Click to view geologic map.
Milner Quad Meeker Quad Fruita Quad

[PS]New Mapping of Mancos Shale in Western Colorado*

David C. Noe[1]

Search and Discovery Article #30134 (2010)
Posted September 24, 2010

*Adapted from oral presentation at AAPG Rocky Mountain Section 58th Annual Rocky Mountain Rendezvous, Durango, Colorado, June 13-16, 2010

[1]Colorado Geological Survey, Denver, CO (dave.noe@state.co.us)

Abstract

Geologic maps historically portrayed the Mancos Shale in western Colorado as an undifferentiated unit. However, the oil and gas industry has long recognized that the Mancos Shale contains certain stratigraphic intervals of interest. Examples include the Niobrara Member of the Piceance Basin and the Prairie Canyon Member in the Piceance Basin.

The Colorado Geological Survey (CGS) conducts detailed mapping of the Mancos Shale in western Colorado as part of the STATEMAP national cooperative geologic mapping program. The program uses federal and state matching funds to produce 1:24,000-scale geologic maps. The STATEMAP program has contributed eighty-nine new quadrangles in Colorado since 1993.

The western Colorado mapping focuses on population-growth areas in the Uncompahgre and Gunnison River valleys, from Montrose to Delta to Hotchkiss (see Orchard City Quadrangle, on page 3); the Yampa River valley from Yampa to Craig (see Milner Quadrangle); the White River valley near Meeker (see Meeker Quadrangle); and the Colorado River valley near Fruita (see Fruita Quadrangle).

Collaborating with the USGS, we delineated several members of the Mancos Shale based on physical characteristics and biostratigraphy, as identified by field observations and invertebrate fossil collections.

The following members are delineated as primary mapping units, from the basal contact upward: Graneros, Bridge Creek, Blue Hill, Juana Lopez, Montezuma Valley, Smoky Hill, Prairie Canyon, Sharon Springs, Lujane Point (informal upward-coarsening, offshore equivalent of the Castlegate Sandstone); and the Buck Tongue. We correlate these units with reference sections in the Mesa Verde, Book Cliffs, and Front Range (Pueblo) areas.

Although creating detailed stratigraphic sections is beyond the scope of STATEMAP, the creation of a mappable framework of Mancos Shale subunits is of potential use for oil and gas exploration, selenium abatement studies, and geologic-hazard investigations.

The mapping identified features of potential interest for future geologic studies. An example is the Prairie Canyon Member section north of Delta, which contains spectacular exposures of sand- and organic-shale-filled submarine channels.

In another example, our field observations reveal that selenium is concentrated within coarser grained units, such as the Juana Lopez Member. Selenium dissolution from dark shale units and its associated transport to and precipitation within coarser reservoir facies may merit further study by environmental geologists and geochemists.

The maps are available as CD-ROM publications from CGS. Each CD contains a geologic map for a particular quadrangle, correlation of map units, oblique view of the map, cross section(s), and illustrated authors' notes.

Reference

Bass, N.W., J.B. Eby, and M.R. Campbell, 1955, Geology and mineral fuels of parts of Routt and Moffat Counties, Colorado: U.S. Geological Survey Bulletin 1027-D, p. 143-240.

Website/URL

Colorado Geological Survey STATEMAP program, Web accessed 29 August 2010, http://geosurvey.state.co.us/Default.aspx?tabid=121

NEW MAPPING OF MANCOS SHALE IN WESTERN COLORADO

David C. Noe, Colorado Geological Survey, 1313 Sherman Street, Room 715, Denver, CO 80203

ABSTRACT

Geologic maps historically portrayed the Mancos Shale in western Colorado as an undifferentiated unit. However, the oil and gas industry has long recognized that the Mancos Shale contains certain stratigraphic intervals of interest. Examples include the Niobrara Member of the Piceance Basin and the Prairie Canyon Member in the Piceance Basin.

The Colorado Geological Survey (CGS) conducts detailed mapping of the Mancos Shale in western Colorado as part of the STATEMAP national cooperative geologic mapping program. The program uses federal and state matching funds to produce 1:24,000-scale geologic maps. The STATEMAP program contributed eighty-nine new quadrangles in Colorado since 1993.

The western Colorado mapping focuses on population-growth areas in the Uncompahgre and Gunnison River valleys from Montrose to Delta to Hotchkiss; the Colorado River valley near Fruita; the White River valley near Meeker; and the Yampa River valley from Yampa to Craig.

Collaborating with the USGS, we delineated several members of the Mancos Shale based on physical characteristics and biostratigraphy, as identified by field observations and invertebrate fossil collections.

