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BIG PINEY LA BARGE TERTIARY OIL AND GAS FIELD

by
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LOCATION

The Big Piney LaBarge field is located in southern Sublette County and northeastern Lincoln County, Wyoming, in the west central part of the Green River Basin (Fig. 1). The north end of the field lies 12 miles northwest of the town of Big Piney and the south end three miles southwest of the town of LaBarge, a distance of 27 miles. Production in the field is from formations as young as Paleocene Fort Union or "Almy" (local usage), to as old as the Triassic Nugget formation.

HISTORY AND DEVELOPMENT

Interest in the petroleum potential of the Big Piney LaBarge area dates back to the discovery of oil seeps as early as 1907 (Schultz, 1914). Subsequent shallow cable tool holes encountered minor oil and non-commercial quantities of gas in the fractured Hilliard Shale exposed on the north end of the Tip Top Anticline.

The Tertiary age rocks of the area have been productive since 1924 when oil was discovered in the Paleocene rocks at LaBarge Field. Krueger (1960) cites this as the first commercial Tertiary production in the Rocky Mountain Area. The first significant Tertiary gas discovery was at Wyoming Petroleum Corporation's Budd No. 1 (Sec. 10, T. 29 N., R. 113 W.) which blew out from a depth of 1695 feet in mid winter of 1938. Estimates of 22-75 MMCFPD were made during the two months required to bring the well under control. Between 1938 and 1952 intermittent drilling resulted in 11 potentially commercial wells. In September 1952 the Western Oil & Refining Company's No. 2 well (Sec. 28, T. 28 N., R. 113 W.) blew out while coring in the Tertiary at a depth of 984 feet. Rates of 70 MMCFPD were measured during the ten days required to control this well (Krueger 1955).

Beginning in 1952 an intensive gas development drilling program was initiated by Mr. A. B. Belfer and Belco Petroleum which by 1956 had defined sufficient reserves to justify the building of a pipeline to the Pacific Northwest Pipeline Company main line at Opal.

Exploration and development of the Tertiary sands has continued to the present and there are now some 18 pools or pool areas (Fig. 2) producing from one or more of the Fort Union ("Almy") sands. These pools contain more than 400 wells and have produced more than 25 million barrels of oil and 180 billion cubic feet of gas.

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STRUCTURE

The Big Piney LaBarge field is located on a large structural high known as the LaBarge Platform. Prior to Tertiary deposition this feature was a large doubly plunging anticline with Upper Cretaceous, Mesaverde, and Baxter formations exposed at the surface. Subsidence of the Green River Basin to the northeast and onlap by Tertiary deposition has resulted in generally east-northeast dips of 4 to 8 degrees in the Fort Union or "Almy". Southeast and south dips in T. 26 N., Rs. 112 and 113 W. in the Tertiary beds still reflect the original south plunge (Fig. 2).

The west flank of the LaBarge Platform has been modified by thrust faulting which in some areas has overridden the Platform to place Paleozoic and Cretaceous rocks above rocks of Paleocene age.

A number of anticlinal folds with associated high angle reverse faults and tear faults have been encountered on the platform. On some of these folds, such as the one defining the East LaBarge Shallow Field (Fig. 2), the initial movement was prior to Tertiary deposition, and the associated reverse faulting is up thrown to the east. The LaBarge Field fold also appears to be of this type. Others such as the one in Sec. 25, T. 28 N., R. 113 W., apparently were not active until after Fort Union deposition, since the underlying Mesaverde formation has not been significantly more eroded than the structurally lower adjacent areas.

STRATIGRAPHY

The predominant surface outcrops on the LaBarge Platform consist of the light tan lacustrine shales of the Green River formation and the interfingering and underlying varicolored sands, shales, and siltstones of the Wasatch formation.

Unconformably underlying the Wasatch is 600 to 3000+ feet of varicolored to light gray and drab, lenticular sands, shales, and mudstone with minor coal and freshwater limestone. Underlying this sequence is a zone of conglomerate, quartzitic sandstone and interbedded mudstone, locally termed the "Transition". In the producing area the Transition zone varies in thickness from a few feet to several hundred feet. Further west in the west half of T. 29 N., R. 113 W., the conglomeratic zone thickens to include lateral equivalents of all the Fort Union as well as the overlying Wasatch.

