

GEOCHEMICAL AND PETROGRAPHIC ATTRIBUTES OF LAVAS ERUPTED AT SMALL VOLCANIC CENTERS IN NORTHERN OREGON; IMPLICATIONS FOR MAGMA FORMATION WITHIN AN INTRA-VOLCANIC ARC GRABEN

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Introduction

Quaternary volcanism in the northern Oregon Cascade Range is dominated by eruption of calc-alkaline andesite to rhyodacite lava flows and associated pyroclastic deposits at long-lived, subduction-driven composite volcanoes such as Mt. Hood and Mount Jefferson. This study investigates small and more mafic Quaternary volcanoes in the Mt. Hood vicinity, including **Clear Lake Butte (CLB)**, **Pinhead Buttes (PHB)**, and **Olallie Butte (OB)**. These volcanoes are located within an intra-volcanic arc graben, which developed approximately 7-8 Ma to the south and propagated northward to the Mt. Hood region (Smith et al, 1987). This study compares geochemical and petrographic characteristics of Quaternary basalt and basaltic andesite lavas erupted at small volcanoes within the northern graben to those of primary and near-primary lavas mainly erupted within southern graben regions.

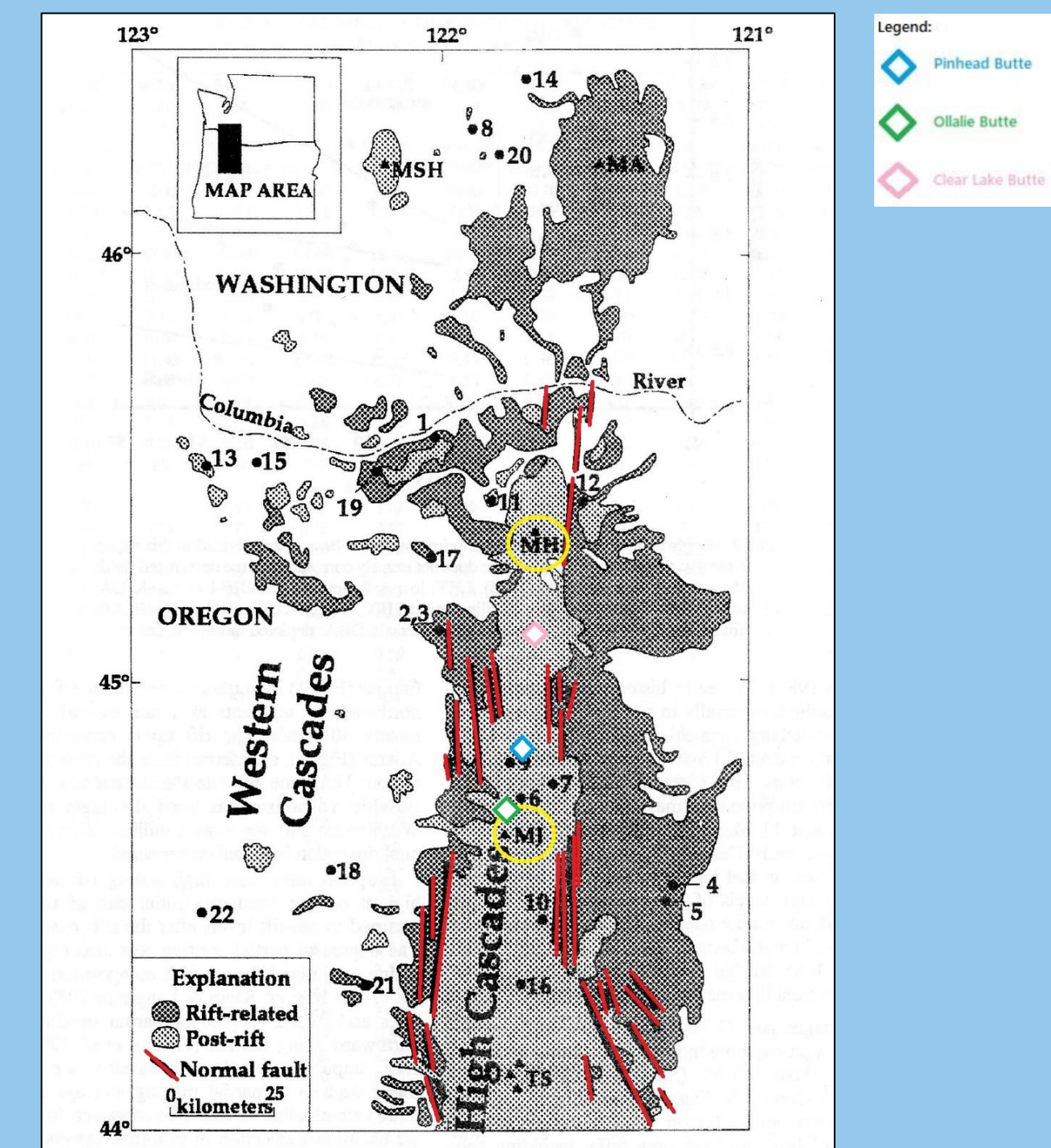
Research Objective

Identify geochemical and petrographic similarities and differences among intra-arc graben lavas less than 7 ma in age in order to better understand conditions of magma formation at small volcanoes in the central to northern Oregon Cascade Range. Specifically, we are interested in the possibility that crustal extension within the graben played a role in the formation of these magmas, as has been documented in the Newberry Volcano region.

