DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS INVESTIGATIONS SERIES
MAP I-1407

CORRELATION OF MAP UNITS

Qa Qe Qlo Qae		Holocene to Pleistocene	QUATERNARY
UNCONFORMITY			
Tbp		Miocene	TERTIARY
UNCONFORMITY			
Tb		Oligocene	TERTIARY
UNCONFORMITY			
Kmv Kmd Kmm Kmm		Upper Cretaceous	CRETACEOUS
UNCONFORMITY			
Kmm Kmm Kmm		Lower Cretaceous	CRETACEOUS
UNCONFORMITY			
Jsm Jsm		Upper Jurassic	JURASSIC
UNCONFORMITY			
Jsc Jsc		Middle Jurassic	JURASSIC
Jn Jn		Upper Jurassic and Upper Triassic	JURASSIC and TRIASSIC
UNCONFORMITY			
TRc TRcg		Upper Triassic	TRIASSIC
Lower Triassic			TRIASSIC
Pp Ppw Ppc Ppl		Permian	PERMIAN
PROBABLE UNCONFORMITY			
Pmu Pmu Pmc Pmc		Middle Pennsylvanian	PENNSYLVANIAN
Lower Pennsylvanian			PENNSYLVANIAN
Upper Mississippian			MISSISSIPPIAN
POSSIBLE UNCONFORMITY			
Mm Mm		Lower Mississippian	MISSISSIPPIAN
UNCONFORMITY			
OCg / INTRUSIVE CONTACT		Lower Ordovician or Upper Cambrian	OROVICIAN OR CAMBRIAN
UNCONFORMITY			
Cl		Upper Cambrian	CAMBRIAN
ANGULAR UNCONFORMITY			
Yc Yuu			PROTEROZOIC Y

DESCRIPTION OF MAP UNITS

Qa ALLUVIUM (HOLOCENE)—Gravel, sand, and silt, poorly sorted, subangular to rounded, cobbly and bouldery, but well sorted in some river bars. Includes floodplain deposits, islands and bars in river channels, bouldery debris fans and alluvial fans, and silty sandy gravel fills along minor tributaries. Humic zones toward tops of some deposits. Maximum thickness probably a few meters

Qe EOLIAN SAND (HOLOCENE)—Sand, fine- to medium, well-sorted, well-rounded. Mostly patchy, vermiculite dune-like deposits but includes active dunes, especially in the Vermillion Creek-Conway Draw area east of Ladore Canyon. Derived chiefly from Weber Sandstone, Glen Canyon Sandstone, and Browns Park Formation. Locally intermixed with alluvium. Many small patches unmapped. Maximum thickness a few meters

Qlo TALUS AND LANDSLIDE DEPOSITS (HOLOCENE AND PLEISTOCENE)—Talus: accumulations of coarse angular rock fragments below cliffs and steep slopes. Colluvium: heterogeneous mixes of soil (angle)ensing sensed and rock; grades into alluvium. Maximum thickness a few tens of meters

Qae LANDSLIDE DEPOSITS (HOLOCENE AND PLEISTOCENE)—Rock fragments and soil (angle)ensing sensed, very heterogeneous, locally including blocks and (or) slabs of rock many meters long. Grades into colluvium. Maximum thickness several tens of meters

Qoa OLDER ALLUVIUM (PLEISTOCENE)—Gravel and sand, commonly cobbly to bouldery, capping terraces and pediments. Includes some fine-grained deposits in tributary valleys. Maximum thickness probably a few meters. Some valleys contain as many as 5 terrace levels. A deposit in Sec. 12 and 13, T. 9 N., R. 103 W., Moffat County, CO fills an old high-level channel of the Green River. Locally includes unmapped eolian sand. On East Cactus Flat near head of Yampa Canyon includes small hills of bouldery cobble gravel that may be remnants of Bishop Conglomerate. Maximum thickness probably a few meters

Tbp BROWNS PARK FORMATION (MIOCENE)—Sandstone (predominant), white to very light yellowish or greenish gray, calcareous to tuffaceous, fine- to coarse-grained, friable, commonly crossbedded; tuff (abundant), white, very light gray, or very pale green, commonly bentonitic, commonly (predominant), white, slightly sandy, underlying John Weller Mesa and Limestone Hill; conglomerate (see in map area), pink, pebbly to cobbly, locally derived submargular to submounded stones. Top eroded; base very uneven; thickness highly varied—from a wedge edge to 290 m in Sec. 30, T. 9 N., R. 101 W., Moffat County, CO (S. J. Luft, U.S. Geological Survey, written commun., 1980)