During the early stages of the field development the producing group of rocks was assigned to the Almy Formation (Krueger, 1955). Subsequent work has indicated that the lower part of the Tertiary producing interval on the Platform is Paleocene in age (Asquith and Oriel), whereas the type

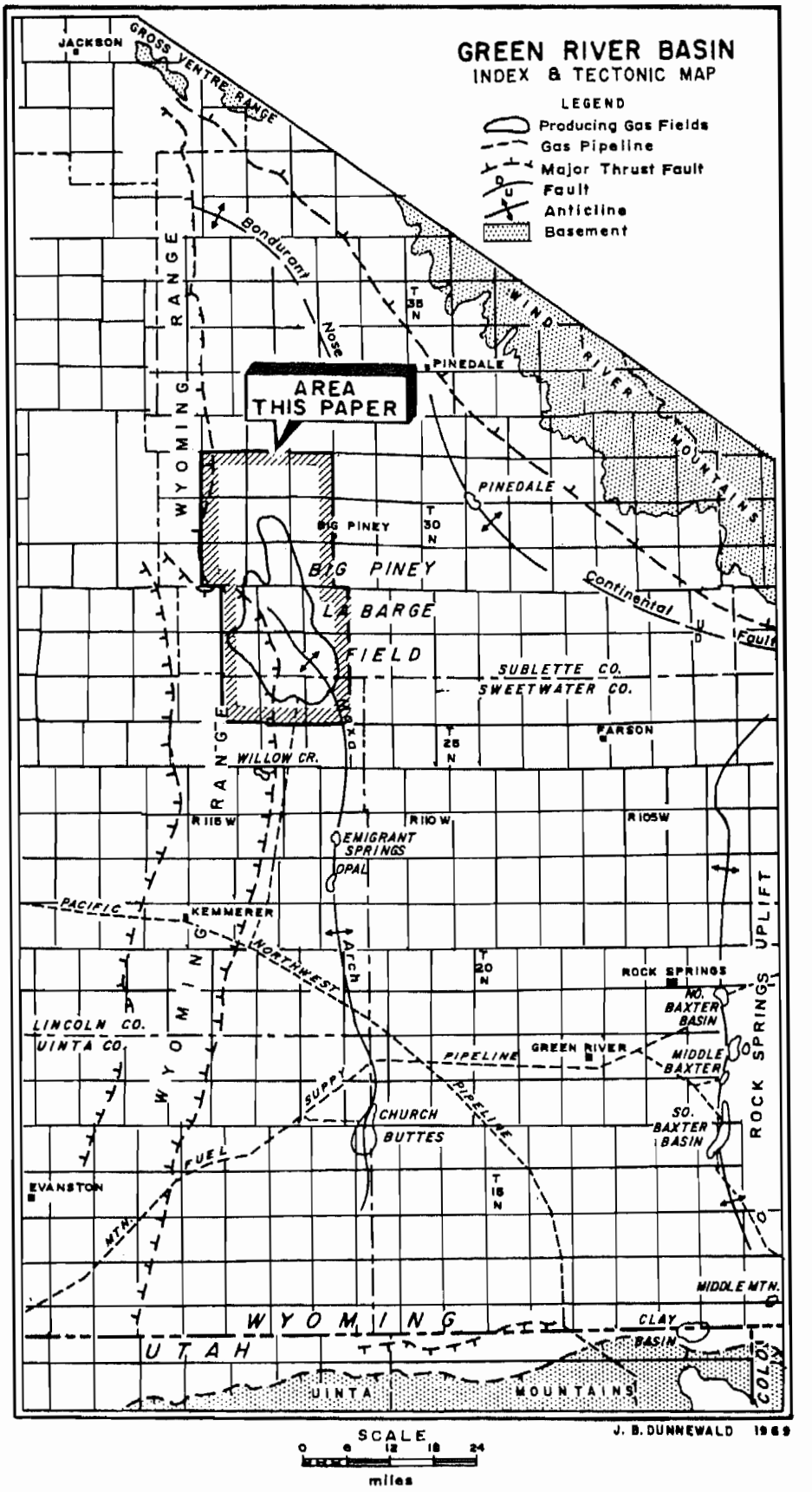
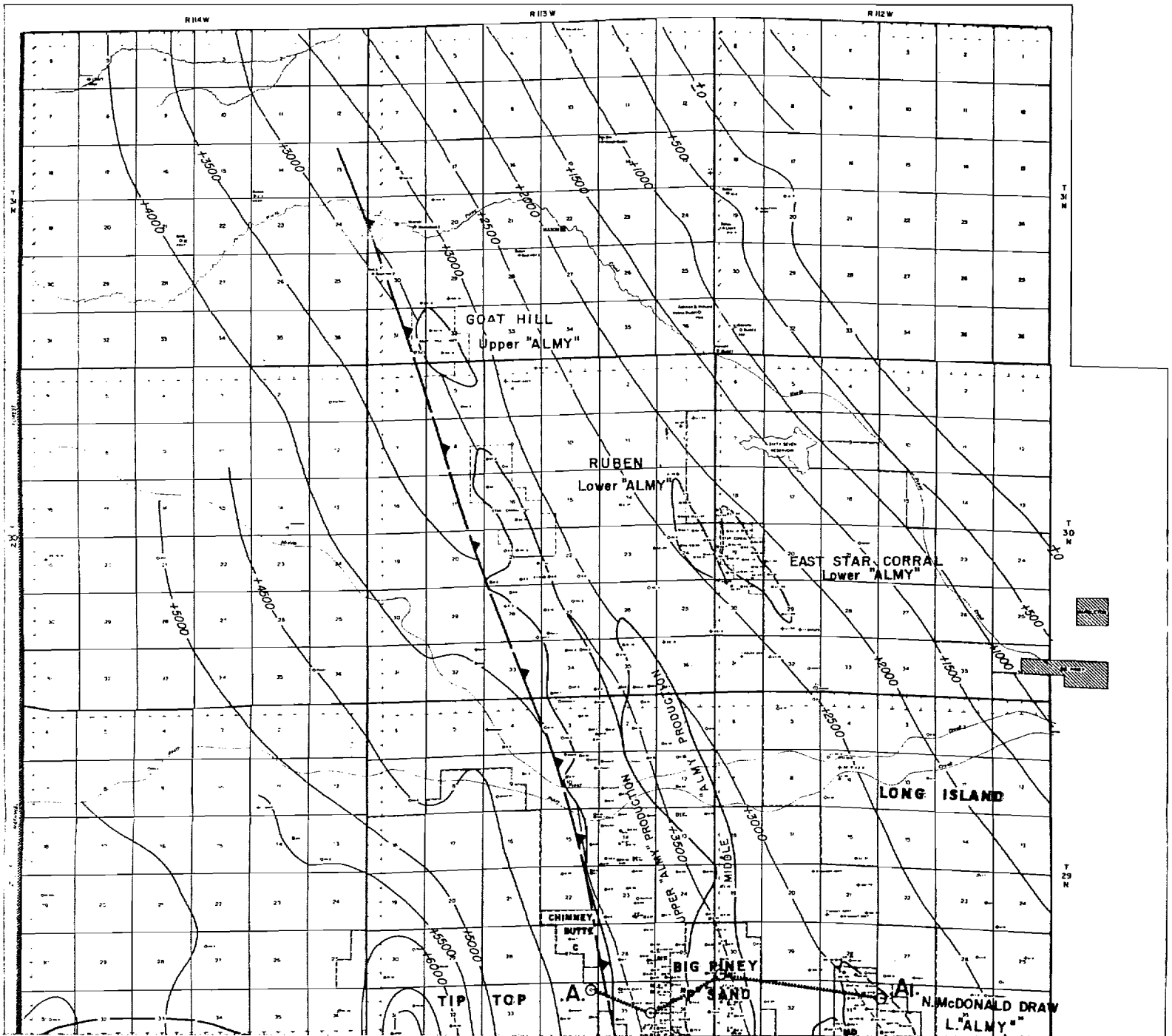

