

NORTH DAKOTA GEOLOGICAL SURVEY CIRCULAR NO. 231

Summary of the British American Oil Prod. Co.- Julia Van DeErve #1
Renville County, North Dakota
Well No. 2609 - Permit No. 2621

by William P. Eastwood
May, 1960

British-American - Van DeErve, #1 located in SW 1/4, SE 1/4, Section 15, T. 163N., R. 84W., (1980 FEL, 660 FSL) Renville County, North Dakota. Elevation of K.B. 1603; GL 1591.

The drilling permit was issued on March 9, 1960. The well was drilled to a total depth of 4265 feet and completed as a producer from the middle part of the Frobisher-Alida interval on March 31, 1960, making it the discovery well of Eden Valley field.

Drill Stem Tests:

#1 4167-4186 (Frobisher-Alida) 3-17-60. Good blow with gas to surface in 10 minutes - too small to measure, continuing throughout test. Recovered 240 feet frothy oil and gas cut mud, 1020 feet of oil and 120 feet of salt water.

ISIP - 1894
IFP - 108
FFP - 556
FSIP - 1811
HYD - 2330

#2 4186-4202 (Frobisher-Alida) 3-18-60. Good blow immediately, decreasing to weak blow throughout test. Gas to surface in 110 minutes, too small to measure. Recovered 300 feet of gas cut mud, 120 feet of oil cut mud, 420 feet of free oil, 180 feet of oil cut water, and 1230 feet of salt water.

ISIP - 1894 (near static)
IFP - 240
FFP - 1060
FSIP - 1811 (not static)
IHP - 2420
FHP - 2362

Completion Data:

1. Perforated 4182-4186 with 4 holes per foot. Acidized with 500 gallons.
2. 3-25-60. 15 hour swab test. Swabbed 181 barrels of oil and 25 barrels salt water. GOR too small to measure. Gravity 28⁰ API.
3. 4-1-60. 24 hour pump test. No choke, 2 inch tubing. Pumped 24 barrels of oil and 85 barrels of water. Gas too small to measure. Gravity 27.1⁰ API.

Casing and Tubing Record:

529 feet of 8 5/8 inch surface casing cemented with 300 sacks.
4278.5 feet of 5 1/2 inch production casing cemented with 200 sacks.
Cement top at 3215.
4210.4 feet of 2 inch tubing.

Mechanical Logs:

- Induction - Electrical (531-4267)
- Sonic Log (2600-3200; 3900-4267)
- Microlaterolog (2600-3200; 3871-4271)
- Gamma Ray -Neutron and Cemoton (0-4219.5; 0-4231.5; 3000-3500)

Core Record:

1. 4168-86 Full recovery
2. 4186-4202 Full recovery

Core Analysis averages (Core Labs., Dallas)

Interval	Permeability	Porosity	Residual Saturation		Remarks
			Oil	Water	
4168-74	0.1	8.5	0.9	70.0	Non-Productive
4174-79	8.1	23.6	8.0	59.9	Oil and water
4179-80	0.1	4.9	0.2	69.5	Impermeable
4180-95	Ave. 140.5	Ave. 17.4	11	37	Oil Productive
	Min. 2.3	Min. 10.8			
	Max. 952.0	Max. 24.3			
4191-4202	26.0	14.6	0	69.2	Water

The formation tops were determined from samples and mechanical logs. Color names are those used in the Rock Color Chart of the National Research Council. Limestone petrography terms are those proposed by Folk (1959) Bull. Amer. Assoc. Petroleum Geologists, vol. 43, no. 1, pp. 1-38.

FORMATION TOPS

Cretaceous

- Niobrara formation 1861
- Greenhorn formation 2152
- Fall River formation 2651

Jurassic 3040

- Piper formation 3530

Triassic (?)

