

## OIL TESTS IN BLACK HILLS FRINGE, SOUTH DAKOTA

Allen F. Agnew  
State Geological Survey, Vermillion

### ABSTRACT

In the past 50 years, 191 tests have been drilled for oil in the Black Hills area of South Dakota, and 80 per cent of this number have been drilled in the last 15 years. Of the 175 holes for which information is available, approximately 60 per cent tested only as deep as the Cretaceous Newcastle or Fall River sands. An additional 25 per cent reached the Pennsylvanian Converse or Leo sands, but only three per cent penetrated all the sedimentary rocks to the Precambrian basement.

The reasons for not testing deeper include (1) lack of money, (2) narrowness of objective, (3) prejudice, and (4) promotional aspects.

The oil possibilities of the Black Hills area deserve a re-appraisal.

### HISTORICAL DEVELOPMENT

Since 1910 at least 191 oil tests have been drilled in the Black Hills area, and 152 (80 per cent) of them have been drilled since 1944.

The Black Hills area is here discussed in three arbitrary sub-areas. In the southwestern subarea (west of the Cascade Springs anticline in Fall River County, fig. 1), the incidence of drilling shows two peaks of activity—one in 1946 and the other in 1956-58, which correspond with surges in exploration and discoveries in the adjacent Powder River Basin of Wyoming. Drilling in the eastern Black Hills subarea likewise shows two periods of activity—1945 and again in 1955-57. In the northern subarea (west of a line drawn from the southeastern corner of Butte County to the southwestern corner of Lawrence County) drilling has been much less, and has not resulted in more than four holes in any one year.

### DEEPEST ZONE TESTED

Adequate information (depths, formations tested, shows, etc.) is available for 175 of these 191 holes. Although more oil shows have been reported from the Pennsylvanian sands, most of the holes (60 per cent) reached only the upper, or Cretaceous sands (fig. 1 and table 1). Two holes stopped short in the lenticular Mowry sands, 34 continued another 125 feet deeper to test the better developed

