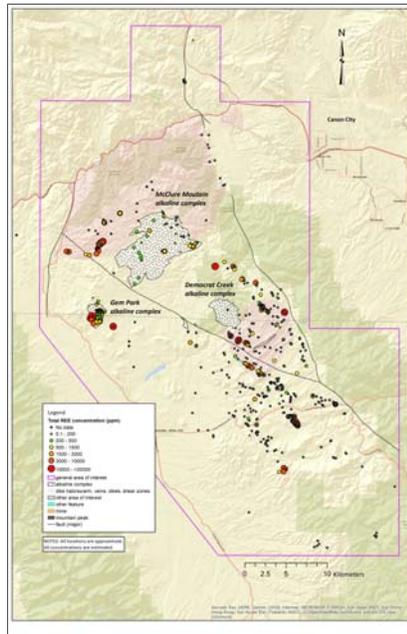


OFR_20_11_WetMountains_CriticalMineral_DataCompilation

Shapefile



Tags

alkaline complexes, carbonatite, Wet Mountains, DeWeese, Custer, Fremont, REEs, critical minerals, niobium, scandium, titanium, Colorado

Summary

Colorado hosts several alkaline igneous intrusions that formed in a variety of geological settings. These intrusions are associated with some mineral deposits of economic interest, including the precious metal deposits at Cripple Creek and other deposits that contain potential titanium, niobium, rare earth elements (REEs), uranium, and thorium resources. An area along the western flank of the Wet Mountains located in Custer and Fremont counties, Colorado, hosts three alkaline complexes that reportedly contain elevated concentrations of these minerals deemed critical by the U.S. Geological Survey in 2018. The Colorado Geological Survey (CGS) compiled historic sample results of select critical minerals (e.g., REEs, niobium, titanium) from this area as reported by other authors. Although thorium is not listed as a critical mineral, some of the first studies in the area concentrated on thorium exploration, therefore, it was included in the data compilation. Recent data collected by the CGS are also included in the data set. The data compilation is provided in an electronic ArcGIS file, spreadsheet, and a comma-separated values (csv) file available for download that includes sample locations, sample descriptions, concentrations, references, and other locations of associated alkaline rocks, veins, dikes, etc. in this area. A summary of the geology, mineralization, and data set, plus a bibliography, are presented below. The bibliography includes documents referenced in this report as well as other publications that pertain to this area. Appendix A includes documentation and the laboratory results of the samples collected by the CGS. Appendix B contains a data dictionary and explanation of data modifiers and acronyms used in the data compilation. This open-file report may be updated with additional data in the future. The research for this publication was completed by the end of 2019 and submitted for final review in May 2020.

The material presented here is from a limited literature review and is intended for general information purposes only. Those making use of or relying upon the material, previous exploration results, results of this investigation, and any other information provided herein assume all risks and liability arising from such use or reliance. Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the Colorado Geological Survey.

notes2 Notes and/or comments.

La_ppm Concentration of La in parts per million.

La_mod Modifier for La_ppm, see list of modifiers.

Ce_ppm Concentration of Ce in parts per million.

Ce_mod Modifier for Ce_ppm, see list of modifiers.

Pr_ppm Concentration of Pr in parts per million.

Pr_mod Modifier for Pr_ppm, see list of modifiers.

Nd_ppm Concentration of Nd in parts per million.

Nd_mod Modifier for Nd_ppm, see list of modifiers.

Sm_ppm Concentration of Sm in parts per million.

Sm_mod Modifier for Sm_ppm, see list of modifiers.

Eu_ppm Concentration of Eu in parts per million.

Eu_mod Modifier for Eu_ppm, see list of modifiers.

Gd_ppm Concentration of Gd in parts per million.

Gd_mod Modifier for Gd_ppm, see list of modifiers.

Tb_ppm Concentration of Tb in parts per million.

Tb_mod Modifier for Tb_ppm, see list of modifiers.

Dy_ppm Concentration of Dy in parts per million.

