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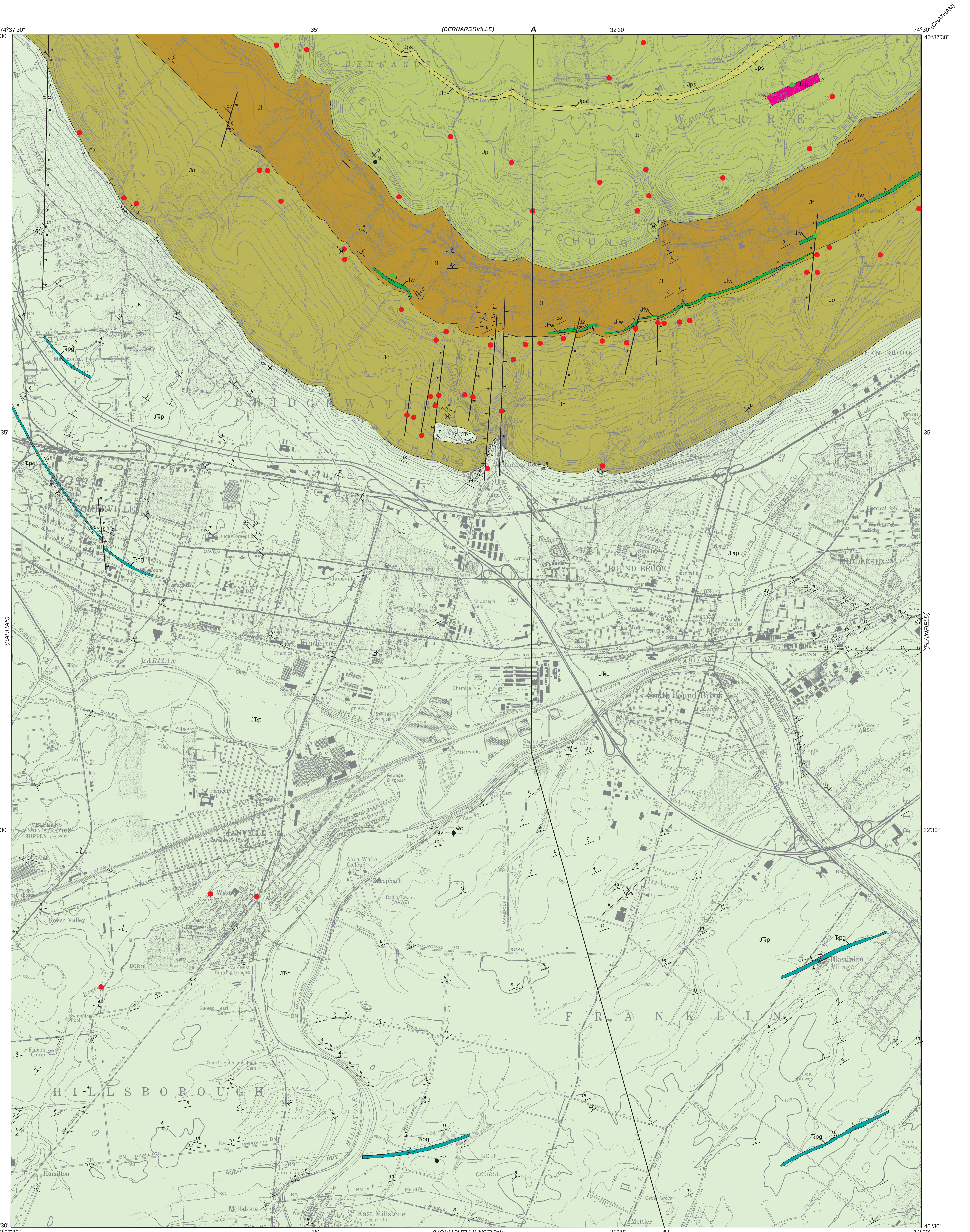

Topography compiled 1944. Planimetry derived from imagery taken 1995. Survey control current as of 1955.

