DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

Preliminary geologic map of the Mount Baird quadrangle, Bonneville County, Idaho, and Teton and Lincoln Counties, Wyoming

by

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This map is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards (and stratigraphic nomenclature).

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DESCRIPTION[1] OF MAP UNITS

af ARTIFICIAL FILL--Rock and soil placed by road-building machinery; up to 25 m thick

Qgt TORRENTIAL GRAVEL (HOLOCENE)--Narrow recent deposits of angular pebbles to boulders that stand 1-2 m above other channel deposits in Hell's Hole; downvalley end of deposit is lobate in plan; deposit includes the coarsest part of debris flows from which fines have been washed away; thickness 0-3 m

Qal ALLUVIUM (HOLOCENE)--Stratified silt, sand, and gravel; rounded cobbles are common in main stream bottomlands; includes low terraces above main streams; deposits of intermittent streams draining Tertiary bedrock areas are mainly pebbly sand and silt; as much as 6 m thick

Qc COLLUVIUM (HOLOCENE)--Unsorted clay- to boulder-sized fragments derived from underlying and upslope rock layers; not bedded; commonly on slopes 20^{o}-45^{o}; upper 10-20 cm silt to silt loam, of this, the upper 1-3 cm is brownish gray carbon-enriched humic silt; mostly 0-3 m, but as much as 8 m thick. Near the southeastern edge of the quadrangle the unit includes eolian and sheetwash silt, too poorly exposed to map, but conspicuously exposed in cuts of Highway 26 and along the eastern shore of Palisades Reservoir. The deposit is massive, medium brown to dark yellowish brown, firm silt and silty very fine sand; stands in vertical cuts; thickness 0.5-6 m

Qt TALUS (HOLOCENE)--Steeply sloping (30^{o}-40^{o}) deposits of loose blocks or slabs, cobble to boulder size, of chiefly one rock formation that have fallen from limestone, dolomite, or quartzite cliffs; as much as 20 m thick

Qpr PROTALUS RAMPART DEPOSITS (HOLOCENE)--Chiefly angular, boulder-size debris forming a sinuous ridge parallel to cliffs and below talus deposits but separated from them by a trough 2-5 m deep; deposits stand 2-7 m above cirque floors and valleys that exceed about 2500 m (8200 ft) elevation; may form at foot of snowbanks below north- and east-facing cirque walls during intervals of cool climate. Differs from talus by its form and from glacial till by its lack of fines; thickness 2-6 m

Qls LANDSLIDE DEPOSITS (HOLOCENE)--Mixed soil and unsorted rock fragments emplaced by downslope sliding; includes rockfalls, mudflows, debris flows, and slumps; finer deposits have a hummocky surface and local sag ponds; as much as 10 m thick

Qfa FAN ALLUVIUM (HOLOCENE)--Crudely bedded sand, silt, and gravel; finer downslope; larger fans contain subangular boulders of limestone, dolomite, or quartzite; includes debris flow deposits; steep fans grade upslope into talus; as much as 10 m thick

Qrg ROCK GLACIER DEPOSITS (HOLOCENE)--Lobate deposits of angular blocky fragments, cobble to boulder in size; sparse silt matrix in lower part; in cirques; nourished by talus; steep fronts 3-8 m high facing downvalley; concentric ridges on surface; boulders stand on surface in bold relief; deposits in north- and east-facing cirques in Blowout, Dry, and Garden Canyons, some may have ice core that facilitates downslope creep of the deposits; thickness mostly 4-8 m, up to about 20 m

Qra ROCK AVALANCHE DEPOSIT (HOLOCENE?, UPPER PLEISTOCENE?)--Gray and light brown limestone rubble in Blowout Canyon forming a deposit 6 km long by .2 to .8 km wide; coarse angular blocks and slabs in upper canyon, small angular boulders to silt in lower canyon; uncemented openwork gravel at surface. A source of crushed rock. Characteristics of deposits are:

