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DEPOSITIONAL ENVIRONMENTS AND CORRELATION OF THE MESAVERDE FORMATION, WIND RIVER BASIN, WYOMING

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INTRODUCTION

The Mesaverde Formation is one of the major sedimentary deposits in the Rocky Mountain region. In the past few years the Mesaverde section has generated considerable interest as a source of energy resources in the basins of Wyoming. The Upper Cretaceous Mesaverde Formation in the Wind River Basin is a marine, nonmarine, and transitional sequence of sandstones, siltstones, shales and coals. The sedimentation was characterized by pulses of regressions and transgressions resulting in intertonguing of marine and nonmarine deposits. Lenticular sandstones interstratified with shales and coals make correlations and interpretations of interrelationships of the intertonguing units difficult.

The Wind River Basin is a northwest-southeast trending, intermontane, structural basin in central Wyoming (Fig. 1). The basin is bounded on the south by the Granite Mountains, on the west by the Wind River Range, on the north by the Owl Creek and Big Horn Mountains, and on the east by the Casper Arch (Keefer and Van Lieu, 1966, p. B2). The area discussed in this paper lies predominantly in the south-central part of the Wind River Basin, extending somewhat into the western and parts of the northwestern segment of the basin.

The Mesaverde Formation is exposed on the flanks of the Casper Arch to the east. Limited discontinuous bands of Mesaverde rocks outcrop on the flanks of northwest trending anticlines along the southern margin of the Wind River Basin (Fig. 1).

NOTE: Cross Sections A-A', B-B', C-C', and D-D' in back pocket

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The purpose of this paper is to briefly describe and offer interpretation of the stratigraphic relationships of the Mesaverde Formation. The discussion includes stratigraphic and lithologic relationships and reconstruction of depositional environments as interpreted from the sedimentary structures, textures and compositions of rocks in selected wells (Table 1). An effort is made to present a regional correlation of the Mesaverde Formation and its members. Stratigraphic relationships are illustrated by electric log correlation cross-sections (Plates 1, 2, 3, and 4). The line of cross-sections are shown on Figure 2. The general lithologies, bed thicknesses and boundaries are well demonstrated from electric logs. Figure 3 is a typical electric log of Mesaverde Formation and its members in southeastern Wind River Basin.

STRATIGRAPHY

Detailed studies of the stratigraphy of the Wind River Basin region have been published by Gill, Merewether and Cobban (1970); Keefer and Troyer (1964); Weimer (1960); Yenne and Pipiringos (1954).

The Mesaverde Formation was first defined and described by W. H. Holmes (1877, p. 245-248), from exposures in Montezuma County in southwestern Colorado. In the Wind River Basin, the Mesaverde section differs considerably from its type locality. In the area of this study, the Mesaverde Formation includes all rocks between the base of the Lewis and Meeteetse and the top of the Cody (Fig. 3).

Lithology

The Mesaverde Formation represents an alternating and interfingering sequence of lenticular sandstone, shale, siltstone and coal of variable thicknesses. Regional correlation suggests that the sandstones are thicker and more prominent in the western part of the area, while shales generally thicken eastward.

In the subsurface, the sandstones are very light gray to white. The predominant grain size of the sandstones ranges from very fine- to medium-grained. Rare coarse-grained, poorly-sorted sandstones are present along the margins of the basin, indicative of a genetically related series of coarse clastics possibly reflecting a regressive-transgressive phase of sedimentation (Weimer, 1960, p. 8-10). Well cuttings contain occasional dark, heavy minerals and chert grains.

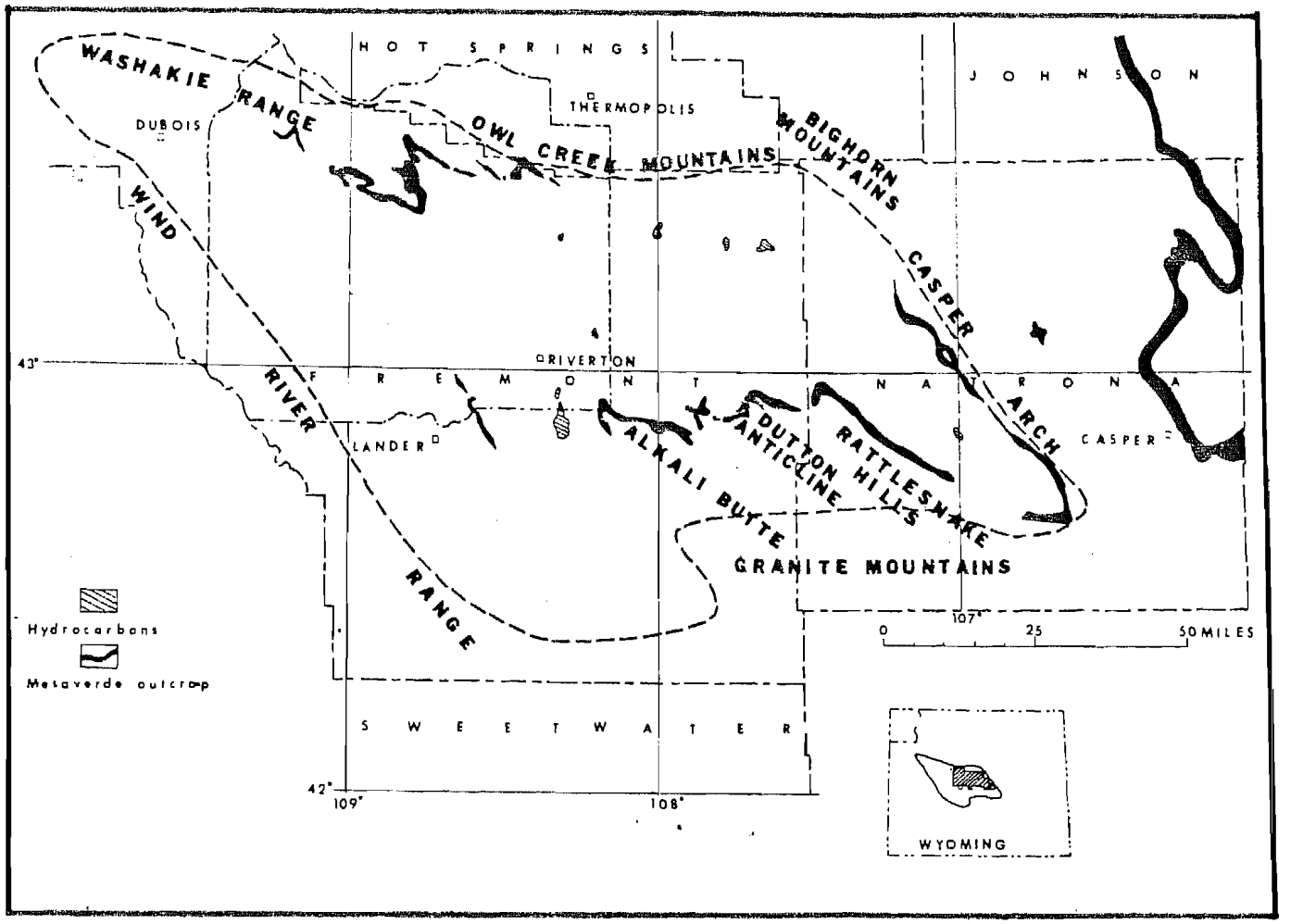

Figure 1. Index Map of Wind River Basin showing the distribution of Mesaverde exposures and areas of hydrocarbon occurrence within the Mesaverde Formation.

Detrital chert particles produce the characteristic salt and pepper appearance. Mesaverde sandstones include feldspars, mica (muscovite, biotite, and minor amounts of chlorite), carbonaceous fragments and occasional glauconite. Feldspar content ranges from 3 to 10 per cent as estimated from binocular microscopic examination of well cuttings. Common cements are calcite, minor dolomite, silica and detrital clay filling resulting from the alteration of feldspars. Pryor (1961, p. 34-46), presented a regional petrographic analysis and concluded that the Mesaverde sandstones range from protoquartzite to lithic graywacke.

