Overlapping calc-alkaline and tholeiitic magmatism in the southernmost Cascade Range

L.J.P. MUFFLER[1] AND M.A. CLYNNE[2]

[1]U.S. Geological Survey, Volcano Hazards Team, Menlo Park, CA, USA (pmuffler@usgs.gov)
[2]U.S. Geological Survey, Volcano Hazards Team, Menlo Park, CA, USA (mclynne@usgs.gov)

The Lassen region of NE California (Clynne and Muffler, in press) consists of <3.5 m.y. volcanic rocks derived from two distinct parental magmas: calc-alkaline basalt, and low-potassium olivine tholeiitic basalt (LKOT). The two parental magmas are derived from distinct mantle sources (Clynne, 1993; Clynne and Borg, 1997; Borg *et al*., 2002). The calc-alkaline basalt dominates in both volume and vent abundance and is related to Cascade arc magmatism. It displays a range of primitive geochemistry produced by flux and decompression melting with variable proportions of mantle- and slab-derived components. Calc-alkaline basalt and its derivative more-silicic magmas built a broad platform 4 km thick of basalts–andesites within which are intercalated a few voluminous long-lived volcanic centers with compositions as silicic as rhyolite (e.g., the Lassen Volcanic Center). LKOT erupted from fissures between the calc-alkaline volcanoes and floods intervening valleys, commonly forming large-volume but thin flows of remarkable chemical and petrographic homogeneity. The few LKOT vents west of the active Cascade arc are of small volume. LKOT is produced by decompression melting of depleted sub-continental peridotite (Borg *et al.*, 2002). Vents for LKOT appear to be related to extensional tectonism along the western margin of the Basin and Range geologic province. Edifices containing both calc-alkaline and LKOT rocks are not recognized, even though their vents can be associated in space and time. For example, the vents for the 24 ka Hat Creek LKOT Basalt are only 0.5 km from 46–75 ka vents of the Sugarloaf chain of calc-alkaline andesites.

References

Borg L.E., Blichert-Toft J. and Clynne M.A., (2002), *J. Petrol.* **43**, 705–723.

Clynne M.A., (1993), Ph.D. Dissertation, Univ. Calif. Santa Cruz, 404 p.

Clynne M.A. and Borg L.E., (1997), *Can. Mineral.* **35**, 453–472.

Clynne M.A. and Muffler L.J.P., (in press), U.S. Geol. Survey, Misc. Inv. Map, scale 1:50,000.

Basalts and high-Mg andesites from the Northern Cascade arc (Glacier Peak, Washington): Insights into mantle and crustal processes

S.M. DEBARI[1], D.D. TAYLOR[1] AND T.W. SISSON[2]

[1]Geology Dept., MS-9080, Western Washington Univ., Bellingham, WA 98225 (debari@geol.wwu.edu)
[2]USGS, Menlo Park, CA, USA (tsisson@usgs.gov)

Four Quaternary mafic cinder cones and flows are present 5-15 km south of Glacier Peak, a dacitic stratovolcano in the northern segment of the Cascade arc. These include the Whitechuck high-alumina olivine tholeiite (HAOT) and the calcalkaline (CA) basalts and basaltic andesites of Indian Pass, Lightning Creek, and Dishpan Gap. Whitechuck lavas have high Al_2O_3 (>18 wt.%), low K_2O (<0.45 wt.%), and trace element characteristics similar to HAOT in the central and southern Cascades. All of the CA lavas have Mg# >58. Indian Pass lavas are the most primitive, with 51-54 wt.% SiO_2, Mg# 65-68, 260-307 ppm Cr, and 160-217 ppm Ni. Lightning Creek and Dishpan Gap lavas are basaltic andesites with lower Ni and Cr than Indian Pass. Most samples have olivine in equilibrium with bulk rock compositions.

Ba/Nb is lower in the HAOT than for the CA lavas, indicating that they had the least amount of subduction zone enrichment. However, Nb and Ta concentrations are also lower in HAOT than in CA lavas, suggesting a more depleted source (or higher degree of partial melting). Of the three mantle domains inferred beneath the Cascades, only MORB-source mantle and subduction-fluxed mantle are represented beneath the Glacier Peak region. No OIB-like mantle domain is thus-far known in the Cascades north of the Mt. Rainier region. This could indicate a boundary in the mantle between the southern and northern Cascade arc segments.

None of the suites can be related to each other by fractional crystallization or mixing and must be derived from distinct sources. In addition, the range of major and trace element compositions *within* two of the CA suites (Lightning Creek and Dishpan Gap) cannot be modeled by fractional crystallization, but instead show a distinct mixing trend toward Glacier Peak dacite. Sr and La *decrease* with increasing SiO_2 in these suites, and modeling shows that those high-Mg andesites are derived by mixing between primitive magmas and dacite, possibly derived from the crust. Disequilibrium phenocryst textures support this conclusion.