DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

OPEN FILE MAP 78-443
FROELICH—PLANAR AND LINEAR FEATURES OF
FAIRFAX CO., VA.

EXPLANATION

FOLIATION (generalized, in metamorphic rocks)	strike and dip direction of moderately inclined schistosity (15-55°)
	strike and dip direction of steeply inclined schistosity (56-89°)
	strike of vertical foliation
BEDDING (generalized, in sedimentary rocks)	strike and dip direction of gently inclined layers (1-15°)
	strike and dip direction of moderately inclined layers (16-35°+)
JOINTS	strike and dip of inclined joints
	strike and dip direction of moderately inclined joint sets in Triassic rocks
	strike of steeply dipping to vertical joints in Coastal Plain clays; (average of 15 readings)
	strike of vertical joints
FAULTS (approximately located, dashed where inferred, dotted where concealed)	normal, bar and ball on downthrown side, dip angle where known
	thrust or reverse, sawteeth on upper plate, dip angle where known
	S subsidiary structures of the Stafford fault system
	indeterminate, in crystalline rocks, fractures commonly healed or annealed
SHEARED ZONES	phyllonite zones of intense shearing, retrograde metamorphism
DIABASE	aligned dikes and intrusive bodies of Triassic(?) igneous rock that occupy and heal ancient tensional fractures
SERPENTINITE	aligned metamorphosed ultramafic bodies of Lower Paleozoic(?) age that interrupt the physical continuity of schist terrane
TOPOGRAPHIC ALIGNMENTS	ridge and drainage alignments interpreted from 1971-75, 1:24,000 Topographic maps by M.D. Pavich, R.H. Johnston, R.E. Eggleton and A.J. Froelich
ERTS IMAGERY ALIGNMENTS	interpreted from 1975, 1:500,000 coverage by T. Iwahashi
AIR PHOTO ALIGNMENTS	interpreted from 1971, 1:60,000 coverage by A.D. Beccasio and A.J. Froelich

Table 1. Exposures of post Early Cretaceous faults in Occoquan and Fort Belvoir quadrangles

(After Seiders & Mixon, in prep.) Fairfax County, Virginia

Location	Type	Strike & dip	Vertical separation	Rock units cut by faulting
Stream bank 0.42 mi W of Vaughan School, Marumsco Hills area	High angle reverse	N44E 70NW	>10 ft	Potomac group (Kp) Quantico slate (Eq)
Connecting road, Routes 123 and 642 0.1 m N of D.C. Dept. of Corrections complex, Occoquan quadrangle	Low angle reverse	N70E 34SE	>8 ft	Potomac group Occoquan granite (Eo)
Silt catchment basin, industrial complex W of Newington, Fort Belvoir quadrangle	High and low angle reverse	N33E 23NW N84E 72NW	>1.0 ft	Potomac Group Occoquan granite
Road cuts, junction Silver Brook Road and Lorton Road, Fort Belvoir quadrangle	High angle normal	N60E 80N	1.0 ft	Potomac group Chopawamsic Fm.

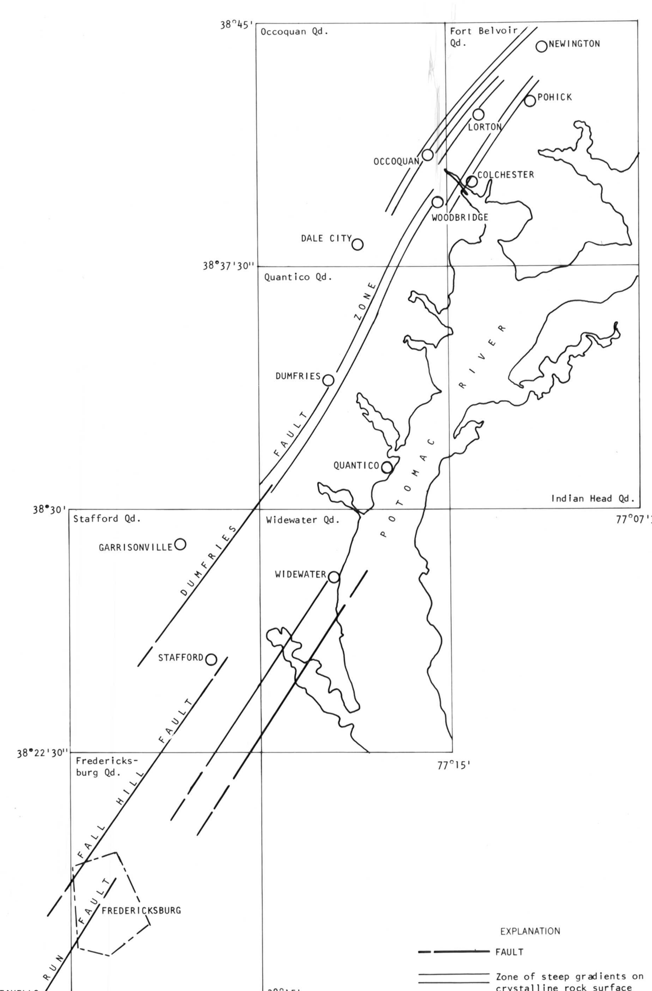

Fig. 1--Map showing main structures of Stafford fault system and zones of steeper-than-average gradients on crystalline rock surface suggesting a northeastward extension of faulting and (or) folding into the Occoquan and Fort Belvoir quadrangles, Fairfax County, Va.

A great variety of natural planar and linear features are present in Fairfax County, ranging in scale from local joint sets clearly visible in rock outcrops to major alignments detected by Earth Resources Technology Satellite (ERTS) imagery. This map is based mainly on data published elsewhere, and it shows the most prominant planar and linear features without assigning value or interpretive judgements to their presence or potential significance.

