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Quarterly Technical Progress Report

INCREASED OIL PRODUCTION AND RESERVES FROM IMPROVED COMPLETION TECHNIQUES IN THE BLUEBELL FIELD, UINTA BASIN, UTAH

DRAFT

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Objectives

The objective of this project is to increase the oil production and reserves in the Uinta Basin by demonstration of improved completion techniques. Low productivity is attributed to gross production intervals of several thousand feet that contain perforated thief zones, water-bearing zones, and unperforated oil-bearing intervals. Geologic and engineering characterization and computer simulation of the Green River and Wasatch Formations in the Bluebell field will determine reservoir heterogeneities related to fractures and depositional trends. This will be followed by drilling and recompletion of several wells to demonstrate improved completion techniques based on the reservoir characterization. Transfer of the project results will be an ongoing component of the project.

SUMMARY OF TECHNICAL PROGRESS

Subsurface Studies

Clay analysis using X-ray diffraction (XRD) is completed on 33 outcrop (table 1) and 35 well core samples (table 2) from the Green River and Wasatch Formations. Preliminary analysis of clay types indicate illite, chlorite, and kaolinite in both the clastic (predominantly sandstone) and carbonate rocks. Also, minor amounts of potentially swelling mixed-layer clays (illite-smectite and chlorite-smectite) are present. Examination of core shows that in general, the carbonate rocks have randomly orientated, interconnected fractures, whereas in the sandstones fractures are more vertical and isolated. However, the sandstones have the best storage capacity due to greater matrix porosity.

Engineering Studies

A database of completion and recompletion treatments of wells in the Bluebell field was developed using the well records at the Utah Division of Oil, Gas and Mining. From this database 94 wells, a total of 150 to 250 completion and recompletion treatments, were selected for further study.

Additional details about the treatments were requested from the well operators. All the operators responded positively and the additional treatment information is being entered into the database. When data entry is completed it will be sent to Halliburtons' Technical Team in Denver, Colorado who will evaluate each of the treatments and resulting production responses to determine what has been the most effective treatment (technique, fluids, and additives).

TECHNOLOGY TRANSFER

Ann Garner presented her paper entitled *"Reservoir characterization through facies analysis of the lower Green River Formation for hydrocarbon production enhancement in the Altamont-Bluebell field, Uinta Basin, Utah"* at the American Association of Petroleum Geologists (AAPG) 1995 Annual Meeting in Houston, Texas, and at the Ninth Annual Spring Research Conference sponsored by Brigham Young University, Provo, Utah.

MaryBeth Wegner presented her paper entitled *"Facies analysis of well cores from the lower Green River Formation, Bluebell field, Uinta Basin, Utah: implications for identifying highly productive zones"* at the Ninth Annual Spring Research Conference sponsored by Brigham Young University, Provo, Utah.

Project materials were displayed at the Utah Geological Survey booth during the Annual Meeting of the AAPG, Houston, Texas, and at the 1995 regional meeting of the Society of Petroleum Engineers, Denver, Colorado.

NEXT QUARTER PLANNED ACTIVITIES

During the next quarter the team will be synthesizing Phase I results into preliminary recommendations on selection of zones for recompletion, techniques and fluid types for recompletions, and new completions. Specific tasks to be completed during this quarter are:

1. Develop better log calculations through evaluation of previous log calculations, core data, water chemistry, and clay composition.
2. Complete examination and analysis of drill core determining paleodepositional environments and reservoir properties.
3. Complete detailed mapping of thickness, porosity, and structure of select beds in the proposed demonstration area.
4. Identify the most effective treatments from evaluation of the well completion database.
5. Make a presentation to the Department of Energy in Tulsa, Oklahoma, June 1995.

Table 1. Porosity, permeability, and clay and authigenic mineral analysis of samples collected from the lower Green River and upper Wasatch transition outcrop in Willow Creek Canyon, Duchesne County, Utah. C = chlorite, I = illite, K = kaolin group, S = smectite, Z = zeolites, multiple letters are mixed layer combinations and the letter size is proportional to the relative abundance. Comments refer to the peak intensity on the XRD plots.

