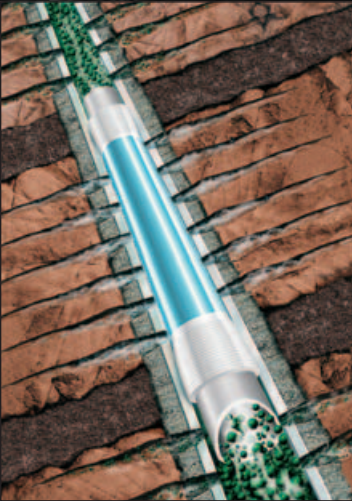
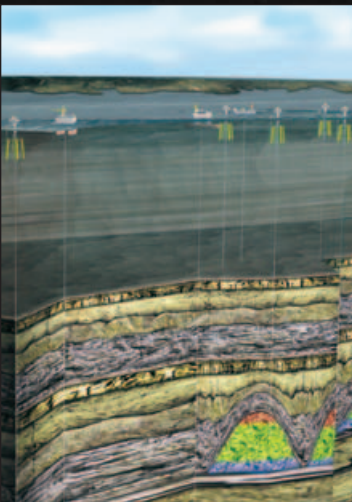




RESERVOIR DESCRIPTION



PRODUCTION ENHANCEMENT



RESERVOIR MANAGEMENT

# CORE LABORATORIES IS THE RESERVOIR OPTIMIZATION COMPANY™



**CORE LABORATORIES IS THE  
RESERVOIR OPTIMIZATION COMPANY™**

Optimizing reservoir performance and maximizing hydrocarbon recovery from producing fields – those are goals we all share.

Yet on average, worldwide oilfields produce only 40 percent of their hydrocarbons. Any improvement in optimizing the performance of these reservoirs requires a detailed understanding of the complexities of the reservoir system – the rocks, natural gas, crude oil, and water, as well as the mechanisms that control the flow of liquids and gases through the rocks.

Core Laboratories exists to help you produce increasing amounts of oil and gas daily, while maximizing ultimate hydrocarbon recoveries from your fields. Core is uniquely qualified by virtue of the proprietary and patented services and products offered through our three business units:

- Reservoir Description
- Production Enhancement
- Reservoir Management

To maximize the production and total recovery of hydrocarbons, oil companies must have a complete understanding of the reservoir rocks and fluids present in their producing fields. Core Laboratories is the only global provider of services that characterize the porous reservoir rock and all three reservoir fluids.

Our Reservoir Description technologies measure rock properties and the ways that reservoir fluids behave when a reservoir is being produced. For wireline and seismic data estimates to be used



effectively in reservoir optimization, they must be calibrated with precisely measured petrophysical and fluid datasets such as those provided by Core Laboratories.

We begin by analyzing samples of reservoir rocks for their porosity to determine reservoir storage capacity and for

their permeability to define the ability of the rock to permit fluid flow. We then combine these basic measurements with advanced rock properties analyses to provide detailed input for log calibration, saturation distribution, and fluid flow parameters. We also perform formation damage analysis to provide detailed solutions to wellbore and production impairment problems and support investigation of stimulation and treatment effects.

The ability of Core Laboratories to combine all aspects of reservoir characterization allows us to develop critical input for the development of reservoir simulation models that are central to the appraisal and development of any hydrocarbon accumulation. Core's fundamental and basic measurements provide the foundation for determining how much oil and gas are present in a reservoir and the rates at which the hydrocarbons can be produced. The more completely the properties of your oilfields' reservoir systems are understood, the more oil and gas these fields will ultimately produce.

Core Laboratories is the world's largest reservoir fluids analysis company.

Core Laboratories is the world's largest core analysis company.

## TIGHT GAS RESERVOIRS

Core's unique knowledge of reservoir rock and fluids will help you gain a better understanding of your tight gas reservoirs. With our technologies you can:

- Build a petrophysical model to determine effective gas permeability, water block, water saturation, or fracture design.
- Overcome near-wellbore formation damage with StimGun™ propellant-assisted perforating systems.
- Measure geomechanical properties of your specific reservoir to optimize fracture design.
- Evaluate frac fluid performance and assess early zonal contribution with SpectraChem™ tracers.
- Design and deliver better fracturing treatments using Core's real-time fracture monitoring system.
- Utilize our permanent downhole monitoring systems to provide flowing bottomhole pressure data for optimizing drawdown rates, avoiding retrograde gas condensate production, or reducing potential water influx problems.



data from separator and subsurface oil and gas samples that will help you decide what changes to make to optimize production and field recovery rates.

