**Transcript of MCS v.2019 AFC Run MCS Demonstrate YouTube Video**

**0:00**

In this tutorial, I’ll be showing you how to do a Magma Chamber Simulator run when assimilation is involved. So first, we need to open up the Magma Chamber Simulator; we also need to open up the terminal window. We can navigate to our Documents folder, then to the MCS folder, and into the MCS VBL Code folder, and open up the Magma Chamber Simulator. Remember, we want to enable macros; we also need to navigate to make sure the MCS folder is selected at the top of the final pop-up window, and then click “Choose”. Again, this is a work-around for security between the Mac operating system and Excel, and it’s necessary.

**0:56**

We also need to make sure that we have two terminal windows open. So you can open up a second tab like that by using Cmd+T; I find that there’s no real need to have separate windows open when you can have separate tabs open. We need two tabs: one for the wallrock subsystem, and one for the magma subsystem. If you’re doing an RAFC run where you’re using all three subsystems, you’re going to want three different tabs open: one for the recharge, one for the magma, and one for the wallrock subsystems. Now something else that you’ll remember from the FC-only tutorial is that going between Excel and the batch terminal window can be a bit finicky, so if you are in the batch terminal window and you need to get back to Excel, uh… make sure that you’re clicking somewhere in the region of the title first, and then click on what you need to in Excel. Otherwise, Excel will freeze up, and you might have to restart it.

**1:58**

So, for Step 1 we’re going to put the command terminal window prompts in to our batch terminal windows. For this model, we’re going to be running version 1.2.0. Uh, but, let’s say… let’s say you want to run 1.1.0 instead (uh… we’re not actually going to paste text). But you’ll notice that after we changed the batch terminal, the Magma Chamber Simulator tells you “Hey, you’ve changed this, by the way….” And MELTS will reset. Uh… we can go ahead and put it back. So, change it back to 1.2.0, and we can again click on the “Put in Clipboard” button to paste the batch terminal text to the Clipboard, and come over here to the batch terminal window, and Cmd+V to paste.

**2:55**

Now again, to get back to the terminal command window… er, to get *back* to Excel from the terminal command window, you want to click somewhere in the region of this title. And then we can click on the second “Put in Clipboard” button, and paste that text in. Close out this user form, and again the Magma Chamber Simulator’s telling us “By the way, we’ve switched versions of MELTS again”, and now we’re certain we have been set at version 1.2.0. The next step is to select our MES Input File, and do an output file name. So we can make our output file name “AFC\_Tutorial”. And we want to choose our existing MES Input file, that’s “MES\_AFC\_1”. Click “Finish”, and that will upload our MES Input File.

**4:16**

Okay, so prior to right now, all of our steps (with the exception of the wallrock… that second wallrock terminal) have been the exact same as for an FC-only run. This is the part that’s a little bit different, so the…. When we consider wallrock using the Magma Chamber Simulator, the MCS wants to know all of the conditions of the wallrock subsystem before it actually does the run – and that’s what this Wallrock Find Solidus step is. You’re essentially finding out everything about the wallrock subsystem before doing your actual MCS run. So to start out, we need to click on the button for “Step 3: Find [the] Wallrock Solidus”.

**5:05**

And you’ll notice that we have activity now over here in the batch terminal; in the wallrock batch terminal, not the rechar- er… not the Magma batch terminal. During this step, you’ll also see that there’s a graph showing the liquid percent remaining in the wallrock subsystem versus temperature, as well as those numbers given up here and those do update automatically. This is now finished, and it tells us “Hey, at our fmZero, which is 5%, uh… the closest that the MCS can get to that… the closest equilibration step occurs at 750 degrees where we’re at 4.07% liquid. Click “Okay”, and I’m just gonna go ahead and expand this right now, make it more visible, so we can see what’s going on a little bit more.

**6:06**

And now that we’ve done that Find Wallrock step, now we can run the Magma Chamber Simulator. If you’re not sure what step is next, you can check down here in the bottom left-hand corner, and it tells us that the “Wallrock Find Solidus step is complete, and Step 4 Run MCS is next”.

