

STRUCTURE OF THE BREVARD ZONE AND BLUE RIDGE
NEAR LENOIR, NORTH CAROLINA, WITH OBSERVATIONS
ON OBLIQUE CRENULATION CLEAVAGE AND A PRELIMINARY
THEORY FOR IRROTATIONAL STRUCTURES IN SHEAR ZONES

by

Andy R. Bobyarchick

A Dissertation

Submitted to the State University of New York

at Albany

in Partial Fulfillment of

the Requirements for the Degree of

Doctor of Philosophy

College of Science and Mathematics

Department of Geological Sciences

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ABSTRACT

Stratigraphy on the eastern flank of the Southern Appalachian Blue Ridge near the Grandfather Mountain window is arranged in a series of fault-bounded lithotectonic belts stacked so that the structural section dips steeply southeast. The Fries block of the Blue Ridge thrust sheet overlies the Grandfather Mountain window along the Linville Falls fault. The Laytown belt overlies the Fries block along the Winding Stairs Mountain fault. The Brevard zone, bounded at its base by the Ripshin Mountain fault and bounded at its top by the Yadkin fault, lies on the Laytown belt. Augen gneiss and granitic gneiss of the Inner Piedmont, here called Henderson gneiss, sharply abuts the Brevard zone along the Yadkin fault. It is unlikely that any coherent stratigraphy exists in the Brevard zone.

All principal foliations in the Grandfather Mountain window, Blue Ridge thrust sheet, and Brevard zone are the result of the transposition of an earlier layering or foliation. Brevard zone mylonites commonly show isoclinally refolded isoclines. The mylonitic foliation there is the culmination of multiple deformation. Distinct zones in the Fries block contain a superimposed cleavage that results in locally transposed, mylonitic shear zones. These shear zones are sites for retrograde metamorphism and they are interpreted to be faults, possibly splays off a thrust that may emerge as the Linville Falls fault. Lineations were produced as a result of transposition. The principal lineation in the Grandfather Mountain window is older than the principal lineation in the Blue Ridge and the Brevard zone. Interpretations of shear sense in the Brevard zone

based on orientations or reorientations of the lineations are not appropriate.

Shear across low angle oblique crenulation cleavage is consistently dextral in the Brevard zone. The cleavage event is interpreted to have occurred in the latter stages of late Paleozoic ductile deformation and retrograde metamorphism in the Brevard zone. The cleavage geometry suggests dextral strike-slip motion on the Brevard zone.

Theoretical models for irrotational structures in two-dimensional plane strain demonstrate that: (1) lines of material particles lying in an oblique irrotational orientation make an angle, α , with the shear zone boundaries whose vertex indicates the shear sense for the simple shear component and (2) the oblique irrotational direction could experience a component of simple shear equal in sign to that of the shear zone.

To MB

TABLE OF CONTENTS

	<u>Page</u>
TABLE OF CONTENTS.....	i
LIST OF FIGURES.....	iii
CHAPTER 1 - INTRODUCTION AND ACKNOWLEDGEMENTS.....	1
INTRODUCTION.....	2
Research Methods and Funding.....	4
ACKNOWLEDGEMENTS.....	5
CHAPTER 2 - STRATIGRAPHY IN THE EASTERN BLUE RIDGE AND BREVARD ZONE.....	6
Introduction.....	7
Grandfather Mountain Window.....	9
Blue Ridge Thrust Sheet.....	12
Laytown Belt.....	23
Brevard Zone.....	26
Lineated Granitic Gneiss.....	34
Layered Gneiss.....	37
Inner Piedmont.....	41
CHAPTER 3 - SUPERIMPOSED FOLIATIONS, LINEATIONS, AND STRUCTURE IN THE BLUE RIDGE THRUST SHEET AND BREVARD ZONE..	44
Introduction.....	45
The Brevard Zone.....	46
Terminations of the Brevard Zone.....	49
Origin of the Brevard Zone.....	54
Blue Ridge Thrust Sheet.....	56
Previous Structural Interpretations.....	58
Grandfather Mountain Window.....	60
Structures Near the Linville Falls Fault.....	88
Lineations in the Blue Ridge Thrust Sheet North of the Laytown Belt.....	102
Lineations in the Laytown Belt.....	107
Lineations in the Brevard Zone.....	110
Discussion.....	125
Stretching Lineations, Fold Axes, and Tectonic Transport.....	128
Summary.....	131
CHAPTER 4 - OBLIQUE CRENULATION CLEAVAGE IN THE BREVARD ZONE	134
Introduction.....	135
Occurrence.....	136
Geometry of Oblique Crenulation Cleavage.....	138
Oblique Crenulation Cleavage in the Brevard Zone.....	145
Petrographic and Field Description.....	145
Structure.....	179
Displacement in the Brevard Zone.....	184
Timing of Deformation.....	186
Subsequent Rotation.....	189
Notes on the Origin of Oblique Crenulation Cleavage....	190
Summary.....	197