The value of the crude oil and natural gas is related to the hydrocarbon's composition.

Core Laboratories is recognized as a leader in crude oil inspection and related services.

sampling services to determine the value of the crude oil and its derived products as they are transported to the refinery. Crude oil value is directly related to the quantity of gasoline that can be refined

from it. Natural gas value is tied to its British Thermal Unit (BTU) content; the higher the BTU content, the higher the value of the gas. Core provides data

sets to help determine the value of oil and natural gas. These values are then used to calculate the return on investment the oilfield development project may yield the operator.

### From the Reservoir to the Refinery

To identify and understand the type of crude oil in the reservoir and how it will interact with the natural gas and water as the field is being produced, the three reservoir fluids must be characterized to evaluate fluid-phase behavior properties. These data sets are critical elements for attempting to produce the maximum quantities of oil and gas daily and over the life of the field. Since the reservoir fluids change composition over the producing life of the field, the methods by which the field is produced need to change also. Core provides reservoir fluids



Core Laboratories' data describing the reservoir system are used by engineers, geologists, and geophysicists worldwide to enhance hydrocarbon production so that it will exceed the 40% average oil-field recovery factor. Two production-enhancement methods commonly used are hydraulic fracturing of the reservoir rock to improve flow and flooding the field with water, carbon dioxide, nitrogen, or hydrocarbon gases to force more oil and gas to the wellbore.

The most effective means of enhancing production is controlling formation damage, the leading cause of underperforming wells worldwide. No one can do more than Core Laboratories to identify, remediate, and minimize the damage to producing formations that can occur during drilling and completion of a well.

## Hydraulic Fracturing

Hydraulic fracturing is typically achieved by pumping a proppant material in a gel slurry into the reservoir zone at extremely high pressures. This forces fractures to open in the rock and "props" the fractures open so that reservoir fluids can flow to the production wellbore.



Unfortunately, less than 50% of hydraulic fractures result in optimum production. A thorough understanding of the reservoir system is necessary for success. And Core provides patented and proprietary completions diagnostics technology to help you achieve it.

By coupling our data on rock types and strength you can ensure that proppants are placed as they were intended in the stimulation design, enabling you to significantly increase hydrocarbon production.

In addition, Core's testing indicates whether the gel slurry is compatible with the reservoir fluids so that the porous rock network is not damaged.

Core Laboratories  
is the world's leading  
fracture diagnostics  
company.

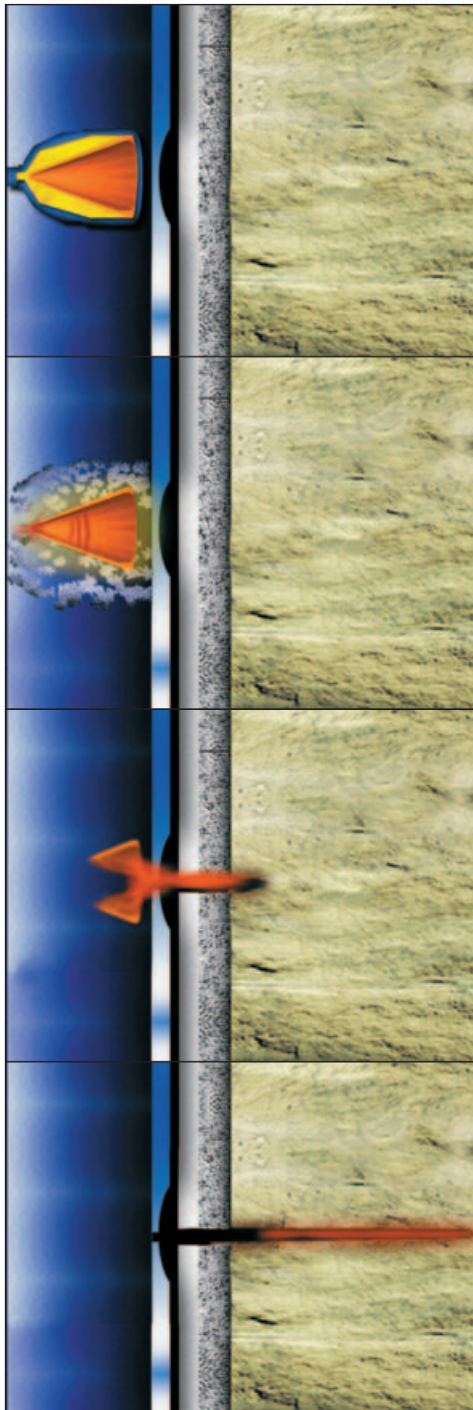
## FIELD FLOODS

Core's unique knowledge of reservoir rock and fluids will help you optimize your field floods. With our unique technologies you can:

