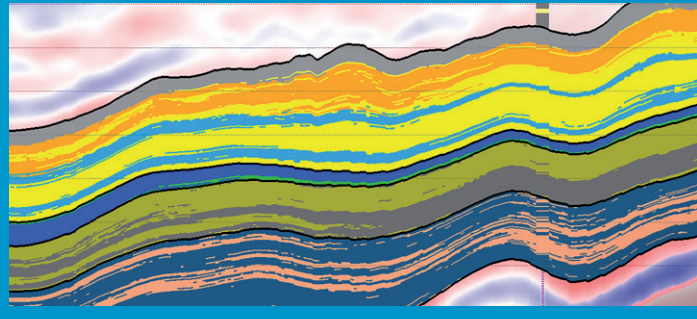


ASSET EVALUATIONS



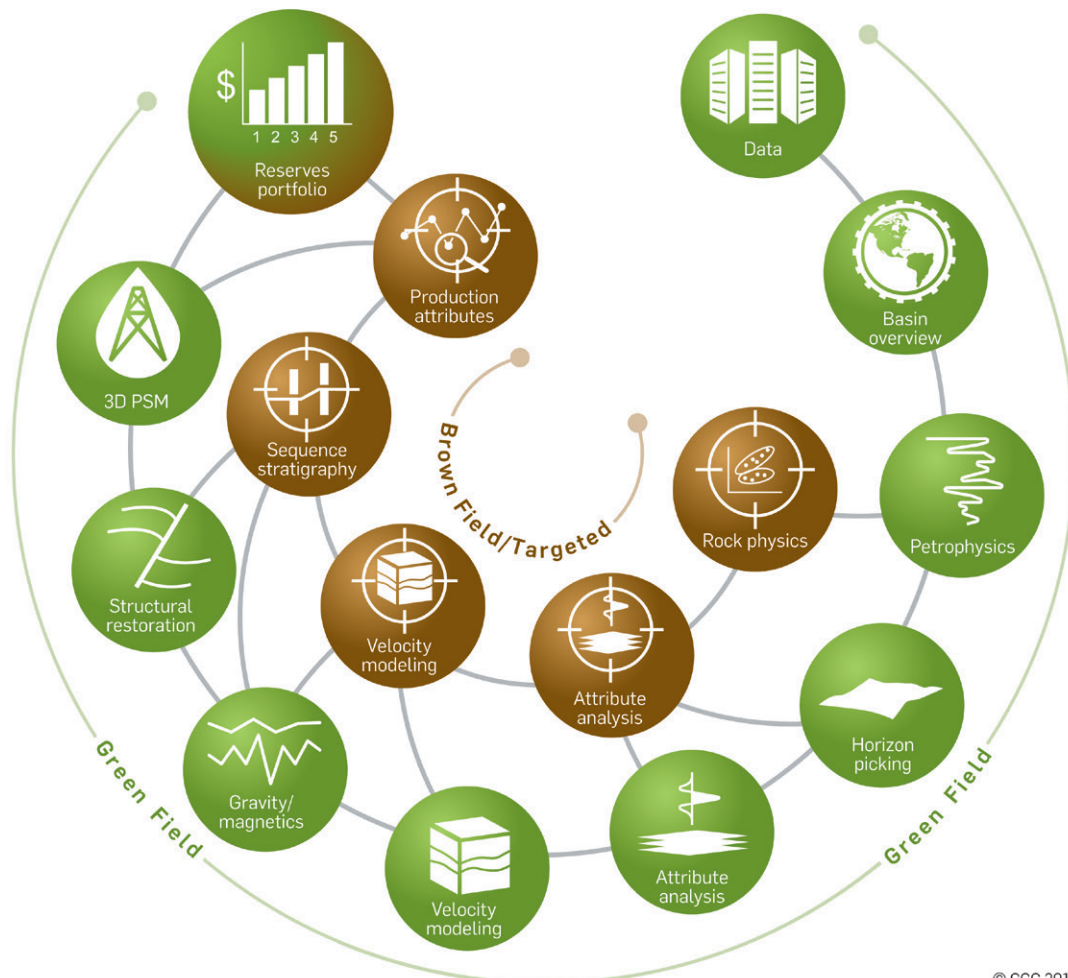
For A&D and M&A activities

Asset Evaluations for A&D and M&A Activities

The CGG A&D and M&A team provides integrated subsurface evaluation consulting services to assist in the acquisition, divestiture and merger of mineral assets. Our experienced reservoir geologists, petrophysicists, geophysicists, reservoir engineers and economists have completed evaluation projects across the globe, providing integrated multi-disciplinary subsurface data sets that reveal critical insights into the producibility of assets.

