Oils are the answer

TO BE SUCCESSFUL IN EXPLORATION ACTIVITIES IN BRAZIL AND MAKE INTELLIGENT DECISIONS WITH REGARD TO ACQUISITION OF NEW CONCESSIONS, OIL COMPANIES NEED A CLEAR UNDERSTANDING OF PETROLEUM SYSTEMS. FOR **CRAIG SCHIEFELBEIN**, ONE OF THE FOUNDERS OF GEOCHEMICAL SOLUTIONS INTERNATIONAL (GSI), PETROLEUM GEOCHEMISTRY IS A FUNDAMENTAL TOOL – TOGETHER WITH GEOPHYSICS AND GEOLOGY – FOR REGIONAL EXPLORATION AND PRODUCTION PROGRAMS. ACCORDING TO SCHIEFELBEIN, A GEOCHEMIST, ONE OF THE ANSWERS CAN BE SUPPLIED BY A COMPARATIVE STUDY OF THE DIFFERENT TYPES OF OIL. "FOR US, OILS ARE THE ANSWER", HE STATES.

by **Fernando Zaider**

GEOCHEMICAL SOLUTIONS INTERNATIONAL

Founded in 1998, GSI offers the oil and gas industries geochemical technology for the exploration, production, refining, transportation and distribution of hydrocarbons. Considering the stage of the oil industry between 1998 and 1999, when the sector began opening up in Brazil, GSI was highly successful since, at the time, companies that wanted to come to Brazil were lacking information on Brazil's petroleum systems.

"We realized the market's need for geochemical support and decided to contact the ANP (National Petroleum Agency) to supply data on Brazilian sedimentary basins in order to help promote Brazil´s exploratory efforts", remarks Schiefelbein.

"Based on the principle that oils are compositional derivatives of their sources, the geochemistry of oil can be used to determine the number of sources in a particular basin and its respective stratigraphic and geographic distribution, age of the source, lithology, paleoenvironment (marine, non-marine and fluvial), thermal maturity, and quality ", he assures.

An excellent example of the power of geochemistry in defining petroleum systems is a comparison between the Brazilian sedimentary

Studies elaborated by GSI represent an important tool for an exploration company. Below are the sample locations for oil studies in the Campos, Santos and Espirito Santo basins.

