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Shell Exploration & Production Co., Inc.

2009 Anvil Points Mine Core Recovery Program

Piceance Creek Basin
Rio Blanco County, Colorado

Anvil Points Mine Site

USGS CR-2 Core Hole

SEC. 36, T01N, R97W

2009
Summary Report and Well Data
For
United States Geological Survey

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Boxed USGS Core from the Piceance Creek Basin
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In 2008, a project to remove and archive rock samples from the Anvil Points Mine was undertaken by Shell Exploration and Production Company (SEPCo) partnered with the U. S. Geological Survey (USGS) from the Denver Federal Center (DFC). The Anvil Points Mine (APM) is an abandoned oil shale mine located near Rifle, Colorado, and was the first experimental mine/extraction plant built as a result of the Synthetic Liquid Fuels Act of 1944 (J. H. East and E. D. Gardner, *Oil Shale Mining, Rifle, Colo., 1944-56).* Since 1997, the mine has served as a repository for multiple boxes of oil shale drill cores and cuttings (crushed samples) from Colorado, Wyoming and Utah. The decision to remove the boxes from the mine was made because of increased vandalism, deterioration of the core boxes and pallets due to atmospheric conditions in the mine, and degradation of the access road. The majority of the core will be catalogued and stored in the USGS Core Research Center at the DFC, and made available for study by the public and private sectors. The remaining core will be temporally used by SEPCo for shale oil research, and will be inventoried, described, photographed, re-boxed and stored at a core handling facility operated by Daub & Associates, Inc. in Grand Junction, CO. These cores will ultimately be shipped back to the USGS CRC at the DFC in Lakewood, Colorado.

In August 2008, Daub & Associates, Inc. (geological consulting firm), Johnson Construction of Rifle, and Berry Brothers Oilfield Services were contracted to perform the project. The project plan is as follows:

- Repair the mine access road to accommodate heavy truck traffic;
- Open the APM and inspect for safe working conditions, remediate any deficiencies, and assess amount and condition of boxes to be removed;
- Prepare pallets for shipping with the majority being transported to the USGS Core Research Center and the remainder being transported to a core facility in Grand Junction, CO;
- Leave the APM “as is” once all the items of interest have been removed

- Process and document the samples at their new respective locations; and
- Ship the core processed in Grand Junction, Colorado by Daub & Associates, Inc. back to the USGS Denver Federal Center.

Johnson Construction began road grading operations in September 2008 to repair and clear debris from the mine access road. This one-lane road is steep and consists of multiple switchbacks cut into incompetent soils. The grading and shoring operations lasted approximately one month. After remediation, the road was inspected and deemed safe for travel by trucks carrying the heavy equipment necessary to move the pallets out of the mine. Equipment and personnel were mobilized to the APM. The mine was opened and inspected for integrity. Once the integrity was found to be satisfactory, workers entered the APM.

Daub & Associates, Inc. (Daub) was tasked with assessment of boxes and pallets prior to removal from the mine, preparation of the boxes and pallets for shipping, and shipping coordination. The pallets were identified with the aid of a USGS OFR report and maps made during the previous storage operation. Most of the identification tags with the original USGS storage numbers were intact and visible on each pallet. However, some pallets had been moved to another location within the mine, vandalized, or weathered by exposure. These pallets were identified by inspecting their contents and re-labeled accordingly. A total of 712 pallets were identified, and included boxes of core, crushed FA bulk samples, and rotary drill cuttings. Once identified and marked, the pallets were grouped by destination in a staging area inside the mine. Each pallet was individually assessed for stability and durability. In some cases, pallets were entirely disassembled, re-stacked, and shrink-wrapped prior to shipping.

Pallets were taken out of the mine and transported to the staging area (Johnson Construction Yard) by eight one-ton flatbed trucks. Each truck carried two pallets per load. The trucks were loaded as a group and led slowly down the road in a convoy. At the staging area, pallets were unloaded and sorted by destination. Two Ryder cargo trucks were used for shipping, with 20–22 pallets included per load.

Five hundred six (506) pallets were transported to the USGS Core Research Center in Lakewood, Colorado. Two hundred six (206) pallets were transported to the Daub Core Handling Facility, including 54 pallets of core samples collected by Phillips Petroleum between 1979 and 1981 from areas in the Piceance Creek Basin. Berry Brothers Oilfield Services was responsible for loading pallets and subsequent transportation by truck to the designated facility.

The Phillips Petroleum cores were handled as a special case in this operation due to their long-time storage at the mine, and the poor condition and organization of the boxes. All samples were inadequately wrapped and labeled. Core boxes from multiple core holes were stacked on each pallet. Re-used and re-marked boxes of two-foot crushed samples intended for Fischer Assay were intermingled with boxes of core. The unstable condition and disorganization of the boxes on the pallets was rectified by disassembling each pallet and sorting samples box-by-box. Crushed samples were sorted by core hole number and depth; inventoried; newly bagged and boxed; and re-stacked in numerical order on pallets. Each pallet was shrink-wrapped for shipping to maintain pallet integrity. After this process was completed, 16 pallets of Phillips Petroleum core were shipped to the DFC and 54 pallets were shipped to Grand Junction.

