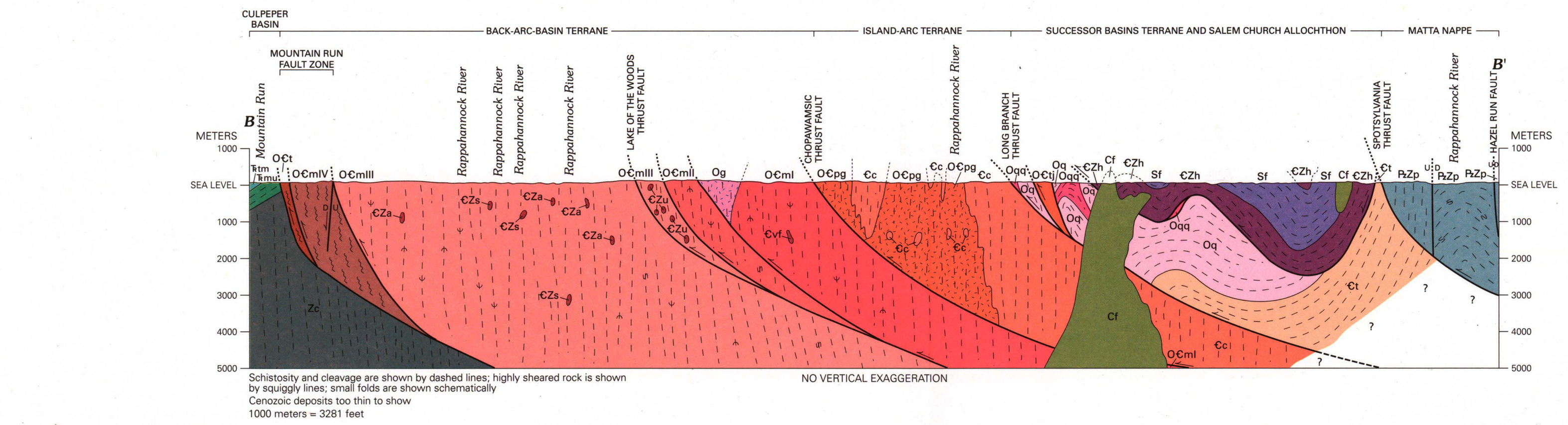
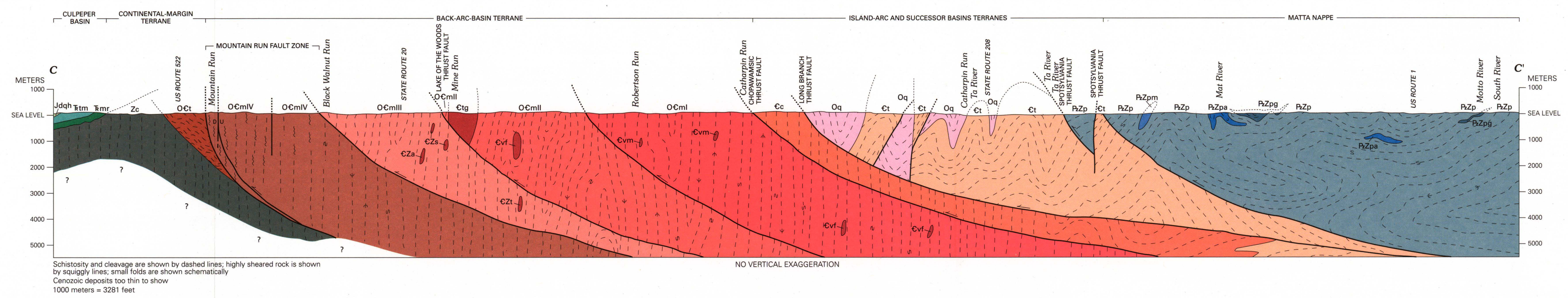
GEOLOGIC INVESTIGATIONS SERIES
MAP I-2607 (SHEET 2 OF 2)
Explanatory pamphlet accompanies map



Schistosity and cleavage are shown by dashed lines; highly sheared rock is shown by squiggly lines; small folds are shown schematically
Cenozoic deposits too thin to show
1000 meters = 3281 feet



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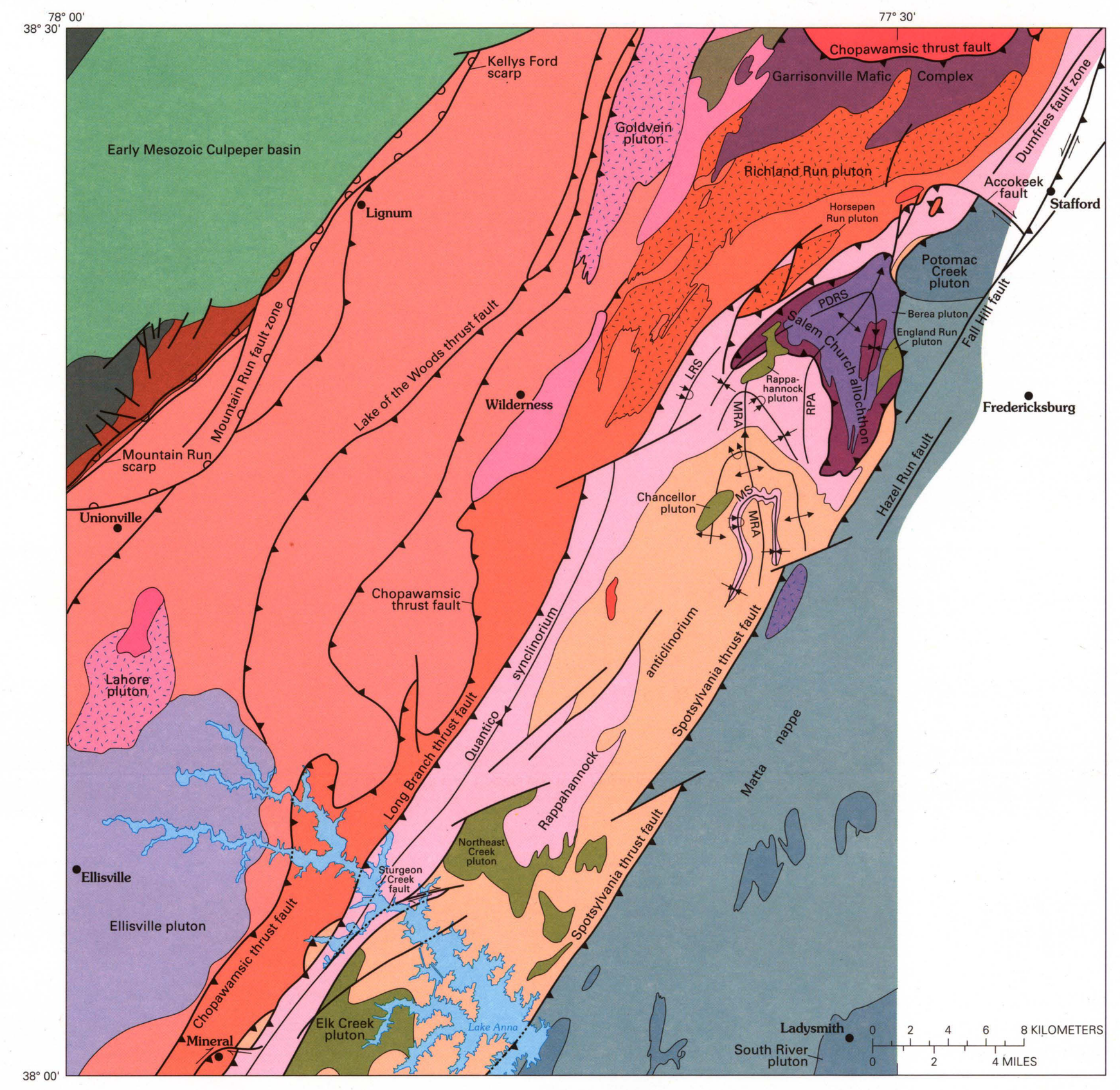


EXPLANATION

Continental-margin terrane
- Catoctin Formation
- True Blue Formation

Black-arc-basin terrane (mélange deposits)
- Block-in-phyllite mélange
- Metadiamictite mélange

Island-arc terrane
- Continentward facing
- Oceanward facing

Successor basins terrane
- Quantico Formation
- Other basins

Salem Church allochthon
- Falls Run Granite Gneiss (Berea pluton)
- Holly Corner Gneiss

Matta nappe

Early Mesozoic Culpeper basin

Plutons
- Carboniferous felsic pluton
- Silurian felsic pluton
- Silurian or Ordovician felsic pluton
- Ordovician felsic pluton
- Ordovician and (or) Cambrian felsic pluton
- Paleozoic and (or) Proterozoic felsic pluton
- Ordovician mafic pluton
- Cambrian mafic pluton
- Cambrian or Proterozoic mafic pluton

