

**U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY**

**PRELIMINARY GEOLOGIC MAP OF THE PALEOZOIC ROCKS IN THE
ARROW CANYON QUADRANGLE, CLARK COUNTY, NEVADA**

By

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

1992

DESCRIPTION OF MAP UNITS

Colors of map units are from the Rock-Color Chart (Rock-Color Chart Committee, 1951)

QT **Quaternary and Tertiary units undivided (Holocene to Tertiary)**--Quaternary deposits, mostly alluvium, colluvium, and landslides, and Tertiary deposits including the Tertiary Muddy Creek and Horse Spring Formations

Bird Spring Formation (Lower Permian, Upper, Middle, and Lower Pennsylvanian, and Upper Mississippian)--Six informal members in descending order, Pb6, Pb5, Pb4, Pb3, Pb2, and Pb1. Incomplete thickness of formation is 1,640 m; top not exposed in quadrangle

Pb6

Sandy limestone member (Lower Permian)--Two parts of member recognized but not mapped. Upper part and thickest part of member consists of limestone and interbedded calcareous sandstone and arenaceous limestone. Limestone is medium gray (fresh), and medium light gray to light olive gray (weathered), aphanic to finely crystalline, and thin to thick bedded. Calcareous sandstone and arenaceous limestone are medium gray to pale red (fresh), and light brown, grayish brown, and dusky yellowish brown (weathered), fine grained, subrounded, moderately well sorted, and thin bedded; upper part contains twelve sandstone beds as thick as 1 m. Common discontinuous layers and nodules of dusky-yellowish-brown-weathering secondary chert. At base of upper part is 15- to 25-m-thick yellowish-gray-weathering, silty, dolomitic limestone. Upper part contains abundant pelmatozoan, bryozoan, brachiopod, and gastropod fragments, and fusulinids. Lower part (about 15- to 20-m-thick) is predominantly massive limestone, medium gray (fresh), and medium light gray to light olive gray (weathered), finely crystalline, thin to thick bedded; less resistant limestone partings are light olive gray and have planar to wavy laminations. Some moderate-yellowish-brown, yellowish-gray, and dusky-yellowish-brown (weathered) arenaceous limestone at the base. Several laterally continuous colonial rugose coral biostromes; coral heads are as great as 0.6 m in diameter; lower part also contains pelmatozoan columnals, bryozoans, brachiopods, and gastropods. Member forms ledgy cliffs that cap underlying less resistant Pb5 member; as much as 500 m of unit exposed in southeast part of quadrangle

Pb5 Red slope-forming member (Lower Permian)--Upper part is cherty, laminated micritic limestone, and lower part is silty mudstone, siltstone, and micritic limestone. Upper limestone, medium dark gray (fresh), grayish orange, moderate yellowish brown, and yellowish gray (weathered), aphanic to finely crystalline, and very thinly laminated. Abundant continuous to discontinuous layers and nodules of dark-gray (fresh) and dusky-yellowish-brown, moderate-brown, to brownish-black (weathered) chert. Common ripple marks and convolute bedding; abundant sponge spicules. Upper part forms ledgy slope. Lower part consists of pale-red, silty, calcareous laminated mudstone and calcareous siltstone, containing thin beds and lenses of medium-dark-gray, finely crystalline limestone that has planar laminations. Distinctive gray limestone concretions 0.5- to 4-cm in diameter are present at the base of member; concretions are commonly cored by fish-bone fragments. Lower part forms slope and is about 12 m thick. Entire member forms pinkish-reddish-brown slope easily identified on aerial photographs and is equivalent to unit d of the Bird Spring Formation, 15 km north of quadrangle in the Meadow Valley Mountains (Pampeyan, 1989). Thickness of member is about 120 m

