# Deformation Styles and Kinematics along the Rockfish Valley Fault Zone in Central Viriginia

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This study examined deformation styles in rocks found along the Rockfish Valley Fault (RVF) shear zone in the Blue Ridge structural province of central Viriginia. Its purpose was to investigate the nature and timing of different deformational events along the RVF, through the use of fabric description and kinematic indicators.

The RVF strikes northeast-southwest and dips variably to the southeast. Movement along the RVF has been associated with northwest vergent thrusting of the Lovingston massif over the Pedlar massif, during the middle Paleozoic. Paleozoic compression is believed to be related to continental collisions occurring between North America and Eurasia (Bartholomew 1977; Sinha & Bartholomew 1984). Recent evidence has suggested that the RVF was initiated in the Proterozoic during either the Grenville Orogeny (Herz & Force 1984) or during the rifting of North America in the Late Proterozoic (Simpson & Kalaghan 1989) and was later reactivated as a thrust fault in the Paleozoic.

The deformational fabrics in six outcrops along an west-east transect across the shear zone, were described and measured in the field. At some sites a sense of movement was indicated by offset of one fabric by another. Oriented samples were collected and thin sections were cut perpendicular to the foliation and parallel to the lineation of the dominant fabric. Descriptions of microfabrics were made and microscopic kinematic indicators were examined.

A mylonitic fabric, developed to varying degrees, was found throughout the shear zone. The best preserved mylonites were found further from the center of the shear zone, in fine -grained, quartz -rich rocks. Closer to the shear zone center, several sets of brittle and ductile shears cut across, and at some sites intensely deform the mylonitic fabric.(Fig.1) The rocks closer to the shear zone center are coarser-grained and rich in potassium feldspar. The later shears tend to deform feldspar through brittle fracturing and quartz through recrystallization and the formation of ribbons. (Fig.2) There is also evidence of ductily deformed

(p. 19). The Catoctin Formation, where present, lies between the Blue Ridge basement and the Unicoi Formation (Reed, 1969).

The greenstones in the area mapped are found only along North Creek. It is not known if the greenstones are volcanics or related shallow intrusives. There is no evidence of pillows or columnar joints, and the greenstones seem to strike parallel to the nearby sedimentary strata. Furthermore, thin section analysis shows that although metamorphism has occurred and most of the original mafics are missing, the crystal structures are fairly intact, implying a static, post-deformational metamorphism. To escape being folded and structurally altered, one would expect emplacement long after the Cambrian period.

However, considering the rarity of volcanic activity in this area, the similarity of the surrounding sediments, and the placement of the greenstones, I tentatively support renaming the lower part of the Unicoi in this area the Catoctin.

<u>References Cited</u>

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Spencer, E. W., 1968, Geology of the Natural Bridge, Sugarloaf Mountain, Buchanan, and Arnold Valley quadrangles, Virginia: Virginia Div. Min. Resources Report of Investigations 13, 55 p.

## Figures

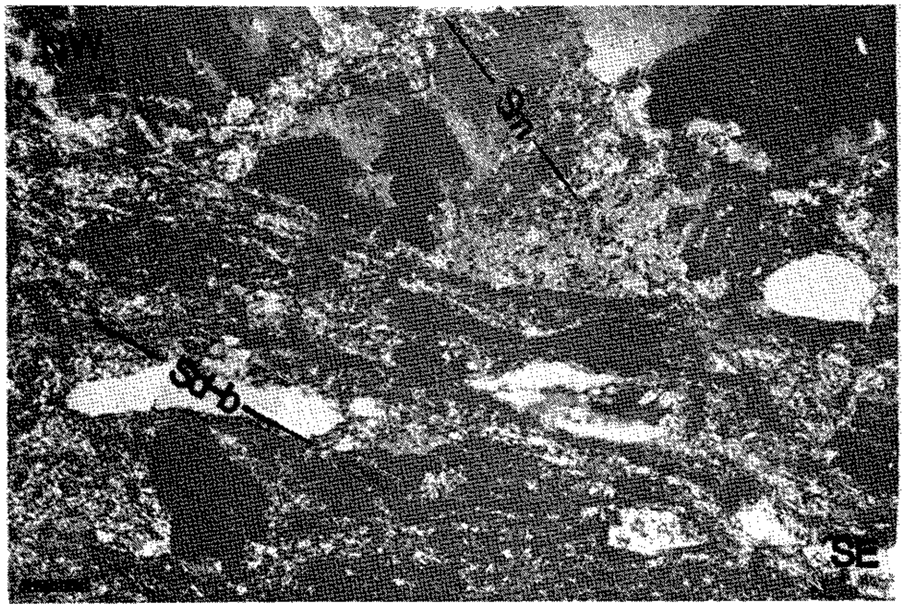


Figure 1. Photomicrograph of coarse-grain, potassium feldspar-rich rocks, closer to the shear zone center. Sm is the mylonitic foliation and Sd-b is a later cross-cutting ductile shear. Crossed nicols, scale bar = 200 microns.