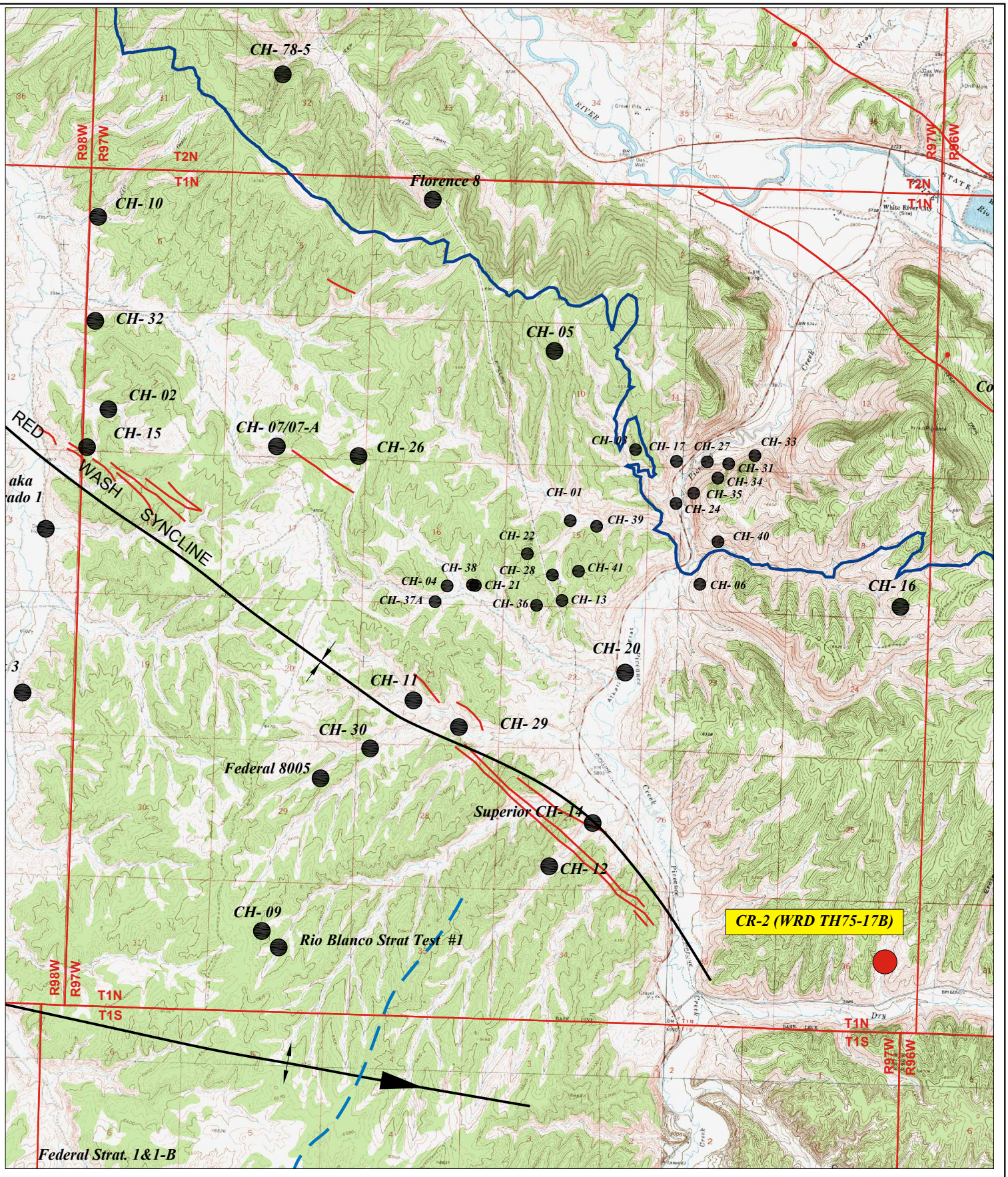
Daub geologists began organizing, logging, photographing, re-boxing and re-palletizing shale cores and selected cuttings in early November 2008. Boxes containing core samples were sorted by core hole number and depth onto new pallets. These pallets were sorted by descending core box number and inventoried. Most core samples had been marked with black footage marks, and blue (left) and red (right) orientation stripes (orientated downhole). The majority of the core had been split with a mechanical splitter or saw and continuous two foot samples taken for Fischer Assay. Mechanical splitting often destroyed the orientation and footage marks, so re-marking was required. Much of the sandstone, presumably of the Uinta Formation, was not split or sampled for Fischer Assay.

