



RECORD OF LOGS AND TESTING

Logs:

A complete sample log and core description was kept from 40 feet to total depth. A Schlumberger electrical log and Gamma Ray-Neutron log was run from 128 feet to total depth, and a Micro-Log was run from 950 feet to total depth. A temperature log was run from surface to 3,703 feet. All logs are included in the back of this report.

Cores were cut through the Dakota sandstone and part of the Purgatoire formation. In the Pennsylvanian, the entire Upper Madera clastic and 100 feet of the Carbonate zone, and 50 feet of the Lower Clastic zone was cored. A 2 foot core in Granite was cut also at total depth.

RECAPITULATION OF GEOLOGICAL LOG AND SAMPLE DESCRIPTION

Carlos Sandoval #3

The E. W. Pauley-Bruce Sullivan No. 3 Sandoval was spudded on April 8, 1956, and abandoned as a dry hole on July 3, 1956 at a total depth of 5043 feet. The well is located in the Garcia area about 12 miles east of Trinidad, Colorado. Shallow gas had been produced in this area from the Timpas-Codell zone but the field has been abandoned for a number of years.

The #3 Sandoval well was drilled primarily to test structural and stratigraphic possibilities of the Pennsylvanian formations along the east side of the Raton-Trinidad Basin. However, some other formations in the area represented possibilities, so all potential oil or gas zones were carefully checked.

An automatic recording mud analyzer was attached to the flow line throughout the drilling of the well. Any and all possible shows detected by this device were checked and tested. In addition, a portable gas analyzer was used as an added check of the cores and cuttings. All cuttings and all cores from 40' to total depth were checked with an ultraviolet light for any signs of fluorescence. As a matter of scientific curiosity, all cores and cuttings from 30' to total depth were checked with a sensitive Geiger counter for abnormal radiation.

The #3 Sandoval spudded in Upper Cretaceous Pierre shale, and drilled through formation of Jurassic, Triassic, Permian, and Pennsylvanian age, terminating in Pre-Cambrian granite.

UPPER CRETACEOUS

PIERRE SHALE:

From 0 to 916 feet the well encountered dark gray to black shale, with occasional beds of bentonitic shale and bentonite.

Niobrara (Apishapa) Shale:

From 916 feet to 1636 feet, well drilled a total of 720 feet of gray to dark gray, calcareous shale, with occasional thin beds of siltstone and fine grained sandstone. From 1250 to 1524 feet the well lost circulation and no cuttings were recovered.

Timpas Limestone:

This zone was topped at 1636 feet and consisted of approximately 90 feet of

gray limestone and calcareous shale.

Greenhorn Limestone:

This zone was well developed consisting of approximately 160 feet of gray limestone and calcareous gray shale. It was topped at 1804 feet.

Graneros Shale:

The Graneros shale extended from the base of the Greenhorn limestone to the top of the Dakota sandstone at 2046 feet and consisted of 194 feet of black, fissil ? shale.

Dakota Sandstone:

The Dakota sandstone was cored throughout its thickness of 97 feet and appeared to be water bearing throughout.

Purgatoire Fm:

The base of the Cretaceous section was topped at 2143 feet and was composed of about 30 feet of black shale and 97 feet of very light gray to white sandstone.

JURASSIC

Morrison Fm: (2270' to 2510')

The Morrison formation was 240 feet thick, and was largely variegated greenish gray, green and reddish shale interbedded pink, green, blue green and red sandstone.

Wanakah (Todilto) Limestone (2510 to 2621)

89 feet of dark gray, black, pink, and green limestone and gypsum represented the Wanakah Formation.

Entrada Sandstone (2621' to 2672')

The Entrada sandstone is only 51 feet thick, and is composed of light red to pink, fine to medium grained, partially frosted sandstone. It makes a distinct marker from the overlying Wanakah limestone.

TRIASSIC

Dockum (Chinle) 2672' to 2852')

The Dockum group is represented by 180 feet of dark brown shale and interbedded reddish brown sandstone.

Santa Rosa Sandstone (Shinarump) (2852' to 2954')

The Santa Rosa sandstone is composed of 102 feet of red and purple sandstone and siltstone. Slightly pyritic in places.

