Crystal-Plastic Deformation and Chemical Evolution of Clinoamphibole

by

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(ABSTRACT)

Clinoamphibole from a mylonitic amphibolite, located on Senja, Norway, exhibits microstructures characteristic of dynamic recrystallization, including larger host grains in a finer grained matrix of needle-shaped amphibole. The matrix amphibole defines an LS fabric and host grains have core and mantle structures with a core containing undulose to patchy extinction and (100) deformation twinning surrounded by a mantle of recrystallized grains. In addition intragranular grains also occur within the cores.

TEM analysis of the host grains revealed high densities of dislocations, dislocation arrays/subgrain boundaries parallel to {hk0}, stacking faults, and (100) deformation microtwins. Dark field, weak beam images show that the dislocations are commonly dissociated. Diffraction contrast experiments compared with computer simulation of dislocation images indicate the primary unit Burgers vector is [001]. This information in conjunction with trace analysis of glide loops and dislocation line directions shows that the following glide systems were operative: [001]{110}, [001](100), and possibly [001](010), in order of relative occurrence. These data along with dislocation energies are considered in order to propose a possible model for the [001] unit Burgers vector in the clinoamphibole structure. TEM also showed that matrix grains and intragranular grains have relatively low defect densities, and that the intragranular new grains occur at localities in the host grains characterized by high densities of dislocations. These observations along with the chemical and orientation relationships between the recrystallized grains and their host indicate that the new grains may have formed by heterogeneous nucleation and that further growth probably occurred by both strain assisted and chemically induced grain boundary migration or liquid film migration. This

recrystallization event is interpreted to be synkinematic based on the fact that no recrystallization textures are present in the matrix grains and that the matrix grains define an LS fabric. However, the low defect densities in the matrix grains and the lack of intracrystalline strain in other phases indicate that post-kinematic recovery processes were active.

Acknowledgements

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Chapter 1, "Dynamic Recrystallization and Chemical Evolution of Clinoamphibole from Senja, Norway" has been accepted for publication in Contributions to Mineralogy and Petrology. Chapter 2, "Defect Microstructures in Naturally Deformed Clinoamphibole" has been accepted for publication in The American Mineralogist. Both papers were coauthored with . Appendix B, "AMPHAX: A FORTRAN Program for Calculating the Lower Hemisphere Stereographic projection of Clinoamphibole from Universal Stage Measurements" is currently in review in Computers and Geosciences.

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Chapter 1: Dynamic Recrystallization and Chemical Evolution of Clinoamphibole from Senja, Norway

INTRODUCTION

Minerals can deform in a variety of ways depending upon the metamorphic environment during strain (Ashby, 1972; White, 1976). Potentially, environmental factors such as the presence and composition of fluids (Hobbs, 1981), strain rate, pressure, and temperature may significantly affect which deformation mechanism is predominant in accommodating strain. Synkinematic recrystallization may also accommodate strain in minerals, and where this occurs without the growth of new mineral phases the process is termed dynamic recrystallization (see Urai et al., 1986 for discussion). In general, dynamic recrystallization has been shown to occur by a complex interplay of subgrain rotation, subgrain growth, grain boundary bulging, and grain growth (Drury et al., 1985). In this paper we describe microstructural and chemical changes accompanying dynamic recrystallization of clinoamphibole.

Clinoamphibole is an important rock forming mineral in several respects. It may comprise a significant component of the lower crust (Rabach, 1987) thereby making its

rheological properties important in deformation. It is also commonly used in isotopic studies because its behavior is well characterized for many isotopic systems.

Previous studies of deformed clinoamphibole have noted a disparity between experimentally and naturally deformed samples. Clinoamphibole typically deforms experimentally by twinning on $(\bar{1}01)$ in the $C_{2/m}$ setting (Buck,1970; Rooney et al., 1970; Rooney et al., 1975; Morrison-Smith, 1976). Although translational glide has been produced in experimentally deformed clinoamphibole (Rooney et al., 1975; Morrison-Smith, 1976) dynamic recrystallization has not been reported. In contrast, $(\bar{1}01)$ twinning has not been reported in naturally deformed clinoamphibole except in environments characterized by exceedingly high strain rates (Chao, 1967; Borg, 1972). Previous studies of naturally deformed clinoamphibole have reported a variety of microstructures on both the optical and TEM scales. These include fracturing, bending and kinking, (100) twinning and the development of subgrains and sheath-like aggregates of recrystallized grains (Biermann, 1979; 1981; Biermann and Van Roermund, 1983). Also, TEM analysis has revealed high densities of dislocations in relic grains and relatively low densities in subgrains and recrystallized grains (Brodie, 1981; Biermann and Van Roermund, 1983). The disparity between experimental results and naturally deformed clinoamphibole is probably a result of the high laboratory strain rates necessary to produce significant strains in sufficiently short times. This emphasizes the need for the study of natural amphiboles.

