

The Next El Dorado

by Neville M. Henry

The Northern Paradox Basin, Utah

After searching the world for more than 30 years and having had a taste of discoveries in a number of basins worldwide, at first it seems surprising to be introduced to such an attractive play here in the United States that has had little exploration. The basin has produced more than 1 billion barrels equivalent, and it has multiple reservoirs, proven source rocks, moderate operating conditions and access to production pipelines. So what are we doing with a \$60 oil price and predictions of \$20 gas this winter?

The hardest question to answer is, "why this has not been played in a serious fashion?" Finding oil or gas is really a combination of technical analysis, imagination and ideas, but it is more about having the courage to be the first to test those ideas. Many times over, explorationists have reported seeing great plays, but fear driven by politics, corporate directives, killer phrases, high costs or the potential negative impact on their career if they are wrong, get in the way. That is why there are still many great opportunities for new ideas in old areas.

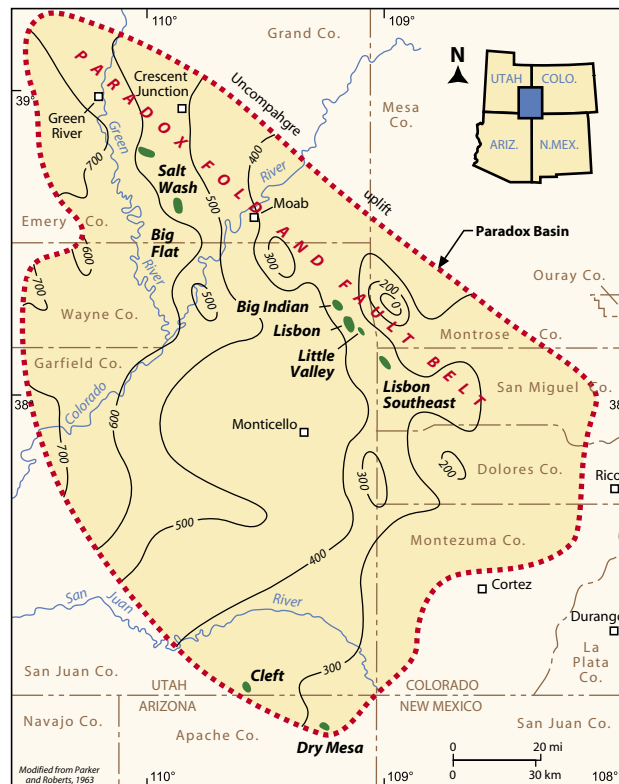
The Play

The Northern Paradox basin is in the southeastern part of Utah, in the Four Corners region of the United States. After Nevada, Utah is acknowledged as one of America's best jurisdictions for exploration and development and low state and federal royalties.

The basin is asymmetrical, dipping toward the north into a large, basement uplift. The depositional sequence is composed of dominantly carbonates, shales and evaporites. Production is primarily associated with Mississippian and Pennsylvanian carbonates. The Mississippian carbonate and deeper Cambrian production comes from secondary porosity as a result of post-depositional exposure, with fractures and thermal alteration enhancing productivity. The Pennsylvanian production comes from a series of algal mounds that developed along a series of old WNW-ESE-trending shelf margins that faced a shallow marine evaporitic basin. Each cycle of the Pennsylvanian commences with a dark, organically rich shale with source potential. The evaporites and fine micritic carbonates produce the seal.

The Paradox Basin is richly productive with estimated recoverable reserves of more than 1 billion barrels of oil equivalent in 171 fields principally south of the salt-related fold and fault trend that somewhat parallels the uplift margin. The two largest fields:

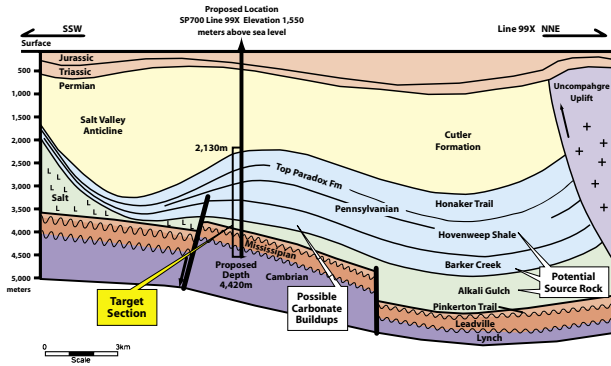
- The Lisbon Field, with a cumulative production to date of approximately 700 billion cubic feet (Bcf) of gas and 52 million barrels of oil (MMbo) plus 10 million barrels of condensate from Mississippian reservoirs; and
- The giant Aneth Field (385 MMbo and 343 Bcf of gas) from Pennsylvanian carbonates.