	<u>Page</u>
CHAPTER 5 - PRELIMINARY THEORY FOR IRROTATIONAL STRUCTURES IN SHEAR ZONES.....	200
LIST OF SYMBOLS.....	201
Introduction.....	203
Incremental Deformations and Mohr Circles.....	204
Derivations of Equations for Superimposed Deformations	209
<u>Variations in α</u>	219
Instantaneous Deformations and Irrotational Structures	226
A Hypothetical Shear Zone.....	235
A Possible Irrotational Structure.....	235
Summary.....	238
REFERENCES CITED.....	240
APPENDIX I - THE EASTERN PIEDMONT FAULT SYSTEM AND ITS RELATIONSHIP TO ALLEGHANIAN TECTONICS IN THE SOUTHERN APPALACHIANS.....	261
Abstract.....	262
Introduction.....	263
Outline of Late Precambrian to Pre-Alleghanian Tectonics.....	264
<u>Late Precambrian Events</u>	264
<u>Taconic Events</u>	268
<u>Post-Taconic and Pre-Alleghanian Events</u>	270
Alleghanian Deformation and the Eastern Piedmont Fault System.....	274
<u>Lateral Movement in the Eastern Piedmont</u> <u>Fault System</u>	278
A Model for the Alleghanian Eastern Piedmont Fault System.....	280
The Alleghanian Suture.....	287
Conclusions.....	289
APPENDIX IA - THE EASTERN PIEDMONT FAULT SYSTEM AND ITS RELATIONSHIP TO ALLEGHANIAN TECTONICS IN THE SOUTHERN APPALACHIANS: DISCUSSION AND REPLY.....	291
THE EASTERN PIEDMONT FAULT SYSTEM AND ITS RELATIONSHIP TO ALLEGHANIAN TECTONICS IN THE SOUTHERN APPALACHIANS: A DISCUSSION by A. W. Snoke and D. T. Secor, Jr.,.....	292
Acknowledgments.....	296
THE EASTERN PIEDMONT FAULT SYSTEM AND ITS RELATIONSHIP TO ALLEGHANIAN TECTONICS IN THE SOUTHERN APPALACHIANS: A REPLY by A. R. Bobyarchick.....	297
Acknowledgments.....	300
APPENDIX II - ABSTRACTS OF OTHER RESEARCH.....	301
INFLUENCE OF THE FORMATION OF TRIASSIC BASINS ON THE REGIONAL THERMAL AND STRUCTURAL HISTORY OF CRYSTALLINE ROCKS IN THE SOUTHERN APPALACHIANS (Abstract).....	302
MICROSCOPIC TEXTURES OF SHEAR BAND CLEAVAGE IN MICACEOUS MYLONITES (Abstract).....	304
LATE CENOZOIC FAULTING ALONG THE MOUNTAIN RUN ZONE, CENTRAL VIRGINIA PIEDMONT (Abstract).....	306