North American Datum of 1983 (NAD 83). Projection and 1000-meter grid: Universal Transverse Mercator, zone 18 2500-meter ticks: New Jersey Coordinate System of 1983 and New York Coordinate System of 1983 (east zone)

SCALE 1:24 000

1 2 0 1 MILE

000 0 000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

Bedrock geology mapped by R.A. Volkert and D.H. Monteverde in 1999. Digital cartography by R.S. Pristas and D.H. Monteverde.

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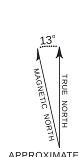
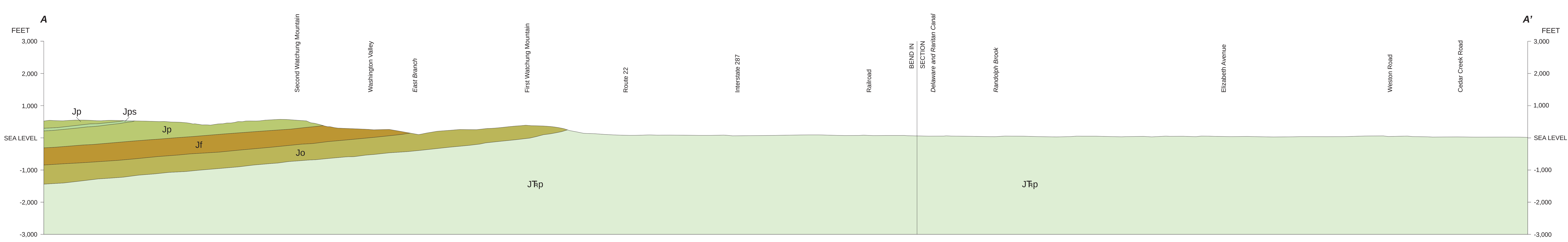
Bedrock Geologic Map of the Bound Brook Quadrangle, Somerset and Middlesex Counties, New Jersey

by
Richard A. Volkert and Donald H. Monteverde
2011

LOCATION IN NEW JERSEY



APPROXIMATE MEAN DECLINATION, 1999



INTRODUCTION

The Bound Brook 7.5-minute quadrangle is located in Somerset and Middlesex Counties within a mixed commercial, industrial and residential setting. The quadrangle is in the Raritan River drainage basin, and the Raritan and Millstone Rivers are the dominant streams in the map area.

The Bound Brook quadrangle is entirely within the Piedmont Physiographic Province. The northern part of the map area consists of two parallel ridges, the First and Second Watchung Mountains, with elevations of as much as 600 ft. above sea level. The central and southern parts of the quadrangle are characterized by relatively subdued topography with elevations of 100 ft. or less.

STRATIGRAPHY

The Bound Brook quadrangle is underlain by bedrock of Mesozoic age (Lower Jurassic and Upper Triassic). Bedrock occurs in the Newark basin, a northeast-trending half-graben in northern and central New Jersey that contains a total of approximately 24,600 ft. of interbedded sedimentary and igneous rocks. These consist of conglomerate, sandstone, siltstone, and shale of fluvial and lacustrine origin, and three interbedded tholeiitic basalt units. However, only the middle and upper parts of this succession crop out in the quadrangle.

The general stratigraphic order of the bedrock is one of progressively younger formations from south to the north. Sedimentary units from oldest to youngest are the Passaic Formation of Upper Triassic and Lower Jurassic age and the Feltville Formation of Lower Jurassic age. The Feltville Formation forms a narrow intermontaine valley between the First and Second Watchung Mountains. Igneous units from oldest to youngest are the Orange Mountain Basalt and the Preakness Basalt. The Preakness Basalt contains a thin sedimentary unit above the first flow, and also contains conformable, coarse-grained to locally pegmatitic layers mapped as gabbroid that occur at several stratigraphic intervals. Gabbroid layers are particularly well exposed to the northeast in the Chatham quadrangle (Monteverde and Volkert, 2004). Puffer and Volkert (2001) interpreted the gabbroid and pegmatite layers to have formed by fractionation of finer-grained basalt in the Preakness.

