

EFFECTIVE HYDROCARBON POROSITY:

AN ELUSIVE PHYSICAL PARAMETER
IMPOSSIBLE TO EVALUATE
FROM CURRENTLY AVAILABLE
CORE AND LOG DATA

**LINDRITH GALLUP-DAKOTA,
WEST**

(Oil)

T. 24-25 N., R. 4 W., NMPM
Rio Arriba County, New Mexico**GEOLOGY (Dakota)**

Regional Setting: Southeastern flank of the San Juan Basin
Surface Formations: Tertiary, San Jose Formation
Exploration Method Leading to Discovery: Subsurface geology
Type of Trap: Stratigraphic
Producing Formation: Dakota Sandstone
Gross Thickness and Lithology of Reservoir Rocks: 40 feet of gray and brown, very fine to fine-grained, subrounded, slightly calcareous to calcareous sandstone with some clay filling and vertical fractures.
Geometry of Reservoir Rock: Stacked series of discontinuous lenses, elongate in a generally northwest direction

DISCOVERY WELL (Dakota)

Name: Johnston & Shear No. 1-1 Jicarilla
Location: SW SW (990' FSL and 990' FWL), sec. 1, T. 24 N., R. 4 W., NMPM
Elevation (KB): 6,919 feet
Date of Completion: March 21, 1959
Total Depth: 7,695 feet
Production Casing: 5½" at 7,610 feet with 550 sacks of cement
Perforations: 7,312 to 7,340 feet; 7,352 to 7,360 feet; 7,386 to 7,394 feet; 7,504 to 7,512 feet
Stimulation: Sand-oil fracture
Initial Potential: 1,914 MCFGD, plus 21 barrels of distillate, (¾" choke)
Bottom Hole Pressure: 3,100 psig (estimated)

GEOLOGY ("Gallup")

Regional Setting: Southeastern flank of the San Juan Basin
Surface Formations: Tertiary, San Jose Formation
Exploration Method Leading to Discovery: Subsurface geology
Type of Trap: Stratigraphic
Producing Formation: Cretaceous, "Gallup" sandstone (basal Niobrara age)
Gross Thickness and Lithology of Reservoir Rocks: 55 feet of gray, very fine to fine-grained sandstone; slightly calcareous shaly sandstone with vertical fractures
Geometry of Reservoir Rock: Stacked series of discontinuous lenses, elongate in a generally northwest direction
Other Significant Shows: Produces gas from the Cretaceous, Pictured Cliffs Sandstone

Oil and Gas Fields of the Four Corners Area]

By: R. Tucker Attebery
Geological Consultant**Oldest Stratigraphic Horizon Penetrated:** Jurassic, Morrison Formation**DISCOVERY WELL ("Gallup")**

Name: Continental Oil Company No. 2-20 Jicarilla
Location: SW SW (349' FSL and 596' FWL), sec. 20, T. 25 N., R. 4 W., NMPM
Elevation (KB): 7,315 feet
Date of Completion: April 16, 1959
Total Depth: 7,020 feet
Production Casing: 5½" at 7,020 feet with 895 sacks of cement
Perforations: 6,870 to 6,980 feet
Stimulation: Sand-oil fracture
Initial Potential: Original well, 41 BOD, pumping; drilled deeper in 1960, 55 BOD, pumping
Bottom Hole Pressure: 2,100 psig (estimated)

DRILLING AND COMPLETION PRACTICES

1. Drill 12¼" hole to 350 feet with lime and gel, set 8 5/8" surface casing to bottom and cement with 300 sacks of cement
2. Drill 7 7/8" hole to total depth with low solids mud; weight 8.8 to 9.0 lbs; viscosity 28 to 32 seconds, water loss 6 to 8 cc
3. For logging: raise mud weight to 9.0 to 9.2 lbs, viscosity 60 to 70 seconds, water loss 6 to 8 cc
4. For evaluation: Induction log, gamma ray log, compensated formation density log with compensated neutron log, caliper log
5. Set 4½" production casing through the Dakota and cement with 900 sacks of cement staged to cover all potential productive intervals
6. Perforate pay zones with 1 to 2 shots per foot, acidize, and sand-water fracture

Note: Circulation loss is commonly encountered at the top of the "Gallup," occasionally necessitating pre-conditioning.

