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Oil in Deep Waters

1. Below the Salt

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“When we drilled beneath the salt, we entered the realm of the unknown,” said Peter Szatmari, a Hungarian-born geologist who works at Cenpes, the research center of Petrobras, Brazil’s state-controlled oil company. “We were finding something entirely new beneath the ocean, as when Columbus was discovering a new continent.”

What Szatmari and others at Petrobras saw below the salt was a new frontier in petroleum discovery, among the last of such frontiers on this planet. The realm of the unknown embraces problems of geology, technology, logistics, safety, finance, politics, human resources, corporate governance and strategies of economic development that still must be solved as Brazil grasps the opportunities of a new era. In this series of articles and in an international conference to follow, *O Estado* will address these issues.

In 2006 Petrobras and its private partners (British Gas [BG], Repsol of Spain and GALP of Portugal) were drilling 7,000 meters below the surface of the South Atlantic, penetrating ancient sediments lying beneath a beds of salt more than 2,000 meters thick, to find the fossilized remains of green microbes that lived 130 million years ago, when dinosaurs still roamed Brazil’s continental interior. Trapped beneath massive salt structures, these microbe fossils were transformed by heat, pressure and time into the supergiant field of Tupi, since renamed Lula, one of the world’s biggest oil and gas discoveries of recent decades. In all, discoveries of 10 giant fields have been announced so far in the deep waters of the Santos Basin.

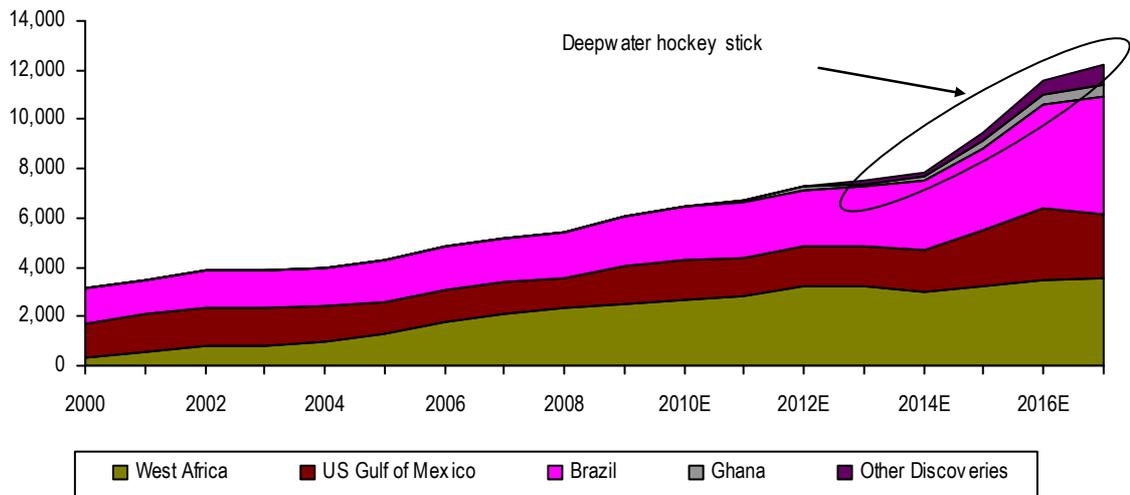
The dimensions of these geological features are enormous. “In the Santos Basin, the continental crust extends offshore for 700 kilometers in the region of the São Paulo Plateau,” a submerged volcanic rise, Petrobras geologists told the Offshore Technology Conference in Houston. “The final breakup between South America and Africa was not symmetrical—the zone of stretched continental crust is wider along the Brazilian margin than along the African margin. Using new strategies in seven years of work in pursuing innovative procedures, adjusted to the geological challenges of the area, Petrobras obtained a tremendous exploratory success and a world-class petroleum province was found.”¹

Carlos Tadeu Fraga, a 30-year Petrobras veteran who formerly headed offshore exploration and production for Petrobras before becoming director of Cenpes, told me that the deep-water area with huge salt beds trapping fossilized microbes, “is almost equal to the area of sedimentary basins in the U.S. portion of the Gulf of Mexico,” which in recent years accounted for one-third of American oil production. “Petrobras is drilling in waters 2,700 meters deep in its Cascade lease in the Gulf of Mexico,” he added. “The world oil industry is

going even deeper. The prospects of the pre-salt region go as deep as 3,500 meters and Petrobras is developing technology to reach these resources.”