Dy_mod Modifier for Dy_ppm, see list of modifiers.

Ho_ppm Concentration of Ho in parts per million.

Ho_mod Modifier for Ho_ppm, see list of modifiers.

Er_ppm Concentration of Er in parts per million.

Er_mod Modifier for Er_ppm, see list of modifiers.

Tm_ppm Concentration of Tm in parts per million.

Tm_mod Modifier for Tm_ppm, see list of modifiers.

Yb_ppm Concentration of Yb in parts per million.

Yb_mod Modifier for Yb_ppm, see list of modifiers.

All locations are approximate. All results are estimated.

Description

Colorado hosts several alkaline igneous intrusions that formed in a variety of geological settings. These intrusions are associated with some mineral deposits of economic interest, including the precious metal deposits at Cripple Creek and other deposits that contain potential titanium, niobium, rare earth elements (REEs), uranium, and thorium resources. The U.S. critical minerals list recently (2018) updated by the U.S. Geological Survey includes niobium, REE, titanium, strontium, and other elements typically associated with alkaline igneous intrusive rocks and carbonatites. An area along the western flank of the Wet Mountains located in Custer and Fremont counties, Colorado, hosts three alkaline complexes that reportedly contain elevated concentrations of these critical minerals. The Colorado Geological Survey (CGS) compiled historic sample results of select critical minerals (e.g., REEs, niobium, titanium) from this area as reported by other authors. Although thorium is not listed as a critical mineral, some of the first studies in the area concentrated on thorium exploration, therefore, it was included in the data compilation. Recent data collected by the CGS are also included in the data set. The data compilation is provided in an electronic ArcGIS file, spreadsheet, and a comma-separated values (csv) file available for download that includes sample locations, sample descriptions, concentrations, references, and other locations of associated alkaline rocks, veins, dikes, etc. in this area. A summary of the geology, mineralization, and data set, plus a bibliography, are presented below. The bibliography includes documents referenced in this report as well as other publications that pertain to this area. Appendix A includes documentation and the laboratory results of the samples collected by the CGS. Appendix B contains a data dictionary and explanation of data modifiers and acronyms used in the data compilation. This open-file report may be updated with additional data in the future. The research for this publication was completed by the end of 2019 and submitted for final review in May 2020. Van Gosen (2020) with the U.S. Geological Survey published laboratory data from samples collected from the Wet Mountains alkaline complexes in late 2020. This data set is not included in this compilation.

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All locations are approximate. All results are estimated.

Data Dictionary - description of fields, notes, abbreviations (see Appendix B of the report referenced below).

Field	Description
ID	Record identification number.
location	Sample or location id from the referenced report.
descript	Sample and location description.
shortref	Short version of the reference field.
notes1	Notes and/or comments.

- Lu_ppm Concentration of Lu in parts per million.
- Lu_mod Modifier for Lu_ppm, see list of modifiers.
- Y_ppm Concentration of Y in parts per million.
- Y_mod Modifier for Y_ppm, see list of modifiers.
- REE_Tppm Total rare earth element concentration in ppm (converted from reported in weight percent and multiplied by 10,000). Note that many analyses do not include all the REEs; therefore, all totals are estimated. See referenced report for more information.
- REE_Tmod REE_Tppm modifier. See list of modifiers.
- LREEppm Light rare earth elements concentration in ppm (assumed to include La/Ce/Pr/Nd/Sm/Eu/Gd - not including Pm because it only exists in small concentrations naturally). See referenced report for more information.
- HREEppm Heavy rare earth element concentration in ppm (assumed to include Tb/Dy/Ho/Er/Tm/Yb/Lu + Y). See notes for variations and referenced report (some totals might not include Y, etc.).
- Ga_ppm Concentration of Ga in parts per million.
- Ga_mod Modifier for Ga_ppm, see list of modifiers.
- Nb_ppm Concentration of Nb in parts per million.
- Nb_mod Modifier for Nb_ppm, see list of modifiers.
- Sr_ppm Concentration of Sr in parts per million.
- Sr_mod Modifier for Sr_ppm, see list of modifiers.
- Ti_ppm Ti concentration in parts per million (NOTE: TiO₂ concentrations reported by many authors not included).
- Ti_mod Modifier for Ti_ppm, see list of modifiers.
- Thppm Concentration of Th in parts per million.
- Thppm_m Modifier for Th_ppm, see list of modifiers.
- ThO₂eq Thorium dioxide calculated from the equivalent uranium by subtracting the chemical uranium and multiplying the difference by the conversion factor of 5.6. In parts per million. See referenced report for more information.
- ThO₂chem Chemical analysis of thorium dioxide in parts per million reported by

