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PRELIMINARY GEOLOGIC MAP OF THE DELAMAR 3 NW QUADRANGLE, LINCOLN COUNTY, NEVADA

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DESCRIPTION OF MAP UNITS

[Ages of surficial units have not been determined by absolute dating techniques; ages are estimates based on field observations of degree of soil development and local surface dissection. The stage of carbonate development reported for a soil is a visual estimate using standards defined by Gile and others (1966). Colors of surficial and bedrock units are from the Rock-Color Chart (Rock-Color Chart Committee, 1951). Descriptions of volcanic units are based largely upon megascopic identification and estimates of phenocryst abundances, except where noted by reference]

Qahl **Alluvium (late Holocene)**--Grayish-orange to pale-yellowish-brown gravel, sandy gravel, and sand; unconsolidated, poorly to moderately well sorted, and poorly bedded. Gravel is angular to subrounded clasts of limestone, dolomite, ash-flow tuff, lava, and sandstone. Unit forms channel along modern washes and small inset fans at the mouths of valleys cut in bedrock. Surface of unit is irregular, and bar-and-swale topography is common. Boulders as much as 2 m across are locally common on the surface of fans. No soil was observed on unit. Unit ranges from 0 to thicker than 3 m

Qahe **Alluvium (early Holocene)**--Grayish-orange to pale-yellowish-brown gravel, sandy gravel, and sand; poorly to well sorted, moderately well bedded to poorly bedded, weakly consolidated to unconsolidated. Gravel consists of angular to subrounded clasts of limestone, dolomite, ash-flow tuff, lava, and sandstone generally less than 2 m across. Unit forms steep inset fans near bedrock ridges and small terrace remnants along larger washes. Surface accumulations of boulders 1-2 m across are common near the heads of fans. Deposits stand 1 to 3 m above modern washes. Surfaces of deposits are generally smooth except where bar-and-swale topography is common on upper part of most fans. A weakly developed stone pavement is locally present; a small proportion of surface clasts have weakly developed rock varnish. Soil development on unit consists of a thin sand vesicular A horizon and a 0.5-m-thick C horizon with stage I carbonate. No color change was observed in the B horizon. Unit ranges from 0 to greater than 4 m

Qc **Colluvium (Holocene and Pleistocene)**--Unconsolidated to moderately consolidated debris consisting chiefly of talus; angular pebble- to boulder-sized clasts, with minor amounts of silt and sand. Colors are inherited from bedrock source. Unit is generally nonbedded and locally cemented by secondary carbonate; occurs along base of steep slopes developed on Tertiary volcanic rocks. Thickness unknown

Qapm **Alluvium (middle Pleistocene)**--Pale-yellowish-brown to moderate-orange-pink gravel, sandy gravel, and sand; weakly to moderately well consolidated, poorly to moderately well bedded, and poorly sorted to moderately well sorted. Gravel consists of angular to subrounded clasts of limestone, dolomite, ash-flow tuff, lava, and sandstone, commonly less than 2 m in diameter. Unit forms fans inset into unit Quaternary and Tertiary alluvium (QTa). Near the mountain front some fans are littered with abundant boulders 1-3 m across of ash-flow tuff that are probably debris-flow deposits. Surfaces of deposits generally are smooth except for bouldery areas; a tightly packed stone pavement is common; surface clasts have a dull to shiny dark-brown rock varnish. Deposits stand 2 to 5 m above active washes. Soil typically consists of a 4- to 6-cm-thick clay, sand, and silt vesicular A horizon, a cambic to slightly argillic B horizon that is rarely preserved, and a 1-m-thick carbonate horizon that is commonly Stage II^+ to III in the upper half. Unit ranges from 0 to thicker than 5 m

QTa **Alluvium (early Pleistocene and Pliocene?)**--Grayish-brown to moderate-orange-pink gravel and sandy gravel; poorly sorted, moderately well consolidated, and poorly bedded. Gravel consists of angular to subrounded clasts of limestone, dolomite, ash-flow tuff, lava, and sandstone commonly less than 2 m across. Unit forms large fans flanking bedrock ridges and small inset fans in older alluvial deposits. Surfaces of fans are dissected and have rounded interfluvial divides. Well exposed only in cutbank exposures along active washes; typical exposure has rubble-covered slopes littered with 1-2-m boulders and abundant chips of pedogenic carbonate. A tightly packed stone pavement is common on gently sloping surfaces; pavement conforms to shapes of eroded surfaces. Surface clasts of igneous origin typically have a dark-brown to black shiny rock varnish. Soil commonly has a 4- to 6-cm-thick clay, silt, and sand vesicular A horizon overlying a 1- to 2-m-thick K horizon that has stage III to IV carbonate development in the upper part. Carbonate horizon commonly conforms to shape of eroded surface along interfluvial divides. Unit is 0 to more than 20 m thick

