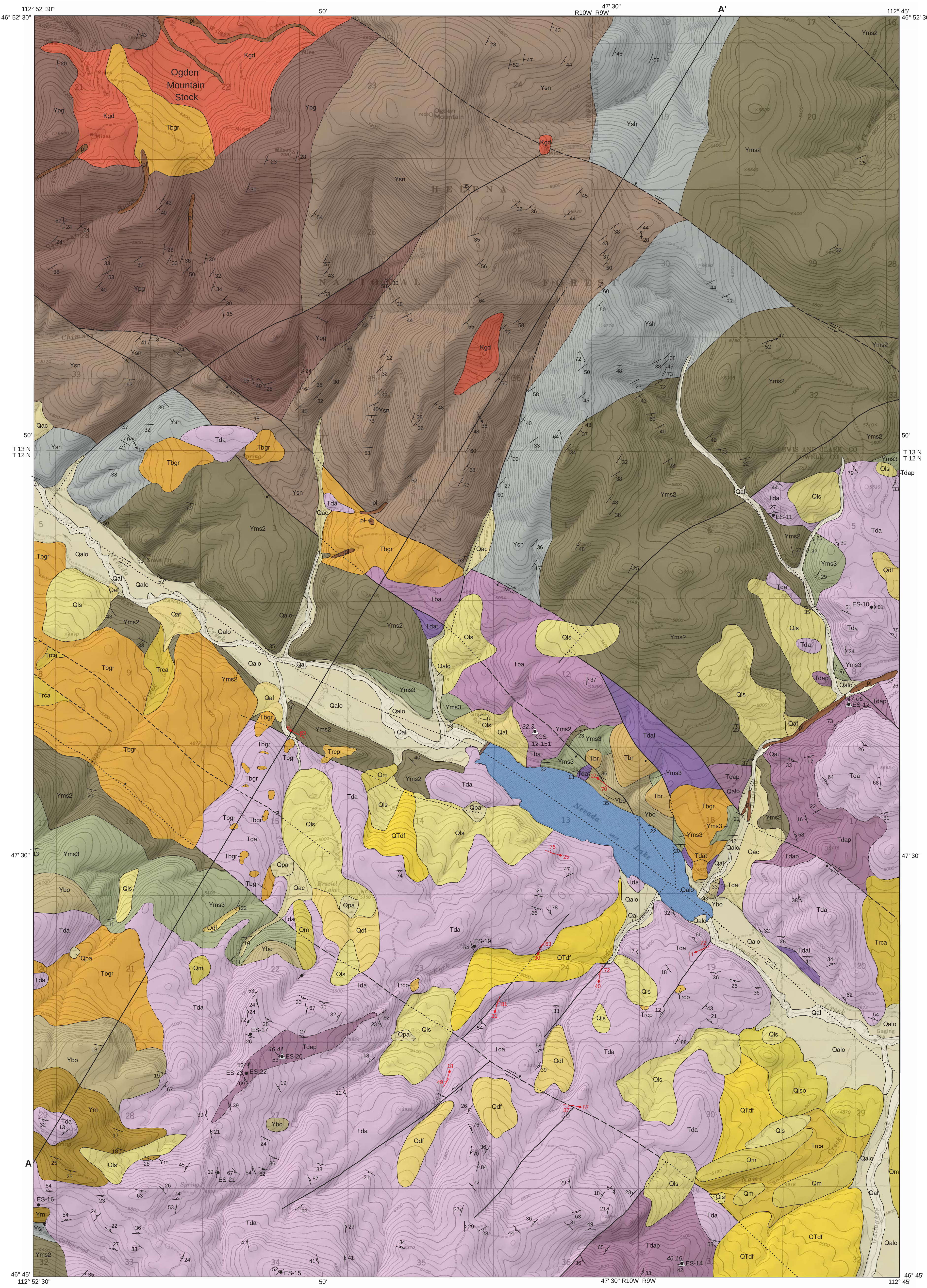
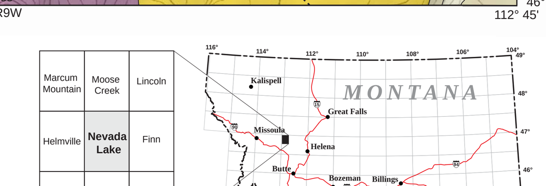
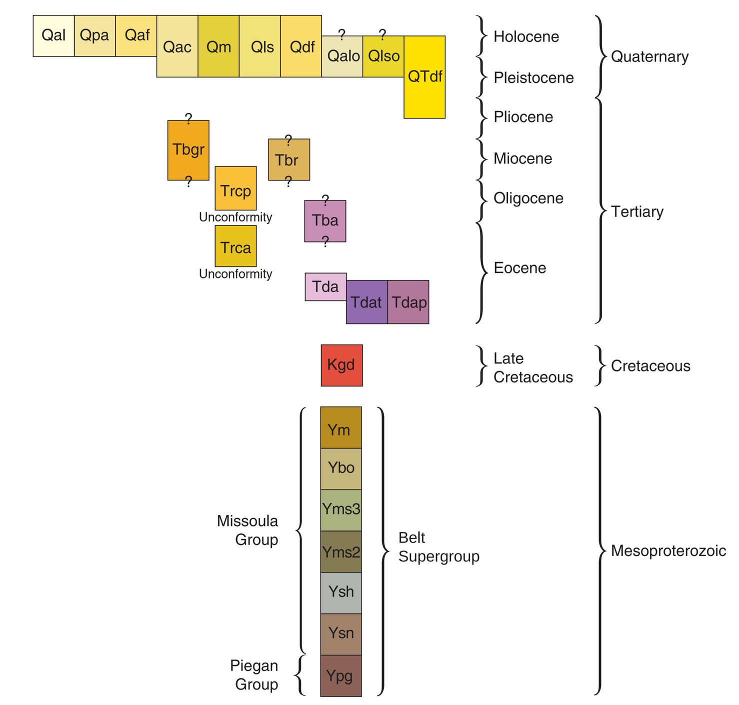


