STRATIGRAPHY AND DEPOSITIONAL ENVIRONMENTS OF THE LATE CRETACEOUS (LATE TURONIAN) CODELL SANDSTONE AND JUANA LOPEZ MEMBERS OF THE CARLILE SHALE, SOUTHEAST COLORADO

by

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ABSTRACT

Late Cretaceous formations in the Rocky Mountains are of significant importance to petroleum exploration throughout the region. Recent exploration in the Codell Sandstone Member of Carlile Shale, Smoky Hill and Fort Hays Limestone members of the Niobrara and Greenhorn formations has rejuvenated interest in not only their petroleum potential, but also stratigraphy, petrography, biostratigraphy, geochemistry and other disciplines within the geosciences.

Throughout most of northern, central and southeastern Colorado and eastern Kansas, the Codell Sandstone represents the final regressive deposit of the Greenhorn cyclothem and the Fort Hays Limestone represents the basal sequence of the Niobrara cyclothem. The intermediate, unconformity bound Juana Lopez Member of the Carlile Shale has been interpreted as a palimpsest deposit, and generally disregarded as a significant stratigraphic interval within the region.

Southeast Colorado contains some of the world's best outcrops of Late Cretaceous strata and has been the focus of research for nearly a century. The purpose of this research was to better understand the impact and regional extent of the late Turonian unconformities on the Codell Sandstone and Juana Lopez members, and the implications on previous interpretations of the depositional environments and Late Cretaceous paleogeography.

Analysis of outcrop, core, subsurface well logs and support from hand-held X-ray fluorescence geochemistry data indicates that significant faulting, topographic highs and subaqueous erosion removed the Codell Sandstone differentially throughout the region, creating a depositional remnant prior to and during deposition of the Juana Lopez and

the basal Fort Hays Limestone. The Juana Lopez is a fossiliferous grainstone to calcareous sandstone, deposited in a sediment starved, high-energy, current winnowed, shallow marine shelf environment during the basal transgression of the Niobrara cyclothem.

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CHAPTER 1

INTRODUCTION

1.1 Study Objectives

The purpose of this research was threefold: (1) Examine the sedimentology, stratigraphy and depositional environments of the Late Cretaceous Carlile Shale and three of its four members; the Blue Hill Shale, the Codell Sandstone and the Juana Lopez in southeast Colorado. Emphasis was placed on the interval between the Carlile Shale and the basal Fort Hays Limestone. (2) Identify and interpret the causes and controls on the present-day distribution of the Codell Sandstone and Juana Lopez members and the impact of the late Turonian unconformities in southeast Colorado. (3) Examine the potential for a connection between the Codell Sandstone in southeast Colorado to an eastern shoreline in west-central Kansas and if any significant sediment was contributed to the seaway from the central craton. Due to the nature of the transition from the Juana Lopez to the Fort Hays Limestone, partial analysis of the basal Fort Hays was needed for greater distinction between the units and stratigraphic correlations.

1.2 Area of Investigation

The area of investigation (AOI) is the southern portion of the Denver Julesburg (Denver) basin including the Cañon City Embayment, Rock Creek anticline, and the northern flanks of the Las Animas and Apishapa arches (Figure 1.1). This AOI is ideal because of its numerous, laterally extensive, well-exposed outcrop belts of the Greenhorn through Niobrara formations, especially the Codell Sandstone through Fort

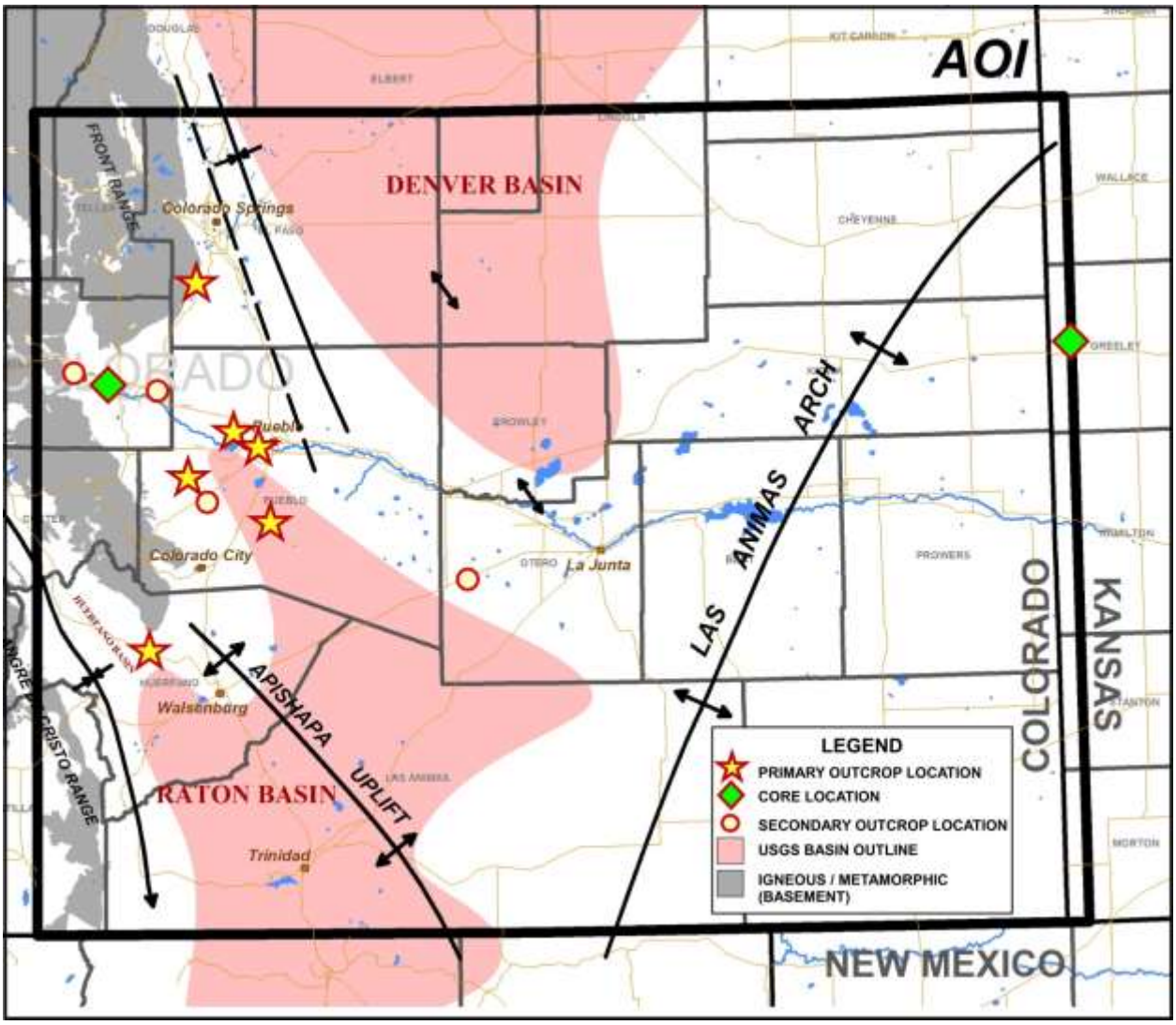


Figure 1.1: Area of Investigation (AOI) in southeast Colorado.

Hays Limestone transition. While most outcrops used in this AOI are confined to the greater Pueblo, Colorado area, well log data and one core in Kansas extended the AOI north to Colorado Springs, east to the Kansas state line and south towards the New Mexico state line.

1.3 Dataset and Procedures

Core descriptions were completed on the USGS Portland 1 and the Amoco Rebecca Bounds 1 at the USGS Core Research Center in Lakewood, Colorado (Table:

1.1). Both cores cover the complete study interval and are excellent data points. The Portland 1 core is located in the center of the AOI and most proximal to outcrops; the Rebecca Bounds 1 core is in western Kansas and is the easternmost data point used in this research. All cores were measured at one foot to sub-one foot intervals and described in detail based on grain size, rock texture, hand-sample mineralogy, fossil assemblage, ichnofacies, and sedimentary structures. A complete list of and details about the subsurface core locations can be found in Appendix A, and Table 1.1 summarizes names and locations referenced in Figure 1.1.

Six primary outcrops were described in detail within the AOI (Table: 1.2). In addition to the six, four secondary outcrops were viewed and informally measured to help in understanding facies changes and regional stratigraphic relationships. Fieldwork was accomplished over two years and several trips to the area. All primary outcrops were analyzed using the same procedures as core analysis. Outcrops also provided limited paleocurrent data and information on stratigraphic architecture. A complete list of and details about the outcrop locations can be found in Appendix A, and Table 1.2 summarizes names and locations referenced in Figure 1.1.

Samples for petrographic thin-section analysis were taken from the Codell Sandstone and Juana Lopez at multiple locations. Samples were analyzed for composition, optical mineralology, fabric, texture, cementation and all samples were half-stained with alizarin red-s (ARS) and potassium ferricyanide (PF) for calcite, ferroan calcite and ferroan dolomite identification. All thin-section images were analyzed using a Dino-Lite AM413ZTAS digital microscope and light stage polarizing plate, and images were captured using the DinoCapture 2.0 software at x220 magnification.

Table 1.1: Core information.

NBR CODE	OPERATOR WELL NAME	API NUMBER CRC LIBRARY	LOCATION	COUNTY & STATE
1 (PC)	USGS Portland 1	N/A E099	S20-T19S-R68W	Fremont, CO
2 (RBC)	Amoco Rebecca Bounds 1	150712044600 E006	S17-T18S-R42W	Greeley, KS

Table 1.2: Primary and secondary outcrop information.

NBR CODE	OUTCROP NAME	LOCATION	COUNTY & STATE
3 (DCO)	Deadman's Curve	S11-T16S-R67W	El Paso, CO
4 (LPO)	Lake Pueblo State Park	S26-T20S-R66W	Pueblo, CO
5 (PCO)	Peck Creek	S21-T21S-R67W	Pueblo, CO
6 (PNCO)	Pueblo Nature Center	S32-T20S-R65W	Pueblo, CO
7 (VRO)	Verde Road	S9-T23S-R65W	Pueblo, CO
8 (WO)	Walsenburg	S4-T27S-R68W	Huerfano, CO
9 (RFPO)	B.F. Rockafellow Park	S7-T19S-R70W	Fremont, CO
10 (BCO)	Beaver Creek	S7-T19S-R68W	Fremont, CO
11 (RHNO)	Rock Hill North	S18-T22S-R66W	Pueblo, CO
12 (SAO)	Sanders Arroyo	S26-T25S-R61W	Pueblo, CO

X-Ray Fluorescence (XRF) elemental geochemistry was obtained using a Thermo Scientific Niton hand-held analyzer on both cores and three primary outcrops. Data were captured at one and two foot intervals, and sub-foot intervals on major

contacts or important changes in lithology and marker beds such as a volcanic ash beds, and interbeds within the Fort Hays Limestone. Data were collected at 90 second intervals with 30 second focus on the lighter elements.

Well log data is abundant throughout the Denver basin, especially in and around Wattenberg, but penetrations of the Niobrara through Greenhorn decrease to the south and east as the formations shallow and petroleum potential within these Late Cretaceous formations decreases. Fortunately deeper exploration targets in the region recorded the shallow Late Cretaceous intervals. Recent oil and gas drilling in the southeast flank of the basin aided in access to newer well logs within the eastern region of the AOI, but in general the available well log control in the southern Denver basin is sporadic and of poor quality due to age. Within the AOI, raster logs were obtained and manually depth calibrated from the Colorado Oil and Gas Conservation Commission website (COGCC). Additional raster logs and digital LAS files were supplied by Enerplus Resources (USA). In total, 141 wells with digital LAS files and 1,881 wells with raster logs were used in this study. It must be stated that many did not cover the entire study interval and were only used for partial correlations. A complete list of and details about the subsurface well log locations and stratigraphic tops can be found in Appendixes B and C respectively.

1.4 Previous Research

Southeast Colorado has been the focus of Cretaceous outcrop research for several decades. E.G. Kauffman published and co-authored several works on biostratigraphy, chronostratigraphy and cyclicity, depositional environments, geochemistry and stratigraphy in the region, starting in the late 1960’s and continued

through the early 1990's. During his tenure, several of his students published separate works and continue today on Late Cretaceous research. Of most significance are: Kauffman, 1969; 1977a; 1977b; 1985; Kauffman et al., 1977; 1985; 1987; 1993; Barlow and Kauffman, 1985; Fisher et al., 1985; and Glenister and Kauffman, 1985. The emphasis of these works was on the major marine cycles of sedimentation within both the Greenhorn and Niobrara cycles from the Dakota up through the Smoky Hill Member of the Niobrara Formation. While the Codell Sandstone and Juana Lopez were recognized, limited information was presented regarding their deposition and distribution throughout southeast Colorado.

The Carlile Shale is part of the unit originally defined as the Fort Benton Group and later recognized as the upper unit of the Benton Shale or Benton Formation. The earliest proposal to divide the Benton in Kansas and Colorado was made by Cragin (1896). The Carlile Shale was named by Gilbert in 1986 from exposures in the Arkansas River valley region of eastern Colorado. Haun (in Meek and Hayden, 1857) and Leconte (1868) gave the first descriptions of the Carlile in Kansas. In 1872 a more detailed description was published by Hayden, who worked along the Union Pacific Railroad in western Kansas and eastern Colorado. The Carlile Shale was first divided into three members (in ascending order): the Fairport Chalk, the Blue Hill Shale and the Codell Sandstone by Bass in 1926 at its type locality in Ellis County, Kansas (NE of Section 3, Township 11 South, Range 17 West). The Blue Hill shale was first named by Logan in 1897 as a grey to blue-grey, fossiliferous, clayey, non-calcareous shale.

T.W. Stanton (1893) first noted "a bed of rather coarse massive grey sandstone" that is almost 15 feet thick at Carlile Springs and lay atop the Fort Benton shales. On

top of this sandstone he noted "1 to 2 feet of brown calcareous sandstone containing *Ostrea lugubris*, impressions of *Prionocyclus wyomingensis*, and numerous sharks teeth." He described a variety of fauna from these units in a section to the south in Huerfano Park and referred to it as the "Pungellus sandstone" after a characteristic gastropod, *Pungellus fusiformis.*

The name Juana Lopez was first applied by Rankin (1944) to the top ten feet of “very calcareous sandstone” which occurs atop of the Carlile Shale on the Mesita Juana Lopez Grant, six miles northwest of Cerrillos, Santa Fe County, New Mexico. Before Rankin’s work, the distinctive nature and wide extent of the beds that he included in his “Juana Lopez Sandstone Member” had been noted by other authors (Newberry, 1876; Stanton, 1893). Rankin however, emphasized the lateral extent and continuity of the member by identifying it in measured stratigraphic sections around the margins of the San Juan basin.

After Rankin’s work, Pike (1947) described the member as the “late Carlile zone” and noted its distinct fauna and lateral persistence in the northwestern part of the San Juan basin. The name Juana Lopez was applied to the member in the type area by Stearns (1953) and along the east side of the San Juan basin by Cobban and Reeside (1952), and Young (1960). In 1965 the name Juana Lopez was officially accepted by the USGS as a member of the Mancos Shale in the Ute Mountains area of southwest Colorado (Ekren and Houser, 1965) and as a member of the Carlile Shale in the Pueblo area of southeast Colorado (Scott, 1964). Kauffman applied the name widely in southern Colorado and northern New Mexico (1965). Scott and Cobban (1964) first applied the name Juana Lopez to the thin calcarenites in the Pueblo area. Dane et al.

(1966) and Hattin (1975) extended the usage of the name Juana Lopez Member of the Carlile Shale throughout southern Colorado and western Kansas.

In his work on the Codell Sandstone Member of the Carlile Shale in southeast Colorado, Krutak (1970), recognized and classified the uppermost Codell Sandstone as a calcarenite or limy sandstone unit, pale yellowish-orange, which may be moderate brown in phosphorite-rich zones. He termed this unit “facies 1” of the Codell Sandstone and recognized that the thickness throughout the region varied, and in all sections it marked the top of the unit. Krutak concluded that based on the “podded” morphology, mineral composition, and sporadic occurrence that this facies represented localized coquinoid thanatocoenosis of molluscan fragments entombed in intertidal flats which were alternately exposed and inundated by tidal fluctuations during late Codell Sandstone time.

Pinel (1977) measured outcrops in Pueblo and Fremont Counties concentrating around the Brush Hollow and Beaver Creek anticlines, north of Highway 50, utilizing the excellent local outcrop exposures of the Codell Sandstone and Juana Lopez. The entire Fort Hays in this area is not always exposed and complete sections are difficult to find. The extent of his investigation was relatively small, and while he was able to view several outcrops, his work did not extend far enough to see the variability and stratigraphic changes within the Codell Sandstone and Juana Lopez. He divided the system (Blue Hill Shale through Fort Hays Limestone) into four depositional environments: (I): foreshore or littoral, (II): shoreface, (III): sub-shoreface, and (IV): deeper neritic (after Land, 1972). Most of the Codell Sandstone in this area was classified as environments (II) and (III) with rare occurrences of environment (I) in only

two of his locations. The Juana Lopez was also classified as environment (II). Based on the evidence of a weathered exposure and partial lithification of the upper Codell Sandstone, Pinel alluded to the potential for periods of brief emergence and erosion of the upper Codell Sandstone, but did not quantify the amount or extent of the possible exposure and erosion.

Aulia (1982) examined 17 sections, measuring 12 in El Paso County, south and southwest of Colorado Springs, concentrating on the eastern edge of Garden of the Gods National Natural Landmark. His work was very local in extent, only covering a few miles and only briefly referenced secondary locations to the south near Lake Pueblo State Park and Highway 50 west of Pueblo. Aulia concluded that there was lack of evidence for subaerial exposure, and that the unconformity between the Codell Sandstone and Fort Hays was a minor submarine process, and the thinning of the Codell Sandstone is considered to be the result of positive structural elements, or erosion related to recurrent fault movement (after Weimer, 1984). In addition, based on the areas of investigation he concluded that the Juana Lopez thins from the north to south over the region.

CHAPTER 2

BACKGROUND GEOLOGY

2.1 Geologic Overview

The Western Interior Cretaceous (WIC) basin consists of marine, marginal marine, coastal plain and alluvial plain sedimentation during periods of maximum flooding by epicontinental seas (Late Cenomanian-Early Turonian, and Coniacian-Santonian) (Fig. 2.1). At its maximum development, the basin extended from Arctic Canada to the Gulf of Mexico, a distance of more than 3,000 miles, in a general north-south direction (Kauffman, 1977a). It extended from the Boreal sea in the north to the Tethyian sea in the south. The seaway was bordered on the west by the rising Cordilleran orogenic belt from which much clastic debris was shed; clastic influx was minimal from the more stable platform to the east (Pollastro, 1992).

Cretaceous rocks and faunas of the WIC basin reflect two major cycles of marine sedimentation, the Greenhorn cyclothem (Albian-Middle Turonian) and the Niobrara cyclothem (Late Turonian-Maastrictian), (Kauffman, 1969) (Fig. 2.2). Each marine cycle is generally marked by a basal transgressive and terminal regressive sandstone unit reflecting complex near-strand environments, associated with variable marginal marine-coastal plain deposits (e.g., Dakota Group, Codell Sandstone, Fox Hill-Laramie sequence, Trinidad-Vermejo sequence). Maximum transgression is characterized by the development of widespread fine-grained carbonates near the center of the depositional basin (Bridge Creek and Fort Hays Limestones) (Kauffman, 1969).

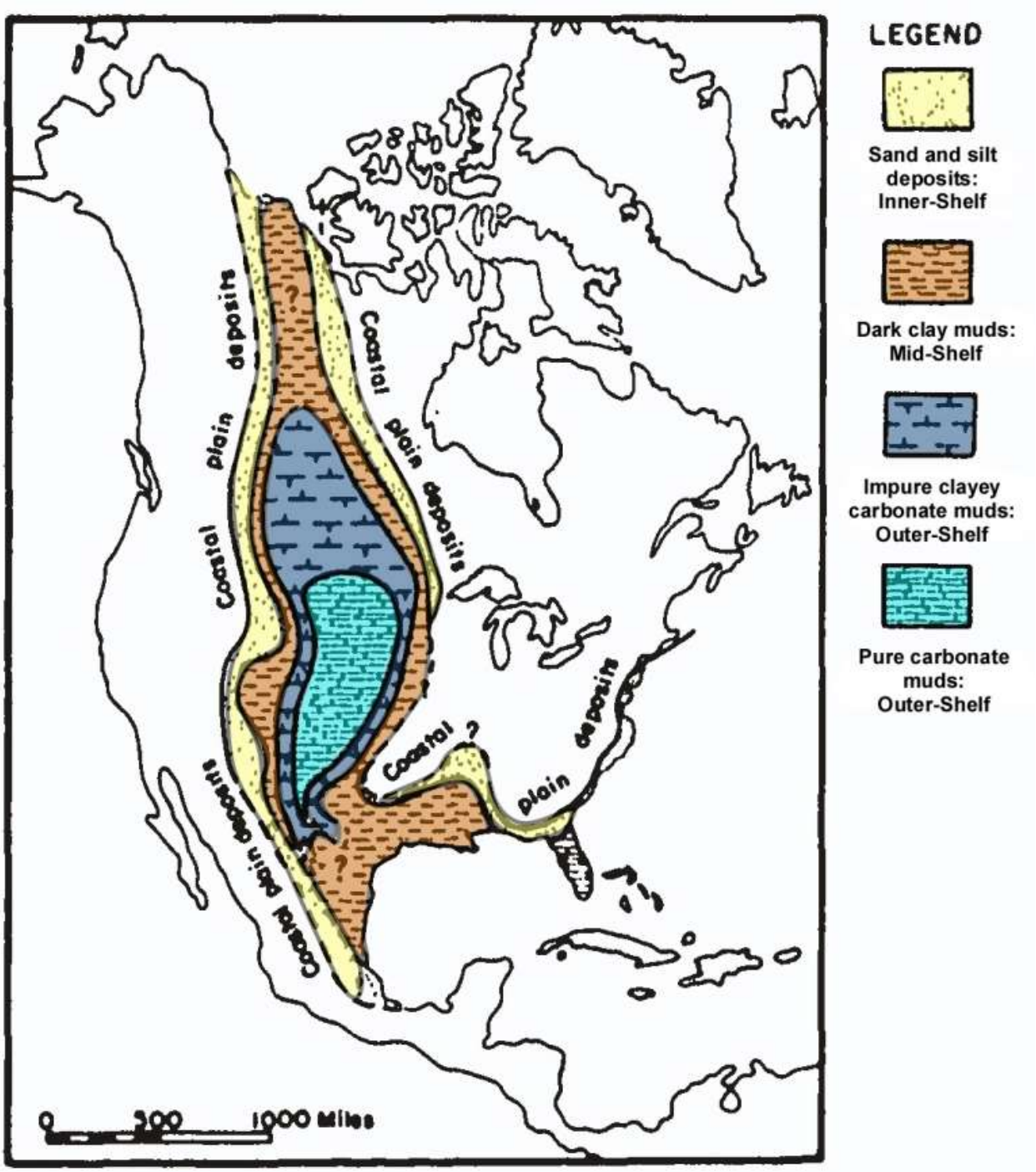


Figure 2.1: Generalized facies distribution of Late Cretaceous strata in the WIC seaway (modified from Kauffman, 1977).

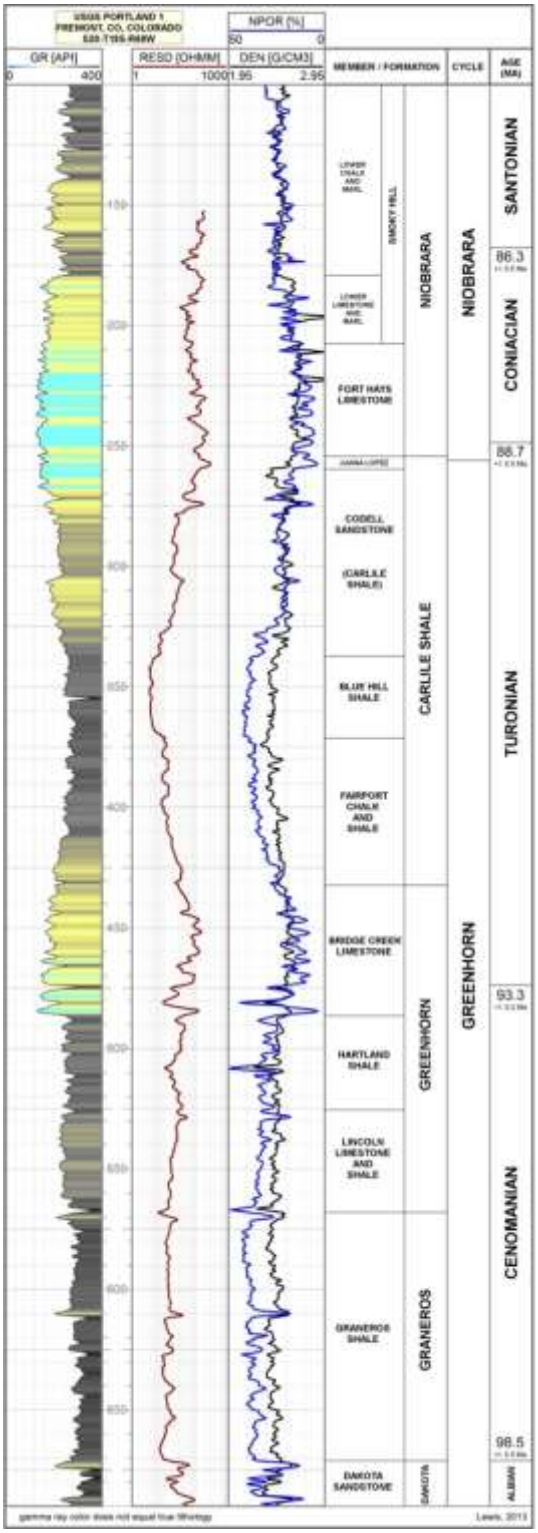


Figure 2.2: WIC seaway marine cycles (partial) from the USGS Portland 1 core (modified from Kauffman 1977, Obradovich, 1993, Ogg et al. 2004, and Locklair 2008).

2.2 Stratigraphy

The Carlile Shale consists of four members, in ascending order: the Fairport Chalk, the Blue Hill Shale, the Codell Sandstone, and the Juana Lopez. The Codell Sandstone and Juana Lopez are overlain by the Fort Hays Limestone Member of the Niobrara Formation (Fig 2.3).

The Fairport Chalk is not included in this study, but it will be briefly described for comparison as it was used in subsurface correlations and viewed in the Portland 1 and Rebecca Bounds 1 cores, but never viewed in outcrop. The Fairport Chalk consists of approximately 80 feet of medium- to light-grey to beige and tan calcareous shale. Numerous thin bentonite layers are present and easily identified throughout the unit. The base of the unit is gradational with the lower Bridge Creek Member of the Greenhorn Formation and is commonly designated above the last massive chalk of the Bridge Creek Limestone. The contact between the Fairport Chalk and overlying Blue Hill Shale is marked by a change in color from dark-grey to black predominantly laminated shale and a marked absence of calcium carbonate content, except where concretions within the lower Blue Hill Shale occur. The contact is rarely found in outcrop, but easy to identify in core. Genetically the Fairport Chalk is more similar to the Bridge Creek Limestone, as it represents the regressive hemicycle of the Greenhorn cycle and should be included as the final member of the Greenhorn Formation instead of the basal member of the Carlile Shale (Kauffman, 1977).

The Blue Hill Shale consists of dark- to medium-grey to olive shale, mudstone, siltstone and silty sandstone. The unit coarsens upward from mudstone to siltstone and fine-grained sandstone that become increasingly more bioturbated. The lower 20-25

feet consists of dark-grey to black often laminated shale and bioturbation is absent to rare. Large Septarian limestone concretions are common, but most are concentrated in the middle of the unit and can be as large at three feet in diameter. The unit is commonly a slope former and therefore covered and concealed in outcrop, making accurate and complete outcrop measurements difficult.

The Blue Hill Shale and its stratigraphic division and nomenclature have not been equally applied by previous authors. Most designate the Blue Hill Shale as everything above the Fairport Chalk up to the first significant sandstone of the Codell Sandstone. This sequence encompasses several intertonguing and gradational lithologies that are technically not shale. Pinel (1977) stated that there was up to 100 feet of Blue Hill Shale in southeast Colorado and included everything above the Fairport Chalk to the first significant sandstone beds of the Codell Sandstone as the Blue Hill Shale. This transition, as it coarsens upward from shale and mudstone to siltstone, to silty sandstone, all of which are heavily bioturbated, makes definitive division difficult. This transition, as the Blue Hill Shale becomes coarser, siltier and more bioturbated is often referred to as just "Carlile Shale". This usage is misleading as the name Carlile Shale is outdated, and has what this author considers formation status within the Benton Group once it was divided by Bass in 1926 (in Kansas Geological Bulletin 11) to contain three, then later four, distinct, regionally mapable members, none of which were termed "Carlile Shale". Furthermore, the USGS is inconsistent in their division and usage of the terms Carlile Shale, Blue Hill Shale and Codell Sandstone. Their report on the Rebecca Bounds 1 core in Greeley County, Kansas divides the Carlile Shale into three of its four members (Juana Lopez is absent): Fairport Chalk (784-905 feet), Blue Hill Shale (755-

784 feet), Codell Sandstone (675-755 feet). Based on their division the Codell Sandstone is 80 feet thick and the Blue Hill is 29 feet thick. The Portland 1 core in Fremont County, Colorado contains similar stratigraphic intervals and facies and is divided into four of the Carlile members: Fairport Chalk (376-456 feet), Blue Hill Shale (273-376 feet), Codell Sandstone (260-273 feet) and Juana Lopez (257-260 feet). Based on their division the Blue Hill Shale is 103 feet thick and the Codell Sandstone is 13 feet thick. As stated, these two cores contain similar stratigraphic intervals and similar facies, yet based on the inconsistency of their naming one could infer significant stratigraphic changes between the two locations that do not exist. While this may seem conjectural when viewing the Carlile Shale as a stratigraphic package of intertonguing and gradational marine facies, a detailed analysis cannot be done without an attempt at greater stratigraphic clarification (Figure 2.3).

To avoid confusion, the name Carlile Shale should not be used to describe a specific facies in the transition from the Blue Hill Shale to the Codell Sandstone, but rather the interval as a whole. However, the name Blue Hill Shale for everything above the Fairport Chalk and below the Codell Sandstone is equally misleading. Difficulty arises when needing to describe and correlate this gradational transition from the true black to dark-grey, fine-grained, laminated Blue Hill Shale to the upper very fine- to fine-grained, bioturbated mudstone and siltstone that is more Codell Sandstone-like in appearance. Furthermore, the vertical succession of facies is not always linear and what is preserved in southeast Colorado does not always adhere to the classic upward-swallowing shelf to shoreface facies models, which creates greater difficulty in vertical stratigraphic division. For the purposes of this research, in core and in outcrop, the

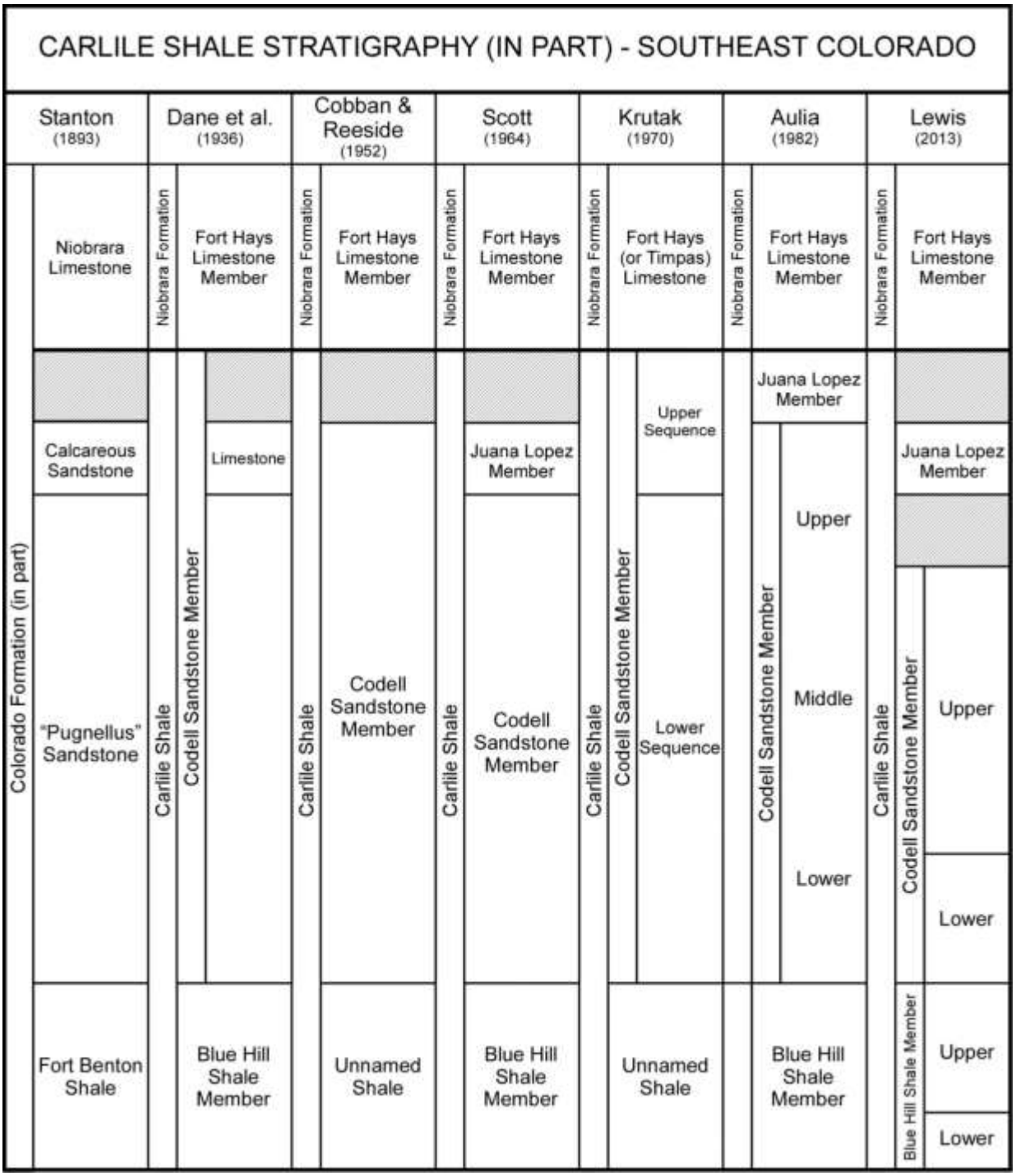


Figure 2.3: Evolution of stratigraphic nomenclature of the upper Carlile Shale (partial) and lower Niobrara formations in southeast Colorado.

name “lower Blue Hill Shale” will used for the lower, dark-grey to black, very fine- to fine-grained, laminated, often friable, sparsely bioturbated shale, where obvious silt content is low. Everything above this interval, once the bioturbation and silt content starts to increase, but below the first occurrence of significant siltstone in the lower Codell Sandstone, will be referred to as the “upper Blue Hill Shale”, not the Carlile Shale. This division of the lower Blue Hill Shale is regionally mapable in core and the subsurface and therefore can be correlated. It is often marked by a color change from a dark- to medium-grey, more resistant slope ledge, near a concretion zone containing significant Septarian nodules that some authors recognized as a laterally continuous regional marker bed of the Blue Hill Shale. It is also generally marked by a decrease in gamma ray and an increase in resistivity and bulk density log responses. The upper Blue Hill Shale is more difficult to distinguish in outcrop than in the subsurface on well logs and in core. The term Carlile Shale will still be used throughout, but only as a general grouping or in the subsurface where distinct facies division between the upper Blue Shale and lower Codell Sandstone transition is not possible. An explanation of these divisions will be addressed in Chapter 3.

The Codell Sandstone consists of 0-40 feet of very fine- to medium-grained, thin to massive, bioturbated to planar and low-angle, cross-bedded siltstone and sandstone. Krutak (1970) divided the Codell Sandstone into two informal divisions, a "lower", or "basal", and an "upper" sequence. Aulia (1982) divided the Codell Sandstone into three units. The lowermost unit was chosen below where previous work placed the contact to accommodate log correlations and the occasional silty-sandstone bed that occurs in outcrop; by doing this Aulia included what many authors consider to be the upper-most

Blue Hill Shale transition or what has been previously called "Carlile Shale", as basal Codell Sandstone. For the purposes of this research, the terms “lower Codell Sandstone” and “upper Codell Sandstone” will be used to represent the Codell Sandstone (after Krutak, 1970 and Aulia, 1982). Further explanation of these divisions will be addressed in Chapter 3. The base of the lower Codell Sandstone with the underlying upper Blue Hill Shale is occasionally abrupt and can appear to be a scoured surface, and flute or load casts are common at the base. This is not always present, but previous authors interpreted this sharp surface as a regional disconformity (Krutak 1970, Reisser 1976, Pinel 1977, and McLane 1982). The lower Codell Sandstone consists of thinly bedded, often lenticular fine-grained siltstone and sandstone with interbedded very fine- to fine-grained siltstone and mudstone. The upper Codell Sandstone consists of thick, pervasively bioturbated, sometimes thin to tabular, and occasionally planar to low-angle cross-bedded, fine-grained siltstone and sandstone. Bioturbation is common throughout the entire Codell Sandstone but it can also be interbedded with stratified sandstone beds and in general it increases towards the top. The uppermost several few feet of the Codell Sandstone is commonly intensely bioturbated creating a *Glossifungites* ichnofacies. This assemblage and the resulting surface and its implications will be discussed in Chapters 3 and 4.

The Juana Lopez Member is the most enigmatic unit within the Carlile Shale. For years it was recognized as an uppermost facies of the Codell Sandstone; often described as a dense, fetid limestone, or calcarenite within the Codell Sandstone. The Juana Lopez varies in thickness from absent to several feet, never greater than six feet and considering its relatively thin and elusive nature, it encompasses a wide variety of

lithologies. Previous work refers to it as a calcarenite, but this term and implied classification is misleading as the lithology varies, and the term, which was first introduced by Grabau (1903), referenced limestones with 50% detrital carbonate grains, or allochems, e.g. corals, shells, ooids, intraclasts and pellets. While shell fragments are common, especially inoceramids, basal intervals do not exceed 50% allochems. In many locations the Juana Lopez is more than 50% detrital lithic and monomineralic grains, commonly quartz, and should be considered a calcareous sandstone, not a calcarenite. The lowermost Juana Lopez contains several inches of an orange to rust-brown, coarse-grained pebble, conglomeratic calcareous sandstone with indistinguishable fragments of broken inoceramids, chert, sharks teeth, bone, and reworked fragments from the underlying Codell Sandstone. The upper Juana Lopez consists of a purple to maroon and grey, very dense, almost crystalline, fossil fragment grainstone. When freshly broken it releases a distinct sulfurous odor. The contact with the lower Codell Sandstone is misleading as it sometimes appears gradational and conformable (Pinel 1970), yet in some areas it is abrupt and sharp. Extensive bioturbation makes the contact between the Juana Lopez and Codell Sandstone difficult to distinguish when present. Similarly, the contact between Juana Lopez and upper Fort Hays Limestone is also reworked by bioturbation and difficult to distinguish. This contact and its implications will be discussed in Chapters 3 and 4.

The Niobrara Formation consists of two members, in ascending order: The Fort Hays Limestone, and the Smoky Hill. The Smoky Hill is not included in this study, but it will be briefly described for comparison as it was viewed in Portland 1 and Rebecca Bounds 1 cores and occasionally viewed in outcrop. The Niobrara as a whole is

generally referred to as alternating "chalks and marls". The Fort Hays Limestone is however the only pure rhythmic chalk limestone with cycles of dense, diagenetically altered, recrystallized, coccolith-rich, planktonic Foraminifera, inoceramid packstone and argillaceous to calcareous mudstone and marlstone. The Smoky Hill is an impure or argillaceous chalk with thicker alterations of coccolith-rich, planktonic Foraminifera, inoceramid wackestone to packstone and mudstone. Facies and division of the Fort Hays Limestone will be discussed in Chapter 3.

2.3 Structural Framework

Southeast Colorado encompasses Late Cretaceous regional Laramide and pre-Laramide structural elements. The Denver basin is a Laramide asymmetric basin with a steeply dipping western flank adjacent to the greater Colorado Front Range. The southern extents of the basin are defined by the Apishapa arch to the southwest, which divides the basin from the Raton and Huerfano basins in southern-most Colorado and northern New Mexico, and the Las Animas arch to the southeast. The eastern edge of the basin is broad and less structurally defined with a gradual transition to the Hugoton embayment and Kansas platform. South of Colorado Springs the Front Range plunges south into the Cañon City embayment creating a junction with the Wet Mountains to the south. This embayment creates an offset in the greater Front Range trend that was active during the formation of the Ancestral Rocky Mountains and pre-Pennsylvanian (Gerhard, 1967) (Figure 2.4).

Within the Cañon City embayment several faults and flexures exist that are easily mapped at the surface over relatively short distances. The largest is the southeast to

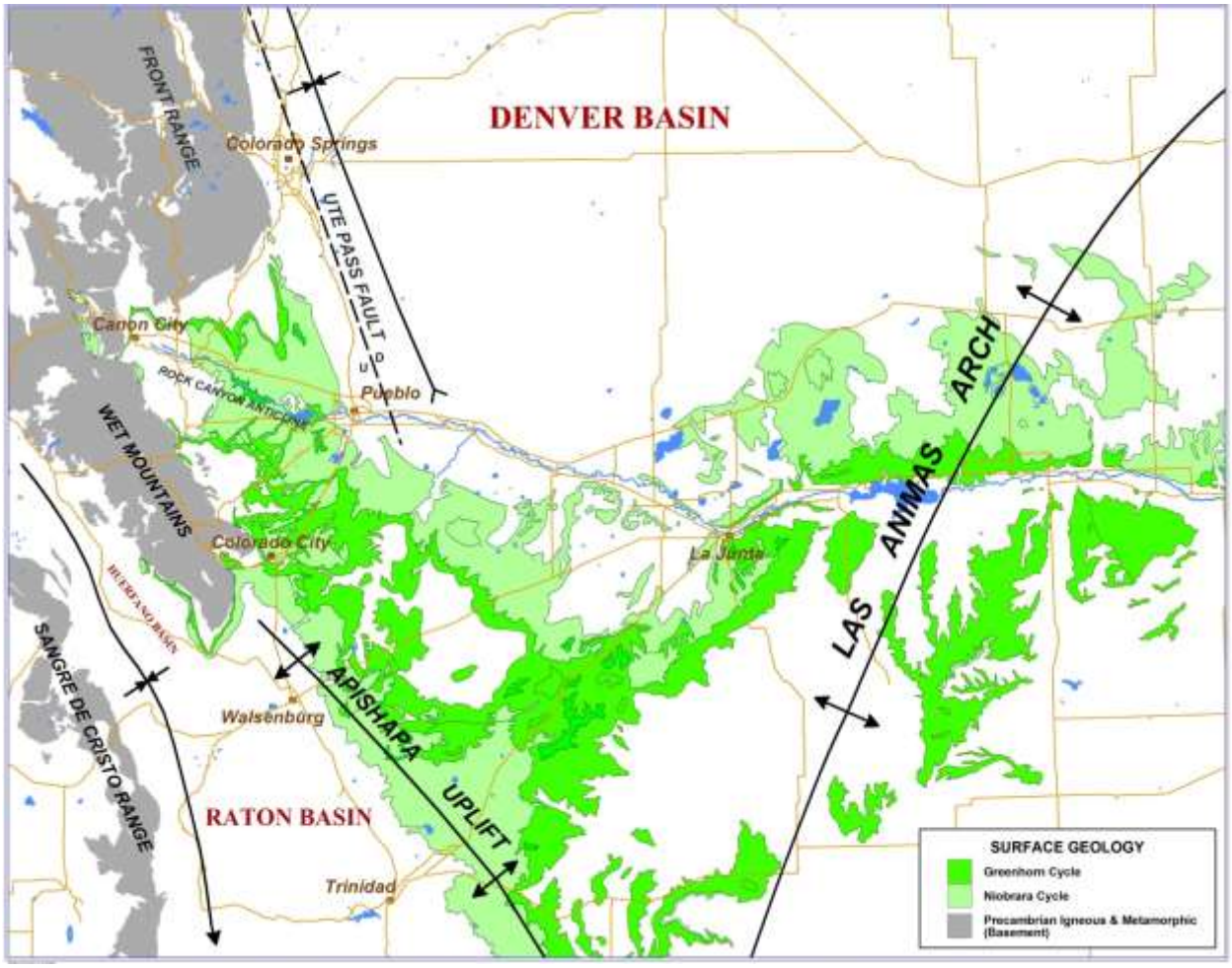


Figure 2.4: Regional structural features in southeast Colorado (modified from Pinel, 1977).

northwest plunging Rock Canyon anticline. This structure is a transpressional feature, related to the offset of the Rampart Range and Wet Mountains that warped Mesozoic sediments over the plunging southern nose of the Front Range. It was breached during the Quaternary and is actively being down-cut by the Arkansas River today. Perpendicular to the Rock Canyon anticline are the Brush Hollow, Beaver Creek and Turkey Creek anticlines, which were the areas of focus by Pinel (1977). The Cañon City syncline is the westernmost structure before the Wet Mountain thrust and the Red

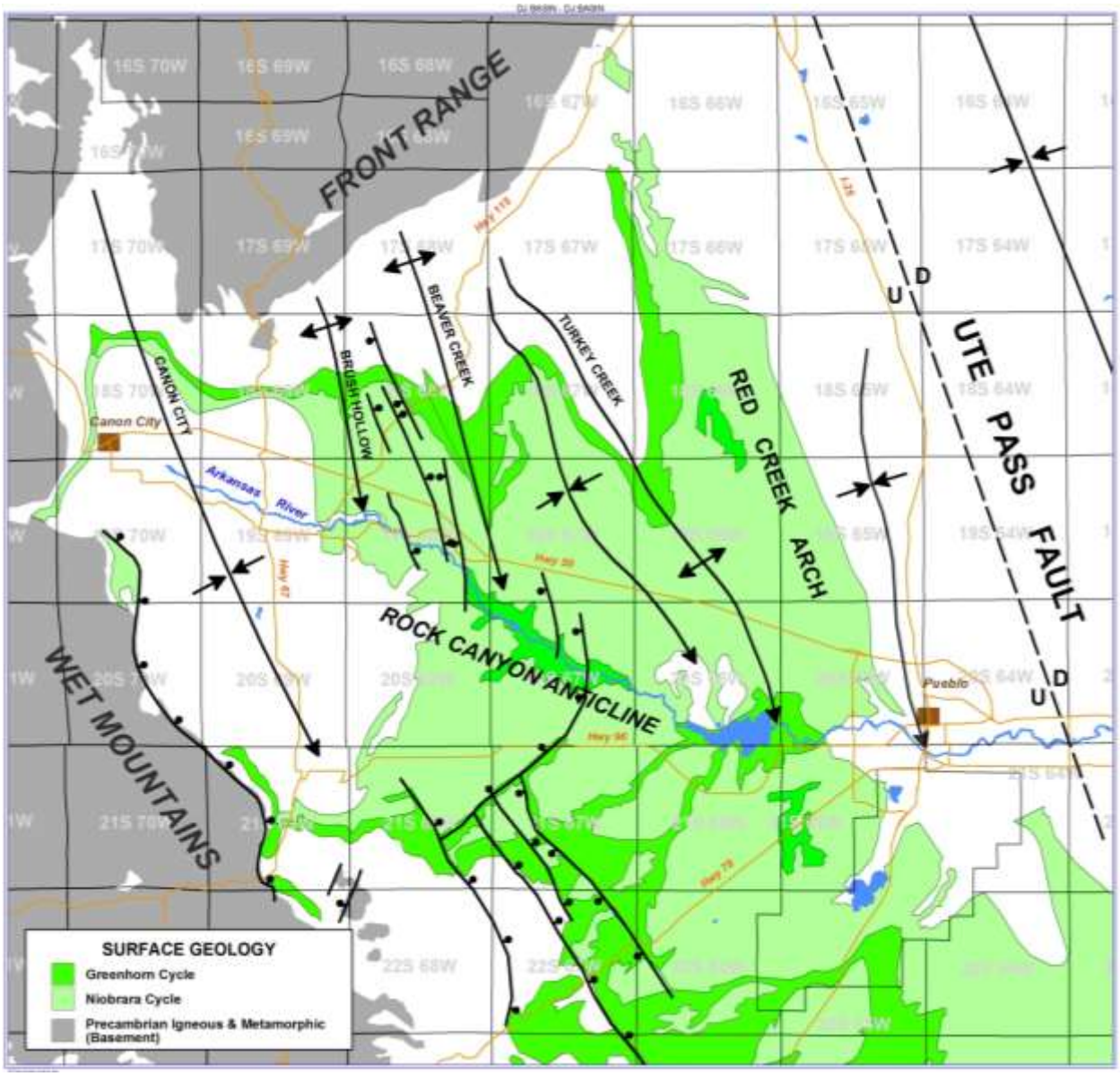


Figure 2.5: Structural features within the Cañon City embayment and western flank of the Denver basin (modified from Pinel, 1977).

Creek arch is the easternmost flexure before the Ute Pass fault which defines the western edge of the Denver basin. Many of these structures show evidence of a pre-Pennsylvanian formation with impacts on thickness variations within Upper Cretaceous formations (Brown 1978) (Figure 2.5).

2.4 Regional Stratigraphic Unconformities

Throughout the WIC of the United States three widespread, regional major unconformities that reflect regional marine regressions and transgressions are observed in the stratigraphic record (Figure 2.6). The oldest of the three, within the Frontier Formation and partial age-equivalents (including the Carlile Shale), separates Cenomanian or lower Turonian beds from middle Turonian beds in central and western Wyoming, northwestern Colorado and areas of Montana and Utah. A younger disconformity, within the Frontier Formation and lateral equivalents, separates upper Cenomanian or lower or middle Turonian strata from middle or upper Turonian strata in central and eastern Wyoming, southwestern South Dakota, western Nebraska, and central and eastern Colorado (Merewether et al., 2007). The youngest of the three disconformities, and most applicable to the scope of this study, separates strata of middle or late Turonian ages in the Carlile Shale and lateral equivalents from upper Turonian or lower or middle Coniacian beds of the basal Niobrara Formation in Wyoming, Colorado, Nebraska, and adjoining states (Merewether et al., 2007). Within the Denver and neighboring inner-mountain basins to the west and areas to the south in Colorado, this youngest disconformity is marked by the conclusion of the Greenhorn cyclothem and transition from the Codell Sandstone to the Juana Lopez and the basal sequence of the Fort Hays Limestone. This transition is marked and widely recorded by a eustatic lowering of sea level (R6) (Kauffman, 1977a). The Juana Lopez is sparse and thin in the central and western Denver basin. However, it is pervasive and thick the southern Denver, South Park, Middle Park, North Park and Raton basins. The contact between these two major marine cyclothems has long been recognized as a

disconformable or unconformable contact (McLane, 1982). While often referred to as one major unconformity between the Codell Sandstone and the Fort Hays Limestone, two unconformities exist in the transition, one beneath the Juana Lopez with the Codell Sandstone and one above the Juana Lopez with the Fort Hays Limestone.

In their work on bedding patterns and thickness variations within the Fort Hays Limestone Member of the Niobrara Formation in southeast Colorado and Kansas, Laferriere and Hattin (1989) concluded that several small-scale, localized structural features controlled the preservation of preserved thickness variations within the basal Fort Hays Limestone. Using the Milankovich-type, rhythmic depositional, chronostratigraphic cycles and therefore laterally correlative nature of the Fort Hays Limestone, they were able to identify several pre-Niobrara southwest to northeast and southeast to northwest trending arches, or topographic highs that impacted depositional patterns in the basal Niobrara sequence. In addition, they presented a regional erosion surface that truncates progressively older Carlile Shale members in a northeastward direction. They concluded that these structures may share similar timing and behavior to the Transcontinental arch in northern Colorado (Weimer, 1984) and the northwestwardly trending Precambrian faults (Tweto, 1980) (Figure 2.7). The timing and impact of these structural features and their potential impact on the underlying Codell Sandstone will be discussed in Chapter 5.

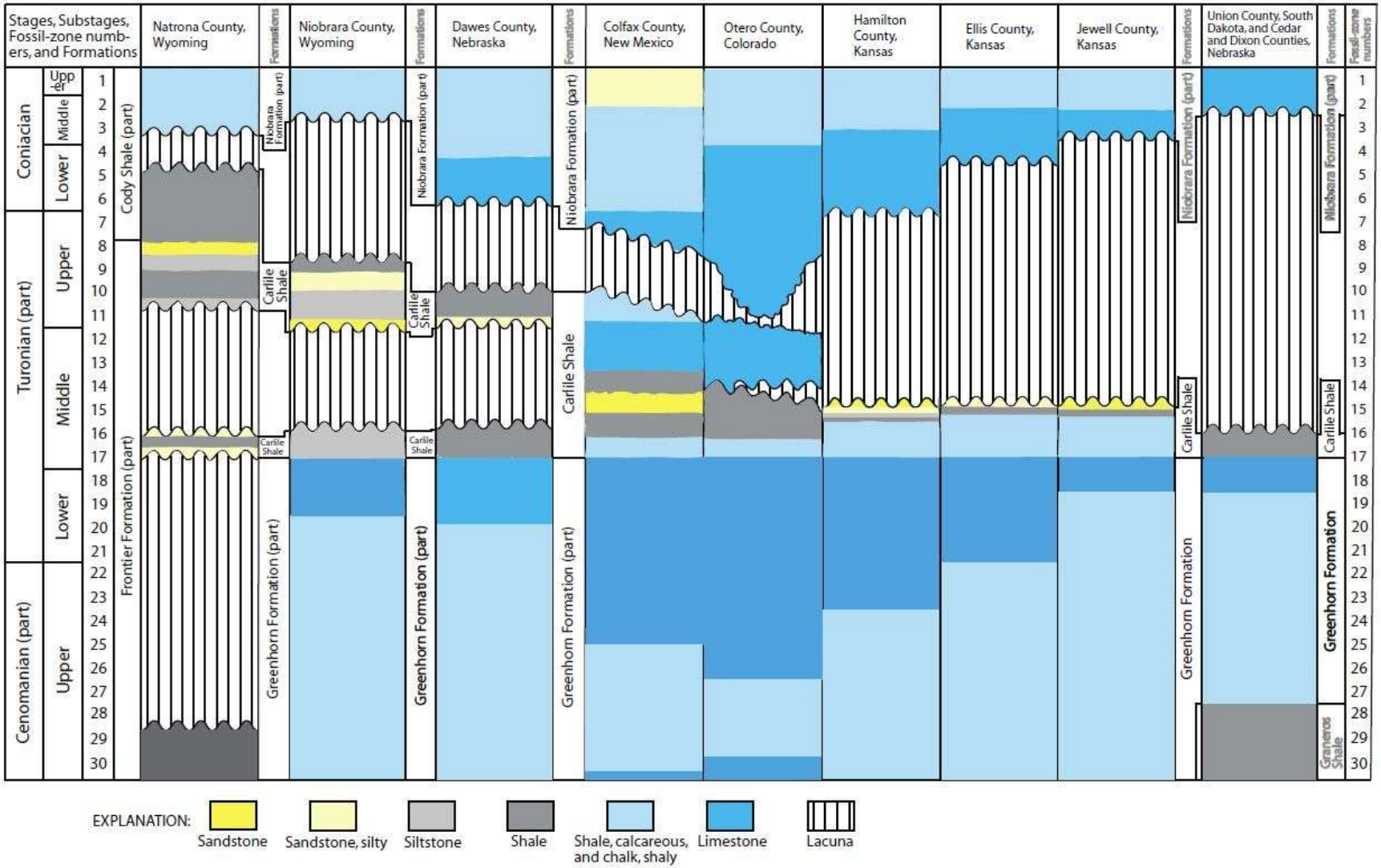


Figure 2.6: Lithologies and lacunae in strata of Cenomanian, Turonian, and Coniacian (Late Cretaceous). Otero County, Colorado is the most applicable to this research (Merewether et al., 2007).

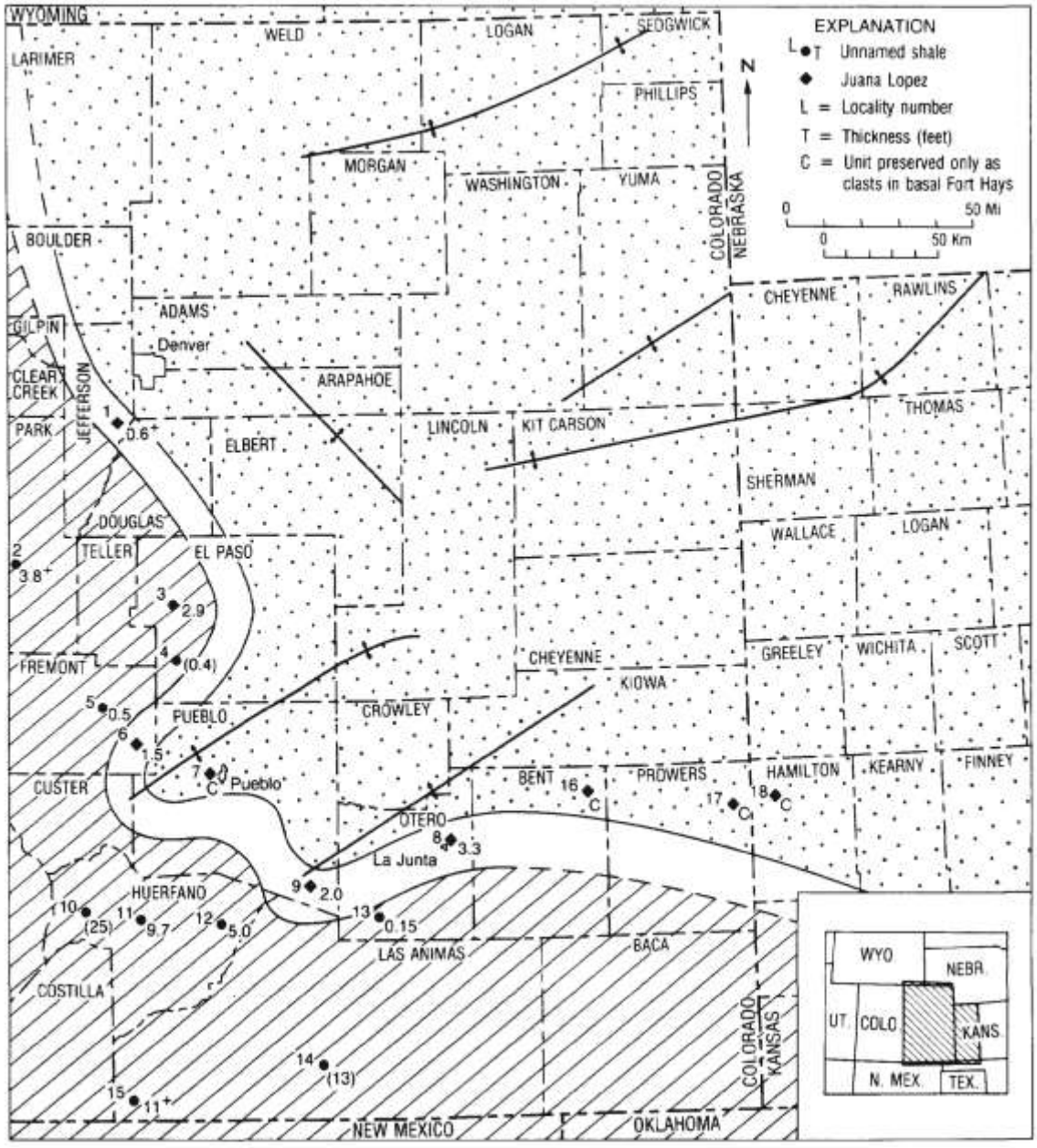


Figure 2.7: Positive structural elements and pre-Niobrara erosion in southeast Colorado (Laferriere and Hattin, 1989).

