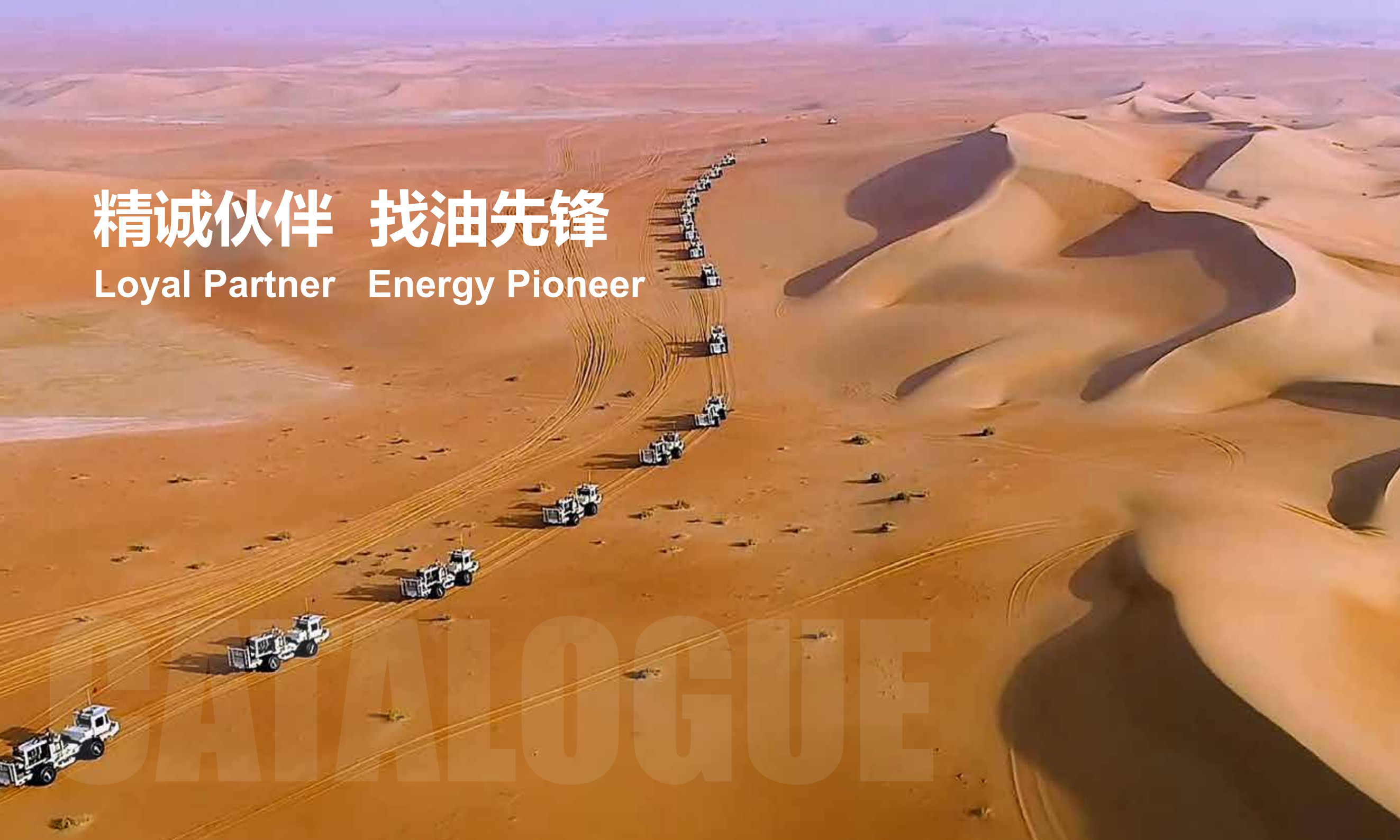**CNPC**
BGP

CNPC
BGP

BGP – Beyond Geophysical Prospecting

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www.bgp.com.cn

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

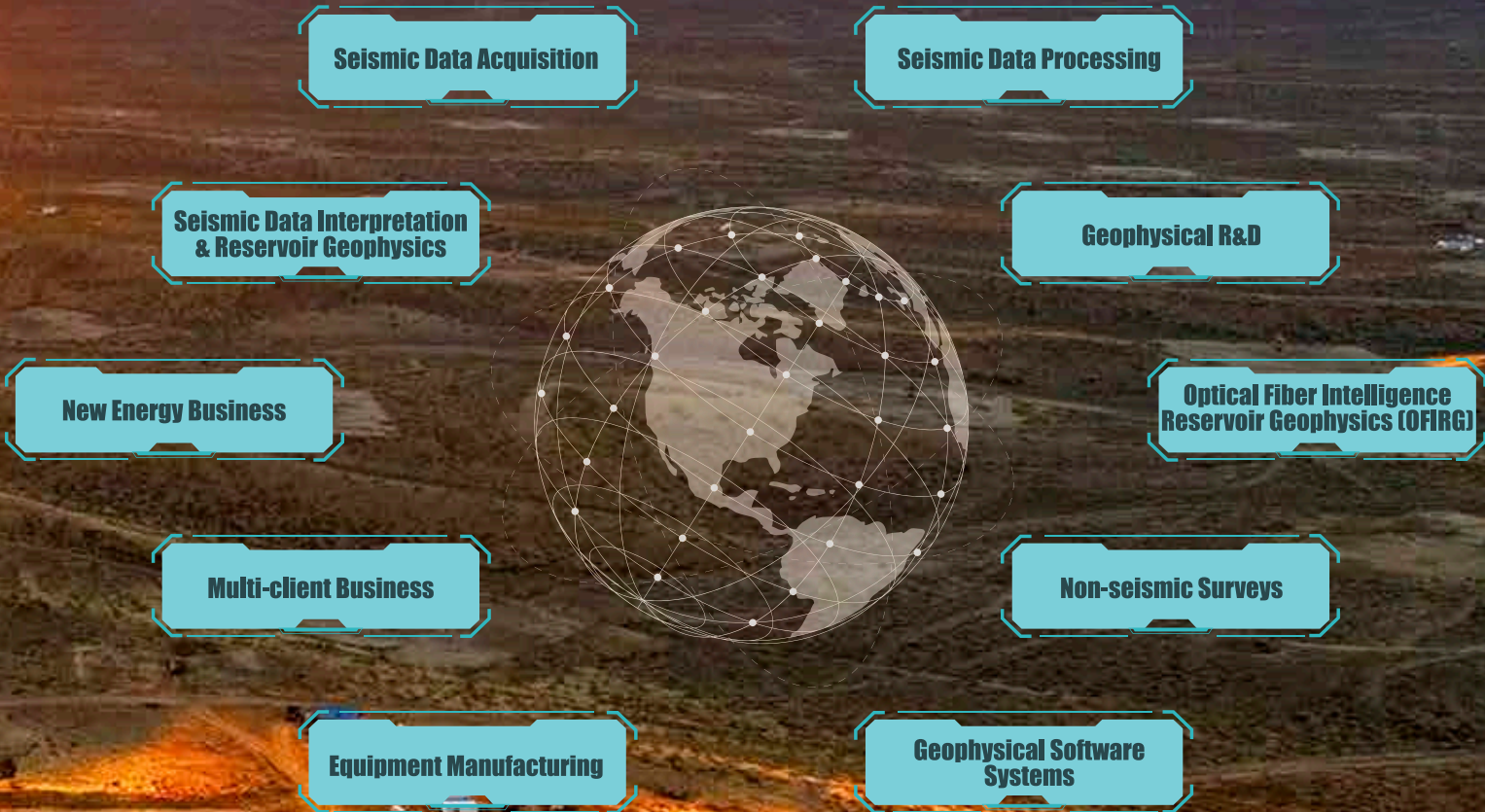Loyal Partner　Energy Pioneer

CATALOGUE

BGP BUSINESS INTRODUCTION

BGP is one of the world's fully 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 152 land seismic crews, 10 OBC and OBN crews, 4 streamer vessels, 11 VSP crews, 5 gravity magnetic crews, 16 electromagnetic crews, as well as 15 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.

Seismic Data Acquisition

Seismic Data Processing

Seismic Data Interpretation & Reservoir Geophysics

Geophysical R&D

New Energy Business

Optical Fiber Intelligence Reservoir Geophysics (OFIRG)

Multi-client Business

Non-seismic Surveys

Equipment Manufacturing

Geophysical Software Systems

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 BGP covers 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 500 million tons and gas fields totaling 3 trillion cubic meters.

BGP operates and maintains 68 onshore seismic crews as well as 32 branches and offices outside China. We have developed five regional markets including the Middle East, Central Asia, Southeast Asia, Africa and the Americas and have been providing quality services to over 300 energy companies worldwide.