Our clients are small independents, IOCs and NOCs, covering brownfield development (rejuvenation) and greenfield prospecting (exploration) for onshore, offshore, unconventional and conventional fields.

Exploration Workflow

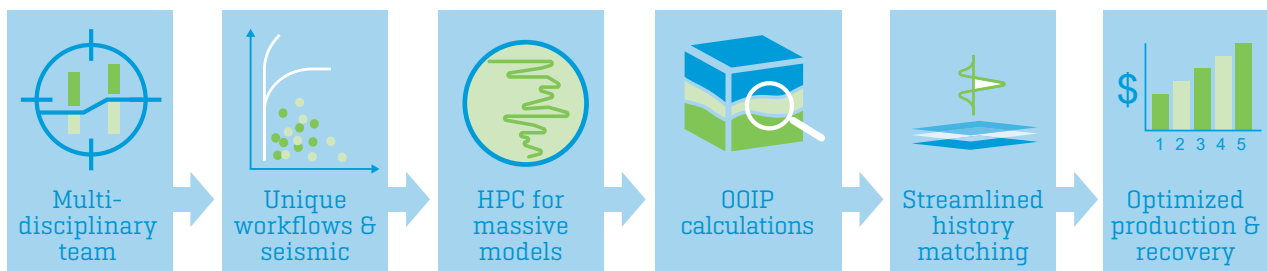


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CGG Asset Evaluations

The standardized and succinct approach adopted by CGG's A&D and M&A team delivers the data-driven subsurface interpretation required to provide quantitative asset valuations for conventional and unconventional resource plays.



The above generalized workflow highlights how well log data and regional geological understanding are used to generate regional correlations of key formations to highlight reservoir continuity and thickness. This interpretation, coupled with petrophysical analysis, provides a key insight into lithology, porosity, water/oil saturations and relative brittleness across an asset. The organic geochemistry and petroleum systems analyses deliver critical interpretations and predictions relating to either/both the in-situ source rock properties [e.g. maturity, type, expulsion] and the understanding of potential migrated hydrocarbon accumulations that may have occurred. Reservoir properties away from well

control are also critical aspects to evaluate as areas of unidentified pay can be quickly identified. Where seismic data is available, our team of reservoir geophysicists use CGG's industry-leading reservoir characterization software to perform fast seismic inversions, identifying high-porosity reservoirs away from well control points. Our geophysical approach can also identify geobodies in the subsurface that may host significant oil and gas accumulations. Additionally, if an asset is driven or affected by fractures or faulting, our workflows can quickly identify and map these features - of particular importance for those assets where water production or disposal and H_2S is a challenge.

The following pages summarize selected case studies, as well as CGG's data library that can be used as part of an asset evaluation study.

