

### Appendix 3. Detailed Petrography.

#### A3.1 Introduction.

This appendix contains petrographic descriptions of all thin sections from the Blanco Trough suite. Because one of the more important aspects of this study is mineral-melt equilibria, descriptions focus on phenocrysts present in the glassy rind of the pillow, unless otherwise indicated. Grains are divided based on size and morphology into phenocrysts (diameter  $\geq 0.5$  mm), microphenocrysts ( $0.5$  mm > diameter >  $0.05$  mm), and microlites (diameter  $\leq 0.05$  mm). Stated grain sizes are averages of  $\sim 10$  grains that display good euhedral morphology, and are reported in millimeters. Very small grain sizes (e.g. chromian spinel, olivine and plagioclase microlites) are less accurate.

#### A3.2 Petrographic Descriptions.

##### VG-169:

Glass rind  $\sim 2.0$  mm thick.

Olivine: Most common as euhedral to subhedral microphenocrysts ( $0.20 \times 0.30$ ), but also present as microlites ( $\sim 0.03 \times 0.04$ ) and phenocrysts ( $0.60 \times 0.70$ ). Embayments present, but not common. Forms occasional glomerocrysts with plagioclase.

Chromian Spinel: Present only as euhedral to subhedral inclusions in olivine ( $\sim 0.02 \times 0.02$ ).

Plagioclase: Plagioclase is more abundant in this sample than in any other. It is common both as larger bladed laths ( $0.10 \times 0.25$ ), and smaller, acicular laths ( $0.02 \times 0.15$ ). Commonly occurs in glomerocrysts with olivine. Some grains display zoning.

##### VG-172:

Glass rind  $\sim 3.1$  mm thick.

Olivine: Common as euhedral microphenocrysts ( $0.10 \times 0.15$ ), but may have skeletal or bladed morphology. Microlites are absent in the glass. Microphenocrysts are commonly surrounded by spherulites in the glass.

Chromian Spinel: Rare. Present as occasional small subhedral inclusions in olivine or at the center of spherulites in the glass.

Plagioclase: Absent.

**VG-178:**

Glass rind ~4.2 mm thick.

Olivine: Common as euhedral or skeletal microphenocrysts (0.10 x 0.15). Microphenocrysts with bladed morphologies are present in the crystalline zone. Microlites are absent in the glass. Microphenocrysts are commonly surrounded by spherulites in the glass.

Chromian Spinel: Absent.

Plagioclase: Absent.

**VG-340:**

Glass rind ~1.0 mm thick. Total area of glass is very small.

Olivine: Olivines in finely crystalline zone are commonly euhedral microphenocrysts (0.25 x 0.40). Microphenocrysts with bladed morphologies are present in the crystalline zone. Microcrolites (~0.01 x 0.02) are scattered throughout the matrix. Olivine "ring-structures" are present in the crystalline zone.

Chromian Spinel: Absent.

Plagioclase: Absent.

**VG-342:**

Glass rind ~2.1 mm thick.

Olivine: Very few phenocrysts present in glass. Euhedral to subhedral phenocrysts (0.65 x 0.75) and microphenocrysts (0.15 x 0.30) are present. Large resorbed-looking grain (~0.65 x 0.80) on edge of section. Microlites are common in the glass, and most are probably olivine, but interference colors are difficult to distinguish due to grain size.

Chromian Spinel: Equigranular. Present as euhedral to subhedral inclusions in olivine (~0.05 x 0.06), as well as along olivine grain boundaries. A few phenocrysts possible in glass.

Plagioclase: Small laths (~0.02 x 0.06) are present in the glass. Two larger grains are present in

the outer part of the crystalline zone. The first ( $\sim 0.20 \times 0.60$ ), intergrown with euhedral-looking olivine and spinel, shows highly resorbed texture (diamond-shaped outline) and may be xenocrystic. The second ( $\sim 0.06 \times 0.20$ ), located very near the first, is a lath.