The core description process for SEPCo is being conducted at the Daub Core Handling Facility in Grand Junction, CO. Personnel consist of four geologists and four technicians. Work schedule is ten hours per day, five days per week. The facility is arranged to flow systematically in an assembly line approach starting with a washing station, moving to the alignment and marking station, and through to the description and photography station. The final step is drying and re-boxing. All activities are documented and electronically recorded in a database. The facility is safe and secure, with the health, safety and well-being of personnel and property being the highest priority. All personnel are trained in proper handling procedures and wearing of appropriate PPE is enforced.

The processing array consists of two separate and parallel work lines, each processing core from different wells. A geologist describes and logs the core for a range of characteristics including but not limited to: general lithology (i.e. oil shale, mudstone, sandstone, and marlstone), noticeable stratigraphic features (i.e. laminations, fabric, pyrite, vug and fracture abundance, grain size, and calcite banding), and overall hydrocarbon richness. The core is digitally photographed in the PVC tray on a foot-by-foot basis using state-of-the-art computerized equipment. The split or cut side is photographed dry. The core is rotated within the tray 180° and the outer curved surface is photographed wet. The newly boxed core is padded with newspaper and bubble wrap to prevent movement within the box, stacked on pallets, shrink-wrapped, and labeled for future shipment.

All core, FA crushed samples, and rotary drill cutting boxes and pallets have been removed from the APM. The core processing portion of the project is currently (early 2009) on-going at both locations. As of January 19, 2009 approximately 5,200 feet of core have been processed at the Daub facility. Upon completion of this project, approximately 67,000 feet of core will have been processed.

USGS CR-2
General Core Hole Location Map



Core Hole Location
Anticline
Fault - dashed where approximate
Syncline

N
W E
S

0 2000 4000
Feet

2009 Anvil Points Mine Core Recovery Program
Well Location Map - CR-2
T1N, R97W, Section 36
Garfield County, Colorado

Daub & Associates, Inc.

Date:
November 27, 2009

USGS CR-2
Core Description Summary Report

Core Hole CR-2 (USGS)
Core Description Summary Report

Piceance Creek Basin, Northwestern Colorado

Prepared by

Daub & Associates, Inc.

for

Shell Exploration & Production Co., Inc.

2009 Anvil Points Mine Recovered Core Description Program

Introduction

The CR-2 (WRD TH75-17B) is a core hole originally drilled by the United States Geological Survey in 1976. The CR-2 is located in Township 1 North, Range 97 West, Section 36, in Rio Blanco County, Colorado (Figure 1). This location is on Bureau of Land Management property east of the Piceance Creek drainage and north of the Dry Fork drainage in the SW quarter of the NE quarter of Section 36. Well information for this core hole is limited due to the fact that the core was obtained by the USGS from industry, stored in Denver, Colorado at the USGS core repository, and then subsequently moved into storage at the Anvil Points Mine near Rifle, Colorado. The core description referenced in this summary report was conducted post-removal (Fall 2008) from the Anvil Points Mine some 32 years after the core was originally drilled. Please refer to the Anvil Points Mine Boxed Core Processing Project document for information detailing the core handling and logging procedure.

USGS CR-2 General and Unique Findings Noted During Core Description

The USGS CR-2 well was cored from 507.0 to 2400.0 feet. The entire core was mechanically split approximately in half for FA analysis. A few boxes of core were in poor shape, and contained core that appeared rearranged due to factors unknown. In these rearranged boxes of jumbled core, appropriate depths and core orientation were often indiscernible and the core was described as it lay in the box, or was described after a best attempt at reconstruction was conducted.

Hydrocarbons in the form of **bitumen (**a reddish brown to black near-solid to solid hydrocarbon), **dead oil**, and **organic stains** were ubiquitous in this well. They were found as nodules and were noted in fractures, tuffs, collapse breccia, vugs, and porous clastic bands at the depths and stratigraphic zones found in Table 1 below.

Major and minor fracture zones were largely comprised of high angle fractures with a calcite, pyrite, or bitumen infilling or a combination of the three and were present at the depths and stratigraphic zones found in Table 2 below.

Small to large vugs and pits often contained a pyrite, bitumen, or calcite infilling and were present at the depths and stratigraphic zones found in Table 3 below. The dissolution surface was present at a depth of 1736.7 feet in the R-4 stratigraphic zone. The vugs noted below this depth were produced from the leaching of nahcolite during the coring process, and were not true naturally occurring vugs.

Nahcolite was noted at four intervals: as vug infilling and a honeycomb band from 1082'-1087' (R-6 zone); as vug infilling and rounded irregular aggregates from 1702'-1708' (R-4 zone); as rounded irregular aggregates and nodules from 1736'-1739' (R-4 zone); and as sparsely disseminated crystals, rounded irregular aggregates, granular beds, and semi-honeycomb bands from 1905'-1941' (R-3 zone). No major nahcolite beds were seen. The top of significant nahcolite was determined to be at a depth of 1905.1 feet (R-3 zone).