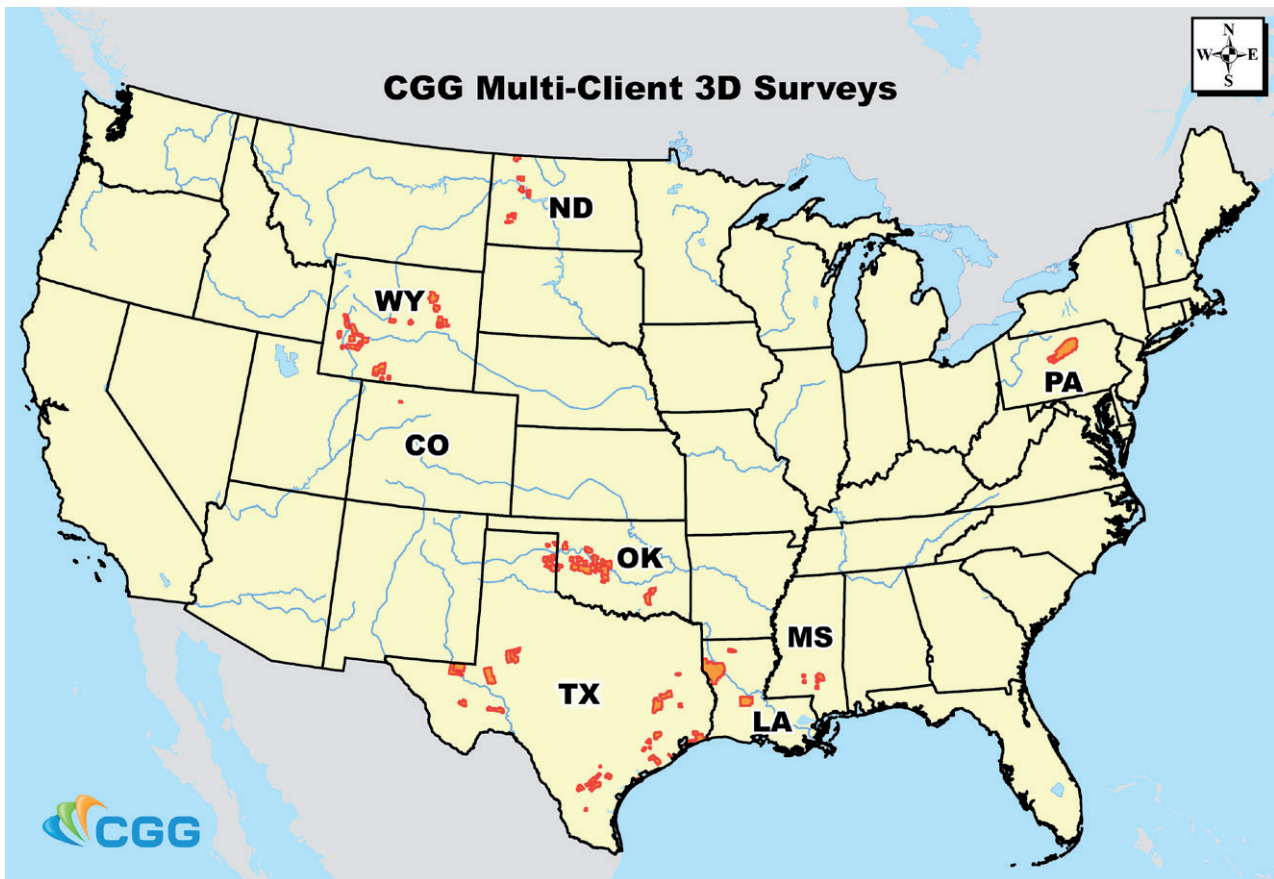


Asset Evaluations for A&D and M&A Activities

CGG Data Library

Seismic Data

CGG hosts an extensive multi-client 3D onshore seismic data library within the main hydrocarbon basins of the United States, which has been used by multiple E&P companies to explore and develop assets. If an asset is located onshore US, and is covered by a CGG 3D seismic survey, CGG can provide data images to assist in A&D and M&A activities. By sharing samples of the available data, clients can validate the high quality of the 3D seismic data over their asset.



Digital Geoscience

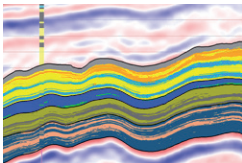
Over the past 10 years, CGG's subsurface characterization team have generated a global subsurface database of rock and log data to assist in the generation of basin-to-formation specific evaluation studies. These studies have led to the collection of public subsurface data and the acquisition of new rock data via CGG's organic and inorganic laboratories. This data, combined with CGG's expertise in reservoir geology, petrophysics, geophysics and reservoir engineering, has led to the development of industry-acknowledged surface interpretation and risking products. Additionally, CGG completes proprietary subsurface characterization studies for small and large E&P companies across the Lower 48 and globally, further adding to the experience of our subsurface team.

Asset Marketing

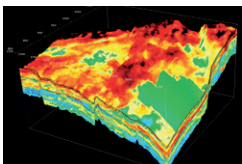
When the opportunity arises, CGG will write, compile and publish technical articles with industry-recognized publications. This has proven to be a valuable and cost-effective way of further promoting the asset, as well as increasing its marketing reach and exposure to a larger audience.

