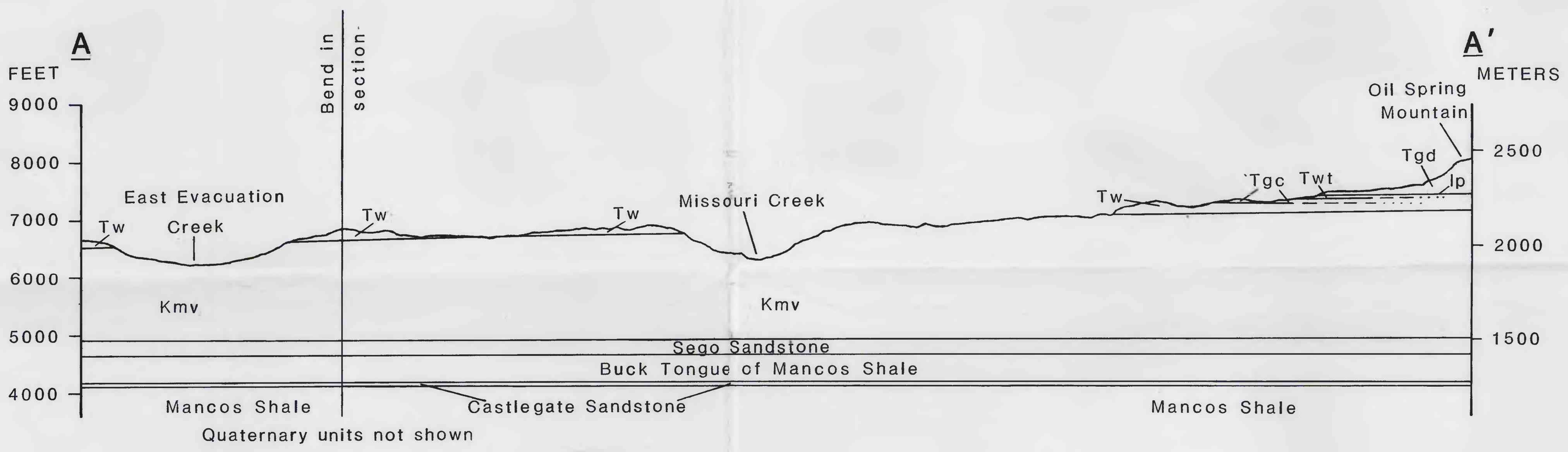
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