SAMPLE NAME	Meters Above Base	Horiz. Perm (md)	Vert. Perm (md)	Porosity (%)	Clay Content	Comments	Lithology
5-DN5	6.3	0.07	0.05	10.90	Cs, Is, K, z	mostly K	Feldspathic wacke
7-DN7	7.8	0.66	0.02	2.70			Fossiliferous packstone
21-DN21	21.3				Cs, Is, K	moderate/equal	Fossiliferous wackestone
36-DN36	34.5				cS, Is, K, z	moderate/equal	Wackestone
37-DN37	35.7	4.40	0.53	27.20	Cs, Is, Ks	very little of any	Ostracodal packstone
43	48.2	<0.01	<0.01	7.70	Cs, IS, K	very little of any	Mudstone
47-DN47	59.6	<0.01	0.01	3.80	Cs, I	very little of any	Mudstone
102-EH47	103.9	93.+	<0.01	4.70	CS, Is	very little of any	Mudstone
113-EH58 (BAG)	129.2	0.01	0.01	3.10	cS, Is, Ks?	very little of any	Mudstone
113-EH58 (BLOCK)	129.2	0.01	0.01	5.80	cS, Is, Ks?	very little of any	Mudstone
140-EH85	149.9	285.00	208.00	23.70	Cs, I, K/Cs, z	more illite	Feldspathic arenite
140-EH85A	149.9	48.00	19.00	23.00	Cs, Is, Ks, z	more illite	Feldspathic arenite
265-RP18	379.8	0.20	<0.01	6.60	Cs, Is, K/Cs, Z	moderate/equal	Feldspathic wacke
282-RP35	394.3	0.13	0.05	14.50	Cs, Is, z	moderate/equal	Feldspathic arenite
424-AA25	558.5	18.00	4.40	21.90	cS, Is, K/C	mostly cS	Feldspathic arenite
438-AA39	571.9				cS, Is	mostly cS	Mudstone
451-AA52	584.1	0.01	<0.01	8.30	cS, Is, Ks	very little of any	Peloidal quartz mudstone
479-CC4	614.75	<0.01	<0.01	12.80	cS, Is, z	very little of any	Peloidal mudstone
608-RC2	752.4	0.69	0.02	7.70	Is	also brushite	Feldspathic arenite
623-RC17	762.6	0.01	<0.01	0.20	cS	maybe some i	Mudstone
638-RC32 A	776.3	0.09	0.01	12.70	cS, Is	mostly cS	Mudstone
638-RC32 B	776.3	0.01	<0.01	14.10	cS, Is	mostly cS	Mudstone
GB2	740.2	0.03	0.02	14.20	Cs, Is, K, Z	mostly Cs & K	Quartz wacke w/ clay clasts
H10	693	0.63	0.88	17.20	cS, Is	very little of any	Fossiliferous packstone
J3	650.7	0.04	0.03	13.20	Cs, Is, Ks, Z	mostly Cs & K	Feldspathic wacke
2nd J7	653.7	1241.00	1342.00	25.80	cS, Is, K, z	mostly cS & Is	Feldspathic arenite
4th J7	654.2	3.4+	0.01	4.00	cS, I, K/Cs, z	mostly cS & Is	Feldspathic arenite
11-10-12-1A	654.2	0.03	0.02	5.50	CS, Is, z	mostly cS	Feldspathic arenite
11-10-12-2	653.7	0.02	0.02	3.40	cS, Is, K/C, Z	mostly cS & Is	Feldspathic arenite
11-10-12-13a A	653.7	0.01	0.01	3.30	Is	also brushite	Feldspathic arenite
11-10-12-13a B	653.7	0.05	NA	3.90	Is	also brushite	Feldspathic arenite
11-10-13-1b	534	6.50	2.00	24.00	Cs, Is, K, z	moderate/equal	Feldspathic arenite
11-10-13-1c	528	2.20	0.53	23.90	Cs, Is, K, Z	scanty/equal	Subfeldspathic arenite
11-10-13-1f	535.5	15.00	1.30	25.10	cS, Is, K/Cs, z	mostly cS, & Is	Feldspathic arenite