Unassigned terrane

Thrust fault

Mountain Run fault zone

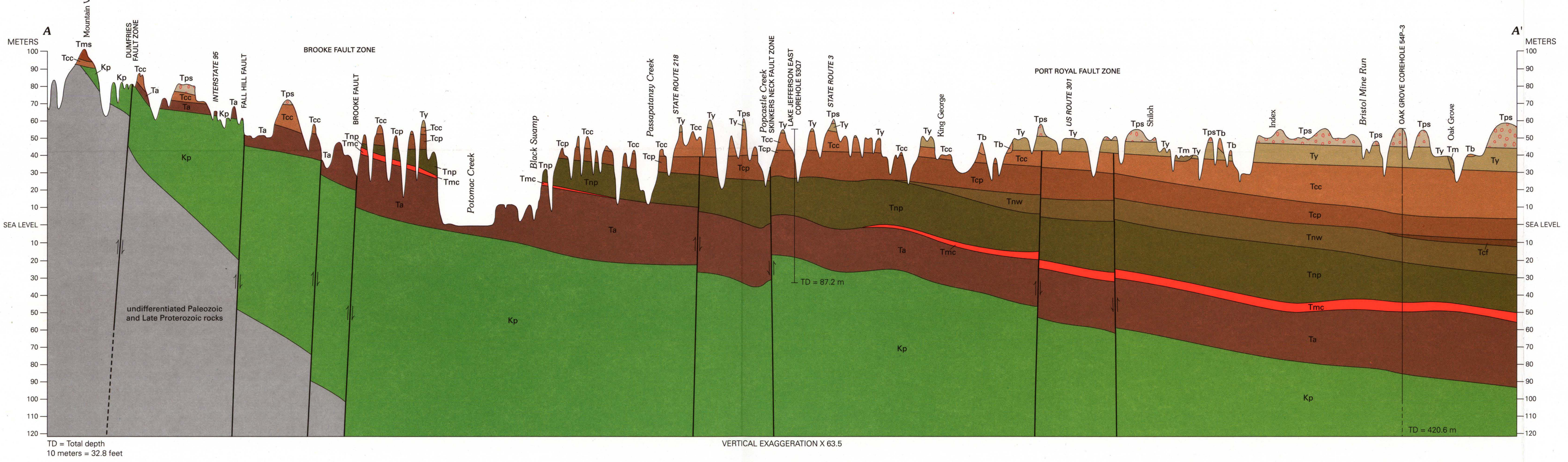
Antiform

Synform

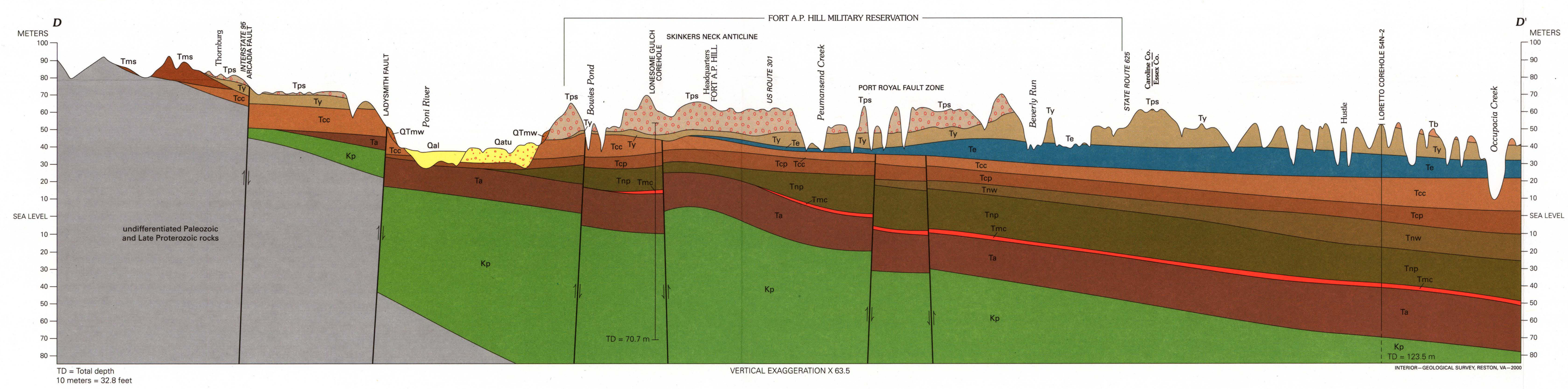
Overturned antiform

Overturned synform

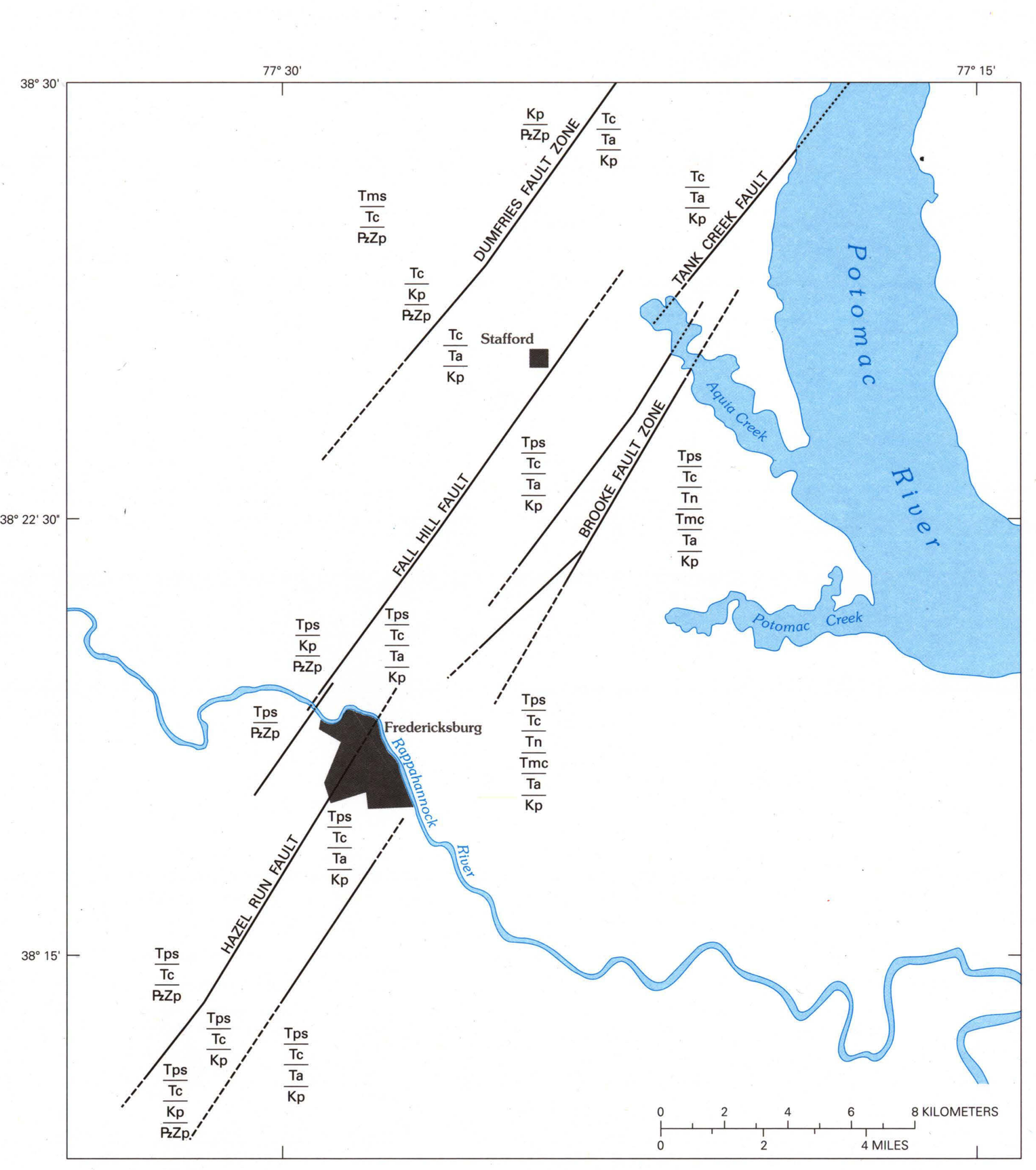
Figure 1.—Simplified tectonostratigraphic map of the Piedmont and Blue Ridge provinces in the Fredericksburg 30′ x 60′ quadrangle map area. Coastal Plain sediments and alluvium not shown. MRA, Mine Run antiform; RPA, Rocky Pen antiform; PDRS, Pipe Dam Run synform; LRS, La Roque synform; MS, Massaponax synform.



