THE DETERMINATION OF BACKGROUND EROSION RATES USING COSMOGENIC ANALYSIS OF ^{10}Be IN THE SHENANDOAH NATIONAL PARK

Appalachian Mountains

- **Appalachian Mountains paradox**
- **Determine erosion rates within the Park on a 10^3 to 10^6 year timescale**
- **Testing erosion as a function of lithology**
- **Test Hack's (1960) model of dynamic equilibrium and steady state erosion**
- **Relationship between grain size and ^{10}Be concentration (Matmon et al. 2003)**

Blue Ridge Mountains, VA

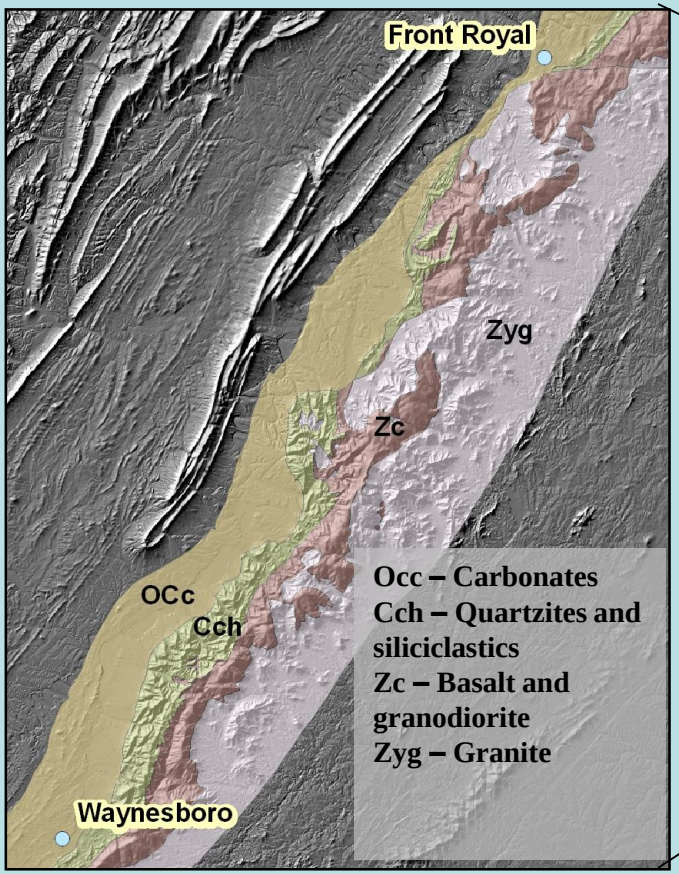
Specific Goals for Investigation

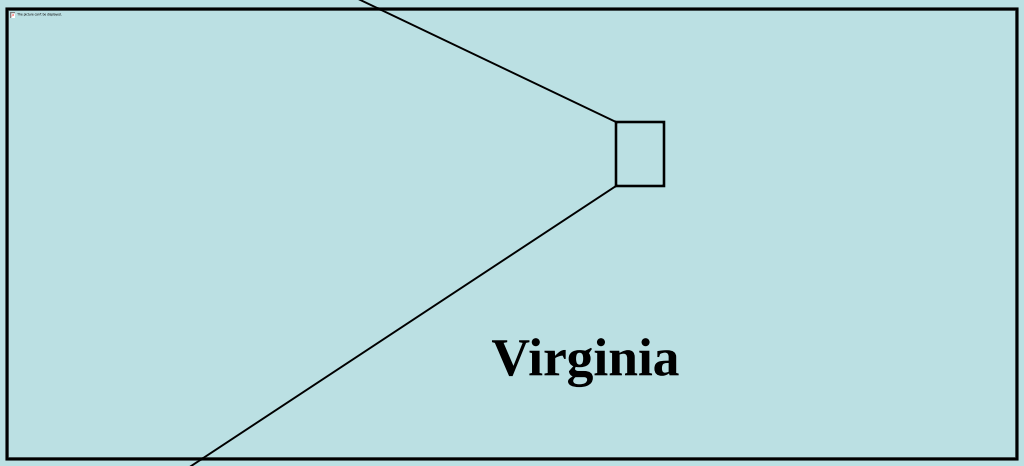
- To determine how rapidly the basins of different lithologies of Blue Ridge in Shenandoah National Park are eroding
- To assess the relationships between erosion rate, lithology, slope and basin area
- To compare the relationships between ^{10}Be based erosion rates, slope, lithology and grain size with those reported by Matmon et al. (2003a, 2003b), Reuter (2004), U-Th/He erosion rates of Spotila et al. (2004) and fission track erosion rates of Naeser et al. (2005)

