



BGP – Beyond Geophysical Prospecting
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中国石油集团东方地球物理勘探有限责任公司
BGP Inc., China National Petroleum Corporation



精诚伙伴 找油先锋

Loyal Partner Energy Pioneer

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An Address from Chairman of BGP

As a globally trusted integrated geophysical service provider, BGP has served more than 300 energy companies during the last several decades with a remarkable footprint in over 80 countries, enabling BGP to become one of the leading geophysical contractors in the world today. In retrospect, it would be impossible for BGP to achieve such outstanding success without the steadfast trust and support of its clients, business partners and friends. To all of them, I would like to express my deepest appreciation.

As we all know, the energy industry has been subject to unavoidable changes in the markets in recent times, however global situations are forever changing and it can now be seen that the energy industry is becoming stronger after a turbulent few years and also it is changing with the need for transition from hydrocarbons to greener renewable energies. BGP, as a major geophysical services company, is actively preparing to meet such challenges by continuing to improve its strategies, developing innovative solutions, reducing operational costs and attracting elite geoscience-talent. Also extending into non-hydrocarbon geophysical activities and assisting energy companies with their development of CCUS, geothermal and wind farm placements amongst others.

BGP has vigorously stressed that both technological and business innovations are vital to its success as demonstrated by the roll out of a series of core and proprietary technology packages that include the GeoEast® and KLSeis® software systems, rugged and reliable seismic instruments including the eSeis and Quantum land node, the oSeis Ocean Bottom node, G3i® NXT cable recording system and the shallow water DP hybrid vessel. Also included are the customizable land source products to accommodate variations in terrain, environment and imaging requirements including the high-precision broadband vibrator EV-56, the shear-wave vibrator EV-56S, the industry-leading AHV-V TITAN(480), AHV-IV™ (364/380) and other vibrator series along with high-productivity vibroseis techniques, the digital-seis system and uDAS VSP techniques, etc. The application of these cutting-edge products enables BGP to design more efficiently when executing the most complex seismic programs while lowering costs, improving data quality and considerably increasing client satisfaction.

BGP regards “zero injury, zero pollution and zero accidents” as its HSE targets and adheres to the solemn commitment to not making profits at the cost of employees’ life and health. BGP always put the environmental protection as its highest priority. Additionally, BGP actively engages in a

“green seismic” campaign to minimize the impact of our operations on the environment. Over the past decades, BGP has consistently adhered to the HSSE management philosophy, advocating a proactive safety culture in the workplace.

One of BGP’s core values is to be Client-Oriented. BGP champions the idea of win-win cooperation, endeavoring to obtain all present resources, reducing client risk and helping clients discover additional hydrocarbon reservoirs at the lowest possible cost with the best service quality, while also extending its reach into helping energy companies develop their green energy portfolios.

BGP supports the philosophy of an open and inclusive culture by respecting every client and partner while greatly respecting differing cultures, religions and customs around the world. BGP is committed to its socially responsible activities and projects through its support of charitable causes and construction of roads, schools and hospitals, amongst others, which are essential in facilitating economic development of the countries in which BGP operates.

BGP will continue its dedication to geophysical innovation by accelerating the integration of programs and practices of seismic with

non-seismic, onshore with offshore, in addition to the current integration of geophysics with AI technology. BGP believes these developments will create more value for its clients allowing them to continue in the improving energy markets and also with the necessary transition to renewable energies.

“Innovation is seeing what everybody has seen and thinking what nobody has thought.” BGP continues to innovate in order to enrich the Future of Energy.

Thank you!



Zhang Shaohua
Chairman of BGP



Business Introduction

BGP is one of the world's completely integrated geophysical companies, delivering a full spectrum of geophysical products and services while its state-of-the-art R&D facility is staffed with outstanding personnel that are unrivalled in the industry.

In 2002, BGP was formally established as a liability-limited company after its merger with six other geophysical divisions operating within different parts of China. BGP's headquarters are located in Zhuozhou City, Hebei province, P.R.China.

Currently BGP owns and operates a fleet of 156 land seismic crews, 6 OBC and OBN crews, 3 streamer vessels, 11 VSP crews, 22 non-seismic crews, as well as 16 seismic data processing and interpretation centres distributed around the world.

BGP has been actively engaged in seismic activities since 1951 in China with the opening of its international operations in the 1990's. In all, BGP has proven to be a very good quality and reliable service provider for more than 300 energy companies around the world including almost all the major national and international energy companies.

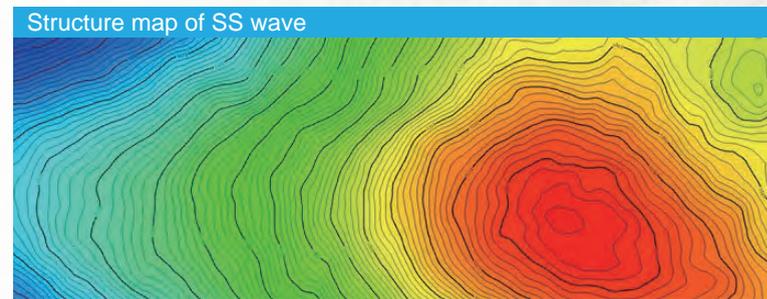
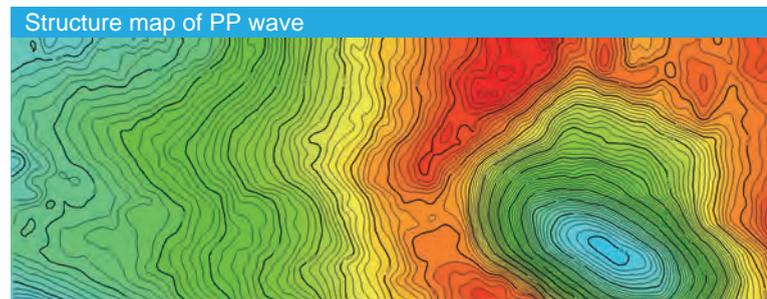
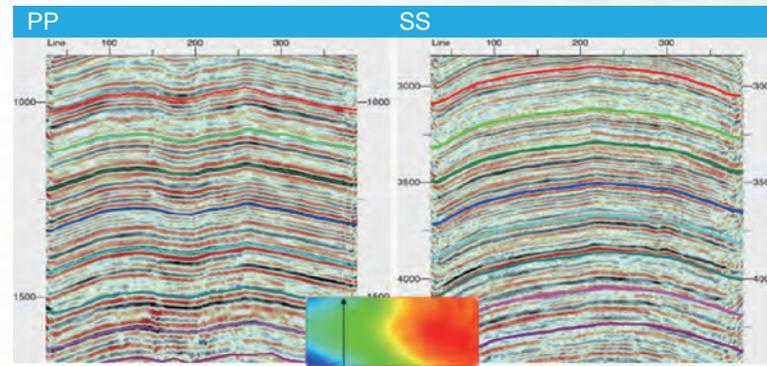
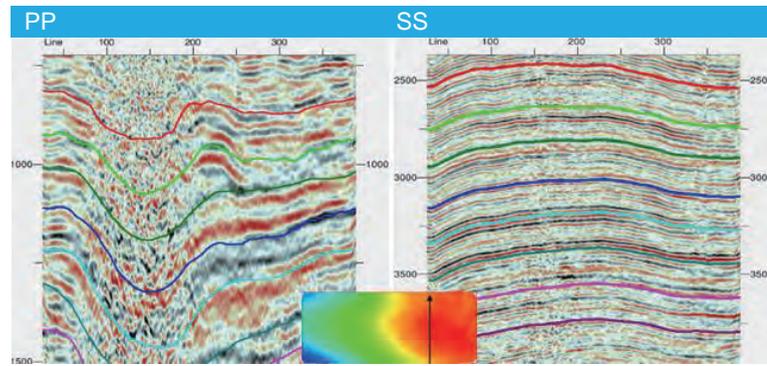
Onshore Seismic Acquisition

Underpinned by the remarkable experiences accrued in the past 70 years along with the ownership of the most advanced technologies, BGP has the resources and confidence to successfully undertake seismic data acquisition projects under all terrain conditions, such as mountains, deserts, loess lands, gravel plains, swamps, jungles, and urban areas.

In China: Covering 30 provinces and regions, promoting breakthroughs and discoveries in oil and gas exploration across seven main basins. Through collaboration with oil and gas fields, we have successfully discovered large oil fields totaling 300 million tons and gas fields totaling 4 trillion cubic meters.

BGP operates and maintains 65 onshore seismic crews outside China as well as 54 branches and offices spanning across the Middle East, Africa, Central Asia, Southeast Asia and the Americas. We have established seven large-scale production bases globally and have been providing quality services to over 300 energy companies worldwide.