Ta **Alluvium (Pliocene and Miocene)**--Yellowish-gray to pale-yellowish-brown gravel with a silt and sand matrix; poorly sorted to unsorted, poorly bedded, well consolidated; weakly to strongly cemented with secondary carbonate. Gravel consists of angular to rounded clasts of limestone, dolomite, ash-flow tuff, lava, and sandstone. Clasts as much as 2 m across are common; includes scattered clasts as much as 6 m across. Unit forms deeply dissected fans along mountain front; locally conformably overlies volcanic rocks. Well exposed only in cutbank exposures along active washes. Typical exposure has steep, rubble-covered slopes littered with abundant boulders; interfluvial divides are generally sharp. Stone pavement occurs only locally; surface clasts of igneous origin commonly have a thick, black, shiny rock varnish. Unit is distinguished from unit Quaternary and Tertiary alluvium (QTa) by deeper dissection, sharp interfluvial divides, and heavier coating of rock varnish. Thickness of unit range from 0 to more than 80 m

QTs **Landslide debris and gravity-slide block complex (Quaternary to late Miocene?)**--Complex mixture of unconsolidated debris and coherent blocks that consists of volcanic units as old as Monotony Tuff (Tm). Rubble is unconsolidated to moderately consolidated. Generally slide unit shows an upward gradation from subrounded rubble at the base to larger and more coherent blocks at the top; attitudes of foliation of ash-flow tuff within blocks near base of slide unit are highly variable, but the top of the slide unit locally contains relatively undisturbed blocks of rock with nearly consistent foliation attitudes close to those of surrounding intact rocks. Locally, coherent slide blocks are bounded laterally by chaotic slide debris. Slide debris is cemented locally by secondary carbonate. Slide unit occurs near the base of steep slopes, most commonly where surrounding strata dip gently down slope. Thicknesses are as great as 120 m. (Unit is shown by stippled pattern and, where appropriate, by fault trace with open teeth on the slide body. Where individual rock units in slides are mappable, rock units are shown with unit symbols and the symbol QTs is not used; where individual rock units are unmappable, the slide is designated by the symbol QTs)

Tbu **Basalt flow (Miocene)**--Medium-dark-gray plagioclase-olivine-phyric basalt flows containing megacrysts of plagioclase commonly greater than 1 cm in diameter; as many as three separate flows exposed in the west central part of the quadrangle. Locally contains as much as 30 percent vesicles. Forms cap rock of volcanic rocks in central part of quadrangle. K-Ar age is 12.7 Ma (Novak, 1984). Thicknesses range between 0 and 30 m

Tbd **Basalt dike (Miocene)**--Medium-dark-gray plagioclase-olivine-phyric basalt dike containing megacrysts of plagioclase commonly greater than 1 cm in diameter; feeder dike for basalt flows (Tbu) along the central-east edge of the quadrangle and just south of the westernmost point of the plateau formed by the Delamar Mountains

Kane Wash Tuff (Miocene)--Peralkaline ash-flow tuff sequence consisting of four informally named units

Tkb **Gregerson Basin unit**--Comenditic to trachytic ash-flow tuff consisting of at least two nearly identical cooling units. Map unit includes units V2 and V3 of Novak (1984). The cooling units are not mapped separately because lithologic similarities make them nearly indistinguishable and the cooling break between them is not traceable at all localities. Where the cooling break is traceable, it is shown as a dashed contact within the Gregerson Basin unit. Variations in degree of welding indicate that the lower cooling unit is a compound cooling unit. Each cooling unit may contain a trachytic cap above upper, middle, and basal comenditic zones. The trachytic caps are partly vitric, partially welded, and pale brown; they commonly contain abundant cognate inclusions of scoriaceous trachyte in matrices that are noticeably darker and browner than those of underlying zones of the cooling units. Trachytic caps vary from 1 to 10 m thick but are commonly absent. The upper zones are devitrified, moderately to densely welded, and yellowish gray to light brownish gray in most places. Upper zones contain few recognizable pumice fragments and have 0-20 percent lithophysal cavities that contain abundant vapor-phase crystals of amethyst and blocky mafic minerals (riebeckite and unidentified phases). Upper zones contain about 20 percent phenocrysts that consist of 25 percent quartz, 60 percent sanidine, and 15 percent hedenburgite, fayalite, and ilmenite (Novak, 1984). Upper zones range from about 1 to 50 m thick. The middle zones are partly devitirified, densely welded, commonly mottled pale blue, medium bluish gray, grayish green or pale yellowish brown where devitrified, and black where vitrophyres are locally developed. Middle zones commonly have partings between layers of different degrees of devitrification, range in abundance of phenocrysts between 5 and 25 percent, and are generally 1-7 m thick. The basal zones are most commonly nonwelded to partially welded, moderately orange pink to pale yellowish orange, contain less than 5 percent phenocrysts, and are about 1-3 m thick. The K-Ar age of the Gregerson Basin unit is 14.1 Ma (Novak, 1984). Cooling units form cliffs, and the cooling break between them has little or no geomorphic expression. The combined Gregerson Basin unit is locally absent in the west part of the quadrangle and is about 85 m thick in the east part