Base from U.S. Geological Survey
Nevada Lake 7.5' topographic quadrangle
Map date: 1968
Projection: UTM zone 12; 1927 NAD
UTM grid declination 1°19' West
1968 Magnetic North Declination 19° East
Contour Interval 40 feet; NGVD of 1929

SCALE 1:24,000
CONTOUR INTERVAL 40 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929



CORRELATION DIAGRAM



MAP SYMBOLS

- Contact: dashed where approximately located
- Fault: dashed where approximately located; dotted where concealed, bar and ball on downthrown side; arrows indicate relative lateral movement; A, away from viewer; T, toward viewer
- Reverse or thrust fault: teeth on upthrown block; dashed where approximately located; dotted where concealed
- 44 Strike and dip of inclined beds
- Strike and dip of vertical beds
- 63 Strike and dip of cleavage
- Strike of vertical cleavage
- 50 Strike and dip of joints
- Strike and dip of vertical joints
- 28 Bearing and plunge of bedding/cleavage intersection
- 51 Strike and dip of volcanic foliation
- 63 30 Strike and dip of fault plane, and trend and plunge of slickenlines, including small unmapped faults
- U-Th-Pb zircon age (Ma)
- K-Ar (whole rock) age (Ma)
- ES-10 Geochemical analysis with sample ID
- pl Placer workings

Table 1. Raw bulk rock geochemical data from samples collected in the Nevada Lake 7.5' quadrangle.