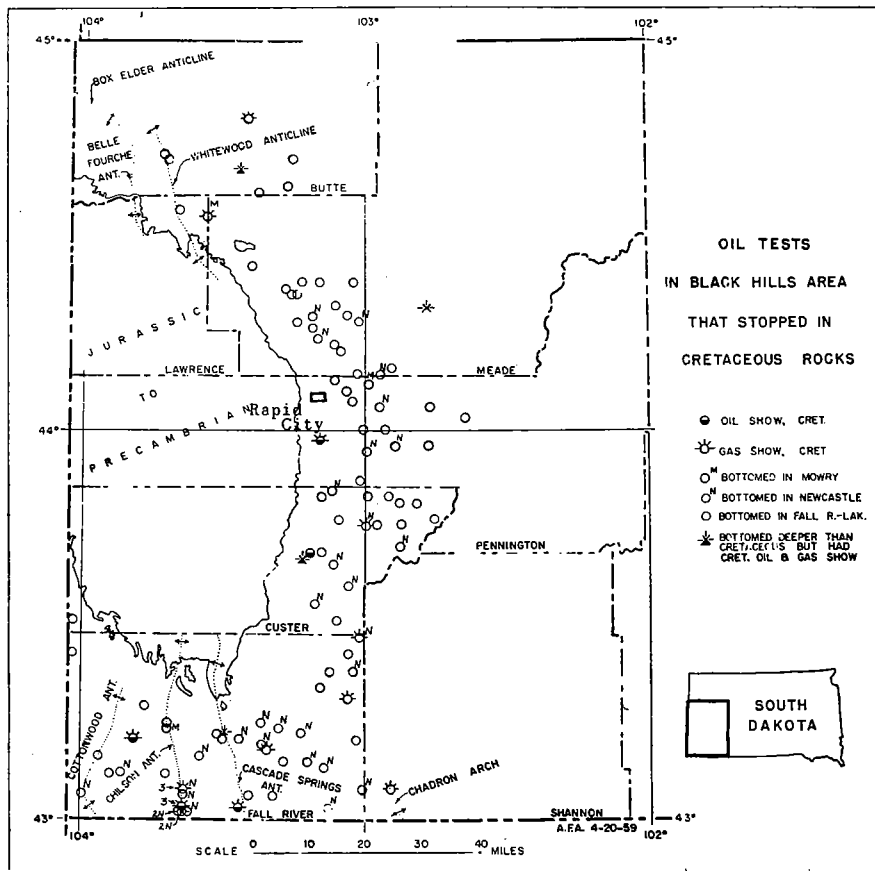


Figure 1. Oil Tests in the Black Hills Area That Stopped in Cretaceous Rocks

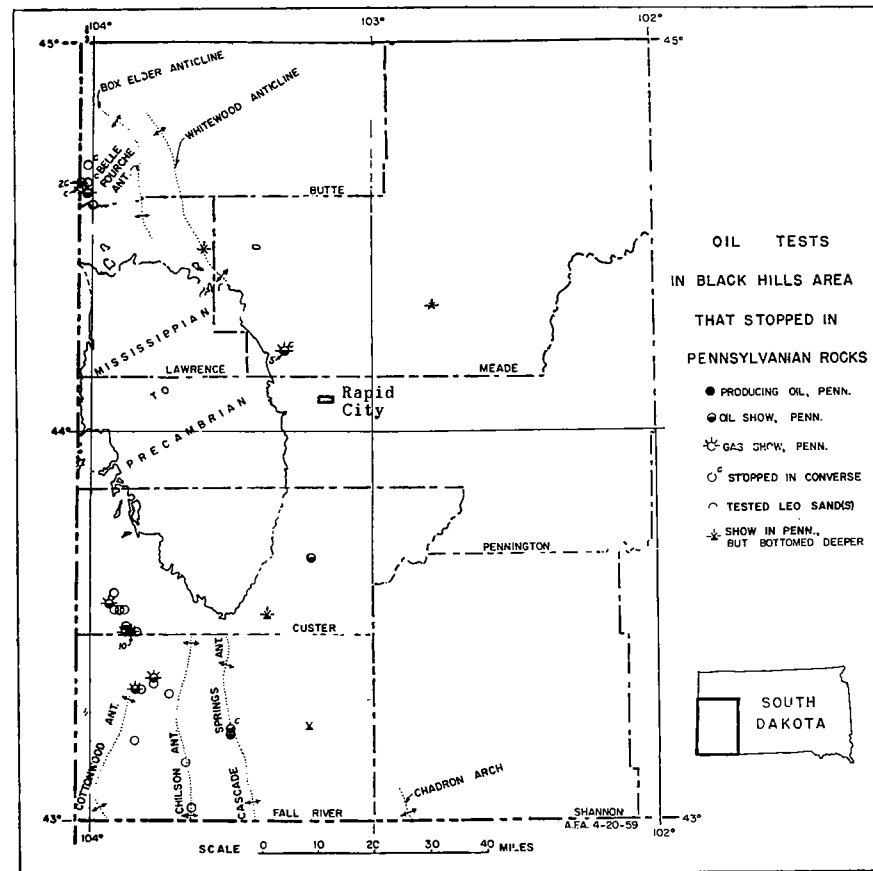


Figure 2. Oil Tests in Black Hills Area That Stopped in Pennsylvanian Rocks

**TABLE I**  
**POTENTIALLY OIL-PRODUCING ZONES IN THE**  
**BLACK HILLS AREA**

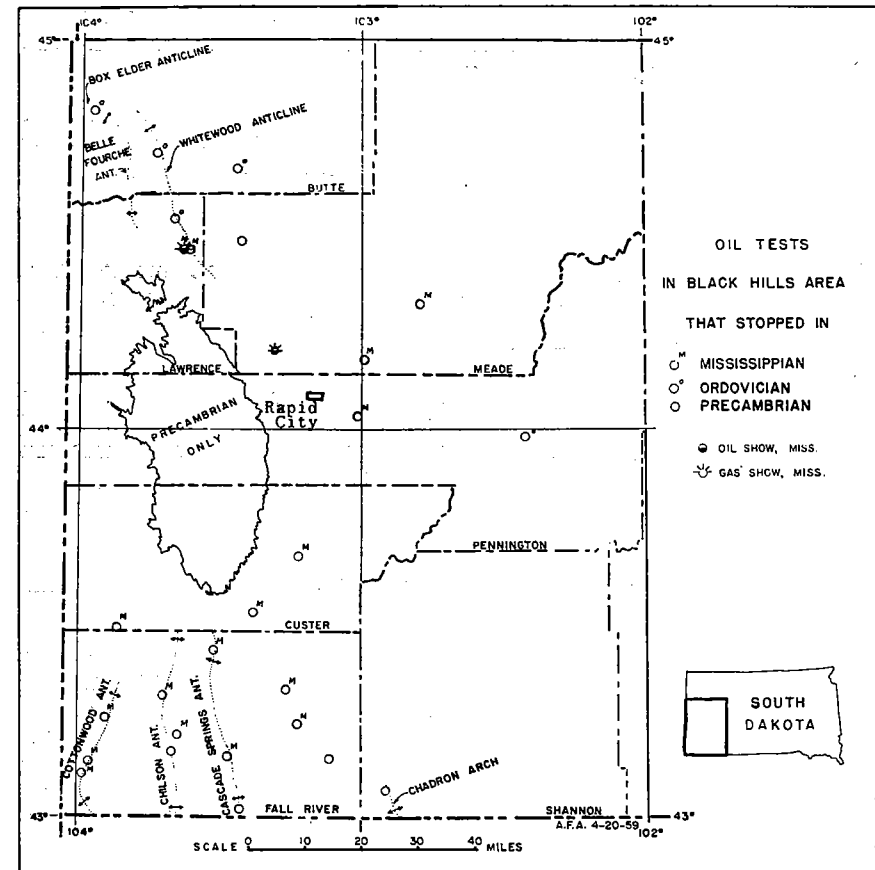
System	Zone
Cretaceous	Mowry sand Newcastle sands Fall River sand Lakota sand
Jurassic	Sundance sand
Pennsylvanian	Converse sands Leo sands Bell sand
Mississippian	Pahasapa limestone
Ordovician	"Aladdin" sand (northern half of area, only)

