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THE GEOLOGY AND RESERVES OF HAWK POINT OIL FIELD CAMPBELL COUNTY, WYOMING

by

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INTRODUCTION

Hawk Point Field is located in the central part of the Powder River Basin, 20 miles south of Gillette and about 50 miles east of the structural axis of the basin (**Figure 1**). The field was discovered by Total Petroleum in July, 1986. Since The Hawk Point Federal #41-30 discovery well was drilled in section 30, T.47N., R.72W. (**Figure 2**), Total Petroleum has completed four additional producing wells and Exxon Corporation has completed three additional producing wells in the field. Production is from the "B" sand cycle of the upper Minnelusa Formation. Hawk Point Field is significant among other Minnelusa fields because it is currently the most southwesterly major field in the Minnelusa trend and it is the field with the deepest Minnelusa production on the eastern flank of the Powder River Basin. The Hawk Point discovery has spurred interest in extending the productive Minnelusa trend even farther to the southwest. Occidental USA, Incorporated successfully bid $1,100 per acre for a lease about 1 mile southwest of Hawk Point Field at the U.S. Bureau of Land Management's lease sale in August, 1988.

STRATIGRAPHY AND STRUCTURE

The Early Permian upper Minnelusa Formation in and around Hawk Point Field is characterized by a cyclic series of regressive, mainly eolian, sandstones and transgressive dolomites with some evaporites. The upper Minnelusa Formation in the Hawk Point Field area has been informally divided into "A", "B", and "C" sand intervals in descending order (George, 1984). Wells in Hawk Point Field generally show examples of all three sand intervals. Only about 200 feet of the upper Minnelusa Formation is usually logged because the "B" sandstone of the "B" sand interval is the target in the field. The wells usually bottom in the "B" dolomite or the upper part of the "C" sandstone (**Figure 3**).

The upper part of the "C" sandstone in Hawk Point Field and the immediate vicinity can be described generally as tightly cemented eolian sandstones. One well, the Ickes #32-30 logged an 80-foot section of "C" sandstone (**Figure 3**, section B-B'). The log from this well clearly shows two stacked dune sequences separated by an interdunal carbonate and evaporite deposit.

The transgressive "B" dolomite is mainly marine dolomite with a thickness of up to 60 feet in the area, but it thins to about 25 feet to the southeast (**Figure 3**, section A-A'). The "B" sandstone is the producing unit in the field and is mainly stacked eolian dune sandstones. The stacked dunes are often separated by interdunal carbonate and evaporite deposits similar to the example in the "C" sandstone. Logs from the Ickes #32-30 and the Hawk Point Federal #12-29 wells (**Figure 3**) show good examples of the stacked dunes of the "B" sandstone separated by interdunal deposits. The structure on top of the porous "B" sandstone (**Figure 4**) shows a nearly circular shape with a slight northwest to southeast elongation. The circular shape suggests that the "B" dune sands

were reworked when the seas transgressed across the dunes and deposited the "A" dolomite. The reworking of the "B" dune sands was responsible in part for the porosity development in the "B" sandstone reservoir. The isopachous map of the porous "B" sandstone (**Figure** 5) shows a dome-shaped configuration for this sandstone. This shape also suggests reworking of a sand dune deposit. The tite "B" sandstone consists of deposits that were not reworked or were more tightly cemented.

The "A" dolomite forms the trap for the oil in Hawk Point Field and is mainly interdunal and marine carbonates with some evaporites. The "A" sandstone thins over the thicker "B" sandstone pay zone in Hawk Point Field and is tightly cemented. Once again, this sandstone probably is a regressive dune. In most cases the "A" sand interval has thickened off structure to fill in low points above the "B" sandstone (**Figure** 3); however, the Viking Federal #2 lacks the "A" sand interval and the lower Opeche Shale in this well may be an eroded "A" sand interval.

The Late Permian Opeche Shale extends across the field area and fills the low spots on the Minnelusa surface. It is principally reddish brown anhydritic shale and siltstone. The isopachous map of the Opeche Shale (**Figure** 6) shows a thin area of Opeche through the productive area of Hawk Point Field with the same trend as the structural high on the porous "B" sandstone. There are also three dry holes within the thin Opeche Shale trend; however, no producing wells have more than 47 feet of Opeche in them. In the case of all three of these dry holes, the top of the porous "B" sandstone is below the oil/water contact. The "A" sand interval has thickened in each case and filled in the low spots on top of the "B" sandstone surface, thus requiring less Opeche to fill in low areas. Thin Opeche over structurally high "B" sandstone with an overlying thin "A" sand

interval looks exactly like thin Opeche over structurally low "B" sandstone with an overlying thicker "A" sand interval. This makes it hard to define prospective areas from seismic data.