1) upper canyon--several short longitudinal ridges centered on a wide deposit covering floor of a large cirque-like amphitheater; estimated thickness 25-90 m; limestone is segregated into Cambrian and Mississippian in narrow strips that extend downcanyon, marking flowpaths; deposits on north wall are 60 m above canyon floor; 2) midcanyon--rubble piled in wave-like forms, 6-12 m high, which extend across the canyon; 3) lower canyon--central part is hummocky; north edge is a breccia levee, 6-12 m high; on its surface is light yellowish brown thin loamy soil developed in a thin loess or colluvium; deposit ends beyond mouth of canyon on a river terrace (now below water). Here deposit is 5-8 m thick (estimated from aerial photographs taken before reservoir).

The deposit formed by catastrophic collapse of a precipitous headwall of a glacial cirque. West-dipping layers of limestone resting on a west-dipping fault, fell from the mountain, perhaps shaken by an earthquake. The rock shattered violently upon striking the cirque floor, instantly forming a large, highly energetic mass of debris at the head of steeply sloping Blowout Canyon. The mass surged down the canyon as a rock avalanche, initially northward, 120 m up the north wall, then deflected westward before sliding the length of the canyon into the Snake River valley, a distance of 6 km. In the lower canyon, a levee (lateral ridge) on the north edge of the deposit and a hummocky central area suggests collapse of center of deposit during emplacement by dissipation of a basal layer of compressed air (Shreve, 1968). Deposit is at least 200 yrs old based on ages of trees growing on it (Thompson, 1978). However an age of a few 1000 yrs is suggested to us by an immature soil (A horizon 5 cm thick) on the deposit in the lower canyon. A much greater age is not favored because of the youthful appearance of the deposit and the scarce sediment fill in adjoining streams dammed by the deposit. The deposit can not be older than about 15,000 years, the estimated age of a terrace of the Snake River that the deposit rests on. The terrace correlates to one that Walker (1964) assigned to the Pinedale glaciation. Deposit is mostly 10-20 m thick; up to an estimated 100 m locally

Qtb CEMENTED TALUS BRECCIA (HOLOCENE/UPPER PLEISTOCENE)--talus partly cemented by calcite; forms massive deposits immediately below Cambrian limestone cliffs and at the upslope edges of a few large alluvial fans in the canyon of Big Elk Creek; abundant large voids; forms tan-weathering cliffs and pinnacles 20 m high. As much as 20 m exposed, base covered

Qfao OLDER FAN ALLUVIUM (HOLOCENE AND PLEISTOCENE)--Crudely sorted angular diamictite, mostly coarse carbonate boulders near the source; cemented by calcite; veneered by 0.3-1 m of silty colluvium; large boulders of dolomite and limestone protrude from surface; forms moderately steeply sloping deposits 30-120 m above ephemeral streams on northwest wall of Big Elk Canyon. In NW1/4 sec. 9, T. 1 S., R. 46 E., angular pieces of Darby Formation and Lodgepole Limestone 0.25-20 cm in light brown silty calcareous matrix. 4-6 m exposed; base covered; perhaps up to 30 m thick

Qco OLDER COLLUVIUM (HOLOCENE AND PLEISTOCENE)--Like Qc except has a thicker, more mature surficial soil, the deposit is cut through by ravines 4-12 m deep, and the lower part of the deposit is cemented by calcite; occurs mainly on moderately steep canyon walls and in sec. 9, T. 2 S., R. 46 E. on gently sloping bench 60-90 m above Indian Creek and on slopes above and graded to the bench; up to 7 m thick on west slope of Cabin Creek Canyon

Qtg2 TERRACE GRAVEL (HOLOCENE)--Very light gray sandy gravel, light brown matrix; subround cobbles are 85-90 percent medium gray limestone (Mississippian), 10-15 percent tan to white orthoquartzite (Pennsylvanian and Permian), 0.5-1 percent reddish brown sandstone (Triassic). Base is about 5-7 m above stream channel; thin, weakly developed soil on surface; locally veneered with 0.5-3 m of fan and slopewash alluvium from tributary drainages; thickness about 2-4 m