PERMIAN

San Andres Member: (2954' to 3024')

70 feet of red and orange silt, clay and occasional thin limestone beds; from the base of the Santa Rosa sandstone to the top of the Glorietta sandstone appear equivalent to the San Andres member in this area. This is a more or less arbitrary assignment but appears justified based on descriptions in other areas to the south and west.

Glorietta Sandstone (3024' to 3328')

The Glorietta sandstone is an extremely well defined marker in the area and consists of 304 feet of brown, yellowish brown, and gray, fine to coarse, pyritic sandstone. The Glorietta sandstone contains CO₂ gas over a wide area of the Las Animas Sierra Grande Uplift and it appeared to contain CO₂ gas in the Sandoval #3. This was indicated by strong negative readings from the mud and cuttings on both gas analysers, which is a characteristic of CO₂ gas.

Yeso (3328' to 3473')

145 feet of orange reddish brown siltstone, sandstone and shale, with traces of gypsum.

Sangre de Cristo Formation (3473' to 3584')

111 feet of very fine orange arkosic sandstone, above the Pennsylvanian appeared to differ sufficiently from the overlying Yeso that it has been tentatively assigned to the Sangre de Cristo formation. This assignment is not based on fossil evidence but with a comparison of descriptions in other areas. The existence of definable Sangre de Cristo may be debatable.

PENNSYLVANIAN

Upper Madera Clastic: (3584' to 4379')

The Upper Madera Clastic zone was 795 feet thick and consisted of

pink and purple very fine to very coarse grained arkosic sandstone, siltstone and reddish brown calcareous shale and dolomite. This zone was cored from top to bottom and many of these cores bled gas. Five drill stem tests were made in this zone. The more porous zones proved to be wet. The gas appeared to be mostly CO₂.

Carbonate Zone: (4379' to 4593')

214 feet of predominately orange and orange red arenaceous limestone and dolomite. Finely to coarsely crystalline.

Lower Clastic: (4593' to 4896')

97 feet of red and reddish brown, medium to fine calcareous sandstone, and red purple and gray limestone. Becomes very coarse arkose in lower 100 feet.

Granite Wash: (4896' to 4989')

93 feet of very coarse conglomeratic granite wash consisting of large angular fragments of feldspar and quartz, with occasional thin beds of red-brown micaceous shale.

Weathered Granite (4989' to 5026')

37 feet of granitic material but showing slight evidence of weathering of the feldspar and mica.

Granite: (5026')

Fresh, pink, unaltered, quartz-feldspar and biotite.

Carlos Sandoval #3 Drilling Log and Well History (Continued)