- Obtain the deepest penetration, cleanest tunnels, and the highest productivity with Raptor™ perforating systems.
- Evaluate flood movement and sweep efficiency with SpectraFlood™ interwell tracer monitoring.
- Anticipate and control asphaltene-related formation damage by combining the technology of Petroleum Services' Pressurized Fluids Imaging (PFI™) system and the expertise of the Core Laboratories technical staff.
- Understand natural and induced fracture orientation and conductivity to maximize well placement.
- Optimize sweep efficiency by understanding and optimizing the locations and injection rates throughout the field with our permanent downhole monitoring system.

## Field Floods

An oilfield can yield additional quantities of hydrocarbons when an operator floods the producing zone with water, carbon dioxide, nitrogen, or a miscible



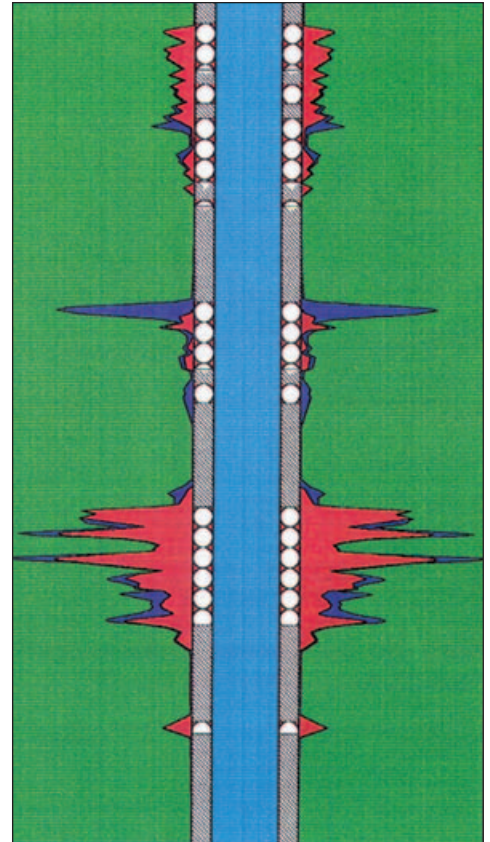
gas. When Core's reservoir description datasets are combined with dynamic flow tests run in Core's laboratories, a field flood program can be implemented to maximize hydrocarbon recovery. We conduct dynamic flow tests of the reservoir fluids through the reservoir rock, at actual reservoir pressure and temperature, to realistically simulate the actual flooding of a producing zone.

The success of a flood design can be bolstered by using our proprietary field-flood tracer technologies to track the movement of the flooding agent. This enables you to identify injection flow patterns and pinpoint fluid breakthrough through to producing wells.

## Formation Damage

Formation damage limits daily production and severely reduces the ultimate recovery from the field by up to 25%.

Core Laboratories is the global leader in identifying, remediating, and minimizing formation damage.



These economics make the avoidance and mitigation of formation damage a top priority. To ensure the maximum return possible, you frequently have to stimulate the reservoir to yield additional production. The reservoir rock and fluid data dictate the most effective way

to complete the well and stimulate the formation. If it is completed improperly, the producing formation will be