Qtg1 TERRACE GRAVEL (HOLOCENE AND UPPER PLEISTOCENE?)--Subround sandy gravel, same as Qtg2 except surficial soil is moderately developed; base is 5-11 m above channel; thickness about 2-4 m

Qp YOUNGER GLACIAL TILL (PLEISTOCENE, PINEDALE? GLACIATION)--Diamicton, thin, weakly developed surficial soil; occupies center of north-facing cirques or valley floors between 2500 and 2680 m (8200 and 8800 ft); generally downslope from rock glaciers and not as close to talus slopes as is Qpr; gently rolling surface, brown silty matrix chiefly limestone silt and sand grains, subordinate quartz sand; may include "Neoglacial" deposits; 0-2 m thick

Qb OLDER GLACIAL TILL (PLEISTOCENE, BULL LAKE? GLACIATION)--Diamiction, moderately well-developed soil, in headwaters of Blowout Canyon; on intertributary divide about 60 m above stream channel; 1-3 m thick

GRABEN-FILL STRATA (TERTIARY AND LOWER PLEISTOCENE?)

Sedimentary rocks west of the Grand Valley fault, most beds dip 5^{o}-25^{o} east and northeast; some are horizontal or dip gently west; form wooded, rounded foothills. These poorly consolidated rocks are continuous with and closely resemble those in the Alpine, Wyoming area that were assigned to the Teewinot Formation (Merritt, 1956) based on fossils they contain that suggest a Pliocene age (Taylor, 1956; Merritt, 1956). A prism of sediments fills the graben under the Palisades Reservoir, called the Swan Valley graben, and is thickest immediately west of the west-dipping listric normal Grand Valley fault (Royse and others, 1976). Merritt (1956), measured more than 1525 m of Teewinot Formation about 6 km to the south along the Snake River. In the Mount Baird quadrangle, the rocks include five mappable intertonguing units that, excepting the volcanic ash, fine westward from the Grand Valley fault: (1) breccia (QTbx); (2) diamictite (Td); (3) conglomerate with minor siltstone and sandstone (Tc); (4) slide mass (Ts); (5) volcanic ash (Tx)

QTbx BRECCIA--Medium gray, massive to crudely layered; weathers very light gray to grayish orange, includes minor proximal facies of alluvial fans and landslide rubble. Predominantly Cambrian or Mississippian limestone; angular gray limestone pieces 0.1 to 50 cm in grayish brown, 2-10 percent micrite cement; common pebble-size angular voids; individual large pieces 0.5-4 m across weather out of deposit and are so pervasively fractured and recemented that bedding and fossils are mostly destroyed; but sparse, poorly preserved pieces of horn coral and brachiopod (?) shells occur, blocks are laced with fine network of microfractures filled with white calcite; unit forms resistant layers 3-7 m thick; occurs west of the Grand Valley fault, north of the North Fork of Indian Creek; bound on the east by layered Paleozoic rocks of the range, intertongues westward with conglomerate, diamictite, and slide masses. In the lower 30 m of the deposit at Indian Creek, the rock resembles sheared Cambrian limestone, and above, sheared Mississippian limestone. Thickness unknown. May occur discontinuously beneath the surface along the Grand Valley fault; about 500 m exposed at Indian Creek

Td DIAMICTITE--Brownish-gray to light brown, crudely stratified to massive, contains angular to subangular clasts with some subrounded clasts of gray limestone with brown "silty" layers and inclusions, and light brown to white orthoquartzite, all Paleozoic rock types; boulders to 0.75-1 m common; yellow-brown silty and sandy matrix cemented by microcrystalline calcite; chiefly proximal facies of alluvial fan; may include debris flows, older colluvium and other mass-wasting deposits; thickness 0-150 m

