THE BLUE RIDGE BASEMENT CONTACT NEAR ARCADIA, VIRGINIA

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Introduction

The Blue Ridge Anticlinorium is a thrust-faulted overturned fold, which runs NE-SW along the trend of the Appalachian Mountains. The Blue Ridge Province is the core of the anticlinorium and is composed of metamorphosed Precambrian rock. The basement rocks of the Blue Ridge are thrust over Paleozoic sedimentary rocks on the northwest flank. In the summer of 1990, an area along the Blue Ridge contact was mapped in the Jefferson National Forest, near the town of Arcadia. The purpose was to distinguish the late Precambrian and early Paleozoic units and to understand their structural setting.

Stratigraphy and Structure

The oldest unit is the Precambrian basement complex, here thrust northwest over Paleozoic rocks and known as the Blue Ridge front. These crystalline rocks are essentially hypersthene granodiorite, consisting primarily of quartz and feldspar with some pyroxene.

Resting unconformably on the basement is the Unicoi Formation, according to Spencer (1968), who describes it as "consisting primarily of pebble conglomerate graywackes, arkosic sandstone, and some volcanic rocks, primarily greenstones." The Unicoi has its boundary atop the uppermost conglomerate.

Overlying the Unicoi is the Hampton Formation, primarily composed of laminated shale, graywacke and quartzite (Spencer, 1968). Spencer (1968) mapped the Hampton and the Unicoi as a single unit.

The most varied and exposed late Precambrian-early Paleozoic sequence is located in streambeds and adjacent roadcuts along the North Creek branch of Jennings Creek. Near the contact, the weathered basement and the overlying rocks of the Cambrian Unicoi Formation are difficult to distinguish because the lowermost sedimentary layers are composed of detritus derived from the basement rocks. Where the basement has been subjected to weathering, it appears to have a sedimentary texture. Both units have similar concentrations of quartz and feldspars. To further confuse matters, the sedimentary rocks have been subjected to some degree of metamorphism in the process of burial, increasing their similarity to the basement rocks.

These factors make the contact difficult to locate. Unless the contact itself is exposed, the older and younger rocks cannot be distinguished with confidence without sedimentary structures.

In general, the Precambrian rocks of the Blue Ridge are in thrust-fault contact with the Paleozoic sedimentary rocks. However, along North Creek a basal conglomerate lies atop the basement (figure 1), which means that here the contact is an unconformity. The basal conglomerate may have been carried forward with the thrust sheet and if so, the fault trace must lie northwest of the basal conglomerate.

West along North Creek, the rocks become less arkosic as the contribution of basement detritus diminishes. Greywackes and shales become the dominant lithologies. Further west are greenstones and a local reappearance of the basement (figure 1). The presence of basement rock here has not been previously observed. This basement outcrop may be explained in several ways.

1) It may be the core of a minor antiform. If this were the case, however, the same lithologies should occur on opposite sides of this structure. Limited exposure makes verification of this difficult.

2) The western and eastern basement outcrops may be two thrust slices formed during a single polyphase thrusting event. The western basement outcrop may have been carried forward over the Late Precambrian and Early Cambrian sedimentary rocks to the west. That basement slice would have carried younger sedimentary rocks on top of basement as it was emplaced over other sedimentary rocks. Later a second thrust brought the eastern basement slice onto the earlier one. This is the explanation reflected in figure 1.

The sandstones and shales in the southwestern part of the region along Jennings Creek are so intensely folded that detailed mapping is quite difficult. Where bedding does assume a measurable orientation it usually strikes northeast and dips at various angles to the southeast. Overturned folds are visible.

Igneous rocks

A number of greenstones as well as a possible tuff are exposed along North Creek. These relict volcanics and/or intrusives occur near both of the creek's basement outcrops. The altered basalt consists primarily of plagioclase, epidote, sphene, and hematite. A layer of fine-grained, reddish rock composed of highly angular crystals probably represents an ancient ash fall. These rocks may be associated with the Late Precambrian Catoctin Formation or they may be part of the basal Unicoi as described by Spencer (1968).

