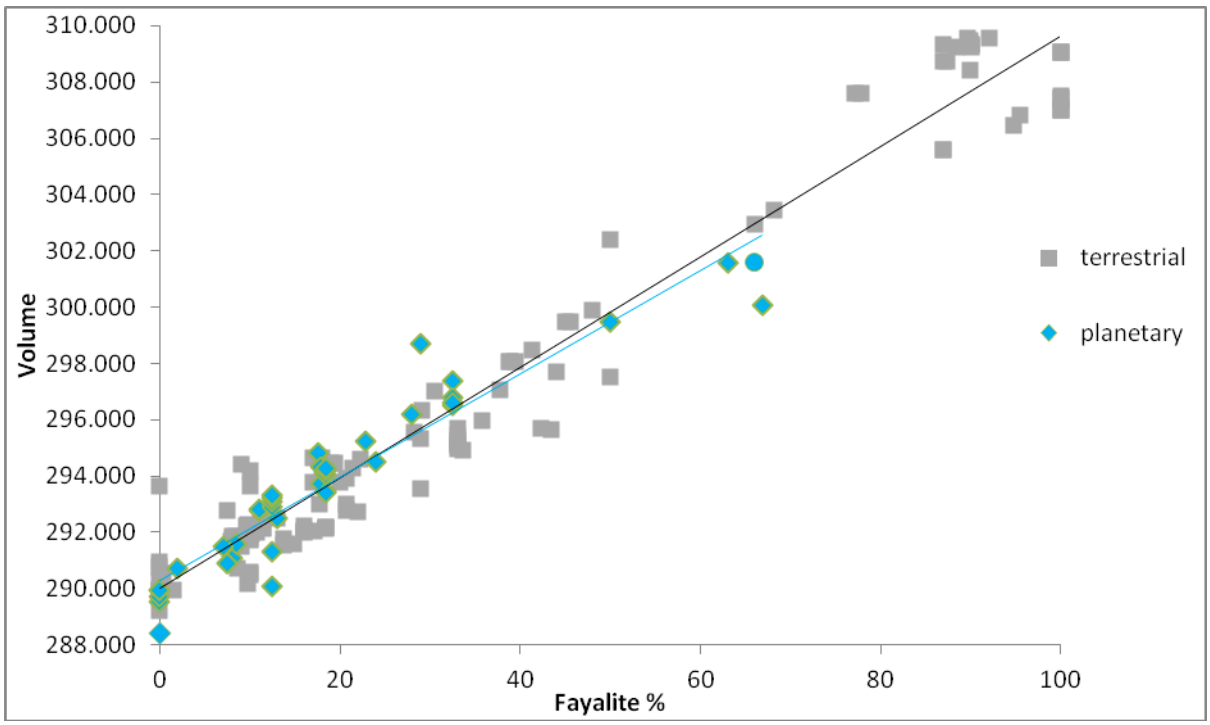
ASTRO report summer 2013

Diego Uribe

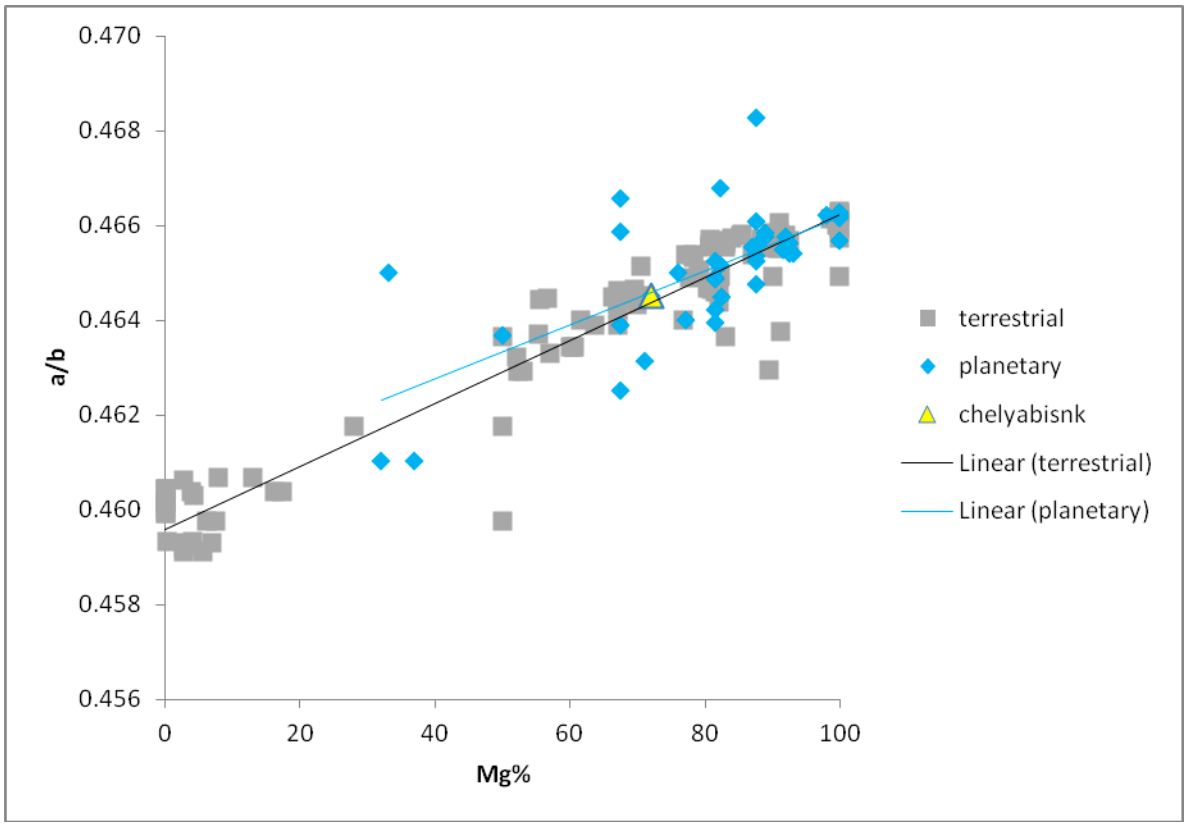
The research conducted this summer under the supervision of Dr. Phil McCausland at Western University looked at the relationship between the change in unit cell parameters with increasing fayalitic olivine in terrestrial and planetary materials. In planetary materials, this relationship can be used to determine meteoritic composition between objects where higher Fayalite content results in higher unit cell parameters. Synthetic study samples were discarded as it was discovered that unit cell appears to deviate among similar fayalitic values, which may be attributed to rapid quenching conditions of the synthesized material found in literature. The research done this summer involved expansion of the planetary olivine database to determine whether results were correspondent with those seen with terrestrial materials.

Preliminary results indicate that unit cell vs. fayalite composition in planetary and terrestrial materials shows a positive correlation that can be effectively be used as a proxy to determine meteorite composition. This study was compared with other method of using unit cell Vs. olivine volume where a/b ratio is used instead of total unit cell volume. Results show that volume shows a closer relationship between planetary and terrestrial materials than a/b ratios as each individual parameter is susceptible to change in compositions and not just a and b.

Future work will target the use of UWO meteorite collection to determine if preliminary results continue to be seen at higher fayalitic values and to conclude whether it will be an effective method as means of meteorite composition. Microprobe work as well as XRD and SEM techniques will be used to expand this research.



a. Research method summer research.



b. Butterworth method.

My research also included scanning meteorite samples using the micro CT scanner located the Robarts center at Western university in order to determine bulk volume and porosity of planetary materials in a non evasive way. Threshold values were altered to determine the sensitivity between bulk volume and also to determine if scan intensity plays a role in altering bulk volume values. Using similar threshold values Vs. different intensity scans, shows that bulk volume is significantly different so that perhaps different threshold values are needed for different intensity scans. Surface quality factors <0.50 appear to be enough to determine bulk volume of meteoritic samples. Higher surface quality factor values seem to significantly increase overall area and volume which is likely due to voxels from the air that are incorporated into overall sample volume.