

## **Basic Geologic History and Structure- Blue Ridge, Shenandoah Valley and Alleghenies, Virginia**

### **4 Significant Mountain Building Events in Appalachians**

#### **1. *Grenville Orogeny*- 1.1 Billion to 600 million(?) yrs. Ago ( Late Precambrian Period)**

Early proto-continent plate collision and fusion, followed by rifting apart, formation of the proto-Atlantic Ocean and a long period of volcanic activity with intermittent lava flows and periods of erosion. The collision formed the Pedlar granodiorite and Old Rag granite we see in Shenandoah National Park and more of the Blue Ridge. The rifting period, from about 850 to 600 million years ago formed lava flows and ash beds which are the Catoctin metamorphosed basalts or greenstone. The Swift Run Formation is a layer of metamorphosed sediments between the granites and the lava flows.

**550 to 450 million yrs. Ago** –Quiet with Warm shallow sea on western continental margin and carbonate( limestone) deposition and shelf sediments. ( Weverton, Antietam, Hampton, Rome and Elbrook formations)

#### **2. *Taconic Orogeny* – 460 to 440 million yrs. Ago ( Ordovician to early Silurian Period)**

Micro-continent ( North of Va.) and a volcanic island arc collide with N. America. Initial downwarping in Eastern West Va., Shenandoah Valley and western Blue Ridge; then filling with sediments, coarse changing to finer. As the collision continued, the land was uplifted and folded, finally filling with hard igneous and metamorphic basement rocks pushed in from the east. Local rocks include Edinburg and Lincolnshire limestone, and Martinsburg, Oswego, Juniata and Tuscarora sandstones and shales in the Valley and Ridge. None in the Blue Ridge.

#### **3. *Acadian Orogeny*- 410 to 380 million yrs. Ago ( Devonian Period)**

N. Europe (Baltica) and micro-continent( Avalon) collide with N. America, forming Laurussia and closing most of the proto-Atlantic Ocean. Once again down warping occurred over much of the area and sediments washing off the new mountains, pushed up to the east of the Valley, filled the basin, ultimately 7500 ft. thick. Last of the sediments were the Hampshire and Pocono formations we see on Shenandoah Mtn. on the west side of the Valley.

**60 million years of Quiet:** A warm, shallow sea covered much of our area. Greenbrier Limestone( West Va.) was deposited.

#### **4. *Allegheny Orogeny* – 320 to 240 million yrs. Ago ( Pennsylvanian, Permian into the early Triassic Periods)**

Gondwana ( Africa) collided with N. America( Laurussia) , closing all of the proto Atlantic Ocean. This was the most intense of the mountain building events, due to Gondwana riding up over top the eastern edge of N. America. This formed the supercontinent, Pangea. Rocks deposited the Taconic and Acadian events were shoved several miles to the west, folded, faulted and pushed over top of each other. The



resulting mountains were probably as high as the Himalayas, but have been almost eroded away. The Blue Ridge and Alleghenies are the remnants.

**Plate Rifting** : About 220 million years ago, Pangea began rifting apart and the modern Atlantic Ocean basin began forming. The rifting is still occurring today. Rift basins opened up along the Virginia Piedmont and scattered volcanic activity formed igneous dikes cutting up through the local igneous and sedimentary rocks. These can be seen in many locations in Blue Ridge and Shenandoah Valley and Virginia Alleghenies.

### **The Rocks We See in Shenandoah National Park**

***Old Rag Formation- Granite***- Light gray, coarse-grained, quartz-potash granite with distinctive blue quartz.

***Pedlar Formation- Granodiorite*** – Greenish-gray to tan, coarse-grained, massive to banded granodiorite. Has a very rough surface texture. The basement rock beneath other formations in SNP.

***Swift Run Formation*** – Dark-gray to purple sericitic shale, gray to brown quartzite, and brown argillaceous pebble conglomerate. A narrow erosional formation criss-crossing the AT in the Skyland area and just south of Powell Gap.

***Catoctin Formation- Greenstone*** – Dark-green metamorphosed basalt with interbedded purple phyllite. Fine-grained; Some distinctive columnar jointing in several locations. This also forms intrusive volcanic dikes which rise through the lower Catoctin beds and the older Old Rag and Pedlar granites.

***Chilhowee Group Sedimentary Rocks*** along western side of SNP.

***Weverton Formation***: Tan to purple quartz sandstone, meta-conglomerate and beds of tan to silvery green phyllitic shale.

***Hampton(Harpers) Formation***: Metamorphosed dark greenish grey to brown thin-bedded shale and sandstones and phyllite, Rusty weathering

***Erwin-Antietam Formation\****: Tan to gray, fine to medium grained sandstone and quartzite, thick beds;

\* Has prevalent ***Skolithos*** tube worm burrows; the only fossil in Shenandoah National Park and formed by marine worms burrowing in the clean sands close to the shore in the early Cambrian period, about 500 million years ago.