

Regional Dikes Near the Mount Rosa Intrusive Center, Pikes Peak Batholith, Colorado
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Introduction

Lamprophyric dikes were mapped in the southeastern portion of the Mount Rosa intrusive center (Gross & Heinrich, 1966). Some of these dikes appear to be contemporaneous with Pikes Peak granite. Samples from regional dikes were collected for the purpose of obtaining geochemical and petrologic data which permit classification and petrogenetic determinations of these dikes.

Previous Work

Work by Gross & Heinrich (1965, 1966) included the location of Mount Rosa area riebeckite granites, pegmatites, and lamprophyres and sample collection from them to conduct descriptive mineralogical analyses. In a short article on the lamprophyres, they described two compositionally distinct groups of sodic syenites and sodic diorites based on petrography. The sodic syenites have phenocrysts of individual or glomeroporphyritic anorthoclase, highly perthitized, in a matrix of anhedral-granular feldspar, aegirine, barkevikite, and biotite. The accessory minerals of this group were riebeckite, allanite, zircon, apatite, fluorite, and magnetite. The sodic diorite group is characterized by a variety of mafic constituents. Some samples contain augite and olivine, others consist primarily of amphibole, and some have only biotite. These mafic minerals occur as phenocrysts in a fine-grained matrix of feldspars. The plagioclase ranges from An28 to An38. Magnetite, allanite, and an abundance of apatite make up the accessory minerals. Major element analysis was presented for one sample from the sodic syenite group. No further chemical analysis nor isotopic data was presented.

Field Work

Mafic dikes of Tertiary age are known to exist near the study area. Therefore, a key feature of the field work was to verify dike age by association with Mount Rosa-type pegmatites or Pikes Peak granite. The Gross & Heinrich (1965) geologic map which included the location of lamprophyres along the south, southeastern section of the Mount Rosa intrusive center was used as an initial guide in this field area. However, some of the previously mapped lamprophyres could not be found at the map locations while a number of unmapped dikes were found.

Distributed throughout the southeastern Mount Rosa area, the predominantly mafic dikes occur within both fine-grained and coarse-grained Pikes Peak granite, particularly with pegmatites from the Mount Rosa intrusive center. Very fine- to fine-grained, these dikes are particularly resistant to weathering and weather angularly or spheroidally. Although typically black in color, grey, blue-grey, and dark red dikes do occur. Most commonly, the dikes crop out nearly vertically, striking predominantly northwest, and range in size from .5m x 75 m to 5m x 15m. Also, anastomosing sills and sub-horizontal bodies occur. Chilled margins of dike material in contact with Pikes Peak granite and xenoliths of dike material within cross-cutting veins of Mount Rosa-type pegmatite suggest that these Precambrian dikes overlap the Mount Rosa-type pegmatites in age. In hand specimen, samples from the dikes contain mafic and potassium feldspar megacrysts, surrounded by a dark groundmass.

Petrography

Of the forty one dikes mapped, twenty two thin sections were produced and examined. Five groups could be distinguished.

Group A: Stove Mountain, Subset A

Hornblende Diabase

These rocks are from five angularly weathered dikes with very fine-grained black groundmass, randomly oriented visible plagioclase crystals, and fine to medium-grained mafic clots. Structural orientation and similar composition and texture suggest that three of the samples may be from one long dike which crops out intermittently. The other dikes represented indicate this same tendency for single-dike occurrence. Age relationships from this group include dike material inclusions in granitic veins which cross-cut the dike and chilled margins indicating intrusion into Mount Rosa-type pegmatite. These relationships verify that the dikes are contemporaneous with the activity of the Mount Rosa intrusive center. In thin section, the mafic minerals comprise 35-40% of the rock. Subhedral to anhedral hornblende may indicate replacement of earlier material. Subtabular crystals of biotite replace amphibole as a late-stage phase. The plagioclase formed early and is An40-44 in composition. Very little perthite occurs in this group. The laths of feldspar

are highly seritized. Minor interstitial quartz is late-stage. Opaque minerals (5%) are poikilitic and enclosed by the amphibole. All the samples are magnetic suggesting that magnetite contributes to the opaque content. Apatite is minor and fluorite is an accessory. Glassy microphenocrysts of green amphibole and apatite rim the boundaries of mafic clusters and feldspar and also occur within the feldspar. The textures of these samples are hypidiomorphic and holocrystalline.