The Minnekahta Limestone was deposited over the Opeche Shale and maintains a nearly constant thickness throughout the field area (**Figure 3**). This constant thickness suggests little or no relief on top of the Opeche Shale at the time of deposition.

PRODUCTION

Production at Hawk Point Field is mainly oil of good quality, which ranges from 37.9 to 39.1 degrees API gravity, and the field also produces a fair amount of associated combustible gas. Through September, 1988, the eight producing wells accounted for 1,222,520 barrels of oil and 245,953 thousand cubic feet of gas (**Table 1**). Estimated primary recovery for the field is 2,340,000 barrels of oil. Secondary and possible tertiary recovery operations at the field could more than double primary recovery and would make Hawk Point an important producing field for many years to come.

Table 1. Production from wells in Hawk Point Field (Petroleum Information, 1988).

Well	Completion date	Cumlative (barrels)	Cumulative (MCF)
Hawk Point Federal #34-19	11/86	138,852	23,698
Kluemper Federal #1	1/87	339,063	61,440
Kluemper Federal #2	6/87	64,020	26,699
Hawk Point Federal #12-29	12/86	88,336	15,636
Viking Federal #1	1/87	133,156	28,881
Hawk Point Federal #41-30	7/86	299,765	58,077
Ickes #31-30	8/86	44,700	8,507
Ickes #42-30	10/86	114,628	23,015
TOTAL		1,222,520	245,953

OIL RESERVES

Recoverable barrels of primary oil were calculated for the field by using reservoir parameters from **Table** 2 and a planimeter to measure the acres of porous "B" sandstone above the oil/water contact.

A recovery factor of 15 percent yields recoverable primary oil for the field of 2,340,000 barrels of oil. Each percentage change in the recovery factor equates to 155,000 barrels of recoverable oil.

Table 2. Reservoir parameters for Hawk Point Field

Average pay thickness - 42 feet

Average feet of pay with porosity of 10 percent or greater - 42 feet

Average porosity from sonic logs - 14 percent

Gravity of oil - 37.9 to 39.1 degrees API

Oil/water contact - 6553 feet below sea level

Productive area - 570 acres

Estimated recovery factor - 15 percent of original oil in place

Cumulative production - 1,222,520 barrels of oil (9-31-88)

Estimated primary production - 2,340,000 barrels of oil

REFERENCES

George, G.R., 1984, Cyclic sedimentation and depositional environments of the upper Minnelusa Formation, central Campbell County, Wyoming: Wyoming Geological Association 35th Annual Field Conference Guidebook, p. 75-95.

Petroleum Information, 1988, Wyoming monthly production report, p. 1066.

