahniuk Rumbelsperger & L. Cury
LAMIR INSTITUTE / UNIVERSIDADE FEDERAL DO PARANÁ (UFPR)

Modern carbonate environments, where microbialites are forming under comparable geomorphological, biological, climatic, volcanic and tectonics characteristics as those during the formation of the Aptian Pre-Salt microbialites on the Brazilian continental shelf, are possible analogues to improve our understanding of the physical-chemical processes involved the formation of ancient microbial carbonate deposits. Nevertheless, it is difficult to study a single modern example, which fulfils all the criteria required to define a realistic evolutionary model for the Aptian equivalent. Thus, we have selected for our evaluation several modern locations containing microbialites, which form under variable environmental conditions, e.g., the Pantanal, Central Brazil, Patagonia, Chile, and Puna, Argentina. These environments present vastly different conditions, which can furnish important insights, and taken together provide fundamental information to decipher relationships between the inorganic and organic processes involved in carbonate reservoir formation. In the Pantanal region, thousands of lakes are found distributed throughout one of the largest fan river systems. Microbial activity in many of these water bodies mediates the production of carbonates associated with authigenic clay mineral precipitation, e.g., smectite. In Chile's Patagonia Torres Del Paine region, the Sarmiento and Amarga lakes are located in an area of glacial regression, which represents an environment with recent microbialite formation in a cold and arid climate. Additionally, in this cold, arid region, Lake Pali Aike, situated in the crater of a dormant volcano, is potentially an interesting case study. Finally, in the Puna region, northwest Argentina, between the provinces of Salta and Catamarca, the lakes are situated in salares located on the altiplano at altitudes of ~5000 m and are often surrounded by volcanic structures. Each of these three different regions is characterized by extreme environmental conditions, such as a desert climate with high temperatures during the day and very low temperatures at night, strong winds and high incidence of solar radiation. The primary goal of integrating studies of these three distinctly diverse environments located in varying geological settings is to develop an actualistic facies model representing the ancient conditions of the various Pre-Salt lacustrine depositional environments, ranging from deep subaqueous, intermediate subaqueous, shallow subaqueous and subaerial systems.

Curriculum Vitae

Graduated in Geology from the Federal University of Paraná (2004), a Master in Exploratory Geology from the Federal University of Paraná (2007), and a Ph.D. in Natural Sciences from the Swiss Federal Institute of Technology in Zurich, Switzerland (ETHZ). Guest researcher for the Isotopic Geochemistry Course at CALTECH (USA) and attended the Geobiology Course promoted by NASA and Agouron Institute. She has experience in Geosciences, with emphasis on Mineralogy and Geochemistry, working mainly on the following subjects: geochemistry of carbonate rocks, depositional environments, and geomicrobiology. She is currently a Professor of Mineralogy at the Department of Geology at UFPR, and vice-director of the LAMIR Institute and the Forensic Science Center at UFPR. And, Research Productivity of CNPq - Brazil. A mother of two boys.

DIAGENESIS OF THE PRE-SALT DEPOSITS OF ALTO DE TINGUÁ ON THE OFFSHORE CABO FRIO HIGH, BRAZIL

Mettraux Monique,[1,2] Homewood Peter,[1,2] Neumann Reiner,[3] Arai Mitsuru,[2] Dias-Brito Dimas,[2] Gaspar José Carlos,[2] Santos Roberto Ventura,[4] Caetano-Filho Sergio[2]

1 GEOSOLUTIONS TRD; 2 UNESP; 3 CETEM;
4 UnB UNIVERSIDADE DE BRASÍLIA, INSTITUTO DE GEOCIÊNCIAS

Alto do Tinguá lies at the northern limit of the Santos Basin, at the border with the Campos Basin. This study is based on observations on core, sidewall cores, thin section and SEM microscopy, as well as the mineralogy, petrography, elemental and isotope geochemistry of samples from a cored well. Regional geology is combined with well data to build a local geohistory framework. Massive Cretaceous-Palaeogene magmatic intrusions complicated the geohistory recorded by the Alto do Tinguá deposits. This precludes establishing a simple succession of Eo-, Meso-, and Telo-diagenetic phases for the rift & sag deposits together. Reconstruction of the geohistory of Alto do Tinguá provides a framework for seven diagenetic phases, comprising the effect of the intrusive magmatics. Magmatics cored by the well were emplaced much later than the Pre-Salt sequence and overprinted earlier diagenetic features to some extent. Diagenesis phase I, before the Pre-Salt carbonates,affected the basement gneiss and stream transported clastics with surface exposure, erosion and weathering.Diagenesis phase II is early diagenetic, recorded in Jiquiá coquinas & clastics, and occurred in a shallow lacustrine environment with periods of emersion, karst (sedimentary Neptunian dyke with basement-derived conglomerate infill), groundwater pedogenesis, glauconitization and cementation. Diagenesis phase III, with fracturing and cementation of the Jiquiá and basement, corresponds to a strong structural event or several events (DPA, transition from strong rift faulting to sag flexural subsidence). Diagenesis phase IV occurred in the shallow alkaline-saline lacustrine environment of Alagoas lake, with early diagenetic dolomitization, silicification and cementation of both in-situ growths and reworked Alagoas deposits, but little addition to the features of the earlier diagenetic phases in the Jiquiá deposits. Diagenesis phase V recorded moderate burial effects in both Jiquiá and Alagoas rocks, with compaction and cementation under overburden of a shallow to intermediate depth marine environment. Diagenesis phase VI records massive igneous intrusions with heating loading and increased burial effects in the Pre-Salt (fracturing, compaction, stylolitisation) as the magmatic plumbing system fed extrusives and volcanoes, clearly seen on seismic; Diagenesis phase VII corresponds to progressive burial effects of the Pre-Salt deposits under the overburden deposited in a deeper marine environment. Thermal effects are documented close to the contacts with magmatic intrusives in both Jiquiá and Alagoas rocks with partial recrystallization of both calcite and NS dolomite. Metasomatic products are evidence of farther reaching effects from circulation of fluids linked to the intrusions (Fe-rich saddle dolomite, Zntennantite,chalcopyrite, goyazite-svanbergite). Ongoing analyses may help to better constrain temperatures and fluid origins linked to the magmatic intrusions. Porosity-permeability consequences of each of the diagenetic phases in the Pre-Salt at Alto do Tinguá are mainly a reduction of the porosity and the permeability network, although other locations could have greater karst development, open fractures with potential enhancement of the poroperm network from dissolution (circulation of hydrothermal or metasomatic fluids). Alto do Tinguá may provide a well-established analogue for similar scenarios, but other nearby locations may have different diagenetic stories.

SUPPORT: Libra Consortium, comprising Petrobras, Shell Brasil, Total Energies, CNODC and CNOOC Limited and Pré-Sal Petróleo S.A (PPSA), (ANP's R,D&I Investment Clause) Unesp-Petrobras agreement

Curriculum Vitae

Monique Metttraux (PhD: Fribourg Switzerland 1988) is senior partner of GEOSOLUTIONS TRD SAS. From 2011 to 2015 Monique worked exclusively with Petrobras in Rio de Janeiro on sedimentology, geochemistry and diagenesis of carbonates. Previously, Monique carried out training for PDO, IFP, IAP, Sonatrach, and Petrobras, and worked on Formation Damage Prevention for Petroleum Development Oman. Monique previously worked on numerous industrial carbonate projects (Andra – radioactive waste disposal; Elf Aquitaine - sedimentology and sequence stratigraphy; Gaz de France – carbonate reservoirs), and concurrently maintained academic research projects successively with Strasbourg, Dijon, Rennes (France); SQU (Oman) and more recently with UNESP (Brazil: 2017-2021).

SALTA OUTCROPS AND SIMILARITIES TO BRAZILIAN PRE-SALT

Maria Mutti,[1] Michele Vallati,[1] Sara Tomás,[1] Claudia Galli,[2] Anelize Manuela Bahniuk Rumbelsperger,[2] Sven Maerz,[1] Beatriz Coira[2]

1 POTSDAM; 2 SALTA ; 3 PARANÁ

Lacustrine and microbial carbonates in continental rift settings have been for decades important exploration targets in many rift basins and have gained more attention after the leading-edge South Atlantic pre-sal discoveries. The stratigraphic architecture of lacustrine systems reflects the complex interaction at different time scales of tectonics, depositional processes, climate and environmental factors and generate complex facies patterns and depositional heterogeneities. Understanding and constraining how these different processes interplay over different temporal and spatial scales is essential to predict spatial heterogeneities in facies distribution and reservoir properties at the large basin scale and at the reservoir zonation and characterization scale. However, given the localized nature of lacustrine settings, there are still very few studied outcrops of significant continuity where the integration of different scales of observation is possible within a regional framework. The late Cretaceous Salta basin in Nortwestern Argentina, in particular the Yacoraite Formation, comprise spectacular extensive outcrops of lacustrine carbonates and offer the chance to investigate lacustrine carbonates at different scales, providing insights into controlling processes. In this presentation we will discuss facies variability and controls over stratigraphic packaging, the lateral and vertical interplay of microbial carbonates, ooids and clastics , the 3D distribution of stromatolite layers and the petrophysical properties of the carbonates.

Curriculum Vitae

Maria Mutti is Professor and Chair of Sedimentary Geology (carbonates) at the University of Potsdam (Germany).Her research interests focus on carbonate systems in relation to Earth History as well as to 3D analogue studies in regard to facies, stratigraphy and petrophysics as applied to carbonate reservoirs. She has worked on pre-sal rocks since 2008. She has served as President for SEPM and is currently President elect of AAPG Europe, where she will focus on the role of geosciences in the energy transition.

USE OF MACHINE LEARNING FOR RESERVOIR CHARACTERIZATION

Lalita Venkataramanan
SCHLUMBERGER

Presentation will focus on the applications of Artificial Intelligence (AI) and Machine Learning (ML) for reservoir evaluation. It will introduce machine learning, lay out sample workflows and steps for machine learning applications. It will provide a good overview of some of the used cases for formulation evaluation and fluid property prediction in pre-salt carbonates and turbidite reservoirs.

Curriculum Vitae

Lalitha Venkataramanan is a Scientific Advisor in the Applied Math and Data Analytics department at Schlumberger Doll Research, Boston. She managers a program on Automated Log Interpretation. Her interests include petrophysics, machine learning, mathematical modeling and inversion, optimization, probability and stochastic processes. Trained as an Electrical Engineer, she obtained her M.S and PhD degrees from Yale University in 1998. She has published over 25 research papers and holds more than 14 U.S. patents. She is currently an active member of SPWLA, SPE and a board member of Society of Industrial and Applied Math (SIAM) industry committee.