Interpretation

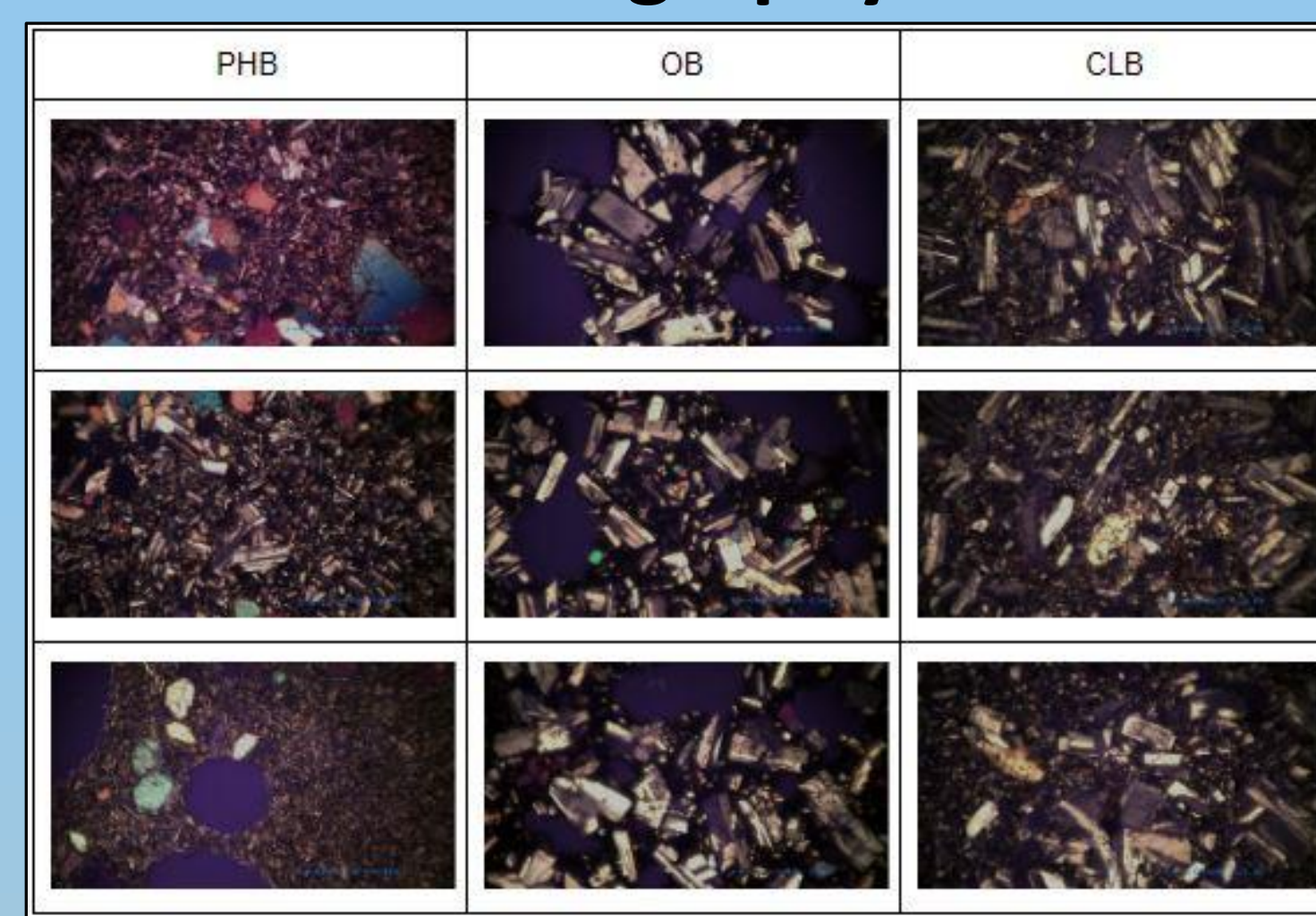
Geochemical and petrographic data suggest that although CLB, PHB, and OB lavas share certain geochemical and petrographic characteristics with intra-graben primary and near-primary magmas attributed to decompression melting, subduction-related processes cannot be ruled out for magma formation at small northern Oregon Cascades graben volcanoes. Notably, most primary and near primary lavas exhibit higher concentrations in MgO and CaO, and lower concentrations of Rb than CLB, PHB and OB.

Petrographically, olivine is not as common in CLB, PHB and OB lavas. We interpret these differences as suggesting that CLB, PHB and OB lavas are more characteristic of subduction-related magmas, rather than magmas formed as a result of crustal extension.



Above map – location of northern Oregon High Cascades Graben and locations of samples included in this study (modified from Conrey et al., 1997).

Petrography



	Sample #	Plagioclase	Clinopyroxene	Orthopyroxene	Olivine	Glass
PHB	H-03-4A	Y	Y	Y	Y	N
	H-03-4D	Y	Y	Y	N	Y
	H-04-12	Y	Y	Y	N	Y
OB	H-04-14A	Y	Y	Y	N	Y
	H-04-14B	Y	Y	Y	N	Y
	H-04-14E	Y	Y	Y	N	Y
CLB	H-16-01	Y	Y	Y	N	N
	H-16-02	Y	Y	Y	N	N
	H-16-06	Y	Y	Y	N	N