**VG-345:**

Glass rind  $\sim 2.2$  mm thick.

Olivine: Common as euhedral to subhedral microphenocrysts ( $0.30 \times 0.45$ ). Euhedral microlites present in the glass ( $\sim 0.04 \times 0.07$ ).

Chromian Spinel: Present as euhedral to subhedral inclusions ( $\sim 0.03 \times 0.04$ ) in olivine only.

Plagioclase: Present in glass as microlite laths ( $0.04 \times 0.15$ ). Some microlites form glomerocrysts with olivine microlites. Small laths present just inside spherulitic zone ( $0.13 \times 0.50$ ).

**VG-347:**

Glass rind  $\sim 2.4$  mm thick.

Olivine: Abundant as dominantly euhedral microphenocrysts ( $0.25 \times 0.40$ ). Present as microlites in the glass ( $\sim 0.02 \times 0.02$ ). Microphenocrysts commonly form glomerocrysts.

Chromian Spinel: Abundant as euhedral inclusions in olivine and free in the glass. Size is variable ( $\sim 0.02 \times 0.02$  is common).

Plagioclase: Present as small laths in glass ( $0.05 \times 0.25$ ). Sometimes intergrown with olivine microlites.

**VG-348:**

Glass rind  $\sim 2.5$  mm thick.

Olivine: Abundant as microphenocrysts ( $0.25 \times 0.50$ ) which display a range of grain sizes. Microlites ( $\sim 0.05 \times 0.05$ ) are common throughout the glass. Glomerocrysts, with grains ranging in size from microlites to small microphenocrysts, are found throughout the section.

Chromian Spinel: Abundant as dominantly euhedral inclusions in olivine, on olivine grain boundaries, and in the glass ( $\sim 0.05 \times 0.05$ ). Forms occasional glomerocrysts.

Plagioclase: Absent in the glass, but a few grains ( $\sim 0.03 \times 0.20$ ) are present in the outer portion of the crystalline zone.

**VG-355:**

Glass rind ~2.0 mm thick.

Olivine: Most common as euhedral to subhedral microphenocrysts (0.10 x 0.15), but also commonly present as microlites (~0.03 x 0.05). Some microphenocrysts show skeletal textures.

Grains commonly surrounded by spherulites.

Chromian Spinel: Absent.

Plagioclase: Small grain surrounded by spherulite in outer portion of spherulitic zone displays apparent albite twinning.

**VG-356:**

Glass rind ~2.3 mm thick.

Olivine: Commonly occur as euhedral to subhedral microphenocrysts (0.15 x 0.25), which sometimes form glomerocrysts. Occasionally forms intergrowths with plagioclase laths.

Microlites (~0.03 x 0.05) are scattered throughout the glass.

Chromian Spinel: Most commonly occurs as dominantly euhedral inclusions in olivine, but also found in the glass (~0.02 x 0.02).

Plagioclase: Occurs as laths (~0.03 x 0.15), which commonly form glomerocrysts. Often surrounded by spherulites.

**VG-357:**

Glass rind ~1.7 mm thick.

Olivine: Common as euhedral to subhedral microphenocrysts (0.15 x 0.25). Some bladed morphologies present. Sometimes forms glomerocrysts and intergrowths with plagioclase laths. Subhedral grain in crystalline zone which displays deformation bands and fluid inclusions could be xenocrystic.

Chromian Spinel: Most common as dominantly euhedral inclusions in olivine, but also occurs in the glass (~0.02 x 0.02).

Plagioclase: Occurs as laths in the glass (0.05 x 0.20). Does not form intergrowths as frequently as in other samples, although intergrown plagioclase, and olivine-plagioclase intergrowths do

occur.

**VG-358:**

Glass rind ~3.1 mm thick. Total area of glass is very small

Olivine: Abundant euhedral to subhedral microphenocrysts (0.10 x 0.20), commonly with glass inclusions. One large grain (~0.15 x 0.35) is embayed. Bladed and skeletal morphologies are present. Microlites (~0.03 x 0.10) not uncommon.