Shales are predominantly dark to very dark gray, fissile and micro-micaceous. Intervals of carbonaceous shales interbedded with light gray, very fine-grained, sandy, calcareous siltstones, coals and local bentonite stringers are present. Coal beds are limited to small areas in the western part of the Wind River Basin. These beds are lenticular and are separated by thin beds of shale.

Nomenclature

The nomenclature of the Mesaverde Formation in the Wind River Basin presents one of the most difficult problems because of complex intertonguing of marine, transitional and nonmarine deposits. The sedimentation is characterized by facies changes and variations in thickness over relatively short distances. Several workers have proposed a various nomenclature for the Mesaverde section in the Wind River Basin and adjoining areas (Fig. 4). Because of the intertonguing deposits and complexities involved, the stratigraphic discussion is presented in two parts: Eastern Area and Western Area. In the discussion that follows, the dividing line between the two areas lies approximately between the western flank of the Rattlesnake Hills and the Dutton Anticline (Fig. 1). Figure 5, which is modified from Gill, Merewether and Cobban (1970), shows the nomenclature of the Mesaverde Formation in the Wind River Basin.

EASTERN AREA

The Mesaverde Formation in the eastern area is composed of several distinctively recognizable units intertongued with the Cody Shale. In the eastern and southeastern part of the Wind River Basin, the Mesaverde Formation can be subdivided into three members. These

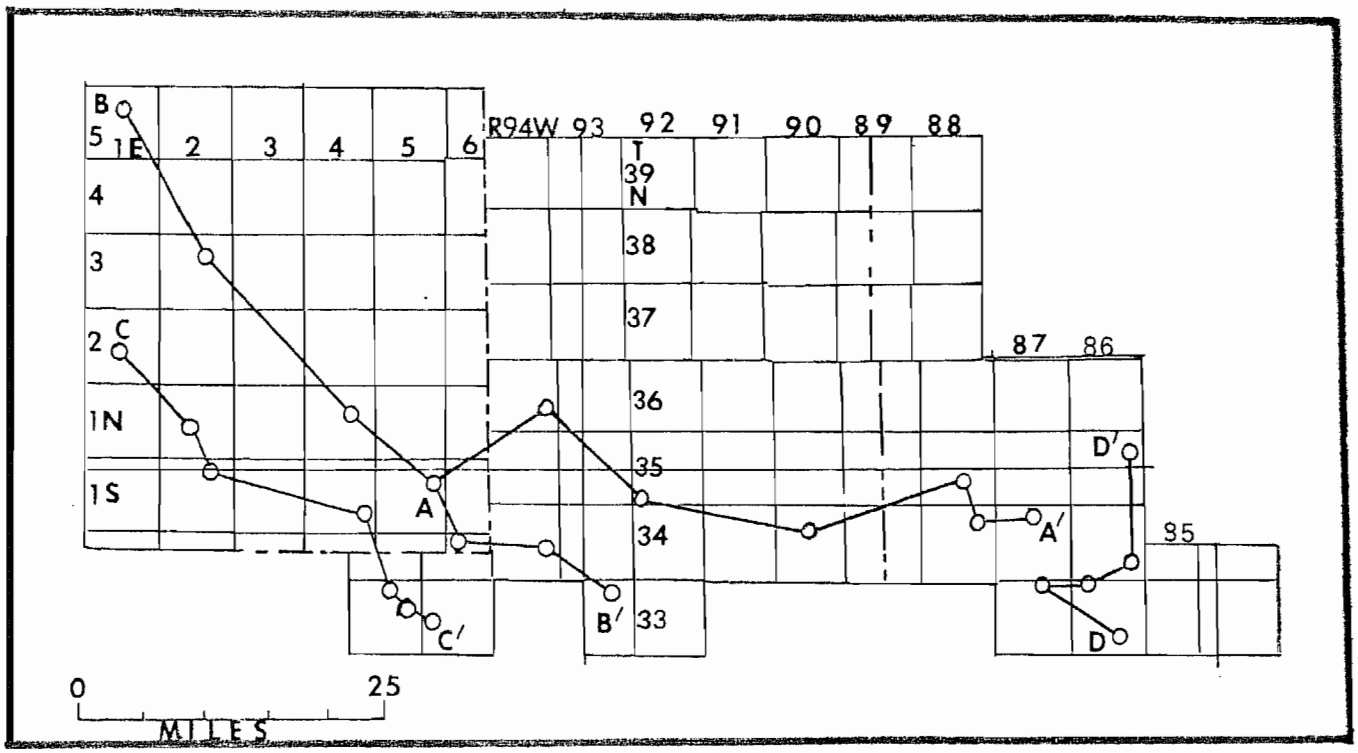

Figure 2. Index Map of cross sections.

TABLE 1 INDEX OF WELLS STUDIED

Operator and Well Name	Location Section	Township — Townships North	Range Ranges East
Phillips Petroleum No. 1 Johnstown Draw-C	SW NW	5	1N 1E
Exxon No. 1 Shoshone-Arapahoe Tribal 731	E/2 SW SE	20	1N 2E
Union Oil Company No. 1-C-14 Forbis	NW NE	14	1N 4E
Continental Oil Company No. 3 Tribal 36	SE NW SE	36	1N 5E
Farmers Union No. 1 Shoshone-Arapahoe	SW SE NE	28	1N 6E
Exxon No. 1 Shoshone-Arapahoe Tribal 90	SE NW	21	2N 1E
Shell Oil Company Tribal 33-X-10	NW SE	10	3N 2E
Tom Brown Inc. No. 24-43 Tribal Trigg	NE SE	24	4N 2E
Pan American Petroleum No. 1 Wirth	SE NW	28	4N 2E
Humble Oil and Refining No. 1 Shoshone-Arapahoe Tract 86	NW SE	19	4N 5E
Cities Service No. 1 Tribal	SW NE SW	9	5N 1E

Robert Emanuel No. 1 Tribal-A	C NE SW	7	5N	2E
Phillips Petroleum No. 1 Boysen	N/2 SE SW	27	5N	5E

Townships South — Ranges East

Exxon No. 1 Shoshone-Arapahoe Tribal 534	C NW SE	2	1S	2E
Atlantic Refining No. 1 Tribal	C SW SE	25	1S	4E
Stanolind Oil and Gas No. 1 Tribal C	SW SW SE	1	1S	5E
Continental Oil Company No. 12-2 Tribal	NW SE	12	1S	5E
Atlantic Refining No. 1 Mary O'Connor	C NE SE	1	2S	4E
Chicago Corporation No. 1 Arapahoe-Shoshone	C NE	5	2S	6E

Townships North — Ranges West

Union Oil Company No. 2 Kinniburgh	NW SW	13	33N	84W
Tidewater Association No. 1 Poison Spring		31	33N	84W
Continental Oil Company No. 1 McClanahan Draw Unit	SW SE	5	33N	86W
Ensearch Exploration No. 1 McClanahan Draw II Unit	NE SW	6	33N	86W
Diamond Shamrock No. 1-27 Kissler-Federal	NW NE NE	27	33N	86W
Davis Oil Company No. 1 Govt. - Clare	C NW NE	3	33N	87W
Pan American Petroleum No. 1 USA - Deuel	NW SW	35	33N 33N	92W
Occidental Petroleum No. 1 Govt. - Rongis	SW SW	3	33N	93W
Occidental Petroleum Bobcat Draw No. 1 Unit	NE SW	18	33N	95W
Stanolind Oil and Gas No. 1 Johnson	C SE SE	3	33N	96W
Stanolind Oil and Gas No. 32-G	NE SE SE	10	33N	96W
Chorney Oil Company Soap Creek Unit No. 26-1	C SE SE	26	34N	86W
Davis Oil Company No. 1 R. K. Federal	SE SE	9	34N	87W
Bay Petroleum Corporation No. 1 Unit		15	34N	87W
C. E. Brehm No. 1 Govt.	S/2 SW SW	4	34N	88W
Pubco Petroleum No. 11-11 Federal	NE SW	11	34N	88W
Apache Corporation No. 1 Smelting-State	NE NW	16	34N	90W