Deep waters as a new frontier for petroleum development grew in importance as the source of half of the oil and gas discoveries added to the world’s reserves since 2006.² Edward L. Morse, a leading analyst, predicts that the world’s deep water output should double to 12.2 million BD between 2010 and 2017, mainly in the new “Golden Triangle” of Brazil, the Gulf of Mexico and West Africa, but also in Australia and Indonesia.³ Petrobras is a leader in deep-water exploration, employing 61 rigs able to drill to ocean depths of at least 1,000 feet, compared with 38 in the Gulf of Mexico and 32 in West African waters.⁴ Petrobras says that it is increasing its deep-water drilling fleet, despite the worldwide shortage of rigs, to meet its target of drilling 270 wells, each taking three or four months of rig rental time, in just one of the newly discovered fields.⁵

World deep-water output should double by 2017 to 12.2 million barrels daily



Source: Credit Suisse Equity Research Estimates

The pre-salt euphoria bred in the political class the illusion of limitless resources on the horizon. Proposing legislation to create a new institutional framework governing these discoveries, Lula’s cabinet ministers said they promise “extremely low exploration risks and great profitability.” Lula’s successor as Brazil’s president, Dilma Rousseff, supervised drafting of the new legal framework while chairing the Petrobras governing board before entering the 2010 election campaign. Furious Congressional debate on the new institutional regime focused almost entirely on distribution of royalties among states and municipalities, neglecting the governance and technical issues posed by deep-water exploration and production.

In her inaugural address as president, Dilma called the pre-salt discoveries “our passport to the future” but warned against “hasty spending that reserves for future generations only debts and desperation.” Nevertheless, the new production-sharing regime fortifies a politically-protected state capitalism with broad discretionary powers and little transparency. A reinforced Petrobras monopoly would reduce chances for competition and spreading risk among several companies. The new laws oblige Petrobras to become the operator, with a 30% minimum stake, of all exploration blocks in “strategic” deep-water areas embracing 149,000 km², an obligation that would overburden Petrobras’s already stretched manpower, financial and technical capacities. All operating decisions, including contracting of personnel, suppliers and service providers, would be subject to veto by political appointees in a new state company, PetroSal Petr leo, created to supervise these ventures.

Petrobras plans to double its production of oil and gas to 5.4 million barrels daily of oil equivalent (BDOE) by 2020, with investments equal to one-tenth of Brazil’s gross fixed capital formation.⁶ Including capital spending by Petrobras suppliers, this overall effort would involve total investments of from \$624 billion to \$824 billion in 2011-14. The government borrowed more than R\$207 billion (US\$121 billion) to lend at heavily subsidized rates to the BNDES (National Bank for Economic and Social Development), large share of which was lent to Petrobras and its suppliers.⁷

Petrobras President José Sérgio Gabrielli warned of “critical areas, strangulation” in the supply chain. “One of them is drilling rigs. A rig takes three or four months to drill a well through 2,000 meters of water. A converted supertanker known as a FPSO (Floating Production and Storage Offloading), which becomes the hub of a production system, uses 15 or 20 wells. So with one rig it takes four years to create a production system. Rigs are critical and Brazil doesn’t produce them. We also lack subsea systems, tubing to connect the ocean floor to the surface. Today we have the whole world’s production capacity contracted and we need more. We must advance in the area of large turbo-compressors, which are floating electricity generators. We are talking about gigantic quantities of equipment. Each system produces from 100,000 BD to 180,000 BD. So if we are going to meet our production goals by 2020, we need 41 of these systems. Each system costs about \$3 billion. To operate, each one needs an average of five support ships. So we are talking of 200 support ships of different kinds (tugs, anchor handling, fire extinguishers, etc.). To meet our goals, we will need 20 or 30 more tankers, each with 1.1 million barrels capacity, to transport all this.”⁸