Group B: Stove Mountain, Subset 2

Clinopyroxene Diabase

This group is characterized by the presence of clinopyroxene and a finer grain size than Group A. Two of the six dikes are oriented parallel to each other and 75 m away from dikes of Group A and intrude Pikes Peak granite. A chilled margin from both of these dikes is indicated by slaty material at the contact which becomes progressively more friable. One dike in this group has cross-cutting veins of granitic material constraining these rocks to be Pikes Peak in age. Mafic minerals range in content from 25-35% of the rock and include fine-grained clinopyroxene with late-stage biotite and larger subhedral crystals of biotite. Plagioclase is An41 in composition and is well-preserved. The percentage of preserved plagioclase varies with respect to anhedral perthite in the group's samples. The feldspars within the group range from blade-like laths to sub-rounded crystals, minor quartz occurs as well. Opaque minerals (magnetite) contribute up to 5% of the dike material. Apatite in these samples is more abundant in comparison to Group A, but remains minor. Haloes of potassium feldspar surrounding mafic minerals are visible in hand sample. Glomeroporphyritic clots of biotite, blue amphibole, quartz, and monazite occur. The texture of this group is allotriomorphic and glomeroporphyritic.

Group C: Helen Hunt Falls

Quartz Diorite

This pair of dikes are recognized by their feldspar composition and their annite content. Field relationships were indeterminate. The mafics constitute 15% of the rock. Large grains of anhedral annite commonly enclose opaque minerals. Subhedral grains of late-stage amphibole are nearly equal in size to the plagioclase (An 39), minor perthite, and quartz that make up the equigranular groundmass. Accessories include zircon, subhedral monazite, apatite, and fluorite. Glomeroporphyritic clots of amphibole, annite, and opaque minerals are commonly associated with xenoliths of microcline, perthite, and quartz. The texture is hypocrystalline, glomeroporphyritic, and porphyritic.

Group D: Sweetwater Creek

Quartz Monzonite

Similar to the Helen Hunt Falls dikes in Group C, these five dikes are severely weathered and light grey in outcrop. However in contrast to Group C, they are granitic in composition with abundant feldspar. Inclusions of dike material in veins of Mount Rosa-type granite date these dikes as contemporaneous with Mount Rosa intrusive activity. The mafic content in this group ranges from 5-25% and includes euhedral to subhedral dark blue amphibole. Large phenocrysts of Carlsbad-twinned perthite is common. Well-preserved plagioclase (An42), microcline, quartz, and perthite make up the silicate portion of the groundmass. Sericitization varies within the group. Accessories include fluorite, monazite, apatite, zircon, and opaques. The porphyritic, allotriomorphic, phaneritic texture is varied with occasional clots of amphiboles, perthite, plagioclase, and quartz. One sample contains well-developed lath-like feldspars, while another is very similar in texture to Group C.

Group E: St. Peters Dome

Syenite

The two dikes belonging to this group were both marked by planar contacts. One was a vertical dike with the surrounding material eroded away. A thin Carlsbad-twinned, coarse-grained feldspar coating left on the sides of this dike indicates they intruded into Pikes Peak granite. The mafics (30% of the rock) consist of fine grains of altered amphibole. The texture is trachytoidal containing some perthite laths and commonly Carlsbad-twinned laths of potassium feldspar. Some large blocky crystals of potassium feldspar occur as well as large blade-like phenocrysts of perthite. One glomeroporphyritic clot consists of a core of blue and green amphibole with a rim of biotite. Subhedral annite and clusters of amphiboles are rare. Traces of interstitial opaques and apatite exist.