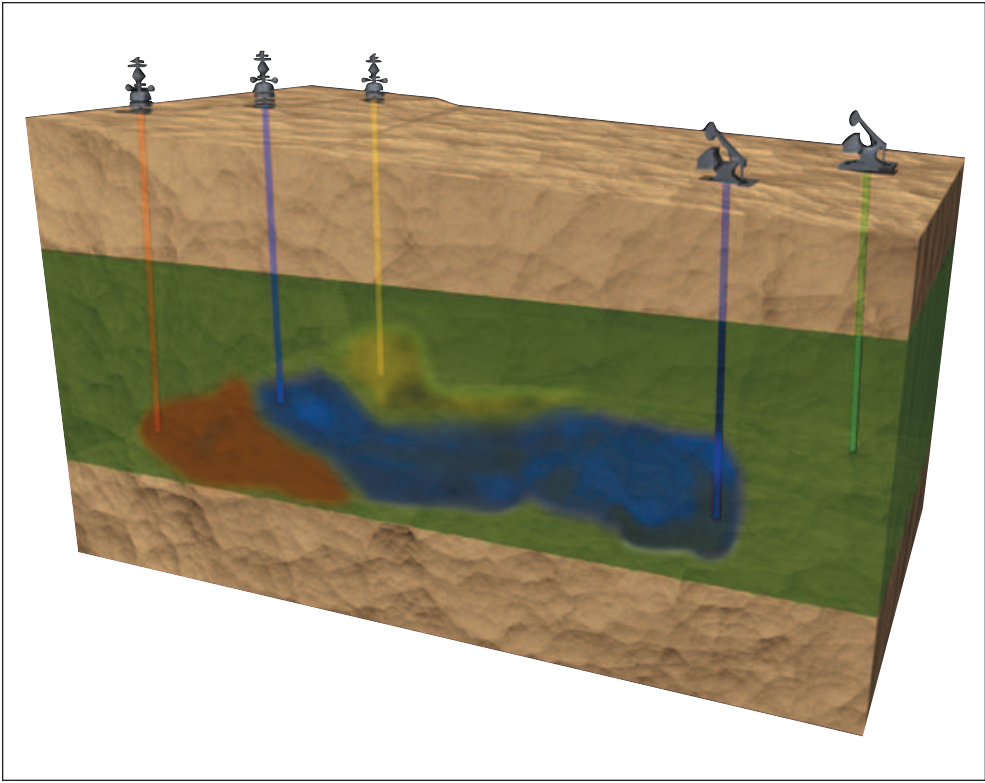
damaged; and hydrocarbon flow to the wellbore will be impaired.

Core provides well completion perforating gun systems specifically designed to minimize formation damage while maximizing the communication, or transmissibility, between the producing formation and the wellbore. Core is in the best position to recommend patented and proprietary

perforating systems and prepare the reservoir for stimulation.

Reservoir production is significantly enhanced whenever formation damage can be controlled. Formation damage is a multi-billion-dollar/year problem for the oil and gas industry; and no one can do more to identify, remediate, and minimize formation damage than Core Laboratories.

Core Laboratories is the world's largest independent supplier of perforating gun systems.



## FRACTURED CARBONATE RESERVOIRS

Core's unique knowledge of reservoir rock and fluids will help you gain a better understanding of your fractured carbonate reservoirs. With our technologies you can:

- Predict fracture propagation direction through acoustic anisotropy studies on oriented core.
- Evaluate the relative fracture conductivity versus formation stress of natural, acid, or proppant-fractured reservoirs.
- Ensure that you're producing from all your pay zones by combining Zero Wash<sup>®</sup> tracers and SpectraScan<sup>®</sup> logging.
- Use Core's real-time production monitoring to enable your reservoir engineers to understand boundary conditions and drainage limits, and to allow your drilling engineers to properly design infill wells and recompletions.

# RESERVOIR MANAGEMENT

Lowering finding costs is critically important for any E&P company, and maximizing production from existing reservoirs is generally recognized as the most cost-effective way to achieve this goal.

The Reservoir Management group focuses on specialized projects to help Core Laboratories' clients optimize their oil and gas exploration and exploitation programs. An example is our Tight Gas Sand Fracture Stimulation and Optimization Program (A Systematic

Approach to Improved Well Performance). This is a complete evaluation package that profiles the geological, petrophysical, and geomechanical properties of tight gas sand reservoirs to enhance well performance.