TD = Total depth
10 meters = 32.8 feet



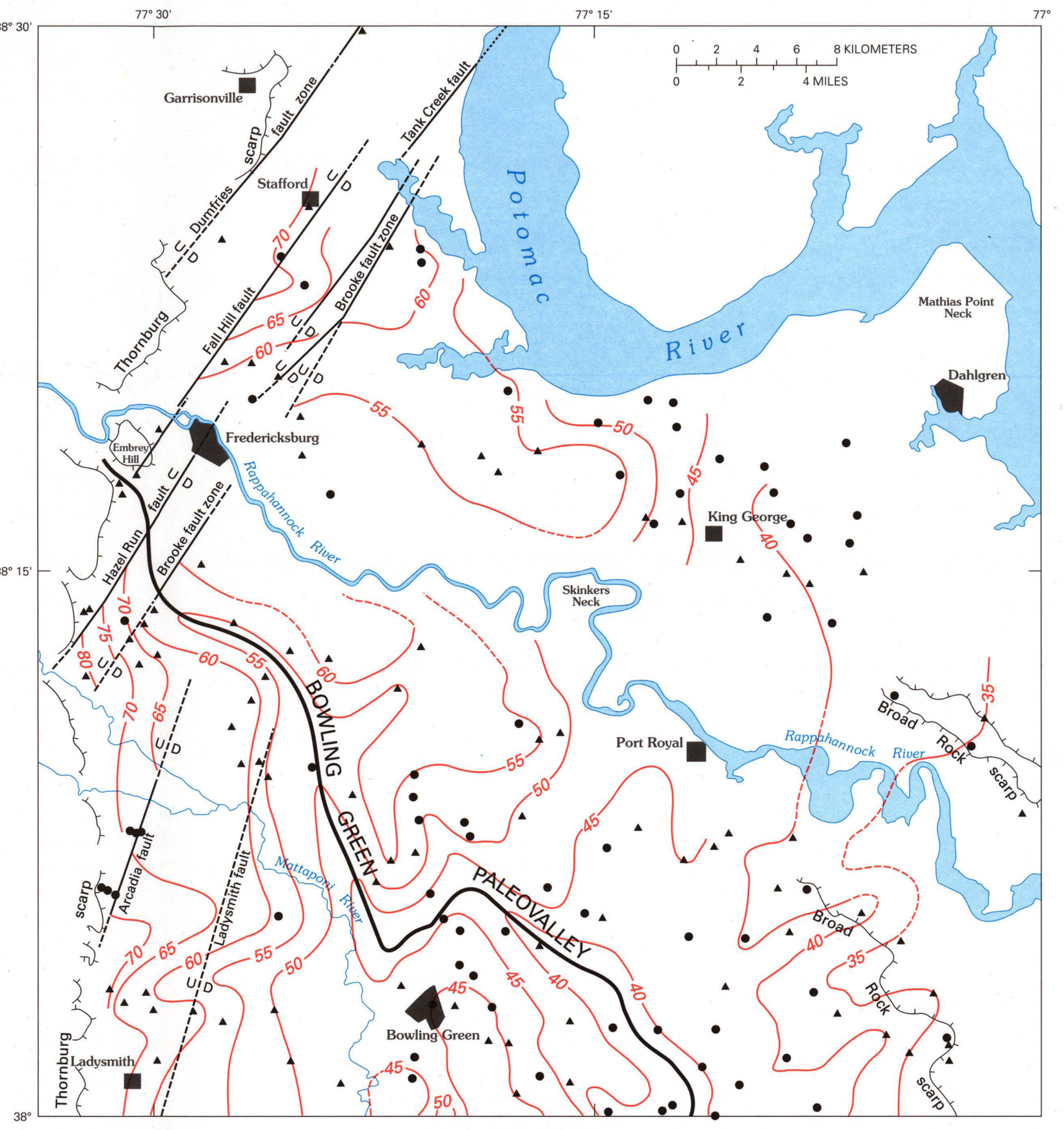
TD = Total depth
10 meters = 32.8 feet



EXPLANATION

Tps	**Pliocene sand and gravel**	Ta	**Aquia Formation (upper Paleocene)**
Tms	**Miocene sand and gravel**	Kp	**Potomac Formation (Lower Cretaceous)**
Tc	**Calvert Formation (lower and middle Miocene)**	PzZp	**Piedmont rocks (Late Proterozoic and lower Paleozoic)**
Tn	**Nanjemoy Formation (lower Eocene)**		**Fault**—Dashed where inferred; dotted where concealed
Tmc	**Marlboro Clay (upper Paleocene)**		

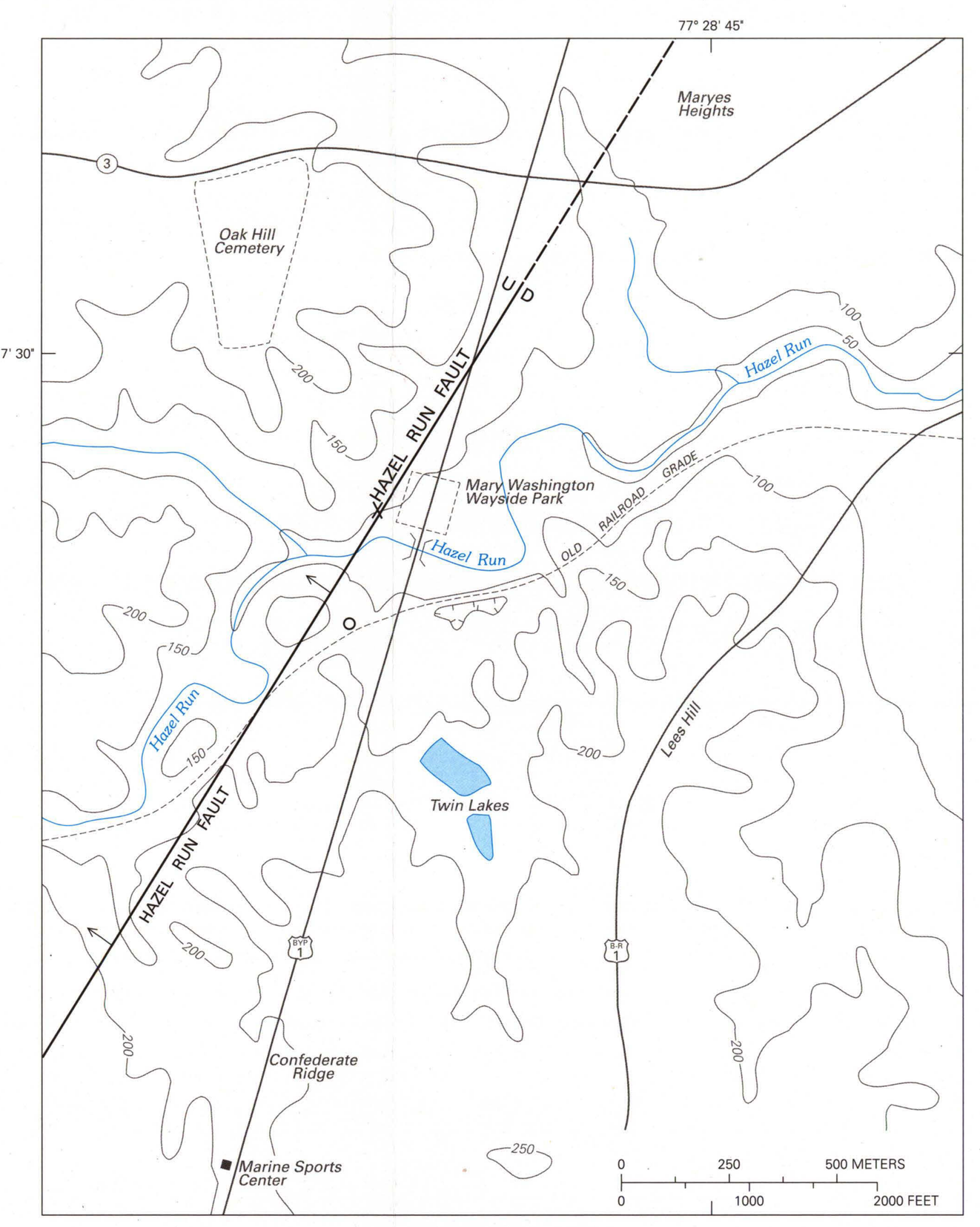
Figure 2.—Variation in stratigraphic section across structures of Stafford fault system as observed in outcrop. Down-to-the-coast displacement of Coastal Plain beds by high-angle reverse faults preserves thicker and more complete sections on the southeastern side of structures. Conversely, on the relatively upthrown, northwestern side of faults, westward onlap by marine formations (Aquia and Calvert) has resulted in sharp truncation of older strata. Southwest-northeast differences in stratigraphic section reflect varying amounts of displacement along structural strike and relief on unconformities. Modified from Mixon and Newell (1982)



EXPLANATION

- **Contour on base of Yorktown Formation**—Interval 5 m. Dashed where datum is above land surface. Locally, where Yorktown is absent, contours are on base of Unit Tps
- **Fault**—Dashed where inferred; dotted where concealed; U, upthrown side; D, downthrown side
- **Scarp**—Ticks on downslope side
- **USGS corehole with or without geophysical logs or water well with geophysical logs or USGS auger hole**
- **Outcrop showing base of Yorktown Formation or base of Unit Tps (Pliocene sand and gravel)**

