Global Plate Tectonics and its Relevance to Hydrocarbon Reserves in the Suriname-Guyana Basin

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Abstract

Over the Earth's history, the rifting of continents has produced continental margins, where sedimentary basins lie on top of a wide boundary between stretched continental crust and oceanic crustal rocks. Rifting and opening of the Atlantic was sometimes accompanied, and perhaps even facilitated by voluminous magmatism. Examples of these volcanic margins are found offshore Greenland and the eastern Gulf of Mexico. On the other hand, the rifted margins of eastern Canada and southwestern Europe formed without much mantle melting, and it is more likely that breakup of the continents was facilitated here by the infiltration of seawater along large faults into the continental mantle. The difference between volcanic and nonvolcanic mantle may be attributed to the temperature of the mantle during continental rifting. The widespread occurrence of volcanic dikes and volcanoclastic sediments around the Triassic/Jurassic boundary suggests that the margins of the southeastern U.S. and northern South America where formed when the underlying mantle was relatively hot. Marine seismic studies show that volcanic wedges with a thickness larger than 10 km formed at these margins. We need more marine geophysical data to test whether the basins that formed off northern South America, such as the Suriname-Guyana Basin, are floored by thick volcanic wedges as well. The deep crustal structure and rifting history of the margins of northern South America are probably an important factor for the maturation of hydrocarbon deposits in their sedimentary basins.

Dr. Harm Van Avendonk is a seismologist whose main scientific interest is the deep crustal structure of the Earth's crust, particularly near the plate boundaries. After he received his Bachelor's degree in geophysics from Utrecht University in the Netherlands, Van Avendonk moved to the United States to conduct his graduate studies at the Scripps Institution for Oceanography. For his PhD thesis he chose to work on active-source seismic data to understand the structure and dynamics of oceanic spreading centers. Subsequently, he studied continental margins as a postdoctoral fellow at the University of Wyoming, before he joined the science staff at the University of Texas Institute for Geophysics. He has now participated in fifteen geophysical data acquisition projects on land and at sea. In these studies he uses seismic data to investigate the structure and evolution of rifted margins, subduction zones, and mountain belts. Van Avendonk's primary expertise is in the inversion of wide-angle seismic refraction data, which can provide good constraints on the geometry and composition of the deep crust.

"UTIG – a small, nimble partner for marine geology and geophysics investigations worldwide"

James A. Austin, Jr.
Senior Research Scientist/Associate Director, International Relations

Abstract

The University of Texas Institute for Geophysics (UTIG), now part of the Jackson School of Geosciences (JSG), was founded by Maurice Ewing, the founder of Lamont-Doherty Geological Observatory, when he returned to his native Texas in 1972. UTIG started as the Galveston Geophysics Laboratory on the Gulf Coast, but moved to Austin in 1981-1982. UTIG is now one of the three units composing the JSG; the others are the Bureau of Economic Geology and the Department of Geological Sciences. Since its inception, UTIG has specialized in a broad approach to the study of the geologic evolution of the oceans. Investigations by UTIG researchers have been conducted worldwide, and include tectonic plate boundary investigations, seismic stratigraphic studies of continental margins, and more recently "rapid response" programs designed to examine the ephemeral effect of natural disasters like hurricanes and tsunamigenic earthquakes. UTIG is funded primarily by the State of Texas and federal agencies like NSF, NOAA, NASA, but more recently support from private donors has augmented these more traditional fiscal streams. UTIG researchers are always looking for new collaborations, and new types of marine investigations. And the scale of the JSG allows UTIG to augment its human scientific resources with technical and equipment capabilities unmatched in the Earth sciences in the U.S.

James A. Austin is a Senior Research Scientist/Associate Director International Relations, Institute for Geophysics (UTIG), University of Texas. Austin uses a wide variety of geophysical techniques – 2D and 3D multichannel seismic reflection (MCS) profiling, CHIRP high-resolution imaging, echo-sounding – to investigate diverse continental margin and tectonic plate boundary sedimentary and structural environments. He has worked in such environments worldwide over more than 40 years: from the Antarctic to the Arctic, and in all of the major (and some of the minor) ocean basins. He has received major funding from the Office of Naval Research, the National Science Foundation, the National Oceanic and Atmospheric Administration, and the oil and gas industry. He has also served twice as Co-Chief Scientist aboard the scientific drillship *JOIDES Resolution*, once in the Bahamas (1985) and a second time offshore New Jersey (1997). Austin has also served in various national and international community leadership positions: as head of development of the American Geophysical Union (2004-2010), as director of the scientific ocean drilling program (1994, 2004), as an advisor to NOAA's ocean exploration program (2004-2014), and as a Trustee of Woods Hole Oceanographic Institution (2007-present). His work around the world has landed him on TV, on the radio and in newspapers numerous times. Austin earned a B.A. (*magna cum laude*) in geology at Amherst College (1973) and a Ph.D. in Oceanography at the MIT/Woods Hole Oceanogfraphic Institution Joint Program in 1979. He has been at what is now UTIG for more than 35 years. Austin has spent more than 4 years at sea on 28 different research vessels, and has co-authored more than 100 peer-reviewed publications.