Pb4 Massive gray limestone member (Lower Permian)-- Predominantly massive limestone, dark gray (fresh), medium dark gray to light olive gray (weathered), finely to coarsely crystalline, thick to very thick bedded. Some discontinuous layers and nodules of dusky-yellowish-brown-weathering chert. About 3 m below the top is a 10-m-thick sequence of flaggy weathering, finely crystalline, very thin bedded, fusulinid-rich limestone that is medium gray (fresh), grayish orange, light brown, moderate brown, and dusky yellowish brown (weathered). Lower contact of member was mapped at the base of a 7-m-thick cherty limestone (commonly consisting of more than 40 percent chert) that is medium gray, medium dark gray to grayish red (fresh), and light gray, pale red, and pinkish gray (weathered), aphanic to finely crystalline, and thin bedded. Member contains abundant fossils including pelmatozoan columnals, *Pseudoschwagerina*, bryozoans, *Syringapora*, *Durhamina*, brachiopods, and planispiral gastropods. Forms massive cliffs and is about 45 m thick

PIPb3 Dolomitic member (Lower Permian and Upper and Middle? Pennsylvanian)--Limestone, dolomitic limestone, and dolomite, medium dark gray, olive gray to light olive gray (fresh), light gray, yellowish gray, light olive gray, moderate yellowish brown, and dusky yellowish brown (weathered), finely crystalline, less commonly medium to coarsely crystalline, and thin to thick bedded. Upper 55 m of member is predominantly light-gray-weathering dolomitic limestone and dolomite that is approximately equivalent to the lower part of Bs_e unit, Bird Spring Group, of Langenheim and others (1962); middle 95 m is approximately equivalent to unit Bs_d, Bird Spring Group, of Langenheim and others (1962); and basal 60 m is approximately equivalent to the uppermost part of Bs_c unit, Bird Spring Group, of Langenheim and others (1962). Fauna includes pelmatozoan columnals, solitary rugose corals, *Syringopora*, fusulinids, brachiopods, and bryozoans. Permian-Pennsylvanian contact estimated to be about 70- 80 m below the top of member; estimate based on fusulinids described by Cassity and Langenheim (1966). Member forms step-like ledges and is about 210 m thick

IPb2 Tungsten Gap member (Middle Pennsylvanian)--Upper 7 m is dolomitic limestone, slightly arenaceous, medium gray (fresh), dusky yellowish brown to moderate brown (weathered), finely crystalline, and thin bedded. Middle 1 m is limestone, light gray to medium light gray (fresh), light olive gray (weathered), medium to coarsely crystalline, containing brachiopod and pelmatozoan fragments; contact between upper and middle parts undulatory due to soft-sediment compaction. Lower 7 m is slightly arenaceous dolomitic limestone, medium gray (fresh), yellowish gray, grayish orange, to moderate yellowish brown (weathered), finely crystalline; beds range from 0.5 to 1.0-m in thickness, and become thinner near top. Member is equivalent to the Tungsten Gap Chert (Castle, 1967; Langenheim and Webster, 1979). Member is within unit Bs_c, Bird Spring Group, of Langenheim and others (1962), forms resistant, rounded cliff about 15 m thick

IPMb1 Basal limestone member (Middle Pennsylvanian to Upper Mississippian)--Limestone, and minor dolomite.
Limestone is medium gray, medium dark gray, and olive gray (fresh), and light gray, yellowish gray, light olive gray, grayish orange to moderate yellowish brown (weathered), commonly arenaceous and bioclastic, finely to coarsely crystalline, thin to thick bedded; some beds contain planar laminations and small-scale trough crossbeds. Abundant discontinuous layers and nodules of dark-gray (fresh) and dusky-yellowish-brown (weathered) chert; some parts of member contain more than 50 percent chert. Dolomite near middle of unit is medium gray (fresh), and yellowish gray to light gray (weathered). Member contains *Syringapora*, solitary rugose corals, brachiopods, and pelmatozoan columnals; *Chaetetes* present about 60 m above base. Member equivalent to most of Bs_c unit, Bird Spring Group, of Langenheim and others (1962). Approximately the basal 14 m of member is reported to be Upper Mississippian (Chesterian) in age based on brachiopods, conodonts, and calcareous foraminifers (Webster, 1969; Brenckle, 1973; Lane and others, 1983). Member forms step-like ledges and is estimated to be 650 m thick