- Spearfish 3795

Mississippian

- Midale subinterval 3986
- Frobisher-Alida interval 4030
- Top "Massive Anhydrite" 4063

- 0-560 No samples.
- 560-590 Shale, medium light gray, very slightly silty and slightly calcareous, fissile.
- 590-620 Shale as above with common greenish gray non-calcareous, slightly pyritic shale.
- 620-710 Common greenish gray shale as above with abundant dark gray shale.
- 710-800 Medium gray to dark gray clayey fissile shale. Rare pyrite masses.
- 800-890 Common medium to dark gray shale as above with common brownish gray to olive gray blocky shale.
- 890-1040 Abundant dark gray shale as above, rare brownish gray shale as above. Very rare medium light gray non-calcareous shale.

1040-1100 Medium gray, non-calcareous blocky shale. Rare brownish gray shale and medium light gray shale as above.

1100-1160 Abundant dark gray to black shale with rare light gray bentonitic shale. Rare mollusk fragments.

1160-1220 Medium light gray to light gray, non-calcareous, blocky shale. Very rare mollusk fragments.

1220-1280 Abundant dark gray shale, common light gray bentonitic shale.

1280-1440 Medium light gray to light gray non-calcareous blocky shale. Rare light gray bentonitic shale. Rare medium-sized, iron stained, rounded quartz grains at 1370-1400 (caving?).

1440-1460 Abundant dark gray shale, common light gray shale as above.

1460-1480 Abundant light gray shale as above. Rare medium-sized rounded quartz grains. Common very light gray bentonitic shale.

1480-1500 Abundant dark gray shale. Rare medium gray shale as above.

1500-1700 Abundant medium gray shale as above. Rare mollusk fragments. One piece of white shaly limestone at 1560-80. One piece pink gypsum at 1660-1680.

1700-1720 Common dark gray shale, common light gray shale, common brownish gray shale. Rare brownish gray siltstone.

1720-1860 Medium gray and dark gray shale as above. Rare white limy shale.

1861 Top of Niobrara formation

1860-1880 Abundant medium gray shale as above.

1880-1900 "Speckled shale". Dark gray to brownish gray shale containing small white calcareous specks. Common dark gray to medium gray shale.

1900-1920 Abundant black fissile shale, common brownish gray calcareous speckled shale as above.

1920-1940 Black shale as above, rare speckled shale.

1940-1980 Brownish gray and dark gray shale as above, rare brownish gray siltstone. No speckled shale seen.

1980-2060 As above with common light gray calcareous soft shale.

2060-2080 Abundant medium gray to light gray shale, rare black shale.

2080-2120 Black fissile shale, common mollusk fragments.

2120-2140 Abundant medium gray shale, common light gray bentonitic shale, rare black shale.

2152 Top of Greenhorn formation

2140-2200 Abundant black shale some of which is slightly speckled, rare gray shale.

2200-2400 Common black shale and common gray shale as above. One piece white fine crystalline limestone at 2260-80. Rare pieces of gray medium-grained quartz sandstone at 2380-2400.

2400-2420 Abundant light gray to medium gray shale, rare dark gray shale, very rare pieces of brown sublithographic limestone. Rare mollusk fragments.

2420-2460 Abundant dark gray shale, rare medium gray to light gray shale, rare mollusk fragments.

2460-2720 Dark gray shale and medium to light gray shale. Common medium sized rounded quartz grains 2655-2720.

2651 Top of Fall River formation

2720-2760 Sandstone, medium to fine grained, quartzose, friable, calcareous cement white associated with medium to coarse sized rounded quartz grains as above. Abundant shale as above.

2760-2785 Abundant black shale, rare sandstone and quartz grains as above.

2785-2930 Abundant medium gray non-calcareous shale very rare pyrite crystals. Rare to common dark gray shale. Medium to fine-grained sandstone (cavings ?) 2910-2915.

2930-3045 Shale as above. Abundant medium to coarse rounded quartz grains and medium to fine grained friable sandstone with calcareous cement. The coarse quartz grains may be cavings.

3045-3075 Shale as above, rare sandstone as above.

3075-3095 As above with rare light gray shaly sandstone and siltstone. Rare pieces of red shale in 3085-90.

3095-3110 Shale as above. Common light gray to greenish gray (5GY6/1) very fine grained sandstone and siltstone.

3110-3150 Shale as above, badly caved. Some sandstone as above.

