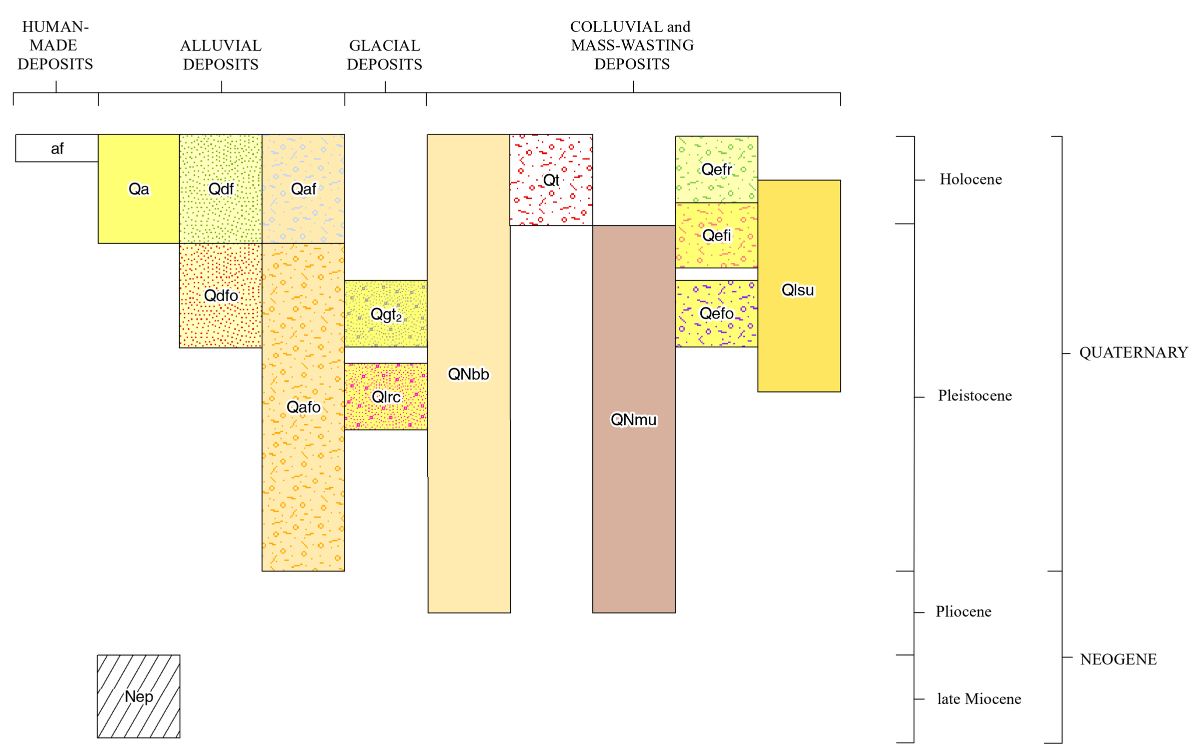
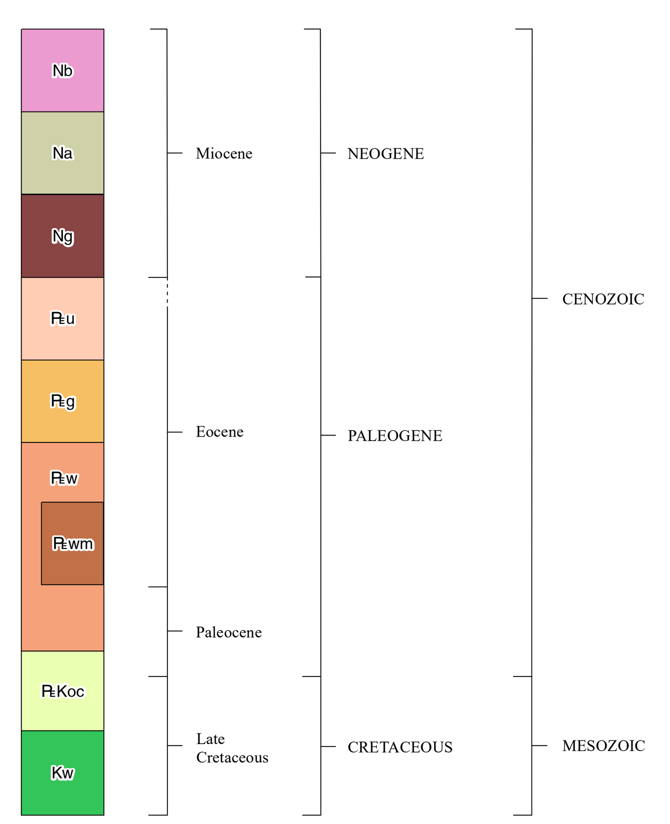
CORRELATION OF MAP UNITS