Asset Evaluation Deliverables

Industry-renowned data coupled with reservoir characterization expertise provides unrivaled support for your asset.



If your asset is located within an area covered by CGG's multi-client seismic data, a high-definition seismic section image will be provided to enhance subsurface understanding and promotion.



We include an integrated reservoir characterization study, with regional correlations, isopach mapping, geochemistry evaluations, petrophysical analysis, fault analysis, and seismic inversions.



We deliver original oil-in-place volumes that can be used for economic assessments, valuations and commercial reserves.






Marketing and data room support from CGG's subsurface experts help in the development and technical promotion of your asset.



Case Study 1

Asset Sale – Midland Basin

CHALLENGE	SOLUTION	RESULTS
 <ul style="list-style-type: none"> • Midland Basin Eastern Shelf asset located in Sterling County • Wolfcamp ‘conventional’ asset, outside core Wolfcamp Basin development • Vertical well development with logs, cuttings and 3D seismic data • Develop a fast subsurface evaluation to highlight the production potential of the asset 	 <ul style="list-style-type: none"> • Regional correlation of the Wolfcamp Formation across Sterling and Glasscock Counties • New rock analyses to collect key rock property information (mineralogy, TOC, maturity) • Petrophysical modeling of key vertical wells • Geophysical coherency analysis of seismic volumes • Isopach mapping and OOIP calculations 	 <ul style="list-style-type: none"> • Delivery of an integrated subsurface evaluation study within 30 days • Delivery of OOIP volumes for economic calculations • Delivery of detailed subsurface marketing material for VDR’s and potential buyers • CGG’s subsurface team available to deliver study results to potential buyers in person or via video conference



Case Study 2

Asset Development & Sale – Midland Basin

CHALLENGE



- Midland Basin asset located in Howard County
- Wolfcamp and Spraberry Formation targets under the town of Big Spring
- Complex geology in East Midland Basin Shelf
- Urbanized asset with limited well control; only on the city limits
- Evaluate lateral well placement and frac height growth - how many lateral wells can be drilled to effectively drain hydrocarbon from the Wolfcamp and Spraberry

SOLUTION



- Regional correlation of the Wolfcamp and Spraberry Formation across Howard and Martin Counties (300+ wells)
- Petrophysical modeling of key vertical wells, calibrated to available core data
- Deterministic seismic inversion using CGG's 3D seismic data to identify lateral well target zones
- Geostatistical seismic inversion to resolve fine-bed heterogeneity
- Perform 1D mechanical earth modeling and simulate fracture stimulation to evaluate vertical frac growth height

RESULTS



- Delivery of an integrated subsurface evaluation study within 30 days
- Delivery of OOIP volumes for economic calculations
- Delivery of detailed subsurface marketing material for VDR's and potential buyers
- CGG's subsurface team available to deliver study results to potential buyers in person or via video conference
- Generation of deterministic and geostatistical seismic inversion models to identify and validate lateral drilling targets based on optimum rock properties
- Lateral well cuttings analysis generating pseudo-elastic logs as an input to optimized completion designs - coupled with the geostatistical inversion model



Case Study 3

Prospect Portfolio Generation – Middle East

CHALLENGE



- Kuwait: Partition Zone between Kuwait & Saudi Arabia
- Focus on entire stratigraphic column
- 4,600 km² new high-res. 3D seismic, 120 wells, previous reports & analysis
- Generate a new greenfield prospect portfolio (risked volumes & single-well economics) of 50 prospects/leads

SOLUTION



- Fully integrated approach; 2.5 years
- Regional seismic & gravity/magnetic interpretation, well ties and sequence stratigraphic correlation
- Rock physics modeling
- Seismic attribute analysis
- All as input to a very detailed 3D petroleum systems model as the building block to prospect/ lead identification

RESULTS



- 50 new risked and ranked prospects & leads including single-well economics and cashflow forecasts
- Extension of petroleum province life well into the 21st century
- Better understanding of the hydrocarbon habitat of the study area
- More detailed knowledge of the hydrocarbon types, spatial distribution and volumes available

MULTI-YEAR INTEGRATED STUDY DELIVERED AHEAD OF SCHEDULE FOR KGOC

Experts from the Kuwait Gulf Oil Company (KGOC) and CGG's Geoscience team worked together to identify resource growth potential in the mature, onshore Partitioned Zone (PZ) between Kuwait and Saudi Arabia five months ahead of schedule. By integrating geoscience capabilities, from geological control through rock physics and seismic inversion to 3D petroleum systems modeling, they were able to identify and build a risked prospect portfolio that will extend the hydrocarbon potential of the PZ until the mid-21st century.