The Mahogany Marker tuff bed was present from 793.85 to 794.2 feet. Additional tuff bands or series of tuffs greater than or equal to 0.3 feet thick were present at depths of 848.0'-848.4' (R-7 zone), 1032.75'-1033.35' (R-6 zone), and 1056.8'-1057.2' (R-6 zone).

The USGS CR-2 exhibited some anomalous characteristics. The occurrence of bitumen and organics was abnormally common, especially in the R-6 and L-5 stratigraphic zones, where it was present throughout the entire stratigraphic intervals for these zones. Though present in minor amounts in the other stratigraphic zones, the visual presence of hydrocarbons was seen throughout the entire cored interval, which is extremely rare. Fractures, too, were ubiquitous throughout the entire cored interval, even in the lower stratigraphic zones. The R-7, R-6, and L-5 stratigraphic zones were highly fractured throughout nearly all of their respective stratigraphic intervals. A large partially leached interval was present from 1082 to 1935 feet. The only richness in the R-8 stratigraphic unit was the basal 5 feet due to the R-8 being mostly siltstone to sandstone beds.

Feature	Depth Interval (ft)	Stratigraphic Zone
Bitumen	509-510	UT
Bitumen	542-544	UT
Bitumen/Organic Stains	565-566	UT
Bitumen	581-595	R-8
Organic Stains	620-621	R-8
Organic Stains	629-631	R-8
Organic Stains	640-648	R-8
Organic Stains	670-678	R-8
Organic Stains	697-698	R-8
Bitumen	766-767	A-Groove
Organic Stains	781-782	R-7
Organic Stains	790-791	R-7
Bitumen	799-802	R-7
Bitumen/Organic Stains	811-823	R-7
Bitumen	834-835	R-7
Bitumen	842-843	R-7
Bitumen	909-910	R-7
Dead Oil	931-941	R-7
Bitumen	1029-1037	R-6
Bitumen	1069-1072	R-6
Bitumen	1095-1097	R-6
Bitumen	1125-1126	R-6
Bitumen/Organic Stains	1139-1240	R-6
Bitumen	1247-1269	R-6
Bitumen/Organic Stains	1276-1358	R-6 and L-5
Bitumen/Organic Stains	1380-1395	L-5
Bitumen/Organic Stains	1407-1429	L-5 and R-5
Bitumen/Organic Stains	1461-1469	R-5
Bitumen	1493-1500	R-5
Bitumen	1540-1541	R-5
Bitumen	1553-1575	R-5
Organic Stains	1611-1613	R-5

Bitumen/Organic Stains	1634-1684	R-5 and L-4
Organic Stains	1739-1745	R-4
Bitumen	1818-1833	R-4
Bitumen	1844-1846	R-4
Bitumen	1879-1895	L-3 and R-3
Organic Stains	1968-1969	R-3
Organic Stains	1981-1986	L-2
Organic Stains	1999-2000	R-2
Organic Stains	2015-2022	R-2
Bitumen/Organic Stains/Dead Oil	2059-2073	L-1
Bitumen	2089-2093	L-1 and R-1
Dead Oil	2108-2118	R-1
Bitumen/Dead Oil	2135-2148	R-1
Organic Stains	2202-2203	R-1
Bitumen	2225-2236	R-1
Bitumen/Organic Stains/Dead Oil	2276-2281	R-1
Bitumen/Dead Oil	2297-2299	L-0
Bitumen/Organic Stains/Dead Oil	2311-2315	R-0
Bitumen/Organic Stains	2325-2381	R-0

Table 1. Hydrocarbon occurrence in the CR-2 well.

Feature	Depth Interval (ft)	Stratigraphic Zone
Major	910-917	R-7
Major	1139-1239	R-6
Major	1255-1359	R-6 and L-5
Major	1380-1395	L-5
Major	1407-1429	L-5 and R-5
Major	1654-1662	L-4
Major	1878-1895	L-3 and R-3
Major	1976-1991	L-2
Minor	587-595	R-8
Minor	629-648	R-8
Minor	774-791	A-Groove and R-7
Minor	811-822	R-7
Minor	846-863	R-7
Minor	883-901	R-7
Minor	934-961	R-7
Minor	1006-1009	B-Groove
Minor	1021-1037	R-6
Minor	1067-1072	R-6
Minor	1095-1099	R-6
Minor	1461-1469	R-5
Minor	1493-1500	R-5
Minor	1553-1575	R-5
Minor	1674-1684	L-4
Minor	1739-1745	R-4
Minor	2021-2031	R-2
Minor	2070-2074	L-1
Minor	2089-2105	L-1 and R-1
Minor	2157-2164	R-1
Minor	2360-2369	R-0