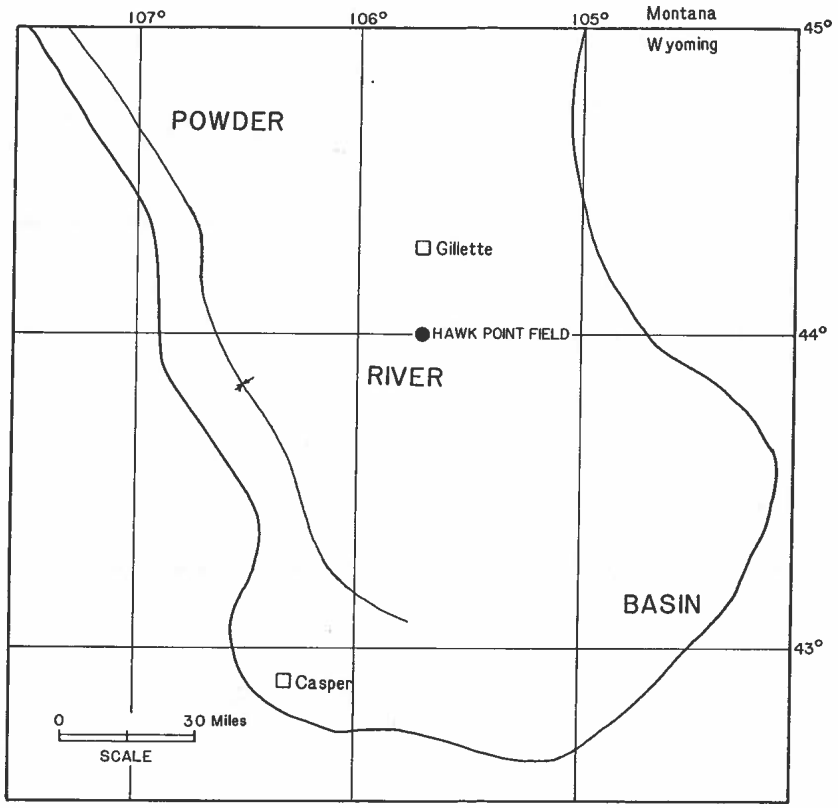

Figure 1. Index map of the Powder River Basin, showing the location of Hawk Point Field.