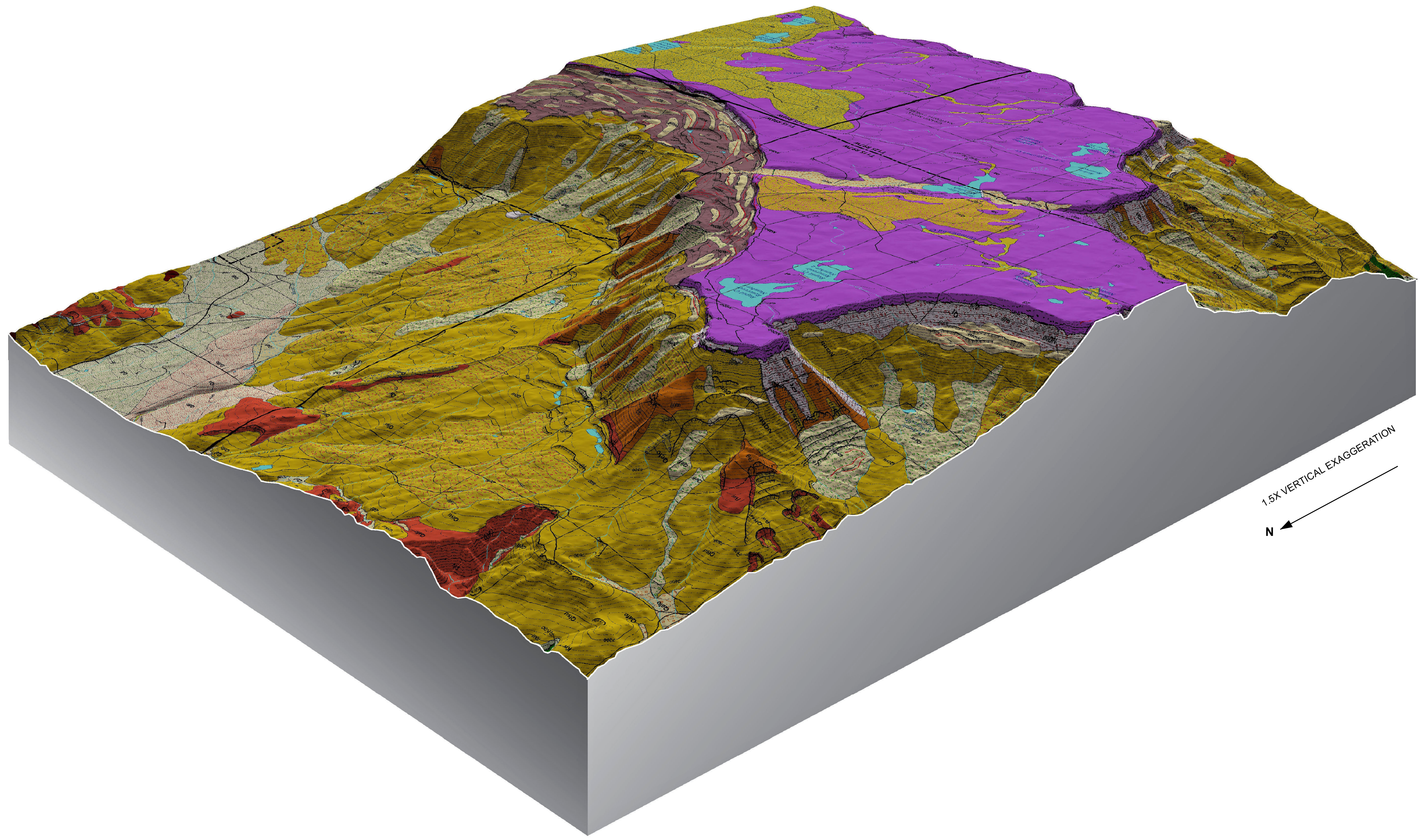
SURFICIAL DEPOSITS



BEDROCK UNITS



3-D OBLIQUE VIEW



PHYSIOGRAPHIC AND GEOLOGIC SETTING

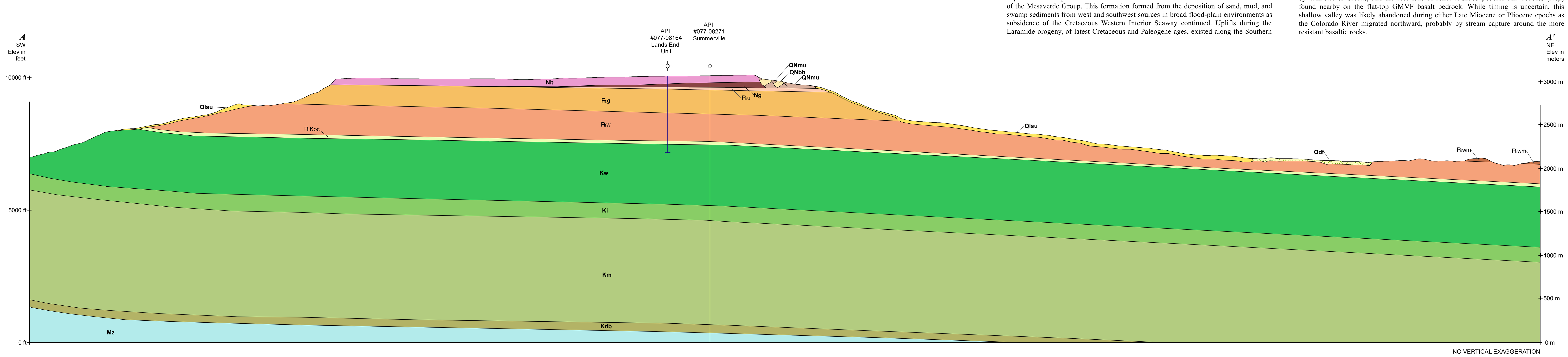
The Lands End quadrangle lies in Mesa County, Colorado, approximately 17 mi (27.4 km) east of Grand Junction. The map area is characterized by a high mesa formed by the Miocene eruption of the Grand Mesa Volcanic Field (GMVF), epeirogenic uplift, and topographic inversion. Lava flows of the GMVF formed two westward lobes, now divided by the Kannah Creek Basin. The Lands End quadrangle includes almost the entire northern Palisade Lobe. Grand Mesa rises a mile (1.6 km) in elevation above Grand Junction and is a major physiographic landmark of western Colorado. In the map area, the annual precipitation ranges from 36 inches (91 cm) on Grand Mesa where alpine forest is predominant, to 16 inches (41 cm) at the lowermost flank of the map area where semi-arid oak brush and pinyon-juniper woodlands occur. Powderhorn Mountain Resort ski area is located on the north flank of Grand Mesa on National Forest Service land.

The highest elevation of Lands End quadrangle is 10,398 ft (3,169 m) at the northeast corner of the basalt rim on a low ridgeline of Bull Lake (?) glacial till. The lowest is 6,326 ft (1,928 m) on the floor of Mesa Creek where it flows north, exiting the map boundary. The GMVF surface elevation in the map area averages about 10,000 ft (3,048 m) AMSL and covers 21.5 sq mi (55 sq km), or 37% of the map area. Mapped surficial mass-movement and landslide deposits on the flank of Grand Mesa cover 29.8 sq mi (77.2 sq km), which accounts for the majority of the map area - 51.4%. The remaining 11.6% of the map area was mapped with other unconsolidated surficial units and exposed Paleogene bedrock. The geology of the Lands End quadrangle was previously mapped at 1:100,000 scale by Ellis and Gabaldo (1989). Landsliding is ubiquitous to the flanks of Grand Mesa and were previously mapped by Yeend (1969), Baum and Odom (1996), and Carrera (2000).