The following members are delineated as primary mapping units, from the basal contact upward: Graneros, Bridge Creek, Blue Hill, Juana Lopez, Montezuma Valley, Smoky Hill, Prairie Canyon, Sharon Springs, Lujane Point (informal upward-coarsening, offshore equivalent of the Castlegate Sandstone); and the Buck Tongue. We correlate these units with reference sections in the Mesa Verde, Book Cliffs, and Front Range (Pueblo) areas.

Although creating detailed stratigraphic sections is beyond the scope of STATEMAP, the creation of a mappable framework of Mancos Shale subunits is of potential use for oil and gas exploration, selenium abatement studies, and geologic-hazard investigations.

The mapping identified features of potential interest for future geologic studies. An example is the Prairie Canyon Member section north of Delta, which contains spectacular exposures of sand- and organic-shale-filled submarine channels.

In another example, our field observations reveal that selenium is concentrated within coarser-grained units such as the Juana Lopez Member. Selenium dissolution from dark shale units and its associated transport, and precipitation within, coarser reservoir facies may merit further study by environmental geologists and geochemists.

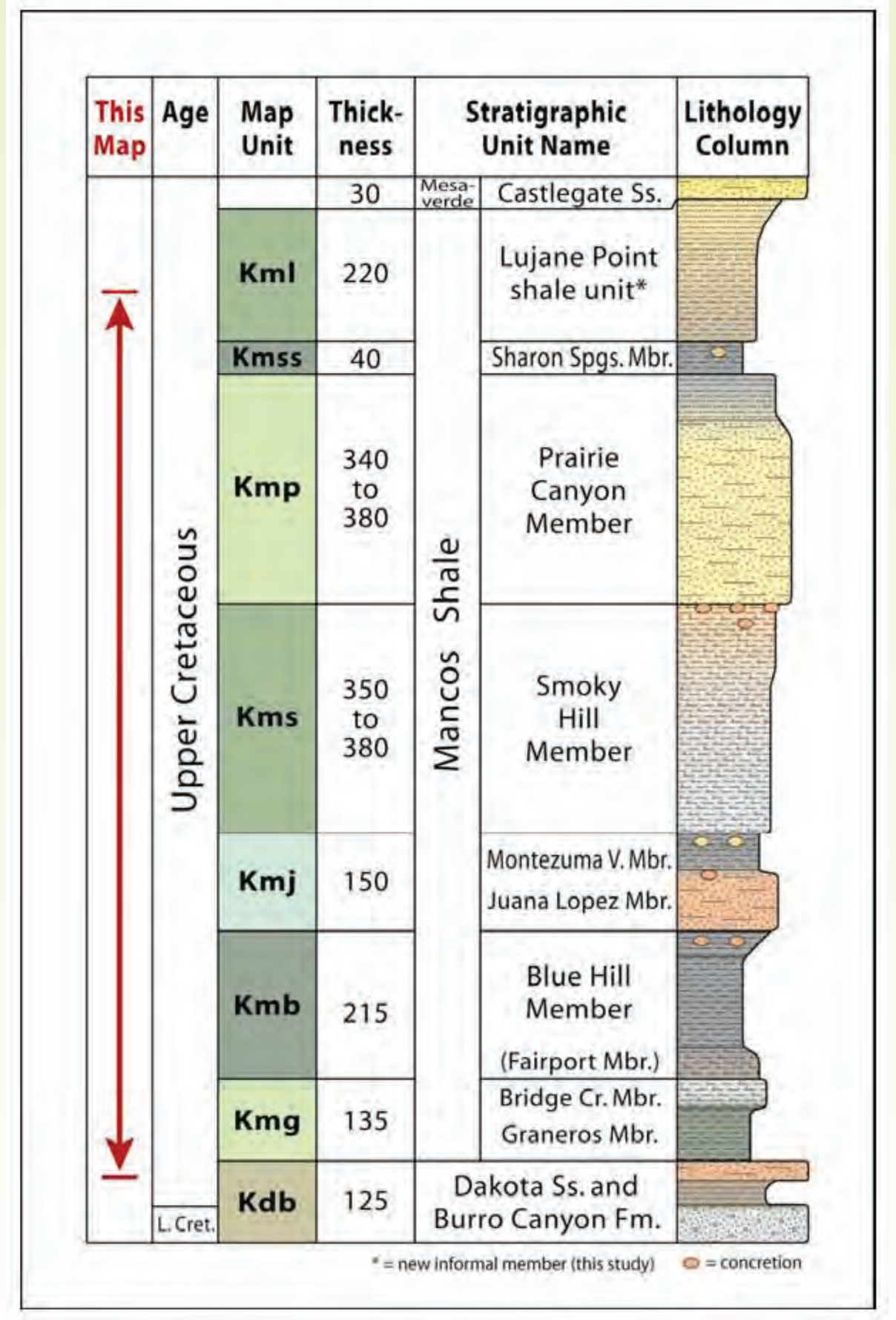
The maps are available as CD-ROM publications from CGS. Each CD contains a geologic map for a particular quadrangle, correlation of map units, oblique view of the map, cross section(s), and illustrated authors' notes.