Travis Oil No. 7 State	SW NE	36	34N	91W
Amerada Petroleum Corporation No. 1 USA Grisby	NW SW	23	34N	94W
Union Oil Company Hells Half Acre Unit II-1-K-11	NE SW	11	35N	86W
Pan American Petroleum No. 1 USA Birdsong	NE SE	20	35N	87W
Diamond Shamrock No. 1-27 Conoco Coal Bank	NE NW	27	35N	88W
Shell Oil Company No. 1 Unit	NW SE	16	35N	90W
A. Edmiston No. 1 Govt.	C NW NW	26	35N	91W
Sun Oil Company No. 1 Wolf Federal	SE NW SE	31	35N	92W
Shell Oil Company No. 22-27 Unit	SE NW	27	35N	93W
Pan Americal Petroleum No. 1 USA - Lewis	NE SW	24	36N	94W
Mobil Oil No. F33-14-G Unit	NW SE	14	37N	94W
Monsanto No. 1-7 Line-MDU	SE NW	7	38N	89W
Monsanto No. 1-32 Federal - Dolezal - MDU	NW NW	32	39N	90W
Monsanto No. 1 Long Butte	SE SE	32	39N	91W
Exxon No. 1 Tough Creek Unit	SE SE	6	39N	93W

are, in ascending order: Fales member (Phayles of some authors), an unnamed middle member, and the Teapot sandstone member.

Barwin (1959, p. 141), applied the name Phayles Reef member to the basal regressive tongue of the Mesaverde Formation, and later modified the name to Phayles member (Barwin, 1961, p. 174). The Phayles member occupies a position between the top of the Cody Shale and the base of the Wallace Creek tongue of the Cody Shale (Fig. 6). The type section of the Phayles member is on the west flank of the Rattlesnake Hills in SW¼ Sec. 4, T33N, R78W. (Barwin, 1961, p. 174). Gill, Merewether and Cobban (1970, p. 11), reexamined the type area and adopted the spelling of "Phayles" as indicated on the Garfield Peak 7½ minute quadrangle map. The writer of this paper accepts the established and repeatedly published spelling "Fales."

The Fales member can be subdivided into three distinctive lithologic units: a basal sandstone unit, a middle carbonaceous shale, and an upper unit of interbedded sandstone, siltstone and shale. When typically developed, the units within the Fales member can be recognized on electric logs (Fig. 3). At the type locality the Fales member attains a maximum thickness of 250 feet (76.2 meters). The member thins eastward and interfingers with the Cody Shale. The Fales member is conformably overlain by the Wallace Creek tongue of the Cody Shale.

The unnamed middle member includes all rocks above the Wallace Creek tongue of Cody Shale and below the Teapot sandstone member. The unnamed middle member consists of a basal very fine- to medium-grained sandstone, overlain by a unit of sandstone, shale and carbonaceous shale. The unnamed middle member ranges in thickness from 300 feet (91.4 meters) to 600 feet (182.8 meters) and thins towards the west. The upper contact between the unnamed middle member and the Teapot sandstone appears to be slightly disconformable.

The Teapot sandstone member represents the uppermost unit of the Mesaverde Formation. The top of the Teapot sandstone is in conformable contact with the marine tongue of Lewis Shale. This conformity persists in the eastern part of the study area. Towards the eastern edge of the Rattlesnake Hills, tongues of Maine Lewis interfinger with nomarine tongues of the Meeteetse Formation. Consequently, the Teapot member is overlain by the Meeteetse Formation towards the west. In the subsurface, the Teapot sandstone member attains a maximum thickness of about 175 feet (53.3 meters).

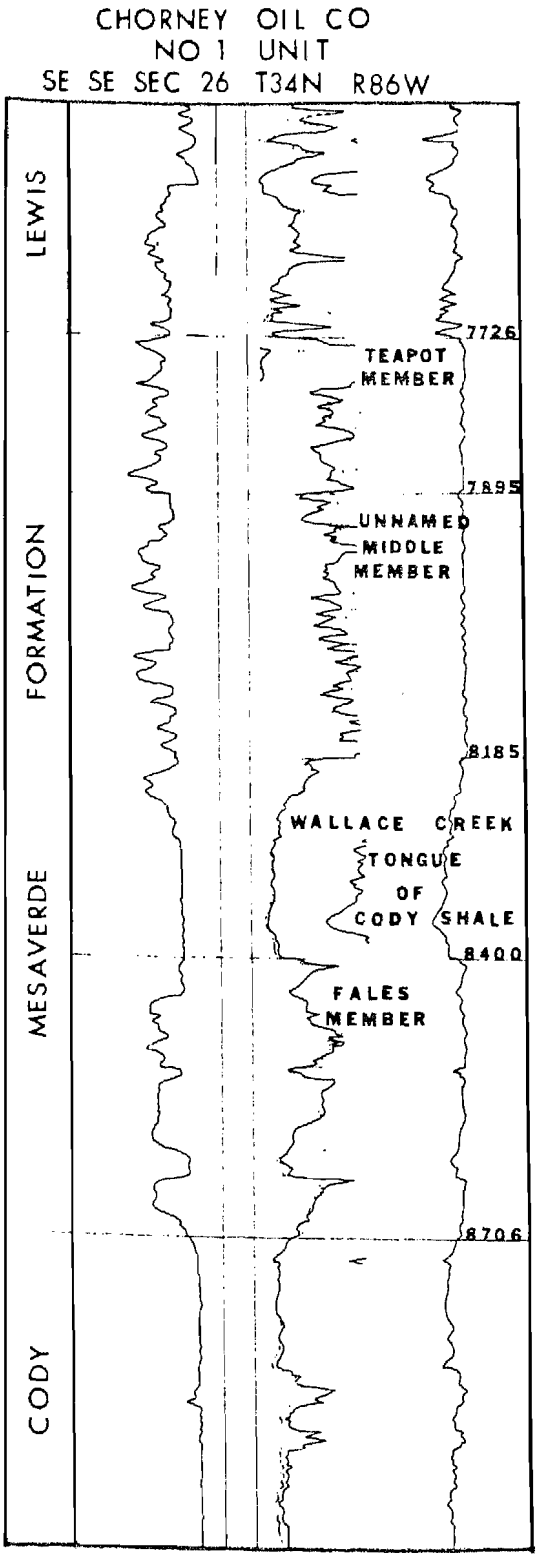

Figure 3. Typical electric log showing common subdivisions of Mesaverde Formation in southeastern Wind River Basin.

The writer recognizes a tongue of Parkman sandstone member extending westward from the Casper Arch. The Parkman sandstone member is encountered in the Union Oil, No. 1-K-11 Hells Half Acre Unit 2, NE SW Sec. 11 T35N R86W, at 13,165 feet (cross section D-D'). The Parkman member appears to be stratigraphically younger than the Fales member and is in conformable contact with the Wallace Creek tongue of the Cody Shale. The writer believes that the Parkman member occupies a position above the Wallace Creek tongue of Cody Shale and below the unnamed middle member (Fig. 6). This member thins considerably to the west and pinches out between the east flank of the Rattlesnake Hills and the West Poison Spider field.