The difficulties of petroleum exploration and production in deep waters were dramatized in April 2010 by the blowout in BP’s Macondo well in the Gulf of Mexico, an accident with many political, economic and ecological ramifications, including additional insurance and credit costs for deep-water operations. The \$560 million Deepwater Horizon, a 33,000-ton rig floating on pontoons and dynamically positioned by huge thrusters, with a derrick rising 20 stories above its top deck, was a workhorse of the fleet of Transocean, the world’s largest drilling contractor, which operates 11 rigs in the Gulf of Mexico and another 11 offshore Brazil. A year before it exploded, burned and sank, killing 11 crew members, while trying to seal the Macondo well, Deepwater Horizon had set a world record by drilling 10,683 meters below surface waters in BP’s nearby Tiber field. Human and mechanical failures, including neglect of maintenance protocols for complex equipment, overcame redundant safety systems installed to prevent disaster. Today some 3,500 platforms and drilling rigs in the Gulf of Mexico produce one-fourth of the U.S. domestic oil supply.

“Modern oil and gas drilling rigs and producing platforms are enormous floating machines, densely equipped with powerful engines and responsible for keeping within geologic formations large volumes of highly combustible hydrocarbons at high temperatures and pressures,” according to a report on the accident commissioned by President Barack Obama.⁹ “Drilling rigs are dangerous places to work, dense with heavy equipment, hazardous chemicals and flammable oil and gas –all surrounded by an open sea environment far from shore, where weather and water conditions can change rapidly and dramatically.” The commission added that the causes of the Macondo accident “were rooted in systemic failures by industry management, extending beyond BP to contractors,” all operating worldwide.¹⁰

Disasters on the scale of Deepwater Horizon are rare, but near-misses are common. In the months before the Macondo accident, a blowout in Australian waters poured oil into the Timor Sea for weeks. In the Gulf of Mexico on a rig owned by Noble, a drilling contractor with a worldwide fleet of 71 rigs, an out-of-control well dislodged a two-ton piece of equipment on the deck, sending workers scurrying for safety. A gas leak on a North Sea production platform in Norwegian waters lacked only a stray spark to set off a disaster like Macondo. During 2009 in the U.S. Gulf of Mexico there were 28 major oil spills, gas surges and episodes of workers losing control of wells, a two-thirds increase over 2006. In the British North Sea there were 85 serious incidents over the past year, a 39% increase over 2009. In Norway, 37 such cases in 2009, up 48% from 2008. In Australia, 23 near blowouts in the first half of 2010, occurring at twice the rate of 2009. The accident records, supplied by the governments of these four countries, appeared in a survey by *The Wall Street Journal*, to which Brazilian authorities refused to contribute data.¹¹

The Wall Street Journal also surveyed work routines of the 55 U.S. government inspectors checking safety procedures and equipment on drilling rigs and platforms operating in the Gulf of Mexico, finding that “these inspectors have been overruled by industry, undermined by their own managers and outmatched by the sheer number of offshore installations they oversee....Inspectors are mostly former oilfield workers without college degrees, have little formal training and aren’t required to pass any certification tests; they are expected to learn their craft by shadowing more experience peers. They have almost no direct experience in the specialized field of deep-water drilling.” The last inspector to visit BP’s Deepwater Horizon spent only two-hours on the platform three weeks before a gas leak led to the fatal explosion.¹²

Petrobras suffered four major offshore accidents in recent decades, with scores of deaths and the loss in 2001 of the P36 platform, then the world’s biggest, in the Campos Basin.¹³ The National Petroleum Agency (ANP), the regulator, is severely understaffed and its technicians complain of lax safety procedures. In 2010 the oil workers union forced suspension of operations of Campos Basin Platforms 33 and 35 because of unsafe conditions.¹⁴ Offshore production

platforms are transient and polyglot communities, where staff lives for two weeks every month and works on 12-hour shifts, with foreign employees of service contractors coming aboard for brief periods to perform specific tasks. Union leaders and safety inspectors complain of the high proportion of temporary contract workers. “The contractors lack qualified people for specialized tasks, so there’s rapid turnover and many Asian workers doing these jobs,” said one ANP inspector. “The ANP has only 10 engineers to inspect 200 drilling rigs and production platforms in the Campos Basin.”