Tb BISHOP CONGLOMERATE (OLIGOCENE)—Conglomerate and coarse stony sandstone, very light gray to pinkish gray to tan, very poorly sorted, loosely cemented, pebbly to cobbly to bouldery. Locally derived stream, submargular to submounded, chiefly from Paleozoic limestones and Proterozoic Uinta Mountain Group. Pebble-size rock clast common. Many boulders exceed a meter across, some >2 m. Contains light-gray hornblende tuff on Diamond Mountain, Yampa Plateau, and along Mud Springs Draw south of Round Top Mountain. Caps mesas and fills old valleys. Thickness highly varied, from a wedge edge to perhaps 150 m on Diamond Mountain and 60 m along Harpers Corner road and on Klauson Pasture near head of Yampa Canyon

Kmv MANCOS SHALE (UPPER AND LOWER CRETACEOUS)
Main body (Upper Cretaceous)—Shale, dark gray, silty to clayey, generally calcareous, expansive, marine; weathers light gray to light yellow. Subordinate siltstone, sandstone (in upper half) and layered bentonite (in lower half). A zone of large calcareous concretions (septarian) in middle part. Thickness about 1,500 m in Sweetwater County, Wyo., complete in map area but as thick as 1,500 m in adjacent areas (Walton, 1944; Thomas and others, 1945; Kinney, 1955; Dyni, 1968)

Kmf Frontier Sandstone Member (Upper Cretaceous)—Upper part: Sandstone, light-brown to light greenish gray, thin-bedded to massive, calcareous, locally crossbedded, ripplemarked; marine fossils, coal. In westerly area contains thin beds of shale. Lower part: Shale, dark gray, silty, locally sandy, calcareous, dark gray, weathers light yellowish gray, calcareous, silty, fossiliferous. Upper part forms hogbacks and ledges; lower part forms slopes and saddles. Near Dinosaur Quarry, upper part is 44 m thick and lower part is 26 m. (Ahrnsbrak and Ostermann, 1968); near Dowbridge Park upper part is 26 m thick and lower part is 40 m

Kmv Mowry Shale Member (Lower Cretaceous)—Shale, dark-gray, hard, siliceous, flaky, abundant fish scales; weathers silvery gray. Beds of bentonite. Forms slopes and strike valleys. Thickness about 33–55 m in western part of area, 33 m in eastern part

Kdf DAKOTA SANDSTONE (LOWER CRETACEOUS)—Sandstone, light-gray to light-yellow, medium- to coarse-grained, pebbly, crossbedded, ripplemarked, fluvialic; subordinate chert-pebble conglomerate and dark-gray shale. Forms hogbacks and dipslopes. Thickness highly varied, 12–30 m

Kcm CEDAR MOUNTAIN FORMATION (LOWER CRETACEOUS) AND MORRISON FORMATION (UPPER JURASSIC), UNDIFFERENTIATED—Claystone and siltstone, variegated red, lavender, gray, green, and yellow, and interbedded fine- to coarse-grained gray lenticular fluvialic sandstone. Lavender rims are prevalent in the Cedar Mountain Formation; the discontinuous but distinctive chert-pebble Buckhorn Conglomerate Member marks its base. Nonmarine. The Morrison Formation also contains lenticular fluvialic conglomeratic sandstone, including the renowned dinosaur-bearing beds at the fossil quarry, and bluish-water limestone. Lower beds of the Morrison are shaly except for a 6- to 15-m thick sandstone (correlated with Windy Hill Member of the Sundance Formation of Wyoming by Imlay, 1968). Claystone, siltstone, and shale are regarded as overbank floodplain deposits. Unit forms dry and in slide prone. Cedar Mountain Formation is 30–60 m thick at the quarry area and Morrison Formation is about 260 m

Jsr STUMP FORMATION
Redwater Member (Upper Jurassic)—Siltstone and shale, light-green to olive-green, soft, fissile, glauconitic, marine, sparse interbeds of tan, lenticular, or greenish gray crossbedded glauconitic rotlitic fossiliferous marine limestone and sandstone. Forms slopes. Thins from about 60 m in western part of Monument to 22–27 m in eastern part.