3150-3160 Shale as above, badly caved.

3160-3185 Common light brown (5YR6/4) silty fissile shale abundant dark gray shale cavings as above.

3185-3240 Dark gray shale.

3240-3345 Common light gray soft calcareous shale. Rare to common brown shale and light gray sandstone as above. Abundant dark gray shale as above. Badly caved.

3345-3360 Common light brown shale as above, common pale reddish brown (10R5/4) siltstone.

3360-3375 Common light gray to white fine grained quartz sandstone with calcareous cement. Shale as above.

3375-3515 Shale as above, rare sandstone as above. Badly caved.

3530 Top of Piper formation

3515-3535 Limestone, dolomitic, white, sublithographic, containing rare small pyrite crystals. Shale as above.

3535-3560 Shale as above with medium gray fine-grained sandstone.

3560-3600 Limestone, two kinds. Yellowish brown subsucrosic dense limestone and white sublithographic limestone. Shale cavings. Sandy limestone at 3575-95.

3600-3650 Shale and sandstone cavings (?) as above. Common white limestone as above, rare yellow brown limestone as above. White limestone containing secondary gypsum as above.

3650-3670 White limestone as above with rare yellow brown very fine crystalline, limy dolomite.

3670-3685 Rare limestone and dolomite as above. Abundant black fissile shale.

3685-3700 Abundant white limestone as above, rare dolomite as above. Common cavings.

3700-3770 Medium gray to light gray shale. Very rare limestone. Rare white gypsum.

3770-3785 Light gray non-calcareous soft shale. Rare limestone and gypsum as above.

3795 Top of Spearfish formation

3785-3800 As above with rare greenish gray (5G6/1) waxy shale.

3800-3975 Gray shale as above with rare pale reddish brown (10R5/4) shale and rare reddish brown fine-grained silty sandstone. The sandstone is relatively abundant from 3855-3875 and 3905-3950.

3985 Top of Midale subinterval

3975-3995 Limestone, pale yellowish brown (10YR6/2) to very pale orange (10YR8/2) subsucrosic, anhydritic. Common shale as above. Limestone has good intercrystalline porosity.

3995-4015 Limestone, very pale orange, subsucrosic, non-anhydritic, good intercrystalline porosity, contains rare pale yellowish brown pellets and ostracods (?) valves. Shale cavings.

4030 Top of Frobisher-Alida interval

4015-4055 Limestone as above with common pale yellowish brown limestone consisting of small indistinct pellets in a matrix of sub-lithographic limestone and clear calcite (pelsparite and pelmicrite). Rare to common white to pinkish calcium sulphate (anhydrite or gypsum) which may be cavings.

4055-4065 Limestone, moderate yellowish brown (10YR5/4) texture as above, common light brown (5YR5/6) limy anhydrite crystals.

4063 Top of "Massive Anhydrite"

4065-4100 Common white to bluish gray anhydrite, rare limestone as above, badly caved.

4100-4115 Anhydrite as above with abundant very pale orange subsucrosic anhydritic limy dolomite. The dolomite and anhydrite seem to have been interlaminated.

4115-4135 Limestone, pale yellowish brown, small pellets in sublithographic matrix (pelmicrite) with rare pieces of oolites in a matrix of clear calcite and pelmicrite (oopelmicrite with patches of sparite). No vugs or open pores seen. Fair intergranular porosity. Rare pinpoint porosity 4120-85. No anhydrite below 4120.

4135-4145 Limestone as above, oolites more numerous, associated with abundant pale yellowish brown pelintrasparite (small pellets which may be calcispheres and very small intraclasts in a finely crystalline calcite matrix). Good intergranular and pinpoint porosity. No cut.

4145-4150 Limestone as above with common white to bluish gray, anhydrite.

4150-4160 Anhydrite. Shale cavings.

4160-4168 As above with abundant bluish gray fine-grained anhydrite sandstone. Sand is composed of clear angular anhydrite fragments in a dolomitic anhydritic matrix.

4167-4186 Drill Stem Test #1. Gas to surface in 10 minutes, recovered 240 feet frothy oil and gas cut mud, 1020 feet oil, and 120 feet of salt water.