Sample ID	ES-10	ES-11	ES-12	ES-14	ES-15	ES-16	ES-17	ES-19	ES-20	ES-21	ES-22	ES-23	KCS-12-151
Map unit	Tda	Tda	Tdap	Tda	Tdap	Tda	Tda	Tda	Tdap	Tdap	Tda	Tdap	Tba
Latitude	46.816	46.825	46.807	46.751	46.750	46.757	46.774	46.783	46.772	46.760	46.770	46.770	46.804
Longitude	-112.755	-112.769	-112.758	-112.782	-112.840	-112.875	-112.845	-112.812	-112.840	-112.849	-112.845	-112.845	-112.803
Major elements (wt %)—X-ray fluorescence (XRF)													
SiO_2	62.46	62.74	62.34	65.91	64.51	60.67	64.62	61.26	59.24	63.36	60.19	63.88	49.22
TiO_2	0.60	0.62	0.69	0.60	0.55	0.95	0.58	0.70	0.68	0.62	0.77	0.60	1.87
Al_2O_3	15.95	16.28	15.92	16.17	15.79	15.21	15.78	16.34	15.05	15.87	16.64	16.07	16.92
FeO*	4.50	3.96	3.86	2.43	3.88	4.78	4.03	4.83	4.69	4.21	5.23	3.71	8.59
MnO	0.07	0.04	0.03	0.01	0.03	0.06	0.05	0.06	0.06	0.07	0.08	0.02	0.15
MgO	2.05	1.69	2.01	0.84	0.88	2.42	1.93	2.83	3.06	2.65	3.29	0.55	5.84
CaO	4.05	3.77	3.03	2.46	3.00	3.44	3.31	4.30	3.74	3.47	4.75	2.84	8.13
Na_2O	4.22	4.39	4.28	3.72	4.04	3.77	4.38	4.52	3.90	4.37	4.61	4.34	3.32
K_2O	3.09	3.16	3.47	3.96	3.56	4.86	3.42	2.89	3.12	3.21	2.73	3.55	2.92
P_2O_5	0.30	0.36	0.35	0.32	0.27	0.72	0.29	0.43	0.47	0.32	0.49	0.35	1.00
Sum	97.28	97.01	95.97	96.41	96.48	96.87	98.39	98.17	94.00	98.13	98.77	95.90	97.96
LOI	1.83	2.52	2.68	2.79	2.96	2.34	1.14	1.57	5.14	1.42	0.08	2.31	1.51
Trace elements (ppm)—XRF													
Ni	58.47	56.59	62.73	27.65	24.08	85.13	50.14	46.08	63.23	60.45	58.96	12.81	84.83
Cr	112.38	77.40	121.89	44.69	31.71	121.60	79.08	84.04	145.28	90.58	108.51	21.77	109.31
Sc	8.82	8.32	9.22	7.43	6.44	9.51	7.14	7.93	8.72	7.93	9.91	5.81	19.13
V	68.97	63.82	82.65	58.27	53.81	82.65	56.09	74.62	62.14	67.49	85.23	58.51	181.55
Ba	2291.49	2465.81	2395.74	2379.89	2626.74	4395.09	2290.50	2686.90	2957.24	2302.98	2692.35	2619.61	3817.13
Rb	68.18	64.91	74.13	87.31	88.20	79.08	85.92	59.26	61.84	70.76	51.83	79.98	57.48
Sr	1059.87	1227.65	1219.82	859.20	936.89	1868.53	1053.04	1337.75	1270.36	1075.93	1457.86	1068.33	1450.43
Zr	169.86	172.24	180.86	187.30	193.25	267.67	184.72	185.52	194.24	181.95	188.29	183.21	210.98
Y	9.22	9.51	10.11	9.91	10.41	11.40	8.62	12.09	14.37	9.71	12.19	11.33	24.18
Nb	8.72	9.61	11.79	9.32	9.81	14.87	10.90	15.06	25.17	11.40	15.56	12.12	42.61
Ga	18.83	19.82	19.52	21.80	19.92	19.92	20.32	21.31	18.73	20.61	20.91	21.08	18.23
Cu	14.67	13.68	16.55	10.50	14.07	19.23	11.89	18.63	16.85	12.78	9.61	12.02	28.14
Zn	98.70	80.96	60.15	66.69	99.20	122.29	89.49	91.47	102.17	94.24	98.51	105.00	92.26
Pb	20.32	21.11	22.40	23.78	23.59	23.59	21.21	19.32	20.22	19.82	15.26	25.02	7.23
La	59.76	65.60	62.83	62.14	56.49	103.36	59.56	81.76	110.60	68.78	84.04	75.84	60.55
Ce	103.96	120.60	115.35	110.00	101.38	201.97	100.59	144.88	187.99	113.47	153.80	126.97	124.67
Th	10.90	11.40	11.20	12.29	11.89	14.57	11.79	12.88	18.33	11.40	13.58	14.48	8.42
Nd	39.34	42.32	44.00	42.91	38.65	84.04	39.05	54.51	67.78	44.40	58.37	47.77	55.79
U	3.07	4.06	2.38	3.57	2.08	4.26	0.99	1.88	2.58	2.68	2.97	2.76	2.38

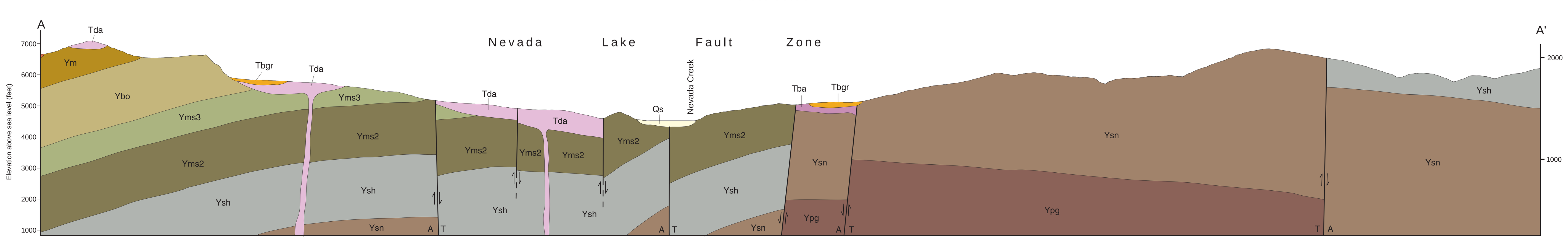
All samples analyzed by X-ray fluorescence (XRF) and inductively coupled plasma mass spectrometry (ICP-MS) at the Washington State University GeoAnalytical Lab. All major elements and trace elements denoted by + were analyzed by XRF, all other trace elements were measured by ICP-MS. FeO* indicates all Fe expressed as Fe_2+. LOI is loss on ignition.