The Catoctin basalts are described by Reed (1969) as flow basalts, consisting today primarily of albite, chlorite, epidote, actinolite, and sphene. Further, he says that the Catoctin greenstones record the only extensive volcanic activity in this part of the range. The similarities between the Catoctin Formation described by Reed (1969) - which includes sedimentary members - and the sedimentary members near Arcadia attributed to the lower Unicoi Formation also present evidence in favor of a Catoctin association of these lavas. Just as the contact between the basement and the overlying sedimentary rocks is difficult to locate in this area, Reed (1969) writes of the Catoctin, "at many places the lower contact of the basal sedimentary layer rocks in unclear"

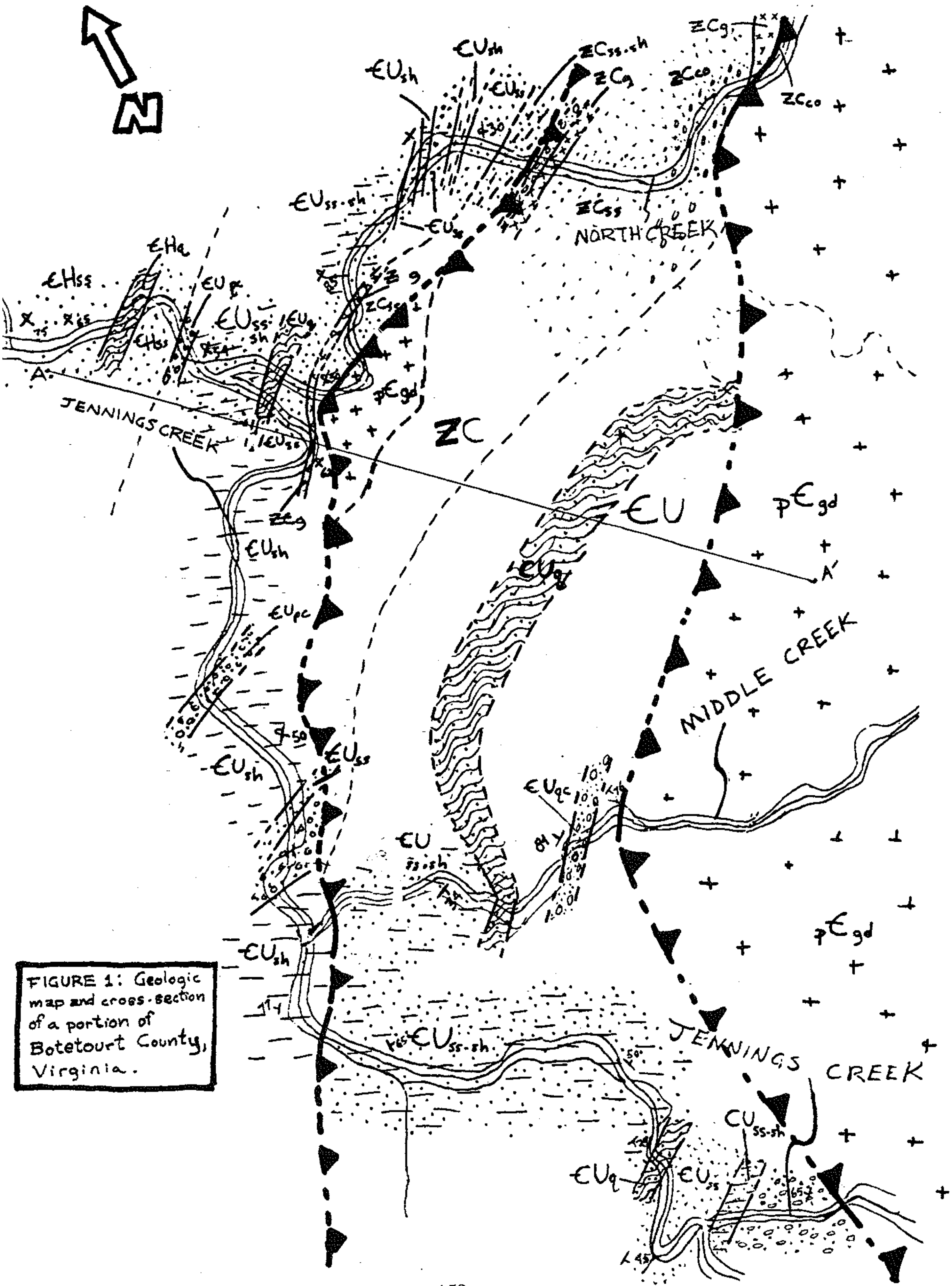
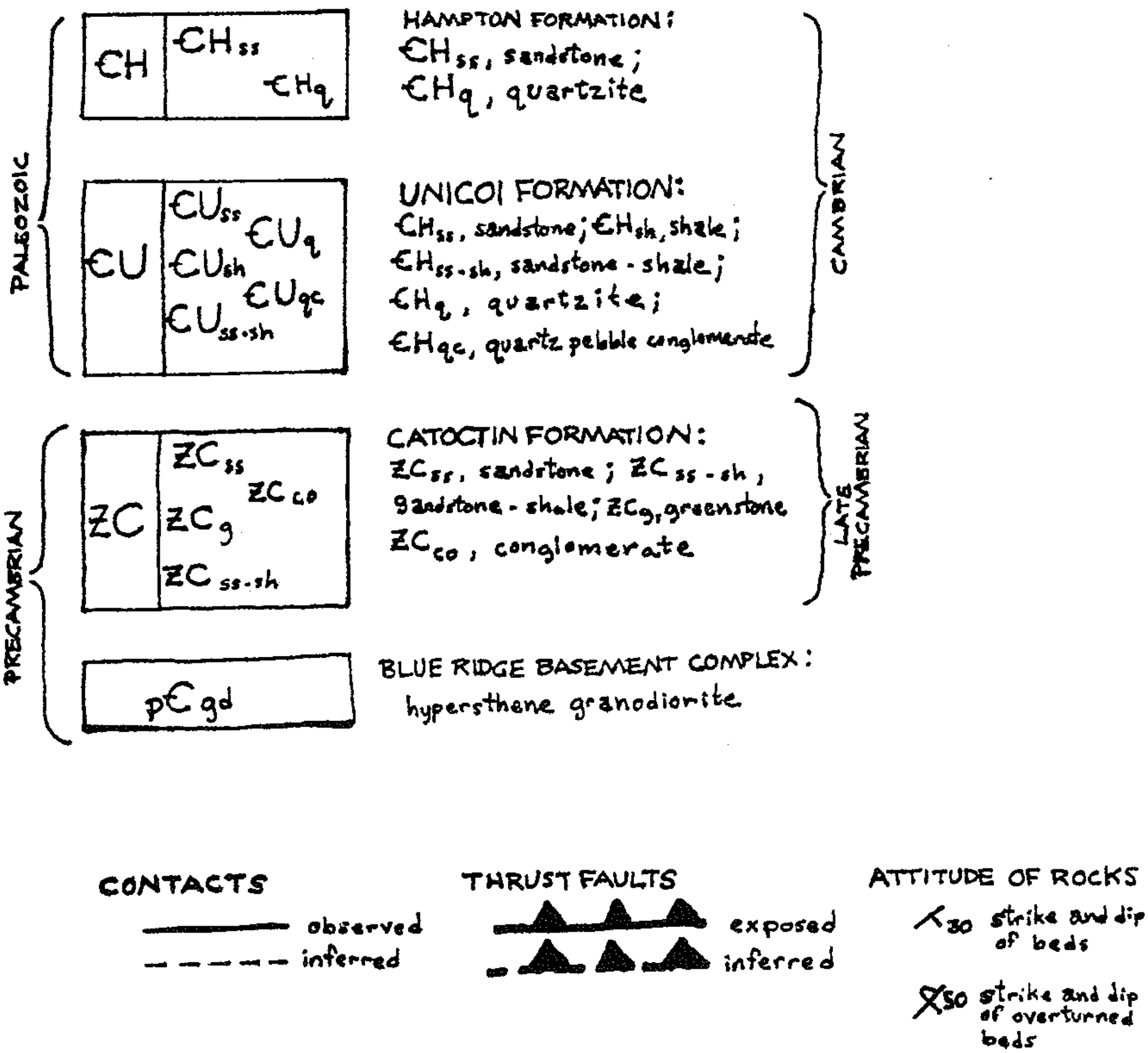
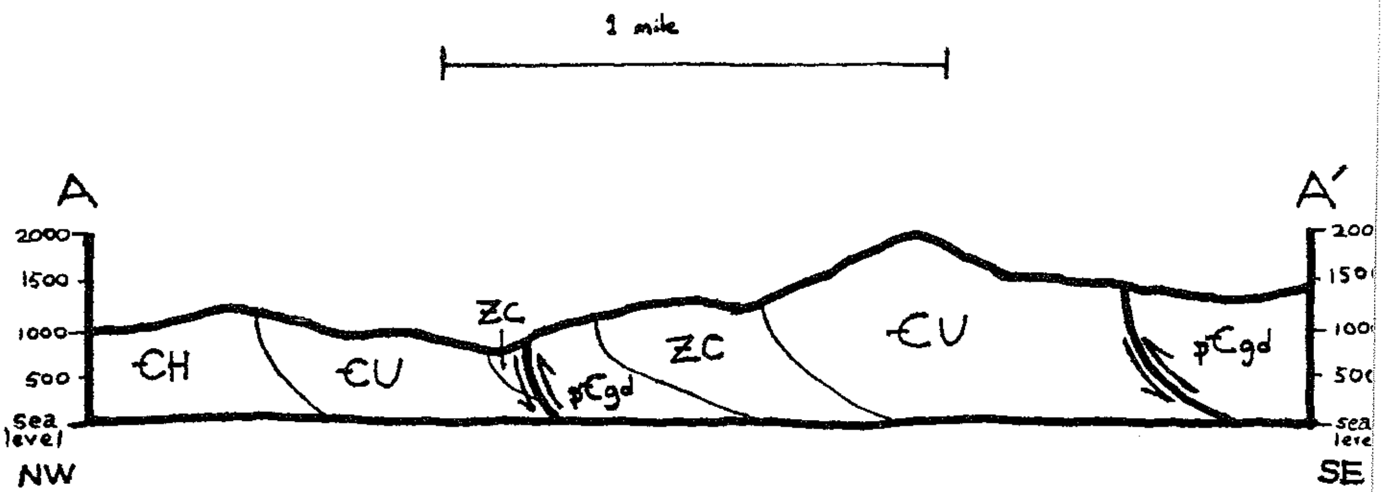


