#37-2

An Unusual Mafic Dike in Easton, Pennsylvania

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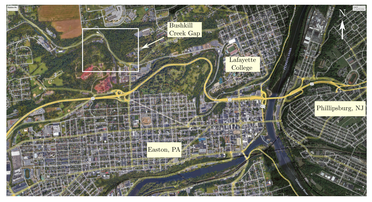
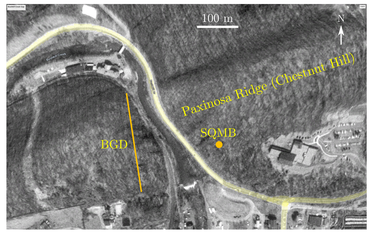
Abstract

We present a preliminary report on a newly (re-?)discovered and seemingly unusual mafic dike that cuts Precambrian rocks near Easton, PA (and new data for a previously identified dike/sill located nearby). At its one outcrop, the new dike is about 2 m wide, and exhibits sharp contacts with enclosing Mesoproterozoic quartzo-feldspathic gneiss. Based on float located along its apparent strike, the dike also cuts both post-orogenic pegmatite and talc-bearing rocks derived from the Franklin Marble. The dike is porphyritic, and initial petrographic and geochemical analyses suggest that it is likely distinct from the Catoctin-related metadiabase dikes that are relatively common within the Precambrian rocks of the New Jersey Highlands and the Reading Prong. A total alkali vs. silica diagram suggests that the new dike has a basaltic to trachy-basaltic composition.

Location and History

The Bushkill Gap Dike (BGD) and the Schweyer Quarry Mafic Body (SQMB) are located on Paxinosa Ridge (Chestnut Hill), a NE-SW-oriented mass of Precambrian rock that is exposed for about four miles just NW of Easton, PA. The principal exposures of BGD and SQMB lie within 400 m of one another, on opposite sides of Bushkill Creek. At its one outcrop, BGD shows sharp contacts with enclosing gneiss. Along strike to the S, BGD transects a post-orogenic pegmatitic body and altered remnants of the Franklin Marble. At its primary outcrop, SQMB appears to be stratiform within the altered Franklin Marble. It seems that both BGD and SQMB were described by F. B. Peck (1862-1925), Professor of Geology at Lafayette College. BGD was re-discovered by the first author in 2021. SQMB was re-discovered and sampled circa 2000 by Robert C. Smith II.





(a) BGD contact with gneiss

(b) SQMB contact with altered marble

Geochemistry

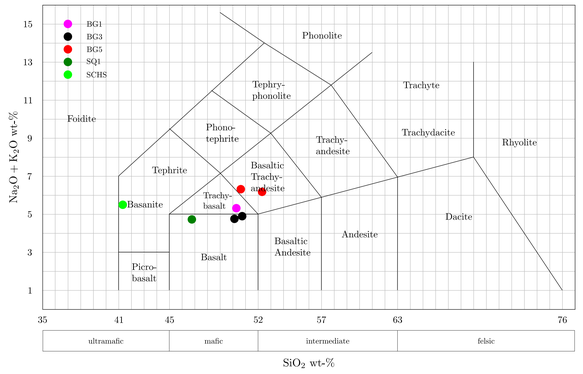
Full geochemical analyses of two samples from BGD were provided by Actlabs. One sample (BG3) was taken from the apparent center of the dike. A second sample (BG5) was taken from the fine-grained margin of the dike, near its contact with the enclosing gneiss. A similar analysis of a sample (SCHS) taken from SQMB was obtained by Robert C. Smith II, and is incorporated with his permission in the various diagrams presented below. Actlabs also provided major oxides data for two additional samples: BG1 from between the margin and center of BGD, and SQ1 from the interior of SQMB.

Major Oxides

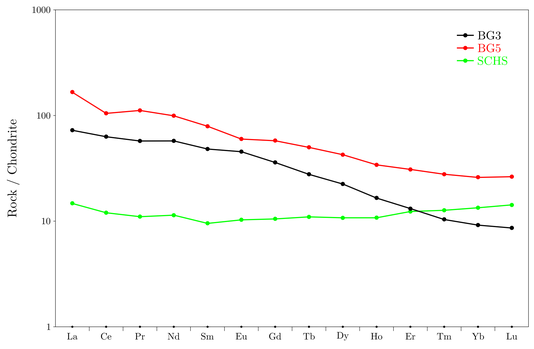
	SiO_2	Al_2O_3	Fe_2O_3	MnO	MgO	CaO	Na_2O	K_2O	TiO_2	P_2O_5
BG1	50.29	13.37	12.69	0.219	5.20	5.80	3.51	1.80	3.167	0.60
BG3	50.14	12.61	12.66	0.139	5.70	6.90	3.09	1.66	2.935	0.53
*BG3	50.75	12.55	12.81	0.141	5.86	7.03	3.21	1.68	2.948	0.51
BG5	50.64	13.86	13.05	0.172	4.47	4.49	3.66	2.65	3.425	0.65
*BG5	52.32	13.50	12.95	0.172	4.53	4.53	3.55	2.62	3.339	0.63
SQ1	46.78	13.96	11.09	0.159	10.81	8.22	1.91	2.81	0.468	0.09
SCHS	41.33	14.37	9.45	0.183	14.2	6.80	1.19	4.30	0.486	0.07

*Samples BG3 and BG5 were each analyzed twice for major oxides.