WESTERN AREA

The western study area bears a simpler nomenclature. The Mesaverde Formation is represented by the lower Mesaverde section, including all deposits between the base of the unnamed tongue of Cody Shale and the lower sandy member of Cody Shale (Fig. 6). The lower Mesaverde is composed of a basal sandstone overlain by a unit of interbedded sandstone, siltstone, shale and coal. The basal sandstone unit of the lower Mesaverde intertongues with the sandy member of Cody Shale resulting in great variation in thickness. The thickness ranges from about 350 feet (106.7 meters) to 1,800 feet (548.6 meters), thinning and intertonguing with the Cody Shale to the east. At some localities, the upper part of the lower Mesaverde is missing due to either nondeposition or post-Mesaverde erosion (Keefer and Rich, 1957, p. 73). The lower Mesaverde contains several coal beds of commercial quality and quantity.

In the extreme northwest part of the area, a distinctive unit composed of very light gray sandstone is recognized. This sandstone unit is referred to as the White sandstone member of Mesaverde Formtion (Troyer and Keefer, 1955). The White sandstone member overlies the lower Mesaverde and is overlain by the Meeteetse Formation. The contact between the lower Mesaverde and the White sandstone member may be disconformable. In the subsurface, the White sandstone member is encountered in the Cities Service, No. 1 Tribal well (NE SW Sec. 9, T5N, R1E) at 310 feet. The White sandstone member ranges in thickness from 225 feet (68.5 meters) to 435 feet (132.6 meters) in the Shotgun Butte area (Keefer and Troyer, 1964, p. 22). Keefer and Rich (1957, p. 73), believe that the White sandstone member is identical to and occupies the same stratigraphic position as the Teapot sandstone member; but a direct correlation between these members is uncertain due to erosion of section in the central part of the region.

CORRELATION AND AGE

The stratigrahpic relationships suggested in this study are illustrated on regional cross sections (Plates 1, 2, 3, and 4). Correlations are based on four criteria: gross lithology,

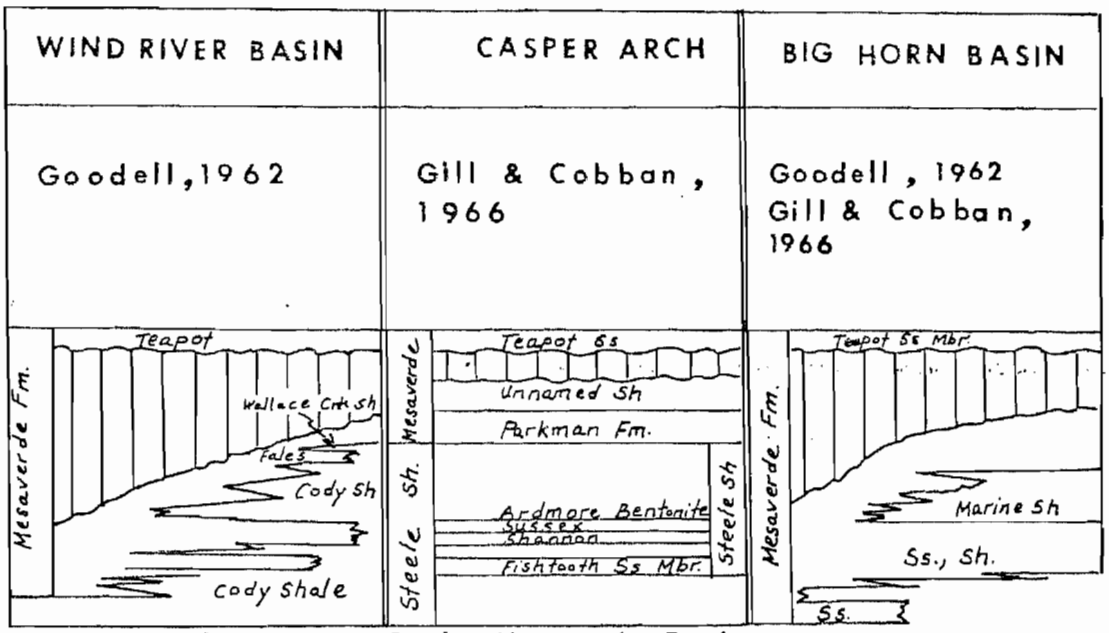

Figure 4. Stratigraphic Nomenclature Chart of Mesaverde Formation in Wind River Basin and ajoining areas.

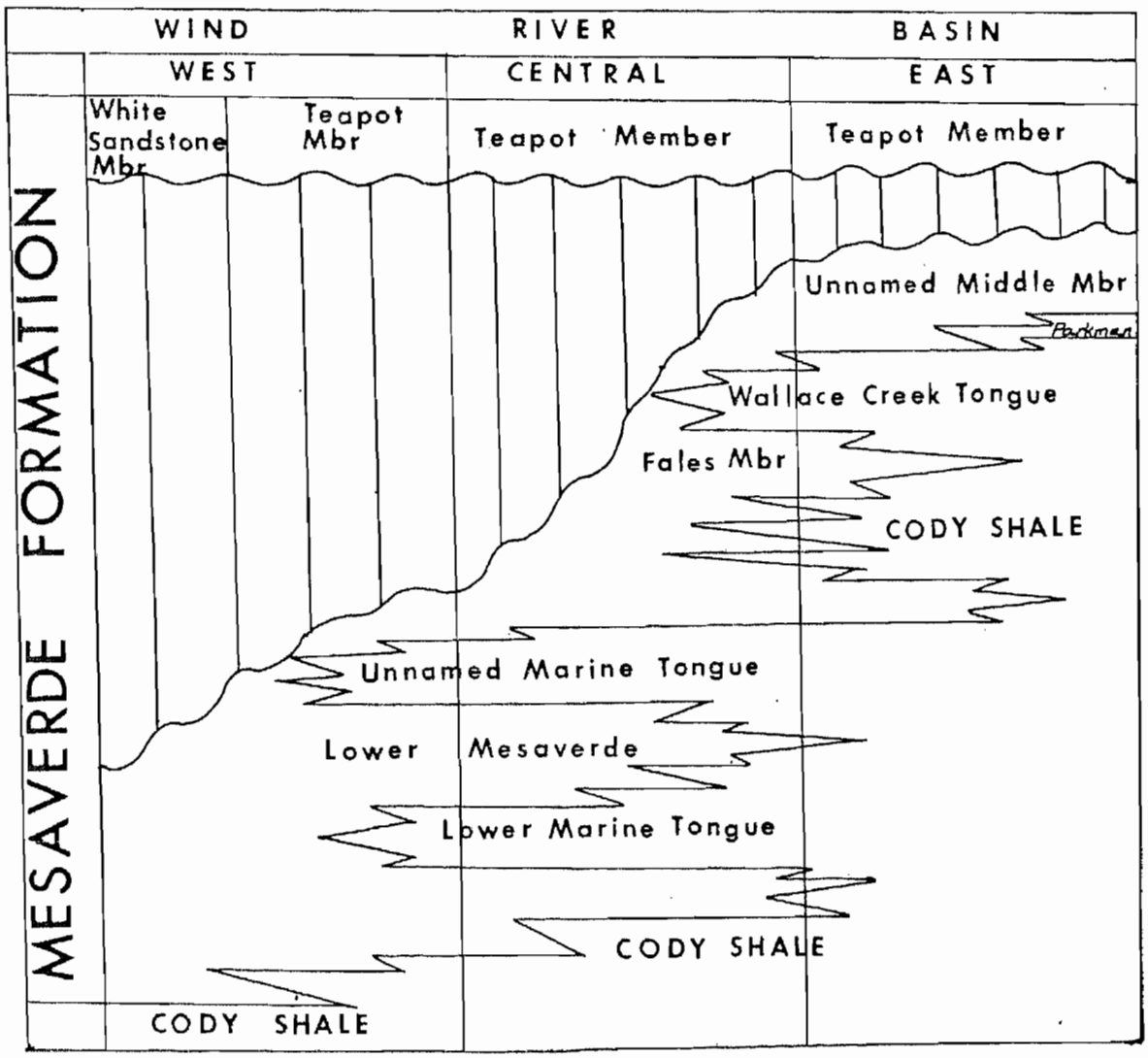

Figure 5. Correlation of Terminology. (Note: Dimensions of units are for convenience. No scale intended.)

electric log characteristics, similarities in depositional environments and available faunal evidence. A major problem encountered in this study is the extreme difficulty in correlation of individual units within the area. It is not the intent of this paper to resolve all correlation problems, but rather to identify areas where problems exist and suggest possible interpretations. Lenticular sandstone beds, great thickness variations, intertongued marine and nonmarine deposits, absence of distinctive marker beds and lack of key electric log responses within the Mesaverde section are factors which affect local and regional correlations.