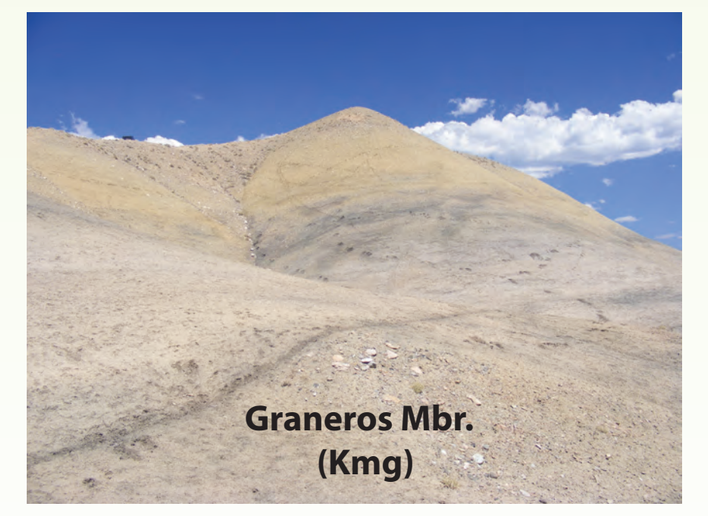
Stratigraphy of Lower and Middle Mancos Shale: Montrose East Quadrangle

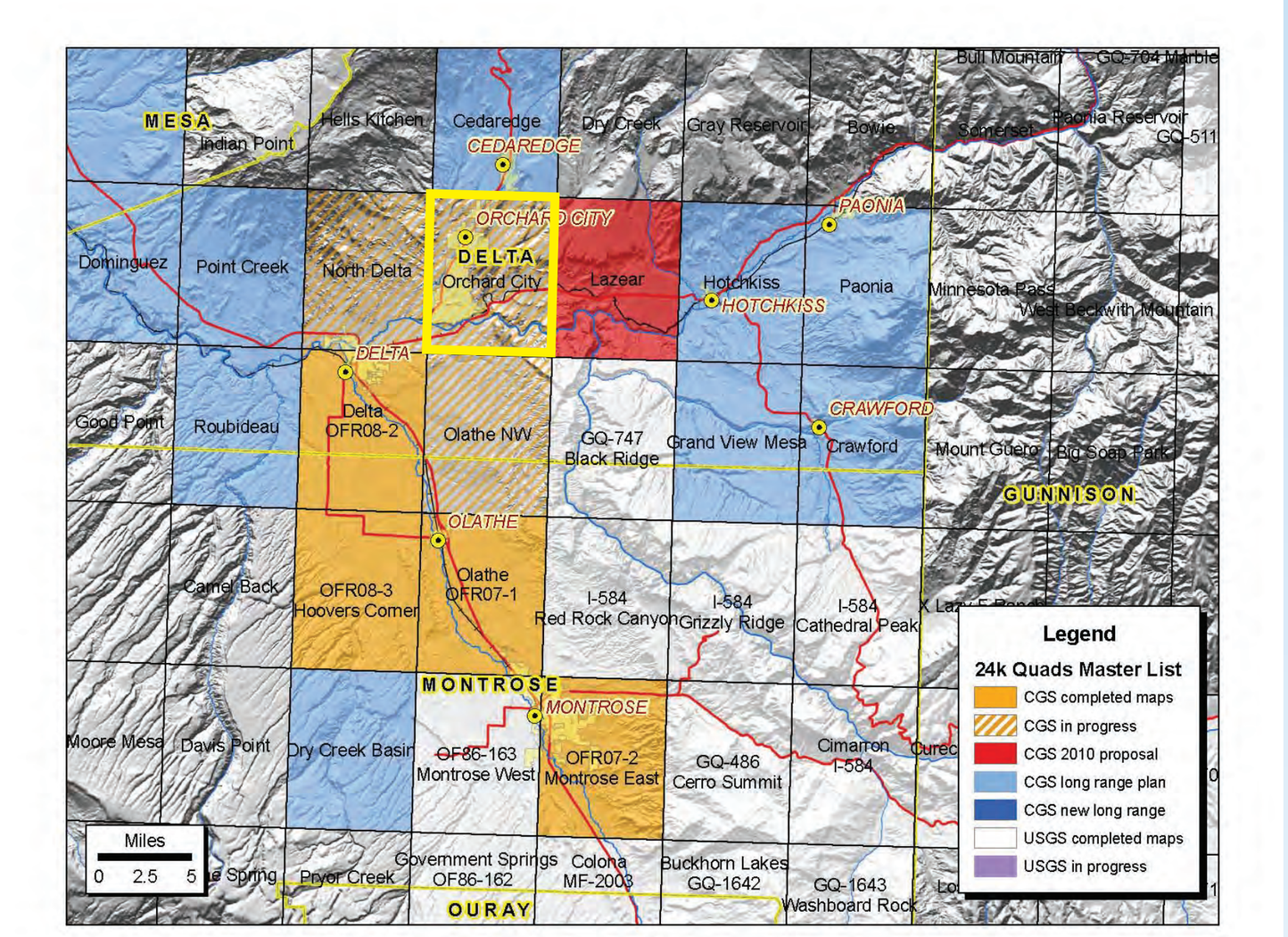
We subdivide the Mancos Shale into members on the basis of physical properties and biostratigraphy.