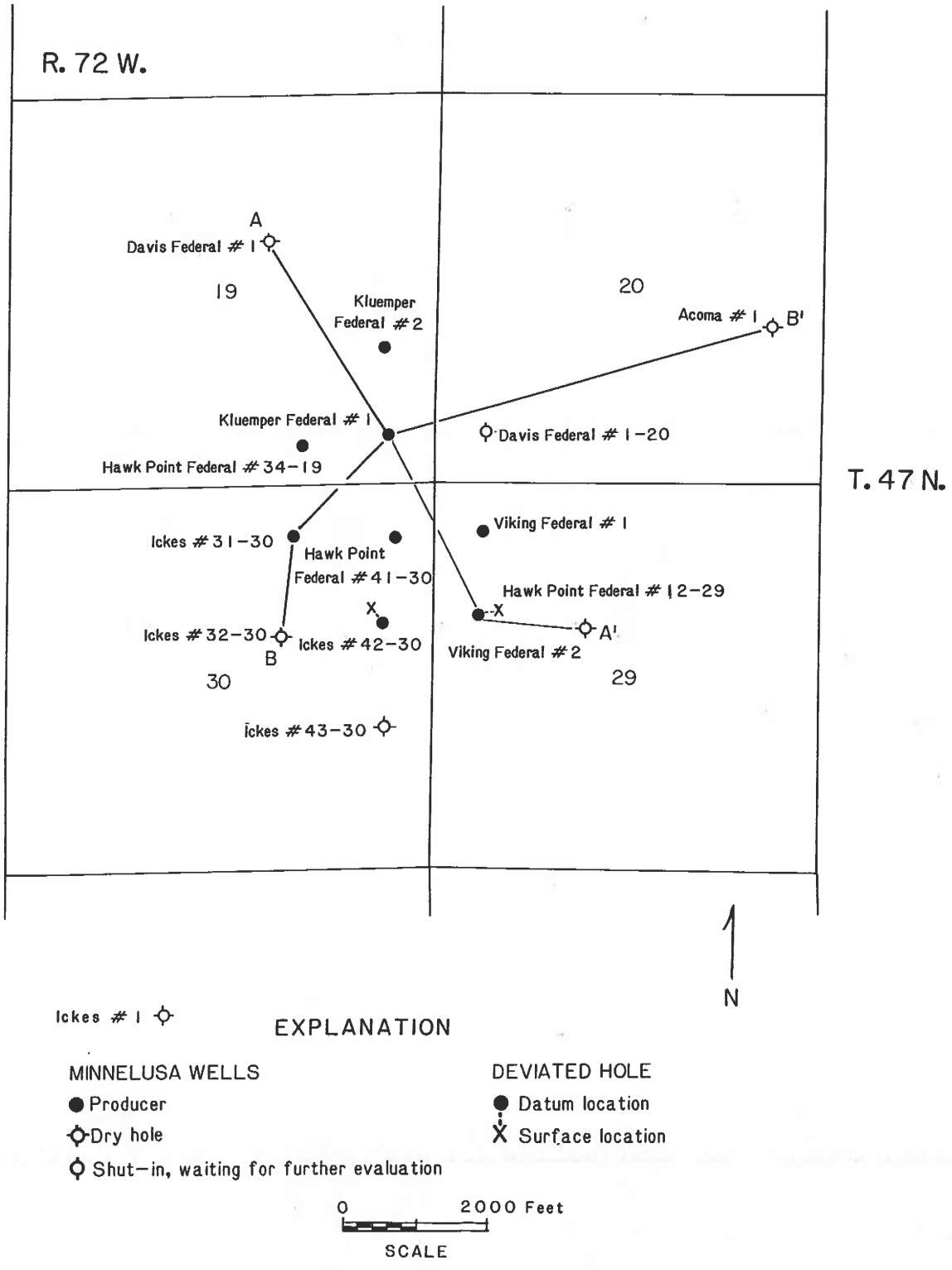

Figure 2. Wells in and around Hawk Point Field. Locations of structural cross sections A-A' and B-B' are shown.

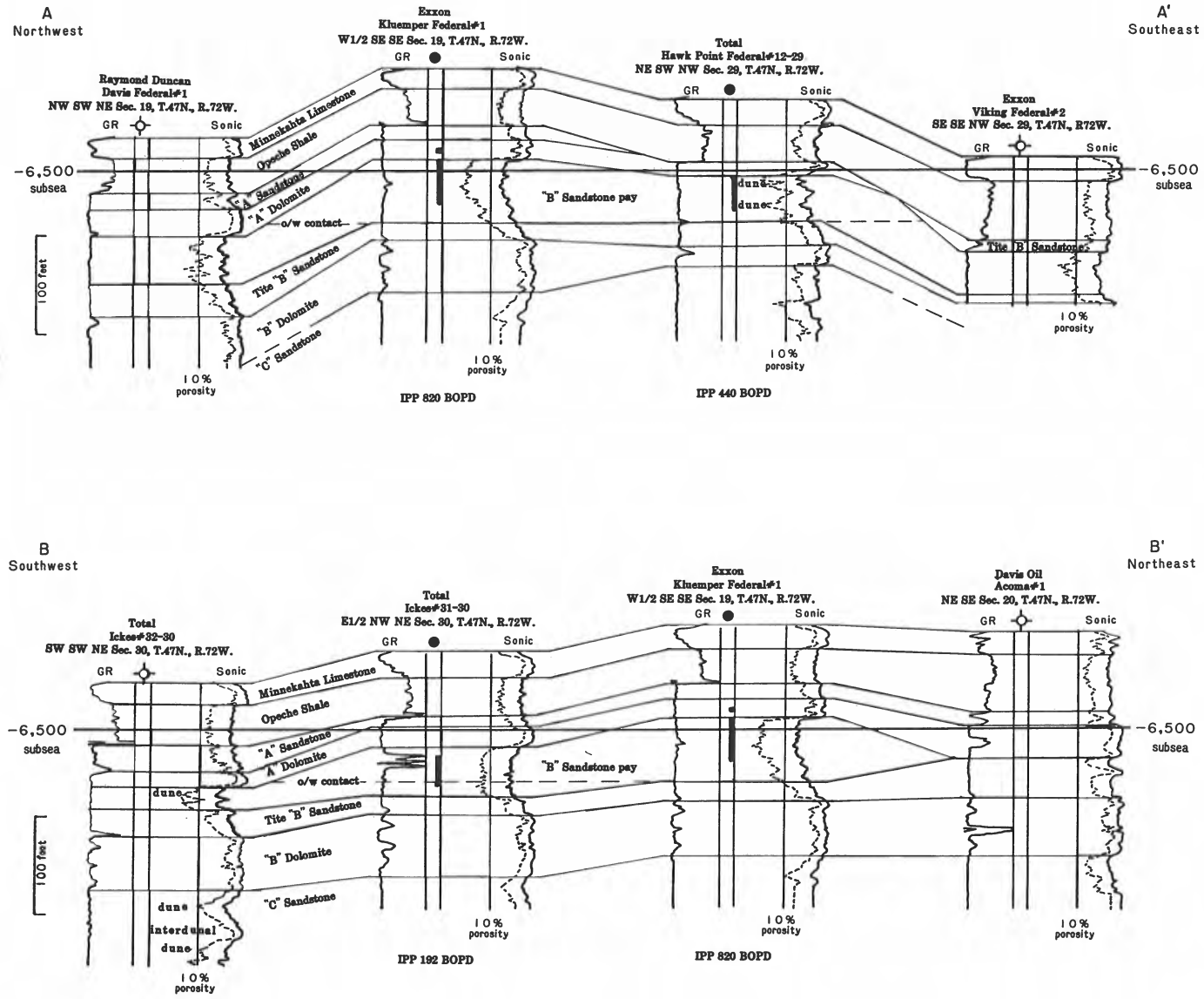

Figure 3. Structural cross sections A-A' and B-B' through Hawk Point Field. Well perforations are shown as solid blocks in the depth column. O/W = oil/water contact.