**6:42**

Now right now it’s just undergoing fractional crystallization. Uh, I can tell this because I’m looking over here at the Magma batch terminal and I see the little wheel spinning that tells me that it’s calculating and that there’s movement. But I’m not gonna click on it; I would just rather not click on anything, because I don’t want to mess anything up. Up here, if you want to watch these numbers, uh… the wallrock temperature is given on the right and you can watch that change; as the Magma cools that wallrock is gonna heat up. Uh, here the percentage of liquid accumulating in the wallrock is given, uh, when it says “n/a” that means that the wallrock is still entirely solid, it’s below the solidus composition, er, the solidus temperature, and so there is no liquid there. At the point where you cross the solidus but you’re below the value set for fmZero, it will say “soft coupled”, and then once you hit above that fmZero threshold, you start to have percentages given here.

**8:10**

And assimilation has just been triggered – I can tell that because both of these batch terminal windows now have movement. You can see there’s actually some movement in the wallrock terminal window right now. So, at each equilibration step now, the Magma Chamber Simulator will calculate the amount of liquid that has been accumulating in the wallrock subsystem. Any difference between fmZero and whatever amount of liquid is in that subsystem will be transferred to the Magma subsystem at the end of that equilibration step, and then the new Magma composition will be calculated. And when we go through the output file for this run, you can see that…. You can see that each AFC step is given. So I’m gonna go ahead and pause the video, because we have a ways to go until thermal equilibration is reached between the Magma and Wallrock subsystems.

**9:14**

Okay, so we should be pretty close to thermal equilibration. The temperature of our magma has reached 896 degrees, and our wallrock is at 862 – so they’re pretty darn close. It shouldn’t take too long for this run to finish.

**10:01**

And it’s done! So, the Magma and Wallrock subsystems have reached thermal equilibration. Our run has completed. We can click “OK”, and we want to “Export” our run results. Now we can go ahead and close out the Magma Chamber Simulator – remember, do not save! And that completes that run.

**10:42**

The final thing I want to show you in this tutorial is another function of the Magma Chamber Simulator, so we’re gonna go ahead and open it back up. You can leave the batch terminal windows as they are, unless MELTS has crashed. For some reason, you can probably get away with… two or three runs out of them before I stop them, clear terminal out, completely exit the program, and then put new batch terminal windows up.

**11:21**

So let’s say that for your next run, uh… you’ve completed that run, but now you want to know what might happen if the initial temperature of the wallrock were a little bit different. Uh, you don’t want to have to go through the same thing every single time and find the wallrock conditions every single time, if the wallrock conditions haven’t changed. That means that if your pressure hasn’t changed, if your *f*O2 hasn’t changed, if the composition of the wallrock hasn’t changed, and if your fmZero hasn’t changed. Any of those parameters that are involved in that “Wallrock Find Solidus” step have to stay the same. *But*, things like the amount of wallrock, and the initial wallrock temperature – those *can* change, and you can actually just do this “Wallrock Hack”, where you impose the last wallrock solution. So let’s go ahead and change some of those parameters. In our Input & Output folder, let’s open that MES file. And let’s change the initial temperature of our wallrock. Let’s raise it – to 600 degrees. Now I’m not interested in doing the *whole* run all over again, uh, just for the purposes of this video, I just want to demonstrate that this *does* work, so we’re gonna use this “Hard Stop Melt Mass in Magma”; I’m gonna stop the run when there’s 75% liquid. Of course, that means that assimilation won’t happen, but I can demonstrate the wallrock hack.

**12:53**

So I don’t need to go through Step 1, since our batch terminal windows are already full. I can name this output file… let’s try “AFC\_3alt”. And I’m gonna input my changed MES file now. Of course, you don’t even actually have to change anything – you can even do the same run over again, and just use this alternate Step 3. So, as before, where we would use the “Step 3” button, now we’re going to use the “Alternate Step 3” button. And now the Magma Chamber Simulator’s telling us that “Oh, hey! Uh, a little while ago you had this solution. We’re going to use this same solution, and then after that, go ahead and run the Magma Chamber Simulator in the normal way, using Step 4”.

**13:55**

And it gives us the same Wallrock Prime information as it did for the prior run, and now we can run the MCS again. Alright! And that concludes this tutorial on an assimilation and fractional crystallization run for the Magma Chamber Simulator. In our next tutorial, we’ll be going through how to run a simulation for recharge and fractional crystallization.

**14:25**