











**Upper part of the Mancos Shale (Upper Blue Shale Member) (Upper Cretaceous)** – Dark gray to gray-black, non-carbonaceous, broadly banded shale. The shale is finely fissile throughout and near surface, however, with increasing depth (or fresh) exposed in ravines, the shale partings are more massive and less fissile (Fig. 6). Thin black shales, thin-bedded, weathered, bentonite beds and secondary crystalline gypsum are common. Orange-brown dolomite concretions occur, most typically in concretionary horizons in bedding; some are calciferous, some are siliceous, and some are cherty. The concretions are commonly dark gray-black and bentonitic, and lithostratigraphically equivalent to the Sharon Spargens Member mapped in the North Dakota quadrangle (Nee and others, 2015). Bedrock color change from the orange-black shale to the gray-black shale occurs at approximately 10 m below the base of the conspicuous concretionary horizons of the top of the Kmp unit mark the basal contact with the Prairie Canyon Member (Kms). This unit does not correlate with the named Kmn Unit (lower unnamed members of the Mancos Shale) of Livencov and Hodge (2009). The Kmn unit is about 42m

	<b>Strike and dip of inclined bedding</b> — Showing direction and angle of dip
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	<b>Oil and gas well</b> — Label is the American Petroleum Institute (API) Unique Well Identifier. Label does not include preceding State Code (05) and County Codes (077 for Mesa County or 045 for Garfield County)
	<b>Burrow pit</b>
	<b>Gravel pit</b>
	<b>Optically stimulated luminescence sample site</b> (See Table 1 on Plate 2)
	<b>Contact</b> — Dashed where approximately located
	<b>Fault</b> — Dashed where approximately located, dotted where concealed
	<b>Syncline</b> — Dashed where approximately located, dotted where concealed
	<b>Alignment of cross section</b>

## BEDROCK GEOLOGY

**Corcoran and Coarse Members of the Iles Formation, undivided (Upper Cretaceous)**  
Sandstone, mudstone, marine shale, carbonaceous shale and the **Anchor and Palisade Coal Zones**. The thickness of the unit is estimated to be 100 to 150 m. The sandstone is medium to coarse grained with a conformable contact of the first thinly interbedded sandstones in the upper Mancoes shale tongue of the underlying Sego Sandstone unit (Knses). Up section, these interbedded sandstone and shale become increasingly fine grained and the sandstone is more finely bedded. The sandstone is interbedded, very fine- to medium-grained, planar to crossbedded, thin to thickly bedded sandstone that carries a conspicuous ledge in outcrop above the Mancoes shale tongue slope of the Knses unit. Above this sandstone package is an 18-m-thick interval of mudstone, very thin to thickly bedded, channel filled, and crossbedded. The mudstone is dark gray to black, silty, and contains the **Anchor (Coal Zone)** that were deposited in an estuarine/coastal plan environment. Above this coal-bearing slope-forming interval lies another package of thin to thickly bedded sandstone that is 13 m thick. This interval contains a thin, 1-m-thick, coal bed. The sandstone is medium to coarse grained map area. Up section, additional similar packages of interbedded strata include dark-gray Mancoes shale tongues ( $<5$  m), thin to thick-bedded tan-brown sandstone and "slickrock" gray-white mudstone, sandstone, and shale. The sandstone is medium to coarse grained and is capped by a second coal-bearing interval (Palisade Coal Zone). This bedrock unit forms a steep, benchy slope in the middle elevations of the Book Cliffs and extends northward and off the map area to the prominent ridge zone within the Book Cliffs of the Williams Fork Formation. The total thickness of the unit to the Cameo Coal Zone is about 120 m.

**Sego Sandstone Member with upper Mancoshe Shale tongue (Upper Cretaceous)**—This unit includes the Sego Sandstone and an overlying thick tongue of the Mancoshe Shale. The base of the sandstone is marked by the presence of thin, dark gray shale lenses. The sandstone is composed of fine-grained sand (K<sub>m</sub>) that coarsens up section to thicker and more resistant shoreface sandstone beds, which prominently crop out as a near-vertical bench in the upper Mancoshe Shale slope. The Sego Sandstone is buff-colored and contains some clayey partings at its top surface. It grades upward into medium-bedded sandstone interbedded with dark-gray, silt- to sandy shale. Gutter casts are present in the lower sandstone beds interbedded with shale. Higher in the unit, sandstone beds predominate, are primarily medium grained, and become thickly bedded. The sandstone portion is well-sorted and forms the bulk of the cliff face. Clastic drapes occur in the upper sandstone in the map area. The top of sandstone is in sharp contact with the overlying dark-gray fissile non-conformable tongue of the Mancoshe Shale. A horizon of concretions, like the K<sub>m</sub> unit description above, occurs in this sandstone. The sandstone tongue extends about 55 m north, making the combined thickness of the map unit 78 m.

**Upper part of the Mancos Shale (Upper Blue Shale Member) (Upper Cretaceous)** – Dark gray to gray-black, non-carbonaceous, broadly banded shale. The shale is finely fissile throughout and near surface, however, with increasing depth (or fresh) exposed in ravines, the shale partings are more massive and less fissile (Fig. 6). Thin black shales, thin-bedded, weathered, bentonite beds and secondary crystalline gypsum are common. Orange-brown dolomite concretions occur, most typically in concretionary horizons in bedding; some are calciferous, some are siliceous, and some are cherty. The concretions are commonly dark gray-black and bentonitic, and lithostratigraphically equivalent to the Sharon Spargens Member mapped in the North Dakota quadrangle (Nee and others, 2015). Bedrock color change from the orange-black shale to the gray-black shale occurs at approximately 10 m below the base of the conspicuous concretionary horizons of the top of the Kmp unit mark the basal contact with the Prairie Canyon Member (Kms). This unit does not correlate with the named Kmn Unit (lower unnamed members of the Mancos Shale) of Livencov and Hodge (2009). The Kmn unit is about 42m