2020 Virtual Structural Geology Lab

This work is a photo-based compilation of bedrock tectonites collected in the Appalachian Mid-Atlantic region between 1985 and 2015. Many have catalogued locations from work conducted at the N.J. Geological Survey and are cut and polished to highlight structural fabrics as part of my MS and PhD research. Related work is available on my publications page: http://www.impacttectonics.org/gcherman/publications.htm
2020 Virtual Structural Geology Lab
Comparative crustal fault models

© EarthStructure (2nd ed)
2020 Virtual Structural Geology Lab – Breccia and Cataclasite

Breccia

Cataclasite

Natural faces

Breccia

Cataclasite

Breccia

Cut & polished face
2020 Virtual Structural Geology Lab – Breccia and Cataclasite

- Reedsville Formation roof thrust, PA (C)
- Triassic sandstone, NJ (B)
- Wright Pond Fault, NJ (C)
- East Fault, NJ (B)
- Green Pond Conglomerate, NJ (C)
- Glen Gardner, NJ magnetite shear zone in Proterozoic Y (C)

Natural faces
Cut & polished faces
2020 Virtual Structural Geology Lab – Breccia and Cataclasite

Reedsville Formation roof thrust, PA (C)

Triassic sandstone, NJ (B)

Wright Pond Fault, NJ (C)

Green Pond Conglomerate, NJ (C)

Glen Gardner, NJ magnetite shear zone in Proterozoic Y (C)

East Fault, NJ (B)
2020 Virtual Structural Geology Lab – Breccia and Cataclasite

- Reedsville Formation roof thrust, PA (C)
- Wright Pond Fault, NJ (C)
- Green Pond Conglomerate, NJ (C)
- Triassic sandstone, NJ (B)
- East Fault, NJ (B)
- Glen Gardner, NJ magnetite shear zone in Proterozoic Y (C)
- Natural faces
- Cut & polished face
2020 Virtual Structural Geology Lab – Breccia and Cataclasite

Slickensided and faulted lithon (horse) in Triassic mudrock

Sheared silt and mudrock

Folded limestone

Quartz veins with mudrock seams in shear zone

Two halved of a cut & polished faulted and folded gneiss
2020 Virtual Structural Geology Lab – Various structures

Slickensided and faulted lithon (horse) in Triassic mudrock

Sheared silt and mudrock

Natural faces

Two halved of a cut & polished faulted and folded gneiss

Folded Paleozoic limestone, Pa

Quartz veins with mudrock seams in shear zone
Sheared granitic gneiss along the Reservoir fault, NJ

Granitic “L” mylonite, NJ

Sheared silt and mudrock

Gneiss cataclasite, NJ

Mylonitic Jacksonburg Limestone, NJ

All samples cut & polished except for the Jacksonburg Limestone
2020 Virtual Structural Geology Lab - Cataclasite and Mylonite

Sheared granitic gneiss along the Reservoir fault, NJ

Granitic “L” mylonite, NJ

Sheared silt and mudrock

Gneiss cataclasite, NJ

Natural faces

Natural face

Gneiss cataclasite, NJ

Gneiss cataclasite, NJ

Mylonitic Jacksonburg Limestone, NJ
Granitic “L” mylonite, NJ

Franklin Marble “S-C” mylonite, NJ
2020 Virtual Structural Geology Lab – Quartzite mylonite
2020 Virtual Structural Geology Lab
3 Fold-classification criteria relative to tectonic reference axes

1. INTERLIMB ANGLE
   - Isoclinal: 0 - 10°
   - Tight: 11 - 59°
   - Open: 60 - 119°
   - Gentle: 120 - 179°

2. HINGE-LINE PLUNGE
   - Horizontal: 0°
   - Shallow: 1 - 29°
   - Intermediate: 30 - 59°
   - Steep: 60 - 89°
   - Vertical: 90°

3. AXIAL-SURFACE DIP
   - Recumbent: 0 - 9°
   - Inclined: 10 - 69°
   - Upright: 70 - 90°
2020 Virtual Structural Geology Lab
Folds 1 – Open- to tight, upright folds in dark gray limestone
2020 Virtual Structural Geology Lab
Folds 1 – Open- to tight, upright folds in dark gray limestone
2020 Virtual Structural Geology Lab
Folds 2 - Tight, inclined folds in gray dolomite weathered light brown
2020 Virtual Structural Geology Lab
Folds 2 - Tight, inclined folds in gray dolomite weathered light brown

Anticline

Syncline

Natural sample profile

Profile view
2020 Virtual Structural Geology Lab
Folds 3 - Tight, recumbent folds in laminated mudrock

Cut and polished profile
Profile view
Natural weathered joint face

Profile view

2020 Virtual Structural Geology Lab
Folds 3 - Tight, recumbent folds in laminated mudrock
2020 Virtual Structural Geology Lab
Folds 3 - Tight, recumbent folds in laminated mudrock
2020 Virtual Structural Geology Lab
Folds 4 - Compound structures Open- to recumbent folds and conjugate faults in dark-red to tan mudrock
2020 Virtual Structural Geology Lab

Folds 4 - Compound structures Open- to recumbent folds and conjugate faults in dark-red to tan mudrock

Anticline

Syncline

Fault

Cut & polished profile
2020 Virtual Structural Geology Lab
Folds 5 – Compound structures
Fault-propagation folding in Paleozoic Limestone
cut by mineralized extension fractures
Fault-propagation folding in Paleozoic Limestone cut by mineralized extension fractures
2020 Virtual Structural Geology Lab
Folds 6 - Compound structures: Open- to recumbent folds and faults in sheared gneiss.