MERO FIELD: AN OVERVIEW OF THE DEVELOPMENT PLAN USING NEW TECNOLOGIES

Ana Luiza Silva Costa, Daniel Henrique Gonçalves, Fabio Menezes Passarelli, Marcelo Becher Rosa, Mauro Yuji Hayashi, Paulo Fernando Aragão Sampaio

PETROBRAS

The giant Mero Field, 315 km^2, is among the biggest hydrocarbon discoveries in Brazilian Pre-salt province, located in the NW part of Libra block in Santos Basin ultra-deep waters (around 2,100 meters) and 180 km from the coast. The carbonate reservoir is around 5,300 meters deep, with a netpay that reaches 420 meters, filled with a high-quality oil 29oAPI, Gas-Oil Ratio (GOR) of 420 m^3/m^3 and CO2 content of 44%. In 2013, Libra Consortium (Petrobras - Operator, Shell Brasil, TotalEnergies, CNODC and CNOOC Limited) won the bid to explore and develop Libra block under a Production Sharing Contract (PSC), which is managed by the stateowned company Pré-Sal Petróleo S.A.(PPSA). The dimensions and complexity of Mero Field, lead the Consortium to build an integrated strategy for field development (De-Risking Strategy), that is based on the concept of fast track for technical information acquisition in order to conceive an optimized and robust Base Case to accelerate production and optimize Mero Project's economics, including the following approved systems for the Initial Production Development phase: 3 Early Production Systems (EPSs), using the chartered FPSO Pioneiro de Libra (50 thousand bbl/day of oil and 4 million m^3/day of gas), 4 Mega Definitive Production Systems (Mero 1, 2, 3, 4), using 4 chartered FPSOs (180 thousand bbl/day of oil and 12 million m^3/day of gas) and 1 complementary project (Mero FR), using Pioneiro de Libra FPSO to accelerate production from Mero 2 region. The 1st Oil occurred in 2017 within the EPS campaign. Regarding the CO2 Capture, Utilization and geological Storage project (CCUS), obtaining a sustainable development, and to maximize oil recovery, Mero Project considers the reinjection of gas and CO2 through alternating water and gas injection method (WAG) in all injectors, since the beginning of the field development. Smart completions will be widely used as all Mero wells will have two or three zones being remotely controlled. It is estimated that the Mero Project will reach the important milestone of about 330 million tons of CO2 reinjected (accumulated) by the end of the field's life, making it one of the largest offshore CCUS projects in the world. Mero leverages existing or innovative technologies and aims to identify and close technology gaps in an integrated approach to maximize project value and increase its attractiveness. As a result of this integrated approach, key applied technologies are being deployed like the innovative HISEPTM, which is an unprecedent high CO2 gas subsea separation and boosting that accelerates the production and consequently increase the recovery factor as well as the CTV (Cargo Transfer Vessel), an alternative solution for oil offloading with potential do reduce costs and CO2 emissions, step changes for the O&G Industry. In addition of these technologies in final stages of deployment, Mero Project has already pushed other offshore technologies beyond its previous limits, establishing industry "firsts", which have enabled an accelerated approval process and the development of the next production systems, maximizing the project´s results.The Libra Consortium acquired the rights to develop a new discovery that turned out to be a giant and high productivity reservoir with a huge volume of high-quality oil, but with a high GOR and CO2 content. The challenge is to transform this huge volume into an opportunity to delivery an optimized and sustainable project.

KEYWORDS: CCUS, HISEP, CO2, LIBRA, MERO

Curriculum Vitae

Daniel is Project Manager in Libra team at Petrobras, actually responsible for the HISEP® implementation and Mero Field and Libra Central Area integrated development. Joint the company in 2013 when specialized in Subsea Engineering. Since then, worked on several production projects in pre-salt and post-salt fields.
Graduated in Mechanical engineering at Universidade Federal de Minas Gerais (UFMG) has a specialization in Business Management at Fundação Dom Cabral (FDC).

THE GIANT BACALHAU FIELD

Lars Jetlund Hansen
EQUINOR

The Bacalhau Field is a giant, complex and overpressured pre-salt carbonate field located in the Santos basin, approximately 185 km from shore and in water depths of ~2100m. The field spans across two licenses, the BM-S-8 concession contract in the south and the Norte de Bacalhau Production Sharing Agreement (PSA) area in the north. The two license were unitized in 2021.

The field was discovered in 2012 by Petrobras, and operatorship later transferred to Equinor in 2016 through Equinor acquisition of Petrobras share and operatorship of the BM-S-8 license. Norte de Bacalhau license was won by a consortium of Equinor, ExxonMobil and Petrogal in the 2nd pre-salt PSA bid round late 2017.

The reservoirs are pre-salt carbonate lacustrine rocks that represent a plethora of different depositional and diagenetic environments and subsequently buried to a total depth of ~6000 meters from sea level. Initial reservoir pressure is approximately 900 bar, with more than 300 bar over pressure. The oil is of high quality, heavily undersaturated, and with insignificant CO2 and H2S content. Three wells were drilled in BM-S-8 by Petrobras prior to the Equinor acquisition, and two additional appraisal wells were drilled by Equinor in Norte de Bacalhau, allowing for a more complete understanding of the full field potential.

Bacalhau is being planned as a phased development. The Bacalhau Phase 1 development is being planned for the southern part of the field. The selected concept for Phase 1 comprises a subsea production system, and a floating production, storage and offloading (FPSO) facility. The drainage strategy is re-injection of produced gas and in addition injection of water to maintain reservoir pressure. The Phase 1 project had Final Investment Decision in 2021, and is currently in execution phase and will start pre-drilling of development wells in 2022.

Curriculum Vitae

Lars has a broad upstream experience within development of assets in all phases from exploration to production. He holds an MsC within Petroleum Engineering and Industrial Economics in 2002 from NTNU in Norway, and started his career in Equinor working with reservoir and production management, as well as offshore operations. He has throughout his career worked in professional and leadership positions across the portfolio of Equinor within project development, operations, asset management and business development in Norway, Angola, Brazil and Tanzania, among other. He currently holds the position as Subsurface Development manager for the Bacalhau Area, and Chair of Bacalhau Technical Committee, located in Rio de Janeiro.

TUPI 2.0 - A NEW MASTER PLAN FOR THE PIONEER PRE-SALT SUPER GIANT.

Luciana dos Santos Silva, Saulo Telles de Souza Lima, Jose Sergio de Araujo Cavalcante Filho, Tetsuo Mineiro Miyakawa, Flávio Alves Souto Cruz, Bruno Moczydlower

PETROBRAS

Currently the largest deep-water oil producer in the world, the Tupi Field is operated by Petrobras in a consortium formed by Petrobras, Shell, Petrogal and PPSA. Located in the Santos Basin, offshore Brazil, 230 km away from the Rio de Janeiro's coast, the 1500 km2 reservoir is composed by carbonate rocks containing fractures and karsts that impact the dynamic behavior of the subsurface fluid flow and that must be considered in the production and injection strategies. The reservoir total depth is higher than 5000 m, being 2100 m of water depth and around 2000 m of a salt layer. The reservoir fluid is classified as a volatile oil with compositional grading and CO2 content ranging from 8% to 20%. Due to high CO2 content and to comply with export gas composition constraints and with emissions guidelines from all companies in the consortium, reinjecting the CO2-rich produced gas is mandatory but also an opportunity, since the main recovery mechanism applied in the field is the water alternating gas injection (WAG). With a fast-track project development, between 2010 and 2019 nine production systems were deployed (including 2 in the Iracema area), consisting of: 9 FPSOs; around 120 subsea wells; and over 2000 km of subsea risers and flowlines. Due to the development strategy defined, Tupi field reached a production peak in 2020 of near 1.2 million barrels per day. Nowadays, with almost 12 years of commercial production, Tupi has a cumulative oil production of over 2.3 billion barrels.

Although some FPSOs are still in the ramp up period, the consortium decided that it was already time to start a new phase, in search for new opportunities to improve oil recovery and increase the production life of such an important asset. The challenging task of developing a new master plan for this pioneer pre-salt super giant field began at the end of 2020 in an integrated task force composed by different specialists of each company. Starting from a "no further actions" (NFA) development scenario, several new opportunities were thoroughly discussed, such as: drilling infill wells; increase of WAG infrastructure; debottlenecking production/injection capacities; extending production life of current production units; and adding new production units in substitution to some of the current ones. Each new opportunity was then incorporated in the reservoir numerical simulator to obtain production forecasts and the respective economic indicators. The result of this intensive and integrated work was the addition of new potential opportunities in the field's project portfolio, even though most of these alternatives depend on the extension of the current concession contract. Many other opportunities were identified but left for future field scale evaluation due to lack of commercial and/or technological readiness level. Among these other opportunities, foam injection and the use of innovative subsea technology to increase desulphated water injection in the reservoir are very promising and may generate new pilot projects, opening new frontiers for the Brazilian Pre-salt Giant Tupi.

KEYWORDS: TUPI, IOR, EOR, REVITALIZATION, RECOVERY FACTOR
SUPPORT: Petrobras, Shell, Galp

Curriculum Vitae

Graduated in telecommunication engineering from IME, Luciana joined Petrobras as a petroleum engineer in 2004 where she started working as reservoir engineer of Roncador pos salt field in Campos Basin. She worked as a reservoir management engineer till 2009. After that she did her master's degree in uncertainty analysis at UNICAMP. Since 2012, she works as a manager of reservoir teams, starting with the pos salt field of Roncador. In 2018, she began to work with pre-salt fields, coordinating the reservoir project teams of Iara, Búzios and more recently Tupi, Iracema and Sapinhoá.

HISEP™ - A SUBSEA RICH CO_2 GAS SEPARATION SYSTEM DO DEBOTTLENECK PLATTAFORMS

Fabio Passarelli
PETROBRAS

Some deepwater offshore reservoirs contain fluids with high Gas-Oil Ratio (GOR), CO2 content and productivity index (PI). These characteristics, found in some Brazilian Pre-salt areas, lead to large production facilities with complex gas processing sections and constrained oil processing capacities. In these scenarios, the application of HISEPTM, a high pressure, dense phase separation technology patented by PETROBRAS and under development by PETROBRAS and Libra Consortium, allows enhancing production by enabling the separation and reinjection of a major fraction of the CO2 rich associated gas from the seabed as a dense fluid. Thus, HISEPTM has the potential of reducing the need for large gas processing plants in topsides, allowing to increase the oil processing capacities, extend the oil production plateau and accelerate production. As HISEPTM is a new concept of a subsea system, a robust qualification program based on API 17Q has been planned to assess the technology maturity until HISEPTM is considered as a field-proven system. By concluding a de-risking phase that validated the separation at high pressures and the performance of centrifugal pumps for handling dense gas, the HISEPTM technology is considered validated as a non-integrated system. Next steps in the technology roadmap comprise the system construction, integration, installation, and operational tests in the actual environment (Mero Field). This work presents the HISEPTM technology, informs on recent activities in its qualification program and presents the next steps until it reaches the field proven status.

KEYWORDS: HISEPTM, High GOR, CO2, Subsea Processing, Gas Plant Debottlenecking

Curriculum Vitae

Carioca, graduated in chemical engineering and post-graduated in petroleum processing engineering from UERJ. Started his career at Companhia Brasileira de Petróleo Ipiranga, at the lubricating oil factory in Rio de Janeiro, where worked for 4 years. Joined PETROBRAS in 2002, at CENPES, in the area of Petroleum Evaluation. He resigned from PETROBRAS in 2005 and worked for 2 years at the National Petroleum Agency (ANP) as a Specialist in Regulation of Petroleum and Derivatives. In 2008, he returned to CENPES (PETROBRAS), in the area of development of processing technologies. From 2014 to 2022 he worked on the Libra Project, focusing on subsea and topside systems. Has been at CENPES since March 2022, leading the development of disruptive production concepts and the integration of technology portfolios. Coordinated the embedded GTL research project, and is the author of PETROBRAS patents for the HISEP technology.

OPERATIONAL UPDATE ON WAG INJECTION MECHANISM BENEFITS IN THE BRAZILIAN PRE-SALT CARBONATE

Roland Bouchet, Serugue Abreu e Santiago
TOTALENERGIES EP BRASIL

Some characteristics of the Brazilian pre-salt carbonate fields include ultra-deep water depths of 1.5-3.0 km, thick salt layer, thick reservoir interval (200-400m), good porosity, very high productivity per well, complex permeability distribution, with technical and operational challenges for their development. To maximize project value, it is essential to achieve the highest ultimate oil recovery from these fields. The application of enhanced oil recovery (EOR) processes on this relatively new deep-offshore frontier has been studied since the early development stages by Petrobras, the operator in many of the pre-salt fields. Water-Alternating-Gas (WAG) injection was found to be an interesting mechanism since it uses two readily available resources: sea water and produced (associated) gas. In this process, gas and water are alternately injected into the reservoir for specific periods of time (cycles). WAG injection combines the improved displacement efficiency of alternating gas and water injection, that have different viscosities and densities. As the injected fluids (gas/water) start to breakthrough on the producers, the gas-oil ratio (GOR) and the water cut (WCT) increase on the wells. To control this increase and optimize production, the injected fluid is swapped routinely from gas to water and vice-versa in cycles that usually last from 6 to 12 months. WAG injection depends on the operational constraints such as limitations on the topside (pump, compressor, pipe, valves, etc.) and reservoir/well constraints such as reservoir fracturing pressure, wellhead and casing pressure limits. For such complex recovery mechanism, it is important to monitor closely the reservoir and well parameters by gathering as much information as possible that may support on the understanding of the reservoir behavior. In this context, it is a common reservoir monitoring practice to inject tracers (either in the gas phase and in the water phase) into the injection wells. As the tracers arrive on the producers, it is possible to identify communication paths between injector and producers as well as to estimate the displaced oil volume. This provides valuable data that can be used for history matching the reservoir model. A sound reservoir management, which includes the definition of the optimum WAG configuration and cycles length, is key to take full advantage of this EOR process. This presentation shares some operational observations.

