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Bedrock Geologic Map of the Black Hills 1:24,000 Quadrangle, Nevada

By

Peter L. Guth

Open-File Map 86-438

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

Las Vegas, Nevada
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INTRODUCTION

Geologic work in the ranges north of Las Vegas began in 1871 when G.K. Gilbert traversed the region during the Wheeler Survey (Wheeler, 1875). Spurr (1903) carried out additional reconnaissance mapping, but significant exploration did not begin until the work of C.A. Longwell beginning in the the 1920's (summarized in Longwell and others, 1965). My mapping in the Black Hills quadrangle began in 1979 as part of a larger project that consisted of mapping in the Hayford Peak 1:62,500 quadrangle undertaken for a thesis at the Massachusetts Institute of Technology (Guth, 1980). Mapping of the unmapped Desert Range part of the Black Hills quadrangle resumed in 1984 as part of a U.S. Geological Survey project to map the Indian Springs 1:100,000 quadrangle. The work of Ebanks (1965) in the Gass Peak Quadrangle to the southeast is the only only other large scale mapping in the vicinity.

My field work in this quadrangle was greatly aided by field assistants Heidi Schultz in 1979 and Steve Garwin in 1984. The personnel of Desert National Wildlife Range, custodians of the region, went out of their way to accommodate us. Range Control personnel from the Nellis Bombing and Gunnery Range cooperated with access to the Desert Range. This work has been supported by or carried out in cooperation with the Department of Energy, Geological Society of America Penrose grants, a Fannie and John Hertz Foundation fellowship, the Massachusetts Institute of Technology, the U.S. Army, and the U.S. Geological Survey.

GENERAL GEOLOGY

The Black Hills and vicinity is characterized by late Precambrian and Paleozoic miogeosynclinal strata, large-scale Mesozoic thrust faults, and Tertiary extensional tectonics. Normal and strike slip faults, clastic and lacustrine strata, and widespread landslides characterize the Tertiary. Outstanding exposures of the structures at the breakaway zone of a detachment fault occur within the quadrangle along the west side of the Sheep Range.

Miogeosynclinal rocks exposed in the quadrangle range in age from Middle Cambrian to Late Mississippian (see Guth, 1980 for details of local Paleozoic stratigraphy). The rocks exposed in the Black Hills quadrangle conformably overlie late Precambrian (?) and Early Cambrian clastic strata consisting largely of sandstone, quartzite, and siltstone (Stewart, 1970), exposed in the Desert Range 15 km to the northwest and the Las Vegas Range 15 km to the east of the Black Hills quadrangle. Middle Cambrian to mid Devonian rocks are mostly dolomite with some limestone and a few clastic units including the Eureka Quartzite. The higher Devonian units and the Mississippian rocks are mostly

limestone with a few shale units including the Mississippian Indian Springs Formation (Chesterian), the youngest Paleozoic unit exposed in the quadrangle. Pennsylvanian, Permian, and lower Mesozoic rocks occur in nearby areas, but have all been eroded from the Black Hills quadrangle.

The rocks of the Black Hills quadrangle lie in the upper plate of the Mesozoic Gass Peak thrust. This thrust, exposed in the Las Vegas Range to the east of the quadrangle, correlates with the Wheeler Pass thrust in the Spring Mountains to the southwest (Burchfiel and others, 1974). The thrust plate must have been at least 9000 m thick and probably had at least 30 km of horizontal displacement (Guth, unpublished). The Wheeler Pass-Gass Peak thrusts, like most of the Sevier thrusts in the southern Great Basin, have only been indirectly dated. Recent work by Carr and others (1986) questions previously accepted regional interpretations and suggests the possibility of significant diachroneity of motion in the thrust belt. A Late Triassic or Early Jurassic age for thrusting now appears likely (see Carr, 1980; Axen, 1984; Jones and others, 1984; and Carr and others, 1986, for details of the dating arguments).

Tertiary structures include synchronous strike-slip faults, low- and high-angle normal faults, and landslides. Associated with these structures are sedimentary deposits that occur in small tectonic basins. A large Tertiary basin, exposed along the west side of the Sheep Range in the White Sage Flat quadrangle immediately north of the mapped area, extends into the northern part of the quadrangle. Tertiary lacustrine limestone in the basin has been isoclinally folded beneath landslide masses composed of Paleozoic carbonate rocks.