I have only recently been introduced to the basin, and when I read the early reports and checked on a few wells it became apparent that a common geological model for the basin had a fundamental problem. Published cross-sections show the northern basin adjacent to the Uncompahgre uplift to have a thick arkosic alluvial fan and molasses-type deposits derived from the uplifting basement, which extended south from the uplift to the fold and thrust belt. Wells along the northern margin did contain significant arkose. However, the principal Pennsylvanian section, with source rocks that are currently capable of generating wet gas, is present beneath the Uncompahgre.

Composite-type structures that are cored by basement-involved fault blocks with structural components and size that are similar to the large Lisbon Field to the south. The Lisbon Field has a three-way closure against a large basement-involved fault, and its pay section is more than 300 feet thick. Lisbon has estimated ultimate reserves reported of more than 1 trillion cubic feet equivalent (Tcfe). At 2005 prices, this equals a gross cash flow of more than US\$12 billion.

In addition, there are large Pennsylvanian structures induced by salt withdrawal overlying the early fault trap, which contains a thick prospective Pennsylvanian section similar to that encountered in the giant Aneth Field, and recent seismic has identified multiple potential algal type anomalies in the section.



Prospect Sizes and Risks

Structures with areas of up to 5,000 acres (2,000 hectares, or 20 square kilometers) with multiple target horizons commencing from a depth of 7,500 feet down to some 18,000 feet have been identified using new and reprocessed 2D data. Targets include multiple carbonate zones within 4,500 feet of Pennsylvanian (upper carboniferous) section plus 800 feet of deeper Mississippian (lower carboniferous). Secondary targets are Jurassic sands where gas may have migrated along the uplift margin. The reserve potential is certainly very large, with an upside to 3 Tcfe for the largest prospects. Nearby well data and seismic information indicate a potential total gross reservoir section of more than 1,000 feet with 11 target pay zones.

Both structural and stratigraphic traps in this location were formed early in the history of the Paradox Basin and thus have been in place to capture migrating hydrocarbons for more than 100 million years. Given the tectonic activity in the area, it is possible that during this time the traps have been breached or partially breached on occasion. However, the section is estimated to have been in the hydrocarbon generation window for much of the past 65 million years and is still considered to be capable of generating wet gas and therefore still able to charge the structures. A few wells have been drilled, most of which can be demonstrated to be drilled off structure, and most have shown indications of residual hydrocarbons in the prospective section. The traps are likely to be sealed by salt and micritic carbonates.

Economic Potential

The area is well serviced by county roads and within proximity of the Williams 26-inch Northwest gas pipeline, with ample current excess capacity for up to 100 million cubic feet of additional gas per day.

Drilling costs will account for the bulk of any development program cost, since the cost of processing equipment, connection pipe work and tap fee are modest. A discovery could be rapidly commercialized, with cash flow expected within four to six months of success.

Who Is Exploring

In a previous article (*World Energy Monthly Review*, August 2005) I wrote about a U.S. explorer going Down Under for big plays. Surely, then, it is appropriate for an Australian explorer (namely, Golden State Resources) to team up with a long-time play generator in the Rockies (namely, Eclipse Exploration) to find a way to drill one of these. "No worries," said John Hasleby, Golden State's exploration manager. "Aussies have been explorers in some way all their lives. Maybe we will be the ones to find the lost 'black' gold in this neighborhood."

Ranking

Technical Risks:



- Structure could use some 3-D, but large structures are present.
- Source rocks and seals are present.
- Traps, oil generation and timing are good (some breaching risk, but it is offset by refill).
- Reservoir, carbonates are always tricky to predict.

Commercial/Political Risks:



- No major development issues; however, well costs to 18,000 feet are significant and good flow rates will be the most important issues.

Impact Potential:



- A major discovery in this area will result in a resurgence of exploration for a multitude of plays along the northern Paradox Basin Margin that would include sub-thrust traps, fault block traps and salt-induced traps.

Overall Ranking:

This prospect receives a total of 11 out of a possible score of 15. She's a big beauty, mate.

Neville M. Henry is an independent consultant and contributor to *World Energy* magazine with more than 30 years of successful exploration and production experience worldwide. He has held positions with UNOCAL and Marathon, senior positions with Trend Exploration (Adobe) and Anadarko and has been associated with significant exploration discoveries in Southeast Asia, Australia, North Africa, the North Atlantic as well as North and South America.

Mr. Henry has undertaken technical work on the area as a consultant but has no financial interest in the play.