Table 2. Major and minor fracture occurrence in the CR-2 well

Feature	Depth Interval (ft)	Stratigraphic Zone
Vug	705-706	R-8
Vug	764-768	A-Groove
Vug	875-876	R-7
Vug	886-896	R-7
Vug	905-912	R-7
Vug	973-974	R-7
Vug	1012-1014	B-Groove
Vug	1044-1067	R-6
Vug	1082-1086	R-6
Vug	1098-1100	R-6
Vug	1151-1171	R-6
Vug	1187-1190	R-6
Vug	1210-1230	R-6
Vug	1287-1291	L-5
Vug	1384-1390	L-5
Vug	1422-1430	R-5
Vug	1444-1456	R-5
Vug	1465-1467	R-5
Vug	1515-1540	R-5
Vug	1550-1553	R-5
Vug	1572-1573	R-5
Vug	1604-1610	R-5
Vug	1619-1620	R-5
Vug	1648-1650	L-4
Vug	1687-1722	R-4
Vug	1733-1737	R-4
Vug	1905-1935	R-3

Table 3. Vug occurrence in the CR-2 well.

USGS CR-2
Core Data Examples

Anvil Points Mine Core Description Legend

FEATURES	
CODE	DESCRIPTION
BIT	bitumen
CB	collapsed breccia
CLB	clay band
CV	collapsed vug
DZ	dissolution zone
F	featureless rock
FxS	fracture swarm
FZ	fissile zone
LB	lean band
MARL	marlstone band
MB	massive band
MF	microfaults
NB	nahcolite band/bedded
NM	nahcolite microcrystalline
NN	nahcolite nodules
O	other
OF	oxidation feature
ORG	organic band
PB	porous band
R	rubble
RB	rich band
SBB	streaked-blebby band
SLTB	siltstone band
SLTL	siltstone lens
SSB	sandstone band
SSD	soft sediment deformation
SSL	sandstone lens
TB	tuff band
TL	tuff lens
V	vug

LITHOLOGY	
CODE	DESCRIPTION
CB	collapsed breccia
CLYST	claystone
CS	crushed sample
CSR	core sample removed
INTRBD	interbedded
LC	lost core
MARL	marlstone
MRLSS	marly sandstone
MC	missing core
MS	mudstone
NAHC	nahcolite
OS	oil shale
SLTCS	silty claystone
SLTMRL	silty marlstone
SLTMS	silty mudstone
SLTST	siltstone
SS	sandstone

RICHNESS	
CODE	DESCRIPTION
L	lean (0-10 gal/ton)
M	moderate (10-20 gal/ton)
MR	moderately rich (20-30 gal/ton)
R	rich (30-40 gal/ton)
VR	very rich (40-50 gal/ton)

LITHOLOGIC FABRIC	
CODE	DESCRIPTION
B	blebby
L	laminated
M	massive
S	streaked

FRACTURE STATUS	
CODE	DESCRIPTION
C	closed
O	open
PO	partially open

FRACTURE INFILLING	
CODE	DESCRIPTION
BIT	bitumen
Ca	calcite
CaP	calcite/pyrite
Cl	clay
D	dolomite
FeO	iron oxide
GIL	gilsonite
N	none
NAHC	nahcolite
O	other
Org	organic
P	pyrite
UNK	unknown

PYRITE AMOUNT	
CODE	DESCRIPTION
N	none
SL	slight
M	moderate
A	abundant

Company: USGS
Well: CR-2
Elevation, ft: 6100.0

Section: 36
Township: 1 North
Range: 97 West
County: Rio Blanco, CO

Date: 8-10-09
Geologist: RGD

Daub and Associates, Inc.

Depth, ft	Box No.	Strat	FA Oil g/ton (0 – 50)	Graphic	Feature	Top Depth, ft	Bottom Depth, ft	Comments
775					FxS	774.7	776.	general angle: 64-71
			1.7					
776		A-Grv			R	776.4	777.0	w/ FxS
777			1.8					
778			4.3					
779		779			SLTL	779.57	—.62	
			11.4					
780								

Depth, ft	Fx Open	Fx Angle	Fx Infill	Fx, # per ft	Vug Poros, %	Nahcolite, %	Pyrite Amt.
775				0			A
							A
776				0			A
							A
777		68		1			A
	C	61	Pyr				A
778	C	61					A
		0	P/R	4			
		0					A
		103					
779							M
	PO	85	P	2			
		85					M
780							

Depth, ft	Top Depth, ft	Bottom Depth, ft	Lithology	Richness	Fabric	Color	Comments
775							
776							
777							
778							TOP OF L-7 @ 779.0
779	779.0	780.4	OS	M	L	10YR 5/4 5YR 7/2	O.H., Discont. Lams; Sl. silty. Common dissem pyr
780							

Company: USGS
Well: CR-2
Elevation, ft: 6100.0

Section: 36
Township: 1 North
Range: 97 West
County: Rio Blanco, CO

Date: 3/10/09
Geologist:

Daub and Associates, Inc.