Tkg **Grapevine Spring unit**--Rhyolitic to trachytic, informally named ash-flow tuff, consisting of one compound cooling unit. Grapevine Spring unit is unit V1 of Novak (1984). Map unit grades downward through 4 zones that include a poorly, and locally, developed trachytic cap above upper, middle, and lower rhyolitic zones. Cap rocks contain sparse dark scoriaceous trachytic cognate inclusions in matrix that is slightly darker brown than that of underlying zones. Upper zone is devitrified, moderately to densely welded, and yellowish gray to light brownish gray. The upper zone contains few recognizable pumice fragments and 0-10 percent lithophysal cavities that contain small vapor-phase crystals of quartz and sparse garnet. Upper zone contains as much as 30 percent phenocrysts that consist of 25 percent quartz, 60 percent sanidine, and 15 percent hedenburgite, fayalite, titano-magnetite, and ilmenite (Novak, 1984). Upper zone contains less than 1 percent lithic fragments and ranges from about 10 to nearly 60 m thick. The middle zone is partly devitrified, densely welded, and moderate brown. Sparse vitrophyres are characterized by grayish-orange-pink devitrification centers in a black vitric matrix. Highly lenticular local lithophysae are 2-4 cm in diameter in the plane of foliation. Middle zone contains less than 5 percent phenocrysts and is about 1 m thick. The basal zone is generally nonwelded to partially welded, is pale brown to dark yellowish brown, contains less than 2 percent phenocrysts and is 1-1.5 m thick. The unit is a cliff former, and the break between it and the Gregerson Basin unit (Tkb) forms a slight notch or bench in cliffs. The K-Ar age of the unit is 14.1 Ma (Novak, 1984). Thickness of Grapevine Spring unit ranges from about 15 m along the west part of the quadrangle to about 60 m in the east

Sunflower Mountain unit--Rhyolitic ash-flow tuff, consisting of a compound cooling unit and containing two mappable zones. The Sunflower Mountain unit is unit W of Novak (1984). The K-Ar age of the unit is 14.7 Ma (Novak, 1984). The combined thickness of the two zones ranges from about 170 m in the north part of the quadrangle to 60 m in the southwest part

Tksu **Upper zone**--More welded upper part of the Sunflower Mountain unit, grading downward from partially welded, through moderately welded, to moderately to densely welded. Upper zone is devitrified, pale red, and mottled. Mottles consist of distinctive moderate-orange to very pale orange altered blotches in a pale-red matrix. Upper zone contains about 20 percent phenocrysts that consist of subequal amounts of quartz and sanidine and sparse hedenburgite and fayalite (Novak, 1984). Lithic fragments form less than 1 percent of the rock. Zone forms bold cliffs; a small notch or bench in the cliff above the map unit marks the base of the Grapevine Spring unit (Tkg) in most areas. The zone ranges in thickness from about 85 m in the north part to about 30 m in the southeast part of the quadrangle

Tksl **Lower zone**--Less welded part of the Sunflower Mountain unit, grading downward from partially welded, through partially to moderately welded, to a nonwelded tuff. The lower zone is devitrified and very pale orange to grayish orange. Pumice fragments range between 0.2 and 1.5 cm in diameter and form about 15 percent of the rock. Lower zone contains about 10-15 percent phenocrysts that consist of subequal amounts of quartz and sanidine and sparse altered mafic minerals (Novak, 1984). Volcanic lithic fragments are commonly as large as 2 cm across and form about 10 percent of the rock at most localities. Lower zone forms distinct slopes. Map unit is as thick as 85 m in the north part of the quadrangle but thins to about 35 m along the southwest part of the quadrangle

