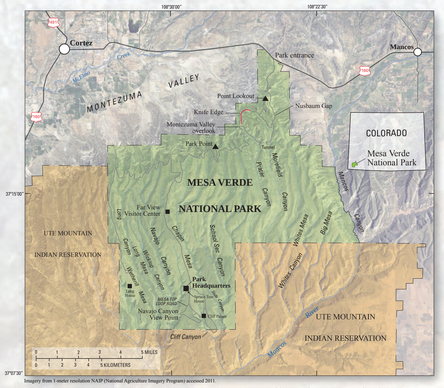
U.S. Department of the Interior
U.S. Geological Survey

Prepared in cooperation with the
National Park Service

Scientific Investigations Map 3224
Pamphlet accompanies Map

Surficial Geologic Map of Mesa Verde National Park, Montezuma County, Colorado

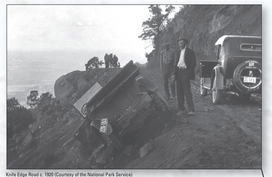
By Paul E. Carrara
2012



Imagery from 1-meter resolution NAIP (National Agriculture Imagery Program) accessed 2011.

Figure 1. Index map showing location of Mesa Verde National Park in the southwestern corner of Colorado with place names mentioned in the text.

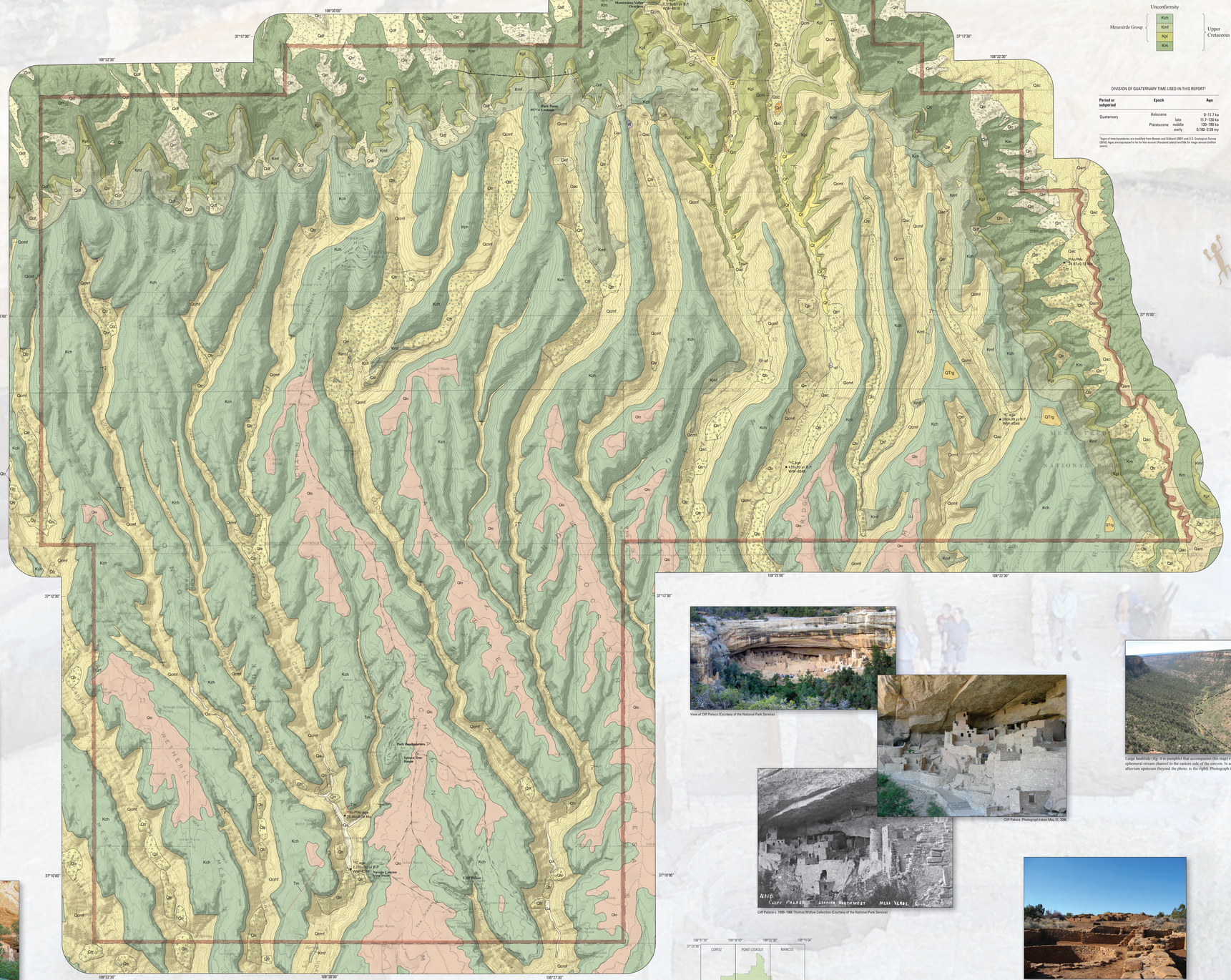
Claret Cup Cactus in Navajo Canyon. Photograph taken May 17, 2007.