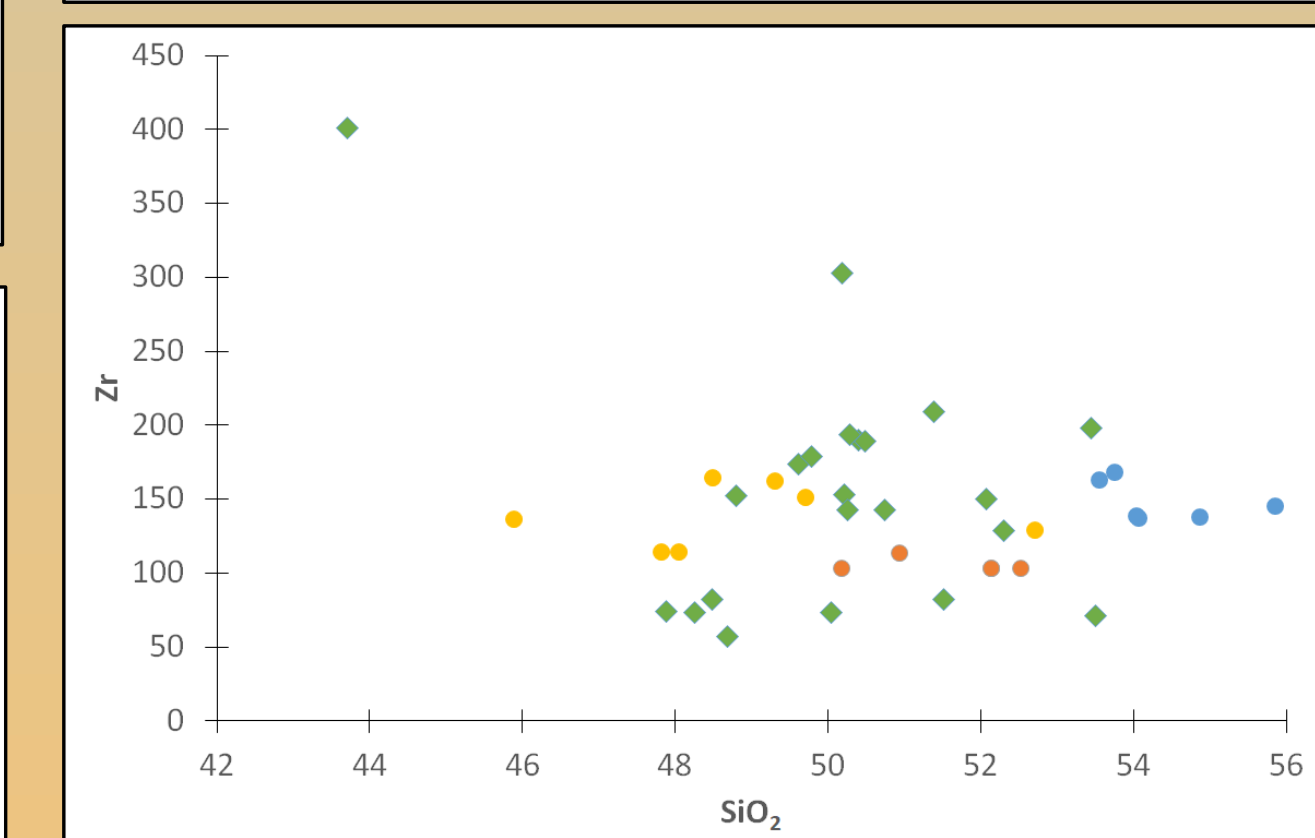
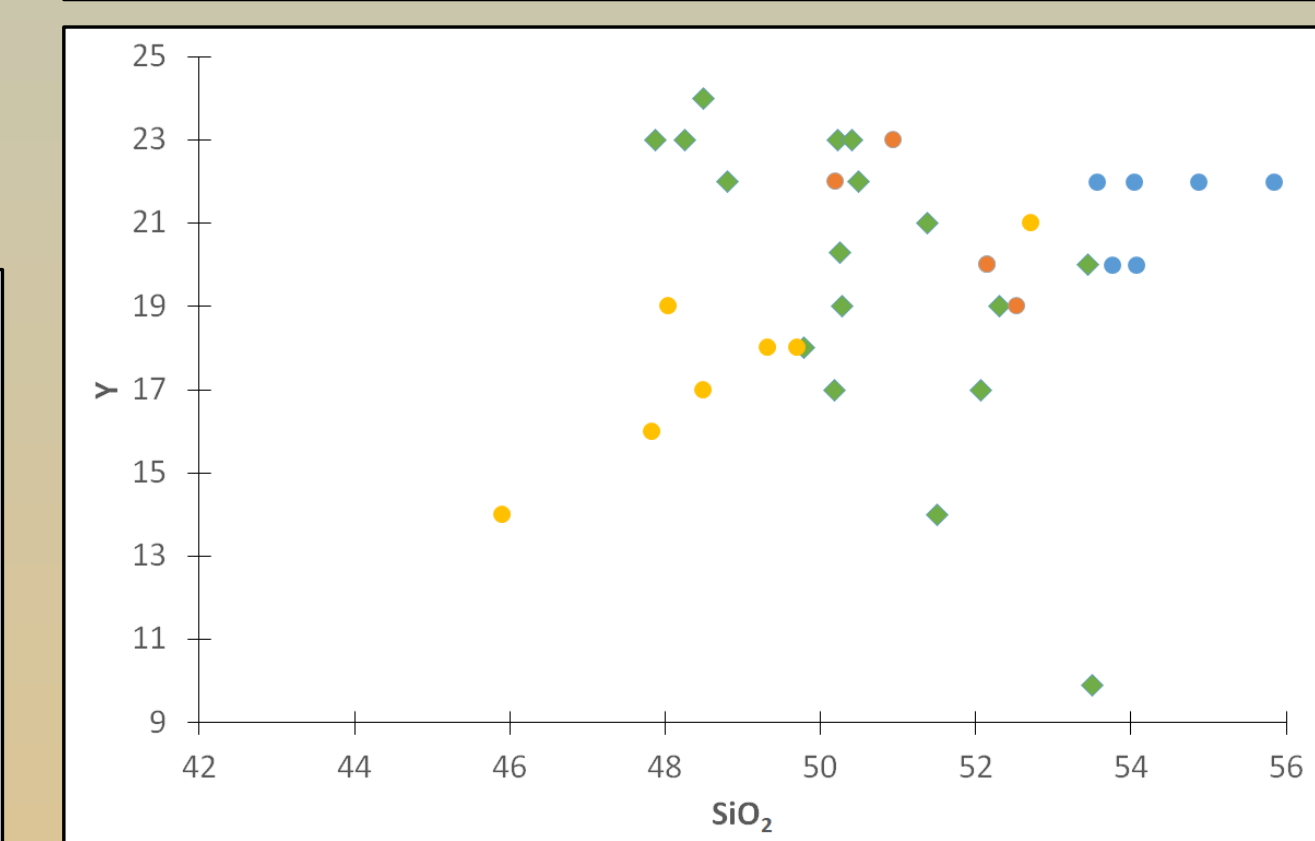
