

Vernon Field — Waking a Sleeping Giant in North Louisiana

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EXTENDED ABSTRACT

From humble beginnings as a sub-commercial gas discovery in 1980, the Lower Cotton Valley pool at Vernon Field in Jackson Parish, Louisiana, has emerged as one of the top giant gas fields of the past decade, with more than 300 producing wells and proven reserves in excess of 1.8 trillion cubic feet (TCF) of gas. Along the way, at least five different operators recognized its potential, but for various reasons did not fully develop it. The field did not reach its full potential until after a more favorable product price environment developed, but provided a number of hints of its promise after only a relatively few wells were drilled during its initial development period.

Upper Cotton Valley Cadeville production had been established in the area as early as 1967, with nine Cadeville tests drilled in the vicinity of the field by 1979. Respectable production from Lower Cotton Valley sands had been established at Bear Creek Field to the West in 1967, and in 1979 Amoco had encountered tight Lower Cotton Valley sands at a southern outpost of Clay Field to the North. Anschutz sited the Davis Bros. Lumber #1 well in Section 20, T. 16 N., R. 2 W., as a Cadeville test with an exploratory tail to the Lower Cotton Valley in late 1979. The Cadeville proved non-productive, but the discovery well encountered shows in the Lower Cotton Valley and flowed 427 thousand cubic feet of gas per day (MCFD) from unstimulated “Bossier” perforations @ 12,905-920 ft. The well produced 44.7 million cubic ft (MMCF) of gas over the next two years prior to abandonment in 1981.

Crystal Oil & Gas saw potential in the Anschutz test and by 1982 had assembled a sizeable acreage position within the Vernon area. From 1982 through 1984, they drilled and completed twelve Lower Cotton Valley producers. Crystal found that, when stimulated, these tight sandstones could produce gas at respectable rates, reaching potentials as high as 6 MMCFD. Furthermore, the impressive pay thicknesses encountered could flow at relatively high sustained rates for many years. Field gas production remained rather modest, however, reaching a peak of only 50 MMCFD in 1984, and as product prices dropped in the mid-1980s, expensive CO₂ fracture treatment costs severely impacted project economics. Only two additional wells were drilled in 1994 by Crystal before they divested to Apache in 1995. Apache drilled three additional wells between 1996-97, and concurrently Union Pacific Resources acquired an acreage position to the east of established production and drilled three Lower Cotton Valley wells there. Both companies were discouraged by the results of their efforts and sold out of the field in 1999 (Fig. 1). By the end of that year, daily gas production had fallen to 8 MMCFD. Estimated ultimate recoveries ranged between 2.3-9.9 billion cubic feet (BCF) of gas per well, with a truncated mean (sampled between P₁ & P₉₉) of 7.12 BCF/well (Fig. 2).