Tc CONGLOMERATE--Light brown, thick-bedded to massive sandy; mainly subrounded pebbles and cobbles of gray limestone, light gray dolomite, and pinkish-gray quartzite derived from Paleozoic formations; proportions vary; near the southern edge of the quadrangle unit includes less than 1 percent round cobbles of a light gray porphyry (diorite?) that increases southward to 2-4 percent of clasts 2 km into the Alpine quadrangle. A possible source for these is a diorite stock 13-14 km east at Indian Peak in the Observation Peak quadrangle (Oriel and Moore, 1985); unit locally cemented into resistant layers by sandy to silty micrite; west of Highway 26 and towards center of the Grand Valley graben the unit intertongues with pebbly sand, sand, and silt layers (not mapped, poorly exposed); conglomerate is channel facies of alluvial fans deposited on downdropped side (west) of Grand Valley fault; most voluminous facies of the Tertiary strata; base concealed, but 550 m exposed

Ts SLIDE MASS--Medium gray to medium-dark gray monolithologic limestone breccia forming hard, calcite-cemented and mainly east-dipping layers; profoundly fractured into angular pieces mostly sand to small pebble size, but few are boulder size; layers have been intensely brecciated and subsequently remented by microcrystalline calcite which is 2-15 percent by volume; interlayered with conglomerate of unit Tc; pinches out laterally; interpreted as gravity-slid masses bound by a basal detachment fault (Pierce, 1957) or ancient rockfall avalanche deposits that formed by the process described for the Qra unit; the tabular geometry, cataclastic texture, monolitholgic composition, and similarity of vertical stratigraphy to that of the modern setting at Blowout Canyon argues favorably for the Ts units being ancient analogues of the Qra unit of Blowout Canyon. Thickness 0-40 m

Tx VOLCANIC ASH--White, firm, medium and wavy bedded to thinly laminated; poorly exposed; 98 percent 0.02-0.05 mm glass shards with blocky shards 0.05-0.5 mm, about 1 percent white, very fine silt- to clay-sized material (zeolite ?), 1 percent lithic fragments and accessory minerals, chiefly fine-sand sized pink zircon and water-clear euhedral quartz crystals of the quartzoid type (two rhombohedrons combined, no prism between); bright red 0.1-0.05 mm grains of amorphous mineral, some with black magnetite cores; an airfall ash water-laid in part; sparse cross bedding; alternating gray and tan thick laminae. At a highway 26 roadcut 30 m north of Jack Branch Canyon (SW1/4 NE1/4 SW1/4, sec. 6, T. 2 S., R. 46 E.) is 3-10 m of white ash interbedded with sandy pebble gravel and light brown, poorly sorted sand having cut-and-fill structure, thin beds of silt and clay become more numerous below the ash. An ash sample (DF 4322) from this roadcut was dated at 6.68 ± 0.4 m.y. using fission tracks in zircon (analysis by R. G. Bohannon, 1983)

Ti INTRUSIVE--Two basalt sills intrude Lodgepole Limestone in the north canyon wall of Hell's Hole; lower one is 8 m thick, the upper is 3 m thick; 20 m of limestone separates sills; both pinch out 300 m east of their thickest part; extremely hard, finely crystalline to aphanatic groundmass, with very fine phenocrysts, brownish gray, weathers olive brown to reddish brown spheriodal boulders between vertical joints

TRt THAYNES LIMESTONE (LOWER TRIASSIC)--Olive-gray to medium gray, interbedded finely crystalline to microcrystalline silty limestone and calcareous siltsone; mostly very thin to thin bedded, less commonly massive; weathers dark yellowish brown to dusky yellowish brown, of which the darkest values are a patina resembling desert varnish, an iron- and manganese-enriched rind. Raised burrow-like trace fossils on bedding surfaces. The unit is about 240 m thick where completely exposed in the Observation Peak quadrangle 3 km eastward (Albee, 1973). There the lower one-third (about 80-120 m) is brown-weathering thinnly bedded to laminated ("slabby") silty limestone that forms ledges; the upper two-thirds is brownish yellow-weathering thin- to medium-bedded calcareous siltstone and silty limestone. In the central part of the range, about 28 km northnorthwest of Garden Canyon, the Thaynes is about 300 m thick (Gardner, 1944). On the east edge of the Mount Baird quadrangle only the lower brown-weathering part, 110-120 m thick, is poorly exposed in Garden Canyon in the footwall of the St. John thrust fault