CHAPTER 3

SEDIMENTOLOGY

3.1 Blue Hill Shale Facies

The Blue Hill Shale is a dark- to medium-grey, fine-grained, well-sorted, subangular to rounded, often laminated, non-calcareous, shale to mudstone. Thin, light-grey streaks or blebs are common in the lower Blue Hill Shale and thin bentonite beds are present but not always identifiable in outcrop. It is usually not seen in its entirely in outcrop, but can be completely viewed in both the Portland 1 and Rebecca Bounds 1 cores. It contains little to no calcium carbonate and it does not react when tested with hydrochloric acid (HCL), except for localized deposits of Septarian concretions and in the upper intervals where calcite has cemented the fine-grained siltstone. The contact with the Fairport Chalk is often difficult to distinguish visually, but very sharp when tested with HCL. The upper Blue Hill Shale becomes increasingly silty, and bioturbation gradually increases towards the top. The upper contact with the lower Codell Sandstone is commonly gradational, yet sharp in some instances. XRF data within the Blue Hill Shale displays a general vertical trend in decreasing aluminum and potassium, probably associated with decreasing clay content, and occasional spikes in calcium within calcite cement or Septarian concretions. The top of the Blue Hill Shale commonly has a shift in in the titanium/aluminum ratio which most likely indicates an increase it terrigenous sediment (Sageman, 2003) with the transition to the lower Codell Sandstone.

Based on the sedimentological and stratigraphic divisions in this research, there are three Blue Hill Shale facies represented. One of these facies (BHS-1) and its designation as Blue Hill Shale is supported by all previous work. The remaining two

facies (BHS-2 and BHS-3) are debatable, and depending on previous work have been classified as Blue Hill Shale, Carlile Shale, or Codell Sandstone. Table 3.1 contains photographs and summary descriptions of these facies and can be found at the end of the chapter.

3.1.1 Facies BHS-1 – Lower Blue Hill Shale

Dark-grey to black, weathers to grey, very fine grained, subangular to rounded, well-sorted, streaky to laminated, often friable, argillaceous shale. Bioturbation is absent to rare. Fossils in both outcrop and core are rare, but specimens of *Inoceramus cuvieri* and *Inoceramus flaccidus* have been found in the lower interval in western Kansas and the Pueblo area (Hattin and Cobban, 1977). Both disseminated and nodular pyrite is present but does not visually appear abundant in core and outcrop.

3.1.2 Facies BHS-2 – Lower Blue Hill Shale

Dark- to medium-grey, weathers to grey, very fine grained, subangular to rounded, well- to medium-sorted, mudstone and siltstone. Bioturbation is present throughout, but subtle and dominantly horizontal. Individual trace fossils and ichnofauna are difficult to distinguish. BHS-2 differs from BHS-1 by an increase in silt and bioturbation and a lack of bedding laminations.

3.1.3 Facies BHS-3 – Upper Blue Hill Shale

Medium- to light-grey, weathers to grey and beige, very fine grained, subangular to rounded, poorly-sorted, bioturbated muddy siltstone. Bioturbation is common to abundant and ichnofuana diversity is greater than BHS-2 with recognizable feeding structures of *Zoophycos* and *Teichichnus* and burrows of *Ophiomorpha* and

Thalassinoides. Cementation, especially calcite, increases in some intervals. BHS-3 differs from BHS-2 by an increase in silt and bioturbation with an increase in recognizable vertical burrowing and calcite cement.

3.2 Codell Sandstone Facies

Sandstone can be a misleading classification for the Codell Sandstone. A majority of the lower unit is interbedded fine-grained mudstone to siltstone to sandstone and the upper true sandstone facies are not present at all outcrop locations and in the subsurface. The Codell Sandstone is a light- to medium-grey, weathers to tan, beige and rusty-brown to orange, fine- to medium-grained, poor- to well-sorted, angular to well-rounded siltstone to sandstone. Planar and low-angle cross-bedding and hummocky cross-stratified (HCS) are common, especially in the upper Codell Sandstone. Many facies within the Codell Sandstone are devoid of silt and mud while some are interbedded with significant siltstone and mudstone. Bioturbation is present to pervasive throughout most of the Codell Sandstone, but some intervals show little to no bioturbation and well preserved sedimentary structures. Intervals of significant calcite cement are common but their distribution within the upper Codell Sandstone is not as uniform and predictable as the lower Codell Sandstone and intervals within the upper Blue Hill Shale. Discrete facies classification in the Codell Sandstone, especially the lower Codell Sandstone, can be difficult as bioturbation varies to such an extent that facies changes are gradational. Preserved primary sedimentary structures, abrupt shifts in silt and mud content and the pervasiveness and occurrence of bioturbation are often the only distinguishing characteristic between facies. Based on the sedimentological and stratigraphic divisions in this research, there are four facies of the Codell Sandstone

represented. Facies CDL-1 is the only facies that differs from previous work as most authors place this facies in the upper Blue Hill Shale, as it sits stratigraphically below the first massive mapable sandstone layer. Aulia (1982) however, also include this facies as lower Codell Sandstone. XRF data within the Codell is relatively uniform, owning to its sediment maturity. No distinct trends occur in aluminum, potassium (assumed to be clay), or any other elements. Silicon is the dominant elemental response from quartz. Table 3.1 contains photographs and summary descriptions of these facies and can be found at the end of the chapter.

3.2.1 Facies CDL-1 – Lower Codell Sandstone

Medium- to light-grey, fine-grained, angular to subrounded, poorly-sorted, sandy siltstone mixed with silty mudstone. Primary sedimentary structures are commonly obliterated from bioturbation, but faint "ghost" beds of more cemented and therefore more resistant siltstone is present in outcrop. Feeding structures of *Zoophycos* and *Teichichnus* are common, but burrows of *Ophiomorpha*, *Thalassinoides* and *Palaeophycus* are the most common ichnofauna. In general cementation is strong throughout this facies, but certain intervals have a significant increase in calcite cement that occurs within the upper portion of what appears to be minor upward-shallowing sequences. This can be difficult to observe in outcrop, but easy to identify in the Portland 1 core.

3.2.2 Facies CDL-2 – Lower Codell Sandstone

Interbedded planar and hummocky, lenticular siltstone and sandstone and

bioturbated siltstone and mudstone. Siltstone and sandstone are medium- to light-grey, weathers to tan and beige, fine-grained, well-sorted, subangular to rounded, and well-cemented. HCS, ripple cross lamination, low-angle to planar and "platy" bedding are common. Bedding is undulating, lenticular and often discontinuous and scoured in outcrop. Bioturbated siltstone and mudstone are dark- to light-grey, weathers to tan, very fine- to fine-grained, subangular to angular, poorly-cemented, and primary sedimentary structures are difficult to recognize. Observed burrows are dominantly horizontal and commonly filed with siltstone and sandstone from adjacent beds and the color contrast in composition is quite noticeable in outcrop. Feeding structures of *Zoophycos* and *Teichichnus* are less observed than Facies CDL-1, but burrows of *Ophiomorpha* and *Thalassinoides* are still the most common ichnofauna. CDL-2 differs from CDL-1 by an increase in preserved sedimentary structures and interbeds of siltstone and sandstone and muddy siltstone and mudstone.

3.2.3 Facies CDL-3 – Upper Codell Sandstone

Medium- to light-grey, weathers to tan and beige, fine- to medium-grained, subangular to rounded, medium- to well-sorted, bioturbated, sandy siltstone to medium-grained sandstone. Bioturbation is pervasive and extensive with *Ophiomorpha* the most dominant ichnofauna. Primary bedding is often obliterated by bioturbation, but occasional planar to low-angle cross-bedded intervals are observed. In outcrop, splotchy intervals of rusty-brown to orange weathering are common, which is most likely limonite (Reisser, 1976), with a "swiss cheese" appearance from differential weathering of cementation within linings and fill of *Ophiomorpha* burrows. CDL-3 differs from CDL-2

by a decrease in mudstones and siltstones and a general lack of interbedded lithologies, bioturbation is more homogenous and massive.

3.2.4 Facies CDL-4 – Upper Codell Sandstone

Medium- to light-grey, weathers to tan, beige and brown, subrounded to rounded, well- to medium-sorted, fine-grained, planar to low-angle cross-bedded, silty sandstone and fine- to medium-grained sandstone. Swaley cross-stratification (SCS) is rare but present in some locations. Bioturbation is less obvious than facies CDL-3, and overall the bioturbation gradually increases towards the top (similar to CDL-3) but is still present throughout, especially in cycles that cap planar to low-angle cross-bedded event sequence (Figure: 3.1). *Ophiomorpha* and *Thalassinoides* are the most common observed ichnofauna. This facies has the only preserved occurrence (location: PNCO) of wave rippled bedding surfaces near the very top of the Codell Sandstone, with enough resolution to measure paleocurrent data. All data indicates a south to southeast current direction at the time of deposition (Figure: 3.2). CDL-4 differs from CDL-3 by an overall lack of homogenous bioturbation and an increase in recognizable massive bedding and preserved sedimentary structures, grain-size and sand content. This facies is commonly the uppermost and final facies succession within the Codell Sandstone. In most locations the top of this facies and therefore the top of the Codell Sandstone sequence contains a *Glossifungites* ichnofacies and surface that is extensively bioturbated. In most occurrences the lining fill of the burrows contain vertically reworked sediment from the overlying Juana Lopez or Fort Hays Limestone. In some instances several generations of material has been burrowed down several feet below the contact.

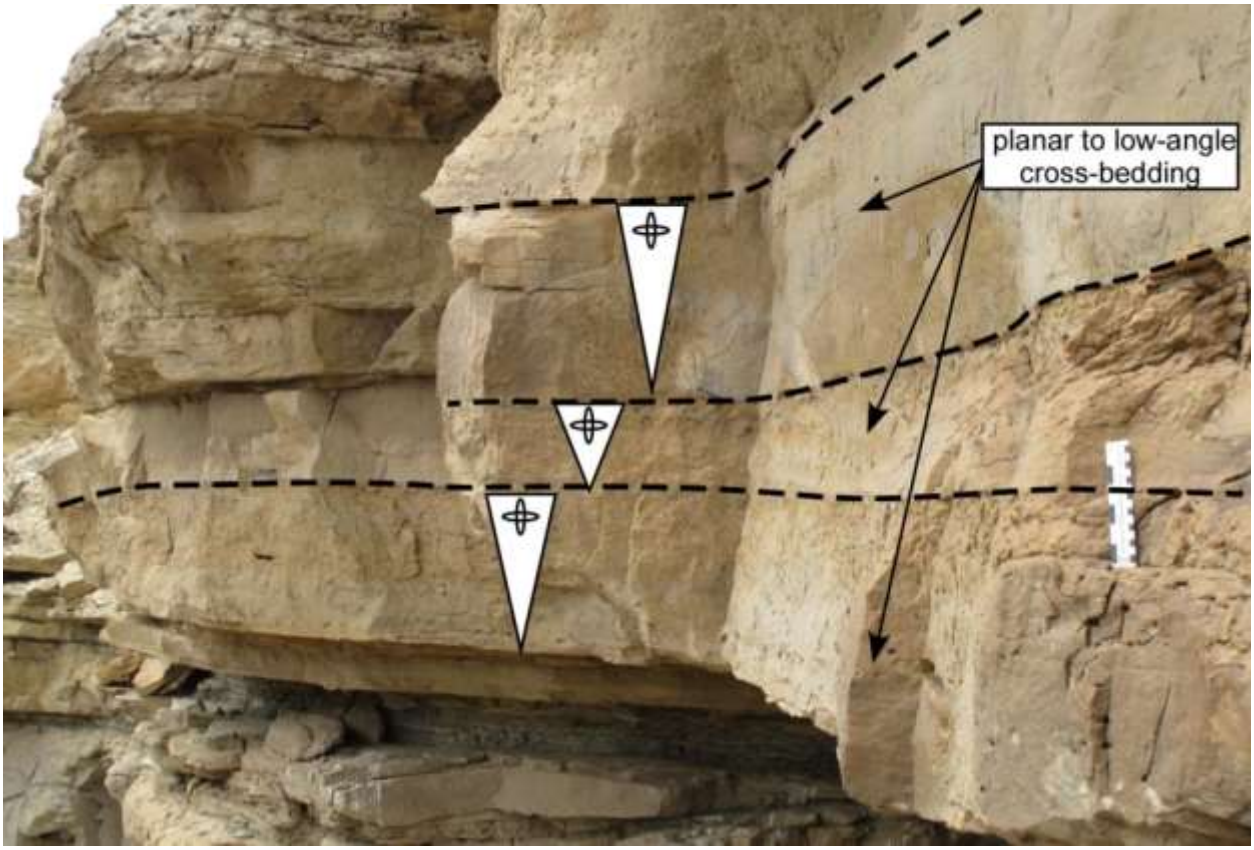


Figure 3.1: Repeating depositional sequences in the upper Codell Sandstone. Bedding is massive with upward gradation of planar to low-angle cross-bedding to increasingly more bioturbated near the top (location: PNCO).

This surface demonstrates discontinuity and a significant pause in sedimentation and extensive erosion in a series of events, not just one surface, that are important in understanding these units. *Glossifungites* assemblages are common in lowstand marine surfaces of erosion and represent sharp breaks in the vertical stratigraphic record and may signify fundamental changes in depositional environments and initiation of new cycles of sedimentation (MacEachern, Raychaudhuri and Pemberton, 1992). They are commonly thought to occur where lowstand conditions expose or exhume the substrate, but no evidence is present or remains in the Codell Sandstone to support significant exposure, especially subaerial. This surface therefore represents a long duration with

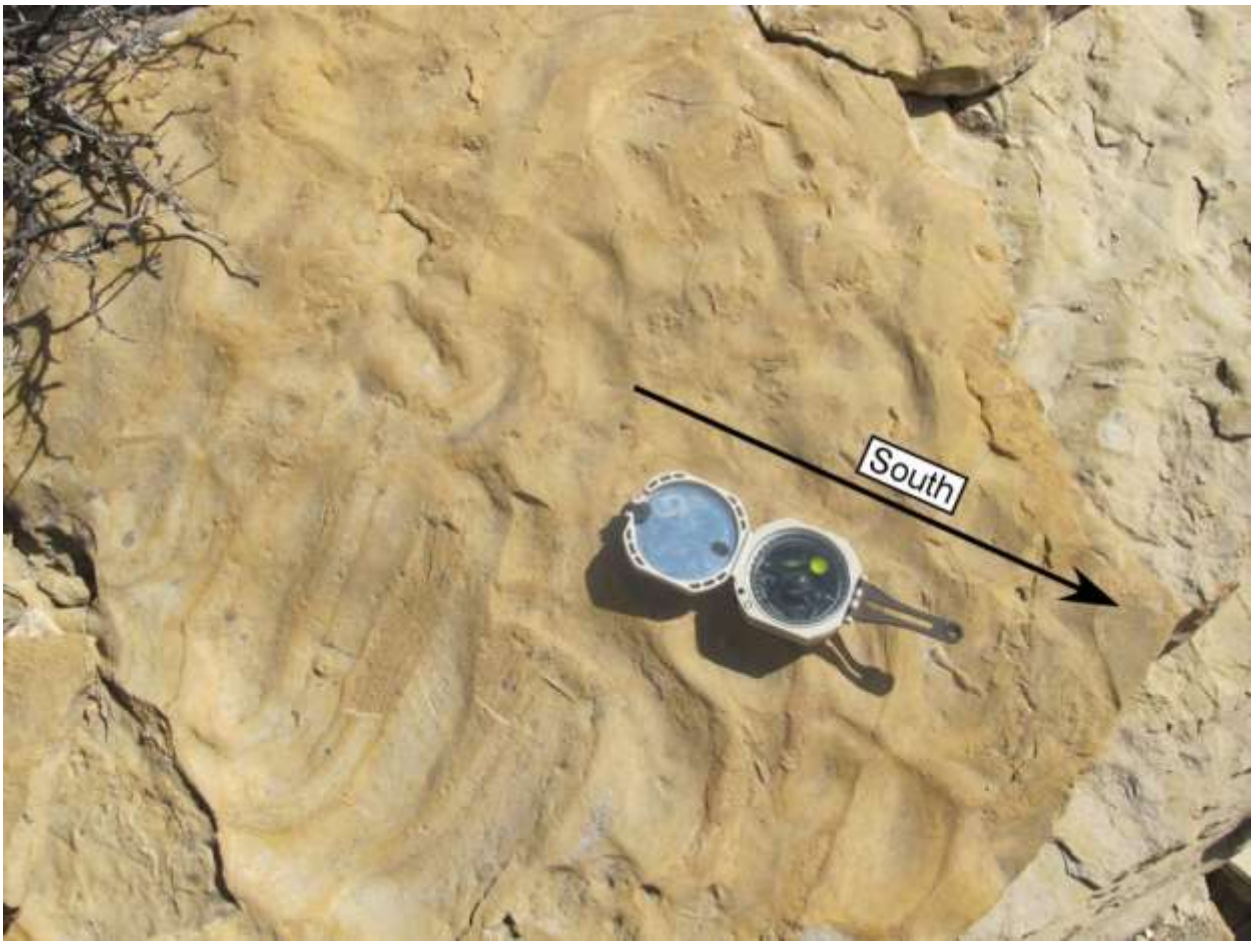


Figure 3.2: 2D symmetrical to slightly asymmetrical wave ripples with evidence of crest plaining and interference. Paleocurrent direction is dominantly south to southeast (location: PNCO).

little to no sedimentation and one generation of significant reworking of the upper Codell Sandstone that was followed by another generation that continued through the initial transgression of the Juana Lopez and Fort Hays Limestone (Figure: 3.3).

3.3 Codell Sandstone Petrography

Petrographic thin-sections of the Codell Sandstone were taken at three outcrop locations and the Rebecca Bounds 1 core. The Codell Sandstone is dominantly quartz; greater than 80% in observed thin-sections (mean quartz 87.5% from Reisser, 1976),

Figure 3.3: Significantly burrowed and vertically reworked surface atop the Codell Sandstone as a *Glossifungites* inchofauna. Lighter grey streaks are burrows lined with overlying Fort Hays Limestone mud (location: LPO).

and almost entirely monocrystalline with straight and undulose extinctions, with a small fraction polycrystalline. Pore-filling cement is abundant, often comprising 25-30% of the rock and is dominantly quartz, calcite and chert, with rare occurrences of hematite. Compaction and its effects on grains increase vertically within the Codell Sandstone. The lower Codell Sandstone is dominantly unaligned grains that are well-cemented with occurrences of minor grain-to-grain deformation and some fracturing (Figure: 3.4). The upper Codell Sandstone shows more evidence with greater grain-to-grain contact, fracturing, suturing and dissolution seams.

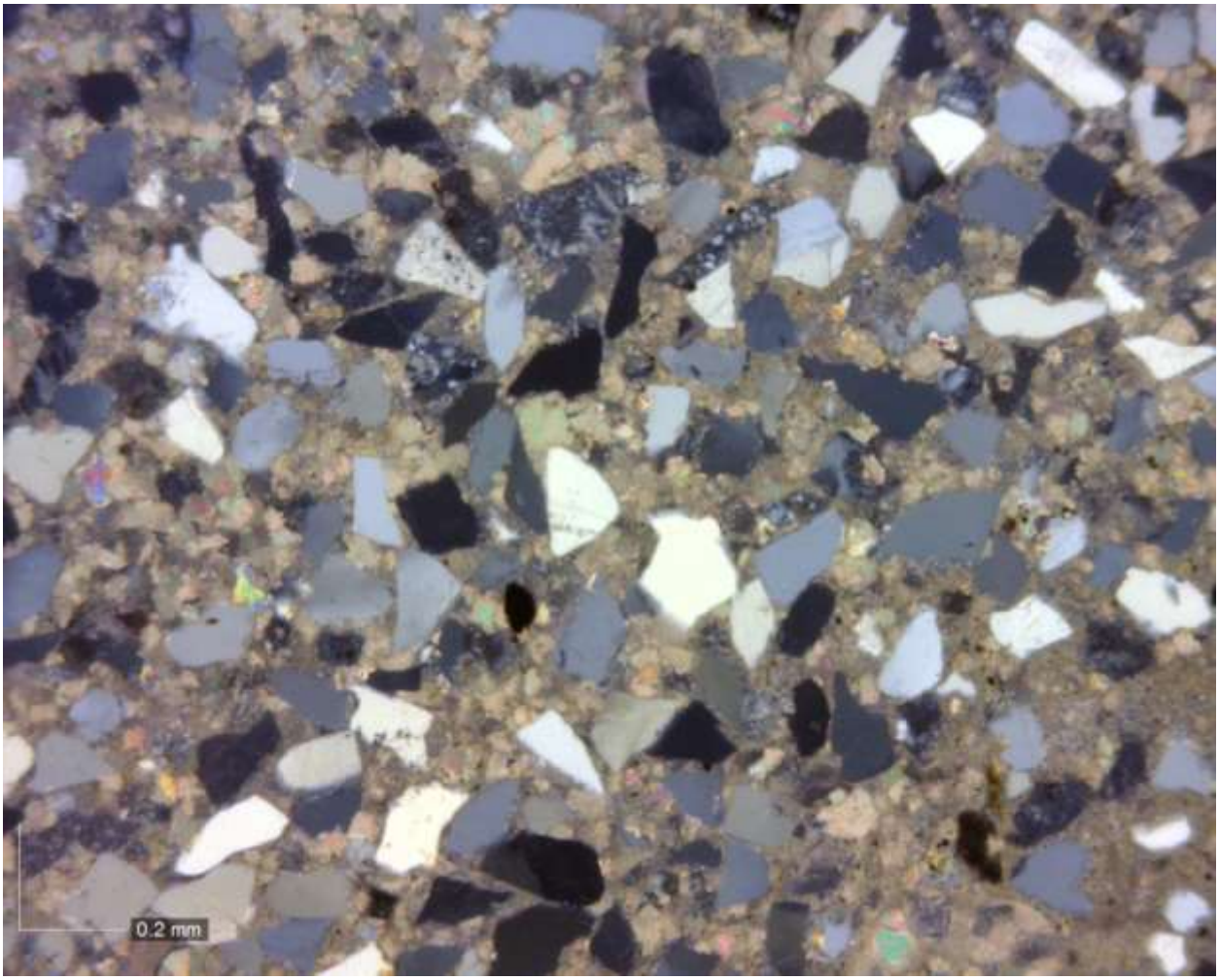


Figure 3.4: Cross-polarized thin-section of the lower Codell Sandstone facies CDL-1 (x220 magnifications). Angular to subrounded monocrystalline quartz grains in a dominantly drusy mosaic or equant spar calcite cement with minor chert and clay (location: RBC).

3.4 Juana Lopez Facies

Based on the sedimentological and stratigraphic divisions in this research, there are two Juana Lopez facies represented. Previous work did not divide the Juana Lopez into distinct facies and both were previously described as calcarenites, but as discussed earlier this classification is inaccurate. The thin and commonly gradational nature of the Juana Lopez makes division between the two difficult and both are not always present at all locations. Trends within the XRF data were difficult to observe as many locations

Figure 3.5: Contact between Juana Lopez facies JL-1 and underlying Codell Sandstone. Pervasive bioturbation and vertical reworking as a Glossifungites ichnofauna (location: VRO).

only contain one to three feet of the Juana Lopez. One trend that was observed (location: PC) was a distinct shift in silicon/aluminum and titanium/aluminum, probably as a response to terrigenous sediment in the lower Juana Lopez (Sageman et al., 2003), but most often the XRF response from the Juana Lopez is similar to the Fort Hays Limestone. A table of facies with photographs and summarized descriptions can be found at the end of the chapter.

3.4.1 Facies JL-1 – Juana Lopez

Orange to rusty-brown, medium- to coarse-grained, often pebble-sized, well-

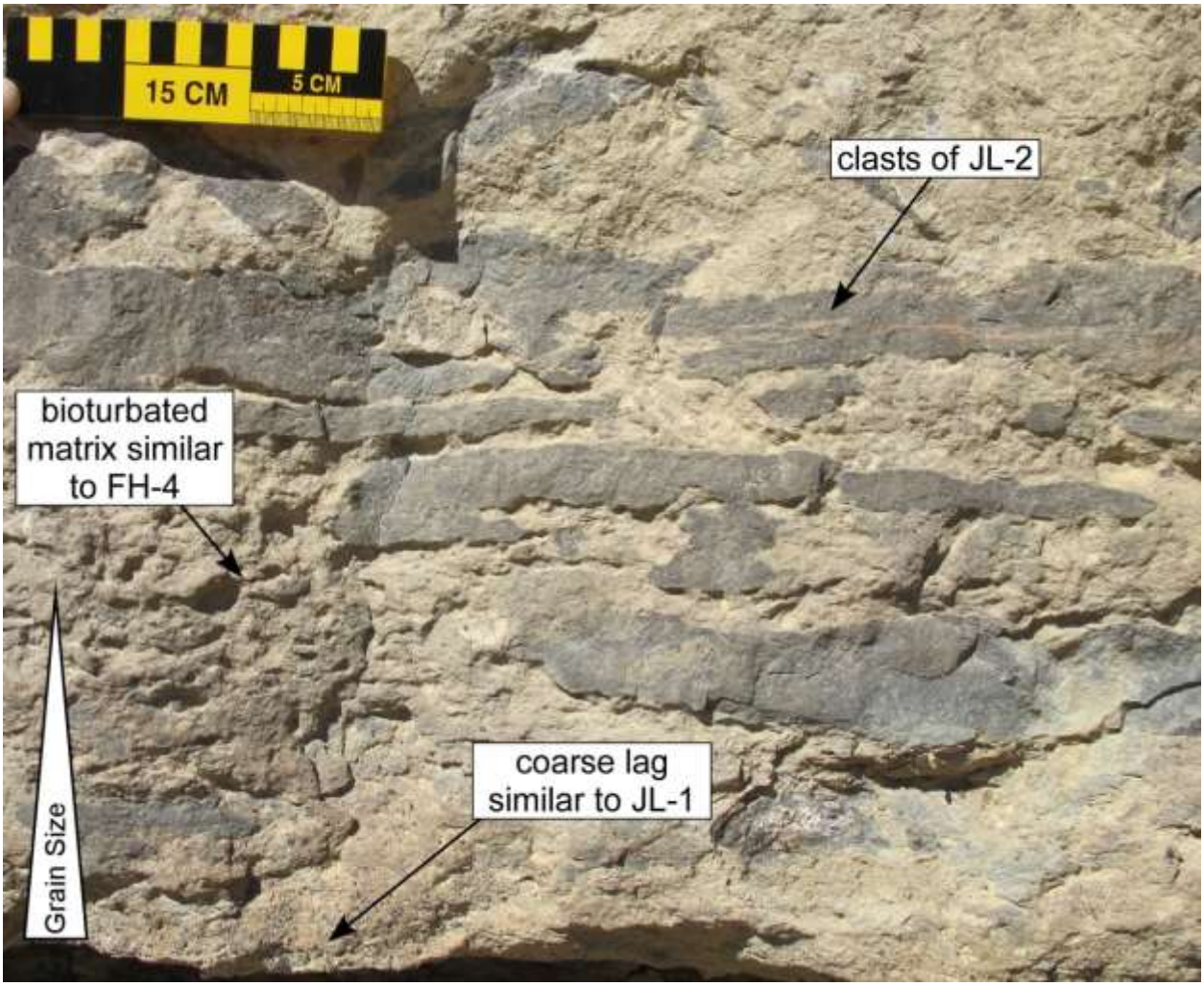


Figure 3.6: Contact between Juana Lopez facies JL-2 and overlying Fort Hays Limestone (facies: FH-4). Pervasive bioturbation and vertical reworking of Fort Hays Limestone mud down into “clasts” of Juana Lopez (location: PCO).

rounded to angular, poorly-sorted, calcareous conglomerate to sandstone. Clasts consist of broken shell fragments of unidentifiable inoceramids and oysters, including *Lopha lugubris*, chert, phosphatic nodules, sharks teeth, quartz grains of reworked Codell Sandstone, and other various allochems and detrital lithic and monomineralic fragments are common. Bioturbation is absent to pervasive with multi-generational mélanges of burrows containing sediment from the underlying Codell Sandstone and overlying Fort Hays Limestone. Bedding and sedimentary structures are commonly

indistinguishable, with a few rare occurrences of low-angle to planar cross-bedding. Clasts or fragments commonly show no orientation or imbrication.

3.4.2 Facies JL-2 – Juana Lopez

Dark-grey to maroon and brown, very dense, extremely well-cemented to almost crystalline, often "fetid " in odor, fossiliferous grainstone. Clasts consist of broken shell fragments of unidentifiable inoceramids and oysters of *Lopha lugubris.* Detrital components are less than facies JL-1. Bedding can be tabular and massive to undulating and wavy to lenticular, with distinct breaks between beds. Bioturbation is absent to pervasive and in some locations so extensive that pieces or clasts are "suspended" or "floating" in a bioturbated matrix from the overlying Fort Hays Limestone and sand grains from the underlying Codell Sandstone. Angularity, continuity and orientation of these "floating" clasts indicate that, in some areas, the Juana Lopez may have been lithified antecedent to bioturbation, possibly representing a firmground.

This facies is common in the uppermost of the Juana Lopez below the Fort Hays Limestone. Similar to the surface atop the underlying Codell Sandstone, extensive reworking and bioturbation is common, interpreted as a *Glossifungites* ichnofacies (Figure 3.5). This surface is slightly different from the Codell Sandstone surface as the Juana Lopez is much coarser and was lithified pre-Fort Hays deposition. This surface has more evidence of downward reworking of the overlying Fort Hays Limestone into the burrows that not only penetrate the Juana Lopez but also the underlying Codell Sandstone (Figure: 3.6).

3.5 Juana Lopez Petrography

Petrographic thin-sections of the Juana Lopez were taken from all of the six primary outcrop locations. An attempt was made to obtain equal samples from both facies. Facies JL-1 is the least common and is a well-cemented calcareous conglomerate to sandstone with a variety of fragments. Monocrystalline quartz grains are common and vary from fine- to coarse-grained and angular to rounded. Compaction is minor with some occurrences of grain-to-grain contact. Calcite fragments from broken inoceramids are common, but the largest population is quartz grains with fragments of chert, bone, sharks teeth and other phosphatic grains (Figure: 3.7). Facies JL-2 (Figure: 3.8) consists of almost entirely broken inoceramid fragments with the occasional large, well-preserved fragment and is extremely well-cemented with dominantly calcite cement. Quartz grains and other fragments of bone, teeth and phosphatic grains are still common (Figure: 3.9), but less than facies JL-1. Compaction is obvious throughout this facies with grain deformation, fracturing and suturing common and alignment of grains is very common. One sample in particular (Figure: 3.10) exhibits several generations of syntaxial overgrowths of calcite cement encasing not only calcite grains but several monocrystalline quartz grains. Although difficult to conclude with certainty, several grains within this facies have a mauve to purple to even turquoise stain that may indicate the presence of ferroan calcite or ferroan dolomite. Trace amounts of dolomite have been observed in the Juana Lopez (Reisser, 1976) but no obvious dolomite grains were observed in this research.

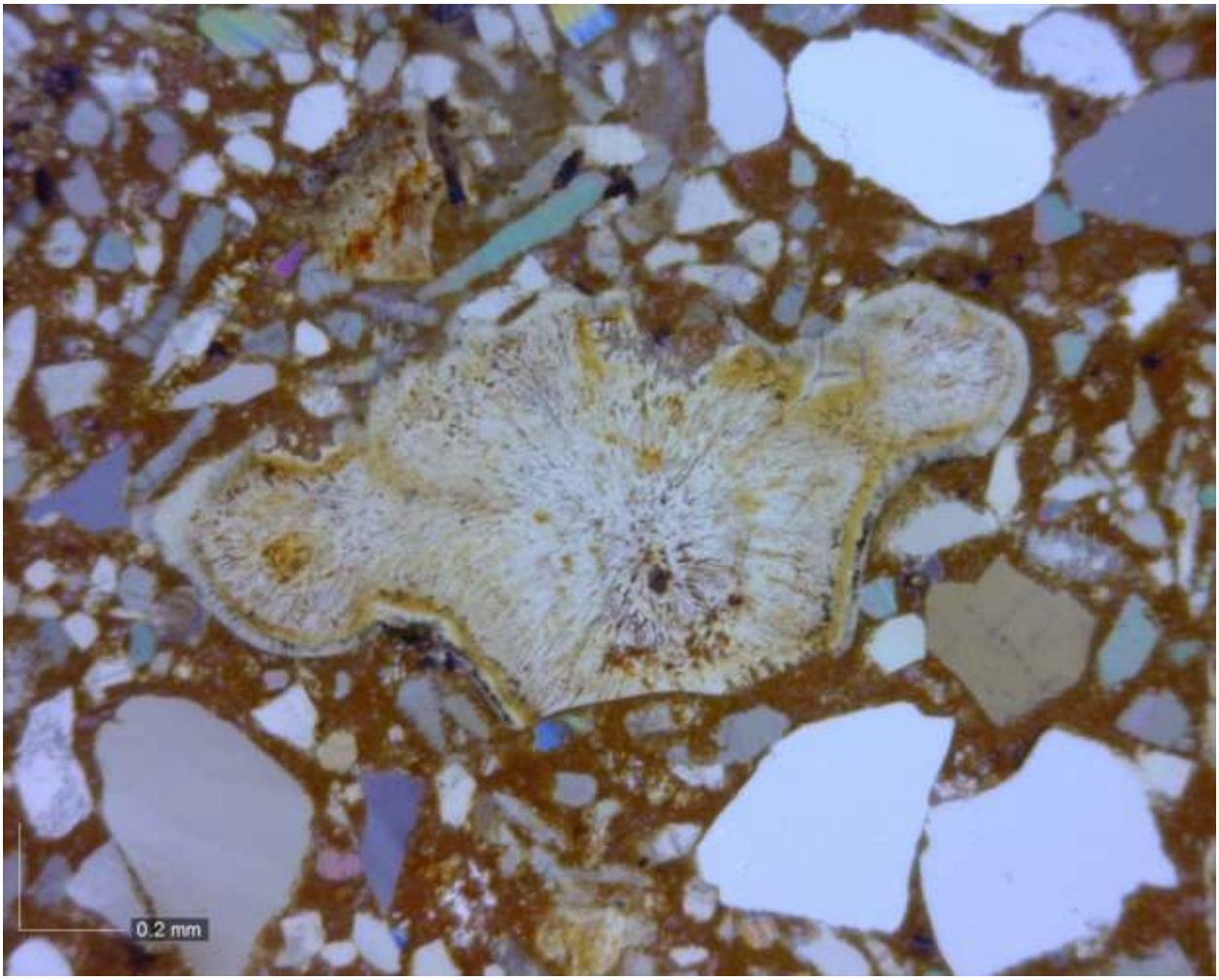


Figure 3.7: Thin-section of Juana Lopez facies JL-1 (x220 magnification). Mixed population of large quartz grains with smaller mixed quartz and broken inoceramid fragments in drusy mosaic of equant spar calcite and limonite-stained cement. Large fragment in the center is an unidentified vertebrae (location: PCO).

3.6 Fort Hays Limestone Facies

The Fort Hays Limestone consists of rhythmic alterations of grey to white, very fine grained, diagenetically altered, re-crystallized, coccolith-rich, planktonic Foraminifera packstone with interbedded argillaceous to calcareous mudstone and marlstone, commonly referred to as "chalks and marls". The effect of diagenesis and Rebecca alteration on the Fort Hays Limestone increases from east to west within the

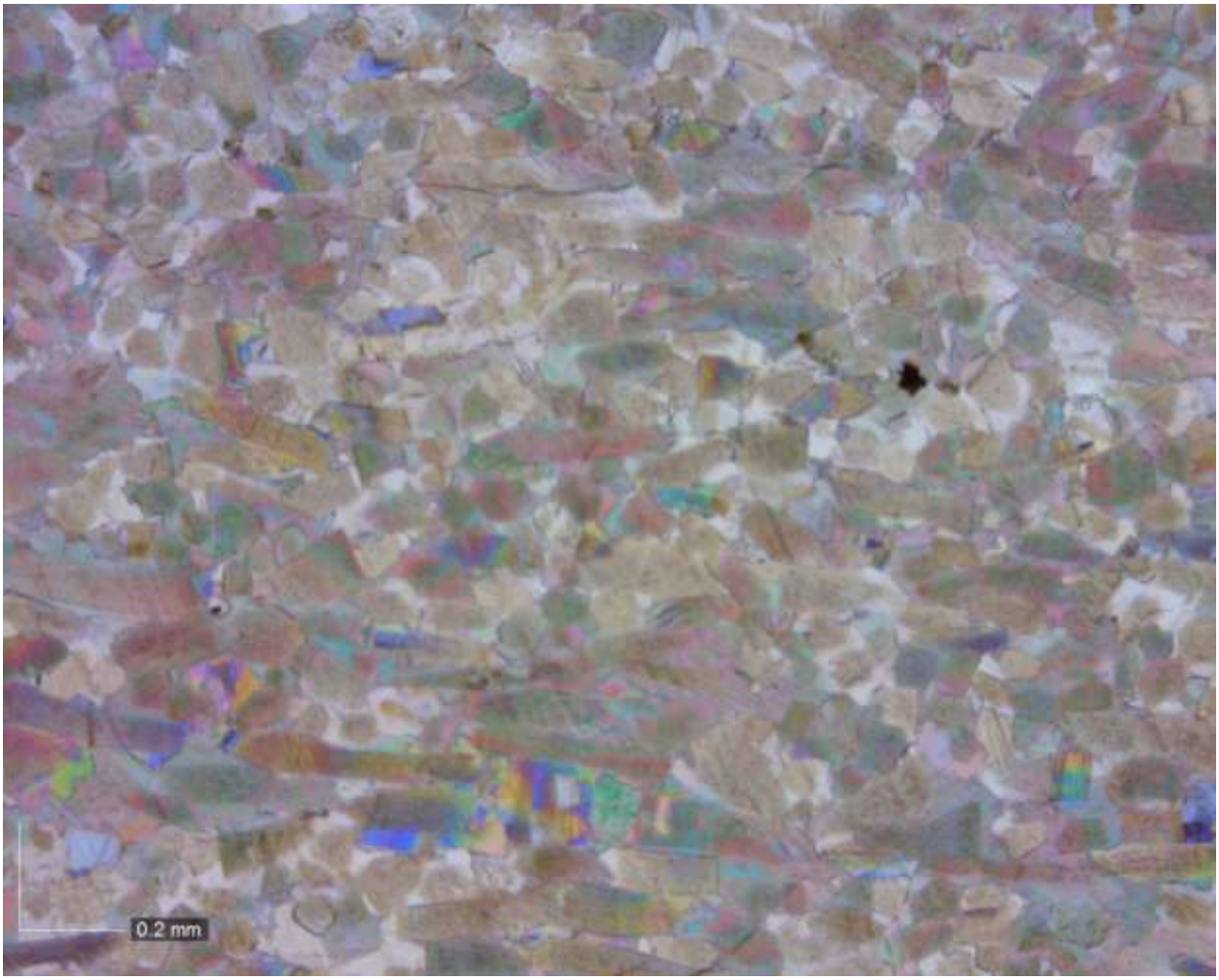


Figure 3.8: Thin-section of Juana Lopez facies JL-2 (x220 magnification). Sample is almost entirely broken inoceramid fragments in poikilotopic and syntaxial calcite cement. Mauve to purple and turquoise stain might indicate the presence of ferroan calcite or ferroan dolomite. Note the faint but recognizable parallel-to-bedding grain alignment from compaction (location: PNCO).

AOI. The Rebecca Bounds 1 core has been less buried than the Portland 1 core and outcrops to the west and was therefore less compacted and cemented; in core it appears whiter and less dense. Based on the sedimentological and stratigraphic division in this research there are four facies within the Fort Hays Limestone and lower interbedded limestone. Table 3.2 contains photographs and summary descriptions of these facies and can be found at the end of the chapter.

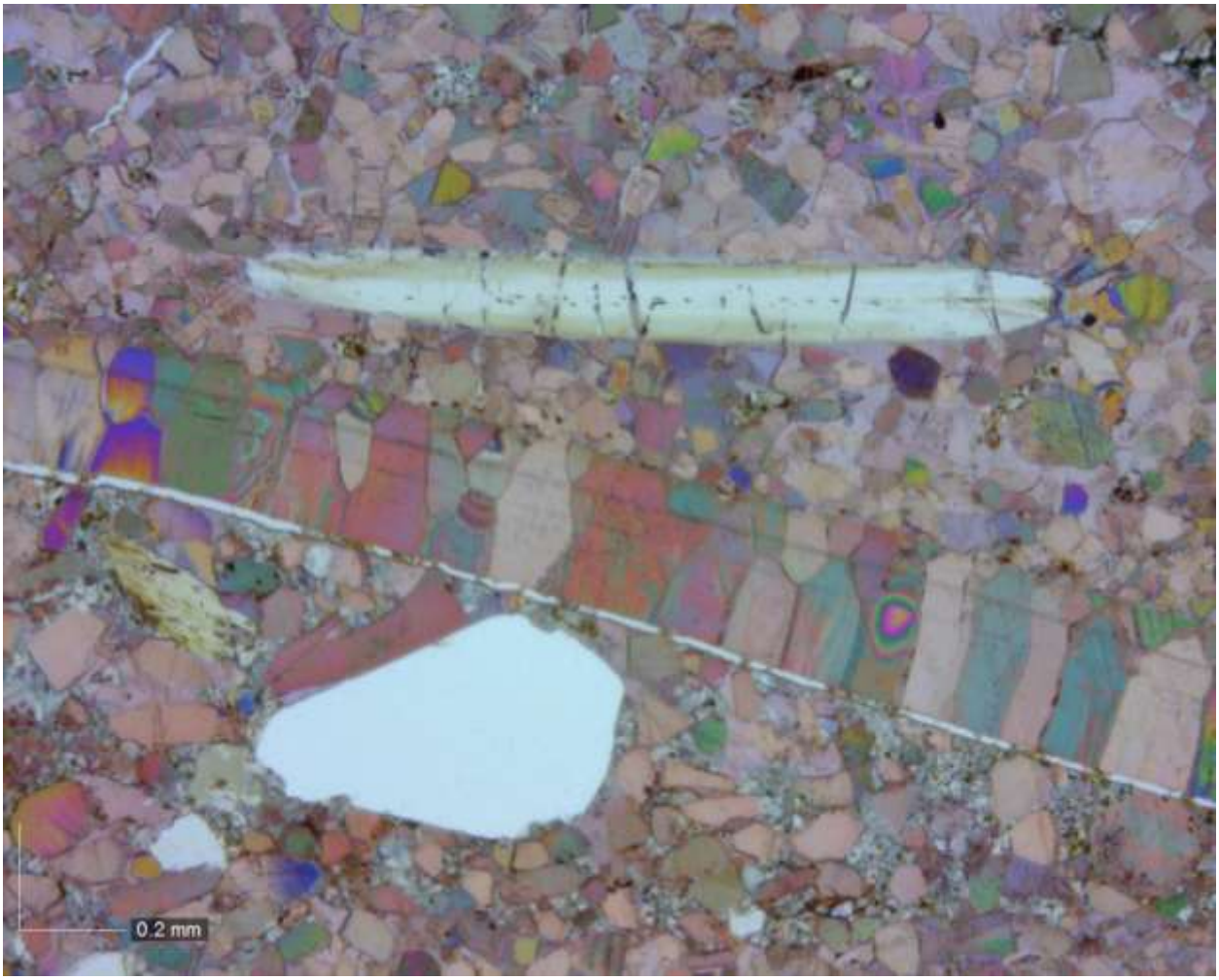


Figure 3.9: Thin-section of the Juana Lopez facies JL-2 (x220 magnification). Sample is almost entirely broken inoceramid fragments with a trace of quarts grains and variable calcite cement. Note the very large quartz grain beneath the still intact inoceramid fragment. The third fragment is most likely a tooth fragment or bone. Mauve to purple and turquoise staining response may indicate ferroan calcite or ferroan dolomite (location: PNCO).

Detailed facies divisions within the Fort Hays Limestone and Niobrara Formation in general were beyond the scope of this study. The divisions here were simplified for identification and comparison between the underlying Carlile Shale facies. Greater subdivision and more detail would be needed for further analysis of the Niobrara Formation.

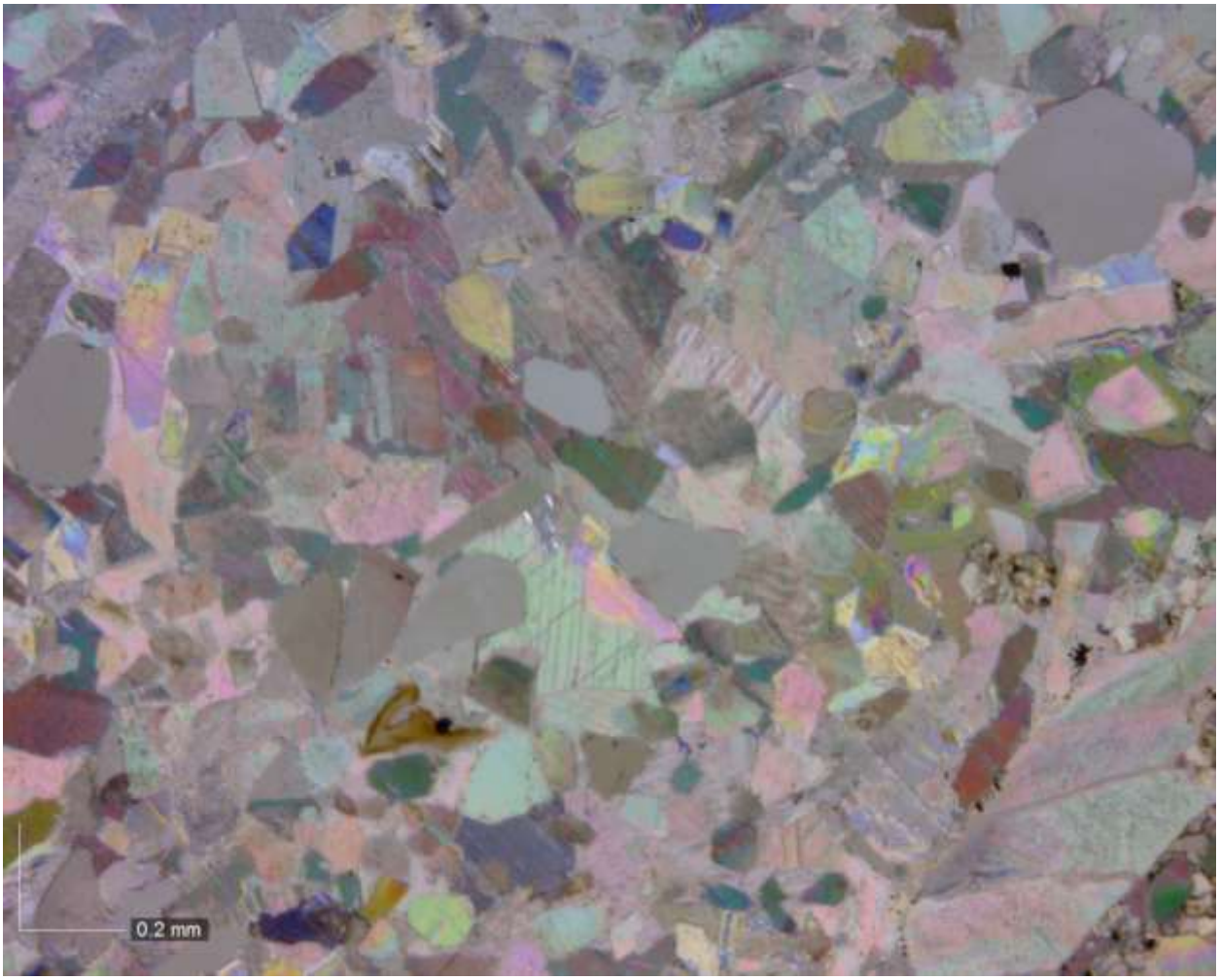


Figure 3.10: Thin-section of the Juana Lopez facies JL-2 (x220 magnification). Sample is mostly broken inoceramid fragments, but there is a larger percentage of monocrystalline quartz grains (grey color). Note the abundant syntaxial overgrowths near the center of the sample (location: PCO).

3.6.1 Facies FH-1 – Fort Hays Limestone

Dark- to medium-grey, fine-grained, laminated to rarely bioturbated argillaceous to calcareous mudstone and shale, inoceramid fragments are present but not overly common (<10%). Disseminated framboidal pyrite in distinct layers is common. Bentonite layers from preserved volcanic ash falls are common and may account for a majority of the argillaceous material. XRF data indicates increases in assumed clay

elements of aluminum and magnesium, and iron from pyrite with an increase in silicon and a strong decrease in calcium as compared to adjacent facies (commonly FH-4).

3.6.2 Facies FH-2 – Fort Hays Limestone

Medium- to dark-grey, fine-grained, wispy laminated to rarely and commonly bioturbated, calcareous mudstone to inoceramid wackestone "Marl". Fossil fragments of broken inoceramids are common and often imbricated parallel to bedding. FH-2 differs from FH-1 by an increase in carbonate material, inoceramus fragments and a decrease in XRF responses of aluminum, magnesium and silicon, with an increase in calcium.

3.6.3 Facies FH-3 – Fort Hays Limestone

Medium- to light-grey, fine-grained, bioturbated, coccolith-rich, planktonic Foraminifera and inoceramid packstone to wackestone "Argillaceous Chalk". Bioturbation is extensive with multi-generational burrows of *Ophiomorpha, Thalassinoides, Chondrities, Zoophycos* and *Teichichnus*. Fragments of inoceramids are abundant. FH-3 is similar to FH-4 with an increase in argillaceous material and decrease in fine-grained carbonate material.

3.6.4 Facies FH-4 – Fort Hays Limestone

Light-grey to white, very fine grained, well-cemented, diagenetically altered, crystalline, coocolith-rich, Foraminifera and inoceramid packstone, "Chalk". Bioturbation is extensive and consists of multi-generational burrows of dominantly *Ophiomorpha* and *Thalassinoides* with lesser amounts of *Chondrities, Zoophycos* and *Teichichnus.* XRF data indicates higher amounts of calcium from calcium carbonate and decreases in clay

assigned elements of aluminum and magnesium, and iron from pyrite, with a decrease in silicon as compared to adjacent facies (commonly FH-1).

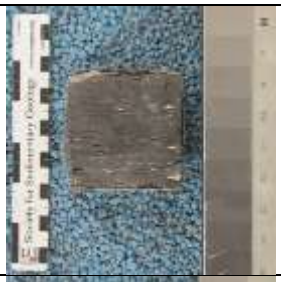
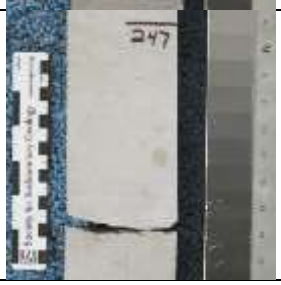
Table 3.1: Carlile Shale facies summary. Order generally reflects increasing depositional energy.

CARLILE SHALE	PHOTO	DESCRIPTION	MBR
Laminated to streaky shale (BHS-1)		Dark-grey to streaky medium-grey, fine-grained, friable, argillaceous mudstone and shale. Bioturbation is cryptic to rare. Fossils in core and outcrop are present but rare.	LOWER BLUE HILL SHALE
Bioturbated silty mudstone (BHS-2)		Dark- to medium-grey, fine-grained, angular to subrounded mudstone to wispy silty mudstone. Bioturbation is common, but not intense of mostly indistinguishable, small horizontal burrows.	UPPER BLUE HILL SHALE
Bioturbated muddy siltstone (BHS-3)		Medium- to light-grey, fine-grained, subangular to subrounded, mixed muddy siltstone. Bioturbation is intense with obvious vertical and horizontal burrows. Primary sedimentary structures and bedding have been obliterated.	UPPER BLUE HILL SHALE
Bioturbated muddy siltstone to fine-grained sandstone (CDL-1)		Light- to medium-grey, fine-grained, subangular to subrounded, mixed siltstone with lesser amounts of fine-grained mud. Bioturbation is pervasive with obvious vertical and horizontal burrows. Primary sedimentary structures and bedding have been obliterated.	LOWER CODELL SANDSTONE
Interbedded siltstone and sandstone with bioturbated siltstone and mudstone (CDL-2)		Interbedded planar and hummocky, fine-grained, well-sorted, subangular to subrounded, lenticular siltstone and sandstone, and bioturbated siltstone and mudstone. Bioturbation in muddy intervals is dominantly horizontal and common.	LOWER CODELL SANDSTONE

Table 3.2: Carlile Shale facies summary. Order generally reflects increasing depositional energy.

CARLILE SHALE	PHOTO	DESCRIPTION	MBR
Fine to medium-grained bioturbated sandstone (CDL-3)		Light-grey, weathers to beige, tan to orange, fine- to medium-grained, subangular to rounded, pervasively bioturbated sandstone with faint occurrences of planar to low-angle cross-bedded sandstone.	UPPER CODELL SANDSTONE
Fine to medium-grained cross-bedded to low-angle and planar sandstone (CDL-4)		Light-grey, weathers to beige, tan to orange, fine- to medium-grained, medium- to well-sorted, subangular to rounded, planar- to low angle cross-bedded sandstone. Bioturbation is less common that facies CDL-3	UPPER CODELL SANDSTONE
Coarse to medium-grained, fossiliferous and detrital lithic, calcareous sandstone (JL-1)		Orange to rust-brown, medium- to coarse-grained, often pebble-sized, calcareous sandstone. Clasts consist of broken shell fragments, sharks teeth, phosphatic fragments with varying amounts of detrital lithic debris. Sedimentary structures are rare.	JUANA LOPEZ
Dense fossiliferous and detrital lithic and monomineralic grainstone (JL-2)		Maroon to brown and grey, very dense, almost crystalline fossil fragment grainstone, commonly "fetid" in odor. Bedding is commonly tabular to undulating and lenticular. Sedimentary structures are rare.	JUANA LOPEZ

Table 3.3: Fort Hays Limestone and lower Smokey Hill facies summary. Order generally reflects increasing depositional energy.

FORT HAYS	PHOTO	DESCRIPTION	MBR
Laminated Calcareous Mudstone (FH-1)		Dark- to medium-grey, fine-grained, laminated to faintly bioturbated “marly mudstone”. Fossil fragments of broken inoceramids are common (but often less than 10%) and often imbricated parallel to bedding. Bentonite ash beds and pyrite are common.	FORT HAYS LIMESTONE
Laminated to wavy Wackstone (marl) (FH-2)		Medium- to dark-grey, fine-grained, laminated to faintly bioturbated coccolith-rich, planktonic, Foraminifera, inoceramid wackstone. Fragments of inoceramids are often imbricated parallel to bedding.	FORT HAYS LIMESTONE & SMOKEY HILL
Biotrubated Wackstone to Packstone (dirty chalk) (FH-3)		Medium- to light-grey, fine-grained, bioturbated coccolith-rich, planktonic Foraminifera, inoceramid wackestone to packstone “dirty chalk”. Bioturbation is extensive with multi-generational burrows. Fragments of inoceramids are abundant.	FORT HAYS LIMESTONE & SMOKEY HILL
Bioturbated Packstone (chalk) (FH-4)		White to light-grey, pervasively bioturbated coccolith-rich, planktonic Foraminifera, inoceramid, packstone “chalk”. Bioturbation is extensive, with multi-generational burrows. Fragments of inoceramids are common.	FORT HAYS LIMESTONE

CHAPTER 4

CORE AND OUTCROP STRATIGRAPHY

4.1 Primary Outcrops and Core

Subsurface core retrieval is invaluable to geological analysis. While this particular study relied heavily on the use of outcrop analysis and subsurface well log data, the two core locations were important data points for creating the main facies classifications used in this research.

There are numerous Late Cretaceous-aged outcrops in southeast Colorado, the six chosen for this study were some of the most complete and varied enough to illustrate the regional changes in facies, stratigraphy and depositional settings. Previous work by Krutak (1970) incorporated several more (over 50) but access to these outcrops has changed due to development in the area. Much like core, outcrops present an excellent chance to view the sedimentology and stratigraphy of the formations, but unlike cores, larger bedding architectures and localized changes can be observed. Correlations between outcrop and core locations can be found in Plate 9.

4.1.1 Portland 1 Core (PC)

The Portland 1 (USGS Core Library E099) was drilled by the USGS in 1992. It is located NW SE SE of Section 20, Township 19 South, Range 68 West, Fremont County, Colorado. It was drilled to Cretaceous age sediments of the Dakota Formation with a total depth of 700 feet. The core has been studied extensively and sampled by the USGS and all reports and data are available on the USGS Core Research Center website. The digital well log data used for this research was created by scanning and digitizing the data in IHS Petra. The description of the Portland 1 core can be found in

Plate 1. The lower Blue Hill Shale (BHS-1) is 25 feet thick, the upper Blue Hill Shale (BHS-2 and BHS-3) is 65 feet, the lower Codell Sandstone (CDL-1 and CDL-2) is 10 feet, the upper Codell Sandstone (CDL-3 and CDL-4) is 12-15 feet, and the Juana Lopez (JL-2) is 2-3 feet.

4.1.2 Rebecca Bounds 1 Core (RBC)

The Rebecca Bounds 1 core (API: 15071204460000 / USGS Core Library E006) was drilled by Amoco in 1988. It is located NE SE NE of Section 17, Township 18 South, Range 42 West, Greeley County, Kansas. It was drilled to Mississippian age sediments with a total depth of 5,956 feet. The core has been studied extensively, especially the Greenhorn Formation, and sampled by the USGS. All reports and data are available on the USGS Core Research Center website. The digital well log data used for this research was supplied by Enerplus Resources (USA) and licensed from TGS-NOPEC Geophysical Company. The description of the Rebecca Bounds 1 core can be found in Plate 2. The lower Blue Hill Shale (BHS-1) is 25 feet thick, the upper Blue Hill Shale (BHS-2 and BHS-3) is 70 feet, the Codell Sandstone is very thin, only about 10 feet, and the only facies present is CCL-2, no upper Codell Sandstone facies are present. The Juana Lopez is absent.

4.1.3 Deadman's Curve Outcrop (DCO)

Deadman's Curve (Figure: 4.1) is located on Highway 115 roughly twelve miles south of Colorado Springs in the NW of Section 11, Township 16 South, Range 67 West, El Paso County, Colorado. It is easily found and accessible on the west side of the highway just as it curves to the west, south of Keeton Ranch Road. Parking is safest

to the south of the outcrop on the west side. The outcrop contains the Upper Blue Hill Shale (BHS-3), five feet of the lower Codell Sandstone (CDL-1 and CDL-2), and 17 feet of the upper Codell Sandstone (CDL-3 and CDL-4). Two to three feet of the Juana Lopez (JL-2) is present, with a thick section of the Fort Hays Limestone (FH-1 and FH-4). It is difficult to find the lower Blue Hill Shale as the slope creates significant cover which is too deep to trench and accurately find the contact. The outcrop contains an excellent example of the massive, yet splotchy calcite cementation that can occur in the upper Codell Sandstone. This is also one the two locations where scouring within the lower the Fort Hays Limestone is present. The description of the Deadman's Curve outcrop can be found in Plate 3.

