Outline of Lecture 8 (4-18-02)

I) Returned HW 1 (average = 92.4/120, median =93/120)

II) Clarify that it is okay to use a thermal diffusivity of 1 mm²/s for homework and lab unless otherwise noted

III) Extra credit question in homework set #2
   3e) What is the difference between the geomagnetic timescale in the homework and lab and why is it different?

IV) Volcanic Applications of Heat Flow:
   1) Consider a lava lake with that does not flow (thus no heat exchange via advection)
      A) how long will it take to create a 2 m skin?
      B) What would happen if the material beneath started to flow once again?
      C) What happens to a rock when it cools that will make it harder to melt once again?
   2) Now lets consider the interface between a silicic batholith intrusion and country rock (case of contact metamorphism)
      A) What would a geotherm (temperature profile) look like?
      B) What assumptions are we making to use the equation that I gave you in class?
      C) What are the boundary conditions that must be satisfied?
   3) Case of a basaltic sill intrusion (heat is flowing in two directions here)
      A) What are the boundary conditions that we must satisfy?
      B) How long would it take for a 2 m thick intrusion to solidify?
   4) Strombolian activity (lava fountains, e.g. Mt. Etna, Stomboli, Hawaii)
      A) What is a bomb and how does it get ejected from a volcano?
      B) How small will a bomb have to be to hit the ground as a solid?
         i) First lets us determine how long it is in the air (knowing how high into the sky it travels
            • \( V_z = V_{z=0} - gt \) (vertical velocity as a function of time)
            • use conversion of kinetic to potential energy to get the relationship between height of bomb and initial velocity \( (\frac{1}{2} m V_z^2) = mgL \)
         ii) Now that we have a travel time we need to calculate how large a body will cool in that timescale. We will take the assumption that for a volcanic bomb (3-D diffusion equation) of radius, \( \delta = (\kappa t)^{1/2} \)