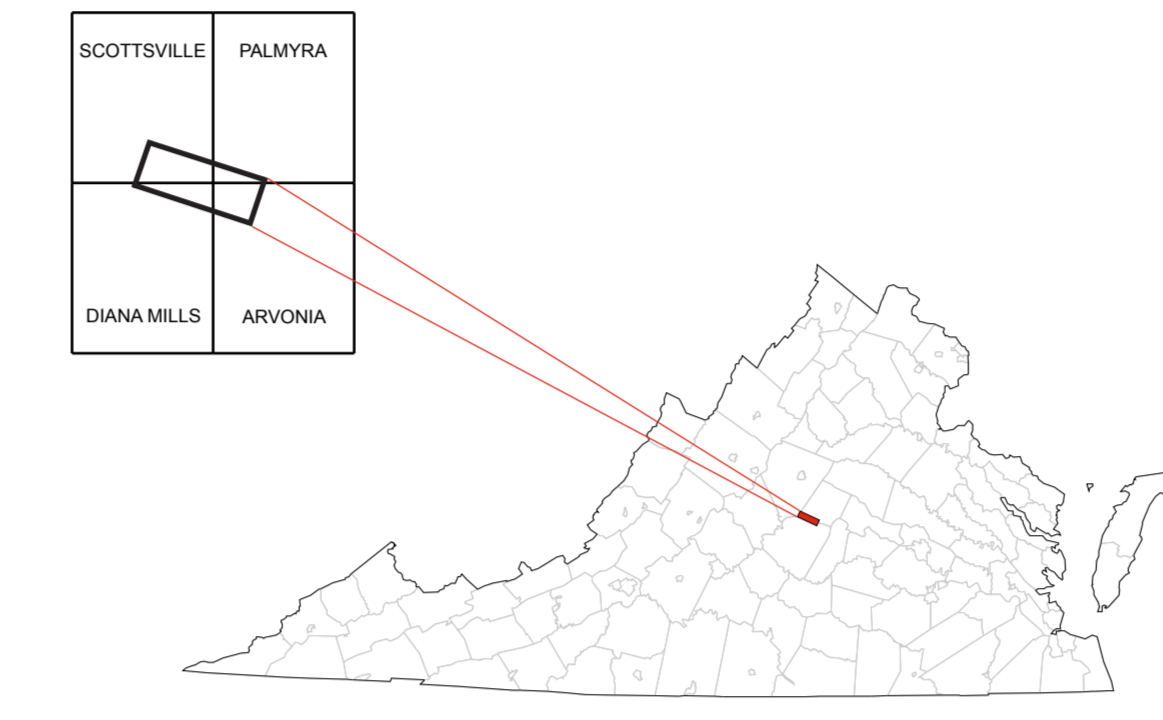