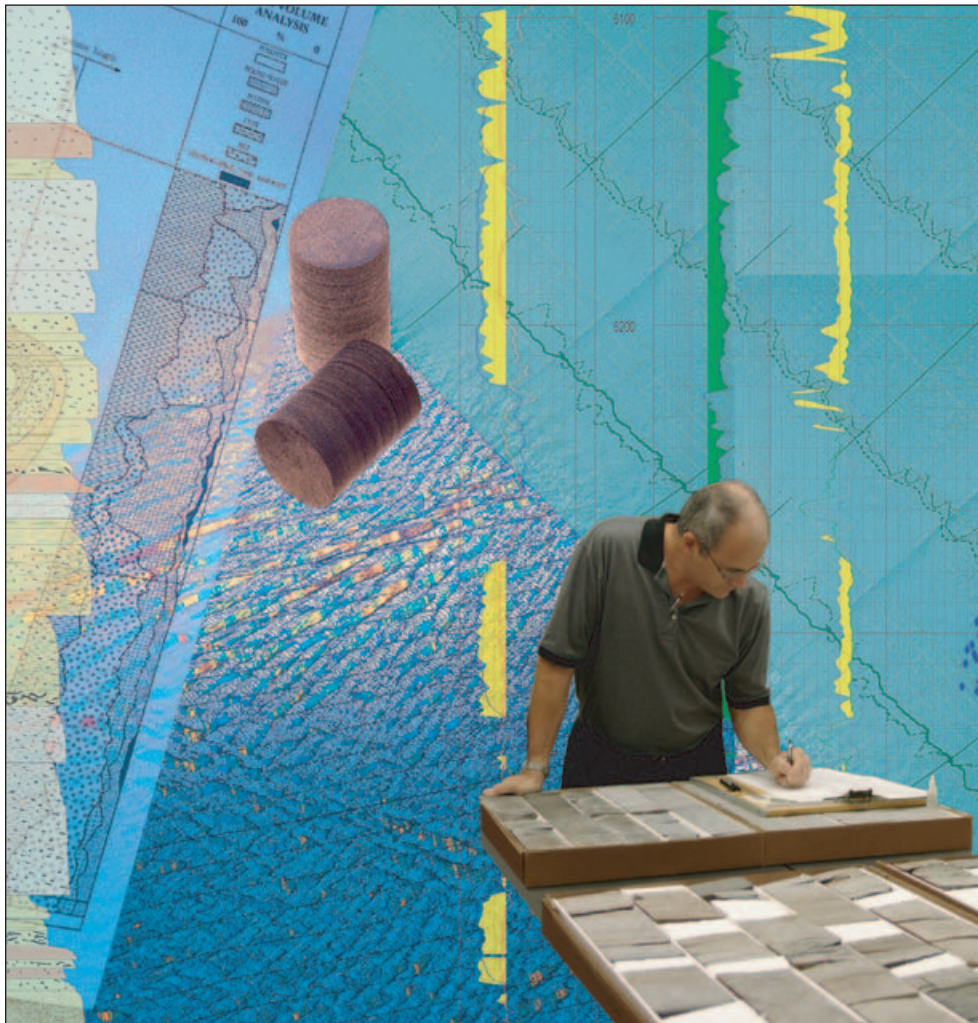
**Core Laboratories has pioneered innovative technologies that integrate multiple disciplines for reservoir optimization.**

Increasingly, operators are recognizing that cost-effective, real-time, permanent well monitoring systems enable them to "see" how their reservoirs are performing and are critical to the successful implementation of any reservoir



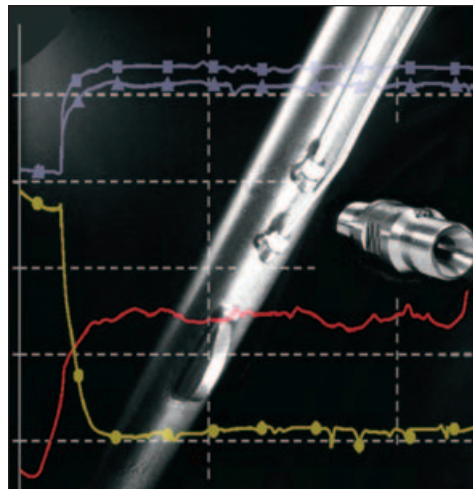
management, production enhancement, or enhanced oil recovery (EOR) project.

Core Laboratories makes continuous real-time measurements of reservoir temperature, pressure, and flow. Our permanent downhole monitoring systems provide our customers with "eyes to the reservoir" to improve well productivity, reduce operating costs, and understand reservoir performance on a real-time basis. Our unique surface and downhole instrumentation systems are designed to be reliable, flexible, and easy to use – whatever the application.