Table 2. Summary of K-Ar and U-Pb zircon ages from the Nevada Lake 7.5' quadrangle.

Sample	Map Unit	Latitude	Longitude	Age (Ma)	2σ	Method
*R77R8	Tba	46.804	-112.804	32.30	1.30	K-Ar
ES-12	Tdap	46.807	-112.758	47.06	0.12	U-Pb zircon
ES-14	Tdap	46.751	-112.782	46.16	0.26	U-Pb zircon
ES-20	Tdap	46.772	-112.840	46.41	0.18	U-Pb zircon

*Schmidt and others (1994).

Cross Section A–A'



No vertical exaggeration
Qs = undifferentiated Quaternary sediments
A = away / T = toward

SCALE 1:24,000

Maps may be obtained from:
Publications Office
Montana Bureau of Mines and Geology
1300 West Park Street
Butte, Montana 59701-8997
Phone: (406) 496-4167 Fax: (406) 496-4451
http://www.mbmg.mtech.edu

Research supported by the U.S. Geological Survey, National Cooperative Geologic Mapping Program, under USGS award number G12AC20277.
GIS production: Yiwen Li and Paul Thale, MBMG. Map layout: Susan Smith, MBMG.

INTRODUCTION

The Montana Bureau of Mines and Geology (MBMG), in conjunction with the STATEMAP advisory committee, selected the Nevada Lake 7.5' quadrangle in west-central Montana for detailed mapping to provide new information on stratigraphy and structure in an area where only reconnaissance mapping (Lewis, 1998; 1:250,000 scale) existed. Detailed mapping in this area is part of the MBMG's effort to complete the Elliston 30' x 60' quadrangle (1:100,000 scale) geologic map. The quadrangle is located in the mountains between the Avon and Nevada Valleys (fig. 1).

GEOLOGIC SUMMARY

Metasedimentary rocks of the Mesoproterozoic Belt Supergroup underlie the north and far west part of the Nevada Lake quadrangle. The oldest Belt rocks are carbonates and calc-silicates of the middle Belt Piegan Group. The Piegan Group includes the Helena and overlying Wallace Formations (Winston, 2007), which were not differentiated due to poor exposure and contact metamorphism adjacent to the Ogden Mountain Stock. Overlying the Piegan Group are formations of the upper Belt Missoula Group, including the Snowslip, Shepard, Mount Shields (members 2 and 3), Bonner, and McNamara Formations. Missoula Group strata form an approximately 6,780-m (22,250-ft) thick section of quartzites, argillites, and dolomites.

Igneous plutonic and volcanic rocks are exposed throughout the Nevada Lake quadrangle. Granodiorite of the Late Cretaceous Ogden Mountain Stock intrudes the Piegan Group in the northwest corner of the map. Schmidt and others (1994) report K-Ar ages of 81.1 ± 2.8 Ma (biotite) and 85.4 ± 3.9 Ma (hornblende) for the stock. Extensive volcanic rocks unconformibly overlie Belt rocks. Volcanic rocks are predominantly aphanitic and porphyritic dacite, trachydacite, and basalt (table 1, fig. 2). Samples from the lower (older) volcanic sequence (map unit Tdap) yielded six U-Pb zircon ages ranging from 46.74 ± 0.27 to 47.1 ± 0.29 Ma (table 2). The lower sequence (Tdap) is locally intercalated with volcanic ash (map unit Tdat).

The youngest units mapped are Tertiary and Quaternary valley-fill and surficial deposits. Tertiary valley-fill deposits include isolated exposures of the Renova Formation (Eocene Climbing Arrow Member and Miocene–Oligocene Cabbage Patch member) south of Nevada Creek. The Renova Formation is overlain by Tertiary boulder gravel deposits that may be alluvial fans. Quaternary surficial sediments include alluvium along Nevada Creek and scattered landslide, alluvial fan, debris flow, and alluvial fan deposits.

Structure

The Nevada Lake quadrangle is within the eastern part of the Lewis and Clark line (LCL)–a major western Montana WNW-striking tectonic zone recurrently active since the Proterozoic (Sears and Hendrix, 2004; Wallace and others, 1990; Reynolds, 1979). From Late Cretaceous to late Paleocene, the LCL underwent sinistral (left-lateral) transpression associated with crustal shortening (Sears and Hendrix, 2004). Beginning in the late Eocene and continuing to present, deformation has been predominantly dextral (right-lateral) transtension associated with regional Basin and Range extension (Stickney, 2015; Sears and Hendrix, 2004).