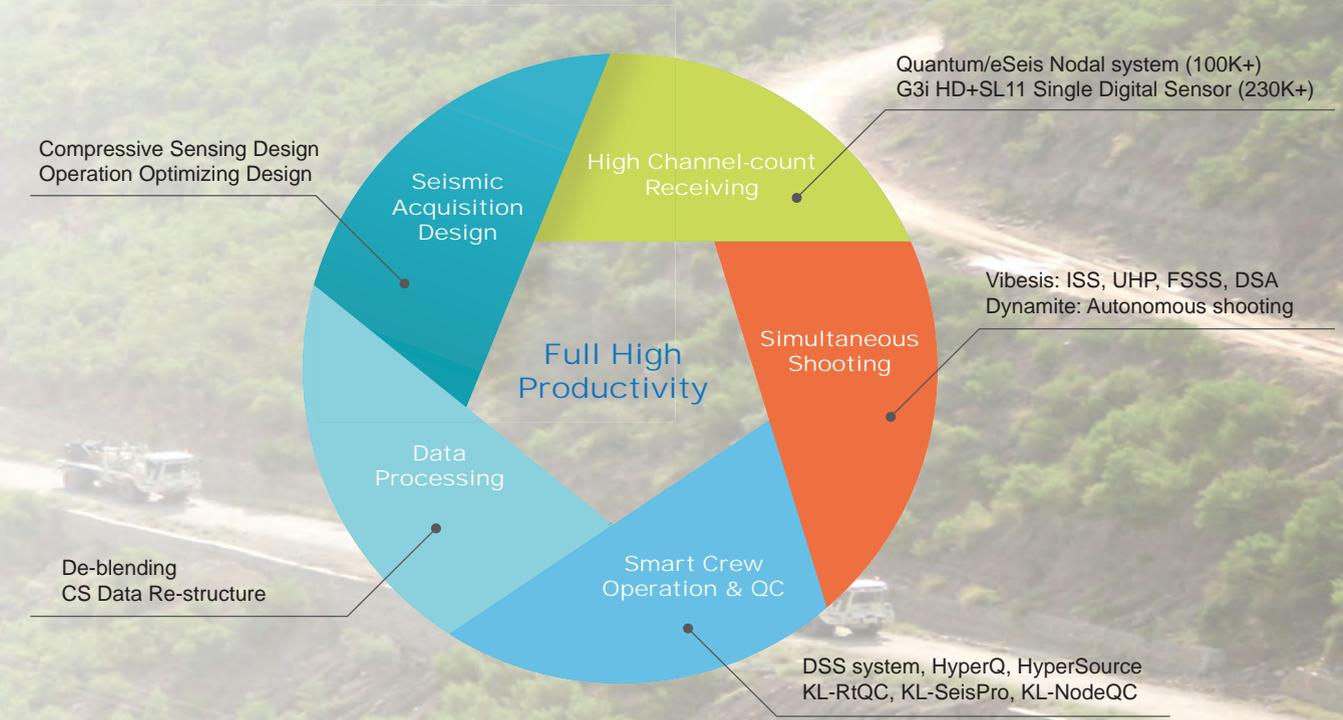


Full Wave Field

BGP has been performing land full wave field seismic acquisition in terms of nine-component data with the high-precision vibrator EV-56 (1.5-160Hz) and the specially designed shear wave vibrator (EV-56S).

Full High Productivity

- Compressive sensing acquisition
- High channel-count acquisition
- Simultaneous acquisition
- Smart crew operation & QC



Offshore Seismic Acquisition

BGP provides the high quality 2D, 3D and 4D seismic services globally using OBC / OBN and streamers.

With over 40 years of experience in OBC operations and nearly 10 years of experience in OBN operations, we have eight seismic fleets comprising one 12-streamer vessel and seven OBN seismic crews with 100 thousand nodes.

BGP has specialized equipment and techniques dedicated to transition zone seismic acquisition. A series of equipment such as shallow water crafts, mini volume air-gun source boat, TZ vibrators and techniques including vessel & vehicle monitoring system, shallow water node positioning and quality control of seismic data acquired from different terrains have been incorporated into the transition zone seismic acquisition to provide the seamless seismic data from onshore to offshore.

- Seismic survey design and high-efficiency acquisition
- Comprehensive navigation and positioning techniques
- Quality control and processing for large volume seismic data
- Offshore seismic equipment design and manufacturing



OBN automatic deployment & retrieval system

- Fully automatic node attach & de-attach system
- High-efficiency deployment & retrieval
- High accuracy positioning
- Containerized automatic modular system

BGP Innovator

- DP shallow water vessel
- Node handling and multi-source hybrid vessel
- Minimum draft of 2.85 meters
- Low carbon emission with electrically driven thrusters
- Comprehensive capability with integrated navigation system, large volume seismic data QC & processing, USV for acoustic positioning



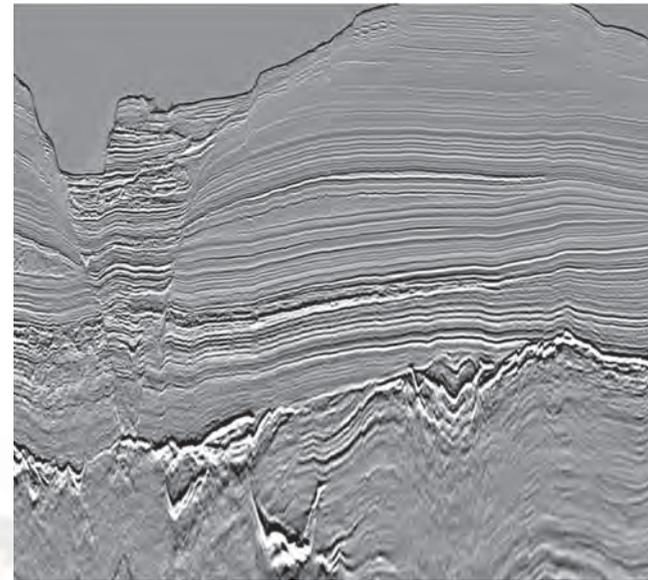
Seismic Data Processing

BGP boasts the largest seismic data processing and interpretation center in Asia, and have established 10 branches of geophysical research institutes and 5 research centers in China, and have set up 14 research centers overseas.

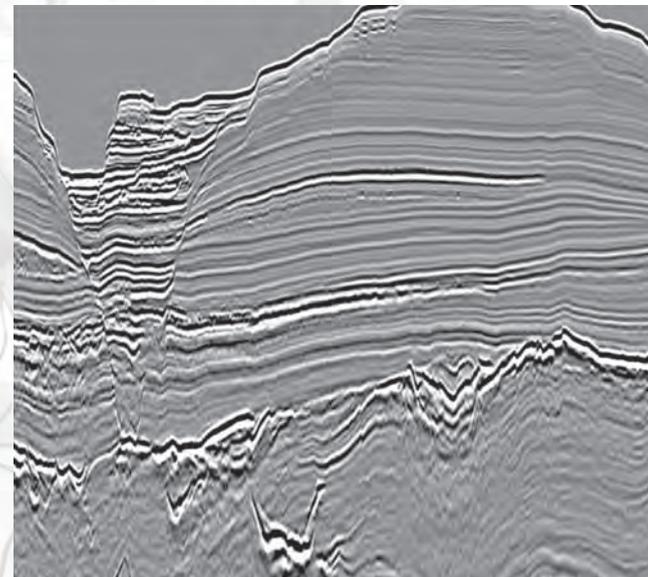
BGP offers a range of signal processing and imaging solutions, through its global processing centers. From acquisition through to final subsurface image, our integrated approach utilizes well logs, geological information and multi-physics into our imaging workflows and achieve geophysical objectives from large-scale exploration to reservoir-focused imaging challenges.