Mis Indian Springs Formation (Upper Mississippian)--Interbedded limestone, shale, and sandstone, described in order of abundance. Limestone is medium gray, grayish red, and moderate yellowish brown to grayish brown (fresh and weathered), fine to coarsely crystalline, and mostly thin bedded; contains *Rhipidomella nevadensis*, spiriferid, and productid brachiopods, solitary rugose corals, pelmatozoan columnals, and fenestrate bryozoans. Shale is dusky red, grayish red purple, grayish orange, and grayish black (fresh and weathered), and laminated. Sandstone in upper part is olive gray to light gray (fresh), and moderate brown, and moderate yellowish brown to dusky yellowish brown (weathered), fine grained, subrounded, and moderately sorted. Beds range from 0.5 to 1.0 m in thickness, and have planar laminations. Member is equivalent to unit Bs_b of the Bird Spring Group (Langenheim and others, 1962) and reported as late Chesterian (Webster, 1969; Brenckle, 1973; Lane and others, 1983). Formation forms slope and is approximately 60 m thick

- Mbw Battleship Wash Formation (Upper Mississippian)--**Consists of limestone and subordinate sandstone. Limestone is slightly arenaceous and bioclastic, medium dark gray (fresh), and light olive gray to purplish gray (weathered), mostly coarsely crystalline, and thin bedded. Basal 1.5 m of formation consists of sandstone and sandy limestone. Sandstone is calcareous, medium light gray (fresh), and grayish orange to olive gray (weathered), fine to medium grained, and thin bedded. Fossils in formation include *Faberophyllum* and other unidentified rugose corals, spiriferid brachiopods, and *Stigmarella* is present on bedding planes near top. Formation is equivalent to Bird Spring Group unit Bs_a of Langenheim and others (1962), and reported as Uppermost Meramecian and Lower Chestarian (Brenckle, 1973; Lane and others, 1983; Poole and Sandberg, 1991). Formation forms ledgy cliff and is about 80 m thick
- Monte Cristo Group (Upper and Lower Mississippian)--**Includes, in descending order, Yellowpine Limestone, Bullion Limestone, Anchor Limestone, and Dawn Limestone. Total thickness of group is as much as 445 m
- Mmcy Yellowpine Limestone (Upper Mississippian)--**Limestone, medium dark gray to dark gray (fresh), and medium light gray to light olive gray (weathered), medium crystalline, thin to thick bedded; contains sparse nodules of medium-dark-gray (fresh) and dusky-yellowish-brown (weathered) chert. Formation contains solitary rugose corals, colonial *Syringapora* mounds, pelmatozoan columnals, and a *Lithostrotionella* colonial coral biostrome occurs at the top. Included within the Yellowpine is the 1-m-thick Arrowhead Limestone member of the Monte Cristo Group, present about 15 m above the base (C.A. Sandberg, U.S. Geological Survey, 1991, personal commun.). The Arrowhead Limestone stratigraphically separates the Yellowpine Limestone and underlying Bullion Limestone at the type section of the Monte Cristo Group, 60 km southeast of quadrangle in the Spring Mountains. Yellowpine forms massive cliffs, and is about 100-120 m thick