Depth, ft	Box No.	Strat	FA Oil g/ton (0–50)	Graphic	Feature	Top Depth, ft	Bottom Depth, ft	Comments
780	Box 26							
781		R-7	17.7		RIB	781.0	781.6	5YR 3/2 - Indist. Stk'd
782			9.4		O	782.3	—.4	Contorted bond w/ NB - Msv, non-calc mineral + pass ORG
					FxS	782.4	—.5	Alt vertical Fxs w/ FeO ~ probably closed.
					RIB	782.9	783.0	5YR 3/2
783			19.5		slth	783.18	783.22	
					SSD	783.8	784	
784			18.8		SSD	784.7	785.5	Multiple sm. zones of SSD w/ arose. LDK, expansive sulfide
785								

Fx Open	Fx Angle	Fx Infill	Fx, # per ft	Vug Poros, %	Nahcolite, %	Pyrite Amt.
			0			SL
PO	80	ORG	2			SL
	85	Py				M
C	90	FeO	≥6			SL
						SL
			0			SL
			0			SL
						M

Top Depth, ft	Bottom Depth, ft	Lithology	Richness	Fabric	Color	Comments
780.4	781.0	MC				
781.0	783.5	→				→ I.A. + Occ sm clstLs
783.5	786.0	OS	MR	L	5YR 7/2 10YR 5/4	Diff. Lam'd to Msv I.P. Common deformed bonds. Additional colors include 5YR 3/2. - Common color variation Occ silty lams.


781
782
.1
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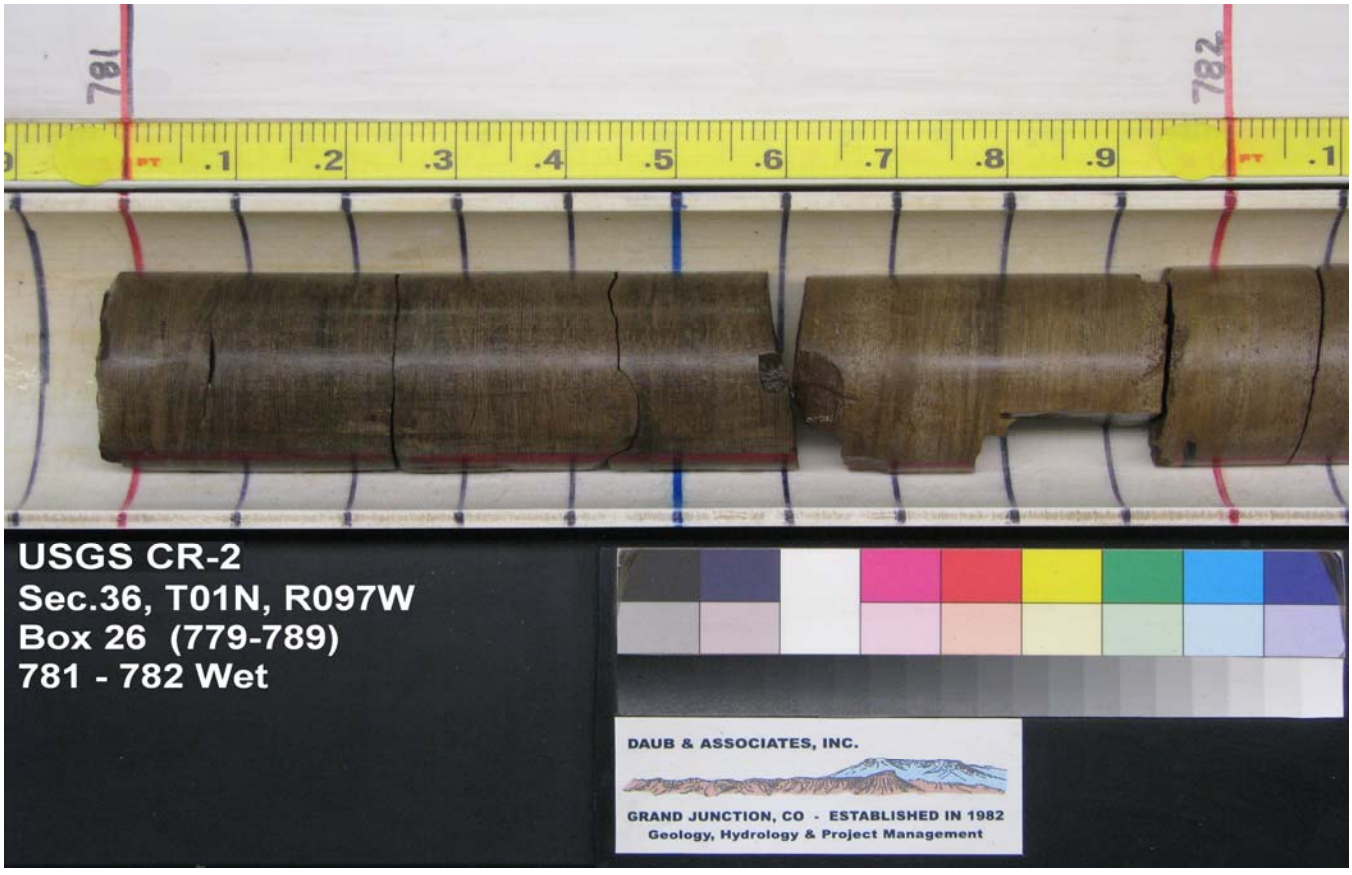
.1
USGS CR-2
Sec.36, T01N, R097W
Box 26 (779-789)
781 - 782 Dry
DAUB & ASSOCIATES, INC.
GRAND JUNCTION, CO - ESTABLISHED IN 1982
Geology, Hydrology & Project Management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USGS CR-2
Sec.36, T01N, R097W
Box 26 (779-789)
781 - 782 Wet
DAUB & ASSOCIATES, INC.
GRAND JUNCTION, CO - ESTABLISHED IN 1982
Geology, Hydrology & Project Management