The major LCL structures in the Nevada Lake quadrangle are steep, oblique-slip faults and folded Belt Supergroup rocks. The Belt rocks form a broad anticline cored by the Piegan Group. Regional-scale folding is interpreted to be related to Cretaceous shortening and associated intrusion of the Late Cretaceous Ogden Mountain Stock. The most prominent LCL faults form a NW-striking, several kilometer-wide zone of highly brecciated and fractured bedrock adjacent to Nevada Creek and Nevada Lake, herein called the Nevada Lake Fault Zone. The NW- and NE-striking faults are interpreted as kinematically linked transtensive structures. The structures offset Oligocene basalt (Tba) and Tertiary (Miocene?) boulder gravel deposits (Tbgr), suggesting Miocene or younger displacement. The NW- and NE-striking faults offset the folded Belt rocks.

Active faults are not recognized in the Nevada Lake quadrangle, but recent seismicity in the area indicates continued tectonism on pre-existing faults having oblique-normal slip (Stickney, 2015).

PREVIOUS MAPPING

The entire quadrangle was included on small-scale (1:250,000) maps by Lewis (1998) and Wallace and others (1987). Weber and Witkind (1979) completed a reconnaissance geologic map of the southern half of the Nevada Lake quadrangle. Stout (1949) mapped the Ogden Mountain mining district, located in the northwest corner of the quadrangle.

DESCRIPTION OF MAP UNITS

Qal **Alluvium (Quaternary: Holocene)**—Gravel, sand, silt, and clay along Nevada Creek and its tributaries. Clasts are generally rounded to subrounded, cobble size and smaller, but boulders also present. Thickness generally less than 10 m (33 ft).

Qpa **Paludal deposit (Quaternary: Holocene)**—Argillaceous silt, sand, and organic matter deposited in pond or marsh environments. Thickness probably less than 5 m (15 ft).

Qaf **Alluvial-fan (Quaternary: Holocene)**—Gravel, sand, silt, and clay in deposits with fan-shaped morphology along Nevada Creek and Buffalo Creeks. Large, locally derived clasts are both matrix- and clast-supported. Cobbles are the dominant clast size, but also includes boulders and pebbles. Thickness generally less than 15 m (50 ft).

Qac **Alluvium and colluvium (Quaternary: Holocene)**—Silt, sand, granules, and pebbles deposited on slopes by sheetwash intermixed with locally derived fine-grained colluvium. Thickness generally less than 8 m (20 ft).

Qm **Mantle (Quaternary: Holocene and Pleistocene)**—Unconsolidated deposits on pediments that include sheetwash alluvium, fine-grained colluvium, coarse-grained (pebble, cobble, small boulder) lag from older debris-flow deposits, and regolith. Thickness generally less than 6 m (20 ft).

Qls **Landslide (Quaternary: Holocene or Pleistocene)**—Mass-wasting deposits of rotated or chaotic beds. The bentonitic Climbing Arrow Member of the Renova Formation (Trca) and units that immediately overlie it are particularly prone to developing landslide deposits. Thickness generally less than 60 m (200 ft).

Qdf **Debris-flow (Quaternary: Pleistocene or Holocene)**—Sandy, matrix-supported deposits of local, upslope-derived volcanic rock and sparse sedimentary rock. Clasts range from granule to boulder size. Thickness generally less than 20 m (75 ft).

Qalo **Alluvium, older than Qal (Quaternary: Pleistocene)**—Sand and gravel deposits along Nevada Creek at altitudes 3–35 m above recent stream channel. Clasts generally rounded to subrounded, cobble size and smaller, but boulders also present. Thickness as much as 15 m (50 ft).

Qlso **Landslide, older than Qls (Pleistocene)**—Mass-wasting deposit of rotated or chaotic beds that slid downslope. Geomorphic expression suggests that deposits are older than Qls. Thickness not known.

QTdf **Debris-flow, older than Qdf (Quaternary: Pleistocene, or Tertiary: Pliocene?)**—Matrix-supported deposits with clasts of upslope-derived volcanic rock and sparse sedimentary rock. Clasts range from granules to boulders. Geomorphic expression suggests the deposits are older than Qdf. Thickness less than 30 m (100 ft).