- Mmcb Bullion Limestone (Lower Mississippian)**--Three parts are recognizable but were not mapped separately. Upper part is about 50 m thick, and consists of limestone, medium dark gray (fresh), light gray to light olive gray (weathered), finely to medium crystalline, thick bedded; commonly contains discontinuous layers of dusky-yellowish-brown chert. Fauna includes pelmatozoan columnals and brachiopods. Middle part is about 110 m thick and consists of cherty limestone, medium light gray (fresh) and medium gray to light olive gray (weathered), mostly coarsely crystalline, and thin bedded; commonly contains more than 60 percent chert. Chert is dark gray (fresh) and moderate brown to dusky yellowish brown (weathered) and occurs in beds generally 7-10 cm thick that have planar laminations and small-scale trough crossbeds; abundant pelmatozoan columnals. Lower part about 30 m thick consists of relatively chert-free limestone, medium light gray (fresh), and light gray (weathered), mostly coarsely crystalline, thick bedded; contains abundant pelmatozoan columnals and some solitary rugose corals. Formation forms massive cliffs and is about 160-190 m thick
- Mmca Anchor Limestone (Lower Mississippian)**--Alternating limestone and chert. Limestone is medium dark gray (fresh), medium gray to light olive gray (weathered), finely crystalline, and thin bedded. Chert is smoky medium gray to medium light gray (fresh), and moderate yellowish brown to dusky yellowish brown (weathered); thin bedded. Middle 4 m of unit is a light-gray, coarsely crystalline, pelmatozoan-rich limestone, similar to lower part of overlying Bullion Limestone. Formation weathers to massive cliffs, and is about 55-60 m thick
- Mmcd Dawn Limestone (Lower Mississippian)**--Limestone, medium dark gray (fresh), medium gray, medium light gray and light olive gray (weathered), aphanic to finely crystalline, and thin bedded; some coarsely crystalline crinoidal limestone beds. Commonly contains elongate nodules and discontinuous layers of moderate-brown to dusky-yellowish-brown-weathering chert. Formation contains solitary rugose corals, *Lithostrotionella* corals, and pelmatozoan columnals. Brenckle (1973) reported disconformity at lower contact with Crystal Pass Limestone based on foraminifers. Forms ledgy cliffs and is about 65-75 m thick

MDcp **Crystal Pass Limestone (Lower Mississippian and Upper Devonian)**--Limestone, medium light gray (fresh) and light gray (weathered), mostly aphanic, some finely crystalline, thin to thick bedded showing planar laminations. Sparse silicified mollusks (as great as 15 cm long), and gastropods. Poole and Sandberg (1991) reported a regional unconformity between the lower Mississippian and Upper Devonian parts of the formation, and a 2.5-m-thick, laterally discontinuous, sandstone bed about 15 to 20 m below the top of formation in the Arrow Canyon NW quadrangle (adjacent quadrangle west of the Arrow Canyon quadrangle) may mark the unconformity. Forms massive cliff, about 80 m thick

Guilmette Formation (Upper and Middle Devonian)--Divided and mapped as upper and lower informal members. Formation is 400-450 m thick

Dgu **Upper member**--Limestone, dolomite, and sandstone. Upper part of member is limestone and interbedded sandstone. Limestone is medium light gray (fresh), and medium gray to light gray (weathered), aphanic to finely crystalline, thin bedded; some planar laminations; brachiopods, gastropods, and stromatoporoids. Contains four sandstone beds that thicken upward in the upper part of member. Sandstone is pale yellowish brown to medium gray (fresh), and dusky yellowish brown to light brown (weathered), mostly medium grained, less commonly fine and coarse grained, moderately well to moderately sorted, subrounded to rounded; beds range from 15 to 30 cm in thickness and contain planar laminations and trough crossbeds. Lower 65 m of member is dolomite, dark gray (fresh), and medium gray to medium dark gray (weathered), finely crystalline, thin bedded; contains abundant stromatoporoid biostromes, common *Amphipora* and gastropods. Member is equivalent to Arrow Canyon Formation of Langenheim and others (1962), and is about 320-340 m thick