USGS CR-2
Electronic Data CDs

USGS CR-2
List of Abbreviations

Abbreviations Commonly Found in Daub & Associates, Inc. Reports

Abbreviations Commonly Found with Survey Information

FEL	From East Section Line
FNL	From North Section Line
FSL	From South Section Line
FWL	From West Section Line
GL	Ground Level
NAD	North American Datum
TOC	Top of Casing

Abbreviations Commonly Found in Daily Drilling Reports

Circ	Circulation or Circulate
Cmt	Cement
Csg	Casing
gpm	gallons per minute
LEL	Lower Explosion Limit
Prog	Prognosis
psi	pounds per square inch
rpm	revolutions per minute
TD	Total Depth
TIH	Trip in Hole
TOC	Top of Cement
TOH/TOOH	Trip out of Hole

Abbreviations Commonly Found in Diagrams or Data Sheets

#	Number	MB	Mahogany Bed
API#	American Petroleum Institute number	MD	Measured Depth
BHP	Bottom Hole Pressure	N/A or na	not applicable
BHT	Bottom Hole Temperature	nd	no data
BST	Bottom Seal Test	nr	not recorded
BTC	Bellaire Technology Center	OD	Outside Diameter
D & A	Daub & Associates, Inc	P&A	Plugged and Abandoned
Deg C	Degrees Celsius	P atm	Pressure, atmospheric
Dirr Thick	Directional Thickness	R/L Zone	Rich/Lean Zone
DS	Dissolution Surface	RQD	Rock Quality Designation
Est	Estimated	sks	sacks
FA Grade (Gal/Ton)	Fischer Assay Grade	T amb	Temperture, ambient
Grv	Groove	TI	TI Nahcolite Bed
GW	Groundwater		
HD	High Density Marker	TVD	True Vertical Depth
ID	Inside Diameter	UT	Uinta Transition
in Hg	inches Mercury	Vert	Vertical
lb/ft	pounds per foot		

Abbreviations Commonly Found in Daub & Associates, Inc. Reports

Abbreviations used for Rock Descriptions (Core, cuttings and outcrop)

abt	abundant	com	common
agg	aggregate	cont	contorted
ang	angular	crm	cream
app	appearance	xln	crystalline
ard	around	xtals	crystals
aa	as above	def	deformed
band	banded	dk	dark
bed	bedded, bedding	descr	description
biot	biotite	difus	diffuse
bit	bitumen	dissem	disseminated
blb	blebby	dissl	dissolved
blk	black	discont	discontinuous
blu	blue	dis	disturbed
brec	breccia, brecciated	dol	dolomite
br	bright	f	fine-grained
brn	brown	fx	fracture
calc	calcareous, calcite	gy	gray
carb	carbonaceous	grn	green
cmt	cement, cementing	hd	hard
clayst	claystone	HC	honeycomb
c	coarse-grained	indst	indistinct
coat	coatings	intbd	interbedded
CB	collapse breccia	IB	interbedded
incr	increasing	spl	sample
IP	in part	ss	sandstone
lam	laminations	scat	scattered
ln	lean	sh	shale
lt	light	shle	shale
mkr	marker	slt	silt
med	medium	sltst	siltstone
m	medium-grained	mrlst	marlstone
MFlt	microfaulted	mass	massive
Mfrac	microfractured	mat	material
mod	moderate	sl	slight
mudst	mudstone	sp	specks
nahc	nahcolite	str	streaky, streaked
occ	occasional	strless	structureless
os	oil shale	tan	tan
orn	orange	tx	texture, textured
org	organic	thru	throughout
ox	oxidized	tt	tight
pale	pale	tr	trace
pnk	pink	v	very
por	porous	vf	very fine
poss	possibly	vv	very, very
pyr	pyrite	vvf	very, very fine
Qtz	quartz	wav	wavy
rr	rare	wk	weak
red	red	wht	white
rch	rich	xln	crystalline
rgh	rough	xtals	crystals
rnd	round	ylw	yellow

Munsell Color Code Abbreviations Commonly Found in Daub and Associates, Inc. Reports