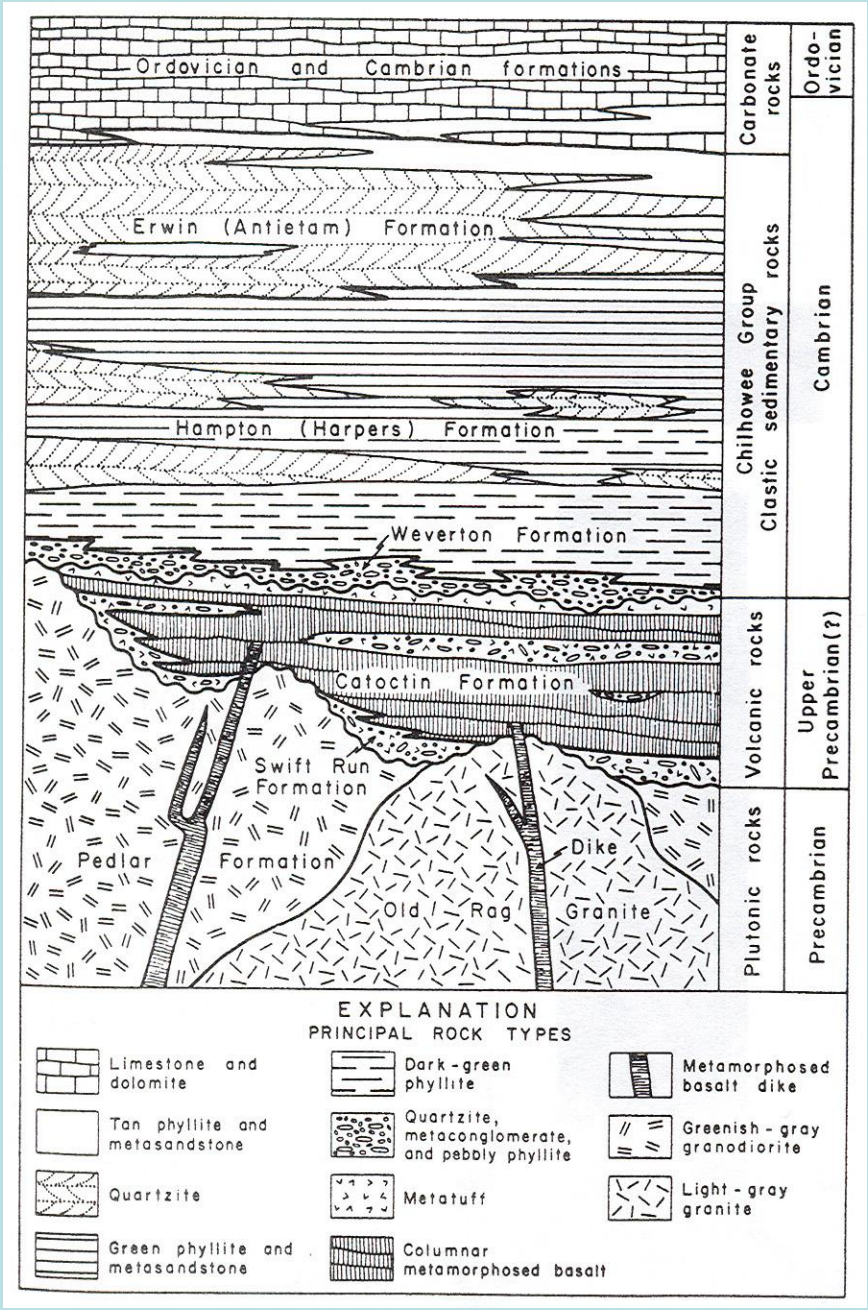
Physical Setting

- Appalachian Mountains formed via three major orogenic events:
  - Taconic (Ordovician)
  - Acadian (Devonian)
  - Alleghenian (Pennsylvanian)
- Continental rifting and denudation in the Mesozoic
- Continued relief since cessation of orogenic events ~ 300 Mya

Shenandoah National Park







Principle Rock Types

Granites - Old Rag Granite and Pedlar Formation (Granodiorite)