Tkd **Delamar Lake unit**--Rhyolitic ash-flow tuff, consisting of two simple cooling units. The Delamar Lake unit is unit O of Novak (1984). The upper cooling unit is nonwelded to moderately welded and is grayish pink to pale red. Pumice as large as 3 cm in diameter in the plane of foliation forms about 20 percent of tuff. About 15-20 percent of the rock consists of phenocrysts that include 20 percent quartz, 75 percent sanidine, and 5 percent fayalite and other mafic minerals (Novak, 1984). The tuff contains less than 2 percent volcanic lithic fragments. The lower cooling unit is nonwelded to moderately welded and is grayish orange pink to pale red to light brownish gray. Pumice as large as 4 cm in diameter in the plane of the foliation forms as much as 30 percent of the tuff. About 10-15 percent of the rock consists of phenocrysts that include 35 percent quartz, 60 percent sanidine, and 5 percent fayalite and other mafic minerals (Novak, 1984). The tuff contains less than 3 percent volcanic lithic fragments. The two cooling units form slopes in their less welded zones and small cliffs where the degree of welding is greater. The K-Ar age of the Delamar Lake unit is 15.6 Ma (Novak, 1984). The Delamar Lake unit is about 60 m thick in the north part of the quadrangle except where it is absent over a thick accumulation of basalt flows (Tb) in the northwest part of the quadrangle; the map unit pinches out in the south

Tb **Basalt flow (Miocene)**--Brownish-black to olive-black aphyric basalt lava flow. The basalt is locally vesicular near the top and is as great as 250 m thick in the northwest part of the quadrangle but is absent elsewhere

Th **Hiko Tuff (Miocene)**--Rhyolitic ash-flow tuff, consisting of one cooling unit which grades downward from a moderately welded devitrified zone, through a local vitrophyre, to a glassy nonwelded to partially welded basal zone. The devitrified zone is eutaxitic, devitrified, moderately welded, and mottled very light gray to light gray; pumice is lighter in color. Lenticular pumice as large as 5 cm in diameter in the plane of foliation forms 10 percent of the rock, and lithophysae are commonly 4 cm in diameter parallel to foliation. Rock contains 35 percent phenocrysts that consist of 25 percent very pale purple quartz, 25 percent sanidine, 35 percent plagioclase, 10 percent biotite, and less than 5 percent hornblende and pyroxene. The tuff contains less than 2 percent lithic fragments consisting largely of argillite. The vitrophyre is partly glassy and partly devitrified, eutaxitic, moderately to densely welded, and mottled medium gray to grayish black; pumice is darker in color. The basal zone is nonwelded to partially welded, and very light gray; pumice is white. The Hiko Tuff forms crumbly but rugged cliffs and has a very distinctive rounded knobby exfoliated surface in the devitrified zone; these knobs range from 1-4 m wide and 1-3 m high. The $^{40}Ar/^{39}Ar$ age of the Hiko Tuff is 18.6 Ma (Taylor and others, 1989). The tuff is at least 75 m thick in the north part of the quadrangle and as thin as 20 m in the south part

Thh **Harmony Hills Tuff (Miocene)**--Andesitic ash-flow tuff, consisting of one cooling unit grading downward from a partially welded upper zone. a densely welded central zone, and a nonwelded basal zone. The map unit is devitrified, phenocryst rich, and massive, with only a crudely developed foliation. The moderately to densely welded zones of the tuff ranges from pale red where more weathered to light olive gray and pinkish gray where fresher. Pumice fragments are sparse. One-half of the rock consists of phenocrysts that consist of 5 percent quartz, 65 percent plagioclase, 15 percent biotite, 10 percent hornblende, and less than 5 percent clinopyroxene. Lithic fragments are sparse. The unit forms cliffs, the lower parts of which are commonly covered with colluvial debris from the Hiko Tuff (Th) and the Harmony Hills Tuff. A small bench above the Harmony Hills Tuff marks the base of the Hiko Tuff. Five K-Ar ages by Armstrong (1970) and one by Noble and McKee (1972) average 21.6 Ma for the map unit; however, isotopic ages of 22.5-22 Ma for plutons and an ash-flow tuff that postdate the Harmony Hills Tuff in the Iron Springs District may provide a better age constraint (Rowley and others, 1989). Although the Harmony Hills Tuff, Bauers Member of the Condor Canyon Formation (Tcb), and Leach Canyon Tuff (Tlc) were included in the Quichapa Group by Cook (1957), Williams (1967), and Anderson and Rowley (1975), the group name will not be used here because the source(s?) of all these ash-flow tuffs have not been determined. The Harmony Hills Tuff ranges from about 85 m thick in the central part of the quadrangle to about 60 m thick in the south part