PP | SS

PP | SS

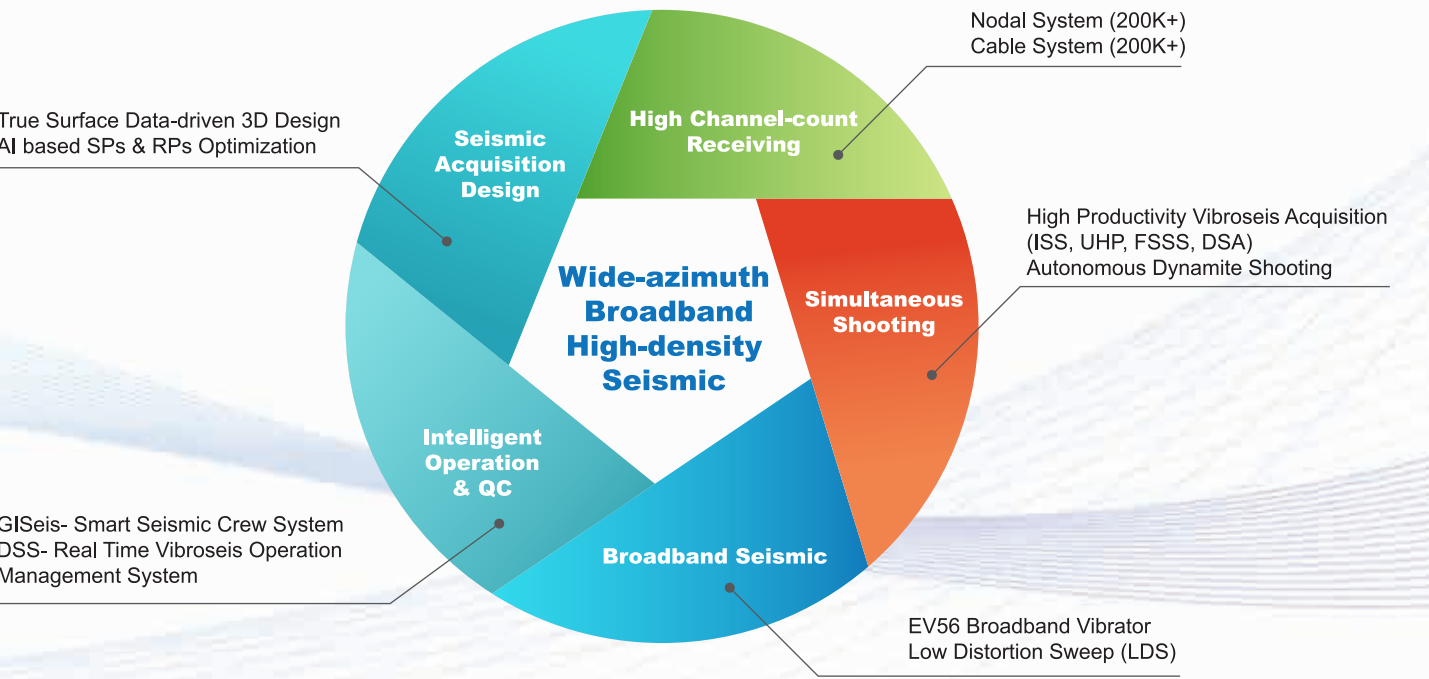Structure map of PP wave

Structure map of SS wave
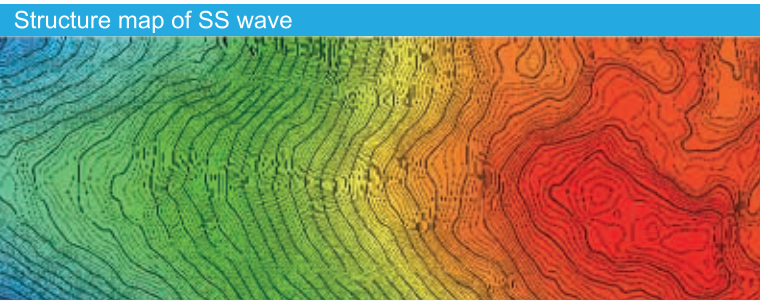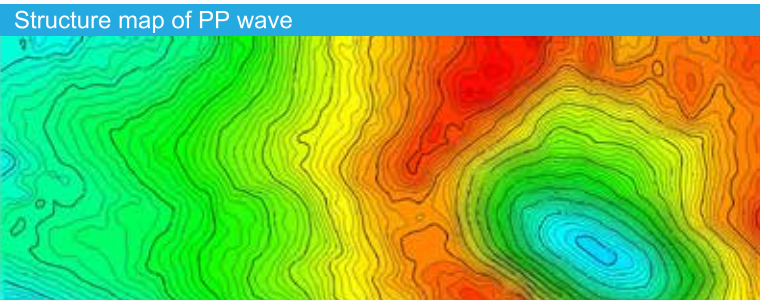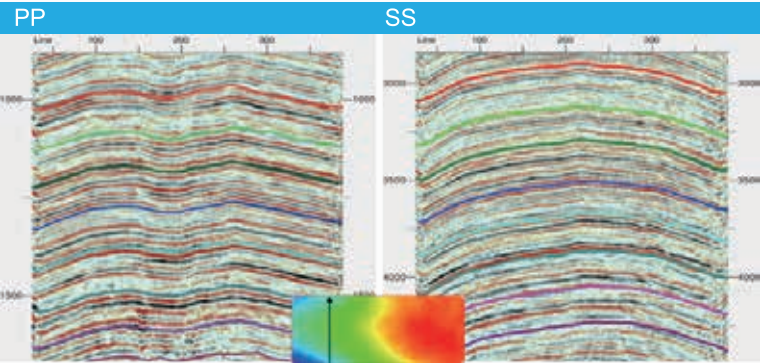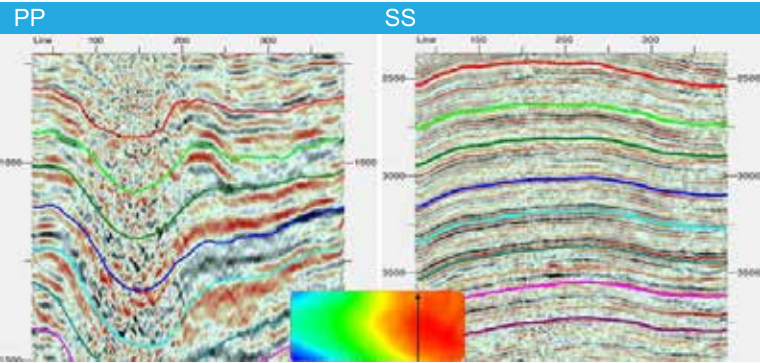
FULL WAVE FIELD

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

TECHNICAL SOLUTIONS TO ONSHORE SEISMIC ACQUISITION

BGP has developed Wide-azimuth, Broadband, and High-density (WBH) seismic acquisition technology, which has notable advantages in stratigraphic trap exploration, deep/complex geological body imaging, and fine reservoir characterization/monitoring.

True Surface Data-driven 3D Design
AI based SPs & RPs Optimization

Nodal System (200K+)
Cable System (200K+)

High Productivity Vibroseis Acquisition (ISS, UHP, FSSS, DSA)
Autonomous Dynamite Shooting

GISeis- Smart Seismic Crew System
DSS- Real Time Vibroseis Operation Management System

EV56 Broadband Vibrator
Low Distortion Sweep (LDS)

Seismic Acquisition Design

High Channel-count Receiving

Simultaneous Shooting

Intelligent Operation & QC

Broadband Seismic

Wide-azimuth Broadband High-density Seismic

OFFSHORE SEISMIC ACQUISITION

With extensive global experience in 2D/3D/4D Streamer, Ocean Bottom Cable/Node (OBC/OBN) and Transition Zone (TZ) seismic surveys, BGP consistently deliver successful projects to our satisfied clients through a full suite of offshore seismic acquisition solutions.

BGP has further established its industry leading capabilities not only in shallow water NOAR OBN operations, with vast resources for operating in very shallow water and transition zones, but also for deep-water ROV OBN surveys, where we are actively developing both deep-water seabed nodes and handling systems.

Up to now, BGP has 14 offshore seismic crews, comprising 4 streamer vessels and 10 OBN crews.

BGP global offshore seismic project experience is further enhanced by our operation of world leading OBN technology, including:

• The world's first MEMS node
• Modular automatic node deployment and recovery systems
• Industry leading data quality control system - KLSeisTM
• DolphinTM integrated navigation and node positioning system
• DP seismic vessel manufacture
• High efficiency survey design and acquisition techniques
• Multi-source, over/under source, broadband and multi-azimuth seismic acquisition technology

Automated OBN Deployment & Retrieval System
• Fully automatic node attachment & detachment
• High-efficiency deployment & retrieval
• High accuracy positioning
• Containerized modular system

BGP Innovator
• 5m shallow water depth operation capacity
• DP2 system
• Hybrid OBN operation functions
• Clean Ship Design & Green Passport (EU) notations

BGP Dragon
• Helicopter helideck
• DP2 system
• Maximum six source capacity
• Wide source separation models
• 4D seismic source steering technology
• Expanding ROV deep water acquisition capability

SEISMIC DATA PROCESSING

At BGP, we harness cutting-edge technology and advanced algorithms to transform raw seismic data into accurate, high-resolution subsurface images. From marine, land, and ocean-bottom seismic (OBS) to advanced 4D seismic processing, our solutions optimize exploration and reservoir characterization for the most complex geophysical challenges.

• **Broadband Processing & Conditioning** – Noise attenuation, deghosting, multiple suppression, and 5D regularization.

• **Velocity Model Building** – Full-Waveform Inversion (FWI), tomography, and anisotropic parameter estimation for precise imaging.