Quartzite - Erwin and Swift Run formations

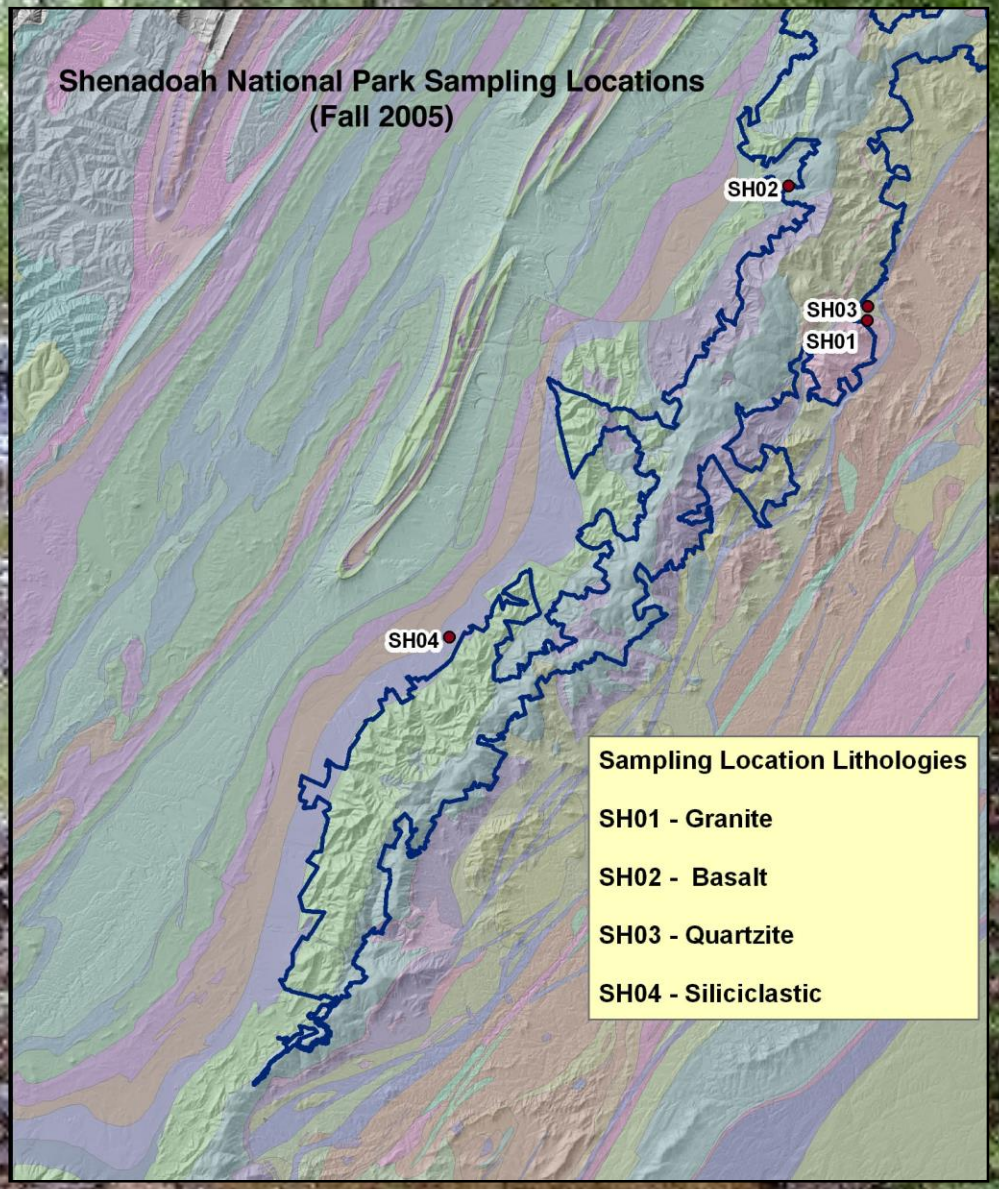
Basalt - Catoctin Formation

Siliciclastics - Weverton and Hampton formations

Fall 2005 Sample Collection

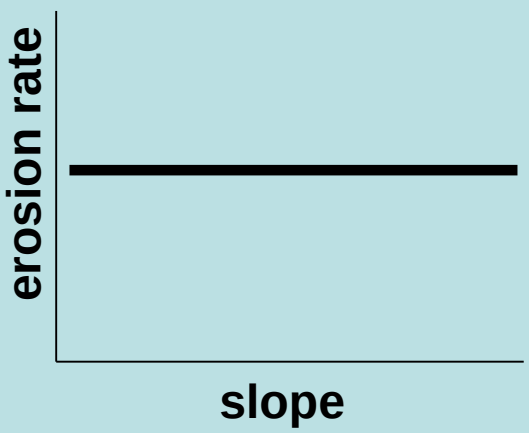
- Collected samples from four lithologies - basalt, quartzite, granite, siliciclastics
- Four grain sizes

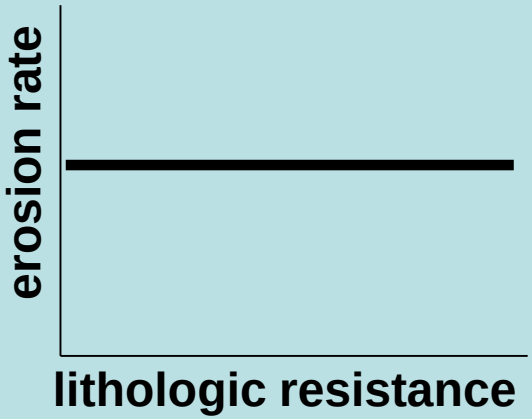
- 0.25 - 0.85 mm
- 0.85 - 2 mm
- 2 - 10 mm
- > 10 mm