Curriculum Vitae

Roland L. Bouchet started his career with TotalEnergies in Indonesia in 1985. He was posted around the world initially as a reservoir engineer and later as a subsurface / development / technical / asset manager. The countries he was posted includes: United Arab Emirates, France, Argentina, Venezuela, Angola, Kazakhstan, China. In several instances he was seconded to Partner companies: Conoco (Dubai Petroleum Company), PDVSA (Sincor now Petrocedeno), North Caspian Oil Company (Kashagan), CNPC (PCOC Sulige), ADNOC Onshore (previously ADCO). He is since October 2020 Geosciences Manager at TotalEnergies EP Brasil, in Rio de Janeiro.

WHAT WE'VE LEARNED FROM THE ONSHORE REVOLUTION TO UNLEASH THE ENERGY TRANSITION IN BRAZIL

Frederico Miranda
ENEVA S.A

Although with an extended exploration history, since the 1950s, the number of commercial discoveries in the Amazonas, Paraná, Parnaíba and Solimões basins in Brazil is minor compared to their own potential and to other Paleozoic basins worldwide. The exception so far, in Brazil, is the Solimões basin which has produced hydrocarbons since the 80s with significant oil and gas discoveries.

The recent application of the reservoir-to-wire (R2W) business model in the Brazilian onshore Paleozoic basins unleashed the awakening of these basins across the country. The concept consists of integrating within the same company exploration, production, power generation, construction engineering and monetization capabilities. This integration allows dynamic, fast decision-making process, and optimized value-creation projects.

The Parnaíba basin was the first one in the country to have a commercial R2W project implemented. The project consists of monetize gas trough power generation using gas fired turbines. Later, vapor turbines were added to the system to increase efficiency, enhance generation capacity, and reduce carbon footprint. The use of integrated small scale solar plants in the well clusters and gas treatment units also contribute to reduce emissions.

The second basin to have a reservoir to wire project was the Amazonas basin in which the business model was adapted to onsite LNG production and road transportation to a power plant located 1.000 km north from the gas field in the Roraima State. The replacement of diesel generators reduced 38% of CO2 emissions in the region and ensured energy stability, instead of relying in imports.

The Paraná basin, although it had a few gas discoveries in the early 80s and late 90s have never produced commercial hydrocarbons. With a massive areal extent, excellent source rocks and reservoir units the basin has a promising potential. Considering its geographical location there's also a lot of interest in the basin due to its location in the most developed and industrialized region in Brazil.

Parallel ongoing investments in low carbon footprint projects such as solar, CCUS and green hydrogen done by the major onshore player in Brazil were only possible due to the development of the above initiatives that brought a new and fresh start for the Paleozoic basins in Brazil.

The diversity of energy source and the understanding of each region aptitude is key to develop a sustainable future for the oil & gas industry. Hopefully, the major offshore players are going in the same direction, helping the world to achieve a lower CO2 emissions realm without having to stop the development of their O&G projects.

Curriculum Vitae

Exploration Director at Eneva and a professor at the FGV MBA Program for Oil & Gas, Frederico Miranda, worked extensively over 15 years in the Paleozoic onshore basins in Brazil, such as Parnaíba, Amazonas, Solimões, and more recently Paraná. Mr. Miranda holds an Msc. in Geology and Stratigraphy from the Federal University of Rio de Janeiro, focused on Parnaíba's unconventional resources. Also, hold specializations in Basin Analysis from the State University of Rio de Janeiro and in Petrophysics from Petrobras Corporate University.

COPPE LOW CARBON SOLUTIONS CENTER

ANGELA ULLER
COPPE/UFRJ

In tune with current global concerns and initiatives, COPPE/UFRJ - The Alberto Luiz Coimbra Institute for Graduate Studies and Research in Engineering – presents its organization and competences for addressing these challenges in the decades to come. The Low Carbon Solutions Center is the result of gathering the 13 Engineering Programs at COPPE around the theme, dedicated to creation and use of environment-friendly technology, green solutions and processes.

The multiple expertise available at COPPE are organized around the theme, under seven main topics of interest: Enhanced Oil Recovery (EOR), Carbon Capture, Storage and Use (CCUS & CCS), Renewable Energies New Materials Development, Decommissioning of O&G Facilities, Platform Electrification, Subsea to Somewhere.

A collection of transversal, underlying techniques and methods provides the fabric enabling assessment, valuation and development of solutions. These techniques range from the extensive use of state-of-the-art digital transformation, analysis of carbon credits for compensation up to energy and environmental planning.

Innovation Eco-System at COPPE/UFRJ, bringing together academia and society (SMEs, large companies, social organizations, etc.) provides a fruitful partnership environment fostering synergy among the involved actors.

Examples of relevant RD&I projects, currently ongoing or prospective proposals illustrate the capabilities and range for COPPE-LCSC.

Curriculum Vitae

She holds a degree in Chemical Engineering from the Federal University of Rio de Janeiro (1975), a Master's degree in Chemical Engineering from the Federal University of Rio de Janeiro (1976) and a PhD in Chemical Engineering from Ecole Superieur de Chimie / Université de Paris (1980). She is currently Associate Professor IV at the Federal University of Rio de Janeiro. Has experience in Chemical Engineering, with emphasis on Organic Processes, working mainly on the following subjects: experimental determination of phase equilibrium data, simulation and thermodynamic modeling, separation processes by equilibrium, in particular, in supercritical extraction, with application in natural products, oil and gas, ethanol and biodiesel.

EOR & CO2, ADDING VALUE FROM PILOTS, EXPANSION AND CARBON INTENSITY, IN A NET ZERO ECOSYSTEMS

César Augusto Patiño Suarez
IEA

EOR is the opportunity to develop and continue growing assets of our Oil and Gas Industry fields. Decarbonizing and Inclusive alternatives with Energy Efficiency, Renewables Energy, Natural Solutions, and New Engineeering concepts are applicable and on -going in our EOR developments from Pilot to Expansion development. Adding together these front lines, allow our industry to draw an integrated pathway to develop pur offshore and Offshore Projects. How we can articulate them, with cases and Carbon Intensity measurements a way to continue allowing our projects going on. Decarbonization and adding Value from Subsurface to Surface with EOR it is possible and required it.

Curriculum Vitae

IEA EOR TCP-Technology Collaboration program - Executive Chairman 2020 – actually , Leader of Latin America and Caribbean SPE region, Regional Director,2018-2020, Gaia Latin America 2021. Reservoir Engineer at ECOPETROL , with SosTECnibility applicable to oilfield assets with Geothermal – Hydrogen and CO2 abatement initiatives, into the development plans. Petroleum Engineer, MBA , Master Innovation, Studies at Government, Innovation , Technology and Knowledge management. 23 years of experience at Oil and Gas Industry . Ecopetrol Professional . EOR Technology Group, Technology Strategic Unit , Senior Petrophysicist , Reservoir Engineer ,G&G and Operations Manager Weatherford, Wireline Schlumberger (Argelia at - GTFT- In Amenas - Hassi Rmel- Hassi Messaoud) Founder of SPE YP Colombia, SPWLA CAFE Chapter, Innovative ideas at Colombian and Latin America and Caribbean sector. Advisor on strategic Innovative , Clustering and Entrepreneurship proposals in the frame of New Technology trends, Vision , with a great base on Sustainability and Social Valued added

CCUS AS A TOOL FOR SUSTAINABLE DEVELOPMENTS

Eduardo Falabella Sousa-Aguiar,
Magdalena Ramirez-Corredores and Mireya Goldwasser
UFRJ

CCUS (Carbon Capture, Utilization and Storage) is an important concept that may enable Energy industry from fossil fuels to continue producing oil and derivatives, in a scenario aiming at achieving a temperature increase that does not exceed 1.5 °C by 2050. Emphasis is given on pathways to convert emitted (or otherwise wasted) CO2 into more valuable product or chemical feedstock (CU) as means for adding value or creating revenues through CO2 utilization, which might contribute to attaining economic sustainability while solving energy and environmental issues to warrant a green future. In that sense, inorganic as well as organic valorization routes are described, together with other routes, such as artificial photosynthesis, keeping in mind that CO2 abatement cannot rely on natural photosynthesis as the unique process to reduce CO2 concentration in the atmosphere.

Curriculum Vitae

Prof. Eduardo Falabella Sousa-Aguiar, Chemical Engineer, MSc, DSc, has a long career in the field of Catalysis and Catalytic Processes. He is currently Full Professor in the Department of Organic Processes of the School of Chemistry, Federal University of Rio de Janeiro. He has worked in Petrobras Research Centre for more than 30 years, where he was the manager of the GTL Cell, a group dedicated to the development of GTL/CTL/BTL technologies. He has worked as a researcher in the AKZO Research Centre, in Amsterdam and in the Texas Ketjen plant in Houston, USA. Also, he spent some time as a post-doctoral research fellow in the University of Brunel, UK and the Technische Universität Wien. He has been involved in many research projects, being one of the leaders of the team that developed and installed the "Fábrica Carioca de Catalisadores", an industrial plant in which more than 40.000 tons of FCC catalysts are produced per year in Brazil. Prof. Falabella has dedicated a great deal of his professional life to the synthesis, modification and characterisation of zeolites. Prof. Falabella has authored several patents and more than 300 articles, having been the advisor of more than 40 PhD thesis. He has been the focal point in Brazil of the international programme CYTED for the area of Catalysis. Furthermore, he has been a scientific advisor and a member of the Scientific Committee of the International Centre for Science and High Technology (ICS-UNIDO). Prof. Falabella has been awarded many times, deserving special attention the following national awards.

FROM THE ARCADIAN TO THE CONTEMPORANEOUS: THE CURIOS HISTORY OF PRE-SALT'S SECTION KNOWLEDGE EVOLUTION IN THE CAMPOS BASIN

Cristiano Camelo Rancan, Ary Gustavo Candido, Claudia Maria de Siqueira Penna Quintaes, Marília Rodrigues de Castro, Carlos Maurício Monnerat de Oliveira, Kayo Delorenzo Nardi Dias, Ricardo Fonseca Sampaio

PETROBRAS

The pre-salt is currently a target composed by aptian limentones in the Campos and the Santos basins. The knowledge about pre-salt's section has begun in the Campos Basin and is divided into three phases: Arcadian, Modern and Contemporaneous. Arcadian's Phase is related to the beginning of hydrocarbon's exploration and production in the basin, started on shallow water section in the early 1970s. This section was firstly drilled by 1-RJS-3 well (1971), which found siliciclastic rocks below the evaporites. The first commercial discovery was made by well 1-RJS-13 (1975), in coquinas (bivalve limestones) at Jiquiá Stage, covered by these same evaporites. At that time, this stratigraphic interval was mostly composed by jiquia's to alagoas's conglomerates covering and laterally interdigitated with jiquia's coquinas and pelites, both capped by alagoas's anhydrites, all of them with Aptian Age. The wells 1-RJS-99 and 1-RJS-117 (1979) had found new strange alagoas's limestones covering coquinas at the previous position of conglomerates bellow anhydrites, characterized as stromatollites, microbial arborescent calcite and intraclastic limestones. They were not considered as a target due to unavailable technology and also paleogeographic position. Exploration and production advanced throughout the 1980s, producing hydrocarbons in the coquinas and in older igneous hauterivian rocks, too. In the late 1990s, the understanding about strange alagoas's limestones has begun to change, starting the Modern's Phase. The milestone was the test of 1-RJS-531 well (1999), the first to recover fluids confirming the occurrence of effective porosity in these reservoirs. It was followed by the discovery of new hydrocarbon kitchens different from the traditional one (1-RJS-554, 2000), porosity characterization in image profiles and sedimentation model (2004), culminating in the first free oil recovery (6-MLL-14, 2005). which confirmed a new exploratory target with great potential. The pre-salt's hydrocarbons discoveries at the Campos Basin Outer High during Modern's Phase are in the deeper stages of wells drilled by post-salt's targets. The Contemporaneous's Phase started with the 1-RJS-628A well discovery in the Santos Basin (2006). In the Campos Basin, the well 4-ESS-172 (2007), at the Parque das Baleias area, was the first exclusively drilled by this target as primary objective, with positive results. The 1-ESS-103A well also had drilled this section in 2002, at the same area as 4-ESS-172, and, after partial evaluation, was cased on the pre-salt's section and hibernated. Six years later, it was reassessed with new tools, and his long-term test became the first commercial's production in the brazilian's Contemporaneous Phase. Several exploratory pre-salt targets drilled from 2000 to 2015 at southern Campos Basin became Discovery Assessment Plan Areas, but only the BM-C-33 area (2012) was economical. Something notable in this campaign was the high content of siliciclastics mixed with limestones in the southwestern to southcentral area and the strong hydrothermal component in the BM-C-33, at southeastern area. On the Outer High, several pre-salt structures under pos-salt accumulations were tested since 2005 and resulted in the new discoveries commonly smaller than in Parque das Baleias and BM-C-33. A small group of accumulations have thicker oil columns extended from Albian to Alagoas, with shally marine albian seal, due to salt windows. The test of stratigraphic traps has just resulted in few geological successes, but economically unviable. The hydrocarbon production of pre-salt has significantly reversed the natural downward trend of the production curve of the Campos Basin. At the eastern exploratory margin, alagoas and jiquia limestones on igneous highs were drilled and are under evaluation. The Campos Basin is the link connecting Arcadian's and Contemporaneous's knowledge and was key to the discoveries in the Santos Basin.