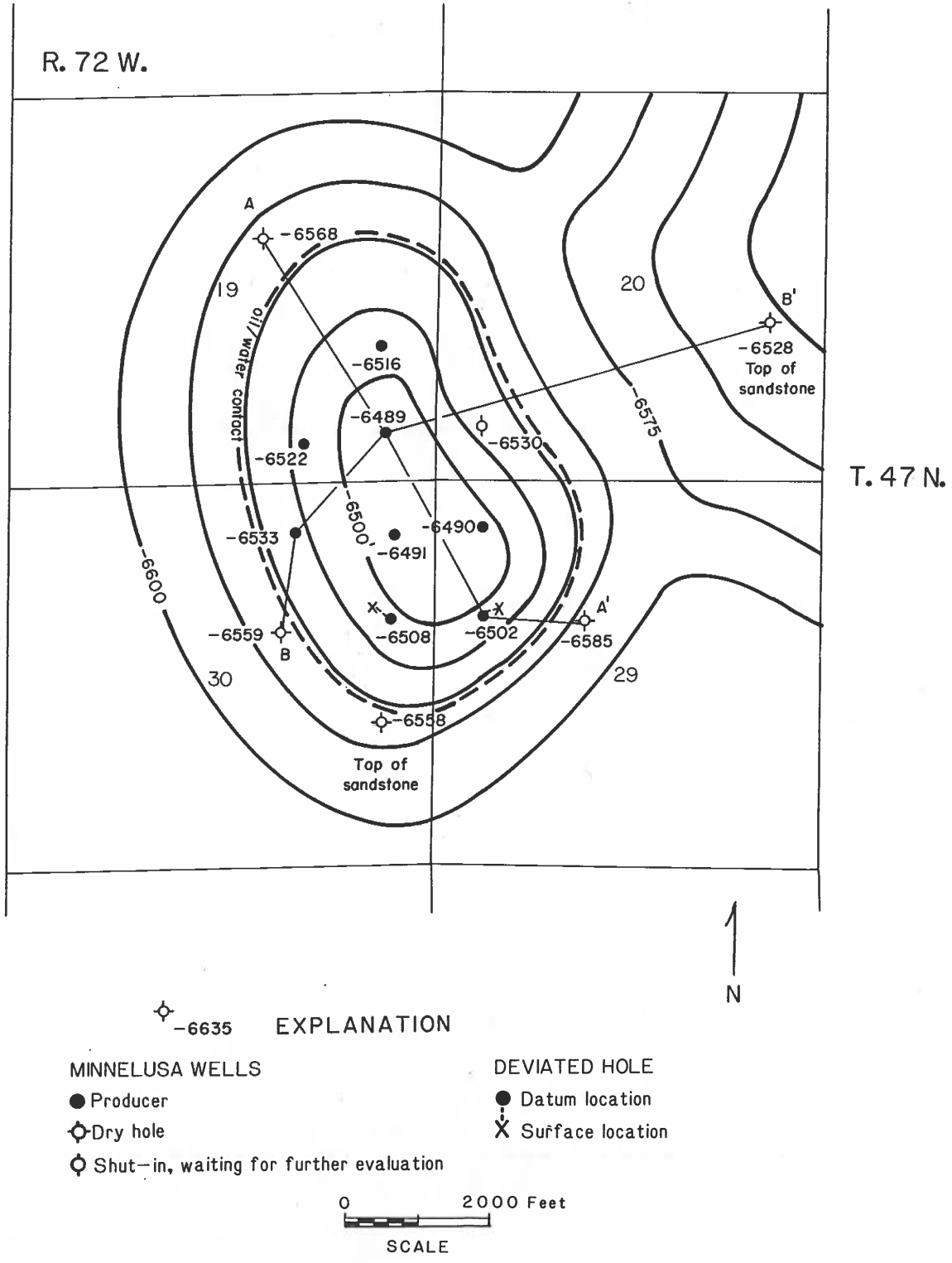

Figure 4. Structure contour map on top of the porous (10 percent or greater porosity) "B" sandstone (contour interval is 25 feet and contours are in feet below sea level). The top of the "B" sandstone is contoured where there is no porous "B" sandstone.