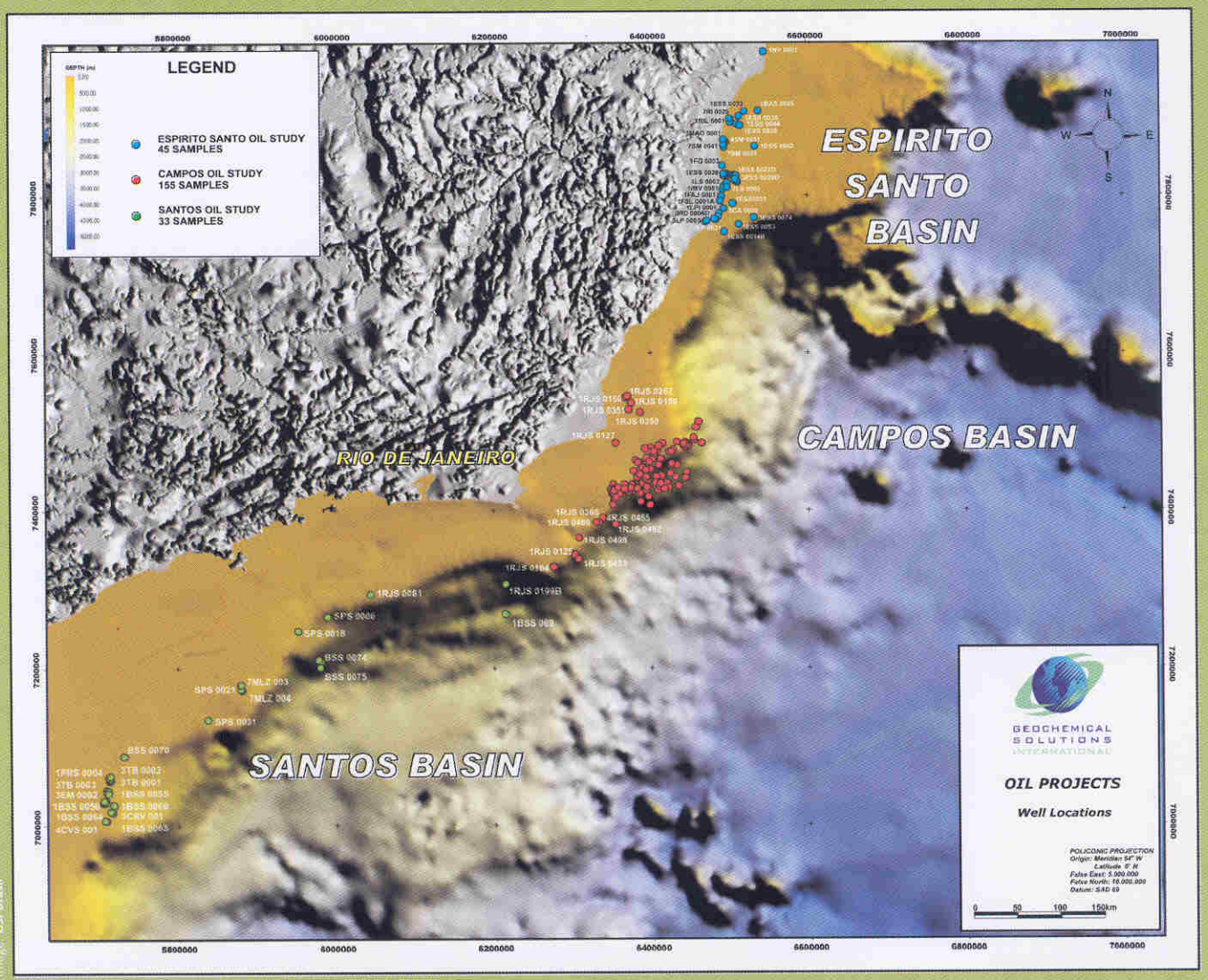


Image: GSI Brasil

basins and those of West Africa (above figure). Although geographically distant presently, these regions were adjacent at the time these important hydrocarbon source rocks were deposited. "Our studies show that various petroleum systems existing in West Africa are analogous to those on the Brazilian margin", says Schiefelbein. Considering the large volume of oil discovered off the Congo and Angola coast, there is good reason for optimism among the energy companies exploring Brazil.

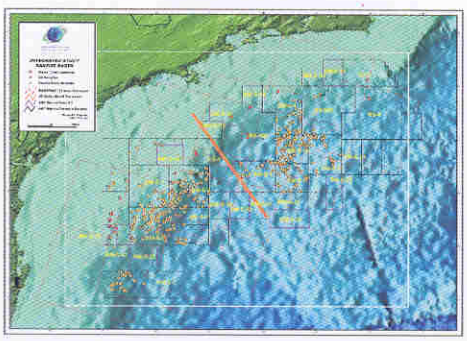
Up to now, GSI has been involved in over 25 support projects in the exploration of hydrocarbons in Brazil. In association with ANP, the company has evaluated the petroleum systems of Brazilian offshore basins in Campos, Santos, Espírito Santo, Camamu-Almada, Jequitinhonha, Recôncavo, Sergipe/Alagoas, Potiguar, Ceará, Pará/Maranhão and Foz do Amazonas. Oil samples have been classified by their physical properties (API gravity, sulfur percentage, presence of heavy metals, viscosity, decantation point and composition). Additionally, state-of-the-art techniques, such as gas chromatography, stable carbon isotopes and biomarker distributions, were used to characterize the hydrocarbon composition of the oil. Oils were grouped in families of different compositions by using statistical methods such as principal components analysis and hierarchical clustering. They were also classified according to their thermal maturity and degree of alteration.

GSI also uses other technologies to improve the concept and forecasting of the occurrence of crude oil in marginal Brazilian basins. This approach is supplemented by results obtained through other exploratory tools such as surface geochemistry and basin modeling. "Surface geochemical prospecting, which identifies oil and gas seeps using technologies such as piston coring and onshore surface geochemistry, forms a link between petroleum systems / known accumulations and the prospecting possibilities of unexplored regions", informs Adolfo (Rick) Requejo, the other founder of GSI "If oils have the answers, seeps are the fortune tellers, allowing us to predict what we might encounter ahead of the drill bit." says Requejo.

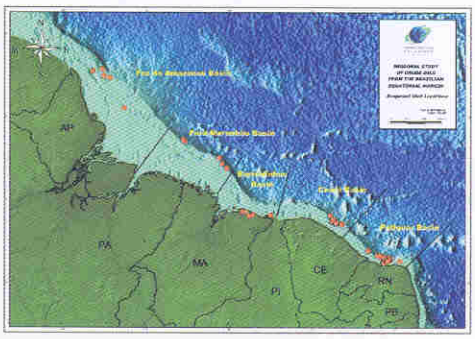
GSI has collected and analyzed approximately 3,000 soil samples and 2,000 ocean sediments from the Santos, Campos, Espírito Santo, Camamu-Almada and Sergipe-Alagoas basins to detect surface hydrocarbon seeps. These studies have identified various sites of oil and gas seepage. "Sampling oil and gas seeping at the earth's surface is like getting a subsurface sample without drilling the well," says Requejo. The materials recovered can be analyzed geochemically just like well samples to determine source characteristics and thermal history.

Also in the area of research, the company has developed an important tool that helps to predict the quality of oil based on geochemical results for over 500 samples of Brazilian oil in its data bank, which has a significant impact on the economic side of oil discoveries. "Knowing the physical properties of these oils, a regressive model can be utilized that makes it possible to predict physical characteristics from rock samples or traces of oil when there is insufficient material to measure these properties directly", explains Schiefelbein.