Core chips

4168-4169 Anhydrite, massive, bluish gray, translucent. Contains numerous very small, very pale orange calcareous pellets. The pellets are not arranged in laminae but are scattered throughout the anhydrite.

4169-4170 Anhydrite, fine crystalline, white to bluish gray. Interlaminated with light gray, very finely crystalline, limy dolomite which contains angular anhydrite fragments similar to the anhydrite sandstone at 4160-4168.

4170-4171 As above only no anhydrite fragments in the dolomite.

4171-4172 As above, some patches of anhydrite sandstone.

4172-4173 Anhydrite sandstone. Good porosity. Very limy.

- 4173-4174 Limy sucrosic dolomite as in sandstone matrix above. Contains rare anhydrite fragments. Good intergranular porosity.
- 4174-4175 As above, abundant small pyrite crystals on fracture surface.
- 4175-4176 White sucrosic dolomitic limestone. Good pinpoint and intergranular porosity. Scattered oil stain. Faint indication of pelmicrite texture.
- 4176-4177 Limestone, white to light gray. Pelintra-microsparite yellow brown pellets and small intraclasts which appear to be floating in a fine crystalline calcite matrix. Generally, the intergranular porosity is low but parts of the rock have a more sucrosic matrix with better porosity and with a few open pores. These more porous parts of the rock are heavily oil-stained.
- 4177-4178 Limestone, mottled yellowish brown and white. The major part is yellow brown pel-sparite consisting of pellets tightly packed in a sparite matrix. This part has many large open pores and very good intergranular porosity, in places there is very little cement. The white parts of the rock are pelintra-sparite consisting of very small pellets and small intraclasts closely packed in a calcite matrix. This part of the limestone is very tight. The brown color may be due to oil staining. Good cut.
- 4178-4179 Limestone, mottled as above only staining and difference in porosity not so pronounced. Contains a few large surficial oolites the nuclei of which are white subsucrosic limestone.
- 4179-4180 Limestone pelintra-sparite, pellets and large intraclasts in a sparry calcite cement with possibly a few surficial oolites. Very good intragranular porosity. Heavy oil stain, good oil odor. Most of the rock has very little cement and the porosity is very high. Also, a piece of white limestone, pelo-microsparite, pellets and small oolites in a finely granular matrix, common small pyrite crystals, many pinpoint pores. Intercrystalline porosity appears to be high. No oil stain, no odor, no cut.
- 4180-4181 Limestone, pelintra-sparite, heavily oil-stained, as above.
- 4181-4182 Limestone, pale yellowish brown to very pale orange. Pelintra-sparite with a few large surficial oolites. Low intergranular porosity, scattered oil stain. Some of the matrix or cement appears to have fair intercrystalline porosity.
- Perforated Interval 4132-86
- 4182-4183 Limestone, pelo-intra-sparite. Heavily oil stained. High porosity and permeability. Similar to the highly stained limestone above.
- 4183-4184 Limestone pale yellowish brown, pelo-sparite. Pellets and small oolites with rare large intraclasts tightly packed in a matrix of fine crystalline calcite. Low intergranular and intercrystalline porosity. Common large open pores lined with calcite crystals. No stain. Good cut in carbon tetrachloride.
- 4184-4185 Limestone as above. Common large surficial oolites. More large pores and better intergranular porosity than above. Faint oil odor. Very good cut. A corner of one is composed of pel-sparite, very small pellets and rare oolites very closely packed in the cement. This part has very low porosity and apparently has no oil.

4185-4186 Limestone, oosparite. Medium sized oolites with possibly rare rounded intraclasts with calcite cement. Very little cement so the oolites are loosely stuck together resulting in very high porosity. Parts of the rock are rather heavily cemented resulting in lower porosity. Many irregular large pores lined with drusy calcite crystals. Heavily oil stained. Good oil odor.

Drill stem Test #2 4186-4202

Gas to surface in 110 minutes. Recovered 300 feet gas cut mud, 120 feet oil cut mud, 420 feet of free oil, 180 feet of oil cut water, 1230 feet of salt water.