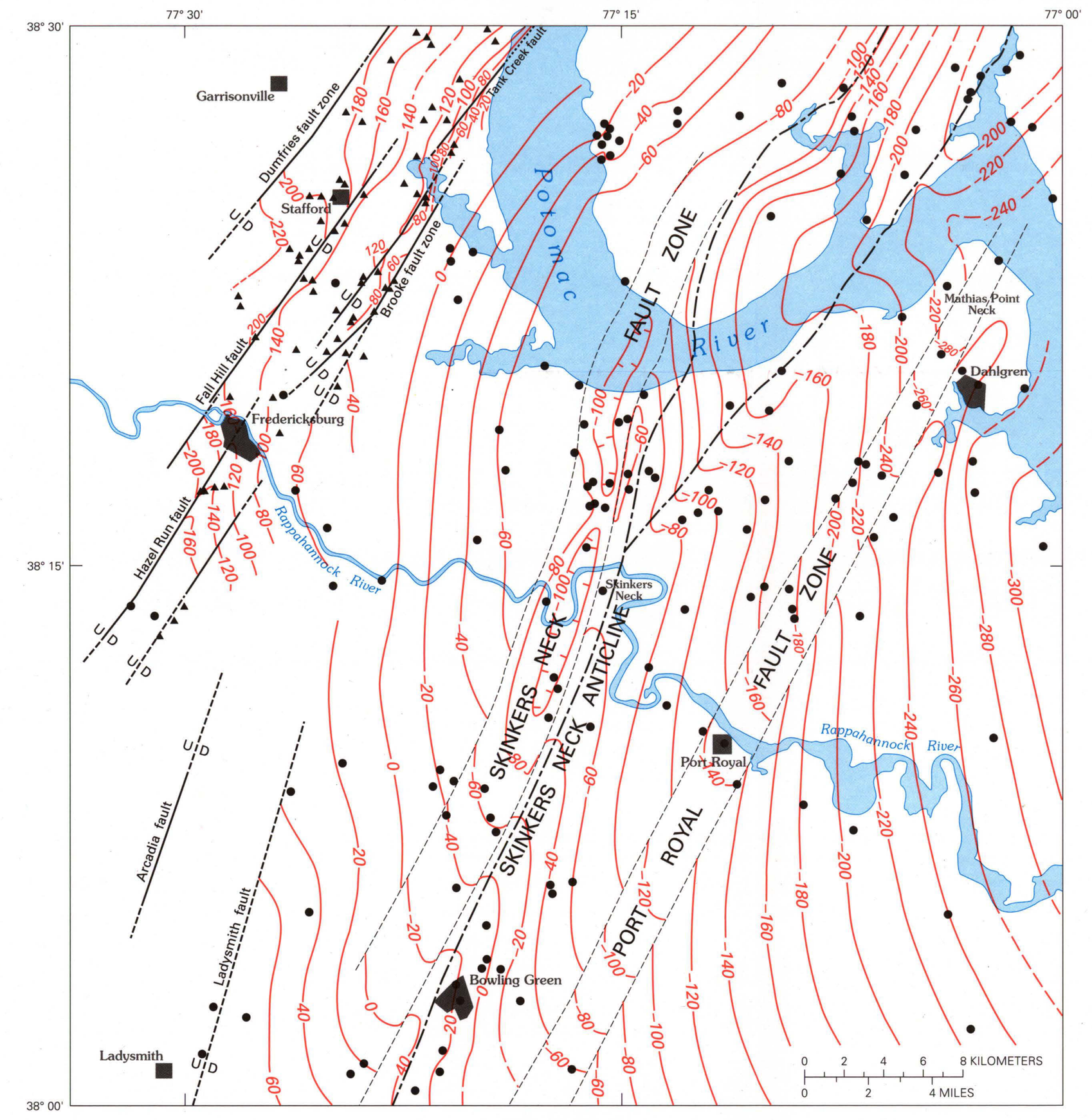
Figure 3.—Map showing configuration of the base of the Yorktown Formation and the trends of the Thornburg and Broad Rock scarps. Bowling Green paleovalley is an ancient course of the Rappahannock River. The Thornburg scarp is believed to be a wave-cut paleoshoreline formed during the deposition of the Yorktown.



EXPLANATION

- **Fault**—Arrow indicates direction of dip of fault plane; U, upthrown side; D, downthrown side
- X **Natural outcrop at mouth of ravine**
- O **Borehole to crystalline rocks**

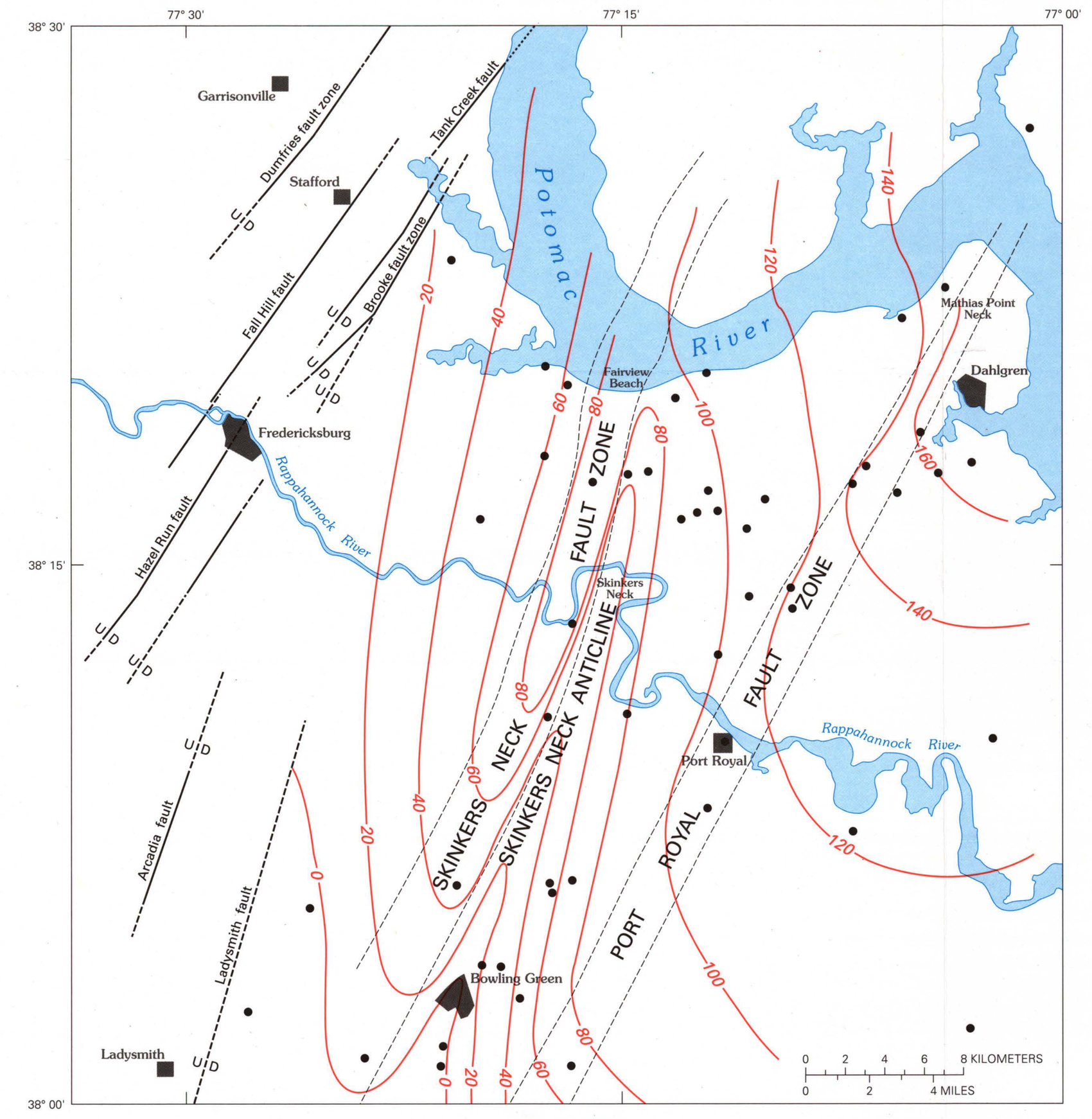
Figure 4.—Location of Hazel Run fault relative to Mary Washington Wayside Park and U.S. 1 Bypass in south Fredericksburg, Va. Arrows indicate direction of dip of fault plane; U, upthrown side; D, downthrown side. x, natural outcrop at mouth of ravine. Contour interval 50 ft. Modified from Mixon and Newell (1982).



EXPLANATION

- **Structure contour**—Dashed where approximately located; hachures point toward structural depression
- **Fault**—Dashed where inferred; dotted where concealed; U, upthrown side; D, downthrown side
- **USGS corehole with or without geophysical logs or water well with geophysical logs or USGS auger hole**
- **Outcrop of the Potomac Formation and overlying unit**
- **Gravity lineament**

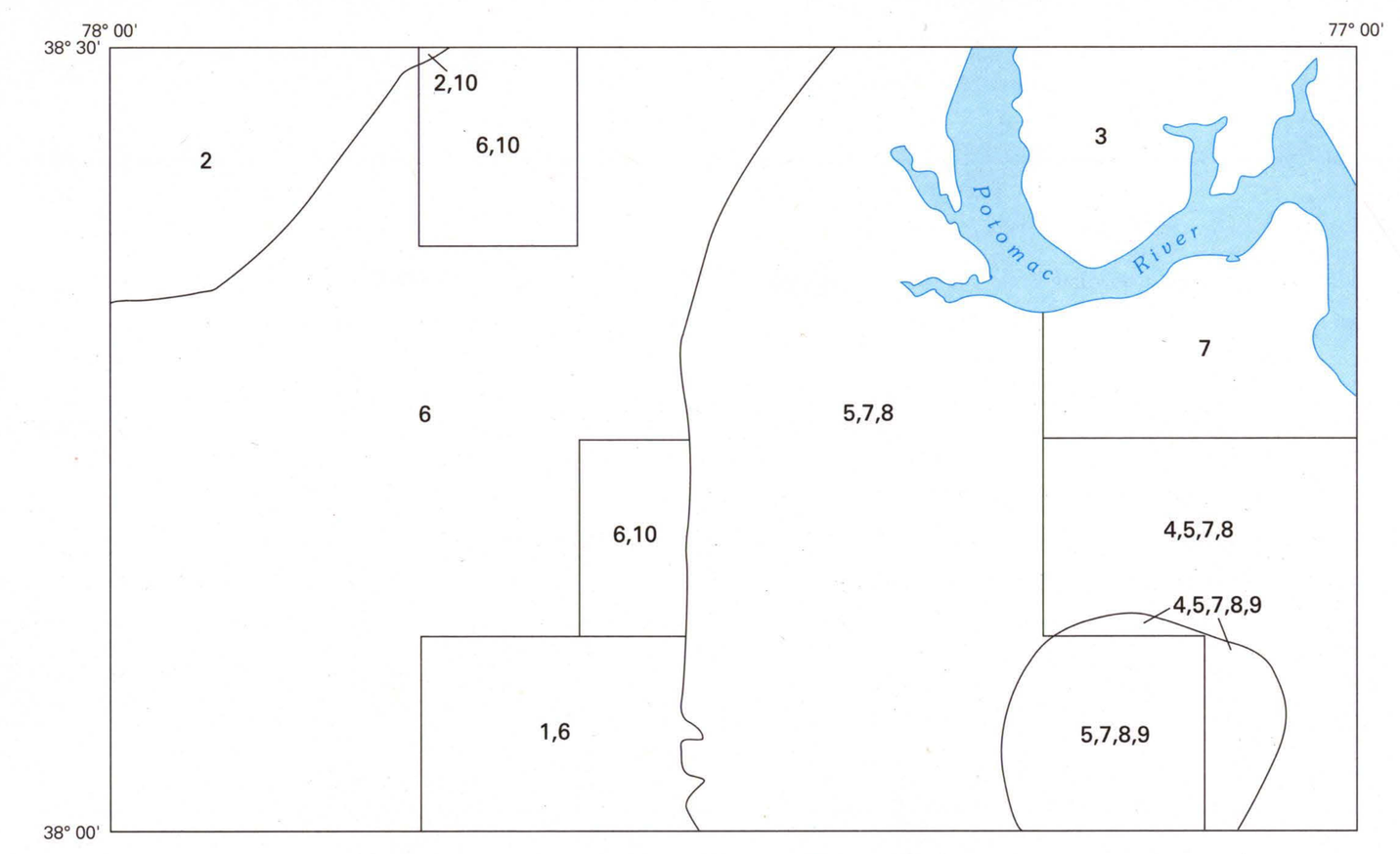
Figure 5.—Structure contour map of the top of the Lower Cretaceous Potomac Formation. The steep, upper part of the east-dipping gravity gradient that trends north-northeast of Bowling Green, Va., marks the western edge of the buried early Mesozoic Taylorsville basin (Mixon and others, 1992). Skinkers Neck anticline shown by form of structure contours.