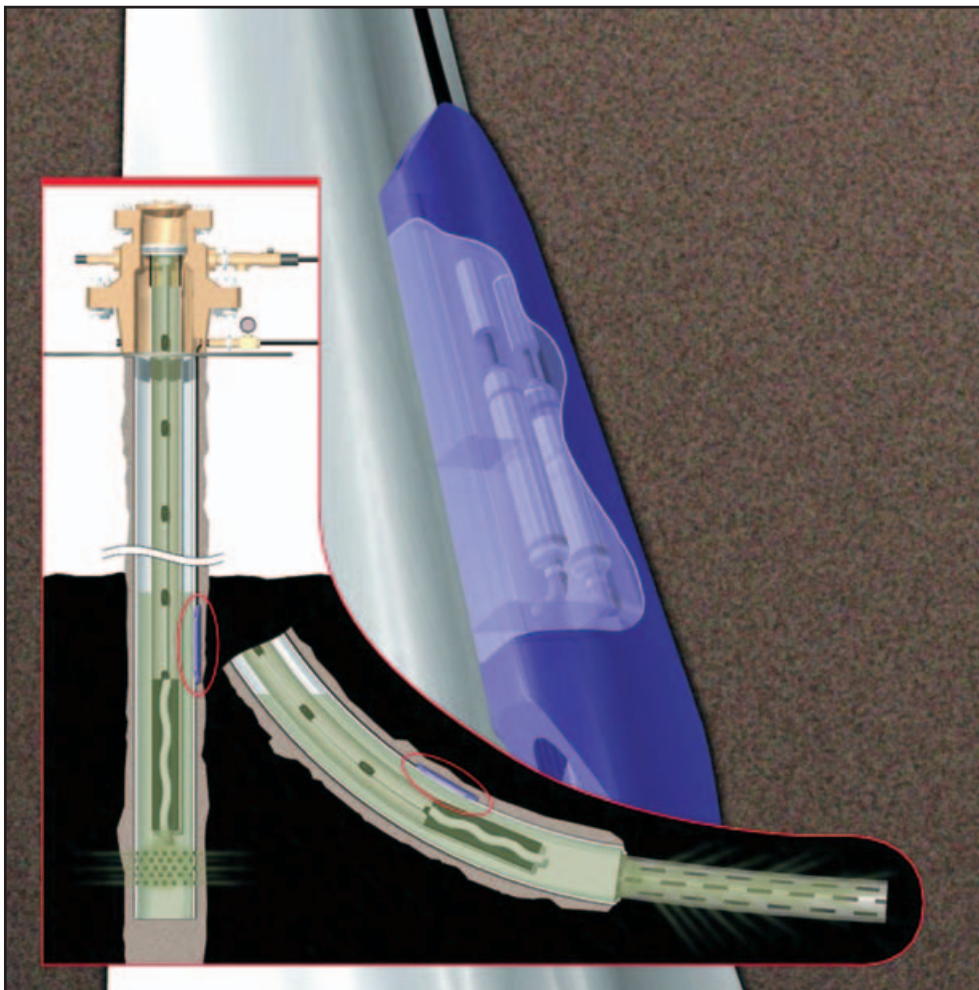


While accurate data generation is important, understanding how to use the data is critical. Core Laboratories is expert at generating, compiling, and interpreting reservoir data. Through regional geological and petrophysical studies that integrate detailed seismic, geological, petrophysical, and well production information, we provide you with a multi-disciplinary approach to complete reservoir characterization.

And to help you manage your field optimally, Core offers integrated teams of engineers, geologists, petrophysicists,



and geophysicists to apply our unparalleled knowledge of reservoir systems and our proprietary completion and production enhancement techniques to reservoir management projects worldwide.



## DEEPWATER RESERVOIRS

Core's unique knowledge of reservoir rock and fluids will help you gain a better understanding of your deepwater reservoirs. With our technologies you can:

- Eliminate debris problems from big-hole perforating using Phantom™ perforating systems.
- Determine the quality of deepwater completions with SpectraScan completion imaging and Pack Scan® gravel pack density imaging.
- Ensure the integrity of your unconsolidated core with our proprietary well-site handling and laboratory techniques.
- Protect and ensure the quality of your reservoir fluids by using the transfer and analytical capabilities of our *Next Generation* mobile laboratory on the drillship or platform.
- Gain a better understanding of your reservoir's geological and petrophysical properties by using our Deepwater Gulf of Mexico Database and Worldwide Rock Catalog®.
- Monitor reservoir performance and evaluate potential production problems using our industry-unique real-time well monitoring systems.

