COMPUTER METHODS AND MODELING IN GEOLOGY
RADIOACTIVE DECAY AND GEOCHRONOLOGY - FORTRAN

This week we'll take our STELLA model of U-Pb decay and code it into the fortran 90 computer language. The rudimentary introduction to fortran that I've given you should be sufficient for you to do this, just keep in mind that we will have to potentially adjust things like the timestep, because fortran will require us to use an integer counting loop.

1) To start your modeling, in Windows go to Start > Programs > Compaq Visual Fortran 6 > Developer Studio.

2) In Compaq Visual Fortran, go to File > New and when the dialog box pops up, hit the Files tab. Select Fortran Free Format Source File. The screen on the right will turn white and you'll get a cursor to begin typing. Type in a couple of lines of your program.

3) Go to File > Save As and save your fortran program to a new folder that you create on your zip disk. If you're not familiar with how to do this in Windows, when the Save As dialog box pops up, hit the little folder icon with what looks like an asterisk on the upper right corner and create a new folder for yourself. Then save your fortran file as filename.f90 in this folder.

4) Go to Build and compile your filename.f90. You'll get a little warning that a workspace needs to be created in order to do this. Go ahead and answer yes that you would like to use the default workspace.

5) When you compile, you'll notice that text appears in the bottom window of the screen - this is the compiler reporting back any errors that it finds in your program and letting you know whether the program compiled successfully or not.

6) After you've written your program and compiled it, go to Build > build filename.exe. This will create an executable file that you can run to execute your program.

7) After the file has been built, go to Build > Execute filename.exe and a black DOS prompt window will appear in your field of view indicating that the program is executing. When it's done, it will tell you to press any key and you'll go back to the programming window. At this point, if you've told the program to create any output files, they'll be found in the folder that you originally created to save your fortran file. You can use kaleidagraph or excel to open them up and plot your results.

What I'd like you to do in this exercise is to take your STELLA model that incorporates Pb loss, U loss, and U gain and code it into fortran. You can get a hint of how to do the math if you open your STELLA model at the same time, and click on the down arrow in the upper left corner to go to the equations level. Here you'll find all the relationships governing the change in the U and Pb reservoirs over time, what the flows are dependent on, and what the initial conditions are. You'll even find the if/then/else statements. In

fact, the STELLA equation level is a lot like fortran. The only things that are missing are the declaration of variables and the do loops.

Once you've created your model, use it to create the concordia diagram and then do a couple of experiments with Pb loss, U loss, and U gain to make sure that your model is functioning properly. You don't need to answer any other questions or do any other experiments unless you want to. Learning to code is enough work for this week!