Three core holes were drilled in the Bound Brook quadrangle as part of the Newark Basin Coring Project (Olsen et al., 1996) (see map for core hole locations). They are the Somerset core hole near East Millstone, drilled to a depth of -3,009 ft., Weston Canal core hole near the confluence of the Raritan and Millstone Rivers, drilled to -2,601 ft., and the Martinsville core hole near Martinsville, drilled to -4,015 ft.

STRUCTURE

The overall trend of the bedrock units is affected by their location on the south end of the Watchung syncline, a regional, northeast-plunging fold structure (Drake and others, 1996). Bedding in the sedimentary rocks closely parallels the trend of the igneous rocks. In general, beds in the western part of the map area strike northwest and dip northeast, and in the eastern part of the quadrangle strike northeast and dip northwest. The mean strike of all beds is N.83°E. (fig. 1). Beds range in dip from 2° to 16° and average 8°.

Small, north-trending brittle faults of Mesozoic age and of minor displacement cut the formations in the northern part of the map area. These faults range in width from <1 foot to about 20 feet, and the wider faults commonly consist of zones of multiple thin faults. The faults are characterized by very close-spaced jointing, thin zones of breccia and (or) clayey gouge, slickensides locally coated with chlorite or calcite, and eroded gaps in basalt outcrops. Kinematic indicators that consist of subhorizontal to gently north-plunging slip lineations on fault surfaces suggest that the predominant movement was right-lateral strike-slip. Faults cutting the Preakness Basalt have an average strike of N.02°W. (n=8) and dip 88° west. Faults cutting the Orange Mountain Basalt have an average strike of N.03°E. (n=31) and dip at an average of 86° with equal abundance toward the east and west.

Joints are a ubiquitous feature in all of the bedrock units. In the sedimentary rocks, northeast-striking joints are the most abundant and they strike at an average of N.15°E. (fig. 2) and dip at an average of of 85°. These joints are characteristically planar, moderately well formed, and variably spaced from <1 ft. to several feet. Joint surfaces are typically unmineralized, except near faults where they may contain sparse calcite, and are smooth and, less commonly slightly irregular. Joints in sandstone tend to be better developed and more continuous than joints developed in the finer-grained lithologies such as siltstone and shale. Joints in the latter are commonly discontinuous over short distances. All joints formed near faults are spaced <1 ft.

Joints in the igneous rocks consist of two types, columnar (cooling) and tectonic. Columnar joints are present in both of the basalt formations in the map area. They are characteristically polygonal, arrayed radially and are variable in height and spacing. A comprehensive study of cooling joints in the Watchung basalts was made by Faust (1978). Tectonic joints occur in both basalt formations but are commonly obscured by the more pervasive cooling joints. Tectonic joints are best preserved in the Orange Mountain Basalt where they are typically planar, well formed, smooth to slightly irregular, steeply dipping, generally unmineralized, and variably spaced from a few feet to tens of feet. However, in outcrops that are near faults joint spacing is 1 ft. or less. The principal tectonic joint trend in the basalts is indistinguishable from the predominant fault trend.

ECONOMIC RESOURCES

Copper deposits in the map area containing native copper, cuprite, malachite, azurite, and chrysocolla were mined mainly during the 19th century, and possibly also during the 18th century, at several locations along the lower and upper contacts of the Orange Mountain Basalt. Descriptions of the mines (American, Chimney Rock, Bolmer) and the history of their workings are given in Woodward (1944). Lower Jurassic basalt was formerly quarried for use as aggregate and dimension stone from several locations in the quadrangle and Orange Mountain Basalt is presently quarried at Chimney Rock. Passaic Formation was formerly quarried from a single location at Millstone in the southern part of the quadrangle and Feltville Formation from a single location north of Washington Valley Reservoir.

