

TOW CREEK OIL FIELD Routt County, Colorado

UNIVERSITY OF UTAH
RESEARCH INSTITUTE
EARTH SCIENCE LAB.

By A. SATERDAL

Wm. Ross Cabeen & Associates, Denver, Colorado

LOCATION

The Tow Creek Anticline is located in Routt County, Colorado, approximately twenty miles west of Steamboat Springs. The axis is traversed by the Yampa River and by U.S. 40. The structure is plainly visible from this highway. Mancos shale is exposed in the core of the anticline and this part of the structure is quite accessible. Mesaverde sandstones, outcropping on the flanks, form more mountainous terrain which is characterized by incised gulches. This area is accessible mainly by trails and small subsidiary roads.

HISTORY AND DEVELOPMENT

The presence of an anticline was recognized as early as 1906 (Fenneman and Gale, U.S.G.S. Bull. 297). Willson and Perini mapped the structure and their map appears in Colo. Geol. Bull. 23, 1920, along with a fairly complete report. Open file U.S.G.S. material prepared by Campbell, Bass and Eby released in 1954 is probably the most complete available surface work in the area. However, it does not appear to cover details of structure along the axis. Mr. John E. Frey, with The Texas Company, has published a Niobrara map and presented considerable statistical data in "Oil and Gas Fields of Colorado" which is current through 1954.

The first exploratory test of record was the Hills-Gross No. 1, SE NW, SE section 7, T. 6 N., R. 86 W., which was drilled in 1910 to T.D. of 2540 feet. Shows of oil were reported in shale but it appears that the well did not fully penetrate the Niobrara section. A second well, reportedly drilled by Mid Continent Oil Co. in 1916 to T.D. 2290 feet, probably did not reach the Niobrara. This well reportedly had shows of oil in the shale at 2145 to 2155 feet. It was plugged back to 2190 feet and shot with resultant production of 5 BO and 200 BWPD. Records on this well, as on all wells drilled prior to 1949, are very poor.

The discovery well in the Tow Creek field was located on the basis of surface geology and was drilled by The Texas Production Co. on the Adair Lease in 1924. It had an I.P. of 131 BOPD from fractures in Niobrara shale. This well averaged better than 100 BOPD of 35.4° gravity oil during 1925. It was deepened to 3108 feet in 1928 and abandoned.

Discovery well at the North Tow Creek pool was The Texas Production Co. Carstarphen-Irwin No. 1 in

NE SE NW, section 5. This was completed in 1927 at T.D. 3288 feet for 200 BOPD. It was deepened to 3301 feet later in 1927 and produced until 1932, when it was deepened to 4793 feet in the Dakota (?) and abandoned.

Development subsequent to the two discoveries resulted in a total of 24 significant tests on the South Tow Creek pool of which 18 produced varying amounts of oil with I.P.s up to 600 BOPD. Cumulative production in one case, The Texas Co. State Lubers No. 1, is over 305,000 BO and the well still produces some 20 BOPD relatively free of water.

In the North Tow Creek pool there have been a total of seven wells drilled of which six were producers with I.P.s up to 210 BOPD.

In addition to the pool wells and stepouts, 11 dry tests have been drilled between the pools on the axis and on the flanks for a total of 42 significant tests drilled on the structure.

The only cable tool well drilled in recent years is The Texas Co. State Lubers No. 3, NE NW SE, section 18. This well is a 10 acre offset to the State Lubers No. 1 which has produced over 305,000 BO and is still pumping. At this writing The Texas Co. is drilling Quaintance Hocking No. 9, SW NE SE, section 18, T. 6 N., R. 86 W.