The quadrangle lies north of the Las Vegas Valley shear zone, which forms the southern boundary of a large extensional terrane (Anderson, 1973; Guth, 1981; Wernicke and others, 1984). Tertiary tectonic and sedimentary relations in the quadrangle are related to this extensional terrane and in part to the Las Vegas Valley shear zone. A similar relationship of structures to extension and strike slip faulting has been described by Bohannon (1983) near the Lake Mead fault system 50 km to the southeast.

DESCRIPTION OF MAP UNITS

SURFICIAL DEPOSITS

Qal ALLUVIUM (QUATERNARY)--Moderately to poorly sorted, unconsolidated sands and gravels along washes, on alluvial fans, and in valley fill. In places difficult to differentiate from weathered outcrops of the Horse Spring Formation (Ths)

BEDROCK

Ths HORSE SPRING FORMATION (MIOCENE)--Diverse, well-indurated fluvial and lacustrine rocks. Primarily sandstone and conglomerate with clasts of Paleozoic sedimentary rocks; also includes lacustrine limestone and tuffs. Deposited in one or more tectonically active basins. The limestones contain non-diagnostic fresh-water fossils. Similar tuffs in the adjacent Gass Peak quadrangle yielded K-Ar ages of 15.2 and 15.9 m.y. (J.F. Sutter, personal communication to W.J. Ebanks, 1968, cited in Guth, 1981)

Mis INDIAN SPRINGS FORMATION OF Webster (1969) (MISSISSIPPIAN)--Fissile red to yellow shale. Contains common fossils, especially goniatites. Poorly exposed; generally highly deformed by normal faults and landslides. Chesterian in age. Correlative with the Chainman Shale (see Barnes and others, 1982). About 30 m thick

Mj JOANA(?) LIMESTONE (MISSISSIPPIAN)--Thin- to thick-bedded, well-bedded, dark-gray limestone with abundant pelmetazoan debris. Contains a zone with abundant dark-gray chert nodules. The lithology of the Mississippian limestone in the Sheep Range appears similar to rocks in southwestern Lincoln County (Tschanz and Pampeyan, 1970), including the Pahranagat Range (Reso, 1963), which have been assigned to the Joana Limestone. The Sheep Range rocks are significantly different from rocks assigned to the Monte Cristo Group by Langenheim and others (1962) in the Arrow Canyon Range or the Monte Cristo Limestone by Burchfiel and others (1974) in the Spring Mountains. Correlative with the limestone of Timpi Canyon and the Mercury Limestone (see Barnes and others, 1982). About 250 m thick

Mp PILOT(?) SHALE (MISSISSIPPIAN)--Shale, quartzite, bedded chert, and limestone, all generally light colored. Poorly exposed and generally deformed by faults. The Pilot Shale has been identified in the Pahranagat Range (Reso, 1963) and the Desert Range (Tschanz and Pampeyan, 1970). Correlative with the Narrow Canyon Limestone in the Spotted Range (Barnes and others, 1982). About 15 m thick

MDc CARBONATE ROCKS (MISSISSIPPIAN AND DEVONIAN)--Brecciated and recemented limestone clasts derived from the Joana(?) Limestone (Mj) and Devils Gate Limestone (Ddg).

Ddg DEVILS GATE LIMESTONE, UNDIVIDED (DEVONIAN)--Generally homogeneous dark-gray, coarse-grained, thick-bedded limestone consisting of three distinctive lithologies: (1) a basal orange-weathering, recessive, silty dolomite; (2) an interval in the lower part of the formation with abundant, cabbage-sized, chertified, stromatoporoid heads; and (3) an interval in the middle and upper parts of the formation with as many as five thin beds of pure quartz sandstone. The sandstone beds are either frequently brecciated or missing due to faulting. About 440 m thick. Locally divided into:

Ddgq Quartzite--Pure quartz sandstone that occurs throughout the area, but which is mapped separately only where it forms a thick interval in the upper part of the formation. Up to 15 m thick

Dbs BAY STATE(?) DOLOMITE AND SENTINEL MOUNTAIN(?) DOLOMITE, UNDIVIDED (DEVONIAN)--Generally well-bedded, locally well-laminated dolomite. Common color bands of white, gray, and black. A distinctive Stringocephalus brachiopod bioherm occurs just below the top of the unit. Correlative with the upper unit of the Nevada Formation of former usage in the Spotted Range (see Barnes and others, 1982). About 195 m thick

