Text and references accompanying Nevada Bureau of Mines and Geology Open-File Report 2023-04

Geologic Map of the South Bastian Spring Quadrangle, White Pine County, Nevada

by

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ABSTRACT

The South Bastian Spring quadrangle includes the very southwestern tip of the northern Snake Range and the northwestern tip of the southern Snake Range. Bedrock exposure is minor compared to alluvium, but the geology of this quadrangle is an important component to the story of the northern Snake Range metamorphic core complex. North of Highway 50, exposures of Cambrian Prospect Mountain Quartzite and overlying Pioche Shale lie in low-angle fault contact with normal-faulted and tilted Paleozoic strata. The Prospect Mountain Quartzite is not lineated or foliated as is typical of the same unit in Snake Range metamorphic core complex, beneath the northern Snake Range detachment (NSRD) (e.g. Miller et al., 1999a). It is, however, highly brecciated, locally folded, and bedding readings show variability. We have interpreted the low-angle fault above the Pioche Shale in the South Bastian Spring quadrangle as the westernmost exposure of the northern Snake Range detachment fault**.** Here**,** unit contacts and foliation in the Pioche Shale beneath the mapped trace of the inferred NSRD are subparallel to it. To the south, in the northwestern exposures of rocks in the southern Snake Range, the Snake Range detachment fault as defined in the northern Snake Range ceases to exist, and Neoproterozoic to Cambrian age strata display original bedding (no mylonitic foliation or lineation) and are cut by normal faults. Faulting prevents knowledge of specific unit thicknesses in the South Bastian Spring quadrangle. Values cited are those listed in Miller et al. (1999b) based on previous stratigraphic work in the region.

DESCRIPTION OF MAP UNITS

Stratified Rock Units

Qal Active alluvium (Quaternary) Veneer of generally unconsolidated sand and gravel deposited within modern drainage systems and slopes.

Qla Lacustrine/alluvial deposits, undivided (Quaternary) Veneer of poorly consolidated lacustrine and alluvial deposits located at the western base of the southern Snake Range.

Qlg Lacustrine gravels (Quaternary) Lacustrine gravel, sand, and pebbly sand with some sandy marl deposited in beach, embankment or sand bar setting.

Qll Lagoonal deposits (Quaternary) Deposits of fine sand and marl that were deposited in a lagoonal environment behind gravel bars of unit Qlg.

Qlf Fine-grained lacustrine deposits (Quaternary) Fine-grained clay silt and some sand and marl playa and lake deposits.

Qol Older alluvium (Quaternary) Flat-lying or gently dipping consolidated to unconsolidated, alluvial fan, sand and gravel deposits that form pediment surfaces, rest in sharp angular discordance on older rocks, and are incised by present-day drainages. Clast types and morphology of these deposits reflect derivation from the present-day drainage systems developed in flanking mountain ranges.

Dg Guilmette Formation (Devonian) The Guilmette Formation consists predominantly of interbedded limestone and dolomite. The base is generally light- to medium-gray, massive cliff-forming, micritic to very finely recrystallized, mottled, somewhat fossiliferous limestone. Fossils include gastropods, crinoids, and brachiopods. This part of the formation may contain solution collapse breccia. The formation becomes better-bedded upwards, where fine-

grained gray limestone alternates with medium- to dark-brown, coarser-grained dolomite. Fossils are abundant and include stromatoporoids, brachiopods, crinoids, gastropods, and corals. The top of the formation is more limestone rich, and the uppermost portion is a highly burrowed, platy limestone. The section is incomplete in this quadrangle. Regional thickness reported for the Guilmette Formation is about 750 m (Hose et al., 1976).