Mr. Abdullah Al-Sumaiti, Acting CEO & DCEO Planning & Commercial Affairs, KGOC (left), and Mr. Mohammad Al-Haimer, DCEO, Joint Operations, KGOC (right), receiving the Exploration Portfolio Catalogue from Dr. Guy Oliver, VP, CGG Geoscience & Project Director (center).



Case Study 4

Basin Screening – Permian Basin

CHALLENGE



- Identify asset portfolio growth opportunities within the Permian Basin for a mid-sized exploration and development company
- Understanding the hydrocarbon success of the Permian Basin and highgrading those least explored areas of the Permian Basin
- Vast and unstructured public subsurface database

SOLUTION



- Identify and map those areas of the Permian Basin with limited production history
- Obtain well and rock data of those target formations to identify intervals hosting rock properties ideal for lateral well development and production
- Generate hydrocarbon play risk maps of those identified formations

RESULTS



- Generation of a comprehensive exploration portfolio, allowing our client to identify acquisition opportunities in less developed areas of the Permian Basin



Case Study 5

Proprietary Subsurface Databasing – Lower 48

CHALLENGE



- Develop a data-rich onshore USA subsurface database to assist with exploration, development, M&A and A&D activities
- Collect public subsurface data from multiple data sources; QC and appropriately database

SOLUTION

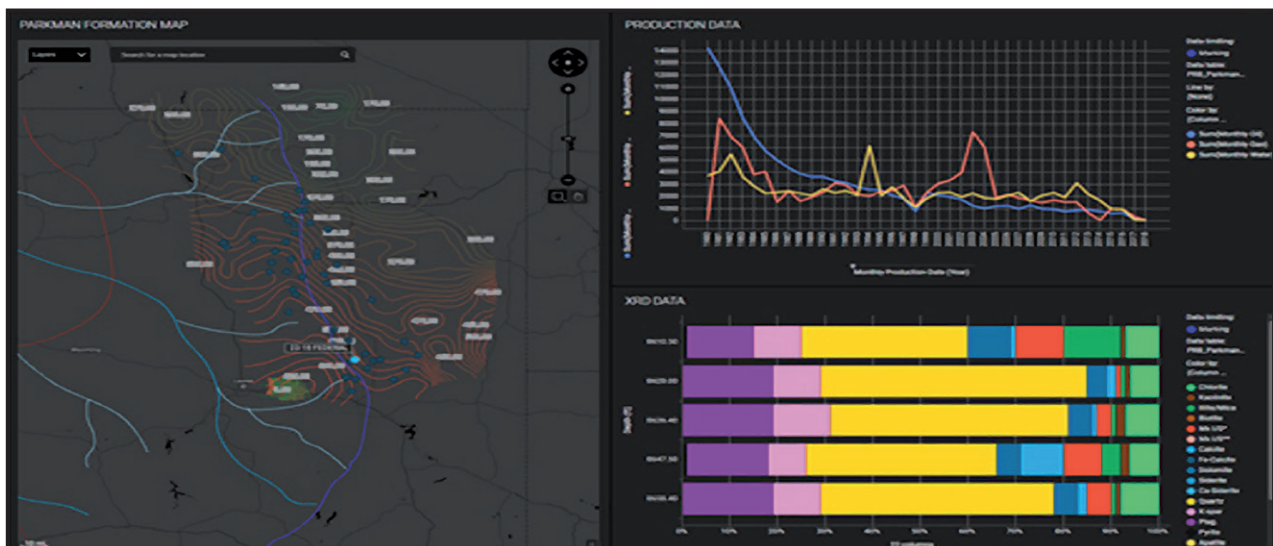


- Form partnerships with data vendors allowing for the generation of derivative and interpretive products
- Use Python coding to efficiently identify public subsurface data and download to an SQL database
- CGG's geoscience team performs a QC of the data