• **Advanced Imaging & Migration** – Pre-Stack Depth Migration (PSDM and QPSDM), Reverse Time Migration (RTM), Least-Squares Migration (LSM), Beam and Kirchhoff.

• **Mutli-Parameter Inversion Technology:** FWI for velocity, anisotropy and impedance from raw data.

• **Multi-Component & 4D Seismic Processing** – Time-lapse seismic for reservoir monitoring and ocean-bottom seismic (OBS) for deepwater insights.

• **AI-Driven Seismic Processing** – Machine learning for noise reduction, automated fault detection, and intelligent seismic interpretation.

BGP's industry leading FWI framework overcomes cycle-skipping by solving a least-squares objective function which minimizes the travel time misfit in both data and image domains providing higher resolution and more confidence in the geological models.
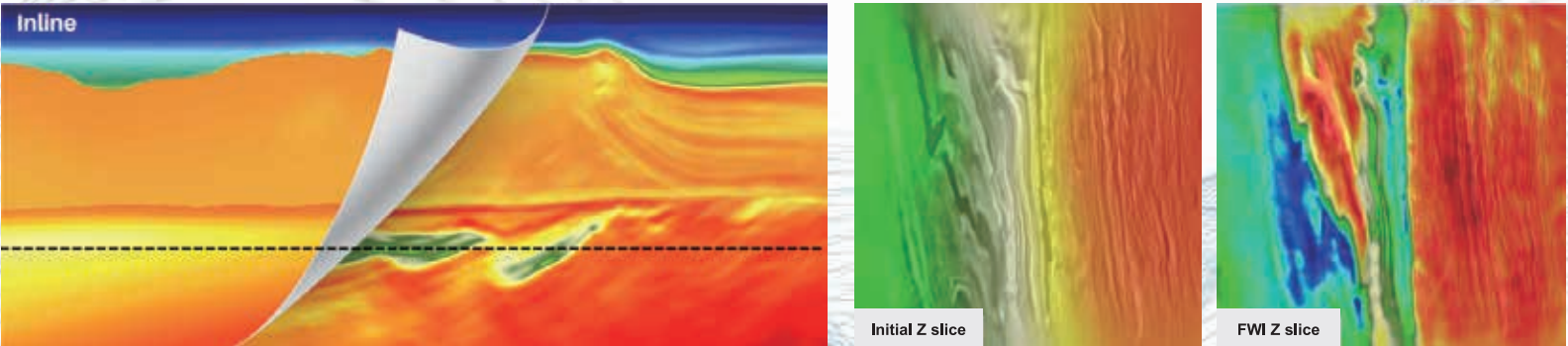
From raw data and a poor initial model, BGP's FWI technology produces highly accurate detailed geological models with dramatically improved imaging quality.
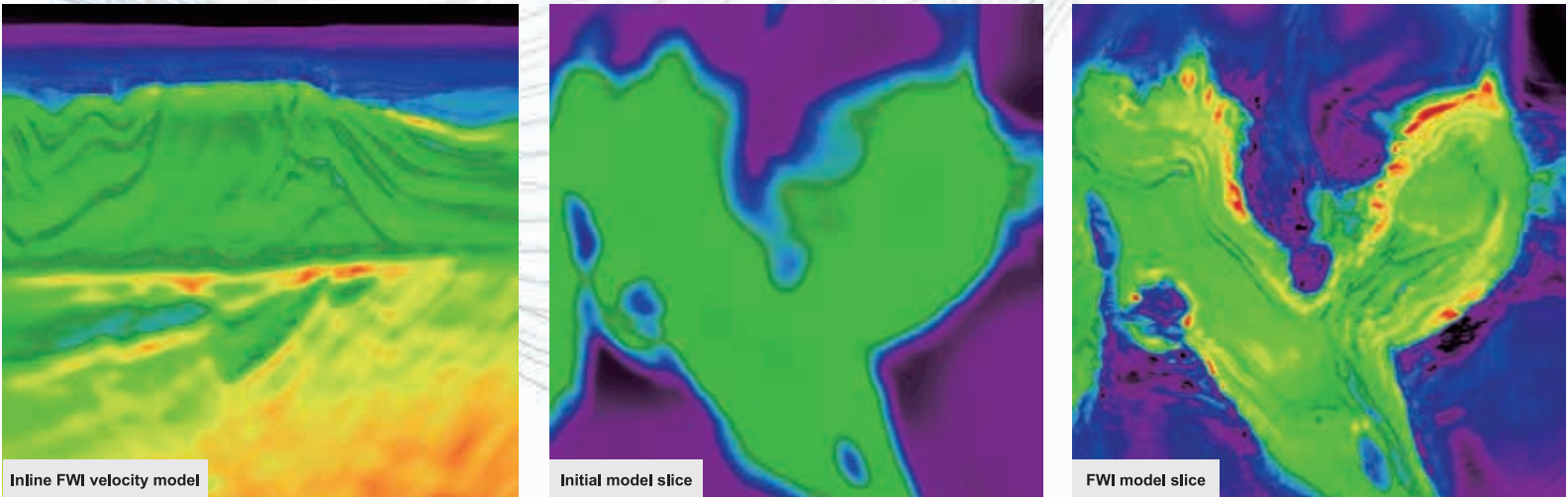
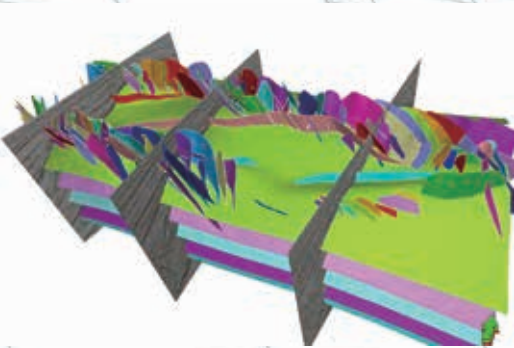Geological modeling   Pore pressure prediction   Integrated analysis

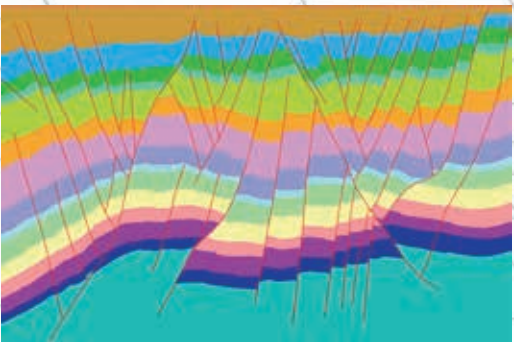# SEISMIC DATA INTERPRETATION & RESERVOIR GEOPHYSICS

With decades of experience in professional G&G studies across diverse basins and reservoirs in China and worldwide, BGP has developed an integrated analysis system incorporating advanced techniques applicable to all types of reservoirs.
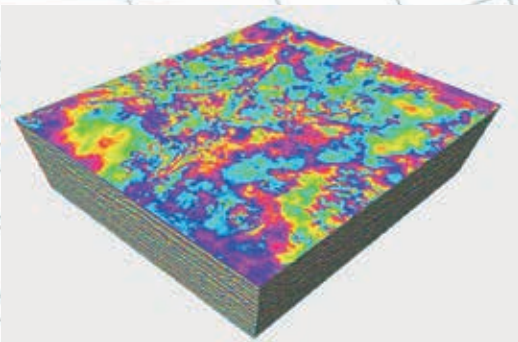
Data Interpretation
• AI interpretation
• Complex structure interpretation
• 5D interpretation and fracture detection
• Subtle fault prediction
• Multi-attributes analysis
• AVO & pre-stack inversion
• PP-PS joint inversion
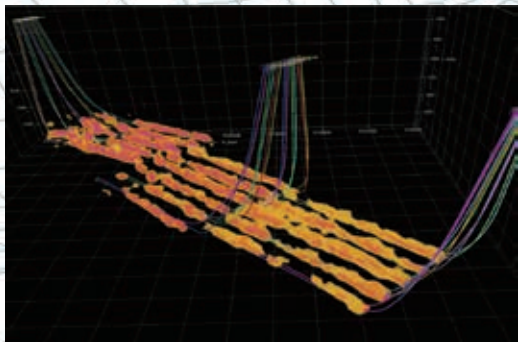• 4D data seismic inversion
• Sweet spot prediction

Whether at the well, field, or basin scale, our specialists utilize proprietary workflows to extract maximum value from seismic data, delivering real-time support and rapid turnaround - enhanced by our global presence.