Table 2. Porosity, permeability, and clay and authigenic mineral analysis of samples collected from drill core of the lower Green River and Wasatch Formations, Bluebell field, Duchesne and Uintah Counties, Utah. C = chlorite, I = illite, K = kaolin group, S = smectite, Z = zeolites, multiple letters are mixed layer combinations. Lower case letters indicate trace amounts. NA = not available, h = horizontal, v = vertical.

Core	Depth (ft)	Lithology	Clay	% Porosity	Perm. (mD)	Depth (P&P)
BVP22	12,289	ss	K, Z	2.17 (h)	0.026 (h)	12,290
BVP22	12,299	shale	K, i, Z	4.25 (h)	0.001 (h)	12,299
BVP22	12,307	silty ls	Z, s	3.2 (h)	0 (h)	12,308
BVP22	12,365	ss	I, Ch, k	1.67 (h)	0.001 (h)	12,365
CCHAS	10,632	ost. packstone	sl	0.15 (h)	0.001 (h)	10,632
CCHAS	10,795	ss w/ siltstone	sl, Ch	3.95 (v)	0.001 (v); 0.002 (h)	10,795
CCHAS	11,010.5	ss	sl, sCh	5.04 (h)	0.2 (h)	11,010
CCHAS	11,203	ss	sl	4.8 (h); 5.08 (h)	0.021 (h)	11,209
BVP19	9177	shale	sl	2.53 (h)	0.034 (h)	9191
BVP19	9638	ost. ls mudstone	sl, k, ch	0.27 (h); 0.73 (v)	0.004 (h); 0.002 (v)	9632
BVP19	9648	ss	sl, k	3.06 (h); 2.04 (v)	0.002 (h); 0.001 (v)	9652
P17	13,587	finely crys. ls	sl, Ch	NA	NA	NA
P17	13,590	wackestone	sl, Ch	2.82	0.461	13,590
P17	13,603	mudstone	sl, k	0.29	0.001	13,603
P17	13,609	ls mudstone	i, (k)	0.62	0.007	13,615
P17	13,656	ss	sl, Ch, k	1.27	0.024	13,660
CHIKO	10,482	mudstone	I	0.27 (h); 0.3 (v)	0.002 (h); 0.004 (v)	10,481
CHIKO	10,596	silty ls/dolo.	I (k, ch, z)	0.27 (h)	0.002 (h)	10,588
CHIKO	10,629.5	silty dolomite	I	NA	NA	NA
C94B1	11,023.5	silty mudstone	sl, Ch, k	0.88	0.001	11,030
C94B1	11,094	ls mudstone	sl, Ch, k	1.86	0.113	11,086
C94B1	11,110.5	ss	I, ch, k	1.57	0.005	11,111
C94B1	11,141	silty mudstone	sl, Ch, k	0.49	0.001	11,143
C94B1	12,671	mudstone	sl, Ch	NA	NA	NA
CBOR	12,159	silty ls mudstone	sl, ch	4.24 (h)	0.004 (h)	12,142
CBOR	12,168.5	ss	sl, Ch, k	0.68 (h)	0.002 (h)	12,173
CSM	11,121.5	siltstone	sl, sch	NA	NA	NA
CSM	11,128	wackestone	sl, ch	NA	NA	NA
CSM	11,146.5	ss (marl?)	sl, ch	NA	NA	NA
CSM	11,157.5	ss	sl, ch, (k)	NA	NA	NA
C17A1	12,252	ss	sl, Ch, k	NA	NA	NA
C17A1	12,264	ss	sl, Ch	NA	NA	NA
C17A1	12,303	ss	sl, sCh, z?	NA	NA	NA
C17A1	14,372	ss	sl, K	NA	NA	NA
C17A1	14,384	ss	sl, K, ch	NA	NA	NA