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GEOLOGIC REPORT
ON THE
SAN CARLOS ANTICLINE
PUEBLO COUNTY, COLORADO

by

H. W. C. PROMMEL

March 1918

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GOLDEN, COLORADO

Report furnished by: H. W. C. Prommel

INTRODUCTION.

The San Carlos Anticline is situated 12 to 16 miles south of the city of Pueblo, Pueblo County, Colorado. The area covered by this report is shown on the accompanying map and lies within Townships 22 and 23 South, Ranges 64 and 65 West.

GEOLOGY

The highest formation exposed in the field is the Timpas Limestone of the Niobrara Group. Underlying this follow normally the older cretaceous formations which were studied in detail in the area under question where they outcrop in various places. The still older Jurassic, Triassic, Carboniferous and Silurian formations do not come to the surface on the San Carlos Anticline and their thicknesses were obtained from Gilbert's Pueblo Folio. A small area northeast of the Marnel postoffice is covered by the Nussbaum Alluvium and Conglomerate of Tertiary age which here overlies the Carlile Shale unconformably. A geologic section of the region of the San Carlos Anticline is as follows:

Timpas limestone	0 - 52'
Carlile shale	0 - 210'
Greenhorn limestone	0 - 40'
Graneros shale	0 - 200'
Dakota sandstone	350'
Morrison formation	250'
Fountain formation	2200'
Millsap limestone	200'
Harding sandstone	30'
Shists and granite	

The Timpas limestone consists of a series of limestone beds 1 to 2 feet thick, of pale blue to gray color, weathering to white chalky to creamy color, alternating with thin layers of gray, calcareous shales. Below this limestone lies a bed of yellowish green sandstone, which, in the northern part of the structure is 1 foot thick; to the southwest its thickness increases to 5 and 6 ft; and a small area about 1 mile due east from the Marnel postoffice shows this sandstone to be 16 feet thick here, however, thinning out again in all directions. This sandstone is followed by 200 feet of gray to black Carlile shale. Below this shale occurs the Greenhorn Limestone consisting of alternating layers of thinly bedded limestone and gray colored, thicker bedded shales. This in turn is underlain by 200 ft. of carbonaceous shales, called the Graneros Shales.

Near the center of Section 2, T-23-S, R-65-W, there is a small area over which the top layers of the Dakota sandstone outcrop. Dense, black, carbonaceous shales alternate here with thin sandstone layers, giving a laminated appearance. The thickness of these alternating shale and sandstone layers exposed is from 8 to 10 ft.

Below the Dakota sandstone lies the Morrison formation, made up of green and maroon colored clays and shales with thin contained layers of fresh water limestone. The Fountain formation which underlies the Morrison is made up of red, brown, and white sandstones containing a considerable admixture of clay. This formation rests unconformably on the Millsap Limestone of the carboniferous system. The Millsap Limestone consists of 200 feet of gray and purple, massive limestones, which are largely dolomitic. The Harding Sandstone which underlies the Millsap, is a white, sugar-like sandstone, 30 feet thick, which rests upon granite.

The lowest formation exposed near the center of the San Carlos Anticline is the Dakota Sandstone, while the Graneros Shales, Greenhorn Limestone, Carlile Shales and Timpas Limestone form slopes and escarpments to the north, south, east and west. The opening to the Dakota sandstone near the top of the structure permitted the escape of any oil that could have accumulated in the Benton Group, especially the sands in the Graneros Shales. Oil colors have been obtained from several shallow prospect holes recently drilled into these shales. This renders the fold of value only with reference to black oil. The region most probable for the accumulation of black oil, if any is found on this structure, is in the sandstones of the lower measures of the Fountain formation where these sandstones lie below clay or shale partings of sufficient magnitude and compactness to act as an impervious cover.

No deep test wells have yet been drilled on this structure and it cannot be said with certainty that black oil will be found in the carboniferous limestones which underlie this region. Oil seeps occur on these formations and those directly overlying them, along the entire Rocky Mountain Front Range from Wyoming into New Mexico. A deep test well which is at present being drilled on the Wild Horse Structure approximately 30 miles north of the San Carlos Anticline and which will penetrate the same formations underlying the latter may show whether these carboniferous limestones are productive of black oil.