Reservoir Geophysics
• Carbonate reservoir prediction
• Thin reservoir prediction
• Static modeling and reservoir simulation
• Real time seismic guided drilling (SDG)
• Lithological / stratigraphic prospect identification
• Pore pressure prediction (PPP)
• Geological modeling
• Petrophysical evaluation

AI assisted interpretation

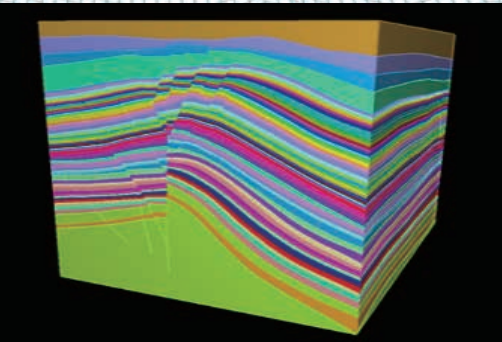
Petrophysical analysis

Structural interpretation
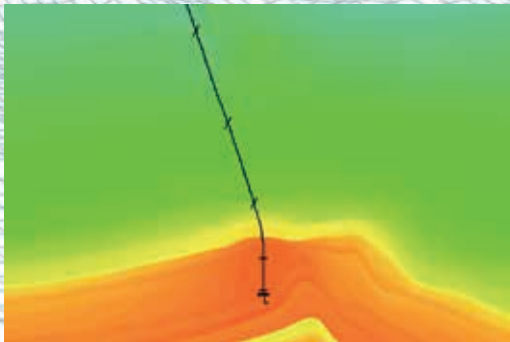

Integrated seismic attributes

Pre-stack inversion & 4D inversion

Geological modeling

Pore pressure prediction

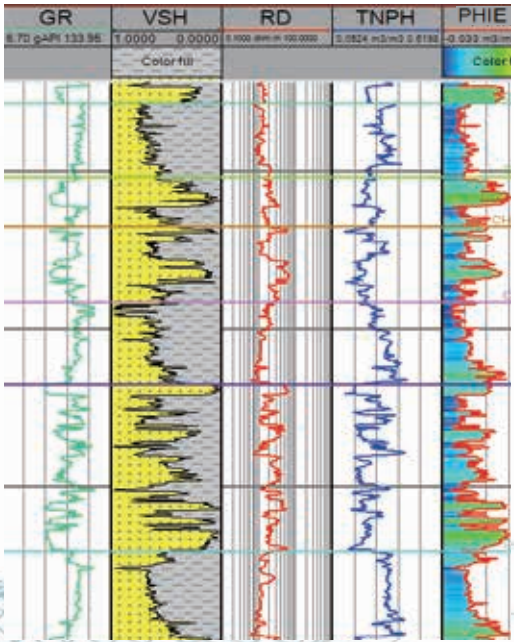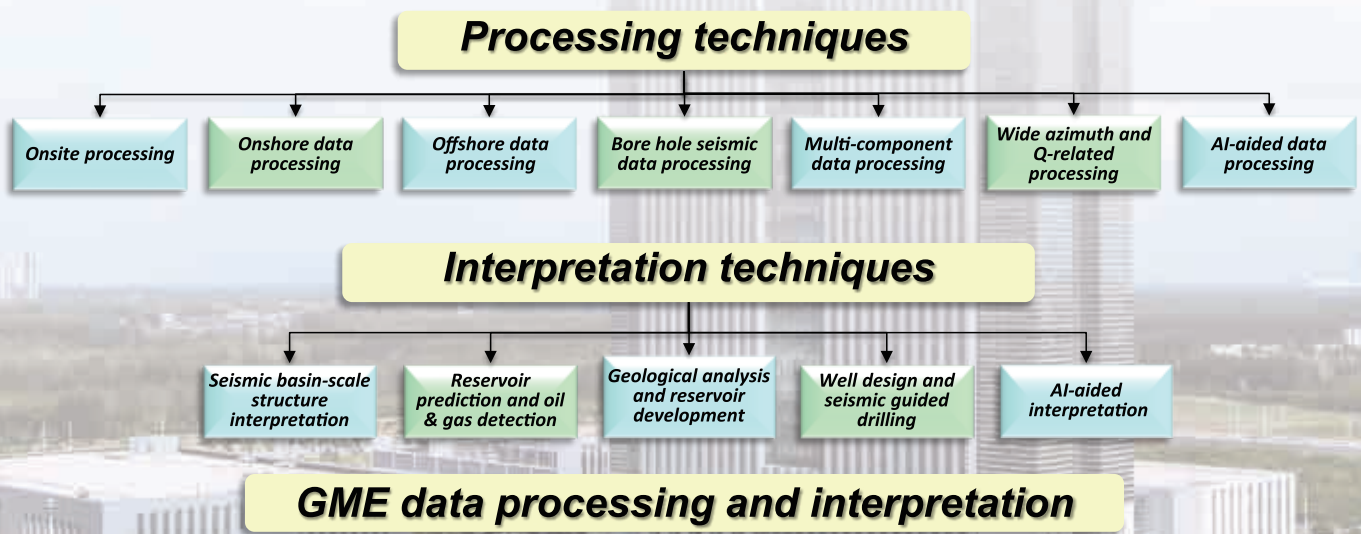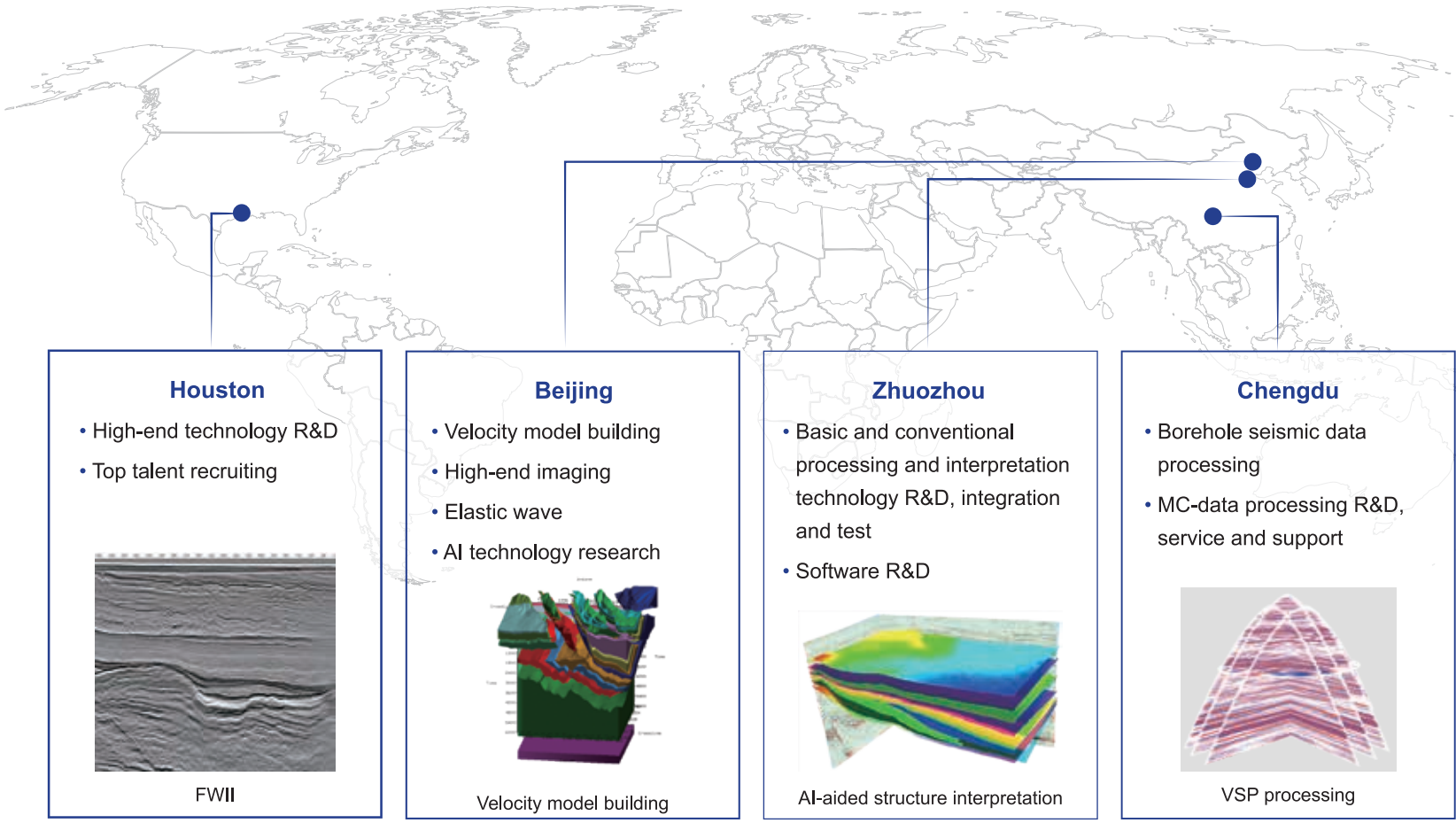Integrated analysis

GEOPHYSICAL R&D

As a global leader in geophysical exploration, BGP has established a comprehensive four-dimensional synergy comprising "global R&D networks, professional talent teams, self-developed software ecosystems, and intelligent technology frameworks." With strategic R&D hubs in Beijing, Chengdu, Zhuozhou (China), and Houston (USA), BGP seamlessly integrates cross-regional technical resources to accelerate innovation cycles, building core technological competitiveness across the entire exploration value chain. In partnership with over 30 leading universities and research institutions worldwide, BGP drives cutting-edge advancements in geophysical technologies, ensuring its solutions remain at the forefront of the industry.

Through sustained investment in R&D and talent development, BGP continues to push the boundaries of geophysical technology. By delivering high-value solutions for global energy exploration, the company serves as a driving force behind the digital transformation of oil and gas exploration worldwide.