Geochemistry

Seventeen of the freshest samples representing the range of variation were analyzed for major and trace element geochemistry by x-ray fluorescence on a Rigaku 3070 x-ray spectrometer. From these samples, five were chosen and submitted to XRAL Activation Services Incorporated for Rare Earth Element

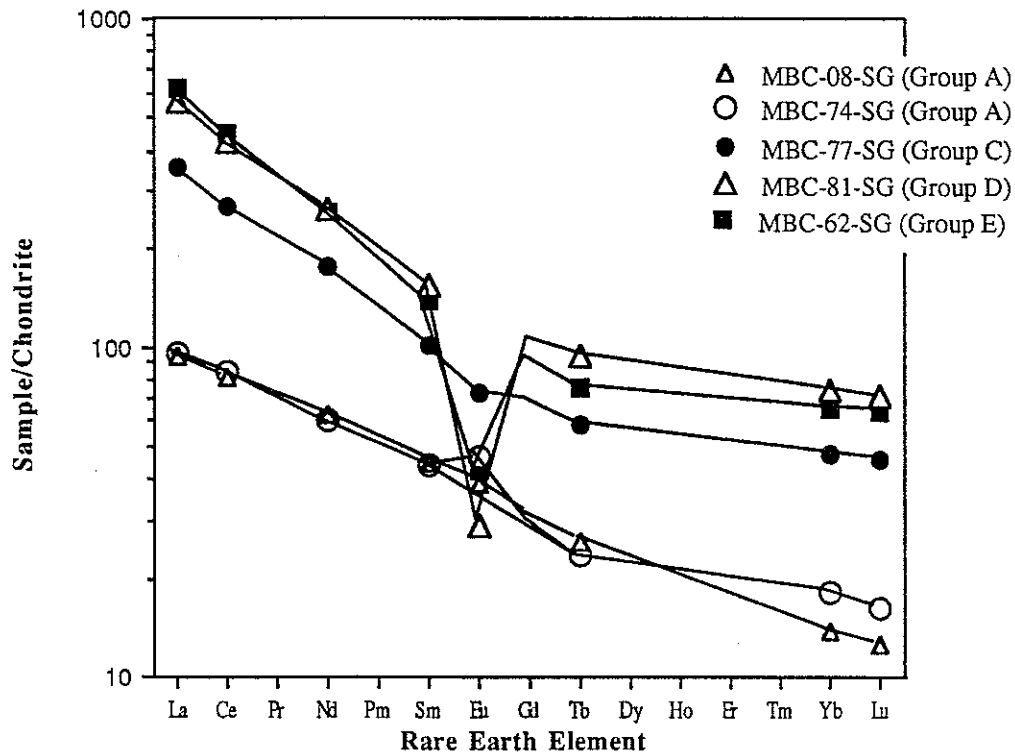


Figure 1. Rare earth element chondrite plot.

analysis by Induced Activation Analysis. Isotopic analysis was completed for one sample by Jill Douglass (this volume).

Preliminary results show the SiO₂ content for the five groups described above: Group A (44-51%), Group B (47-53%), Group C (60-61%), Group D (58-65%), and Group E (60-64%). Incompatible element data are compared to primordial mantle composition in Figure 2. (Pearce, 1984). The results show an enrichment in incompatible elements, particularly Ta, Rb, Ce, Nb, K, and Ba. Hf, P, Sm, Ti, Sr, K, and Yb are less enriched. MBC-74-SG has a Yb value less than that of primordial mantle composition. MBC-62-SG (Group E) also shows values for Sr and Ti less than primordial mantle composition. A rare earth element plot of the results produced by INAA for selected samples which represent Group A, C, D, and E is shown in Figure 1. This plot shows two distinct trends. One trend developed by MBC-62-SG (Group E) and MBC-81-SG (Group D) includes LREE enrichment and a negative europium anomaly. The other trend has a flatter profile with less LREE enrichment and no europium anomaly. This trend is demonstrated by MBC-8-SG and MBC-74-SG (Group A) and MBC-77-SG (Group C). Isotopic analyses on MBC-8-SG (Group A) indicates an undepleted mantle source (Douglass, this volume).