Curriculum Vitae

Geologist from Unb (2004), entered in Petrobras (2004), worked with Well Geologic Analysis for two years and Exploratory Interpretation for 11 years, both at Sergipe-Alagoas Basin. Studied ancient and modern sedimentary environments at UFS (2005) and limestones at UNESP (2012). Worked in Exploratory Interpretation at Gulf of Mexico (2015) and Libra in Santos Basin (2016-2019). Master's in Stratigraphy at UNESP (2017). More recently working with regional exploration risk analysis at Campos and Santos basins (2020-2022). Love evaporites, komatiites, volcanism, turbidites, pre-cambrian geology, field geology, human history, science, music, capoeira, pasta, travels and soccer.

CAMPOS BASIN POST-SALT EXPLORATION: 50 YEARS OF EVOLUTION IN GEOSCIENTIFIC KNOWLEDGE

Ary Gustavo Candido, Ricardo Fonseca Sampaio
PETROBRAS

The Campos Basin is placed in the south-central portion of the Brazilian continental coast, its more than 100,000 km2 extension, has already produced more than 14 billion barrels of oil equivalent, most of it in siliciclastic turbidite reservoirs, here called the post-salt section. Throughout its exploratory history, this basin has been the scene of numerous demonstrations of pioneering and leading role in the global oil and gas industry. Petrobras is part of this chronicle and, over more than 50 years of investments in the Campos Basin, it has overcome the most diverse challenges through management focused on search and dissemination of knowledge, with permanent qualification of its technical staff, continuous data generation and drilling hundreds of wells. The development and application of cutting-edge technologies have resulted in the discovery and production of large accumulations of oil. The history of exploration in the Campos Basin can be divided into 03 (three) phases. The 1st phase starts in 1971 with the drilling of well 1-RJS-1 and extends until 1983. During this period, the first commercial discovery of oil took place in Campo Garoupa (1974) followed by several other discoveries, mainly in Carbonatic and Siliciclastic reservoirs. In 1976, the first commercial production began, in Enchova Field. This was a period of modest volumes discoveries and exploration in areas still restricted to the technological limits of drilling up to 400 meters of water depth, but the basin already showed promise, encouraging the industry to go beyond. The 2nd phase began with the approval of large prospects whose traps boldly indicated new models of accumulation. Such prospects drilling was very successful, confirmed in the mid-1980s by the discoveries of the giant fields of Marlim and Albacora, the first ones located in deep waters. It is a great technological leaps phase, with the first 3D seismic processing, use of amplitude anomalies, application of seismostratigraphy concepts in the identification of new plays and control of salt tectonics in the migration of oil and traps formation that, together with other techniques, contributed significantly to the high exploratory success rate in this period. The 3rd exploratory phase begins in 2005 with Regional Studies projects, focused on updating the geological models already established in the basin, supporting the proposition of exploratory prospects aimed at maintaining the brown fields production curves and the identification of new plays in exploratory blocks under exclusive concession even partnership. In this scenario, post-salt carbonates once again play an important role. In 2008, after confirming the Santos Basin exploratory potential in pre-salt carbonates, studies were intensified, also aiming to identify the potential of this play in the Campos Basin. This phase has yielded excellent results, contributing to the maintenance and revitalization of production fields, as well as incorporating new discoveries, some of which are already in production. Nowadays, we are experiencing a flourishing of new technologies, especially regarding to data. Petrobras has been involved in creation and application of technological solutions aimed at using 100% of the information acquired in the last 50 years, investing heavily in its computational capacity, data science, artificial intelligence, machine learning and encouraging its technical staff to follow this path that will lead us to overcome the challenges of the present and the future.

Curriculum Vitae

He graduated in 2005 at the Universidade Federal do Paraná. Concluded his Master's thesis at the same university, in which studied Basin Analysis and Sequence Stratigraphy. Joined Petrobras in 2006 where worked for 11 years in the Exploration area contributing to exploratory projects and well drilling in the Campos Basin. Currently works with exploratory potential analysis, which contributes to the regional geological interpretation in all the sedimentary basins in which Petrobras operates.

REVITALIZING MATURE FIELDS THROUGH IOR

Maria Clara Costa
EQUINOR

Improved oil recovery (IOR) is the ultimate discovery in any oilfield. Equinor has a long history of evaluating and implementing IOR projects on the Norwegian Continental Shelf (NCS), and has brought this experience to Brazil, in operated and partner-operated fields. The most important measures to increase oil recovery include adding more wells at lower costs, while a holistic multi- disciplinary approach, collaboration and integrated work are necessary to achieve successful results. The IOR is also relevant to climate ambitions to reduce the carbon footprint: it allows CO2 intensity to be reduced due to higher production, compared to ending production earlier.

Curriculum Vitae

Maria Clara Costa is Manager in the reservoir area at Equinor, currently responsible for the projects of the partnership with Petrobras in the Roncador field, which has the ambition to add 1 billion barrels of oil equivalent in the recovery of the field.
She has been with Equinor since 2012, having previously worked at BG Group and Schlumberger (when she worked as a contractor at Petrobras Internacional).
She is passionate about the area of enhanced oil recovery (IOR), using technology to extend oil production from reservoirs, providing mature fields with the potential to extend their useful life.

FRADE FIELD: A TURNAROUND CASE

Luis Angelo Longhi Escarcena
PRIO

Frade field was discovered in 1986, and 12 wells were drilled (2008-20011) to produce in June 2011 (heavy oil 16,5 – 22 API) from turbidites with a subsea system and a FPSO.
Frade field had two blowout incidents (2011 and 2012) with the former field operator. As consequence of those incidents, drilling and injection for development were suspended in 2011. Production was closed in March 2012 and returned in 2013 with 4 wells and 10 wells in 2014, safely in a such way that reservoir integrity was protected.
PRIO (PetroRio) gets Frade concession in October of 2018 and granted the operation of the field in early 2019 when an additional 51.74% of the asset was acquired from Chevron.
Since them, the company started to work on a new Revitalization Campaign, called "Frade Redevelopment Plan (FRP)", aiming the drilling of four production wells and three horizontal injection wells. The main objectives of this plan are increase the cicle life, at least 2030, and increase the recovery factor.
PRIO started successfully his drilling campaign in July 2022 with "ODP4-FR54" producer well, significantly above original projections, the stabilized initial production was approximately 15,000 barrels of oil per day, increasing the Field's production in 100% and Company's production by 45%, to 48,500 barrels of oil per day. To achieve efficient oil recovery, skilled and experienced specialists worked on well placement with geo-navigation technology to maximize net to gross ratio and increase productivity.
Subsequently, to optimize time and cost of the project two wells were drilled (producer MUP3-A, an injector ODI1-A) using disactivated wells trajectories, reducing operational risk and CO2 emissions too.

Curriculum Vitae

Luis Longhi is currently the Subsurface Manager of PRIO, leading Geology & Geophysics and Reservoir Engineering teams. 20-year experience as a Petrophysicist and Geoscientist for multidisciplinary projects of hydrocarbons exploration and production in Peru, Brazil, Argentina and Colombia. Wide knowledge in Open and cased hole log analysis, probabilistic formation evaluation, multi mineral reservoir analysis well log integration with cores, production information and reservoir test. Luis joined PRIO in 2015, since then, has participated in Polvo field drilling campaigns, and now is leading the Frade Redevelopment Plan for Subsurface Manager.

TECHNOLOGY DEVELOPMENT, HOW IT IMPACT YOUR P&A PROJECTS

Jørn Tore Giskemo
HALLIBURTON NORWAY

The technology for P&A has changed over the last 10-15 years and this change has slowly changed the way the industry has conducted P&A operations. What is the outlook for the next 10 years? What effects will this have on the industry as a whole?

Curriculum Vitae

Jørn Tore Giskemo, Bachelor of Mechanical Engineering and a Master of Petroleum Engineering from the University of Stavanger, Norway. Spent the first 5 years in Halliburton working with intervention activities like CT and snubbing while the focus the last 12 years in Halliburton has been P&A. Spent 4 years in Houston working as a global technical advisor for P&A operations globally.

WELL ABANDONMENT – WELL FORMATION & EVALUATION WORKFLOW FOR THROUGH TUBING PLUG AND ABANDONMENT

Rafael Kenupp,[1] Rodrigo Freitas,[1] Rafael Furuie,[1] Carlos Duarte,[1] Leonardo Malouf,[2] Vincent Geyl,[2] Bruno Souza,[2] Rafaella Marques[2]

1 TRIDENT ENERGY, 2 QUARTIC ADVISORY

In 2020 Trident Energy do Brasil closed the acquisition of the Pampo and Enchova clusters in Campos Basin, approximately 90 km offshore Southeast of Brazil and with this starting its operation in country these 2 clusters encompass 10 concessions, mostly in shallow waters, dominantly composed by mature fields developed by the previous operator since the late 70's. The fields are currently connected to 4 platforms: PPM-1, PCE-1, P-8 and P-65.

A total of 112 wells (several of those are subsea) have been left in a temporary abandonment stage by the previous operator, for several years or, in many cases, for several decades.

Following the acquisition of the asset and the attribution of non-conformities towards ANP 46/ 2016 resolution (SGIP – Well Integrity Management System) Trident Energy do Brasil has started preparation for a campaign to restore the Well Barrier Envelope status of these wells based on a risk-based approach. The non-conformities are focused on the requirement to permanently plug and abandon (P&A) wells in a TP&A (temporary P&A) condition within a 3-year period if no well barrier monitoring is performed. With 112 wells currently in TP&A, most of subsea wells are in breach of the regulations due to their disconnection from installations or failure in the capability to monitor these.

The overall campaign strategy is based on one main concept: "de-risking" the plug and abandonment activity:

By having the ability to move quickly between wells, in case of a challenging re-entry and therefore limit the vessel time spent on uncompleted P&A.

By having flexibility to adjust the well candidates which will be executed, in case of abnormal risk related to reservoir, access and barrier establishment.

The candidate well selection for the first two-year campaign was performed utilizing a multidisciplinary analysis, taking into consideration inputs from the following disciplines/departments: Well Integrity, Subsea, Geology, Petrophysics and Reservoir Engineering. The analyses were performed based on:

Well integrity risk considering OLF-117. The worst the well risk status, the higher the well classification to be included on the campaign

Reservoir producing potential. The higher the reservoir potential, the lower the well classification on the list. In case the well is classified with high remaining reserves (greater than 3.1 MMBO), the well would be automatically removed from the list

Assessment of the subsurface risks on a well-by-well basis, posed by the different reservoirs and respective fluids and pressures to prioritize higher risk wells. Each well has been evaluated based on best understanding of current reservoir pressures, petrophysical properties and risk of crossflow between different units.