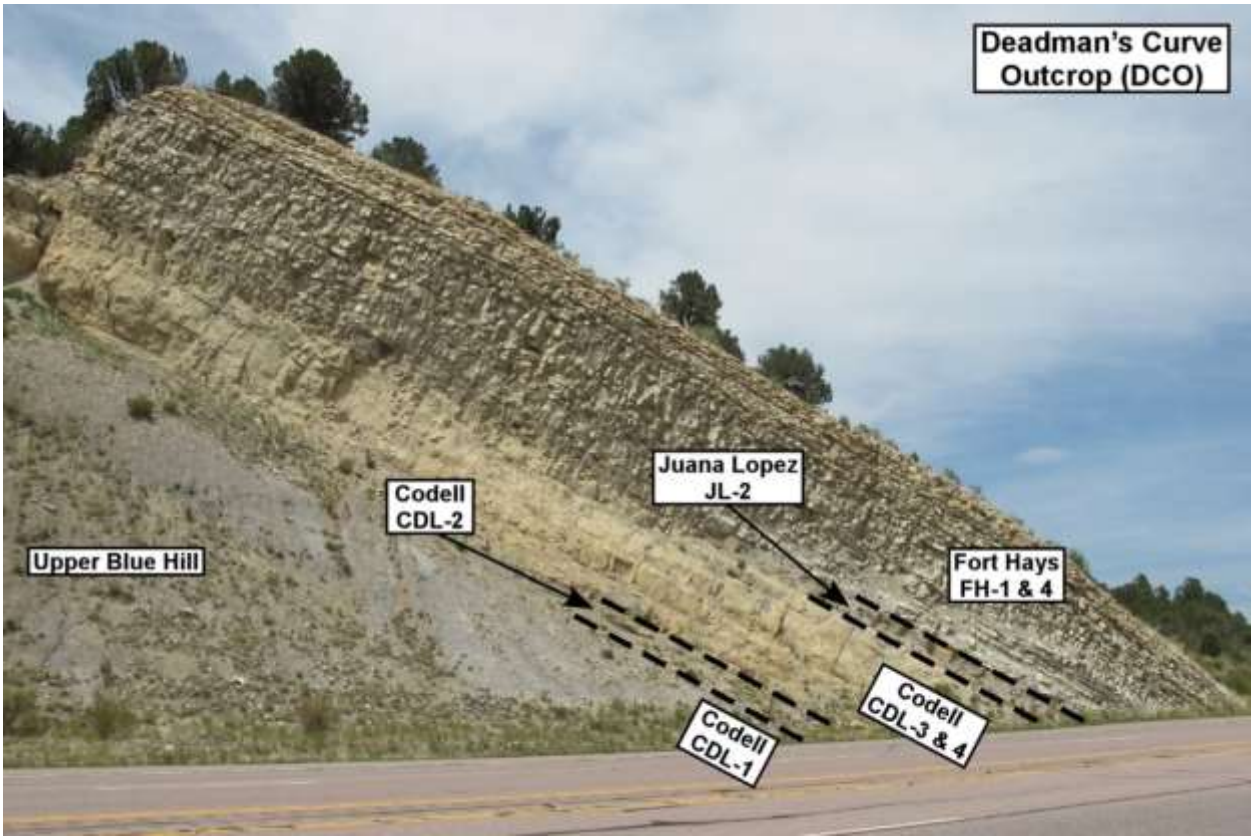


Figure 4.1: Deadman's Curve outcrop (DCO).

4.1.4 Lake Pueblo State Park Outcrop (LPO)

Lake Pueblo State Park (Figure: 4.2) has several excellent outcrops of the Dakota Formation through the Fort Hays Limestone Member of the Niobrara Formation. The area was the focus of research by Kauffman, E.G. and his students in the 1980's and continues to be an area of interest today. One of the better Carlile Shale through Fort Hays Limestone outcrops is on Juniper Road located just south of the railroad tracks, SE NE of Section 26, Township 20 South, Range 66 West. Three outcrops are actually accessible here, one directly north and one directly south of the road and the third is further north on private property along the railroad tracks. These outcrops contain more than 40 feet of the upper Blue Hill Shale (BHS-2 and BHS-2), six to

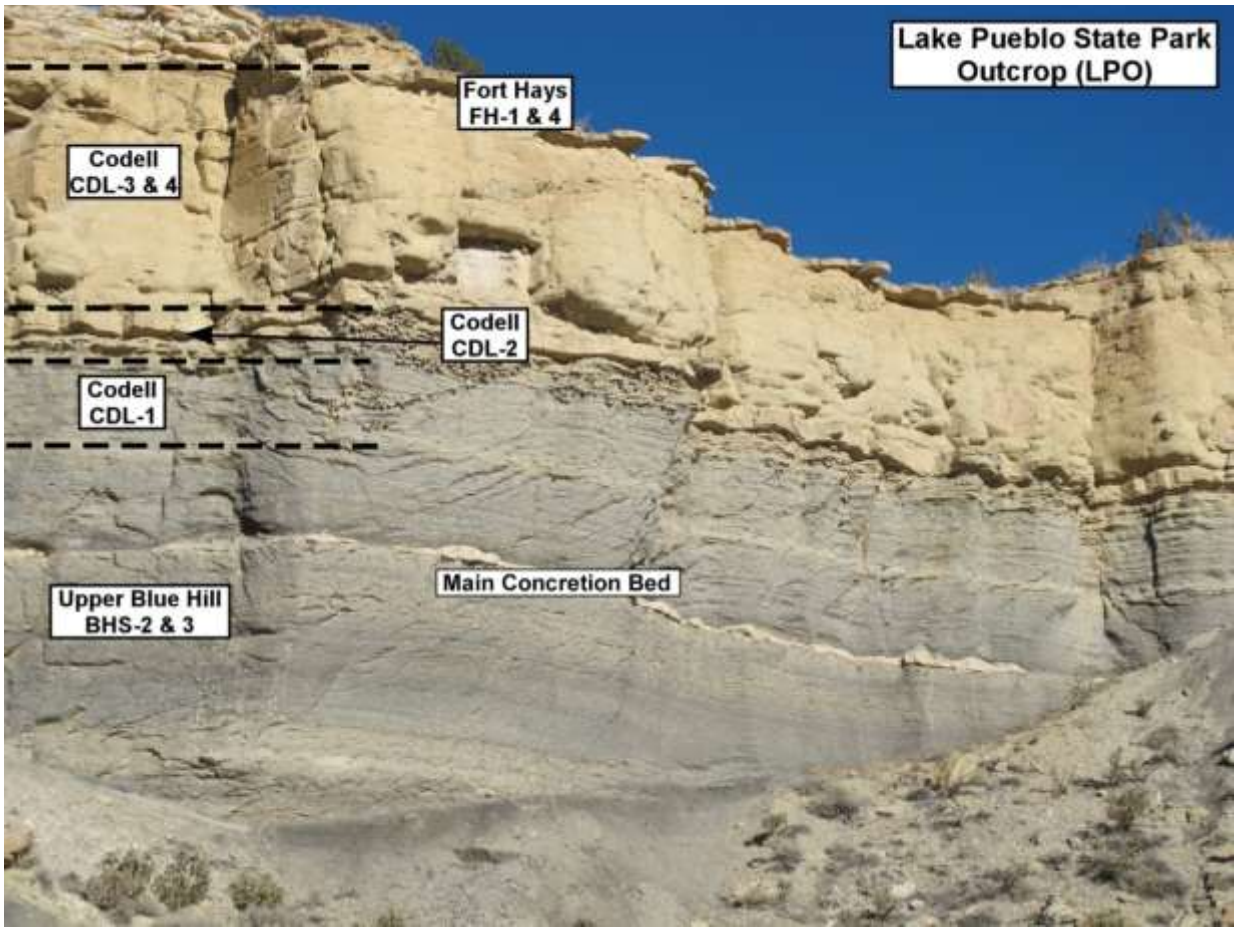


Figure 4.2: Lake Pueblo State Park outcrop (LPO).

eight feet of the lower Codell Sandstone (CDL-1 and CDL-2), 25 feet of the upper Codell Sandstone and a thin Fort Hays (FH-1 and FH-4) due to erosion. Thicker sections of the Fort Hays Limestone can be found in the area. The Juana Lopez is thin to absent in the area, but the surface atop the upper Codell Sandstone has extensive bioturbation and a *Glossifungites* assemblage that contains hints of the Juana Lopez within burrow linings. This outcrop is also one of the few where a thick Blue Hill Shale is exposed, revealing the lower Septarian concretion beds. The description of the Lake Pueblo State Park outcrop can be found in Plate 4.

4.1.5 Peck Creek Outcrop (PCO)

The Peck Creek outcrop (Figure: 4.3) is four miles south of Highway 96 on the north side of Red Creek Springs Road West, also known as Colorado Road 200, in the SW of Section 21, Township 21 South, Range 67 West. Access to the outcrops is just north of Peck Creek, near the intersection of Bronquish Road, on private land. Permission to access the area is required. This outcrop contains a thin upper Blue Hill (BHS-3), five feet of the lower Codell Sandstone (CDL-1 and CDL-2), 30 feet of the upper Codell Sandstone (CDL-3 and CDL-4) and a well-preserved two to three feet of the Juana Lopez (JL-1 and JL-2). This outcrop, along with Verde Road outcrop, dislplay an excellent example of the contact between the Juana Lopez and Fort Hays Limestone where clasts of the JL-2 are "suspended" within a matrix of Fort Hays Limestone in a significantly burrowed surface. A complete Fort Hays Limestone is present, but difficult to access. The description of the Peck Creek outcrop can be found in Plate 5.

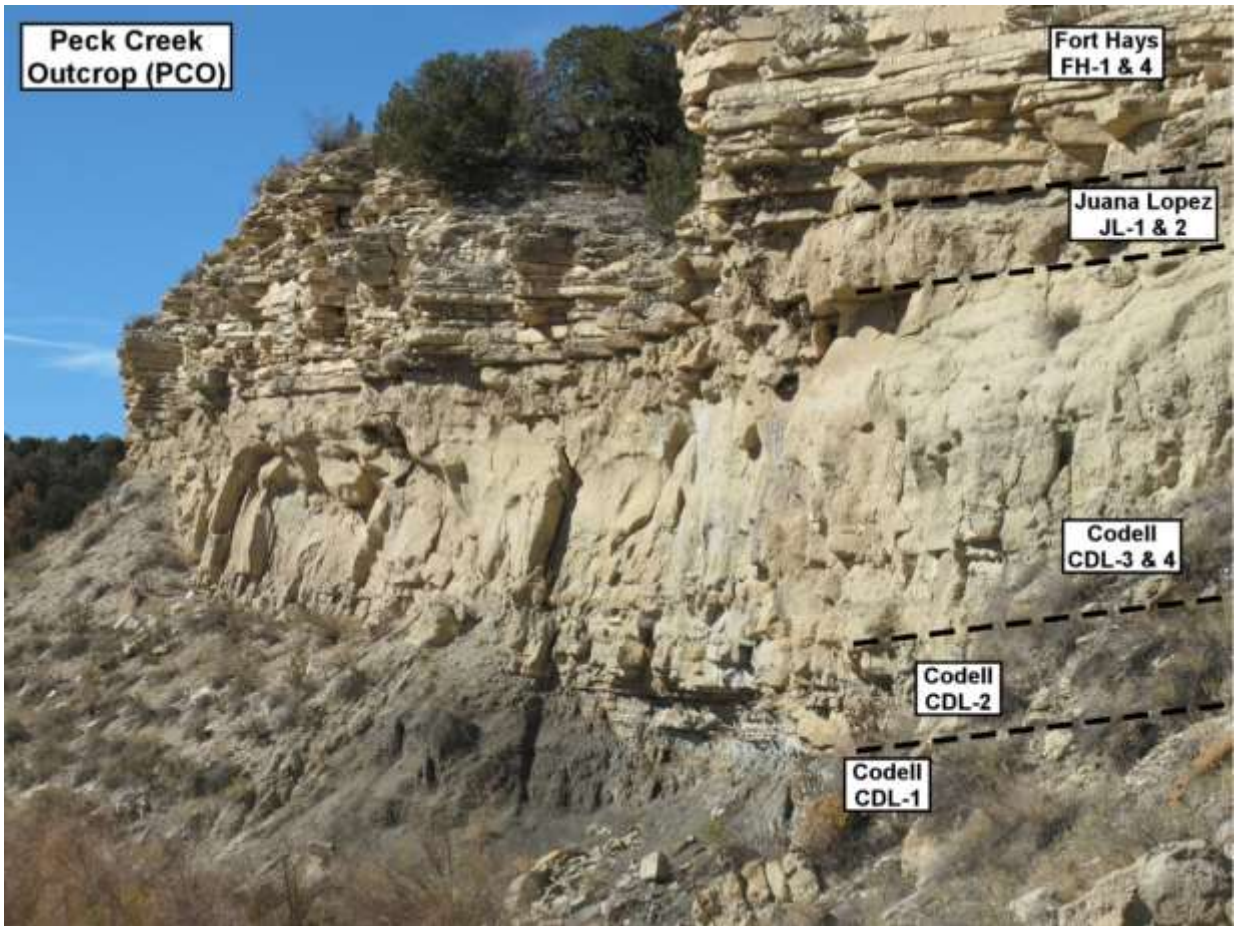


Figure 4.3: Peck Creek outcrop (PCO).

4.1.6 Pueblo Nature Center Outcrop (PNCO)

This outcrop locality (Figure: 4.4) consist of a series of bluffs and terraces along the Arkansas River, just west of downtown Pueblo in the SW NW of Section 32, Township 20 South, Range 65 West. Access is a mixed public and private road and paved walking path that runs west from the Pueblo Nature Center along the river. Several outcrops of the upper Blue Hill Shale through the lower Smoky Hill member of the Niobrara Formation are easily accessible. The best Carlile Shale outcrops are a large bluff, less than a mile west of the main parking lot. These outcrops contain a thin section of upper of Blue Hill Shale (BHS-2 and BHS-3) ten feet of the lower Codell

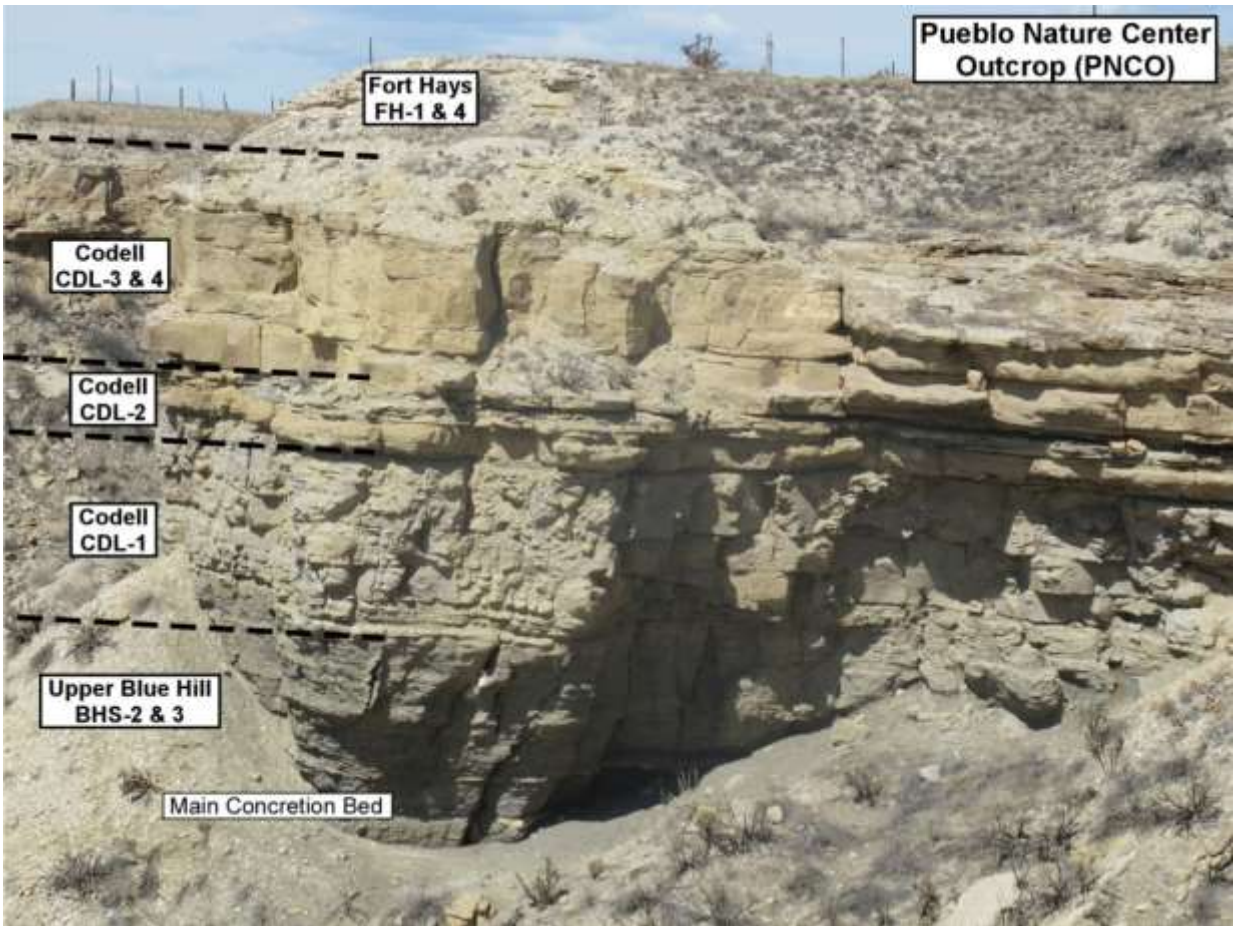


Figure 4.4: Pueblo Nature Center outcrop (PNCO).

Sandstone (CDL-1 and CDL-2), and 15 feet of the upper Codell Sandstone. The Juana Lopez is present (JL-2) but very thin (< two inches) and the Fort Hays Limestone (FH-1 and FH-4) is well preserved in the area at other outcrops. The description of the Pueblo Nature Center outcrop can be found in Plate 6.

4.1.7 Verde Road Outcrop (VRO)

The Verde Road outcrop (Figure: 4.5) is located 15 miles south of Pueblo, east of I-25 in the NW of Section 9, Township 23 South, Range 65 West. Exit I-25 onto Colorado Road 337 (Verde Road) and continue east, the road will veer south as it approaches Graneros Creek. As the road continues south a bluff of outcrops will

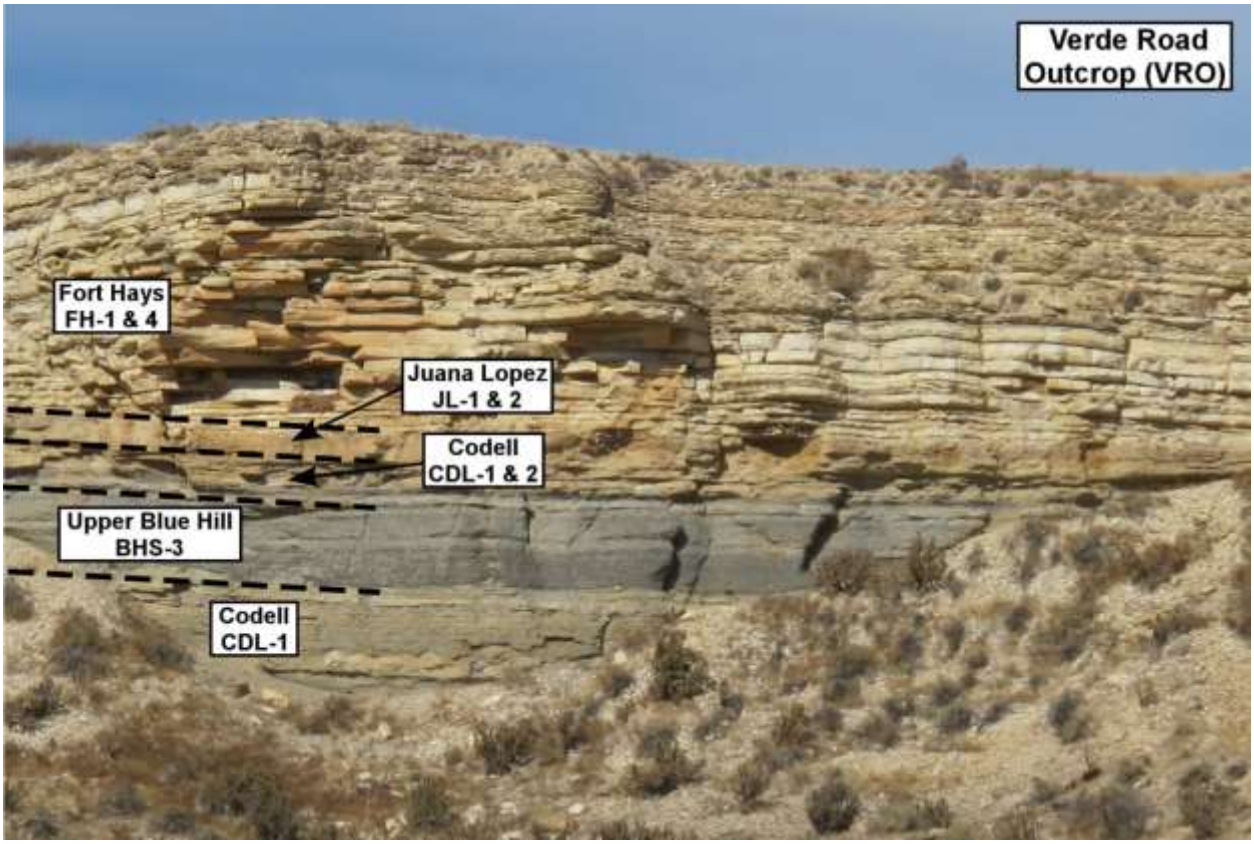


Figure 4.5: Verde Road outcrop (VRO).

appear to the west. The outcrop is on private land owned by the Reno Family and permission to access the area is required. Verde Road is one of the best outcrops to illustrate the intertonguing, non-vertical succession of facies within the upper Blue Hill Shale and lower Codell Sandstone. Twenty feet of the upper Blue Hill Shale is present (BHS-2 and BHS-3), less than five feet of the lower Codell Sandstone, and the upper Codell Sandstone (CDL-3 or CDL-4) is absent. The Juana Lopez (JL-1 and JL-2) is approximately two feet thick. The Fort Hays Limestone is thick, but difficult to measure accurately. Of the six primary outcrops it is one of the best examples of the significant erosion and removal of the Codell Sandstone in the area. The description of the Verde Road outcrop can be found in Plate 7.

4.1.8 Walsenburg Outcrop (WO)

The Walsenburg outcrop (Figure: 4.6) is located on Highway 69 roughly fifteen miles northwest of Walsenburg, just before Colorado Road 520 and 616 in the SE of Section 4, Township 27 South, Range 68 West. It is the southernmost outcrop, located on the south side of the highway, just before the exit for Colorado Road 520. Technically it is in the northern Huerfano basin, but it provides an excellent southern data point for the greater Cañon City area. The outcrop is very exposed and parking is safest west of the outcrop near the intersection of Colorado Road 520 on the south side. The outcrop contains ten feet of the upper Codell Sandstone (CDL-3 and CDL-4) and four to five feet of bioturbated muddy siltstone which is similar to the lower Codell Sandstone (CDL-1) at other locations, yet it sits above the usual upper Codell

Figure 4.6: Walsenburg outcrop (WO).

Sandstone facies (CDL-4) and below the Juana Lopez. The occurrence of this additional unit illustrates the intertonguing relationship of the Codell Sandstone and Blue Hill Shale and the decrease in erosion and removal of the upper Codell Sandstone towards the west and south. The Juana Lopez is four feet thick and this particular outcrop is one of the best for the Juana Lopez in the area. The Fort Hays Limestone is thick and well exposed. The description of the Walsenburg outcrop can be found in Plate 8.

4.2. Secondary Outcrops

The greater Cañon City and Pueblo areas have more outcrops of Late Cretaceous strata than one could ever hope to see in a lifetime. While the six outcrops previously described were the primary focus, four additional outcrops were viewed in completing this research. These outcrops were used to help define facies and stratigraphic relationships. None of the outcrops were formally measured and no samples were taken for analysis.

4.2.1 B.F. Rockafellow Ecology Park Outcrop (RFPO)

B.F. Rockafellow Park (Figure: 4.7) is located just south of Cañon City on Colorado Road 3 in the SW of Section 7, Township 19 South, Range 70 West. It is best found by walking directly west of the parking area down into the drainage and then head south following the creek. It contains excellent outcrops of the Dakota Group, Bridge Creek Limestone Member of the Greenhorn and Fort Hays Limestone and Smoky Hill members of the Niobrara. The Juana Lopez is very thick but, overall, not an ideal location to measure. The upper Codell Sandstone appears to be absent with only a

Figure 4.7: B.F. Rockafellow Park outcrop (RFPO).

very thin lower Codell Sandstone present.

4.2.2 Beaver Creek Anticline Outcrop (BCO)

Beaver Creek anticline (Figure: 4.8) is a large road cut within Highway 50 seventeen miles east of Cañon City and twenty miles west of downtown Pueblo in the S1/2 of Section 24, Township 19 South, Range 68 West. It is just west of the Old Portland Road 120. Access is best from the west side of the outcrop off the east-bound side of Highway 50. The outcrop is actively weathering and exposed to traffic and caution should be taken while accessing. The upper Codell Sandstone is present (CDL-3 and CDL4), so are the Juana Lopez (JL-2) and Fort Hays Limestone (FH-1 and FH-4).

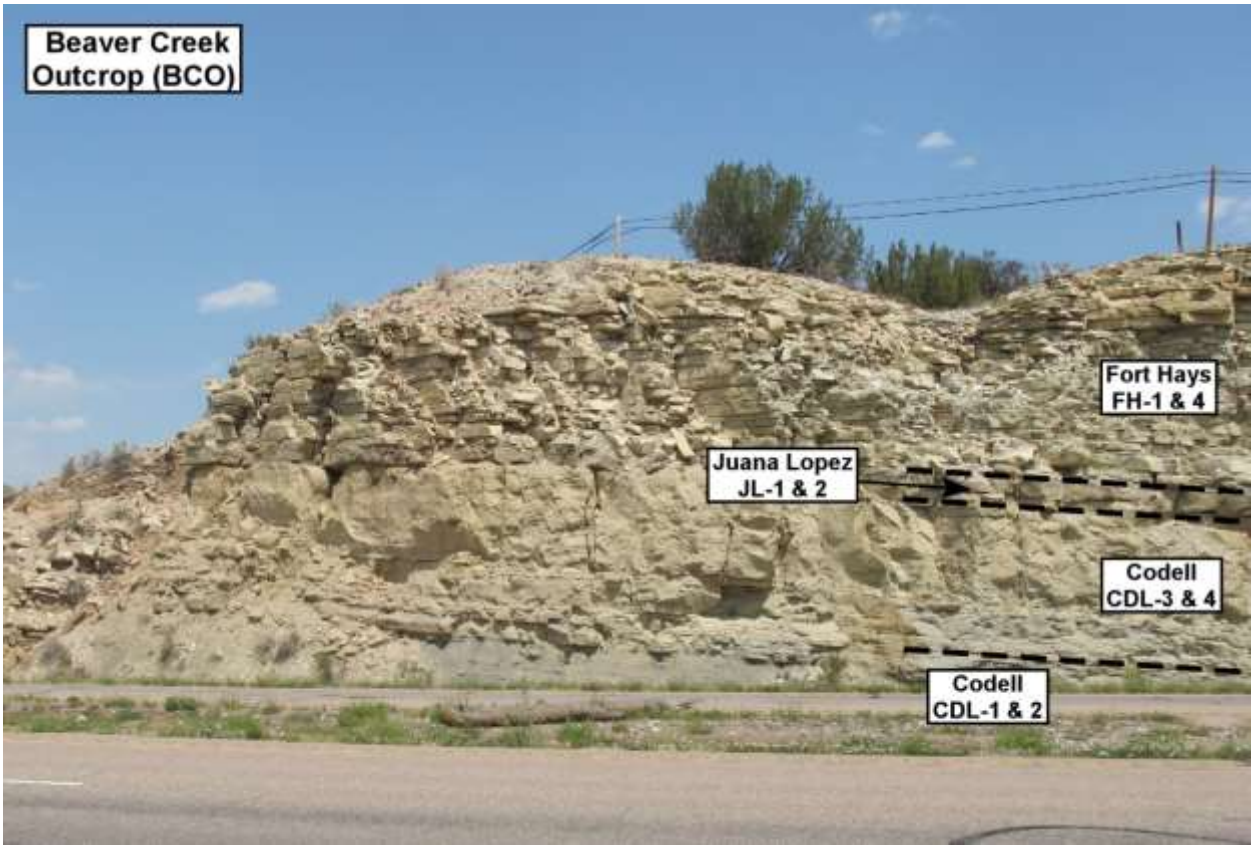


Figure 4.8: Beaver Creek anticline outcrop (BCO).

4.2.3 Rock Hill North Outcrop (RHNO)

Rock Hill North (Figure: 4.9) is fourteen miles southwest of Pueblo on Highway 78 in the NE of Section 18, Township 22S, Range 66W. The outcrop is on the northwest side of the road and parking is best on the east side of the road near the turnout. The outcrop is exposed to traffic and caution should be taken while accessing. The upper Blue Hill Shale (BHS-2 and BHS-3) through Codell Sandstone (CDL-1 through CDL-4) are present. No distinguishable Juana Lopez is present and the Fort Hays Limestone is poorly exposed and hard to access. This outcrop is unique as there is noticeably less bioturbation throughout the entire Codell Sandstone. This creates what appears to be a thicker section. McLane (1982) interpreted this location as a "lagoon fill" behind an ebb-

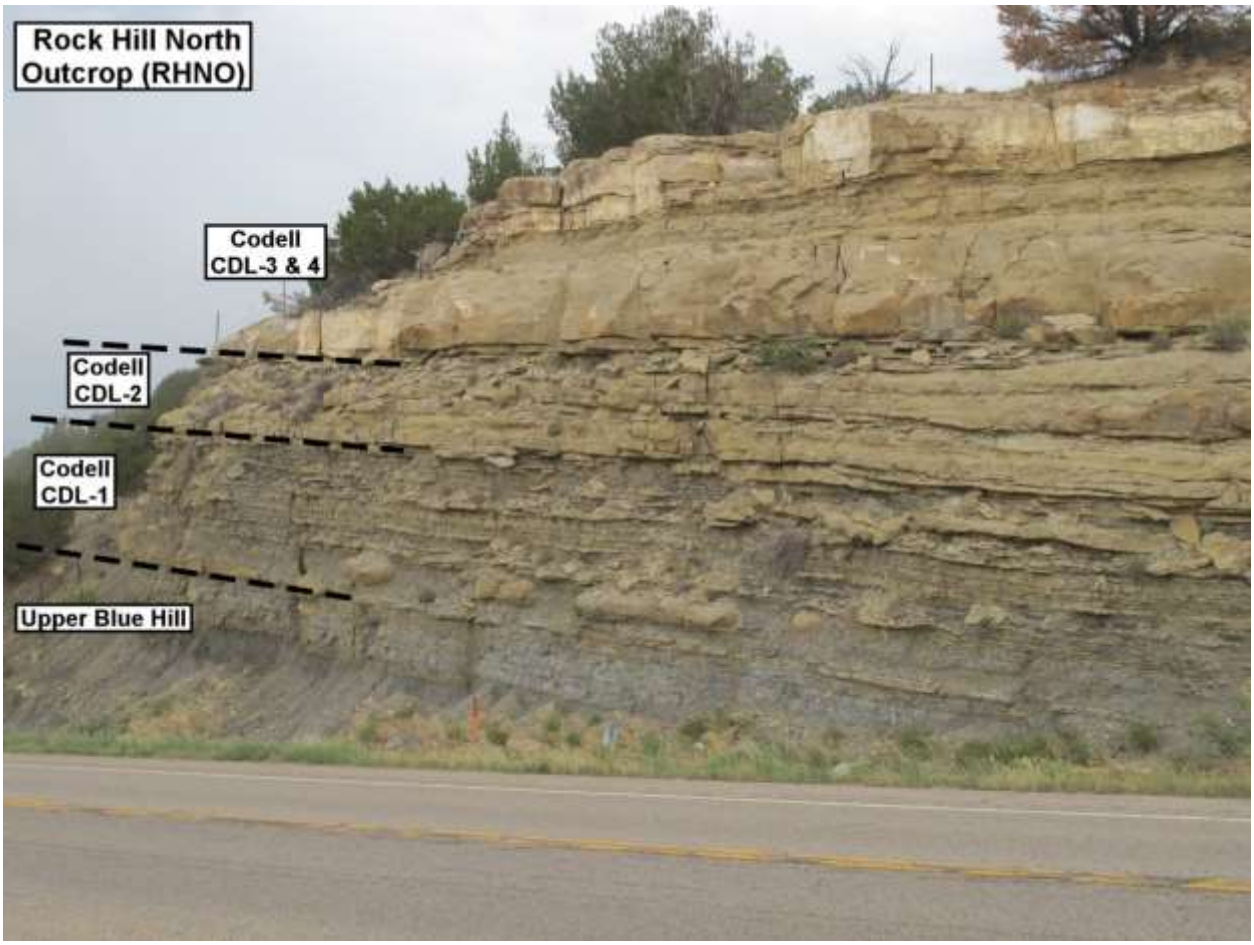


Figure 4.9: Rock Hill North outcrop (RHNO).

tide delta, yet based on facies associations this location is nearly identical to other measure sections in the area. This lack of bioturbation aids in understanding the heterogeneity in primary bedding and sedimentary structures within similar depositional settings that are commonly obliterated from bioturbation and therefore often not well preserved.

4.2.4 Sanders Arroyo (SAO)

The Sanders Arroyo outcrop (Figure: 4.10) is not accessible. The landowner will no longer allow access. Access to the outcrop was granted once and photographs were taken but it was not possible to return and measure the section in detail. It is located in

Figure 4.10: Sanders Arroyo outcrop (SAO).

the NE of Section 26, Township 25S, Range 61W. This outcrop is one of the best in southeast Colorado to illustrate the erosion and removal of the entire Codell Sandstone and to a lesser degree thickness variations in the Juana Lopez. It is the only observed outcrop in the AOI where the Juana Lopez is in direct contact with the upper Blue Hill Shale with zero preservation of the Codell Sandstone. It is the easternmost outcrop and illustrates the significant and eastward truncation of the Codell Sandstone below the regional Juana Lopez unconformity.

CHAPTER 5

SUBSURFACE STRATIGRAPHY

5.1 Overview

Inside the AOI there were 1818 well locations used for various levels of correlations and isopach mapping. Digital LAS files were available for 141 wells and the remaining contained raster logs alone or were combined with digital LAS. Some locations were outside the AOI but were used to aid in stratigraphic mapping and are included in the Appendixes. Many wells had incomplete coverage and while they were suitable for picking certain stratigraphic tops, they were not complete enough for all isopach maps. A complete list of the well locations used and the formation tops can be found in Appendixes B and C respectively.

Well log resolution does not allow for the same level of detail as outcrop and core in the subsurface. Correlations were done in detail where possible, but generally treated as stratigraphic packages, especially the transition from the upper Blue Hill Shale to lower Codell Sandstone. Throughout southeast Colorado the Codell Sandstone, what is commonly facies CDL3 and CDL-4 of the upper Codell Sandstone, is resolvable on log, but division between these two facies is not possible. Figure 5.1 is a summary of the stratigraphic tops and packages that were used for correlations and isopach mapping and their typical log responses in southeast Colorado.

5.2 Blue Hill Shale Stratigraphic Distribution

Stratigraphic variations within the Blue Hill Shale are difficult to measure between outcrop locations as a complete Blue Hill Shale outcrop section was never viewed in its

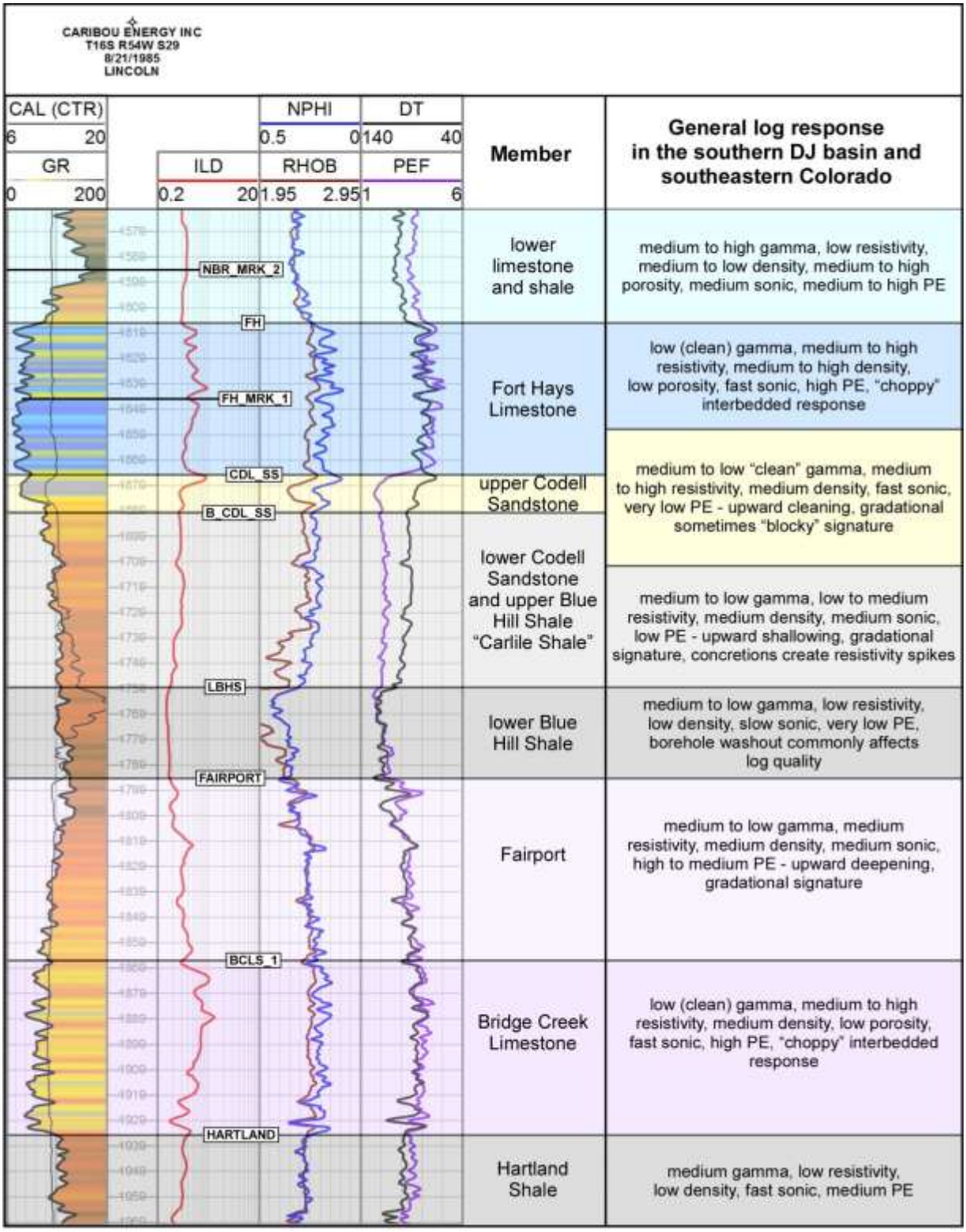


Figure 5.1: Reference log illustrating subsurface units and stratigraphic tops used in this research and their typical log response.

entirety by observing the contact with the Fairport Chalk. Both the Portland 1 and Rebecca Bounds 1cores contain the complete section of the Blue Hill Shale and both portray the typical log response and thickness. Regional stratigraphic analysis of the Blue Hill Shale can better be accomplished with the use of subsurface data. For the purpose of this research the mapping interval defined as Blue Hill Shale (Carlile Shale) is from the top of the Fairport Chalk (top: FAIRPORT) to the base of the upper Codell Sandstone (top: B_CDL_SS).

Weimer and Sonnenberg (1983) documented that the Blue Hill Shale becomes progressively truncated to the north from the south and east approaching Wattenberg field. They proposed that the Transcontinental arch and associated topographic highs within the northern Denver basin were reactivated prior to the deposition of the Fort Hays (Figure: 5.2). In and around Wattenberg field the Codell Sandstone is very thin and rests directly on the Fairport Chalk. This thinning and gradual truncation of the Blue Hill Shale by the Codell Sandstone is also apparent near the center of the basin from Colorado Springs south to the Pueblo area (Figure: 5.3). No significant thickness variation is observed however in the Blue Hill Shale from the Pueblo area east into Kansas towards the Rebecca Bounds 1 core. Even though the Pueblo area and immediately east is within the axis of the basin, no apparent thickness variations, or erosion has affected the deposition or preservation of the Blue Hill Shale (Figure: 5.4).

5.3 Blue Hill Shale Regional Isopachs

Two regional isopach maps of the Blue Hill Shale were created: (1) lower Blue Hill Shale (tops: FAIRPORT to LBHS) and (2) the entire Carlile interval (minus the Fairport),

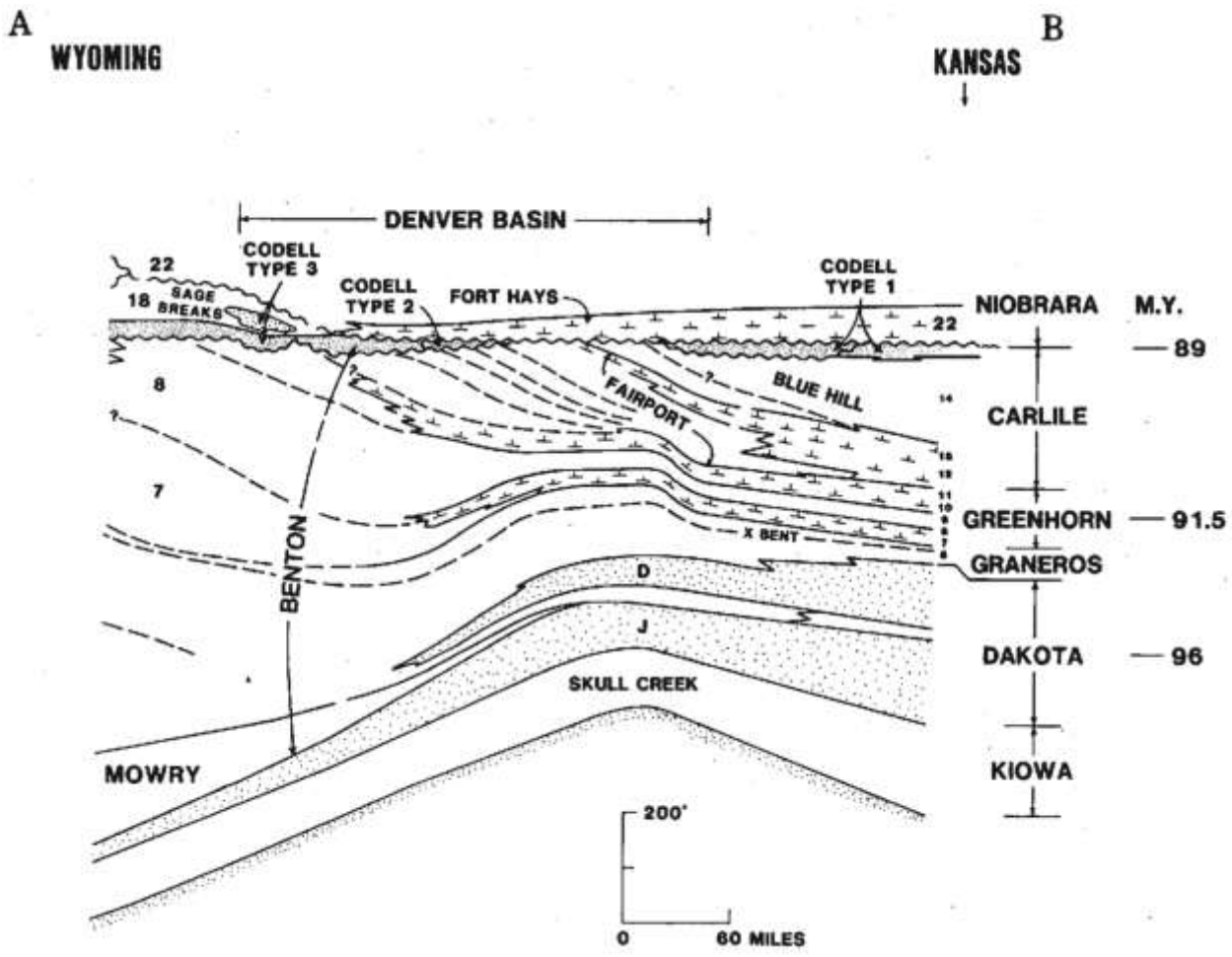


Figure 5.2: North to southeast resorted stratigraphic section illustrating truncation of the Blue Hill Shale to the north (Weimer and Sonnenberg, 1983).

(tops: FAIRPORT to CDL_SS). The LBHS top, and therefore the lowermost isopach, is not resolvable throughout the area. The LBJS top is easier to identify in the eastern portion of the AOI and less resolvable to the west. This probably represents a lateral facies change from BHS-1 to BHS-2, or lack of deposition of that specific facies. While data points were sparse for this interval, the isopach does illustrate thinning towards the northwest, especially in the west of the AOI near the basin axis. The eastern portion creates an off-trend thick that may represent an isolated low or area of preservation of facies BHS-1 (Figure: 5.5). A small southwest to northeast thick is also preserved

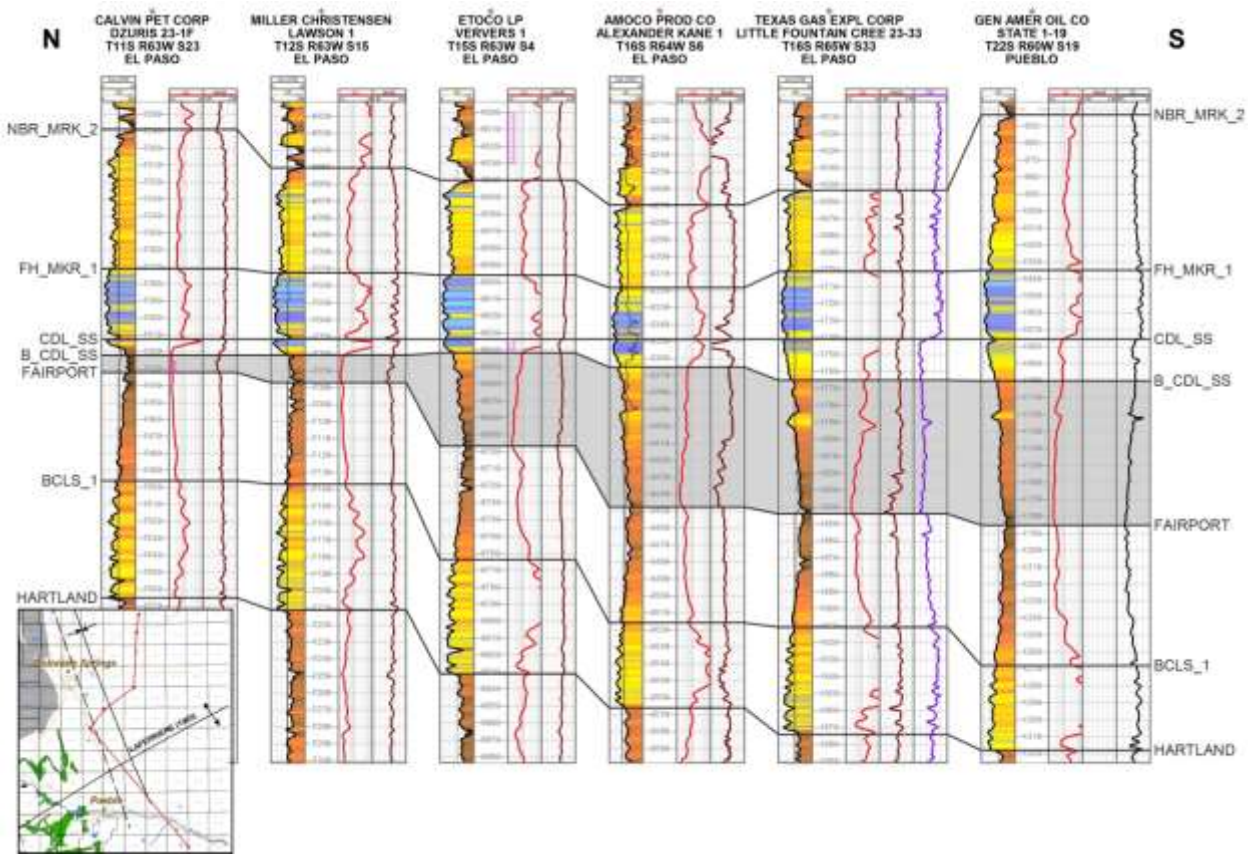


Figure 5.3: North to south cross-section from Colorado Springs to Pueblo illustrating the truncation of the upper Blue Hill Shale. Grey shading represents Blue Hill Shale "Carlile Shale" interval (datum=CDL_SS).

between the two proposed topographic highs presented by Laferriere and Hattin (1989) in Pueblo and Crowley Counties that may be the result of increased accommodation or preservation within a syncline between these two highs. Some thinning is also observed near the crest of both structures. The isopach of the complete interval (Figure: 5.6) more uniformly illustrates the previously discussed thinning to the north towards Wattenberg field. In addition, near the town of La Junta and the Sanders Arroyo outcrop, a thin exists within the interval that appears to correlate to the positive structural high that affected Niobrara deposition described by Laferriere and Hattin (1989). This trend however does not continue, or it may not have influenced Carlile

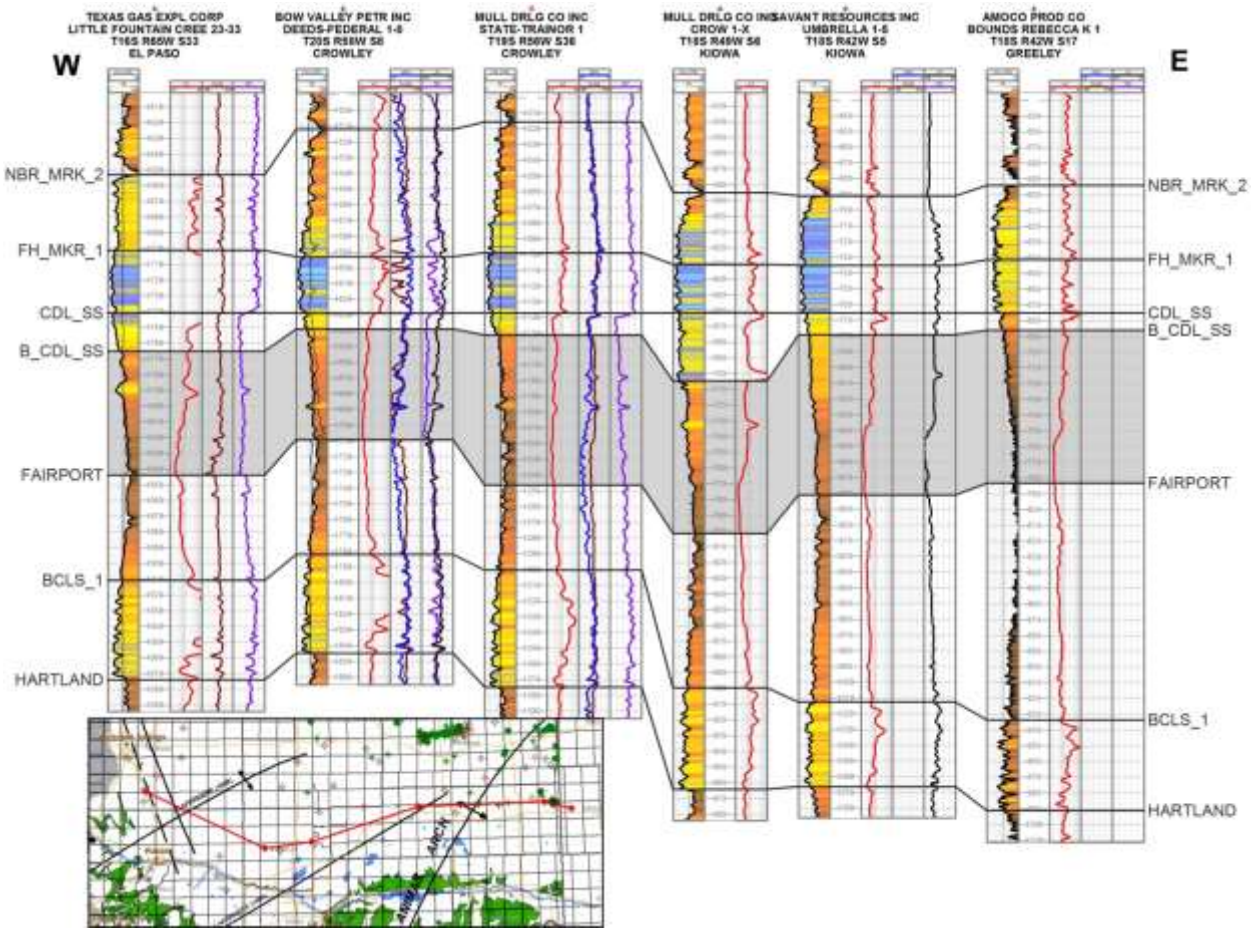


Figure 5.4: West to east cross-section from Pueblo to Rebecca Bounds 1 core in Kansas. Grey shading represents Blue Hill Shale "Carlile Shale" interval (datum = CDL_SS).

Shale deposition the same as the Fort Hays Limestone, as to the east their trend correlates to a preserved thick. In general, from Pueblo to the Kansas state lines there is a preserved west to east thick, but due to a lack of data in the south, as you approach outcrops of both the Greenhorn and Niobrara cycles, it is not possible correlate and confirm the extents of the trend to the south.

5.4 Codell Sandstone Stratigraphic Distribution

The preserved thickness and facies distributions of the Codell Sandstone may

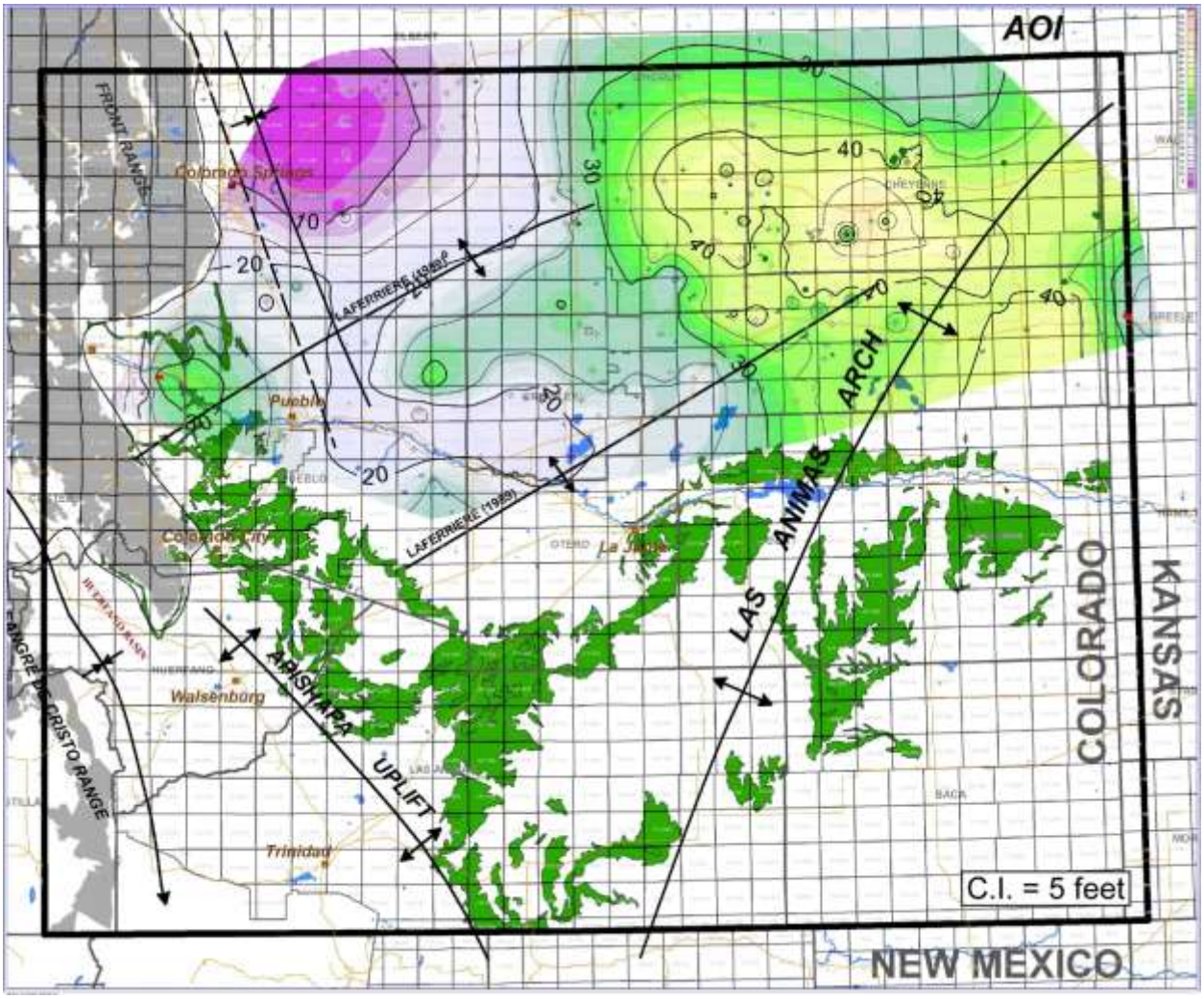


Figure 5.5: Regional isopach of the lower Blue Hill Shale (tops: FAIRPORT to LBHS). Contour interval equals 5 feet.

seem consistent within localized areas but regionally it varies greatly between most outcrops and in the subsurface. Subsurface correlations can be inaccurate as the gradational transition between the upper Blue Hill Shale and lower Codell Sandstone makes defining the base of the upper Codell Sandstone difficult on well logs. Much like the underlying Blue Hill Shale and lower Codell Sandstone the upper Codell Sandstone thins to the north from Pueblo to Colorado Springs (Figure: 5.7). The preservation of the Codell Sandstone to the north truncates the underlying Blue Hill Shale. The underlying

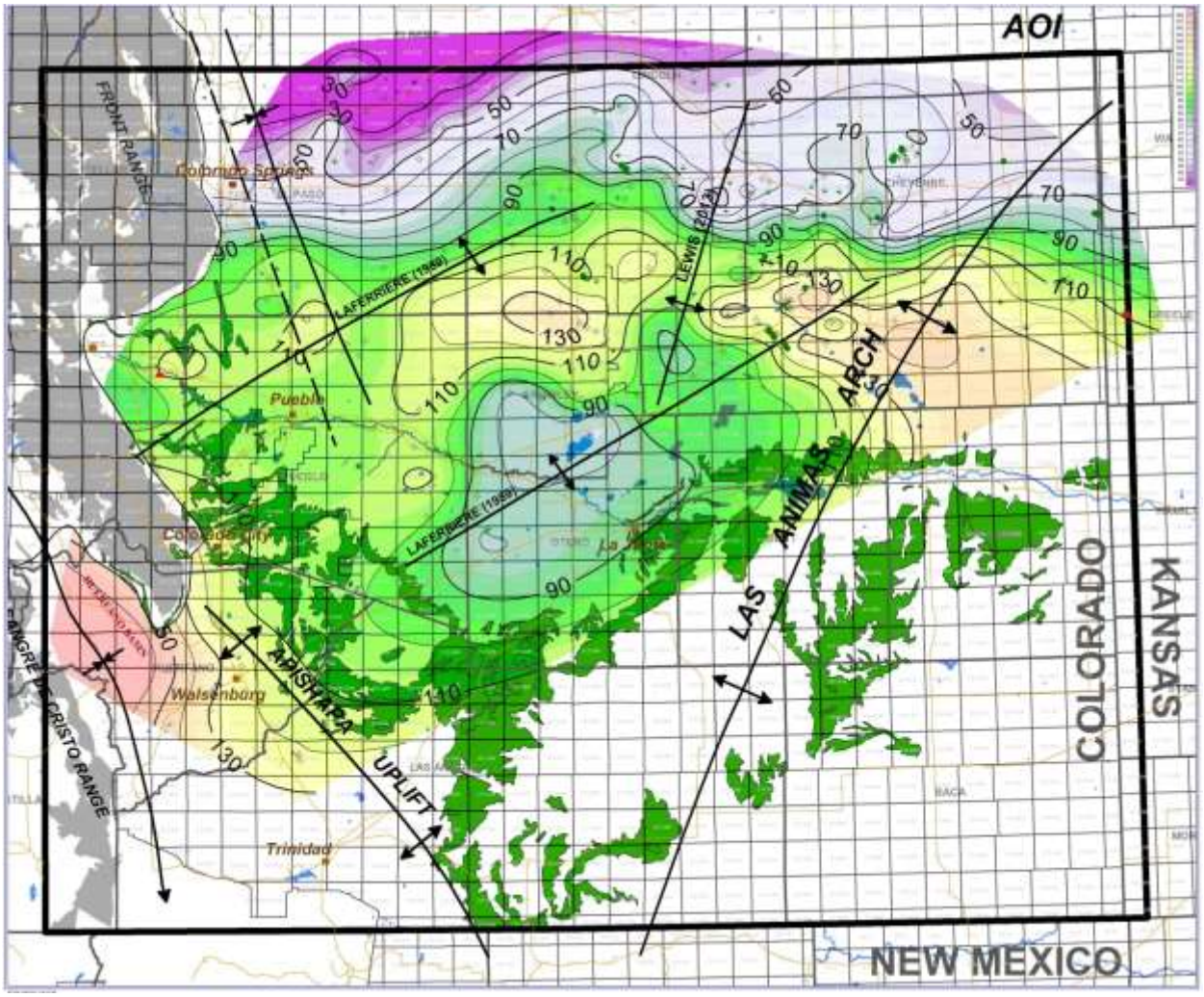


Figure 5.6: Regional isopach of Carlile Shale excluding Fairport Chalk (tops: FAIRPORT to CDL_SS). Contour interval equals 10 feet.

