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Wildcat Recollections

Analysis, Guts Trump Paralysis

Previous Wildcat Recollections Columns

By JAMES D. ROBERTSON
(with MARLAN W. DOWNEY)

Editor's note: Robertson retired on June 1st, after 25 years with Arco, the last 10 as an exploration executive in Arco's international division.

Graphics courtesy of James Robertson/Indonesian Petroleum Association

Click on graphic to see closer detail.

Indonesia is a prolific oil and gas province with discovered reserves of more than 23 BBO and 150 TCFG. Most of the reserves originate from Tertiary source rocks and are trapped in Tertiary reservoirs on or immediately offshore of Java, Sumatra and Kalimantan.

Though these western areas have been the main focus of the country's petroleum activities, explorers have searched for giant accumulations in eastern Indonesia for more than a century.

In Irian Jaya, Trend Exploration discovered about 350 MMBO of Miocene-sourced oil in Tertiary reefs in the Salawati Basin during the 1970s. Phillips, Conoco, Total and Occidental subsequently tried to emulate Trend's success by exploring the adjacent Bintuni Basin, but found only a small (3 MMBO), shallow onshore oil field called Wiriagar in 1981 and some uneconomic offshore gas in the early 1990s.

Arco entered Irian Jaya in 1989 by farming into a Conoco-led partnership holding an onshore block called KBSA on the northern side of Berau Bay. Gene Richards, Arco Indonesia's exploration vice president, executed the original farm-in as an opportunity to explore for large reserves in a frontier area where Pertamina had recently instituted improved fiscal terms.

Two dry holes were drilled in 1990, and Arco faced a decision -- to drop out of the Petroleum Service Contract (PSC) and exit Irian Jaya, or to continue exploration in the Bintuni Basin.

Looking Deeper

Arco's new ventures exploration manager in Indonesia was Dick Garrard, who had joined the

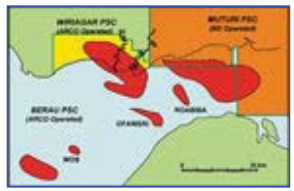
company's Jakarta office in 1989. Working with him was a team comprising Larry Casarta, Sonny Sampurno and Suherman Tisnawidjaja.

This group performed two critical analyses that convinced Arco not to relinquish its position:

1. The first was Casarta's interpretation of some old KBSA seismic data, which hinted at a pre-Tertiary structure below the shallow Wiriagar oil field.
2. The second was a new geochemical evaluation of the Wiriagar oil, which showed that the oil was from a Jurassic, not Tertiary source.

Combined with the knowledge from well control that the Jurassic Roabiba sandstone pinched out from south to north across the Wiriagar area, the two analyses suggested that there could be a hydrocarbon-bearing structural/stratigraphic trap at Jurassic level below the shallow Wiriagar field.

The prospect was christened Wiriagar Deep.



The team convinced Arco's international exploration executive management, Marlan Downey and Jamie Robertson, of the merits of their analyses and hypothesis, and Arco stayed in the play.

Overcoming Obstacles

Arco approached the rest of the KBSA partnership in late 1991 with a recommendation to jointly drill a deep test (Wiriagar Deep No. 1) on the Wiriagar structure.

The partners, who had already spent $145 million on the block, declined the proposal. Arco was unwilling to carry the other partners in a deep test despite the attraction of retaining KBSA's sunk cost pool, and no deal was reached among the group.

Arco's commercial manager in Jakarta, Thorkild Juul-Dam, then developed an economic case for a new PSC, aided by drilling manager Brett Crawford's analysis that the deep well could be drilled for much less than operator Conoco's cost estimate. The KBSA PSC expired, and Arco began discussions with Pertamina for a new PSC.

Crucial to these discussions were Roger Machmud, president of Arco Indonesia, and Larry Asbury,

operations corporate vice president. Machmud and Asbury entered into serious negotiations with Pertamina in June 1992.