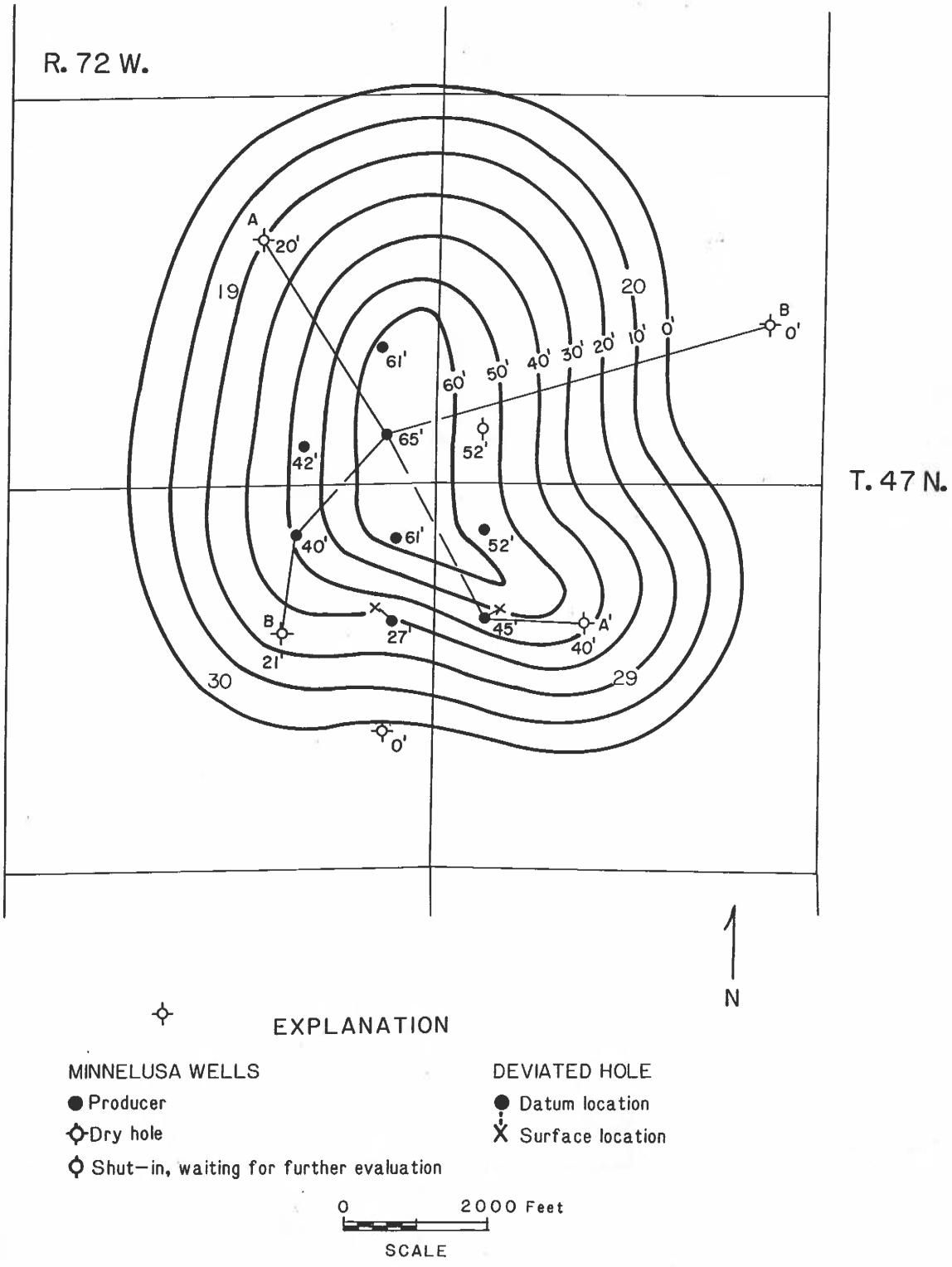

Figure 5. Isopachous map of the porous (10 percent or greater porosity) "B" sandstone in and around Hawk Point Field (contour interval is 10 feet).