Chromian Spinel: Absent.

Plagioclase: Absent.

**VG-360:**

Glass rind ~2.0 mm thick. Glass is very dark (thick section?).

Olivine: Euhedral to subhedral microphenocrysts (0.20 x 0.30) are abundant, and microlites (~0.03 x 0.05) are also present in the glass. Some microphenocrysts appear to be bladed, but are oblique to the plane of the section. Embayments are present in some grains. Commonly forms glomerocrysts.

Chromian Spinel: Present euhedral to subhedral inclusions in olivine and in the glass (~0.04 x 0.04).

Plagioclase: A few laths (0.05 x 0.15) present in the glass. Some intergrown with olivine.

**VG-368:**

Glass rind ~5.0 mm thick.

Olivine: Euhedral to subhedral microphenocrysts (0.15 x 0.25) are common, while microlites (~0.03 x 0.05) are present, but not common. A few bladed grains are present, and a few skeletal grains are present in the crystalline zone. Microphenocrysts commonly form glomerocrysts.

Chromian Spinel: Rare. Small, subhedral grains (~0.02 x 0.02) occur as inclusions in olivine only.

Plagioclase: Absent.

**VG-370:**

Glass rind ~3.7 mm thick.

Olivine: Euhedral to subhedral microphenocrysts ( $0.20 \times 0.35$ ) are common, with some displaying skeletal textures. Some bladed morphologies are present. Microlites ( $\sim 0.02 \times 0.04$ ) occur throughout the glass. Microphenocrysts sometimes form glomerocrysts.

Chromian Spinel: Fairly abundant, occurring as euhedral to subhedral inclusions in olivine, as well as in the glass ( $\sim 0.02 \times 0.02$ ).

Plagioclase: Occurs as laths ( $0.05 \times 0.25$ ) in the glass, commonly surrounded by spherulites. Rarely intergrown with olivine.

#### **VG-372:**

Glass rind  $\sim 3.7$  mm thick.

Olivine: Microlites ( $\sim 0.03 \times 0.05$ ) tend to be euhedral or bladed, and are more abundant than microphenocrysts. Microphenocrysts ( $0.15 \times 0.25$ ) are euhedral to subhedral. A well developed bladed microphenocryst is present in the crystalline zone.

Chromian Spinel: Absent.

Plagioclase: Absent.

#### **VG-373:**

Glass rind  $\sim 2.8$  mm thick.

Olivine: Grains tend to be euhedral to subhedral. Grain size ranges from phenocrysts ( $0.60 \times 1.00$ ), to microphenocrysts ( $0.30 \times 0.40$ ) and microlites ( $\sim 0.04 \times 0.06$ ). Larger grains tend to show embayments. Subhedral grain in crystalline zone which displays deformation bands and fluid inclusions could be xenocrystic.

Chromian Spinel: Abundant as both inclusions in olivine and in the glass. Grains are euhedral to subhedral, and display a range of sizes, with the most common  $\sim 0.05 \times 0.05$ .

Plagioclase: Common as laths ( $0.05 \times 0.30$ ) which tend to form glomerocrysts and intergrowths with olivine.

**VG-376:**

Glass rind ~3.7 mm thick.

Olivine: Abundant as euhedral to subhedral microphenocrysts (0.20 x 0.30), commonly forming glomerocrysts. Microlites (~0.02 x 0.04) are common throughout the glass. Olivine "ring-structures" are present in the crystalline zone.

Chromian Spinel: Abundant as euhedral to subhedral inclusions in olivine and in the glass (~0.04 x 0.04).

Plagioclase: Common as laths (0.05 x 0.25) which tend to form glomerocrysts, and sometimes intergrowths with olivine.

**VG-378:**

Glass rind ~3.0 mm thick.