CODE	DESCRIPTION			
5R 8/2	GRAYISH PINK		5BG 3/2	DUSKY BLUE GREEN
5R 7/4	MODERATE PINK		5B 8/2	VERY PALE BLUE
5R 6/2	PALE RED		5B 7/6	LIGHT BLUE
5R 6/6	LIGHT RED		5B 6/2	PALE BLUE
5R 5/4	MODERATE RED		5B 5/6	MODERATE BLUE
5R 4/2	GRAYISH RED		5PB 7/2	PALE BLUE
5R 4/6	MODERATE RED		5PB 5/2	GRAYISH BLUE
5R 3/4	DUSKY RED		5PB 3/2	DUSKY BLUE
5R 2/2	BLACKISH RED		5RP 8/2	PALE PINK
5R 2/6	VERY DARK RED		5RP 6/2	PALE RED PURPLE
5R 8/4	MODERATE ORANGE PINK		5RP 4/2	GRAYISH RED PURPLE
5YR 7/2	GRAYISH ORANGE PINK		5RP 2/2	VERY DUSKY PURPLE
5YR 6/4	LIGHT BROWN		10R 8/2	GRAYISH ORANGE PINK
5YR 5/2	PALE BROWN		10R 7/4	MODERATE ORANGE PINK
5YR 5/6	LIGHT BROWN		10R 6/2	PALE RED
5YR 3/4	MODERATE BROWN		10R 6/6	MODERATE REDDISH ORANGE
5YR 4/4	MODERATE BROWN		10R 5/4	PALE REDDISH BROWN
5YR 3/2	GRAYISH BROWN		10R 4/2	GRAYISH RED
5YR 2/2	DUSKY BROWN		10R 4/6	MODERATE REDDISH BROWN
5YR 8/1	PINKISH GRAY		10R 3/4	DARK REDDISH BROWN
5YR 6/1	LIGHT BROWNISH GRAY		10R 2/2	VERY DUSKY RED
5YR 4/1	BROWNISH GRAY		10YR 8/2	VERY PALE ORANGE
5YR 2/1	BROWNISH BLACK		10YR 8/6	PALE YELLOWISH ORANGE
5Y 8/4	GRAYISH YELLOW		10YR 7/4	GRAYISH ORANGE
5Y 7/2	YELLOWISH GRAY		10YR 6/2	PALE YELLOWISH BROWN
5Y 7/6	MODERATE YELLOW		10YR 6/6	DARK YELLOWISH ORANGE
5Y 6/4	DUSKY YELLOW		10YR 5/4	MODERATE YELLOW BROWN
5Y 7/6	LIGHT OLIVE GRAY		10YR 4/2	DARK YELLOWISH BROWN
5Y 5/6	LIGHT LIVE BROWN		10YR 2/2	DUSKY YELLOWISH BROWN
5Y 4/4	MODERATE OLIVE BROWN		10Y 8/2	PALE GREENISH YELLOW
5Y 3/2	OLIVE GRAY		10Y 7/4	MODERATE GREENISH YELLOW
5Y 8/1	YELLOWISH GRAY		10Y 6/2	PALE OLIVE
5Y 6/1	LIGHT OLIVE GRAY		10Y 6/6	DARK GREENISH YELLOW
5Y 4/1	OLIVE GRAY		10Y 5/4	LIGHT OLIVE
5Y 2/1	OLIVE BLACK		10Y 4/2	GRAYISH OLIVE
5GY 7/2	GRAYISH YELLOW GREEN		10GY 7/2	PALE YELLOWISH GREEN
5GY 7/4	MODERATE YELLOW GREEN		10GY 6/4	MODERATE YELLOWISH GREEN
5GY 5/2	DUSKY YELLOW GREEN		10GY 5/2	GRAYISH GREEN
5GY 3/2	GRAYISH OLIVE GREEN		10GY 4/4	DARK YELLOWISH GREEN
5GY 8/1	LIGHT GREENISH GRAY		10GY 3/2	DUSKY YELLOWISH BROWN
5GY 6/1	GREENISH GRAY		10G 8/2	VERY PALE GREEN
5GY 4/1	DARK GREENISH GRAY		10G 6/2	PALE GREEN
5G 7/2	PALE GREEN		10G 4/2	GRAYISH GREEN
5G 7/4	LIGHT GREEN		N 9	WHITE
5G 6/6	BRILLIANT GREEN		N 8	VERY LIGHT GRAY
5G 5/2	GRAYISH GREEN		N 7	LIGHT GRAY
5G 5/6	MODERATE GREEN		N 6	MEDIUM LIGHT GRAY
5G 3/2	DUSKY GREEN		N 5	MEDIUM GRAY
5G 2/1	GREENISH BLACK		N 4	MEDIUM DARK GRAY
5BG 5/2	GRAYISH BLUE GREEN		N 3	DARK GRAY
5BG 4/6	MODERATE BLUE GREEN		N 2	GRAYISH BLACK
			N 1	BLACK