Following the lead of USGS, we apply nomenclature that is extended from the Front Range area (Graneros, Bridge Creek, Fairport, Blue Hill, Juana Lopez, Smoky Hill, and Sharon Springs Members).

We bring some nomenclature from SW Colorado (Montezuma Valley Member) and the Book Cliffs (Prairie Canyon Member). We recognize an informal unit (Lujane Point shale unit) that appears to be an upward-coarsening, offshore equivalent to the Castlegate Sandstone.







Uncompahgre and Gunnison River Valleys: Orchard City Quadrangle

The Orchard City quadrangle contains the lower two-thirds of the Mancos Shale. The section contains the basal Graneros Member up to the lower part of the Lujane Point shale unit.

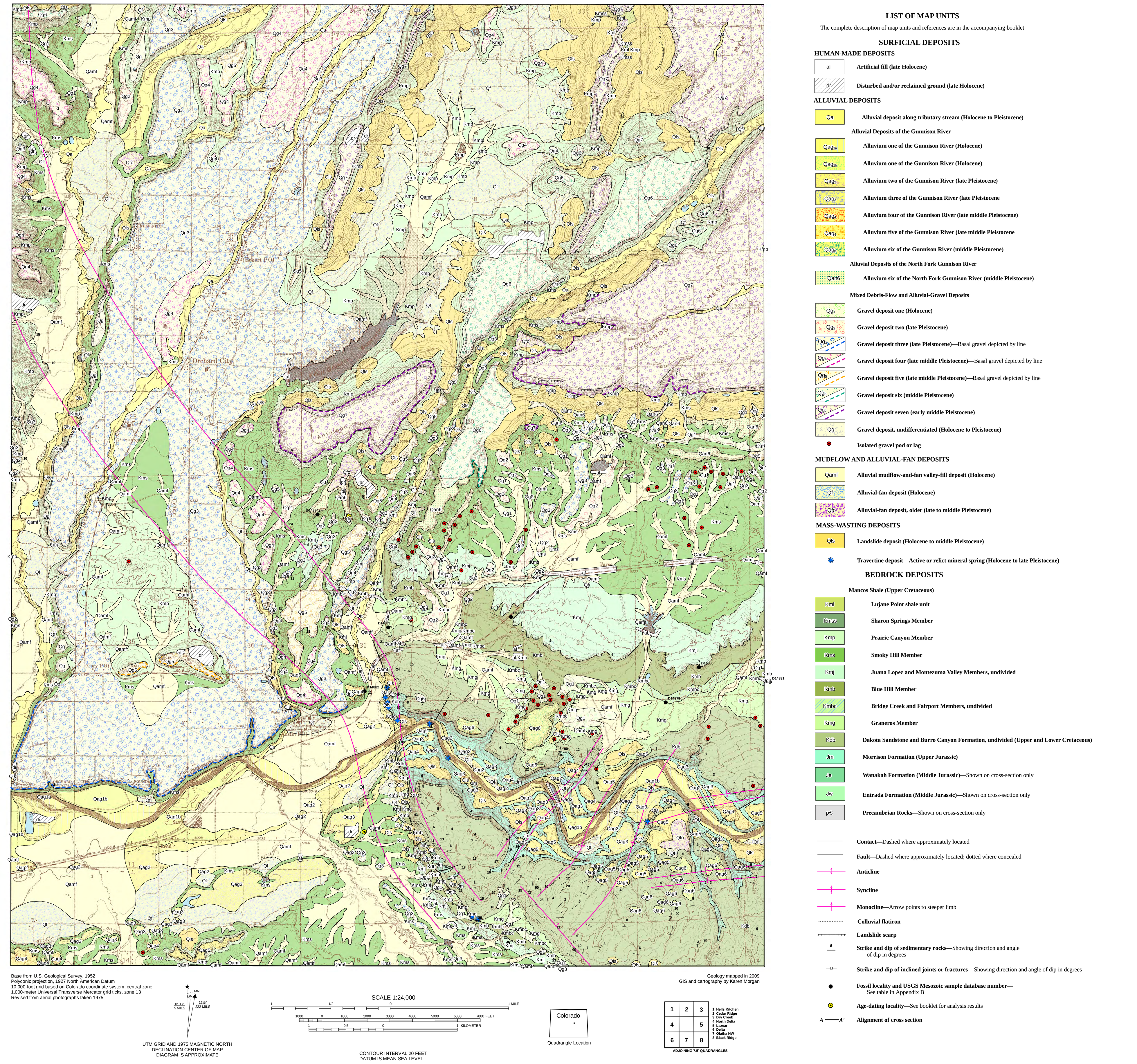
The Mancos units in this quadrangle are partially covered by glacial-outwash, debris-flow, and alluvial gravels of mid-Pleistocene to Holocene age.