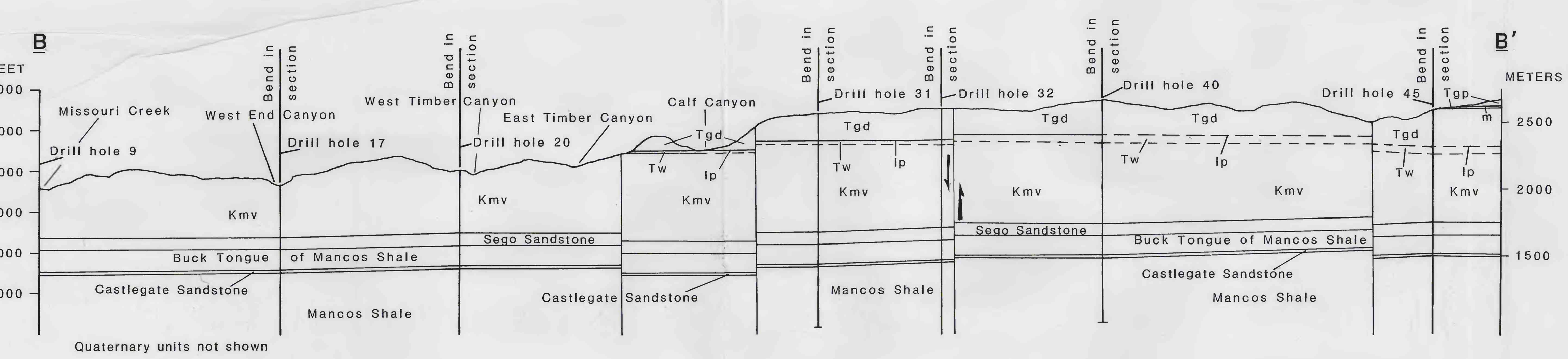
MISCELLANEOUS FIELD STUDIES
MAP MF-2220

Base from U.S. Geological Survey, 1964

Geology mapped in 1986, 1987, and 1989

Manuscript approved for publication December 30, 1992





CORRELATION OF MAP UNITS

Unit	Epoch	Period
Qal	Holocene	QUATERNARY
Qc	Holocene	QUATERNARY
Qs	Pleistocene	QUATERNARY
Unconformity		
Tgp, m	Eocene	TERTIARY
Tgd	Eocene	TERTIARY
Ip	Eocene	TERTIARY
Twt	Eocene	TERTIARY
Tgc	Paleocene	TERTIARY
Tw	Paleocene	TERTIARY
Unconformity		
Kmv	Upper Cretaceous	CRETACEOUS

Contact—Dashed where approximately located

Drill hole

Fault—Dotted where covered, dashed where approximately located, queried where inferred

Paleocurrent rose diagram—Arrow is average trend, vertical line is north indicator, N is number of readings taken on sandstone bed

N = 22

Structure contour—Approximately located, queried where inferred. Structure contours are on top of Dakota Sandstone. Contours are omitted in north-western and south-eastern part of quadrangle due to lack of subsurface information. Structure map is part of larger computer-generated map of eastern part of the Uinta Basin including the Douglas Creek arch

DESCRIPTION OF MAP UNITS

[1 ft = 0.305 m; All Quaternary units are approximately located]

Qal **Alluvial deposits (Holocene)**—Unconsolidated clay, silt, sand, and gravel of slope wash, fan, alluvial and colluvial deposits

Qc **Colluvial deposits (Holocene)**—Unconsolidated alluvial and eolian sand, silt, and clay from weathering of exposed bedrock. Deposits often form at base of mesas, in depressions on mesa tops, and with alluvium

Qs **Slump deposits (Holocene and Pleistocene)**—Talus, slope wash, and debris from slumping, landslides, and other mechanisms of mass wasting. Deposits commonly have conspicuous hummocky topography. Slumped areas often contain pools of water and springs in southeastern part of the quadrangle. Slumps commonly occur on steep canyon walls along Wasatch Formation-Green River Formation boundary, Mesaverde Group-Wasatch Formation boundary, and in areas of faulting. Map units may be displaced as slump blocks

Green River Formation (Eocene)

Tgp **Parachute Creek Member**—Lacustrine unit composed of gray-green dolomitic marlstone, yellow-brown siltstone, gray and dark brown to black oil-shale, green-gray silty claystone, and some light brown to tan altered tuff beds. Marlstone and siltstone beds weather to light brown or light gray slopes and ledges where exposed. Oil-shale beds weather to silver-gray ledges. Tuffs weather to tan, thin ledgy beds one inch or less in thickness. About 240 ft of Parachute Creek Member is exposed in southeastern corner of quadrangle

—m— **Mahogany oil-shale bed**—Dark brown to black oil-shale, weathering to dark gray and dark silver-gray ledges. Mahogany oil-shale bed is richest oil-shale bed in Mahogany ledge (Mahogany zone in subsurface). Bed is about three feet thick where exposed on ridge top in southeastern corner of quadrangle

Tgd **Douglas Creek Member**—Predominantly marginal lacustrine and fluvial unit composed of brown sandstone and siltstone, light gray and brown oolitic, ostracodal, and algal limestone, brown and gray marlstone, green and gray-green claystone, and some oil-shale. Sandstone is very fine to fine grained with some units laterally persistent and more than 40 ft thick. Sandstone and siltstone beds weather to ledges and cliffs showing many channel-form features and local displays of lateral-accretion bedding. Limestone units weather to white or orange cliffs or ledges. Orange weathering is most characteristic of ostracodal units. Algal units are abundant in middle part of member, are laterally persistent, and vary from one to several feet in thickness. Marlstone beds weather to gray or light brown slopes. Claystone beds weather to slopes of clay and flaky clay shale, locally pinching out between sandstone beds. Oil shale weathers to silver-gray or black thin ledge-like beds in lower part of member. About 900 ft of Douglas Creek Member is exposed in quadrangle