Jsc STUMP FORMATION
Carmel Member (Upper Jurassic)—Limestone, light-gray, sandy, oolitic, fossiliferous, marine. Forms ledges. Thins from about 15–30 m in westernmost part of area to 7 m at Dinosaur Park

Jn ENTRADA SANDSTONE (MIDDLE JURASSIC)—Sandstone, mostly pink but in some places yellowish gray, fine- to medium-grained, thick-bedded, cross-bedded, eolian. Forms cliffs. Thins uncertainly eastward from 90 m or more to 0 in Sec. 30, T. 9 N., R. 101 W., Moffat County, CO (S. J. Luft, U.S. Geological Survey, written commun., 1980)

Jcm CARMEL FORMATION (MIDDLE JURASSIC)—Shale, siltstone, and mudstone, dark-red, sandy, marine; some fine- to medium-grained sandstone; a few thin beds of marine limestone. Forms slopes and saddles. About 30–40 m thick in western part of Monument but pinches out eastward and is nonexistent at Dinosaur Park

J'sg GLEN CANYON SANDSTONE (LOWER JURASSIC AND UPPER TRIASSIC)—Sandstone, mostly pink but lighter gray to grayish yellow in some areas, mostly fine-grained. Large-scale eolian crossbedding predominant, but flat bedding increases toward base. Eolian sands deposited by winds that blew from north and northeast (Poole, 1961). Includes some fluvialic sandstone and conglomerate in Red Canyon Member of Chinle Formation of adjacent areas and partly equivalent to Navajo Sandstone. Thickness about 180–200 m

Trc CHINLE FORMATION (UPPER TRIASSIC)
Main body—Siltstone, shale, sandstone, and conglomerate, variicolored red (predominant) and gray, fluviatile; locustrine or paludal ochreous mantstone, sandstone, and conglomerate 10–25 m above base correlate with the Gartra Grit Member of the Chugwater Formation. Forms slopes. About 90 m thick.

Trcg Gartra Member—Sandstone, pale yellowish gray to tan to pink, coarse-grained to conglomeratic, generally thickbedded, crossbedded, fluviatile; subordinate chert-pebble conglomerate and variicolored siltstone. Forms cliffs, benches, and ledges. Maximum thickness about 30 m, but member is nonexistent locally.

Trm MOENKOPI FORMATION (LOWER TRIASSIC)—Siltstone and shale, variicolored red (predominant) to green and gray; reddish brown to chocolate-colored interbeds, overall color being moderate reddish orange; gypiferous toward base and in middle section; ripplemarks. Shoreward member, possibly a tidal-flat deposit. Forms slopes, but sandstone beds near middle form ledges or low cliffs. Ranges in thickness from 240 m at Split Mountain to 171 m at Disappointment Creek

Pp PARK CITY FORMATION (PERMIAN)—Undivided in some areas of poor exposure. Marine.

Ppw Upper unit—Limestone, siltstone, sandstone, and dolomite, mostly nonresistant, light-gray; light-yellowish-gray to pale-yellowish-brown, fossiliferous, thin-bedded, ripplemarked, partly phosphatic; contains phosphatic dolomite pebble conglomerate 5–10 m below top (Schell and Vuchetich, 1969). Considered by Schell and Vuchetich with upper part of Franson Member of Park City Formation. Forms slopes. About 30–21 m thick.

Ppl Lower unit—Sandstone, dolomite, and limestone, light grayish brown, cherty (light gray), locally phosphatic, unevenly bedded, locally fossiliferous, marine. Resistant, forms long dipslopes and caprocks on cliffs. In places contains a persistent crossbedded unit underlying Weber Sandstone; in other places contact is gradational. Considered by Schell and Vuchetich (1969) with the lower part of the Franson Member and with the Meade Peak Phosphatic Shale Member of the Phosphoria Formation. About 30–21 m thick.