GREEN RIVER BASIN
INDEX & TECTONIC MAP
LEGEND
Producing Gas Fields
Gas Pipeline
Major Thrust Fault
Fault
Anticline
Basement
JACKSON
GROS VENTRE RANGE
Bondurant
Nose
WYOMING RANGE
WIND RIVER MOUNTAINS
PINEDALE
AREA THIS PAPER
BIG PINEY
LA BARGE FIELD
Continental Fault
SUBLETTE CO.
SWEETWATER CO.
PARSON
WILLOW CR.
EMIGRANT SPRINGS
OPAL
PACIFIC
KEMMERER
NORTHWEST
Arch
LINCOLN CO.
UINTA CO.
PIPELINE
GREEN RIVER
SUPPY
CHURCH BUTTES
FUEL
EVANSTON
MTN.
ROCK SPRINGS
NO. BAXTER BASIN
MIDDLE BAXTER
SO. BAXTER BASIN
ROCK SPRINGS UPLIFT
MIDDLE MTN.
CLAY BASIN
WYOMING
UTAH
COLORADO
UINTA MOUNTAINS
T 35 N
T 30 N
T 25 N
T 20 N
T 15 N
R 118 W
R 110 W
R 105 W
SCALE
0 6 12 18 24
miles
J. B. DUNNEWALD 1969

Fig. 1.


R114W
R113W
R112W
T 31 N
T 30 N
T 29 N
GOAT HILL
Upper "ALMY"
RUBEN
Lower "ALMY"
EAST STAR CORRAL
Lower "ALMY"
LONG ISLAND
CHIMNEY BUTTE
BIG PINEY
TIP TOP
A.
A'
N. McDONALD DRAW
L. "ALMY"
+0
+500
+1000
+1500
+2000
+2500
+3000
+3500
+4000
+4500
+5000
+5500
+6000