Processing techniques

| Onsite processing | Onshore data processing | Offshore data processing | Bore hole seismic data processing | Multi-component data processing | Wide azimuth and Q-related processing | AI-aided data processing |

Interpretation techniques

| Seismic basin-scale structure interpretation | Reservoir prediction and oil & gas detection | Geological analysis and reservoir development | Well design and seismic guided drilling | AI-aided interpretation |

GME data processing and interpretation

BGP R&D CENTER DISTRIBUTION

Houston
- High-end technology R&D
- Top talent recruiting

FWII

Beijing
- Velocity model building
- High-end imaging
- Elastic wave
- AI technology research

Velocity model building

Zhuozhou
- Basic and conventional processing and interpretation technology R&D, integration and test
- Software R&D

AI-aided structure interpretation

Chengdu
- Borehole seismic data processing
- MC-data processing R&D, service and support

VSP processing

The BGP R&D Center has a total of 420 staff members, including 16 international experts and 31 senior experts, with over 65% holding master's or doctoral degrees.

OPTICAL FIBER INTELLIGENCE RESERVOIR GEOPHYSICS (OFIRG)

Focusing on the global demand for efficient oil and gas exploration and production, our company is dedicated to enhancing reservoir recovery rates. We have developed a suite of fiber-optic intelligent reservoir geophysical technologies and successfully demonstrated the applicability of fiber-optic sensing across the entire oil and gas exploration and development value chain. Over the past five years, we have completed 100+ fiber-optic dynamic monitoring projects across major oil and gas regions, including China, the Middle East, and the Americas, significantly contributing to improved recovery rates. Equipped with 400+ high-precision geophones, 25 uDAS fiber-optic sensing units, 20+ vibroseis units and cable car systems, we provide ultra-deep VSP logging beyond 10,000 meters and dynamic monitoring for wells exceeding 6,000 meters. As one of the few service providers with full-chain expertise in borehole fiber-optic technology, our experienced technical team has successfully executed numerous multinational projects.
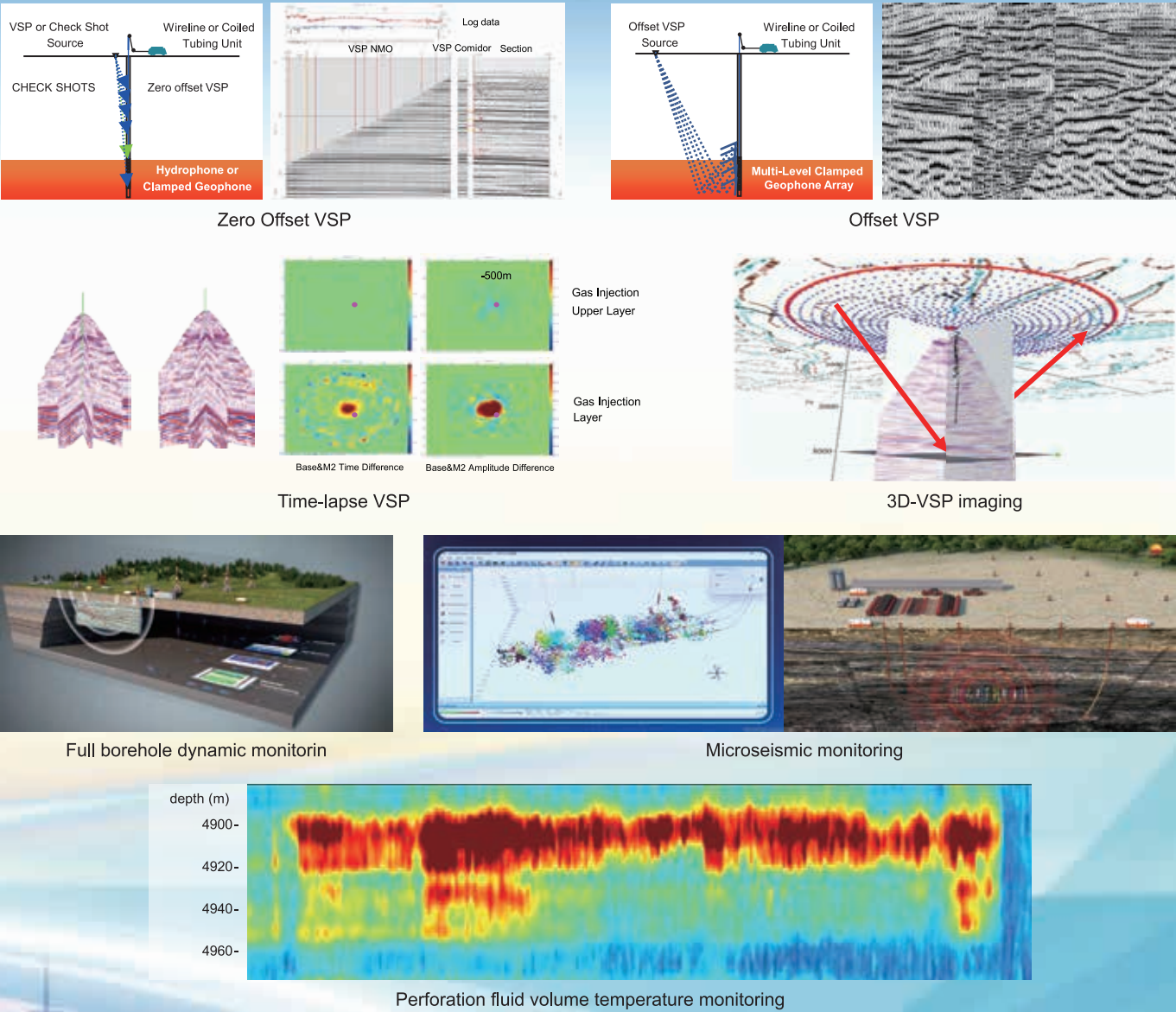
We are a provider for the following: Zero offset VSP, Offset VSP, 3D-VSP, Borehole Time-lapsed seismic, Fracturing micro-seismic monitoring, Reservoir dynamic monitoring, Gas storage field CCUS monitoring, Ultra-high sensitivity distributed acoustic sensing interrogator development and manufacturing.

uDAS & DTS

uDAS LF

Zero Offset VSP

Offset VSP

Time-lapse VSP

3D-VSP imaging

Full borehole dynamic monitorin

Microseismic monitoring

Perforation fluid volume temperature monitoring

NON-SEISMIC SURVEYS

BGP possesses extensive expertise in the design, data acquisition, processing, and interpretation of gravity, magnetic, electrical, electromagnetic, and geochemical surveys. Our capabilities encompass both individual and integrated surveys, even in challenging environments such as remote areas, complex terrain and geological structures. Furthermore, we have expanded our methodologies to deliver comprehensive exploration solutions across land, marine, and airborne domains, providing clients with a full spectrum of spatial exploration services.

Business Scope
• Oil and gas exploration and production
• Mineral exploration
• Geothermal and groundwater prospecting
• Unconventional resource exploration
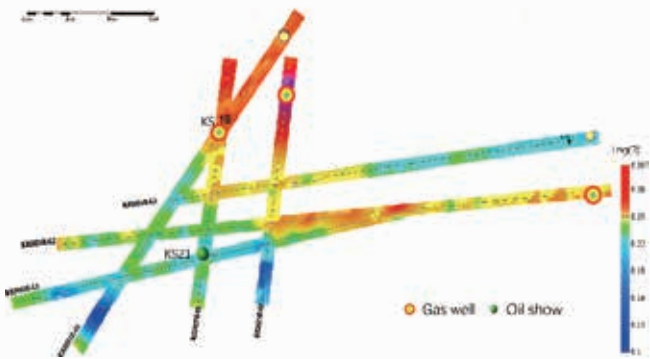• Engineering survey
• Topographic and bathymetric survey

Products
• Land EM acquisition units: HAWK EM Node
• Marine EM acquisition system: OBNEM
• Onsite data processing and QC software: GMECS
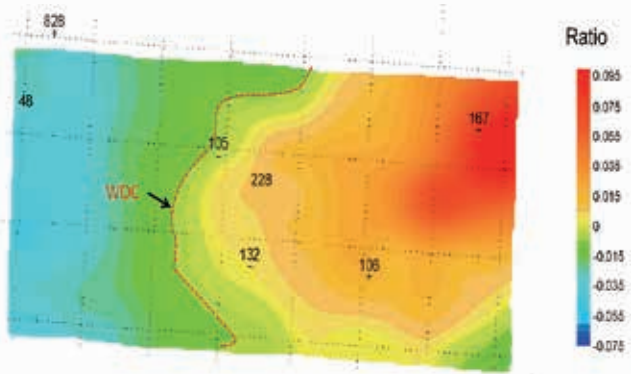• Data processing and interpretation software: GeoGME

Key Techniques

• Time-Frequency Electromagnetic (TFEM)