Seismic data processing techniques and solutions

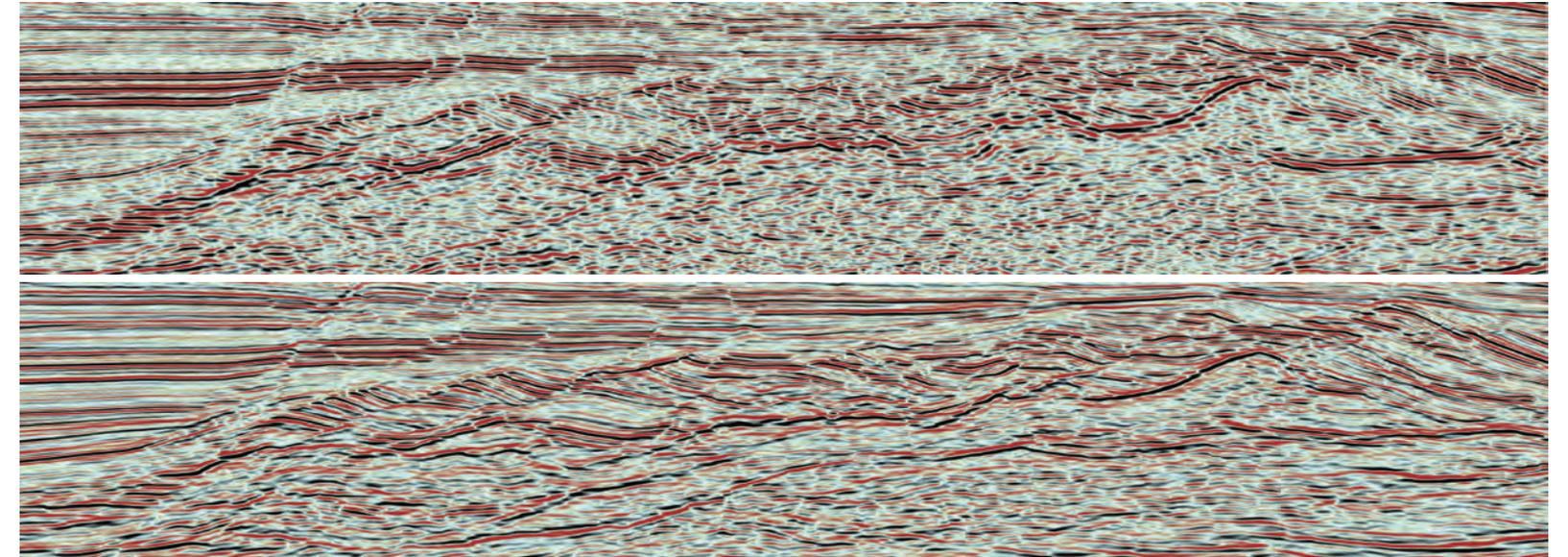
- Advanced statics solution (3D Tomo, DWI and SWI)
- Deblending (OBC/OBN, streamer and land data acquisition)
- Multiple attenuation (GSRME, EPSI, extended SRME, ISS-IME)
- Velocity model building (FWI, Hybrid Tomo, Q Tomo)
- Complex structure imaging (RTM, LSM, Q-Migration)
- Marine seismic data processing (OBN, OBC and streamer)
- WAZ and broadband seismic data processing
- Time-lapse seismic data processing
- Multi-component seismic data processing
- Shear wave seismic data processing



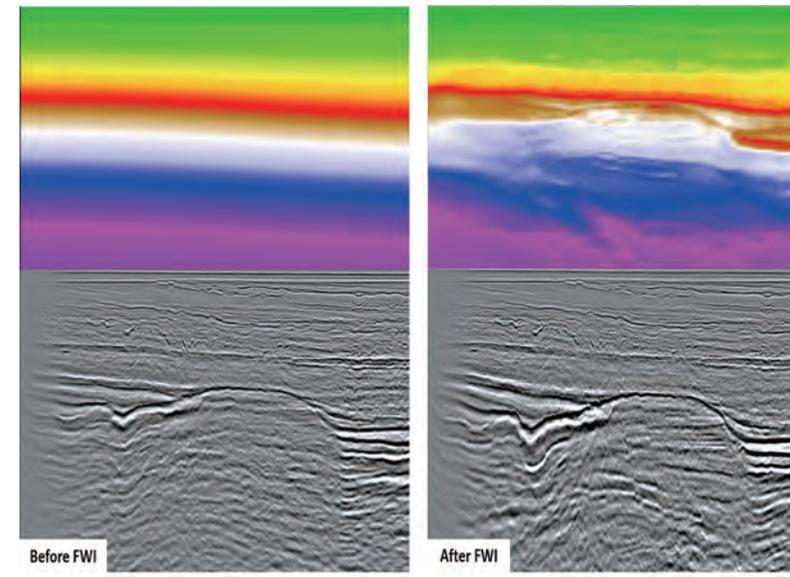
PSTM section from BGP broadband



PSTM section from conventional processing



Legacy acquisition PSTM (top) vs New WBH acquisition PSDM (bottom)

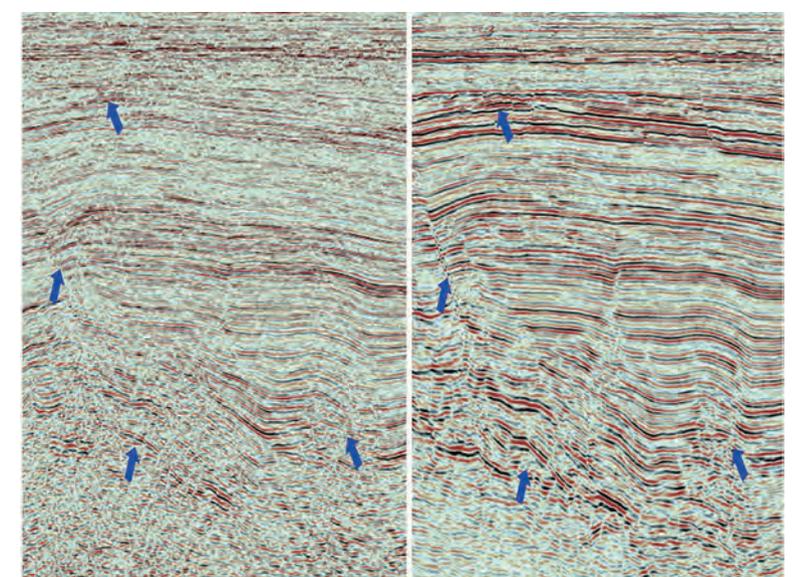


Before FWI

After FWI

Initial velocity with OBN PSDM section

FWI velocity and OBN PSDM section



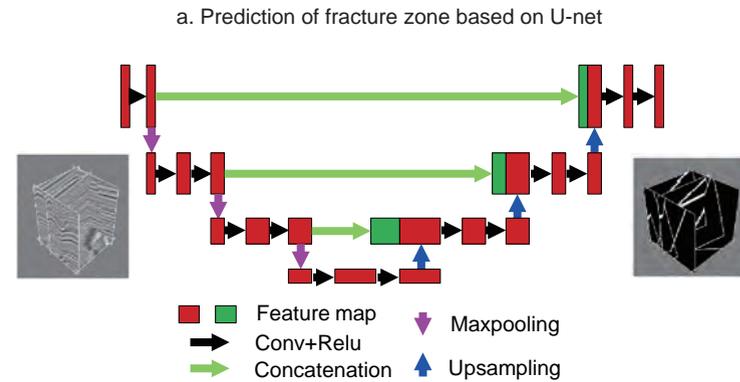
Legacy streamer 3D PSTM section

New OBN 3D PSTM section

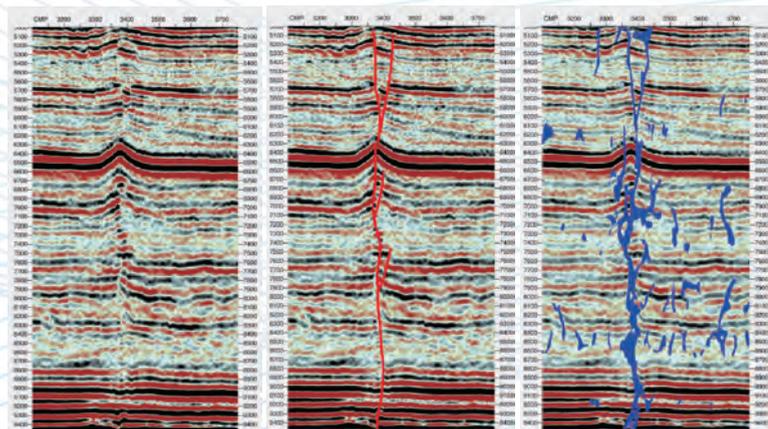
Seismic Data Interpretation & Reservoir Geophysics

Having dedicated itself to professional G&G studies for decades in a wide variety of basins and reservoirs in China and around the world, BGP has developed an integration analysis system with many advanced techniques which are applicable to all kinds of reservoirs.

