Oil Occurrence in the Waltersburg Formation (Chesterian) of Southwestern Gibson County

David K. Johnston
Exxon Incorporated, Lafayette, Louisiana

and

Walter H. Pierce, R. Wm. Orr, Alan C. Samuelson
Department of Geology, Ball State University,
Muncie, Indiana 47306

Over eight million barrels of oil have been produced from the Waltersburg Formation of the study area. Does the production of oil from the Waltersburg Formation come from stratigraphic or structural traps? What is the distribution of reservoir rock within the Waltersburg Formation? What is the origin of that reservoir rock, and is there potential for more oil to be found within the Waltersburg interval in southwestern Gibson County? This paper represents a report of a subsurface investigation designed to answer these questions.

The Waltersburg interval can be mapped between the Menard Limestone above and the Vienna Limestone below. Sandstone within the Waltersburg forms the reservoir rock. The percentage of sandstone within the Waltersburg Formation varies significantly. Structural contour maps on the top and bottom of the Waltersburg interval, and percent and net sandstone maps based on 591 electric logs show that the oil is associated with shoestring and belt-shaped sandstone bodies (1). The oil may be trapped either structurally or stratigraphically.

Figure 1 displays the structural configuration of the top of the Waltersburg Formation. Generally, the top of the Waltersburg Formation dips west-southwest at 40 to 50 feet per mile. In the southeast part of the area the Owensville Fault breaks the structural surface. This fault strikes N20E and is downthrown to the northwest. A southwest plunging anticline is present northwest of the Owensville Fault.

Figure 1 also shows where sandstone thickness exceeds 40 feet. One thin string of sandstone occurs in the northwestern part of the area. This sandstone body coincides with the Rochester oil field shown in black dots. A larger body of sandstone occurs in the southeast part of the area. A large ribbon of sand, from 1 to 1.5 miles wide, trends northeast-southwest across the area and a more narrow, less thick sand ribbon joins the larger along a north-northeast trend. Together these ribbons form a bifurcating pattern.

Based upon the bifurcation geometry in plan view and the common barrel shape of the spontaneous potential logs taken from wells cutting these sandstones, we interpret the depositional environment to be distributary channels of a fluvial-dominated delta system. We must emphasize that no core was available to us.

Three separate petroleum fields produce oil from the Waltersburg Formation of the study area. To the northwest the Rochester field had produced approximately 5.5 million barrels of oil by the end of 1980. The Rochester field is a stratigraphic trap in which the oil is trapped in the northwest (up dip) terminus of a shoestring sand.

In the southeast part of the study area two oil fields are present in close proximity. The Mounts field is the northeasternmost field (Figure 1) and is controlled by the coincidence of the major sandstone belt and structural closure. The Mounts

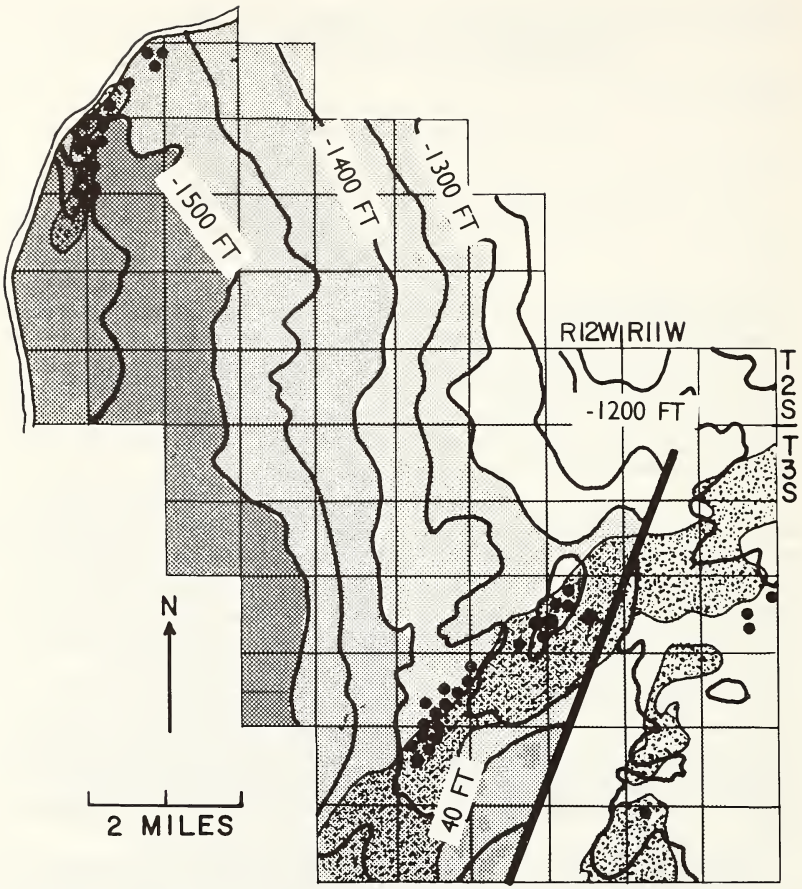

FIGURE 1. *Composite map of the Waltersburg Formation in southwestern Gibson County. The elevation of the top of the Waltersburg Formation is shown by the -1200 ft. to -1500 ft. contour lines. The distribution of the net sandstone exceeding 40 feet in thickness is shown by the coarse stipple pattern surrounded by the line marked 40 feet. Black dots indicate locations of wells that have produced oil from the Waltersburg sandstone. The heavy black line marks the position of the Owensville Fault.*

field is a structural trap that had produced approximately 1.2 million barrels of oil by the end of 1980.

The Fleenor field is the southwesternmost (Figure 1). This field had produced approximately 1.1 million barrels of oil before the end of 1980. The occurrence of oil in the Fleenor field is strange in that the oil appears to be offset down the northwest flank of the southwest plunging anticline. The position might be explained by a) a cementation barrier up dip from the oil field, b) a tilted oil/water contact resulting from hydrodynamics or changes in capillary pressure resulting from

permeability changes, or c) a second fault acting as a seal with negligible slip that would not be recognized by structural contouring. In Figure 1 it can be noted that the southeastern boundary of the field forms a rather straight edge which is subparallel with the Owensville Fault. For this reason we favor the concept of a second fault as being the most likely up dip seal of the Fleenor field. This concept needs to be tested by more detailed mapping of the oil-water contact within the Fleenor field.

In conclusion, oil occurring within the sandstones of the Waltersburg Formation is controlled by both structural and stratigraphic causes. The sandstone body of the Rochester field is distinct and separate from the sandstones of the Fleenor and Mounts fields. Recognition that larger sandstone bodies extend to the southwest and that additional faults parallel the Owensville Fault may provide encouragement for further exploration in the Waltersburg Formation.

Literature Cited

1. JOHNSTON, DAVID K. 1981. Detailed Subsurface Geology and Potential Petroleum Production of the Waltersburg Sandstone (Chester Series, Upper Mississippian) in Southwest Gibson County, Indiana. M. S. Thesis, Ball State University. 135 p.