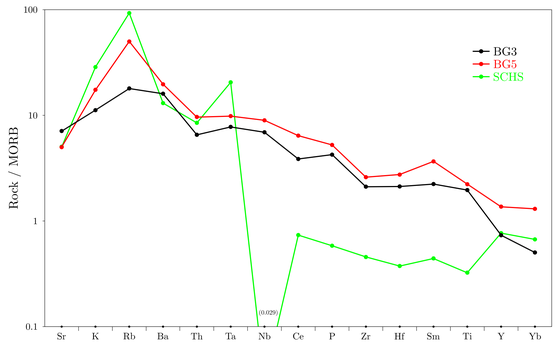
Total Alkali vs. Silica



Sun-McDonough, 1989



Pearce, 1983



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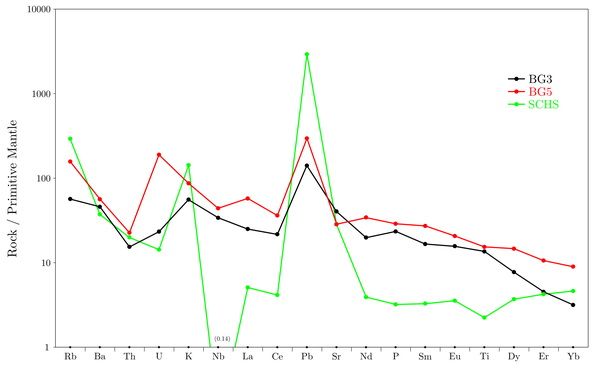
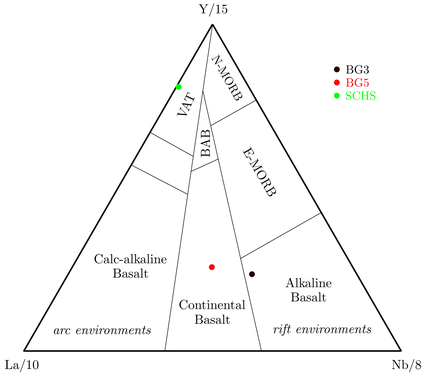
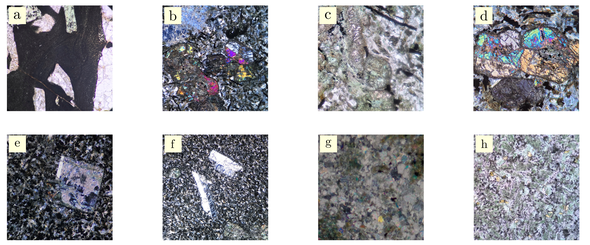


Cabanis-Lecolle, 1989



Petrography

Petrographic thin sections were provided by R. A. Petrographic. Selected micro-photographs appear below. The width of each of these images is approximately 4 mm.



(a) BGD-gneiss contact, showing flow structure, and altered amphibole and feldspar
(b) Twinned clinopyroxene and altered sanidine or anorthoclase phenocrysts in BGD
(c) Chlorite-altered elongate amphibole and clinopyroxene phenocrysts in BGD
(d) Glomerocrystic clinopyroxene with possible chlorite-altered olivine core in BGD
(e) Highly altered anorthoclase(?) phenocryst in a fine-grained matrix in BGD
(f) Twinned sanidine phenocrysts in a fine-grained matrix in BGD
(g) Possible carbonate xenolith in BGD
(h) Equigranular chlorite, actinolite, epidote and plagioclase from interior of SQMB

Discussion

BGD appears to be an unusual mafic dike. It possesses many features suggestive of a calc-alkaline lamprophyre. It is porphyritic, and both petrographic and XRD analyses indicate the presence of amphibole, clinopyroxene and biotite. It is enriched in Cr and Ni, and also in K, Rb, Sr, Nb, and LREE. However, feldspar phenocrysts occur in BGD, contra-indicating its classification as a lamprophyre. BGD is also similar mineralogically to rocks of the shoshonite series. However, BGD is less potassic and quite enriched in both Fe and Ti relative to such rocks. BGD appears to be distinct from the many Catoctin-related diabase dikes that cut the Grenville terrane in PA and NJ. In particular, BGD is calc-alkaline, while the Catoctin-related dikes are tholeiitic.

Despite their proximity, SQMB and BGD differ geochemically, mineralogically and texturally. Initial analyses suggest that SQMB is an volcanic-arc tholeiite. SQMB appears to have been metamorphosed to greenschist facies and contains abundant epidote, which is entirely absent from BGD. And while BGD is decidely porphyritic, SQMB has a coarser, equigranular texture.

References

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