RESERVOIR DATA**Productive Area:**

Proved (as determined geologically): 10,000+ acres
 Unproved: Field limits are presently being extended
 Approved Spacing: 160 acres
 No. of Producing Wells: 39
 No. of Abandoned Wells: 0
 No. of Dry Holes: 0

Average Net Pay: "Gallup," 32 feet; Dakota, 41 feet

Porosity: "Gallup" 12 percent, effective; Dakota 9 percent, effective

Permeability: Natural fracturing distorts the formation averages which are: "Gallup" 0.06 millidarcy; Dakota 0.05 millidarcy

Water Saturation: "Gallup" 45 percent; Dakota 40 percent

Initial Field Pressure: "Gallup" 2,100 psig (estimated); Dakota 3,100 psig (estimated)

Type of Drive: Solution gas and fluid expansion

Gas Characteristics and Analysis (Commingled): Specific gravity 0.765; mixture heating value 1,280 Btu at 14.73 psig and 60°F, dry; analysis (normal molecular percent): CO₂ 0.62, N₂ 0.73, methane 77.74, ethane 12.0, propane 6.01, iso-butane 0.66, normal butane 1.47, iso-pentane 0.31, normal pentane 0.24, hexane plus 0.22

Oil Characteristics and Analysis: "Gallup," 43.7° API gravity; Dakota 45.6° API gravity

Associated Water Characteristics and Analysis (Commingled): Salt water; resistivity 0.14 ohm at 150°F; analysis (typical in mg/l): HCO₃ 354.6; SO₄ 2,000.0; Cl 8,787.0; Ca 389.8; Mg 171.2; total dissolved solids 19,661

Original Gas, Oil, and Water Contact Datums: Not available

Estimated Primary Recovery: "Gallup," 102,000 BO (10 to 12 percent) and 100,000 MCFG per well; Dakota, 131,000 BO (10 to 12 percent) and 130,000 MCFG per well

Type of Secondary Recovery: None

Estimated Ultimate Recovery: Not available

Present Daily Average Production: 353 BOD, 3,511 MCFGD, and 62 BWD

Market Outlets: Gas: pipelines—El Paso Natural Gas Company and Gas Company of New Mexico; sales—El Paso Natural Gas Company, Gas Company of New Mexico, and Northwest Pipeline Corporation. Oil: transportation—Inland Corporation, Permian Corporation, Plateau Incorporated; sales—Permian Corporation, Plateau Incorporated, Shell Pipeline Corporation

FIELD COMMENTARY

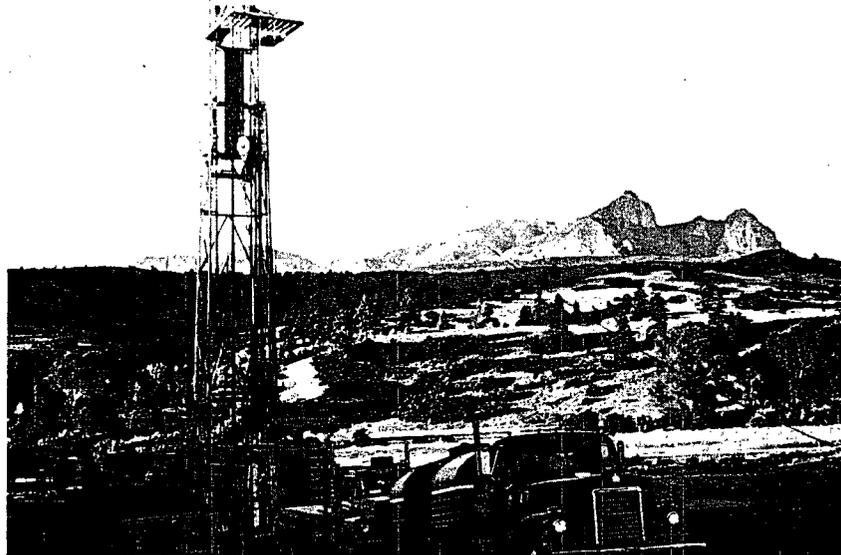
The Lindrith Gallup-Dakota, West field is located on the Jicarilla Apache Indian Reservation at the southern end of Rio Arriba County, New Mexico. Geologically, this position is on the southeast flank of the San Juan Basin. The discovery wells were completed in 1959, and the pool was created in March, 1972. Associated gas is produced with oil from reservoirs in the Upper Cretaceous marine "Gallup" sandstone (transgressive basal Niobrara age sandstones) and marine to marginal-marine Dakota Sandstone. Deposition occurred during major transgressive episodes, resulting in a stacked series of sandstone lenses. These lenses are elongated in a northwest direction. Local thinning of the lenses and the subsequent increased shaliness and permeability loss of the section will limit the field width; however, development drilling will probably extend the field length to the margins of the adjacent fields. To the southeast, Dakota production is expected to extend beyond the "Gallup" productive limits.

Closely spaced structural changes noted on the Dakota structure map, together with anomalous gas-oil ratio variations between wells, and the frequency of vertical fracture occurrence, as reported from field cores, probably indicate the presence of fracture and minor, high-angle fault sets. Therefore, deliverabilities are probably often fracture enhanced, and the higher gas-oil ratios are thought to occur on upthrown features.

The productivity of the low permeability sandstones was commonly overlooked in the early 1950's. The overall economics are now being optimized by formation stimulation and production commingling. The rate of development drilling, on 160 acre spacing, has accelerated dramatically from 1975 levels. This drilling is rapidly infilling and extending the field.