- Dgl Lower member--Dolomite, and subordinate interbedded limestone.** Dolomite is mostly light gray, light olive gray and olive gray (fresh), and yellowish gray (weathered), finely to medium crystalline, and thin to thick bedded; shows planar laminations, tepee structures and mud cracks. Less commonly contains beds of medium-dark-gray (fresh) and medium-light-gray to light-gray (weathered) coarsely crystalline dolomite. Limestone, more common near base, is olive gray to medium dark gray (fresh), and medium gray to medium light gray (weathered), mostly aphanic, and thin to thick bedded. Karst zones present near top of unit. Member is equivalent to Moapa Formation of Langenheim and others (1962). Forms step-like ledges and is about 80-100 m thick
- Dsi Simonson Dolomite (Middle Devonian)--Upper 13 m is biostromal dolomite, medium dark gray to dark gray (fresh), and medium gray to light olive gray (weathered), medium crystalline, and thin bedded.** Biostromes consist of *Thamnopora*, brachiopods, and bulbous stromatoporoids; *Stringocephalus* brachiopods occur at the top, and a 0.6-m-thick quartzite bed at base of the biostromal dolomite. Most of the formation consists of alternating beds of yellowish-gray, medium-gray, to dark-gray, commonly mottled yellowish gray, and light-olive-gray, slightly argillaceous, finely crystalline, and thin bedded dolomite, showing abundant planar to slightly wavy laminations, mudcracks, and convoluted bedding. Basal 3-12 m of formation is quartzite, yellowish-gray (fresh), dark yellowish brown, and moderate brown to brownish black (weathered), fine to very fine grained, subrounded, and moderately well sorted, and thin bedded; contains trough crossbeds and planar laminations. Formation equivalent to Piute Formation of Langenheim and others (1962). Forms ledgy slope and is about 80-120 m thick
- DSd Unnamed dolomite (Lower Devonian? or Silurian?)--Upper part is dolomite, medium gray (fresh), and medium light gray to light olive gray (weathered), finely crystalline, common light-olive-gray mottles.** Upper part contains solitary corals and pelmatozoan fragments; a 5-7 m thick karst zone present near top of unit. Lower part is dolomite, medium gray to medium light gray (fresh), and light gray to very light gray (weathered), aphanic to finely crystalline; distinctive wavy algal laminations. Unit was identified as upper part of the Laketown Dolomite by Langenheim and others (1962), but may be equivalent to part of the Lower Devonian Sevy Dolomite. Unit forms bench and is about 80 m thick

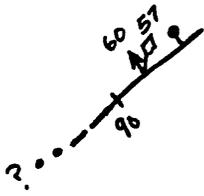
- Sl** **Laketown Dolomite (Silurian)**--Dolomite, medium dark gray (fresh), light olive gray (weathered), finely crystalline, thin bedded, planar and wavy laminations; some ripple cross-bed sets about 2.5-cm-thick; basal part of unit is vuggy. Pelmatozoan columnals, solitary cylindrical corals, and brachiopods. Forms cliff and is about 60 m thick
- Oes** **Ely Springs Dolomite (Upper Ordovician)**--Dolomite and subordinate sandstone. Three-part informal subdivision recognized but units not mapped separately. Upper part of formation is about 25 m thick and consists of dolomite, medium gray to medium light gray (fresh), and light olive gray (weathered), splotchy medium-light-gray mottling, and thin to thick bedded. Common zones of oncoids, and abundant pelmatozoan columnal, brachiopod, and coral fragments. Upper part weathers lighter gray than the overlying Laketown Dolomite and underlying darker gray dolomite of the middle part of formation. Middle part is thickest part of formation (about 80 m thick) and consists of dolomite, dark gray (fresh), and medium dark gray (weathered), finely crystalline, thin bedded, common planar laminations; contains pelmatozoan columnals, brachiopods, and corals. A 10- to 15-m-thick cherty zone is present near the center of the middle part. Middle part forms massive cliff. Lower part is about 15 m thick and consists of medium-light-gray to light-gray bioclastic dolomite; contains abundant pelmatozoan columnal fragments. Dolomite contains interbeds of resistant moderate-brown to dusky-yellowish-brown silty to sandy dolomite that is very thin bedded and trough-crossbedded. Below arenaceous dolomite is a zone of moderate-red to pale-red thin-bedded to laminated, slightly calcareous shale, siltstone, and fine-grained sandstone. Lower part forms less resistant unit between overlying part of formation and the underlying Eureka quartzite. Formation is about 120 m thick
- Oe** **Eureka Quartzite (Middle Ordovician)**--Quartzite and friable sandstone, both are white (fresh), light brown, and moderate brown to dusky yellowish brown (weathered), fine to medium grained, subrounded, moderately well sorted, thin to thick bedded, and contain tabular planar crossbeds and less commonly trough crossbeds; crossbed sets average about 0.4 m thick. *Skolithos* burrows present on tops of beds. Forms rounded cliff and is 40-50 m thick