Tpl **Tuff of Pahranagat Lake (Miocene)**--Rhyolitic ash-flow tuff, consisting of one simple cooling unit grading downward from nonwelded, through partially welded, to nonwelded. This informally named tuff is the Pahranagat Lake tuff of Williams (1967). The tuff is devitrified and is grayish pink, very light gray, to grayish orange pink. Pumice fragments as large as 5 cm in diameter form as much as 20 percent of tuff. Rock contains 15 percent phenocrysts consisting of 45 percent quartz, 25 percent sanidine, 25 percent plagioclase, and less than 5 percent biotite. Less than 1 percent lithic fragments occur in the tuff. The tuff forms gentle slopes commonly covered by talus from the Harmony Hills Tuff (Thh). The $^{40}Ar/^{39}Ar$ age of the tuff is 22.65 Ma (Deino and Best, 1988). The tuff of Pahranagat Lakes is as thick as 6 m in the south part of the quadrangle but pinches out to the north

Tcb **Bauers Tuff Member of the Condor Canyon Formation (Miocene)**--Rhyodacitic ash-flow tuff, consisting of one simple cooling unit grading downward from a light-brownish-gray to pale-red, moderately to densely welded devitrified zone through a brownish-gray, moderately welded vitrophyre to a grayish-pink, partially to nonwelded basal zone. Lithophysal cavities are 2 to 4 cm in diameter and form as much as 20 percent of the member. Pumice fiamme generally less than 0.5 cm diameter in the plane of foliation and make up less than 5 percent of the rock. Rock contains 10 percent phenocrysts consisting of 35 percent sanidine, 65 percent plagioclase, and 5 percent biotite and a trace of hornblende. Volcanic lithic fragments form about 2 percent of the rock and are generally less than 1 cm in diameter. Unit forms a resistant ledge. The $^{40}Ar/^{39}Ar$ age of the tuff is 22.8 Ma (Best and others, 1989). The Bauers Tuff Member is locally absent over a Miocene topographic high in the central west part of the quadrangle but is about 10-15 m thick elsewhere

Tlu **Limestone, upper (lower Miocene or upper Oligocene)**--Lacustrine limestone containing disrupted algal plates. Limestone is very light gray to pinkish gray, medium grained, and recrystallized. Beds range from 0.1 to 1.5 m thick. Limestone occurs locally in south part of quadrangle and is as thick as 6 m

Tlc **Leach Canyon Formation (Oligocene)**--Rhyolitic ash-flow tuff conisting of a compound cooling unit grading downward from a grayish-pink partially welded devitrified tuff, through grayish-orange-pink moderately welded devitrified tuff and locally developed grayish-black vitrophyre, to a pinkish-gray nonwelded to partially welded tuff at the base. Pumice fragments are less than 0.5 cm in diameter and form less than 5 percent of the rock. The rock contains about 15 percent phenocrysts consisting of 35 percent quartz, 25 percent sanidine, 35 percent plagioclase, 5 percent biotite, and a trace of hornblende. Lithic fragments are sparse. Unit forms gentle, undulating slopes, and locally, cliffs. The average K-Ar age of the Leach Canyon Formation is 24.7 Ma (Armstrong, 1970). Leach Canyon Formation is about 25 m thick in the north central part of the quadrangle, thickens to 130 m in the south central part, and thins again to 80 m in the south part of the quadrangle

Shingle Pass Tuff (Oligocene)--Two members of rhyolitic ash-flow tuff

Tspu **Upper member**--Rhyolitic ash-flow tuff consisting of a simple cooling unit grading downward from a grayish-orange-pink to very pale pink, moderately to partially welded devitrified tuff, through a locally developed dark-gray to brownish-gray vitrophyre, to a pinkish-gray nonwelded to partially welded tuff at the base. Distinctive grayish-yellow to moderate-greenish-yellow partings formed by altered devitrified layers (1 mm thick) are common in the vitrophyre. Pumice fiamme are as large as 3 cm in diameter in the plane of foliation and form about 15 percent of the rock. The rock contains about 5 percent phenocrysts that consist of a trace of quartz, 35 percent sandine, and 50 percent plagioclase. Lithic fragments are as great as 3.5 cm in diameter and form 10 percent of the rock. Unit forms gentle slopes except for ledge where vitrophyre is present. The $^{40}Ar/^{39}Ar$ age of the upper member is 26.0 Ma (Best and others, 1989, table 2). Map unit is about 4 m thick in the southern part of the quadrangle and is absent elsewhere