EXPLANATION

- **Isopach**—Interval 20 ft
- **Fault**—Dashed where inferred; dotted where concealed; U, upthrown side; D, downthrown side
- **USGS corehole with or without geophysical logs or water well with geophysical logs**

Figure 6.—Generalized isopachs showing thickness of lower Eocene Nanjemoy Formation in area of the Skinkers Neck anticline and Port Royal fault zone. The Brooke fault zone and Ladysmith fault mark the present-day updip limit of the Nanjemoy.



Sources of Geologic Data

1 Bobyarchick and others (1981)
2 Froelich (1985, 1989); Smoot (1991); R.E. Weems and Scott Southworth (unpub. data)
3 McCartan (1989a, b); D.S. Powars (unpub. data)
4 Milici and others (1991)
5 Mixon and Newell (1977, 1978, 1982); Mixon and Powars (1984); Mixon and others (1989a); Mixon and others (1994); Newell and others (1976); Newell and Rader (1982); R.E. Weems (unpub. data)
6 Pavlides (1981, 1986, 1989, 1990, 1994); Pavlides and others (1982b); R.E. Weems and Scott Southworth (unpub. data)
7 Powars (1987); D.S. Powars and R.B. Mixon (unpub. data)
8 Reinhardt and others (1980a, b); Gibson and others (1980); Edwards (1989); Edwards and others (1984); Ward (1985)
9 Weems and others (1996); R.E. Weems (unpub. data)
10 Wier (1977); Wier and Pavlides (1985)

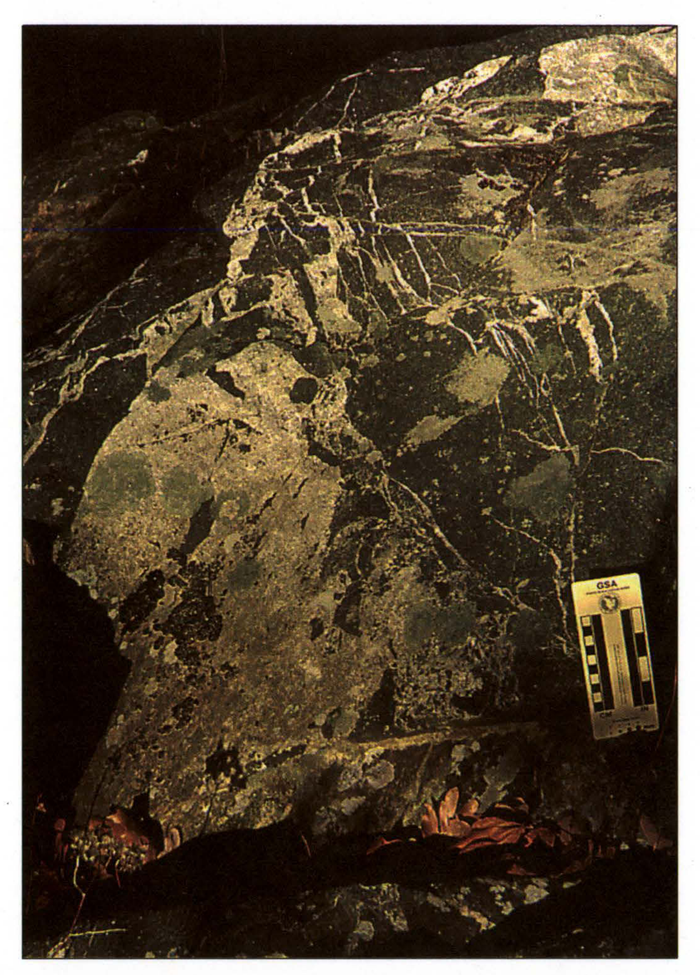


Figure 7.—Hornblendite and amphibolite of the Garrisonville Mafic Complex (ЄZg) of Early Cambrian or Late Proterozoic age, northern Stafford County, Virginia. Emplacement of a network of light-colored dikelets of plagiogranite has formed a striking intrusive breccia. Outcrop is in the southern bank of Aquia Creek about 100 m (328 ft) downstream from the Route 641 bridge on the road between Garrisonville and Camp Barrett (near the north-central edge of this map; see also Stafford 7.5-min quadrangle).

Figure 9.—Lacustrine member of the Balls Bluff Siltstone (Ћbl) constitutes the 80-m (262-ft)-thick section exposed in walls of the Culpeper Crushed Stone Quarry just west of Stevensburg, Va. (see northwestern part of map). Sequence consists mainly of alternating cycles of reddish-brown silty mudstone and siltstone and light- to dark-gray shale and siltstone.

Figure 11.—Trough-crossbedded, feldspathic sandstone of the Lower Cretaceous Potomac Formation (Kp). These thick-bedded, poorly sorted, medium to very coarse sands, which contain abundant bedding-parallel impressions of stems of conifers, are thought to have been deposited in channels of braided streams. Bluff is along Hazel Run stream valley in Alum Springs Park, southwestern Fredericksburg, about 0.25 km (0.16 mi) southeast of the U.S. Highway 1 Bypass bridge over Hazel Run.

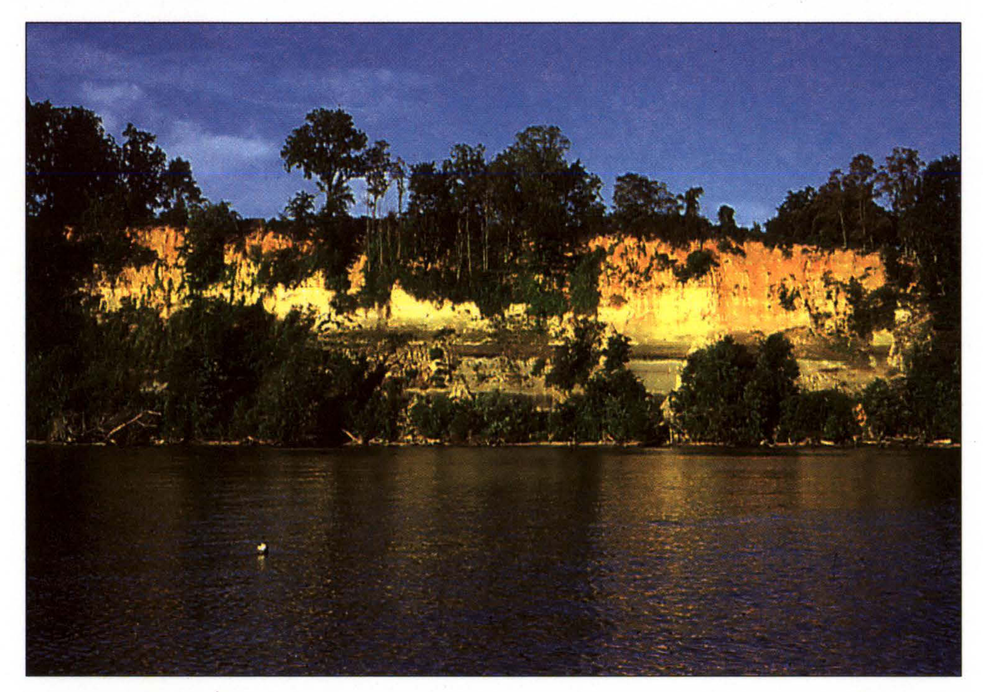


Figure 13.—Principal reference section of the Woodstock Member of the Nanjemoy Formation (Tnw) in bluffs along the Potomac River estuary about 2.7 km (1.7 mi) upstream from Mathias Point, Va. (see Mathias Point 7.5-min quadrangle). Clayey and silty, very fine to fine, glauconitic and micaceous quartz sand of the Woodstock Member constitutes the lower 12.2 m (40 ft) of the 24- to 30-m (79- to 98-ft)-high bluffs. The Woodstock is unconformably overlain by 8 m (26 ft), or more, of clayey and silty, yellowish-gray fine sand and diatomaceous silty clay of the middle Miocene Calvert Formation (Tc). Upper part of bluff exposure is yellowish-orange sandy gravel and coarse sand of the Windsor Formation (QTw).