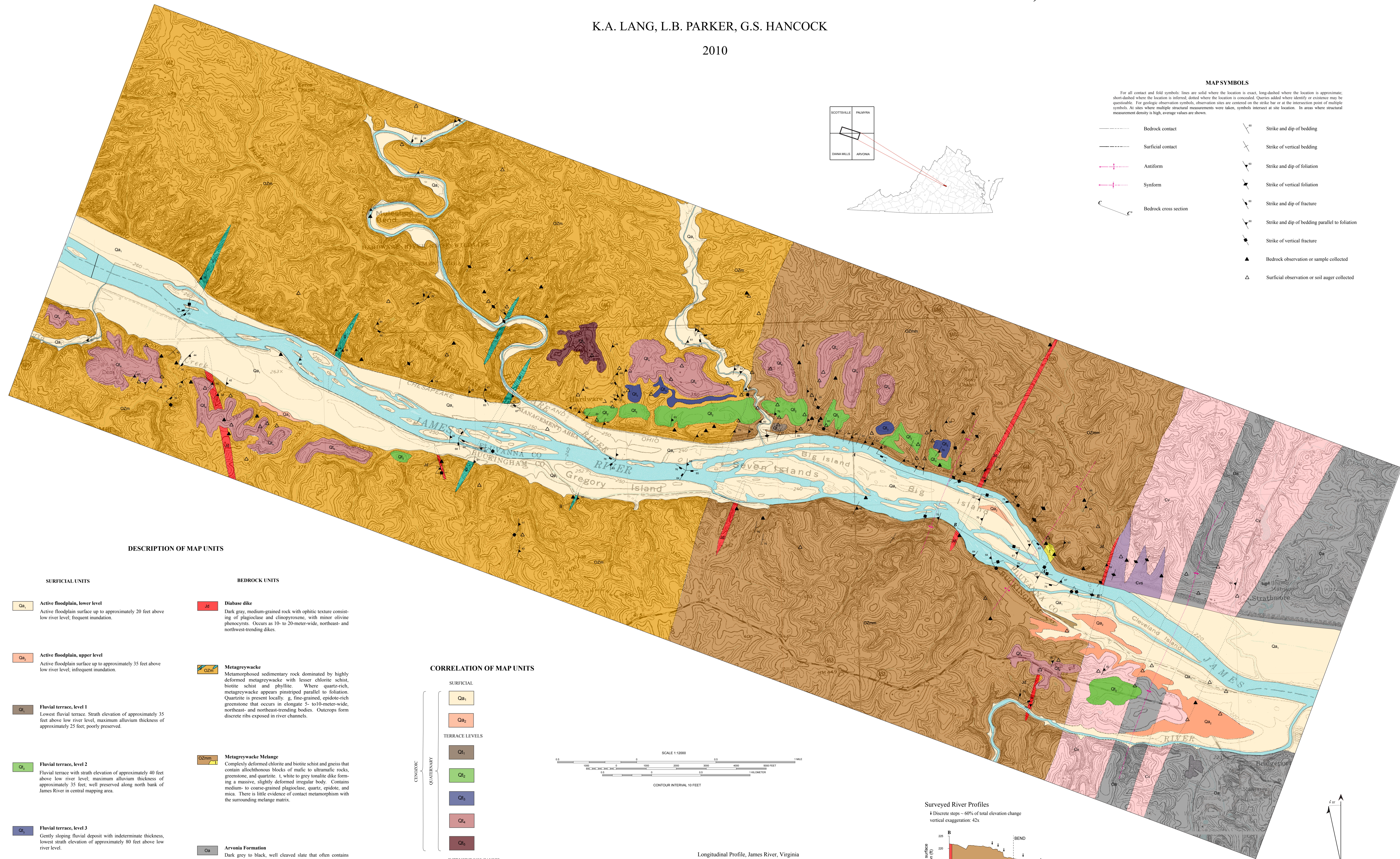