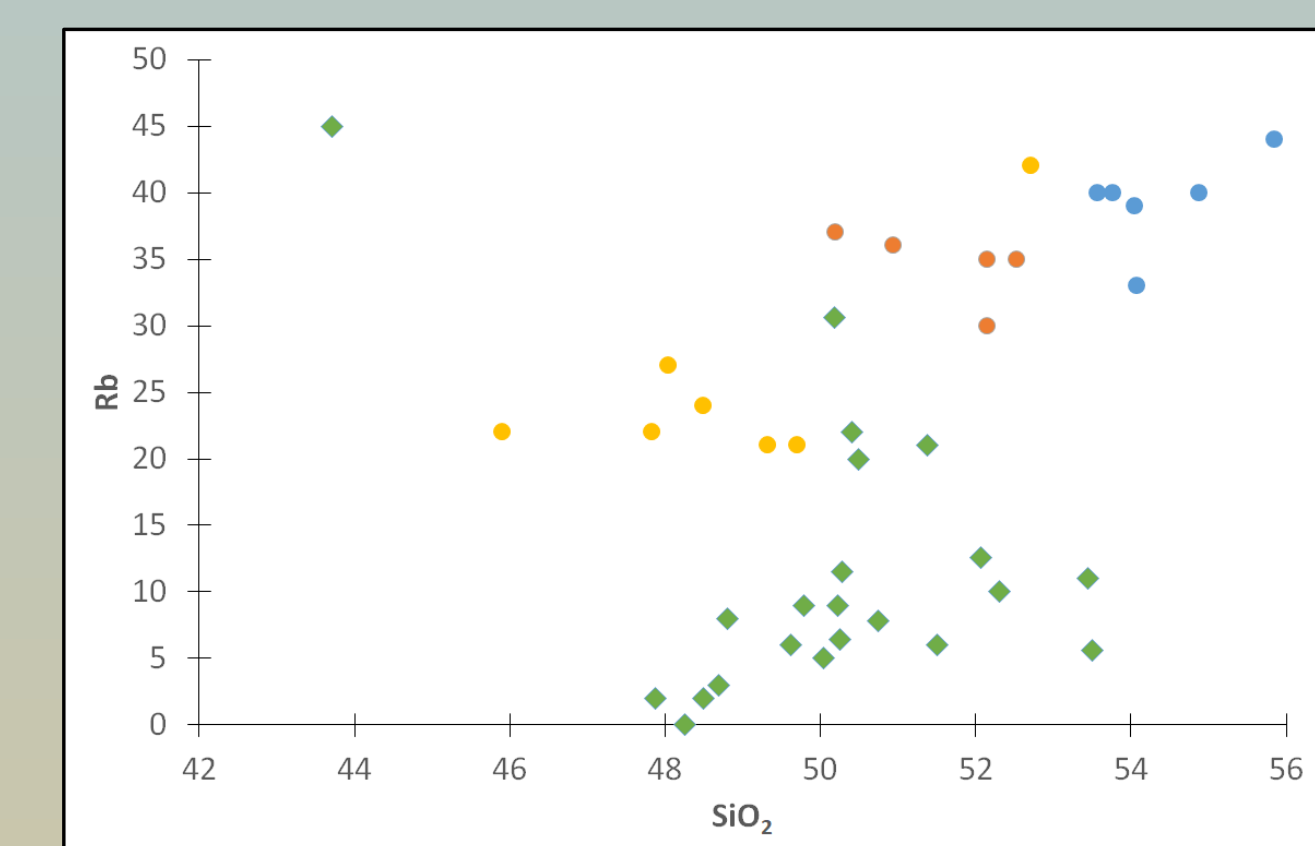