Required operations to reduce the well integrity risk of the well: The higher the cost and work to achieve ALARP for the well to return to production (considering flowline installation/XMT replacement and any other necessary interventions), the higher the well classification to be included on the campaign.

After the execution of this campaign, and based on lessons learned, future P&A campaign will enable further optimization in time and cost, playing between different vessels (Rig, LWI and subsea intervention), as well as the deployment of tailor-made tools and techniques for well access and downhole PP&A.

KEYWORDS: WELL ABANDONMENT, FORMATION EVALUATION, WELL INTEGRITY, WELL BARRIER, PLUG AND ABANDONMENT.

Curriculum Vitae

Rafael Kenupp has over 20 years Oil and Gas experience in Shallow and Deepwater operations, with strong background in Well Construction, on the last 3 years worked as Well Engineering Specialist and now working as Senior Decommissioning Wells Engineer for Trident Energy do Brasil.

THE NEW MATURE ERA OF THE CAMPOS BASIN: OPPORTUNITIES TO INCREASE THE RECOVERY FACTOR

Rodrigo de Carvalho Amaral, Otávio Diniz Lameira
PETROBRAS

Of all the oil already produced offshore in Brazil, about 75% come from the Campos Basin. Starting its development at the end of the 1970s and intensified from the 1990s in its giant fields, the Campos Basin is recognized worldwide as a successful case in deepwater oil exploration and production, having been a pioneer for the development of various technologies in the industry. Currently 25 production units are operated by PETROBRAS in the Campos Basin, with more than 250 producing and injecting wells connected by more than 15,000 km of subsea pipelines. But it doesn't mean there's no more to come. The moment now is for renewal and search for new opportunities to increase the recovery factor in its reservoirs. And for this, PETROBRAS has a robust project portfolio, with investments of US$ 16 Billion between 2022 and 2026 for the Campos Basin. More than 100 new wells are planned to be drilled in complementary development and revitalization projects and the start-up of three new FPSOs, two of them as part of the Marlim and Voador Fields Revitalization Project, which will start operating in 2023, and for 2024 the FPSO Maria Quitéria will be in operation in Jubarte field, as part of the Integrated Parque das Baleias Project. In addition to the revitalization of Marlim and Voador, PETROBRAS is also studying revitalization projects for Albacora, Barracuda, Caratinga, Marlim Sul, Marlim Leste and Roncador. And in order to support the challenges associated with the objective of increasing the recovery factor in mature fields, the Campos Basin is the target of strategic programs of PETROBRAS, such as RES20, which has the ambition to incorporate 20 Bi boe in reserves by 2030, of which 5 Bi boe are in the Campos Basin, and CÉOS, that through Artificial Intelligence and knowledge aims to develop better reservoir models, which will allow greater accuracy in production forecasts and minimization of risks to identify new opportunities. Another initiative to achieve the goal of increasing the recovery factor and reserves of the Campos Basin is the intensive use of 4D Seismic, with investments of US$ 2.5 Billion to cover an area of 39,000 km2 in various fields. Also through strategic partnerships, which allow the sharing of experiences with other operators, the objective of increasing FR is pursued. In Roncador, in a strategic partnership with Equinor, only in the last two years was approved the drilling of 29 wells, and is under study the drilling of more than 20 new wells, as well as the extension of the life-time of the production systems or replacement of the current production units. As well as being a pioneer in technologies development, the Campos Basin will continue to be a pioneer for the decommissioning of facilities and the revitalization of mature fields, remaining relevant in PETROBRAS' projects portfolio for the next decade, contributing to increase the reserves and generate value for the company.

KEYWORDS: REVITALIZATION, RENOVATION, MATURE FIELDS, RECOVERY FACTOR

Curriculum Vitae

Rodrigo is the manager of Technical Skills and Integrated Management for Reservoirs and Flow Assurance for the deep water fields of the Campos Basin at PETROBRAS. Graduated in Civil Engineering from the Federal Fluminense University, he has 20 years of experience in the oil and gas area, with over 10 years of management experience, with emphasis on his recente performance in the Revitalization Project for Marlim and Voador fields. He likes to spend his free time with his wife and two sons watching movies and shows on streaming.

SIMILARITIES IN SELECTED PETROLEUM SYSTEMS OFFSHORE GUAYANA, SURINAME AND BRAZIL

Sidnei Pires Rostirolla[1], Vitor Abreu[2], Mikael Arnemann[1]

1 3R PETROLEUM, 2 ACT CONSULTING

Guyana nation experienced the onset of a local O&G industry with important global impact after the discovery of Liza in 2015, which expanded to expressive reserves growth with other important discoveries in the Stabroek Block, and in the adjacent blocks in Guyana and Suriname. The geological attractiveness of Guyana and Suriname basins goes back to discoveries made in Africa and later in French Guiana, which brought a model of hydrocarbon accumulations, with reservoirs and source sections of Cretaceous age, replicating the geological history from West Africa to Brazil and Guianas region.

The geological conditions of Guyana and Suriname can be extended to the French Guiana and to the Equatorial Margin of Brazil, based on the contiguity of the petroleum system, which elements and processes are analogous to other discoveries in Latin America and its counterpart in West Africa. Despite the success of French Guiana that goes back to 2011, with the discovery of Zaedyus, with reservoir depths about 6,000 m in Cenomanian to Turonian turbidite sandstones with significant net pay, its subsequent appraisal activities were not so rewarding. The disappointing appraisal results of Zaedyus forced the shift of exploration from French Guianas to Guyana, which led to expressive discoveries in the Guyana Basin, with the breakthrough by Liza in 2015. After that, tens of large fields with excellent conditions of reservoir and type of fluid were discovered offshore Guyana and Suriname.

The Guyana Basin extends to Suriname, where it is bordered by the Demerara Plateau that separates the basin from French Guiana Basin and the Pomeroon High that separates the basin from the offshore portion of the East Venezuela Basin.

The proof of the Upper Cretaceous accumulation concept brought from Africa, can be expanded to the Brazilian equatorial margin, with potential reservoirs deposited over oceanic crust or over rift depocenters, with increasing potential to discover new light oil accumulations.

It is expected in this work to make a quick comparison between the accumulations in Guyana-Suriname, its continuation to the French Guianas and Foz do Amazonas, as well as the analogous conditions in the Sergipe-Alagoas Basin, where the turbidite reservoirs in deep waters can be charged from post-rift or rift generating sections.

KEYWORDS: Turbidites, Cretaceous Reservoirs, Liza, Equatorial Margin, Guyana Basin, Foz do Amazonas, Sergipe-Alagoas.

Curriculum Vitae

Sidnei Rostirolla has a hybrid career as a geoscientist in the industry, research scientist and professor, including senior management and leadership positions. He holds a Geologist degree, with a PhD and Master in Geology. Key practices include exploration and development, portfolio analysis, and reserve certification. In operations, the main tasks were the contracting and supervision of drilling, seismic acquisition and processing. He worked as an employee at Petrobras, UFPR, Vale, PetroRio (formerly HRT), Rosneft Brasil and IHS Markit, including some short periods as a consultant. He is currently responsible for managing G&G and Reservoirs in 3R Petroleum's Offshore Fields.

THE PETROLEUM POTENTIAL OF THE EQUATORIAL MARGIN AS SEEN IN NEW SEISMIC DATA

Pedro Victor Zalán,[1] Randall Etherington,[2] Milos Cvetkovic[2]

1 ZAG CONSULTING/ TGS RIO DE JANEIRO, 2 TGS HOUSTON

Fifty-two years have passed since the first well was drilled in offshore Foz do Amazonas Basin. During the 70`s and early 80`s several sub-commercial and small commercial discoveries were made in the shallow waters (SW) of four of the five basins that constitute the Brazilian Equatorial Margin (BEM). Two of them, Ceará (CE) and Potiguar (POT) have established perennial production in modest amounts. Since then practically no major discoveries were made, with the exception of two deep-water yet-undeveloped discoveries, one in each POT and CE Basins. Less than 20 wells were drilled in the deep (DW) and ultra-deep waters (UDW) of the BEM, leaving a huge tract of unexplored areas open for exploration. Half a million square kilometers constitute the potential frontier area of the BEM.

On the other hand, wells with oil and gas shows were plentiful. Although the main play in the SW were mostly the rift related strata and structures, several haphazard drillings of Late Cretaceous turbidites were rich in oil shows. Geochemical analysis tied most of such shows to the marine anoxic shales of the Early and Late Cretaceous (Albian to Coniacian in age). The presence of proved reservoirs and source rocks of Late Cretaceous age, together with new seismic data of high quality acquired in the last decade, point to an enormous potential existing in the vast areas of the unexplored DW and UDW of the BEM, especially in the Foz do Amazonas (FOZ), Pará-Maranhão (PAMA) and Barreirinhas (BAR) Basins. The similarities with the discoveries and producing fields in Guyana/Suriname and Ghana/Ivory Coast are tremendous and the conditions exist to replicate such histories of successes.

The FOZ, PAMA and BAR Basins situated in the western part of the (BEM) constitute the natural uninterrupted continuation of the Guyana/Suriname/French Guyana continental margin to the south. They are typical two-stage normal- to oblique-rift, followed by drift, extensional basins developed upon a magma-poor passive margin. Since the Zaedyus discovery in French Guyana, situated only 50 km to the north of the Brazilian maritime border, the hopes for further similar discoveries in the Brazilian side were high. The recent extraordinary success of ExxonMobil in Guyana and other companies in Suriname strongly reinforced such belief and points to the urge of resuming exploration in these basins. Their homologous basins in a cross-atlantic correlation are the producing deep waters of Ghana and Ivory Coast. New seismic surveys in these three basins revealed leads and prospects similar to those played successfully in both sides of the Equatorial Atlantic.

The similarity starts with the source rocks. Late Albian, Cenomanian-Turonian and Coniacian marine anoxic shales are the main source rocks in the DW and UDW of the Equatorial Atlantic conjugate margins. Their existence in the FOZ, PAMA and BAR Basins are indicated by the strong biomarker correlation of oil shows in some wells with the marine anoxic shales. DW and UDW areas in the three basins are devoid of Rift Sequences, their sedimentary section resting directly upon oceanic crust. The Late Cretaceous petroleum system, thus, was developed in the Drift Sequence. Turbidites are well developed in the Late Cretaceous sections of all three basins, being stratigraphic and mixed-type traps the dominant accumulations seen in the seismic sections. Migration routes are fractures and faults related to volcanic loading and in subtle drape folds atop volcanic highs. An important secondary target in both areas, visible in new vintages of 2D seismic surveys, consist of Albian carbonate constructions developed on top of buried Albian volcanos (atolls), mimicking the Ranger-type play of Guyana.

The CE and POT Basins present their Rift Sequences extending into their DW and UDW regions. The Pecém discovery (CE) and the Pitu discovery (POT) mimic structural traps of long-producing commercial fields in the SW. Several similar structures are clearly visible in the seismic sections of the DW and UDW of these basins. The Late Cretaceous petroleum system is also present in both basins. A novel play was unfolded by 3D survey in the DW/UDW of POT where a Late Cretaceous transtensional event created faults and folds that affect both the Aptian Rift Sequence as well as the Late Cretaceous Drift Sequence.

Curriculum Vitae

Pedro Victor Zalán received a Bachelor degree in Geology from the Federal University of Rio de Janeiro, and the M.Sc. and Ph.D. titles in Geology from the Colorado School of Mines, Golden. He worked for Petrobras for 34 years where he held the positions of well site geologist, interpretation geologist, explorationist, coordinator of technical teams and exploration manager for several basins in Brazil and worldwide, notably for the North Sea, Gulf of Mexico, West Africa and South America. He was appointed top senior consultant in his last 8 years with the company. Zalán has produced several tens of publications and has given presentations in numerous international conferences. Zalán founded ZAG Consulting in Petroleum Exploration, based in Rio de Janeiro. Since 2012 he has been a consultant for exploration matters for more than 30 companies in Brazil and abroad; as well as for Brazilian government entities such as ANP, EPE and the Navy.