Tspl **Lower member**--Rhyodacitic ash-flow tuff consisting of a simple cooling unit grading downward from a moderate-orange-pink, moderately welded devitrified tuff, through a nearly ubiquitous, very dark red, brownish-black to grayish-red vitrophyre, to a pinkish-gray, nonwelded to partially welded tuff at the base. Pumice fiamme as large as 4 cm in diameter in the plane of foliation form about 5 percent of the rock. The rock contains about 15 percent phenocrysts that consist of 5 percent quartz, 55 percent sanidine, 40 percent plagioclase, and a trace of hornblende. Lithic fragments as large as 2 cm in diameter form less than 5 percent of the rock. Flattened lithophysal cavities as great as 6 cm in diameter form about 10 percent of the rock. Unit forms a sharp cliffy ledge above the gentle slopes of the Monotony Tuff (Tm). The $^{40}Ar/^{39}Ar$ age of the lower member is 26.7 Ma (Best and others, 1989, table 2). The map unit is 5-6 m thick in the south part of the quadrangle, but pinches out in the north half

Tm **Monotony Tuff (Oligocene)**--Rhyodacitic ash-flow tuff consisting of a nonwelded to partially welded very light gray to pinkish-gray simple cooling unit. Layers of bedded ash-fall tuff present above and below ash-flow tuff. Pumice fragments are sparse. Rock contains about 15 percent phenocrysts that consist of 15 percent quartz, 10 percent sanidine, 50 percent plagioclase, 10 percent biotite, 5 percent hornblende, and 5 percent pyroxene. Lithic fragments are sparse. Unit forms gentle slopes. The $^{40}Ar/^{39}Ar$ age is 27.3 Ma (Best and others, 1989, table 2). Monotony Tuff is as great as 60 m thick in the south central part of the quadrangle, but is absent elsewhere

Tl **Limestone (early Tertiary ?)**--Very light-gray, medium-grained, recrystallized lacustrine limestone. Beds vary between 0.1 and 2.0 m thick. Limestone is 3-7 m thick in the south part of the quadrangle but is absent in the north part

Tc **Conglomerate (early Tertiary ?)**--Conglomerate derived from Paleozoic limestone, dolomite, sandstone, quartzite, and chert; includes subordinate beds of limestone. Pale-red color of the conglomerates is imparted by the calcareous cement. Oldest unit deposited on the angular unconformity above Paleozoic rocks. Conglomerate is locally present in the south central part of the quadrangle where it is as thick as 7 m

Dse **Sevy Dolomite (Lower Devonian)**--Dolomite correlates with informal dolomite member found in Delamar 3 SW quadrangle (Page and others, 1990); the upper sandy member present in that quadrangle is absent here. Dolomite, medium-light-gray (fresh), light-gray and light-olive-gray (weathered); in some localities mottled in light and dark shades of gray. Dolomite is mostly aphanic, homogenous, dense, and thin to thick bedded with planar bedding-parallel laminations; sparse stylolites, rock breaks conchoidally. Common interbeds of quartzite present in upper part; quartzite is light olive gray to medium gray (fresh) and moderate brown to dusky yellowish brown (weathered), dolomitic, fine grained, well rounded, and moderately well sorted. Beds range from 0.1 to 1 m thick and exhibit trough crossbedding. Unit forms ledgy cliff and is about 200 m thick; top of unit not exposed

Sl **Laketown Dolomite (Upper and Middle Silurian)**--Dolomite, consisting of upper dark-gray, middle light-gray, and lower dark-gray informal members. Upper dark-gray member is dolomite, medium-dark-gray to dark-gray (fresh), light-olive-gray to grayish-orange (weathered), finely crystalline to slightly aphanic, and includes highly abundant discontinuous layers and nodules of black (fresh) and moderate-brown to dusky-yellowish-brown (weathered) chert. Member contains *Favosites*, silicified corals, pelmatozoan stems, and brachiopods. Forms cliffs and is about 15 m thick. Middle light-gray member is dolomite, light-gray to yellowish-gray (weathered), finely crystalline, sugary, and vuggy with some zones of aphanic dolomite near top. *Favosites*, *Halysites*, corals, and brachiopods are present. Forms cliffs and is about 115 m thick. Lower dark-gray member is dolomite, medium-gray to medium-dark-gray (fresh), medium dark-gray to light-olive-gray (weathered), finely to medium crystalline, and thin- to thick-bedded with planar bedding-parallel laminations. The lower dark-gray member is more fossilierous than the upper members; it contains *Favosites*, *Halysites*, solitary corals, pelmatozoan stems, and brachiopods. Basal 10 meters is medium-dark-gray, vuggy dolomite which forms a massive cliff. Lower dark-gray member forms cliffs and is about 115 m thick. Combined thickness of Laketown Dolomite is about 245 m