Fairport Chalk retains is regional thickness, but towards the north of the AOI, the Codell Sandstone disconformably erodes and truncates the upper Blue Hill Shale and to the south it appears more transitional and conformable. This supports previous observations by Weimer and Sonnenberg (1983). From the Pueblo area east towards the state line the upper Codell Sandstone thickness is more variable and the underlying Blue Hill Shale is more consistent. Thinning of the Codell Sandstone appears to be the result of erosion of the upper Codell Sandstone, with little impact on the underlying Blue

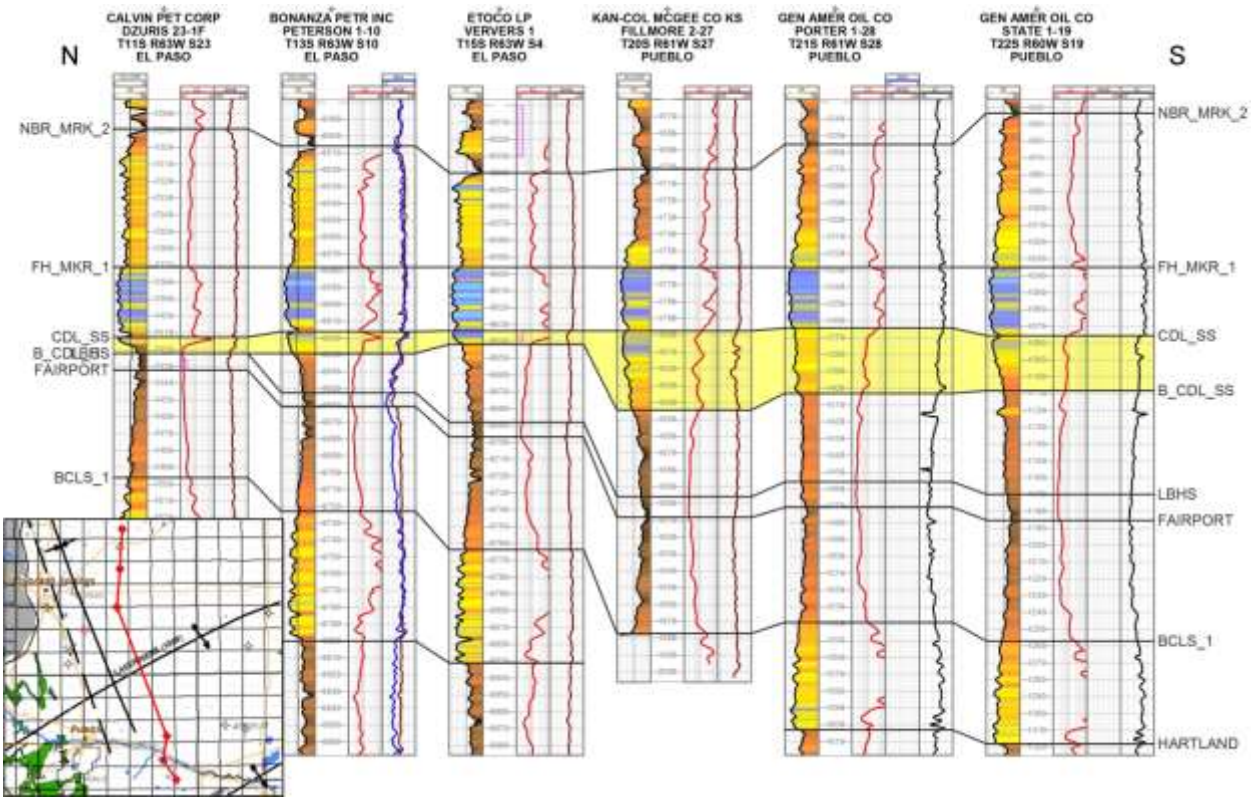


Figure 5.7: North to south cross-section from Colorado Springs to Pueblo. Yellow shading represents upper Codell Sandstone (datum = FH_MRK_1).

Hill Shale (Figure: 5.8).

5.5 Codell Sandstone Regional Isopachs

For the purpose of regional stratigraphic analysis the upper Codell Sandstone cannot be broken into facies, only a package by log response (tops: B_CDL_SS to CDL_SS). This isopach is the only interval that incorporates the measured outcrop thicknesses into the subsurface. In southeast Colorado the upper Codell Sandstone does not thin as uniformly as the underlying Carlile Shale to the north. The Pueblo area and further to the east creates a preserved southwest to northeast thick that once again seems to roughly correlate with the topographic highs from Laferriere and Hattin (1989), but further to the east in Cheyenne and Kiowa Counties another preserved thick creates

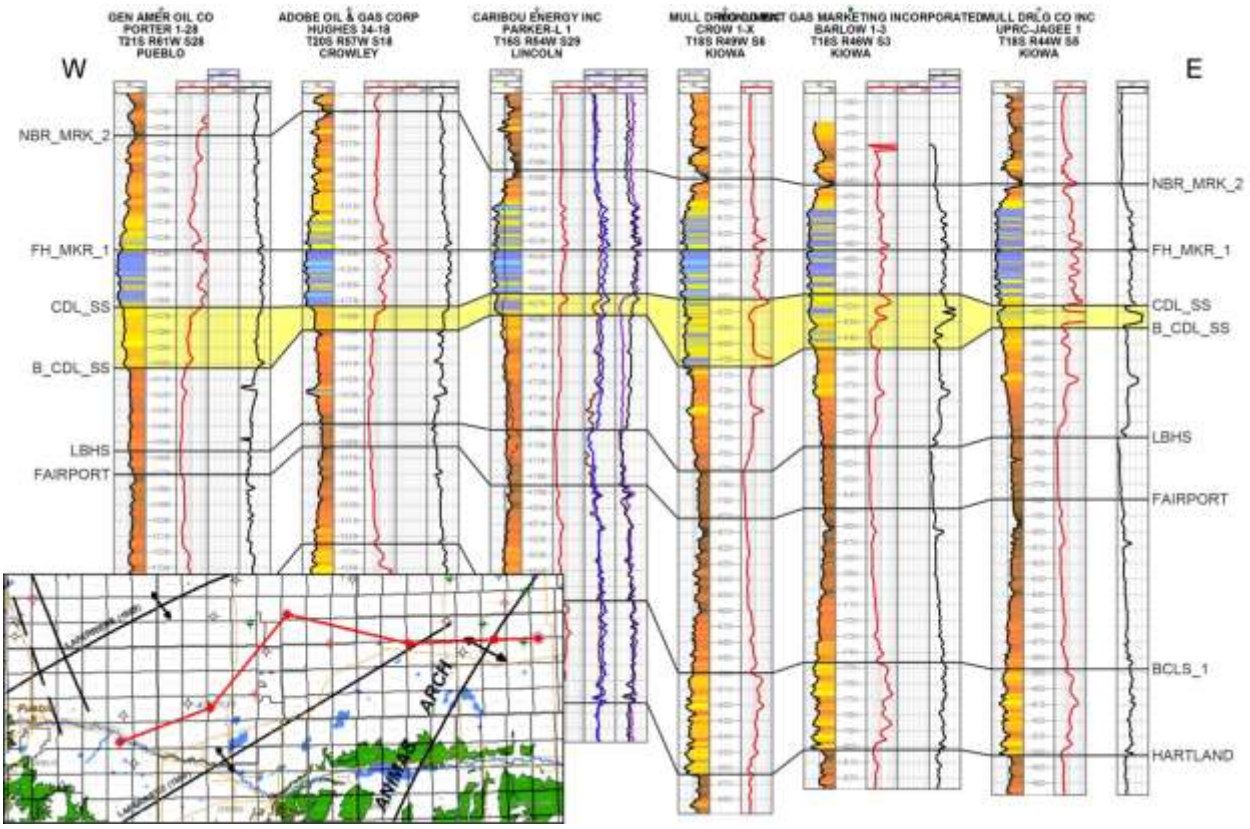


Figure 5.8: West to east cross-section from Pueblo to the Kansas state line. Yellow shading represents upper Codell Sandstone (datum=FH_MRK_1).

a more south to north trend (Figure: 5.9). These two trends are separated by an elongate, southwest to northeast thinning that correlates well to the southernmost topographic high from Laferriere and Hattin (1989). It does however have a more northern trend that is offset, but parallel to the present-day position of the Las Animas arch. This thinning may suggest that the Las Animas arch or similar structure was active in the late Turonian and has shifted eastward to its current position. If the arch was active, as this thinning suggests, then it could have been a major influence in the erosion of the Codell Sandstone. Furthermore, this thinning is also apparent in the previous Carlile Shale isopach (Figure 5.6), which may indicate a gradual increase in its movement or reactivation through time.

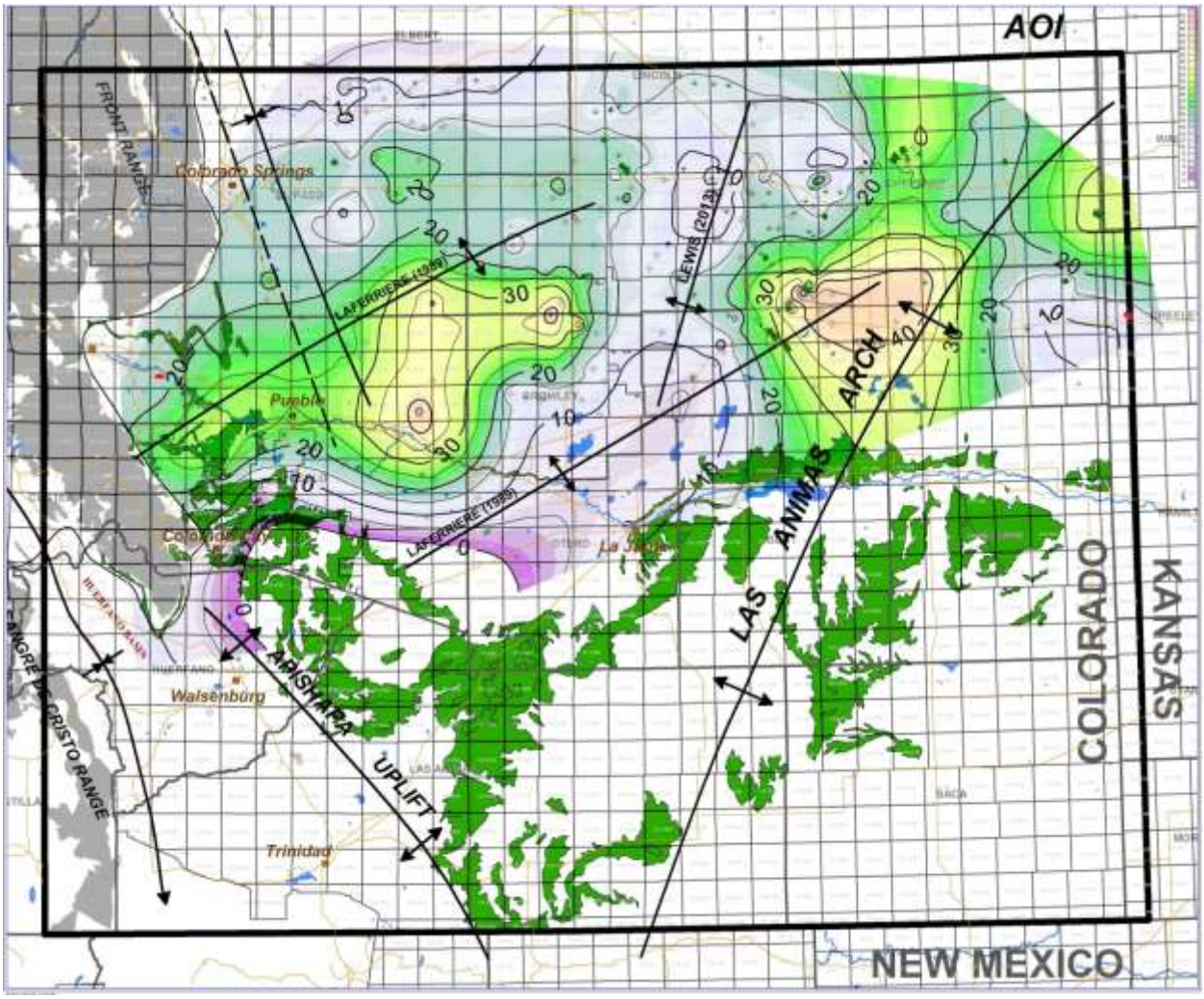


Figure 5.9: Regional isopach of the upper Codell Sandstone (tops: B_CDL_SS to CDL_SS). Contour interval equals 5 feet.

5.6 Juana Lopez Stratigraphic Distribution

Regional outcrop relationships within the Juana Lopez are difficult to recognize and even more difficult to correlate in the subsurface. It is generally too thin and similar in composition to the Fort Hays Limestone to accurately subdivide. Plate 9 contains core and outcrop correlations of the Juana Lopez. Two of the thickest sections are found in the westernmost B.F. Rockafellow Park (RPO) outcrop and the easternmost Sanders Arroyo (SAO) outcrop. The only area within the AOI where subdivision of the

Juana Lopez in the subsurface may be possible, without extensive digital LAS data, is within the northern Huerfano basin. This small basin, south of the Walsenburg outcrop, has in the subsurface what appears to be the same upper Codell Sandstone facies (CDL-1) sitting above what is commonly the final upper facies of the upper Codell Sandstone (CDL3 and CDL-4), but below the Juana Lopez (JL-2). Well log coverage in this area is extremely sparse so no significant correlations could be made beyond this well location. Figure 5.10 illustrates the log response and thickness of the Juana Lopez and upper Codell siltstone that occurs in the area.

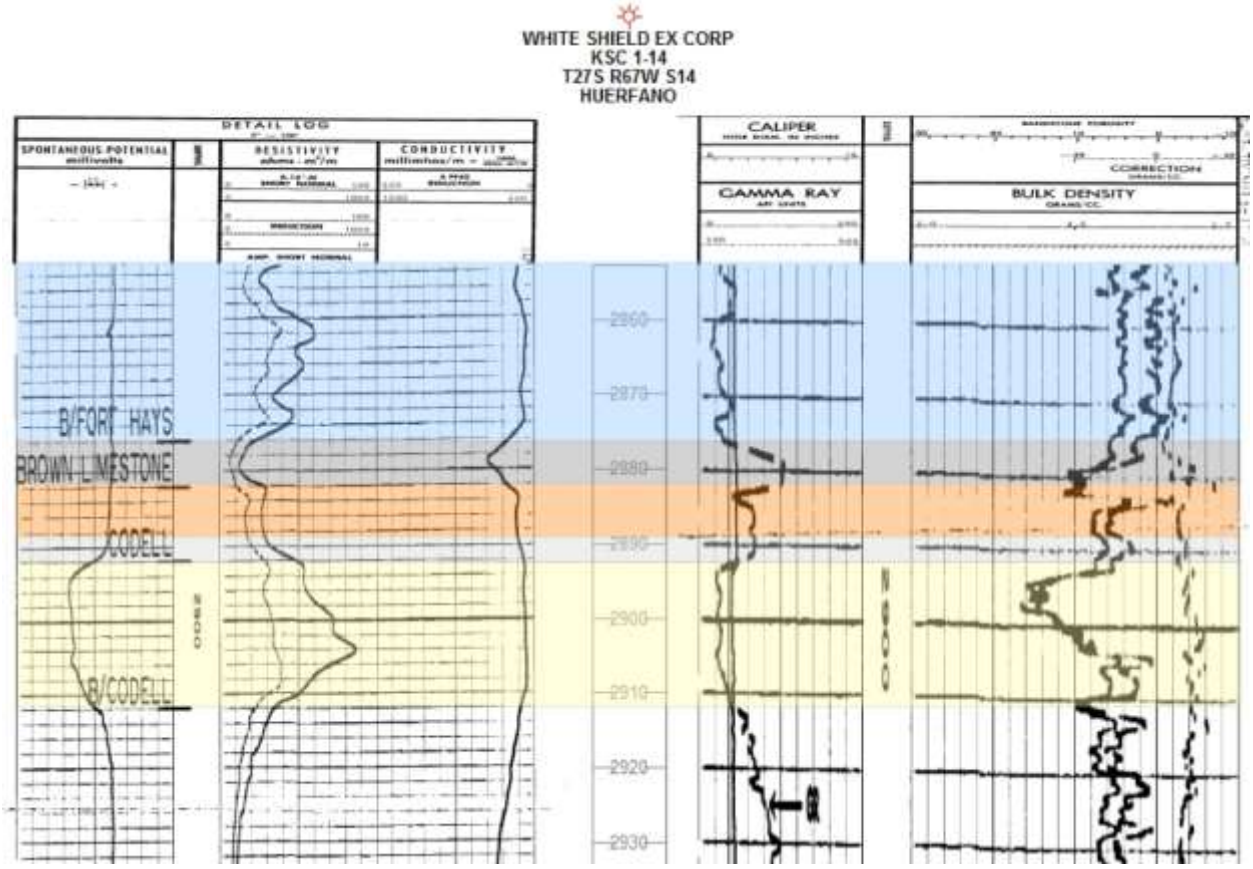


Figure 5.10: Stratigraphy in the northern Huerfano basin. Yellow represents upper Codell Sandstone, grey represents upper Codell siltstone, orange and brown represent Juana Lopez and blue represents Fort Hays Limestone.

5.7 Fort Hays Limestone Stratigraphic Distribution

The work done by Laferriere and Hattin (1989) illustrated that the cyclic depositional patterns in the Fort Hays Limestone are laterally extensive and contain several distinct correlative limestone beds and interbedded markers. Based on this, southwest to northeast structural movement created topographic highs that affected the preservation in the Fort Hays Limestone. Their marker number 6, which they describe as a significant bentonite bed separating limestone beds of units 6 and 7 is the same as top FH_MKR_1 used in this research. Laferriere and Hattin (1989) used this marker number 6 as a regional datum and the top of the main regional lower Fort Hays Limestone isopach. In southeast Colorado this interval ranges between 30 and 40 feet, with some anomalous thin areas near Florence field and south near the Walsenburg outcrop. Localized faulting is the most likely cause of this as regionally this interval in the Fort Hays maintains a constant thickness. Figure 5.10 is a west to east cross-section within the southern Denver basin that illustrates the relationship between the Fort Hays and the variability of the underlying Carlile Shale. Based on the consistent thickness of the Fort Hays Limestone and the variability within the Carlile Shale, the same faulting that affected the Codell Sandstone may have influenced the Fort Hays Limestone, but overall had little impact on thickness variations in the overlying formations.

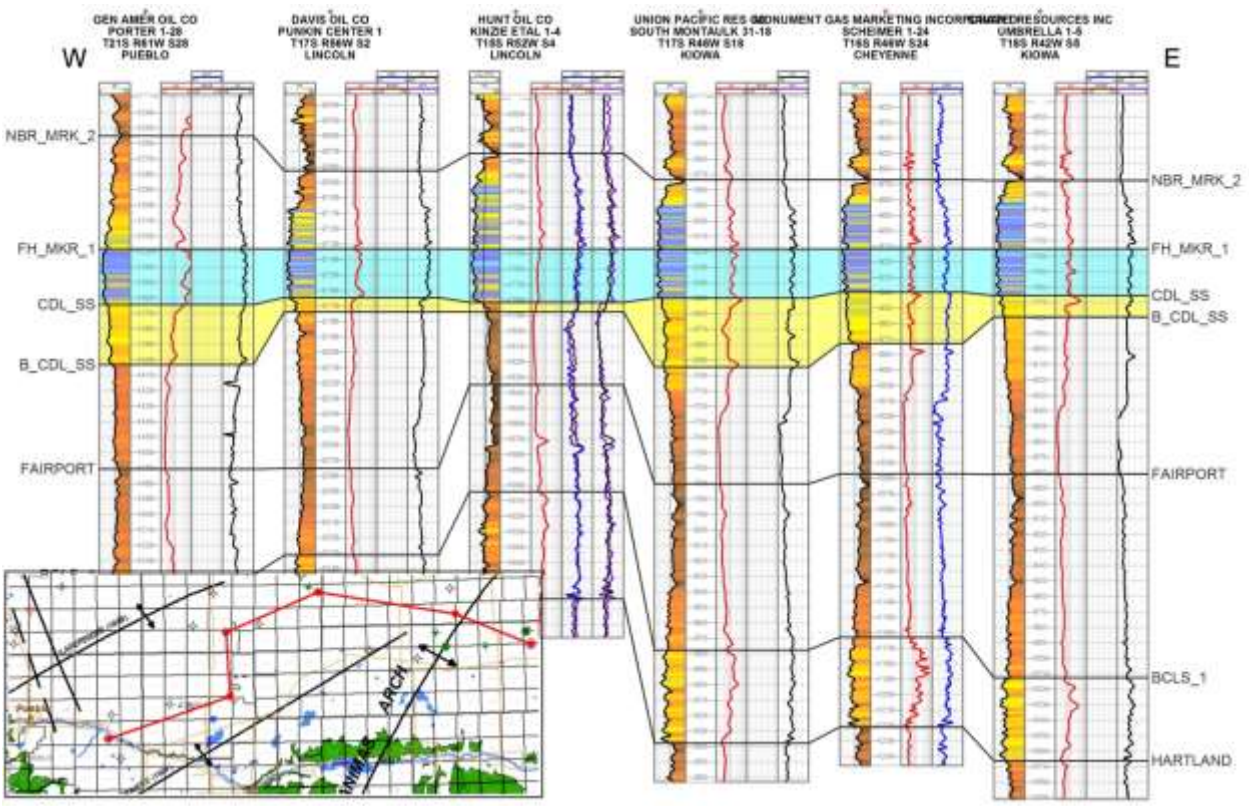


Figure 5.11: West to east cross-section from Pueblo to the Kansas state line. Blue shading represents lower Fort Hays Limestone (datum = FH_MRK_1).

CHAPTER 6

GEOCHEMISTRY

6.1 X-ray Fluorescence Overview

Energy Dispersive X-ray Fluorescence (XRF) devices have long been used by the mineral and mining industries for elemental geochemical analysis. The handheld devices are easy to use, portable and relatively inexpensive given the number of samples that can be obtained over a short period of time. Compared to traditional X-ray crystallography and X-ray diffraction (XRD), which require large and expensive machines in a laboratory setting, XRF is ideal for core and outcrop analysis.

XRF has limitations as the devices (depending on manufacturer and model) are restricted in their detectable range of elements. The lightest is usually magnesium (Mg, element 12), the heaviest is uranium (U, element 92), and the sensitivity in the focus beam of the detector can deliver poor results on uneven surfaces, which creates variable error ranges dependent on each element. Regardless of these limitations, XRF is an excellent tool for qualitative elemental analysis. While the potential usages of raw elemental data are numerous, two main techniques were used for the purposes of this research: (1) raw plots of elemental data to infer mineralogy, and therefore lithology to correlation between locations, and (2) elemental ratios of transition metals to analyze provenance.

Direct assignment or mapping of elementals to a specific chemical compound can be used to interpret mineralogy and lithology. Example: calcium. While more than one mineral exists in nature that contains calcium, the most likely in a mature sedimentary environment is calcium carbonate as a constituent of limestone, dolomite,

or as a calcite cement. Again, this approach is qualitative and chances for error in interpretation are high. Without the confirmation of mineralogy from XRD, and to lesser accuracy petrographic thin-sections, assumptions of mineralogy and lithology from XRF data alone could be inaccurate and misinterpreted. Plots of elements that were used to infer mineralogy and lithology are incorporated within the descriptions for both core and outcrop descriptions. This data can be found for each location in Plates 1-8.

Certain transition metals can be analyzed to interpret composition of sediment source, or provenance. Ratios of these elements and cross-plots with other known mafic and felsic indicators can be used to interpret the composition and sediment maturity. Nickel, chromium and titanium are transition metals that commonly substitute for iron and magnesium in mafic igneous rocks and are therefore suitable to represent "mafic component" elements (Krauskopf, 1979). Although iron and magnesium are potential choices to represent the "mafic component", magnesium is at the upper elemental limit of the XRF device and was commonly below detectable amounts, and when present, the values varied widely. In reducing and anoxic depositional environments iron will commonly combine with sulfur to create pyrite. Concentrations of pyrite can be localized in nodules and or diffused and disseminated throughout the background; both occurrences can lead to variable readings and therefore inaccurate iron measurements.

6.2 Provenance Analysis

Provenance studies of foreland basins have focused mainly on sandstones (McBride, 1962; Rowley and Kidd 1981; Mack 1985), and recent work by Schwab (1986, 1991) suggests that the framework grain composition of sandstones does not

constrain tectonic models very accurately. This may be due to diagenetic processes that remove or alter framework grains (McBride, 1985, Grantham and Velbel, 1988; Miliken and others, 1989; Johnson and Stallard, 1989, Girty 1991; Ramseyer and others, 1992). Mudstones and siltstones potentially provide three advantages over sandstones for provenance studies: (1) mudstones and other very fine- to fine-grained deposits are the predominant rock type of foreland basin sedimentary sequences, as is the case with the WIC of North America, and (2) mudstones are less subject to significant changes in bulk composition during diagenesis (Shaw, 1956), and (3) mudstones better represent the average composition of regional source areas (Heller and Front, 1988) (Andersen, 1995).

The Late Cretaceous Carlile Shale in southeast Colorado and western Kansas is dominantly a fine-grained mudstone and siltstone, and is therefore potentially appropriate for the application of provenance analysis presented by Andersen (1995). While the lower Blue Hill Shale is truly the only significant fine-grained shale in the AOI, the transition to the Codell Sandstone contains enough fine-grained mud and silt in its composition to still be suitable for analysis. Based on the conclusions summarized by Andersen (1995), elemental analysis in the carbonate-rich Fort Hays Limestone and Juana Lopez should not be used in provenance analysis as diagenesis could have altered the framework grain composition. In addition, differences in the depositional environments and potentially provenance for the Fort Hays and Juana Lopez could affect the results. XRF data collected from the Fort Hays Limestone Juana Lopez were excluded completely from the following provenance analysis.

6.3 X-ray Fluorescence Results

Titanium, chromium, nickel and niobium are suitable in provenance studies of shales since they are less mobile during diagenesis (Andersen, 1995) and are essentially incompatible with carbonate minerals. In provenance studies, the abundances and ratio between chromium and nickel may be used to estimate the influence of ultamafics in the source area (Garver et al.,1996). Titanium is also generally associated with mafic and ultramafic source rocks. Niobium however, is more abundant in felsic rocks (Krauskopf, 1979; Faure, 1986). Anderson (1995) uses the quantity:

$$\frac{\sqrt[3]{\mathrm{Cr} * \mathrm{Ni} * \mathrm{Ti}}}{\mathrm{Nb}}$$

to represent a mafic to felsic ratio (MFR). The calculation of this quantity is extremely sensitive to variability in readings from the XRF device. If any of the four elements are below the level of detection, then calculation of the MFR for that particular point is not possible. The MFR calculated for the 5 locations used in this research are summarized in Table 6.1.

Table 6.1: Mafic to felsic ratio (MFR) for two core and three outcrop locations where XRF data was obtained.

NAME / LOCATION	MFR POINTS	MFR RANGE	MFR MEDIAN	MFR AVERAGE
Portland 1 Core	9	16.5 – 24.5	20.6	20.6
Rebecca Bounds 1 Core	53	10.1 - 28.1	14.7	15.8
Lake Pueblo State Park Outcrop	17	20.8 - 52.5	29.8	29.5
Pueblo Nature Center Outcrop	22	15.8 - 42.5	26.2	26.9
Walsenburg Outcrop	1	n/a	19.4	19.4

A cross-plot of MFR and Si/Al can be used demonstrate the presence of mixed felsic, mafic and ultramafic sources. Anderson (1995) demonstrated that the MFR and Si/Al from Taconic foreland was more mafic as compared to the Blountian foreland (Figure: 6.1), and concluded that stratigraphic changes in the shale composition reflected a tectonic evolution of the source terrain and differing amounts of mafic magmatic-arc-derived sediment. The data used for this analysis presents two trends within the MFR and Al/Si ratio, similar to that of Andersen (1995). Trend 1 calculated an average MFR greater than 20, which includes the Portland core, Pueblo Nature Center outcrop and Lake Pueblo State Park outcrop. The Walsenburg outcrop was excluded due to insufficient data, but based on its single data point, it could be grouped with Trend 1.This trend of three locations represents a more mafic composition. Trend 2 calculated an average MFR of nearly 15, and is only represented by the Rebecca Bounds 1 core. This trend represents a more felsic composition (Figure: 6.2).

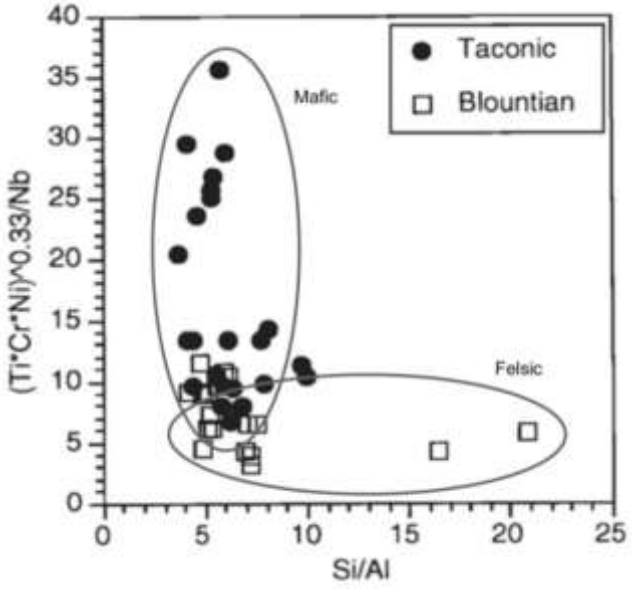


Figure 6.1: Mafic to felsic ratio (MFR) versus Si/Al for the Taconic and Blountian foreland basins (Andersen, 1995).

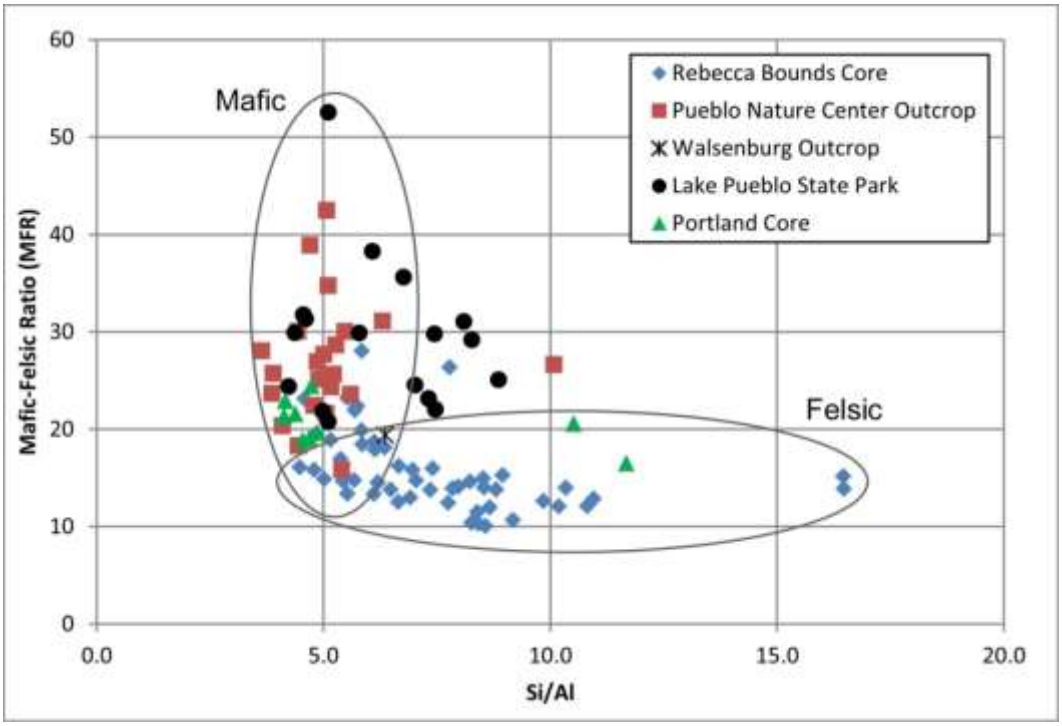


Figure 6.2: Mafic to felsic ratio (MFR) versus Si/Al for the Blue Hill Shale and lower Codell Sandstone.

MFR versus depth can indicate stratigraphic changes in mafic and felsic indicators. When plotted for the four main locations, a distinct trend occurs in the Rebecca Bounds 1 core (Figure: 6.3). Unlike the three locations that are further to the west, the Rebecca Bounds 1 not only plots more felsic overall, it also shows a distinct trend where the Blue Hill Shale plots significantly more mafic (average near 20), similar to the three western locations, and then shifts to more felsic with the transition to the lower Codell Sandstone (average < 15).

In addition to MFR versus Si/Al and MFR versus depth, trends were also noticed in Cr/Nb and Ni/Nb when plotted against Ti/Nb (Figures: 6.4; 6.5). Niobium can be used as a normalizing denominator, since it is more felsic relative to the more mafic chromium, nickel and titanium. In both cross-plots the data from the Rebecca Bounds

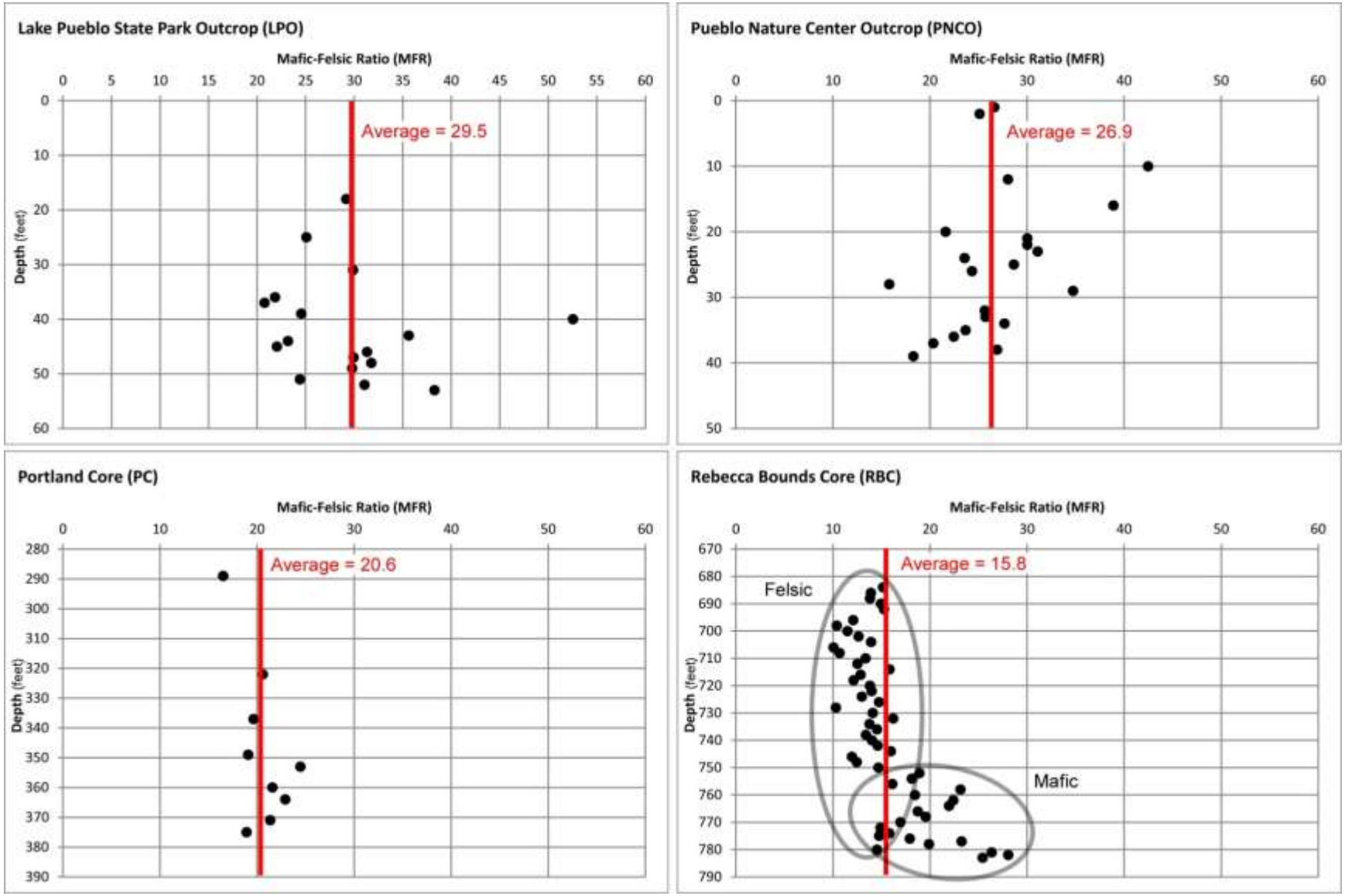


Figure 6.3: Mafic to felsic ratio (MFR) versus depth for the Blue Hill Shale and lower Codell Sandstone.

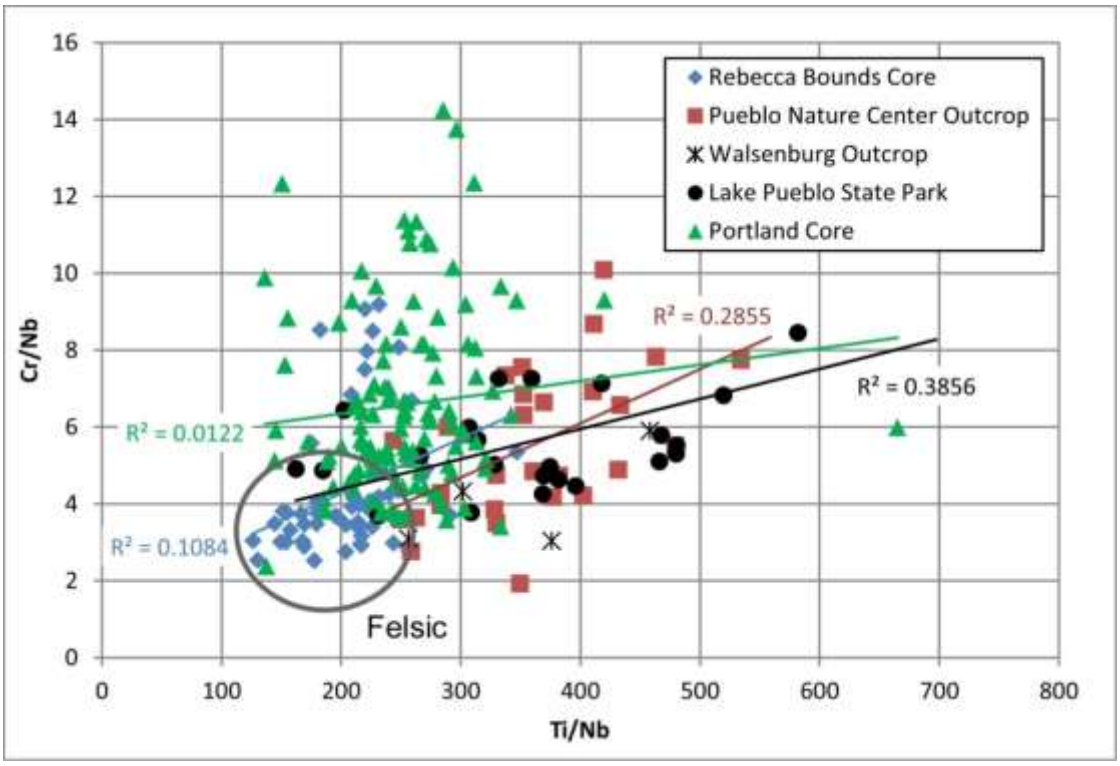


Figure 6.4: Cr/Nb versus Ti/Nb for the Blue Hill Shale and lower Codell Sandstone.

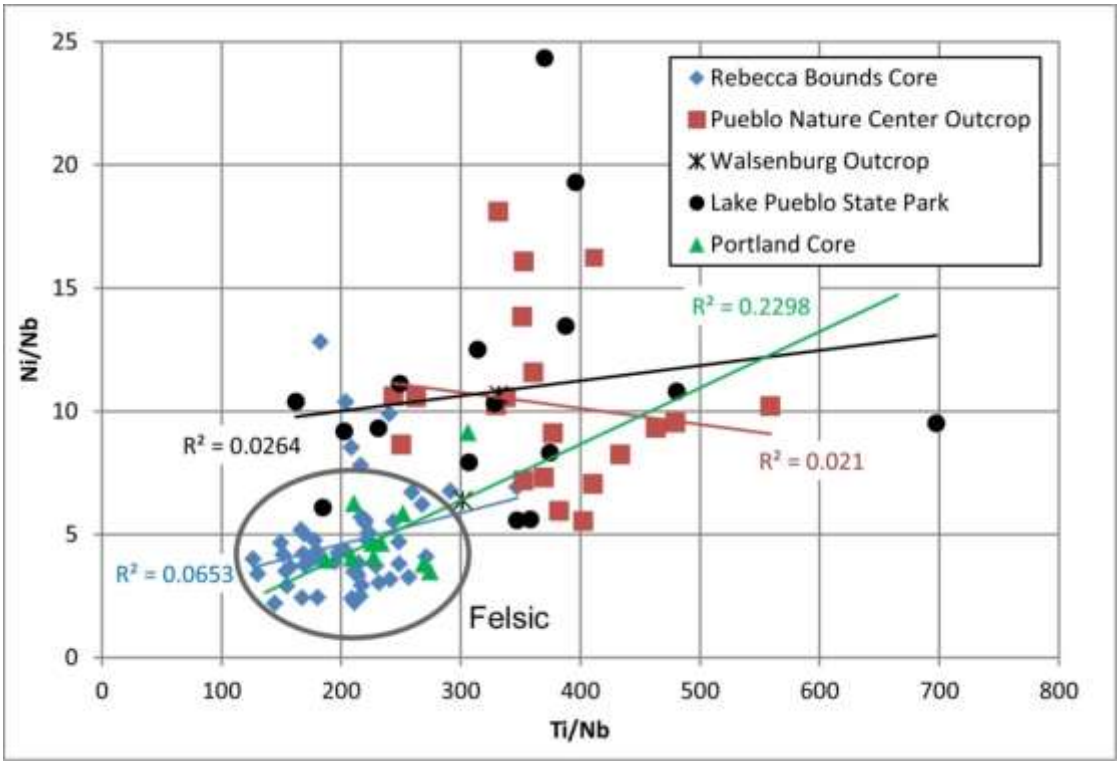


Figure 6.5: Ni/Nb versus Ti/Nb for the Blue Hill Shale and lower Codell Sandstone.

core plotted lower in the more mafic components and higher in the more felsic than the other three western locations. While the highest correlation coefficient (R^2) for all of these trends was low, less than 0.38 for Cr/Nb versus Ti/Nb, and less than 0.22 for Ni/Nb versus Ti/Nb, the data for each location did plot in suitable clusters, given the variability of the XRF data. General trends indicate that the Rebecca Bounds 1 is more felsic in overall composition.

6.4 Provenance Summary

The analysis performed by Andresen (1995) showed that within the Appalachian Blountian and Taconic foreland basins changes occurred in the composition and mixture of sediments being eroded from the outer-arc and magmatic-arc terrains of the colliding arc system. Changes in composition do not always reflect changes over time within the same sediment provenance from the same region or geologic terrain. Changes can also be inferred to represent changes in sediment contribution from different terrains. It is this concept that may support the application of this analysis to the WIC seaway, even though the geologic ages and formation of the foreland basins may not be analogous. Regardless of the geologic differences, the behavior of the elements chromium, nickel and titanium can still be used to represent a more mafic proxy, and are inferred to be a different, potentially more western sediment source. Niobium can therefore be used as a proxy for a potentially more felsic source of eroded Paleozoic sediments from the stable eastern craton. Kauffman (1977) and Kauffman and Caldwell (1993) documented that the Cretaceous was a period of extensive volcanism with intrusions and uplifts from the western Sevier Orogeny within the Eastern Great basin. Ash beds are commonly preserved in marine facies and while their

use as chronostratigraphic markers is important, their existence and abundance, particularly in the middle Albian through the Turonian are an indication that any western derived sediment would comparatively be more mafic than any eastern sediment derived from the Paleozoic craton.

Wallace (1975) completed an outcrop-based petrographic and depositional environment analysis of the Codell Sandstone in central and western Kansas. Based on the presence of angular quartz grains, chert grains and angular lithic clasts of limestone, siltstone and shale, he concluded the Codell Sandstone in Kansas was deposited in a near-shore marine environment that was sourced from the eastern eroded Paleozoic craton of the central United States.

The Rebecca Bounds 1 core is the furthest east within the AOI and west of the research conducted by Wallace (1975). Based on the felsic composition of the data, the stable eastern craton on the eastern edge of the seaway may have supplied more sediment to this location as compared to the three locations further to the west near Pueblo. While one data point is rarely sufficient enough to represent a trend, it may provide enough evidence to suggest that during the final stages of the late Turonian regression (R6) (Kauffman 1977a) an eastern shoreline was proximal enough to the Rebecca Bounds 1 core location to supply enough felsic sediment to affect the bulk composition of the upper Blue Hill Shale and Codell Sandstone. The implications of this data on the Late Turonian paleogeography will be discussed further in Chapter 7.

CHAPTER 7

DEPOSTIONAL ENVIRONMENTS AND PALEOGEOGRAPHY

7.1 Cretaceous Interior Seaway

The upper Cretaceous strata of the WIC have been recognized as a cyclic sequence of intertonguing marine and non-marine facies, deposited in and marginal to a Cretaceous seaway. According to Kauffman (1969), the Greenhorn Cycle initiated with the transgressive deposits of the Dakota Group. Transgression continued and reached its maximum extent during the Greenhorn Formation with the deposition of the Bridge Creek Limestone. The final regression (R6) (Kauffman, 1977a) concluded with the deposition of the Codell Sandstone.

7.2 Blue Hill Shale

The lower Blue Hill Shale (Facies BHS-1) consists of black to dark-grey, very fine grained, well-laminated mudstone and shale with pyrite and an overall lack of bioturbation. Combine this with no preserved sedimentary structures and deposition was mostly likely within a reducing and restricted, offshore to outer shelf, marine environment, well below both storm- and fair-weather wave base.

The upper Blue Hill Shale (Facies BHS-2 and BHS-3) is coarser with a larger grain size and an increase in silt, with recognizable and vertically increasing bioturbation. There are few preserved sedimentary structures, and no significant evidence of periodic storm influence, which places these facies, and the Blue Hill Shale in general, below storm- and fair-weather wave base. The upper Blue Hill, displays shallowing upward cycles of facies BHS-2 to BHS-3 which are difficult to recognize, but may correlate updip to a prograding Codell Sandstone shoreline. This is not conclusive

however as mapping of these smaller intervals was not done extensively and there was not enough resolvable well data to correlate and support lateral continuity.

7.3 Codell Sandstone

In many ways the data compiled in this study is consistent with the previous work of Weimer (1960), Kauffman (1969), Krutak (1970), Reisser (1976), Pinel (1977) Aulia (1982), McLane (1983), and many others for the Codell Sandstone. The described "sheet-like" distribution of the Codell Sandstone has been interpreted by many to support a marine-shelf, or bar-shelf sand deposition set forth by Potter (1967). These characteristics also include mineralogic maturity, good sorting and roundness, abundant crossbedding, bioturbation and the presence of detrital carbonate skeletal debris and Collophane (Reisser, 1976). McLane (1983) supported shallow, low-energy microtidal, coastal marine environments with northeast-trending sand bodies and shorelines.

The characteristics of the Codell Sandstone may share similarities to Potter's model and interpretation for the Campanian sandstones of the Pierre Shale, but this does not mean that the presence of these characteristics is diagnostic to that interpretation alone. Several depositional environments can contain many of the characteristics described in the Codell Sandstone. This author questions the interpreted “sheet-like” and “linear bar” form distribution of the Codell Sandstone in northeast-trending shoreline sand bodies. Based on outcrop, core and especially subsurface correlations presented in Chapter 5, the Codell Sandstone does not exhibit these trends in distribution, or rather preservation, throughout southeast Colorado. The region does contain areas of localized, somewhat equal thicknesses, but removal of the Codell Sandstone has created a depositional remnant that is not linear or predictable in

preservation. In general the erosion and removal of the Codell Sandstone and down into the Carlile Shale does increase to the east as presented by Laferriere and Hattin (1989), but it is not regionally uniform. The oversight in recognition of the significant erosion and removal of the Codell Sandstone, and therefore interpretations based on present-day preserved sand-body thicknesses, may have led previous authors to depositional interpretations that were not accurate for the Codell Sandstone. The discontinuous nature of the remaining sand-bodies should not be interpreted as primary trends representative of the environment at the time of deposition; rather as depositional remnants.

The Lower Codell Sandstone (facies CDL-1 and CDL-2) consists of fine-grained, heavily bioturbated to laminated siltstone and sandstone and interbedded mudstone, with open marine ichnofacies, deposited at or below fair-weather wave base, yet still shallow enough to be periodically exposed to and reworked by storm deposits and storm-weather wave base. Most of the preserved sedimentary structures are HCS and symmetrical ripples from oscillatory wave energy with little outcrop evidence of current derived transport and deposition. Erosion and truncation of the lenticular beds is common, and the laminated to often tabular and massive siltstone and sandstone was deposited rapidly, as evident from the cycles of massive to planar bedded and dominantly horizontal burrows that occur in the mudstone and siltstone, but not in the more tabular sandstone. The upper Codell Sandstone (facies CDL-2 and CDL-3) consists of fine- to medium-grained bioturbated massive and planar to low-angle siltstone and sandstone, with open marine ichnofacies, that was deposited in cycles of gradual to rapid deposition as evident from escape structures, planar to low angle

sedimentary structures and repeating truncated sequences of upward increasing bioturbation. The only preserved paleocurrent data indicates a southern flow at the time of preservation and these observations are supported by the previous data supplied by Aulia (1984) and Pinel (1977). The upper Codell Sandstone was deposited in a lower shoreface to possibly lowermost upper shoreface setting, low to mid-shelf, proximal to storm deposits and was periodically affected by shelf or geostrophic currents from the north.

There is no remaining evidence within the preserved Codell Sandstone in southeast Colorado to support deposition in a "classic" prograding upper shoreface or foreshore setting. Trough cross-bedding is absent to rare and when present it is very thin. There is no evidence of seaward-inclined laminae, no associated fluvial, floodplain or lagoonal facies and no foreshore or littoral environment as interpreted by Pinel (1977) or McLane (1982). The lack of evidence for these environments does not however conclusively support that they were not originally deposited as part of the original facies succession within the upper Codell Sandstone. Erosion of the upper Codell Sandstone, prior to and during deposition of the Juana Lopez and Fort Hays Limestone could have removed these facies and all evidence of their depositional environments and shelf to shoreline sequence. Furthermore, the base of the Codell Sandstone is sometimes a sharp, or scoured surface with the underlying upper Blue Hill Shale, yet in some areas it is gradational. In a low gradient shelf or ramp setting, lowstand shorelines will undergo major seaward translation as a consequence of a drop in relative sea level. With an ensuing transgression, these sharp-based shorelines would become encased in muds deposited in a shelf or offshore environment, potentially several miles removed, and

isolated from preserved shorelines (Plint, 1988). If the coeval upper shoreface, foreshore and associated alluvial plain deposits were thin as a consequence of sediment bypass, low accommodation or ravinement then the subsequent transgression could erode and remove any evidence of these shorelines and alluvial plain deposits.

7.4 Juana Lopez

The variable lithology, extensive bioturbation and sporadic preservation of the Juana Lopez make depositional interpretations difficult. Krutak (1970), Pinel (1977) and (Aulia 1982) and Reisser (1976) all support a high-energy, current swept shallow marine to inter-tidal environments, similar to winnowed shelf carbonates and sand environments present today. Most recognized the basal erosional surface and thin natured limestones with abundant shell material and suggested that it be regarded as a shallow marine palimpsest deposit. The lower calcareous conglomerate to sandstone (JL-1) represents the basal transgressive lag of the Niobrara cycle and the upper inoceramid grainstone (JL-2) a winnowed shallow marine setting with low-sedimentation rates as an "omission surface".

The Juana Lopez contains little to no mud and a significant amount of coarse, angular and disseminated shell fragments with lithic and monomineralic fragments from the underlying Codell Sandstone. While this supports a shallow, high energy current swept environment, it also supports a sediment starved system. The grainstones within the Juana Lopez may reflect periods of significant shallow marine sediment winnowing and washing in what would ultimately be deposited as a condensed section of nothing more than broken inoceramids and other localized fragments - the only "sediment" available at the time. To further complicate the issue, the Juana Lopez is unconformably

overlain by the Fort Hays Limestone, which many consider to be a deep water limestone deposited in the transgressive to highstand systems tracts during the seaward invasion of the Niobrara cyclothem, yet the only preserved evidence from the initial transgression of the Niobrara sequence is within the Juana Lopez itself. In some instances (locations: PCO and VRO) large clasts of the Juana Lopez appear to be "floating" in a matrix of pervasively bioturbated Fort Hays Limestone mud. The casts all appear to be in-situ as there is no evidence of any transport. The large, angular clasts are broken in such a pattern to suggest desiccation from subaerial exposure, but there is no conclusive evidence to support such exposure. For these clasts to form and retain their angularity and present-day orientation, the Juana Lopez must have been partially lithified prior to the deposition of the Fort Hays. This surface and the mélange of lithologies as a *Glossifungites* assemblage suggest long periods of time with little to no sedimentation.

7.5 Late Turonian Paleogeography

Existing work on the paleogeography and distribution of facies and depositional settings within the WIC is plentiful, especially the middle to late Turonian: (Lowman, 1977; Cobban and Hook, 1979, Aulia, 1982; Merewether and Cobban, 1986; and Laferriere and Hattin, 1989). Paleogeographic reconstructions of facies within the upper Blue Hill Shale and Codell Sandstone based on *Collignoniceras woolgari* and *Prionocyclus hyatti* from (Lowman 1977, Aulia, 1982 and Merewether and Cobban 1986) and data presented here can be found in Figure 7.2. This diagram illustrates the remoteness of the shoreline in western Utah. The equivalent Ferron Formation is about 350 miles to the west and inferred to be surrounded by marine shale to the east.

However a lack of correlative units in central and western Colorado makes analysis difficult. Equivalent units of the Frontier Formation in southwestern Wyoming share a similar remoteness and lack of correlative units in northern and north-central Colorado. While some of the previous work on the Codell Sandstones infers a direct western source in southeast Colorado (Reisser, 1976, Pinel 1977, Aulia 1982, and Laferriere and Hattin 1989), there is little evidence to support this connection and considering the significant distance of correlative shorelines in Utah and the western position of the basin foredeep, sediment transport from the west seems unlikely. In addition, there are time equivalent offshore mudstones for 100-200 miles west of the AOI towards northern New Mexico and eastern Utah.

A northern source from western and south-central Wyoming in the equivalent Emigrant Gap Member of the Frontier formation delta system has potential merit given the sparse, north to south, paleocurrent data and slightly closer proximity to southeast Colorado. However, the position of the transcontinental arch and other northeast trending topographic highs, in central and north-central Colorado may have obstructed significant north to south distal delta sediment transport. Furthermore, the Codell Sandstone is not an isolated current-derived shelf sand, it is a depositional remnant of a shoreface deposit with no remaining shoreline connection that was only reworked by and subjected to event deposition by geostrophic currents.

Evidence for a dominant sediment transport direction within the upper Codell Sandstone is a mixture of cross-bedding and symmetrical and asymmetrical wave ripples, during the final stages, approaching maximum regression and probably the most shallow water depths (Pinel, 1977 and Aulia, 1982). All existing cross-bedded

paleocurrent data in the Codell Sandstone supports a dominantly southeast direction, but there is a strong east to west component within the symmetrical wave ripples and more importantly an eastward component in the asymmetrical wave ripples.

The Colorado Springs area, Brush Hollow and Beaver Creek anticlines have the best preservation of paleocurrent data within the Juana Lopez (Krutak, 1970, Pinel 1997, and Aulia, 1982). Both Pinel (1977) Aulia (1982) concluded that the dominant preserved transport direction was from south to north, opposite to the Codell Sandstone, but Aulia (1982) failed to elaborate on the secondary set of west and east symmetrical wave ripples, with a strong easterly compounded, that could have been deposited by waves swallowing towards a shoreline. These secondary populations occur in both the Codell Sandstone and Juana Lopez (Figure: 7.1), yet none of the previous work elaborated on their possible significance.