GUIANA BASIN PETROLEUM SYSTEM AND RESULTS

Victor Vega, Regan Palsgrove
FRONTERA ENERGY

The first commercial oil discovery in the Guiana-Suriname Basin, the Tertiary-aged Tamboredjo heavy oil field, was discovered in onshore Suriname in 1965 and put on production in 1982. Before and after that, there were numerous other wells drilled in the basin onshore and in shallow water, with intriguing, but non-commercial results. The Guiana-Suriname Basin became an exciting focus for international exploration in 2015 with the discovery of the Liza oil field in deep water by Exxon, Hess and CNOOC. The Liza discovery was in a stratigraphically trapped, Upper Cretaceous turbidite sand on the basin floor. The resource of the Liza field and the successive discoveries in that geologic setting has been estimated at over 10 Bbbls and has been dubbed the "Golden Lane". Recently, operators are targeting new exploration trends closer to shore, with discoveries in both Suriname and Guiana within the Upper Cretaceous slope paleoenvironment. Frontera Energy and partner/subsidiary CGX Energy jointly hold working interest in the Corentyne Block in Guiana, which sits offshore and alongside the Surinamese border. The Corentyne Block extends from very near the modern shoreline to just beyond the edge of the modern shelf, coincident with the Upper Cretaceous shelf and slope. The block is situated in the depocenter of the basin, and above the active kitchen of the primary source rock. A new 3D seismic survey was acquired in 2019 over the northern potion of the block, to add to the 3D data set acquired previously; and several prospective play types were identified. Earlier this year, the Joint Venture announced a discovery at the Kawa-1 location on the block. The discovery is comprised of 5 gross pay intervals with 228 feet pay. The pay is dispersed over 5000 feet of strata, from Coniacian to Maastrichtian, with hydrocarbon charge in almost every zone; indicating good potential for further exploration and appraisal drilling targeting multiple zones. Hydrocarbon type was not confirmed with MDT or DST but was interpreted from multiple other data sources and advanced geochemical analyses. The trends observed were consistent with that seen in adjacent blocks, being oil-prone in the deepest horizons and more condensate-prone stratigraphically higher. High quality 3D seismic and integration with log data from Kawa-1 have allowed for detailed seismic modelling and mapping, and recognition of depositional environments and reservoir distribution. Sedimentary structures apparent on image logs, and fauna identified by biostratigraphic analysis support the interpretation of deposition of the Campanian and Upper Santonian in an upper slope channel and lobe complex, with best reservoir quality associated with axial channel fill. The CGX-Frontera JV will soon begin drilling a second well on the Corentyne Block, at a location named Wei-1. The location targets oil-prone Santonian and Campanian channel complexes similar to those proven to have potential in Kawa-1, as well as secondary Maastrichtian targets. Additional exploration opportunities in many other zones have been identified on other areas on the block, and they will become the target of future drilling.

KEYWORDS: GUYANA, SLOPE, KAWA

Curriculum Vitae

Victor Vega is a Geologist from Universidad Nacional de Colombia with a Msc from the University of South Carolina. Over 32 years of experience in Amoco, BP, Talisman and Shell with senior management roles during the last 20 years. Currently working as VP of Exploration & Development with a portfolio of production and exploration assets in Colombia, Ecuador and Guyana.

VISION AN EXPECTATIONS FOR THE FUTURE OF EXPLORATION AND PRODUCTION

Marta Vieira Abrão
PETROBRAS

Energy transition and energy security are the main subjects regarding the global energy landscape. O&G is an important source of energy during the energy transition process, and its role is not a role of passage, but of an enabler, a part of the solution for sustainable, low-carbon energy.

To be a part of the solution it is imperative to provide affordable, reliable, and clean energy. And to do so, our approach to exploration and production must be different. Geosciences, innovation, and technology are means of changing our business as usual and transforming our projects and our portfolio.

A New Generation of Greenfields and Energy Ecosystems: The future of energy walks together with the future of O&G.

Curriculum Vitae

Marta holds a bachelor's degree in Production Engineering from the Federal University of Rio de Janeiro (UFRJ) and a master's degree in Business Administration with major in Corporate Finance from the COPPEAD School of Business of the Federal University of Rio de Janeiro.

With more than 12 years of experience in the industry, she works at Petrobras as General Manager of Exploration Data and Applications Technology. Marta is responsible for providing data, systems, applications, digital solutions, and technological infrastructure to ensure maximum application of exploratory data to the business and, hence, value creation.

Marta joined Petrobras in 2010, since then she progressed through a number of assignments having worked with exploration portfolio performance, new business development, regulatory affairs, operational supply for well drilling campaigns and strategic planning.

PETROLEUM SYSTEMS OF THE BRAZILIAN EQUATORIAL MARGIN: THE NEXT BRAZILIAN EXPLORATION FRONTIER

Bruno David, Eric Zagotto
TOTALENERGIES E&P AMERICAS

The Equatorial Margin of Brazil (part of the Equatorial Atlantic Margin) occupies an area of more than 650000km2 across 5 offshore basins from Potiguar to the SE to Foz do Amazonas in the NW. This margin evolved from three rift systems from the Upper Triassic to the Lower Cretaceous (Albian) and is home to several proven petroleum systems and potentially others waiting to be unlocked.

Despite exploration having started in the mid 50's onshore and moving to the shelf during the 70's, only 21 wells have been drilled thus far in water depth greater than 400m and only 5 in water depth greater than 2000m. In contrast, the African Equatorial Margin and the Guyana-Suriname basin from which analogies can be drawn from source rock and reservoir characteristics to trapping styles, have seen an intense and successful exploration campaign unfold with more than 40 deep water wells drilled in the Guyana-Suriname basin alone and close to 50 deep water new field wildcat drilled on the African margin.

The recent successes in the conjugate margin; starting with the Jubilee discovery (2007) in Ghana by Tullow and more recently with the Baleine discovery (2021) in Cote d'Ivoire by ENI, as well as the giant discoveries of the Guyana-Suriname Basin by Exxon (2015) & TotalEnergies (2020), provide a glimpse of what the future may hold for this exciting new frontier in Brazil.

Keywords: Equatorial margin, deep water, petroleum systems

Curriculum Vitae

Bruno David is an exploration geologist. His career started in the mining industry prospecting for gold in French Guyana in 1995, after his Msc from the Ecole Nationale Superieure de Geologie in Nancy, France. He joined the oil industry in 1999, working for Galp, the Portuguese National Oil company, where he was lucky and honored to be part of the team responsible for the early access to the deep-water Santos basin and what would become the giant pre-salt play a few years later. Bruno's career took him to several other countries from Angola to the North Sea passing through Australia, but his heart has always been with Brazil where he has spent most of his career amongst the multiple offshore basins of this beautiful country. Bruno worked for 14 years in BP having occupied leadership positions. He joined TotalEnergies 4 years ago to help with its ambitions of growth in Brazil.

THE EASTERN MARGIN BASINS: A NEW VISION FOR EXPLORATORY PERSPECTIVES IN BRAZIL.

João Cláudio Conceição
FINDOUT OIL&GAS

The Brazilian East Coast corresponds to the Continental Shelf Basins located between the Abrolhos Volcanic Complex in southern Bahia State and the Touros High in Rio Grande do Norte State. This portion of the South Atlantic Rift has been extensively studied over the years. Recently, with the support offered by the GXT-Ion seismic lines, a thorough review of the regional geology was carried out, also taking into account information from the corresponding basins in West Africa. This resulted in significant changes in the evolutionary model of the rift, with important reflections on the petroleum systems, bringing a new exploratory vision for the east coast.

The rift evolution process in the east coast presented two very distinct phases, the first one being of Aptian age or older, corresponding to the classic rifts in the Campos and Santos basins and the onshore areas of the Sergipe-Alagoas and Recôncavo basins, among others. This rift phase was deployed in well-defined segments, both on the African and South American flanks. A relative structural high separated these two segments, which remained completely isolated until almost the end of the Albian. The salt basins that deployed north of the Abrolhos Volcanic Complex were never continuous, between the two segments of rifted Gondwana.

The second rift phase occurred near the end of the Albian, about 96 million years ago, with the main deformation axis displaced to the east in relation to South America, acting over the mentioned structural high, which characterizes this portion of the rift as a Wide Asymmetric Margin from a geodynamic point of view.

As a consequence, the east coast basins are characterized by having younger and younger deformations in the west-east direction, with the African margin mirroring the Brazilian one. An Albian rift hinge can be traced in most basins, delineating the boundaries of the Classic Rift and Albian Rift, which exhibit completely different petroleum systems from each other and, as a consequence, very different exploratory opportunities. This paper will present a summary of this new exploratory vision of the East Brazilian coast.

Curriculum Vitae

Graduated in Geology in 1977, Master in Structural Geology in 1992, both at UFRJ, MBA from FGV in 2001. He led his career as an oil geologist at Petrobras, where he worked for 39 years, working in Research (CENPES) and Exploration. His main achievements as Exploration manager were the discoveries of light oil in the Albian carbonates Campos basin (Parque das Tartarugas), and the discoveries of gas and light oil in the deep waters of the Sergipe basin. After retirement in 2016, he joined COPPE/UFRJ, where he works as a researcher. In 2019 he founded Findout Oil&Gas, a research and consulting startup, focusing on innovative technologies in oil exploration.

TURBIDITE ZONES, IMPACTS FOR EXPLORATION STRATEGY AND RESERVOIR CHARACTERISTICS: EXAMPLES FROM SANTOS, CAMPOS AND ESPÍRITO SANTO BASINS

Roberto S.F. d'Avila, Diogo A. Buck, Lucas A. Gonçalves, Kayo D. Nardi Dias; Ednilson B. Freire, Ary G. Cândido, Gerson Caravaca & Luís Claudio R. Machado

PETROBRAS

Turbidites are the most important petroleum reservoirs in the deepwater depositional context, both in the seas and in lakes. Turbiditic systems can be subdivided into different depositional domains (zones), which are characterized by substrate physiography, tectonostructural aspects and facies associations, that determine different characteristics of reservoirs and, consequently, their properties, with impacts on exploration strategies and production development. The recognition and characterization of different depositional compartments allow inferring the dominant geometry of deepwater sandy reservoirs (turbidites and associated facies), which becomes a predictive exploratory tool to establish scenarios about the possible reservoir type, quality, and heterogeneities. Different turbidite systems producing in many oilfields of the Espírito Santo (BES), Campos (BC) and Santos (BS) basins, whose ages vary from the upper Cretaceous to Oligocene-Miocene, were deposited in three mains depositional contexts: canyons, troughs/channels and turbidite fans, in regions with ramp or the classical tripartite morphology, shelf, slope and basin. Canyons and troughs are the main focusing conduits (transfer zones) delivering huge amounts of sands to deepwater. Fans constitute the main area of turbidite sand deposition at the end of canyons, troughs, and channels, forming more extensive and continuous reservoirs, with lobate and channelized geometries. Bottom currents operate along canyons and troughs (tidal amplified bottom currents) as well as in the turbidite fan region (contour currents). In divergent margin basins bottom currents are important for the removal of muds brought by the turbidity current, allowing vertical amalgamation of turbidite sands.

In the production scale, these three domains can be differentiated from the predominance of typical architectural turbidite elements: channels, lobes, overbank, and crevasse splay deposits. In all these domains the proportion of these architectural elements, vertical or lateral distribution is controlled by allocyclic controls in high resolution. The presence and abundance of chaotic beds and the reworking by bottom currents also allow a refinement of the model and the relationship of deposits with broader background physiography... (see the end of this abstract at bpc2022.com.br).

Curriculum Vitae

Graduated in Geology from UFRGS in 1985. Master's in Stratigraphy from UFRGS in 1999. PhD at Unisinos in 2009. Geologist at Petrobras since 1986, where he worked in the geological monitoring of wells, geology laboratory, exploration interpreter, field guide in basins in Brazil and Argentina, laboratory manager, stratigraphy manager, exploration manager for the Equatorial Margin, manager exploration for onshore basins (complex and unconventional reservoirs). Consultant and instructor in stratigraphy and sedimentology of basins, specialist in sedimentology and stratigraphy of turbidite and pre-salt reservoirs, with 96 works including congress publications, Petrobras reports and articles and book chapters.