Regional relationships indicate that the Mesaverde-Cody contact does not always occupy the same stratigraphic position. The lower limit of the Mesaverde Formation reflects an eastward regression and appears to be older towards the west. The upper contact indicates a westward transgression. In the western part of the study area, where the basal Mesaverde sandstones interfinger with the sandy member of the Cody shale, the Mesaverde-Cody contact is difficult to determine. Here, the contact is based on lithology, electric log correlations and environmental interpretations. The contact is best defined as the base of a massive carbonaceous sandstone (indicative of a brackish water environment), overlying a marine shale unit containing thin-bedded noncarbonaceous sandstones. Electric log responses show a decrease in resistivity in the uppermost Cody. The upper limit of the Mesaverde Formation shows lithologic similarities with the overlying Meeteetse Formation. In the subsurface, electric log characteristics are thin, sharp responses through the Meeteetse, in contrast to smoother responses in the Mesaverde, which aids in determining the Mesaverde-Meeteetse contact.

The upper limit of the Mesaverde is easily defined in areas where the Teapot sandstone member is well developed and overlain by the lower marine tongue of the Lewis shale. In the subsurface, electric log responses in the Teapot interval reflect high resistivity and self-potential values in contrast to lower values in the overlying Lewis and underlying unnamed middle member. The basal contact of the unnamed middle member with the Wallace Creek tongue of Cody Shale is reflected on electric logs by an abrupt change from a relatively high resistivity interval above, to low resistivity below. Electric log responses indicate a higher resistivity in the Fales interval in contrast to lower resistivity values in the Wallace Creek tongue, and is used as a criteria marking the contact between the Fales member and the overlying Wallace Creek tongue of Cody Shale. The lower contact of the Fales member is transitional, picked at the base of a persistent massive sandstone yielding higher resistivity responses.

Available paleontological evidence suggests that the Mesaverde Formation as presented in this paper ranges from Eagle to Bearpaw in age (Fig. 6). Yenne and Pipiringos (1954), studied fossils collected from the uppermost part of the sandy member of the Cody Shale near Alkali Butte and dated them as Eagle age. They assigned Eagle or Claggett age to marine invertebrates in beds east of Alkali Butte, correlative to the unnamed tongue of Cody Shale. Barwin (1961, p. 178) believes that the unnamed tongue of Cody Shale correlates with the Claggett-age upper part of Cody Shale in the Rattlesnake Hills. On the basis of these age determinations and other published faunal evidence within the study area, the writer believes that the Eagle-Claggett age boundary lies above the base and within the unnamed tongue of the Cody Shale.

Faunal evidence indicates a Claggett age for the Fales member in the eastern part of the area (Barwin, 1961, p. 174). Keefer and Rich (1957, p. 72) assigned Claggett age to the top of the Cody Shale in southeastern Wind River Basin. In additional, several authors have dated the Wallace Creek tongue as Claggett age. Invertebrate fauna of Judith River age have been identified from the Parkman sandstone member in the Powder River Basin, which correlates with the lower half of the basal sandstone of the unnamed middle member in the Wind River Basin (Keefer and Rich, 1957, p. 73). It is therefore suggested that the Clagget-Judith River age boundary lies at the base of the unnamed middle member.

Fossil data within the Teapot sandstone member in the Wind River Basin are not sufficient to determine the age of the Teapot. However, a marine faunal assemblage, assignable to Late Bearpaw age, has been identified in the Lewis shale in southeastern Wind River Basin (Rich, 1958, p. 2438). Marine fauna of Bearpaw age have also been collected in the Powder River Basin from beds correlated to the unnamed middle member in the Wind River Basin (Cobban, 1958, p. 117). This suggests that the Teapot sandstone member in the Wind River Basin is Bearpaw in age. The writer believes that the Judith River-Bearpaw age boundary lies within that part of the unnamed middle member which correlates with the top of the Parkman sandstone member in the Casper Arch and Powder River Basin.

DEPOSITIONAL ENVIRONMENT

Surface and subsurface studies show several transgressive and regressive pinch-outs within the Mesaverde Formation (Rich, 1958, p. 2424). The sedimentary pattern in the study area reflects an overall eastward regression of the Late Cretaceous sea, interrupted periodically by minor transgressions, resulting in intertonguing of marine, transitional and nonmarine deposits within the Mesaverde Formation. Figure 7 shows intertonguing of at least three distinctive facies, reflecting differing depositional environments. The facies and their corresonding depositional environments are illustrated in Table 2.

Lithologic sequences apparently deposited as a result of transgressive and regressive events have been described in considerable detail by Keefer and Rich (1957), Barwin (1961) and Rich (1958). Deposition of the lower Mesaverde Formation in the western area indicates a widespread eastward regression of the Late Cretaceous sea, resulting in