Oes **Ely Springs Dolomite (Upper Ordovician)**--Dolomite, medium-dark-gray, finely crystalline; generally thin to thick bedded, with planar bedding-parallel laminations. Upper 24 m is light-olive-gray (weathered) aphanic dolomite that contrasts sharply with adjacent darker dolomite units. Middle part of map unit commonly contains zones of discontinuous stringers and nodules of dark-brown (weathered) chert and vugs and streaks both lined with coarse recrystallized white dolomite. Lower part is slightly arenaceous. Fossils include *Favosites*, *Halysites*, large horn corals, pelmatozoan stems, and brachiopods. Ely Springs Dolomite forms massive cliffs, has a dark color and craggy appearance from a distance, and is about 135 m thick

Oe **Eureka Quartzite (Middle Ordovician)**--Quartzite and friable sandstone, white (fresh), and moderate-brown, moderate-reddish-brown, dark-yellowish-orange, and dusky-yellowish-brown (weathered). Quartzite and sandstone are fine to medium grained, subrounded, and moderately well sorted; upper part is thin to thick bedded and lower part is very thin to thin bedded. Unit contains abundant 0.1- to 2-m-thick sets of tabular-planar crossbeds, and less common small-scale trough crossbeds. Trace fossils (burrows and trails) locally occur on tops of beds. Formation forms cliffs and is as thick as 40 m

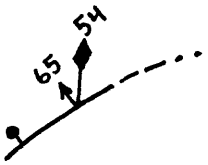
Op **Pogonip Group (Middle and Lower Ordovician)**--Predominantly limestone with subordinate dolomite, shale, siltstone, and sandstone. Five parts are recognized, consisting of an uppermost dolomite, an upper limestone, a middle limestone, a lower limestone, and a basal dolomite part. Uppermost dolomite part consists of mottled alternating light- and dark-gray to grayish-yellow (weathered), arenaceous dolomite. Rock is aphanic to finely crystalline, laminated to thin bedded, and contains abundant pale-red shale partings and very thin beds of fossil hash. Brachiopods, corals, gastropods, and sponges are present. Uppermost dolomite part forms ledgy slopes and is about 30 m thick. Upper limestone part is limestone, medium-light-gray to medium-dark-gray (fresh), light-olive-gray to yellowish-gray (weathered), mottled, mostly aphanic, and laminated to thin bedded. Most beds consist of 5- to 15-mm-thick alternating layers of micritic and fossiliferous intraclastic limestone that contain abundant partings of pale-red shale and shaly limestone, and less abundant interbeds of grayish-red (fresh) and yellowish-gray and pale-red (weatheres) laminated siltstone. Brachiopods, *Maclurites*, and other gastropods, corals, pelmatazoan stems, *Orthoceras*, and oncolites are present; *Receptaculites* and sponges are common near the base. Upper limestone part forms cliffs and is about 180 m thick. Middle limestone part is limestone, medium-gray (fresh), and yellowish-gray (weathered), mottled, aphanic to coarsely crystalline, characteristically very thin bedded, and intensely bioturbated. Beds consist of 2- to 10-mm-thick alternating layers of micritic and fossiliferous intraclastic limestone. Contains abundant partings of grayish-red siltstone and pale-red shale. Trilobites, brachiopods, pelmatozoan stems, and trace fossils on bedding planes are common. Forms ledgy slopes and is about 135 m thick. Lower limestone part is limestone with subordinate dolomite, shale, and siltstone. Limestone is medium gray to medium dark gray (fresh), and light gray to grayish orange (weathered), mottled, aphanic to coarsely crystalline, and thin bedded. Beds consist of 2- to 15-mm-thick alternating layers of micritic and fossiliferous intraclastic limestone. Contains abundant nodules and discontinuous layers of dusky-yellowish-brown (weathered) chert. Shaly limestone and shale partings are common and as thick as 1 m; shaly limestone is medium dark gray (fresh), and grayish orange (weathered); shale is pale red (fresh) and pale yellowish brown (weathered). Ripple marks are present on some bedding planes. Lower limestone part forms ledgy cliffs and is about 190 m thick. Basal dolomite part consists of argillaceous dolomite that is olive gray (fresh), and yellowish gray (weathered). Dolomite is aphanic, thin bedded, mottled and bioturbated. Contains brachiopods, trilobites, and oncolites. Basal dolomite part forms cliffs and is 10 m thick. Pogonip Group is about 545 m thick