Foliation is the most common planar element in the Piedmont metamorphic rocks of Fairfax County. Foliation is the laminated structure resulting from the segregation of platy minerals such as mica and chlorite into parallel layers during metamorphism. Generally rocks readily split along foliation planes. Foliation trends (strikes) generally northeasterly across the County and is inclined (dips) at moderate to steep angles to the east or west. Commonly the main foliation is cross-cut by two or more subordinate foliations.

Generalized strike and dip directional data are shown on the map in the Triassic Lowland for gently and moderately inclined sedimentary beds. Strike and dip data are not shown for Coastal Plain strata because the layers are sub-horizontal dipping less than 100 feet per mile (19 m per km) to the southeast (see structure contour map by Larson and Froelich, 1977).

Joints (fractures or partings with no significant displacement that abruptly interrupt the physical continuity of a rock mass) are very abundant in Piedmont and Triassic bedrock, and are commonly oriented in intersecting sets both parallel and perpendicular to regional foliation and bedding. Standard symbols for joints, foliation and bedding are shown on the Explanation and are used to identify these features on the map.

Faults are fractures or fracture zones along which there is relative displacement of the two sides parallel to the plane of the fracture. Most of the known faults in Fairfax County are very poorly exposed, and only short segments of what are undoubtedly much more extensive features can be identified. For example, the northeast-trending Stafford Fault Zone of Mixon and Newell (1977) is known to extend into and possibly across eastern Fairfax County; however, only local reverse faults of very small displacement (labeled S and S? on map) and poorly defined flexures along the inner margin of the Coastal Plain indicate its presence within the county (see inset map and Table 1, Seiders and Mixon, in prep.). Neither epicenters of historic earthquakes nor active faults have been located in Fairfax County to date; however, this does not necessarily preclude their presence.

The extent and displacement of faults mapped in the crystalline rocks of the Piedmont are commonly indeterminate. In fact, major fracture zones that probably mark ancient regional deep-seated dislocations are now healed and annealed so that their engineering strength exceeds that of some less deformed metamorphic rocks. Sheared (phyllonite) zones shown on this map reflect changes produced in rock fabric by intense shearing and retrograde metamorphism. Phyllonites may locally be zones of relatively weak rocks subject to deeper weathering and engineering instability.

In the western part of the county, the poorly exposed margin of the Triassic Lowland is characterized by a generally north-trending high angle fault system that is much more prominent south of Fairfax County. Deformation and fracturing of the crystalline rock basement undoubtedly has produced a surface effect as fractures in the Triassic sedimentary and igneous rocks.

Diabase intrusive rocks are tabular or lens-like igneous bodies of Triassic to Jurassic age. North-trending dikes probably occupy and heal ancient tensional fractures occurring within or near the margin of the Triassic Lowland. Similarly, serpentinite occurs as narrow northerly-aligned ultramafic bodies within the crystalline rocks of the Piedmont.

Finally, three types of alignments are shown that are based principally on indirect evidence: 1) topographic and drainage alignments, 2) air photo alignments, and 3) ERTS imagery alignments. Only the most prominent and continuous of the alignments are shown, and no valid evaluation of the significance or precise location of most of these features is presently possible. The three different types of alignments are detected by entirely different means at totally different levels of discrimination, and lack of coincidence does not necessarily imply lack of corroboration or confirmation. On the other hand, the Utterback Store road lineament and the Triassic border fault northeast of Manassas are examples of lineaments detected by each technique independently. Correlations of this type lend credence and support to the potential significance of such linear features. It seems possible that the most prominent alignments are the surface manifestation of subsurface fracture traces with preferred alignments trending northeast, northwest, and nearly due north.

Possible Uses of the Map

The map can be used in conjunction with the Bedrock map (Drake and Froelich, 1977) and the Preliminary Geologic map of Fairfax County (Drake and others, in prep.) to provide a better understanding of the regional structure. It might also be used with the Bedrock aquifer well yield map (Johnston, 1978) to help locate potentially favorable areas to explore for groundwater supplies. In general, the fracture zones in the important bedrock aquifers will be the most transmissive, and thus the most favored sites for water wells. The map might prove useful to engineers in the planning and location of major construction of environmentally or geologically sensitive structures such as power plants, dams or hospitals. It will provide source information for the evaluation of an area for zones of potentially weak, fractured and unstable rock.

List of References

Drake, A.A., Jr., and Froelich, A.J., 1977, Bedrock map of Fairfax County, Virginia: U.S. Geol. Survey Open-file report no. 77-523.

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Johnston, R.H., 1978, Probable yields of wells in the bedrock aquifers of Fairfax County, Virginia: U.S. Geol. Survey Open-file report 78-267.

Mixon, R.B., and Newell, W.L., 1976, Preliminary investigation of faults and folds along the inner edge of the Coastal Plain in northeastern Virginia: U.S. Geol. Survey Open-file report no. 76-330, 18 p.

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Seiders, V.M., and Mixon, R.B., 197_, The geology of the Occoquan quadrangle and part of the Fort Belvoir quadrangle, Prince William and Fairfax Counties, Virginia: U.S. Geol. Survey Geol. quad., GQ (in prep.).

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OPEN FILE REPORT
This report is preliminary and has not been edited for conformity with Geological Survey standards or nomenclature.

MAP SHOWING PLANAR AND LINEAR FEATURES OF FAIRFAX COUNTY, VIRGINIA

By

A. J. Froelich

1978