Improving procedures for ion exchange chromatography used in ^{10}Be surface-exposure dating chemistry

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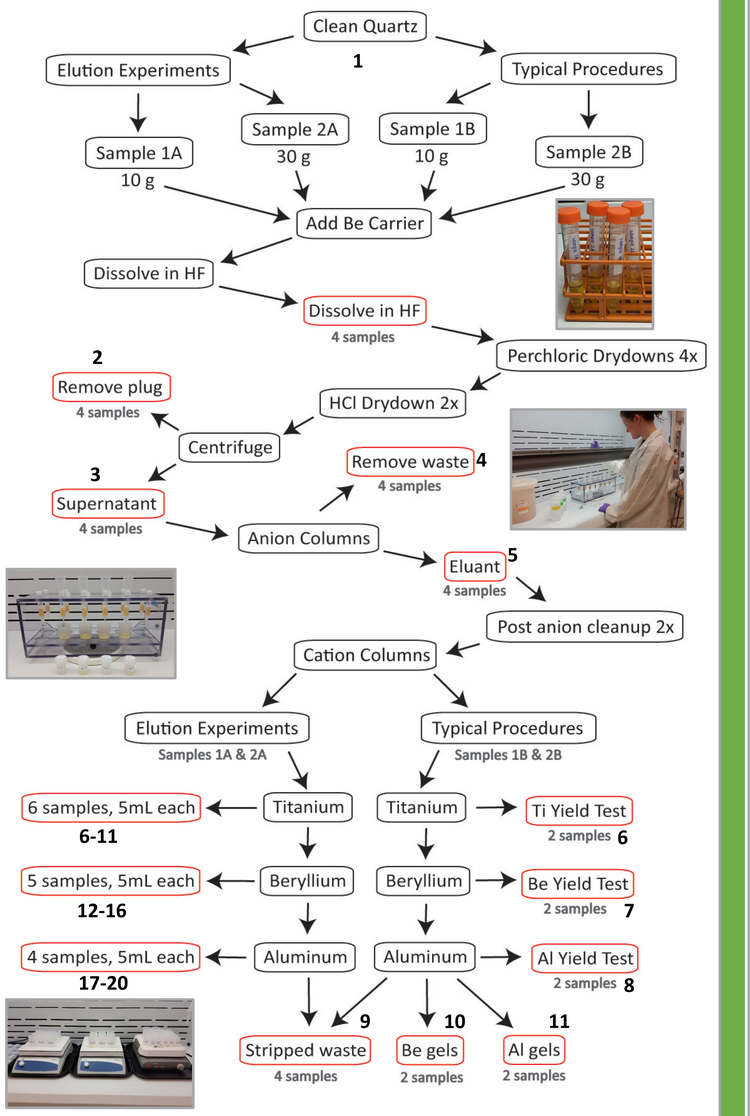
Introduction

- Dating techniques used to constrain geologic history, such as ^{10}Be dating, require careful chemistry in order to produce reliable, precise results.
- Cation and anion columns in sensitive chemistry techniques were used to determine element composition during each step of the experiment, and to determine amounts of beryllium lost throughout the procedure.
- Experiments were all done to determine if an overloaded sample can be ran using the same techniques used for a typical sample .

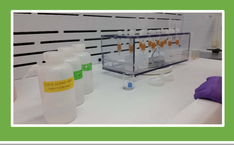
Methods

- In ^{10}Be dating, we isolate elemental Be from other major cations found in rock samples.
- To streamline this isolation procedure, we measured the concentration of major cations periodically throughout procedure (steps in red), which has never been done before at UB.



- Samples were analyzed using the ICP-AES at University at Colorado, Boulder

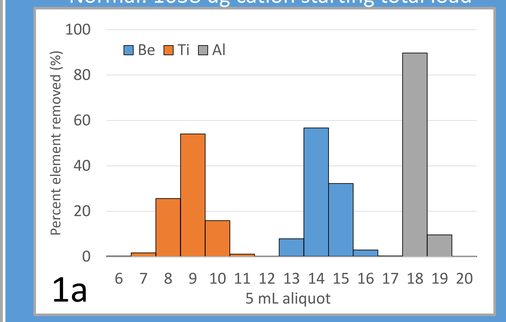




Results

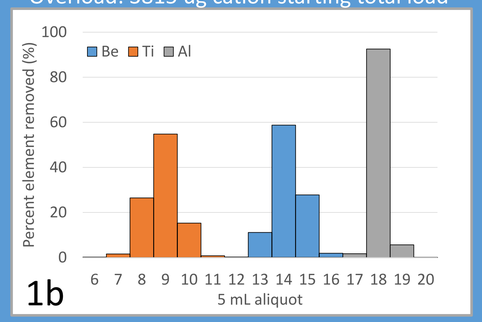
Elution Experiment: Sample 1A

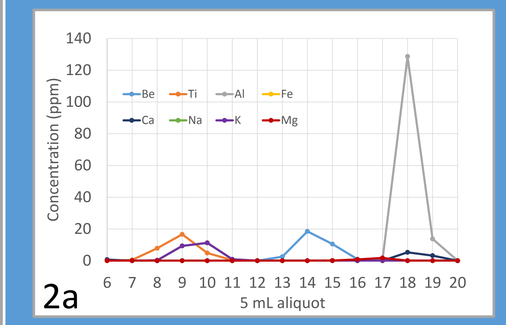
Normal: 1638 ug cation starting total load