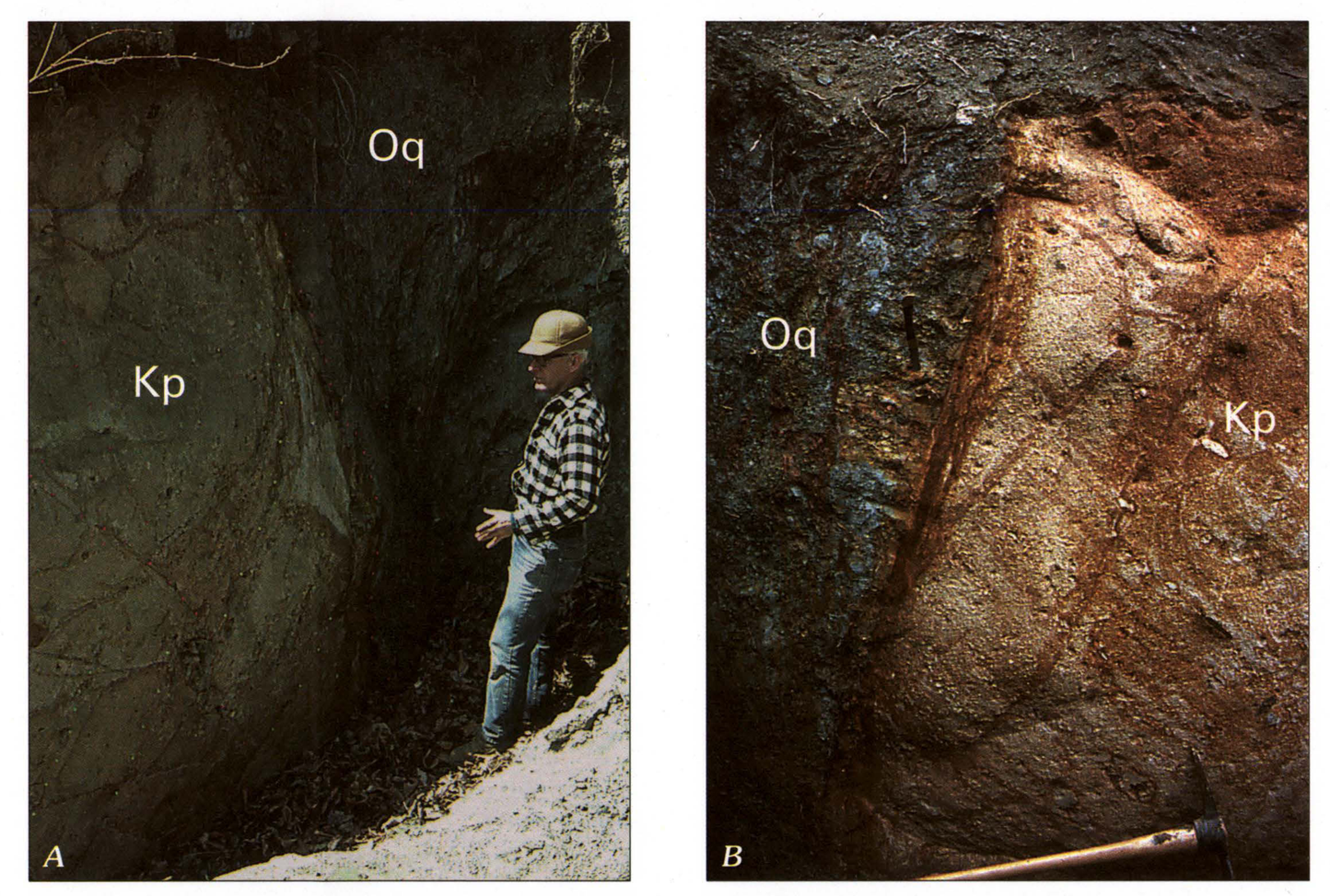


Figure 15.—*A*, Reverse fault in trench (southern wall) across Dumfries fault zone 3 km (1.9 mi) northwest of Stafford, Va. Dark-gray phyllite of the Ordovician Quantico Formation (Oq) (background) is thrust at a high angle over yellowish-gray to orange-brown sand of the Lower Cretaceous Potomac Formation (Kp). Upturned beds of Potomac sand (marked by yellow tacks) in southern wall of trench show drag on fault. *B*, Close view of Dumfries fault (northern wall of trench) shows 10- to 30-cm (3.9- to 12-in)-wide gouge zone (several centimeters to either side of knife). Slickensides indicate fault displacement is chiefly dip-slip but includes a right-lateral component. Adjacent borehole data indicate vertical separation of top of Quantico Formation across the fault is 35 m (115 ft). Pick-mattock gives scale.

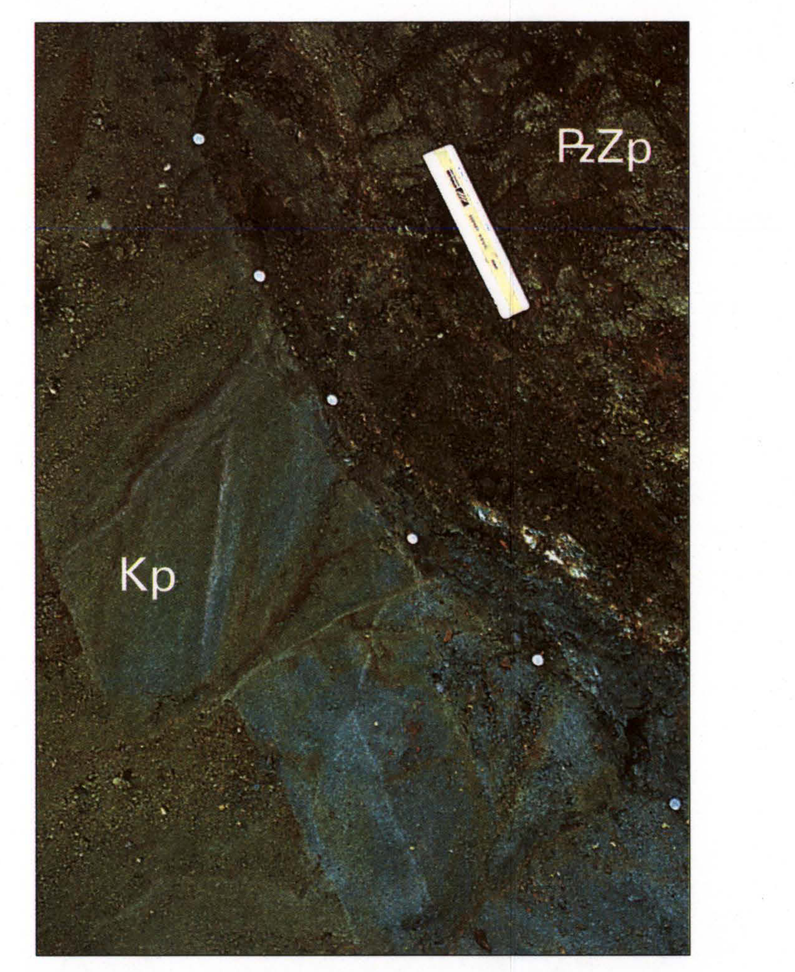


Figure 19.—A nearly vertical southwest-facing outcrop of westward-dipping Hazel Run reverse fault (marked by white tacks) in the mouth of a narrow ravine in Hazel Run stream valley, southwestern Fredericksburg, Va. The ravine is on the northern side of Hazel Run, about 90 m (295 ft) west of picnic tables at Mary Washington Wayside roadside park on U.S. Highway 1 Bypass (see fig. 4). In this area, schist and biotite augen gneiss of the Po River Metamorphic Suite (PzZp) are thrust at a high angle over bluish- to greenish-gray sand of the Potomac Formation (Kp). Pale-gray clay gouge outlines minor shears adjacent to left of main fault.