Dsi Simonson Dolomite (Devonian) The Simonson Dolomite consists of light- to dark-brown, thin- to medium-bedded, laminated, microcrystalline to coarsely crystalline dolomite. The basal part is thicker bedded and uniformly light brown. The upper part is strikingly laminated with alternating light-brown and dark-chocolate-brown layers on a centimeter scale. Fossils are rare but include gastropods, crinoids, brachiopods, and coral debris. A typical thickness reported for this unit is about 175 m (Hose et al., 1976).

OSd Fish Haven and Laketown Dolomites, undivided (Silurian and Ordovician) The OSd dolomite is a light-gray to dark-chocolate-brown, slope- to cliff-forming dolomite. Regionally it averages approximately 600 m thick and is often divided into Ordovician Fish Haven Dolomite and Silurian Laketown Dolomite. The OSd dolomite varies from poorly bedded, dark-brown dolomite with rust- to black-colored nodular chert beds 1 to 3 cm thick and spaced about 4 to 6 cm apart, to uniformly chocolate-brown to a light-rust-gray, poorly bedded, fossiliferous dolomite with lesser, variable amounts of chert nodules, to massive, light-brown-gray dolomite similar in appearance to the Sevy Dolomite. Fossils include colonial, rugose, and tabulata corals as well as crinoids, brachiopods, and gastropods. A distinctive feature of the OSd dolomite is a several-meter-thick zone of algal stromatolite beds found about two-thirds of the way up through the unit. The upper part of the OSd dolomite that underlies the Sevy Dolomite is light-gray, cliff-forming, poorly bedded sugary dolomite.

Oe Eureka Quartzite (Ordovician) The Eureka Quartzite is white, cliff- to ledge-forming, thick-bedded orthoquartzite consisting of nearly 100% fine-grained (0.3–0.5mm), extremely well-sorted and well-rounded, silica-cemented quartz grains. It is a distinctive stratigraphic marker, occurring as it does between dark dolomites above and the yellow-weathering, blue-gray limestone of the Pogonip Group below. Complete sections in surrounding areas range from 40 to 150 m thick (Hose et al., 1976). Fresh surfaces are white and vitreous, weathered surfaces are rust-brown and pitted. The Eureka Quartzite commonly occurs as thin, brecciated, fault-bounded slivers and is often attenuated into such slivers along mapped faults that cut this formation.

Op Pogonip Group (Ordovician) The Pogonip Group consists of yellow-weathering, ledgy-slope- to slope-forming, well-bedded, fossiliferous, medium-blue-gray to light blue-gray, silty limestone. A number of fossil types occur in the Pogonip Group, including brachiopods, gastropods, crinoids, ostracods, coiled nautiloids, and tabulate corals. Due to areal variations within the group, various authors have divided it differently into formations. In the northern Snake Range, it is most convenient to follow the nomenclature of Fritz (1968), who divided the Pogonip Group into six units: A, B, C, D, Kanosh Shale and Lehman Limestone. In this quadrangle, complete sections are absent, and the unit cannot be subdivided. In surrounding areas the Pogonip Group is approximately 600 to 900 m thick.

Ꞓn Notch Peak Formation (Upper Cambrian) The Notch Peak Formation is a medium-gray, fine- to medium-grained, cliff- to ledge-forming, thin-bedded, cherty limestone. Partial sections of the Notch Peak Formation are exposed in the southern part of the quadrangle where they form impressive cliffy ridges. Typically, the limestone contains 1- to 2-cm-thick, rust- to brown-colored chert nodules in layers 2 to 4 cm apart. In some intervals, the chert occurs as isolated nodules that are sporadically distributed in thin-bedded to massive limestone or is entirely absent. Bedding, defined by silty limestone interlayers, can be irregular to well developed. Regional thickness is about 500–700 m.

Ꞓl Lincoln Peak Formation (Upper Cambrian) The Lincoln Peak Formation is a platy and slope-forming medium- to dark-gray, very thinly bedded limestone. In outcrop, it is platy and slope forming. Silty intervals and chert stringers weather distinctly brown. The limestone contains sparse trilobite hash and oncolites. The unit is estimated to be 1200–1400 m thick in the southern Snake Range but is only exposed in a small area at the northern edge and in the southern part of this quadrangle. Slopes underlain by poorly exposed Lincoln Peak Formation in the southern part may also include the Dunderberg Shale and have been mapped as Ꞓl.