Predict HC potential areas by TFEM

• Borehole-Surface Electromagnetic (BSEM)
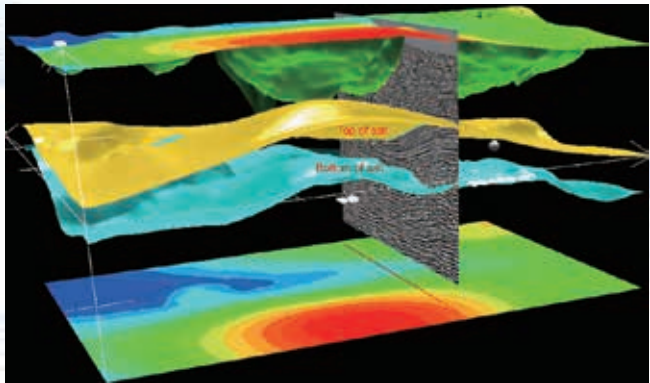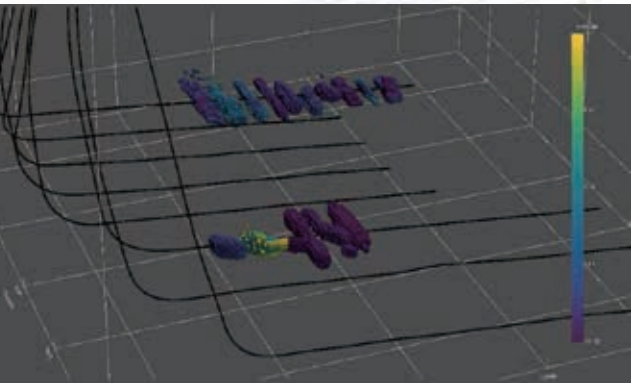
Predict WOC by BSEM

• 3D Gravity, Magnetic and Electromagnetic (GME3D)

Study subsalt structures by GME3D

• Internet EM on time (iEot)

Hydraulic fracturing monitoring by iEot

KLSeis is a leading seismic acquisition software system independently developed by BGP. The intelligent software platform features openness, cross-platform, high performance, massive data, and collaborative research. It covers all types of terrain, including land, transitional zones, and marine areas.
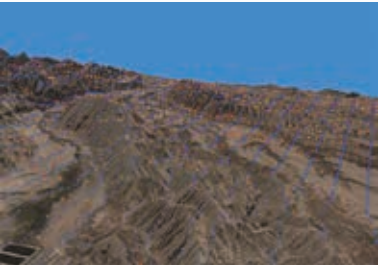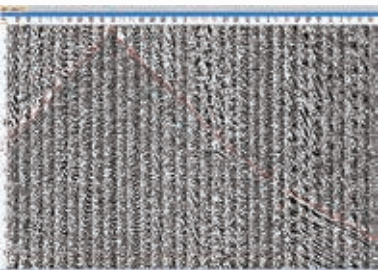
Software Modules

Distinctive Modules

- Seismic acquisition design and analysis

- Artificial intelligence first-break picking for high-precision near-surface modeling

- Full lifecycle support for marine seismic acquisition

- Complex geological model building and forward modeling & illumination
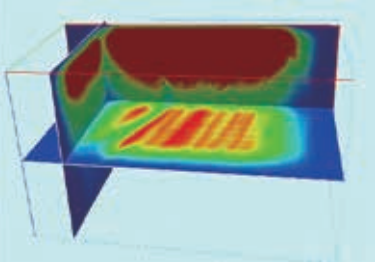
- Comprehensively integrated economic and technical evaluation through precise acquisition simulation
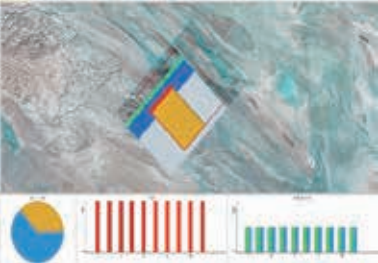
- Near-surface solution improving PSTM & PSDM imaging

- High-speed data segmentation and quality control, full-process support for node acquisition

- Real-time equipment QC and monitoring to ensure data quality

With two decades of technological refinement, the GeoEast software platform has developed integrated capabilities for seismic data processing and interpretation, supporting exploration in complex onshore/offshore geological environments and unconventional reservoirs. In the field of artificial intelligence, BGP has pioneered the deep integration of deep learning technologies into seis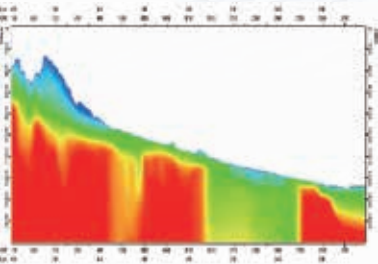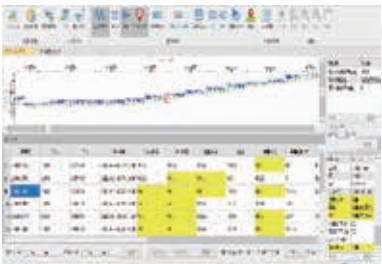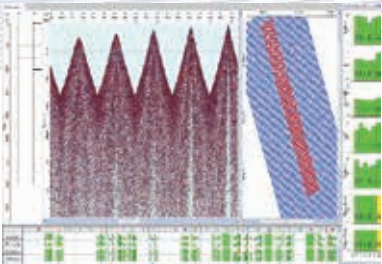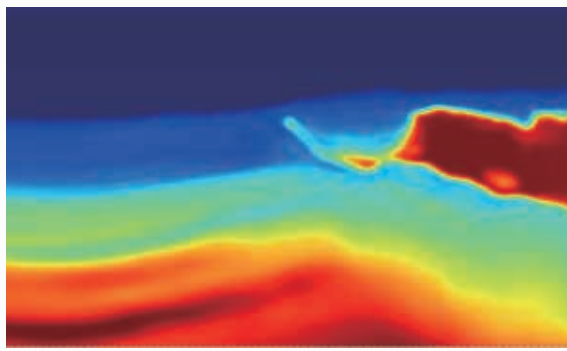mic data workflows, overcoming efficiency bottlenecks inherent to traditional methods in velocity modeling, noise suppression, and geological interpretation. These advancements significantly enhance exploration accuracy and operational efficiency.
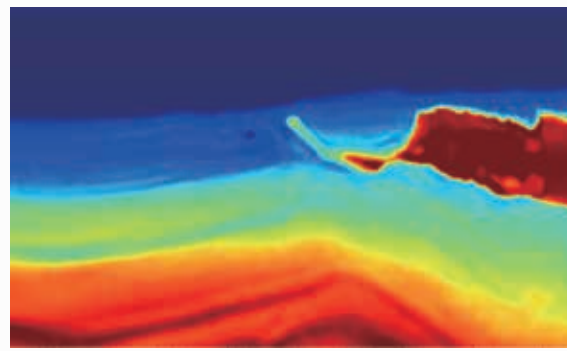
GeoEast-PRO
Intelligent comprehensive processing software
- Near-surface VMB and statics
- High precision noise suppression
- Velocity modelling and imaging
- Wide-azimuth and Q processing
- AI-aided processing

GeoEast-INT
Exploration-oriented seismic and geological interpretation system
- Basin-level data management
- High-efficiency structure interpretation
- Modern attribute extraction and analysis
- Integrated seismic inversion
- AI-aided interpretation

GeoEast-Marine
Marine data processing software
- Broadband processing
- 3D signal deconvolution
- De-multiple
- Upgoing and downgoing wavefield separation
- OBN velocity modelling and imaging

GeoEast-RC
Development-oriented fine reservoir description system
- Well seismic joint geological analysis
- Multi-well comparative analysis
- Well interpretation and rock physics analysis
- Controlled geological mapping
- Geological modelling

GeoEast-VSP
Well seismic processing and interpretation software
- DAS-VSP noise suppression
- Polarization analysis and three-component rotation
- VSP wave field separation
- VSP imaging
- VSP bridge calibration

GeoEast-SGD
Unconventional reservoir-oriented integrated Seismic-Geological -Engineering system
- Sweet spot prediction
- Well location justification
- Well path design
- Seismic geosteering for horizontal drilling
- Seismic-assisted fracturing analysis

GeoEast-MC
Multi-wave processing and interpretation software
- Converted-wave integrated static correction
- Four-parameter analysis of converted-wave prestack time migration
- Converted-wave anisotropic PSTM
- Multi-component layer matching
- Multi-wave joint inversion

GeoEast-iEco
An open software platform for multidisciplinary integration
- PB-level massive data management
- AI application development
- Cross-platform support (Linux/Windows)
- Multi-language support

GeoEast
an Integrated Seismic Data Processing and Interpretation System

PRO　INT　RC　SGD　iEco　MC　VSP　Marine

FWI:
The system incorporates multi-domain full waveform inversion (FWI) capabilities spanning time, frequency, and Laplace domains, enabling seamless integration with tomographic inversion methods.
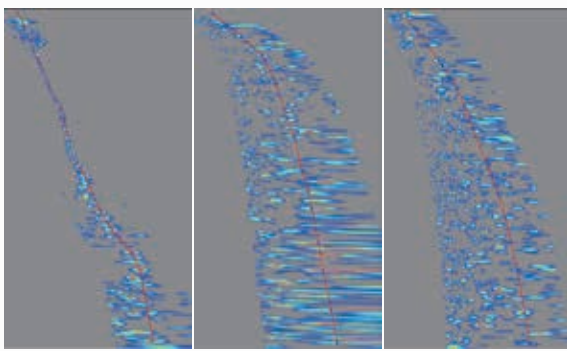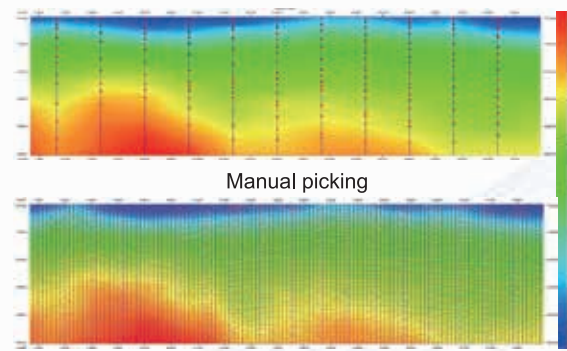