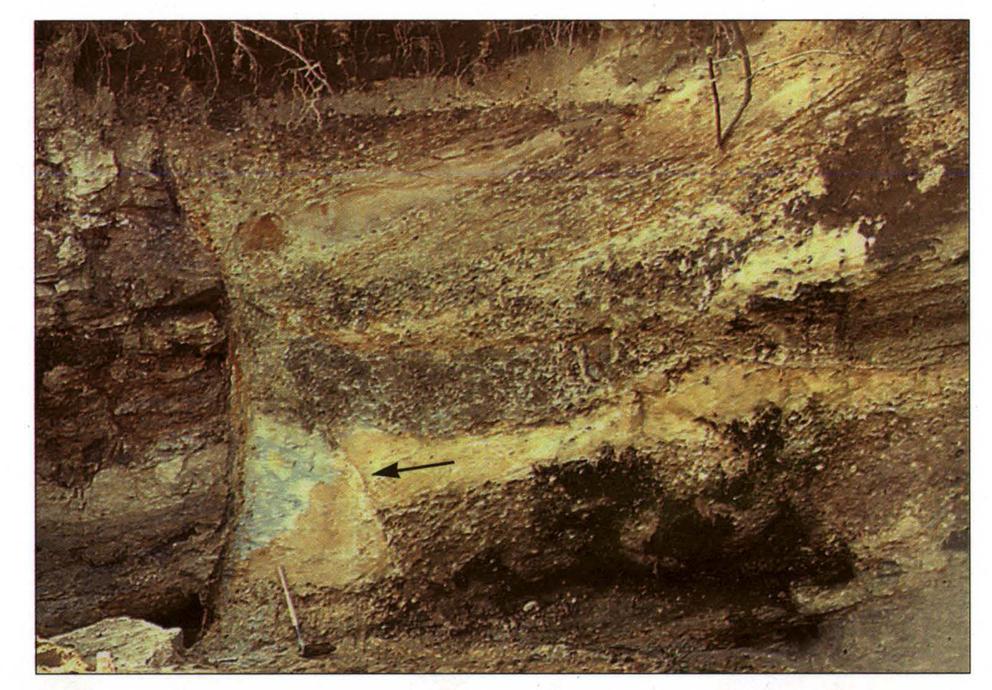


Figure 20.—Outcrop of Tank Creek fault in Potomac River bluff near southeastern corner of the Quantico Marine Corps Military Reservation and 2 km (1.24 mi) northeast of the community of Widewater, Va. The structure, which is a main strand of the Brooke fault zone, includes an arcuate, high-angle fault (left) of uncertain classification and an intersecting, high-angle reverse fault (arrow) that shows up-to-the-Piedmont displacement of the Potomac Formation beds (Kp). A strike-slip component of movement is indicated by abrupt change in thickness of the crossbedded sand across the reverse fault. Piedmont is to right, river to left (beyond photo).

Figure 8.—Potholed outcrops of banded biotite-muscovite gneiss and lesser amounts of schist of the Po River Metamorphic Suite (PzZp) of early Paleozoic and (or) Late Proterozoic age. Micaceous materials are concentrated in the dark layers, and quartz and feldspar are concentrated in the light layers. Foliated gneissic granitoid and pegmatoid rocks occur in tabular and nontabular bodies. Note small fold in upper left corner of pothole (arrow) in center foreground. Outcrops are in bed of Rappahannock River at Fall Line between Falmouth and Fredericksburg, Va. The pothole referred to previously is approximately one meter across.

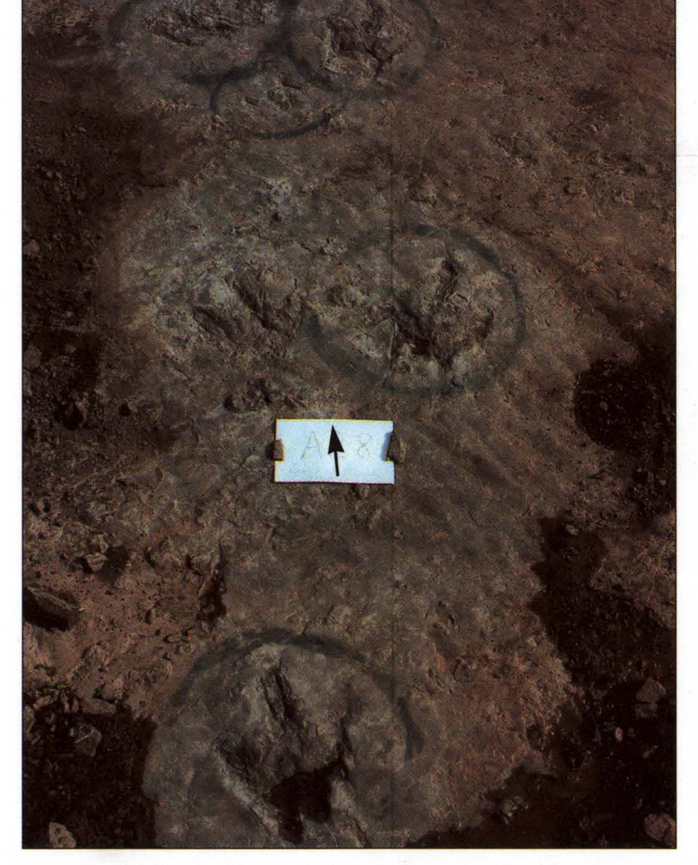


Figure 10.—Dinosaur footprints of Triassic age in the lower trackway horizon, Culpeper Crushed Stone Quarry, Virginia (see fig. 9). Four large bipedal dinosaur footprints (*Kayentapus minor*) include print of a left rear foot at bottom of photo, side-by-side prints of rear feet that indicate a pause in movement (center), and a right rear footprint at top center. Arrow indicates direction of movement of dinosaur across a ripple-marked surface of an ancient lake shoreline. At upper left corner are right-rear and right-front footprints of an aetosaur (a quadruped) that cross the other trackway.

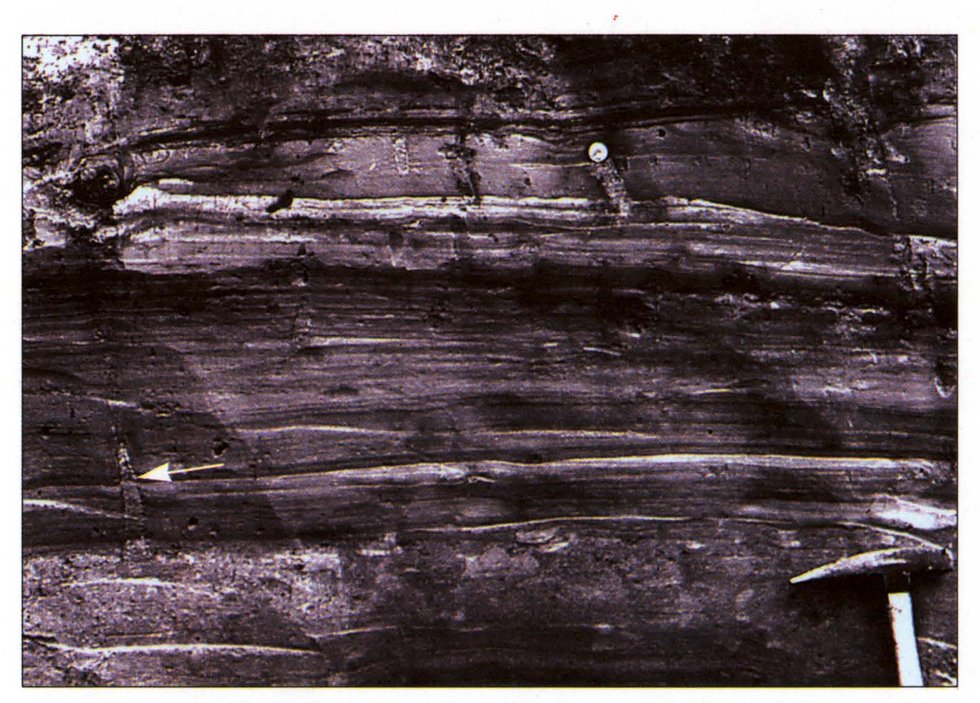


Figure 12.—Laminated to thin-bedded sand of the updip, nearshore-shelf facies of the Aquia Formation (Ta) (upper Paleocene) in Stafford County, Virginia. Light-colored beds consist mainly of quartz sand. Dark-colored beds contain abundant black heavy minerals (ilmenite and magnetite) and some glauconite. Noded, clay-lined *Ophiomorpha* burrows (lower left corner (arrow) and just below quarter) were made by a marine crustacean similar to the present-day mud shrimp, *Callianassa major*. In lower part of photo, mottled dark and light bed to left of pick is highly bioturbated by mollusks and marine worms. Outcrop is a roadcut, across from State Highway Department office in southwestern part of Stafford, Va.

Figure 14.—Typical outcrop of sand and diatomaceous silty clay of the middle Miocene Calvert Formation (Tc) in roadcut in Essex County, Virginia. Uneven contact through middle of outcrop (above man's head and marked by iron-oxide staining) is a minor disconformity between two upward-fining sand-silt-clay sequences within the Calvert Formation. Upper unit is a yellowish-weathering, poorly sorted, fine to medium quartz sand that contains scattered very fine pebbles, fish teeth, and, locally, bones of marine vertebrates including whale vertebrae. This unit is the basal sand of a sand-silt-clay sequence whose upper part is not seen here. The sand is deeply burrowed into grayish-olive to light-olive-gray, sandy and silty clay which is the upper part of an underlying sequence. Outcrop is on Route 641 about 1.4 km (0.9 mi) southwest of junction with U.S. Highway 17 in Loretto 7.5-min quadrangle.