- 4/20/56 Drlg. at 1940' in black fissil shale.
4/21/56 Preparing to core at 2048' Possible top Dakota ss. at 2046'
4/22/56 Coring at 2068'. Cut core #1, rec. 20' ss.
4/23/56 Coring at 2112'. Cut core #2, 20' all ss.
4/24/56 Coring at 2150'. Cut core #3, rec. 50' ss. and black sh.
4/25/56 Lost circulation at 2174' after coring through low angle fault.
Pulled core #4. rec. 36' ss. & blk sh.
4/26/56 Attempting to regain circulation at 2176'
4/27/56 Drl'd. to 2181' with partial circulation
4/28/56 Drilled to 2186' without circulation. Cemented bottom of hole with
19 sax. W. O. C.
4/29/56 Drlg. at 2210' with intermittent partial and full returns.
4/30/56 Drlg. at 2236' Ran schlumberger and DST #1.
5/1/56 Drlg. at 2267'
5/2/56 Drlg. at 2326' Loosing mud.
5/3/56 Drlg. at 2382' in Morrison formation.
5/4/56 Drlg. at 2449' with full returns. Formation very hard.
5/5/56 Drld. to 2480' loosing mud, shut down to jet pits, mix mud, etc.
5/6/56 Drlg. at 2500' with some mud loses, averaging 8' per bit.
5/7/56 Drlg. at 2518' with some lost circulation.
5/8/56 Drlg. at 2606' in Wanakah formation.
5/9/56 Drlg. at 2660'
5/10/56 Drlg. at 2766' and loosing mud, topped Dockum.
5/11/56 Drlg. at 2834' and loosing mud.
5/12/56 Drlg. at 2910' in Santa Rosa ss., loosing mud.
5/13/56 Drlg. at 3018' and loosing mud.
5/14/56 Drlg. at 3057' in Glorietta ss. and loosing mud.
5/15/56 Drlg. at 3130' and making a little mud.
5/16/56 Drlg. at 3214'.
5/17/56 Drlg. at 3260'. No lost circulation.
5/18/56 Drlg. at 3302' in Glorietta ss.
5/19/56 Drlg. at 3329' with some lost circulation and 10 to 12' per bit.
5/20/56 Drlg. at 3387' in Yeso formation.
5/21/56 Drlg. at 3427'.
5/22/56 Drlg. at 3454' Lost a $\frac{1}{2}$ pit of mud on morning tower.
5/23/56 Drlg. at 3492'
5/24/56 Drlg. at 3558' Topped Sangre de Cristo formation.
5/25/56 Drlg. at 3602' in Upper Madera Clastics.
5/26/56 Drlg. at 3620' and nearing coring point.
5/27/56 Drld. to 3651' commenced coring.
5/28/56 Cored to 3690' Pulled core #5, Rec. 10' of siltstone.
5/29/56 Reaming at 3697' Pulled core #6, Rec. 36', mostly siltstone.
5/30/56 Drld. to 3703' and lost and recovered circulation, Gas show. Ran
Schlumberger.

5/31/56 Testing at 3703' DST #2 Rec. 1250' of gas cut salt water.
6/1/56 Testing at 3703' DST #3 Rec. 250' of mud and water.
6/2/56 Cored to 3734' Pulled core #7 and #8.
6/3/56 Cored to 3747' Pulled core #9, Rec. 13' wet and gassy ss. DST #4.
6/4/56 Cored to 3782' Pulled cores #10, 11 and 12.
6/5/56 Cored to 3832' Pulled core #13. W/O tester.
6/6/56 Testing at 3832' DST#5
6/7/56 Cored to 3856' Pulled core #14, Rec. 34'.
6/8/56 Cored to 3922' Pulled core #15, Rec. 26'.
6/9/56 Cored to 3971' Pulled core #16 and #17.
6/10/56 Coring at 4026' Pulled core #18, Rec. 49'.
6/11/56 Cored to 4043' Pulled core #19, Rec. 23'. DST #6.
6/12/56 Coring at 4098' Pulled core #20, Rec. 8'.
6/13/56 Cored to 4148' Pulled core #21 and 22.
6/14/56 Coring at 4168' Pulled core #23, DST #7.
6/15/56 Cored to 4179' Pulled core #24, Rec. 11'. Lost circulation.
6/16/56 Cored to 4223' Pulled core #25, Rec. 24'.
6/17/56 Fishing at 4306' Pulled cores # 26 and 27.
6/18/56 Cored to 4355' Pulled core #28, Rec. 49' with 17' of conglomerate.
6/19/56 Cored to 4363' Pulled core #29, Rec. 35' DST #8.
6/20/56 Cored to 4401' Pulled core #30, Rec. 38'.
6/21/56 Cored to 4451' Pulled core #31, Rec. 50'.
6/22/56 Cored to 4489' Pulled core #32, Rec. 38'.
6/23/56 Reaming at 3966'
6/24/56 Reaming at 4279'
6/25/56 Drlg. at 4500' in Carbonate zone.
6/26/56 Drlg. at 4580'
6/27/56 Drlg. at 4710' in Lower Clastic
6/28/56 Drlg. at 4759'
6/29/56 Cored to 4807' Pulled core
6/30/56 Drlg. at 4891'
7/1/56 Drlg. at 4932' in Granite wash.
7/2/56 Drlg. at 4982'
7/3/56 Core to 5030' Pulled core #33, Rec. 2' pink unweathered granite.
7/4/56 Drillers TD 5030' Ran Schlumberger with TD 5043'. Abandoned well.