some authors. See referenced report for more information.

ThO2chemo	Thorium dioxide modifier for ThO2chem. See list of modifiers.
U_ppm	Concentration of U in parts per million.
Uppm_m	Modifier for U_ppm, see list of modifiers.
Ueq	Chemical equivalent of uranium (calculated, see original publication in reference field for more information).
Ueq_m	Ueq modifier, see list of modifiers.
Uchem	Chemical analysis of uranium concentration in ppm reported by some authors. See original publication for more information.
Uchem_m	Uchem modifier, see list of modifiers.
REEox	Rare earth element oxide concentration in ppm.
REEox_m	REEox modifier, see list of modifiers.
ThREEox	Thorium and rare earth element oxide concentration in ppm (see referenced report for more information).
ThREEoxm	ThREEox modifier, see list of modifiers.
samlengt	Sample length in feet, if zero then no length reported or grab sample.
year	Year of referenced publication.
refer	Full reference.
x_meters	x coordinate in NAD 83 meters.
y_meters	y coordinate in NAD 83 meters.
coordsys	Coordinate system.

Modifier Description

>	Greater than reported value.
a	A total of La/Ce/Nd/Y/Yb only, value converted from weight percent.
e	Estimated.
na	Not analyzed. In some cases (data from Christman and others, 1959), these analytes were analyzed; however, the results were qualitative and only reported by orders of magnitude (e.g., La = 0.X, Ce = 0.OX weight percent). In some cases, the individual REEs

were not reported so they are listed as na. Total LREE and/or HREE do include these results (e.g., Armbrustmacher, 1988). Although an element concentration may be reported as 0.0, this modifier indicates that they did not analyze for the element.

- nau Not analyzed unknown - unclear if analyte was not detected or not analyzed.
- nc Not complete - no results were reported for over 3 or 4 of the REEs.
- nd Not detected, same as modifier u.
- nr Not reported here, see referenced report for details.
- ppm Parts per million.
- u Not detected, value is the detection/reporting limit (in many cases, it is unknown if the reported number is the detection or reporting limit, also includes detections that were lower than the detection limit (the detection limit wasn't always reported so, these are essentially non-detects). If element concentration is 0.0 with a "u" modifier, analysis for the element was conducted but not detected.

Notes: Estimated location not shown on map = the exact location is not shown on the map from the original reference. Only the general location is provided for the claim/property. The location was placed on this location.

The Tuttle property map was georeferenced however, there were not many points that could be used to georeference this map. Therefore, its location and sample point locations are estimated.

The Haputa ranch property map was georeferenced however, its location is estimated and therefore, all the points in this file as well as the Haputa Ranch Extension are estimated.

Estimated location - only shown in report figure: the report figure doesn't give enough detail to show the location, therefore, the location is estimated.

Credits

O'Keeffe, M.K., Peretyatko, A.I., and Mahatma, A., 2021, Alkaline complexes of the Wet Mountain area, Colorado: A geological summary, bibliography, and data compilation of critical mineral laboratory results, Colorado Geological Survey Open-File Report 20-11, 48 p.

Use limitations

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Extent

West -105.659610 **East** -105.131092
North 38.524757 **South** 38.007056

Scale Range

Maximum (zoomed in) 1:500,000
Minimum (zoomed out) 1:20,000,000

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