Whether characterization and monitoring are at the well, field, or basin scale, our specialists can use proprietary workflows to derive the maximum value from the seismic data obtained and provide real-time support and quick turnaround time based on our global presence.



b. Comparison of interpretation effect profiles

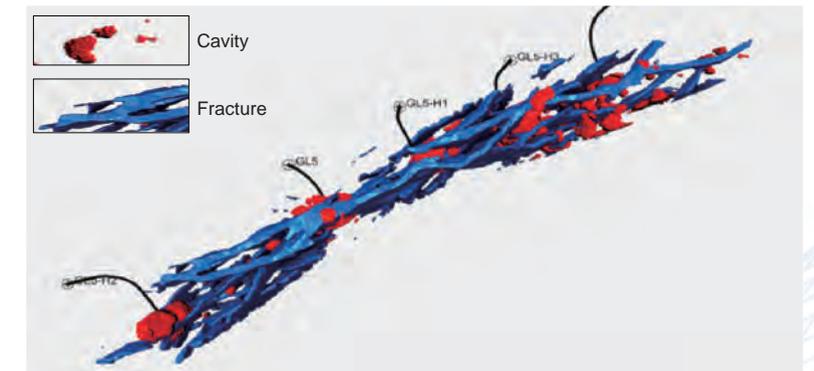


Data Interpretation Techniques and Solutions

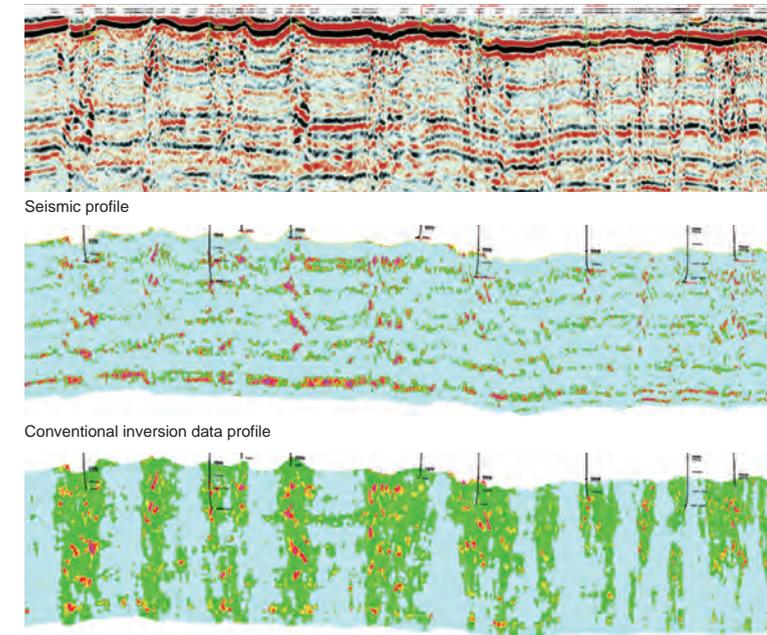
- Multi-attributes analysis
- Thrust structure interpretation
- 5D interpretation & fracture detection
- PP-PS joint inversion
- AVO & pre-stack inversion
- 4D data seismic inversion
- AI interpretation
- Sweet spot prediction

Reservoir Geophysics Techniques and Solutions

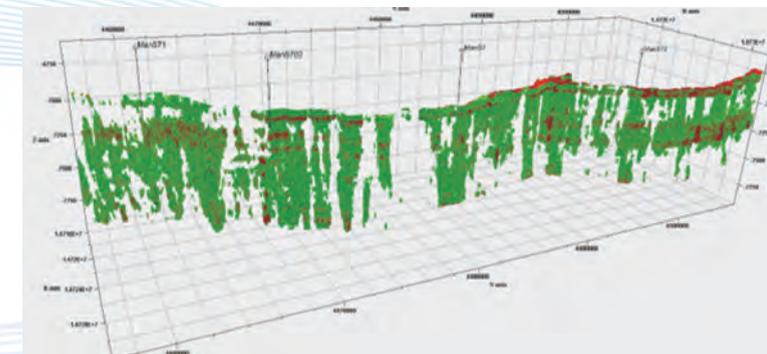
- Real time seismic guided drilling (SDG)
- Lithological / stratigraphic prospect identification
- Static modeling & reservoir simulation
- Petrophysical evaluation
- Pore pressure prediction (PPP)



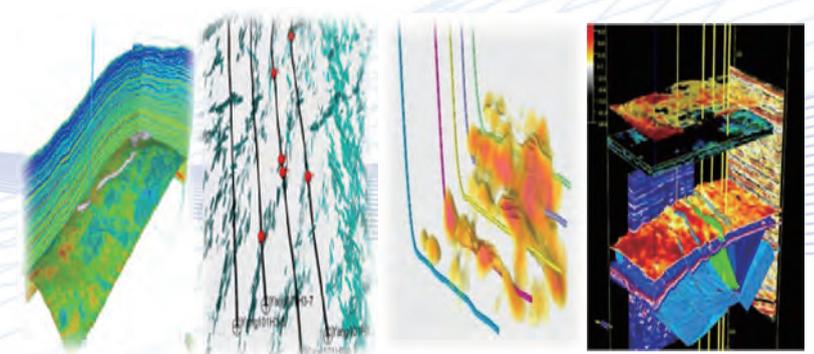
3D carving visualization diagram of a fault controlled fractured-vuggy unit



Comparison of different inversion data profiles



3D carving visualization diagram of fault controlled reservoir in F119 fault zone



Reservoir Geophysics

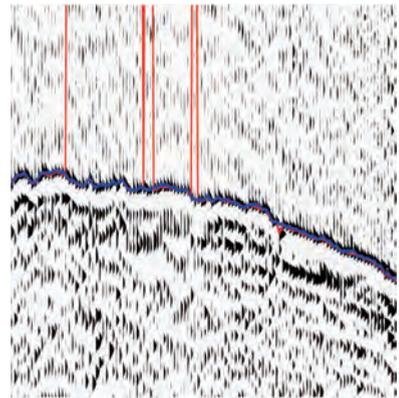
Geophysical R & D

BGP has established an international R&D layout known as the "Four Countries and Seven Centers". This layout enables us to accelerate our research and development efforts in cutting-edge technologies within the field of global geophysical exploration.

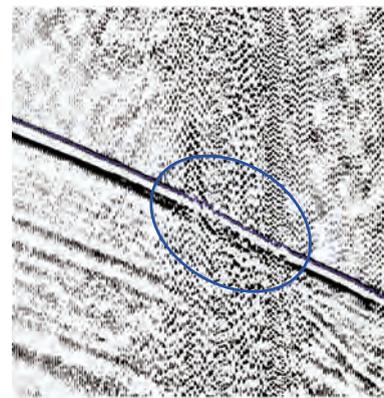
BGP understands that it is the geo-talent that makes it possible for BGP to maintain a sustainable development. BGP has long-term strategies in the development of new technologies to improve the acquisition and processing quality of seismic data.

BGP has attached great importance to technology advances and to its GeoEast software development. Over the past twenty years of constant effort in research and development, GeoEast has been developed into an integrated geophysical-geological interpretation system that includes twelve processing and interpretation packages. It has evolved from onshore to offshore, from surface to borehole, from time to depth, from P-wave to multi-wave and from conventional to unconventional reservoir exploration and development.

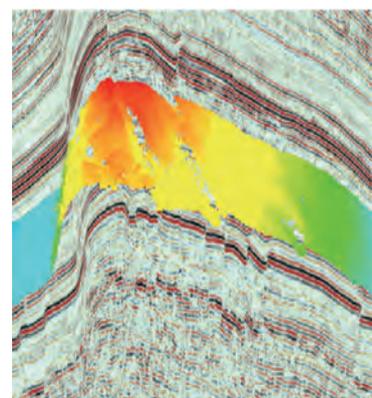
In the oil & gas exploration field, artificial intelligence (AI) techniques have been paid increasingly more attention. BGP attaches great importance to the research and development of AI techniques and recently, many intelligent technologies have been developed, such as intelligent velocity spectrum interpretation, first-arrival pickup, random noise attenuation, fault identification, horizon interpretation, logging interpretation, geological body identification, etc.