BEDROCK AND SURFICIAL GEOLOGIC MAP ALONG THE JAMES RIVER NEAR HARDWARE, VIRGINIA

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MAP SYMBOLS

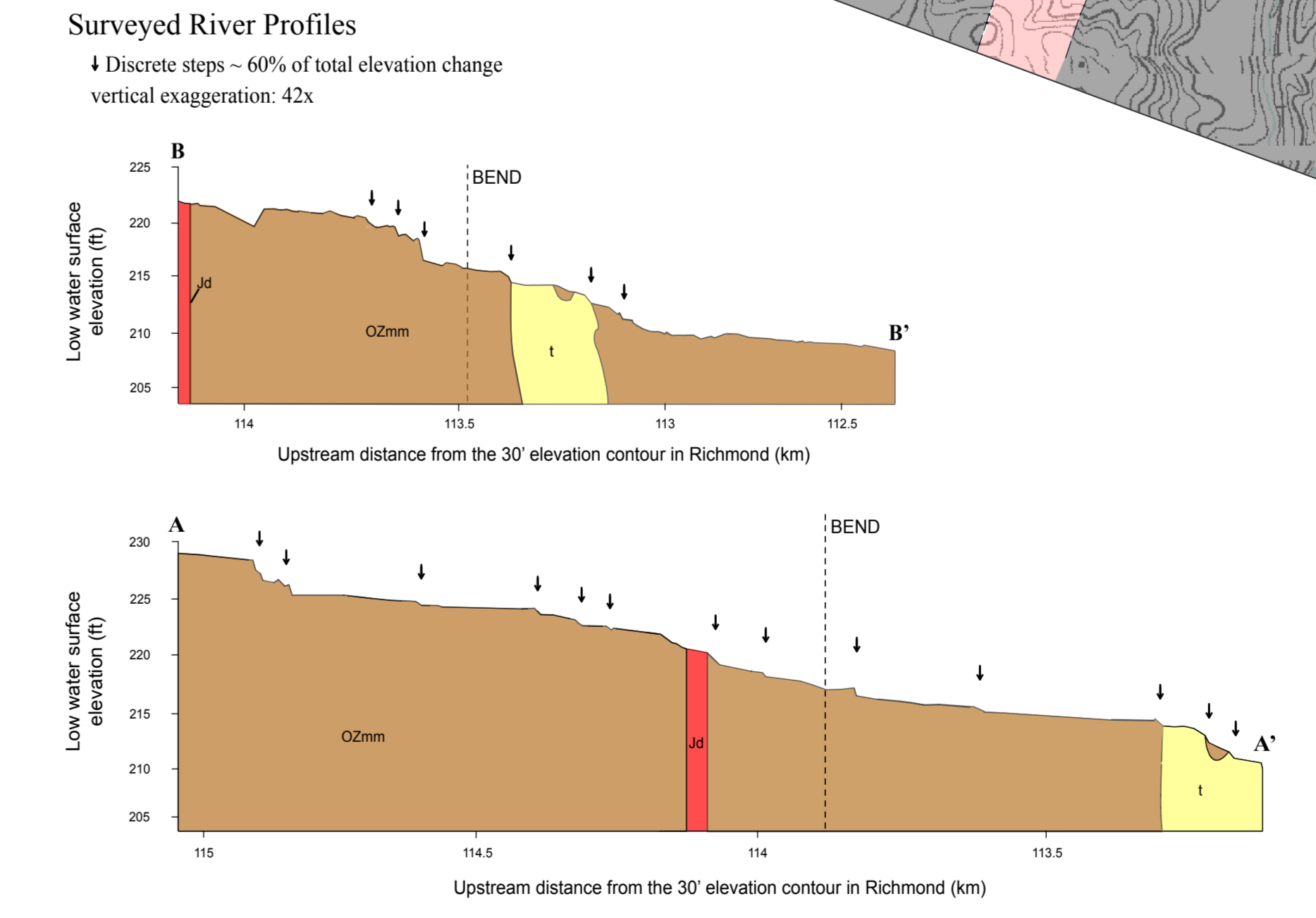
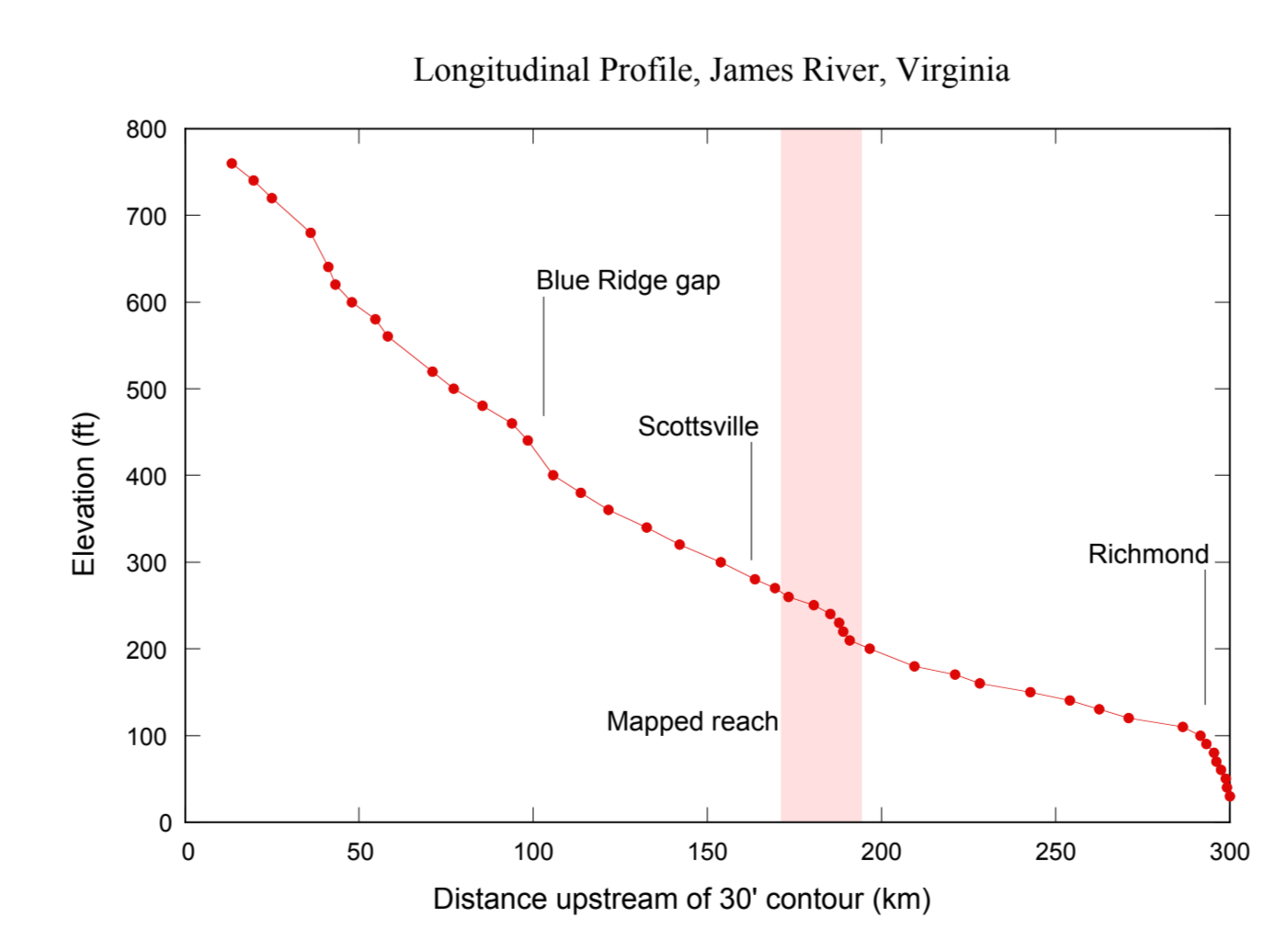
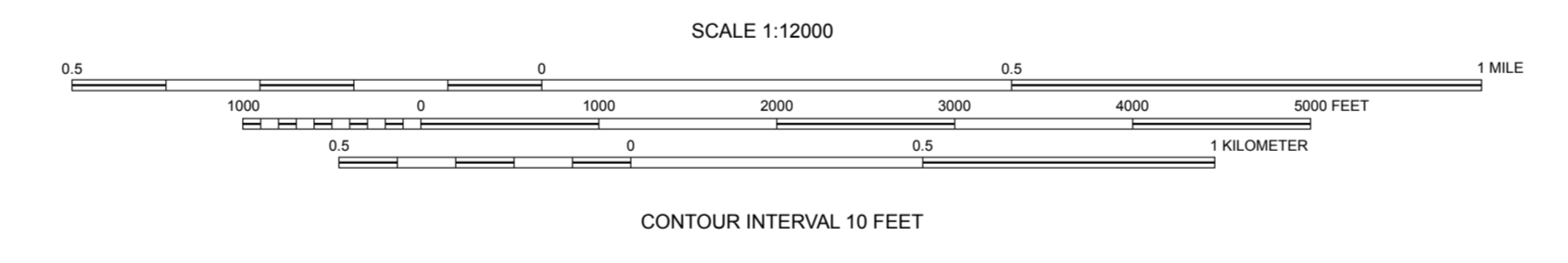
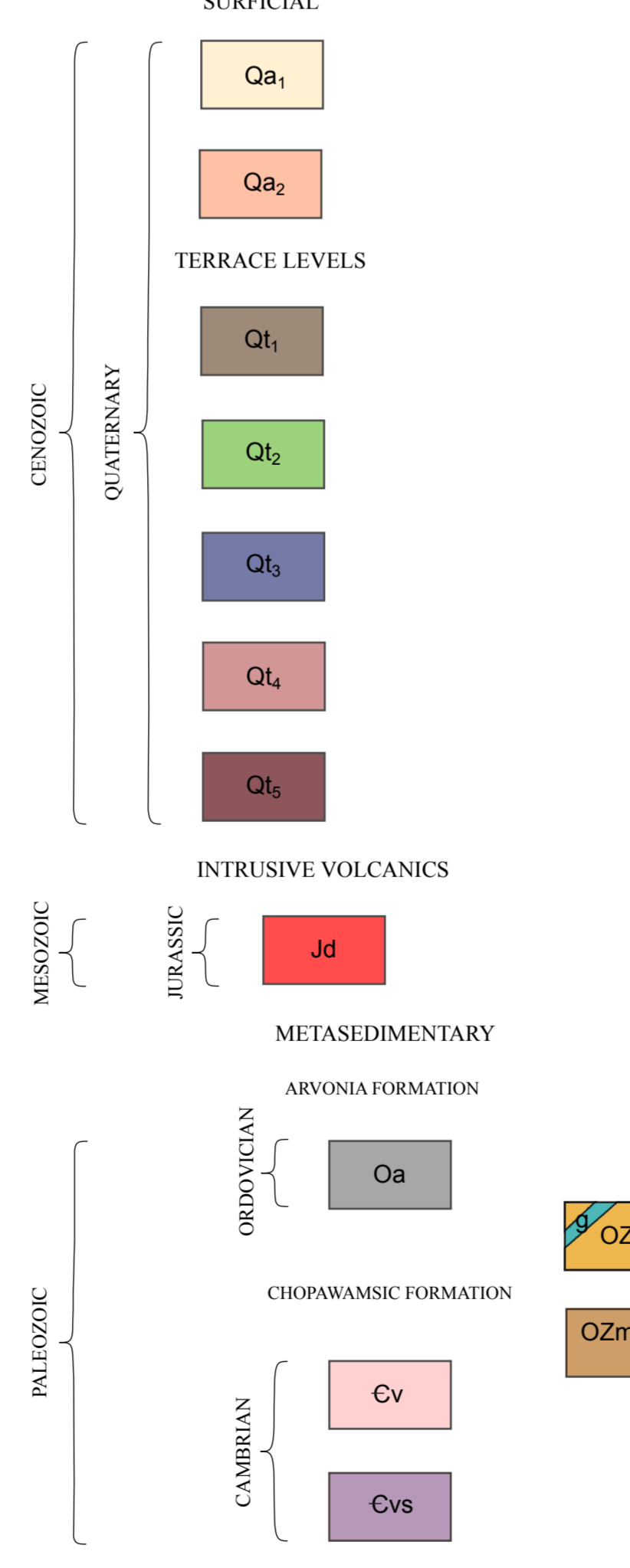
For all contact and field symbols lines are solid where the location is exact, long-dashed where the location is approximate, short-dashed where the location is inferred, dotted where the location is concealed. Quences added where identity or existence may be questionable. For geologic observation symbols, observation sites are centered on the strike bar or at the intersection point of multiple symbols. At sites where multiple structural measurements were taken, symbols intersect at site location. In areas where structural measurement density is high, average values are shown.

