Descriptive Mineralogical Analysis of an Igneous Dike found in the Kingston Peak Formation, Mojave Desert, CA

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Abstract

Located in California's Mojave Desert is the Kingston Range where the Precambrian Kingston Peak Formation is found. This formation is mostly sedimentary but it hosts multiple igneous intrusions, including the approximately 5-meter-wide dike that is the focus of this study. Samples were collected off the side of Excelsior Mine road near the Horse Thief Springs Camp, where both the Kingston Peak Formation and igneous dike are exposed. Samples were cleaned and photographed before being prepped for analysis with XRD (X-Ray Diffraction) and SEM (Scanning Electron Microscope). The dominant mineralogy of the dike was determined using XRD. Accessory minerals were identified with SEM. Whole rock analysis was conducted with both the XRD and SEM. Additional mineral separates were studied with the SEM. XRD produced a dominant mineralogy of quartz (SiO_2), albite ($NaAlSi_3O_8$), and orthoclase ($KAlSi_3O_8$). SEM identified the presence of titanium and titanium-iron rich minerals. Apatite ($Ca_5(PO_4)$) and manganese dendrites (MnO2) are also present. Together the geochemistry and mineralogy characterize the dike as a trachydacite, which correlates with its light colored, felsic appearance. It is likely that this dike is related to other large felsic igneous intrusions in the region.

Geologic Background

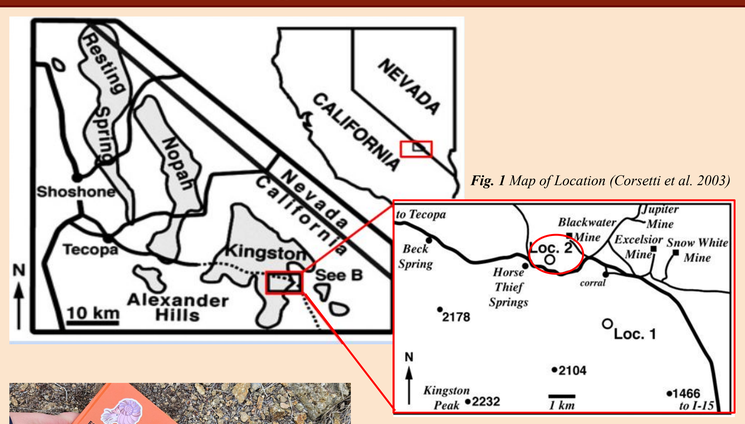


Fig. 1 Map of Location (Corsetti et al. 2003)

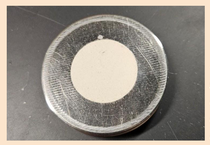
Fig. 2 Sample from outcrop in the field.

Fig. 3 Photograph of the dike, bordered by the sedimentary Kingston Peak Formation, with Dr. Farthing (5'7") for scale.

Materials & Methods

- First samples were gathered from the dike in the Kingston Peak Formation (Fig.2, 3). Samples were then brought back to SUNY Geneseo for analysis with the XRD and SEM.
- Samples were cleaned and photographed before being prepped for analysis (Fig.4-5). Powdered sample was used in both XRD and SEM, and uncrushed pieces and mineral separates were only studied with the SEM (Fig.6-7).