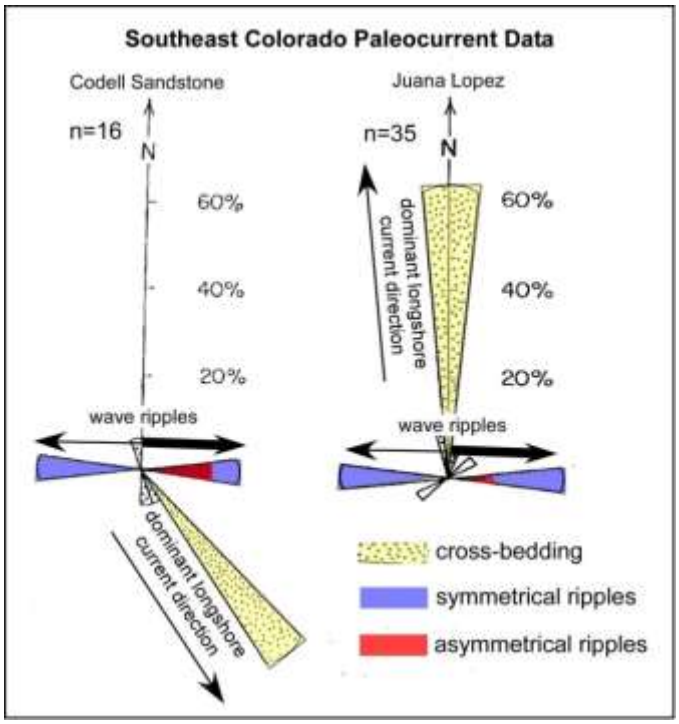


Figure 7.1: Southeast Colorado paleocurrent data (Aulia, 1982).

Another possible interpretation for a potential shoreline connection and additional sediment source for the Codell Sandstone in southeast Colorado may exist in central Kansas. Wallace (1975) depicted a vertical coarsening sequence of barrier-beach and barrier-bar environments with the presence of tidal channels in central Kansas sourced from the stable eastern craton that prograded to the west. He concluded from petrographic samples that detrital chert and other lithic fragments all increased from the southwest to the northeast towards their provenance.

The eastern platform of the WIC seaway has long been thought to be a broad low angle, relatively stable and flat platform that supplied little sediment to the seaway (Kauffman, 1969; Pollastro 1992). Given this low angle configuration, the eastern platform would have had very low accommodation with relatively no space for significant vertical sediment accumulation. Relatively minor decreases in sea level would have created significant lateral westward migration and progradation of a very thin shoreline. This configuration could also explain why there is no preserved upper shoreface, foreshore and contributing alluvial sequence in southeast Colorado. Erosion and removal of the evidence would have occurred in three stages. The first stage initiated with the conclusion of the Codell Sandstone which resulted in a pause in sedimentation and significant biological reworking and subaqueous removal along topographic features. The second stage initiated with the high-energy Juana Lopez transgression that further eroded and re-deposited sediment from the underlying Codell Sandstone. As this shallow winnowing continued, all fine-grained sediment was eventually removed from the system, and deposition of the grainstones commenced. The third and final stage was the eventual deepening and deposition of the Fort Hays Limestone, which

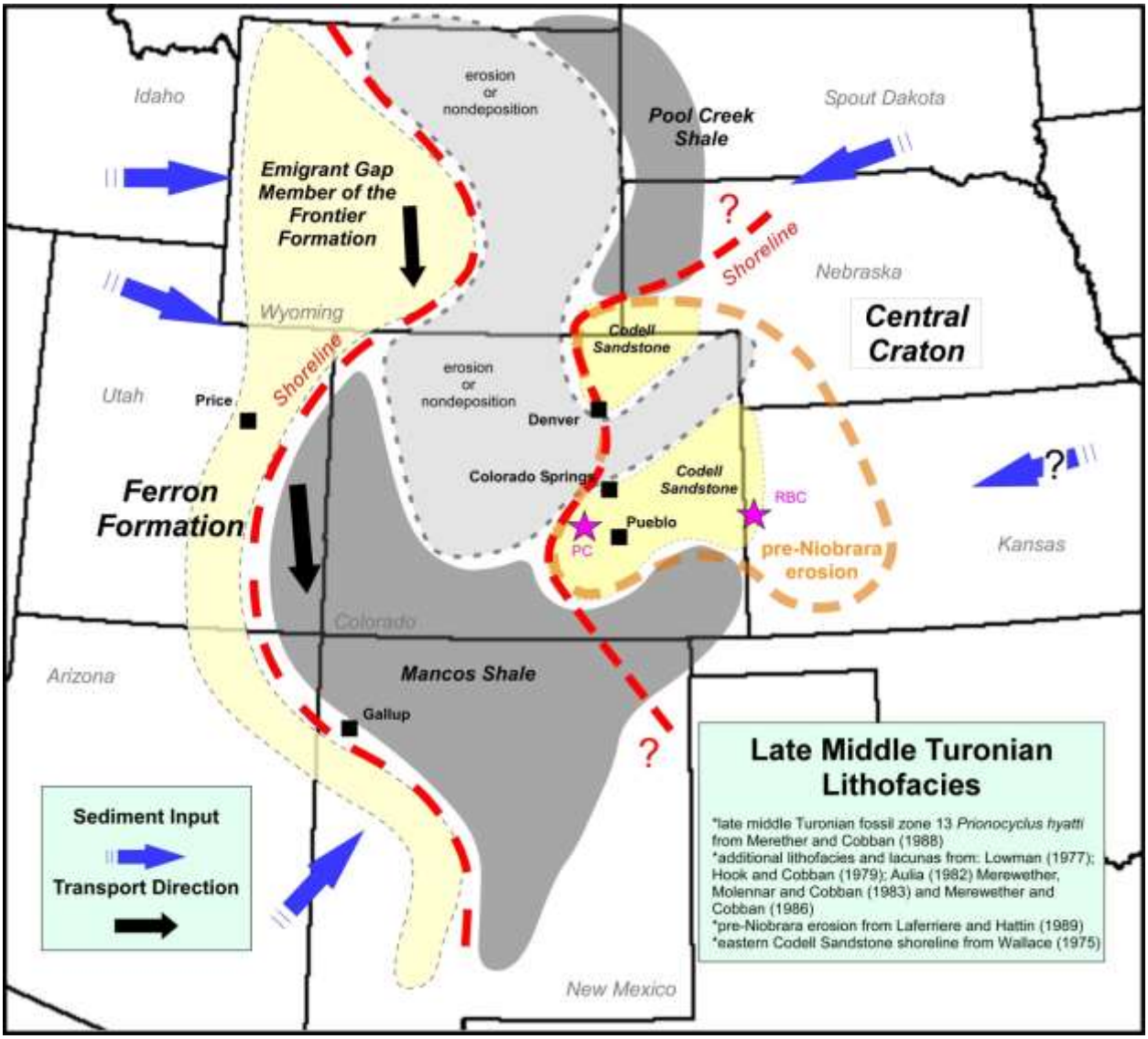


Figure 7.2: Paleogeography of the late middle Turonian, zone *Prionocyclus hyatti.* (edited from Wallace, 1975; Lowman, 1977; Hook and Cobban, 1979; Aulia, 1982; Merewether, Molenaar and Cobban, 1983; Merewether and Cobban, 1986 and Laferriere and Hattin, 1989).

continued significant biological reworking and erosion of the Juana Lopez and Codell Sandstone.

CHAPTER 8

CONCLUSIONS

1) The Codell Sandstone Member of the Carlile Shale is a fine- to medium-grained, mineralogically mature, bioturbated to planar and cross-bedded siltstone and sandstone that was deposited in a shoreface environment, under normal marine conditions, during the final stages of the Greenhorn regression.

2) Evidence presented here supports a lowstand prograding shoreline sequence with present-day preservation of the shelf to lower shoreface transition. Upper shoreface, foreshore and alluvial deposits were eroded or top-truncated before and during the Juana Lopez transgression.

3) Significant erosion and removal of the upper Codell Sandstone in the form of several subaqueous unconformities created a depositional remnant with present-day preservation that does not reflect primary distribution at the time of deposition. No evidence exists, or remains, to support subaerial exposure.

4) Isopach mapping illustrates that Laramide and pre-Laramide structures and topographic features were active and influential during and after deposition of the Codell Sandstone and were one controlling factor in the erosion and removal of the upper Codell Sandstone.

5) The Juana Lopez Member of the Carlile Shale in southeast Colorado is a coarse-grained detrital and fossil fragment calcareous sandstone and inoceramid grainstone that was deposited in a sediment-starved, high-energy, current swept, winnowed, shallow marine environment that reflects the basal transgressive sequence of the Niobrara cyclothem.

6) Transgression and the initiation of the Niobrara cyclothem and the deposition of the basal Juana Lopez member created a transgressive surface of erosion that aided in erosion and removal of the upper Codell Sandstone.

7) Outcrop and core analysis indicates a significant break in sedimentation in the form of a *Glossifungites* assemblage at the conclusion of the Codell Sandstone and the contact with the Juana Lopez that reflects a regional unconformity. A similar assemblage and unconformity exists between the Juana Lopez and overlying Fort Hays Limestone Member of the Niobrara formation.

8) Elemental geochemistry data and the use of mafic to felsic ratios (MRF) suggests that the eastern portion of the AOI has a greater felsic composition and is interpreted to reflect an eastern shoreline and provenance for Codell Sandstone sediment, probably from eroded Paleozoic sediments of the central craton.

9) Paleogeographic reconstructions, combined with basin geometries, interpretations of depositional settings and conclusions from elemental geochemistry and the use of new and existing paleocurrent data suggest that that during the deposition of the Codell Sandstone, significant longshore or geostrophic currents carried sediment from the north to the south, parallel to an eastern shoreline in Kansas. During deposition of the Juana Lopez member, transgression occurred from south to north creating a south to north current transport that may have paralleled the pre-existing eastern Codell Sandstone shoreline.

FUTURE WORK

1) Incorporate more outcrops within the AOI and the greater Rocky Mountain region. While all of the outcrops that were originally analyzed by Krutak (1970), McLane (1982), Reisser (1976), Pinel (1977), Aulia (1982), and others are no longer accessible. Additional outcrops that are still accessible should be re-measured and re-correlated. This does not only apply to southeast Colorado. Outcrops on the eastern flank of the Raton basin in northern New Mexico, far eastern Colorado and western Kansas, and outcrops further west in the South Park and North Park basins and north in southern Wyoming should be incorporated. More outcrop-based evidence for a potential eastern influence for the Codell Sandstone may exist in Kansas.

2) Detail well log and subsurface facies analysis. With proper funding and support, mainly in the form of digital data, it may be possible to divide and regionally correlate the Juana Lopez in the subsurface from southeast Colorado to the west. Furthermore, greater subdivision within the lower and upper Codell Sandstone is possible, but this can only be done with enough digital LAS data.

3) Additional XRF geochemistry data from more outcrop locations and especially cores throughout the basin. The conclusions presented in this work on the potential eastern shoreline and contribution from an eastern sediment source, based in part on mafic to felsic ratios, needs support from other locations within the Denver basin. Additional data may help in determining if the analysis itself, originally presented by Anderson (1995), is truly applicable to the Cretaceous Interior Seaway.

4) Detailed regional petrographic and diagenesis analysis of the upper Codell Sandstone and Juana Lopez member of the Carlile Shale. There are zones within the

upper Codell Sandstone where calcite cement varies greatly from absent to pervasive, yet no trends seem apparent in vertical and lateral distribution. A better understanding of the cause, timing and types of these cements is not only important for this region, but other basins within the Rocky Mountains containing similar stratigraphic intervals, especially for future oil and gas exploration. The work done by Reisser (1976) focused on southeast Colorado and while the conclusions presented were in alignment with this research, more analysis is needed to incorporate regional distribution.

5) Integration of seismic. In gathering information for this research, one seismic line was discovered. The line is a concatenated of several smaller lines that begins south of Canon City and runs east well into the Denver basin. A paper copy of the data was observed and the data quality is excellent. It was previously analyzed by Brown (1978) and while the emphasis was on pre-Pennsylvanian influences on the stratigraphy of the Fountain Formation, the data does include and clearly resolves shallower Cretaceous intervals, and should be studied in detail for timing and distribution of regional faulting.

6) XRF data in the Fort Hays Limestone could be a very useful tool for detailed chemostratigraphic analysis. While not conducted in this research, it may be possible to analyze and therefore "type" based on XRF response, major fine-grained mudstone, siltstone and bentonite beds within the Fort Hays and create regional correlations between locations. Given the responses in data seen here, it may be possible to isolate particular bentonite beds geochemically and distinguish them stratigraphically.

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APPENDIX A: CORE AND OUTCROP INFORMATION

1 (PC) - USGS Portland 1

API: N/A, CRC Library Number: E006

Location: Latitude / Longitude: 38.3766 / -105.0216

Congressional: NW SE SE of S20, T19S, RT18S-R42W68W

Fremont County, Colorado

Comments: Contact the USGS Core Research Center to view

2 (RBC) - Amoco Rebecca Bounds 1

API: 15071204460000; CRC Library Number: E099

Location: Latitude / Longitude: 38.4895 / - 101.9742

Congressional: NE SE NE of S17, T18S, R42W

Greeley County, Kansas

Comments: Contact the USGS Core Research Center to view.

3 (DCO) - Deadman's Curve Outcrop

Location: Highway 115 roughly 12 miles south of Colorado Springs.

Latitude / Longitude: 38.6736 / -104.8520

Congressional: NW of S11-T16S-R67W

El Paso County, Colorado

Comments: Outcrop is on the west side of Highway 115, south of Colorado Springs, access is from the south.

4 (LPO) - Lake Pueblo State Park Outcrop

Location: North end of the reservoir off Juniper Road.

Latitude / Longitude: 38.2802 / -104.7395

Congressional: SE NE of S26-T20S-R66W

Pueblo County, Colorado

Comments: Three outcrops are accessible near Juniper road and the Juniper campgrounds on the north side of the lake.

5 (PCO) - Peck Creek Outcrop

Location: Highway 200 roughly 4 miles south of intersection with Highway 96.

Latitude / Longitude: 38.2031 / -104.8975

Congressional: SW of S21-T21S-67W

Pueblo County, Colorado

Comments: Private Property. Contact Gilmore Family to access outcrops.

6 (PNCO) - Pueblo Nature Center Outcrop

Location: Honor Farm Road roughly 3/4 of a mile east of main parking lot.

Latitude / Longitude: 38.2676 / -104.6951

Congressional: SW NW of S32-T20S-R65W

Pueblo County, Colorado

Comments: Follow walking path west from parking for one mile.

7 (VRO) - Verde Road Outcrop

Location: 10 miles south of Pueblo, exit road 337, follow south on to Verde Road.

Latitude / Longitude: 38.0734 / -104.6568

Congressional: NW of S9-T23S-R65W

Pueblo County, Colorado

Comments: Private Property. Contact Reno Family to access outcrops.

8 (WO) - Walsenburg Outcrop

Location: Highway 69 roughly 15 miles west of Walsenburg, near Bandito.

Latitude / Longitude: 37.7246 / -105.0126

Congressional: SE of S4-T27S-R68W

Huerfano County, CO

Comments: Outcrop is near intersection of Hwy 69 and Rd 520 on south side.

9 (RFPO) – B.F. Rockafellow Park Outcrop

Location: Temple Canyon Road (County Road 3), 2 miles south of Cañon City.

Latitude / Longitude: 38.4146 / -105.2685

Congressional: SW of S7-T19S-R70W

Fremont County, Colorado

Comments: Park in designated parking area and walk directly west down into drainage, turn south and follow drainage past Bridge Creek Limestone outcrop.

10 (BCO) – Beaver Creek Outcrop

Location: Highway 50, 17 miles east of Cañon City and 20 miles west of Pueblo.

Latitude / Longitude: 38.3758 / -104.9472

Congressional: S1/2 of S24-T19S-R68W

Fremont County, Colorado

Comments: Highway road cut, east of Old Portland Road. Access from the west of the outcrop on the east bound side of the highway.

11 (RHNO) – Rock Hill North Outcrop

Location: Highway 78 roughly 12 miles southwest of Pueblo.

Latitude / Longitude: 38.1394 / -104.8164

Congressional: NE of S18-T22S-R66W

Pueblo County, Colorado

Comments: Outcrop is on west side of the road, park on the east side.

12 (SAO) – Sanders Arroyo Outcrop

Location: Highway 10 roughly 35 miles northeast of Walsenburg.

Latitude / Longitude: 37.8521 / -104.1948

Congressional: NE of S26-T25S-R61W

Pueblo County, Colorado

Comments: Private Property. Contact owner to access outcrops (good luck).

APPENDIX B: WELL INFORMATION

UWI / API	Operator	Well Label	T	R	S
PORTLAND 1	USGS	PORTLAND 1 CORE	19S	68W	20
050010505000	ROUSE JACK	MCVEY 1	3S	65W	17
050010509800	ROUSE JACK	BOX-ELDER 2	3S	66W	1
050010542900	HUNT OIL CO	KOCH 1	1S	68W	34
050010620200	GREAT WESTERN OIL & GAS	HARTNAGLE 1	2S	64W	2
050010631100	ANSCHUTZ CORP	STATE 93 1	3S	64W	16
050010631200	ANSCHUTZ CORP	KING RANCH 1	3S	65W	21
050010637400	DIAMOND OPERATING	STATE-P 3	1S	65W	36
050010638300	DIAMOND OPERATING	STATE OF COLORADO-P 4	1S	65W	36
050010646200	MCCARTNEY ENGINEERING INC	COLORADO A-B 2	2S	66W	16
050010646300	CITY AND COUNTY OF DENVER	BOX ELDER A 1	2S	66W	12
050010647900	PAINE JOE JC & ASSOC	BOX ELDER FARMS CO 1	3S	65W	6
050010648100	AMOCO PROD CO	CHAMPLIN 125 AMOCOC 1	2S	66W	23
050010649400	RUTH ULA PEARL	RUTH 3	3S	64W	21
050010650400	AMOCO PROD CO	CHAMPLIN 117 AMOCOD 1	2S	66W	9
050010652700	NOBLE ENERGY INC	CHAMPLIN-78-A 1	1S	65W	35
050010653100	AMOCO PROD CO	EMMA E MCVAY 1	3S	65W	29
050010653600	AMOCO PROD CO	FLADER INDUSTRIES-B 1	3S	65W	34
050010655000	AMOCO PROD CO	CHAMPLIN 80 AMOCO-A 1	3S	66W	20
050010656900	CHANDLER & ASSOC INC	GRIMM 16-25	3S	66W	25
050010659500	MARTY BROTHERS	MARTY BROTHERS 1	2S	67W	21
050010662600	ENCANA OIL & GAS (USA) INC	MARTIN 1	1S	65W	25
050010664700	BEAVER MESA EXPL	WAGNER 14-12	1S	65W	12
050010665200	SOVEREIGN ENERGY LLC	BOX ELDER /G/ 2	2S	65W	24
050010665500	RENEGADE OIL & GAS	CHAMPLIN 75 AMOCO-C 1	2S	64W	19
050010668400	SOVEREIGN ENERGY LLC	BOX ELDER-H 1	1S	65W	31
050010670500	BARRETT BILL CORP	EDAN STATE 1	2S	65W	36
050010671100	BOBCAT OIL CO	EVERINGIM 1	3S	64W	20
050010671700	BARRETT BILL CORP	MORAN 1	2S	64W	30
050010673200	CITY AND COUNTY OF DENVER	BOX ELDER-J 1	1S	65W	32
050010673500	BARRETT BILL CORP	ROSENBROCK 1	1S	65W	30
050010674100	BOBCAT OIL CO	DAVIDSON 1	3S	66W	14
050010674400	CITY AND COUNTY OF DENVER	C E SMITH 1	2S	64W	18
050010677300	BARRETT BILL CORP	CHAMPLIN-DANFORD 1	2S	64W	32
050010678200	CITY AND COUNTY OF DENVER	BOX ELDER K 1	2S	65W	6
050010678500	RENEGADE OIL & GAS	PUGH 20-7	2S	64W	20
050010688100	NOBLE ENERGY INC	CHAMPLIN BOX ELDER 1	1S	65W	35
050010688400	TEXON OIL & GAS LLC	BOX ELDER FARMS 2	2S	66W	1
050010689500	WEBB RESOURCES INC	JEFF DROHAN 23-1	3S	65W	23
050010694700	KAISER-FRANCIS OIL	MARTIN 11-25	1S	65W	25
050010694800	ENCANA OIL & GAS (USA) INC	OHD 1	2S	66W	6
050010695600	OVERLAND RESOURCES LIM	MUEGGE 6-1	3S	64W	6
050010695700	MGF OIL CORP	MATHEWS 41-26	1S	65W	26
050010696900	WEBB RESOURCES INC	JEFF DROHAN 14-1	3S	65W	14
050010699700	MGF OIL CORP	E JOHNSON 31-28	2S	64W	28
050010701200	KERR-MCGEE OIL & GAS LP	BOXELDER G 2	1S	65W	26
050010701300	WEBB RESOURCES INC	FLADER 13-1	3S	65W	13
050010704700	WEBB INC	DROHAN JEFF 2-C	3S	65W	2
050010709200	CUTLER BROTHERS	FREEMAN 1-A	1S	66W	31
050010709800	SUMMIT OIL CO ETAL	KUGEL A-1	2S	64W	12

UWI / API	Operator	Well Label	T	R	S
050010712500	SOVEREIGN ENERGY LLC	BOX ELDER M 1	1S	65W	34
050010717300	GRAYROCK CORP THE	STEELE 1	3S	64W	17
050010719200	HILCORP ENERGY	CHAMPLIN 75 AMOCO-G 1	2S	64W	29
050010719800	HILCORP ENERGY	UPRR 23 PAN AM-H 1	2S	64W	17
050010722200	RENEGADE OIL & GAS	CHMPLN 248 AMOCO-B 1	2S	64W	31
050010725100	O R M EXPLORATION	CHAMPLIN 75 AMOCO-I 1	2S	64W	21
050010730000	KAUFFMAN K P INC	UPRR 24 PAN AM-C 1	2S	64W	3
050010733200	HILCORP ENERGY	CHAMPLIN 75 AMOCO-J 1	2S	65W	25
050010733400	AMOCO PROD CO	BOX ELDER-H 1	1S	65W	27
050010734500	TRINITY ENERGY CORP	BOX ELDER I 1	2S	66W	26
050010739600	FAHEY OIL & GAS	BULLARD 2	2S	64W	24
050010740100	HILCORP ENERGY	UPRR 24 PAN AM E 1	2S	64W	15
050010744400	PAPES OILFIELD SERVICE	PILAND 1-12	3S	64W	12
050010746600	OVERLAND RESOURCES LIM	FARM RANCH EXPL 1	2S	64W	34
050010747600	RME PETROLEUM	MONAGHAN FARMS 1-A	3S	65W	5
050010751700	UNITED STATES EXPLORATION	80 TOWER INVESTMENT 1	2S	66W	27
050010760100	LIFESTYLE ENRGY CORP	DANFORD-CHAMPLIN 2-24	3S	64W	24
050010764200	SOHIO PETROLEUM CO	QUALLS 5-8	3S	64W	5
050010769900	MORGAN OIL CO INC	LARSON OSCAR 1	3S	64W	9
050010774000	THREE FORKS RESOURCES LLC	BULLARD 26-13	2S	64W	26
050010775900	SUNSET PRODUCING	BULLARD 5	3S	64W	2
050010781600	PETROLUM CRP OF AMER	BOX ELDER FARM 1-8	3S	65W	8
050010786700	NIGAS INC	MCHUGH 2	2S	66W	28
050010787000	SCHNEIDER ENERGY SERVICES	AMOCO-TUPPS 1-19	3S	64W	19
050010787600	OVERLAND RESOURCES LIM	LISCO 14-32	3S	64W	14
050010793100	MORMAC OIL & GAS CO	MUNDELL 43-14	2S	64W	14
050010794300	RME PETROLEUM	ATWATER 1	3S	64W	1
050010803800	FARM RANCH EXPL CORP	CARLSON 1	3S	64W	18
050010806800	CHAMPLIN PETRO CMPNY	LOPEZ-CHRISMAN 1	3S	64W	11
050010807300	HOOKS BROS OIL CO	MCCARTNEY 1	2S	66W	17
050010809700	RME PETROLEUM	STATE 42-36 1	2S	64W	36
050010810400	UNITED STATES EXPLORATION	TRUPP 32-35 2	2S	64W	35
050010823300	KAUFFMAN K P INC	CHMPLN 117 AMOCO-I 2	2S	66W	21
050010823900	DIAMONDBACK OIL CORP	LARSON 4-12	3S	64W	4
050010824900	RENEGADE OIL & GAS	CHMPLN 248 AMOCO-C 8	2S	64W	33
050010830600	ROCKY MTN PRODUCTION	WAGNER 22-13	1S	65W	13
050010834800	MCCARTNEY ENGINEERING INC	CUSTY 3	2S	66W	15
050010835000	CHANDLER & ASSOC INC	UPRR 15-7	3S	65W	7
050010835700	PILAND RESOURCES	PILAND 15-3	3S	64W	15
050010837600	PIKE PETROLEUM CORP	RADAR-UPRR 1	3S	64W	3
050010837900	ROCKY MTN PRODUCTION	UPRR-WAGNER J 33-25	2S	64W	25
050010842000	BASS ENTRPRS PROD CO	BASS LINNEBUR 12-31	3S	65W	12
050010842300	PIKE PETROLEUM CORP	AKREP-UPRR 248-1	3S	65W	1
050010844900	KAUFFMAN K P INC	RUEBEL ET AL 1-1	1S	65W	1
050010846000	SOHIO PETROLEUM CO	SOHIO CHAMPLIN 7-1	3S	64W	7
050010849800	ROCKY MTN PRODUCTION	UPRR STARK 13-23	2S	64W	23
050010851700	SOUTHWESTERN PROD CORP	GOOSE 1	1S	65W	34
050010853800	BASS ENTRPRS PROD CO	BASS BOX ELDER 10-24	3S	65W	10
050010854800	ROCK OIL CORP	GREMLIN 2	2S	65W	2
050010855200	GRIFFIN OIL & GAS CO	GOOSE-UPRR 12-35	1S	65W	35
050010872000	SOUTHWESTERN PROD CORP	GOOSE 2	1S	65W	34
050010873200	KAUFFMAN K P INC	RUEBEL ETAL 1-3	1S	65W	1
050010881800	CITY AND COUNTY OF DENVER	LIBERTY 1	3S	65W	11

UWI / API	Operator	Well Label	T	R	S
050010884300	MATRIX ENERGY LLC	BOXELDER 27-1	1S	65W	27
050010885000	MATRIX ENERGY LLC	BOXELDER 27-2	1S	65W	27
050010885400	MATRIX ENERGY LLC	BOX ELDER 28-1	1S	65W	28
050010901900	FOUNDATION ENERGY MANAG	NIES 6-1	2S	64W	6
050010902300	PDC ENERGY INC	MCKAY LAKE F UNIT 1	1S	68W	21
050010904600	ENERGY MINERALS CORP	BLACK DIAMOND A-1	2S	64W	11
050010905200	MERIT ENERGY	AMBUSH 23-22	2S	64W	22
050010907600	ROCKIES OIL & GAS INC	MOORE 2	2S	64W	9
050010907700	SOVEREIGN ENERGY LLC	AMBUSH 41-27	2S	64W	27
050010909600	RENEGADE OIL & GAS	LEONE HOSMER 4-11	2S	64W	4
050010911300	DIAMOND OPERATING	COLORADO STATE C 3	2S	64W	16
050010920000	KERR-MCGEE OIL & GAS LP	HSR WENZEL 6-29	1S	65W	29
050010921800	KERR-MCGEE OIL & GAS LP	HSR-HANSON 14-1	2S	65W	1
050010922000	ENERGY MINERALS CORP	HSR-HOSMER 8-5	2S	64W	5
050010922100	ENERGY MINERALS CORP	HSR-GREG 7-10	2S	64W	10
050010924100	KERR-MCGEE OIL & GAS LP	HSR-VAN SCHAACK 4-33	1S	65W	33
050010925000	KERR-MCGEE OIL & GAS LP	HSR-MILE HIGH 6-6	1S	65W	6
050010925400	KERR-MCGEE OIL & GAS LP	HSR-ACKARD 5-2	2S	66W	2
050010926100	MCCARTNEY ENGINEERING INC	HSR-FULENWIDER 6-10	2S	66W	10
050010927800	KERR-MCGEE OIL & GAS LP	HSR-VAN SCHAACK 13-33	1S	65W	33
050010930300	KERR-MCGEE OIL & GAS LP	HSR-VAN SCHAACK 6-11	2S	66W	11
050010930700	KERR-MCGEE OIL & GAS LP	HSR-TR RANCH 10-3	2S	66W	3
050010930900	HILCORP ENERGY	HSR-NAZARENUS 16-8	2S	64W	8
050010933500	NORTH AMERICAN RES	DANFORD CHAMPLIN 23-8	3S	64W	8
050010936900	MATRIX ENERGY LLC	BOXELDER 22-28	1S	65W	28
050010939500	NOBLE ENERGY INC	MUSTANG 33-24	1S	65W	24
050010940800	BARRETT BILL CORP	ROSENBROCK 2	1S	65W	30
050010941000	BARRETT BILL CORP	BOX ELDER H-3	1S	65W	31
050050500000	VAUGHEY & VAUGHEY II	JOLLY JAMES 1-B	5S	57W	35
050050500900	HAWKS JEFF	UPRR-JOLLY 2	5S	57W	27
050050620300	AMOCO PROD CO	FRANK M CAVANAUGH 1	4S	64W	8
050050630200	DAVIS OIL CO	MURPHY 1	4S	64W	25
050050632700	RENEGADE OIL & GAS	STATE 13-25	5S	65W	25
050050633700	BWAB INC	STATE 1-10	5S	65W	10
050050637700	GARY SAMUEL	AMOCO 13-16	4S	64W	13
050050639000	MORGAN OIL-RINCON OP	GRIMM-TINIANOW 1	4S	64W	34
050050640000	BASIC EARTH SCIENCE SYSTEMS	STATE 1	5S	65W	36
050050643100	RENEGADE OIL & GAS	PAR-STATE 28-1	5S	64W	28
050050645100	INTERCNTNTL ENR CORP	LOWRY 11-29	4S	64W	29
050050645900	CONTINENTAL ENERGY SERVICE	BYRNE 1	5S	65W	33
050050646300	GWR OPERATING	STATE 1-33	5S	64W	33
050050647400	PRIVATE OIL INDUSTRIES	ETTER 1-26	4S	64W	26
050050648900	GARY SAMUEL	HOULIHAN 24-13	4S	64W	24
050050649100	TRANS-TEXAS ENERGY	MURPHY 1-8	5S	65W	8
050050650000	TRANS-TEXAS ENERGY	STATE SMITH 1-16	4S	65W	16
050050650300	HEADINGTON OIL	RRR & S 1	4S	64W	28
050050650800	TRANS-TEXAS ENERGY	CCIAS #2 1-4	4S	64W	4
050050651500	TRANS-TEXAS ENERGY	MEDSKER-ALAN-LUKE 1-28	5S	65W	28
050050654900	CHANDLER & ASSOC INC	BOX ELDER-STATE 4-10	5S	64W	10
050050655400	CHANDLER & ASSOC INC	BUCKLEY-STATE 16-16	4S	65W	16
050050655900	CHANDLER & ASSOC INC	SMOKY HILL-STATE 13-34	5S	64W	34
050050656000	EXCO RESOURCES INC	STATE OF COLORADO-U 2	5S	64W	30
050050657100	TEXACO INC	STATE OF COLO-V 3	5S	64W	19

UWI / API	Operator	Well Label	T	R	S
050050657200	CHANDLER & ASSOC INC	NE LOWRY-STATE 5-17	5S	64W	17
050050657500	BOBCAT OIL CO	SUN-STATE 1	4S	65W	34
050050657700	THOMAS OPERATING INC	STATE-W 3	5S	65W	24
050050658900	TIMBERLINE ENERGY INC	COUNTY LINE-STATE 1-32	5S	64W	32
050050659000	CHANDLER & ASSOC INC	AIRLINE ROAD-STATE 15-12	5S	65W	12
050050659200	CHANDLER & ASSOC INC	COAL BUTTE-STATE 1-34	5S	65W	34
050050659900	TEXACO INC	STATE OF COLORADO-Y 1	5S	64W	20
050050661000	TEXACO INC	STATE OF COLORADO-X 1	5S	65W	13
050050661700	BWAB INC	ROSENFIELD 1	5S	65W	20
050050664200	TEXACO INC	STATE OF COLORADO-Z 1	5S	64W	18
050050665100	SMITH OIL	STATE 10-16	5S	64W	16
050050665400	THREE FORKS RESOURCES LLC	STATE OF COLO-AA 1	5S	64W	29
050050666000	RENEGADE OIL & GAS	STATE-B 1	5S	64W	15
050050666100	AMOCO PROD CO	CHAMPLIN-191-AMOCOA 1	4S	64W	23
050050666200	TEXACO INC	TEXACO-CHANDLER 2	5S	64W	7
050050667100	HUSKY OIL LTD	HUSKY ETAL STATE 13-21	5S	64W	21
050050674000	BURLINGTON NORTHERN	STATE 13-22	5S	64W	22
050050675200	KISSINGER PET CORP	KISSINGER-STATE 7-35	5S	65W	35
050050677200	SUMMIT OIL CO ETAL	SUMMIT-BN STATE 1	5S	64W	8
050050678300	TRANSCONTINNT OIL CO	GRIMM 2	5S	63W	32
050050679900	S & D LLC	KISSLER DAN 1	4S	64W	10
050050683000	TRINITY ENERGY CORP	PETERSON HEIRS 1	4S	64W	11
050050683600	SANDS AMERICAN CORP	DTH VENTURES 2	5S	64W	14
050050684400	HEADINGTON OIL	CAVANAUGH 4	4S	64W	22
050050685800	HEADINGTON OIL	COLUMBINE-STATE 1	4S	64W	16
050050687700	S & D LLC	KISSLER DANIEL 1-9	4S	64W	9
050050693700	HOUY CARL A	BROCKMAN 34-34	5S	63W	34
050050696300	CONCORD OIL	CONCORD-STATE 26-1	5S	65W	26
050050696400	MATRIX ENERGY LLC	UPRC 21X-21	4S	64W	21
050110505000	SHANNON OIL CO	STATE 1	21S	52W	33
050110506100	SHANNON OIL CO	STATE 1	21S	52W	15
050110600200	DIAMOND SHMROCK CORP	STATE 1-18	21S	52W	18
050110606600	AMERCN PETROFINA INC	STATE 1-15	21S	53W	15
050110611800	WEXPRO	TERMO-STATE 17-1	21S	53W	17
050110613000	BURTON-HAWKS INC	STATE 7-1	21S	52W	7
050110614000	HUNT OIL CO	STATE OF COLO 1-5	21S	50W	5
050130607400	KERR-MCGEE OIL & GAS LP	MAYHOFFER-ROTOLO 25-2	1S	70W	25
050130608300	KERR-MCGEE OIL & GAS LP	SUPERIOR ASSOCIATES 35-2	1S	70W	35
050130611700	NOBLE ENERGY INC	TLD 13-4	1S	70W	13
050130611800	NOBLE ENERGY INC	BERGER LAND 13-1	1S	70W	13
050130614900	NOBLE ENERGY INC	COX 13-3	1S	70W	13
050130629200	KERR-MCGEE OIL & GAS LP	PELTIER 1-15	1S	69W	15
050140908300	ENCANA OIL & GAS (USA) INC	HILLTOP F UNIT 1	1S	68W	19
050170501200	CONTINENTAL OIL CO	CONTINENTAL & UPRR 1	13S	46W	19
050170610200	JOSEY LENOR M INCORP	CAGE UPRR 1-A	14S	51W	33
050170617400	PHILLIPS PETRLM CO	COLOCONN A 1	13S	48W	1
050170618800	BLAIR JACK N	COLLINS RANCH 1	16S	50W	33
050170619600	AMERCN PUBLIC ENERGY	MAURER 1	14S	51W	19
050170622700	SHAKESPEARE OIL CO	ALPINE RANCH 1	12S	46W	17
050170624600	CHAMPLIN PETRO CMPNY	UPRR-CARRINGAN 2-3 1	14S	51W	3
050170626200	MULL DRLG CO INC	CHAMPLIN-SMELKER 1	13S	46W	7
050170626800	MULL DRLG CO INC	BREITENBACH FARMS 1	13S	46W	30
050170628200	MULL DRLG CO INC	RUCK 1	14S	49W	24

UWI / API	Operator	Well Label	T	R	S
050170629100	MULL DRLG CO INC	STATE-CULLEN 1-16	14S	48W	16
050170634700	MURFIN DRILLING	S-S-M PELGER 1-12	13S	51W	12
050170635100	MURFIN DRLG CO	S-S-M CONNELLEY 1-8	15S	50W	8
050170635400	MURFIN DRLG CO	SSM-UP-KITCHELIN 1-5	12S	51W	5
050170637200	MURFIN DRLG CO	S-S-M FICK 1-2	14S	47W	2
050170638000	MULL DRLG CO INC	STEWART 1	14S	49W	22
050170638500	LEAR PET EXPL INC	SCHAFER 18-13	13S	51W	18
050170638600	LEAR PET EXPL INC	REED 20-11	14S	49W	20
050170640300	MICHIGAN OIL	LAS ANIMAS MINERALS 1-10	13S	50W	10
050170640500	MULL DRLG CO INC	HOCK 1	13S	50W	8
050170640800	MURFIN DRLG CO	S-S-M KELLER 1-30	15S	49W	30
050170640900	HBB INC	SAYLES 44-12	14S	50W	12
050170641100	HBB INC	SIMMONS-STATE 16-7	13S	50W	16
050170641300	CHANDLER & ASSOC INC	SANDERS 16-24	13S	51W	24
050170641900	SKYLINE OIL CO	JELINEK 14-13	15S	48W	14
050170642800	TRICENTROL RES INC	WILKERSON 22-8	14S	49W	8
050170643000	CHAMPLIN PETRO CMPNY	PILGER-BERGE 11-7 1	13S	50W	7
050170643300	MURFIN DRLG CO	S-S-M UPRR 1-5	15S	48W	5
050170643500	TXO PROD CORP	SHADE 1	12S	50W	28
050170643700	MURFIN DRLG CO	S-S-M BLEDSOE 1-20	12S	51W	20
050170643800	MARLIN OIL	SANDERS 1	13S	50W	18
050170646300	HBB INC	STATE 33-16	13S	50W	16
050170647300	MURFIN DRLG CO	H & L ENTERPRISES 1-22	13S	51W	22
050170649000	WILLIFORD ENERGY CO	RHOADES 2-6	14S	48W	6
050170650400	RME PETROLEUM	MITCHEK 3	13S	48W	34
050170651200	MULL DRLG CO INC	KERNS FARMS 1-30	13S	43W	30
050170652600	MURFIN DRLG CO	CELSIUS-STATE 1-16	13S	44W	16
050170653000	GEAR PETRO CO INC	MITCHEK 1-18	13S	47W	18
050170653900	RME PETROLEUM	MOUSEL 2	13S	47W	30
050170654100	CHAMPLIN PETRO CMPNY	MCCORMICK 24-25 1	13S	49W	25
050170654200	RME PETROLEUM	SAYLES 13-29 1	13S	47W	29
050170654700	RME PETROLEUM	SAYLES 24-29 5	13S	47W	29
050170655200	TOTAL PETROLEUM INC	STATE 1-24	12S	50W	24
050170655800	RME PETROLEUM	SAYLES 31-29 7	13S	47W	29
050170656200	RME PETROLEUM	SAYLES 42-29 9	13S	47W	29
050170656300	MULL DRLG CO INC	STATE DECHANT 1-36	13S	47W	36
050170656400	MULL DRLG CO INC	RANDOLPH 1	14S	48W	12
050170656800	MULL DRLG CO INC	STATE-HINES 1-16	13S	47W	16
050170657600	BURCH BOB	SAYLES 1	14S	50W	13
050170658100	RME PETROLEUM	ERVIN 31-33 3	13S	48W	33
050170658200	MULL DRLG CO INC	BLODER 1	12S	48W	23
050170658500	BURCH BOB	PELTON 1	12S	45W	27
050170658700	RME PETROLEUM	WHITE 44-25 7	13S	48W	25
050170659100	BURCH BOB	JELENIK 1	15S	48W	15
050170659200	MULL DRLG CO INC	LAS ANIMAS MINERALS 1	13S	47W	28
050170659300	CHAMPLIN PETRO CMPNY	KREGEL 44-32 1	12S	51W	32
050170659700	TOTAL PETROLEUM INC	DAVID CURE 1-18	12S	49W	18
050170660300	MULL DRLG CO INC	VON-A 1	13S	47W	20
050170660400	CHAMPLIN PETRO CMPNY	EUREKA 1 42-21	13S	47W	21
050170660600	MULL DRLG CO INC	LAS ANIMAS MINERALS 2	13S	47W	28
050170661100	MULL DRLG CO INC	HITZING 1	13S	47W	24
050170661500	MEDALLION OIL CO	L KUHN 1-10	14S	51W	10
050170661700	MULL DRLG CO INC	ERVIN 1	13S	47W	14

UWI / API	Operator	Well Label	T	R	S
050170661900	MULL DRLG CO INC	SNELKER FARMS-A 1X	12S	47W	26
050170662800	RME PETROLEUM	SCHALLENBERGER 31-5 1	13S	50W	5
050170663400	MULL DRLG CO INC	ERVIN `A` 1	13S	47W	22
050170663900	MEDALLION PET INC	WILDHORSE 4-1	13S	50W	4
050170664100	MEDALLION OIL CO	KREGEL 1-4	13S	51W	4
050170665000	MULL DRLG CO INC	ISLEY 1	13S	47W	26
050170665700	SEAHAWK OIL	SMIRNOFF-BLEDSOE 1	12S	51W	10
050170666400	ANADARKO E & P	PHILLIPS-STATE 22-36 2	13S	49W	36
050170667000	ANADARKO E & P	WOLVERINE UPRC 22-6 1	14S	46W	6
050170667500	UNION PACIFIC RES CO	WECO-UPRC GRANITE RU 1	12S	51W	33
050170668500	UNION PACIFIC RES CO	WECO-UPRC FIC 42-2 1	14S	47W	2
050170669200	RME PETROLEUM	UPRC GRAYS-STATE 44- 3	12S	51W	36
050170670900	CITIES SERV O&G CORP	STEWART A 1	15S	50W	1
050170671100	UNION PACIFIC RES CO	JOLLY STATE 33-36 1	12S	49W	36
050170671200	CITIES SERV O&G CORP	CAGE A 1	14S	51W	32
050170671800	RME PETROLEUM	BERGE 31-1 1	13S	51W	1
050170674600	UNION PACIFIC RES CO	WECO-UPRC COLLINS RA 1	15S	49W	1
050170675900	RME PETROLEUM	BERGE 22-1 3	13S	51W	1
050170676000	ANADARKO E & P	MAUL 1	15S	42W	24
050170677900	ANADARKO E & P	MAUL 3	15S	42W	24
050170678500	CITIES SERV O&G CORP	OLSON A 1	12S	49W	14
050170679700	UNION PACIFIC RES CO	MOUSEL 11-6 3	14S	46W	6
050170680300	ANADARKO E & P	MAUL 4	15S	42W	24
050170682800	UNION PACIFIC RES CO	WECO-UPRC SANDERS RA 1	13S	50W	18
050170688000	WIEPKING-FULLERTON ENERGY	WECO-ISLEY 21C-34 1	13S	47W	34
050170688700	RME PETROLEUM	BERGE 13-1 9	13S	51W	1
050170690100	NORTHERN MICH EXP CO	STEVENS 1-6	15S	46W	6
050170690900	MULL DRLG CO INC	KNOTT PARTNERSHIP 1	13S	43W	19
050170691100	BEARD OIL INC	STATE-DECHANT 3-36	13S	47W	36
050170691500	ANADARKO E & P	J&M DECHANT 13-27 1	13S	47W	27
050170693000	UNION PACIFIC RES CO	MITCHEK 33-27 1	13S	47W	27
050170694900	MULL DRLG CO INC	ERVIN A 2	13S	47W	22
050170695200	UNION PACIFIC RES CO	P&P DECHANT 21-25 1	13S	47W	25
050170699600	MURFIN DRLG CO	GERGEN-BAINER 1-24	12S	45W	24
050170699800	MULL DRLG CO INC	LAS ANIMAS MINERALS 3	13S	47W	28
050170703100	UNION PACIFIC RES CO	ADRIAN 12-31 1	13S	46W	31
050170703200	UNION PACIFIC RES CO	GEORGE 43-3 1	14S	47W	3
050170705400	UNION PACIFIC RES CO	SCHUTTE 11-7 1	12S	46W	7
050170705900	UNION PACIFIC RES CO	PAUL 32-11 1	14S	47W	11
050170706000	UNION PACIFIC RES CO	GEORGE 32-3 2	14S	47W	3
050170712400	UNION PACIFIC RES CO	EIGER 14-11 1	12S	43W	11
050170712600	UNION PACIFIC RES CO	HARKER 43-35 3	12S	43W	35
050170712700	CITATION OIL & GAS CORP	HARKER 12-35 4	12S	43W	35
050170712900	UNION PACIFIC RES CO	AGWAY FARMS 43G-11 2	13S	43W	11
050170713200	UNION PACIFIC RES CO	WOOD 33-14 1	15S	48W	14
050170713600	UNION PACIFIC RES CO	TIMBER CREEK 41-6 1	13S	42W	6
050170713700	UNION PACIFIC RES CO	LAZY A FARMS 12-7 2	13S	42W	7
050170713900	UNION PACIFIC RES CO	NORRENE 14-2 4	13S	43W	2
050170714000	UNION PACIFIC RES CO	DURR 34-5 2	13S	42W	5
050170714100	UNION PACIFIC RES CO	D D DURR 41-12 5	13S	43W	12
050170714400	UNION PACIFIC RES CO	POD 41-14 1	13S	43W	14
050170714500	THOMAS OPERATING INC	CAMPBELL 12-22X	13S	43W	12
050170714800	UNION PACIFIC RES CO	HARKER RANCH 14-1 1	13S	43W	1

UWI / API	Operator	Well Label	T	R	S
050170716300	SANTA RITA RES INC	RANDOLPH 1-12	14S	48W	12
050170718600	MULL DRLG CO INC	KENNECREEK INC 1	13S	46W	30
050170718700	MULL DRLG CO INC	WAYNE 1	13S	47W	27
050170719400	RME PETROLEUM	BLEDSOE 13-12	12S	51W	12
050170720500	RME PETROLEUM	SPEAKER 3-13	12S	51W	13
050170720900	CITATION OIL & GAS CORP	WILLIAMS 42-11 6	13S	51W	11
050170721500	RME PETROLEUM	BLEDSOE 5-12	12S	51W	12
050170721600	ANSCHUTZ CORP	SPEAKER 1-11	12S	51W	11
050170721700	RME PETROLEUM	SPEAKER 5-13	12S	51W	13
050170721800	RME PETROLEUM	SPEAKER 7-13	12S	51W	13
050170722700	RME PETROLEUM	BLEDSOE 11-12	12S	51W	12
050170723000	ANSCHUTZ CORP	BLEDSOE 7-14	12S	51W	14
050170723200	CITATION OIL & GAS CORP	BLEDSOE 9-14	12S	51W	14
050170723400	UNION PACIFIC RES CO	SPEAKER 43-13 2	12S	51W	13
050170723500	UNION PACIFIC RES CO	CARL 43-11 1	12S	51W	11
050170723600	RME PETROLEUM	SPEAKER 23-13 1	12S	51W	13
050170723800	COASTAL O&G CORP	LIESEN 1	15S	49W	26
050170724100	PETROGULF CORP	BLEDSOE 1-24	12S	51W	24
050170724500	UNION PACIFIC RES CO	CHRISTOPHER 14-1 1	12S	51W	1
050170724700	MULL DRLG CO INC	CSJ MINPOOL A 1	15S	50W	4
050170724900	ANSCHUTZ CORP	BLEDSOE 1-14	12S	51W	14
050170725100	MULL DRLG CO INC	IBERG 1	14S	51W	22
050170725200	UNION PACIFIC RES CO	DERBY 14-2 1	14S	47W	2
050170725700	MULL DRLG CO INC	STATE-KELLER 1	15S	50W	36
050170726000	UNION PACIFIC RES CO	SANDERS RANCH 14-19 1	13S	50W	19
050170726400	UNION PACIFIC RES CO	SHILOH 21-19 1	12S	49W	19
050170726500	UNION PACIFIC RES CO	SIKA 32-9 1	14S	51W	9
050170726600	UNION PACIFIC RES CO	SPEAKER 14-13 3	12S	51W	13
050170726700	UNION PACIFIC RES CO	SPEAKER 34-13 4	12S	51W	13
050170726900	UNION PACIFIC RES CO	WHITNEY 41-3 1	13S	49W	3
050170727600	UNION PACIFIC RES CO	ISLEY 41-34 2	13S	47W	34
050170728000	MULL DRLG CO INC	MORGAN 1	16S	51W	22
050170728100	UNION PACIFIC RES CO	TETRIS 41-31 1	14S	48W	31
050170728400	UNION PACIFIC RES CO	EAGLE 24-23 1	12S	48W	23
050170729400	MULL DRLG CO INC	CSJ MINPOOL B1	15S	49W	8
050170730000	UNION PACIFIC RES CO	ALENA MAE 34-13 1	15S	48W	13
050170730600	UNION PACIFIC RES CO	HAMMERHEAD 23-9 1	12S	49W	9
050170730700	MULL DRLG CO INC	STATE-WINSHIP 1	16S	51W	16
050170730800	MULL DRLG CO INC	CAGE RANCH 1	15S	51W	24
050170730900	MULL DRLG CO INC	CSJ MINPOOL 1	15S	51W	22
050170731600	UNION PACIFIC RES CO	VICKSBURG 31-21 1	13S	47W	21
050170731800	UNION PACIFIC RES CO	SPEAKER 41-13 6	12S	51W	13
050170732000	MUSTANG O&G CORP	BLEDSOE 15-12	12S	51W	12
050170732400	CHARTER PROD CO	FEDERAL ARCHER 44-18 1	12S	50W	18
050170733900	WIEPKING-FULLERTON ENERGY	KREGEL A 1	12S	51W	32
050170734000	CHARTER PROD CO	RHOADES BROTHERS A 1	14S	48W	5
050170735800	MULL DRLG CO INC	NICOLARSEN 1	16S	49W	10
050170735900	UNION PACIFIC RES CO	ZUNI 14-31 1	16S	49W	31
050170736100	MULL DRLG CO INC	MORGAN A 1	16S	51W	26
050170736200	MULL DRLG CO INC	ANSLEY 1	16S	51W	8
050170736400	MUSTANG O&G CORP	BLEDSOE 3-24	12S	51W	24
050170736500	RME PETROLEUM	BLEDSOE 3-12	12S	51W	12
050170736600	UNION PACIFIC RES CO	OTTAWA 44-19 1	14S	51W	19

UWI / API	Operator	Well Label	T	R	S
050170737500	RME PETROLEUM	CHRISTOPHER 34-1 2	12S	51W	1
050170737900	ANSCHUTZ CORP	DAVIES 7-4	12S	50W	4
050170738300	RME PETROLEUM	CHRISTOPHER 43-1 4	12S	51W	1
050170738400	UNION PACIFIC RES CO	CHRISTOPHER 23-1 3	12S	51W	1
050170738600	RME PETROLEUM	BLEDSOE 7-12	12S	51W	12
050170738800	RME PETROLEUM	BLEDSOE 1-12	12S	51W	12
050170739100	SATURN LAND CO INC	BLEDSOE 16-2	12S	51W	2
050170739300	RME PETROLEUM	CHRISTOPHER 41-1 5	12S	51W	1
050170739400	MULL DRLG CO INC	GOSSARD 1	15S	46W	14
050170739700	RME PETROLEUM	CHRISTOPHER 32-1 6	12S	51W	1
050170740500	RME PETROLEUM	SPEAKER 44-13 8	12S	51W	13
050170740700	MUSTANG CO INC	BLEDSOE 13-6	12S	50W	6
050170741200	ANSCHUTZ CORP	BLEDSOE 5-6	12S	50W	6
050170741400	MULL DRLG CO INC	ELDON 1	15S	50W	8
050170741500	MULL DRLG CO INC	MULL UPRC-WINSHIP 1	15S	51W	31
050170741600	MULL DRLG CO INC	SIX J PARDNERS 1	14S	50W	34
050170741700	MULL DRLG CO INC	ROGERS 1	16S	50W	8
050170741800	MULL DRLG CO INC	CHUCK 1	15S	50W	26
050170742400	UNION PACIFIC RES CO	ROBERT 41-24 1	12S	51W	24
050170742600	UNION PACIFIC RES CO	SPOTTED OWL 14-29	12S	46W	29
050170742700	UNION PACIFIC RES CO	ZINGER 11-1 1	14S	47W	1
050170743500	ANSCHUTZ CORP	FARSIDE 2-19	12S	48W	19
050170744700	WIEPKING-FULLERTON ENERGY	RANDOLF 1-9	14S	47W	9
050170747800	UNION PACIFIC RES CO	SE SPEAKER 21-19 1	12S	50W	19
050170748100	UNION PACIFIC RES CO	PTERO 23-31 1	12S	43W	31
050170748200	UNION PACIFIC RES CO	HADROS 41-3 1	12S	49W	3
050170748300	UNION PACIFIC RES CO	HOUSE 24-7 1	12S	50W	7
050170748700	CITATION OIL & GAS CORP	WILLIAMS 31-11 7	13S	51W	11
050170748800	ANSCHUTZ CORP	FARSIDE 6-19	12S	48W	19
050170749600	ANSCHUTZ CORP	EAST BIG TIMBER 6-1	12S	43W	1
050170752300	ANADARKO E & P	JUDY 43-27 1	12S	43W	27
050170752500	AMOCO PROD CO	BUZZARD BREATH 1-2	13S	46W	2
050170752700	UNION PACIFIC RES CO	PYROPE 13-12 1	13S	51W	12
050170753700	ANSCHUTZ CORP	DAIRY 9-2	12S	51W	2
050170753900	ANSCHUTZ CORP	WILDHORSE 8-21	12S	50W	21
050170754100	MULL DRLG CO INC	CHAMPLIN-HORNBOSTAL 3	13S	44W	33
050170754400	LEEDE OIL & GAS INC	WILDHORSE 1-23	12S	51W	23
050170755500	MULL DRLG CO INC	PHARO 1-2	13S	44W	2
050170756300	ANSCHUTZ CORP	LOWE 13-20	12S	45W	20
050170756400	UNION PACIFIC RES CO	SOUTHEAST SPEAKER 22 2	12S	50W	19
050170757000	UNION PACIFIC RES CO	REVEILLE 21-12 1	12S	43W	12
050170757100	UNION PACIFIC RES CO	EIGER 43-11 3-X	12S	43W	11
050170757200	UNION PACIFIC RES CO	ESTHER 41-22 3	12S	43W	22
050170757500	WIEPKING-FLLRTN EXPL	NORRENE 2	13S	43W	2
050170757600	UNION PACIFIC RES CO	WEED 21-27 4	12S	43W	27
050170758600	DALLAS UNITED PET	UNITED - EMAL 1-12	13S	42W	12
050170760200	ANSCHUTZ CORP	NORBURG 4-20	12S	48W	20
050170760700	CITATION OIL & GAS CORP	SHOTGUN 33-17 2	13S	43W	17
050170761800	MONUMENT GAS MARKETING INC	SCHEIMER 1-24	16S	46W	24
050250500000	MURCHISON J W	STATE 1	22S	56W	14
050250500200	HUNT NLSN BNKR TR ES	TOWN OF FOWLER-ETAL 1	21S	59W	33
050250500500	AMERADA PETRO CMPNY	WOODS 1	21S	59W	11
050250500800	AMERADA PETRO CMPNY	COLORADO STATE 1-C	20S	56W	17

UWI / API	Operator	Well Label	T	R	S
050250500900	CASEY D C	STATE 1	20S	57W	16
050250501000	STODDARD J B DECEASE	WRIGHT 1	20S	58W	11
050250501100	KATZ SID	L W BAILEY 1	19S	57W	30
050250501300	GULF OIL CORP	UNIT 1	18S	56W	36
050250501500	GULF OIL CORP	KAKAVAS 1	18S	56W	23
050250501600	UTAH SOUTHERN OIL CO	SHERIDAN-WORM 1	18S	57W	4
050250600100	TERRA RESOURCES INC	HORSECRKGRAZING14-8	18S	56W	8
050250600200	TERRA RESOURCES INC	STATE 10-16	18S	56W	16
050250600400	SHELL OIL CO	FERREE 42-14	20S	55W	14
050250600500	TRUE OIL LLC	TRUE-STATE 12-14	21S	55W	14
050250600600	PETRO LEWIS CORP	TROTTER 3-9	18S	55W	9
050250600700	TRUE OIL LLC	SCHIRO 23-35	20S	56W	35
050250600900	CRADALL DRLG&TRENCH	HUGHS 1	20S	57W	17
050250601000	BOW VALLEY PETR INC	DEEDS-FEDERAL 1-8	20S	58W	8
050250601100	ADOBE OIL & GAS CORP	HUGHES 34-18	20S	57W	18
050250601200	MULL DRLG CO INC	STATE-TRAINOR 1	19S	56W	36
050250601300	MULL DRLG CO INC	ARMSTRONG 1	19S	56W	22
050310530700	CITY AND COUNTY OF DENVER	ANDERSON & STATE 1	2S	65W	16
050310613200	ENCANA OIL & GAS (USA) INC	BOX-ELDER FARMS 1	2S	65W	30
050310639000	CITY AND COUNTY OF DENVER	KALLSEN 2	2S	65W	18
050310639900	CITY AND COUNTY OF DENVER	CHAMPLIN 117 AMOCO 2	2S	65W	7
050310644900	CITY AND COUNTY OF DENVER	MONAGHAN 1	2S	66W	24
050310648600	CITY AND COUNTY OF DENVER	BOX ELDER-C 1	2S	65W	11
050310659600	CITY AND COUNTY OF DENVER	BOX ELDER 1-D	2S	65W	14
050310665300	CITY AND COUNTY OF DENVER	BOX ELDER-E 2	2S	65W	20
050310669500	CITY AND COUNTY OF DENVER	JEFFERY 1	2S	65W	8
050310688000	CITY AND COUNTY OF DENVER	CHAMPLIN 1	2S	65W	19
050310707600	CITY AND COUNTY OF DENVER	BOX ELDER L 1	2S	65W	12
050310733900	CITY AND COUNTY OF DENVER	CHAMPLIN 125 AMOCO 1	2S	65W	3
050310735000	CITY AND COUNTY OF DENVER	CHAMPLIN125AMOCO-H 1	2S	65W	21
050310736700	CITY AND COUNTY OF DENVER	CHAMPLIN 125-G 1	2S	65W	17
050310787300	SANDLIN OIL CORPORAT	BOXELDER-AMOCO 1	2S	66W	35
050310882500	CITY AND COUNTY OF DENVER	DIA W AMBUSH 23-31	2S	65W	23
050310882800	PRIMA OIL & GAS CO	DIA W AMBUSH 13-33	2S	65W	13
050310883100	CITY AND COUNTY OF DENVER	DIA AMBUSH WEST 26-21	2S	65W	26
050350500000	HOLL F G CO	GREENLAND & CATTLE 1	10S	66W	17
050350600200	CLARK CANADIAN EXPL	SEIDENSTICKER 1	8S	66W	32
050350600700	AMOCO PROD CO	CHAMPLIN 85-AMOCO-A 1	6S	65W	21
050350600800	BROWNLIE-WLLCE-ARMST	RAMPART RANGE 1	6S	67W	13
050350601000	NORSK HYDRO PET	WINKLER STATE 1	8S	66W	36
050390500400	HAWKS JEFF	TAYLOR 1	9S	61W	30
050390500700	MURPHY CORP	STATE LIMON 1-4286	9S	57W	22
050390500800	GINTHER WARREN&CO ET	MAUL 1	9S	62W	17
050390500900	GINTHER WARREN&CO ET	STATE HERRICK 1	9S	62W	16
050390501700	SINCLAIR OIL & GAS C	J E TAYLOR 1	8S	63W	13
050390502200	STERLING DRLG CO	COLORADO B 1	8S	59W	6
050390502400	STERLING DRLG CO	UPPER-MATHEWS 1	7S	59W	27
050390502800	VAUGHEY & VAUGHEY II	UPRR-J B JOLLY 1-B	6S	58W	35
050390503400	VAUGHEY & VAUGHEY II	UPRR-J B JOLLY 1-C	6S	57W	27
050390510000	PAN AMERICAN PETROLE	DAVID R NAGEL 1	7S	60W	8
050390510200	PAN AMERICAN PETROLE	UPRR 1	7S	62W	25
050390600100	UNION PACIFIC RAILRD	UPRR 44-21	7S	58W	21
050390600600	TIGER OIL	UPRR-STEWART 1	8S	62W	13