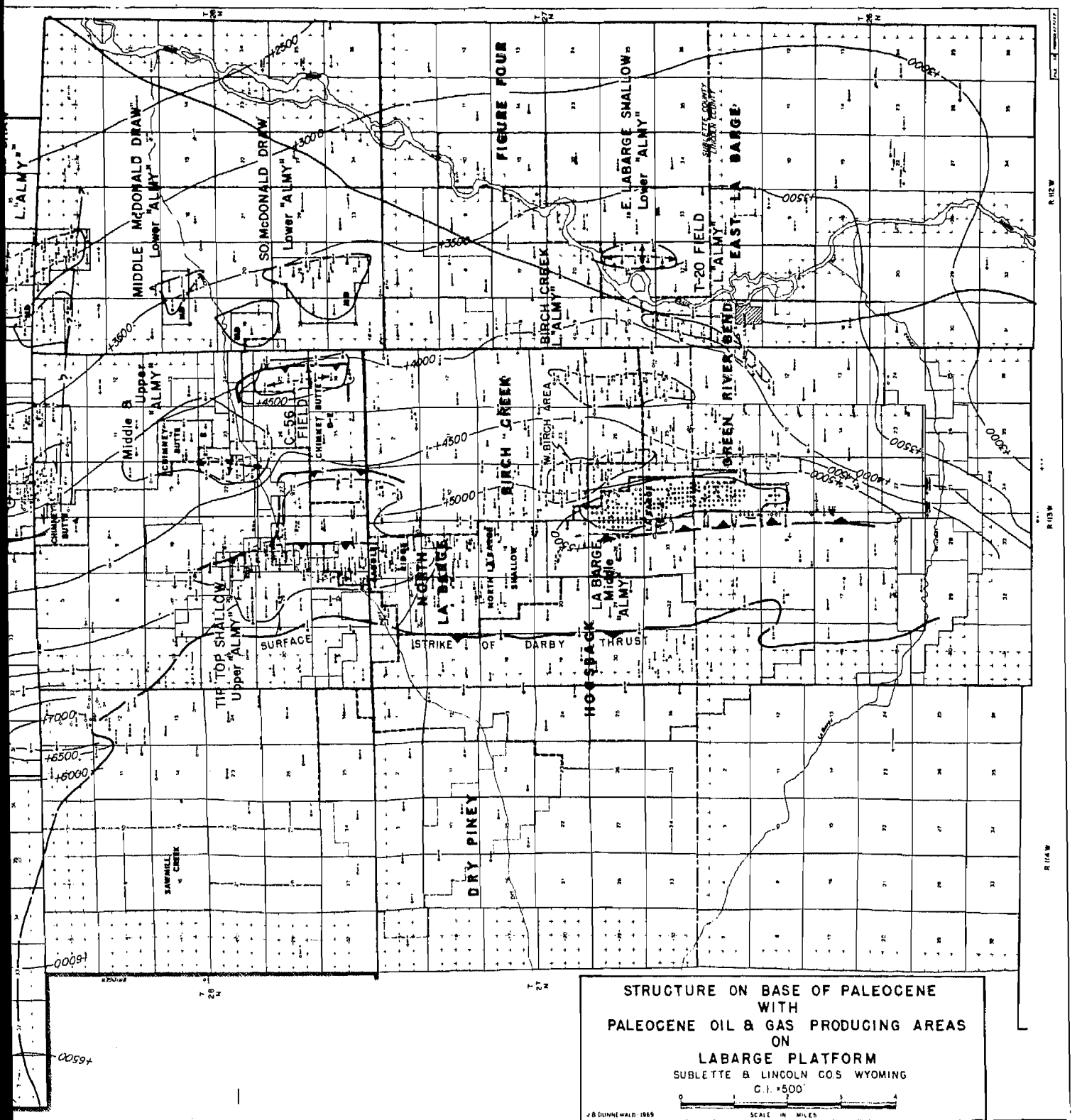


FIGURE FOUR
STRUCTURE ON BASE OF PALEOCENE
WITH
PALEOCENE OIL & GAS PRODUCING AREAS
ON
LABARGE PLATFORM
SUBLETTE & LINCOLN COS WYOMING
C.I. =500'
SCALE IN MILES
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MIDDLE McDONALD DRAW
SO. McDONALD DRAW
BIRCH CREEK
E. LABARGE SHALLOW
T-20 FIELD
GREEN RIVER BEND
EAST LA BARGE
C-56 FIELD
NORTH LA BARGE
HOGBACK
DRY PINEY
TIP TOP SHALLOW
SURFACE
STRIKE OF DARBY THRUST
SAWMILL CREEK

Fig. 2

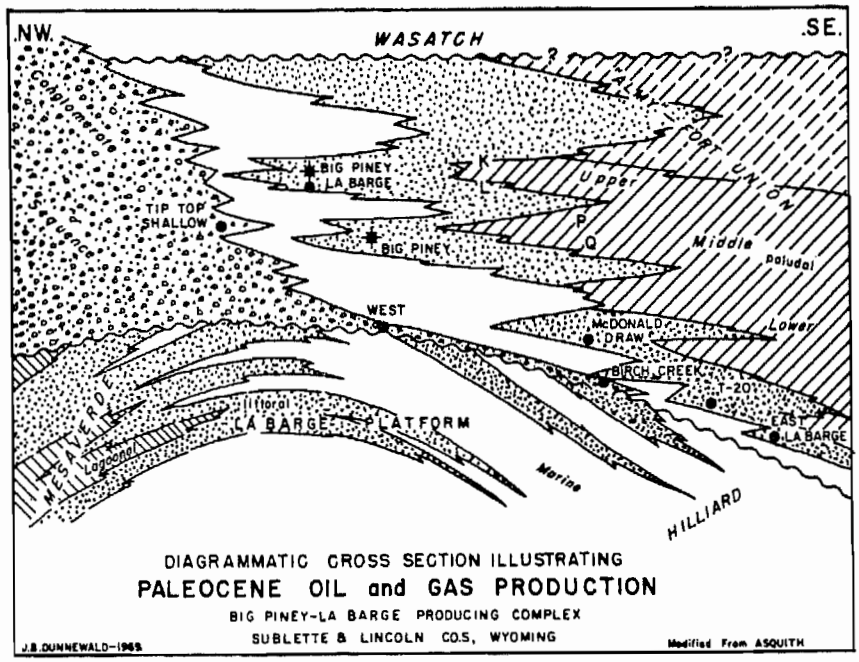


Fig. 3.