Results

Groups A, B, and D are verifiably Pikes Peak in age. Although, no direct field relationships were found for Group C and Group E, mineralogy suggests that the samples from these groups are also Pikes Peak in age.

Gross & Heinrich (1965) termed the regional dikes of the southeastern portion of the Mount Rosa intrusive center as lamprophyres based on field occurrence and presence of mafic phenocrysts. However, Rock (1991) constrains the definition of lamprophyres by including a stipulation which allows no feldspar

or quartz phenocrysts, both of which occur commonly within the samples. These minerals may be a result of assimilation.

The magma comprising dikes from Group A and B are the most primitive melts yet identified within the Pikes Peak Batholith. Magma in Groups C, D, and E are the results of assimilation and fractional crystallization processes. Continued modeling is necessary to explore the petrogenetic origin.

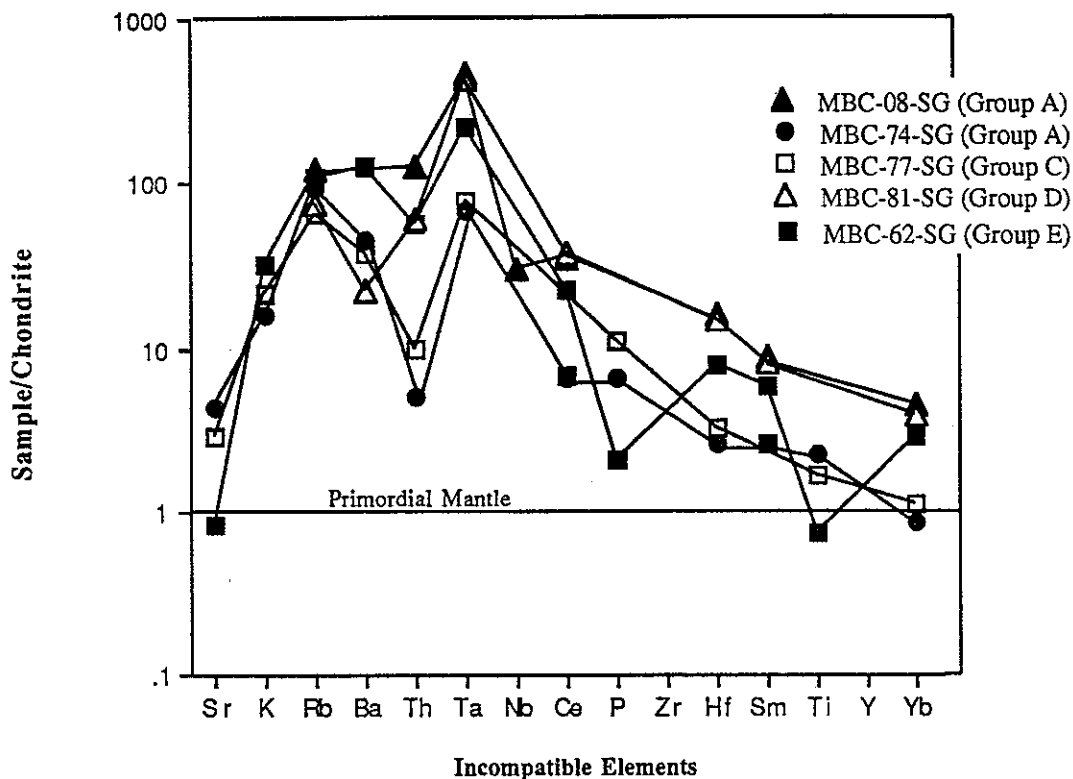


Figure 2. Comparison of trace element data. The data are normalized to N-MORB.

References

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