UWI / API	Operator	Well Label	T	R	S
050390600700	TIGER OIL	UPRR-SCOTT 11-1	8S	62W	11
050390601000	SHELL OIL CO ET AL	UNION PACIFIC 41-23	11S	58W	23
050390601100	SHELL OIL CO	UNION PACIFIC 42-23	11S	59W	23
050390601200	SHELL OIL CO ET AL	UNION PACIFIC 41-15	6S	63W	15
050390601500	SHELL OIL CO	UPRR-SCHMEISER 44-15	10S	57W	15
050390601900	SHELL OIL CO ET AL	PHIPPS JR 13-5	7S	62W	5
050390602100	SHELL OIL CO ET AL	E L BENNETT 11-20	8S	58W	20
050390602300	SHELL OIL & UPRR	STATE 43-22	7S	58W	22
050390602600	SHELL OIL CO ET AL	JOHN HIGGINS 42-34	7S	57W	34
050390602900	SHELL OIL CO ET AL	UP-JOHNSON 22-11	7S	63W	11
050390603100	SHELL OIL CO ET AL	UPRR-KICKAPOO LAND 44-23	7S	60W	23
050390603300	CHANCELLOR EXPL	J E CLARK 1	8S	63W	9
050390603400	WEBB RESOURCES INC	STATE 20-12	10S	62W	20
050390603700	SHELL OIL CO	VAN CAMPEN 13-24	9S	61W	24
050390603800	SHELL OIL CO	MCFARLIN 14-34	9S	62W	34
050390603900	SHELL OIL CO	LUCORE-BROWN 14-9	9S	63W	9
050390604000	SHELL OIL CO ET AL	MORRIS 22-2	7S	63W	2
050390604100	SHELL OIL CO	CASEY 14-11	10S	63W	11
050390604800	SHELL OIL CO	STATE 11-2	10S	60W	2
050390604900	SHELL OIL CO	STATE 31X-8	10S	59W	8
050390605000	SHELL OIL CO ET AL	FELCH-GARRISON 44-8	11S	59W	8
050390605800	SHELL OIL CO& UPRR*	UPRR-STATE 24-36	7S	58W	36
050390606200	SHELL OIL CO& UPRR*	DUFFY 12-15	7S	63W	15
050390606800	DAVIS OIL CO	KILLIAN 1	9S	64W	13
050390607000	DAVIS OIL CO	CLINTON 1	7S	64W	9
050390607200	DAVIS OIL CO	MADIGAN 1	9S	62W	14
050390607600	DAVIS OIL CO	PHIPPS 1	6S	64W	35
050390607800	DAVIS OIL CO	GEESEN-STATE 1	7S	59W	16
050390608200	DAVIS OIL CO	BUTLER-STATE 1	7S	58W	24
050390608300	TRUE OIL LLC	STATE 41-16	11S	57W	16
050390608400	TRUE OIL LLC	STATE 14-16	10S	57W	16
050390608600	DAVIS OIL CO	MAUL 1	9S	63W	13
050390609200	TOLTEK DRLG CO	CHAMPLIN-WILLIAMS 1-25	7S	59W	25
050390609400	DAVIS OIL CO	CULBERTSON-STATE 1	8S	58W	22
050390609600	TOLTEK DRLG CO	CHAMPLIN-BLANTON 1-7	8S	59W	7
050390609900	DAVIS OIL CO	TRACY-STATE 1	8S	58W	18
050390610100	DAVIS OIL CO	SIMON 1	9S	57W	28
050390610300	CLARK CANADIAN EXPL	TANIN 1	9S	65W	1
050390610500	CLARK CANADIAN EXPL	WARE 1	9S	62W	29
050390611000	TOLTEK DRLG CO	CHAMPLIN-YOUNG 1-19	9S	60W	19
050390611100	TRUE OIL LLC	SIMPSON 11-24	10S	57W	24
050390611500	TRUE OIL LLC	STATE 41-26	11S	57W	26
050390611700	DAVIS OIL CO	JONES 1	9S	61W	22
050390611800	TOLTEK DRLG CO	LAMBERT 1	7S	60W	28
050390611900	TOLTEK DRLG CO	STORY 1	6S	64W	32
050390612100	TOLTEK DRLG CO	CHAMPLIN-GRIFFIN 1-1	10S	60W	1
050390612200	TOLTEK DRLG CO	CHAMPLIN-MCKIM 1-5	10S	60W	5
050390612400	CLARK CANADIAN EXPL	BEARDSLEY 1	10S	65W	34
050390612900	DAVIS OIL CO	HAAS 1	7S	62W	29
050390613000	DAVIS OIL CO	BRUCHEZ 1	6S	63W	28
050390613100	DAVIS OIL CO	LAWRENCE 1	7S	62W	3
050390613200	DAVIS OIL CO	SKIPTON 1	7S	63W	28
050390613300	TOLTEK DRLG CO	ENGEL 1	7S	58W	18

UWI / API	Operator	Well Label	T	R	S
050390613400	KIDD BARRON	STANDER 1	7S	61W	12
050390613600	TOLTEK DRLG CO	STATE-RECTOR 1	8S	59W	14
050390613800	TOLTEK DRLG CO	EHMANN 1	7S	61W	8
050390613900	TOLTEK DRLG CO	MONKS 1	7S	59W	14
050390614000	TOLTEK DRLG CO	NAGEL 1	7S	60W	12
050390614100	PETROLEUM EXPL&PROD	HIGGINS B 1	7S	57W	24
050390614200	DAVIS OIL CO	MARY 1	7S	64W	17
050390614300	BROWNLIE-WLLCE-ARMST	HANLON 1	6S	63W	2
050390615300	CHANDLER & ASSOCIATES INC	DAVIDSON 16-3	6S	65W	3
050390615400	KOCH EXPL CO	ALBERT PEARSON 1	6S	65W	34
050390615500	KOCH EXPL CO	ALMA MILLER 1	7S	65W	14
050390615600	TOLTEK DRLG CO	COLYER 1	9S	64W	21
050390616000	BWAB INC	BALCEROVICH 1	7S	63W	4
050390616100	BWAB INC	MAYER 1	6S	63W	8
050390616300	BOBCAT OIL CO	LANE 1	6S	63W	30
050390616500	KOCH EXPL CO	C EVERITT 1	6S	65W	24
050390616800	KOCH EXPL CO	BENTLEY 1	7S	65W	15
050390617300	KOCH EXPL CO	EVANS 1	7S	64W	32
050390618000	MIDWEST OIL	OSCAR REUTH 1	7S	63W	28
050390618100	WEBB RESOURCES INC	CHAMPLIN-LAWRENCE 3-16	7S	62W	3
050390618500	DAVIS OIL CO	COMANCHE CREEK 1	7S	64W	12
050390618600	BOBCAT OIL CO	STATE OF COLO 1	6S	63W	16
050390618800	WEBB RESOURCES INC	STATE 16-1	7S	62W	16
050390619100	TEXACO INC	L M NORDMAN 1	6S	64W	2
050390619400	BEAVER MESA EXPL	RARICK 14-18	7S	61W	18
050390619500	NORSK HYDRO PET	BOONE 1	9S	64W	8
050390619600	NORSK HYDRO PET	ZION STATE 1	10S	65W	36
050390620900	WEBB RESOURCES INC	UPRR-AMOCO 35-13	6S	63W	35
050390622400	SOHIO PETROLEUM	JOHNSON 6-4	7S	62W	6
050390622800	BROWNLIE-WLLCE-ARMST	STATE-DEZZUTTI 36-6	6S	63W	36
050390622900	WEBB RESOURCES INC	MATTHEWS 20-11	7S	62W	20
050390624100	WEBB RESOURCES INC	DUFFY 8-4	7S	63W	8
050390624300	WEBB RESOURCES INC	BALCEROVICH 34-3	6S	63W	34
050390624600	WEBB RESOURCES INC	CARLOCK 7-12	7S	62W	7
050390624800	RME PETROLEUM	JR JOHNSON 1	7S	63W	1
050390625100	WEBB RESOURCES INC	UPRR-AMOCO 27-4	7S	62W	27
050390625300	WEBB RESOURCES INC	CARLOCK 17-1	7S	62W	17
050390625800	WEBB RESOURCES INC	AMOCO-UPRR 25-4	6S	63W	25
050390625900	WEBB RESOURCES	AMOCO-UPRR 11-9	6S	63W	11
050390626100	RENEGADE OIL & GAS	SARTI 24-6	6S	63W	24
050390627200	BIRD OIL CORP	STEWALT 14-14	6S	63W	14
050390628000	TIMBERLINE ENERGY INC	MORRIS 13-6	6S	63W	13
050390628900	WEBB RESOURCES INC	DAVIES 12-13	7S	63W	12
050390629200	WEBB RESOURCES INC	STEWART 10-11	6S	63W	10
050390629400	WEBB RESOURCES INC	ROTH 22-10	7S	63W	22
050390632900	MORGAN OIL CO INC	UPRR-WHITEHEAD 1	7S	62W	21
050390633000	L & B OIL CO INC	SKIPTON F 1	7S	63W	21
050390634800	BIRD OIL CORP	REININGER 10-2	7S	63W	10
050390635600	GARY SAMUEL OIL PROD	AMOCO 11-4	6S	65W	11
050390635700	RENEGADE OIL & GAS	WHITEHEAD 12-7	6S	63W	12
050390636700	GARY SAMUEL	AMOCO 33-16	6S	64W	33
050390637000	MAZUMA OPERATING	AMOCO 13-16	6S	64W	13
050390637100	AMOCO PROD CO	CHAMPLIN 303 AMOCO-A 1	7S	63W	3

UWI / API	Operator	Well Label	T	R	S
050390637900	GARY SAMUEL OIL PROD	DAUGHENBAUGH 24-12	6S	64W	24
050390638100	BLACK HAWK RES CORP	SKIPTON 34-1	7S	63W	21
050390638600	PRIVATE OIL INDUSTRIES	UPRR-WELCHEL 1-15	6S	65W	15
050390638800	TRANS-TEXAS ENERGY	MILLER TRUST-ROOT 1-20	7S	64W	20
050390638900	TRANS-TEXAS ENERGY	MARGE 1-11	6S	64W	11
050390639400	TRANS-TEXAS ENERGY	BRADBURY-PHIPPS 14 1-26	7S	62W	26
050390639600	BIRD OIL CORP	LYCAS 4-13	6S	64W	4
050390639700	TRANS-TEXAS ENERGY	BRADBURY-PHIPPS 15 1-4	7S	62W	4
050390639900	VIKING RES CORP	STEWART 1	7S	64W	13
050390640100	TRANS-TEXAS ENERGY	BRADBURY-PHIPPS 1-11	7S	64W	11
050390640500	TRANS-TEXAS ENERGY	2 H-B PARTNERSHIP 1-11	7S	65W	11
050390641100	KETAL OIL PROD CO	KETAL /UPRR/ BOEGEL 1	7S	65W	1
050390641700	ROCK OIL CORP	CAMBRIDGE 1	6S	63W	26
050390641800	KETAL OIL PROD CO	UPRR-MILLER 1	6S	65W	25
050390642700	TIMBERLINE ENERGY INC	ERICKSON 2-5	6S	65W	2
050390643200	COBRA OIL & GAS CORP	EHMANN RANCH 1	7S	61W	30
050390644400	SANDS AMERICAN CORP	DAUGHENBAUGH 26-8	6S	64W	26
050390644500	DIAMONDBACK OIL CORP	BRADBURY-PHIPPS 2-4	7S	64W	2
050390644700	MAZUMA OPERATING	AMOCO 23-14	6S	64W	23
050390645000	SANDS AMERICAN CORP	AMOCO 17-4	6S	63W	17
050390645200	GARY-WILLIAMS OIL PR	STATE 16-13	6S	63W	16
050390645400	PIKE PETROLEUM CORP	LAUREL 1	6S	63W	23
050390647200	BIRD OIL CORP	BIRD-BALCEROVICH 9-8	7S	63W	9
050390647300	H & R WELL SERVICES INC	MILLER 20-11	6S	64W	20
050390647500	HABCO INC	COGGINS 10-5	6S	64W	10
050390648200	GARY-WILLIAMS OIL PR	BENNETT 10-1	6S	65W	10
050390648300	ROCK OIL CORP	FERN-UPRR 303-1	6S	64W	27
050390648400	ROCK OIL CORP	CYPRUS-UPRR 302-1	7S	62W	25
050390649000	GARY-WILLIAMS OIL PR	MILLER 28-4	6S	64W	28
050390649300	SETEX OIL AND GAS	2 EVERITT A-41-30	6S	64W	30
050390650600	CRIMSON EXP OPERATING	UPRR-EVERITT 43-19	6S	64W	19
050390650900	THREE FORKS RESOURCES LLC	RUNNING CREEK RANCH 15-6	6S	64W	15
050390651100	HABCO INC	COGC-2-4-6-63-K VETT 2	6S	63W	4
050390651300	BROWN INVESTMENT	WESTFALL 1	9S	57W	25
050390651400	ARGENTIA CORP	STATE 1-36	9S	57W	36
050390651900	CHAMPLIN PETRO CMPNY	WEST FALL 32F-25 2	9S	57W	25
050390652000	MORGAN OIL CO INC	STATE 1	7S	64W	16
050390652100	ARGENTIA CORP	STATE-VRATIL 1-2	10S	57W	2
050390654500	ENCANA OIL & GAS (USA) INC	K VETTER 4-4-6-63	6S	63W	4
050390654900	GARY-WILLIAMS OIL PR	NORDMAN ESTATE 11-5	6S	64W	11
050390655000	MARLIN OIL	SWANSON 1-6	11S	57W	6
050390655500	RENEGADE OIL & GAS	VETTER 2-9-6-63-K	6S	63W	9
050390656100	COASTAL O&G CORP	HOAGLAND 1	7S	64W	10
050390657200	MILLER OIL COM	CHAMPLIN 13-25	9S	57W	25
050390657300	MILLER OIL COM	STATE 32-36	9S	57W	36
050390657800	MILLER OIL COM	CHAMPLIN 12-25	9S	57W	25
050390658000	MILLER OIL COM	WINKELMAN 21-22	10S	57W	22
050390658100	CRIMSON EXP OPERATING	UPRR E MILLER TRUST 44-17	6S	64W	17
050390658300	SMITH ENERGY CORP	RUNNING CREEK STATE 11	6S	64W	16
050390658400	RENEGADE OIL & GAS	MYERS 32-3 2	6S	63W	3
050390658500	KERR-MCGEE OIL & GAS LP	NORDMAN TRUST 15	6S	64W	9
050390659500	EOG INC	HOAGLAND 1-9	7S	64W	9
050390660400	FERRIS W W	UPRC-FERRIS 1	9S	57W	33

UWI / API	Operator	Well Label	T	R	S
050390662100	EOG INC	WINKELMAN 1-22	10S	57W	22
050390662300	HS RESOURCES INC	HSR-MILLER 6-1	6S	63W	1
050390662500	NORTH AMERICAN RES	BRADBURY INVEST 32-2	7S	64W	2
050390662900	KERR-MCGEE OIL & GAS LP	HSR-HUNT 8-22	6S	63W	22
050390663500	RITCHIE EXPL INC	STATE BEAVER CANY 26-21	7S	58W	26
050390663800	RITCHIE EXPL INC	CANY ENERGY STATE- 2-43	10S	57W	2
050410500200	US SMELTING&REFINING	GOVT-17-63 1-26	17S	63W	26
050410500600	WYOMING OIL & GAS	PHILLIPS 1	17S	60W	19
050410501500	US SMELTING&REFINING	BOHART 1	16S	62W	22
050410502000	NEW DRILLING	WHITTEMORE 1	16S	60W	9
050410502100	OWEN K D	STATE B 1	15S	62W	21
050410502200	STODDARD J B DECEASE	STATE 1	15S	62W	20
050410502300	AMARILLO OIL	FIELD BOHART 1	15S	62W	19
050410502400	SINCLAIR OIL & GAS C	ENOCH A 1	15S	63W	3
050410502600	HILL AL G JR	STRATTON 1	14S	67W	26
050410502800	COMMERCIAL PET&TRNSP	SCHUBERT 1	14S	62W	27
050410503000	PETERSON SR MILTON	LEWIS RAYMOND 1	14S	65W	23
050410503100	LION OIL CO	HIGGINS 1	14S	61W	19
050410503200	DIABLO DRLG INC	RIEGER 1	14S	60W	20
050410503500	SINCLAIR OIL & GAS C	LEWIS R W 1	14S	65W	2
050410503800	HAWKS JEFF	TIPTON 1	13S	61W	23
050410504100	D&L OIL	STATE-MURR 1	13S	63W	16
050410504500	SINCLAIR OIL & GAS C	ANDERSON 1	12S	62W	14
050410504700	NIGH C R	JARRETT 1	12S	60W	12
050410504900	VICKERS PETROLEUM CO	MANYIK 1	12S	62W	8
050410505000	SINCLAIR OIL & GAS C	CARL F WHITE 1	11S	64W	34
050410505500	JUSTHEIM PETROLEUM	ASPER 1	11S	60W	21
050410505600	D&L OIL	J LAZOR 1	11S	61W	21
050410505700	D&L OIL	EURICH 1	11S	62W	22
050410510900	INTL O & G CORP	MURR 1	13S	63W	20
050410600300	FUNDAMENTAL OIL ETAL	JARRETT 1	13S	62W	21
050410600400	DUNIGAN E J	STATE 1	17S	64W	5
050410600500	CHANCELLOR EXPL	IRONHORSE-STATE 1	12S	61W	16
050410600600	CHANCELLOR EXPL	MARTIN 1	12S	60W	21
050410600700	SHELL OIL CO	DZURIS 11-14	11S	63W	14
050410600800	DAVIS OIL CO	BENNETT 1	11S	63W	30
050410600900	DAVIS OIL CO	RALPH 1	11S	63W	15
050410601000	DAVIS OIL CO	DZURIS 1	11S	62W	7
050410601300	DAVIS OIL CO	ALFORD 1	11S	60W	14
050410601400	DAVIS OIL CO	HENRY 1	12S	61W	2
050410601500	BEAVER MESA EXPL	NEWELL-HARDING 43-32	12S	62W	32
050410601600	EMPIRE STATE OIL CO	STATE 1	13S	62W	16
050410601700	DAVIS OIL CO	BALSICK 1	11S	62W	26
050410601800	DAVIS OIL CO	GALLAGHER 1	12S	61W	23
050410601900	TOLTEK DRLG CO	FREEMAN 31-21	13S	61W	21
050410602000	TOLTEK DRLG CO	CONRY-WAGNER 21-29	12S	61W	29
050410602100	ERICKSON E L	ADA M MCCLINTOCK 1	14S	61W	31
050410602200	ERICKSON E L	F WARD EDWARDS 1	15S	61W	18
050410602300	ERICKSON E L	J A YODER 1	15S	61W	28
050410602500	FERGUSON OIL & GAS I	STATE-BIG SPRINGS 1	14S	62W	14
050410602600	AMOCO PROD CO	ALEXANDER KANE 1	16S	64W	6
050410602700	NORSK HYDRO PET	RETTERREE STATE 1	12S	63W	16
050410602800	NORSK HYDRO PET	ROBERT WILSON 1	13S	61W	5

UWI / API	Operator	Well Label	T	R	S
050410603200	PLACID OIL CO	STATE OF COLORADO 36-1	17S	65W	36
050410603300	GILBERT M	STATE 11-32	16S	63W	11
050410603400	GILBERT M	STATE 10-14	15S	62W	10
050410603500	TEXAS O&G CORP	STATE-L 1	17S	64W	8
050410603900	TEXAS O&G CORP	WARD-B 1	17S	65W	20
050410604200	BONANZA PETR INC	PETERSON 1-10	13S	63W	10
050410604300	CALVIN PET CORP	DZURIS 23-1F	11S	63W	23
050410604400	MILLER CHRISTENSEN	LAWSON 1	12S	63W	15
050410604600	TEXAS GAS EXPL CORP	LITTLE FOUNTAIN CREE 23-33	16S	65W	33
050410605100	ETOCO LP	VERVERS 1	15S	63W	4
050430600800	FOREST OIL CORPORATN	MACKENZIE 1-3	19S	69W	3
050430605100	MIZEL EXPL CO	ADAMIC 22-1	19S	69W	22
050430606100	MIZEL EXPL CO	RUBY 4-1	19S	69W	4
050430607500	TRUE OIL LLC	J S PHILLIPS 14-26	19S	69W	26
050430607600	TRUE OIL LLC	YELLICO LAND & CATTL 43-2	20S	69W	2
050430607700	TRUE OIL LLC	R W MORRIS 44-11	20S	69W	11
050430607800	TRUE OIL LLC	YELLICO LAND & CATTL 13-23	20S	69W	23
050430608300	TRUE OIL LLC	ROBB 44-35	19S	69W	35
050430613800	CARR EXPL CORP INC	SLANOVICH 1	19S	70W	33
050430614100	THOMPSON ENGR & PROD	FLORENCE 33-1	19S	69W	33
050430614800	MOUNTAIN PET CORP	SLANOVICH 32-23	19S	70W	23
050550504900	KINGWOOD OIL CO	US ALAMO DOME-A 1	27S	68W	34
050550600400	CLARK E B SR	GOEMMER LAND CO 1	29S	67W	11
050550600500	HAMON JAKE L	CISNEROS 1	27S	70W	5
050550600800	WHITE SHIELD EX CORP	KSC 1-14	27S	67W	14
050550600900	WHITE SHIELD EX CORP	CROKE ETAL 1-21	27S	66W	21
050550601500	SUNDANCE OIL CO ETAL	GOVT 1-34	27S	66W	34
050550602200	CHAMPLIN PETRO CMPNY	HUGHES 32-5/27-70/ 1	27S	70W	5
050550602600	ATLANTIC RICHFLD CO	SHEEP MOUNTAIN 1	27S	70W	16
050550603200	ATLANTIC RICHFLD CO	SHEEP MTN UNIT 8-14	27S	70W	14
050550604200	ATLANTIC RICHFLD CO	SANTANA 1	25S	69W	21
050550604500	ARCO OIL & GAS CORP	DIKE MOUNTAIN UNIT 5-19	28S	69W	19
050550605000	ENERGETICS INC	MAJORS 42-4	28S	68W	4
050550605300	BROOKS EXPL INC	HOMERDING 1	27S	68W	12
050550605600	BROOKS EXPL INC	GRIFFITH 1-12	26S	71W	12
050550605800	ARCO OIL & GAS CORP	SHEEP MOUNTAIN 1-3-M	28S	70W	3
050550606600	OXY USA INC	SHEEP MOUNTAIN U 6-15-I	27S	70W	15
050550606700	OXY USA INC	SHEEP MOUNTAIN U 5-15-F	27S	70W	15
050550607000	OXY USA INC	SHEEP MOUNTAIN U 5-15-O	27S	70W	22
050550608000	OXY USA INC	SHEEP MOUNTAIN U 7-22-P	27S	70W	27
050550609000	HIGH SUMMIT O&G	HUERFANO-STATE 1-16	26S	67W	16
050550609100	HIGH SUMMIT O&G	HUERFANO-STATE 2-36	26S	67W	36
050550609400	HIGH SUMMIT O&G	SPORLEDER 1-26	26S	67W	26
050550610600	OXY USA INC	SHEEP MOUNTAIN 7-35-L	28S	70W	2
050550613900	EOG INC	POISON CANYON FED 1-13	26S	71W	13
050550629400	PETROGLYPH OPERATING	MCCOMBS 31-10	27S	66W	31
050590500600	GREAT BASINS PET CO	PALLAORE 1	5S	69W	6
050590506300	FLAGG OIL	METZ INDUSTRIES INC 1	5S	69W	23
050590600900	TETON ENERGY CO INC	CHURCH 22-1	2S	70W	22
050610502800	STANOLIND O&G CO	BOLTON-LAMBERSON 1	20S	52W	7
050610504000	SANDS OIL CO	PHILPY 1	19S	53W	33
050610504800	LION OIL CO	CLAIR 1	19S	54W	23
050610506000	CITIES SERVICE	BAUGHMAN 1-B	19S	51W	2

UWI / API	Operator	Well Label	T	R	S
050610506200	CITIES SERVICE	BAUGHMAN-A 1	19S	51W	1
050610506500	MUSGROVE CHANDLER	LEMON 1	18S	49W	31
050610506700	RISING KEITH L	BAUGHMAN 1	18S	50W	30
050610514700	TEXACO INC	P L REED 1	19S	52W	8
050610602900	MCBRIDE W C INCORP	W F FRAZEE 1-3	19S	50W	3
050610604000	DIAMOND SHMROCK CORP	FERGUS-STATE 1-36	17S	49W	36
050610605600	APPLETON OIL	KIMCO 1	19S	51W	10
050610606500	GERMANY INVST CO	WILLIAM ROSE 2-24	20S	50W	24
050610611000	GERMANY INVST CO	NEUFIELD 1	18S	50W	23
050610611800	RODMAN GAS ETAL	CHAMPLIN-GREENWELL 1	17S	49W	25
050610613100	MARATHON OIL	UP-BERRY 1	17S	49W	21
050610614400	KEMMERER COAL CO	GRANDVIEW 1	20S	50W	21
050610615800	ANSCHUTZ CORP	BARTON 1	19S	49W	17
050610615900	ANSCHUTZ CORP	MITCHELL 1	20S	51W	8
050610616000	ANSCHUTZ CORP	WEINMAN ETAL 1	20S	52W	26
050610616300	RENEGADE OIL & GAS	PHILPY 1	20S	52W	18
050610616600	RENEGADE OIL & GAS	BOLTON 1	20S	52W	7
050610620100	PETRO LEWIS CORP	MARX 1-19	19S	54W	19
050610620400	MICH WISC PIPE LINE	BOLTON 2-7	20S	52W	7
050610620600	TRUE OIL LLC	JOHNSON 23-22	18S	54W	22
050610621900	MICH WISC PIPE LINE	BOLTON 1-6	20S	52W	6
050610623400	MICH WISC PIPE LINE	BOLTON 1-8	20S	52W	8
050610623600	MURFIN DRLG CO	MURFIN-BLACK 1-27	18S	49W	27
050610624300	KISSINGER PET CORP	ROSE 11-12X	20S	50W	12
050610626000	GEN AMER OIL CO	FEDERAL 1-6	18S	52W	6
050610626900	BURTON-HAWKS INC	SHOTTON 32-1	19S	50W	32
050610627400	SAMSON OIL CO	STATE-FRAZEE 2-36	18S	51W	36
050610627600	SAMSON OIL	FRAZEE 1-31	18S	50W	31
050610627800	BILLS DON	BLOND & GOLDMAN 6-1	18S	52W	6
050610629400	BERRY ENERGY INC	SHOTTON 1	19S	50W	10
050610629600	BERRY ENERGY INC	FRAZEE 1-6	19S	50W	6
050610630200	TEXAS O&G CORP	SHOTTON 2	19S	50W	11
050610630300	TROUSIL & ASSOCIATES INC	FRAZEE-B 1	19S	50W	4
050610631700	SAMSON OIL CO	MCNEIL 1-32	18S	50W	32
050610631800	TXO PROD CORP	FRAZEE-C 1	19S	50W	3
050610632100	TXO PROD CORP	STATE-C 1	19S	50W	16
050610632800	TXO PROD CORP	FRAZEE B 2	19S	50W	9
050610632900	SAMSON OIL	LAS ANIMAS 1-5	19S	50W	5
050610633200	SAMSON OIL CO	DIRKS 1-5	19S	50W	5
050610633400	ENERVEST OPERATING L L C	FRAZEE C 2-31	18S	50W	31
050610634800	SAMSON OIL	FEDERAL-FRAZEE 1-6	19S	50W	6
050610635300	BERRY ENERGY INC	HELFRICH 1	19S	50W	4
050610635700	TXO PROD CORP	KOONTZ A-1	19S	50W	13
050610635800	TXO PROD CORP	FRAZEE-B 3	19S	50W	4
050610636500	BERRY ENERGY INC	FRAZEE 2-6	19S	50W	6
050610636600	SAMSON OIL	HAMBLETON 1-6	19S	50W	6
050610636800	BERRY ENERGY INC	LAS ANIMAS 1-1	19S	51W	1
050610637000	MILESTONE PET INC	SPADY BROTHERS 1	20S	52W	15
050610637300	MARLIN OIL	PHILLIPS-MARLIN 1	18S	53W	1
050610637400	BIG FOUR PETROLEUM	GARVEY 1-27	20S	50W	27
050610637600	BERRY ENERGY INC	FRAZEE (B) 4	19S	50W	9
050610638100	ADOBE OIL & GAS CORP	BLAKEMORE 11-8	17S	51W	18
050610638800	SAMSON OIL	LAS ANIMAS 1-7	19S	50W	7

UWI / API	Operator	Well Label	T	R	S
050610639400	BERRY ENERGY INC	STAVELY 1-26	18S	51W	26
050610639700	BERRY ENERGY INC	FRAZEE-B 5	19S	50W	9
050610640100	TROUSIL & ASSOCIATES INC	FRAZEE B 6	19S	50W	9
050610640200	SAMSON OIL CO	WEBER 1-25	18S	51W	25
050610640300	BERRY ENERGY INC	WEINMANN 1-27	18S	51W	27
050610640800	SAMSON OIL	WEINMANN 1-26	18S	51W	26
050610640900	TXO PROD CORP	FRAZEE-B 8	19S	50W	9
050610641000	TROUSIL & ASSOCIATES INC	FRAZEE-B 9	19S	50W	9
050610641500	SAMSON OIL CO	SALISBURY 1-25	18S	51W	25
050610641700	SAMSON OIL	CHILDS 1-22	18S	51W	22
050610642000	SAMSON OIL CO	STOKER 1-22	18S	51W	22
050610642100	TROUSIL & ASSOCIATES INC	FRAZEE-B 10	19S	50W	9
050610642300	TXO PROD CORP	FRAZEE-B 11	19S	50W	9
050610642900	BERRY ENERGY INC	FRAZEE-G 1	19S	50W	10
050610643100	TROUSIL & ASSOCIATES INC	HELFRICH 2	19S	50W	4
050610643200	TXO PROD CORP	HELFRICH 3	19S	50W	4
050610643300	BERRY ENERGY INC	HELFRICH 4	19S	50W	8
050610643600	SAMSON OIL CO	HELFRICH 1-5	19S	50W	5
050610643800	TXO PROD CORP	RIEMENSCHNEIDER 1	19S	50W	15
050610644500	MILESTONE PET INC	STAVELY 1	18S	52W	10
050610645000	SAMSON OIL	DEAR 1-35	18S	51W	35
050610645100	SAMSON OIL CO	STATE FRAZEE 3-36	18S	51W	36
050610645600	BERRY ENERGY INC	FRAZEE B-12	19S	50W	9
050610645700	TXO PROD CORP	COX `L` 1	19S	49W	30
050610645900	SPRING THOMAS L	STAVELY 1	18S	51W	26
050610647100	TROUSIL & ASSOCIATES INC	FRAZEE-B 16	19S	50W	9
050610647400	MURFIN DRLG CO	HASWELL FARMS 1-5	19S	49W	5
050610647500	CHANDLER & ASSOC INC	FRAZEE 5-12	19S	50W	12
050610647800	TXO PROD CORP	FRAZEE B 14	19S	50W	9
050610649500	TXO PROD CORP	FRAZEE K 1	19S	50W	15
050610650000	MURFIN DRLG CO	HASWELL FARMS 1-8	19S	49W	8
050610651100	WILLIFORD ENERGY CO	LUEKING 1-32	18S	52W	32
050610655400	MULL DRLG CO INC	KRISS 1	17S	42W	18
050610655900	MURFIN DRLG CO	COX 1-29	19S	49W	29
050610656300	PETROLEUM INC	WAGNER F 1-X	18S	52W	4
050610656800	ENRON OIL & GAS CO	FRAZEE 1-26	18S	50W	26
050610657300	MULL DRLG CO INC	STATE-DAVIS 1	18S	49W	16
050610657700	SAVANT RESOURCES INC	UMBRELLA 1-5	18S	42W	5
050610658700	MULL DRLG CO INC	UPRC-JAGEE 1	18S	44W	5
050610659800	MULL DRLG CO INC	UNITED BANK 1	17S	50W	14
050610659900	MULL DRLG CO INC	PECK 1	17S	50W	32
050610660400	UNION PACIFIC RES CO	MARTIN 24-17 1	18S	47W	17
050610660800	MONUMENT GAS MARKETING INC	BARLOW 1-3	18S	46W	3
050610661300	MULL DRLG CO INC	UPRC-ALDRICH 1	18S	50W	5
050610661400	MULL DRLG CO INC	UPRC-BEACHNER BROS 1	17S	50W	23
050610661800	MULL DRLG CO INC	MULL UPRC-RUST 1	17S	50W	31
050610663400	MULL DRLG CO INC	UPRC-LIEBL 1	17S	50W	31
050610664300	MULL DRLG CO INC	BEACHNER BROS 1	18S	50W	6
050610665200	MULL DRLG CO INC	CROW 1-X	18S	49W	6
050610665600	MULL DRLG CO INC	POLLY PARNELL 1	17S	50W	30
050610666400	ALLANTE OPERATING CO	MOCKINGBIRD HILL 1-16	18S	51W	16
050610669300	MULL DRLG CO INC	ZULA 1	18S	51W	8
050610669400	OBRIEN ENERGY RES	PATRICIA 1-23	18S	50W	23

UWI / API	Operator	Well Label	T	R	S
050610669700	WALKER RESOURCES INC	SECOME 19-1	19S	52W	19
050610670000	MULL DRLG CO INC	MULL UPRC-ALDRICH 2	18S	50W	5
050610670100	OBRIEN ENERGY RES	PATRICIA 2-23	18S	50W	23
050610671000	MULL DRLG CO INC	UPRC-ASH 2	17S	42W	17
050610671600	UNION PACIFIC RES CO	SOUTH MONTAULK 31-18	17S	46W	18
050610679400	STRACHAN EXPL INC	ALDRICH 29-1	17S	50W	29
050610679600	STRACHAN EXPL INC	ALDRICH 29-2	17S	50W	29
050610679700	BERRY ENERGY INC	STATE 8-2	19S	50W	8
050610680700	STRACHAN EXPL INC	MOPAC COLORADO EAGLE 1	18S	51W	22
050610684400	JETTA OPER CO INC	GOLDMAN MELCHER FEDE 1	18S	52W	6
050610685900	NAVEX RESOURCES LLC	NEGLEY 1-21	19S	50W	21
050630500200	CONTINENTAL OIL CO	LOWE 1	11S	46W	1
050630500600	HONOLULU OIL CORP	MCCONNELL 1	10S	47W	20
050630501000	CHAMLEE HOWARD ETAL	ARMSTRONG 1	9S	50W	26
050630501200	AMERADA PETRO CMPNY	BECKER 1	9S	48W	29
050630501300	KATZ SID	EINSPAHR 1	9S	47W	23
050630502000	WARD AL & SON	BRACHTENBACH 1	8S	47W	22
050630502200	FALCON SEABORD DRLG	EDMUND 1	7S	47W	28
050630502300	MACDONALD OIL CORP	WILLEY 1	7S	46W	6
050630502600	JOHNSON S D	WALT MEYERS 1	6S	47W	32
050630509000	CONTINENTAL OIL CO	LOWE 2	11S	46W	1
050630509400	PLAINS EXPL CORP	A M LOWE 1	11S	46W	2
050630509600	PLAINS EXPL CORP	CLARENCE VANNIDA 1	6S	46W	6
050630509700	CONTINENTAL OIL CO	MAY 24-1	11S	47W	24
050630600600	TIGER OIL	MILLS ETAL 1	10S	47W	32
050630601200	TIGER OIL	ARTHUR LOWE 1-35	10S	46W	35
050630601300	TIGER OIL	BEESON 1-36	10S	46W	36
050630603000	UNION TEXAS PET CORP	WITTIG 1	11S	51W	10
050630603400	DAVIS EDWARD M	STATE-BEDFORD 1-16	11S	45W	16
050630608700	TEXAS O&G CORP	WITZEL 1	11S	45W	5
050630610900	SHELTER US INC	STATE 1	10S	47W	16
050630611100	SHELTER US INC	KOELLER 1	6S	48W	24
050630611200	SHELTER US INC	ERVIN 1	8S	49W	32
050630613800	AMOCO PROD CO	POTTORFF H C 1	9S	51W	23
050630618100	MARATHON OIL	BEESON 2	11S	46W	1
050630618400	BWAB INC	JOHNSON 1-23	11S	46W	1
050630618500	RITCHIE EXPLORATION INC	PETEX LOWE 1	11S	46W	14
050630618600	RITCHIE EXPLORATION INC	LOWE 1-B	11S	46W	14
050630618700	PETX PETROLEUM CORP	LOWE A-2	11S	46W	14
050630618800	WIEPKING-FLLRTN EXPL	14 RED 1	11S	46W	14
050630618900	AMERADA HESS CORP	UPRR 11-34	11S	46W	11
050630619100	ENERGY OPERATING INC	LOWE 41-14	11S	46W	14
050630619200	RITCHIE EXPLORATION INC	LOWE B2	11S	46W	14
050630619800	ANADARKO E & P	JARNAGIN-A 1	9S	49W	30
050630619900	ANADARKO E & P	KNAPP A 1	10S	48W	18
050630620200	UNION PACIFIC RES CO	WECO-MCARTHER 43-17 1	11S	45W	17
050630620600	ANADARKO E & P	ANDERSON F 1A	10S	48W	32
050630620800	UNION PACIFIC RES CO	MAY BROTHERS 12-13 1	11S	46W	13
050630621500	CONOCO INC	STATE 1-16	11S	49W	16
050630622000	ABERCROMBIE A L INC	POMEROY 1	11S	48W	8
050630622400	CHARTER PROD CO	2-May	11S	46W	13
050630622500	ANSCHUTZ CORP	MYRICK 15-10	10S	46W	10
050630622600	ANSCHUTZ CORP	SMITH 16-20	10S	51W	20

UWI / API	Operator	Well Label	T	R	S
050630623000	ANSCHUTZ CORP	BLEDSOE 5-35	11S	51W	35
050630623100	DRW OPERATING CO	POPEYE 1	11S	46W	12
050630623300	WIEPKING-FULLERTON	WIMPY 1	11S	46W	13
050630623700	UNION PACIFIC RES CO	FLATHEAD 14-31 1	11S	50W	31
050630623800	RME PETROLEUM	SPEAKER-STATE 43-36 1	11S	51W	36
050630623900	CHARTER PROD CO	GREENWOOD TRUST 1	11S	47W	1
050630624000	UNION PACIFIC RES CO	FLATHEAD 12-31 2	11S	50W	31
050630624100	ANADARKO E & P	PATRICIA 43-25 1	11S	51W	25
050630624200	RME PETROLEUM	FLATHEAD 14-31 3	11S	50W	31
050630624300	CHARTER PROD CO	FIRST NATIONAL 1	10S	45W	34
050630624500	UNION PACIFIC RES CO	COLMENO 21-30 2	11S	50W	30
050630624600	ANADARKO E & P	COLMENO 12-30 1	11S	50W	30
050630624700	UNION PACIFIC RES CO	PATRICIA 32-25 2	11S	51W	25
050630624800	UNION PACIFIC RES CO	PATRICIA 41-25 3	11S	51W	25
050630624900	UNION PACIFIC RES CO	PATRICIA 23-25 4	11S	51W	25
050630625200	UNION PACIFIC RES CO	SPEAKER STATE 34-36 2	11S	51W	36
050630625400	ANADARKO E & P	COLMENO 14-19 1	11S	50W	19
050630625600	UNION PACIFIC RES CO	PATRICIA 42-25 5	11S	51W	25
050630625900	ANSCHUTZ CORP	LAZY RIVER 12-29	11S	48W	29
050630627000	ANADARKO E & P	COLMENO 11-30 3	11S	50W	30
050630627200	UNION PACIFIC RES CO	HIGHPOINT STATE 21-3 1	11S	51W	36
050630627800	UNION PACIFIC RES CO	HIGHPOINT 23-19 1	11S	50W	19
050630627900	UNION PACIFIC RES CO	PATRICIA 34-25 6	11S	51W	25
050630628500	ANSCHUTZ CORP	WEST BIG TIMBER 8-11	11S	44W	11
050630628600	UNION PACIFIC RES CO	HIGHPOINT 34-19 3	11S	50W	19
050630629100	UNION PACIFIC RES CO	RETRIEVER 43-19 1	11S	44W	19
050630629200	CITATION OIL & GAS CORP	KIRCHOFFNER 21-35 2	11S	45W	35
050630629400	UNION PACIFIC RES CO	HOVAWART 24-1 1	11S	46W	1
050690508800	FRNT RNGE O&URNUM CO	DEAN 1	7N	69W	4
050690607300	UNIOIL CORP	RODENBERGER 1	7N	68W	12
050690612100	ENSERCH EXPL INC	MOODY-WARREN 1-12	7N	68W	12
050690612700	AMOCO PROD CO	THAYER KENNETH 1	7N	68W	27
050690615200	TOLTEK DRLG CO	DEINES 1	6N	69W	14
050690617400	UNIOIL CORP	TIMNATH 1	7N	68W	34
050710616800	GERRITY CO INC THE	COPPA 20-6	30S	64W	20
050710751500	PIONEER NATURAL RESOURCES	JOLLY 12-17	30S	64W	17
050710770500	EVERGREEN OPERG CORP	DUPONT LAKE 43-18	30S	64W	18
050730500100	UTAH SOUTHERN OIL CO	TUDOR 1	17S	57W	26
050730500400	MCLAUGHLN C T	ANDERSON 1	16S	59W	30
050730500500	MCLAUGHLN C T	HODGSON 1	16S	56W	3
050730500600	MCLAUGHLN C T	MILLER 1	16S	58W	5
050730501000	HUNT H L	NEWELL 1-A	15S	57W	8
050730501600	ROOD C M	WHITE 1	13S	56W	19
050730501700	HOOTS H W	WHITE CARL 2	13S	56W	19
050730501900	KINGWOOD OIL CO	TAYLOR 1	10S	53W	26
050730502100	MURPHY CORP	BENNETT 1-6	10S	55W	6
050730502300	MURPHY OIL	STATE & LIMON 1-4244	9S	56W	36
050730502600	MURPHY CORP	STATE LIMON 1-4242	9S	56W	23
050730502700	KINGWOOD OIL CO	UPRR-GOODMAN-GRN&SD 1	9S	52W	5
050730502800	LOHMANN-JOHNSON DRLG	BAUGHMAN FARM 1	8S	53W	14
050730502900	LOHMANN-JOHNSON DRLG	G ONEILL 1	8S	56W	15
050730503000	LOHMANN-JOHNSON DRLG	E EWING ETAL 1	8S	54W	15
050730503100	LOHMANN-JOHNSON DRLG	CHUBBUCK 1	8S	52W	15

UWI / API	Operator	Well Label	T	R	S
050730503300	KINGWOOD OIL CO	ANDERSON 1	7S	54W	25
050730503400	KINGWOOD OIL CO	HUNTZINGER 1	7S	52W	28
050730503500	TRIANGLE J OIL CO	NEWSON 1	7S	56W	23
050730503600	LBRTY O&URNUM CO THE	S H BRENT 1	7S	53W	17
050730503700	COLORADO OIL VENTURE	JONES 1	7S	52W	15
050730503800	LBRTY O&URNUM CO THE	A E SCHOONOVER 1	7S	53W	15
050730504000	LBRTY O&URNUM CO THE	G L MILLER 1	6S	53W	35
050730504100	LBRTY O&URNUM CO THE	NOTTINGHAM 1	6S	53W	31
050730504200	WYTEX OIL CORP	FRANK LINK 1	6S	54W	25
050730504300	LBRTY O&URNUM CO THE	W NOTTINGHAM 2	6S	53W	29
050730504400	WYTEX OIL CORP	HARRY THOMPSON 1	6S	55W	28
050730504500	WYTEX OIL CORP	HALDO KJOSNESS 1	6S	55W	24
050730504600	DAVIS OIL CO	ELLISTON 3	6S	52W	22
050730504700	DAVIS EDWARD M	TRAHERN 1	6S	54W	20
050730504800	WYTEX OIL CORP	SEASE 1	6S	55W	14
050730504900	WYTEX OIL CORP	RODGERS 1	6S	54W	14
050730505200	DAVIS OIL CO	ELLISTON 2	6S	52W	9
050730505300	WYTEX OIL CORP	AIF BLAKSTAD 1	6S	55W	9
050730505400	WYTEX OIL CORP	HOLDER THOMPSON 1	6S	54W	7
050730505600	DAVIS OIL CO	WORTHINGTON 1	6S	53W	5
050730505700	WYTEX SERVICE	HICKS 1	6S	54W	1
050730511000	PRENTICE SPELMN&ASOC	EIDEM 1	6S	54W	9
050730511200	PLAINS EXPL CORP	TOMMY L TAYLOR 1-B	10S	53W	27
050730600100	ALLISON DRLG	STATE-W 1	9S	56W	26
050730600200	HEWIT WILLIAM D	DAVIS 1	6S	53W	9
050730600300	HEWIT WILLIAM D	DAVIS-STATE 1	6S	53W	16
050730600400	UNION TEXAS PET CORP	STATE 1-36	13S	53W	36
050730600500	HEWIT WILLIAM D	DAVIS 1-4	6S	53W	4
050730600700	UNION TEXAS PET CORP	EMIL F ROSS 1	14S	53W	12
050730600800	JOSEY LENOR M INCORP	UPRR-CAGE 1	15S	52W	5
050730601100	TRUE OIL LLC	AMOCO-STATE 14-18	10S	56W	18
050730601200	TRUE OIL LLC	FORRISTALL RANCH 14-20	10S	55W	20
050730601300	TRUE OIL LLC	AMOCO-STATE 14-26	10S	56W	26
050730601400	TRUE OIL LLC	LEE M THOMP ETAL 14-20	7S	55W	20
050730601600	TRUE OIL LLC	MAUCK ETAL 14-20	8S	55W	20
050730601700	TRUE OIL LLC	COVINGTON 14-28	9S	55W	28
050730601900	BEAVER MESA EXPL	SCHREIBER 14-28	7S	53W	28
050730602000	BEAVER MESA EXPL	GARTEN 41-20	8S	53W	20
050730602200	BEAVER MESA EXPL	ECCLESTON 14-2	8S	55W	2
050730602400	BEAVER MESA EXPL	SCHULTE 14-14	9S	53W	14
050730602800	SAMEDAN OIL CORP	BAUGHMAN 1	6S	54W	3
050730602900	SAMEDAN OIL CORP	BAUGHMAN FARMS 1	6S	54W	23
050730603100	MCKNAB PROD	FORRESTALL 1	14S	54W	10
050730603200	WARD AL & SON	ANDERSON 1	17S	53W	21
050730603300	PETROLEUM EXPL&PROD	HIGGINS-A 1	7S	56W	6
050730603400	PETROLEUM EXPL&PROD	CROSS 1	6S	56W	30
050730603500	PETROLEUM EXPL&PROD	NORBYE 1	6S	56W	26
050730603600	PETROLEUM EXPL&PROD	NEWSOM 1	7S	56W	14
050730603700	PETROLEUM EXPL&PROD	EINSPAHR 1	6S	54W	32
050730604000	DART OIL	GILBERT 1	6S	56W	22
050730604100	PETROLEUM EXPL&PROD	BEEDY 1	7S	54W	14
050730604200	PETROLEUM EXPL&PROD	TRAINER 1	7S	54W	20
050730604400	SNYDER JIM DRLG CO	ANSCHUTZ-B 1	8S	52W	26

UWI / API	Operator	Well Label	T	R	S
050730604500	WESTERN DRLG CO INC	JACK P JONES ETAL 1	14S	57W	28
050730604600	SNYDER JIM DRLG CO	FREEMAN 1	8S	53W	30
050730604700	SNYDER JIM DRLG CO	MARTIN 1	8S	55W	25
050730604800	WESTERN DRLG CO INC	JACK P JONES ETAL 2	14S	57W	13
050730604900	WESTERN DRLG CO INC	JACK P JONES ETAL 3	14S	58W	12
050730605200	LOUISIANA LAND&EXPL	STATE 1	15S	56W	18
050730605300	MIDWEST OIL	UPRR 1	13S	52W	33
050730605500	NORSK HYDRO PET	CR JOHNSON 1	7S	55W	10
050730605600	NORSK HYDRO PET	FALCH 1	6S	55W	11
050730605700	NORSK HYDRO PET	NORBYE-STATE 1	6S	55W	30
050730605800	NORSK HYDRO PET	OSTROWSKI-STATE 1	6S	52W	16
050730605900	NORSK HYDRO PET	CROSS 1	6S	52W	30
050730606100	NORSK HYDRO PET	CRAIG-STATE 1	9S	56W	36
050730606200	NORSK HYDRO PET	TEMPLEMAN 1	7S	56W	30
050730606300	NORSK HYDRO PET	CROSS 2	6S	52W	23
050730606400	PETRO LEWIS CORP	SCHACK 1-14	15S	57W	14
050730606500	WILLIAMS ROBERT G	WILLIAMS 10-27	14S	56W	27
050730606600	CHEVRON U S A INC	WINEINGR DAVIS RNCH 12-33	16S	56W	33
050730607000	VESSELS OIL & GAS CO	LOCKWOOD 3-34	14S	56W	34
050730607100	VESSELS OIL & GAS CO	WILLIAMS 1	14S	56W	28
050730607300	VESSELS OIL & GAS CO	SMITH-FORDER RANCH 1	15S	56W	7
050730607400	VESSELS OIL & GAS CO	HORSE CREEK 1	17S	56W	4
050730607600	SAMSON OIL CO	JENKINS 1-5	17S	57W	5
050730607900	MEDALLION OIL CO	WEBB 1	15S	54W	9
050730608000	GUMZ H F	STATE 1	14S	57W	36
050730609300	BILLS DON	D-4 RANCH 22-1	17S	53W	22
050730609400	BILLS DON	FEDERAL LAND BANK 6-1	17S	53W	6
050730609600	MULL DRLG CO INC	BRAUKMANN FARM 1	12S	53W	1
050730609700	MULL DRLG CO INC	BRAUKMANN FARM 1A	12S	53W	12
050730609800	CITATION OIL & GAS CORP	KOCH 11-7 1	12S	52W	7
050730609900	MURFIN DRLG CO	S-S-M JOLLY 1-11	12S	56W	11
050730610000	MULL DRLG CO INC	BRAUKMAN FARM-A 2	12S	53W	12
050730610200	MULL DRLG CO INC	BRAUKMANN FARM 3	12S	53W	1
050730610300	MURFIN DRILLING	S-S-M O`BRIEN 1-19	10S	53W	19
050730610500	MULL DRLG CO INC	BRAUKMANN FARM CORP 1-B	12S	53W	11
050730610600	MULL DRLG CO INC	BRAUKMANN FARMS 1-C	12S	53W	1
050730610700	MULL DRLG CO INC	BRAUKMANN FARMS 4	12S	53W	1
050730610800	MULL DRLG CO INC	BRAUKMANN FARMS 1-D	12S	53W	15
050730610900	SHELTER US INC	DAUM 1	12S	52W	8
050730611000	SHELTER US INC	CREECH 7-1	12S	55W	7
050730611100	SHELTER U S INC	NEWBY 6-4	12S	52W	6
050730611200	MULL DRLG CO INC	BRAUKMANN FARMS 1E	12S	53W	32
050730611300	CITATION OIL & GAS CORP	KOCH 22-7 2	12S	52W	7
050730611400	CELSIUS ENERGY CO	CELSIUS-JONES 14-1	14S	57W	14
050730611500	MURFIN DRILLING	S-S-M O`BRIEN 2-19	10S	53W	19
050730611600	SOHIO PETROLEUM CO	HAFLICH 4-6	12S	55W	4
050730611800	SOHIO PETROLEUM	HARRIS 19-3	9S	55W	19
050730612000	MULL DRLG CO INC	VICK 1	12S	53W	2
050730612100	SHELTER US INC	NEWBY 6-12	12S	52W	6
050730612200	MURFIN DRLG CO	S-S-M MELLOTT 1-31	11S	53W	31
050730612400	CHANDLER & ASSOC INC	VICK 1-25	12S	53W	25
050730612500	CHANDLER & ASSOC INC	BLEDSOE 1-23	11S	52W	23
050730612600	SHELTER U S INC	PARKER 5-13	10S	53W	5

UWI / API	Operator	Well Label	T	R	S
050730612700	SHELTER US INC	SHELTER ET AL-VICK 32-12	11S	52W	32
050730612900	CITATION OIL & GAS CORP	STATE 1-36	11S	53W	36
050730613100	SHELTER U S INC	PARKER 8-3	10S	53W	8
050730613200	MURFIN DRILLING	S-S-M SOHIO-MELLOT 1-21	11S	53W	21
050730613400	SOHIO PETROLEUM CO	CRAIG 13-10	9S	56W	13
050730613600	MULL DRLG CO INC	BRAUKMANN-C 2	12S	53W	1
050730613700	MURFIN DRLG CO	SSM COLORADO STATE 1-16	13S	55W	16
050730613800	HUSKY OIL LTD	CAGE RANCH 1	15S	52W	32
050730614000	SOHIO PETROLEUM CO	LIGGETT 18-11	9S	55W	18
050730614200	ADOBE OIL & GAS CORP	FRANK 12-27	14S	55W	27
050730614300	MULL DRLG CO INC	CLAY 1	12S	53W	3
050730614400	AMOCO PROD CO	PRAIRIE MINERALS 1	8S	52W	23
050730614500	SHELTER US INC	VICK 31-12	11S	52W	31
050730614600	MURFIN DRLG CO	S-S-M WILL JAMES 1-34	11S	53W	34
050730614800	PHILLIPS PETRLM CO	JACOBSON-A 1	16S	54W	2
050730614900	TXO PROD CORP	STEELE A-1	12S	52W	2
050730615000	SHELTER US INC	PARKER 8-6	10S	53W	8
050730615100	MURFIN DRLG CO	S-S-M/TXO WILL 1-26	11S	53W	26
050730615200	WIEPKING-FULLERTON ENERGY	SELLON 29-8	11S	55W	29
050730615300	MULL DRLG CO INC	BRAUKMANN FARMS 1	12S	53W	14
050730615400	DAVIS OIL CO	PUNKIN CENTER 1	17S	56W	2
050730615500	GRAHAM RESOURCES INC	JOHNSON-TAYLOR 11-22	11S	52W	22
050730615700	SKYLINE OIL CO	MOSHER 32-11	13S	53W	32
050730616000	CHAMPLIN PETRO CMPNY	CLAY 24-35 1	11S	53W	35
050730616100	MULL DRLG CO INC	STATE-FORRISTALL 1	12S	55W	36
050730616200	MURFIN DRLG CO	S-S-M JOLLY-OBRIEN 1-18	10S	53W	18
050730616400	MURFIN DRLG CO	S-S-M MELLOTT 1-6	12S	53W	6
050730616500	TEXAS GAS EXPL CORP	STATE 1-20	13S	54W	20
050730616900	SOHIO PETROLEUM CO	UPRR 5-12	7S	54W	5
050730617000	SOHIO PETROLEUM CO	UPRR 29-2	8S	55W	29
050730617100	SOHIO PETROLEUM CO	SLATER 32-14	10S	56W	32
050730617200	CABOT PETROLEUM CORP	MELIA TRUST 8-10	6S	52W	10
050730617500	MULL DRLG CO INC	CRAIG 1	13S	55W	33
050730617600	WIEPKING-FULLERTON	PAYDAY 1	11S	52W	31
050730617800	PHILLIPS PETRLM CO	STATE-V 1	16S	54W	16
050730617900	RME PETROLEUM	COTTONWOOD 1	12S	52W	3
050730618000	MARLIN OIL	BLACKWELDER FARMS 1	8S	56W	5
050730618200	CARIBOU ENERGY INC	PARKER-L 1	16S	54W	29
050730618400	MULL DRLG CO INC	VICK 2	12S	53W	2
050730618500	MURFIN DRLG CO	BLEDSOE 1-23	11S	52W	23
050730618600	MURFIN DRLG CO	STONE 1-29	14S	55W	29
050730618700	MURFIN DRLG CO	ROWAN 1-18	11S	52W	18
050730618900	MAGPIE OPERATING INC	SAFRANEK-STATE 2-30	9S	56W	30
050730619000	ROCK OIL CORP	MARQUIS 1	7S	52W	23
050730619200	ARGENTIA CORP	SAFRANEK-STATE 3-30	9S	56W	30
050730619300	ROCK OIL CORP	IMPERIAL 1	6S	52W	14
050730620300	KAISER-FRANCIS OIL	WILLIAM H CRAIG ET U 4-34	13S	55W	34
050730620500	HUNT OIL CO	H O C 1-10	14S	52W	10
050730620700	HUNT OIL CO	H O C 1-14	15S	52W	14
050730620800	HUNT OIL CO	KINZIE ETAL 1-31	15S	52W	31
050730621000	MARLIN OIL	TEMPLEMAN 1	7S	56W	32
050730621100	MARLIN OIL	WAGNER 1	8S	56W	6
050730621200	MULL DRLG CO INC	BRAUKMANN FARMS H 1	12S	53W	17