Tbgr **Boulder gravel (Tertiary)**—Dominantly matrix-supported, but locally clast-supported deposits with pebbles to large boulders in clay/silt/sand matrix. Clast composition dominantly Belt Supergroup quartzite with subordinate volcanic and plutonic rock. Matrix in many places has incorporated sediment of the Climbing Arrow Member of Renova Formation (Trca). Deposits have been interpreted as Miocene (Loen, 1990; Schmidt and others, 1994). Contains placer gold (Loen, 1990). May be as thick as 300 m (985 ft).

Tbr **Breccia (Tertiary)**—Sedimentary breccia consisting of angular cobble to boulder, medium- to coarse-grained quartzite clasts derived from the Mesoproterozoic Bonner or Mount Shields Formations. Breccia is lithified and has clay infilling. Exposed on bench immediately north of Nevada Lake Reservoir. May have formed as a fault-controlled colluvial wedge along nearby faults. Thickness probably less than 50 m (165 ft).

Trcp **Renova Formation, Cabbage Patch member, informal (Tertiary: Miocene and Oligocene)**—Deposits of limited extent consisting of locally brecciated, fine-grained, grayish orange sandstone or siltstone and remnants of light gray, gastropod-bearing, thin-bedded limestone. Unit is likely the same as in-place deposits on Antelope Hill, located southwest of the map area on the Gravely Mountain quadrangle (Mosolf, 2015). Exposed thickness probably less than 20 m (65 ft) in map area.

Trca **Renova Formation, Climbing Arrow Member (Tertiary: Eocene)**—Pale olive, light olive gray, moderate olive brown, and medium light gray bentonitic mudstone, yellowish gray siltstone, and subordinate brownish gray sandstone and gravel/conglomerate lenses. Sandstone dominantly medium- to coarse-grained, with quartz, feldspar, biotite, and rhyolite grains. Gravel/conglomerate consists of clast-supported lenses of rounded granules, pebbles, and cobbles of rhyolite porphyry and other dominantly volcanic lithologies in a sandy, or sand and granule matrix. Bentonitic mudstone typically displays "popcorn" weathering, large desiccation cracks, and is prone to landslide development. Thickness not determined.

Tba **Basalt (Tertiary: Oligocene)**—Black, fine-grained, massive trachybasalt (table 1, fig. 2) lava flows with sparse olivine and pyroxene phenocrysts. Locally vesicular and weathers to light brown, angular to sub-rounded blocks. A sample from this unit (sec. 12, T. 12 N., R. 10 W.) yielded a K-Ar (whole rock) age of 32.3 ± 1.3 Ma (Mitchell Reynolds, written commun., 2014). Perhaps age-equivalent to basaltic–andesite flows that occur in the Gravely Mountain quadrangle to the south, which yielded a U-Pb zircon age of 30.00 ± 0.19 Ma (Mosolf, 2015).

Tda **Dacite (Tertiary: Eocene)**—Gray and dark gray weathered, aphanitic to slightly porphyritic dacite, trachydacite, and minor trachyandesite (table 1, fig. 2) lava flows with autobrecciated flow bottoms that are overlain by massive, coherent flow interiors; zones of vesiculation are rarely preserved. Lava flows commonly exhibit distinctive flow banding and form flaggy, angular talus, often with red iron staining on parting surfaces. Aphanitic lavas exhibit a strong trachytic texture consisting mainly of plagioclase microlites, but also include pyroxene, magnetite, and volcanic glass. Slightly porphyritic flows exhibit a similar trachytic texture and groundmass mineralogy but contain subhedral to euhedral phenocrysts of plagioclase, hornblende, and some biotite. Good exposure of the unit occurs in the southwest part of the map area where it overlies the dominantly porphyritic lavas (Tdap) and Phanerozoic through Proterozoic units.

Tdat **Dacite tuff (Tertiary: Eocene)**—Variably silicified dacite tuff that is massive or flow banded and contains phenocrysts of plagioclase, quartz, biotite, and amphibole. The groundmass consists almost entirely of devitrified glass with some magnetite. Scoriaceous pumice lapilli occur locally and account for up to ~50 percent of the rock. Fine-grained intervals often contain preserved plant and wood fragments. Poorly exposed and distinguished by flaggy chips of white, yellow, and orange weathered float. A U-Pb zircon age from the dacite tuff in the Gravely Mountain quadrangle to the south yielded a date of 47.4 ± 0.19 Ma (Mosolf, 2015), and therefore is considered to be correlative to tuffaceous intervals of map unit Tdap.