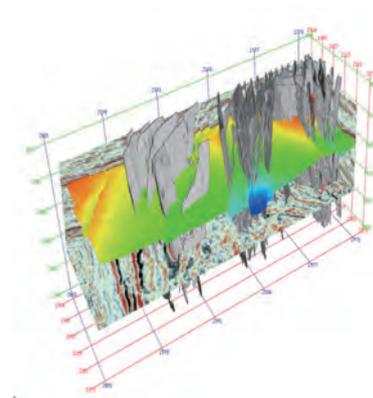
Traditional auto pick



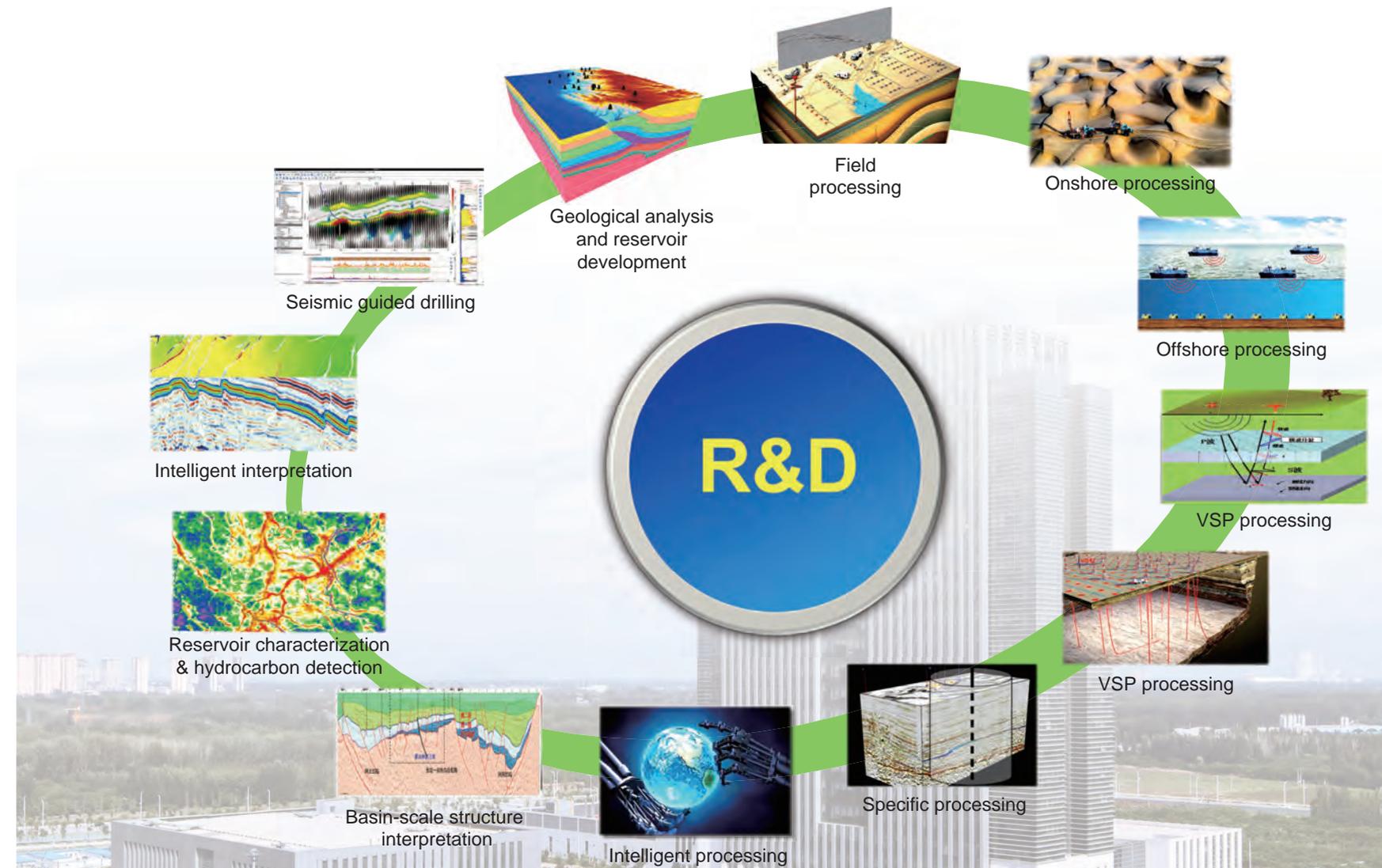
AI pick



Deep learning horizon interpretation in 3D scene



Deep learning-based fault interpretation



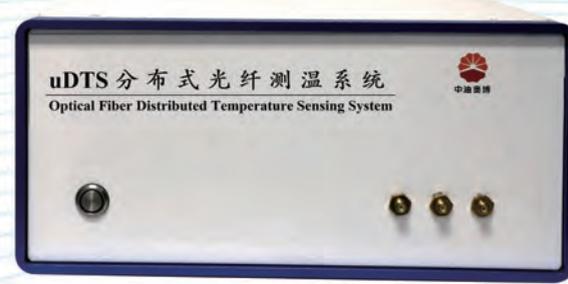
Optical Fiber Intelligence Reservoir Geophysics (OFIRG)

With 11 specialized borehole operation crews, we stand out as the sole provider of optical fiber positioning technology in China and have consistently maintained the leading market share domestically for many years. Our success is attributed to our reliance on the uDAS® optical fiber sensing system, which possesses independent intellectual property rights. Notably, we have achieved a significant milestone by successfully completing the world's largest 3D DAS VSP and marine seismic joint acquisition project.

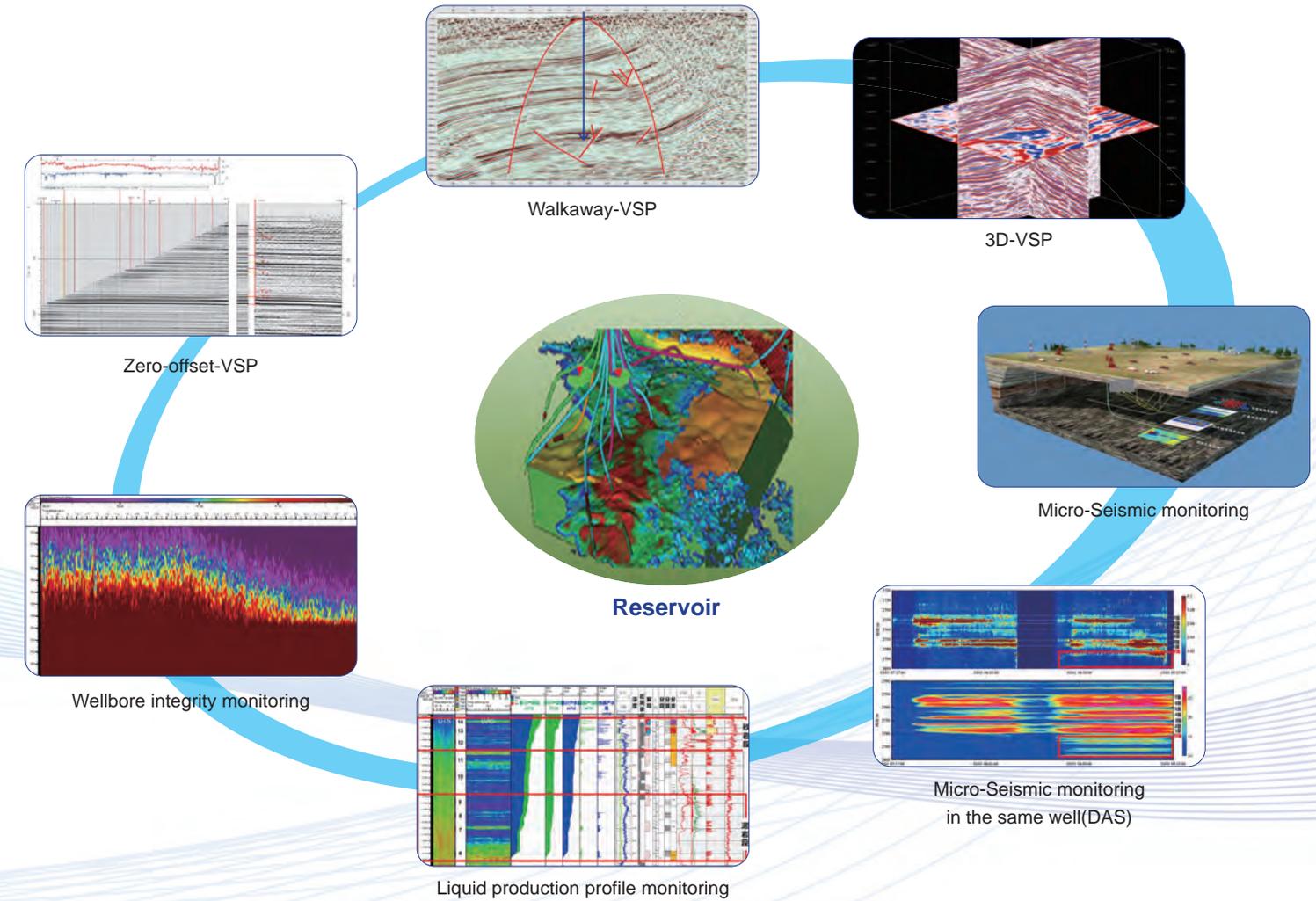
BGP provides optical fiber intelligence reservoir geophysics services, including Zero-offset VSP, Offset VSP, Walkaway VSP, Time-lapse VSP, 3D-VSP, Integrated VSP and Surface Seismic, SWD (Seismic While Drilling), Micro-seismic monitoring (Adjacent well and same well), Liquid production profile monitoring, and Wellbore integrity monitoring, as well as DAS (Distributed Acoustic Sensing) observation using BGP's ultra-sensitive "uDAS" system. We also have strong capabilities to process and interpret the data collected from the above mentioned services.



uDAS



uDTS



Non-seismic Surveys

BGP boasts the world's largest processing and interpretation center for gravity, magnetic, electromagnetic and geochemical acquisition. We possess the expertise and capability to conduct comprehensive exploration and research using multiple methods, even in complex surface terrain and geological structure conditions, which has enabled us to develop 10 unique technologies. Additionally, our business extends to global land, marine, aviation, and non-oil and gas exploration sectors, making us a comprehensive player in the industry.