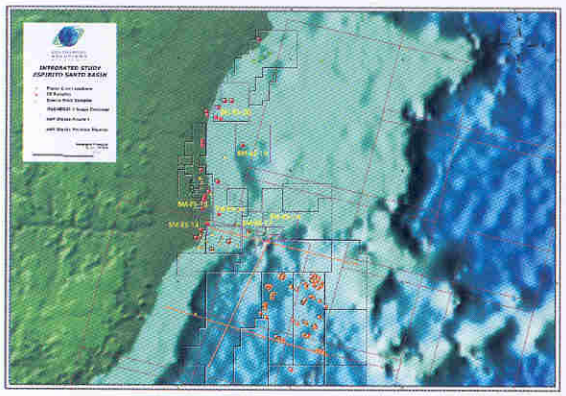
In addition to geochemical analysis, investigations of petroleum systems carried out by GSI are supported by satellite imaging analysis to identify fissures related to seepage, the heat flow along the seabed in order to define



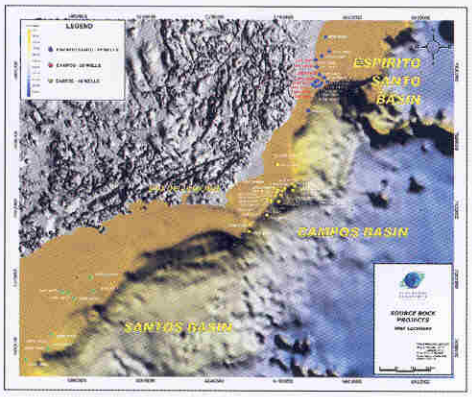
Petroleum Systems of the Santos Basin - An integrated evaluation of the petroleum systems of the Santos Basin



Characterization of crude oil from sedimentary basins on the Brazilian Equatorial Coastline



Integrated study of the petroleum systems in the Espírito Santo basin



Regional Evaluation of the potential Source Rocks from the Campos, Santos and Espírito Santo Basins

subsurface thermal regimes, and 1D and 2D modeling of basins to simulate generation and migration of hydrocarbons. "We believe the integration of these various technologies in a petroleum system context is what sets GSI apart from its competitors, and is the type of information our clients require to support their exploration efforts," Schiefelbein points out.

The energy industry appears to agree with Schiefelbein. In the short four-year history of the company, amongst the forty-odd oil operators currently stationed in Brazil, almost all of these have purchased GSI´s multi-client geochemical studies. Having participated in numerous studies, Petrobras is, by far, its major client, and Brazil its largest market. From the total number of geochemical studies conducted by GSI, 90% were undertaken in Brazil. For Schiefelbein, Petrobras´ position certainly suggests that it acknowledges the importance of investing in geochemical studies, since it intends remaining, for a long time, in the forefront of the exploration and production sector in Brazil. ■

Brain capital

GSI´s introduction to the oil market in Brazil occurred at the end of the 90´s, when the price of oil was low and oil companies, in an effort to cut costs, began downsizing, deactivating their geochemical laboratories, dismissing their specialized teams, in the belief that these cuts would generate more efficiency. This created a market niche since the demand for geochemical studies by companies continued to be very high. In addition to supplying routine technical services, GSI carried out several non exclusive, multi-client and proprietary projects to supply onshore and offshore areas in Brazil, Argentina and Cuba, amongst other Latin American countries.

"Our business model is different from other service companies", states Schiefelbein. GSI does not count on its own laboratories since data interpretation is its strong point. Depending on where it may be conducting its studies, GSI uses different laboratories in Brazil and also abroad. The company also cooperates with the Coppetec Foundation of the Federal University of Rio de Janeiro by providing support to university graduates in their research projects.

With 26 years of experience in petroleum geochemistry, chemo-metrics and data analysis, Craig Schiefelbein worked as a research scientist for the Cities Service Oil Company and for Conoco, where his main line of research was geared towards improving the understanding of oil generation and destruction processes, the results of which were incorporated in basin modeling and maturation programs. Schiefelbein was also responsible, while working for Core Laboratories, for the hydrous pyrolysis laboratory, technical services, in addition to large-scale regional studies in West Africa and South America. He was Head of Geochemistry at GeoMark Research where he developed and supervised several large-scale regional oil studies in Colombia, Peru, Bolivia, Alaska and in several basins in the Pacific region of Asia, and the South Atlantic margin.

Craig Schiefelbein

Another brain at GSI is Adolfo (Rick) Requejo, a renowned scientist in the fields of organic geochemistry, chemometrics and data analysis, who worked for eight years as a research scientist for Arco Oil and Gas and Exxon Production Research. Subsequently, Requejo was Head of Petroleum Geochemistry for the Geochemical and Environmental Research Group of Texas A & M University. . In that capacity, he supervised and developed several regional oil studies and surface geochemistry projects in the Gulf of Mexico, Russia, Trinidad, Angola, Nigeria and Brazil. He was also Vice President of InfoLogic, an American company of information systems for laboratory productivity geared towards the oil industry and services.

From the position of one who has acquired profound knowledge on Brazilian oil systems, Craig Schiefelbein has high expectations regarding the success of the Brazilian oil industry. "It's just a matter of time and combining the experiences of the several operators until the country achieves the desired success", he assures. ■