Legacy velocity model　　　　JDFWI inverted velocity model

AI Processing:
GeoEast has developed intelligent processing modules for time-consuming and labor-intensive stages of seismic data processing, including first break picking, velocity picking, and noise attenuation.
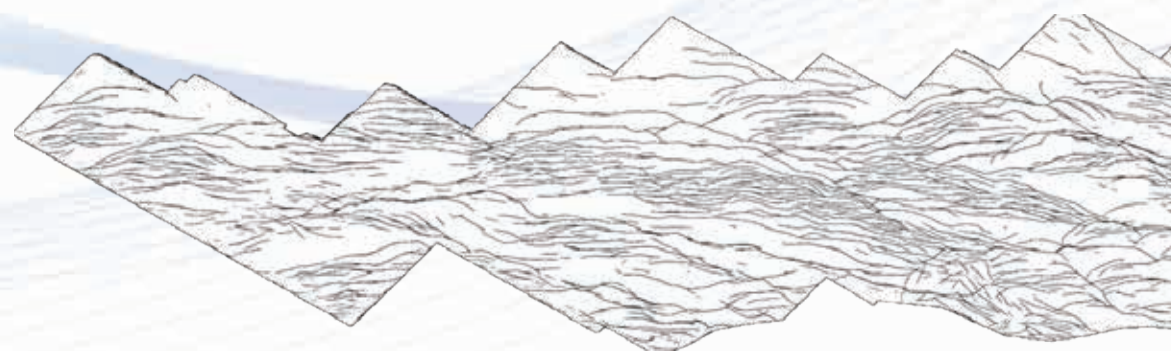

Different S/N data

Manual picking

DL picking

AI Interpretation:
An advanced AI-powered deep learning neural network has been developed, integrating intelligent interpretation technologies for seismic interpretation (horizon tracking and fault detection), well log analysis (curve and lithology prediction), and geological body identification.

AI-aid fault prediction

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 recoding 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 Seismic Vibrator:** The durable, low-maintenance AHV-IV family of vibrators incorporates the latest advances in source technology, implemented in the industry-standard Articulated Hydrostatic Vehicle (AHV) design.

• **The EV Series Seismic Vibrator:** It significantly enhances the low-frequency peak force output while maintaining broadband(1.5-160Hz) performance. This series seismic vibrators can generate P-wave and S-wave signals separately for seismic prospecting. It has reached international leading levels.

• **G3i® NXT** seismic recording system presents an innovative, ultra-lightweight design packed with features for optimal efficiency. This new system offers a smaller, energy-efficient acquisition system that provides real-time data in a robust package.

AHV-IV

EV-56S

AHV-V Titan

EV-56

UV2

BGP Innovator

G3i NXT

Quantum

eSeis Neo

Accuseis

SD7M
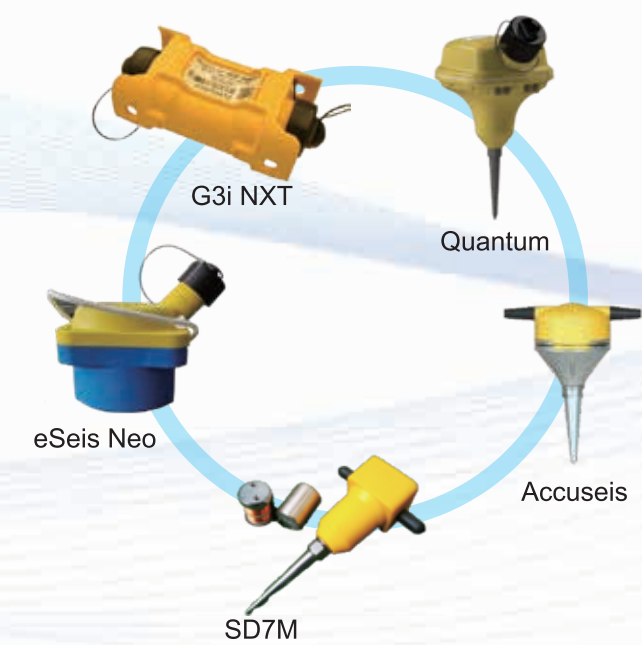
• **Quantum** is an integrated, lightweight, ultra-low power, broadband nodal recording system to conduct high productivity, high resolution and wide azimuth seismic surveys.

• **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.
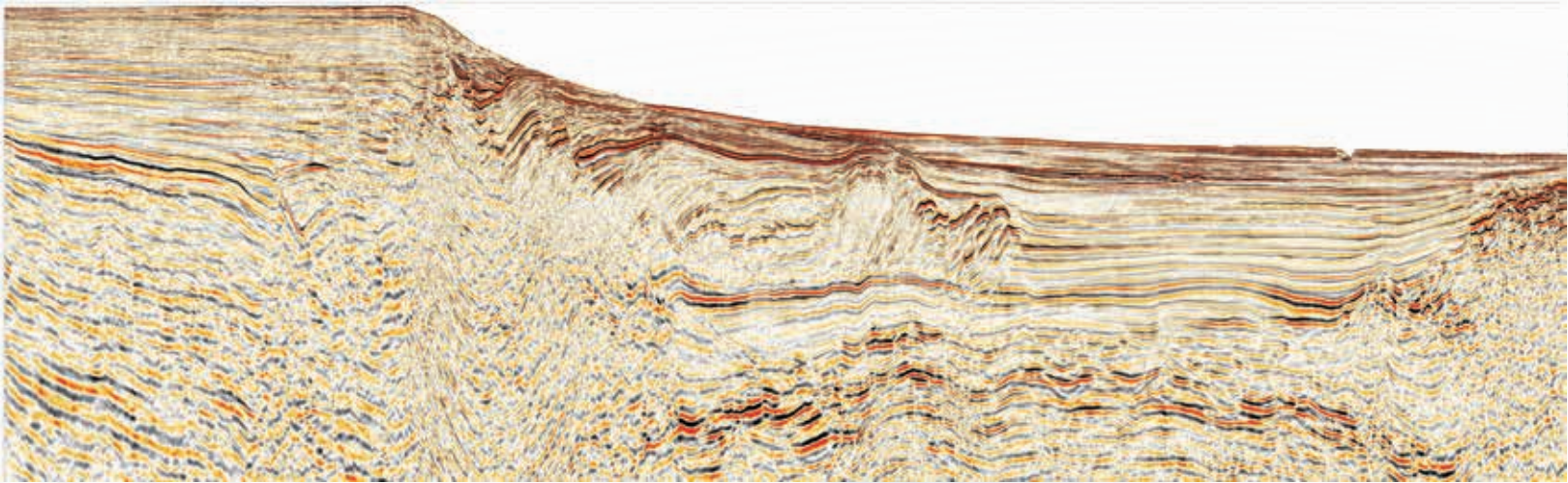
MULTI-CLIENT BUSINESS

Investment in Multi-client data affords our clients with new opportunities in frontier, emerging and mature basins worldwide.
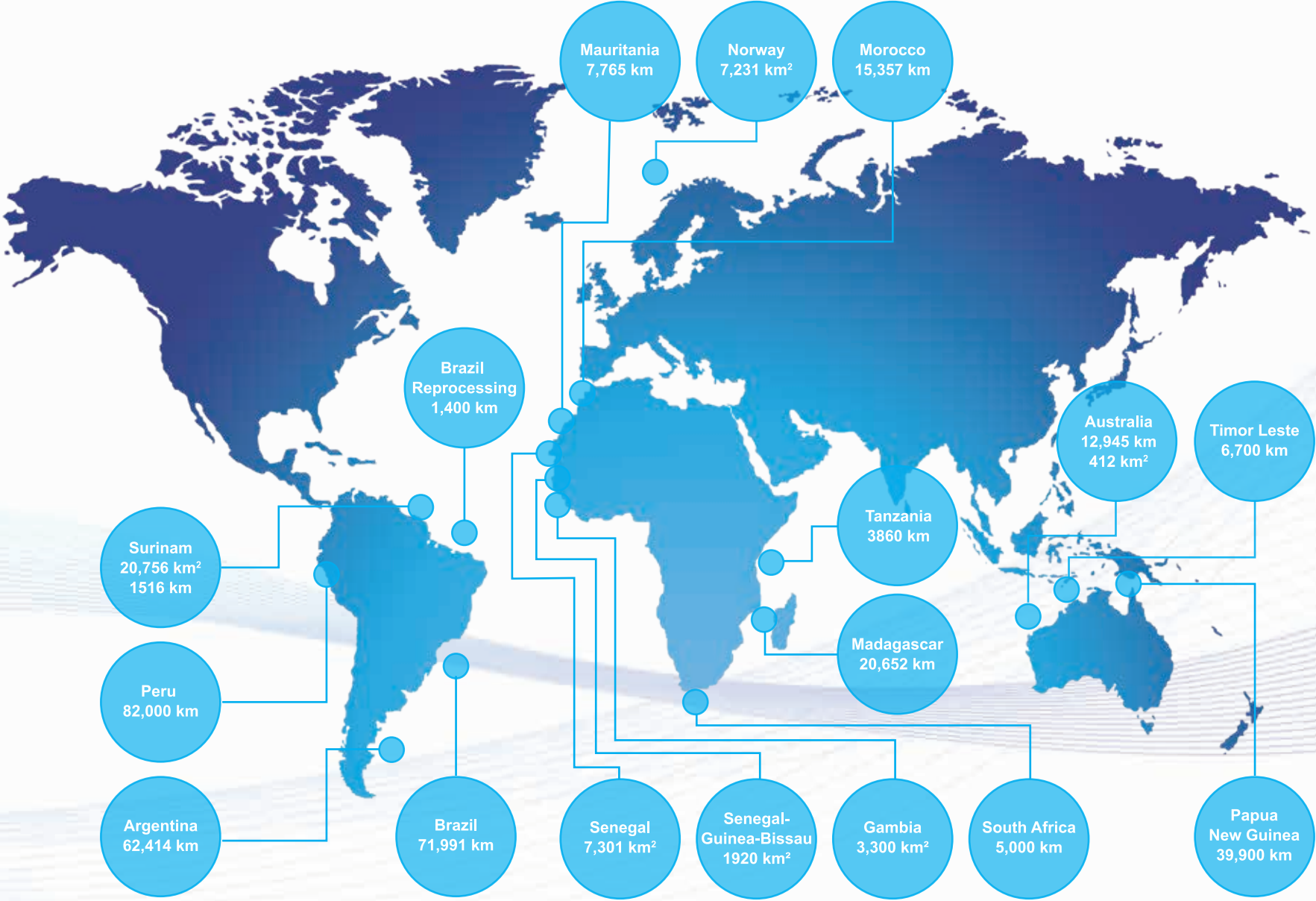
BGP utilizes state-of-the-art technology and equipment on its Multi-client projects ensuring the highest quality multi-client geophysical and geological data & services available to be provided to the energy industry. Our customers include host governments, NOCs, Super-Majors & Major Oil Companies.