Ppc WEBER SANDSTONE (MIDDLE PENNSYLVANIAN)—Sandstone, light gray to light yellowish gray, mostly fine to very fine grained, very thickly bedded. Large-scale eolian crossbeds separated by diastems; eolian sands deposited by winds that blew chiefly from the north (Peterson, 1978). Forms massive ledges (Wallpaper) Formations reported near the top of the formation in Split Mountain area (Bissell, 1964; Bissell and Childs, 1958). Rugged outcrops; the most massive ledges in the Monument. Thickness about 300 m at Split Mountain and about 150 m thick at Morris Ranch (Bissell and Childs, 1958); 290 m at Sand Canyon (Fryberger, 1979), and 300 m at Hells Canyon (Bissell and Childs, 1958); at Deadman Park in 281 m according to Bissell and Childs but 457 m according to Fryberger

Pmu MORGAN FORMATION (MIDDLE PENNSYLVANIAN)
Upper member—Sandstone (predominant) red, fine-grained, crossbedded to planar bedded to massive, well-cemented, and limestone, gray to pale-brownish, cherty, platy, thin-bedded to massive. Chert is pale to dark red. Locally some sandstone is gray and Weber-like. Individual beds <1 m to several meters thick. Total thickness about 175 m in Sec. 12, T. 9 N., R. 103 W., and at east end of Yampa Canyon, but lower contact is generally poorly exposed and is indefinite where well exposed

Pmc Lower member—Shale and siltstone, light-gray (predominant), red, and green, and interbedded gray sandstone and gray to lavender fossiliferous limestone. Forms slopes and is commonly marked with colluvium; slide prone. About 60 m thick at Split Mountain and 90 m at Hells Canyon and head of Yampa Canyon, but contacts are generally poorly exposed

Pmc ROUND VALLEY LIMESTONE (LOWER PENNSYLVANIAN)—Limestone, light-gray to pale-brownish, fine-grained, thick-bedded, cherty, fossiliferous, marine, and thin partings of gray to pale-brownish, fine-grained sandstone and irregular masses, occasionally replacing fossils. Forms cliffs, ledges, and long dipslopes. About 60–95 m thick in Split Mountain area, 100 m at Hells Canyon, and 120 m at head of Yampa Canyon, but contacts are generally poorly exposed

Mdh DOUGHNUT SHALE AND HUMBUG FORMATION (UPPER MISSISSIPPIAN)
Doughnut Shale—Shale, dark-gray clayey (predominant) and red toward base. Largely marine, but contains nonmarine limestone in Sec. 8, T. 9 N., R. 103 W., Moffat County, CO. Forms slopes.

Mm Humbug Formation—Sandstone, light-gray to red, fine-grained to very fine grained, interbedded with light-gray marine limestone and red to black shale. Hematitic sandstone at top at Iron Mine Ridge; mustard-colored sandstone at top in Bear Valley area. Forms ledge slopes, but locally makes good cliff exposures near Bowers Draw in Yampa Canyon. Combined thickness of Doughnut and Humbug is about 75–90 m

OCg LODORE FORMATION (LOWER ORDOVICIAN? AND MIDDLE CAMBRIAN)—Quartzose, light-gray to dark-gray to tan, fine- to medium-grained, thick-bedded quartzite and subordinate dark-gray chert; locally silicic-pebble, sparsely fossiliferous, marine. Forms massive cliffs, ledge toward top, and dipslope. Thickness about 180–200 m thick

Cl DRUE LOWER ORDOVICIAN OR UPPER CAMBRIAN)—Lecelite, medium dark gray, slightly brownish, spherically, slightly microporphyritic (<3 percent phenocrysts of potash feldspar about 1 mm long). Ground mass crowded with disseminated hematite, rutile, and anatase (George A. Desborough, U.S. Geological Survey, written commun., 1979). Thin amygdaloidal zones parallel to walls; highly sheared borders. Very fine grained black dikelets in Lodore Canyon. Dike 30 m thick at Lodore Canyon, 15 m thick at Deerlodge Park, and 6 m thick at Echo Park Creek. Emplaced at a depth of about 1,200 m, the restored thickness of strata above the dike at the time of its emplacement. The only known dike in Dinosaur National Monument. Maximum measured thickness 23 m