Knife Edge Road c. 1920 (Courtesy of the National Park Service)

Prior to 1957, the entrance road into Mesa Verde National Park traversed the steep Mancos Shale slopes along the northern escarpment between the heads of Morefield and Prater Canyons. This 1.5-mile (2.4 km) section of road was known as the "Knife Edge." This section of road was eventually considered too treacherous to maintain by the National Park Service. In 1957 a 1,400-ft (427 m) tunnel was constructed between Morefield and Prater Canyons resulting in the abandonment of the Knife Edge section. From the head of Morefield Canyon one can walk a section of this old road along the park's Knife Edge Trail.

Fault viewed from Park Point, looking north. Photograph taken May 16, 2008.



Base from U.S. Geological Survey 1:24,000-scale maps: Cortez, Colo., 1965; Point Lookout, Colo., 1965; Mancos, Colo., 1965; Wetherill Mesa, Colo., 1966; Moccasin Mesa, Colo., 1967; Trail Canyon, Colo., 1966.

The original projections were Polyconic projections and 1927 North American Datum (NAD 27). The basemaps and datasets have been digitally upgraded to Transverse Mercator projection and North American Datum 1983 (NAD83).

Universal Transverse Mercator (UTM), zone 12

Mesa Verde National Park boundary from the National Park Service, accessed 2008 at http://www.nps.gov/gis/park_info/

Boundaries are approximate

There may be private inholdings within the boundaries of the National or State reservations shown on this map

APPROXIMATE MEAN DECLINATION, 2011

SCALE 1:24 000

CONTOUR INTERVAL 20 AND 40 FEET

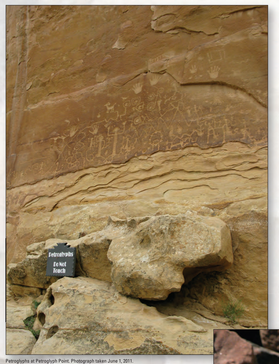
COLORADO
MAP LOCATION

Geology mapped by P.E. Carrara in 2006–2011.

The author was visited and assisted in the field at various times by Mary L. Gillam, consulting geologist; Diana E. Anderson, R. Scott Anderson, and Taylor J. Joyce, Northern Arizona University; Pumpuaya Arakawa, Crow Canyon Archaeological Center; Robert W. Blair Jr., Fort Lewis College; Jason C. Kirby, Utah Geological Survey geologist; David A. Sonnenfeld, Fort Lewis College; R. Mark Leckie, University of Massachusetts; and the following U.S. Geological Survey personnel: Marian Galanzan, Marith C. Reheis, Richard L. Reynolds, and James C. Yount.

D. Paco Vivio Sistine prepared the digital compilation of the geologic map and the GIS database.

Edit and cartographic layout by L.J. Binder
Denver Science Publishing Network



Petroglyphs at Petroglyph Point. Photograph taken June 1, 2011.

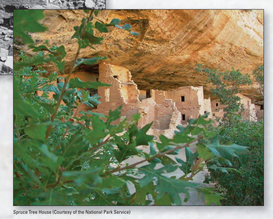
Collared Lizard (Courtesy of the National Park Service)

Prairie Rattlesnake (Courtesy of the National Park Service)

Spotted Owl (Courtesy of the National Park Service)

Wetherills at Spruce Tree House 1891 (Nordenskiöld Photography, Courtesy of the National Park Service)

Spruce Tree House c. 1890–1900 (Courtesy of the National Park Service)



Spruce Tree House (Courtesy of the National Park Service)

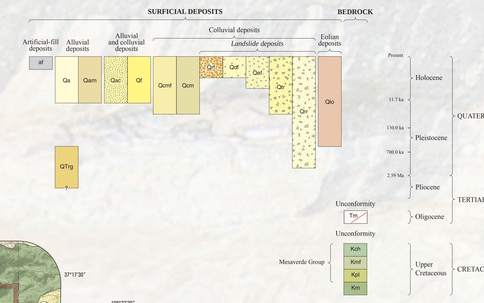
Wild Turkey (Courtesy of the National Park Service)

Mule deer in campground. Photograph taken May 22, 2009

Coyote (Courtesy of the National Park Service)

Western Tanager (Courtesy of the National Park Service)

CORRELATION OF MAP UNITS



DIVISION OF QUATERNARY TIME USED IN THIS REPORT[1]

Period or subperiod	Epoch		Age
Quaternary	Holocene		0–11.7 ka
	Pleistocene	late	11.7–130 ka
		middle	130–780 ka
		early	0.780–2.59 my

[1]Ages of time boundaries are modified from Bowen and Gibbard (2007) and U.S. Geological Survey (2010). Ages are expressed in ka for kilo-annum (thousand years) and Ma for mega-annum (million years).