Dob OXYOKE CANYON SANDSTONE AND BEACON PEAK DOLOMITE, UNDIVIDED (DEVONIAN)-Predominately silty to sandy dolomite constituting a distinctive pair of units that are mapped together. The Oxyoke Canyon Sandstone consists of interbedded quartzite, sandy dolomite, and dolomite which weathers light tan or rusty colored. The Beacon Peak Dolomite (which lies beneath the Oxyoke Canyon stratigraphically) forms a recessive slope of olive-weathering, silty dolomite overlain by fine-grained, medium-gray dolomite with abundant elongated nodules of dark-gray chert. Correlative with the lower unit (Dnl) of the Nevada Formation of former usage and with unit F (Df) of the dolomite of the Spotted Range in the Spotted Range (see Barnes and others, 1982). Thickness about 50 m

Sl LAKETOWN DOLOMITE (SILURIAN)--Light-colored dolomite, generally evenly bedded and fine grained, recrystallized and crystalline. A thick zone of chert nodules occurs within the formation at the southern end of the map area, but disappears along strike to the north. About 300 m thick

Oes ELY SPRINGS DOLOMITE (ORDOVICIAN)--Massive, cliff-forming, black dolomite. About 140 m thick

Oe EUREKA QUARTZITE (ORDOVICIAN)--White to brown, vitreous, fine- to medium-grained orthoquartzite, generally without conspicuous bedding. Includes minor dolomitic quartzite and some dolomite beds in the middle part of the formation, and a distinctive multi-colored quartzite which weathers rust, red, and yellow. Resistant unit, but commonly obscured by talus from the Ely Springs Dolomite which lies above it. Subject to bedding-plane slip movement along its contacts. About 50 m thick

POGONIP GROUP (ORDOVICIAN)--Interbedded dolomite and limestone. Ross (1964) measured a section in Black Gate Canyon in the southeastern corner of the map area, but did not name the units he measured. The stratigraphic nomenclature used for the Pogonip Group in this area has has been slightly modified from Guth (1980). Divided into:

ANTELOPE VALLEY LIMESTONE (ORDOVICIAN)--Consists of:

Oaa Aysees Member--Dolomite that forms two (unmapped) subunits. The lower subunit consists of massive, medium-gray dolomite that forms a cliff. The top of this cliff contains abundant algal pisolites, and large fossil gastropods referred to the genera Palliseria and Maclurites. The upper subunit consists of light-colored silty dolomite with some sandy stringers. Thickness about 280 m

Oal Lower part-- Cliff-forming silty dolomite and limestone. Weathers to form reddish outcrops with commonly dark-colored, silicified, crepe-weathering parts. The only resistant silty carbonate rock unit in the map area. About 130 m thick

On NINEMILE FORMATION (ORDOVICIAN)--Basal, light-colored, orange-weathering silty, bench-forming dolomite that is overlain by silty, cherty, light-gray dolomite and limestone. About 180 m thick

Og GOODWIN LIMESTONE UNDIVIDED (ORDOVICIAN)--Basal, light-colored, silty dolomite that is overlain by medium- to light-gray dolomite with abundant intraformational conglomerates which contain angular clasts of dolomite and dark-gray chert. About 340 m thick. Divided in the Black Hills into:

Ogu Upper member--Light-gray, cherty, well-bedded dolomite. Forms steep slopes with conspicuous ledges formed by bedding

Ogl Lower member--Basal, light-colored silty dolomite, that is overlain by black, cliff-forming dolomite.

NOPAH FORMATION (CAMBRIAN)--Consists of:

€ns Smoky Member--Massive dolomite which exhibits large-scale black and white stripes. Although they are visible from a distance, the stripes do not persist laterally. Dolomite ranges from strongly recrystallized to well-laminated and mottled in appearance, and forms rugged cliffs. Abundant chert and sandy nodules present near the top of the formation. Thickness about 300 m

€nd Dunderberg Shale Member and Halfpint Member, undivided--Lower part (Dunderberg Shale Member) of unit consists of fissile shale and thin limestone interbeds that form a deep saddle and the upper part (Halfpint Member) consists of more resistant limestone and silty limestone. Both members contain abundant elliptical limestone nodules and fossil hash. Thickness about 30 m

BONANZA KING FORMATION (CAMBRIAN)--In this area, consists of:

€bb Banded Mountain Member--Dark- and light-gray banded dolomite, with some limestone. Distinctive color bands and ledge-forming outcrops. Base not exposed. Over 410 m thick

SUBSURFACE UNITS SHOWN ONLY ON CROSS SECTION. Descriptions taken from and thicknesses projected from Guth (1980):

BONANZA KING FORMATION (CAMBRIAN)--In this area, consists of:

€bp Papoose Lake Member--Dolomite and subordinate limestone; 410 m thick

€c CARRARA FORMATION (CAMBRIAN)--Shale and limestone; 265 m thick

€Zw WOOD CANYON FORMATION (CAMBRIAN AND LATE PROTEROZOIC)--Siltstone and sandstone; 620 m thick

€Zs STIRLING QUARTZITE (LATE PROTEROZOIC)--Sandstone and quartzite; 950 m thick

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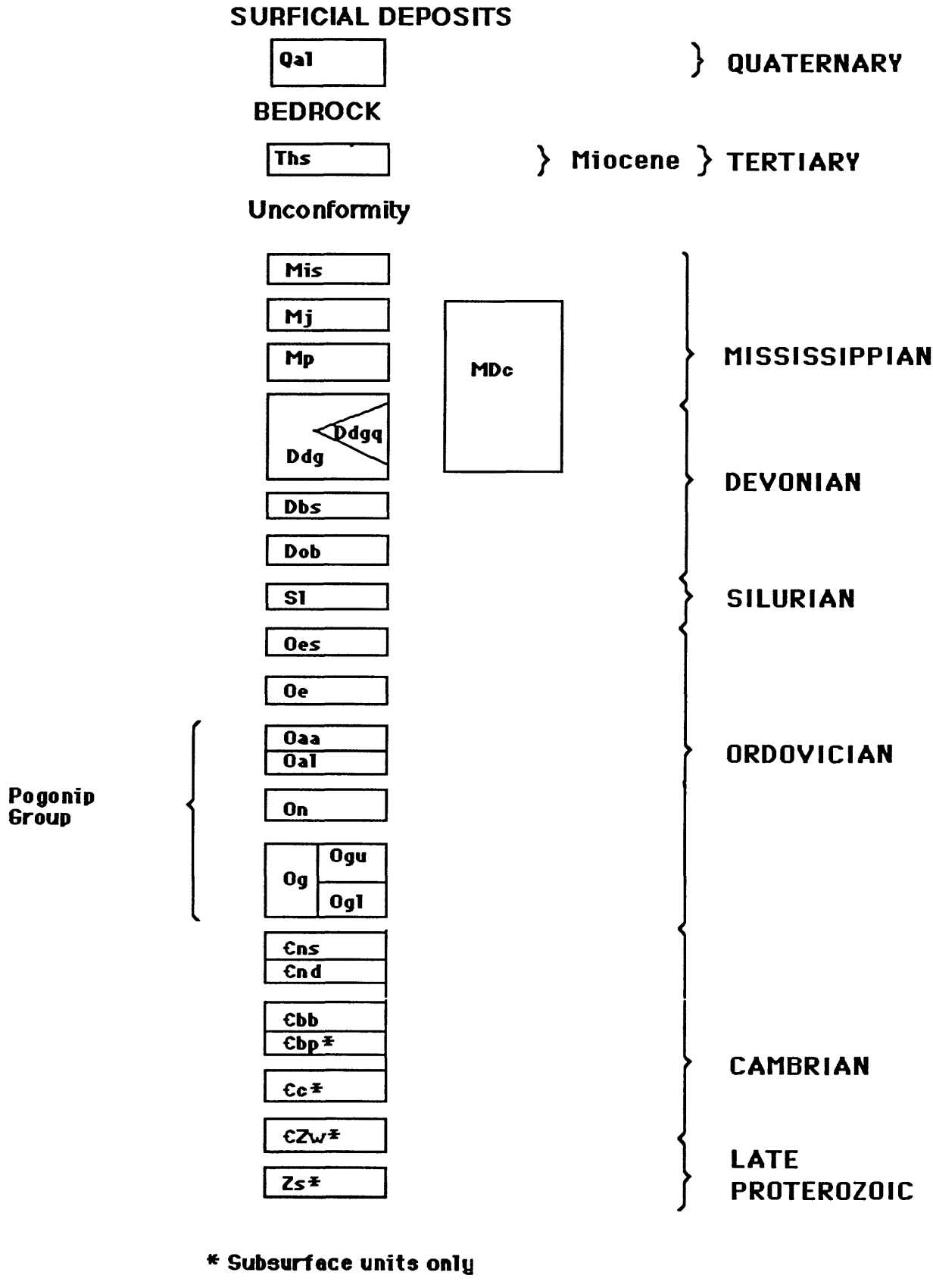
CORRELATION OF MAP UNITS



* Subsurface units only