Cl LODORE FORMATION (UPPER CAMBRIAN)—Ls Lodore and Whitepost Canyons. At the top, sandstone, light-brown to greenish-gray, ledge-forming, as much as 15 m thick, underlain by pink to tan to greenish gray glauconitic fossiliferous (mostly brachiopods) dolomite-forming shale interbedded with ten to pale-green, ledge-forming glauconitic marine sandstone. As much as 90 m thick. Below the shaly unit a variegated pink to gray to green, ledge-forming, fine-grained sandstone and subordinate shale about 30 m thick. The basal unit, which is about 60 m thick, The basal contact is very uneven, and in Whitepost Canyon base like masses (load casts) extend into the Uinta Mountain Group protrude up into the formation. Total thickness of formation in Lodore and Whitepost Canyons is as much as 180 m. Elsewhere the upper shaly unit has been wholly or partly removed by pre-Mississippian erosion and the thickness of the formation varies accordingly. Minimum thickness probably is about 60 m (Hansen, 1965)

Yu UINTA MOUNTAIN GROUP (PROTEROZOIC Y)—The exposed thickness of the Uinta Mountain Group in the Lodore Canyon area is about 2700 m, but the base is unexposed. Thickest section including the base are exposed on the northeast flank of the Uinta Mountains north of Dinosaur National Monument (Fahrner, 1965, p. 33).

Yus Sandstone—Light to dark red, coarse to medium grained, pebbly, quartzitic, crossbedded, fluviatile. Grains subangular to sub-rounded, cemented by quartz overgrowths and (or) hematite. Occasional beds of pebble conglomerate; pebbles, grey to pink quartz and metaquartzite. Occasional beds of red to grey silty shale and (or) siltstone. Forms cliffs and ledges. About 1,500 m thick.

Yus Shale (predominant) and sandstone—Shale, gray, pale olive green, and red, very poorly bedded with micaceous bedding planes, and (in) siltstone, interbedded with fine- to coarse-grained red sandstone. At several horizons in the Uinta Mountain Group. Forms slopes. Shale sampled in the NE¼ Sec. 6, T. 7 N., R. 100 W. about 2.4 km south of Gaynesville, Colo. has a radiometric age of 1,090 ± 50 m.y. (Whole-rock rubidium-strontium age determined by Semthokubo Chanthorn, Kansas State University, written commun., 1980)

CONTACT

FAULT—Dashed where approximately located; dotted where concealed; quarried where doubtful
High angle—Shooting dip; ball and bar on downthrown side
Low angle (reverse)—Sawteeth on upper plate

FOLD AXES—Showing trace of axial plane. Dashed where approximately located; dotted where concealed
Anticline—Showing direction of plunge
Asymmetrical anticline—Shorter limb indicates steeper limb
Syncline—Showing direction of plunge
Asymmetrical syncline—Shorter arrow indicates steeper limb
Anticlinal bend of monocline
Synclinal bend of monocline

STRIKE AND DIP OF BEDS
Inclined
Vertical
Overturned
Horizontal

TRACES OF MASTER JOINTS

EROSIONAL SCARP—An terrace margin separating alluvial deposits at different levels

Dinosaur National Monument boundary

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Geology compiled by Wallace R. Hansen, 1980, from 1:24,000 scale Geologic Quadrangle Maps listed in selected references, with minor modifications by the author and Paul E. Carrara based on field sections in the Tiny Mountain quadrangle, Utah—Colorado; Canyon of Ladore North, Jack Springs, Greystone, and Limestone Hill quadrangles, Colorado

Base from U.S. Geological Survey, Moffat County, Colorado, 1:50,000, 1975; Jones Hole, Dyers Reservoir, Utah—Colorado, 1:24,000, 1950, Island Park, Split Mountain, Utah, 1:24,000, 1950; Dinosaur Quarry, Utah, 1:24,000, 1965

SCALE 1:50 000
1 ½ 0 1 2 3 MILES
1 0 1 2 3 KILOMETERS
CONTOUR INTERVAL 40 AND 80 FEET
DOTTED LINES REPRESENT 20-FOOT CONTOURS
DOTTED LINES CROSSING WARD REPRESENT 5-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

GEOLOGIC MAP OF DINOSAUR NATIONAL MONUMENT AND VICINITY, UTAH AND COLORADO

By

Wallace R. Hansen, Peter D. Rowley, and Paul E. Carrara

1983

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