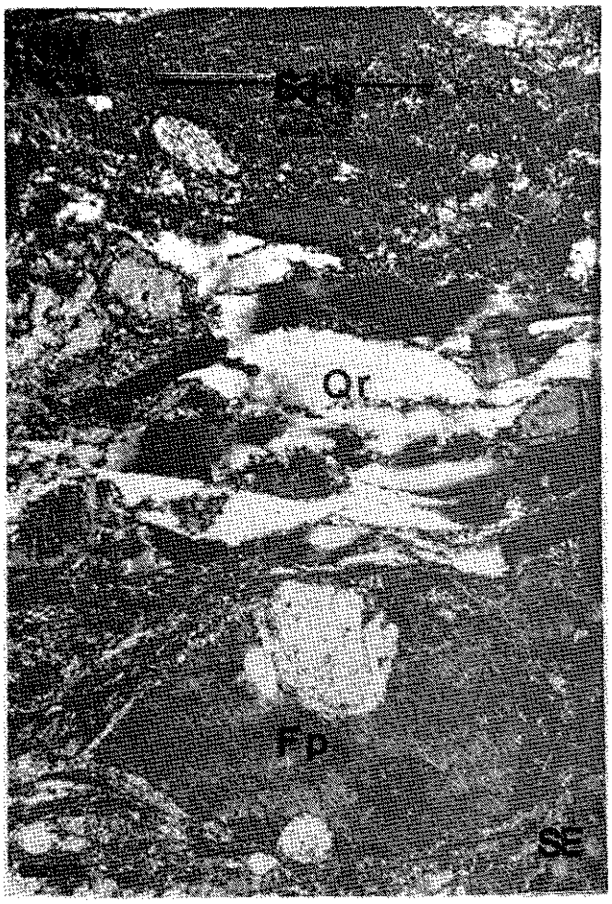


Figure 2. Photomicrograph of ductily deformed quartz ribbons (Qr) and rigid feldspar porphyroclast (Fp). A short assymmetric tail on the right side of the feldspar, is consistent with more developed assymmetric tails in this thin section which indicate, top the NW sense of movement (left lateral). Crossed nicols, scale bar = 200 microns.

feldspar, that suggests these shears formed in the brittle-ductile transition zone. Fabric orientations from the various outcrops suggest at least two deformational events occurred following formation of the mylonitic fabric.

Kinematic indicators for the mylontic fabric were best preserved in the fine-grained, quartz-rich rocks, further from the shear zone center, which showed no later cross-cutting shears. Sense of movement for the mylonites was top to the southeast which indicates extension, possibly related to Late Proterozoic rifting. Generally similiar, but more biotite-rich rocks, from the same site showed top to the northwest sense of movement. The temporal relationship between these two rocks has yet to be clearly determined. Kinematic indicators along the ductile and brittle shears, which clearly post-date the mylonitic fabric, showed a top to the northwest sense of movement, suggesting compression, possibly related to thrusting in the middle-Paleozoic.(Fig.2)

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Sinha, A.K. and Bartholomew, M.J. (1984) "Evolution of Grenville terranes in central Viriginia," in Bartholomew, M.J., ed., The Grenville event in the Appalachians and related topics; GSA Special Paper 194, pp. 175-185.

# The Formation of a Foreland Dipping Duplex at Eagle Rock Gap, Virginia

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## Introduction

Complexly folded and faulted Ordovician and Silurian clastic rocks are exposed in two roadcuts through Eagle Rock Gap, Virginia. Eagle Rock Gap, a watergap cut by the James River, is located within the Eagle Rock Quadrangle (Fig. 1) on the northwest margin of the Great Valley of Virginia. The exposures mapped in this study

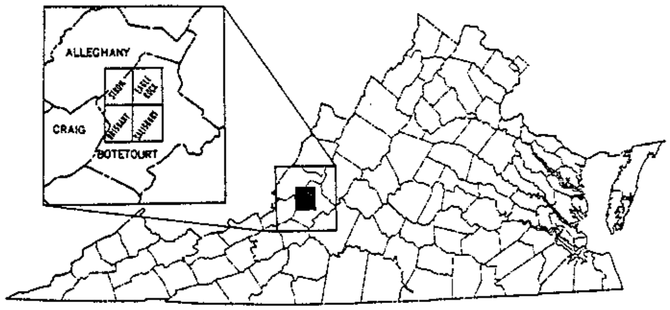


Figure 1. Virginia map showing the location of Eagle Rock Quadrangle (McGuire, 1970).

are located on the north side of the James River between Crawford and Rat Hole Mountains (Fig. 2). The Great Valley of Virginia is located west of the leading edge of the Blue Ridge Province in which Precambrian basement rocks are brought to the surface by thrust faults. West of the Great Valley of Virginia is the Valley and Ridge Province which is characterized by blind thrusts and broad folds.

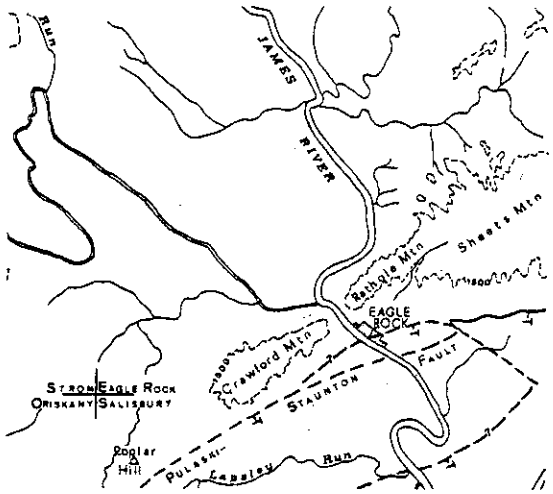


Figure 2. Map showing location of Eagle Rock Gap between Crawford and Rathole Mountains (McGuire, 1970).

A major fault which strikes parallel to the ridge at N50$^{o}$ E and dips about 50$^{o}$ to the northwest duplicates many of the Silurian formations in the exposure. The northwest dip of the fault is in the opposite direction and at a steeper angle than thrust faults mapped in the region, which generally dip gently to the southeast (Fig. 3).

## Methods of Data Collecting

A cross section of the outcrop was prepared by measuring the positions of formation and fault contacts along the outcrop at road level. Field sketches were made and photographs were taken of structures in outcrop. Attitudes of major and minor fault planes, slickensides, bedding planes, and fold axes were measured with a Brunton compass. Orientations of structures were plotted on a stereonet. The positions of structures formed while bedding was