A minor normal fault occurs near the northern extremity of the San Carlos Anticline. The fault trends more or less north and south, but swings to the southwest at the most southerly place where it can be traced. This fault cuts the Greenhorn Limestone to the north where it displaces this limestone not over 45 feet. The fault plane cannot be followed into the Graneros shales underlying the Greenhorn Limestone, although these shales are greatly compressed and contorted at this point. To the south and southwest the fault plane is obscured by erosion products of the Graneros Shales and wash of the Greenhorn Creek, and the only evidence of its continuance was obtained from three natural artesian springs near the bank of Greenhorn Creek. The water evidently issues from the underlying Dakota Sandstone which, according to Gilbert, has its highest water bearing bed 120 feet below its top layer thus indicating that the fault continues into the Dakota sandstone at this point. No indications of dried oil or paraffine were found along this fault and it does not affect the closed part of the structure.

STRUCTURE. The attitude of the surface sedimentary formations exposed in the field was determined by means of a telescopic alidade and plane table, the entire area being mapped on a scale of 2000 feet to the inch. The datum used on the map is approximately mean sea level, it being obtained from the Pueblo Topographic Sheet of the United States Geological Survey. A bench mark could not be found, however, and the elevations were determined approximately from one of the contour lines where it crosses the St. Charles River.

The base of the Timpas Limestone and the base of the Greenhorn Limestone were used as key beds and the contours were drawn at intervals of 50 feet on the base of the Timpas Limestone. Actual elevations on these key beds were taken into consideration, together with well defined dips of the formations, to close this structure in all directions.

The structure as finally determined may be described as a nearly elliptical dome with its axis trending more or less in a northwest-southeast direction. It is completely closed in on all sides and is as nearly as could be determined 100 to 125 ft. high. There is a slight

possibility, however, of the lowest closed contour being open. No more detailed data regarding the attitude of the formations at the critical point in Section 12, T-23-S, R-65-W, could be obtained, as this area is overlain by the Nussbaum Alluvium and Conglomerate formation which here rests unconformably on the Carlile Shale. The area included within the closed contours as shown by the map equals approximately 2 square miles. Of this area that which lies within the 5500 contour is the most promising territory, and I would advise that all possible ground within this contour be obtained.

The most advisable location for the first well, in my opinion, would be the northeast corner of the northwest quarter of Section 2, T-23-S, R-65-W. This well would start in the Graneros shales and would reach the top of the Millsap limestone at a depth approximating 2850 feet. The adjoining area from which this structure can collect oil extends to the east and northeast a distance of not less than 12 miles and comprises an area of roughly 75 miles.

CONCLUSION. From the conditions as found in the field and above set forth the following facts are noted:

First A small, but favorable structure with ample collecting area exists in this field.

Second. The field is underlain by formations productive of oil in other localities. These formations can be reached by the drill.

Third Black oil is found seeping from these formations at various places along the Rocky Mountain Front Range from Wyoming through Colorado into New Mexico.

Fourthly. Conditions for operating and marketing are ideal. A double track of the Colorado & Southern and the Denver & Rio Grande railways crosses the apex of the structure and there are ample side track and switching facilities on these roads at Marnel postoffice. The structure is close to cheap fuel and an abundance of water can be obtained from Greenhorn Creek.

Considering these facts it is my opinion that there is a fair chance for this structure to be productive and I recommend that at least one test well be drilled at the location above designated.