The upper Mancos units outcrop to the north of this quadrangle, on the slopes of Grand Mesa.

Detailed mapping of Mancos units allows us to see the intricate geologic structure of the Gunnison uplift flanking the lower reach of the Gunnison River Gorge (SE corner of map). Additionally, it shows a previously unmapped, broad monocline extending NW from Smith Mountain toward Grand Mesa.

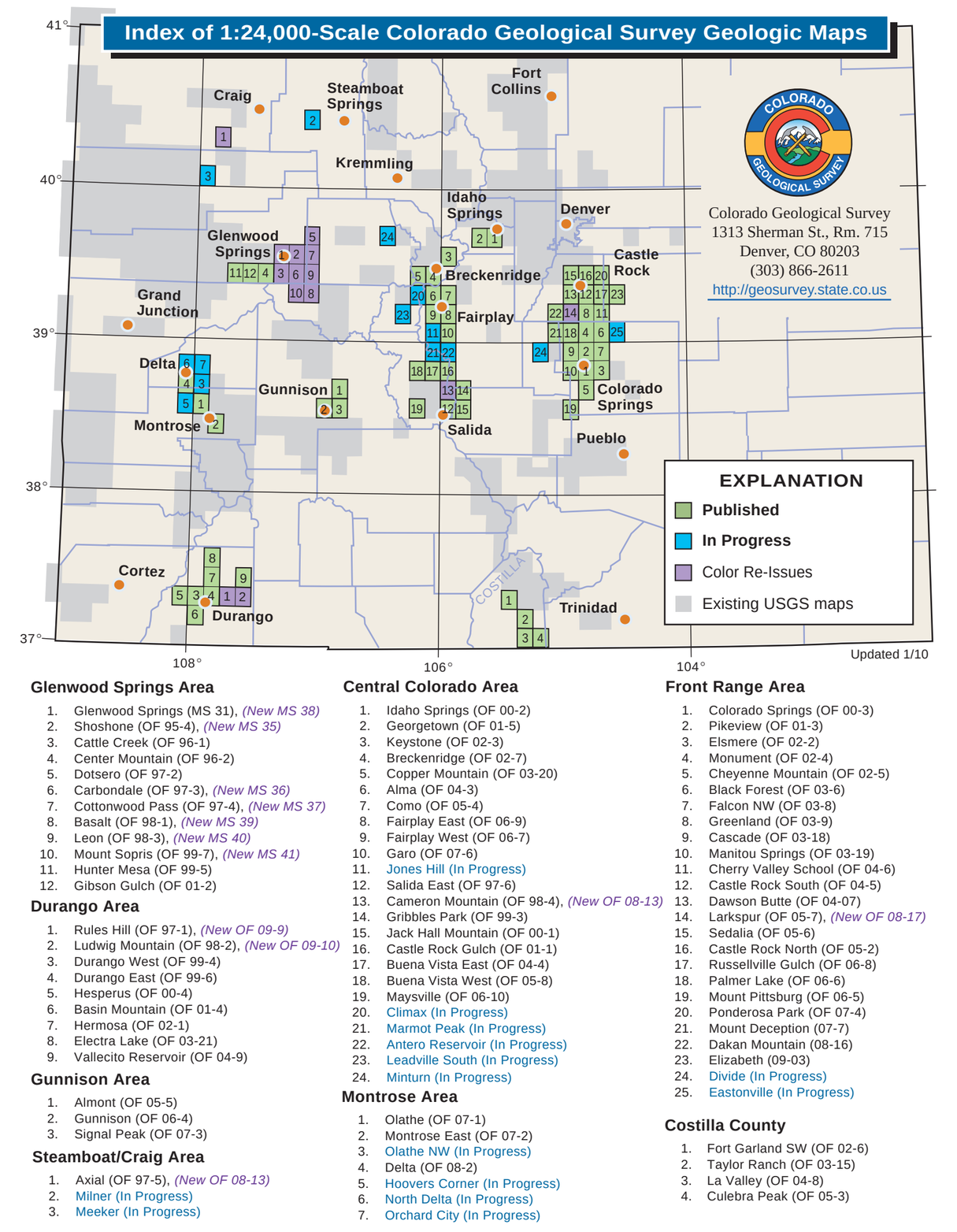
COLORADO GEOLOGICAL SURVEY
DEPARTMENT OF NATURAL RESOURCES
DENVER, COLORADO

ORCHARD CITY QUADRANGLE GEOLOGIC MAP
DELTA COUNTY, COLORADO
OPEN FILE REPORT 10-XX
Booklet accompanies map
Plate 1 of 2



ORCHARD CITY QUADRANGLE GEOLOGIC MAP, DELTA COUNTY, COLORADO

By David C. Noe
2010



CGS MAPS

CGS has mapped 89 1:24,000-scale quadrangles in Colorado since 1993.

The STATEMAP Program involves a 50:50 match between federal and state funds.

The federal portion is funded by the USGS under the National Cooperative Geologic Mapping Program.

The state portion is funded by the Colorado Department of Natural Resources Severance Tax Operational Fund, from severance taxes paid on the production of natural gas, oil, coal, and metals in Colorado.

Total STATEMAP funding from 1993 to present is just under five million dollars.

BIOSTRATIGRAPHY

CGS makes a collection of fossils as part of each mapping project.

We collect marine fossils, primarily ammonites and bivalves, to constrain the biostratigraphic age of each member of the Mancos Shale.

Dr. William Cobban, USGS, graciously provides us with identification of the collected fossils. In turn, CGS donates the collections, which are added to the USGS' Cretaceous Western Interior biostratigraphic database.

The table to the right shows the biostratigraphic results as published for the Montrose East quadrangle.

Appendix A - Fossils Collected From the Montrose East Quadrangle and Vicinity, Colorado