RESULTS



- Delivery of an intuitive onshore USA subsurface database to include:
 - Constrained and conditioned petrophysical logs and interpretations
 - Reservoir and source rock risk maps to quickly identify development potential/risk
 - Any other public data [production, academic interpretations] presented



Asset Evaluations for A&D and M&A Activities

Team

Dr. Guy Oliver - Vice President

Guy Oliver is the Vice President of CGG's Reservoir Americas group. Throughout his 25-year career, he has undertaken numerous subsurface reservoir studies, both at a regional and field scale. He has consulted for a wide range of clients from small independents through super majors to NOC's. His vast global experience extends across a number of geologic disciplines and scales from reservoir geology through frac stage design to fully integrated multi-well, regional projects.

Guy has a high level of expertise in leading and managing integrated asset teams and delivering on-time results. He has a proven track record of creating, leading and inspiring teams to innovate and deliver value to clients.

Prior to joining CGG, Guy worked for Fugro in the UK, Norway and the USA, where he successfully led various business units. He received his Bachelor of Science, Geology from the University of Wales, Cardiff, UK; his Master of Science, Reservoir Geology from Imperial College, London, UK and his Doctor of Philosophy from the University of Plymouth, UK.

Graham Spence - Technical Manager

Graham Spence is the Regional Technical Manager for CGG's Reservoir Americas group and is responsible for the group's geological consulting services, along with the sales & marketing function. During his 15-year career, he has worked on a variety of global subsurface consulting projects focused on exploration and development of both onshore and offshore, conventional and unconventional reservoirs.

Graham developed and leads CGG's subsurface evaluation team for the A&D and M&A market. His team has been retained by operators and asset sale companies to provide subsurface evaluation reports that have assisted in the marketing and sale of mineral assets.

Bertrand Six - Technical Manager

Bertrand Six is currently working as regional technical manager in the Reservoir Characterization group of CGG in Houston, developing new workflows using machine learning, rock physics and petrophysics in both conventional and unconventional plays. In the last ten years he has held various positions for CGG in Europe, the Middle East and North America.

He worked on various integrated projects from exploration in the Berkine Basin, Algeria to 4D reservoir monitoring studies in the Middle East and West Africa. During his six years in the Middle East, he worked closely with seismic processors to develop integrated workflows to improve PSDM imaging using petrophysics, rock physics and regional geology as well as detailed seismic attributes interpretation for strike-slip fault identification in carbonate reservoirs.

He holds a Master of Science in Geology from LaSalle Institute, France and a Master of Science in Petroleum Geoscience from Imperial College, London, UK.



Asset Evaluations for A&D and M&A Activities

Dr. Chi Ly – Technical Manager

Chi Ly is a Regional Technical Manager within CGG's Reservoir Americas group. Over the last 20 years of his career he has worked in the minerals, mining and energy sector focused on the application of new technologies to understand geologic, mineralogic and metallurgical problems for clients globally.

Prior to joining CGG, Chi led the mineralogy group for ALS Metallurgy in Perth, Australia, where he pioneered the commercial application of infra-red spectrometry for iron ore screening. He received his Bachelor of Applied Physics from Curtin University, Perth, Australia; his Master of Science and Doctor of Philosophy from Hiroshima University, Hiroshima, Japan.

Mark Letizia – Technical Manager

Mark Letizia hosts 9+ years of geophysical and integrated project experience across 80+ projects from conventional and unconventional reservoirs from around the globe, specializing in multiple forms of 3D and 4D inversion, azimuthal analysis, multicomponent seismic, geomechanics, and machine learning.

Holding various positions inside CGG, he has been exposed to a wide variety of projects across the globe from Africa, the Middle East, North and South America, and Asia. He has co-authored a number of technical papers since joining the company, including an industry-first comparing and discussing azimuthal seismic techniques, an integrated workflow to use geomechanics for increased production in an induced fracture horizontal well completion, and 4D multi-component

inversion for mobile bitumen identification in a heavy oil SAGD reservoir.