NATURALLY OCCURRING RADIOACTIVITY

Background levels of naturally occurring radioactivity were measured in Mesozoic bedrock outcrops using a hand-held Micro R meter and the results are given under the individual rock unit descriptions. In general, basalt yields consistently low readings of about 5 Micro R/Hr regardless of stratigraphic position, texture, or composition. Sedimentary rocks yield higher and somewhat more variable readings, ranging from 8 to 27 Micro R/Hr that appear to be influenced mainly by grain size. Values recorded from sandstone and pebbly sandstone are lower than those from finer-grained siltstone and shale, suggesting that clay minerals are likely the radiogenic hosts.

DESCRIPTION OF MAP UNITS

Jp
Jpg
Jps

Preakness Basalt (Lower Jurassic) (Olsen, 1980a) - Dark-greenish-gray to black, fine-grained, dense, hard basalt composed mainly of intergrown calcic plagioclase and clinopyroxene. Contains small spherical tubular gas-escape vesicles, some filled by zeolite minerals or calcite, just above scoriaceous flow contacts. Dark-gray, coarse- to very-coarse-grained gabbroid (Jpg) composed of clinopyroxene grains as much as 0.5 in. long and plagioclase grains as much as 1.0 in. long occurs at several stratigraphic intervals in the unit but is most abundant in the lowest flow. Gabbroid has sharp upper contacts and gradational lower contacts with more typical finer-grained basalt. Unit consists of at least three major flows, the tops of which are marked by prominent vesicular zones as much as 8 ft. thick. Radiating slender columns 2 to 24 in. wide, due to shrinkage during cooling, are abundant near the base of the lowest flow. A thin, 6-to-25 ft.-thick sequence of interbedded reddish-brown sandstone and shale (Jps) separates the lowest flows. It is not exposed in the quadrangle but is known elsewhere from outcrops and water-well record data. Maximum thickness is about 1,040 ft. Levels of natural radioactivity range from 4 to 6 (mean=5.5) Micro R/Hr.

Jf
Jfw

Feltville Formation (Lower Jurassic) (Olsen, 1980a) - Reddish-brown, or light-grayish-red, fine- to coarse-grained sandstone, siltstone, shaly siltstone, and silty mudstone, and light- to dark-gray or black, locally calcareous siltstone, silty mudstone, and carbonaceous limestone. Upper part of unit is predominantly thin- to medium-bedded, reddish-brown siltstone and locally cross-bedded sandstone. Reddish-brown sandstone and siltstone are moderately well sorted, commonly cross-laminated, and interbedded with reddish-brown, planar-laminated silty mudstone and mudstone. Two thin, laterally continuous sequences, each as much as 10 ft. thick, of dark-gray to black, carbonaceous limestone, light-gray limestone, medium-gray calcareous siltstone, and gray or olive desiccated shale to silty shale occur near the base and, along with the red beds between, comprise the Washington Valley Member (Jfw) of Olsen (1980b). Gray beds contain fish, reptiles, arthropods, and diagnostic plant fossils. As much as 2 ft. of Feltville has been thermally metamorphosed along the contact with the Preakness Basalt (Jp). Thickness of unit ranges from 450 to 483 ft. regionally. Levels of natural radioactivity from reddish-brown sandstone and siltstone range from 11 to 17 (mean=12.5) Micro R/Hr.

Jo

Orange Mountain Basalt (Lower Jurassic) (Olsen, 1980a) - Dark-greenish-gray to black, fine-grained, dense, hard basalt composed mostly of calcic plagioclase and clinopyroxene. Locally contains spherical to tubular gas-escape vesicles, some filled by zeolite minerals or calcite, typically above base of flow contact. Unit consists of three major flows that are separated in places by a weathered zone, a bed of thin reddish-brown siltstone, or by volcaniclastic rock. Lower part of upper flow is locally pillowed; upper part has pahoehoe flow structures. Middle flow is massive to columnar jointed. Lower flow is generally massive with widely spaced curvilinear joints and is pillowed near the top. Individual flow contacts are characterized by vesicular zones as much as 8 ft thick. Thickness of unit is about 590 ft. Levels of natural radioactivity range from 3 to 6 (mean=5) Micro R/Hr.