FIGURE 1: Geologic map and cross-section of a portion of Botetourt County, Virginia.


PALEOZOIC
ЄH
ЄHss
ЄHq
HAMPTON FORMATION:
ЄHss, sandstone;
ЄHq, quartzite
ЄU
ЄUss
ЄUq
ЄUsh
ЄUqc
ЄUss-sh
UNICOI FORMATION:
ЄHss, sandstone; ЄHsh, shale;
ЄHss-sh, sandstone - shale;
ЄHq, quartzite;
ЄHqc, quartz pebble conglomerate
CAMBRIAN
PRECAMBRIAN
ZC
ZCss
ZCco
ZCg
ZCss-sh
CATOCTIN FORMATION:
ZCss, sandstone; ZCss-sh,
sandstone - shale; ZCg, greenstone
ZCco, conglomerate
LATE PRECAMBRIAN
pЄgd
BLUE RIDGE BASEMENT COMPLEX:
hypersthene granodiorite
CONTACTS
observed
inferred
THRUST FAULTS
exposed
inferred
ATTITUDE OF ROCKS
30 strike and dip of beds
50 strike and dip of overturned beds


1 mile
A
A′
2000
1500
1000
500
sea level
NW
SE
ЄH
ЄU
ZC
pЄgd
ZC
ЄU
pЄgd

(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>

Reed, J. C., 1969, Ancient lavas in Shenandoah National Park near Luray, Virginia: U.S. Geol. Survey Bull. 1265, 43 p.

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.

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