The Cenozoic evolution of western Colorado is recorded in the terrestrial formations exposed in the map area. The basal unit is the Late Cretaceous Williams Fork Formation of the Mesaverde Group. This formation formed from the deposition of sand, mud, and swamp sediments from west and southwest sources in broad flood-plain environments as subsidence of the Cretaceous Western Interior Seaway continued. Uplifts during the Laramide orogeny, of latest Cretaceous and Paleogene ages, existed along the Southern Rocky Mountain orogenic belt in Central Colorado. The resultant erosion shed thick packages of clastic sediments to the west that would become the Paleogene Wasatch Formation. The differentiation of closed, intermontane Paleogene basins formed large fresh-water lakes. Lacustrine sediments and the episodic filling of these basins with stream alluvium would become the Paleogene Green River and Uinta formations (Franczyk and others, 1992). Eventual integration and establishment of the westward drainage network of the paleo Colorado River Basin occurred on a topographically subdued Late Miocene ground surface. The eruption of Neogene volcanic rocks on this surface, broad epeirogenic Neogene uplift of the Colorado Plateau, and later Neogene and early Quaternary river incision by the Colorado River and its tributaries caused several thousand feet of regional topographic lowering, possible erosion-isostatic rebound, and topographic inversion of the more resistant GMVF basalt to form Grand Mesa. Later Quaternary events include the Pleistocene glacial epochs, and mass wasting of the flanks of Grand Mesa that continues today.