TRw WOODSIDE SHALE (LOWER TRIASSIC)--Pale-reddish-brown to reddish-brown mudstone and calcareous siltstone, light olive gray calcareous siltstone and very fine-grained, well-cemented thin-bedded calcareous sandstone; poorly exposed, forms low slopes; poorly exposed only in Garden Canyon. Three kilometers to the east, where it is better exposed, the unit is more than 90 m thick (Albee, 1973)

₸d DINWOODY FORMATION (LOWER TRIASSIC)--Chiefly medium brownish gray to light olive gray thick-laminated to thin-bedded, microcrystalline silty to argillaceous limestone interbedded with dark greenish-gray calcareous mudstone; weathers grayish-orange; commonly has brownish black wavy very thin laminae; locally forms small ridges of resistant brown-weathering sandy, thick-bedded dolomite where bedding is vertical in isoclinal folds in footwall of the St. John thrust fault; fragments of Lingula, sp. common in some limestone layers; about 120 m thick

PHOSPHORIA FORMATION AND EQUIVALENT UNITS (PERMIAN)

Ppu Upper unit--Includes: Retort Phosphatic Shale Member of the Phosphoria Formation, thin interbedded dark-brownish-gray phosphorite, mudstone, and siltstone; lower tongue of Shedhorn Sandstone, light olive-gray medium to thick-bedded fine-sandstone: quartz- and phosphate-cemented, mature, well-sorted, slightly chert-bearing sublitharenite; burrowed locally, sparse, very fine cracks filled with black organic (?) and phosphatic amorphous material; Rex Chert Member of Phosphoria Formation, dark gray thick-bedded dolomitic chert, containing abundant songe spicules and thin interbeds of slightly phosphatic mudstone and dolomite; Franson Tongue of Park City Formation, light-gray cherty dolomite. About 50 m thick

Ppm Meade Peak Phosphatic Shale Member--Thin beds of phosphorite, siltstone, and mudstone; poorly exposed and forms soil-covered swale; phosphorite is mainly grayish-brown, brownish-gray, or olive-brown medium to fine-grained, pelletoidal, argillaceous in part; siltstone is light brown, yellowish-brown, thin-bedded, phosphatic in part; mudstone is mainly dark gray, black, or brownish-black, soft, phosphatic. About 15 m thick

Ppg GRANDEUR MEMBER OF PARK CITY FORMATION--Light gray, white-weathering medium bedded to massive very finely crystalline (0.1 mm) dolomite; 0.5 percent contains moderate red medium silt-sized grains that oxidize to moderate yellow-brown specks (0.2-0.5 mm); the lower 5-10 m contains interbeds of yellowish-gray medium-grained orthoquartzite that becomes dominant toward the base; unit contains beds of a white, bioclastic quartzitic rock, a sandy coquina of abundant small (3-5 mm) brachipod shells (Lingula ?) replaced by finely crystalline authigenic quartz; micritic corals, foraminiferas, and phosphatic fish scales and teeth (?), common phosphatic pellets and scarce apatite oolites. In the absence of fossil identifications, assignment of these beds to the Park City Formation rather than to the Wells Formation is problematic. Mapped as separate unit where well-exposed, e.g. south of Powder Peak, but included with Wells Formation were poorly exposed, for example, in extreme northeast corner of quadrangle. About 50 m thick