UWI / API	Operator	Well Label	T	R	S
050730621300	HUNT OIL CO	KINZIE ETAL 1-4	15S	52W	4
050730621400	CHAMPLIN PETRO CMPNY	C G A 42-12 1	12S	52W	12
050730621600	BRIDWELL OIL CO	PALMER 8-3	15S	52W	8
050730621800	CARIBOU ENERGY INC	PAYDAY 2	11S	52W	31
050730622100	WOODS PETROLEUM CORP	BLAKEMOORE 1-1	17S	52W	1
050730622200	MURFIN DRLG CO	CO STATE LIMON 1-16	8S	56W	16
050730622400	ANADARKO E & P	COTTONWOOD RANCH A 1	12S	52W	10
050730622500	QUESTA ENERGY CORP	NEWSOM 1-13	7S	56W	13
050730622600	SEAHAWK OIL INTL INC	SEAHAWK-SMIRNOFF 3	12S	52W	11
050730622800	SEAHAWK OIL	SMIRNOFF-CWOOD 1-10	12S	52W	10
050730623100	CAVANAUGH&CAVANAUGH	DEADHORSE 1	16S	57W	29
050730623200	BHP PET(AMERICAS)INC	BROCKMAN FARMS 6-12	12S	53W	12
050730623300	CITIES SERV O&G CORP	PALMER A 1	14S	52W	19
050730623400	MURFIN DRLG CO	CO STATE LIMON 2-16	8S	56W	16
050730623800	APEX OPERATING CO	LOCKWOOD 27-22	14S	56W	27
050730624200	TERRA RESOURCES INC	SHELTER-TRI 24-31	11S	52W	31
050730624300	AMPET INC ETAL	GRAEBNER 35-44	14S	56W	35
050730624500	AVALON ENERGY	BRAUKMANN 12-12	12S	53W	12
050730624600	NEW LONDON OIL INC	PRAIRIE 1	12S	52W	9
050730624800	AVALON CORP	BRAUKMAN 2-14	12S	53W	14
050730624900	UNION PACIFIC RES CO	STATE-MONKS 23-6 1	10S	55W	6
050730625200	UNION PACIFIC RES CO	FORRISTAL RANCH-STAT 1	10S	55W	30
050730625400	TEX-CON OIL & GAS CO	UPRR-TEMPLEMAN 1-31	7S	56W	31
050730625500	PANTANO ENERGY	BLAKEMORE 1-12	17S	52W	12
050730625700	UNION PACIFIC RES CO	BENZ 11-24	16S	52W	24
050730625900	UNION PACIFIC RES CO	SMOKER 22-11 1	13S	54W	11
050730626800	WIEPKING-FLLRTN EXPL	JUICE 1	10S	54W	24
050730627100	UNION PACIFIC RES CO	STEGAS 23-15 1	11S	53W	15
050730627300	UNION PACIFIC RES CO	ERIE 33-33 1	13S	52W	33
050730627400	LEEDE OIL & GAS INC	DILL 1-23	12S	53W	23
050730627700	WIEPKING-FLLRTN EXPL	DUNDEE 1	10S	53W	18
050730627800	UNION PACIFIC RES CO	STEGAS 34-15 2	11S	53W	15
050730628000	UNION PACIFIC RES CO	CLIFFORD EAST 32-5 1	12S	52W	5
050730628200	ANSCHUTZ CORP	CRAIG 5-14	14S	55W	14
050730628300	MESA OPER LTD PRTNRS	SMITH CATTLE 1-19	14S	56W	19
050730628500	UNION PACIFIC RES CO	CAGE RANCH 11-23 1	15S	52W	23
050730628600	UNION PACIFIC RES CO	CAGE RANCH 31-23 2	15S	52W	23
050730628700	UNION PACIFIC RES CO	LAPLATA 41-10 1	15S	52W	10
050730628800	UNION PACIFIC RES CO	T-BIRD 14-13 1	15S	52W	13
050730628900	UNION PACIFIC RES CO	WINSHIP 14-2 1	15S	52W	2
050730629000	UNION PACIFIC RES CO	RAPTOR 34-1 1	12S	52W	1
050730629100	UNION PACIFIC RES CO	LAPLATA 42-10 2	15S	52W	10
050730629200	UNION PACIFIC RES CO	MERCEDES 14-14 5	15S	52W	14
050730631100	RUNNING FOXES PET	JOLLY RANCH 2-1	13S	56W	1
050730631600	RUNNING FOXES PET	CRAIG 15-34	13S	55W	34
050730631700	RUNNING FOXES PET	CRAIG 7-34	13S	55W	34
050730631800	RUNNING FOXES PET	CRAIG 15-32	13S	55W	32
050730632000	RUNNING FOXES PET	CRAIG 8-1	14S	55W	1
050730636800	RUNNING FOXES PET	CRAIG 12-28	13S	55W	28
050730636900	RUNNING FOXES PET	CRAIG 10-28	13S	55W	28
050730637000	RUNNING FOXES PET	CRAIG 4-33	13S	55W	33
050730639100	RUNNING FOXES PET	CRAIG 6-4 SWD	14S	55W	4
050730639800	RUNNING FOXES PET	CRAIG 16-32	13S	55W	32

UWI / API	Operator	Well Label	T	R	S
050730641200	UNIT PETROLEUM CO	HUBBARD 1H	12S	55W	5
050890501500	VAUGHEY & VAUGHEY II	W S SIDNEY 1	24S	59W	3
050890501900	PAN AMERICAN PETROLE	ARNOLD HARRIMAN INC 1	23S	59W	5
050890600100	CHAMPLIN PETRO CMPNY	CHAMPLIN ETAL GOVT 1	25S	59W	11
050890600300	CHAMPLIN PETRO CMPNY	JORDAN-GOVT 1-X	25S	58W	2
050890600400	BRUBAKER EARL	MENDENHALL 1	25S	57W	5
050890600500	FULTON RICHARD H	J W MCNALLY 1	26S	56W	15
050890600600	HEWIT WILLIAM D	HARRIMAN 1	24S	59W	3
050890600700	TRUE OIL LLC	TRUE-STATE 23-16	23S	59W	16
050890600800	AMERCN PETROFINA INC	CAREY 1	21S	54W	34
050890600900	TRUE OIL LLC	TRUE STATE 21-4	21S	54W	4
050890601000	LOMAX EXPL CO	STATE 1-3	21S	54W	3
050890601900	MURFIN DRLG CO	PETERSON-FEDERAL 1-8	25S	54W	8
051010500500	PHILLIPS PETRLM CO	JOHNSTON A 1	24S	61W	25
051010501900	PHILLIPS PETRLM CO	STATE 1	23S	63W	17
051010503900	SKELLY OIL	LUTIN M E 1	21S	65W	30
051010506800	US SMELTING&REFINING	OSCAR APPELT 19-63 1-1	19S	63W	1
051010507500	US SMELTING&REFINING	OSCAR APPELT 18-63 1-27	18S	63W	27
051010507700	BRITISH AMER OIL PRD	R COLORADO 1	18S	62W	30
051010508000	BRIDWELL OIL CO	PAIGE 1	18S	64W	6
051010508100	CONTINENTAL OIL CO	PAIGE 1	18S	64W	6
051010600100	SAMEDAN OIL CORP	ARIZ-COLO LD&CATTLE 1	18S	64W	5
051010600200	TRUE OIL LLC	GREEN 11-31	19S	60W	31
051010600300	GEN AMER OIL CO	STATE 1-19	22S	60W	19
051010600400	GEN AMER OIL CO	PORTER 1-28	21S	61W	28
051010600500	KAN-COL MCGEE CO KS	FILLMORE 2-27	20S	61W	27
051010600800	BOGERT OIL CO	STATE 1	23S	61W	25
051010600900	CABOT PETROLEUM CORP	DORTHEA MAE 1	22S	63W	3
051010601000	ROANOKE CORP	ROBERT A JACKSON 1	21S	65W	30
051210500200	WYTEX OIL CORP	LOUDER 1	5S	54W	31
051210500300	HANCO OIL	FALCH K M 1	5S	55W	34
051210500500	KINGWOOD OIL CO	WYMAN 1	5S	54W	35
051210500700	WYTEX OIL CORP	PAULSON MARY 1	5S	55W	32
051210500800	HANCO OIL	RAINES 1-B	5S	54W	33
051210501100	HANCO OIL & GAS INC	ANHOLTZ 1	5S	53W	30
051210501300	TENNESSEE G&O	NICKELL 1	5S	56W	26
051210501600	JACK POT OIL CO	NICKELL 1	5S	55W	30
051210502000	KEWANEE OIL CO	BAILEY 1	5S	55W	19
051210502300	LION OIL CO	BATES 1	5S	54W	18
051210502600	DAVIS OIL CO	SCRIVNER 1	5S	53W	17
051210502800	BRITISH AMER OIL PRD	DOUGHTY 1	5S	53W	18
051210503800	GARFIELD SAM ET AL	NUTTLEMAN 1	5S	54W	11
051210503900	KINGWOOD OIL CO	SCHWERTSEGER 1	5S	54W	9
051210505000	CHANDLER & ASSOC INC	BRANDT 1	4S	54W	32
051210505100	CHANDLER & ASSOC INC	HUTCHINS 1	4S	53W	31
051210505300	GULF OIL CORP	GILCHRIST 1	4S	55W	35
051210505500	RAYMOND OIL CO INC	HUTCHINS 1	4S	54W	35
051210505700	NEW DRILLING	ORTH 2	4S	53W	33
051210505900	RAYMOND C F OIL CO	WHEELER 1	4S	54W	34
051210506000	MIDWEST OIL	HUTCHINS 1	4S	53W	31
051210506300	AMERADA PETRO CMPNY	ORTH 1	4S	53W	33
051210507000	ALLISON DRLG	HUTCHINS 1	4S	54W	25
051210764000	OKMAR OIL CO	THOMAS 1	5S	53W	7

UWI / API	Operator	Well Label	T	R	S
051210814500	SNYDER JIM DRLG CO	CHASE 1	5S	56W	25
051210819300	ARROWHEAD EXPL	DAUGHTY 1	5S	54W	13
051210846500	GRAHAM BROS	STATE 1	5S	56W	36
051210859100	SAMEDAN OIL CORP	DOWNING 1	5S	53W	8
051210865000	CHANDLER & ASSOC INC	SCOTT 1	4S	54W	35
051210865300	WESTERN OPERATING CO	HUTCHINS 1	4S	53W	29
051210884100	GLOBE ENTERPRISES	STATE 1	5S	56W	36
051210903400	GIBSON J W	SCOTT 1	4S	54W	35
051210928500	CRYSTAL EXPL&PROD	MARLIN MCCRACKEN 1	5S	54W	3
051210968300	CARIBOU ENERGY INC	NELSON 1	5S	55W	17
051210979000	ALLISON DRLG	BRINEY 1	5S	53W	29
051210979700	SWANSON ROBERT B	NELSON 1	5S	55W	13
051216003500	TIPPS DRLG CO INC	HUTCHINS 1	4S	53W	32
051216004600	PLAINS EXPL CORP	KELLER 1	5S	55W	31
051230525600	CALIFORNIA OIL CO	WINDER 1	6N	67W	4
051230530000	CHEVRON U S A INC	BROWNELL 1	7N	67W	35
051230531600	BROOKS EXPLORATION INC	BRUNNER 1	7N	67W	26
051230531800	BROOKS EXPLORATION INC	BRUNNER 2	7N	67W	26
051230531900	CALIFORNIA OIL CO	V DENNY 1	7N	67W	27
051230532700	ASHLAND OIL INC	R H HALL 1	7N	67W	26
051230536200	CALIFORNIA OIL CO	WELLS 1	7N	67W	17
051230537000	BRINKERHOFF CO THE	MCMURRAY 1	7N	67W	15
051230537700	MULL DRLG CO INC	FRED HOFFNER 1	7N	66W	14
051230543400	CALIFORNIA OIL CO	BAIAMONTE 4	7N	66W	6
051230544500	STELBAR OIL CORP INC	UNION PACIFIC RR 7	7N	67W	1
051230556000	SUPERIOR OIL CO ETAL	BALL 16-14	8N	63W	14
051230560200	MCLAUGHLN C T	JONES-GOVT 1	9N	62W	32
051230708700	WESTERN RES INTL	FREEMAN 1	8N	62W	13
051230712800	GROSS & TODD	WELD COUNTY 1	8N	63W	33
051230712900	GROSS & TODD	GOVT 1	9N	63W	17
051230713500	GROSS & TODD	NAUTA 1	11N	63W	21
051230716200	VESSELS THOMAS G	MELMO 1	9N	64W	4
051230716500	VESSELS THOMAS G	GOVT 1	11N	64W	32
051230716800	VESSELS THOMAS G	CRA-GOVT B 1	10N	63W	20
051230721900	KERR-MCGEE OIL & GAS LP	GORDON TURKEY FARM 1	2N	67W	10
051230724500	KERR-MCGEE OIL & GAS LP	PHILLIP ARTESE 1	1N	65W	6
051230725800	ENCANA OIL & GAS (USA) INC	MELBON RANCH 1	2N	65W	17
051230727200	MACHII-ROSS PETROLEUM	MILLER 1	2N	67W	17
051230728600	KERR-MCGEE OIL & GAS LP	UNIT-A 1	2N	67W	16
051230730000	KERR-MCGEE OIL & GAS LP	UPRR 38 PAN AM-C 1	2N	66W	11
051230730600	MACHII-ROSS PETROLEUM	KUGEL 1	2N	67W	18
051230731100	NOBLE ENERGY INC	CARLSON 1	2N	67W	11
051230732500	FOREE R L	FRED FELTE 1	7N	67W	25
051230732900	ENCANA OIL & GAS (USA) INC	DEVORE 1	3N	66W	34
051230737900	KERR-MCGEE OIL & GAS LP	DREW 1	2N	67W	18
051230739000	DAVIS OIL CO	STEER 1	10N	62W	11
051230739600	DAVIS OIL CO	MAGNUSON-STATE 1	9N	62W	29
051230741600	PETRO-CANADA RES (USA)	HANKINS 1	5N	67W	22
051230741700	VANGUARD OIL	GOODELL 1	7N	66W	21
051230743400	ENCANA OIL & GAS (USA) INC	IONE LAND & CATTLE 2	2N	66W	10
051230743500	ENCANA OIL & GAS (USA) INC	IONE LAND & CATTLE 3	2N	66W	2
051230745500	ENCANA OIL & GAS (USA) INC	IONE LAND & CATTLE 4	2N	66W	2
051230762200	KERR-MCGEE OIL & GAS LP	1415 CORP GU 1	2N	67W	14

UWI / API	Operator	Well Label	T	R	S
051230772100	CHANDLER & ASSOC INC	WELD COUNTY 13-23	8N	63W	23
051230772300	CHANDLER & ASSOC INC	PETERS 16-34	12N	63W	34
051230773800	KERR-MCGEE OIL & GAS LP	SARCHET B UNIT 1	2N	67W	11
051230775300	KERR-MCGEE OIL & GAS LP	JOHN KUNZMAN C UNIT 1	2N	66W	5
051230776400	KERR-MCGEE OIL & GAS LP	VINCENT RALPH UNIT 1	2N	67W	2
051230777700	NOBLE ENERGY INC	STEINWALD 37	1N	65W	14
051230780100	KERR-MCGEE OIL & GAS LP	GORDON TURKEY FARMS 1	2N	67W	10
051230788200	KERR-MCGEE OIL & GAS LP	PHILLIP MCCOY UNIT B 1	2N	67W	14
051230791200	KERR-MCGEE OIL & GAS LP	EARL BROTEMARKLE 1	3N	66W	24
051230791300	KERR-MCGEE OIL & GAS LP	UPRR-22 PAN AM-F 1	3N	66W	25
051230798200	NOBLE ENERGY INC	NICHOLS 41-16	2N	65W	16
051230806000	KERR-MCGEE OIL & GAS LP	FRANK DAMIANA 1	1N	66W	19
051230808000	KERR-MCGEE OIL & GAS LP	DONALD M VYNCHIER 1	2N	66W	31
051230810400	KERR-MCGEE OIL & GAS LP	HELMER GETZ 1	1N	66W	18
051230816700	HUSKY OIL LTD	WEST-SAND CREEK 8-24	8N	62W	24
051230826900	KERR-MCGEE OIL & GAS LP	T P HOLTON GAS UNIT 1	1N	66W	6
051230829600	AMOCO PROD CO	DONALD COOK GAS UN 1	2N	66W	12
051230834600	KERR-MCGEE OIL & GAS LP	SHAKLEE GAS UNIT 1	2N	65W	26
051230836300	KERR-MCGEE OIL & GAS LP	KELLY GAS UNIT 1	2N	66W	18
051230838500	NOBLE ENERGY INC	GREELEY NATIONAL 1	2N	66W	31
051230840000	ENCANA OIL & GAS (USA) INC	EWING 1	2N	66W	30
051230842100	KERR-MCGEE OIL & GAS LP	LELA S THOMASON GAS 1	1N	65W	6
051230842600	KERR-MCGEE OIL & GAS LP	SAM FUNAKOSHI GAS 1	2N	67W	36
051230864300	KERR-MCGEE OIL & GAS LP	MUSE 1	2N	65W	18
051230869000	KERR-MCGEE OIL & GAS LP	RITCHEY 1	1N	65W	5
051230870600	AMOCO PROD CO	CHAMPLIN 311-A 1	7N	65W	5
051230875800	AMOCO PROD CO	CHAMPLIN291 AMOCO-A 1	10N	65W	15
051230878600	KERR-MCGEE OIL & GAS LP	WILLIAM DEASON GAS 1	1N	66W	6
051230889000	AMOCO PROD CO	CHAMPLIN 344AMOCO-A 1	10N	64W	25
051230896500	AMOCO PROD CO	CHAMPLIN307AMOCO-A 1	7N	64W	9
051230915900	KERR-MCGEE OIL & GAS LP	UPRR 38 PAN AM-F 1	2N	66W	11
051230933600	ENCANA OIL & GAS (USA) INC	ARISTOCRAT ANGUS 41-8	3N	65W	8
051230934900	APACHE CORP	HASBROUCK 1	7N	66W	22
051230938100	APACHE CORP	BLACK WILLOW 1	7N	67W	8
051230947500	KERR-MCGEE OIL & GAS LP	MCCOY PHILLIP S GU ` 1	2N	67W	14
051230957800	NOBLE ENERGY INC	CHAMPLIN 366 AMOCO 1	3N	63W	19
051230958600	KERR-MCGEE OIL & GAS LP	GORDON TURKEY FARMS 1	2N	67W	15
051230977800	KERR-MCGEE OIL & GAS LP	M EICHTHALER-B 2	2N	65W	35
051230984200	NOBLE ENERGY INC	DECHANT-STATE 9	2N	67W	16
051230986500	KERR-MCGEE OIL & GAS LP	WEICHEL-B 2	2N	65W	14
051230994500	NOBLE ENERGY INC	NICHOLS 34-16	2N	65W	16
051230996000	KERR-MCGEE OIL & GAS LP	UPRR 62 PAN AM-I 2	2N	65W	23
051230996200	KERR-MCGEE OIL & GAS LP	UPRR 38 PAM AM-G 2	2N	66W	3
051230996300	KERR-MCGEE OIL & GAS LP	UPRR 38 PAN AM-E 2	2N	66W	3
051231005600	ENCANA OIL & GAS (USA) INC	IONE 13	2N	66W	2
051231005700	ENCANA OIL & GAS (USA) INC	IONE 12	2N	66W	2
051231007000	ENCANA OIL & GAS (USA) INC	IONE 11	2N	66W	10
051231007500	KERR-MCGEE OIL & GAS LP	CLC GAS UNIT 2	2N	66W	18
051231007600	ENCANA OIL & GAS (USA) INC	MASON 3	2N	66W	8
051231010900	ENCANA OIL & GAS (USA) INC	IONE 10	2N	66W	4
051231011700	ENCANA OIL & GAS (USA) INC	DAVIS GAS UNIT 2	2N	66W	9
051231013600	ST MICHAEL EXPL	GRACE-MARATHON 3-1	8N	62W	3
051231017600	PANCANADIAN PET CO	WELLS-CALVE 12-22 1	7N	65W	22

UWI / API	Operator	Well Label	T	R	S
051231019400	NORTEX GAS&OIL CO	AMOCO 1-11	7N	67W	11
051231025100	DIVERSIFIED OPERATING CORP	MARTIN 1	6N	67W	7
051231028200	TOP OPERATING	COUNTER 1-A-D	2N	66W	30
051231033300	NOBLE ENERGY INC	BEEBE DRAW CATTLE 1	3N	65W	8
051231034800	HYNDREX RESOURCES	MCKAY LAND & CATTLE 1	6N	66W	28
051231035600	EP OPERATING	JUKES ETAL 1	7N	66W	17
051231035800	PETERS W J	UPRR-AVERS 1-21	12N	63W	21
051231039500	TRANS-TEXAS ENERGY	UPRR-PETERS RANCH 1-33	12N	63W	33
051231042100	NOBLE ENERGY INC	BEEBE DRAW CATTLE 2-A	3N	65W	4
051231043500	GEN AMER OIL CO	WILFRED-STATE 1-16	7N	67W	16
051231043800	NOBLE ENERGY INC	BEEBE DRAW CATTLE-B 2	3N	65W	4
051231043900	NOBLE ENERGY INC	BEEBE DRAW CATTLE-B 1	3N	65W	4
051231044300	KERR-MCGEE OIL & GAS LP	HARKIS 3	2N	65W	2
051231045500	KERR-MCGEE OIL & GAS LP	SANDLIN-WELD COUNTY 1	2N	65W	17
051231046100	PATRICK PET CO	SEVERIN & CO 1	7N	66W	28
051231048200	GEOCHEMICAL SURVEYS	FREEMAN 14-1	8N	62W	14
051231051900	REDWIN CORP	SCHNEIDER 1-6	7N	67W	6
051231053500	NOBLE ENERGY INC	BEEBE DRAW CATTLE-A 2	3N	65W	3
051231059300	NOBLE ENERGY INC	AMEN 1	5N	67W	19
051231059800	KERR-MCGEE OIL & GAS LP	EARL YOUNG 1	1N	65W	3
051231064400	KERR-MCGEE OIL & GAS LP	MUSE 2	2N	65W	18
051231069200	KERR-MCGEE OIL & GAS LP	BLEHM 1	5N	67W	26
051231076300	GREAT WESTERN OIL CO	RKW 1	5N	66W	24
051231081000	KERR-MCGEE OIL & GAS LP	GORDON TURKEY FARMS 2	2N	67W	10
051231081500	NOBLE ENERGY INC	WIEDEMAN 1	5N	66W	20
051231084100	VESSELS OIL & GAS CO	K & M CO 1	7N	67W	9
051231084500	NOBLE ENERGY INC	FOUR WAY 1	2N	65W	16
051231084700	KERR-MCGEE OIL & GAS LP	GORDON TURKEY FARMS 2	2N	67W	10
051231087100	GO PUMPING & CONSULTING	BRUNNER 1	6N	67W	7
051231087600	KERR-MCGEE OIL & GAS LP	GREELEY NATIONAL 2	2N	67W	15
051231089000	UNIOIL CORP	K-M CO 1	7N	67W	19
051231091100	KERR-MCGEE OIL & GAS LP	SARCHET RAY V-B 2	2N	67W	11
051231092000	UNIOIL CORP	SEVERANCE 1	7N	66W	19
051231092400	KERR-MCGEE OIL & GAS LP	WELD COUNTY UNIT 2	2N	65W	17
051231094200	SYNERGY RESOURCES	JGH GROUP 1-30	5N	67W	30
051231095400	KAUFFMAN K P INC	OCHSNER 3-1	6N	67W	3
051231096200	KERR-MCGEE OIL & GAS LP	VINCENT RALPH UNIT 2	2N	67W	2
051231100500	UNIOIL CORP	PORTER CREEK 1	12N	63W	35
051231102900	BOLET	DALTON BROTHERS 1	7N	65W	30
051231103900	KERR-MCGEE OIL & GAS LP	UPRR 22 PAN AM-K 1	3N	66W	25
051231104400	KERR-MCGEE OIL & GAS LP	LIND 1	5N	67W	6
051231104500	CHAMPLIN PETRO CMPNY	CPC-TRAVELERS 23-1 1	7N	64W	1
051231108100	TUDEX PETROLEUM INC	ALFA-HILL 1	6N	67W	6
051231113700	KERR-MCGEE OIL & GAS LP	UPRR 38 PAN AM-D 1	2N	66W	1
051231113800	KERR-MCGEE OIL & GAS LP	HAGANS VERN UNIT 1	2N	66W	12
051231114000	NOBLE ENERGY INC	UPRR 42 PAN AM UNIT 1	2N	66W	5
051231117700	NOBLE ENERGY INC	DIC-NIELSON FARR 1	7N	65W	19
051231122300	PETERSON ENERGY MANAGEMENT	GALLOWAY 1	7N	66W	32
051231123000	PDC ENERGY INC	KINZER 28-1	5N	67W	28
051231126300	HRUBETZ OIL CO	LINDBLAD 1-12	7N	67W	12
051231126600	PDC ENERGY INC	ANDERSON 1-34	7N	66W	34
051231129000	PETRO-CANADA RES (USA)	SHEEP DRAW SOUTH 1	5N	67W	23
051231129200	TRAILBALZER OIL&GAS	LEFFLER 1-27	7N	66W	27

UWI / API	Operator	Well Label	T	R	S
051231129300	TRAILBALZER OIL&GAS	MAGNUSSON 1-23	7N	66W	23
051231129400	TAMCO DRILLING	SWANSON 1-7	6N	66W	7
051231134200	RWL ENTERPRISES	ACHZIGER 1	7N	65W	18
051231138500	PDC ENERGY INC	GOVE 1	5N	67W	7
051231142300	PETRO-CANADA RES (USA)	HEINZE 24-1	7N	65W	24
051231146900	ANADARKO E & P	COLORADO STATE-A 1	10N	64W	10
051231149600	UNIOIL CORP	ASHCROFT 1	5N	66W	23
051231151800	BARRETT BILL CORP	CUDNEY-SANDSTEDT 1	6N	67W	1
051231152100	PETRO-CANADA RES (USA)	SHEEP DRAW NORTH 1	5N	66W	19
051231152500	POWERS ENERGY RES	SIMPSON 1	7N	65W	4
051231154700	PRIMA EXPLORATION INC	DECALTA NIELSON 34-15	7N	65W	15
051231155100	AMOCO PROD CO	DREW GAS UNIT-TRUE 1	2N	67W	18
051231155500	KAUFFMAN & WEINBERGER	UPRR-SMITH 1-3	6N	67W	3
051231155900	HRUBETZ OIL CO	STATE 1-16	8N	65W	16
051231157300	UNIOIL CORP	L-H 1	5N	67W	16
051231158000	ENCANA OIL & GAS (USA) INC	MILLER 3-17J	2N	67W	17
051231160100	ENCANA OIL & GAS (USA) INC	MILLER 4-17J	2N	67W	17
051231162400	POWERS ENERGY RES	DECALTA-NIELSON 32-22	7N	65W	22
051231164300	ENCANA OIL & GAS (USA) INC	MURATA 4-19J	2N	66W	19
051231164400	ENCANA OIL & GAS (USA) INC	MURATA 1-19J	2N	66W	19
051231165300	SKAER ENTERPRISES INC	DELCALTA-NIELSON 41-21	7N	65W	21
051231173000	BARRETT ENERGY CO	BRANCUCCI 1	1N	66W	30
051231174700	SUN EXPL & PROD CO	SHARK FEDERAL 1	8N	63W	3
051231175000	FRANCIS ENERGY	DUELL 1	5N	66W	24
051231181200	MACEY&MERSHN OIL INC	EWING DALE 1	2N	66W	30
051231185200	VENTURES IN PET	CARLETON 1	7N	67W	2
051231193200	ANDRAU ENTERPRISES	OWL CREEK 11	7N	64W	25
051231193300	SUNSET PRODUCING	OWL CREEK 12	7N	64W	27
051231193400	ANDRAU ENTERPRISES	OWL CREEK 13	7N	64W	29
051231193500	ST JAMES ENERGY OPERATING	OWL CREEK 9	7N	64W	31
051231193600	JENEX PETROLEUM CORP	OWL CREEK 10	7N	64W	33
051231194300	KERR-MCGEE OIL & GAS LP	JEFFERS 1	5N	67W	8
051231194800	ST JAMES ENERGY OPERATING	OWL CREEK 16	7N	64W	21
051231200100	FRANCIS ENERGY	LAW 1	7N	64W	32
051231205900	ANDRAU ENTERPRISES	OWL CREEK 17	7N	64W	19
051231206100	ANDRAU ENTERPRISES	OWL CREEK 23	7N	64W	7
051231206200	SUNSET PRODUCING	OWL CREEK 22	7N	64W	9
051231206300	ANDRAU ENTERPRISES	OWL CREEK 18	7N	64W	17
051231206400	ST JAMES ENERGY OPERATING	OWL CREEK 49	7N	64W	35
051231206500	ANDRAU ENTERPRISES	OWL CREEK 26	7N	65W	13
051231210800	GOLDEN BUCKEYE PET	CPC HUTCHISON 3-1	9N	67W	3
051231211900	SUNSET PRODUCING	OWL CREEK 21	7N	64W	11
051231212000	SUNSET PRODUCING	OWL CREEK 19	7N	64W	15
051231212400	JENEX PETROLEUM CORP	OWL CREEK 42	8N	64W	33
051231220500	BERGE EXPL INC	RUEBEL 2-3	1N	65W	2
051231223500	ST MICHAEL EXPL	SWANSON 34-20	6N	66W	20
051231224800	JENEX PETROLEUM CORP	GROVES FA31-10-7-64	7N	64W	10
051231226100	JENEX PETROLEUM CORP	OWL CREEK 15	7N	65W	25
051231226500	JENEX PETROLEUM CORP	OWL CREEK 25A	7N	64W	3
051231230700	JENEX PETROLEUM CORP	ANDERSON 24-2-7-64	7N	64W	2
051231231800	JENEX PETROLEUM CORP	ANDERSON 22-2-7-64	7N	64W	2
051231231900	FALCON ANDRAU ENR CO	OWL CREEK 24	7N	64W	5
051231236300	JENEX PETROLEUM CORP	OWL CREEK 20	7N	64W	13

UWI / API	Operator	Well Label	T	R	S
051231237500	FALCON ANDRAU ENR CO	OWL CREEK 14-A	7N	64W	23
051231243500	JENEX OPERATING CO	OWL CREEK 27	7N	65W	1
051231247800	FALCON ANDRAU ENR CO	WELD COUNTY FA43-10-7-64	7N	64W	10
051231248600	JENEX PETROLEUM CORP	WELD COUNTY 11-12-7-64	7N	64W	12
051231255500	KAUFFMAN K P INC	ROLLIE J VINCENT 1	2N	67W	2
051231262200	BRANDLY OILMAN CONS	ANDERSON 10-3	6N	66W	10
051231266400	NOBLE ENERGY INC	STATE BOOTH 36-2	7N	65W	36
051231270200	ST JAMES ENERGY OPERATING	MOODY 1-30	7N	64W	30
051231271800	MACHII-ROSS PETROLEUM	MILLER 31-17C	2N	67W	17
051231272000	ENCANA OIL & GAS (USA) INC	ARISTOCRAT 42-4C	3N	65W	4
051231307300	KAUFFMAN K P INC	STATE 36-2	1N	65W	36
051231307600	TRUE OIL LLC	AYARS 13-14	11N	63W	14
051231308800	TRUE OIL LLC	WGB FEDERAL 14-26	10N	63W	26
051231309100	TRUE OIL LLC	PETERSON FEDERAL 41-22	9N	63W	22
051231365900	ENCANA OIL & GAS (USA) INC	ARISTOCRAT ANGUS 22-4	3N	65W	4
051231366100	ENCANA OIL & GAS (USA) INC	ARISTOCRAT ANGUS 31-4	3N	65W	4
051231366200	ENCANA OIL & GAS (USA) INC	ARISTOCRAT 33-4	3N	65W	4
051231366300	BASIC EARTH SCIENCE SYSTEMS	ANTENNA-FEDERAL 22-36	3N	66W	36
051231371600	NOBLE ENERGY INC	DANIEL 1	2N	67W	11
051231374900	SANDLIN OIL CORPORAT	UPRR RICKETSON 1	1N	65W	1
051231410200	BASIN ENERGY CORPOR	DOLPH UPPR 42-1	2N	66W	1
051231424700	NOBLE ENERGY INC	DECHANT GU 2-16	2N	67W	16
051231443700	BASIC EARTH SCIENCE SYSTEMS	ANTENNA FEDERAL 13-36	3N	66W	36
051231444100	UNITED STATES EXPLORATION	HUDSON 1-11 1	1N	65W	11
051231445300	UNION PACIFIC RES CO	LUDWIG 1-5 1	3N	65W	5
051231447400	BOSWELL ENERGY CORP	K & M 1-10	7N	67W	10
051231447500	UNION PACIFIC RES CO	CHINOOK FEDERAL 22-8 1	10N	63W	8
051231454700	UNITED STATES EXPLORATION	UPRR 38 PAN AM UT/S 2	2N	65W	7
051231454900	KERR-MCGEE OIL & GAS LP	UPRR 38 PAN AM UT/V 2	2N	66W	1
051231461100	TOWER ENERGY CORP	KUGEL 1-18	2N	67W	18
051231461900	NORTH AMERICAN RES	BANGERT 3-19	2N	66W	19
051231463400	NORTH AMERICAN RES	BANGERT 2-19	2N	66W	19
051231464000	TOWER ENERGY CORP	DIER 4-8	2N	67W	8
051231464400	BOSWELL ENERGY CORP	JONES 1-32	8N	63W	32
051231472400	BOSWELL ENERGY CORP	WINDSOR 1-24	7N	67W	24
051231497000	MARTIN EXPLOR MGMT C	KNAUB 1-6	3N	65W	6
051231497700	NOBLE ENERGY INC	STATE 36-6F	4N	66W	36
051231499800	KERR-MCGEE OIL & GAS LP	HSR-J T 10-6	3N	65W	6
051231510400	NOBLE ENERGY INC	POTTS X 18-15	2N	65W	18
051231528200	NORTH AMERICAN	KUGEL 2-18	2N	67W	18
051231531500	KERR-MCGEE OIL & GAS LP	ALFRED D SATER UNIT 2	2N	67W	8
051231531600	KERR-MCGEE OIL & GAS LP	UNIT A GAS UNIT 2	2N	67W	16
051231533100	NOBLE ENERGY INC	KUGEL K4-6	2N	66W	4
051231537300	NOBLE ENERGY INC	KUGEL L4-4	2N	66W	4
051231547400	ENCANA OIL & GAS (USA) INC	ECHEVERRIA 1-2	2N	67W	2
051231550700	KERR-MCGEE OIL & GAS LP	HSR-AUSTIN 16-26	4N	66W	26
051231562100	KERR-MCGEE OIL & GAS LP	WATTENBERG SWD 1	2N	66W	19
051231563700	NOBLE ENERGY INC	UPRC 9-4J	3N	65W	9
051231563900	NOBLE ENERGY INC	UPRC 9-6J	3N	65W	9
051231564000	NOBLE ENERGY INC	UPRC 9-11J	3N	65W	9
051231575700	NOBLE ENERGY INC	REHDER X6-3D	2N	65W	6
051231576900	NOBLE ENERGY INC	OPATRIL 12-15L	3N	67W	12
051231582100	KERR-MCGEE OIL & GAS LP	LINCOLN 3	2N	67W	18

UWI / API	Operator	Well Label	T	R	S
051231593700	NOBLE ENERGY INC	UPRC 9-6J-2	3N	65W	9
051231594700	KERR-MCGEE OIL & GAS LP	BARCLAY 44-14	2N	67W	14
051231609400	BASIN OPERATING CO	BEEBE DRAW 41-5	3N	65W	5
051231612300	KERR-MCGEE OIL & GAS LP	BEEBE DRAW 41-9	3N	65W	9
051231623500	KERR-MCGEE OIL & GAS LP	GORDON RED V10-4D	2N	67W	10
051231626300	KERR-MCGEE OIL & GAS LP	HSR-MONTALI 14-33	4N	65W	33
051231638000	NOBLE ENERGY INC	MARSHALL 32-14G	4N	65W	32
051231638800	GERRITY O&G CORP	HARRIS RED X19-2J	2N	65W	19
051231639200	NOBLE ENERGY INC	RANDLE RED XX3-2D	1N	65W	3
051231640900	ENCANA OIL & GAS (USA) INC	ARISTOCRAT ANGUS 11-3	3N	65W	3
051231644900	ENCANA OIL & GAS (USA) INC	ARISTOCRAT ANGUS 13-4	3N	65W	4
051231645000	ENCANA OIL & GAS (USA) INC	ARISTOCRAT ANGUS 31-8	3N	65W	8
051231650300	UNION PACIFIC RES CO	BROZOVICH 3-4 1	1N	68W	4
051231650500	NOBLE ENERGY INC	MAGNESS RED W6-2D	2N	66W	6
051231657200	ENCANA OIL & GAS (USA) INC	ARISTOCRAT ANGUS 23-4	3N	65W	4
051231657400	ENCANA OIL & GAS (USA) INC	ARISTOCRAT ANGUS 21-4	3N	65W	4
051231657500	ENCANA OIL & GAS (USA) INC	ARISTOCRAT ANGUS 12-3	3N	65W	3
051231658200	ENCANA OIL & GAS (USA) INC	ARISTOCRAT ANGUS 22-8	3N	65W	8
051231658300	ENCANA OIL & GAS (USA) INC	ARISTOCRAT ANGUS 21-8	3N	65W	8
051231662000	KERR-MCGEE OIL & GAS LP	GORDON FARMS 21-15	2N	67W	15
051231664300	GERRITY O&G CORP	WATADA RED WW19-4D	1N	66W	19
051231664500	NORTH AMERICAN RES	BARCLAY-CHRISMAN 4-20	3N	66W	20
051231664700	NORTH AMERICAN RES	MILLER 2-17	2N	67W	17
051231667500	KERR-MCGEE OIL & GAS LP	HSR-KOCH 16-32	4N	65W	32
051231676900	ELK EXPL INC	HSR MARLEY 15-33	4N	65W	33
051231679800	KERR-MCGEE OIL & GAS LP	HSR-ROGERS 3-5	3N	65W	5
051231682800	NOBLE ENERGY INC	DANIEL V11-9	2N	67W	11
051231690400	NOBLE ENERGY INC	HEIN W19-5	2N	66W	19
051231690700	NOBLE ENERGY INC	HEIN W19-12	2N	66W	19
051231691300	ENCANA OIL & GAS (USA) INC	FEDERAL 11-10	3N	65W	10
051231691700	KERR-MCGEE OIL & GAS LP	HSR-SAMUELSEN 3-24	3N	66W	24
051231703900	NOBLE ENERGY INC	BB DRAW H8-9	3N	65W	8
051231707000	ENCANA OIL & GAS (USA) INC	ARISTOCRAT ANGUS 42-8	3N	65W	8
051231713600	ENCANA OIL & GAS (USA) INC	FEDERAL 12-10	3N	65W	10
051231719800	KERR-MCGEE OIL & GAS LP	HSR-PAGE 10-5	3N	65W	5
051231730400	KERR-MCGEE OIL & GAS LP	HSR-OBORNE 9-5	3N	65W	5
051231730600	KERR-MCGEE OIL & GAS LP	HSR-RAFALOVICH 14-5	3N	65W	5
051231730800	KERR-MCGEE OIL & GAS LP	HSR-GOODNOW 16-5	3N	65W	5
051231733000	KERR-MCGEE OIL & GAS LP	HSR-NILAND 6-5	3N	65W	5
051231735000	ELK EXPL INC	HSR-MORTON 9-9	3N	65W	9
051231760600	KERR-MCGEE OIL & GAS LP	HSR-HOUSTON 13-34	4N	65W	34
051231765400	NOBLE ENERGY INC	CANNON RED W3-12	2N	66W	3
051231767400	PRIMA OIL & GAS CO	WARDLAW 35-23	6N	64W	35
051231795400	ENCANA OIL & GAS (USA) INC	MELBON RANCH E UNIT 1	2N	65W	17
051231817700	KERR-MCGEE OIL & GAS LP	BOYD 43-5	1N	65W	5
051231913100	KERR-MCGEE OIL & GAS LP	SAM FUNAKOSHI GAS UN 2	2N	67W	36
051231917500	KERR-MCGEE OIL & GAS LP	DONALD VYNCKIER GAS 2	2N	66W	31
051231934800	BONANZA CRK OPER	FEURSTEIN 44-29	6N	66W	29
051231954200	NORTH AMERICAN RES	IONE 23-2	2N	66W	2
051231954300	NORTH AMERICAN RES	IONE 13-4	2N	66W	4
051231954400	NORTH AMERICAN RES	BARCLAY CRISMAN 24-20	3N	66W	20
051231955600	HS RESOURCES INC	HSR-WATADA 11-18A	1N	66W	18
051231955700	HS RESOURCES INC	HSR-BALDWIN 5-11A	2N	65W	11

UWI / API	Operator	Well Label	T	R	S
051231955900	HS RESOURCES INC	HSR-SPERL 16-2A	2N	67W	2
051231956800	ENCANA OIL & GAS (USA) INC	CHAPIN 33-4	1N	65W	4
051231958700	PATINA O&G CORP	DECHANT STATE V 16-4JI	2N	67W	16
051231959000	HS RESOURCES INC	HSR-DREILING 1-5A	1N	65W	5
051231959200	HS RESOURCES INC	HSR-KUNZMAN 11-5A	2N	66W	5
051231959300	HS RESOURCES INC	HSR-ENDERSON 5-11A	2N	67W	11
051231959400	NORTH AMERICAN RES	ECHEVERRIA 21-2	2N	67W	2
051231959500	HS RESOURCES INC	HSR-STREAR 4-10A	2N	67W	10
051231959800	NORTH AMERICAN RES	DEVORE 32-34	3N	66W	34
051231960500	HS RESOURCES INC	HSR-MCPEEK 13-10A	2N	66W	10
051231961100	HS RESOURCES INC	HSR-ELTON MILLER 3-7A	2N	66W	7
051231961300	HS RESOURCES INC	HSR-RALPH VINCENT 1-2A	2N	67W	2
051231962100	HS RESOURCES INC	HSR-MAGNESS 11-6A	2N	66W	6
051231962400	HS RESOURCES INC	HSR-HAMILTON 11-11A	2N	67W	11
051231963000	SOVEREIGN ENRGY CORP	WELD COUNTY 22-15	5N	61W	15
051231963900	NORTH AMERICAN RES	IONE 34-4	2N	66W	4
051231966900	HS RESOURCES INC	HSR-DURAN 7-15A	2N	67W	15
051231967000	HS RESOURCES INC	HSR-STREAR 11-10A	2N	67W	10
051231967400	PATINA O&G CORP	COORS V6-13JI	2N	67W	6
051231967600	HS RESOURCES INC	HSR-AMEN 11-25	1N	65W	25
051231968100	PATINA O&G CORP	DECHANT STATE V 16-11JI	2N	67W	16
051231970700	ENCANA OIL & GAS (USA) INC	STELLING 14-4	1N	65W	4
051231970800	NORTH AMERICAN RES	ECHEVERRIA 23-2	2N	67W	2
051231971200	NORTH AMERICAN RES	IONE 32-10	2N	66W	10
051231971300	PATINA O&G CORP	CARLSON V 11-1JI	2N	67W	11
051231971700	NORTH AMERICAN RES	GITTLEIN 11-4	1N	65W	4
051231972900	NORTH AMERICAN RES	MURATA 23-19	2N	66W	19
051231973000	NORTH AMERICAN RES	BANGERT 43-19	2N	66W	19
051231973300	NORTH AMERICAN RES	MURATA 21-19	2N	66W	19
051231974800	NORTH AMERICAN RES	HERMAN 34-8	2N	66W	8
051231974900	NORTH AMERICAN RES	IONE 43-10	2N	66W	10
051231975100	NORTH AMERICAN RES	DAVIS 12-9	2N	66W	9
051231975200	NORTH AMERICAN RES	DAVIS 32-9	2N	66W	9
051231975400	HS RESOURCES INC	HSR-HERMAN FED 15-7A	2N	66W	7
051231975700	NORTH AMERICAN RES	KUGEL 12-18	2N	67W	18
051231975900	HS RESOURCES INC	HSR-STREAR FARMS 9-10A	2N	67W	10
051231976300	NORTH AMERICAN RES	BOULDER BANK 23-7	1N	66W	7
051231976600	HS RESOURCES INC	HSR-SPERL 9-2A	2N	67W	2
051231976900	PATINA O&G CORP	CARLSON V 11-7JI	2N	67W	11
051231977000	PATINA O&G CORP	DECHANT STATE V 16-12JI	2N	67W	16
051231977300	PATINA O&G CORP	DECHANT STATE V 16-3JI	2N	67W	16
051231977400	PATINA O&G CORP	DECHANT STATE V 16-14JI	2N	67W	16
051231978000	HS RESOURCES INC	HSR-SCHIS 5-15A	2N	67W	15
051231978100	HS RESOURCES INC	HSR-DEEP PURPLE 7-16A	2N	67W	16
051231978200	HS RESOURCES INC	HSR-KIRKMIDD 9-15A	2N	67W	15
051231978700	HS RESOURCES INC	HSR-CAMPBELL 1-14A	2N	67W	14
051231980000	NORTH AMERICAN RES	ECHEVERRIA 14-2	2N	67W	2
051231984100	HS RESOURCES INC	HSR-PARKER 13-15A	2N	67W	15
051231985400	NORTH AMERICAN RES	ECHEVERRIA 11-2	2N	67W	2
051231988000	NORTH AMERICAN RES	BANGERT 32-19	2N	66W	19
051231988600	NORTH AMERICAN RES	ECHEVERRIA 24-2	2N	67W	2
051231989900	NORTH AMERICAN RES	DEVORE 42-34	3N	66W	34
051231990200	NORTH AMERICAN RES	ECHEVERRIA 22-2	2N	67W	2

UWI / API	Operator	Well Label	T	R	S
051231991900	NORTH AMERICAN RES	DIER 44-8	2N	67W	8
051231993000	NORTH AMERICAN RES	EWING 33-30	2N	66W	30
051231993600	NORTH AMERICAN RES	DEVORE 31-34	3N	66W	34
051231994300	NORTH AMERICAN RES	ECHEVERRIA 13-2	2N	67W	2
051231995700	NORTH AMERICAN RES	IONE 44-10	2N	66W	10
051231996000	HS RESOURCES INC	HSR-STREAR 14-10A	2N	67W	10
051231997000	NORTH AMERICAN RES	IONE 32-2	2N	66W	2
051231997600	HS RESOURCES INC	HSR-STREAR 7-10A	2N	67W	10
051231998600	NORTH AMERICAN RES	IONE 43-4	2N	66W	4
051232000300	PATINA O&G CORP	DECHANT STATE V 16-5JI	2N	67W	16
051232001300	PANCAN ENERG RES INC	FOUR WAY 12-16	2N	65W	16
051232002600	HS RESOURCES INC	HSR-PARKER 1-16A	2N	67W	16
051232004800	NORTH AMERICAN RES	IONE 22-2	2N	66W	2
051232005000	NORTH AMERICAN RES	IONE 14-4	2N	66W	4
051232005200	NORTH AMERICAN RES	IONE 33-2	2N	66W	2
051232007900	PATINA O&G CORP	CARLSON V 11-8JI	2N	67W	11
051232010100	HS RESOURCES INC	HSR-SATER 1-8A	2N	67W	8
051232015100	NORTH AMERICAN RES	IONE 44-4	2N	66W	4
051232015200	NORTH AMERICAN RES	BANGERT 44-19	2N	66W	19
051232018800	NORTH AMERICAN RES	LUHMAN 44-4	2N	67W	4
051232018900	NORTH AMERICAN RES	IONE 24-4	2N	66W	4
051232021100	NORTH AMERICAN RES	ECHEVERRIA 12-2	2N	67W	2
051232030700	NORTH AMERICAN RES	KUGEL 42-18	2N	67W	18
051232031000	HS RESOURCES INC	HSR-ENDERSON 4-11A	2N	67W	11
051232031400	KERR-MCGEE OIL & GAS LP	HSR- WITTEMEYER 2-2	2N	67W	2
051232033600	HS RESOURCES INC	HSR-PARKER 15-16A	2N	67W	16
051232034900	HS RESOURCES INC	HSR-STREAR 12-10A	2N	67W	10
051232045400	KERR-MCGEE OIL & GAS LP	HSR-FRENCH 2-6	2N	67W	6
051232049800	NORTH AMERICAN RES	DAVIS 31-9	2N	66W	9
051232050700	HS RESOURCES INC	HSR-WITTEMEYER 8-2A	2N	67W	2
051232050900	NORTH AMERICAN RES	KUGEL 11-18	2N	67W	18
051232051000	KERR-MCGEE OIL & GAS LP	HSR-PARKER 16-15A	2N	67W	15
051232052600	NORTH AMERICAN RES	KUGEL 22-18	2N	67W	18
051232052700	NORTH AMERICAN RES	KUGEL 21-18	2N	67W	18
051232052800	NORTH AMERICAN RES	KUGEL 41-18	2N	67W	18
051232053400	KERR-MCGEE OIL & GAS LP	HSR-STREAR 2-15	2N	67W	15
051232055700	HS RESOURCES INC	HSR-GARDNER 13-11	2N	67W	11
051232056000	STHWSTRN PROD CORP	KINZER 28-2	5N	67W	28
051232057000	KERR-MCGEE OIL & GAS LP	HSR-BARCLAY 10-14A	2N	67W	14
051232057100	RED WILLOW PROD LLC	PARK 43-4	4N	63W	4
051232059100	PANCAN ENERG RES INC	STELLING 23-4	1N	65W	4
051232060000	NORTH AMERICAN RES	BARNES 34-4	2N	67W	4
051232060100	PANCAN ENERG RES INC	MURATA 24-19	2N	66W	19
051232061500	ENCANA OIL & GAS (USA) INC	IONE 23-4	2N	66W	4
051232062300	PANCAN ENERG RES INC	DAVIS 41-9	2N	66W	10
051232062600	KERR-MCGEE OIL & GAS LP	HOOD 2-14	2N	67W	14
051232063700	PANCAN ENERG RES INC	DIER J 1-A	2N	67W	8
051232065200	PANCAN ENERG RES INC	DIER 13-8	2N	67W	8
051232072500	PANCAN ENERG RES INC	MILLER 24-17J	2N	67W	17
051232074700	PANCAN ENERG RES INC	MILLER 21-17	2N	67W	17
051232077000	PANCAN ENERG RES INC	MILLER 11-17	2N	67W	17
051232077500	ENCANA OIL & GAS (USA) INC	MILLER 22-17	2N	67W	17
051232082100	BONANZA CRK OPER	70 RANCH 21-3	4N	63W	3

UWI / API	Operator	Well Label	T	R	S
051232082300	ENCANA OIL & GAS (USA) INC	MILLER CJ 17-A	2N	67W	17
051232082800	ENCANA OIL & GAS (USA) INC	MILLER 13-17	2N	67W	17
051232082900	ENCANA OIL & GAS (USA) INC	MILLER 23-17	2N	67W	17
051232083300	BONANZA CRK OPER	70 RANCH 11-3	4N	63W	3
051232087100	ENCANA OIL & GAS (USA) INC	MILLER 12-17J	2N	67W	18
051232091400	KERR-MCGEE OIL & GAS LP	WELLMAN 6-14A	2N	67W	14
051232091500	KERR-MCGEE OIL & GAS LP	STREAR 1-15A	2N	67W	15
051232091700	KERR-MCGEE OIL & GAS LP	PARKER 14-15A	2N	67W	15
051232092000	KERR-MCGEE OIL & GAS LP	PEC 14-11A	2N	67W	11
051232094100	KERR-MCGEE OIL & GAS LP	RANDI 9-16A	2N	67W	16
051232094200	KERR-MCGEE OIL & GAS LP	THUENER 12-14A	2N	67W	14
051232094400	ENCANA OIL & GAS (USA) INC	MILLER 44-17J	2N	67W	17
051232094500	ENCANA OIL & GAS (USA) INC	MILLER 34-17J	2N	67W	17
051232094600	ENCANA OIL & GAS (USA) INC	MILLER 33-17J	2N	67W	17
051232095000	KERR-MCGEE OIL & GAS LP	BEIERLE 14-14A	2N	67W	14
051232095500	KERR-MCGEE OIL & GAS LP	STREAR 2-10A	2N	67W	10
051232095600	KERR-MCGEE OIL & GAS LP	GARDNER 12-11A	2N	67W	11
051232107300	U S EXPL INC	CAPITAL 31-19	4N	63W	19
051232114000	PETROLEUM DEV CORP	BOOTH 24-35	7N	65W	35
051232116900	PETROLEUM DEV CORP	WELLS RANCH 14-11	5N	63W	11
051232125900	NOBLE ENERGY INC	BAUMAN 12-3	11N	61W	3
051232144800	ENCANA OIL & GAS (USA) INC	ARISTOCRAT ANGUS 12-8	3N	65W	8
051232196700	BONANZA CRK OPER	CENTENNIAL-REIN 23-32	5N	63W	32
051232196800	BONANZA CRK OPER	CENTENNIAL-REIN 13-32	5N	63W	32
051232205000	BONANZA CRK OPER	PRONGHORN 12-9	5N	61W	9
051232205200	CFG ENERGY INC	PRONGHORN 32-8	5N	61W	8
051232205300	BONANZA CRK OPER	PRONGHORN 31-8	5N	61W	8
051232206400	BONANZA CRK OPER	VAN WYKE 22-32	5N	63W	32
051232210200	ENCANA OIL & GAS (USA) INC	ARISTOCRAT ANGUS 41-8A	3N	65W	8
051232229700	WALSH PRODUCTION INC	RAY 7-20	11N	61W	20
051232230900	WALSH PRODUCTION INC	STATE-GROVER 7-16	10N	61W	16
051232243000	CFG ENERGY INC	PRONGHORN 14-4	5N	61W	4
051232244900	RED WILLOW PROD LLC	WETCO FARMS 13-4	4N	63W	4
051232250000	RED WILLOW PROD LLC	WETCO FARMS 22-4	4N	63W	4
051232269600	RED WILLOW PROD CO	PARK 33-4	4N	63W	4
051232269700	RED WILLOW PROD CO	PARK 44-4	4N	63W	4
051232271600	RED WILLOW PROD LLC	WETCO FARMS 31-4	4N	63W	4
051232276800	BONANZA CRK OPER	PRONGHORN 41-16	5N	61W	16
051232278900	PETROLEUM DEV CORP	WELLS RANCH 23-2	5N	63W	2
051232293500	WALSH PRODUCTION INC	HALEY-RAY 13-21	11N	61W	21
051232302900	PETROLEUM DEV CORP	KOHLHOFF 23-22	7N	64W	22
051232307200	BONANZA CRK OPER	PRONGHORN 12-10	5N	61W	10
051232308200	U S EXPL INC	SATER 42-13	4N	64W	13
051232309800	PETROLEUM DEV CORP	CERVI 24-24	4N	63W	24
051232310100	PETROLEUM DEV CORP	CERVI 41-26	4N	63W	26
051232310300	PETROLEUM DEV CORP	CERVI 14-24	4N	63W	24
051232310400	PETROLEUM DEV CORP	CERVI 31-26	4N	63W	26
051232315000	BONANZA CRK OPER	PRONGHORN 24-10	5N	61W	10
051232316600	PATINA O&G CORP	FUEGO `C` 1-19	4N	64W	1
051232317000	PETROLEUM DEV CORP	WELLS RANCH 24-2	5N	63W	2
051232317100	PETROLEUM DEV CORP	WELLS RANCH 44-2	5N	63W	2
051232317200	PETROLEUM DEV CORP	WELLS RANCH 43-2	5N	63W	2
051232318100	PETROLEUM DEV CORP	WELLS RANCH 33-2	5N	63W	2

UWI / API	Operator	Well Label	T	R	S
051232336500	NOBLE ENERGY INC	CFM-RAY 13-20	11N	61W	20
051232336900	PETROLEUM DEV CORP	CERVI 41-4	3N	63W	4
051232337000	PETROLEUM DEV CORP	CERVI 11-10	3N	63W	10
051232337100	PETROLEUM DEV CORP	CERVI 21-10	3N	63W	10
051232337700	PETROLEUM DEV CORP	WELLS RANCH 43-14	5N	63W	14
051232337900	PETROLEUM DEV CORP	WELLS RANCH 33-14	5N	63W	14
051232338000	PETROLEUM DEV CORP	WELLS RANCH 34-14	5N	63W	14
051232338300	PETROLEUM DEV CORP	WELLS RANCH 24-14	5N	63W	14
051232338400	PETROLEUM DEV CORP	WELLS RANCH 13-14	5N	63W	14
051232341400	U S EXPL INC	SATER 32-13	4N	64W	13
051232345500	NOBLE ENERGY PROD	FRANK C 12-17	4N	64W	12
051232350000	PETROLEUM DEV CORP	PAPPENHEIM 33-26	7N	64W	26
051232356600	BONANZA CRK OPER	PRONGHORN 14-8	5N	61W	8
051232356700	BONANZA CRK OPER	PRONGHORN 43-6	5N	61W	6
051232368600	NOBLE ENERGY PROD	FOLEY 22-5	4N	63W	5
051232377700	BONANZA CRK OPER	PRONGHORN 43-15	5N	61W	15
051232389400	BONANZA CRK OPER	PRONGHORN 31-9	5N	61W	9
051232389500	BONANZA CRK OPER	PRONGHORN 32-5	5N	61W	5
051232391000	BONANZA CRK OPER	PRONGHORN 41-6	5N	61W	6
051232391100	BONANZA CRK OPER	PRONGHORN 41-9	5N	61W	9
051232391200	BONANZA CRK OPER	PRONGHORN 31-15	5N	61W	15
051232391300	BONANZA CRK OPER	PRONGHORN 11-12	5N	61W	12
051232391400	BONANZA CRK OPER	PRONGHORN 22-12	5N	61W	12
051232391700	BONANZA CRK OPER	PRONGHORN 23-7	5N	61W	7
051232391800	BONANZA CRK OPER	PRONGHORN 34-22	5N	61W	22
051232392900	BONANZA CRK OPER	PRONGHORN 31-4	5N	61W	4
051232396500	TEXAS AMER RES COMP	70 RANCH CNW-3	4N	63W	3
051232396600	TEXAS AMER RES COMP	70 RANCH 22-3	4N	63W	3
051232412600	NOBLE ENERGY PROD	SATER CC 19-8	4N	63W	19
051232413000	NOBLE ENERGY PROD	SATER CC 19-16	4N	63W	19
051232422400	NOBLE ENERGY INC	GUTTERSEN USX CC 17-19	4N	63W	17
051232422700	NOBLE ENERGY INC	GUTTERSEN USX CC 17-3	4N	63W	17
051232427800	NOBLE ENERGY INC	WOLFE-USX-CC 7-14	4N	63W	7
051232430500	BONANZA CRK OPER	PRONGHORN 41-3	5N	61W	3
051232432600	BONANZA CRK OPER	STATE ANTELOPE 11-12	5N	62W	12
051232432700	BONANZA CRK OPER	STATE ANTELOPE 32-24	5N	62W	24
051232432900	BONANZA CRK OPER	PRONGHORN 42-17	5N	61W	17
051232433000	BONANZA CRK OPER	STATE PRONGHORN 11-16	5N	61W	16
051232434700	NOBLE ENERGY INC	CFM-RAY 15-20	11N	61W	20
051232435800	U S EXPL INC	MEYER USX CC 7-17	4N	63W	7
051232454300	U S EXPL INC	HOWE-USX AB 33-6	7N	64W	33
051232464100	UNIOIL CORP	SATER 24-19U	4N	63W	19
051232464200	PETROLEUM DEV CORP	SATER 13-19U	4N	63W	19
051232503100	UNIOIL CORP	SATER 22-19U	4N	63W	19
051232503500	PETROLEUM DEV CORP	SATER 11-19U	4N	63W	19
051232504300	PETROLEUM DEV CORP	KOHLHOFF 44-2	6N	63W	2
051232505100	NOBLE ENERGY INC	WELL RANCH-USX AA 35-23	6N	63W	35
051232510900	NOBLE ENERGY INC	WELLS RANCH - USA BB 1-19	5N	63W	1
051232511500	NOBLE ENERGY INC	W RANCH - USX BB 11-17	5N	63W	11
051232513100	U S EXPL INC	W RANCH - USX BB 15-25	5N	63W	15
051232513200	U S EXPL INC	WELLS RANCH USX BB 15-4	5N	63W	15
051232514400	UNIOIL CORP	BOOTH 31-DU	4N	63W	31
051232515800	PETROLEUM DEV CORP	BOOTH 22-31U	4N	63W	31