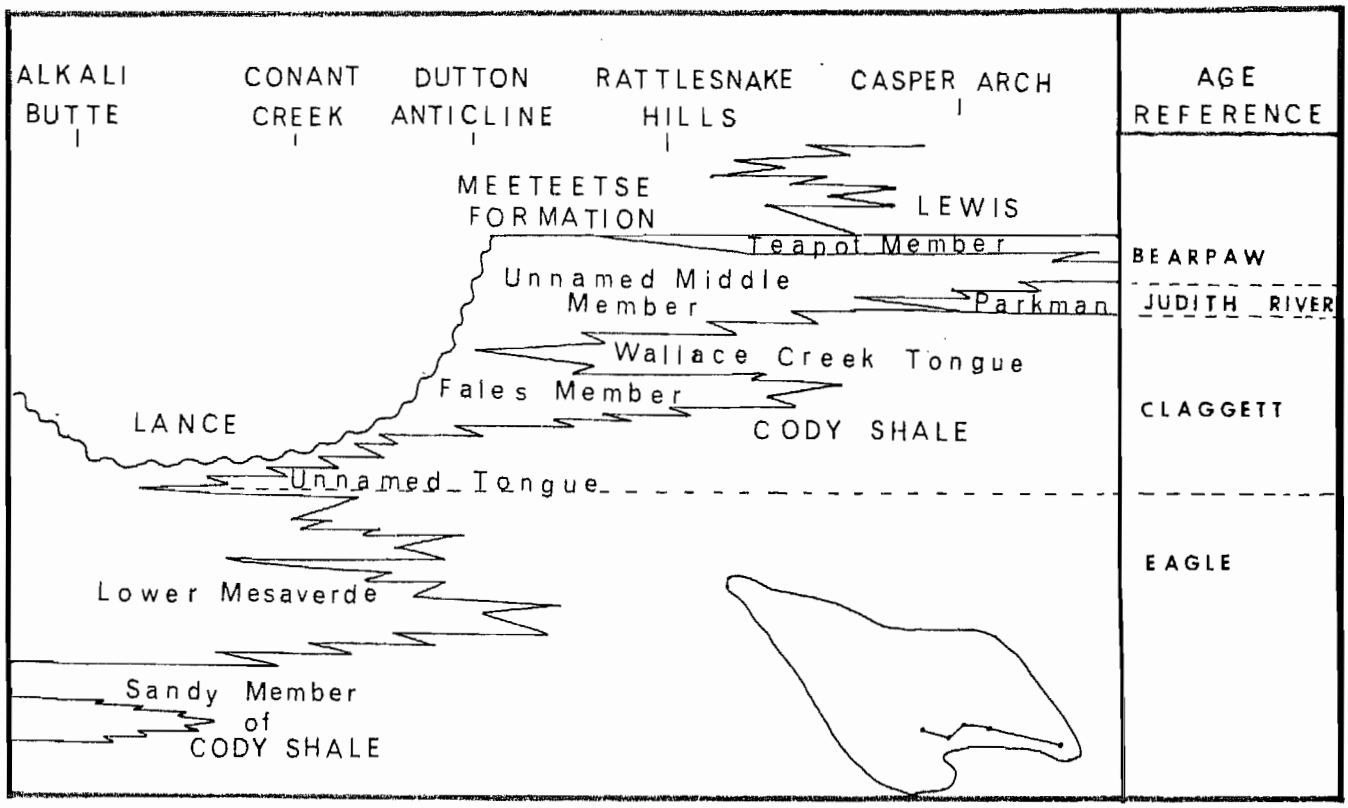

Figure 6. Diagramatic cross section showing age and interlonguing of Mesaverde Formation and Cody Shale, southern flank of Wind River Basin. Modified from Barwin (1961).

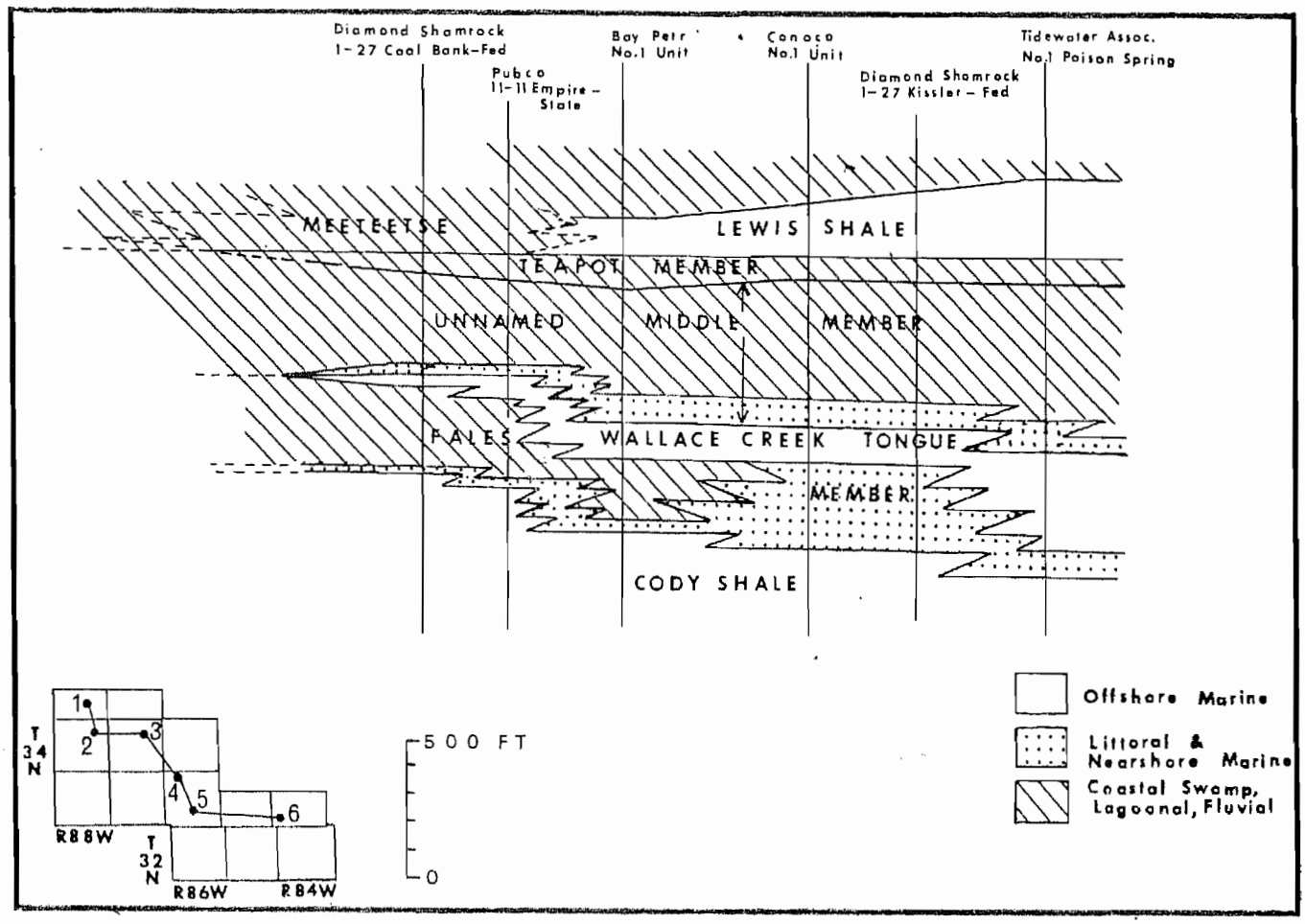

Figure 7. Subsurface cross section illustrating facies and depositional environments of the Mesaverde Formation, Rattlesnake Hills area.

TABLE 2 ENVIRONMENTAL CLASSIFICATION OF THE MESAVERDE FORMATION

Facies	Environments
	MARINE
Dark to very dark gray shale; thin-bedded siltstone; tan sandstones.	Shallow Neritic — offshore marine
	MARINE AND TRANSITIONAL
Light gray and tan massive sandstone; dark gray shale	Shallow Neritic — nearshore marine Littoral
	NONMARINE
Light gray and tan lenticular sandstone; dark gray shale; coal.	Coastal swamp, lagoonal, fluvial.

a thick accumulation of sediments in a nearshore marine, brackish water, swampy and fluvial environment. Minor oscillations of the shoreline resulted in interfingering of littoral and offshore marine deposits as indicated by the Mesaverde-Cody contact.

The Fales member of the Mesaverde Formation shows evidence of littoral, nearshore marine, coastal-swamp and lagoonal environments. Deposition of the Fales member was influenced by a major eastward regression of the Late Cretaceous sea, followed by a period during which the shoreline was relatively stable (Barwin, 1961, p. 174). The end of Fales deposition was marked by a re-advance of the sea, and subsequent deposition of marine shale of the Wallace Creek tongue. The offshore marine sedimentation of the Wallace Creek tongue was terminated by another eastward regression event, interrupted by minor oscillations of the shoreline, resulting in the deposition of the unnamed middle member. The unnamed middle member was deposited in a variety of environmental conditions. The upper part of the member is characterized by lagoonal, coastal-swamp and fluvial deposits. The basal sandstone of the unnamed middle member reflects a littoral and nearshore marine depositional environment. As regression continued eastward, the sandstone of the Teapot member was deposited. Characteristics of the Teapot sandstone member reflects coastal-swamp, lagoonal and fluvial environments of deposition.

Deposition of the Teapot sandstone member was followed by a major westward transgressive phase, and on lap of the lower marine tongue of the Lewis Shale.

ENERGY RESOURCES

OIL AND GAS

The Mesaverde Formation is not a prolific producer of oil and gas in the Wind River Basin. Nevertheless, there is production from a few isolated fields within the basin, and numerous shows have been noted in well cuttings and drill stem tests. The Mesaverde continues to stimulate considerable interest as a potential source of hydrocarbons. Significant outcrops of oil impregnated sandstones, especially in the Fales and Teapot members nears the Rattlesnake Hills and Alkali Butte are significant in evaluating the oil and gas potential of the Mesaverde Formation.