The explosion and sinking of the Deepwater Horizon platform at BP’s Macondo well in April 2010 was 120 kms. from the shore of the Gulf of Mexico, roughly one-half of the distance of the Lula/Tupi cluster from Brazil’s coast. If a similar accident were to occur so far from shore, neither Petrobras nor Brazil’s navy nor private service companies have the capacity to mount an operation approaching the scale of the emergency effort that took place in the Gulf of Mexico, mobilizing 30,000 people, 7,000 ships and 100 aircraft.

The Santos Basin discoveries lie beyond the range of the helicopters that currently support Petrobras’s offshore operations. Gabrielli warned: “The industry has developed neither technology nor equipment for a rapid and adequate response to an accident of these proportions,” adding that “containment barriers do not function adequately, the drilling of alternate relief wells takes too much time and the oil gathering technologies are insufficient. We must improve the mobilization capacity outside the company, of the armed forces, state and municipal governments and civil defense.”¹⁵ In the event of a major offshore accident, Petrobras would suffer a huge capital loss that could mean loss of its investment grade credit rating as well as that of BNDES and of sovereign risk for Brazil. Following BP’s accident in the Gulf of Mexico, the international broker Marsh reported “extreme rises” in insurance premiums in the Gulf, with “up to double” for policy renewals, despite the eagerness of insurers to invest large cash reserves. Tom Bolt of Lloyd’s of London reported that insurers of worldwide offshore energy projects have lost money for eight of the past 10 years.¹⁶

This confirms the oil industry’s vocation for big risks and big rewards. The search for oil in deep waters will continue. The remaining question is how much risk can be tolerated and contained.

The second article in this series will address problems of technology and logistics in the pre-salt discoveries.

¹ M. Carminatti, *From Turbidites to Carbonates: Breaking Paradigms in Deep Waters*. OTC 20124. May 2009.

² John Broder & Clifford Krauss, “Job Losses Over Drilling Ban Fail to Materialize,” *New York Times*. August 24, 2010.

³ Edward L. Morse, “10 Market Issues to Ponder,” presentation to the Center for Energy Economics, Houston, December 1, 2010.

⁴ Angel González, “The End of Deep-Water Drilling? Not in Brazil,” *The Wall Street Journal*. November 29, 2010.

⁵ Credit Suisse, *Petrobras: Stronger asset base, diluted investment case*. São Paulo, October 12, 2010/p9.

⁶ Petrobras, *Plan de Negócios 2010-2014*.

⁷ Raquel Landim, “BNDES negocia aporte com o Tesouro,” *O Estado de São Paulo*. September 12, 2010/B1

⁸ Cristiano Romero, “Licitação acelerada do pré-sal pode levar à desindustrialização,” *Valor*. December 6, 2010/A16.

⁹ National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling, *Deep Water: The Gulf Oil Disaster and the Future of Offshore Drilling*. Washington: January 2011/pp68 & 225.

¹⁰ National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling, *Deep Water: The Gulf Oil Disaster and the Future of Offshore Drilling*. Washington: January 2011/p122; “The Deepwater Horizon Report: The Case for Improvement,” *The Economist*. January 13, 2011.

¹¹ Russell Gold & Ben Casselman, “Far Offshore, a Rash of Close Calls,” *The Wall Street Journal*. December 8, 2010.

¹² Leslie Eaton et. al., “Inspectors Adrift in Rig-Safety Push,” *The Wall Street Journal*. December 3, 2010.

¹³ Carlos Machado de Freitas et. al., “Acidentes de trabalho em plataformas de petróleo da Bacia de Campos, Rio de Janeiro, Brasil,” *Cadernos de Saúde Pública*. Rio de Janeiro: Fundação Oswaldo Cruz, 2001.

¹⁴ Luiz Maklouf Carvalho, “Multiplicação do Perigo,” *Piauí*. Rio de Janeiro: November 2010/p26.

¹⁵ Cláudia Schuffner, “Petrolíferas precisam rever seus procedimentos, afirma Gabrielli,” *Valor*. November 17, 2010/pB1.

¹⁶ *Marsh Insights: Energy Monitor*. October 2010.