**Step-by-step instructions on LA-ICPMS data reduction program Laser-RAWDATA-TEMPLATE.xls**

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Before you import your data, check your file names and extensions, make sure that you have .dat, .asc, .xls files for all your measurement. Besides, if you did overwrite some of your measurements, you will see two .dat files for the same measurement, one of which has [1] at the end. Delete the ones with [1]. Go to “Setup” sheet, copy past folder directory in cell D4. Ctrl+p to import data. After data are imported, you will see sheets named 1 - 100 (number of your measurements) after data import. Those are your raw data and calculations of ratios.

\* If you move your folder to another location, you need to retype folder directory in cell D4, otherwise drifting correction will not work.

**For medium resolution data:**

After you import your data, you should be directed to the "IS" sheet, you need to define your internal standard there. Type in "Ca43(MR)" or whatever internal standard you prefer in cell B6.

Then go through the sheets with your raw data (sheet 1-100). In each sheet, you need to select a background interval and a sampling interval. You need to type in slice numbers according to the "Signal Intensities vs slice#" and "Normalized ratios" (normalized to the internal standard 44Ca) diagrams. Make sure that your selected intervals are relatively flat (an abrupt bump in the signal might mean that you were shooting on an inclusion, gradual decrease/increase of the signal might mean compositional zonation).

After selecting intervals for all your measurements, you need to merge data (step 4 on the instruction), then go to the "MR-rawratios" sheet, hit Ctril+shift+E.

You can pick the standards in cell C5:N5 for calibration. We are using BHVO2g, BCR2g and BIR1g in most of our analyses. Pick two of each standard that were measured at the beginning of the day, and 2 of each measured at the end.

Then type in "Y" after "drift Corr Y/N" (Cell Q1), so that you can correct for the time-dependent instrumental drifting (make sure that you have time values in the first two rows starting from cell AC1).

In cell range P4:Y5, you can pick standards for the drift correction. The upper lane should be the standards measured at the beginning, the lower lane be the standards measured at the end. You can use the same standards you used before for the drift correction. Just make sure that you include all the three standards.

Go to the "Mrdrift-corr ratio" sheet. There is a figure showing calibration curves from the standards for each element. Ideally the standards' values should fall on a straight line for all elements (you should check the calibration curves for all isotopes. To do this, type in 1 (or other numbers) in cell A1, then Ctrl+t). If the ratios in the standards do no fall in a straight line, you might have got bad luck for that particularly spot that you shot inclusion or some heterogeneity in the standard. Go back the "MR-rawratios" sheet and pick another measurement (that's why we are measuring more standards than we need...). Play around with it, until most standards' values fall on straight lines.

Stay in the "MRdrift-corr ratio" sheet, go to cell range A150: A193. Here you need to define your major elements. Type in "1" before the elements you think are majors in your sample (in most cases, we do Na23, Mg25, Al27, Si30, P31, K39, Ca43 or Ca44, Ti48 or Ti49, Mn55 and Fe57). For element with more than one isotopes, just define one of them as the major.

Then go all the way to the bottom of the "MRdrift-corr ratio" sheet, copy the line of Ca concentrations, and paste to the line starting from cell AC6 in sheet "MR-rawratios" (the line filled yellow with bold red outlines above your sample names). If you use other internal standards, copy paste accordingly.

Then go to the "MR-SUMMARY" sheet, your final data should be start from column G.

**For low resolution data:**

In general, the data reduction procedure is similar to that in MR. To define internal standard, you input the internal in cell B9 in sheet IS. You don’t need to define majors in sheet LRdrift-corr ratio, but in the line starting from cell AC6 in sheet LR-rawratios, you need to input the concentration of your selected internal standard. This concentration could be from probe data, XRF data, or LA-ICPMS analyses in MR (the spot for MR analysis should be close to the one analyzed in LR).