—lp— **Long Point Bed**—Light brown to tan ostracodal limestone, and limy ostracodal sandstone. Unit commonly contains fossil gastropods and bivalves. Long Point Bed is basal bed of the Douglas Creek Member of the Green River Formation in much of the eastern Uinta Basin. Bed is described by Johnson and May (1978) and Johnson (1984 and 1985) in the Piceance Creek Basin. Bed weathers to orange-brown or red-brown ledges and benches. Bed ranges from six to 18 inches in thickness in quadrangle

Tgc **Cow Ridge Member**—Predominantly marginal lacustrine and fluvial unit composed of gray-green, gray, brown, and green claystone and mudstone interbedded with brown, yellow-brown and tan sandstone, siltstone, and limestone. Mudstones and claystones weather to very steep slopes. Sandstone is very fine to fine grained and often ostracodal and limy. Sandstone and siltstone beds weather to cliffs and ledges. Limestone is mostly ostracodal, locally containing fossil gastropods and bivalves. Upper part of unit forms cliff where exposed; lower part of unit is usually very steep slope. About 100 ft of unit is exposed in northwestern part of quadrangle. Unit thins to the southeast where it is not identified or not present. Locally mapped as single line where unit is too thin to show upper and lower boundaries, or overlain by Long Point Bed of Douglas Creek Member where Wasatch tongue is missing

Wasatch Formation (Eocene and Paleocene?)

Twt **Unnamed tongue of Wasatch Formation (Eocene)**—Predominantly fluvial unit composed of maroon, gray, and gray-green flaky clay and clay shale, and mudstone, and maroon, gray, and brown sandstone and siltstone. Clay and mudstone beds weather to steep slopes, locally beds are lenticular. Sandstones are channel-form and very fine to fine-grained. Sandstone and siltstone beds weather to cliffs and ledges, locally exceeding 10 ft in thickness. Tongue is 100 ft thick in western part of quadrangle, wedging out and absent in eastern part of quadrangle

Tw **Main body (Eocene and Paleocene?)**—Predominantly fluvial unit composed of maroon, gray, gray-green, and dark gray flaky clay shale and clay; brown, red-brown, light gray to white, and maroon sandstone and siltstone; and brown and red-brown conglomeratic sandstone. Clay shale and clay beds weather to steep slopes with a popcorn like appearance, locally beds are lenticular. Sandstone beds are channel-form and very fine to fine-grained. Sandstone and siltstone beds weather to cliffs and ledges, some exceeding ten feet in thickness. Main body is mostly Eocene, little to no Paleocene is present in quadrangle. Conglomeratic sandstone at base of Wasatch Formation is medium to coarse-grained with chert and quartzite pebbles in lenticular channels or along bedding horizons. Conglomeratic sandstone bed is persistent and observable throughout most of quadrangle. Locally unit has different characteristics, is unidentified, or missing. Base of conglomeratic sandstone bed is mapped as the Cretaceous-Tertiary contact. Wasatch Formation ranges from 340 ft in thickness in western part of quadrangle to less than 50 ft in eastern part of quadrangle

Kmv **Mesaverde Group, undifferentiated (Upper Cretaceous)**—Predominantly fluvial unit composed of gray and white sandstone, gray silty and carbonaceous shale, and a few thin coal beds. Sandstone beds are fine grained, mostly massive with local cross or contorted bedding. Sandstone beds range from three to about 60 ft in thickness and are separated locally by shale beds which may contain thin coal seams. Coal seams rarely exceeded one half inch in thickness. Locally sandstone is yellow-white to white becoming more gray to gray-brown in lower part of section. Color of sandstone in area of Wasatch Formation contact is thought to be kaolinite associated with overlying unconformity (Johnson and May, 1978, 1980). Top of topmost white or leached sandstone is youngest Cretaceous sandstone bed and is mapped as the Cretaceous-Tertiary contact. About 700 ft of Mesaverde Group is exposed in quadrangle