# WHAT YOU WANT, WHEN AND WHERE YOU WANT IT

Core remains dedicated to providing the technology you need to enhance your production. We are continuing to develop and acquire technologies that complement our existing products and services, and we are disseminating these technologies throughout our global network. With seventy offices in fifty countries, we can help you solve your reservoir problems – however and wherever you need us.

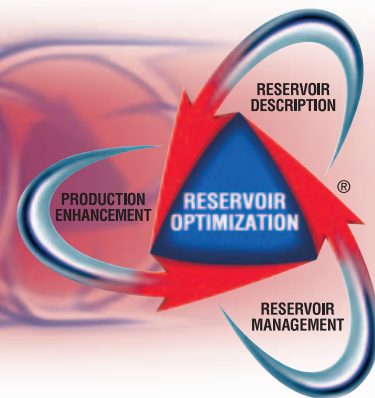
Companies that utilize Core Laboratories' reservoir optimization technologies have been able to increase the total recovery from their existing fields. Increases of 5 to 10 percent of the total recovery have been achieved – with

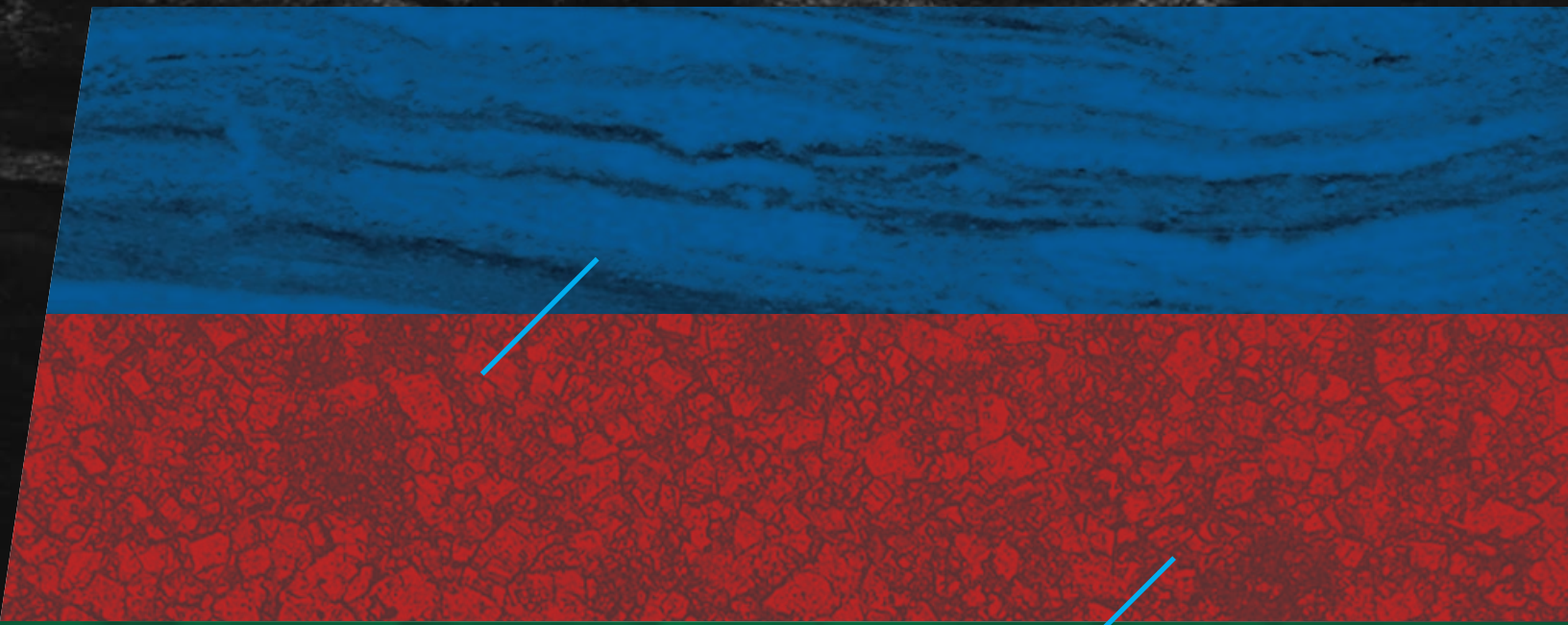
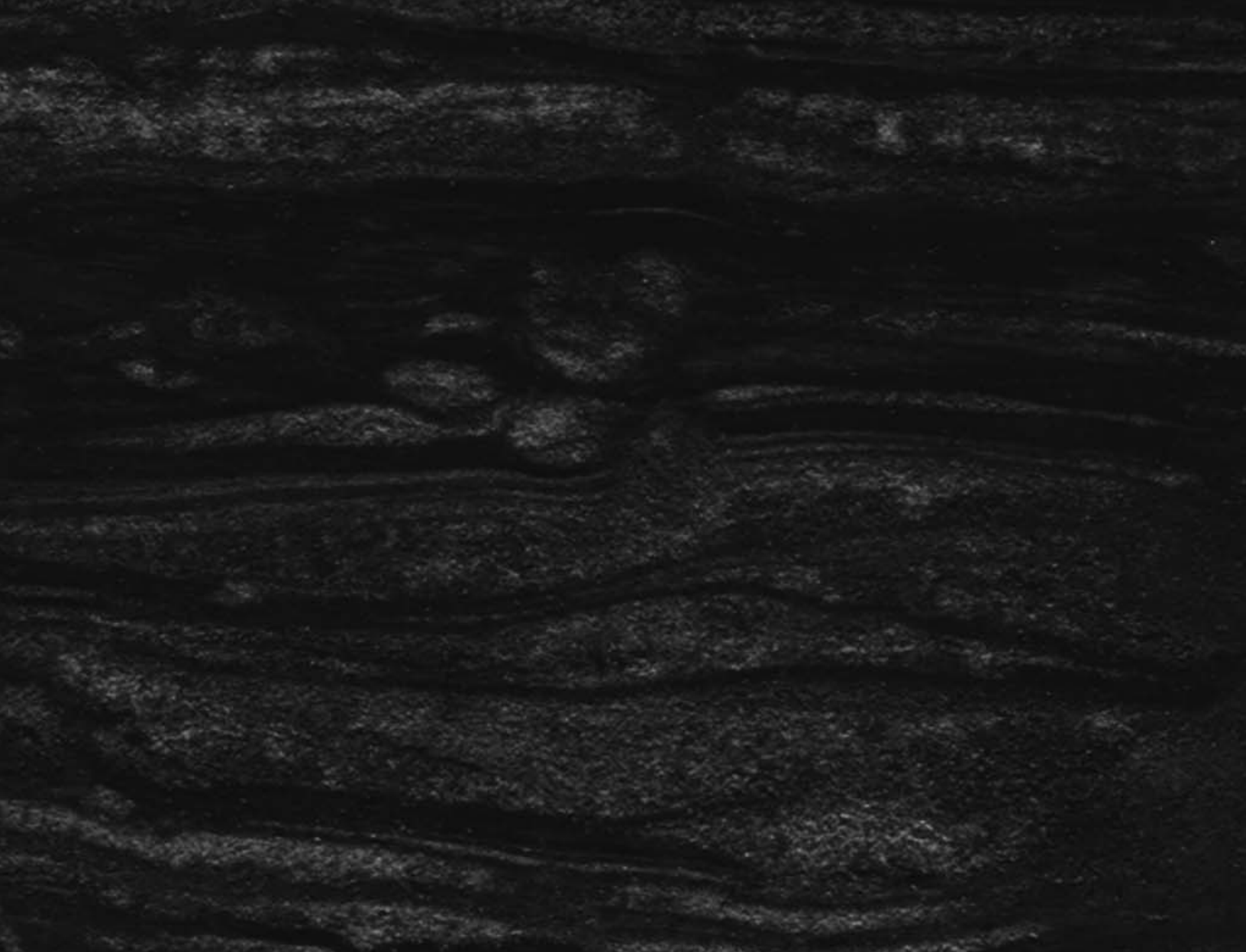


some fields yielding an additional 15 percent of the in-place reserves – an improvement of nearly 40 percent over average recovery levels.

Our commitment to applying and developing new technologies to optimize

reservoir performance is unsurpassed in the oilfield service industry. This commitment to technology and to your bottom line makes Core Laboratories The Reservoir Optimization Company.







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