UWI / API	Operator	Well Label	T	R	S
051232518200	NOBLE ENERGY INC	FARMS LOYD 1-32	12N	61W	32
051232530200	NOBLE ENERGY INC	HAPPY AMIGO C 1-25	4N	64W	1
051232535100	NOBLE ENERGY INC	FRANK CC 7-19	4N	63W	7
051232543300	NOBLE ENERGY INC	SPIKE STATE CC 30-18	4N	63W	30
051232543400	NOBLE ENERGY INC	SPIKE STATE CC 30-20	4N	63W	30
051232546300	NOBLE ENERGY INC	SATER CC 18-18	4N	63W	18
051232558900	NOBLE ENERGY INC	WELLS RANCH AA 26-9	6N	63W	26
051232560800	PETROLEUM DEV CORP	WELLS RANCH 14-14	5N	63W	14
051232560900	PETROLEUM DEV CORP	WELLS RANCH 23-14	5N	63W	14
051232563500	WALSH PRODUCTION INC	CFM-RAY 16-20	11N	61W	20
051232563600	WALSH PRODUCTION INC	HALEY-RAY 14-21	11N	61W	21
051232565800	BONANZA CRK OPER	GUTTERSEN RANCH 33-9	4N	63W	9
051232565900	BONANZA CRK OPER	GUTTERSEN RANCH 43-9	4N	63W	9
051232566100	BONANZA CRK OPER	GUTTERSEN RANCH 21-9	4N	63W	9
051232566200	BONANZA CRK OPER	GUTTERSEN RANCH 11-9	4N	63W	9
051232573900	NOBLE ENERGY INC	WELLS RANCH USX AE 19-14	6N	62W	19
051232574100	NOBLE ENERGY INC	WELLS RANCH USX AE 19-12	6N	62W	19
051232574900	NOBLE ENERGY INC	WELLS RANCH USX AE 7-12	6N	62W	7
051232575300	NOBLE ENERGY INC	WELLS RANCH USX AA 25-02	6N	63W	25
051232576400	NOBLE ENERGY INC	WELLS RANCH-USX AE 31-14	6N	62W	31
051232576500	NOBLE ENERGY INC	WELLS RANCH-USX AE 31-12	6N	62W	31
051232576600	NOBLE ENERGY INC	WELLS RANCH-USX AE 31-04	6N	62W	31
051232582700	BONANZA CRK OPER	NORTH PLATTE 24-24	5N	63W	24
051232582900	BONANZA CRK OPER	NORTH PLATTE 23-24	5N	63W	24
051232597200	BONANZA CRK OPER	ANTELOPE 33-18	5N	62W	18
051232602800	NOBLE ENERGY INC	WELLS RANCH-USX BB 1-5	5N	63W	1
051232606600	NOBLE ENERGY INC	70 RANCH - USX BB 23-2	5N	63W	23
051232607400	BONANZA CRK OPER	GUNTHER 33-31	5N	63W	31
051232610300	NOBLE ENERGY INC	W RANCH - USX BB 11-15	5N	63W	11
051232618500	BONANZA CRK OPER	GUTTERSEN RANCH 22-9	4N	63W	9
051232618600	BONANZA CRK OPER	GUTTERSEN RANCH 12-9	4N	63W	9
051232625400	NOBLE ENERGY INC	GUTTERSEN-USX CC 17-9	4N	63W	17
051232628700	NOBLE ENERGY INC	GUTTERSEN-USX CC 17-1	4N	63W	17
051232633100	WALSH PRODUCTION INC	MARICK 9-29	11N	61W	29
051232643900	NOBLE ENERGY INC	LETTERLY-USX AB 23-13	7N	64W	23
051232644800	NOBLE ENERGY INC	WELLS RANCH - USX BB 3-10	5N	63W	3
051232650200	NOBLE ENERGY INC	WELLS RANCH - USX BB 15-3	5N	63W	15
051232652100	NOBLE ENERGY INC	WELLS RANCH - USX BB 15-1	5N	63W	15
051232652600	NOBLE ENERGY INC	WELLS RANCH - USX BB 15-9	5N	63W	15
051232656600	NOBLE ENERGY INC	W RANCH - USX BB 11-16	5N	63W	11
051232670200	PETROLEUM DEV CORP	WELLS RANCH 23-36	6N	63W	36
051232684300	PETRO-CANADA RES USA	DF RANCH 8-15	11N	61W	15
051232686300	PETROLEUM DEV CORP	WELLS RANCH 43-36	6N	63W	36
051232690500	BONANZA CRK OPER	NORTH PLATTE 11-13	5N	63W	13
051232690600	BONANZA CRK OPER	NORTH PLATTE 21-13	5N	63W	13
051232696600	NOBLE ENERGY INC	WELLS RANCH USX AA 13-06	6N	63W	13
051232704700	NOBLE ENERGY INC	WELLS RANCH USX AA 25-11	6N	63W	25
051232731000	PETROLEUM DEV CORP	DYER D 32-34	7N	64W	34
051232734800	U S EXPL INC	WOLFE-USX-CC 7-10	4N	63W	7
051232734900	U S EXPL INC	WOLFE-USX-CC 7-9	4N	63W	7
051232735300	U S EXPL INC	WOLFE USX CC 7-12	4N	63W	7
051232735400	U S EXPL INC	WOLFE USX CC 7-11	4N	63W	7
051232735500	U S EXPL INC	WOLFE-USX-CC 7-13	4N	63W	7

UWI / API	Operator	Well Label	T	R	S
051232940000	NOBLE ENERGY INC	ROUSE USX AB 31-07	7N	64W	31
051232947900	PETRO-CANADA RES USA	DF RANCH-AG 5-2	11N	61W	2
051232967100	NOBLE ENERGY INC	70 RANCH USX BB 23-07	5N	63W	23
051232967200	NOBLE ENERGY INC	70 RANCH USX BB 23-08	5N	63W	23
051232967300	NOBLE ENERGY INC	70 RANCH USX BB 23-01	5N	63W	23
051232999000	BONANZA CRK OPER	PRONGHORN 31-21	5N	61W	21
051233051300	BONANZA CRK OPER	ANTELOPE 22-18	5N	62W	18
051233099200	BONANZA CRK OPER	DOW 24-28	5N	63W	28
051250500600	DAVIS OIL CO	WIESER 1	5S	45W	15
051250500900	DAVIS OIL CO	DUTTON 1	4S	45W	31
051250501900	GRYNBERG JACK J	WARNER 1	3S	42W	31
051250522900	PLAINS EXPL CORP	G H LIPPELMANN JR 1	5S	46W	30
051250523000	PLAINS EXPL CORP	RALPH H GULLEY 1	5S	47W	25
051250659400	CABOT CORP	STATE 16-16	4S	42W	16
051250666900	AMOCO PROD CO	DICKSON-B 1	4S	43W	22
051250784300	FOUNDATION ENERGY MANAG	ANDREWS 32-34	4S	43W	34

APPENDIX C: STRATIGRAPHIC PICKS

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
PORTLAND 1	486	430	369	337	276	259	207	178
050010505000	8113							
050010509800	8140							
050010542900	8429							
050010620200	7526							
050010631100	7782							
050010631200	8135							
050010637400	7634							
050010638300	7691							
050010646200	8063							
050010646300	8006							
050010647900	8040							
050010648100	8095							
050010649400	7814							
050010650400	8084							
050010652700	7701							
050010653100	8223							
050010653600	8125							
050010655000	8253							
050010656900	8200							
050010659500	8166							
050010662600	7681							
050010664700	7534							
050010665200	7550							
050010665500	7697							
050010668400	7884							
050010670500	7794							
050010671100	7826							
050010671700	7683							
050010673200	7939							
050010673500	7779							
050010674100	8182							
050010674400	7726							
050010677300	7775							
050010678200	7931							
050010678500	7746							
050010688100	7659							
050010688400	7922							
050010689500	7932							
050010694700	7614							
050010694800	7995							
050010695600	7761							
050010695700	7659							
050010696900	7870							
050010699700	7717							
050010701200	7691							
050010701300	7891							

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
050010704700	7904							
050010709200	7927							
050010709800	7401							
050010712500	7797							
050010717300	7757							
050010719200	7733							
050010719800	7625							
050010722200	7685							
050010725100	7706							
050010730000	7648							
050010733200	7764							
050010733400	7691							
050010734500	8087							
050010739600	7451							
050010740100	7564							
050010744400	7572							
050010746600	7682							
050010747600	8062							
050010751700	8061							
050010760100	7625							
050010764200	7749							
050010769900	7775							
050010774000	7547							
050010775900	7627							
050010781600	8064							
050010786700	8085							
050010787000	7848							
050010787600	7652							
050010793100	7473							
050010794300	7578							
050010803800	7841							
050010806800	7612							
050010807300	8028							
050010809700	7509							
050010810400	7588							
050010823300	8066							
050010823900	7764							
050010824900	7746							
050010830600	7546							
050010834800	8014							
050010835000	8132							
050010835700	7711							
050010837600	7675							
050010837900	7483							
050010842000	7816							
050010842300	7828							
050010844900	7440							
050010846000	7742							
050010849800	7566							
050010851700	7725							

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
050010853800	8007							
050010854800	7750							
050010855200	7741							
050010872000	7742							
050010873200	7512							
050010881800	7895							
050010884300	7769							
050010885000	7726							
050010885400	7832							
050010901900	7634							
050010902300	8437							
050010904600	7552							
050010905200	7596							
050010907600	7608							
050010907700	7631							
050010909600	7612							
050010911300	7637							
050010920000	7769							
050010921800	7683							
050010922000	7612							
050010922100	7573							
050010924100	7849							
050010925000	7598							
050010925400	7948							
050010926100	7997							
050010927800	7902							
050010930300	7941							
050010930700	7926							
050010930900	7567							
050010933500	7751							
050010936900	7804							
050010939500	7598							
050010940800	7835							
050010941000	7888							
050050500000	4873							
050050500900	4896							
050050620300	7858							
050050630200	7821							
050050632700	8266							
050050633700	8293							
050050637700	7802							
050050639000	7901							
050050640000	8228							
050050643100	8156							
050050645100	8088							
050050645900	8481							
050050646300	8144							
050050647400	7880							
050050648900	7831							
050050649100	8450							

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
050050650000	8220							
050050650300	8006							
050050650800	7880							
050050651500	8462							
050050654900	7920							
050050655400	8237							
050050655900	8061							
050050656000	8206							
050050657100	8258							
050050657200	8194							
050050657500	8185							
050050657700	8180							
050050658900	8252							
050050659000	8176							
050050659200	8412							
050050659900	8260							
050050661000	8238							
050050661700	8640							
050050664200	8212							
050050665100	8012							
050050665400	8279							
050050666000	7917							
050050666100	7856							
050050666200	8255							
050050667100	8121							
050050674000	7980							
050050675200	8398							
050050677200	8125							
050050678300	7677							
050050679900	7806							
050050683000	7793							
050050683600	8044							
050050684400	7834							
050050685800	7814							
050050687700	7799							
050050693700	7625							
050050696300	8322							
050050696400	7996							
050110505000	315							
050110506100	411							
050110600200	371							
050110606600	474							191
050110611800	507							
050110613000	396							117
050110614000	339							
050130607400	8845							
050130608300	8818							
050130611700	8536							
050130611800	8661							
050130614900	8653							

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
050130629200	8397							
050140908300	8485							
050170501200						1550		
050170610200	1715	1648	1567	1529		1496	1468	1413
050170617400	1894							1582
050170618800	1230	1165	1083	1040		971	940	899
050170619600	1900	1827	1760	1716	1715	1695	1662	1603
050170622700								1777
050170624600								1613
050170626200	1856	1814	1696	1657	1657	1625	1597	1548
050170626800		1612		1450	1448	1422	1391	1334
050170628200	1442	1381	1301		1249	1233	1198	1140
050170629100	1416							1115
050170634700	2184							1872
050170635100	1520	1451	1374			1304	1270	1216
050170635400	2794		2642			2594		2486
050170637200					1323	1299	1269	1219
050170638000	1469	1402	1327		1273	1262	1230	1170
050170638500		2044	1977	1932		1909	1879	1819
050170638600	1528	1456	1385		1336	1325	1292	1236
050170640300	2052							1744
050170640500	2160							1849
050170640800	1336	1273	1194	1149		1095	1065	1013
050170640900		1551	1472		1427	1405	1373	1317
050170641100	2075							1766
050170641300	2104							1803
050170641900							954	897
050170642800		1561	1485		1437	1417	1384	1326
050170643000	2161							1849
050170643300	1335							1029
050170643500	2298							1992
050170643700		2520	2450	2414		2390	2353	2290
050170643800	2100							1795
050170646300	2044							1738
050170647300								1830
050170649000	1649							1339
050170650400		1546			1397	1373	1345	1290
050170651200	1654							1344
050170652600	1770							1454
050170653000	1750							1441
050170653900		1551			1393	1367	1337	1283
050170654100	1719							1413
050170654200		1565	1455	1418	1417	1390	1358	1307
050170654700		1537	1426	1389	1389	1364	1331	1279
050170655200	2284							1983
050170655800		1588	1476	1437	1438	1408	1377	1326
050170656200					1411	1379	1349	1297
050170656300					1394	1368	1338	1288
050170656400	1479							1171
050170656800		1680	1561	1522	1522	1493	1462	1413

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
050170657600		1509	1429		1383	1366	1335	1278
050170658100		1553			1408	1399		1358
050170658200	2190							1895
050170658500		1975	1848	1819	1817	1798	1768	1723
050170658700		1531			1384	1360	1331	1278
050170659100			1076	1026		996	965	911
050170659200					1427	1400	1369	1317
050170659300	2333							2029
050170659700	2259							1959
050170660300		1592	1482	1446	1445	1414	1384	1332
050170660400		1642	1519	1481	1480	1453	1424	1371
050170660600		1563			1405	1376	1347	1294
050170661100		1687	1568	1526	1526	1502	1469	1419
050170661500	1720	1652	1576	1536	1536	1520	1490	1434
050170661700	1760	1724	1603	1563		1535	1507	1457
050170661900		2086	1951	1923				
050170662800	2225							1920
050170663400		1615	1498	1456	1455	1428	1399	1346
050170663900	2171							1862
050170664100	2335							2037
050170665000					1404	1376	1345	1295
050170665700	2614							2305
050170666400	1673							1379
050170667000		1547		1383	1382	1358	1328	1279
050170667500	2387							2071
050170668500					1368	1338	1311	1259
050170669200	2274							1963
050170670900	1398		1257			1184	1151	1096
050170671100	2080							1803
050170671200	1761							1460
050170671800	2225							1916
050170674600							1115	1058
050170675900	2259							1940
050170676000		1298	1171	1131	1132	1096	1065	1017
050170677900		1300	1176	1136	1137	1101	1072	1026
050170678500	2269	2227		2093	2095	2077	2047	1989
050170679700		1551			1387	1364	1332	1281
050170680300		1277	1150	1111	1111	1078	1048	1002
050170682800	2149							1844
050170688000		1540	1428	1387	1388	1359	1331	1277
050170688700	2261							1949
050170690100	1455	1410	1291	1253		1238	1208	1156
050170690900	1694							1381
050170691100				1398	1397	1371	1344	1294
050170691500		1583			1421	1394	1362	1311
050170693000		1568	1453	1411	1412	1388	1357	1305
050170694900		1672	1553	1513	1513	1484	1455	1403
050170695200		1629	1508	1466	1466	1439	1409	1357
050170699600	2114							1816
050170699800		1603	1487	1447	1446	1417	1387	1335

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
050170703100	1607							1296
050170703200					1315	1288	1260	1208
050170705400	2125							1816
050170705900					1298	1271	1241	1187
050170706000	1519				1319	1293	1263	1212
050170712400	2009							1713
050170712600	1792							1491
050170712700	1803							1502
050170712900	1688							1402
050170713200			1084			992	953	906
050170713600	1769							1471
050170713700	1666							1365
050170713900	1934							1630
050170714000	1739							1447
050170714100	1683							1383
050170714400	1705							1407
050170714500	1702							1415
050170714800	1777							1474
050170716300	1440							1123
050170718600	1695							1390
050170718700					1452		1398	1349
050170719400	2562							2259
050170720500	2514							2209
050170720900	2213							1899
050170721500	2616							2343
050170721600	2633							2332
050170721700	2524							2221
050170721800	2494							2186
050170722700	2599							2296
050170723000	2509							2209
050170723200	2483							2174
050170723400	2470							2165
050170723500	2609							2301
050170723600	2449							2147
050170723800		1159	1062	1034		976	941	891
050170724100	2411							2099
050170724500	2665							2357
050170724700	1563	1498	1418			1348	1311	1255
050170724900	2528							2224
050170725100	1654	1584	1509	1464	1465	1449	1421	1365
050170725200					1322	1299	1265	1230
050170725700	1273	1208	1133	1086		1033	999	951
050170726000	2105							1808
050170726400	2237							1947
050170726500	1773	1703	1627	1590	1589	1575	1547	1484
050170726600	2485							2185
050170726700	2412							2108
050170726900	2072							1798
050170727600		1534	1422	1382	1383	1355	1327	1273
050170728000	1329	1264	1184	1147		1080	1050	1002

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
050170728100	1373						1138	1077
050170728400	2204							1906
050170729400	1330		1186			1105	1073	1020
050170730000		1155	1054	1016		994	959	905
050170730600	2349							2062
050170730700	1282	1217	1138	1101		1039	1009	960
050170730800	1383	1320	1237	1202		1149	1126	1075
050170730900	1486	1417	1338	1299		1252	1222	1171
050170731600		1651	1533	1493	1493	1464	1434	1380
050170731800	2542							2230
050170732000	2582							2289
050170732400	2386							2079
050170733900	2404							2107
050170734000		1524	1436		1382	1362	1332	1277
050170735800	1201	1142	1067	1021		961	927	879
050170735900		1125	1047	1004	953	928	894	849
050170736100	1336	1272	1190	1153		1079	1050	1003
050170736200	1376	1308	1228	1189		1140	1107	1057
050170736400	2446							2141
050170736500	2639							2334
050170736600	1869	1798	1725	1684	1685	1665	1630	1575
050170737500	2642							2330
050170737900	2558					2350		2252
050170738300	2663							2360
050170738400	2729							2418
050170738600	2598							2289
050170738800	2613							2307
050170739100	2655							2352
050170739300	2698							2392
050170739400		1573	1459	1419	1418	1402	1371	1318
050170739700	2701							2407
050170740500	2439							2142
050170740700	2629							2319
050170741200	2700							2392
050170741400	1506	1442	1366			1284	1253	1200
050170741500	1435	1369	1289	1249		1201	1164	1111
050170741600	1457	1393	1314			1245	1213	1157
050170741700	1281	1219	1139	1098		1042	1009	960
050170741800	1318	1251	1175	1132		1083	1048	1001
050170742400	2395							2111
050170742600	2050							1730
050170742700	1593							1286
050170743500		2139		2016	2016	1999	1969	1913
050170744700	1475							1168
050170747800	2449							2142
050170748100	1980							1669
050170748200	2498							2198
050170748300	2505							2197
050170748700	2259							1937
050170748800		2128		1987	1987	1970	1940	1889

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
050170749600	1923							1634
050170752300	1922							1619
050170752500	2063	2018		1853	1854	1826	1802	1756
050170752700	2224							1918
050170753700	2678							2375
050170753900	2320							2016
050170754100	1678	1634	1506	1468		1450	1418	1370
050170754400	2473							2161
050170755500	1969							1666
050170756300	2022							1718
050170756400	2435							2123
050170757000	1996							1703
050170757100	1996							1700
050170757200	1884							1586
050170757500	1773							1469
050170757600	1832							1540
050170758600	1760							1472
050170760200		2154		2009	2009	1993	1962	1903
050170760700	1636							1331
050170761800		1163	1057	1010	973	940	911	867
050250500000	818							
050250500200	1517	1449	1380	1360	1304	1294	1255	
050250500500	1788		1662				1540	
050250500800	1310	1242	1178	1153		1075		
050250500900		1563	1500					
050250501000	1714					1492	1461	
050250501100	1838						1567	
050250501300	1779		1649			1529	1498	
050250501500	1867	1793	1736	1710	1632	1614	1584	
050250501600		2297	2235	2208	2144	2098	2068	2042
050250600100	1947	1867	1811	1782	1713	1675	1646	1617
050250600200	1899	1823	1766	1742	1660	1639	1607	1578
050250600400	1247	1178	1113	1091		1018	982	901
050250600500	790							
050250600600	1829							
050250600700	1103	1034	958	937		879	848	
050250600900	1601	1534	1469	1456		1383	1346	
050250601000	1842	1782	1709	1690	1639	1629	1593	1512
050250601100	1592	1525	1463	1448	1389	1374	1338	1250
050250601200	1378	1300	1246	1220	1151	1137	1099	1016
050250601300	1498	1425	1366	1336	1271	1259	1220	1199
050310530700	7995							
050310613200	7997							
050310639000	7948							
050310639900	7978							
050310644900	7963							
050310648600	7801							
050310659600	7798							
050310665300	7992							
050310669500	7954							

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
050310688000	7934							
050310707600	7697							
050310733900	7795							
050310735000	8021							
050310736700	7993							
050310787300	8055							
050310882500	7828							
050310882800	7753							
050310883100	7821							
050350500000	9358							
050350600200	9288							
050350600700	8716							
050350600800	8832							
050350601000	9036							
050390500400	6823							
050390500700	4753							
050390500800	7154							
050390500900	6990							
050390501700	7665							
050390502200	5963							5659
050390502400	5650							
050390502800	5525							
050390503400	4974							
050390510000	6496							
050390510200	6708							
050390600100	5620							
050390600600	6739							
050390600700	6952							
050390601000	4943		4799					4656
050390601100			5342		5312	5303		
050390601200	7636							
050390601500	4737							
050390601900	7273							
050390602100	5522							5216
050390602300	5401							5093
050390602600	5437							5121
050390602900	7649							
050390603100	6132							5839
050390603300	7916							
050390603400	7173							
050390603700	6396							
050390603800	7030							
050390603900	8061							
050390604000	7610							
050390604100	7487							
050390604800	6196							
050390604900	5785							
050390605000	5889	5810	5743	5729	5720	5713	5668	
050390605800	5388							
050390606200	7827							

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
050390606800	8174							
050390607000	8395							
050390607200	6821							
050390607600	8202							
050390607800	5946							5645
050390608200	5250							4940
050390608300	4621		4482					
050390608400	4917							4622
050390608600	7766							
050390609200	5571							5259
050390609400	5442							5123
050390609600	5917							5623
050390609900	5590							
050390610100	4922							
050390610300	8635							
050390610500	7045							
050390611000	6300							
050390611100	4628							
050390611500	4378		4242					
050390611700	6491							
050390611800	6215							
050390611900	8415							
050390612100	6095							
050390612200	6263							
050390612400	8894							
050390612900	7349							
050390613000	7741							
050390613100	6970							
050390613200	7792							
050390613300	5592							
050390613400	6553							
050390613600	5729							5438
050390613800	6855							
050390613900	5641							5344
050390614000	6110							5816
050390614100	5018							4707
050390614200	8412							
050390614300	7590							
050390615300	8498							
050390615400	8661							
050390615500	8634							
050390615600	8418							
050390616000	7718							
050390616100	7748							
050390616300	7896							
050390616500	8411							
050390616800	8940							
050390617300	8532							
050390618000	7855							
050390618100	7013							

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
050390618500	8166							
050390618600	7590							
050390618800	7268							
050390619100	7950							
050390619400	6792							
050390619500	8318							
050390619600	8681							
050390620900	7635							
050390622400	7516							
050390622800	7496							
050390622900	7345							
050390624100	7980							
050390624300	7732							
050390624600	7591							
050390624800	7509							
050390625100	7061							
050390625300	7344							
050390625800	7409							
050390625900	7513							
050390626100	7422							
050390627200	7545							
050390628000	7393							
050390628900	7563							
050390629200	7564							
050390629400	7798							
050390632900	7366							
050390633000	7789							
050390634800	7735							
050390635600	8417							
050390635700	7366							
050390636700	8231							
050390637000	7957							
050390637100	7734							
050390637900	8076							
050390638100	7797							
050390638600	8571							
050390638800	8451							
050390638900	8047							
050390639400	6868							
050390639600	8307							
050390639700	7227							
050390639900	8181							
050390640100	8251							
050390640500	8669							
050390641100	8543							
050390641700	7503							
050390641800	8510							
050390642700	8423							
050390643200	6824							
050390644400	8131							

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
050390644500	8153							
050390644700	8112							
050390645000	7751							
050390645200	7733							
050390645400	7497							
050390647200	7785							
050390647300	8388							
050390647500	8095							
050390648200	8477							
050390648300	8066							
050390648400	6713							
050390649000	8208							
050390649300	8355							
050390650600	8378							
050390650900	8032							
050390651100	7590							
050390651300	4592							4278
050390651400	4662							4354
050390651900	4615							4306
050390652000	8352							
050390652100	4783							4478
050390654500	7636							
050390654900	7955							
050390655000			4809			4765		
050390655500	7686							
050390656100	8264							
050390657200	4584							4277
050390657300	4718							4438
050390657800	4604							4293
050390658000	4758							4456
050390658100	8380							
050390658300	8232							
050390658400	7576							
050390658500	8234							
050390659500	8348							
050390660400	4941							4640
050390662100	4790							4494
050390662300	7409							
050390662500	8175							
050390662900	7645							
050390663500	5388							5079
050390663800	4725							4414
050410500200	3755	3699	3625			3524	3487	
050410500600	4015	3967	3879	3858	3800	3760	3728	
050410501500	4743	4676	4604			4510	4470	
050410502000	4663	4608	4525	4505	4451	4432	4395	
050410502100	5460		5324				5227	
050410502200	5490		5354				5256	
050410502300	5285		5148				5079	
050410502400	5758	5695	5632	5613				

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
050410502600	2553							
050410502800	5838		5701		5667		5603	
050410503000	5629		5486			5431		
050410503100	5960		5828		5793	5767	5735	
050410503200	5470		5334				5238	
050410503500	7254		7109			7060		
050410503800	6259		6123		6090	6069	6035	
050410504100	6850		6731					
050410504500	7016		6879					
050410504700	5824	5746	5681	5667		5638	5599	
050410504900	7095	7022	6964	6958		6948	6903	
050410505000	8047	7972	7909	7903	7902	7891	7847	
050410505500	6288	6209	6142	6130	6121	6112	6072	
050410505600	6493		6359		6342	6333	6294	
050410505700	6902	6829	6767	6758	6758	6744	6708	
050410510900	6899		6760		6732	6712	6670	6604
050410600300	6305		6172		6151	6132	6095	
050410600400	2748	2684	2612	2586		2508	2464	
050410600500	6713	6637	6573	6564	6553	6539	6501	
050410600600	6071	5997	5931	5919	5901	5884	5847	
050410600700			7497		7471	7459	7419	
050410600800	7932	7853	7796	7788	7786	7779	7737	7660
050410600900	7849		7729		7706	7692	7649	7570
050410601000	7391		7271		7249	7238	7200	
050410601300	5976	5895	5827	5814	5809	5800	5757	
050410601400	6601		6463		6445	6434	6397	
050410601500	6818		6686					
050410601600	6421		6280		6261	6237	6202	
050410601700	6841	6766	6705	6696	6698	6686	6646	
050410601800	6383	6311	6243	6233	6222	6207	6169	
050410601900	6406							
050410602000	6864							
050410602100	5788		5651		5620			
050410602200	5558		5423		5392			
050410602300	5362		5221		5191			
050410602500	6000	5947	5870	5859	5832	5813	5776	5718
050410602600	3566	3516	3448	3434	3365	3349	3318	3269
050410602700			7307			7255	7210	7138
050410602800	6753							
050410603200			2232			2131	2100	
050410603300	4892		4753				4627	
050410603400	5680		5548		5512		5447	
050410603500								2320
050410603900			1905	1887	1825	1806	1757	1720
050410604200	6800	6723	6661	6652	6629	6616	6578	6506
050410604300		7496	7432	7422	7422	7412	7371	7289
050410604400		7137	7077	7068	7061	7051	7012	6950
050410604600	1974	1911	1844	1820	1765	1741	1701	1653
050410605100	5831	5764	5697	5688	5642	5634	5596	5540
050430600800	2885							

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
050430605100						3482	3430	3386
050430606100						3610	3558	3505
050430607500							2922	2881
050430607600			2616	2601		2523	2508	2469
050430607700						2426	2381	2349
050430607800						2353	2309	2272
050430608300						2617	2572	2534
050430613800			1072				880	807
050430614100							3912	3866
050430614800			5776				5620	5572
050550504900						1810		
050550600400			5287			5157		
050550600500						3268		
050550600800								
050550600900	2088		1978			1854		
050550601500	2217		2113			1990		
050550602200			3239			3063		
050550602600			5059			4874		
050550603200			7024					
050550604200	1650							
050550604500						5222	5172	5153
050550605000			3278			3124		
050550605300						1756		
050550605600						3216		
050550605800						5282	5230	5199
050550606600						3980		
050550606700						2550		
050550607000						3800		
050550608000						5066		
050550609000						2029	2009	1972
050550609100						2115	2093	2070
050550609400			1924			1805		
050550610600						4422		
050550613900						3083	3046	3009
050550629400						2926	2888	2868
050590500600	9009							
050590506300	8912							
050590600900	9219							
050610502800	630							
050610504000	746	684	606	586	520	515	475	
050610504800	961	898	823	797	740	733	694	
050610506000	864	802	723			610	578	
050610506200	865	798	717			595	563	
050610506500	781	718	622					
050610506700	876	814	732				584	
050610514700	894	832	754	724		661	628	564
050610602900	771							
050610604000	1076	1012	929			794	766	
050610605600	858	795	715				578	
050610606500		511		391				

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
050610611000	798	728					474	
050610611800	1149	1092	1002	973		885	853	
050610613100	989	926	847	807		710	684	637
050610614400	651		431	397				
050610615800	734	672	584	548				
050610615900	590		444	415				
050610616000	525	441						
050610616300	607							
050610616600	642							
050610620100	1209	1150	1057				944	
050610620400	668							
050610620600	1218	1159	1083	1054		993	954	884
050610621900	704							
050610623400	599							
050610623600	756							
050610624300		563	481	447		372	346	
050610626000	1341							1001
050610626900			616	581				
050610627400	870	807	727				575	
050610627600	876	814	733				577	
050610627800	1336	1273	1196				1054	994
050610629400	745							
050610629600	840							
050610630200	837							480
050610630300	794							
050610631700	900							
050610631800	719							
050610632100	732		589					
050610632800	736							
050610632900	800		652					
050610633200	797							
050610633400	883							
050610634800	798	731	654			534	501	453
050610635300	802							
050610635700	778							428
050610635800	752							
050610636500	839							
050610636600	804							
050610636800	848	782	707			578	548	497
050610637000	499							
050610637300								933
050610637400		513	430					
050610637600	807							
050610638100	1323	1259	1179	1140		1064	1029	981
050610638800	788	722	637			511	474	422
050610639400	875							
050610639700	755							
050610640100	782							
050610640200	865	803	719			599	565	514
050610640300	938	876	795			675	639	591

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
050610640800	917	852	772			649	615	562
050610640900	751							
050610641000	791							
050610641500	917	851	770			648	616	565
050610641700	963	899	818			699	665	612
050610642000	994	931	851		759	734	699	653
050610642100	740							
050610642300	817							
050610642900	810							
050610643100	808							
050610643200	819							
050610643300	784							
050610643600	788							
050610643800	798							
050610644500	1348	1283	1203	1163	1088	1075	1043	987
050610645000	877	811	734			613	581	527
050610645100	864							
050610645600	798							431
050610645700	663							
050610645900	908	845	765			639	604	554
050610647100	814							
050610647400	840	777	684	648		551		
050610647500	845							486
050610647800	823							459
050610649500	753							
050610650000	752	690		560				
050610651100	1091	1030	952	921	859	851	815	753
050610655400		1099	961	922	865	855	823	780
050610655900	635							
050610656300	1376	1307	1224	1184	1107	1089	1060	1005
050610656800	714	652						
050610657300	881	816	730	692		594	557	517
050610657700		1013	881	837	779	765	735	691
050610658700		887	779	740	670	656	621	579
050610659800	1160	1096	1017	971	903	874	843	797
050610659900	1058	993	913		807	780	747	698
050610660400		852	761	728	663	622	591	549
050610660800		746	649	609	547	512	484	443
050610661300	1040	980	896			765	734	686
050610661400	1151	1084	1002		910	862	833	786
050610661800	1079	1017	934		839	803	770	721
050610663400	1097	1031	949		860	820	790	744
050610664300	1022	960	882		785	749	718	666
050610665200	964	900	801	771	705	661	631	585
050610665600	1131	1067	985		887	849	817	770
050610666400	1226	1162	1082		987	961	929	878
050610669300	1273	1209	1130	1087	1025	1002	969	919
050610669400	757	687	600					
050610669700	910	848	767	742	683	674	638	569
050610670000	1049	984	904		803	771	740	690

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
050610670100	800	730				505	471	
050610671000		1088	950	915	857	845	814	770
050610671600		878	770	731	695	650	618	573
050610679400	1128	1064	981		885	846	815	766
050610679600	1103	1040	959	926	862	823	792	744
050610679700	789		642				476	427
050610680700	1013							
050610684400	1327	1264	1190				1049	992
050610685900	813							
050630500200								1974
050630500600	2432							2144
050630501000	2816							
050630501200	2640							2347
050630501300	2460							
050630502000	2481							2219
050630502200	2582							2295
050630502300	2470							
050630502600	2659							
050630509000							1998	1952
050630509400		2192	2076	2049			2007	1962
050630509600	2600							
050630509700	2251							1953
050630600600	2308							
050630601200	2254							
050630601300	2237							
050630603000	3017		2870				2786	2716
050630603400	2070						1822	
050630608700	2214							1934
050630610900	2343							2063
050630611100	2696							2425
050630611200	2789							2455
050630613800	3039							
050630618100	2254							1972
050630618400							2020	1973
050630618500							1961	1913
050630618600							1987	1940
050630618700							1917	1872
050630618800							1980	1931
050630618900							1963	1916
050630619100							1974	1926
050630619200							1977	1931
050630619800	2829							
050630619900	2580							2278
050630620200	2075						1833	1788
050630620600	2447							2147
050630620800							1980	1932
050630621500							2262	
050630622000	2480					2257	2228	2172
050630622400							1880	1828
050630622500	2261							1985

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
050630622600	3040							2742
050630623000	2813							2512
050630623100							1955	1908
050630623300							1972	
050630623700	2716							2411
050630623800	2720							2411
050630623900	2314							2028
050630624000	2742							2437
050630624100	2769							2463
050630624200	2708							2405
050630624300	2135							1861
050630624500	2742							2452
050630624600	2759							2455
050630624700	2815							2503
050630624800	2793							2486
050630624900	2811							2501
050630625200	2709							2400
050630625400	2774							2485
050630625600	2782							2470
050630625900	2476							2170
050630627000	2776							2479
050630627200	2793							2484
050630627800	2760							2456
050630627900	2794							2480
050630628500	1982					1773	1742	1702
050630628600	2730							2442
050630629100	1967							1683
050630629200	2030					1813	1783	1737
050630629400							2005	1959
050690508800	1942							
050690607300	6804							
050690612100	6809							
050690612700	6343							
050690615200	4414							
050690617400	6298							
050710616800			1081			959		
050710751500			943			821		
050710770500			969			847		
050730500100	2550	2474	2410	2379	2317	2279	2248	
050730500400	3972		3838		3799			
050730500500	2875	2809	2730		2637	2619	2590	
050730500600	3709		3577	3557	3484	3473	3435	
050730501000	3626		3485				3356	
050730501600			3429					
050730501700			3428			3345		
050730501900	3349							
050730502100	4002							
050730502300	4072							
050730502600	4350							
050730502700	3613							

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
050730502800	3812							
050730502900	4778							
050730503000	4119							3820
050730503100	3531							
050730503300	4065							3765
050730503400	3724							
050730503500	4967							4667
050730503600	3970							3677
050730503700	3638							
050730503800	3920							3609
050730504000	3930							3628
050730504100	4211							3907
050730504200	4276							3979
050730504300	4141							3846
050730504400	4791							4505
050730504500	4537							4248
050730504600	3760							
050730504700	4469							
050730504800	4702							4415
050730504900	4293							4006
050730505200	3787							
050730505300	4795							
050730505400	4588							4302
050730505600	4211							
050730505700	4286							
050730511000	4470							
050730511200	3364							3064
050730600100	4158							
050730600200	4086							
050730600300	4130							
050730600400	2245							
050730600500	4168							3874
050730600700	2287	2221	2150	2107	2106	2090	2066	2004
050730600800	1932							1642
050730601100	4560							
050730601200								
050730601300	4212							3897
050730601400	4727							4434
050730601600	4660							4343
050730601700	4046							
050730601900	3952							
050730602000	3901							3603
050730602200	4502							4220
050730602400	3642							
050730602800	4436							
050730602900	4325							4038
050730603100	2501	2430	2358	2315	2287	2272	2248	
050730603200	1373	1309	1236	1200		1133	1101	1047
050730603300	4930							
050730603400	4900							4610

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
050730603500	4963							4674
050730603600	4916							4620
050730603700	4451							4159
050730604000	5052							4760
050730604100	4168							3864
050730604200	4365							4083
050730604400	3422							
050730604500	3602		3459	3438	3385	3368	3335	3292
050730604600	3950							3649
050730604700	4327							4037
050730604800	3664	3590	3518	3491	3437	3419	3394	
050730604900			3860	3841		3766	3740	
050730605200	3034	2964	2893	2863	2812	2796	2768	2727
050730605300	2165							
050730605500	4550							4255
050730605600	4714							4429
050730605700	4882							4595
050730605800	3804							
050730605900	3874							
050730606100	4068							3735
050730606200	5210							
050730606300	3728							
050730606400	3187		3046	3022	2970	2953	2922	
050730606500	3269							
050730606600	2428	2365	2288		2198	2179	2149	2101
050730607000	3257							
050730607100	3322							
050730607300	3090		2947	2924	2869	2854	2824	
050730607400	2364	2303	2228		2143	2119	2089	
050730607600						2687		
050730607900								2184
050730608000			3110				2987	
050730609300	1390	1328	1253	1221		1147	1115	1059
050730609400	1680	1614	1541	1517	1450	1432	1401	1348
050730609600	2894							2582
050730609700	2857							2535
050730609800	2878							2568
050730609900	3727		3580	3549	3521	3509	3476	3416
050730610000	2881							2576
050730610200	2895							
050730610300	3491							3194
050730610500	2860							2555
050730610600	2893							2585
050730610700	2848							
050730610800	2815							2508
050730610900	2754							2453
050730611000	3636	3561	3492	3459	3433	3422	3389	3328
050730611100	2938							2631
050730611200	2779							
050730611300	2790							2483

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
050730611400	3638	3564	3495	3469	3418	3397	3370	3326
050730611500	3455							3153
050730611600	3641	3562	3486	3456	3426	3410	3380	3318
050730611800	4275							3939
050730612000	2852							2541
050730612100	2904							2608
050730612200	2928							2632
050730612400	2640							2340
050730612500	3128							2835
050730612600	3718							3432
050730612700	2911							2603
050730612900	2944							2651
050730613100	3650							3348
050730613200	2981							2686
050730613400	4357							4069
050730613600	2919							2599
050730613700			2926		2879	2859	2828	2776
050730613800	1629	1562	1489	1446		1396	1365	1318
050730614000	4334							4011
050730614200	2921	2848	2773	2739	2700	2678	2650	2607
050730614300	2856							2549
050730614400	3485							3170
050730614500	2979							2670
050730614600	2903							2594
050730614800	2231	2167	2094	2057	1997	1987	1960	1916
050730614900	2863							2554
050730615000	3619							
050730615100	2948							2687
050730615200							3451	3408
050730615300	2696							
050730615400	2405	2331	2275	2249	2174	2165	2133	2083
050730615500	3266		3120			3074	3036	2963
050730615700	2415	2346	2276	2235	2221	2212	2178	2126
050730616000	2868							2562
050730616100	3167		3000			2936		
050730616200	3473							3170
050730616400	3991							3688
050730616500	2832							
050730616900	4410							4120
050730617000	4606							4294
050730617100	4338							4030
050730617200	3730							
050730617500	3044						2786	
050730617600	3019							2712
050730617800	2052	1984	1911	1873	1804	1792	1763	1717
050730617900	2790						2552	2481
050730618000	5105							4788
050730618200	1924	1859	1785	1750	1677	1664	1636	1585
050730618400	2877							2568
050730618500	3199							2919

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
050730618600	3073	3002	2930	2896	2850	2833	2804	2759
050730618700	3164		3019			2976		2863
050730618900	4553							4241
050730619000	3605							3340
050730619200	4541							4235
050730619300	3715							
050730620300	3069		2913		2857	2835	2808	2758
050730620500	2066	1995	1923	1878	1876	1871	1837	1777
050730620700	1711	1643	1566	1527	1496	1492	1462	1409
050730620800	1690	1628	1550	1507		1455	1421	1371
050730621000	5115							4797
050730621100	5153							4839
050730621200	2762							2461
050730621300	1973	1904	1835	1794	1788	1782	1747	1685
050730621400	2720						2480	2411
050730621600	1903							1627
050730621800	2999							2700
050730622100	1349	1286	1206			1113	1063	1016
050730622200	4910							4588
050730622400	2747							2452
050730622500	4889							4585
050730622600	2769						2535	2469
050730622800	2734						2498	2430
050730623100	3010	2939	2872	2845	2767	2751	2721	2680
050730623200	2860							2555
050730623300	2068	1998	1927	1888	1883	1880	1841	1778
050730623400	4916							4599
050730623800	3302		3158				3036	2993
050730624200	2909							2600
050730624300	3182	3109	3034	3004		2933	2911	2869
050730624500	2827							
050730624600	2806							2507
050730624800	2803							2507
050730624900	4069							3745
050730625200	3962							
050730625400	5191							4882
050730625500	1346							1012
050730625700	1550	1479	1400	1356		1292	1252	1206
050730625900	2718							2397
050730626800	3473							3172
050730627100	3051		2903			2861		2754
050730627300	2109	2041	1973	1937	1935	1924	1893	1833
050730627400	2638							2335
050730627700	3522							3217
050730627800	2989							2707
050730628000	2901							2594
050730628200	2878	2802	2730	2695	2653	2634	2609	2562
050730628300	3561		3423				3300	3258
050730628500	1627							
050730628600	1629						1372	1321

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
050730628700								1544
050730628800	1628							
050730628900	1843							1552
050730629000	2912							2599
050730629100								1536
050730629200	1662							
050730631100	3470	3395	3325	3294	3263	3244	3214	3159
050730631600	3004		2849		2789	2772	2740	
050730631700	3021		2863		2806	2788	2756	2707
050730631800	3086	3000			2869	2858	2819	2772
050730632000	2790	2720			2579	2568	2533	2484
050730636800	3033							
050730636900	3108		2947		2895	2876	2845	2795
050730637000	2999						2741	2692
050730639100	3035						2771	
050730639800	3075							
050730641200	3635		3490	3455	3433	3424	3391	3333
050890501500	835	750	697		619	613	571	
050890501900	973	908	838		762	753	712	
050890600100	753		612				489	
050890600300	532							
050890600400	409						154	
050890600500	178							
050890600600	807	726	669		591	589	544	
050890600700	818	734	680		603	595	554	
050890600800	442							
050890600900	833	763	694	670		597	560	
050890601000	622							
050890601900	269							
051010500500	397							
051010501900	269							
051010503900	211							
051010506800	3006	2953	2881			2781	2736	
051010507500	3148	3097	3019	3000	2936	2914	2865	
051010507700	3267	3210	3137	3119	3063	3036	2998	
051010508000								
051010508100	1818							
051010600100			2090			1971	1934	
051010600200	2679	2619	2542	2510	2461	2425	2390	
051010600300	1318	1257	1185	1170	1108	1075	1035	943
051010600400	1603	1539	1471	1456	1403	1364	1328	1255
051010600500		1977	1908	1896	1844	1797	1760	1701
051010600800	867		729			633	591	
051010600900	905		777			676	638	
051010601000	280		152					
051210500200	4555							
051210500300	4716							
051210500500	4377							
051210500700	4855							4559
051210500800	4476							

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
051210501100	4273							
051210501300	4804							4511
051210501600	4758							4461
051210502000	4735							4441
051210502300	4614							
051210502600	4250							3964
051210502800	4329							4041
051210503800	4454							
051210503900	4517							4236
051210505000	4456							
051210505100	4326							
051210505300	4542							
051210505500	4444							
051210505700	4278							
051210505900	4420							
051210506000	4381							
051210506300	4253							
051210507000	4408							
051210764000	4314							
051210814500	4786							4489
051210819300	4380							
051210846500	4908							4615
051210859100	4279							3988
051210865000	4446							
051210865300	4316							
051210884100	4829							4541
051210903400	4442							
051210928500	4468							4178
051210968300	4666							4372
051210979000	4242							3948
051210979700	4620							
051216003500	4329							4036
051216004600	4734							4442
051230525600	7227							
051230530000	7294							
051230531600	7278							
051230531800	7274							
051230531900	7318							
051230532700	7327							
051230536200	7211							
051230537000	7261							
051230537700	7562							
051230543400	7241							
051230544500	7266							
051230556000	7154							
051230560200	7050							
051230708700	6982							
051230712800	7112							
051230712900	7591							
051230713500	7760							

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
051230716200	7828							
051230716500	8040							
051230716800	7627							
051230721900	7654							
051230724500	7521							
051230725800	7418							
051230727200	7572							
051230728600	7694							
051230730000	7649							
051230730600	7590							
051230731100	7504							
051230732500	7541							
051230732900	7504							
051230737900	7590							
051230739000	7214							
051230739600	7032							
051230741600	7330							
051230741700	7645							
051230743400	7593							
051230743500	7622							
051230745500	7634							
051230762200	7656							
051230772100	7091							
051230772300	7773							
051230773800	7593							
051230775300	7462							
051230776400	7462							
051230777700	7520							
051230780100	7668							
051230788200	7642							
051230791200	7549							
051230791300	7570							
051230798200	7303							
051230806000	7674							
051230808000	7595							
051230810400	7596							
051230816700	6948							
051230826900	7596							
051230829600	7509							
051230834600	7311							
051230836300	7494							
051230838500	7611							
051230840000	7582							
051230842100	7510							
051230842600	7927							
051230864300	7467							
051230869000	7464							
051230870600	7522							
051230875800	8172							
051230878600	7574							

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
051230889000	7669							
051230896500	7228							
051230915900	7611							
051230933600	7349							
051230934900	7553							
051230938100	7263							
051230947500	7565							
051230957800	6961							
051230958600	7666							
051230977800	7337							
051230984200	7654							
051230986500	7260							
051230994500	7325							
051230996000	7336							
051230996200	7576							
051230996300	7542							
051231005600	7613							
051231005700	7601							
051231007000	7605							
051231007500	7511							
051231007600	7499							
051231010900	7524							
051231011700	7501							
051231013600	7036							
051231017600	7357							
051231019400	7244							
051231025100	7160							
051231028200	7568							
051231033300	7375							
051231034800	7199							
051231035600	7638							
051231035800	7944							
051231039500	7942							
051231042100	7313							
051231043500	7272							
051231043800	7289							
051231043900	7277							
051231044300	7265							
051231045500	7383							
051231046100	7490							
051231048200	7072							
051231051900	7121							
051231053500	7267							
051231059300	7140							
051231059800	7391							
051231064400	7492							
051231069200	7396							
051231076300	7348							
051231081000	7590							
051231081500	7512							

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
051231084100	7299							
051231084500	7333							
051231084700	7610							
051231087100	7183							
051231087600	7695							
051231089000	7005							
051231091100	7507							
051231092000	7520							
051231092400	7431							
051231094200	7147							
051231095400	7491							
051231096200	7491							
051231100500	7672							
051231102900	7432							
051231103900	7607							
051231104400	7340							
051231104500	7141							
051231108100	7195							
051231113700	7539							
051231113800	7531							
051231114000	7535							
051231117700	7449							
051231122300	7476							
051231123000	7166							
051231126300	7252							
051231126600	7521							
051231129000	7637							
051231129200	7557							
051231129300	7531							
051231129400	7436							
051231134200	7504							
051231138500	7343							
051231142300	7311							
051231146900	7846							
051231149600	7362							
051231151800	7432							
051231152100	7605							
051231152500	7484							
051231154700	7342							
051231155100	7640							
051231155500	7344							
051231155900	7608							
051231157300	7389							
051231158000	7603							
051231160100	7614							
051231162400	7320							
051231164300	7532							
051231164400	7507							
051231165300	7344							
051231173000	7688							

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
051231174700	7183							
051231175000	7311							
051231181200	7579							
051231185200	7231							
051231193200	7104							
051231193300	7271							
051231193400	7233							
051231193500	7266							
051231193600	7250							
051231194300	7321							
051231194800	7320							
051231200100	7180							
051231205900	7381							
051231206100	7412							
051231206200	7265							
051231206300	7317							
051231206400	7123							
051231206500	7432							
051231210800	8090							
051231211900	7134							
051231212000	7188							
051231212400	7244							
051231220500	7386							
051231223500	7226							
051231224800	7126							
051231226100	7303							
051231226500	7162							
051231230700	7189							
051231231800	7207							
051231231900	7416							
051231236300	7163							
051231237500	7180							
051231243500	7419							
051231247800	7129							
051231248600	7157							
051231255500	7492							
051231262200	7447							
051231266400	7203							
051231270200	7266							
051231271800	7592							
051231272000	7265							
051231307300	7485							
051231307600	7631							
051231308800	7395							
051231309100	7379							
051231365900	7276							
051231366100	7261							
051231366200	7288							
051231366300	7607							
051231371600	7518							

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
051231374900	7293							
051231410200	7560							
051231424700	7638							
051231443700	7540							
051231444100	7380							
051231445300	7359							
051231447400	7233							
051231447500	7670							
051231454700	7477							
051231454900	7574							
051231461100	7594							
051231461900	7522							
051231463400	7511							
051231464000	7528							
051231464400	7147							
051231472400	7497							
051231497000	7456							
051231497700	7408							
051231499800	7489							
051231510400	7508							
051231528200	7602							
051231531500	7494							
051231531600	7722							
051231533100	7534							
051231537300	7487							
051231547400	7499							
051231550700	7376							
051231562100	7527							
051231563700	7300							
051231563900	7294							
051231564000	7294							
051231575700	7499							
051231576900	7393							
051231582100	7570							
051231593700	7282							
051231594700	7578							
051231609400	7333							
051231612300	7262							
051231623500	7643							
051231626300	7321							
051231638000	7420							
051231638800	7513							
051231639200	7368							
051231640900	7225							
051231644900	7289							
051231645000	7395							
051231650300	7948							
051231650500	7449							
051231657200	7300							
051231657400	7306							

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
051231657500	7223							
051231658200	7405							
051231658300	7407							
051231662000	7684							
051231664300	7684							
051231664500	7521							
051231664700	7578							
051231667500	7382							
051231676900	7292							
051231679800	7404							
051231682800	7546							
051231690400	7518							
051231690700	7529							
051231691300	7248							
051231691700	7579							
051231703900	7354							
051231707000	7364							
051231713600	7397							
051231719800	7354							
051231730400	7365							
051231730600	7387							
051231730800	7366							
051231733000	7386							
051231735000	7260							
051231760600	7226							
051231765400	7543							
051231767400	6920							
051231795400	7381							
051231817700	7411							
051231913100	7953							
051231917500	8061							
051231934800	7178							
051231954200	7613							
051231954300	7530							
051231954400	7516							
051231955600	7606							
051231955700	7249							
051231955900	7490							
051231956800	7365							
051231958700	7595							
051231959000	7590							
051231959200	7489							
051231959300	7548							
051231959400	7496							
051231959500	7612							
051231959800	7538							
051231960500	7557							
051231961100	7464							
051231961300	7452							
051231962100	7784							

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
051231962400	7554							
051231963000	6400							
051231963900	7535							
051231966900	7678							
051231967000	7643							
051231967400	7450							
051231967600	7457							
051231968100	7662							
051231970700	7406							
051231970800	7480							
051231971200	7575							
051231971300	7488							
051231971700	7385							
051231972900	7510							
051231973000	7522							
051231973300	7500							
051231974800	7494							
051231974900	7605							
051231975100	7477							
051231975200	7500							
051231975400	7481							
051231975700	7575							
051231975900	7633							
051231976300	7555							
051231976600	7491							
051231976900	7519							
051231977000	7632							
051231977300	7654							
051231977400	7689							
051231978000	7698							
051231978100	7694							
051231978200	7681							
051231978700	7514							
051231980000	7524							
051231984100	7726							
051231985400	7520							
051231988000	7730							
051231988600	7495							
051231989900	7526							
051231990200	7486							
051231991900	7576							
051231993000	7585							
051231993600	7511							
051231994300	7510							
051231995700	7609							
051231996000	7728							
051231997000	7627							
051231997600	7692							
051231998600	7548							
051232000300	7631							

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
051232001300	7388							
051232002600	7690							
051232004800	7624							
051232005000	7519							
051232005200	7628							
051232007900	7492							
051232010100	7550							
051232015100	7521							
051232015200	7537							
051232018800	7617							
051232018900	7532							
051232021100	7516							
051232030700	7584							
051232031000	7536							
051232031400	7488							
051232033600	7711							
051232034900	7638							
051232045400	7400							
051232049800	7523							
051232050700	7475							
051232050900	7552							
051232051000	7707							
051232052600	7611							
051232052700	7585							
051232052800	7552							
051232053400	7871							
051232055700	7656							
051232056000	7530							
051232057000	7587							
051232057100	6629							
051232059100	7365							
051232060000	7595							
051232060100	7531							
051232061500	7712							
051232062300	7676							
051232062600	7541							
051232063700	7590							
051232065200	7606							
051232072500	7613							
051232074700	7564							
051232077000	7831							
051232077500	7978							
051232082100	6825							
051232082300	7650							
051232082800	7786							
051232082900	7926							
051232083300	6613							
051232087100	7763							
051232091400	7618							
051232091500	7667							

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
051232091700	7730							
051232092000	7551							
051232094100	7711							
051232094200	7659							
051232094400	7817							
051232094500	7695							
051232094600	7896							
051232095000	7657							
051232095500	7635							
051232095600	7592							
051232107300	6846							
051232114000	7251							
051232116900	6726							
051232125900	7277							
051232144800	7478							
051232196700	6843							
051232196800	6697							
051232205000	6419							
051232205200	6397							
051232205300	6407							
051232206400	6670							
051232210200	7354							
051232229700	7223							
051232230900	7026							
051232243000	6408							
051232244900	6673							
051232250000	6625							
051232269600	6644							
051232269700	6646							
051232271600	6613							
051232276800	6375							
051232278900	6751							
051232293500	7193							
051232302900	7257							
051232307200	6433							
051232308200	6846							
051232309800	6669							
051232310100	6734							
051232310300	6689							
051232310400	6747							
051232315000	6404							
051232316600	6803							
051232317000	6747							
051232317100	6746							
051232317200	6746							
051232318100	6753							
051232336500	7203							
051232336900	6874							
051232337000	6880							
051232337100	6863							

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
051232337700	6677							
051232337900	6669							
051232338000	6689							
051232338300	6678							
051232338400	6698							
051232341400	6843							
051232345500	6794							
051232350000	7157							
051232356600	6370							
051232356700	6369							
051232368600	6758							
051232377700	6409							
051232389400	6425							
051232389500	6396							
051232391000	6394							
051232391100	6446							
051232391200	6405							
051232391300	6354							
051232391400	6322							
051232391700	6375							
051232391800	6318							
051232392900	6445							
051232396500	6600							
051232396600	6604							
051232412600	6846							
051232413000	6882							
051232422400	6796							
051232422700	6793							
051232427800	6814							
051232430500	6518							
051232432600	6464							
051232432700	6333							
051232432900	6363							
051232433000	6402							
051232434700	7196							
051232435800	6755							
051232454300	7282							
051232464100	6897							
051232464200	6921							
051232503100	6863							
051232503500	6845							
051232504300	6945							
051232505100	6833							
051232510900	6775							
051232511500	6747							
051232513100	6769							
051232513200	6779							
051232514400	6962							
051232515800	6950							
051232518200	7277							

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
051232530200	6813							
051232535100	6773							
051232543300	6914							
051232543400	6940							
051232546300	6822							
051232558900	6910							
051232560800	6694							
051232560900	6681							
051232563500	7190							
051232563600	7202							
051232565800	6808							
051232565900	6726							
051232566100	6711							
051232566200	6747							
051232573900	6806							
051232574100	6837							
051232574900	6964							
051232575300	6812							
051232576400	6694							
051232576500	6699							
051232576600	6729							
051232582700	6644							
051232582900	6640							
051232597200	6628							
051232602800	6772							
051232606600	6682							
051232607400	6726							
051232610300	6673							
051232618500	6747							
051232618600	6764							
051232625400	6806							
051232628700	6832							
051232633100	7207							
051232643900	7205							
051232644800	6789							
051232650200	6794							
051232652100	6738							
051232652600	6716							
051232656600	6723							
051232670200	6843							
051232684300	7287							
051232686300	6739							
051232690500	6683							
051232690600	6658							
051232696600	6880							
051232704700	6818							
051232731000	7206							
051232734800	6779							
051232734900	6775							
051232735300	6803							

UWI / API	HARTLAND	BCLS_1	FAIRPORT	LBHS	B_CDL_SS	CDL_SS	FH_MKR_1	NBR_MRK_2
051232735400	6787							
051232735500	6829							
051232940000	7269							
051232947900	7217							
051232967100	6702							
051232967200	6696							
051232967300	6699							
051232999000	6382							
051233051300	6621							
051233099200	6591							
051250500600	2484							
051250500900	2618							
051250501900	2447							
051250522900	2624							
051250523000	2645							
051250659400	2345							
051250666900	2455							2123
051250784300	2497							2161
150712044600		934	783	760	686	675	641	594

APPENDIX D: SUPPLEMENTAL FILES

SUPPLEMENTAL FILE	DESCRIPTION
PLATE 1 – Core Description – USGS Portland 1 (PC).pdf	Graphical description of the USGS Portland 1 core in Pueblo County, Colorado.
PLATE 2 – Core Description – Amoco Rebecca Bounds 1 (RBC).pdf	Graphical description of the Amoco Rebecca Bounds 1 core in Greeley County, Kansas.
PLATE 3 – Outcrop Description – Deadmans Curve (DCO).pdf	Graphical description of the Deadmans Curve outcrop in El Paso County, Colorado.
PLATE 4 – Outcrop Description – Lake Pueblo State Park (LPO).pdf	Graphical description of the Lake Pueblo State Park outcrop in Pueblo County, Colorado.
PLATE 5 – Outcrop Description – Peck Creek (PCO).pdf	Graphical description of the Peck Creek outcrop in Pueblo County, Colorado.
PLATE 6 – Outcrop Description – Pueblo Nature Center (PNCO).pdf	Graphical description of the Pueblo Nature Center Outcrop in Pueblo County, Colorado.
PLATE 7 – Outcrop Description – Verde Road (VRO).pdf	Graphical description of the Verde Road outcrop in Pueblo County, Colorado.
PLATE 8 – Outcrop Description – Walsenburg (WO).pdf	Graphical description of the Walsenburg outcrop in Huerfano County, Colorado.
PLATE 9 – Outcrop and Core Correlations.pdf	Graphical description and correlation plot between the 2 core and 6 outcrop locations used in this research.
PLATE 10 – Legend.pdf	Legend explaining the symbols and color patterns used in the core and outcrop descriptions from PLATES 1-8.

Plates 1 and 2 are detailed, individual core descriptions of the two cores used in this research. Plates 3 through 8 are detailed, individual outcrop descriptions of the six outcrops used in this research. Plate 9 is a regional correlation between the individual locations described in Plates 1 through 8. Plate 10 is a legend that explains the symbols and colors used to create the individual core and outcrop descriptions in Plates 1 through 8.