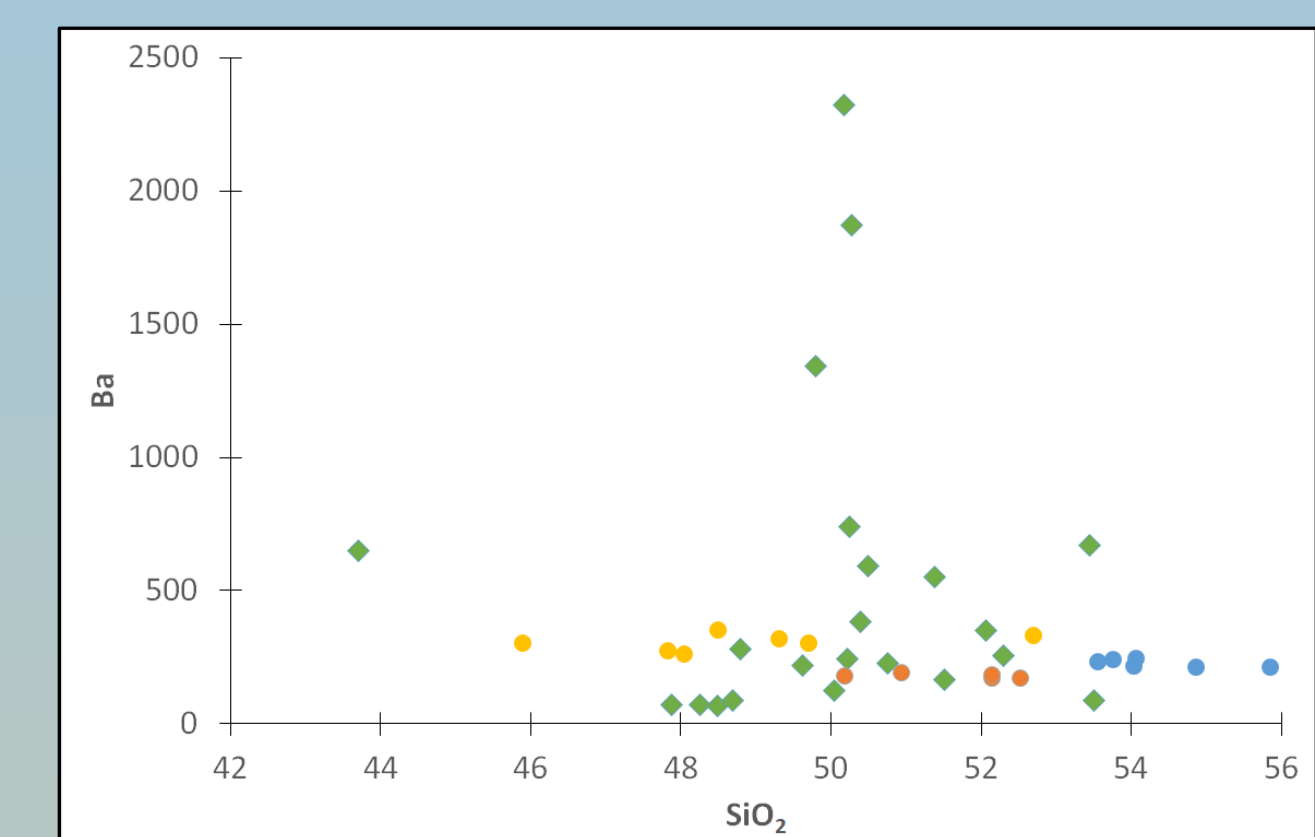
CLB, PHB and OB: Petrographic Observations