***Fig. 4-5** Photographs of clean samples of the dike, with a penny for scale.*



***< Fig. 6** Prepped sample for XRD analysis (powdered and packed into an aluminum holder).*

***Fig. 7 >** Prepped sample for SEM analysis (mineral separates).*

Data

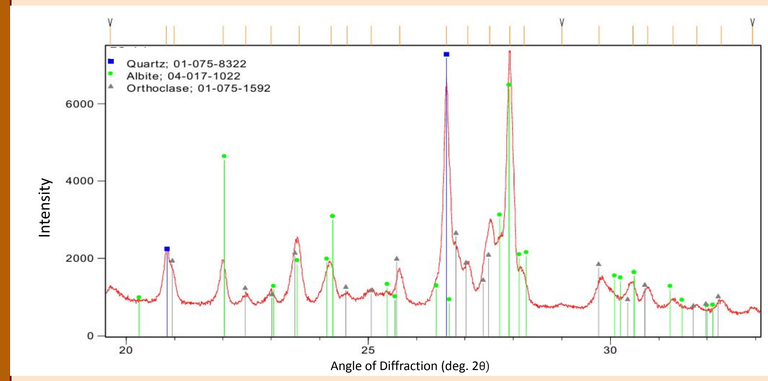


***Fig. 8** XRD analysis produced a dominant mineralogy of 17% Quartz (SiO_2), 66% Albite ($NaAlSi_3O_8$), and 17% Orthoclase ($KAlSi_3O_8$).*

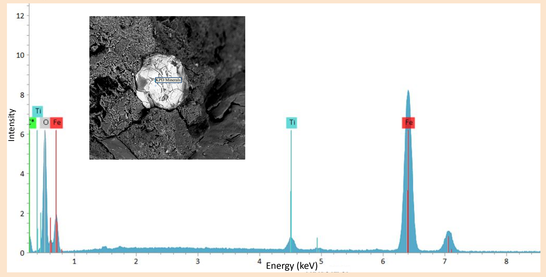


***Fig. 9** SEM/EDS spectrum of ilmenite from chemical analysis of Kingston Peak dike. Back set image is of the analyzed crystal.*

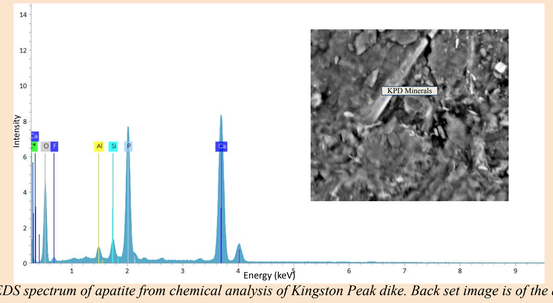


***Fig. 10** SEM/EDS spectrum of apatite from chemical analysis of Kingston Peak dike. Back set image is of the analyzed crystal.*

Rock Chemistry and Mineralogy

- SEM produced an overall chemistry of 4.99% Na_2O, 2.23% MgO, 22.28% Al_2O_3, 62.63% SiO_2, 5.56% K_2O, 2.31% FeO in weight % oxide.
- XRD analysis resulted in a dominant mineralogy of quartz (SiO_2), albite ($NaAlSi_3O_8$), and orthoclase ($KAlSi_3O_8$).
- SEM also identified accessory minerals, including titanium (Ti) and iron-titanium (Fe-Ti) minerals and minerals with phosphorus (P), calcium (Ca), and/or manganese (Mn).
  - Rutile (TiO_2)
  - Ilmenite ($FeTiO_3$)
  - Manganese oxide dendrites (MnO_2)
  - Apatite ($Ca_5(PO_4)$).

Implications

- Both apatite and manganese dendrites are secondary minerals which suggests higher levels of hydrothermal alteration or weathering on the samples of the dike we collected.
- Using the dominant mineralogy found through XRD, normalized SEM dominant chemistry, and a TAS diagram, the dike sampled fell within the Trachydacite field. Which corroborates it's more light colored, felsic appearance.

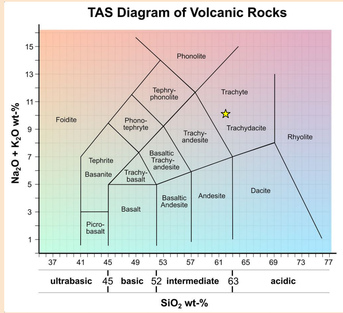


***Fig.11** TAS diagram which uses dominant chemistry in weight % oxide to classify igneous/volcanic rock types.*

Acknowledgements

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References

Corsetti, F.A., Awramik, S.M., and Pierce, D., 2003, A complex microbiota from snowball Earth times: microfossils from the Neoproterozoic Kingston Peak Formation, Death Valley, USA: Proceedings of the National Academy of Sciences of the United States of America, v. 100, p. 4399–4404, doi:10.1073/pnas.0730560100.

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