REFERENCES

- Annual Reports of the New Mexico Oil and Gas Engineering Committee.
- Drilling and completion records of the Petroleum Information Corporation.
- Personal, associates', and operator's files.

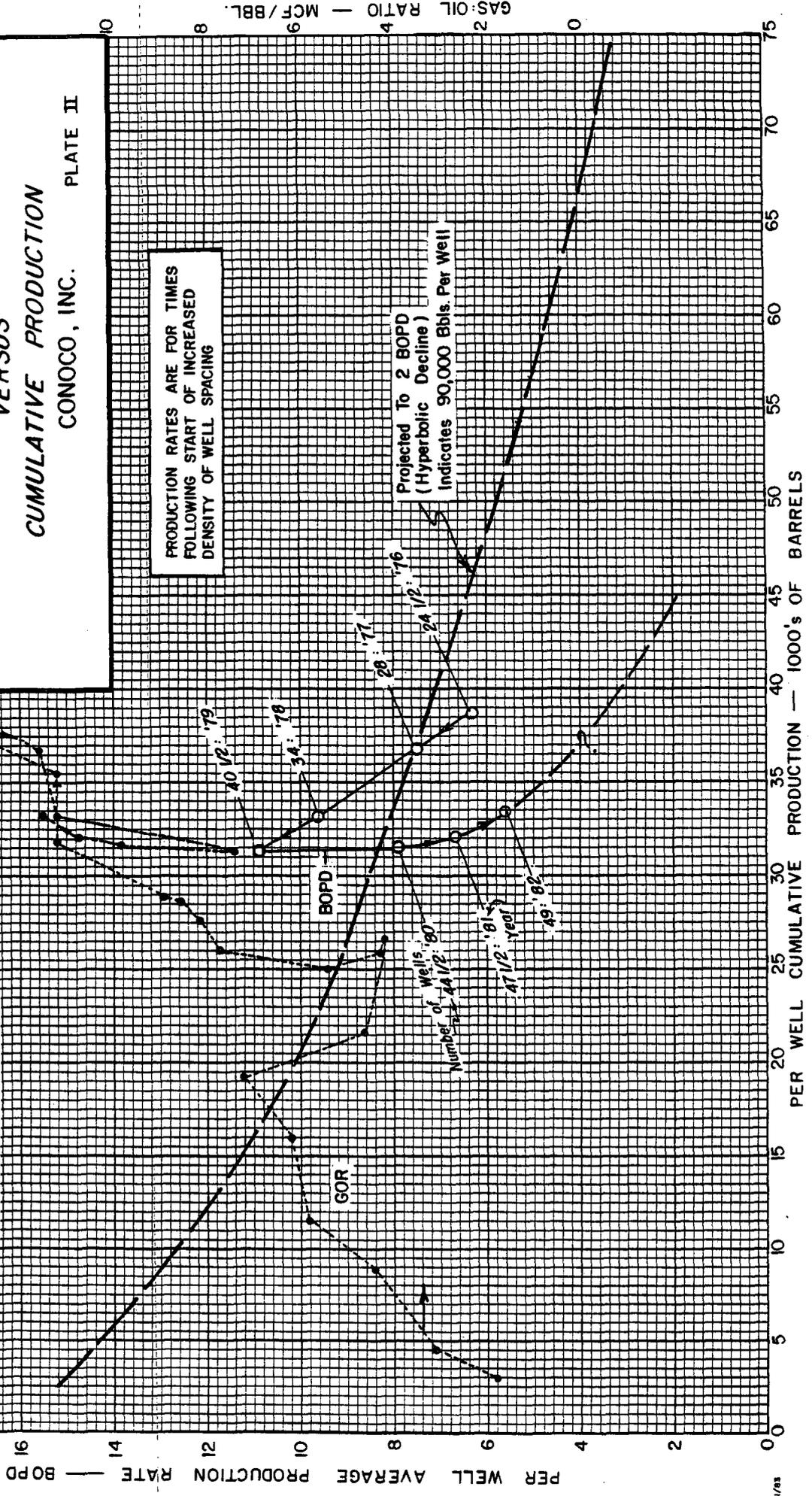


Malcolm Kitchens drill rig on the Osterhoudt-Crowley No. 1-7 Mantoro, 1978, East Chromo, Colorado. Navajo Peaks are on the skyline. (Yes, another dry hole—photo compliments of Walt Osterhoudt)

WEST LINDRITH GALLUP - DAKOTA POOL
 PLAT OF
 PER WELL AVERAGE
 PRODUCTION RATE
 VERSUS
 CUMULATIVE PRODUCTION
 CONOCO, INC. PLATE II

VOLUMETRIC ANALYSIS:

MANCOS - "GALLUP"	102,000 BBLS
DAKOTA	131,000 BBLS
	233,000 BBLS



PRODUCTION RATES ARE FOR TIMES FOLLOWING START OF INCREASED DENSITY OF WELL SPACING

Projected To 2 BOPD (Hyperbolic Decline) Indicates 90,000 Bbls. Per Well