CGS Locality Number	USGS Mesozoic Locality Number	Fossils Identified by W. Cobban, USGS	Mollusc or Ammonite Guide Fossil Zone	Age	Formation or Mancos Shale Member	Quadrangle	County	State	Land Survey Location	UTM83-X	UTM83-Y	Collected by	Date
---	D3850, 51		*B. perplexus*	Middle Campanian	Buck Tongue?	Cerro Summit	Montrose	CO	ne se sw 35-49N-8W	260914	4260670	R.G. Dickinson	pre-1966
---	D3852		*B. perplexus*	Middle Campanian	Buck Tongue?	Cerro Summit	Montrose	CO	nw se ne 35-49N-8W	261602	4261536	R.G. Dickinson	pre-1966
---	D3846, 47		*B. aspiriformis*	Middle Campanian	Lujane Point shale unit	Cerro Summit	Montrose	CO	nw ne ne 4-48N-8W	260138	4260010	R.G. Dickinson	pre-1966
---	D3848, 49		*B. aspiriformis*	Middle Campanian	Lujane Point shale unit	Cerro Summit	Montrose	CO	nw se sw 35-49N-8W	260825	4260777	R.G. Dickinson	pre-1966
DN059	D14534	*Cataceramus balticus*	*B. aspiriformis?*	Middle Campanian	Lujane Point shale unit	Cerro Summit	Montrose	CO	nw ne ne 4-48N-8W	260448	4260241	David C. Noe	05/19/06
DN1013	D14533	*Baculites sp; Cataceramus sp.; Ichthyodectes sp.*	*B. obtusus?*	Middle Campanian	Prairie Canyon Mbr	Cerro Summit	Montrose	CO	nw sw sw 23-49N-8W	261023	4264550	David C. Noe	11/08/06
DN045	D14525	*Baculites sp. (B. haresi?)*; trace fossils	*C. balticus; Scaphites hippocrepis*	Lower Campanian	Prairie Canyon Mbr	Montrose East	Montrose	CO	se nw sw 9-48N-8W	259155	4256619	David C. Noe	05/19/06
DN072	D14529	*Cataceramus balticus*	*C. balticus; Scaphites hippocrepis*	Lower Campanian	Prairie Canyon Mbr	Montrose East	Montrose	CO	ne nw sw 29-49N-8W	255891	4262927	David C. Noe	05/25/06
DN064	D14530	*Baculites aquilaensis*	*C. balticus; Scaphites hippocrepis*	Lower Campanian	Prairie Canyon Mbr	Montrose East	Montrose	CO	se sw sw 21-49N-8W	257684	4263698	David C. Noe	05/25/06
DN066	D14531	*Baculites sp., Cataceramus balticus*	*C. balticus; Scaphites hippocrepis*	Lower Campanian	Prairie Canyon Mbr	Montrose East	Montrose	CO	sw se se 21-49N-8W	258478	4263760	David C. Noe	05/23/06
DN085	D14532	*Baculites aquilaensis; Ichthyodectes* scales	*C. balticus; Scaphites hippocrepis*	Lower Campanian	Prairie Canyon Mbr	Montrose East	Montrose	CO	n nw se 22-49N-8W	259930	4254357	David C. Noe	06/06/06
DN015	D14520	*"Inoceramus" sp.; Pseudoperna congesta*	(can't tell)	Coniacian or Santonian	Smoky Hill Mbr	Montrose East	Montrose	CO	sw nw nw 14-48N-9W	252555	4256167	David C. Noe	04/26/06
DN105	D14521	*"Inoceramus" sp.; Pseudoperna congesta*; trace fossils	(can't tell)	Coniacian or Santonian	Smoky Hill Mbr	Montrose East	Montrose	CO	nw nw sw 13-48N-9W	254138	4255410	David C. Noe	11/06/06
DN106	D14522	*"Inoceramus" sp.; Pseudoperna congesta*; fish scales	(can't tell)	Coniacian or Santonian	Smoky Hill Mbr	Montrose East	Montrose	CO	s nw sw 13-48N-9W	254265	4255165	David C. Noe	11/07/06