Tdap **Porphyritic dacite (Tertiary: Eocene)**—Gray, green, and red weathered dacite to trachydacite (table 1, fig. 2) with a coarse, porphyritic texture. Lava flows contain subhedral to euhedral phenocrysts of plagioclase (up to ~5 mm) and minor amphibole, biotite, and quartz. The aphanitic groundmass commonly has a trachytic texture of aligned microlights of plagioclase, with minor amphibole, biotite, and magnetite. Carapaces of autobreccia several meters thick commonly encompass coherent interiors of individual lava flows. This unit typically weathers to blocks or plates, with some outcrops forming hoodoos and spires. U-Pb zircon ages from 3 samples yielded ages of 46.16 ± 0.26 Ma (sec. 31, T. 12 N., R. 9 W.), 46.41 ± 0.18 Ma (sec. 27, T. 12 N., R. 10 W.), and 47.06 ± 0.12 Ma (sec. 8, T. 12 N., R. 9 W.).

Kgd **Granodiorite (Late Cretaceous)**—Medium to dark gray, equigranular to porphyritic granodiorite composed of plagioclase, potassium feldspar, quartz, biotite, and hornblende; forms main body of the Ogden Mountain Stock and associated smaller intrusions. Schmidt and others (1994) report K-Ar ages of 81.1 ± 2.8 Ma (biotite) and 85.4 ± 3.9 Ma (hornblende) for the stock.

Ym **McNamara Formation (Mesoproterozoic)**—Couplets and microcouplets of variegated red and green fine-grained quartzite, siltite, and waxy argillite. Contains diagnostic red or green chert beds and chert rip-up clasts. Mudcracks and mud rip-up clasts are common. Top part is light gray, thick-bedded, fine- to medium-grained crossbedded quartzite with abundant red mud rip-up clasts, uncommon red chert rip-up clasts, and abundant thin, red, mudcracked argillite interbeds. Exposed thickness about 300 m (1,000 ft) thick.

Ybo **Bonner Formation (Mesoproterozoic)**—Pink to red, medium- to coarse-grained, poorly sorted, feldspathic quartzite. Abundant trough and planar crossbedding in beds typically 0.5–1.0 m thick. Quartzite beds often separated by thin (0.1–1.0 cm), red to maroon argillite beds. Contains sparse subangular granules and small pebbles. Five slabbed and stained samples from the nearby Ophir Creek quadrangle (Lonn and Vuke, 2015) contained 50–75 percent quartz, 15–35 percent potassium feldspar, and 5–15 percent plagioclase. Thickness about 550 m (1,800 ft).

Yms3 **Mount Shields Formation, member 3 (Mesoproterozoic)**—Grayish red to blackish red, fine-grained quartzite to argillite couples and couplets with abundant desiccation cracks, mudchips, and diagnostic cubic salt casts. Includes green interbeds and some red microlaminae. Thickness about 275 m (900 ft).

Yms2 **Mount Shields Formation, member 2 (Mesoproterozoic)**—Pink to red, poorly sorted, medium- to coarse-grained, feldspathic quartzite. Abundant planar and trough crossbeds. Contains sparse subangular granules. Lower part is thinner bedded, consisting of couples of white to pink, medium-grained quartzite and thin red argillite. Bases of quartzite beds contain abundant red mud chips. The lower part of the unit was included in the top part of the Mount Shields Formation, member 1 by Schmidt and others (1994). Two slabbed and stained samples from the Ophir Creek 7.5' quadrangle (Lonn and Vuke, 2015) east of the Avon Valley contained 65–75 percent quartz, 5–15 percent potassium feldspar, and 20 percent plagioclase. Difficult to distinguish from the Bonner Formation (unit Ybo). Thickness about 520 m (1,700 ft).

Ysh **Shepard Formation (Mesoproterozoic)**—Dolomitic and non-dolomitic, dark green siltite and light green argillite in microlaminae. Couplets of non-dolomitic red quartzite to argillite. Poorly exposed, but weathers to thin plates that, when dolomitic, have a characteristic orange-brown weathering rind. Ripples and load casts are common; mudcracks are rare. The upper half of the formation contains intervals of pink to gray, fine-grained feldspathic quartzite included in Mount Shields Formation, member 1 by Schmidt and others (1994). However, we place the formation's upper contact at the top of a 50-m (160-ft) thick interval of distinctive rose-colored, dolomitic siltite–argillite couplets as was done in areas to the west (Lonn and others, 2010). The lower contact is placed at the bottom of the lowest dolomite-bearing intervals. A stromatolite bed is often found near the base. Thickness about 610 m (2,000 ft).

Ysn **Snowslip Formation (Mesoproterozoic)**—Interbedded intervals of quartzite to grayish-red argillite couplets, dark green siltite to light green argillite couplets, and microlaminated couplets. Desiccation cracks and mud rip-up clasts are common throughout. Argillite beds often contain irregular "bumps" thought to be ill-defined salt casts or structures related to microbial mats. Contains beds and lenses of distinctive white, coarse-grained, well-sorted, feldspar-poor quartzite with some well-rounded, frosted (dull, opaque surface) quartz grains. Lower 50 m (160 ft) dominated by microlaminated green dolomitic siltite and argillite. Upper 50–75 m (160–250 ft) is red, flat-laminated medium-grained quartzite in beds 0.5–1.0 m thick. Thickness about 1,430 m (4,700 ft).