Respectfully submitted,

H. W. C. Prommel

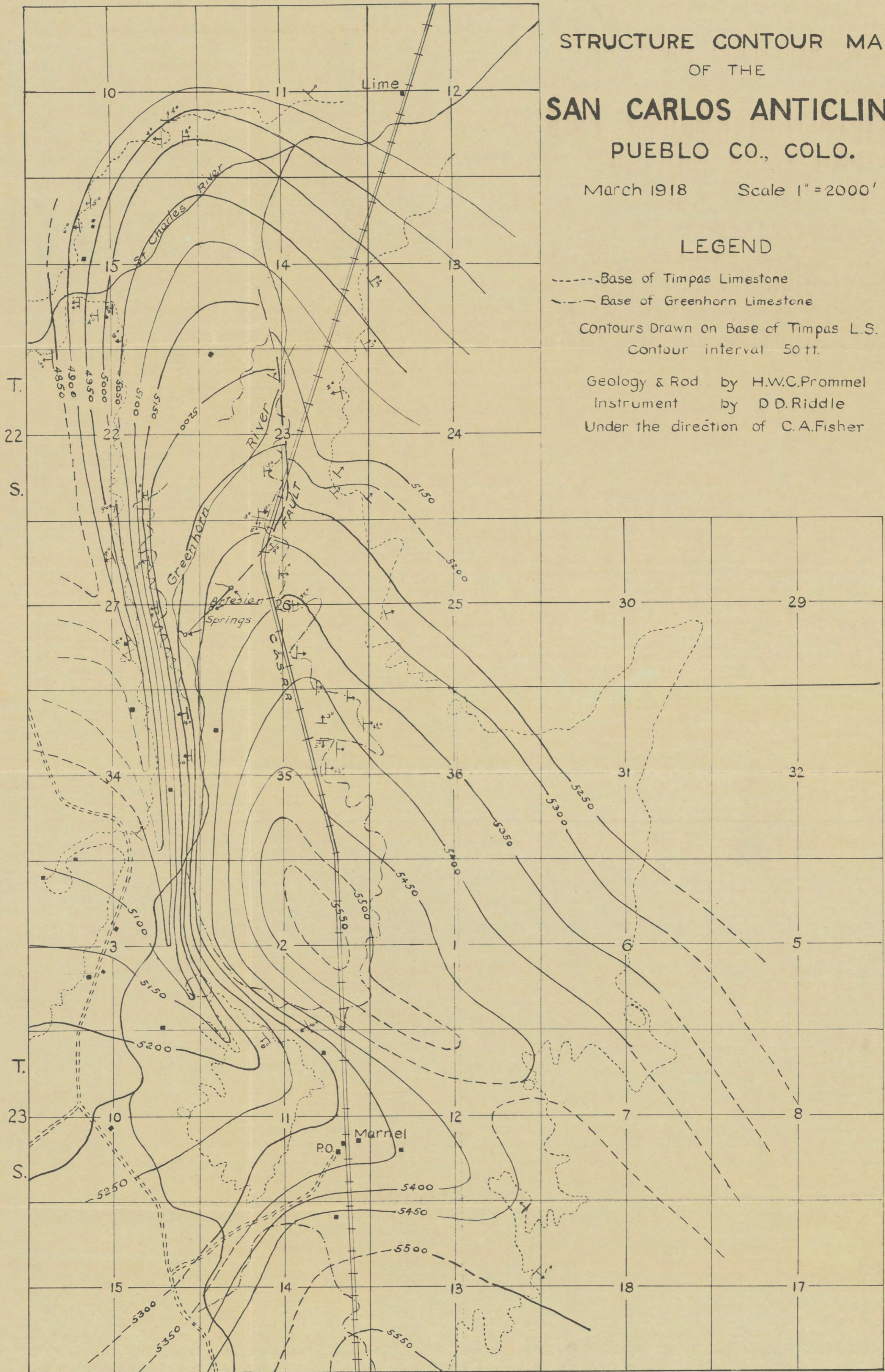
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STRUCTURE CONTOUR MAP
OF THE
SAN CARLOS ANTICLINE
PUEBLO CO., COLO.

March 1918 Scale 1" = 2000'

LEGEND

- Base of Timpas Limestone
- - - - - Base of Greenhorn Limestone
- Contours Drawn on Base of Timpas L.S.
Contour interval 50 ft.
- Geology & Rod. by H.W.C.Prommel
- Instrument by D.D.Riddle
- Under the direction of C.A.Fisher



R. 65 W.

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