DN024	D14523	*"Inoceramus" sp.; Pseudoperna congesta*; fish scales	(can't tell)	Coniacian or Santonian	Smoky Hill Mbr	Montrose East	Montrose	CO	sw ne ne 31-48N-8W	256772	4251090	David C. Noe	05/02/06
DN027	D14524	*"Inoceramus" sp.; Pseudoperna congesta*	(can't tell)	Coniacian or Santonian	Smoky Hill Mbr	Montrose East	Montrose	CO	se se ne 29-48N-8W	258706	4252337	David C. Noe	11/07/06
DN044	D14526	*"Inoceramus" sp.; Pseudoperna congesta*	(can't tell)	Coniacian or Santonian	Smoky Hill Mbr	Montrose East	Montrose	CO	sw se se 8-48N-8W	258591	4256295	David C. Noe	05/17/06
DN082	D14527	*Magadiceramus subquadratus crenulatus; Pseudoperna congesta*	*M. subquadratus crenulatus*	Upper Coniacian	Smoky Hill Mbr	Montrose East	Montrose	CO	ne se nw 7-48N-8W	256399	4257370	David C. Noe	06/05/06
---	D3844	*Baculites asper*	*Scaphites depressus; M. subquadratus crenulatus*	Upper Coniacian	Smoky Hill Mbr	Cerro Summit	Montrose	CO	nw se sw15-48N-8W	260924	4254783	R.G. Dickinson	pre-1966
DN084	D14528	*"Inoceramus" platinus; Psuedoperna congesta*	(can't tell)	Middle to Upper Coniacian	Smoky Hill Mbr	Montrose East	Montrose	CO	se se se 1-48N-9W	255546	4258093	David C. Noe	06/05/06
DN010	D14518	*Mytiloides incertus*	*M. incertus; Scaphites negricollensis*	Upper Turonian	Montezuma Valley Mbr	Montrose East	Montrose	CO	c s 4-48N-9W	250099	4258545	David C. Noe	04/20/06
---	D3842	*Inoceramus perplexus; Prionocyclus macombi; Ostrea lugubris*	*I. Perplexus; I. dimidius; P. macombi*	Middle to Upper Turonian	Juana Lopez Mbr	Montrose East	Montrose	CO	n nw ne 27-48N-9W	251642	4252546	R.G. Dickinson	1962
---	D11880	*Inoceramus perplexus; Prionocyclus macombi; Lopha lugubris*	*I. dimidius; P. macombi*	Middle Turonian	Juana Lopez Mbr	Colona	Montrose	CO	ne ne 3-47N-9W	252090	4249787	E.A. Merewether and W.A. Cobban	1982
---	D11883	*Inoceramus dimidius; Prionocyclus macombi; Scaphites warreni*	*I. dimidius; P. macombi; S. warreni*	Middle Turonian	Juana Lopez Mbr	Colona	Montrose	CO	ne ne 3-47N-9W	252090	4249787	E.A. Merewether and W.A. Cobban	1982
K138	D14513	*Prionocyclus macombi; Lopha lugubris*	*I. dimidius; P. macombi*	Middle Turonian	Juana Lopez Mbr	Montrose East	Montrose	CO	se ne se 27-48N-9W	252175	4252052	Stephen M. Keller	05/23/06
K142	D14514	*Inoceramus dimidius; Prionocyclus macombi*	*I. dimidius; P. macombi*	Middle Turonian	Juana Lopez Mbr	Montrose East	Montrose	CO	e se nw 27-48N-9W	251496	4252598	Stephen M. Keller	05/23/06
K141	D14515	*Prionocyclus macombi; Lopha lugubris*	*I. dimidius; P. macombi*	Middle Turonian	Juana Lopez Mbr	Montrose East	Montrose	CO	s se sw 22-48N-9W	251303	4253215	Stephen M. Keller	05/23/06
DN005	D14516	*Inoceramus dimidius*	*I. dimidius; P. macombi*	Middle Turonian	Juana Lopez Mbr	Montrose East	Montrose	CO	e se ne 5-48N-9W	249160	4259797	David C. Noe	04/19/06