SEAP: A NEW FRONTIER FOR O&G PRODUCTION IN ULTRA DEEP WATER NE BRAZIL

Marcos Aurélio Lucas
PETROBRAS

After 59 years of the first oil in Sergipe State, produced in the onshore Carmópolis Field, Sergipe sub-basin (Sergipe and Alagoas Basin) is very close to start another important chapter in the history of Brazilian oil and gas production. This new province is in the basin's ultra-deep-water sector, representing both a new frontier and an extension of operations in the region, given all the knowledge acquired in the onshore and in the shallow and deep-water sectors.

Among the reservoirs in the area called "Sergipe Águas Profundas" (SEAP), five hydrocarbon accumulations stand out with significant in place volumes which made the production development viable. All these accumulations comprise turbidite deposits composed of thick sandstones with good permoporous system and expressive lateral continuity, three of which are filled with light low viscous oil, and the other two are filled with rich gas, thus yielding considerable volumes of condensate.

Petrobras and its partners have invested a significant amount in data and information acquisition in the region, comprising two high-quality seismic acquisitions, appraisal wells, sampling of rocks and fluids, ten well tests and one extended well test. These data allowed the characterization of reservoirs with geological models calibrated by dynamic data through the integration of seismic attributes, conceptual facies models and test interpretations through sequential simulation of multiple geological realizations. These models made it possible to quantify the main uncertainties in different drainage plan scenarios, which benefit from excellent rock and fluid properties. The designed plans involve the recovery by water, gas and WAG (Water Alternating Gas) injection studies with production forecasts from a compositional simulator.

After the reservoirs' characterization, two projects for production development have been conceived and optimized using an Integrated Production Modeling (IPM) approach, which allows simulating different accumulations producing for the same platform with shared limits of oil and gas production. In addition, this tool enables to simulate separation, treatment, reinjection, and gas exportation processes from reservoir to market. Furthermore, the IPM tool provided means to evaluate several drainage plans concepts, subsea layouts, and gas injection vs exportation comparisons, generating more value from each accumulation in a single project design.

Two Floating Production Systems (FPSOs) are being planned for the region, each one with the capacity to produce 120 thousand barrels per day of oil and condensate, along with a gas pipeline structure for up to 18 million of cubic meters of specified gas for the onshore consumer market. In addition to the use of the WAG methodology for secondary recovery, other initiatives bring robustness and flexibility to the projects, such as convertible wells (producer/injector) in the field drainage plan and intelligent completion to maximize recovery.

To conclude, although these two megaprojects still do not have a Final Investment Decision (FID), when they are put on stream, there certainly is a high potential for generating great value and contributing significantly for the Brazilian energy matrix.

Curriculum Vitae

Graduado em Engenharia Civil pela Universidade Federal de Sergipe e com mestrado em Engenharia de Processos na Universidade Tiradendes (SE), com ênfase em termodinâmica na injeção de CO2 em reservatórios de petróleo, trabalha há 20 anos na Petrobras como Engenheiro de Reservatórios. Atualmente é consultor na área de Reservatórios da empresa e já participou de projetos em campos com diferentes graus de maturidade, nas fases de exploração, desenvolvimento inicial, implantação, melhoria de drenagem e projetos complementares. Com experiência em simulação composicional, atua em modelagem de fluxo, ajuste de histórico e concepção de novos projetos.

REGIONAL GEOMECHANICAL MODELING IN PELOTAS BASIN

Marcos Fetter, Guilherme Lenz, Roberto Miyamoto Pessoa, Ursula Belem, Tais Zanato, Paulo Crampes, Vinicius Werneck, Pedro Sousa, Marco Cetale Santos, Rodrigo Stern

UFF/DOT/GISIS

Most information available in frontier exploration areas come from seismic data, eventually from vintage 2D seismic lines. This is the case of the Pelotas Basin, in the southernmost Atlantic continental margin in Brazil. The basin belongs to the Austral sector of the rift and breakup of Gondwana, occurred in Early Cretaceous. Significant hydrocarbon discoveries have been reported recently in this sector, along the counterpart African margin, in ultradeep-water, offshore Namibia.

This work describes a successfully tested workflow to anticipate geomechanical and petroleum system information during seismic reprocessing of vintage 2D data from Pelotas Basin. A geomechanical model was produced out of seismic velocities double-checked with both NMO and image gathers. The model, which was computed with standard equations (e.g. Gardner's and Eaton's) and conceptual velocity gradients of normal compaction trends, is fully consistent with mechanical stratigraphy and deformation analysis of the studied area, close to the shelf border in Central Pelotas Basin.

The geomechanical results pertinent to petroleum systems indicated good seal potential, and probably hydrocarbon generation associated with a noticeable overpressure regime in the deeper Paleogene and Cretaceous successions of the Pelotas Basin, particularly beyond shelf-border and slope. In this way, the Pelotas Basin may share, in deep-water environments, the same prolific play recently found in Namibia.

Keywods: Pelotas Basin, Geomechanics, Geopressures, Petroleum Systems.

Curriculum Vitae

Marcos Fetter is a Seismic Interpretation and Structural Geology expert who received a bachelor's degree in Geology in 1983 from UFRGS/RS/Brazil, a MSc in Geomechanics in 1995 from UNICAMP/SP/Brazil, and a PhD in Tectonics & Sedimentation in 2007 from UFRGS/RS/Brazil. He joined PETROBRAS in 1986 and his entire career has been spent in petroleum industry. He started to work with seismic in 1987, in acquisition, moving to processing in 1989, and to interpretation in 1995. His experience in PETROBRAS includes seismic interpretation for exploration and reservoir characterization and managing of a Structural Geology/Geomechanics team. He retired from Petrobras in 2021 after 35 years, as a Senior Exploration Geophysicist. Currently, he is a scientific researcher of the Seismic Inversion and Imaging Group (GISIS) at UFF/RJ/Brazil.

DEEP-WATER OFFSHORE NAMIBIA: THE FUTURE GIANT OIL AND GAS PROVINCE OF THE SOUTHERN SOUTH ATLANTIC BASINS

Marcio Rocha Mello
BRAZILPETROSTUDIES, BPS

Despite the skepticism surrounding the offshore Namibia hydrocarbon potential since the discovered the Kudu gas field by Chevron in 1973, recent drilling in the Walvis and Orange Basins by HRT Petroleum, Shell and Total has suggested that deep and ultra-deep-water areas in these basins to be a future supergiant deep-water hydrocarbon exploration province in the South Atlantic Realm. This conclusion is based on widespread presence in Namibia, of all elements and processes of one of the best overcharged work petroleum systems ever touched in west Africa. The star of such petroleum system is a very thick and widespread distribution of multiple lower Cretaceous marine restricted and lacustrine saline, oil prone, anoxic source rock systems (e.g., Kudu Formation) with deep burial and above averaged thermal gradients. The depopods located in deep to ultra- deep-water areas provided a wide range of maturity, spanning the entire oil window, and therefore favorable to form commercially significant volumes of oil, condensate, and gas. The presence of good permo-porosity upper and lower Cretaceous turbidite sandstones and lower and upper Cretaceous carbonate reservoirs associated with widespread occurrence of giant structural, stratigraphic, and mixed traps and with near contact with the overcharged source rock systems satisfied all the critical conditions for the presence of a unique light oil system. The recent discovery of two supergiant's light oil accumulations in deep-water Orange Basin this year, in lower Cretaceous turbidite sandstones reservoirs by Shell, and Total with expected light oil reserves above 700 million and 1,3 Bbbls, respectively, confirms offshore deep-water Namibia to be the next giant hydrocarbon province in the South Atlantic Margin.

KEYWORDS: OFFSHORE NAMIBIA, SUPERGIANT OIL DISCOVERIES, OVERCHARGED KUDU SOURCE

Curriculum Vitae

Marcio is Petroleum Geologist and Geochemist, expert in petroleum geochemistry, environment geochemistry, molecular geochemistry, petroleum exploration and petroleum systems. Founder and first president of the Brazilian Association of Petroleum Geologists (ABGP), Former President of American Association of Petroleum Geologists, Section Latin America. Currently the president of Flow Magic and Brazilpetrostudies, Brazilian service companies aiming to support petroleum exploration, production, and environmental compliance around the world. With more than 45 years of experience in petroleum geology and geochemistry, Marcio was responsible for the development of petroleum systems studies for most of the sedimentary basins of Brazil, West Africa, and Latin America. Marcio has published hundreds of articles, but the most important are the AAPG Memoir 73 "Petroleum System of the South Atlantic Basin" and AAPG Memoir 124 "The Supergiant Lower Cretaceous Pre-Salt Petroleum System of the Santos Basin, Brazil".

PRE-SALT WELL ENGINEERING - TODAY AND TOMORROW

Danilo Signorini Gozzi1
PETROBRAS

This presentation will cover Santos Basin Pre Salt wells engineering, construction and operations aspects. In the conceptual phase of the project, strong iteration with geology, reservoir and production engineers, allow the well's configuration definition. Reservoir data acquisition requirements, number of production zones, temperature, fluids and flow rates are considered in this phase and, combined with well integrity and regulations accordance are the inputs that well engineers need to create several well configurations. In an specific seminar, the most suitable alternative is selected, regarding all the boundary conditions, including workover and abandonment feasibility. In the basic project phase, the selected well configuration is refined with structural, and corrosion engineering, stimulation, and instrumentation strategy and bottomhole equipment specification. The goal is to guarantee safety, integrity, and a feasible operational envelope for all life cycle of the well. Basis of design are founded in this phase as well as the purchase orders for equipment. In the executive phase, all basic engineering and basis of design are refined with well actual scope and characteristics and the well program are prepared to the execution. 6th generation dynamically positioned rigs operates in Santos Basin Pre Salt in order to drill and complete wells for all Pre Salt fields. These rigs follow restrictive technical specification related to performance, but, above all, safety. Well control and subsea equipment, heave compensation, generation and positioning systems must be sufficient to hold the rig in the location, despite the weather condition, to deal with the loads, pressure and reservoir fluids in case of well control. Drilling is conducted to reach reservoir as optimized as possible, without damaging the reservoir, allowing data acquisition and overcoming the challenges, such as post salt wellbore instability, salt creeping and several mud losses in the reservoir phase. Due this last challenge, Managed Pressure Drilling is a fundamental tool to reach the goal. Completions target is to preserve remote selectivity, obtain adequate zonal stimulation, install accurate sensors, reliable valves and devices for scaling prevention and for gas lift as well. Once the well is completed, well handover are made and well operations support start, following the sensors signals and managing the well barriers and integrity. Santos Basin Pre Salt wells also are configured to optimize workover operation, but this is a challenge in smart wells, once there are several hydraulic and electrical lines running through the wellbore and packers. This, combined with a high stimulated carbonates reservoir, may lead to several workover complication, that may lead well engineering team to use some special techniques. Several research efforts has been taken in order to optimize workover and to redo the smart completions after an intervention like that. Despite been far, the well abandonment is also considered in the design and construction phase generating adequate barriers, tests and evidence. This presentation aim to cover this aspects in past, present and coming pre salt well configurations.

KEYWORDS: Wells, Intelligent, completions, drilling, pre salt, MPD

Curriculum Vitae

Graduated as a materials engineer and post graduated as petroleum engineer, Danilo joined Petrobras in 2005. Since then, he has acted in well construction, both in operations and engineering. He worked in Petrobras international area designing Turkey's exploratory well and joined Santos Basin Pre Salt in 2010 as a drilling engineer. He assumed the well engineering division in 2013 and got involved in every single FPSO operating in Santos Basin Pre Salt today.