Almy, as originally named by Veatch, is Eocene in age.

Subsurface correlation as well as lithologic differences indicate that the conglomeratic facies material was derived from a sedimentary source to the west while the non-conglomeratic Fort Union or "Almy" was derived from a granitic source to the east or northeast. As the Green River Basin filled with sediment, Fort Union deposition trangressed across the LaBarge Platform from east to west, resulting in the onlap sequence shown by the cross sections (Figs. 3 and 4).

The individual sands in the Fort Union have a sinuous north-south depositional strike which in some instances can be traced for many miles. These sands may reach 100 feet or more in thickness, however the average is much less. Often the maximum thickness was deposited near the western or up dip pinchout of the sand. East of their maximum buildup, the sands generally thin and become less coherent, being finely interbedded with shale, siltstone, and minor coal.

The pronounced arcuate configuration of some of the sand bodies, along with high angle cross bedding and the general geometry suggest that many of the more prominent sands are point bar and stream channel deposits. Much of the lacustrine type shale and limestone deposition which has been described may have taken place in ox bow type lakes which would account for the narrow east-west extent of such deposits.

PRODUCTION

Fort Union production in the Big Piney LaBarge field has been found under a variety of stratigraphic and structural conditions. These are listed as follows:

1. Eastward deflection of sand pinchout to form a trap on monoclinal dip (Goat Hill, Ruben, East Star Corral, Middle and South McDonald Draw).
2. Sand pinchout crosses anticlinal nose (Birch Creek, T-20).
3. Up dip continuation or continuity of sand pinch out interrupted by faulting (North McDonald Draw, Upper and Middle "Almy" in T. 29 N., R. 113 W.
4. Actual structural closure (C-56 Field, Tip Top Shallow, LaBarge East LaBarge Shallow).
5. Isolated Transition sand production (usually not significant unless associated with an underlying Mesaverde accumulation such as the West Birch Creek pool and the southern Upper "Almy" area in Secs. 35 and 36, T. 29 N., R. 113 W.).