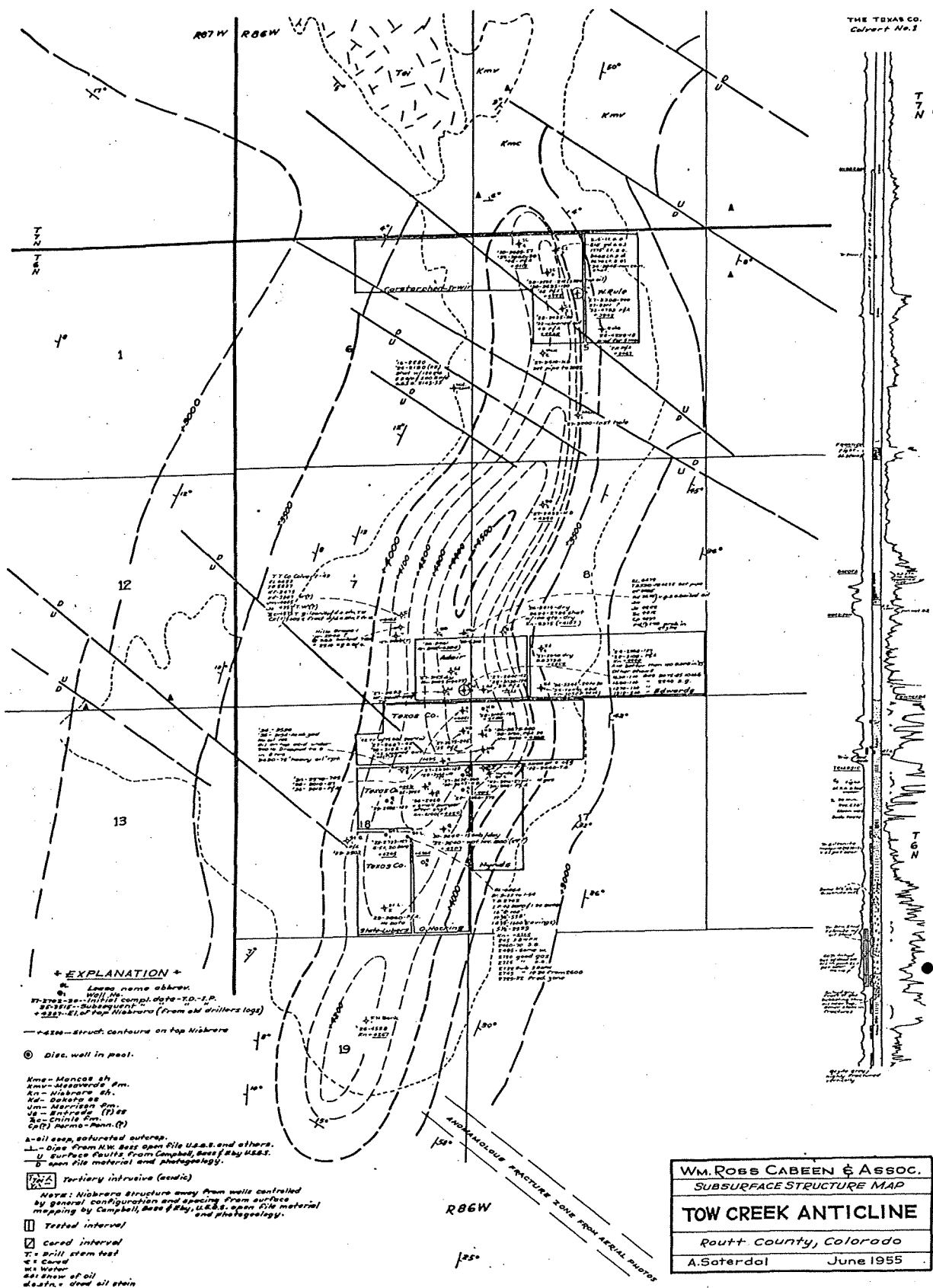
All production has been from fractured Niobrara shale. Significant shows found in deeper formations are as follows:

1. The Texas Co. Belle Dennis No. 4 (first rotary well drilled in Colorado) encountered a very good show of oil either in the "Dakota group" or in the Upper Morrison. Casing was run to test this show but considerable water along with oil was swabbed and the well was abandoned.

2. The Texas Co. Colvert No. 1 was drilled with rotary tools in 1949 and found slight stain in tight-appearing Frontier sand at 3475 feet. Also some 90 feet of lightly stained sand was found in the "Dakota" which appeared wet in samples and had very little odor. Porosity was generally low with exception of the lower bench which appeared wet and had no visible stain. This sand was not tested.

The Entrada also showed light oil stain in this well, but tested 630 feet of clear water. Considerable dead oil stain and gilsonitic material was found in the lower part of the Triassic section and throughout a highly

THE TEXAS CO.
Colvert No. 3



EXPLANATION

- ① - Same name abbrev.
- ② - Initial compl. data - T.P.
- ③ - Subsurface
- ④ - E1 of top Niobrara (From old driller logs)
- - - - - Struct. contours on top Niobrara
- - Disc. well in pool.
- Kms - Mancos sh.
- Kmv - Niobrara fm.
- Kn - Niobrara ss.
- Kd - Dakota ss.
- Jm - Morrison fm.
- U - Niobrara (P) ss.
- Ch - Chino fm.
- Ca (P) - Niobrara - Perm. (P)
- - - - - all deep, saturated surface.
- - - - - Dips from M.S. Base open file U.S.G.S. and others.
- - - - - U. Surface faults; from Campbell, Base # 2 by U.S.G.S.
- - - - - D. open file material and photogeology.
- - Tertiary intrusive (acidic)

Note: Niobrara structure away from wells controlled by general configuration and spacing from surface mapping by Campbell, Base # 2 by U.S.G.S. open file material and photogeology.