Drilling history of the Wind River Basin reveals that commercial quantities of oil and gas have been discovered in the Mesaverde sandstones in the Beaver Creek and West Poison Spider Fields. At Beaver Creek, the production is confined to the Lower Mesaverde sandstones and the upper part of the sandy member of the Cody Shale. The Teapot and Fales members yield oil in the West Poison Spider Field. Oil staining in Mesaverde outcrops has been observed in the Rattlesnake Hills area.

Most of the production in the Wind River Basin is from structural or combination structural-stratigraphic traps (Keefer and Rich, 1957, p77). Regional subsurface studies of the Mesaverde Formation in the Wind River Basin indicate favorable conditions for possible stratigraphic entrapments. Stratigraphic pinch outs of individual sandstone beds, unconformities (in the southwestern part of the sea), and variations in porosity and permeability, are factors that control hydrocarbon accumulation and entrapment. All of these may be potential exploration targets in the Mesaverde Formation.

Recent Mesaverde oil and gas discoveries in the Lysite field and Long Butte Unit, coupled with the current high level of drilling activity in the adjoining Madden Deep Unit, indicate that the search for Mesaverde oil and gas has gained momentum in the deeper portions of the Wind River Basin. It seems likely that substantial reserves of Mesaverde oil and gas remain to be found. Exploration targets do exist, but will require additional detailed subsurface studies and precise geologic interpretations to effectively locate stratigraphic or structural-stratigraphic traps in the unexplored areas of the Wind River Basin.

COAL

Detail geologic investigation and examination of drill holes in the western and southwestern portions of the Wind River Basin indicate that the Mesaverde Formation contains coal of economic significance. In the Wind River Basin, coals are reported in the Cody, Mesaverde, Meeteetse and Fort Union Formations. The most extensive

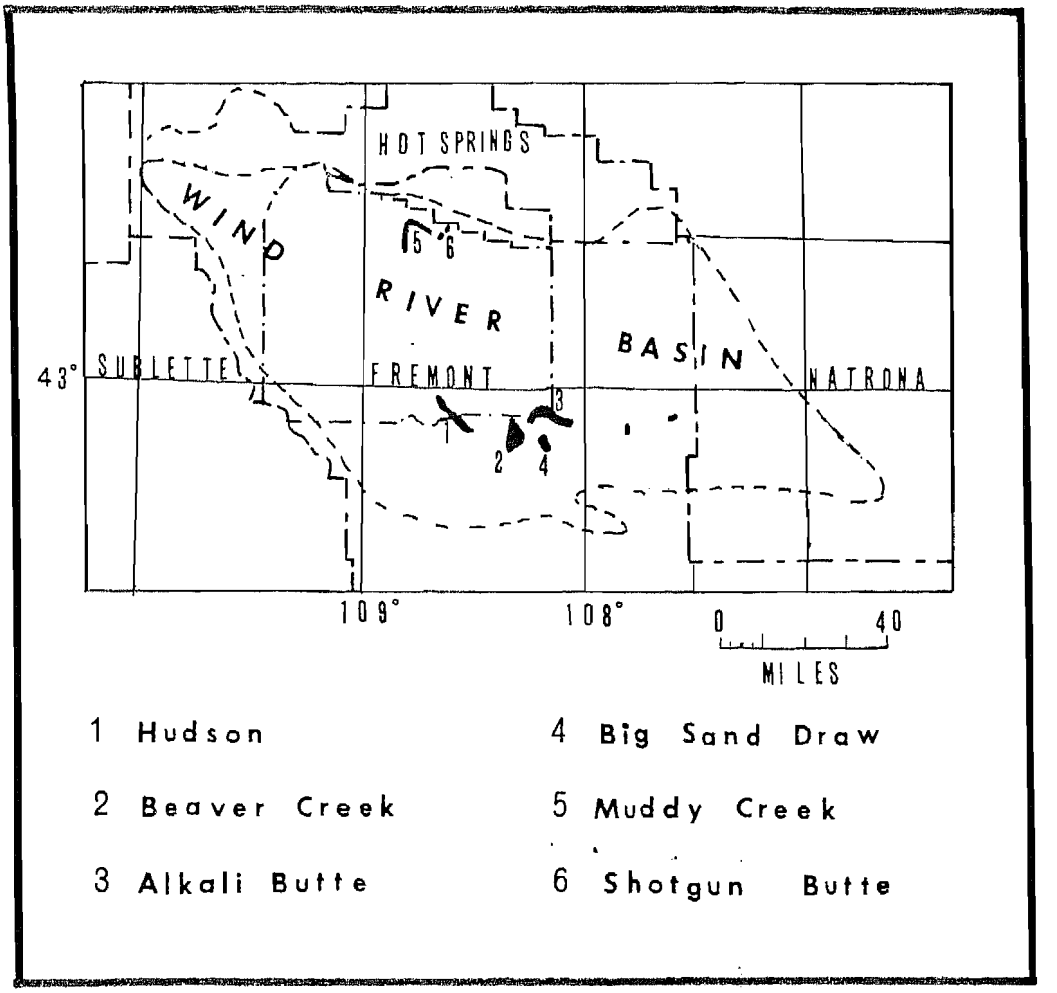

Figure 8. Location of major Mesaverde coal fields.

and commercially important coals, however, are limited to the basal portion of the Mesaverde Formation (Berryhill, et. al., 1950, p. 19-20). At least six Mesaverde coal fields are recognized within the study area. These fields are Hudson, Beaver Creek, Alkali Butte, Big Sand Draw, Muddy Creek and Shotgun Butte (Fig. 8). The geology of the major coal fields in the Wind River Basin has been published by Berryhill, et al. (1950) and Thompson and White (1952).

Discontinuous outcrops of coal bearing strata are exposed along the margins of the Wind River Basin, on flanks of northwest-trending anticlines. Many coal beds of the Mesaverde Formation are lenticular and are separated from each other by carbonaceous shales. Some Mesaverde coals of commercial marketable quality have been mined over large areas. These coal beds range in thickness from a few inches to approximately 17 feet (5.18 meters). Based on drill hole information, most Mesaverde coals of the Wind River Basin are of sub-bituminous rank (Berryhill, et. al., 1950, p. 3).

Several distinctive coal horizons are recognized in the Mesaverde Formation. The Alkali Butte field contains the most extensive coal, attaining a maximum thickness of approximately 17 feet (5.18 meters) and extending for more than 2 miles (3.22 kilometers) along the outcrop (Berryhill, et. al., 1950, p. 20). Four principal zones of coal have been mapped in the Alkali Butte field. In ascending order, these coal zones have been referred to as: Signor coal bed, unnamed coal, Beaver coal bed and Shipton coal (Thompson and White, 1965, p. 11). Signor, which is the lowermost coal, is the thickest and most persistent. Fig. 10 illustrates the stratigraphic position and correlation of the Mesaverde coal beds in the Alkali Butte field. The unnamed coal occupying a position between the Signor and Beaver beds is of local extent and cannot be correlated across the field. The heat value of Mesaverde coals in the Alkali Butte field is low, estimted at 8,760 BTU (Thompson and White, 1952, p. 11).