Olivine: Most common as euhedral to subhedral microphenocrysts (0.20 x 0.35) which commonly form glomerocrysts. Skeletal and bladed morphologies present. Microlites (~0.03 x 0.05) are less common, but present throughout the glass.

Chromian Spinel: Present as euhedral to subhedral inclusions in olivine and in the glass (~0.03 x 0.03).

Plagioclase: Absent.

**VG-380:**

Glass rind ~5.1 mm thick.

Olivine: Euhedral to subhedral microphenocrysts (0.20 x 0.40) are common. some grains show skeletal textures. Some grains may be embayed, but presence of skeletal textures make this uncertain. Microlites (~0.03 x 0.05) are present in the glass, but not abundant.

Chromian Spinel: Absent.

Plagioclase: Absent.

**VG-381:**

Glass rind ~3.2 mm thick.

Olivine: Euhedral to subhedral microphenocrysts (0.15 x 0.30) are common. Some grains display skeletal and bladed morphologies. Some grains may be embayed, but presence of skeletal textures make this uncertain. Microlites (~0.03 x 0.10) are present in the glass, but not abundant.

Chromian Spinel: Absent.

Plagioclase: Absent.

**VG-382:**

Glass rind ~7.6 mm thick.

Olivine: Euhedral to subhedral microphenocrysts (0.20 x 0.30) are most common. Bladed morphologies are present. Larger grains more commonly embayed, also tend to contain more glass inclusions. Microlites (0.02 x 0.05) are present, but not abundant.

Chromian Spinel: Absent.

Plagioclase: Absent.

**VG-383:**

Glass rind ~ 1.2 mm thick. Glass is very dark (thick section?).

Olivine: Microphenocrysts (0.15 x 0.25) are subhedral, commonly displaying deep embayments.

Euhedral to subhedral microlites (~0.02 x 0.06) are found throughout the glass.

Chromian Spinel: Absent.

Plagioclase: A few laths (0.03 x 0.15) are present in the microcrystalline zone, intergrown with olivine.

**VG-384:**

Glass rind ~ 4.0 mm thick.

Olivine: Common as euhedral to subhedral microphenocrysts (0.35 x 0.50), with some grains displaying embayments. Microlites (~0.03 x 0.05) are found throughout the glass.

Microphenocrysts commonly form glomerocrysts. Subhedral grain in crystalline zone which



displays deformation bands and fluid inclusions could be xenocrystic.

Chromian Spinel: Common as euhedral to subhedral inclusions in olivine and in the glass ( $\sim 0.02 \times 0.02$ ).

Plagioclase: Common as laths ( $0.05 \times 0.20$ ) in the glass. Sometimes forms glomerocrysts and intergrowths with olivine, but most abundant as single laths.

#### VG-385:

Glass rind  $\sim 2.2$  mm thick.

Olivine: Microphenocrysts ( $0.35 \times 0.50$ ) are dominantly euhedral to subhedral, although some glomerocrysts contain anhedral grains. Microlites are common throughout the glass. Subhedral grain which displays deformation bands and fluid inclusions could be xenocrystic.

Chromian Spinel: Abundant as euhedral to subhedral inclusions in olivine ( $\sim 0.03 \times 0.03$ ). Some grains may be present in the glass.

Plagioclase: Common as laths ( $0.05 \times 0.35$ ), displaying a range of grain sizes.

#### VG-387:

Glass rind  $\sim 3.3$  mm thick. Total area of glass is very small.

Olivine: Euhedral to subhedral microphenocrysts ( $0.15 \times 0.25$ ) are the dominant grain size, commonly forming glomerocrysts. Microlites ( $\sim 0.03 \times 0.05$ ) are not as common, but are present in the glass. Olivine "ring-structures" are present in the crystalline zone.

Chromian Spinel: Absent.

Plagioclase: A few very small laths are probably plagioclase, but small grain size makes it difficult to identify them unambiguously. Inner portion of crystalline zone contains abundant plagioclase microlites, indicating that the liquid, if not actually plagioclase saturated, was very close.