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SUMMARY OF THE TRIASSIC GEOLOGY OF HERNDON QUADRANGLE, VIRGINIA

by Richard E. Eggleton

Regional setting and general geologic description

The Herndon 7 1/2-minute quadrangle lies in northern Virginia at the eastern edge of the Potomac sedimentary basin. This basin is one of several similar, generally elongate basins in eastern North America containing Upper Triassic sedimentary rocks classified as the Newark Group along with approximately contemporaneous intrusive and extrusive igneous rocks of basaltic composition (Reeside, and others, 1957; McKee, and others, 1959; King, 1969a, 1969b). The basins are scattered along most of the length of the Appalachian orogenic belt and are oriented approximately parallel to its structural grain. Regionally the sedimentary rocks are generally interpreted to be continental fluviatile and lacustrine deposits. They typically include partly conglomeratic, arkosic sandstone with interbedded mudrocks in the basal part. These beds are followed above by a middle sequence characterized by lacustrine rocks and by lithologies such as coal, dark gray mudrocks, varicolored mudrocks, and, locally, limestone. The upper part of the Triassic deposits are generally a red-bed sequence of various mudrocks and sandstone. The Triassic sediments have been unaffected by the regional metamorphism of the Appalachian orogenic belt and rest with sharp angular unconformity on the erosionally bevelled upper Precambrian to Paleozoic

crystalline rocks of the metamorphic and igneous interior zone of the orogen. The Triassic sedimentary rocks have apparently been deposited mostly in down-faulted troughs and tilted and locally uplifted by the igneous intrusions, but otherwise they have been only slightly deformed. Fanglomerates commonly adjoin the faulted borders of the basins. Intrusive dikes and sub-horizontal sheets of diabase are present in most of the basins. In Pennsylvania, New Jersey, Connecticut, and Massachusetts, apparently related basalt lava flows have been recognized interbedded with the Triassic sedimentary rocks. Apparently related thin dikes extensively cut the complex of crystalline rocks that underlie the Triassic rocks (King, 1961).

Herndon quadrangle occupies a little less than half the outcrop width of the Potomac basin. The Triassic sedimentary rocks in the basin generally dip westward. The quadrangle locally contains the outcrop of the basal unconformity of the Triassic basin and also apparently contains representatives of both the basal coarse regional unit and the middle fine-grained regional unit. Varicolored mudstones characteristic of the stratigraphically highest (westernmost) beds in the central part of Herndon quadrangle may include lacustrine deposits. The quadrangle includes numerous thin to thick diabasic intrusive sheets and a few small irregular bodies of related diorite and quartz diorite. The adjoining sedimentary rocks are in general conspicuously contact metamorphosed.

Previous work and the present investigation

The geology of all the Triassic basins in Virginia was mapped and described by Roberts (1928). That work developed the broadest outlines

of the geology of the rocks present in most of Herndon quadrangle; but, due to the reconnaissance nature of the work, it incorrectly represented several specific aspects of the areal distribution of the rock units. Bennison and Milton (1954) mapped the geology of Herndon quadrangle at a scale of 1:62,500 as part of a map covering the Fairfax 15-minute quadrangle (Herndon quadrangle forms its northwestern quarter) and, to the north, the part of the Seneca 15-minute quadrangle lying south of the Potomac River. Their work produced a fairly accurate map-picture of the geology, which is fundamentally the same as that presented here and which provided a helpful context for interpreting the geology of Herndon quadrangle. Analysis by R. G. Henderson and Isidore Zietz of aeromagnetic mapping of the Fairfax 15-minute quadrangle by the U.S. Geological Survey supports the interpretation that the diabase body outcropping around Herndon is a distorted spoon-shaped sheet plunging northward under Herndon with a gently dipping eastern limb and a steeply dipping western limb (Balsley, 1952, p. 331-334).

My mapping of Herndon quadrangle at a scale of 1:24,000 in 1958 and 1959 yielded a refined understanding of the lithology and stratigraphy of the Triassic sedimentary rocks, the forms of the bodies of intrusive diabase and related igneous rocks, and the nature and extent of the contact-metamorphic rocks adjoining the intrusives. The work benefited from examination of extensive exposures resulting from the construction of Dulles International Airport, which now occupies much of an area somewhat larger than the northwestern quarter of the quadrangle. Additional exposures resulting from road, street, and other construction (compare the 1971 photorevised edition of the topographic map with the

base map used here) are currently being examined to permit a revision of the geologic map.

Sedimentary lithology

The lithology of the Triassic sedimentary rocks in Herndon quadrangle was observed and recorded at perhaps 1500 points. The principal data recorded were grain-size and color because these properties could be observed even in float, which was the source of perhaps half the observations. The groups of sedimentary lithologic types present in the quadrangle are described briefly in the following table.