- Op Pogonip Group (Middle and Lower Ordovician)--**Most of unit is dolomite; however, at many localities, dolomite grades laterally into limestone. Dolomite is medium dark gray to medium gray (fresh), and light olive gray to yellowish gray (weathered), and contains grayish-orange to dark-yellowish-orange mottles; mostly finely crystalline and thin bedded. Limestone composed of alternating layers of micrite and grainstone, is medium gray (fresh) and light olive gray (weathered), and commonly shows grayish-orange and dark-yellowish-orange mottles and laminations; aphanic to coarsely crystalline, and thin-bedded; commonly contains discontinuous layers and nodules of dark-gray (fresh) and moderate-brown to dusky-yellowish-brown (weathered) chert. Unit contains abundant trilobites, brachiopods, pelmatozoan columnals, pelecypods, cephalopods, and gastropods; bioturbated, common burrows, tracks, and trails. Uppermost approximate 50 m of unit contains intervals of yellowish-gray-weathering laminated dolomite. About 80 m below top is a 30 m thick brownish-gray bioclastic limestone that has resistant brownish-black to dark-yellowish-brown silty interbeds and laminations. Limestone is finely to coarsely crystalline, thin-bedded to laminated, and contains trilobites, gastropods, *Receptaculites*, and dark-yellowish-orange oncoids. Yellowish-gray dolomite in upper part of unit forms ledgy slopes and gray dolomite and limestone form massive cliffs; unit ranges from about 400 to 450 m in thickness
- €n Nopah Formation (Upper Cambrian)--**Dolomite, mostly dark gray (fresh) and olive black (weathered); less commonly medium light gray (fresh) and light gray to light olive gray (weathered); lighter gray color commonly cuts across depositional boundaries, and is probably in part related to diagenetic alteration. Dolomite is medium crystalline, and thin to thick bedded. Contains discontinuous layers and nodules of moderate-brown to dusky-yellowish-brown weathering chert. Common brachiopods and zones of trough cross-bedded oncoids. Unit is internally brecciated throughout the quadrangle. About 80-90 m below top of unit is a 35-m-thick dolomite interval that is lithologically similar to beds in the Pogonip Group; the dolomite is olive gray, dusky yellow, and medium gray (fresh), and yellowish gray to light olive gray (weathered), finely crystalline, very thin bedded, and bioturbated, and commonly shows grayish-orange to dark-yellowish-orange mottles. Grayish-red to dusky-red stylolites are diagnostic of this sequence. Formation forms massive cliffs and complete thickness estimated at 360 m; base not exposed in quadrangle

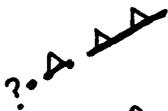
- Cd** **Dunderberg Shale (Upper Cambrian)--Olive-gray to gray-green, brown- to yellowish-weathering shale, siltstone, and silty limestone. Unit shown in cross section only; estimated to be about 60 m thick. Description and thickness from Pampeyan (1989), 15 km north of quadrangle in the Meadow Valley Mountains**
- Chp** **Highland Peak Formation (Upper and Middle Cambrian)-- Alternating beds of light- to dark-gray-weathering dolomite and limestone (Pampeyan, 1989). Unit shown in cross section only; estimated to be from 590-700 m thick. Description and thickness from Pampeyan (1989), 15 km north of quadrangle in the Meadow Valley Mountains**



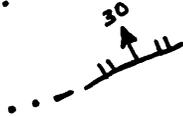
Contact--Dashed where approximately located



High-angle normal or reverse fault--Barbed arrow shows direction and amount of dip. Diamond-shaped arrow shows trend and plunge of lineation. Cross bar shows vertical dip. Dashed where approximately located, dotted where concealed, queried where location is uncertain. Bar and ball on downthrown side.



Thrust fault--sawteeth on upper plate. Dotted where concealed, queried where location is uncertain



Low-angle normal fault--Hachures on upper plate. Barbed arrow shows direction and amount of dip. Dashed where approximately located, dotted where concealed



Syncline--Dashed where approximately located, dotted where concealed, queried where location is uncertain



Anticline--Dashed where approximately located, dotted where concealed



Overtured syncline--Dashed where approximately located, dotted where concealed



Fold--Barbed arrow points in direction of plunge



Carbonate vein

Strike and dip of beds



Inclined



Overtured



Vertical

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CORRELATION OF MAP UNITS -- Arrow Canyon Quadrangle