Ꞓpc Pole Canyon Limestone (Middle Cambrian) The Pole Canyon Limestone is made up of thick alternating layers of light to bluish-gray limestone and darker cliff-forming limestone. Fenestral fabrics are common in the lower part of the unit, and it contains abundant Girvanella fossils and oolitic layers. The best exposures of the Pole Canyon Limestone occur beneath Mount Washington in the Minerva quadrangle to the south, where it has been described by Whitebread (1969). The Pole Canyon Limestone is about 1 km in thickness.

Ꞓpi Pioche Shale (Lower Cambrian) Regionally, the Pioche Shale forms an important lithologic transition between dominantly clastic Early Cambrian and older strata and the overlying clastic-absent Middle Cambrian limestone section. The Pioche Shale is a slope-forming unit of dark, sandy siltstone and clay shale that is greenish-gray to khaki-colored, mostly thin-bedded, and includes some cross-bedded sandstone at the base. The Pioche Shale is complexly deformed and locally exhibits a foliation that is subparallel to the overlying northern Snake Range décollement, which is mapped immediately above it. It is less than 100 m thick.

Ꞓpm Prospect Mountain Quartzite (Lower Cambrian) The regional reported thickness of the Prospect Mountain

Quartzite is approximately 1200 m. The unit is a cliff-forming quartzite that weathers rust-brown, tan or purple with consistent bedding thicknesses (.3–1m). Beds have cross-beds defined by dark laminations. In hand specimen, the quartzite is white to gray, well sorted, fine- to medium-grained, and consists of 90–95% quartz, 5% feldspar and lesser muscovite, chlorite, and opaque oxides. The abundance of cross-beds and the regular bedding help to distinguish the Prospect Mountain Quartzite from the underlying McCoy Creek Group. Pelitic intervals and pebble conglomerates are rare compared to the McCoy Creek Group. In the South Bastian Spring quadrangle, the Prospect Mountain Quartzite and overlying Pioche Shale are interpreted to lie in the lower plate of the northern Snake Range décollement or detachment fault (NSRD), based on the fact that unit contacts and foliation in the Pioche Shale beneath the NSRD are subparallel to it. If so, exposures of Ꞓpm and Ꞓpi in the South Bastian Spring quadrangle would constitute the westernmost exposures of lower plate rocks (Miller et al., 1983; Lee et al., 1987; Lee and Sutter, 1991, Johnston, S.M., 2000). Unlike farther east in the northern Snake Range, lower plate rocks here do not exhibit mylonitic fabrics. They are, however, highly brecciated and complexly folded and faulted on all scales and bedding dips are variable. Very poor exposure precludes detailed analysis of this (mostly brittle) deformation.

pꞒmu McCoy Creek Group, undivided (Proterozoic) The McCoy Creek Group is the formal designation given throughout east-central Nevada to a thick interval of alternating quartzite and shale that underlies the Lower Cambrian Prospect Mountain Quartzite (Misch and Hazzard, 1962). It is generally assumed to be Neoproterozoic. Detrital zircon studies confirm its Neoproterozoic age (Hoiland et al., 2022). In adjacent ranges, this interval has been divided into 6 to10 informal quartzite and shale members, but the regional correlation of these members is not clear. The stratigraphically highest pelite within the McCoy Creek Group rock is the Osceola Argillite (pꞒm_0) (following the nomenclature of Misch and Hazzard, 1962), and lower quartzite and pelite intervals into informal units 1 (pꞒm_1) to 5 (pꞒm_5) in descending order. Total thickness of the exposed units of the McCoy Creek Group in the southern Snake Range is about 4 km.

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