4186-4187 Limestone, pale yellowish brown peloointrasparite. Small pellets, rare oolites and rare large white pelmicrite intraclasts closely packed in a calcite cement. Numerous drusy calcite-lined irregular pores which are stained with a heavy black oil. The pores appear to be concentrated in areas where the texture is coarser; i.e. in places where the oolites are concentrated and around the large intraclasts. In this specimen and in most of those above the porosity appears to be the result of solution of the cement. Anhydrite, white, massive in the same sample.

4187-4188 Limestone, pale yellowish brown, pelmicrosparite. Small pellets in a very fine crystalline calcite matrix. Fair intercrystalline porosity. No stain but good cut. Whole rock looks slightly sucrosic and appears slightly altered. One corner of sample is white anhydrite. Between anhydrite and above limestone is a thin zone of white, subsucrosic limestone which grades into the yellowish brown limestone.

4188-4189 Limestone, moderate yellowish brown, oopelmicrosparite. Large oolites, surficial oolites, and fragments of oolites in a pelmicrosparite matrix. Large irregular pores, some filled with clear anhydrite. The areas containing the anhydrite are lighter colored and appear slightly altered to sucrosic limestone. Good cut in carbon tetrachloride.

4189-4190 As above but with more pellets and less large oolites and intraclasts. Pores are not as numerous but are larger. Good cut.

4190-4191 As above. Contains a large stylitic (?) seam filled with black carbonaceous material and having white sucrosic limestone bordering it.

4191-4192 Limestone, moderate yellowish brown, oopelsparite with very little cement. Very good intergranular porosity which may be the result of solution of the cement. Heavily oil stained. One piece of the sample is a moderate yellowish brown pelsparite consisting of small pellets very tightly packed in a small amount of calcite cement and is oil stained where the cement has been removed. Very little cement even in the less porous parts. Both types of limestone have good cut.

4192-4193 Limestone, sucrosic, white, contains many yellowish brown oolites and surficial oolites. Common pinpoint pores and good intercrystalline porosity. No stain and no cut.

4193-4194 Limestone, as in 4191-92

4194-4195 Limestone, parts of it are white pelsparite with rare patches of micrite cement have good pinpoint porosity but not oil-stained. Other parts are moderate yellowish brown oopelsparite having good intergranular porosity and good oil stain. Brown limestone contains scattered irregular large intergranular pores which are lined with a black tarry substance.

4195-4196 Limestone, white to very pale orange. Pelintrasparite. Pellets and medium sized rounded intraclasts or superficial oolites closely packed in calcite cement. Good pinpoint porosity, fair intergranular porosity. Common medium-sized intergranular pores concentrated in places where the texture is coarser. Associated with these pores are a few small pyrite crystals. No stain, no cut.

4196-4197 As above, oolites more common, texture coarser. Better intergranular porosity than above because of less cement. Some of the larger intergranular pores have clear subhedral calcite crystals. No stain, no cut.

4197-4198 Limestone, texture as above, but cement is subsucrosic or finely granular calcite. Rock appears slightly altered to sucrosic limestone. Fair intergranular porosity and common pinpoint pores. One corner of chip contains white anhydrite apparently replacing the limestone. No stain, no cut.

4197-4198 As above, anhydritic, porosity slightly lower.

4198-4199 As above.

4199-4200 As above. Porosity still lower because of more cement and fewer pinpoint pores.

4200-4201 Limestone, as above but not sucrosic appearing common stylolites.

4201-4202 Limestone, white, pelmicrosparite, slightly sucrosic-appearing, fair intergranular and pinpoint porosity, no stain, no cut.

End of core

4202-4217 Limestone, white, pelletoidal, pelmicrosparite and pelsparite. Pinpoint porosity.

4217-4265 Limestone as above with abundant white to very pale orange pelmicrite with rare oolites, common pinpoint porosity, low intergranular porosity. Patches of clear crystalline calcite. Pinpoint porosity very common at 4252-65.

4265 Circulation sample. As above.

4265 Total depth.

4232 Plugged back total depth.