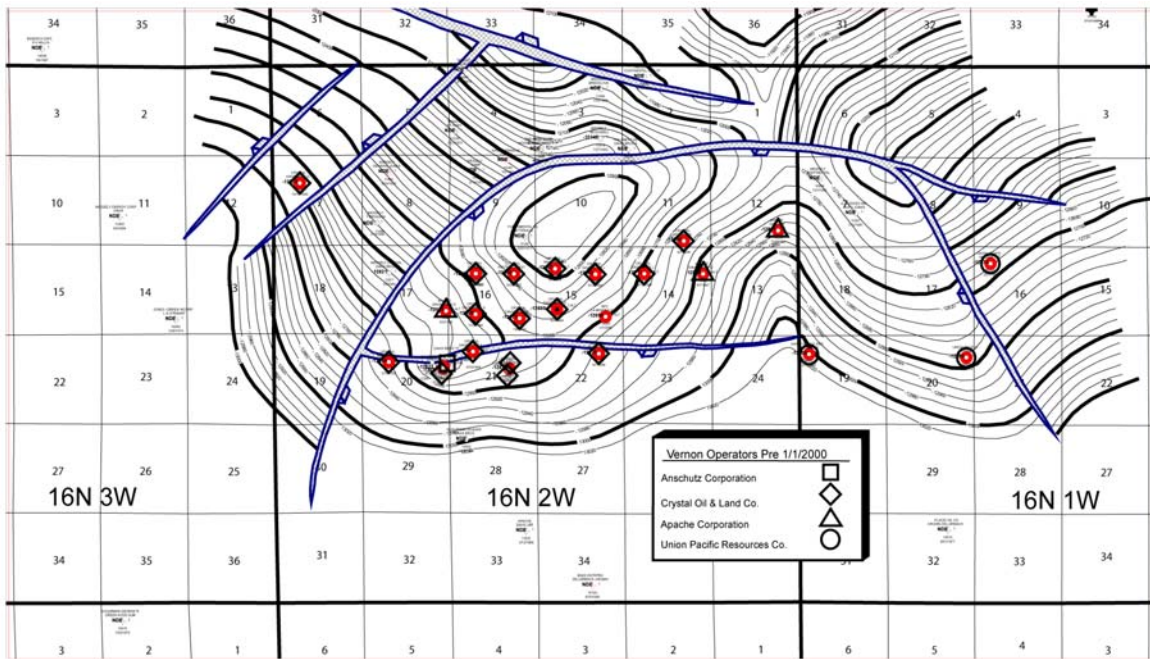


Figure 1. Vernon Field structure and status after its first development phase (1999). Note that the crest of the structure appears to have been undrilled at this time.

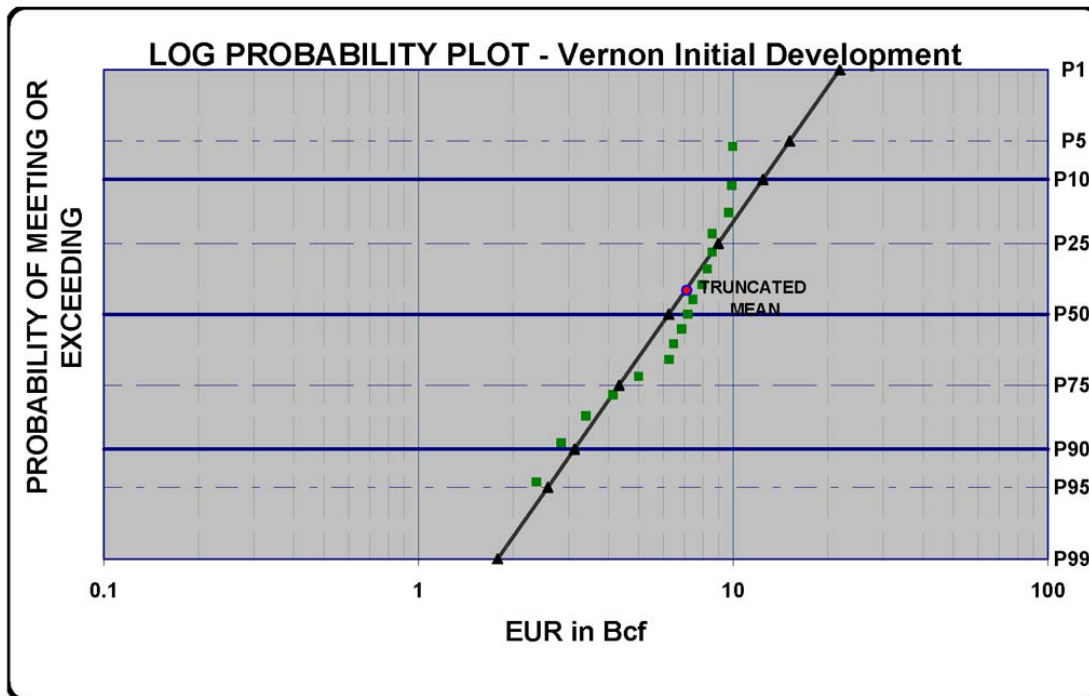


Figure 2. A cumulative probability plot of the first 17 Lower Cotton Valley wells drilled in the field. Estimated Ultimate Recoveries (EURs) ranged from 2.3 to 9.9 BCF/well, with a mean of 7.12 BCF/well.

Improving product prices and success in developing the Bossier Sand resource in the East Texas Basin led Anadarko Petroleum Corporation to evaluate the Vernon Field in late 1999. Though existing 2-D seismic quality was plagued by multiples and short offsets, a few seismic lines hinted at divergent dips and additional events downthrown to a major field-bounding fault. This fault appeared to have a greatly expanded producing section on its downthrown block. Anadarko projected 10 proved undeveloped locations and an additional 48 probable locations within the field area, assuming downspacing from 160 acres to 80 acres. The field's ultimate gas recovery was estimated at 50 BCF. It appeared that the structural crest of the field remained untested, and more significantly, that there was no appreciable water produced from downdip wells.

After acquiring the field in late 1999, Anadarko consolidated its acreage position and drilled a moderately successful pilot program to test the field's potential. With pilot success, drilling progressed to the south to test the downdip limits of the field. A free water contact was not found, but it soon became evident that the degree of faulting within the field was much higher than the existing 2-D seismic grid suggested. A number of wells were drilled to the south of the original field development before it was discovered that a second major syndepositional fault was present that significantly expanded the youngest field pay section there. A 110 square mi 3-D survey was sanctioned on the premise of effective siting of well trajectories, which led to a much improved structural and stratigraphic picture of the field (Fig. 3).