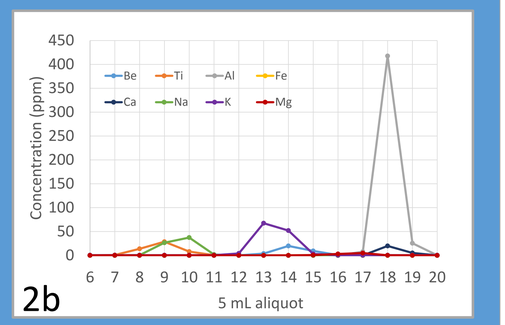


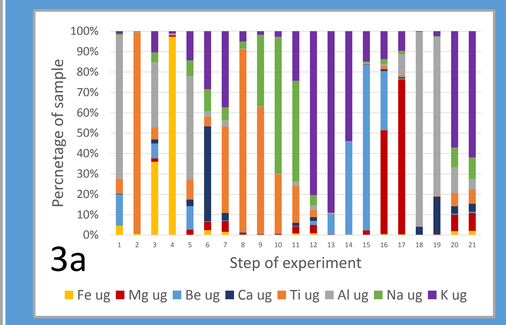
Elution Experiment: Sample 2A

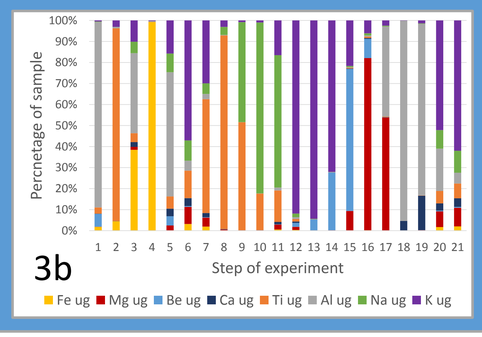
Overload: 3815 ug cation starting total load



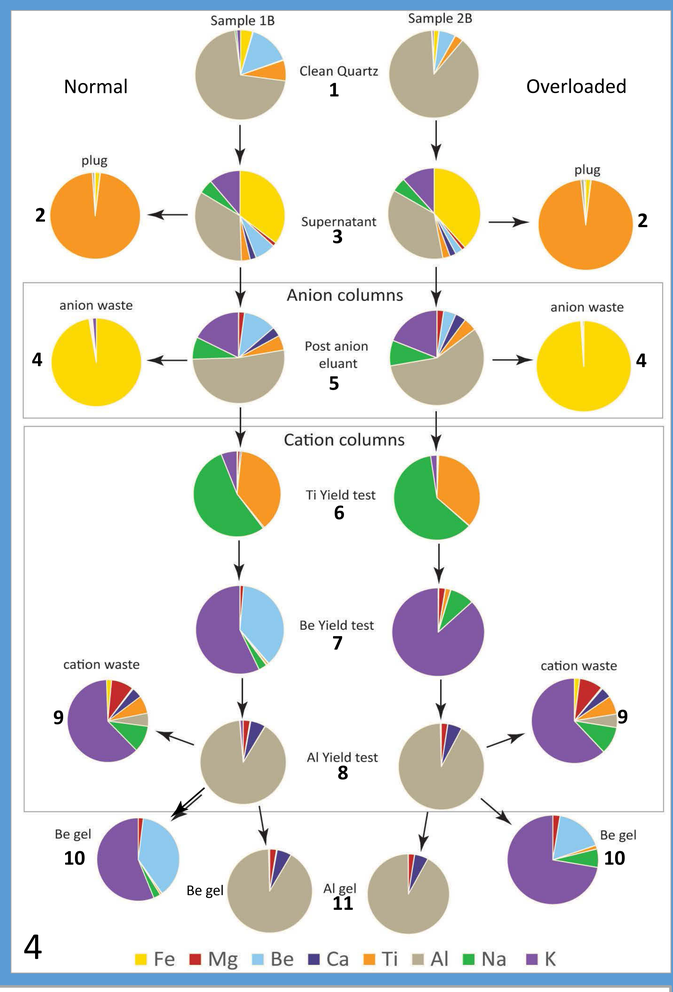








Tracking columns through typical procedure: Sample 1B and Sample 2B



- 1a & 1b show the percentage of Ti, Be and Al that separate out during cation column chemistry of sample 1A and sample 1B.
- 2a & 2b shows the concentration composition of sample 1A and sample 1B during the cation column chemistry.
- 3a & 3b shows the percentage of of Fe, Me, Be, Ca , Ti, Na & K at each step of the experiment in sample 1A and sample 1B.
- 4 shows the percentage of Fe, Me, Be, Ca , Ti, Na & K that the were present during each of step of the elution in sample 2A and sample 2B.

Conclusions

- The cation columns separate Ti, Be, and Al at the predicted times indicating that the cation column chemistry is successful.
- The anion waste was mainly Fe and the cation waste was mainly K, suggesting that minimal Be was lost when the was waste was removed from the sample.
- Some K elutes out at the same time Be elutes out in cation column; the Be yield test and Be gel contain more K than Be.
- The overloaded columns in both the elution experiment and typical procedure show the same trends as the normal amount, this means that the column can handle more and that a larger concentration was needed in order to overload the column.

Future Work

- Create experiments testing different variables of the process.
- Determine if there is a way to remove K from the sample if the K causes interference in the Be.
- Overload the column with an even higher concentrated sample to test the limit of the column.

References

- Briner Lab Procedure
- Corbett, L. B., et al. (2016). "An approach for optimizing in situ cosmogenic 10Be sample preparation." Quaternary Geochronology **33**: 24-34.
- Kohl, C. P. and K. Nishiizumi (1992). "Chemical isolation of quartz for measurement of in-situ-produced cosmogenic nuclides." Geochimica et Cosmochimica Acta **56**(9): 3583-3587.

Acknowledgements

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