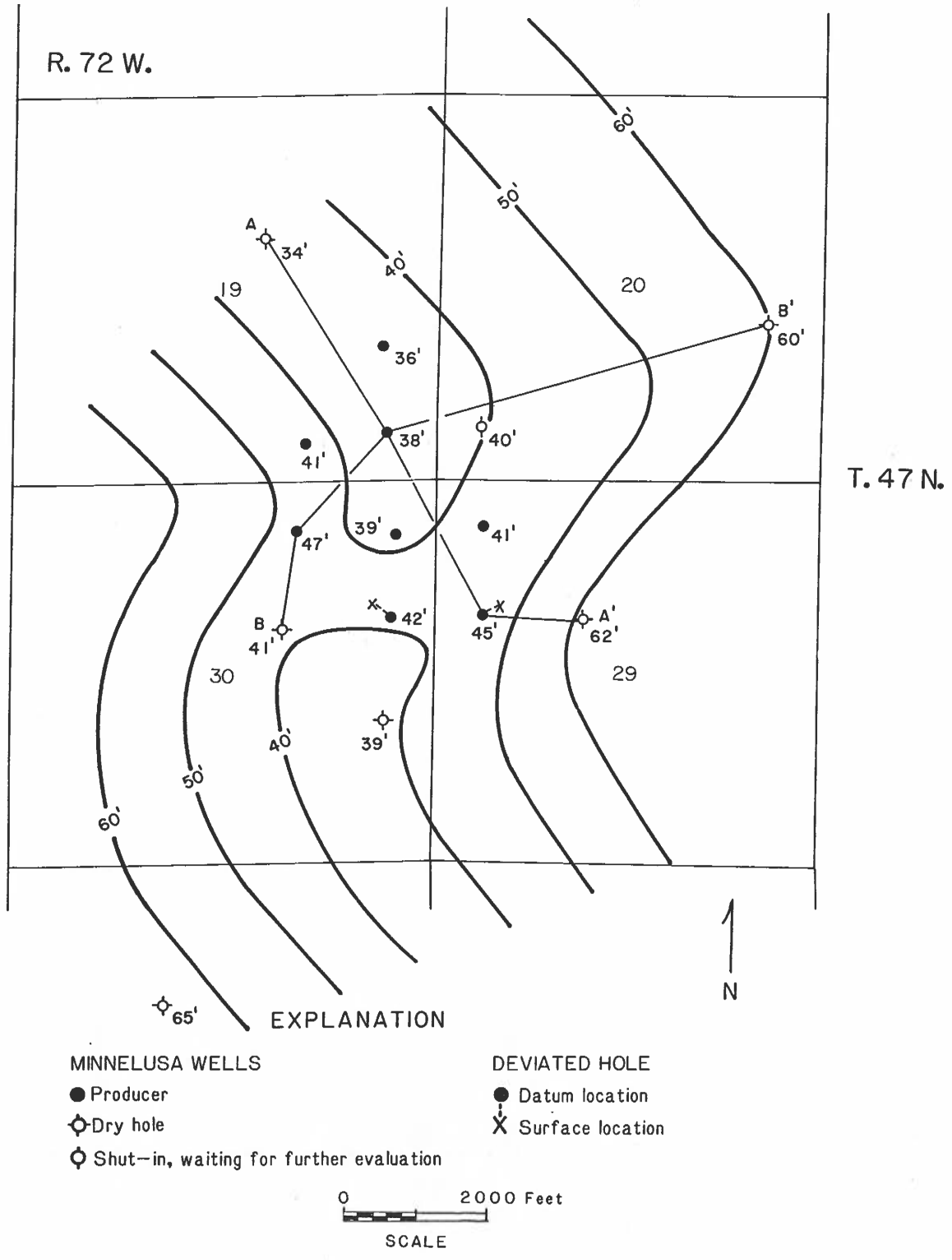

Figure 6. Isopachous map of the Opeche Shale in and around Hawk Point Field (contour interval is 10 feet).