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.
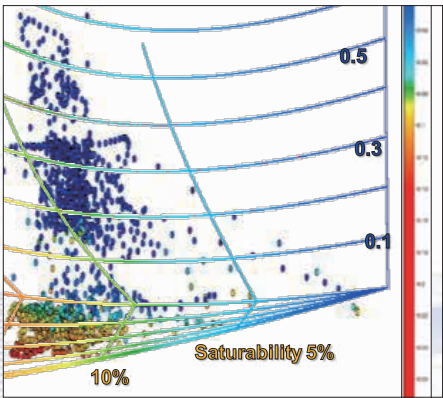
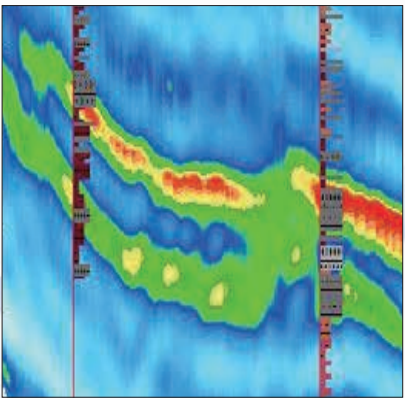Reprocessed 2D seismic section in Brazil equatorial margin

Mauritania
7,765 km

Norway
7,231 km²

Morocco
15,357 km

Brazil Reprocessing
1,400 km

Australia
12,945 km
412 km²

Timor Leste
6,700 km

Surinam
20,756 km²
1516 km

Tanzania
3860 km

Peru
82,000 km

Madagascar
20,652 km

Argentina
62,414 km

Brazil
71,991 km

Senegal
7,301 km²

Senegal-Guinea-Bissau
1920 km²

Gambia
3,300 km²

South Africa
5,000 km

Papua New Guinea
39,900 km

NEW ENERGY BUSINESS

Evaluation Technology for CO_2 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 CO_2 storage process

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

Physical characterization of brackish rock

Seismic reversion of brackish water
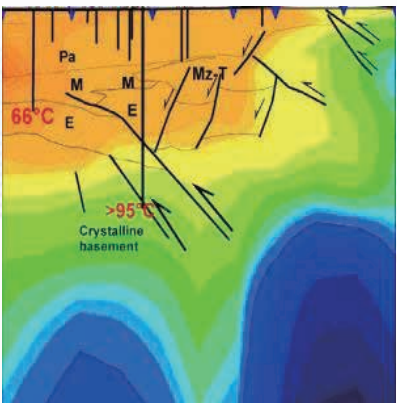
Seismic survey for geothermal exploration
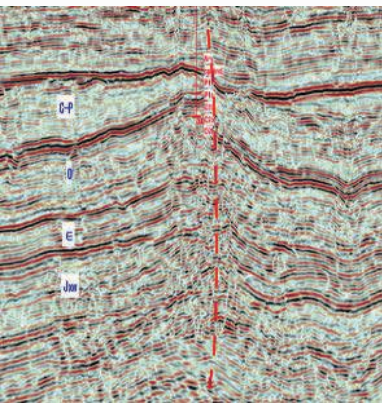
Visual well design based on depth model
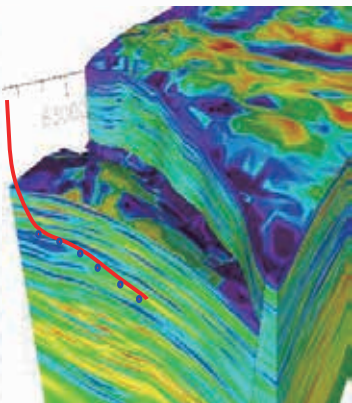

Geothermal temperature map

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, work-caused illness and environmental damage.

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 geophysical 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.
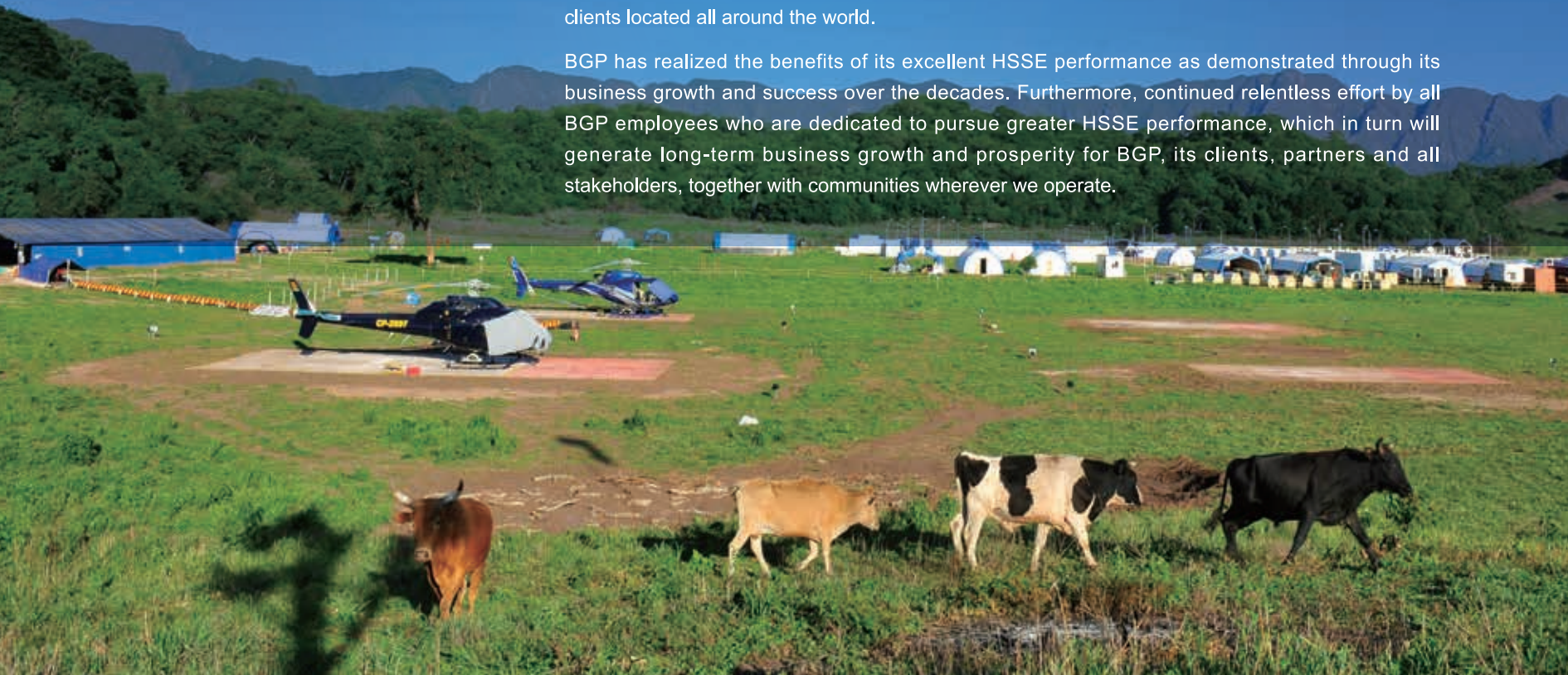
20 years safe operation without LTI

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.

International Activities

- 32 branches for onshore
- 11 branches for offshore
- 15 processing and interpretation centers