Sego Sandstone (Upper Cretaceous)—Shown on cross section only. Mostly fine to medium grained sandstone with some silty shale

Mancos Shale (Upper Cretaceous)—Shown on cross section only. Mostly gray, poorly laminated silty shale, includes Buck Tongue of Mancos Shale

Castlegate Sandstone (Upper Cretaceous)—Shown on cross section only

THE CRETACEOUS-TERTIARY CONTACT AND PROBLEMS WITH MAPPING

A widespread unconformity separates the Upper Cretaceous Mesaverde Group and the Paleocene to Eocene Wasatch Formation. Throughout most of the East Evacuation Creek quadrangle the unconformity is recognized by a brown medium to coarse-grained sandstone with lenticular conglomerate zones overlying a white cliff-forming sandstone. The top of this white cliff-forming sandstone is mapped as the highest Cretaceous sandstone and the base of the conglomerate bearing sandstone is mapped as the base of the Tertiary. The best exposures of the Cretaceous-Tertiary contact are in the middle of the quadrangle.

Local relief on the unconformable surface varies from a few feet to several tens of feet across distances ranging from a quarter of a mile to one mile and is best exposed along West Evacuation Creek. The relief probably indicates paleotopography that resulted from weathering and erosion during the time interval represented by the unconformity.

Mapping of the Cretaceous-Tertiary boundary in the East Evacuation Creek quadrangle is complicated by several factors; (1) the basal Tertiary Wasatch conglomeratic sandstone thins and disappears in the northwestern part of the quadrangle and adjacent areas; (2) the basal Tertiary unit is variable in lithology; (3) the lower part of the wasatch Formation locally contains white sandstone beds similar to those found at top of the Mesaverde group;; (4) the area is highly and complexly faulted; (5) locally colluvium and slump debris cover much of the contact; and (6) forest and other vegetation cover much of the area especially in the southern part of the quadrangle.

In the northern part of the East Evacuation Creek quadrangle and adjacent quadrangles, the basal Wasatch conglomeratic sandstone is missing, possibly because of onlap and loss of lower Wasatch beds on the Douglas Creek Arch. In addition, the Wasatch Formation is missing the distinctive red beds and channel-form sandstone beds that help identify it in this and other quadrangles. In these areas, the Wasatch Formation is composed mostly of gray and gray-green flaky clay, clay shale, and mudstone. Where present, underlying Cretaceous sandstone beds are white, massive, and form cliffs. On the south and south-eastern flanks of Oil Spring Mountain, the Wasatch Formation, where exposed, is less than 50 ft thick and composed of brown, gray, and gray-green flaky clay, clay shale, and mudstone. These beds overlie a slope-forming, badly weathered gray to white clayey siltstone containing pebbles. The Cretaceous-Tertiary contact is at the base of the white pebbly siltstone, where present, or at the base of the clay shale-mudstone unit when the pebble zone is missing.

In the East Evacuation Creek quadrangle and most adjacent areas, the basal Tertiary conglomeratic sandstone bed contains red, brown, gray, and black chert and quartzite pebbles, and two types of silicified wood. One type of silicified wood is brown and coarsely crystalline, the other type is red-brown and amorphous to very finely crystalline. The latter occurs more often in the northern part of the quadrangle and areas to the north. Locally, the silicified wood appears to represent the remnants of the pebble-conglomerate sandstone zone.

Field observations suggest that not all white sandstone beds along the Cretaceous-Tertiary boundary are Cretaceous. Local exposures of the basal Tertiary conglomeratic sandstone bed in the vicinity of Oil Spring Mountain are white and extensively weathered. This effect may be caused by (1) weathering on an erosion surface within the Wasatch Formation as suggested by Franczyk and Pitman (1987); (2) precipitation of minerals and salts from local springs and seeps in the overlying Tertiary rock units and underlying Cretaceous rock units; and (3) in situ diagenesis of minerals in the Tertiary rock units from mineralized water or organic agents. In this quadrangle, water from springs and seeps in the Wasatch Formation and the Mesaverde Group along the Cretaceous-Tertiary boundary, and at fault boundaries is mineral laden and not potable. Locally, salts precipitated from the evaporation of these springs and seeps have coated the area with a white crust.