DN008	D14517	*Inoceramus dimidius*	*I. dimidius; P. macombi*	Middle Turonian	Juana Lopez Mbr	Montrose East	Montrose	CO	c ne ne 9-48N-9W	250698	4257871	David C. Noe	04/20/06
DN011	D14519	*Baculites sp.; Inoceramus dimidius?*	*I. dimidius; P. macombi*	Middle Turonian	Juana Lopez Mbr	Montrose East	Montrose	CO	e ne sw 4-48N-9W	249975	4259193	David C. Noe	05/20/06
DN006	D14535	*Inoceramus dimidius; Prionocyclus macombi*	*I. dimidius; P. macombi*	Middle Turonian	Juana Lopez Mbr	Montrose West	Montrose	CO	nw ne se 5-48N-9W	248940	4259326	David C. Noe	04/19/06
---	D3841	*Inoceramus dimidius; Ostrea lugubris*	*I. dimidius; P. macombi*	Middle Turonian	Juana Lopez Mbr	Montrose West	Montrose	CO	sw ne 5-48N-9W	248520	4259747	R.G. Dickinson	1962
---	D11879	*Prionocyclus macombi; Scaphites carlilensis*	*I. aff dimidius; P. macombi*	Middle Turonian	Blue Hill Mbr	Colona	Montrose	CO	ne ne 3-47N-9W	252062	4249749	E.A. Merewether and W.A. Cobban	1982
---	D11878	*Pycnodonte newberryi*	*Mytiloides hattini; Nigericeras scotti*	Upper Cenomanian to Lower Turonian	Bridge Creek Mbr	Colona	Montrose	CO	ne ne 3-47N-9W	252179	4249594	E.A. Merewether and W.A. Cobban	1982
---	D11882	*Pycnodonte newberryi*	*Mytiloides hattini; Nigericeras scotti*	Upper Cenomanian to Lower Turonian	Bridge Creek Mbr	Colona	Montrose	CO	ne ne 3-47N-9W	252179	4249594	E.A. Merewether and W.A. Cobban	1982
---	D11881	*Plicatula sp.*	*pre I. Pictus?*	Upper Cenomanian	Graneros Mbr	Colona	Montrose	CO	ne ne 3-47N-9W	252113	4249580	E.A. Merewether and W.A. Cobban	1982
---	D14164	*Pycnodonte aff kellumi*	*pre I. Pictus?*	Upper Cenomanian	Graneros Mbr	Montrose West	Montrose	CO	nw nw 20-48N-9W	247739	4254694	???	???
---	26946		*Plesiacanthoceras wyomingensis*	Middle Cenomanian	Dakota Sandstone	Montrose West	Montrose	CO	19-48N-9W	???	???	???	???
---	D2040		*Colinoceras terrantense*	Middle Cenomanian	Dakota Sandstone	Government Springs	Montrose	CO	30-48N-9W	???	???	???	???

Includes collection sites within one mile of the Montrose East quadrangle. Sources of information for fossils collected previous to this study include Dickinson (1965) and Merewether and others (2006)
Note by W. Cobban: Pieces of large inoceremids are referred to as *"Inoceramus"* and may be either *Magadiceramus*, *Volviceramus*, or *Platyceramus*

Accompanies Geologic Map of the Montrose East Quadrangle, Montrose County, Colorado — Compiled by David C. Noe, Colorado Geological Survey. — Version of 2/6/2008

Baculites (awaiting I.D.)
Buck Tongue Member

Prionocyclus macombi
Blue Hill Member

Thick-shelled *Inoceramus sp.* with encrusting oysters (*Psuedoperna congesta*)
Smoky Hill Member

Pycnodonte aff. P. Kellumi
Fairport Member