GEOPHYSICAL TECHNOLOGIES INNOVATION APPLIED TO CAMPOS, SANTOS AND EQUATORIAL MARGIN

Paulo Johann
PETROBRAS

Geophysical technologies have been applied in Brazil since the discovery of the Buracica field, in the Recôncavo basin onshore, in the 1960s. In the 1970s, 2D digital seismic was implemented in the basins of the Brazilian coast, leading to discoveries in the Sergipe-Alagoas and Campos basins, with the important milestone being the discovery of the Garoupa field (1974). The implementation of 2D acoustic seismic inversion in the Namorado field (1980) was another major milestone in the stratigraphic delimitation of a deep-water offshore field, with only five wells drilled. Namorado acoustic inversion application in the 80s was pioneer case. The implementation of 3D seismic in the Cherne field (1978) was the beginning of a technological revolution in geosciences in Brazilian maritime basins. 3D maritime seismic in Brazil, in an uninterrupted way, has been recorded for 44 years with discoveries of dozens of oil fields. In 1995, 3D seismic was responsible for the discovery of the Caratinga oilfield, in the Campos basin, the first offshore field discovered with this technology. Since then, the deep-water fields have benefited greatly in their delimitation and in the positioning of their D&P wells. In 1996, with 3D seismic, the journey of discoveries in ultra-deep waters began, with the Roncador oilfield. In the Santos basin, in 2006, with the 3D seismic, we had the discovery of the Tupi field, establishing the beginning of a new era, the new petroleum oil province, on a world scale, the Brazilian Pre-Salt. In 2011, we started a new cycle, the implementation of full azimuth technology (FAZ), with the permanent optical seismic project in Jubarte (PRM), north of the Campos basin. In 2015, the 4D NODES seismic technology was implemented in the WAG monitoring case - water injection alternating with gas - in the Tupi field. The Mero, Buzios, Sapinhoá and Tupi fields were entirely covered with FAZ technology with NODES. Itapu, Berbigão, Atapu and Sepia will be the next projects. This technology provides long source-receiver distances - offsets, a fundamental parameter for the application of the technology that revolutionized seismic processing, the FWI (full waveform inversion), the detailing of seismic velocities fields that impact on the improvement of imaging and seismic resolutions to provide better interpretation of detailed geological features. These lessons learned and best practices with the implementation of seismic technologies in the last five decades in the Campos and Santos basins will be applied in the new exploratory frontier in deep waters that is the Equatorial Margin, with a well campaign to be started this year by Petrobras, according to its strategic plan 2022 – 2026.

KEYWORDS: Seismic technologies, Full azimuth (FAZ) seismic geometry, 4D seismic, NODES technology and FWI.

Curriculum Vitae

Is currently the Senior Advisor for Petrobras, based in Rio de Janeiro. Paulo has more than 40 years of technical and managerial experience in the petroleum industry. He graduated with a degree in geology from UNISINOS University, RS, Brazil. Paulo received his D.E.A. and Ph.D. degrees in reservoir geophysics from Sorbone University (Paris VI), France. His career has encompassed activities in geophysical acquisition, geophysical interpretation, and reservoir geophysics. Paulo is also a frequent lecturer at Brazilian universities. Paulo became active in the Brazilian Geophysical Society (SBGf) and SEG where he has served in many positions including its vice presidency. He has published and presented several technical papers at SEG, EAGE, SPE, OTC, and SBGf. Paulo was appointed the first Central & South America SEG Honorary Lecturer. He is an active member of EAGE, SEG and SPE. In 2021, Paulo received the Décio Savério Oddone award for Petroleum Geophysicist of the year.

TOWARDS AUTONOMOUS SEISMIC MONITORING OF PRE-SALT FIELDS.

Jorge Luis Lopez
SHELL BRASIL PETRÓLEO

One of the more important challenges of the oil and gas industry is to optimize the production of existing fields. This is particularly relevant for the large carbonate reservoirs of the Brazilian pre-salt region. In this context the challenge may be divided in three parts: (i) increase the recovery factor of the reservoirs from 20% to 30% or more; (ii) reduce the risk of water and gas breakthroughs to the producer wells before expected; (iii) optimize the type and location of infill wells. 4D seismic can be used to map the movement of fluids in the reservoir to help address these challenges. However, even if widely used in other areas, 4D seismic has been demonstrated in the pre-salt only recently in the Tupi field, using sensors placed on the seabed (Ocean Bottom Nodes or OBN). This was a challenge because 4D signals are small from the rigid carbonate rocks, monitoring needs to be frequent to disentangle the effects of alternating injection of fluids (like Water-Alternating-Gas or WAG), and the costs are too high to justify frequent monitoring, for example once per year.

A system that uses ocean bottom nodes that are placed on the seabed for five years, ready to acquire 4D seismic surveys on demand (On-Demand OBN or OD OBN) is under development by Shell Brasil and its partners. The new nodes are able to record seismic data for up to 500 days and geodetic data continuously. The nodes are turned-on and off using acoustic commands by a specialized AUV called FlatFish. Once the survey is completed, the source vessel leaves the field and the FlatFish hovers above each node for several minutes to harvest the data using an optical modem. This is in contrast with conventional OBN surveys, where a large node-handling vessel deploys ROVs to place and retrieve the nodes each time a 4D seismic survey is required. The combination OD OBN plus FlatFish provides an autonomous system for the recording part of seismic acquisition.

The source part of seismic acquisition could be rendered autonomous if the sources are towed by an Autonomous Surface Vessel (ASV). This concept, under the name of RAM4D, has been tested in a limited way using existing ASV technology. The business case becomes interesting when we combine the autonomous recording above with an autonomous source. While there are many practical issues to resolve, including the resilience of the source to shoot a full survey without maintenance, this combination would provide a fully autonomous seismic acquisition system.

A monitoring system should also provide processed data autonomously. One way to implement this requirement would be to push the processing from the processing center into the OD OBN itself. Conceptually this is feasible because the data recorded by each node, when suitably processed, provides a piece of the full image. That piece of the image occupies a volume vastly smaller than the raw data that generated it. This means that it may be transmitted to surface using acoustic means, where it would be received by the same ASV that tows the seismic source. The ASV would traverse the field, picking up the pieces of the image from each node, assembling the full image and transmitting it via satellite. Processing on the node using conventional hardware and workflows would take too much time and consume too much battery power. New, artificially intelligent workflows running on specialized hardware would need to be used to learn from previous vintages recorded by the node to reduce computational effort and battery usage. The output of such autonomous seismic monitoring system would need to be coupled to an autonomous data assimilation system to impact reservoir management decisions in real time.

KEYWORDS: 4D SEISMIC, OBN, AUTONOMOUS

Curriculum Vitae

Is a Geophysicist with 25 years of experience working for Shell in many technical and managerial capacities, including assignments in R&D, Exploration, Enhanced Oil Recovery, and Reservoir Monitoring, applied to reservoirs onshore and in deep water. He is credited with opening new fields of geophysical technology, several patents, and multiple publications. He moved to Brazil in 2019 and currently leads the Subsurface Technology group, tasked with investing the ANP R&D obligation in a large and diverse portfolio of projects. Jorge holds a PhD in Physics from the University of Wisconsin and enjoys coaching and outdoor sports.

BUZIOS GLOBAL DEVELOPMENT PLAN: UNLOCKING THE POTENTIAL OF THE WORLD'S LARGEST ULTRA-DEEPWATER OIL FIELD

Fabiano Omar Ribeiro da Rosa, Victor Costa da Silva
PETROBRAS

Located in Santos Basin at a distance of 180km from the coast of Rio de Janeiro, Buzios Field was discovered in 2010 by the well 2-ANP-1-RJS as part of an investigation project lead by ANP and Petrobras in the exploratory area of Franco. Also, in 2010 was granted to Petrobras the right to E&P activities in Franco through the Transfer of Rights (ToR) contract, which authorized Petrobras to extract up to about 3 billion barrels of equivalent oil from the Area. Along the exploratory and appraisal phases, several wells were drilled finding excellent results in terms of thickness and productivity, indicating that Buzios Field had the potential to produce significantly more than the Transfer of Rights contract allowed. In order to develop the production of the Field, Petrobras, as operator, defined a master plan composed of 5 production units, with 150kbopd of processing capacity and gas exporting facilities, responsible for draining the volume fixed in the ToR contract, while allowing the possibility of future additional units to exploit the remaining volumes. The first four production units started operating between 2018 and 2019, which today are responsible for a production of approximately 575 kbopd, and the fifth unit is expected to start the operation in 2023. In order to make it possible to exploit the additional volumes, in November 2019 the Brazilian Government held the ToR surplus bidding round, with Petrobras as the winner, together with the Chinese companies CNODC and CNOOC. Once accessing the full potential of the Field, the winning consortium together with the state-owned company PPSA began studies and actions to define the Field's global development plan. The first action was to initiate an extensive data acquisition plan with the objective of delimiting and providing reservoir information for defining and optimizing drainage plans. During the years 2020 and 2021, 10 data acquisition wells were drilled, in addition to having completed the seismic processing of the OBN data, until then the largest seismic acquisition of this type ever performed. Using the lessons learned in the development of the other pre-salt fields, as well as the information derived from the development and production of the first modules of Buzios, Operator and Partners defined as main drivers for the optimization of the global development plan the maximization of the recovery factor through the extensive use of the WAG EOR method, the installation of smart completions in the wells, the use of high capacity production units and the application of large diameter pipelines to take advantage of the high productivity of Buzios wells. After extensive studies, including detailed alternative selections, 6 additional production units were already contracted: two 180kbopd units with gas exporting capacity and four 225kbopd units with full gas reinjection. Added with the 5 units already planned to drain the ToR volumes, the current Buzios Global Development Plan has already a total of 11 contracted FPSOs, responsible for exploiting the field, and a 12th FPSO is under study. With this great challenge to unlock all Buzios Field production potential, Petrobras, Partners and PPSA will make all its efforts to implement at least 7 additional production units by 2027, consolidating Buzios as the world's largest ultra-deepwater oil field.

KEYWORDS: BUZIOS FIELD, BUZIOS DEVELOPMENT PLAN, PRE-SALT, PRE-SALT DEVELOPMENT, PRE-SALT RESERVOIR, RESERVOIR CHARACTERIZATION, RESERVOIR DATA ACQUISITION

Curriculum Vitae

Graduated in mechanical engineering from UFRJ and specialist in reservoir engineering, Fabiano joined Petrobras in 2010 where he started working with the production development of the pre-salt Fields in Santos Basin. During his career, Fabiano had the experience of coordinating the reservoir team for the two largest ultra-deepwater Fields: Buzios and Tupi, working with the definition of development plans as well as with the implementation of several production systems. Since 2020, Fabiano has been part of Búzios Management Team as Reservoir Projects Manager.

LEADERSHIP MEETING WITH STUDENTS CHAPTERS

The 3rd BPC is promoting a leadership event for students and new professionals, aimed at:

- **attract professionals to our industry;**
- **accelerating the technical learning curve and developing individual skills for the next generations of energy industry professionals;**
- **greater engagement with technical-scientific associations.**

SEP 13 **Meet &Greet - CONNECTIONS**

Special session to connect students and early career professionals with experienced attendees of the O&G industry. It will be a perfect moment for improving their networking; Sharing industry knowledge, experiences and advises to guide the next professional generation to accelerate the learning curve in their careers; How: Professionals will be paired with one or more students/young professionals during the Icebreaker reception and introduced to other ABGP and SPE members and colleagues

SEP 15 **Leadership Meeting - PROFESSIONALS OF THE FUTURE**

It is a section dedicated to improve the soft skills and give tips to have a successful career in the O&G industry, with the scenario of increasing the energy demand, data driven decisions, digital transformation and ESG necessities.
Talks about:

✓ Successful Carriers
✓ Professional of the future in the energy industry
✓ Digital Transformation
✓ Learning how to Learn
✓ How to improve your carrier

SEP 16 **Technical Training Course - HARD SKILLS**

Início	Término	Temas
08:00	08:30	Welcome Coffe
08:30	09:20	Tendências globais no mercado de energia para o profissional do futuro
09:20	10:10	Geofísica de EXPLORAÇÃO vs. RESERVATÓRIOS / DESENVOLVIMENTO
10:10	10:20	INTERVALO
10:20	11:10	Fundamentos de Sistemas Petrolíferos
11:10	12:00	Modelagem de Reservatório
		INTERVALO
13:30	14:20	Operações Offshore (Perfuração de poços)
14:20	15:10	Perfilagem de poços e suas aplicações em tempo real durante a perfuração
15:10	15:20	INTERVALO
15:20	16:10	Completação de poços
16:10	17:00	Interpretação de dados para identificação de falhas na produção, *Flow Assurance*
17:00	17:50	Transformação digital no E&P
17:50	18:00	ENCERRAMENTO

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