Most of the Mesaverde coal beds in the Wind River Basin occur at great depths, in the structurally deeper portions of the basin. Drill hole information indicates that the Mesaverde section contains potentially minable quantities of coal in the deeper parts of the basin. Underground mining methods would be required to recover the

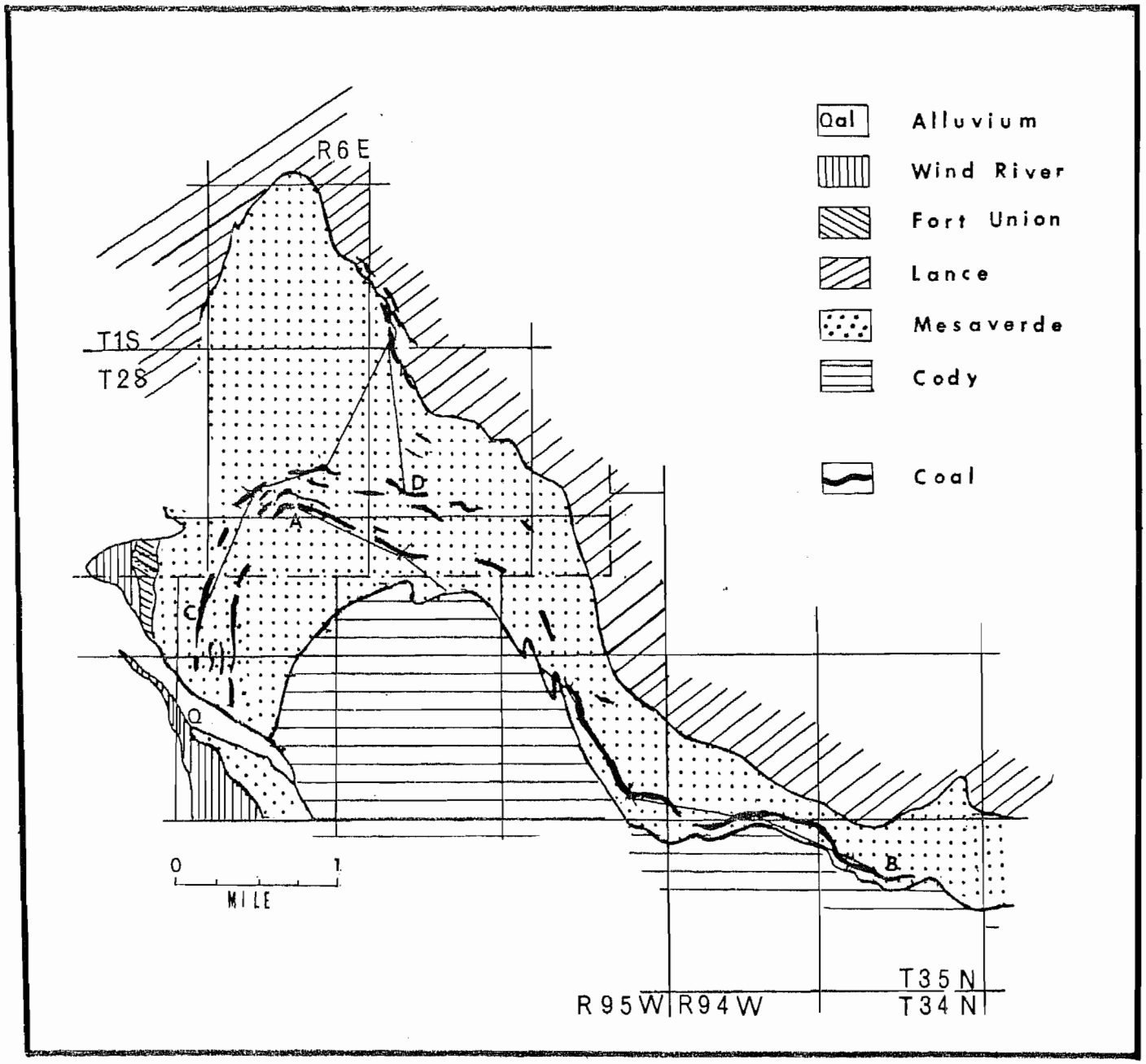

Figure 9. Geologic Map of Alkali Butte Coal field showing the distribution of coal beds within the Mesaverde Formation. (Adopted from Thompson and White, 1952.]

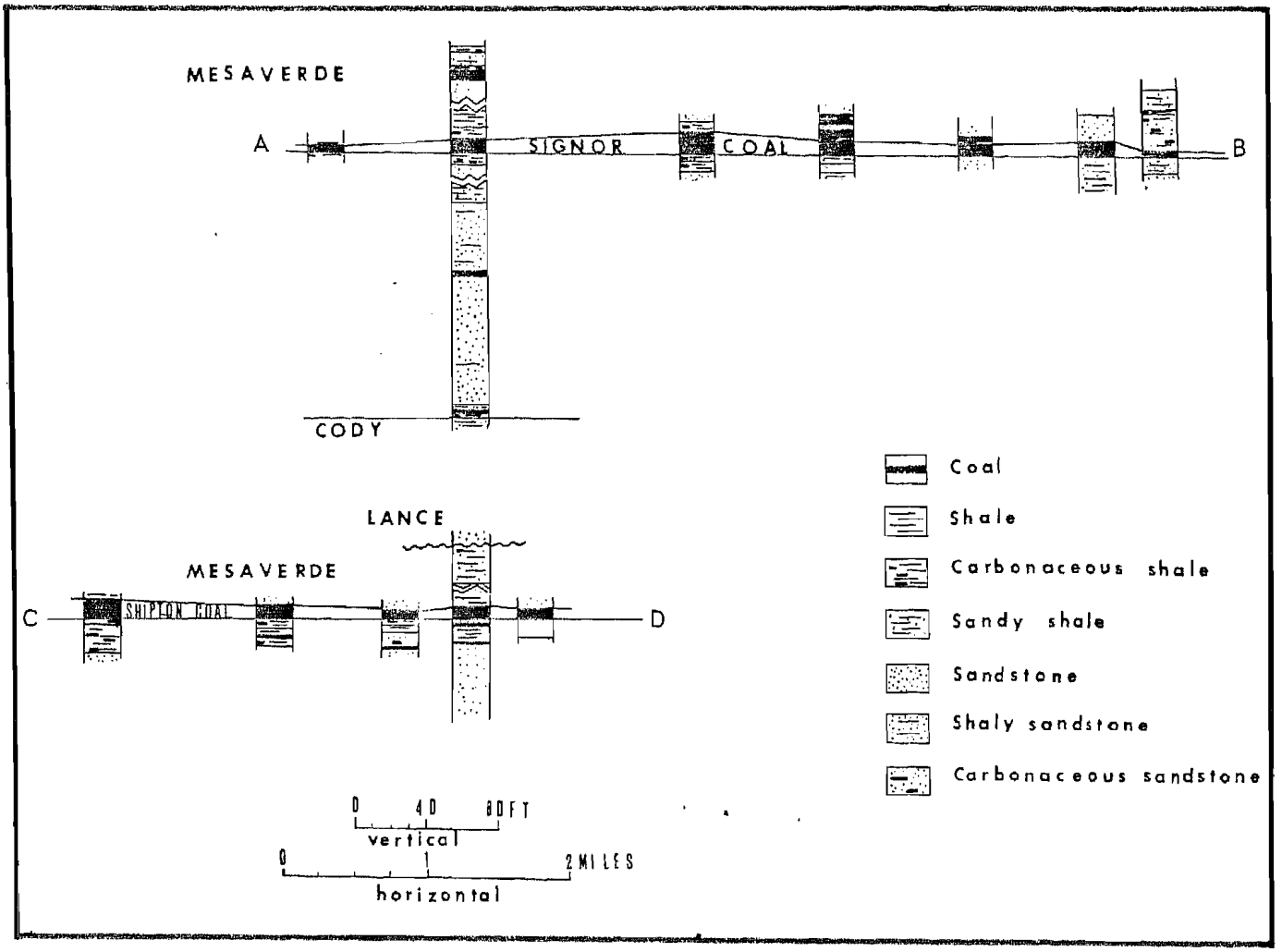

Figure 10. Stratigraphic cross section showing the correlation of coal beds in the Mesaverde Formation, Alkali Butte Coal field. (Modified from Thompson and White, 1952.) Line of cross section is indicated on Figure 9.

Mesaverde coals from most areas of the wetern segment of the Wind River Basin.

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