In areas where the basal Tertiary conglomeratic sandstone is missing, paleocurrent directions were used to distinguish between Tertiary and Cretaceous sandstone beds. Control measurements of paleocurrent directions were taken from Cretaceous and Tertiary sandstone beds in the East Evacuation Creek quadrangle and adjacent quadrangles where the Cretaceous-Tertiary contact are well defined. Directions in the area trend southward in Tertiary sandstone beds and northward in Cretaceous sandstone beds.

The East Evacuation Creek quadrangle contains many northeast-trending faults. They are difficult to map in some areas because of the lack of exposed marker beds and the lenticular shape of Mesaverde Group sandstone beds. Although there has been extensive drilling in the quadrangle, interpretation of subsurface structure at the 1:24,000 scale is difficult because of the complex faulting in the area, the uneven distribution of the drill holes, the loss of Tertiary and Cretaceous stratigraphic units due to onlap of the Wasatch Formation onto the Douglas Creek Arch, and erosion of units during the time interval represented by the Cretaceous-Tertiary unconformity.

The Dark Canyon sequence of Franczyk and Pitman (1987) is interpreted as a Tertiary conglomeratic-sandstone bed that crops out southwest of this quadrangle on the south side of the Book Cliffs near the Cretaceous-Tertiary boundary. This unit is several tens of feet thick and is composed of a fine- to medium-grained sandstone containing pebble-conglomerate lenses. Pebbles in the conglomerate are composed of red, brown, gray, and black chert and quartzite. Although stratigraphically and lithologically similar to the basal Tertiary conglomeratic-sandstone bed in the East Evacuation Creek quadrangle, it is not known if the two units are equivalent. Basal Tertiary sandstone-bed paleocurrent directions in the East Evacuation Creek quadrangle and adjacent areas trend southward, indicating a possible topographic high located to the north. This trend is opposite that of the Dark Canyon conglomeratic-sandstone bed, which has paleocurrent directions that trend northward (Franczyk and Pitman, 1987).

ECONOMIC GEOLOGY

Oil and Gas

Most of the oil and gas produced in the East Evacuation Creek quadrangle is from the Mancos Shale. A smaller amount comes from the Dakota Sandstone, Castlegate Sandstone, Niobrara Formation equivalent, and Morrison Formation.

REFERENCES

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Table 1. Drill holes in East Evacuation Creek Quadrangle
[Drill hole numbers are same as those used on map]