The GMVF is important in the ongoing understanding of the timing of Neogene river incision and tectonic uplift rates for the establishment of the Upper Colorado River Basin within the Colorado Plateau Province (Aslan and others, 2008; Aslan and others, 2010). Supporting this understanding is the radiometric dating of the GMVF, thereby becoming a baseline for a 10 Ma paleo-topographic surface. The presence of ancestral Colorado River gravel found directly below the basalt flows at the Palisade Lobe rim (Aslan and others, 2012) and detrital sanidine dating results (A. Aslan, written communication, 2018) helps constrain the Miocene establishment of the westward flow of the paleo Colorado River drainage network. Shortly after the GMVF eruptions ceased (youngest date is 9.63 Ma (Cole and others, 2017)) an ancestral Middle Miocene river briefly flowed across the GMVF at the Palisade Lobe. The evidence is the now-abandoned valley across the mesa top that shallowly cut into the basalt bedrock (currently occupied by Whitewater Creek), and the locations of relict rounded pebbles and cobbles (Nep) found nearby on the flat-top GMVF basalt bedrock. While timing is uncertain, this shallow valley was likely abandoned during either Late Miocene or Pliocene epochs as the Colorado River migrated northward, probably by stream capture around the more resistant basaltic rocks.

CROSS SECTION A-A'



WATER RESOURCES, MINERAL RESOURCES, AND GEOLOGIC HAZARDS

The Lands End quadrangle includes the Palisade Lobe of Grand Mesa. The upper watersheds along its high-elevation flanks are important water resources for local communities and irrigated agricultural lands to the west. The mesa-top reservoirs and Whitewater, Cottonwood, Rapid, and Kannah creek watersheds provide irrigation water and vital drinking water supplies to the Town of Palisade and City of Grand Junction. In the broad Mesa Creek valley to the north, the many water wells for both human and livestock consumption produce water from the thick unconsolidated surficial deposits that extend upwards to the higher-elevation areas where seasonal snowmelt infiltrates and recharges the aquifers. The underlying rock formations are not appreciable water producers.

Potential oil and gas, coal and coalbed methane, and stone quarrying may be potential mineral resources on the Lands End quadrangle. Sizable coal resources occur within the underlying Mesa Verde Group formations and many historic coal mines encircle Grand Mesa at lower elevations, near where the Rollins Sandstone is exposed. Within the Mancos Shale, the Niobrara Member may also have oil and gas potential. Aggregate resources are limited by the percentages of clay and silt that exists, even within clast-supported debris-flow deposits. Opportunities may exist for the quarrying of lichen-covered landscaping stone from the many basaltic boulder fields in the map area.

Potential geologic hazards in the map area are primarily the risks of ground movements. Landslides are ubiquitous to almost all areas of the map area below the GMVF rim. Except for private lands along State Highway 65 and the ski area, most land within mapped landslide areas is vacant, either public lands or private ranch land. Areas of mapped landslides and earthflows should be considered susceptible to future ground movements. Careful geological and geotechnical investigations should be completed for any site within mapped landslide areas if there are land-use changes and occupied structures are planned. Those investigations would also be warranted for prospective buyers of real estate within mapped landslides, especially if existing residential structures are included. Earth flows and debris-flow/flash flooding can have long runouts so careful planning and siting of structures is also important in the vicinity of creek floors and drainage swales. This map only shows existing landslides and earthflows, and does not reflect future risk or re-occurrence intervals. Future landsliding could occur in any susceptible area along the flanks of Grand Mesa. Those ground movements can range from slow near-imperceptible creep to dangerous, potentially catastrophic, very high velocity, rock avalanche-type earthflows.

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GEOLOGIC MAP OF THE LANDS END QUADRANGLE, MESA COUNTY, COLORADO
CORRELATION OF MAP UNITS, 3-D OBLIQUE VIEW, GEOLOGIC SETTING, AND CROSS SECTION

By Jonathan L. White and Martin J. Palkovic
2018

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