Sedimentary lithologic groups in
Herndon 7 1/2' quadrangle, Virginia

	Major constituents	Minor constituents
1.	A series of rocks grading from extraformationally conglomeratic quartz-feldspar sandstone to extraformational[1/] conglomerate	Partly to dominantly intraformationally lithic quartz-feldspar sandstone (bearing sand-size particles of Triassic mudrock) and corresponding intraformational conglomerate
2.	Varicolored quartz-feldspar sandstone	Very locally grades into intraformational associates as in group 1
3.	Dark-reddish brown mudrock	Very locally grades through intraformationally sandy and conglomeratic phases to intraformationally lithic sandstone (composed mainly of sand-size particles of Triassic mudrock) and corresponding intraformational conglomerate
4.	Varicolored mudrocks	

1/ Extraformational is used in the sense of Pettijohn (1957, p. 255) to indicate that the coarse fraction is composed of fragments derived from rocks outside the basin of deposition (the deposition of Triassic age in this case) as opposed to the intraformational rocks in which the coarse fraction consists of fragments of sediments previously deposited elsewhere in the basin of deposition.

Stratigraphy

Because of the importance of observations of float to geologic mapping in this area, during the mapping in 1958 and 1959 the stratigraphic boundaries mapped were defined on the basis of the essential presence or absence (actually the detectability) of characteristic lithologies rather than on relative abundances of more than one lithology. The sedimentary rocks fall into two formations--the Manassas Formation below and the Bull Run Shale above--based on the presence of quartz-feldspar sandstone in the former and the virtual absence of it in the latter. The Manassas contains a basal extraformationally conglomeratic member. The part of the Bull Run present in the quadrangle may be divided into two members based on the virtual absence of varicolored mudrock in the lower member and the prominence of this lithology in the upper member.

The basal conglomeratic member of the Manassas is dominantly composed of sandstones and conglomerates of lithologic groups 2 and 1. This member is characterized by the conglomeratic rocks of group 1 and contains minor amounts of the mudrocks and associated intraformational clastic rocks of group 3 and possibly traces of varicolored mudrocks of group 4. The remaining upper member of the Manassas is dominantly made up of red mudrocks and quartz-feldspar sandstones and intraformational associates of lithologic groups 3 and 2. It is characterized by the quartz-feldspar sandstones of group 2 and includes minor amounts of varicolored mudrocks of group 4 and sandstones and conglomerates of group 1.

The lower member of the Bull Run Shale is dominantly composed of red mudrock and the associated intraformational clastics of lithologic group 3 with minor amounts of varicolored group 4 mudrocks and obscure traces of quartz-feldspar sandstones of group 2, both in the lowermost part, and with obscure traces of varicolored mudrocks of group 4 in the uppermost part. That part of the upper member of the Bull Run present in the quadrangle is composed dominantly of red mudrocks and associated intraformational rocks of lithologic group 3; this sequence of strata is characterized by a small amount of varicolored mudrocks of group 4, and contains a minor amount of quartz-feldspar sandstone of group 2 in the upper part.

Going northward the base and top of the upper member of the Manassas migrate downward in the section because the rocks become gradationally finer-grained to the north along strike.

Fossils

Fossils found during the mapping include part of a disarticulated skeleton of a phytosaur identified by Nicholas Hotton III of the U.S. National Museum, probable pelecypods about 5 mm long, and possible ostracodes about 1 mm long.

Intrusive igneous rocks and associated structure

Refinements in the mapping of the contacts of the diabase bodies and related igneous rocks along with more crisply defined geometry of the adjoining contact-metamorphic zone, both achieved in 1958 and 1959, have permitted an improved understanding of the form of the igneous bodies and the structural effects of their intrusion. The larger bodies of intrusive igneous rocks may be interpreted as irregular sheets that

uplifted several blocks of overlying sedimentary rocks by varying amounts. The uplifted blocks are bounded mainly by the outcropping edges of sheets but partly by faults. A large raised block underlies Herndon; adjacent to it on the northwest is a smaller, less uplifted block; beyond this is a third block with uplift comparable to that of the block underlying Herndon. The north ends of two blocks similar to those under and northwest of Herndon are in the southern part of the area. Part of a roughly triangular body of intrusive rock is in the western part of the quadrangle; it is probably the basal part of a roughly horizontal sheet. Rocks in the central part of the quadrangle apparently were not uplifted by intrusive rocks.

Contact-metamorphic rocks

A boundary of the contact metamorphism adjacent to the intrusive sheets was mapped on the basis of the color change effected in originally dark-reddish brown mudrocks by the metamorphism. The changed colors were carefully observed using the Geological Society of America rock-color chart (Goddard, and others, 1948). This approach provided a fairly crisply defined boundary that in most of the area was conspicuous and easily determined even in float. Resulting mapped variations in the outcrop width of the contact-metamorphic zone carry implications about the dip and thickness of the adjacent igneous bodies. Epidote is developed in the contact-metamorphic zone, but apparently not as extensively as the color change. Since the epidote is apparently not volumetrically abundant in a form readily determinable in the field, its presence was not mapped. Near the large intrusive bodies spotted hornfelses are common.

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