PIPw WELLS FORMATION (PERMIAN AND PENNSYLVANIAN)--Very pale orange, white, yellowish-gray or grayish orange pink fine- to medium-grained well-sorted slightly calcareous quartzitic sandstone; weathers grayish-orange; mostly massive to thick-bedded, but cross-bedded in part; cliff-forming; upper one-fourth is interbedded with light gray, very finely crystalline, white-weathering cherty dolomite and limestone; detrital quartz grains have euhedral quartz overgrowths; about 300 m thick, but probably tectonically thickened along unrecognized thrust faults in southeastern part of quadrangle

PMa AMSDEN FORMATION (LOWER PENNSYLVANIAN AND UPPER MISSISSIPPIAN)--As mapped, includes the main part and the Darwin Sandstone Member of the Amsden formation, and the Bull Ridge Member of the Mission Canyon Limestone, the lower unit of the Wells Formation as mapped by others (Albee, 1973). Heterogeneous unit of light gray sandstone, medium to dark gray limestone, red shale, siltstone and sandstone, carnelian red, mustard yellow and gray chert, and argillaceous limestone solution breccia. About 180 m thick but tectonically thickened, probably along unrecognized faults, north of Dry Canyon and south of Big Elk Creek Canyon. The Darwin Member is 28 m thick in the St. John thrust sheet, North Indian Creek Pass, 3 km east of the quadrangle and is up to 66 m thick locally.

Mm MISSION CANYON LIMESTONE (UPPER AND LOWER MISSISSIPPIAN)--Light to dark gray, brownish-gray massive to thick-bedded cliff-forming cherty limestone and dolomitic limestone; mainly medium- to coarsely crystalline, locally oolitic and microcrystalline; bioclastic but many beds are nonfossiliferous, lower part includes many crinoidal limestone beds and thin beds of finely crystalline dolomitic limestone. The upper half of the unit includes a zone of solution breccia up to 100 m thick near the west edge of the range. Common fossils are corals, crinoid columnals, gastropods, brachiopods, and bryozoans. Fossils collected from an outcrop of oobiomicrite between Garden Canyon and Indian Creek (USGS sample 28691-PC) were identified by W. J. Sando (written commun., October 8, 1982) as follows: VESICULOPHYLLUM sp., SYCHNOELASMA sp., AMPLEXIZAPHRENTIS, sp. (very large species), ROTIPHYLLUM? sp. According to Sando, these corals are representative of Coral Zone II (Sando and Bamber, 1979) which corresponds approximately to the Osagean Series and includes the Woodhurst Member of the Lodgepole Limestone and about the lower two-thirds of the Mission Canyon Limestone. Thickness 240-300 m

Ml LODGEPOLE LIMESTONE (LOWER MISSISSIPPIAN)--Dark gray thin-bedded argillaceous and silty finely crystalline to microcrystalline limestone; mostly nonfossiliferous, but fossiliferous beds are common and include horn corals, high-spired and planispired gastropods, spiriferoid brachiopods, contains some thin beds of brownish-gray finely crystalline carbonaceous limestone. Thickness 180-210 m

Dd DARBY FORMATION (UPPER AND MIDDLE DEVONIAN)--Upper part (about the upper one-fourth, 32 m thick) moderate brown to dusky yellow nonresistant thin-bedded to wavy thickly laminated calcareous siltstone; also thin wavy interbeds of light olive gray silty limestone; many siltstone beds contain abundant green angular small pebbles of siltstone; upper part weathers to pale yellowish orange slopes; lower three-fourths (115 m thick, North Fork Indian Creek Canyon) dark brown to dark gray, medium-bedded, medium crystalline dolomite and interbeds of dark gray finely crystalline limestone and limestone breccia; weathers to pale grayish brown ("chocolate brown") subround fragments having thin, white veinlets throughout; north-facing slopes usually are thickly forested by Lodgepole pine. Uppermost beds may be of Mississippian age. About 140 m thick

Ob BIGHORN DOLOMITE (UPPER ORDOVICIAN)--White to light gray fine- to medium-crystalline massive to thick-bedded dolomite and slightly calcareous dolomite; some beds mottle pink to gray, weathers very light gray; forms prominent very light gray cliffs. Generally nonfossiliferous. 135 to 140 m thick