From an inauspicious beginning of 17 wells and 8 MMCF of daily gas production at the beginning of 2000, the field now consists of over 300 wells on 40-acre spacing, with proven gas reserves exceeding 1.8 TCF. Field gas production peaked at 350 MMCFD in 2004 (Fig. 4), and currently has stabilized around 260 MMCFD under ongoing infill development and field extension. A cumulative probability plot of 173 wells – those with an adequate production history for a reliable estimate of estimated ultimate recovery of gas shows a truncated mean of 7.36 BCF – little changed from the 7.12 BCF mean for the initial 14 wells (Fig. 5). However, the range of outcomes is now 1.43 BCF/well to 27 BCF/well. The resource distribution has remained essentially the same since the field's initial development; the high and low ends of the distribution were simply not sampled by the 17 wells of the initial program.

Though improved product prices certainly aided in the field's full development, improved operations efficiencies significantly reduced capital costs. This allowed a more aggressive development program, which not only significantly improved the project's net present value through production acceleration, but also provided more chances to sample the high end of the reserve distribution, where the majority of this project's value lies.

ACKNOWLEDGMENTS

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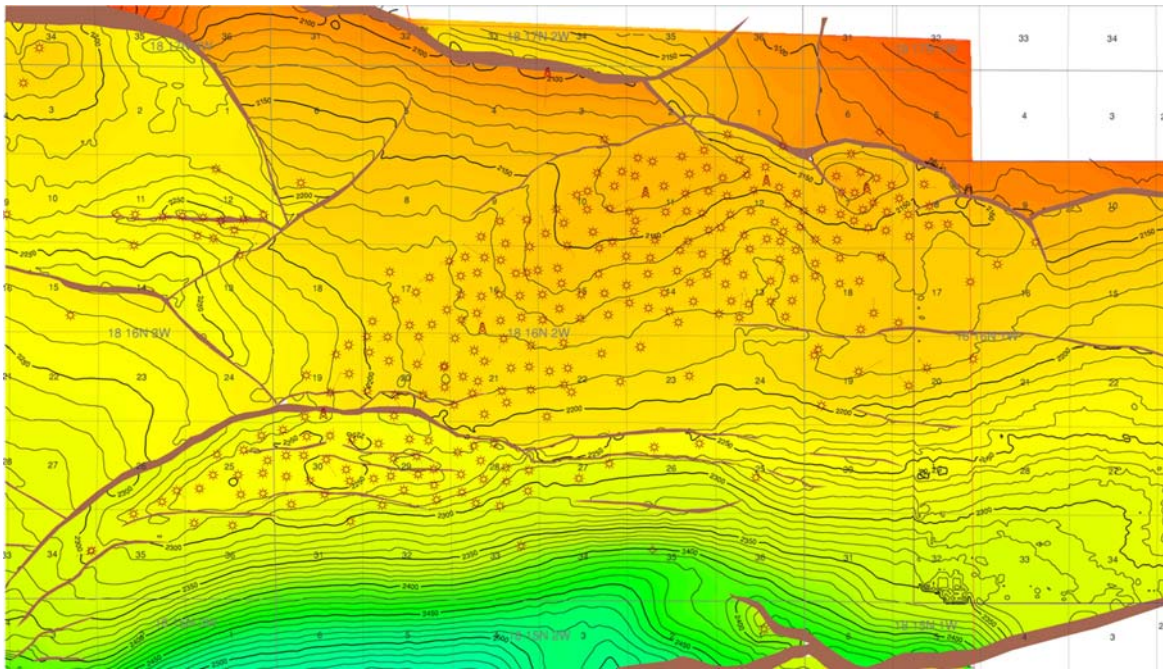


Figure 3. Present-day structure map of Vernon/Ansley field area, based on 3-D seismic, showing a much improved structural picture of a nearly fully developed field.