—	Bedrock contact	↖	Strike and dip of bedding
- - -	Surficial contact	↗	Strike of vertical bedding
~	Antiform	↖↗	Strike and dip of foliation
~	Synform	↗↖	Strike of vertical foliation
—	Bedrock cross section	↖↗	Strike and dip of fracture
		↗↖	Strike and dip of bedding parallel to foliation
		↖↗	Strike of vertical fracture
▲	Bedrock observation or sample collected		
△	Surficial observation or soil auger collected		

DESCRIPTION OF MAP UNITS

SURFICIAL UNITS		BEDROCK UNITS	
Qa1	Active floodplain, lower level Active floodplain surface up to approximately 20 feet above low river level; frequent inundation.	Jd	Diorase dike Dark gray, medium-grained rock with ophitic texture consisting of plagioclase and clinopyroxene, with minor olivine phenocrysts. Occurs as 10- to 20-meter-wide, northeast- and northwest-trending dikes.
Qa2	Active floodplain, upper level Active floodplain surface up to approximately 35 feet above low river level; infrequent inundation.	OZm	Metagreywacke Metamorphosed sedimentary rock dominated by highly deformed metagreywacke with lesser chlorite schist, biotite schist and phyllite. Where quartzite, metagreywacke appears pinstriped parallel to foliation. Quartzite is present locally as fine-grained epidote-rich gneiss that occurs in elongate 5- to 10-meter-wide, northeast- and northwest-trending bodies. Outcrops form discrete ribs exposed in river channels.
Q1	Fluvial terrace, level 1 Lowest fluvial terrace. Strath elevation of approximately 35 feet above low river level; maximum alluvium thickness of approximately 25 feet; poorly preserved.	OZm	Metagreywacke Melange Complexly deformed chlorite and biotite schist and gneiss that contains siliceous blocks of mafic to ultramafic rocks, gneiss, and quartzite. Light to gray tonalite dike forming a massive, slightly deformed irregular body. Contains medium- to coarse-grained plagioclase, quartz, epidote, and mica. There is little evidence of contact metamorphism with the surrounding melange matrix.
Q2	Fluvial terrace, level 2 Fluvial terrace with strath elevation of approximately 40 feet above low river level; maximum alluvium thickness of approximately 35 feet; well preserved along north bank of James River in central mapping area.	Oa	Arvonina Formation Dark gray to black, well cleaved slate that often contains biotite or graphite porphyroblasts. Slate is gannettous further south and east. Locally contains quartzite to east.
Q3	Fluvial terrace, level 3 Gently sloping fluvial deposit with indeterminate thickness; lowest strath elevation of approximately 80 feet above low river level.	Cv	Chopawamsic Formation Light tan to pink metamorphosed volcanic and sedimentary rock including schist derived from classic sedimentary rocks and phyllite of intermediate to felsic volcanic origin. Lesser metagreywacke and quartzite.
Q4	Fluvial terrace, level 4 Fluvial terrace with strath approximately 100 feet above low river level. Maximum alluvium thickness of approximately 50 feet; well preserved along south bank of James River in western study area and north bank of James River in central study area.	Cvs	Metavolcanic schist Light gray, white weathering, muscovite-sericite schist with magnetite or pyrite porphyroblasts. Strongly foliated.
Q5	Fluvial terrace, level 5 Highest observed fluvial terrace with strath elevation approximately 140 feet above low river level and minimum alluvium thickness of approximately 40 feet; although poorly preserved in mapping area, can be contrasted to high terrace level upstream and downstream with a 70° exposure age of ~1.1 Myr (Hancock and Harbo, 2003).		

CORRELATION OF MAP UNITS



SOURCES

Brown, W.R., 1969. Geology of the Dillwyn Quadrangle, Virginia. Charlottesville, Virginia: Virginia Division of Mineral Resources, 17 p.

Hancock, G.S., and Harbo, 2003. Kinematic extent and landscape development on the James River from the Piedmont through the Valley and Ridge, central Virginia, USA. EOS Trans. AGU, v. 84, Abstract H52-114.

Smith, J.W., Miles, R.C., and Greenberg, R.S., 1964. Geologic and mineral resources of Fluvanna County, Virginia. Virginia Division of Mineral Resources Bulletin 79-62.

Virginia Division of Mineral Resources, 1993. State Geologic Map of Virginia. Virginia Division of Mineral Resources, scale 1:500,000.