Profile views

Sample cut in segments with faces polished.
Two matching halves laid open.
2020 Virtual Structural Geology Lab
Folds 6 - Compound structures: Open- to recumbent folds and faults in sheared gneiss.

Sample cut in segments with faces polished.
Two matching halves laid open.
Samples of Alleghenian spaced and slaty cleavage from NJ and Eastern, Pa
Samples of Alleghenian spaced and slaty cleavage from NJ and Eastern, Pa
Samples of Alleghanian spaced and slaty cleavage from NJ

Natural faces
Profile view
Top view
Cut & polished face
Profile view
Top view

2020 Virtual Structural Geology Lab - Cleavage
Samples of Alleghenian spaced and slaty cleavage from NJ

2020 Virtual Structural Geology Lab - Cleavage
Samples of Alleghenian spaced and slaty cleavage from NJ and Eastern, Pa
The bedding-cleavage intersection angle is acute (<25°) as these beds of gray limestone have been sheared and flattened in a fold limb. As oriented at the bottom, showing top-to-the-right shear and flattening of bedding.
The bedding-cleavage intersection angle is acute (<25°) as these beds of gray limestone have been sheared and flattened in a fold limb. As oriented at the bottom, showing top-to-the-right shear and flattening of bedding.
Peach Bottom Slate
Eastern Pennsylvania
showing 2 phases of non-coaxial orogenic compression

Top view

Profile view

Natural faces

Compound structures: Slaty and crenulation cleavage
Peach Bottom Slate
Eastern Pennsylvania showing 2 phases of non-coaxial orogenic compression

The flat face is slaty cleavage (C1)

BCI-2 Trace of crenulation cleavage (C2) in S0 on C1

BCI-1 Bedding (S0) trace on C1

Natural faces

Profile view

Top view
2020 Virtual Structural Geology Lab
Compound structures: Slaty cleavage offsetting slickensided bed-parallel shear planes in Martinsburg Formation, Newton, New Jersey
Cut and polished sample

Traces of slaty cleavage (C1)

Traces of quartz slickensides on bed planes demonstrates rheologic contrast with mudrock and shows early flexural folding of beds before shortening from slaty cleavage development.

Trace of bed (S0) and cleavage 1 (C1) intersection (BC1-1)

Trace of slaty cleavage (C1)

Profile view
Cut and polished sample
2020 Virtual Structural Geology Lab - Compound structures: Two crenulation cleavages in transposed Martinsburg Formation, NJ
2020 Virtual Structural Geology Lab - Compound structures: Two crenulation cleavages in transposed Martinsburg Formation, NJ

Beds (S0) are folded, flattened, and segmented into fishhook shapes (transposed) between C1 (slaty cleavage) slip planes.

Slaty cleavage (C1) plane (top)
Slaty cleavage (C1) plane (bottom)
bc plane
ac plane
Trace of C2 and C1 on ac joint
Slaty cleavage (C3) trace
Profile view
natural sample
Compound structures: Crenulation cleavage and slaty cleavage in Martinsburg Formation, Warren County New Jersey
Brittle, mineral-filled fractures from NJ and Staten Island, NY

- Calcium-carbonate veins in red mudrock, Hopewell, NJ
- Quartz veins with native copper in serpentinite, Staten Island, NY
- Cross-cutting calcium-carbonate veins in red mudrock, Hopewell, NJ
- Calcium-carbonate (limestone) veins in red mudrock
- Natural face
- Cut & polished face
- NQ Rock cores
- Granitic melt infilling brittle veins in Paleozoic dolomite, Phillipsburg NJ

Natural faces

Cross-cutting en echelon veins systems

2020 Virtual Structural Geology Lab
Brittle, mineral-filled fractures from NJ and Staten Island, NY

- Cross-cutting en echelon veins systems
- Calcium-carbonate (limestone) veins in red mudrock
- Cross-cutting calcium-carbonate veins in red mudrock, Hopewell, NJ
- Quartz veins with native copper in serpentinite, Staten Island, NY
- Granitic melt infilling brittle veins in Paleozoic dolomite, Phillipsburg NJ

Natural face
Cut & polished face
Granitic melt infilling brittle veins in Paleozoic dolomite, Phillipsburg NJ

NQ Rock cores
2020 Virtual Structural Geology Lab
Faulted Passaic Formation mudrock from along the Flemington Fault, NJ

Rift valley hand sample from along the Flemington Fault, Flemington, NJ
2020 Virtual Structural Geology Lab

Faulted Passaic Formation mudrock

Rift valley hand sample from along the Flemington Fault, Flemington, NJ

Faulted Passaic Formation mudrock
2020 Virtual Structural Geology Lab

Slickensided horse (fault slice) having watermelon-seed geometry with striae on all faces.