Newcastle sand, 38 tested the Fall River sandstone by drilling an additional 300 feet, but only half of these 38 penetrated the underlying Lakota sandy zone. Thirty-one continued for another 300 feet to test the Jurassic Sundance sandstone.

The data reveal that 40 per cent of the holes in the southwestern subarea tested only the Cretaceous and Jurassic sands, that 81 per cent did so in the eastern area, and that 36 per cent of the holes in the northern subarea reached no deeper geologic formations.

More oil shows have been reported from the Pennsylvanian Converse and Leo sands than from any of the other zones, yet only 24 per cent of the holes reached this objective (fig. 2). The well-developed upper Pennsylvanian, or Converse sands were the goal of most of these holes in the northern Hills, as only one of the total of seven reached the Leo sands below. In the eastern part of the area half of the six holes stopped at the Converse, but in the southwestern area all holes went deeper because the Converse is not well-developed there.

In only 10 per cent of the holes around the Black Hills was the Mississippian Pahasapa cavernous limestone penetrated (fig. 3). This limestone is the source of great quantities of water, and has resulted in flowing wells in many parts of the Black Hills area.



**Figure 3. Oil Tests in Black Hills Area**

The remaining potentially productive sand, locally called the Aladdin, is present only in the northern part of the Black Hills, and was tested by only five wells (fig. 3).

Significantly, *only three per cent* of the total of 175 oil tests reached the Precambrian basement rocks and thus tested all of the potentially productive sands of the Black Hills area (fig. 3).

### ANALYSIS

Shows of oil or gas were reported from the Cretaceous sands in 22 per cent of the wells, and were concentrated in two general areas—near the Chilson anticline at Ardmore in Fall River County, and on a small fold at Fairburn in eastern Custer County.

Many more shows have been reported from the Pennsylvanian sands. In the northern subarea 28 per cent of the holes that tested the Pennsylvanian recorded oil or gas shows, in the southwestern subarea 37 per cent did so, and in the eastern subarea the figure is 47 per cent. The Helms No. 1 Coffing well, located in the Barker Dome oil field in southwestern Custer County, is presently producing oil from the Pennsylvanian Leo sand. Small amounts of oil have been recovered in the past 30 years from several other wells in that field.

The fact that few of the holes drilled in the Black Hills area tested adequately all of the formations can be explained by several general reasons. *Lack of money* plagued many of the operators. Furthermore, the *narrowness of the objective* and *prejudice of the operators* caused many wells to be drilled only as deep as the upper sand, and several wells did not reach their objectives because adequate geologic information had not been obtained (or was misinterpreted by non-geologists).

And lastly, the *promotional climate* under which some of the oil tests were drilled, especially those in the early days, was not conducive to a well-organized and well-executed job of prospecting.

Many areas of the Black Hills fringe deserve a re-appraisal of their oil potential. Several localities that might have productive potentialities have not been drilled (parts of Shannon and Butte Counties, for example). Others have been drilled, but inadequately so (southeastern part of Fall River County and the southwestern part of Butte County). A re-appraisal is therefore overdue.