LIST OF MAP UNITS

[Due to the addition of a shaded relief base, colors on the List of Map Units and the Correlation of Map Units may not exactly match unit colors on the map. More detailed descriptions of these units are available in the accompanying pamphlet]

SURFICIAL DEPOSITS

Artificial-fill deposits

af — **Artificial-fill deposits (latest Holocene)**

Alluvial deposits

Qa — **Alluvium deposited by small ephemeral streams (Holocene and late Pleistocene)**

Qam — **Alluvium deposited by the Mancos River (Holocene and late Pleistocene)**

QTrg — **Residual gravel (middle Pleistocene to Pliocene?)**

Alluvial and colluvial deposits

Qac — **Alluvial and colluvial deposits, undivided (Holocene and late Pleistocene)**

Qf — **Fan deposits (Holocene and late Pleistocene)**

Colluvial deposits

Qomf — **Colluvial deposits derived from the Menefee Formation (Holocene and late Pleistocene)**

Qom — **Colluvial deposits derived from the Mancos Shale (Holocene and late Pleistocene)**

Landslide deposits

Qrf — **Rockfall deposit (late Holocene)**—Subangular sandstone boulders deposited by rockfall; primarily derived from the Point Lookout Sandstone (Kpl)

Qrt — **Debris-flow deposits (late Holocene)**—Debris-flow deposits originating primarily from the Menefee Formation (Kmf)

Qsf — **Earthflow deposit (Holocene)**—Earthflow originating within the Menefee Formation (Kmf)

Qrr — **Translational and rotational landslide deposits (Holocene and late Pleistocene)**—Mainly derived from the Menefee Formation (Kmf) and the Mancos Shale (Km)

Qrs — **Rock-rubble deposits (Holocene and Pleistocene)**—Rock topples, rockfalls, rock avalanches, and debris flows. Mostly derived from the Point Lookout Sandstone (Kpl)

Eolian deposits

Qlo — **Loess (Holocene and middle Pleistocene)**

BEDROCK

Tm — **Minette dike (Oligocene)**

Mesaverde Group (Upper Cretaceous)

Kch — **Cliff House Sandstone**

Kmf — **Menefee Formation**

Kpl — **Point Lookout Sandstone**

Km — **Mancos Shale**

EXPLANATION

Contact—Dashed where approximately located

Normal fault—Dashed where approximately located; bar and ball on downthrown side

Minette dike—Dotted where concealed

Inclined bedding—Showing strike and dip, calculated from map outcrop-pattern geometry

^{14}C age 350±20 yr B.P. WW-4345 — **Sample location**—Location of radiocarbon sample with age and laboratory sample number

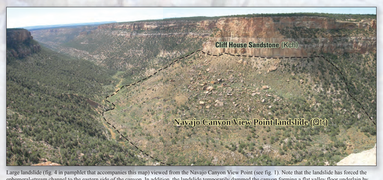
$^{40}Ar/^{39}Ar$ 2.65±0.08 Ma — **Sample location**—Location of $^{40}Ar/^{39}Ar$ sample with age

Mesa Verde National Park boundary

View of Cliff Palace (Courtesy of the National Park Service)

Cliff Palace. Photograph taken May 31, 2006

Cliff Palace c. 1890–1900 Thomas McKee Collection (Courtesy of the National Park Service)



Large landslide (fig. 4 in pamphlet that accompanies this map) viewed from the Navajo Canyon View Point (see fig. 1). Note that the landslide has forced the ephemeral-stream channel to the eastern side of the canyon. In addition, the landslide temporarily dammed the canyon forming a flat valley floor underlain by alluvium upstream (beyond the photo, to the right). Photograph taken Aug. 28, 2005.

Far View House (Courtesy of the National Park Service)

Index map showing Mesa Verde National Park in green, and the U.S. Geological Survey 7.5-minute quadrangles.

CONVERSION FACTORS

Multiply	By	To obtain
inch (in.)	2.54	centimeter (cm)
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
ton	0.9072	metric ton
centimeter (cm)	0.3937	inches (in.)
meter (m)	3.281	feet (ft)
kilometer (km)	0.6214	miles (mi)
metric ton	1.102	tons

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:
°F=(1.8 × °C)+32

Temperature in degrees Fahrenheit (°F) may be converted to degrees Celsius (°C) as follows:
°C=(°F−32)/1.8

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Wildlife photographs credited to the National Park Service are available at: http://www.nps.gov/mesa/naturescience/animals.htm
Cultural photographs credited to the National Park Service are available at: http://www.nps.gov/mesa/photosmultimedia/cultural_sites.htm
All other images taken by the author in Mesa Verde National Park

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