Ypg **Piegan Group (Mesoproterozoic)**—Tan and dark gray dolomite, dark gray limestone, dark gray to tan argillite, siltite, calcareous siltite, and fine-grained quartzite; weathers grayish orange to yellowish gray. The upper 300 m (985 ft) consists of dark gray limestone interbedded with dark gray calcareous argillite that is interpreted as the Wallace Formation, the upper part of the Piegan Group. Below this interval, the Helena Formation is characterized by cycles consisting of a basal clastic zone of tan to gray siltite and fine-grained quartzite that is overlain by tan dolomite, and capped by dark gray argillaceous or stromatolitic limestone. Oolite beds are commonly associated with the stromatolites. Crinkly molar-tooth structure, syneresis cracks, fluid-escape structures, and recessive weathering calcitic pods are common sedimentary structures. Adjacent to the Ogden Mountain Stock, the unit is contact metamorphosed to light and dark green hornfels with diopside and/or tremolite. Base not exposed, but at least 1,220 m (4,000 ft) thick.

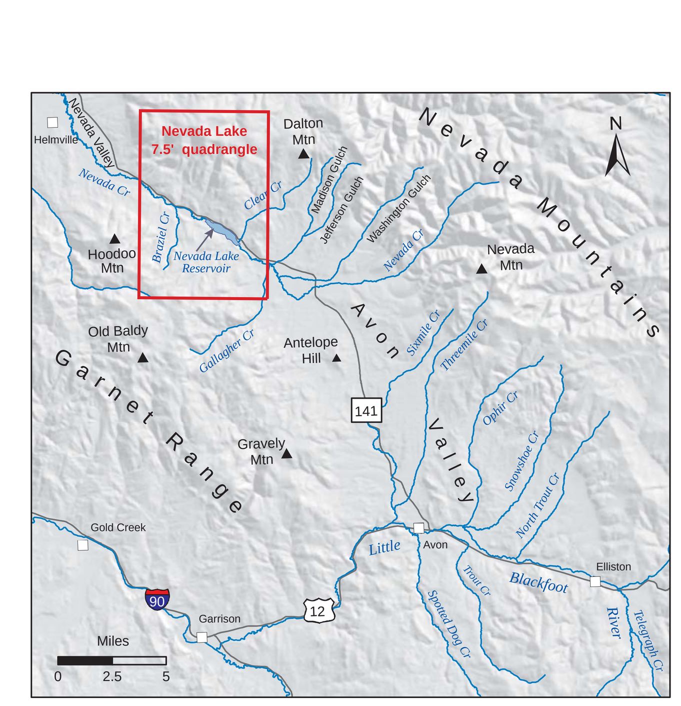


Figure 1. Location map for the Nevada Lake 7.5' quadrangle.

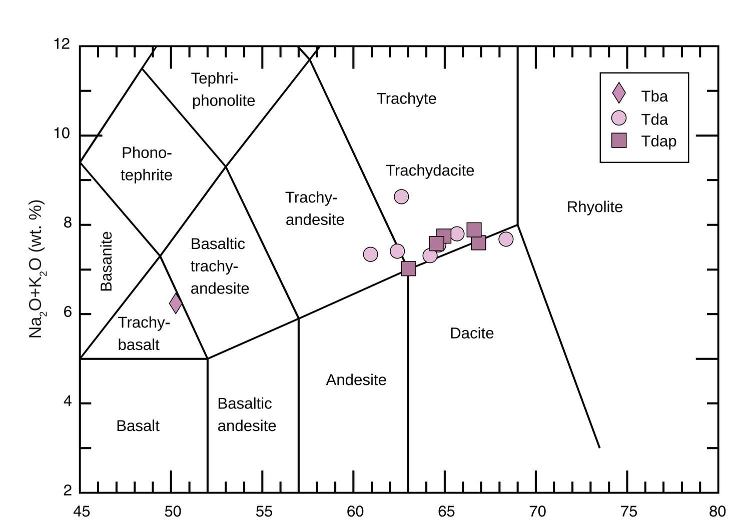


Figure 2. Whole-rock geochemical data from samples collected in the Nevada Lake 7.5' quadrangle. Normalized data are plotted on a total alkali silica diagram ($Na_2O + K_2O$ vs. SiO_2) after Le Bas and others (1986).

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