Business Scope

- Oil and gas exploration and production enhancement
- Reservoir monitoring and oil & gas field development
- Mineral exploration
- Geothermal and groundwater prospecting
- Unconventional resource exploration
- Engineering survey
- Topographic & Topobathymetric Survey

Products

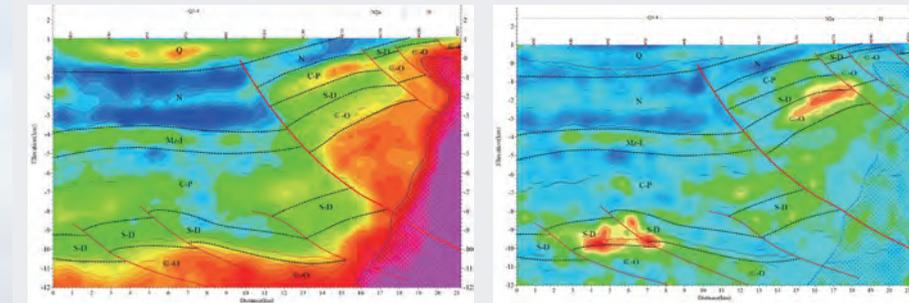
BGP's Non-seismic Department designs and manufactures its own geophysical instrumentation and software, such as:

- Land EM acquisition instrument
- Marine EM acquisition system
- GMECS: Onsite QC and Data Processing
- GeoGME: Data processing and integrated interpretation based on GeoEast® platform

Key Techniques

- Time-Frequency ElectroMagnetic (TFEM®)
- Borehole-Surface ElectroMagnetic (BSEM)
- 3D Gravity, Magnetic & Electromagnetic (GME3D®)
- Gravity, magnetic and electromagnetic data processing and interpretation system (GeoGME®)

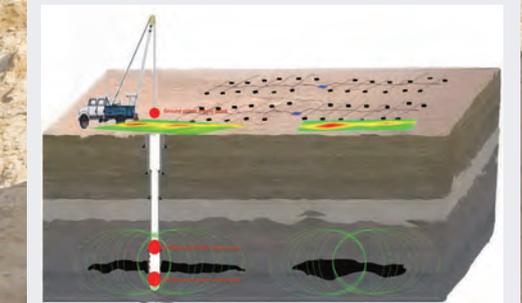
TFEM®



Resistivity section

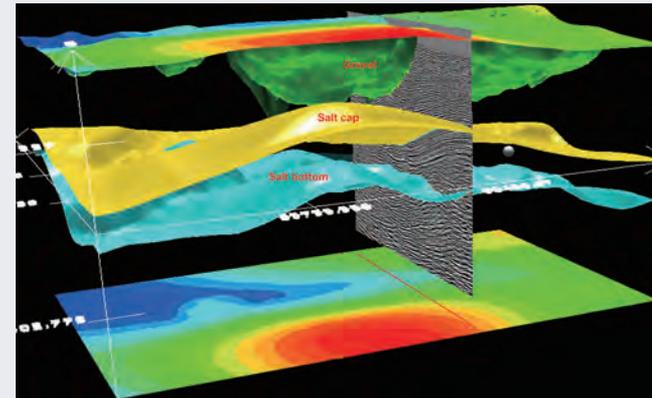
Induced polarization section

BSEM



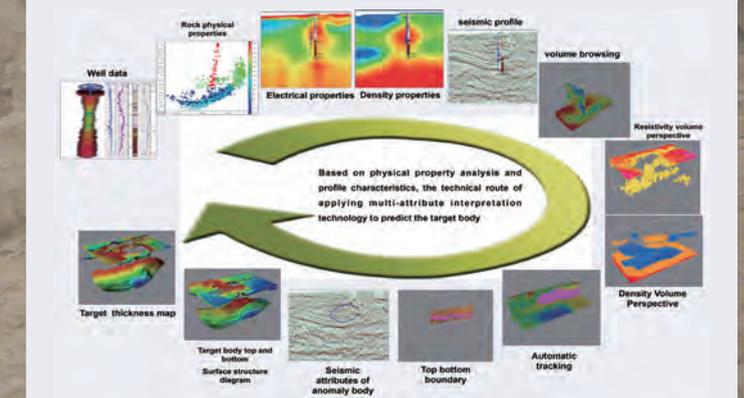
Schematic diagram of BSEM field operation

GME3D®



Joint research on subsurface structural targets

GeoGME®





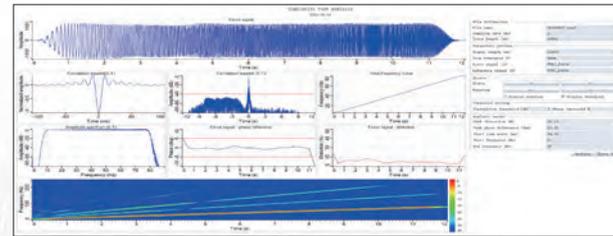
BGP is strongly committed to geophysical method research and software development and integrates all leading technologies to produce its new powerful seismic data acquisition software system.

As a leading seismic acquisition software system, KLSeis II® provides the users with full data acquisition services. It is characterized with openness, high performance and cross platform, comprising 5 main categories of applications, namely Design, Modeling, Data QC, Vibroseis and Statics.

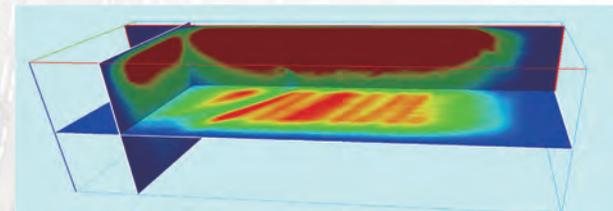
- Optimal geometry design in complex terrains for high-resolution oil & gas exploration
- Real-time equipment QC and monitoring to ensure data quality
- Near-surface solution improving PSTM & PSDM imaging
- Complex geological model building and forward modeling & illumination
- Hybrid & UHP are fully supported



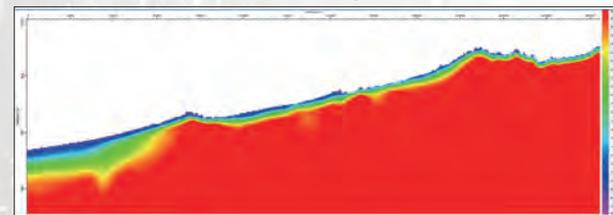
Design



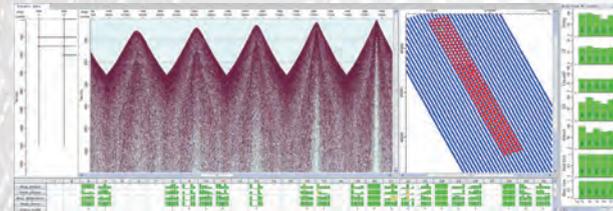
Vibroseis



Modeling



Statics

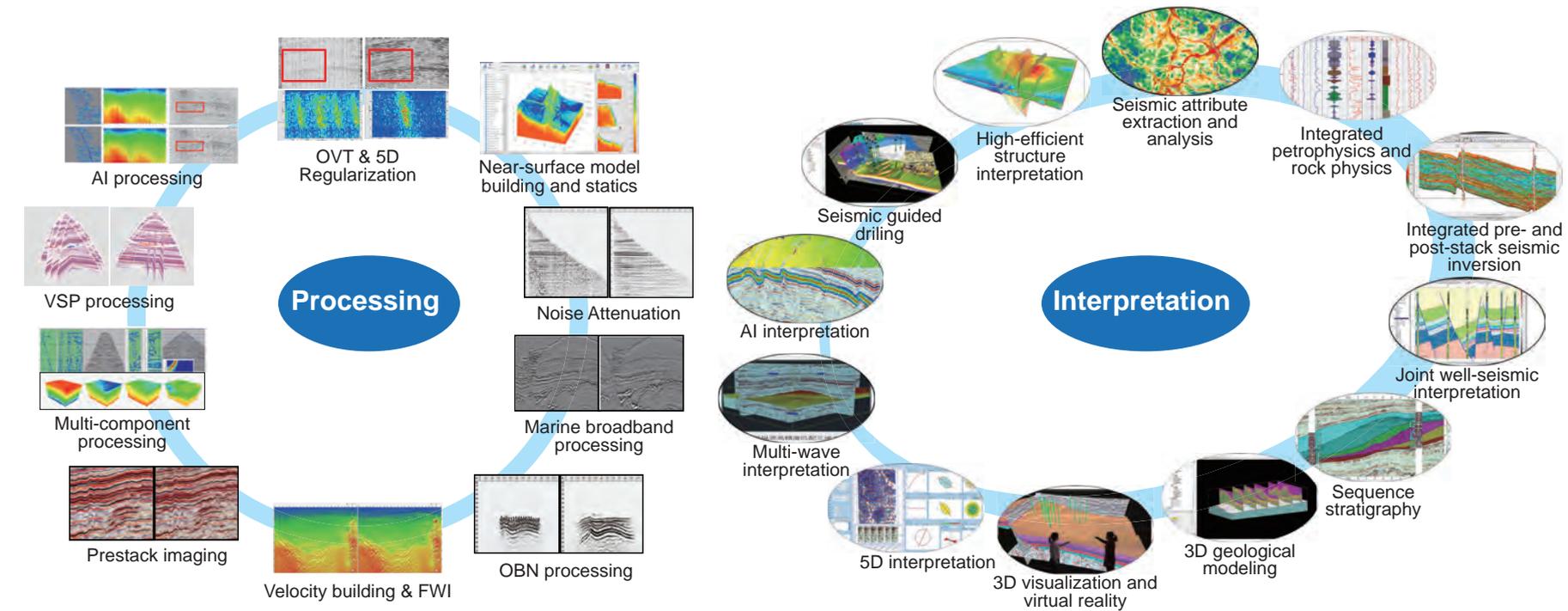


Data QC



GeoEast is an integrated seismic processing and interpretation system that can process onshore, transition zone and offshore seismic data, acquired in complex geology and tomography. It also allows for integrated exploration and development, seismic-geological-engineering and intelligent geological-geophysical interpretation.