Drill hole number	Location: Section	Location: Township	Location: Range	Operator/name	Total depth ft
1	09	4S	103W	Coseka Resources USA Ltd. Federal 16-0-9-4-103	3700
2	16	4S	103W	Coseka Resources USA Ltd. Federal 1-16-4-103, C-12277	6552
3	15	4S	103W	Coseka Resources USA Ltd. Federal 2-15-4-103	6303
4	07	4S	102W	Cities Service USA #1	7990
5	20	4S	103W	Coseka Resources USA Ltd. Federal 14-20-4-103	6679
6	20	4S	103W	Coseka Resources USA Ltd. Columbine Springs 2-20-4-103	3765
7	22	4S	103W	Coseka Resources USA Ltd. Arco Federal 4-22-4-103	*
8	22	4S	103W	Coseka Resources USA Ltd. Federal 9-22-4-103	5932
9	23	4S	103W	Coseka Resources USA Ltd. Federal 17-0-23	3739
10	24	4S	103W	Coseka Resources USA Ltd. Division Of Wildlife	6611
**	24	4S	103W	Coseka Resources USA Ltd. Baxter Pass #2	6502
11	30	4S	103W	Coseka Resources USA Ltd. Columbine Spring 15-30-4-103	3932
12	29	4S	103W	Coseka Resources USA Ltd. Gentry 15-29-4-103	3660
13	29	4S	103W	Coseka Resources USA Ltd. Columbine Spring 7X-29-4-103	1624
14	29	4S	103W	Coseka Resources USA Ltd. Gentry 7-29-4-103	*
**	29	4S	103W	Coseka Resources USA Ltd. Gentry 2-29-4-103	6564
15	28	4S	103W	Coseka Resources USA Ltd. Arco Federal 3-28-4-103	6723
16	28	4S	103W	Arco Oil & Gas Baxter Pass Unit	7016
17	27	4S	103W	Arco Oil & Gas Co. Government Sloan #1 well	6812
18				S.N. Baxter Pass Unit well #1	
19	27	4S	103W	Arco Oil & Gas Government State #2 well	7565
20	26	4S	103W	Arco Oil & Gas Co. Baxter Pass Unit 4-26-A	6989
21	25	4S	103W	Coseka Resources USA Ltd. NW Baxter Pass 14-25-4-103	*
22	19	4S	102W	Tenneco Oil Co. Government 9-19-4-102	*
23	31	4S	103W	Fina Oil and Chemical Co. Urado Unit #4	7023
**	31	4S	103W	Continental Oil Government #1	3850
**	31	4S	103W	Argo Oil Unit 3-31-A	7023
**	31	4S	103W	Coseka Resources USA Ltd. Gentry 8-31-4-103	3900
24	31	4S	103W	status unknown	
25	32	4S	103W	Coseka Resources USA Ltd Federal 12-32-4-103	*
26	32	4S	103W	Arco Oil Co. Baxter Pass Unit #5-32A	3632
27	32	4S	103W	Coseka Resources USA Ltd. Columbine Spring 8-32-4-103	6260
28	33	4S	103W	Coseka Resources USA Ltd. Arco Federal 4-33-4-103	*
29	33	4S	103W	Arco Oil & Gas Co. Federal 33-1	*
30	35	4S	103W	Coseka Resources USA Ltd. NW Baxter Pass 13-35-4-103	5575
31	30	4S	102W	Tenneco Oil Co. Evacuation Creek 30-12 Mancos B Field	5250
**	31	4S	102W	Provident Resources Government 4-31-4-102	5486
32	31	4S	102W	Tenneco Oil Co. Government 13-31-4-102	8120
33	06	5S	103W	Coseka Resources USA Ltd. Gentry 16-6	6828
34	06	5S	103W	Coseka Resources USA Ltd. Gentry 1-6-5-103	3795
35	04	5S	103W	Coseka Resources USA Ltd. Arco Federal 11-4-5-103	6175
36	04	5S	103W	Arco Oil Co. Federal #4-1	6212
37	02	5S	103W	Coseka Resources USA Ltd. Tiaga Mountain 2-T-2	7597
38	31	4S	102W	Tenneco Oil Co. Government 10-31	5526
39	31	4S	102W	Tenneco Oil Co. Government 2-31-4-102	*
**	31	4S	102W	Provident Resources (Tenneco Oil Co.) Federal C-56, 10-31	5510
40	31	4S	102W	Tenneco Oil Co. Evacuation Creek Unit Government 4-31-4-102	5486
41				status unknown	
**	08	5S	103W	Coseka Resources USA Ltd. Columbine Springs 7-8-5-103	6455
42	09	5S	103W	Coseka Resources USA Ltd. Federal 13-9-5-103	6938
43	09	5S	103W	Coseka Resources USA Ltd. Columbine Spring 15-9-5-103	6257
44	10	5S	103W	Coseka Resources USA Ltd. Evacuation Creek Federal 13-10-5-103	6800
**	13	5S	103W	Beartooth Oil & Gas Co. Federal 13-16	7943
45	18	5S	102W	Beartooth Oil & Gas Co. Federal 18-3	7939
46	17	4S	103W	Taiga Energy Taiga-Great Basin 1-17	6311

PRELIMINARY GEOLOGIC MAP OF THE EAST EVACUATION CREEK QUADRANGLE, GARFIELD AND RIO BLANCO COUNTIES, COLORADO

By

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1993

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