1. CLB, PHB, and OB basalts and basaltic andesites are petrographically similar to intra-graben primary and near-primary basalts containing pyroxene and plagioclase phenocrysts, but are dissimilar in that olivine is not ubiquitously present. (Olivine is observed only in PHB samples.)
2. PHB samples contain abundant plagioclase and exhibit the greatest amount of pyroxene.
3. OB samples are highly vesicular, contain plagioclase and partially resorbed pyroxene phenocrysts, and exhibit the greatest amount of groundmass glass.
4. CLB samples are dominated by plagioclase phenocrysts and contain the least amount of groundmass glass.

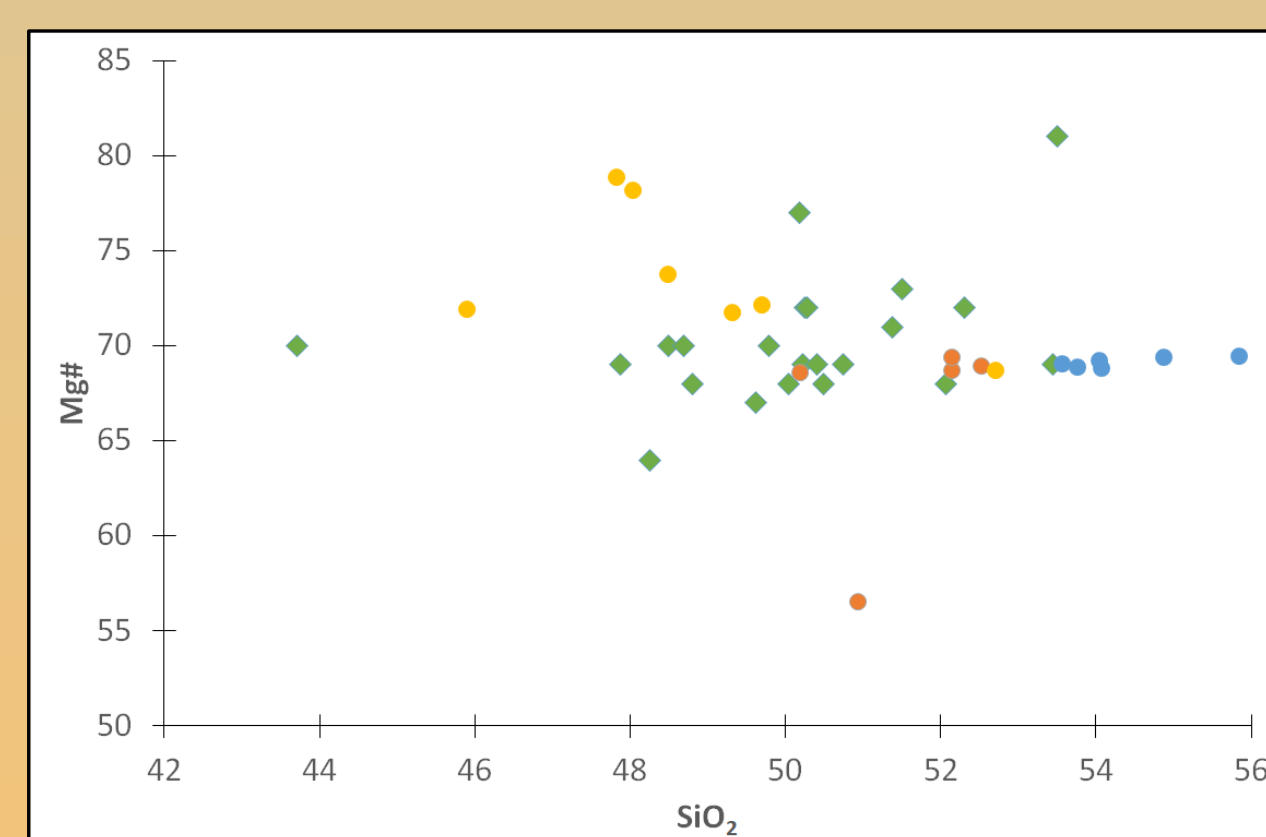
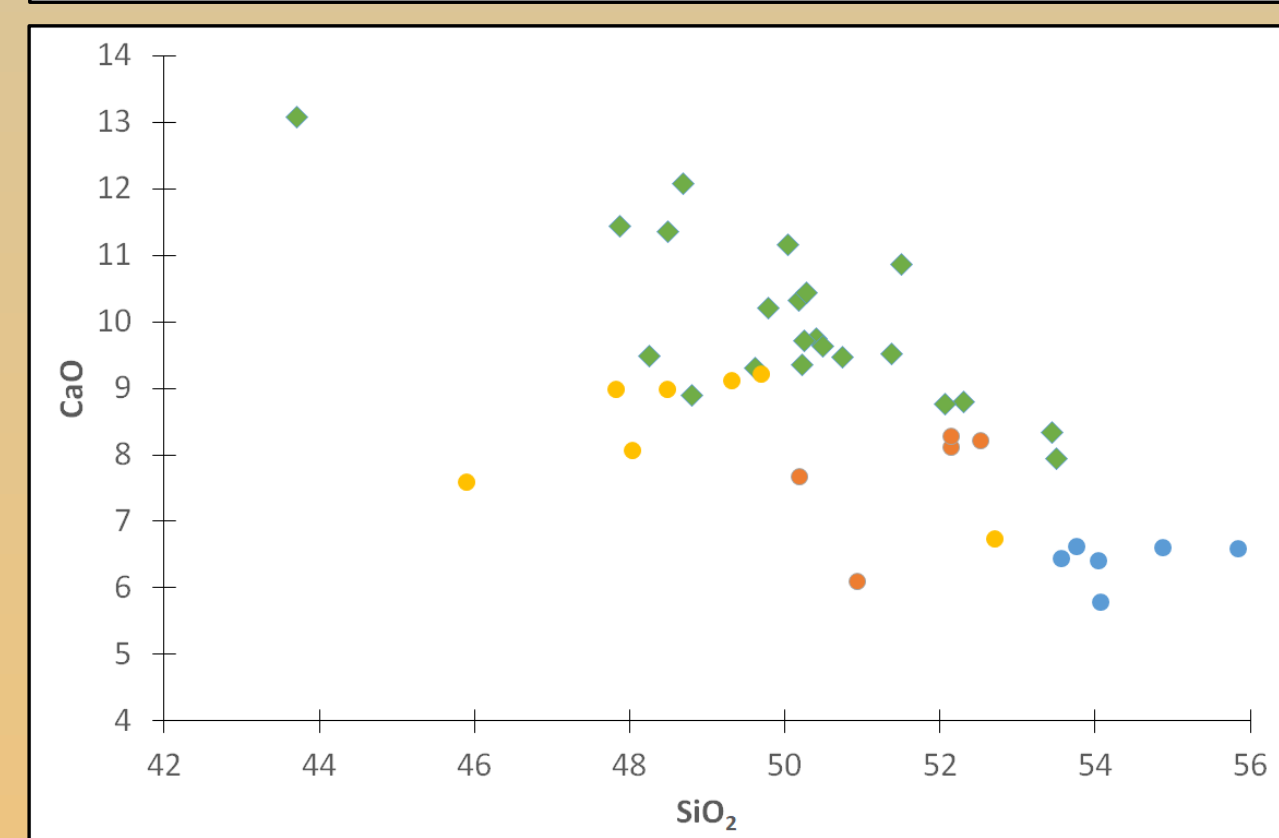
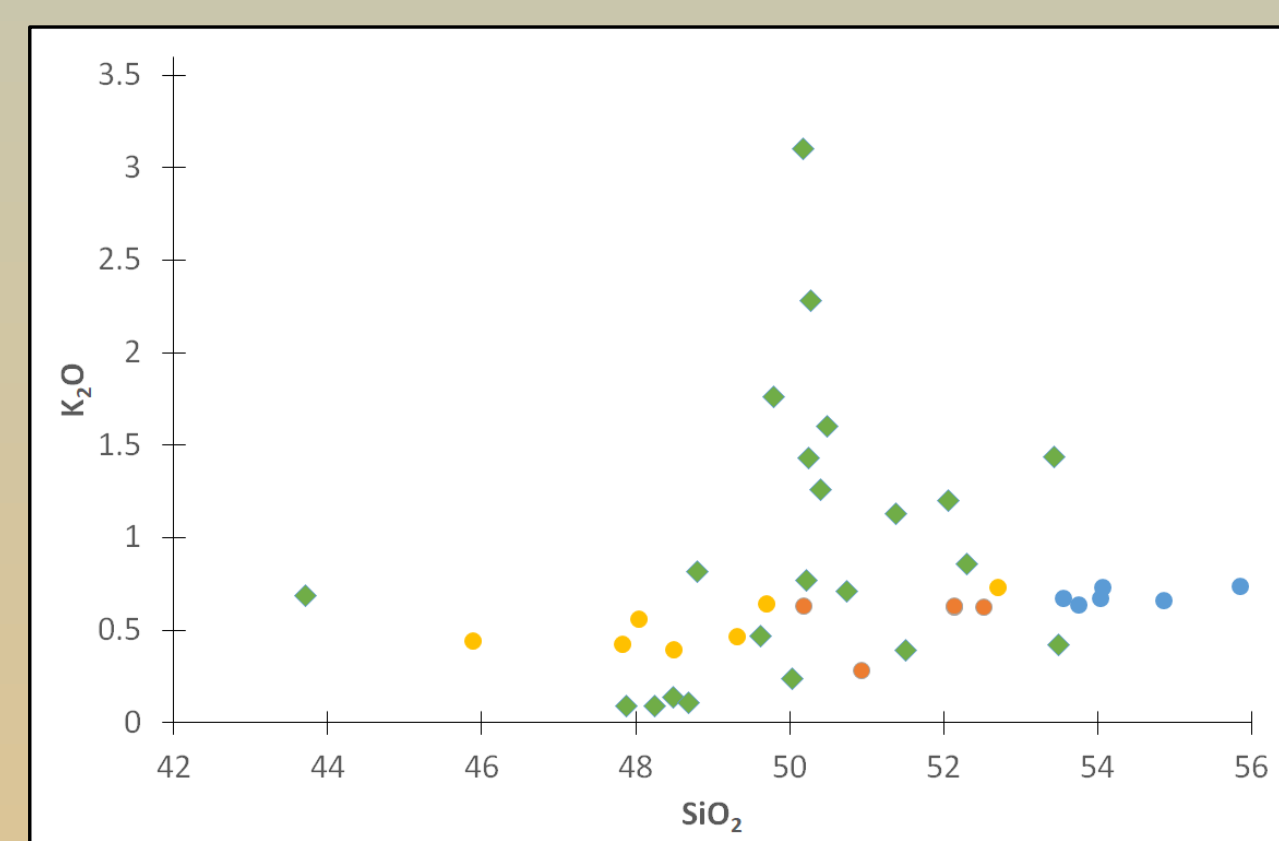
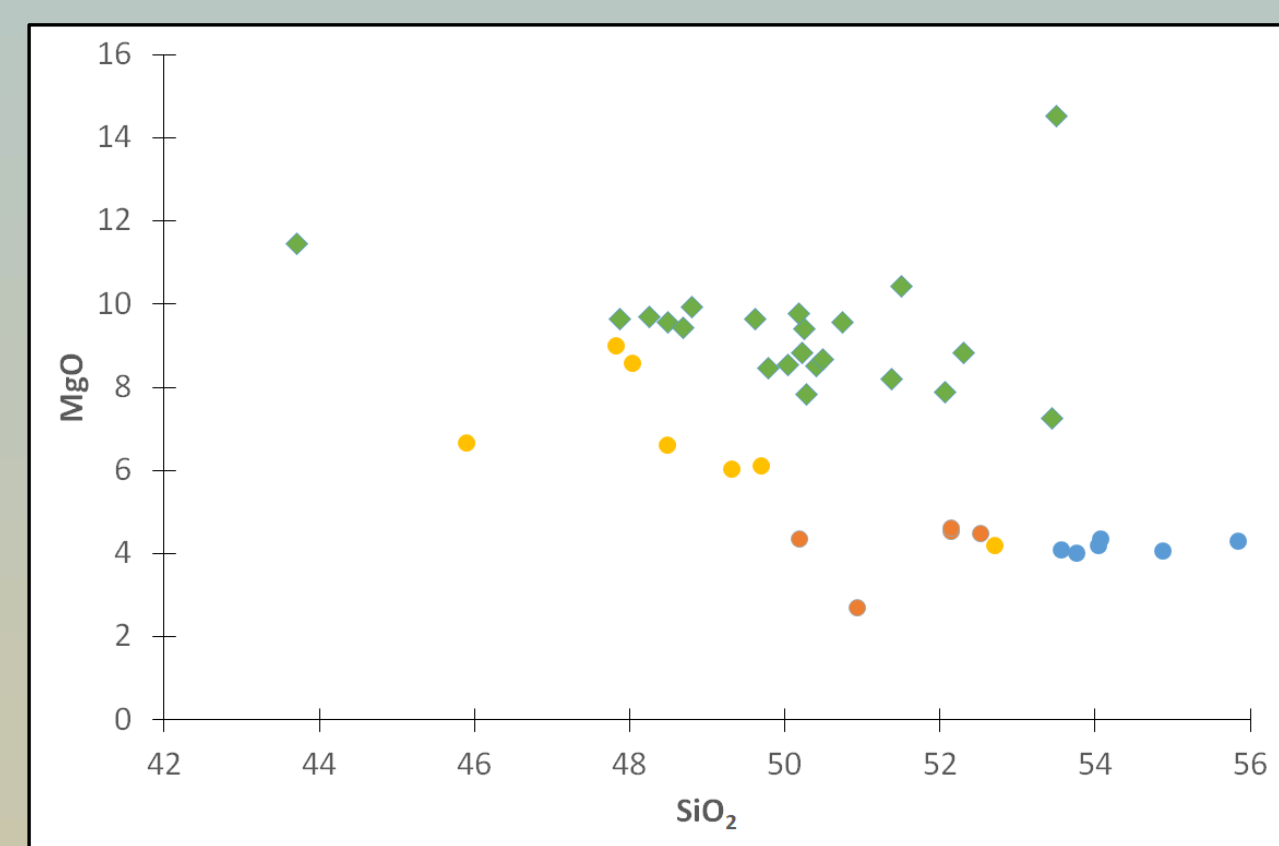
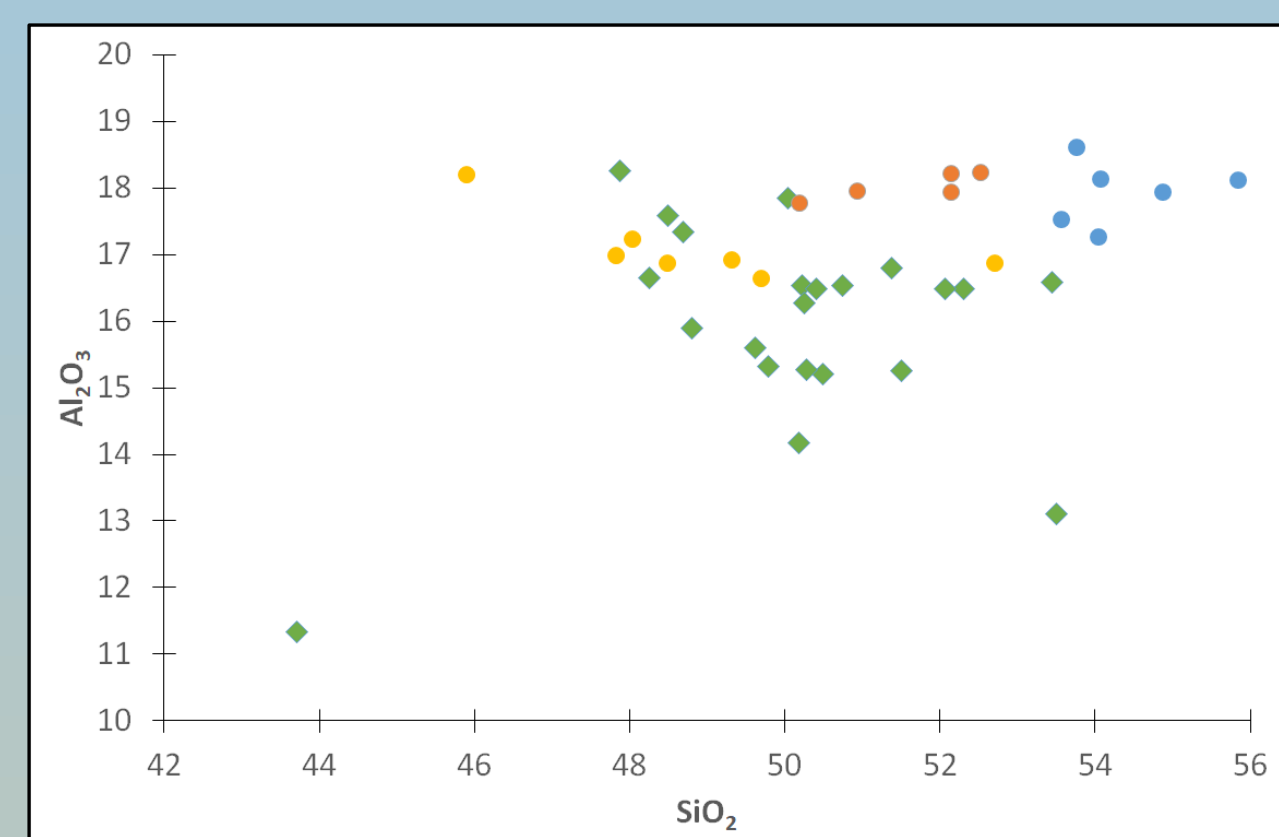
CLB, PHB and OB: Geochemical Observations

1. Lavas at CLB, PHB, and OB are low to medium-K basalts and basaltic andesites ($\text{SiO}_2 = 45.9\text{-}57.3$ wt%; $\text{K}_2\text{O} = 0.28\text{-}0.73$ wt%), similar in composition to intra-graben primary and near-primary basalts interpreted to have formed via decompression-induced melting (Conrey et al., 1997).
2. CLB, PHB and OB lavas are characterized by notably lower ranges in MgO (4.0-9.0 wt%) and CaO (5.8-9.2 wt%), and higher ranges in Al_2O_3 (16.6-18.6 wt%) and Rb (21-44 ppm), as compared to intra-graben primary and near-primary basalts.)

Trace Element Geochemistry



Major Element Geochemistry



References

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