- A unified platform for seismic processing and interpretation
- AI processing and interpretation
- Solutions to data from complex surface conditions and geological targets
- Full approaches to velocity model building and seismic imaging
- Up-to-date techniques in multi-component & VSP processing
- Efficient seismic interpretation
- Cutting-edge attribute analyses
- Comprehensive seismic inversion
- Featured hydrocarbon detection
- Distinctive geo-body characterization





Equipment Manufacturing

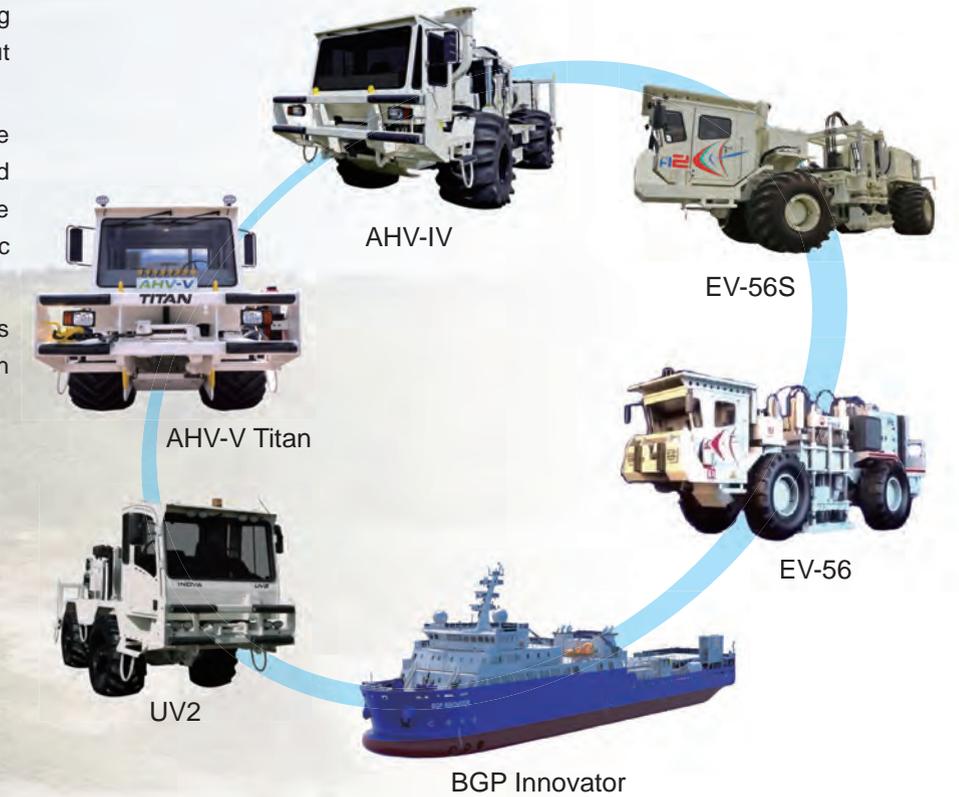
BGP pays great attention to the R & D of geophysical equipment based on its copyrighted and state-of-the-art technologies.

BGP has a strong geophysical equipment R&D and manufacturing capacity and has developed 12 series of proprietary geophysical equipment including the EV & AHV series vibrators, the G3i recording instrument, the eSeis and Quantum nodal systems, etc. This equipment series covers most of the seismic prospecting working procedures and can meet all-terrain seismic operations with their main specifications reaching International geophysical equipment levels.

The expertise and experiences of our specialists make it possible for BGP to continuously optimize seismic equipment solutions for its clients.

The main products include:

- **AHV-IV 364/380 Series vibrator:** Industry-leading, most widely used vibrators in the seismic market, with the peak force of 61800 lbs/80000 lbs and sweep band from 1 to 250Hz, AHV-IV 380 being the best choice for single vibrator shooting with the biggest output force.
- **The EV-56 high precision vibrator** significantly enhances the low-frequency peak force output while maintaining broadband performance. The vibrator can support S-wave and P-wave prospecting and has reached international standards of seismic vibrators for BGP.
- **The G3i® HD recording system** offers multiple key technologies such as high productivity vibroseis (HPVS), dynamic multipath rerouting and its world class 240k channel capacity.



- **Quantum** is an integrated, lightweight, ultra-low power, broadband nodal system to conduct high productivity, high resolution and wide azimuth seismic surveys.
- **The eSeis Neo Nodal system** integrates timed acquisition, 3D space QC data collection, clock fragmentation adjustment, low power long distance communication technologies etc. and its seismic signal response performance is leading international levels in the seismic industry.

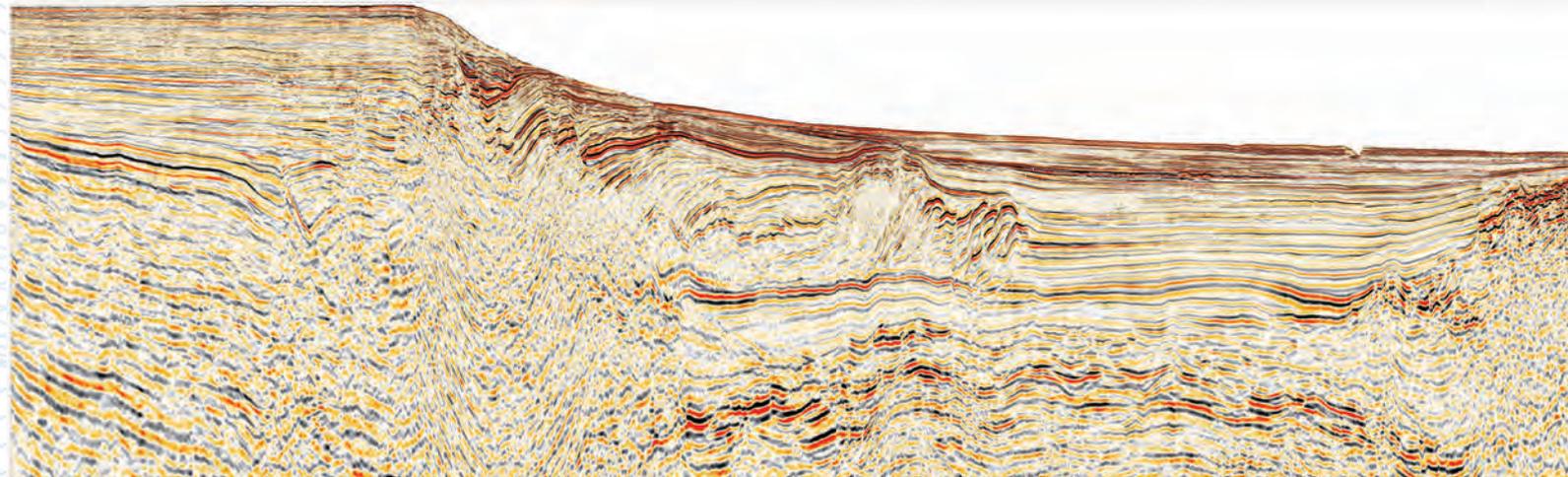
Multi-client Business

Investment in Multi-client data affords our clients with new opportunities in frontier, emerging and mature basins worldwide.

