

## Tangguh – The First Major Pre-Tertiary Discovery in Indonesia

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Indonesia is a prolific oil and gas province in which more than 23 BBO and 150 TCFG of reserves have been discovered. Most of the hydrocarbons originate from and have been trapped in Tertiary rocks in western Indonesian basins on and offshore of Java, Sumatra and Kalimantan (Figure 1).

Throughout the 20<sup>th</sup> Century, explorers searched less successfully for major accumulations in eastern Indonesia. This eastern search was finally rewarded in 1994 when Atlantic Richfield Company (known as ARCO) discovered a super-giant natural gas accumulation in pre-Tertiary rocks in the Bintuni Basin of Papua, which was called Irian Jaya at that time.

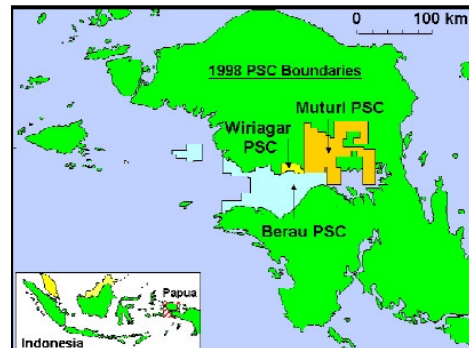


Figure 1 Location Map Tangguh

The ARCO discovery spanned Paleocene through Jurassic formations below a producing Miocene oil field called Wiriagar. The exploratory drilling of the pre-Miocene stratigraphy was justified largely by geochemistry, which showed that the oil in the field was Jurassic despite flowing from a Miocene limestone reservoir. Analysis of pressures in the discovery well indicated that the height of the gas column exceeded 2000 feet, making the gas accumulation potentially large enough to justify construction of a Liquefied Natural Gas (LNG) plant. From 1994 to 1998, ARCO farmed into adjacent acreage containing the majority of the discovery's hydrocarbons, improved commercial terms through negotiations with the Indonesian government, appraised the initial well, identified and discovered two nearby gas fields, shot an extensive 3D onshore and offshore seismic program, and worked with an engineering firm to certify 24 trillion cubic feet of natural gas as reserves (14.4 certified as proved; the rest as probable and possible). These reserves are the basis for what the Indonesian government designated in 1997 as the Tangguh LNG Project. Tangguh was the third largest discovery in the history of ARCO, exceeded only by the Prudhoe Bay and Kuparuk River Fields found in the 1960s on the North Slope of Alaska. Tangguh is also the first major pre-Tertiary hydrocarbon discovery in the history of oil and gas exploration in Indonesia

The discovery and appraisal of Tangguh was an intricate web of technical and commercial analyses, insights, and decisions whose interplay is a fascinating case study in how a modern, multidisciplinary, globally dispersed exploration team operates (Figure 2).

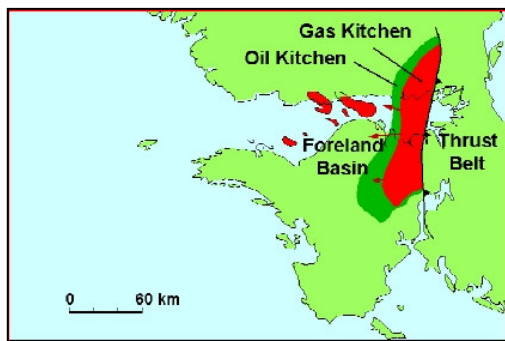


Figure 2 Petroleum System Tangguh

Numerous individual initiatives ranging across petroleum geochemistry, drilling cost reduction, government relations, reservoir pressure analysis, negotiating strategy, porosity prediction and the like turned out in hindsight to be crucial in their accuracy and timing to keeping the project technically viable and commercially attractive. Since Tangguh is so recent, the thoughts and actions of the involved individuals and the linkage and details of successive events can be and have been precisely recorded. This talk will tell the story of the exploration team that discovered Tangguh.

## Speaker Biography

James D. Robertson received a B.S.E. in civil and geological engineering from Princeton University in 1970, and a Ph.D. in geophysics from the University of Wisconsin in 1975. While at Wisconsin, he worked on geophysical and glaciological studies of Antarctica, and spent three field seasons in Marie Byrd Land and on the Ross Ice Shelf as part of the U.S. Antarctic Research Program.

Robertson joined Atlantic Richfield Company (known as ARCO) in 1975, and over a twenty-five year period held various technical and management positions including director of geophysical research, geophysical manager of the offshore Gulf of Mexico exploration group, geoscience operations vice president of ARCO's Lower 48 division, chief geophysicist of ARCO's international division, and exploration vice president of ARCO's international division. After retiring from ARCO in 2000 following ARCO's merger into BP, he founded Rannoch Petroleum LLC, an independent petroleum consulting company based in Fort Worth, Texas.

Robertson has been active in various geological and geophysical societies and was the 1994-95 President of the Society of Exploration Geophysicists. He has been an SEG Distinguished Lecturer, Technical Program Chairman of the SEG Annual Meeting, and an instructor in 3D seismic interpretation in the SEG Continuing Education Program. He received SEG's Best Paper award in the magazine *Geophysics* in 1985 and SEG's Best Paper at the SEG Annual Meeting award in 1979 and again in 1983. He served on the Board of Directors of the Offshore Technology Conference from 1998-2002. He is a past president and honorary member of the Dallas Geophysical Society, and was a founding member of the Fort Worth chapter of SIPES (Society of Independent Professional Earth Scientists) in 2001.



He currently serves on the advisory boards of the geology and geophysics departments of Princeton University and the University of Wisconsin, and previously has been on the geophysics advisory board of the Colorado School of Mines.

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