Dr. Ross Taylor – Senior Reservoir Geologist

Ross Taylor is a sedimentologist in CGG's Reservoir Americas group. He holds a Bachelor of Science and Doctor of Philosophy from the University of Aberdeen. He has 5+ years of experience in CGG, and two years of experience with Corex. He led exploration projects in North Africa and participated in a suite of international exploration projects while working at CGG's North Wales office.

Since joining the Houston team, he has gathered extensive experience of core and wireline-based data across the Lower 48, inclusive of the Haynesville, Wolfcamp, Dean, Barnett, Frontier and Niobrara Formations. He has also technically led provenance, stratigraphy and reservoir-quality studies in Guyana and Suriname in this emerging super basin.

Adriana Pérez – Senior Petroleum Geochemist

Adriana Pérez is a petroleum geochemist in CGG's Reservoir Americas group. She provides interpretation for geochemical evaluation of source rocks and fluid (oil, condensate and gas) samples and petroleum systems analysis. She has more than 15 years of experience as a geochemist and petroleum systems analyst within the oil and gas industry.

Throughout her career she has participated in different projects in different basins and geological settings, gaining wide experience in geochemistry and petroleum systems analysis



of conventional and unconventional plays. Adriana has also worked towards integrating seismic reservoir characterization with petroleum systems modeling and developed a new analytical [pyrolysis] method for evaluating and improving the geochemical evaluation of unconventional plays.

Adriana Pérez began her career with PDVSA-Intevep, S.A and joined CGG in 2013. She holds a Bachelor of Science in Chemistry with a Major in Geochemistry, a specialization in petroleum geochemistry, and a Masters in Geology from the Central University of Venezuela.

Francisco Brito – Technical Team Lead - Petrophysics

Francisco Brito is the Technical Team Lead - Petrophysics for CGG's Reservoir Americas group. He has experience leading teams to deliver complex offshore and onshore reservoir characterization projects in the United States, Mexico, Middle East and Latin America. Francisco brings over 20 years of experience in conventional and unconventional reservoir characterization to the oil and gas industry. Francisco is skilled in rock physics, automated petrophysics and is highly knowledgeable of deepwater environments. He has worked in technical and operational projects for large and small IOCs, NOCs and independents within the global oil and gas industry, including BP, Shell, Ecopetrol, Hocol, Petrobras, PEMEX, PDVSA, KGO and Repsol.

Francisco graduated from Polytechnic University, with a Bachelor of Science in Electrical Engineering. While working at PDVSA he completed fifteen months of

petrophysical training at Universidad Central, with a two-year specialization in Integrated Reservoir Management in the petroleum engineering department.

Paola Fonseca - Senior Petrophysicist

Paola Fonseca is a senior Petrophysicist in CGG's Reservoir Americas group where she provides petrophysical interpretation and rock physics modeling expertise for inversion projects, in both conventional and unconventional plays.

Her experience includes the Permian and Anadarko Basins, particularly the Wolfcamp, Haynesville, Woodford and Meramec plays. Paola has 15 years of industry experience, and holds a Bachelor of Science in Petroleum Engineering from the University of America, Colombia.

Arikuma Tsuyoshi – Technical Team Lead - Geophysics

Tsuyoshi Arikuma is the Technical Team Lead - Geophysics for CGG's Reservoir Americas group. During his 20-year career, he has worked on a variety of reservoir characterization projects focused on exploration and production of conventional and unconventional reservoirs.

Tsuyoshi Arikuma specializes in seismic quality control, gather conditioning, rock physics analysis, amplitude analysis, AVO analysis, pre-stack seismic inversion, quantitative seismic interpretation, brittleness analysis for unconventional, reservoir uncertainty analysis, geostatistical inversion and depth conversion.



Asset Evaluations for A&D and M&A Activities

Inna Tsybulkina – Technical Team Lead - Geophysics

Inna Tsybulkina is a Technical Team Lead - Geophysics for CGG's Reservoir Americas group. She has 12+ years of experience in the oil and gas industry. She completes reservoir characterization studies through the implementation of deterministic and geostatistical inversions on proprietary and non-proprietary seismic data across the Americas region. Inna has worked on onshore and offshore projects in a variety of locations and depositional environments, including the Permian Basin, San Jorge Gulf, North Slope, Caspian Shelf, Timan-Pechora Basin and Western Siberia.