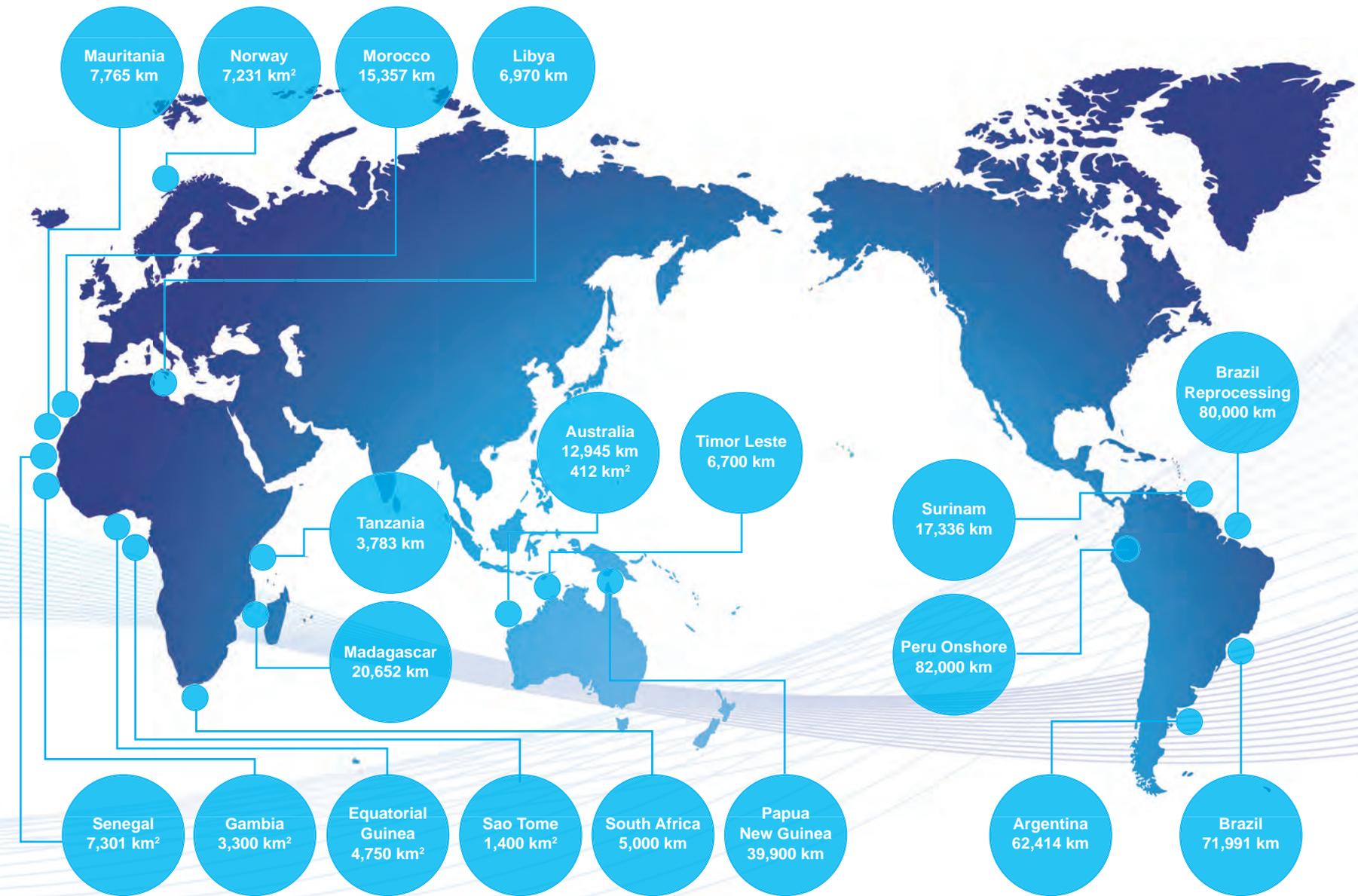
BGP utilizes state-of-the-art technology and equipment on its Multi-client projects ensuring the highest quality multi-client geophysical and geological data & services available to be provided to the energy industry. Our customers include host governments, NOCs, Super-Majors & Major Oil Companies.

BGP offers fully integrated Multi-client services which allow our pre-commit clients to be involved in survey design, acquisition, processing and interpretation. For host governments we can support in marketing and preparation for license rounds.

BGP's extensive multi-client library covers seismic, magnetic, gravity and interpretation products in 23 countries, spreading over south America, Europe, Middle east, Asia pacific and Africa.



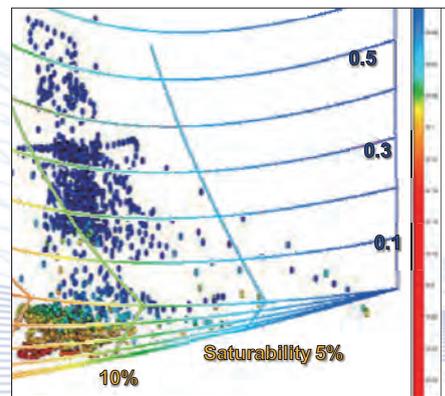
Reprocessed 2D seismic section in Brazil equatorial margin



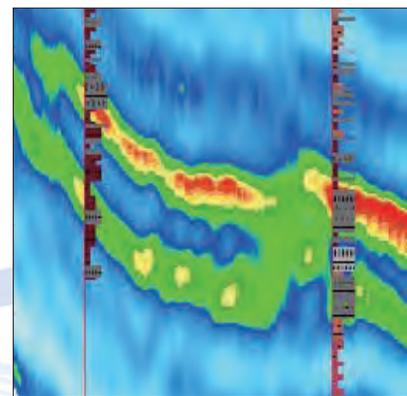
New Energy Business

Evaluation Technology for CO₂ Potential Storage Capability

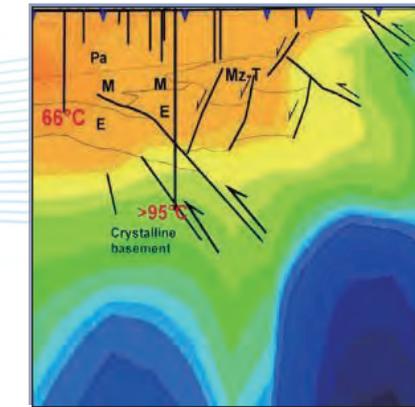
- High resolution and high-fidelity seismic imaging technology
- Seismic and geological characterization of geological bodies in brackish water
- Comprehensive evaluation techniques for reservoirs
- Evaluation technology for storage potential
- Monitoring technology for the CO₂ storage process



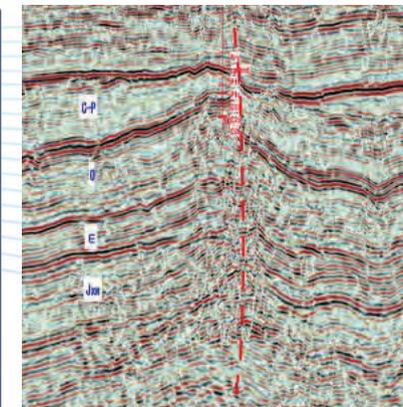
Physical characterization of brackish rock



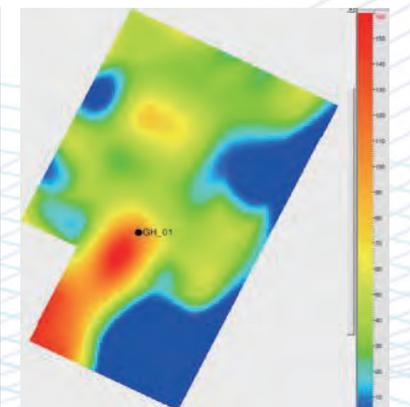
Seismic reversion of brackish water



Seismic survey for geothermal exploration



Visual well design based on depth model



Geothermal temperature map

Geothermal Exploration and Evaluation Technologies

- Geophysical technology used for geothermal exploration
- Geothermal resource evaluation technology on basis of GME
- Evaluation technology for geothermal preferential targets
- Geological characterization technology for deep geothermal resources
- Geothermal temperature prediction technology
- Comprehensive assessment technology for geothermal resources
- Geothermal well location design technology
- Fracturing monitoring technology for tight high-temperature reservoirs

HSSE Management

Rigorous and consistent implementation of its HSSE Management System (HSSE MS), is one of the top priorities for BGP to ensure the health, safety, security and environment of our operations globally. BGP management will provide a healthy and safe workplace where all stakeholders, workers, representatives of the client and third parties involved will protect the operation and workplace from accidents, injuries, and work-caused illness.

BGP's HSSE Management System has been established since the early 1990s based upon relevant industry standards and guidelines from IOGP, EnerGeo, OSHA etc. The HSSE MS is reviewed and updated periodically to incorporate the best practices of the seismic industry, while adapting to the ever evolving needs of field operations to meet the requirements of contracts, local government or authorities as well as communities affected.

To implement the HSSE MS within our operation requires us to develop and execute a specific project HSSE plan based upon all HSSE MS elements and contract clauses. This practice has enabled BGP to complete hundreds of seismic projects safely and successfully for numerous clients located all around the world.

BGP has realized the benefits of its excellent HSSE performance as demonstrated through its business growth and success over the decades. Furthermore, continued relentless effort by all BGP employees who are dedicated to pursue greater HSSE performance, which in turn will generate long-term business growth and prosperity for BGP, its clients, partners and all stakeholders, together with communities wherever we operate.



18 years safe operation without LTI



Peace & Harmony



Peace & Harmony



HSSE training

Multicultural Integration

BGP promotes a humanistic concept of equality, respect, communication, and harmony, which guides our approach to treating employees of different nationalities, beliefs, and cultural backgrounds fairly and impartially. In order to foster the integration of diverse cultures, we organize various employee activities that encourage mutual understanding, trust, appreciation, and learning among our staff. By leveraging the strengths and complementing the weaknesses of each individual, we aim to enhance cohesion and creativity within our workforce.



BGP Worldwide Operations

