1) Surface area exposure and weathering
   a) Chemical weathering happen when water comes in contact with rock
   b) Break a large volume into smaller pieces yields more surfaces
   c) More surface means more weathering on same volume
   d) Highly fractured rock or small pieces of physically weathered rock can chemically weather 1000s of times faster than same volume of unbroken rock
   e) Wind River Basin study
      i) Young moraines weather very rapidly
      ii) Within a few 10s of thousands of years weather is nearly complete
      iii) Tells us that fresh rock will consume atmospheric CO₂, but old rock will not take much

2) So where do we find fresh rocks to weather
   a) In the mountains where it does not look like there is much weathering going on and they are made of silicate rock (granite-types)
   b) The force of gravity is constantly tearing away at steep mountains and breaking up the rocks
   c) Mass wasting – rock falls and slides keep fresh material constantly exposed for weathering
   d) Any soil layers that form( and might protect underlying material) is rapidly removed by water, wind and ice
   e) Amazon Basin study
      i) Studied source area of ions resulting from chemical weathering
      ii) Found most ions in the Amazon river came from the back side of the Andes, not from the rainforest
      iii) Conclusion – young, fresh looking mountain are the places where weathering is occurring

3) Chemical weathering: Feedback and Climate Force agent
   a) Feedback agent
      i) Increased spreading rate
      ii) Increased subduction rate
   b) Climate Forcing agent – Uplift-weathering hypothesis
      i) Continental collisions result in very large mountain ranges NOT associated with rapid spreading
      ii) The weathering of these mountain should remove CO₂ from the atmosphere
      iii) Cooling the planet – leading to icehouse
      iv) Major collisions are not very common
         1) Formation of Pangaea – major collisions started about 325 mya
         2) India colliding with Asia for the last 35 my
         3) Both resulted in icehouse conditions
      v) Uplift-weathering hypothesis needs a thermostat – otherwise, colder and colder world
         1) As weathering of collisional mountains remove CO₂
         2) Global climate cools
         3) Temp and precip decreases should result in less weathering planetwide – although mountains still fast

4) Conclusion
   a) Spreading rate and Uplift-weathering hypotheses both seem to work
      i) Spreading rate hard to test – not enough old ocean floor
   b) 2 of the 3 icehouse worlds of the last 500 my explained – the 440 mya one is not – but it is weird??