A new onshore Wiriagar PSC covering the deep structure and incorporating newly revised frontier incentives was signed in February 1993. Kanematsu joined Arco as a partner in the block. With help from Richard Leturno of drilling operations, petrophysicist Tony Lawrence and reservoir engineer John Marcou, Wiriagar Deep No. 1 was successfully drilled, logged and tested at 30 MMCFPD in August 1994.

The well was initially disappointing, as it was not an oil discovery.

However, a thoughtful analysis of pressure data by Larry Casarta and John Marcou indicated that the gas zones were significantly overpressured, and that a gas column height in excess of 2,000 feet was a reasonable interpretation of the data.

In other words, the discovery could be large enough to anchor an LNG project even if there was no downdip oil leg below the gas.

Tom Velleca, Arco corporate vice president of exploration, encouraged by chief geologist David Nicklin and chief geophysicist Barry Davis, decided to move ahead with appraisal of the Wiriagar Deep discovery -- but there was a commercial obstacle. If Casarta and Marcou were right about the size of the accumulation, much of the field lay to the south on the offshore Berau PSC held by an Occidental-led partnership.

Brad Sinex at Arco International's headquarters in Plano, Texas, took charge of the negotiations with Occidental and worked a farm-in to the Berau Block aided by Thorkild Juul-Dam in Jakarta. Oxy had already spent $64 million on the Berau PSC and had an additional $8 million work obligation.

Sinex was able to secure a 60 percent working interest for the Arco/Kanematsu group and operatorship for Arco in February 1995 in return for funding the drilling of a well. Offshore appraisal subsequently demonstrated that the Wiriagar anticline was indeed a large gas-bearing structure.

Geophysicist Stephen Scott joined the exploration team in December 1994. In addition to producing the maps on which the Wiriagar Deep appraisal locations were selected, Scott worked with Casarta and Sampurno to refine the regional geological picture. Previous Total, Occidental and Arco maps had contoured some small closures to the east of Wiriagar.

Scott put all the regional data together, and conceived that the closures could be part of one large anticline parallel to and immediately east of the Wiriagar fold. The new closure was named Vorwata.

Vorwata had a potential technical problem: At Jurassic level, it was several thousand feet deeper than the Wiriagar anticline, and generally accepted wisdom was that porosity would be low and reservoir quality poor.

John Duncan became exploration VP of Arco Indonesia in 1992, and in addition to managing the Indonesian exploration program was also a technical expert on burial history analysis. Recognizing that there might be a more optimistic scenario for Vorwata Jurassic reservoir quality, Duncan consulted with Alton Brown of Arco's geoscience technology group in Plano.

Brown analyzed burial history, facies controls and diagenesis, and concluded that conventional wisdom was wrong and reservoir quality would be fine.

That analysis gave Arco the confidence to push Vorwata as a viable drilling target to expedite certification of gas reserves. Vorwata No. 1 was drilled in late 1996, Brown's porosity prediction was exactly correct, and the well tested at 31 MMCFPD in January 1997.

Subsequent appraisal confirmed that Vorwata was a significant gas accumulation. The Wiriagar Deep/Vorwata complex, together with satellite gas accumulations, has now been named Tangguh by the Republic of Indonesia.

After 25 wells, 500 pressure measurements, more than a mile of cores and a 3-D seismic survey, DeGolyer & MacNaughton in mid-1998 estimated Tangguh to contain at least 24 TCF of reserves.

Lessons Learned

So what are the lessons of this super-giant gas discovery?

- Perhaps -- That it is very hard to be optimistic and aggressive when you are burdened with past exploration failure costs.
- Perhaps -- Having acreage is nice, but knowing what is on acreage is even more useful.

- Perhaps. -- Proper analysis of pressure data is immensely valuable in exploration.
- Perhaps -- Understanding geochemistry is as important as understanding geology and geophysics.
- Perhaps -- The technical and commercial expertise of team members really makes a difference when applied at the proper moment in the history of a play.

And is that the way it happened?

Well, that's our recollection.

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