JTRp
TRpg

Passaic Formation (Lower Jurassic and Upper Triassic) (Olsen, 1980a) - Interbedded sequence of reddish-brown, and less commonly, maroon or purple, fine- to coarse-grained sandstone, siltstone, shaly siltstone, silty mudstone, and mudstone (JTRp), separated by olive-gray, dark-gray, or black siltstone, silty mudstone, shale, and silty argillite (TRpg). Top of unit in the map area is marked by as much as 4 ft. of massive, coarse-grained sandstone directly beneath Orange Mountain Basalt. Reddish-brown sandstone and siltstone are thin- to medium-bedded, planar to cross-bedded, micaceous, and locally mud cracked and ripple cross-laminated. Root casts and load casts are common. Shaly siltstone, silty mudstone, and mudstone are fine-grained, very thin- to thin-bedded, planar to ripple cross-laminated, locally fissile, bioturbated, and contain evaporite minerals. They form rhythmically fining-upward sequences as much as 15 ft. thick. Thickness of gray bed sequences ranges from about 1 ft. to 40 ft. As much as 2 ft. of unit has been thermally metamorphosed along the contact with the Orange Mountain Basalt (Jo). Regionally is as much as 11,480 ft. thick but only about 5,800 ft. occur in the map area. Levels of natural radioactivity measured in reddish-brown siltstone and shaly siltstone range from 8 to 24 (mean=17) Micro R/Hr, reddish-brown and purple silty mudstone and mudstone range from 10 to 20 (mean=16) Micro R/Hr, and in gray siltstone, silty mudstone and shale range from 14 to 27 (mean=20) Micro R/Hr.

EXPLANATION OF MAP SYMBOLS

Contact - Dashed where approximately located; queried where uncertain

Fault

Normal fault - Ball shows direction of dip

High-angle fault of unknown movement

40 **Strike and dip of inclined beds**

Location of bedrock outcrops or float used to draw unit contacts

Basalt

Sedimentary rock

Cu **Abandoned copper mine**

Active rock quarry

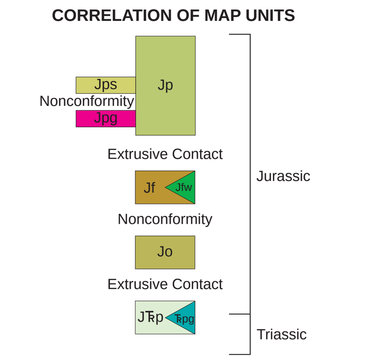
Abandoned rock quarry

B **Basalt**

S **Sedimentary rock**

M **Location of core holes: SO, Somerset; WC, Weston Canal; M, Martinsville**

CORRELATION OF MAP UNITS



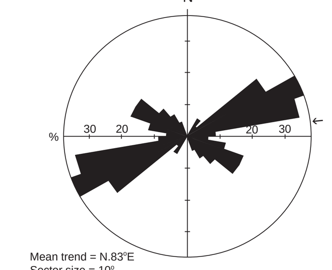


Figure 1. Bedding in sedimentary rocks.

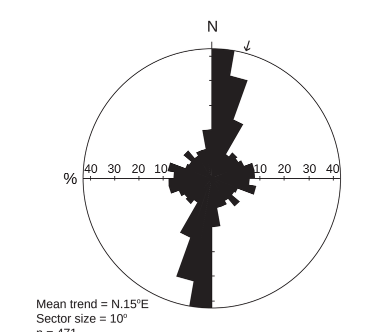


Figure 2. Joints in sedimentary rocks.

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