- - Tested interval
- - Cased interval
- T - Drill stem test
- C - Cased
- W - Water
- Oil - Oil
- Gas - Gas
- Wash. - Wash
- Ab - Abandoned

Wm. ROSS CABEEN & ASSOC.	
SUBSURFACE STRUCTURE MAP	
TOW CREEK ANTICLINE	
Routt County, Colorado	
A. Saterdal	June 1955

anhydritic section tentatively called Permo-Pennsylvanian. Shows were in fractures for the main part. Approximately 50% of the anhydritic section was cored and two tests were run. Considerable fresh water was recovered on one (probably from fractures) and on the second, only drilling mud was recovered.

STRUCTURE

Regionally, the Tow Creek Structure is located on the southeastern flank of the Sand Wash Basin of northwestern Colorado. Local structure appears to be controlled by the Park Range uplift, a major tectonic feature to the east. Local structure is that of a N-S trending anticline with a long, south-plunging nose. Some 500 feet of critical surface closure can be mapped. Structure is probably the result of very late Cretaceous movement modified by Paleocene and Eocene movements. The structure has been altered by a system of NW trending cross faults which can be mapped at the surface. Their presence at depth is conjectural.

An acidic igneous body, either a plug or a very steep sided laccolith, is intruded into the upper part of the Mancos shale immediately north of the Tow Creek closure. This can be dated with certainty only as post-Cretaceous but is probably post-Browns Park (Miocene-Pliocene). Mancos shale in contact with the acid rock does not appear to have been seriously altered for more than a few feet from the contact. Oil saturation has been observed in the basal Mesaverde sands on what could very possibly have been the flank of a closed dome caused by intrusion. This saturation is within a quarter of a mile of the intrusive body, and other saturated sand is reported to have been found on top of the igneous body. The igneous activity does not appear to have altered the structure of the Tow Creek field appreciably. There does appear to be a relationship, however, between the rather extensive fault and fracture system on the north end of Tow Creek and the trend of basic igneous dikes north of the area which probably took advantage of pre-existing lines of structural weakness.

FACTORS CONTROLLING ACCUMULATION

Accumulation of oil at Tow Creek appears to be caused by the coincidence of anticlinal structure with

an upward loss of fracture permeability in the stratigraphic section. All production found to date is in the Niobrara shale and the "caprock" appears to be the relatively plastic overlying Mancos shale. Numerous cores in The Texas Co. Colvert No. 1 indicated extensive open vertical fractures lined with quartz and gypsum crystals which may be a deterrent to large accumulations of oil in lower horizons, at least in the highly fractured parts of the anticline.

It is considered significant that current drilling activity at Tow Creek is by the extension of a producing area along the trend of the fractures instead of along the structural axis. The logic for this development can be seen by constructing an iso-initial production map which defines the better producing areas as being parallel to the fracture trends.

Erratic permeability in the Dakota, Morrison and Shinarump, coupled with a high frequency of oil shows in the area in these formations indicate that productive possibilities are good on untested parts of the anticline but are not specifically defined at present. U. S. Geological Survey mapping and photogeologic work indicate that additional fault or fracture zones, prospective for additional Niobrara pools are present on the anticline, but detailed surface work and further wells are necessary to fully evaluate these possibilities.

The entire prospective section is considered to have been tested by the Belle Dennis No. 4 and the Colvert No. 1. The former reportedly bottomed in "Granite" and the latter bottomed in highly quartzitic, pyritic, gray, fine-grained sandstone which was interbedded with green waxy shale. No definite age correlation has been made.

ACKNOWLEDGEMENTS

The writer has drawn heavily on the excellent published and open file works by the authors listed in the references below and wishes to acknowledge the use of much of their material.

- Campbell, M. R., Bass, N. W., and Eby, J. B.; U.S.G.S. open file material.
- Coffin, R. C., Perini, V. C., Jr., and Collins, M. J. (1920), "Some Anticlines of Western Colorado," *Colo. Geol. Surv. Bull.* 24.
- Crawford, R. D., Willson, K. M., and Perini, V. C., Jr. (1920), "Some Anticlines of Routt County," *Colo. Geol. Surv. Bull.* 23.
- Fenneman, N. M., and Gale, Hoyt S. (1906), "The Yampa Coal Field, Routt County, Colorado," *U. S. Geol. Survey Bull.* 297.
- Frey, John E. (1954), "Oil and Gas Fields of Colorado," *Rocky Mtn. Assoc. of Geol.*