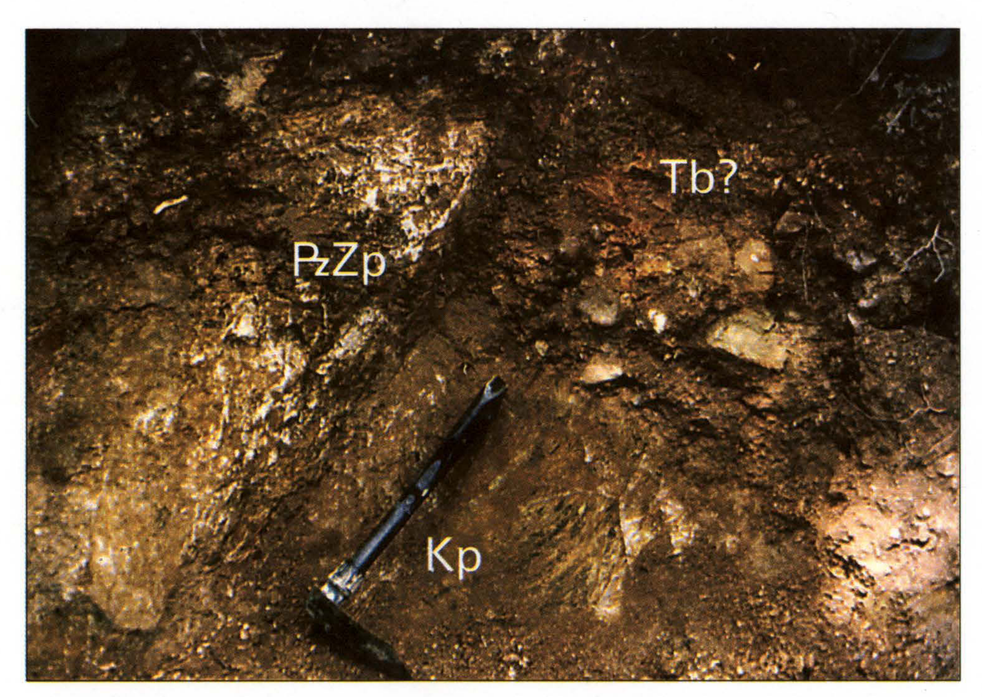


Figure 16.—Fall Hill reverse fault in roadcut on Fall Hill Avenue in western suburbs of Fredericksburg, Va. The fault juxtaposes saprolitized biotite gneiss (PzZp) of upthrown block (left of shovel) against sand of the Lower Cretaceous Potomac Formation (Kp) of downthrown block (behind and to right of shovel). Offset of unconformity (above end of shovel handle) between the Potomac beds and the overlying, high-level terrace gravels of Pliocene (Tb?) age indicates some fault movement in latest Tertiary or Quaternary time.

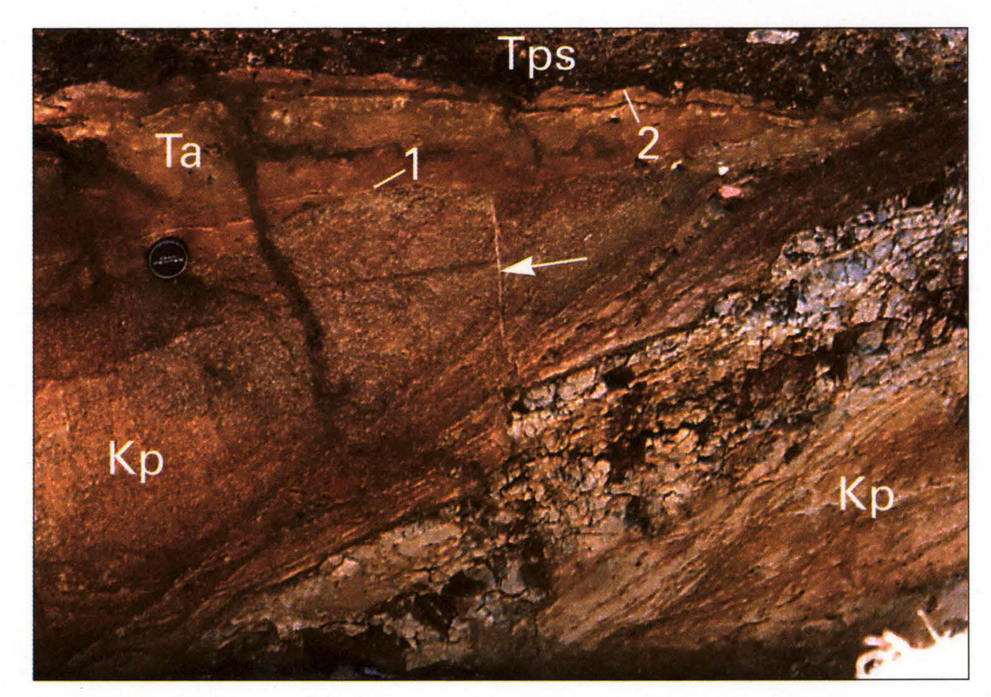


Figure 17.—East-dipping strata in trench exposure of the downthrown, eastern fault block of the Fall Hill fault. Site is on Virginia Power's right-of-way in the northern part of Falmouth, Va. Section includes, from bottom to top: Interbedded coarse, pebbly sand and silty clay of the Potomac Formation (Kp); an inconspicuous unconformity (1) at the top of the Potomac; a 1-m (3.3-ft)-thick remnant of the Paleocene Aquia Formation (Ta) that consists of fine, well-sorted sand oxidized to orange and brown; an unconformity (2) at the top of the Aquia; and a sandy gravel cap of Pliocene age (Tps). Because of truncation by the overlying gravel unit, the Aquia thins abruptly westward and is absent on upthrown western fault block (not seen in photo). Subsidiary reverse fault (arrow) offsets blocky clay bed and sand of the Potomac but not the Aquia sand. Lens cap gives scale.

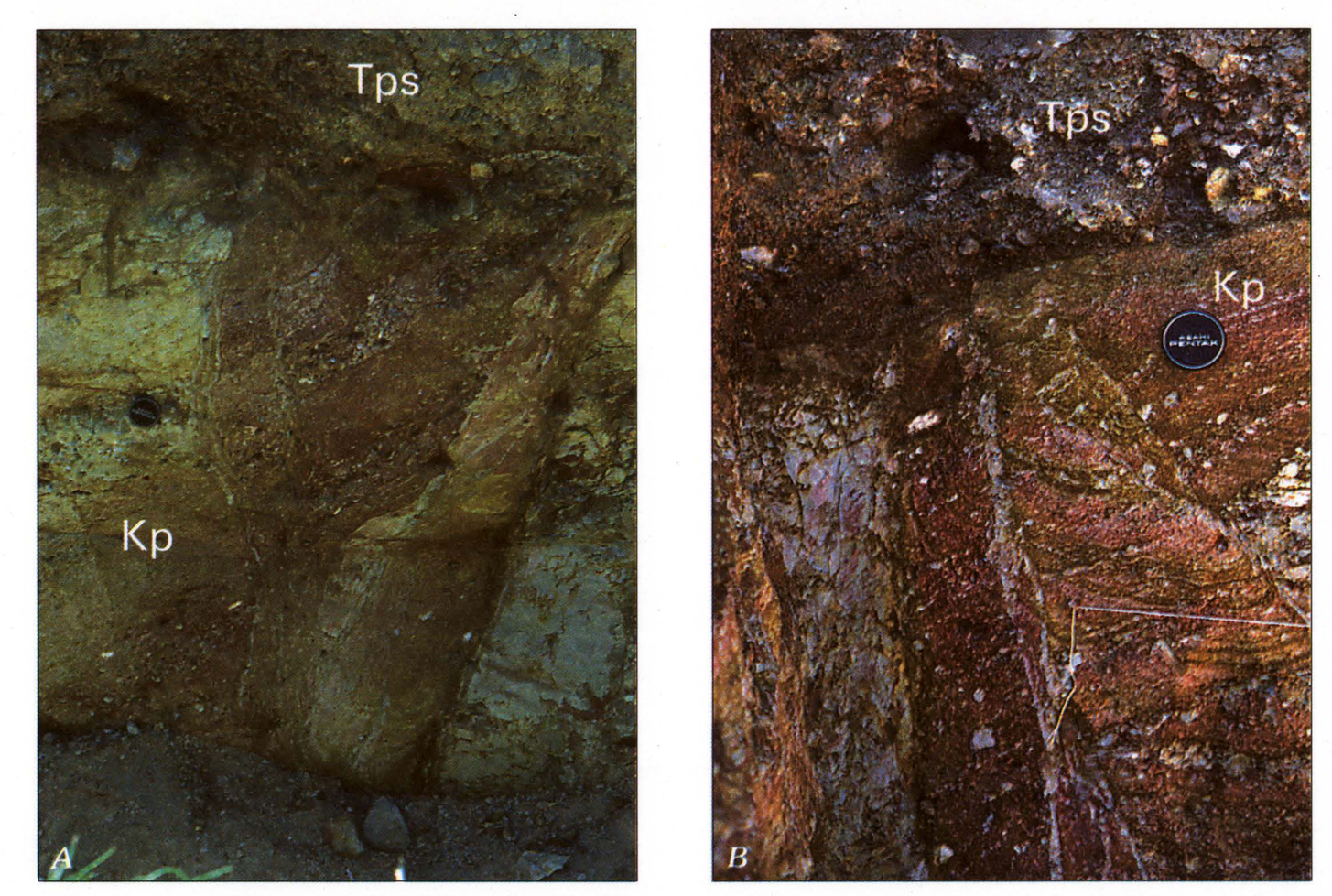


Figure 18.—Main shear zones in Potomac Formation in Potomac Electric Power Company "trench number 1" at the Fall Hill fault study site in the northern part of Falmouth, Virginia. *A*, The 1-m (3.3-ft)-wide shear zone near middle of trench includes four faults that are delineated by pale-gray clay gouge and (or) dark-brown iron oxide. The strike of the faults ranges from north to N. 57° E.; dip ranges from near vertical to 72° NW and 73° SE. The capping sandy gravel (Unit Tps) is not offset by the faults. Lens cap gives scale. *B*, Fault in shear zone at northwestern end of trench offsets the base of the overlying sandy gravel. Although vertical separation of base of gravel is small (2.5 cm (1 in)), this fault and that in the Fall Hill roadcut (fig. 16) clearly show some deformation in Pliocene or Quaternary time.

GEOLOGIC MAP OF THE FREDERICKSBURG 30′ x 60′ QUADRANGLE, VIRGINIA AND MARYLAND

By
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2000

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