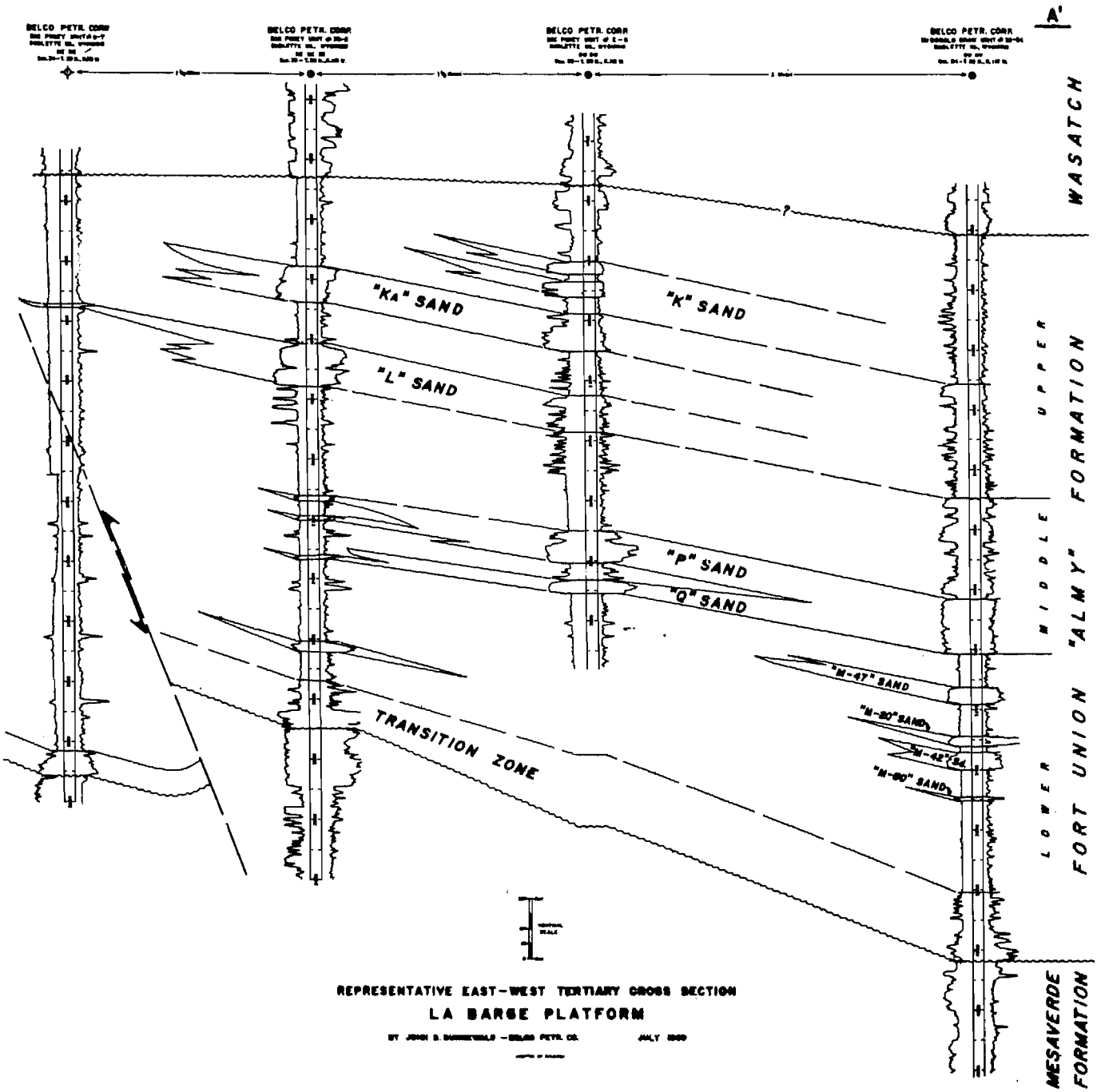
As might be expected, the structural and combination traps generally produce from several sands. The stratigraphic traps only produce from one or two sands.

Production from the upper and middle sands, "K" through "Q" (Fig. 4) has been predominantly gas, although the "P" sand has a significant oil column below a large gas cap and some of the thin sands in the interval between the "L" and "P" have produced small amounts of oil.

The lower sands on the other hand typically contain oil with a relatively small gas cap, or in some pools no apparent gas cap at all. Oil from the upper sands has a gravity in the 23°-26° API range, whereas that from the lower sands has a gravity of 42°- 48° API, which is similar to the gravity of the oil from the underlying Mesaverde Formation.

Oil wells in the better sands will I. P. after frac. for several hundred barrels of oil per day and initial rates as high as 800+ BOPD have been recorded.

Initial production rates for the Fort Union gas sands is usually several million cubic feet of gas per day without frac. Because of the shallow depth and resulting low pressure it is



REPRESENTATIVE EAST-WEST TERTIARY CROSS SECTION
LA BARGE PLATFORM

necessary to compress the gas before delivering it into the 570 pound pipeline. Cumulative production for many of the shallow gas wells currently exceeds two billion cubic feet of gas, and some of the wells have produced more than eight billion cubic feet of gas. Analyses of this gas indicates that it is usually in the 1080-1120 BTU range with 90-94 percent methane, 4-5 percent ethane, nil to a trace of nitrogen, CO_2 and H_2S, and a specific gravity of .6.

All the Fort Union or "Almy" sands, with the possible exception of some isolated sands in the Transition zone, contain water down dip. Although there does not appear to be an active water drive, the sands will produce substantial amounts of water on DST or in structurally low producing wells. In order to improve the oil recoveries from these solution gas and gas cap expansion drive reservoirs, successful water floods have been initiated in most of the pools.

CONCLUSION

Because of the multiplicity of objective sands, the variety of potential traps, and the favorable economics, it is anticipated that exploration for additional Fort Union ("Almy") production will continue for many years.

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