-Cdv **Desert Valley Formation (Upper Cambrian)**--Dolomite, divided into six informal members by P.H. Heckel and Anthony Reso from a measured section in the adjacent Delamar 3 SW quadrangle (P.H. Heckel, written commun., 1987). In descending order the orange dolomite, light dolomite, variegated limy, upper dark dolomite, white band, and lower dark dolomite members of Heckel and Reso were recognized but were not mapped in this quadrangle. The orange dolomite member is included in the overlying Pogonip Group. Light dolomite member consists of medium-gray (fresh) and light-olive-gray (weathered) dolomite that is medium crystalline, sugary, thin to thick bedded with wavy internal laminations and local small-scale trough crossbeds. Contains abundant, discontinuous layers, stringers, and nodules of bluish-gray (fresh) smoky chert that weathers moderate brown to dusky yellowish brown. Vugs lined with coarsely recrystallized white dolomite are common. Member contains sparse stromatolitic zones, forms cliffs, and is about 260 m thick. Variegated limy member is medium-gray to medium-dark-gray (fresh), dark-yellowish-orange to light-olive-gray (weathered), fossiliferous limestone. The limestone is mostly aphanic, bioturbated, and distinctly mottled to shades of yellow, orange, and gray; it contains wavy and planar bedding-parallel laminations. Beds of fossiliferous intraclastic limestone 1- to 3-cm-thick are abundant; rip-up clasts are micritic, subangular, and as great as 3 cm long. Oolitic, trough-crossbedded limestone is very abundant in upper part. Discontinuous stringers and nodules of moderate-brown to dark-brown (weathered) chert are abundant throughout the variegated limy member. Trilobite fragments, brachiopods, oncolites, and burrows are common. Member is less resistant than adjacent members, forms ledgy slopes, and is about 15 m thick. Upper dark dolomite member consists of medium-dark-gray dolomite; dolomite is finely to medium crystalline and thin to thick bedded with planar bedding-parallel laminations. Abundant streaks of coarsely recrystallized white dolomite, and local moderate-brown to dusky-yellowish-brown (weathered) chert nodules and several layers of oncolites and brachiopods occur. Upper dark dolomite member forms cliffs and is about 100 m thick. White band member consists of light-gray, medium crystalline, sugary, thin- to thick-bedded dolomite with common vugs and streaks both lined with coarsely recrystallized white dolomite. The white band member forms cliffs and is about 10 m thick. Lower dark dolomite member consists of dolomite, medium-gray to light-olive-gray, finely to medium crystalline, laminated to thick bedded with both wavy and planar bedding-parallel laminations, sparsely trough-crossbedded, and commonly mottled. Discontinuous stringers and nodules of dark-brown (weathered) chert and streaks and vugs both lined with coarsely recrystallized white dolomite are common. Member contains abundant oncolites, less common stromatolites, brachiopods, and pelmatozoan stems. The lower dark dolomite member forms cliffs and is about 155 m thick. Formation forms massive cliffs and the combined thickness is about 540 m

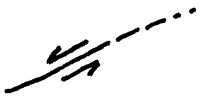
-Cd **Dunderberg Shale (Upper Cambrian)**--Limestone and subordinate interbedded shale and siltstone. Limestone is medium dark gray to olive gray (fresh), and moderate brown to dusky yellowish brown (weathered). In the upper part limestone is aphanic, mottled to shades of brown and gray, and bioturbated; contains interbeds of light-brown, calcareous shale. Small, black, linguloid brachiopods are common in upper part. In the lower part, limestone is medium to coarsely crystalline, very thin bedded, and characteristically flaggy; locally contains interbeds of very thin bedded to laminated pale-red to medium-gray siltstone. Trilobite fragments are abundant throughout. Formation forms slopes and is 60-80 m thick

€hp **Highland Peak Formation (Upper and Middle Cambrian)**--Correlative with upper informal member found in Delamar 3 SW quadrangle (Page and others, 1990). Dolomite, characterized by alternating medium-gray and light-olive-gray (weathered) layers that appear "banded" from a distance. Dolomite is mostly medium crystalline and sugary, but becomes aphanic toward the base. Beds range from 0.1-1.0 m thick, and contain planar bedding-parallel laminations. Bedding-parallel stylolites are abundant. The Highland Peak Formation forms cliffs, and is about 200 m thick; its base is not exposed

Contact



High-angle normal fault--Showing dip (barbed arrow) and trend and plunge of lineation (diamond-shaped arrow). Dashed where approximately located; dotted where concealed. Bar and ball on downthrown side



Strike- or oblique-slip fault--Arrows show relative direction of lateral offset. Dashed where approximately located; dotted where concealed

Low-angle normal fault--Below landslide and gravity-slide complex. Sawteeth on upper plate. Dashed where approximately located; dotted where concealed. Stippled pattern on upper plate

Fault scarp--Hachures on downthrown side where scarp is partially covered by younger surficial unit

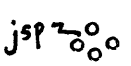
Dome

Strike and dip of sedimentary beds and of compaction foliation of ash-flow tuffs

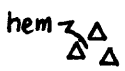
Inclined

Horizontal

Vertical



Jasperoid alteration



Hematite alteration

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DELAMAR 3 NW

Correlation of Map Units