Ꞓg GALLATIN LIMESTONE (UPPER CAMBRIAN)--Medium gray to medium dark gray fine- to microcrystalline thin- to medium-bedded limestone; sparsely oolitic, many thin irregular "silty" partings, mottles, and burrows that weather to a rust color (grayish orange to dark yellow orange); fossil burrows on thin silty bedding surfaces; some layers contain medium-grained roughly cylindrical calcite crystals with dark reddish brown filling of hematite (?) and common fine indeterminate fossil debris resembling disarticulated thoracic segments of trilobites; few light olive gray interbeds of fissile shale; 50-60 m thick

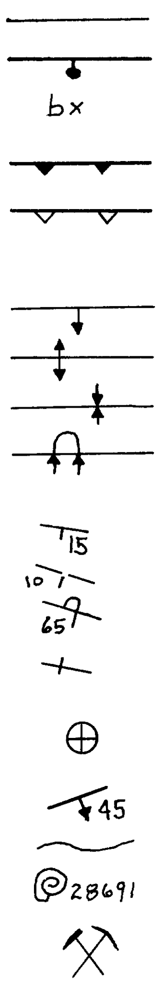
Ꞓgv GROS VENTRE FORMATION (UPPER AND MIDDLE CAMBRIAN)

Ꞓgu Upper Shale member--Light olive gray fissile glauconitic shale; usually weathers to low, colluvial slopes; well-exposed on spur between forks of Indian Creek; interbeds of medium dark gray medium- to thick-bedded finely crystalline slightly oolitic limestone with light brown partings and burrows; many beds of flat-pebble intraformational limestone conglomerate in the lower part of unit. Sharp contact with unit below. Thickness 120 m

Ꞓgd Death Canyon Limestone Member--Bluish to light gray, thin-bedded to massive, cliff-forming limestone having many yellow to orange irregular partings and burrows and patches of calcareous to dolomitic siltstone. Forms prominent cliffs above alluvial fans in the lower canyon of Big Elk Creek. About 150 m thick

Ꞓgl Lower Shale Member--Olive-gray fissile shale and siltstone having common burrow-like trace fossils on bedding surfaces. Thickness 45 m

Contacts and faults --Dashed where inferred or dotted where concealed



Contact

High-angle fault, bar and ball on downthrown side

Breccia, local

Thrust fault, sawteeth on upper plate

Low-angle fault, at base of masses presumed to have slid

Monocline, showing direction of dip of beds

Anticline, showing trace of axial plane

Syncline

Overturned syncline, showing direction of dip of limbs

Strike and dip of beds

- measured*
- estimated in field
- overturned
- vertical
- horizontal

Strike and dip of fault

Crest of levees and depositional ridges in Qra unit

Fossil site, USGS number shown

Gravel pit

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* Note that most bedding attitudes measured on outcrop agree with large-scale bedding attitudes which may be inferred from contacts shown on the map. However, a few do not. This type of variance results from measurements made on small isolated outcrops of beds which were folded on a scale much smaller than the large-scale bedding attitude.

[1] Terminology follows American Geological Institute Guide (1982) except the following:

(1) limestone groundmass crystal size (modified from Williams, Turner, and Gilbert, 1958): coarse >5 mm; medium 1-5 mm; fine 1-0.5 mm; very fine 0.5-microcrystalline; microcrystalline--individual crystals cannot be distinguished with the unaided eye (crystals approximately <0.2 mm)

(2) color: Munsell color system using Rock-color chart, Geological Society of America, 1980

(3) thickness of beds: Ingram (1954). Laminae: thin, 0-0.3 cm; thick, 0.3-1 cm; Bedding: very thin, 1-3 cm; thin, 3-10 cm; medium, 10-30 cm; thick, 30-100 cm; very thick, >100 cm

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CORRELATION OF MAP UNITS