APPENDIX

Petrography

Although the lavas studied are generally sparsely phyric, each sample contains at least one olivine phenocryst population that always includes euhedral or slightly rounded crystals up to ~3 mm across. The large olivine phenocrysts host chromian spinel inclusions (Fig. 2a) that were investigated by Clynne and Borg (1997). Some lavas contain smaller skeletal olivine phenocrysts (Fig. 2d) and in these rocks, the larger olivine phenocrysts commonly have thin, sometimes more Fe-rich, hopper growths. All rear-arc and approximately half of the forearc lavas contain skeletal olivine microphenocrysts. In the study area, at least half of the calc-alkaline forearc lavas (1009, 017, 015, 020, 036, 033, 037, 034, and 032) and northern arc axis lavas (012 and 001) have a sub-population (<3%) of large olivine phenocrysts with orthopyroxene coronas. Some lavas contain olivine-bearing crystal clots (012, 013, 031, 032, 033, 035, 036, and 039).

Orthopyroxene crystals >0.25 mm across are present in three calc-alkaline basaltic andesitic lavas (036 and 037 in the southern forearc, and 001 on the northern arc axis) and one northwest forearc calc-alkaline basaltic lava (017). The orthopyroxene crystals often include minor populations with nonequilibrium textures including resorption and sieved zones with clear rim overgrowth, and sutured grain boundaries in crystal clots.

Clinopyroxene crystals (Figs. 2b) are restricted to calc-alkaline lavas where they occur in glomerocrysts (sometimes with olivine) and as individual phenocrysts. Clinopyroxene is most common in lavas from the northwestern forearc and arc axis regions. It is sporadically present in lavas from the southwest forearc and sparse in lavas erupted from back-arc vents. In several lavas, particularly those from the northwestern forearc region, clinopyroxene crystals have sieved zones surrounded by clear overgrowths. Clinopyroxene in glomerocrysts frequently have sutured grain boundaries, in addition to resorption/regrowth textures such as sieved horizons surrounding clear cores. Cumulate olivine and pyroxene is present in 036 (cf. Clynne 1993).

In 6 of 11 lavas collected from the southern forearc and arc axis areas, no plagioclase phenocrysts are present; the other samples contain multiple plagioclase populations including both zoned (Fig. 2c) and sieved crystals with clear overgrowths. In the northwest forearc and northern arc axis areas, multiple plagioclase populations are often present; only two samples (014 and HAOT 013) have a single population of clear plagioclase. Five of nine northeast rear-arc lavas contain multiple plagioclase populations. Finally, multiple plagioclase populations including sieved crystals with clear overgrowths are present in HAOT samples 002 and 030.

Groundmass textures of the calc-alkaline lavas range from intergranular to hyalo-ophitic, and the three HAOT lavas are sub-ophitic to intersertal (cf. Clynne 1993). Proportions and overall coarseness of groundmass phases (i.e., plagioclase, pyroxenes, opaques, and olivine) vary among the lavas; 22 samples contain <1% glass, while the three glassiest hyalo-ophitic samples contain 7–10% glass. Diktytaxitic textures are common in HAOT samples. Vesicularity is low (<1%) in ~50% of the lavas; other samples have heterogeneous vesicles sizes and shapes with up to 20% vesicularity in a few cases.

Many samples (69%) contain olivine with thin iddingsite coatings. Other secondary mineral phases present include hyalite (31% of the samples), hydrous iron oxides (31% of the samples), and zeolites (17% of the samples). In nearly all samples, the secondary minerals constitute <<1 vol% of the rock. Although about 40% of the lavas contain quartz xenocrysts or small hornfels xenoliths, these materials constitute <<1 vol% of the rock in all cases.