LIST OF FIGURES

<u>Figure #</u>		<u>Page</u>
2-1	Geologic map of the Buffalo Creek area.	(back pocket)
2-2	Map of the Grandfather Mountain area.	13
2-3	Sphene grain in amphibole gneiss near Linville Falls fault.	16
2-4	Hornblende grain from lower part of Blue Ridge thrust sheet.	19
2-5	Contorted layering in layered gneiss complex.	38
3-1	Geologic sketch map of the Brevard zone and adjacent lithotectonic belts.	47
3-2	Lineations in the Buffalo Creek area.	62
3-3	Lineation in phyllonites in the Grandfather Mountain window.	64
3-4	Transposed layering in phyllonites.	67
3-5	Folded quartzite layers in phyllonite.	69
3-6	Crenulations in phyllonites.	72
3-7	Culminations and saddles in phyllonite.	74
3-8	Sericite/chlorite masses in phyllonites.	76
3-9	Folding and transposition in phyllonites.	79
3-10	Pavement outcrop of massive gneiss.	83
3-11	Refolded folds in massive gneiss.	86
3-12	Contoured stereoprojections of foliations.	(back pocket)
3-13	Refolded folds in amphibolite layer from Linville Falls fault.	91
3-14	Folds near the Linville Falls fault.	93
3-15	Porphyroclastic minerals in the Linville Falls fault.	98
3-16	Folds in foliation in the Blue Ridge thrust sheet.	103
3-17	Rootless isoclines in the Laytown belt.	108

<u>Figure #</u>		<u>Page</u>
3-18	Ripshin Mountain mylonites.	111
3-19	Layering in quartzite/schist unit.	115
3-20	Isoclinally folded quartzite layers in mylonitic schist.	117
3-21	Lineations in the Brevard zone.	119
3-22	Microscopic isoclinal folding revealed by opaque inclusions.	121
4-1	Geometry of oblique crenulation cleavage.	139
4-2	Oblique crenulation cleavage geometry.	142
4-3	Displacement direction and magnitude from offset planes on a fault surface.	146
4-4	Bending of a plane in a ductile shear zone.	148
4-5	Phacoidal textures in the Brevard zone.	151
4-6	Ductile faults in Brevard zone mylonites.	156
4-7	Photomicrographs of oblique crenulation cleavage.	160
4-8	Chloritized garnet.	165
4-9	Grain size and shape variations in quartzite layer.	168
4-10	Stretched pyrite grain in oblique cleavage.	175
4-11	Discrete oblique cleavage.	177
4-12	Frequency plots for α .	180
4-13	Stereoprojections of oblique crenulation cleavage.	182
4-14	Flexural flow in thrust ramp.	192
4-15	Variations of strain in shear zones depending on pure and simple shear.	195
5-1	Progressive deformation of a unit square.	205
5-2	Family of Mohr circles representing progressive deformation of a unit square.	207
5-3	Deformation of a unit square by superimposed increments of simple shear and pure shear.	210

<u>Figure #</u>		<u>Page</u>
5-4	Mohr circles for the deformations shown in Figure 5-3.	212
5-5	Variations in α .	220
5-6	R3 isopleths for pure shear followed by simple shear.	224
5-7	Mohr circles for instantaneous deformation of a unit square.	230
5-8	$\dot{\gamma}$ isopleths for instantaneous pure and simple shearing.	232
5-9	A hypothetical heterogeneous shear zone.	236
I-1	Sketch map of major lithotectonic belts of Southern Appalachians.	265
I-2	Sketch map of eastern Piedmont in Southern Appalachians showing major lithotectonic belts and faults.	275
I-3	Present plate convergence in Turkey.	282
I-4	Schematic diagram illustrating position of Eastern Piedmont fault system in relation to Africa-North America collision at end of Paleozoic.	285

Research Methods and Funding

Mapping, at the scale of 1:24,000 was conducted in March and June of 1981 and in April and May of 1982. Base camps for the 1981 season were motels near the field area whereas camps for the 1982 season were tent sites in nearby campgrounds. Foot and road traverses were the principal means of collecting field data. It was found that the best exposures in the Blue Ridge were, in order of quality, road-side outcrops, major stream banks, and ridge crests. Most intermittent and dry stream valleys are filled with colluvium and other debris. Individual outcrops are not shown on Figure 2-1 because the areas underlain by most exposures are too small. Except for a few ridge crests, all outcrops are represented by structure symbols.

Approximately 150 petrographic thin sections were examined throughout the course of research. Of these, probably about 75 sections could be considered informative.

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