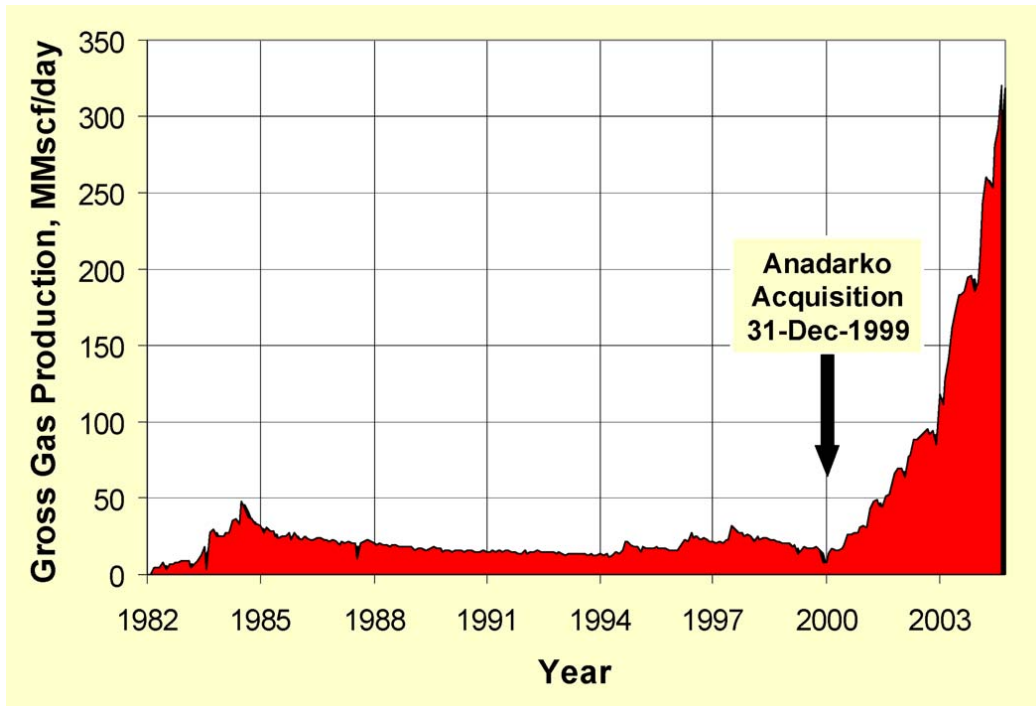


Figure 4. Daily gross Lower Cotton Valley production versus time through 2004. Gas production peaked at 350 MMCFD in 2004 and is currently stabilized at 260 MMCFD under ongoing infill development and field extension.

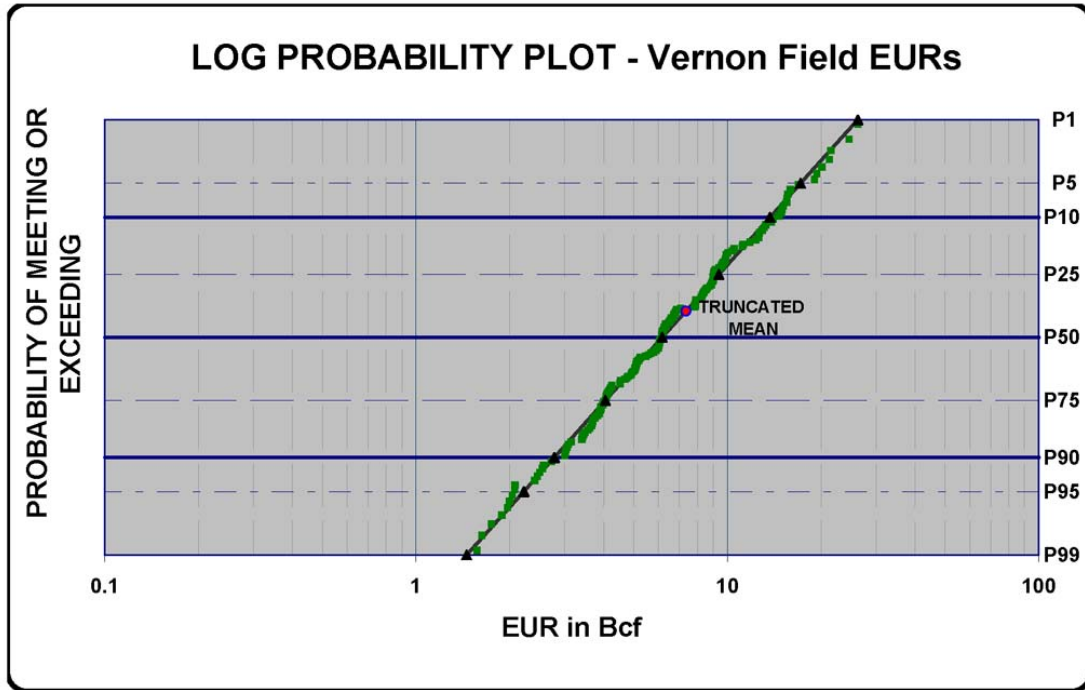


Figure 5. A cumulative probability plot of the 173 Lower Cotton Valley wells for which there exists adequate production history for EUR prediction. The resource distribution has remained essentially the same since the field's initial development (see Figure 2), with a mean of 7.35 BCF/well. However, the range of outcomes is now 1.43-27 BCF/well.