Inna received her Bachelor of Science and Master of Science in Exploration Geophysics at Gubkin Russian State University of Oil and Gas.

Robert Bachman – Reservoir Engineer

Robert Bachman is an independent reservoir engineering consultant. He has 40+ years of experience managing and conducting large petroleum reservoir/production engineering studies throughout the world within a multi-disciplinary team environment. He has worked on hundreds of studies encompassing all facets of reservoir engineering, including reserves, flow modeling, rate transient analysis, pressure transient testing, enhanced oil recovery, hydraulic fracture design, and shale gas and oil. He has consulted for NOC's, major oil companies and small independents. For his contribution to the petroleum industry he has received two Society of Petroleum Engineering (SPE) regional technical excellence awards [Calgary (2015) and

Canada (2010)]. He has published extensively through the SPE and was a chapter co-author on a book about hydraulic fracturing.

Robert worked for five years at CGG's Calgary office. Prior to that he was a partner in employee-owned Taurus Reservoir Solutions, which was acquired by CGG in 2015. Earlier consulting experience includes working at Duke Engineering [Calgary + UK], Simtech Consulting Services and Scientific Software-Intercomp. He started his career in 1978 at Mobil Oil Canada. He received Bachelor and Masters degrees in Civil Engineering from the University of Manitoba in Canada.

Veera Raman – Economist

Veera Raman is a results-oriented business professional with 23 years of experience in domestic/international upstream projects. He has multi-disciplinary experience, including economic modeling, asset evaluations, merger & acquisitions, financial analysis, operational analysis, commercial analysis/negotiations, portfolio planning, business development, project management, reservoir management, production management and oil/gas value chain optimization.

His employment and consulting work history includes Shell E&P, ConocoPhillips, Noble Energy, Vaalco Energy, BW Offshore, BW Energy, PetroTx, CGG, Kuwait Gulf Oil Company, HDM, Atlantia Resources and various other E&P companies.



Andrew Webb – Asset Valuation Manager

Andrew Webb is the Asset Valuation Manager within CGG's Reservoir Sciences group. Throughout his 31-year career, he has undertaken numerous Petroleum Engineering, Acquisitions/Disposals, Economic Evaluations and Corporate Planning consultancy projects, servicing the construction and oil and gas industries.

Andrew's expertise in reserves auditing and certification, competent person report writing, economic modeling and evaluations, risked exploration economics, project facilities costing and petroleum engineering provide a unique skillset to CGG's A&D and M&A team.

Andrew received his Bachelor of Science in Chemical Engineering from the Polytechnic of Wales, UK.

Toni Uwaga – Principal Reservoir Engineer

Toni Uwaga has over 25 years of reservoir engineering experience, most of which was spent with Shell Petroleum Development Company and Centrica Energy Upstream. His previous positions include reservoir engineer, reserves coordinator and lead reservoir engineer.

Toni's areas of expertise are associated with well test analysis, production forecasting, decline curve analysis, nodal analysis and PVT fluid characterization. He received his Bachelor of Engineering from the University of Benin, an Advanced Diploma in Petroleum Engineering from the Robert Gordon University and his Masters of Science in Petroleum Engineering from Heriot Watt University.

Potcharaporn (Yok) Pongthunya – Senior Reservoir Engineer

Yok Pongthunya's areas of expertise cover reservoir engineering, production engineering and reserves evaluations, all used to provide unique insights to reservoir simulation, water flooding, polymer flooding, production optimization, artificial lift and decline curve analysis. Her experience in these assessments spans across the globe covering geographies such as the USA, North Sea, East Africa, Papua New Guinea and Brazil. Yok spent six years working with Chevron holding various roles such as Petroleum Engineer, Production Engineer and Reservoir Engineer.

Yok received a Bachelor of Engineering from Chulalongkorn University, Thailand; a Master of Science in Petroleum Engineering from Texas A&M University, USA; and a Doctor of Philosophy in Petroleum Engineering at Imperial College, London, UK.



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