Plate 3: Map Showing Bedrock Geology, Topography of the Bedrock Surface, and Altitude of the Base of the Potomac Formation City of Alexandria and Vicinity

By Tony Fleming, March 2008

This map depicts the geology of the early Paleozoic metamorphic bedrock, which crops out only in the extreme western part of the city. The bedrock is completely concealed beneath coastal plain deposits everywhere else, but a combination of regional geophysical data, knowledge of bedrock structure in adjacent quadrangles, and descriptions of bedrock encountered in scattered boreholes beneath the coastal plain allow reasonable inferences to be drawn in that area. The map also shows the topography of the buried bedrock surface at the base of the early Cretaceous Potomac Formation; the configuration of this major unconformity was reconstructed from a variety of outcrop and borehole data, some of which provide firm altitudes of the bedrock surface, while others give a minimum depth to bedrock. A more detailed description of the bedrock geology, this map, and how it was compiled can be found in "Plate 3: Bedrock geology and topography-expanded explanation".

Explanation

Bedrock Surface (Base of Potomac Formation)
Structure contour representing line of equal elevation on the buried bedrock surface. The lines also represent the altitude of the base of the Potomac Formation, which rests unconformably on bedrock. Contour interval: 100 feet, datum is mean sea level

Supplemental 50-foot structure contour representing line of equal elevation on the buried bedrock surface. Used for the part of the bedrock surface above sea level, where data are more numerous.

Altitude of outcrop where the base of the Potomac Formation can be observed to rest unconformably on the bedrock surface

Altitude of the bedrock surface as reported or inferred from geotechnical borings ( ) and water wells described by: Johnston, 1961 ( ); Darton, 1950 ( ); and Froelich, 1985 ( ). Queried where doubtful. Underlined values represent the bedrock surface elevation penetrated in wells. Numbers followed by "cs" represent the elevation of the bottom of the well casing for wells where no bedrock is reported, but whose depth suggests that the casing may be seated in or near bedrock. Numbers preceded by a "less than" sign represent the highest possible bedrock altitude based on total well depth for wells that did not reach bedrock. The type of bedrock reported (if any) in a well is represented by a colored symbol corresponding to the bedrock colors shown on the map.

Bedrock Geology-Rock Units *(darker tones indicate areas of bedrock outcrop; lighter tones indicate where bedrock is concealed beneath Coastal Plain sediments)*
Undifferentiated body of granitoid rocks below northern Alexandria. Known only from a pronounced, deep aeromagnetic anomaly and corresponding reports of "granite" from deep wells near Episcopal Seminary

Occoquon Granite (early Ordovician; Drake and Froelich, 1986). Coarse grained, well foliated, light gray muscovite-biotite monzogranite. In Holmes Run Gorge, the granite exhibits multiple foliations and is folded with the enclosing metasedimentary wallrocks.

Chopawamsic Formation (early Ordovician; Southwick and others, 1971). Metamorphosed mafic to felsic volcanic rocks and sediments. Not exposed in map area, but geophysical evidence suggests it

is the dominant unit east of the Rock Creek Shear Zone and floors the coastal plain beneath all of Old Town, where "green rock" and "flint" are reported from deep wells.
Falls Church Tonalite (early Ordovician, Drake and Froelich, 1997). Medium to coarse grained, dark gray, hornblende-biotite tonalite. The only exposure of this unit in the city is a small, well-foliated body in the mouth of the Rynex ravine on the west bank of Holmes Run, at the city limits.

Muscovite monzogranite (early Ordovician, Drake and Froelich, 1986). Sugary textured to coarse grained, well foliated, white and light gray muscovite monzogranite. Crops out just west of the city limits in Holmes Run Gorge.

Sykesville Formation (Hopson, 1964; Cambrian and(?) early Ordovician). Sedimentary mélange broadly similar to the Indian Run Formation, with a somewhat different suite of inclusions. Not exposed in the map area. Interpreted to extend beneath the coastal plain in the eastern part of the city from the adjacent Washington West quadrangle, where it is well exposed.

Indian Run Formation (Cambrian and(?) early Ordovician; Drake and Froelich, 1986). Sedimentary mélange characterized by scattered quartz pebbles and small mica schist "wafers", along with larger olistoliths of Lake Barcroft metasandstone, Accotink Schist, felsic metavolcanic rocks, and rare mafic and ultramafic rocks, set in a medium grained, dark gray brown, massive to foliated quartzofeldspathic matrix with variable amounts of mica and garnet. The Indian Run is interpreted to have formed near the bottom of a submarine trench in the Taconic subduction zone, and may be more than 10,000 feet thick in and near the map area. Most of the rock exposed along Holmes Run within the city is olistolith-poor and is intruded by small bodies of Occoquon Granite; downstream of Shirley Highway, however, it contains abundant inclusions of various types and sizes

Annandale Group (Cambrian or late Proterozoic; Drake and Lyttle, 1981). Lake Barcroft Metasandstone (CZl): fine grained, light gray quartzitic metaarenite forms a swarm of large xenoliths in Occoquon Granite upstream from Shirley Highway, and occurs as thin beds within Accotink Schist (CZa): forms thin, highly folded screens or roof pendants of quartz-mica-garnet schist in Occoquon Granite and Falls Church Tonalite between Holmes Run and head of Rynex Natural Area.

Structure Symbols
Rock Creek Shear Zone (Fleming and Drake, 1998). Complex, multiply reactivated shear zone with major early Paleozoic sinistral and later Paleozoic dextral strike-slip fault motion, followed by late Paleozoic through Pleistocene reverse faulting. Position is marked by a pronounced geophysical lineament that extends southward out of the Washington West quadrangle, where the fault zone is well exposed and mostly consists of mylonite and ultramylonite. In Alexandria, the magnetically-defined trace of the fault zone closely parallels the base of the massive Mt Ida escarpment.

Postulated thrust fault separating the Sykesville and Indian Run Formations. Position inferred from aeromagnetic data and geology in adjacent quadrangles to the north. Based on the regional westerly dip of bedrock structure, the fault is inferred to be overturned. The Sykesville is the tectonically higher unit.

Trace of aeromagnetic lineament parallel to Holmes Run Gorge. Source and significance unknown

Ductile strike-slip fault observed in outcrop. Arrows indicate sense of displacement

Reverse fault observed in outcrop. U/D indicate upthrown and downthrown sides, respectively

Strike and dip of foliation in bedrock units

Antiform