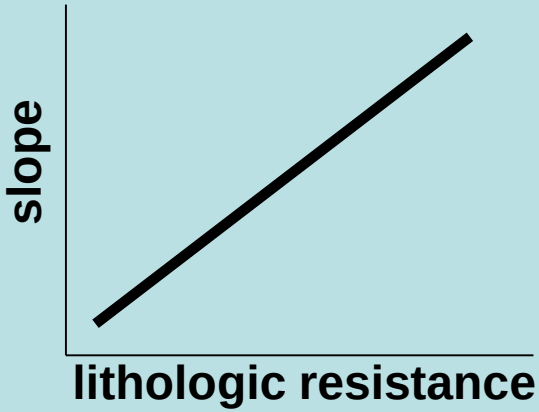


Experimental Design

- Erosion rate vs. slope
- Erosion rate vs. lithology
- Slope vs. lithologic resistance

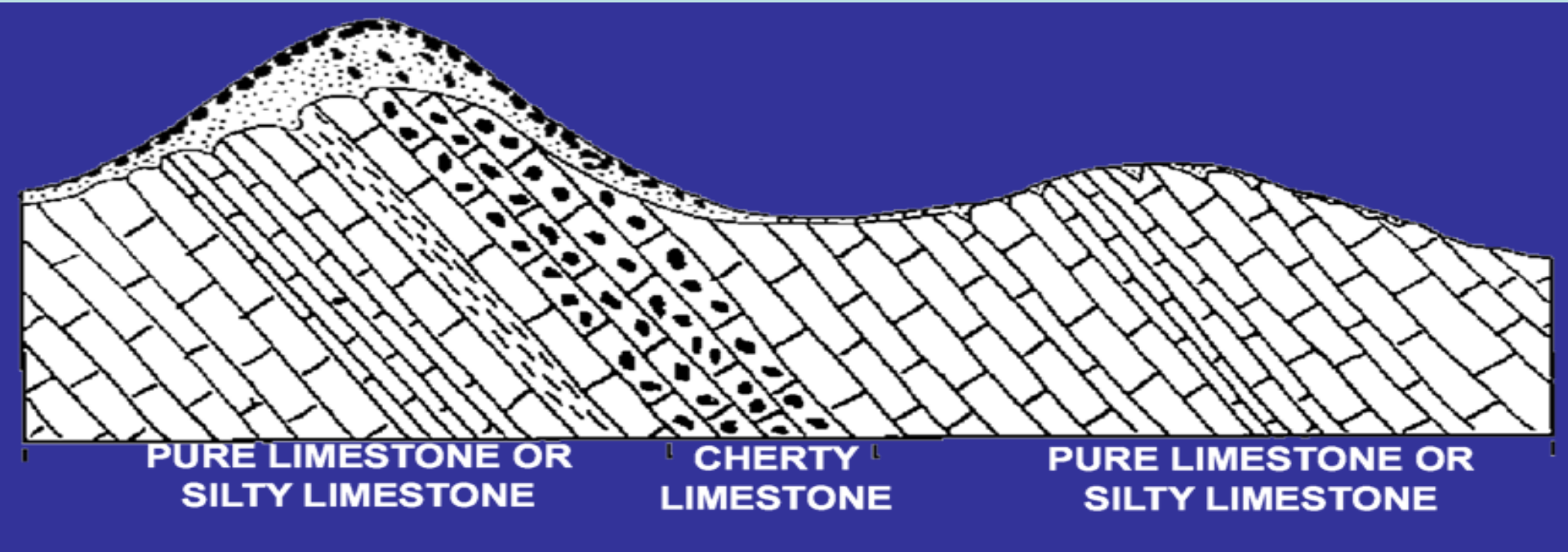






Hack's *dynamic equilibrium*

"It is assumed that within a single erosional system all elements of the topography are mutually adjusted so that they are downwasting at the same rate."



Grain Size Analysis

- Grain size

  Lithologies split into 4 grains sizes:

  0.25-0.85 mm, 0.85-2 mm, 2-10 mm, > 10 mm
- Comparison of my grain size analysis with that of Brown et al. (1995), Clapp et al, (1997, 1998, 2001, 2002) Matmon et al. (2003b)

The first erosion rate data:

0.25 - 0.85 mm	**7 m/My ± 1.48**
0.85 - 2 mm	**9 m/My ± 1.89**
2 -10 mm	**10 m/My ± 2.19**

Significance of the Results

Erosion rates in the context of other research:

- Matmon et al. (2003)
  25 - 30 m/My
- Reuter et al. (2004)
  4 - 54 m/My
- Spotila et al. (2004)
  10 - 20 m/My
- Naeser et al. (2005)
  20 m/My
- This study
  9 m/My