Sample Location and Geologic Setting

The clinoamphibole analyzed in this study occurs as part of a mylonitic amphibolite contained within amphibolite facies carbonate and pelitic units of the Senja Nappe in northern Norway (Cumbest, 1987: Fig. 1). The Senja Nappe forms part of allochthonous Caledonian sequences that were tectonically emplaced over a Precambrian crystalline complex (Western Gneiss Terrane) during Ordovician tectonic activity (Cumbest and Dallmeyer, 1985; Cumbest,

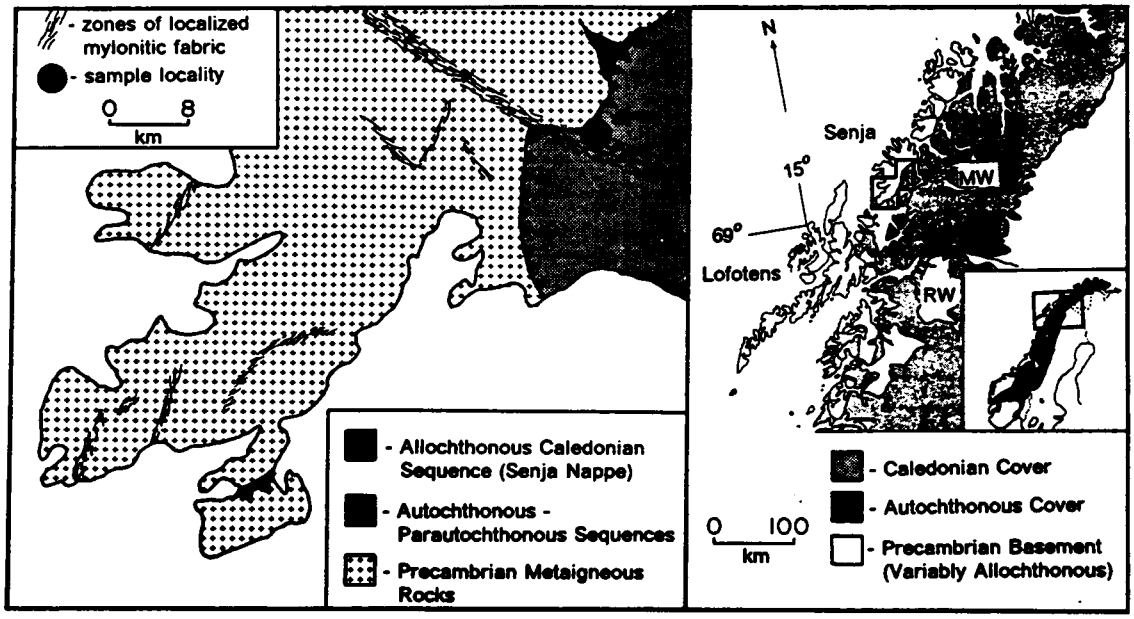


Figure 1. Simplified geologic map of southwestern Senja, Norway: Teeth on upper plate of thrust. Inset shows extent of Caledonian cover in the Scandinavian Caledonides (adapted from Gee, 1978) and in northern Norway (adapted from Andresen, 1980: MW= Maukin Window; RW= Rombac Window). Map area outlined.

1987). Subsequent to emplacement, the basement - cover sequence was overprinted by discrete zones of southwesterly-dipping mylonitic fabrics. The amphibolite occurs along the northern edge of one of these later mylonite zones that is approximately 2 km wide (Fig. 1; Appendix A). The sample location is also near the tectonic contact between the Senja Nappe and the Precambrian crystalline complex. All the lithologies of the Senja Nappe record penetrative ductile strain associated with emplacement of the allochthonous sequence. The strain recorded in the amphibolite is probably a combination of that produced during the nappe emplacement and that produced during the later mylonite-forming event.

Deformation associated with the mylonite zone has rotated the easterly dipping regional fabric formed in association with emplacement of the Senja Nappe to a southerly dip that is coincident with the overall trend of the mylonite zone boundaries. In addition the movement along the zone has resulted in approximately 4 kms of dextral offset of the nappe - basement contact (Hames, 1988). At the sample outcrop the amphibolite has a well defined foliation that dips 70° S. Lineations here plunge 5° towards 100°.

Experimental Techniques

Crystal axes were determined in thin sections with an optical microscope equipped with a universal stage according to the method of Turner and Weiss (1963). This generally involved the measurement of two of the principal axes of the optical indicatrix and at least one cleavage from which the orientation of the crystallographic axes could be calculated (Appendix B). Transmission electron microscopy was carried out at the Institute of Earth Sciences, State University of Utrecht, The Netherlands using a JEOL 200C fitted with a double tilt stage holder and operated at 200 kv. Backscattered SEM was done at The Johns Hopkins University using a JEOL JXA 8600. Dislocation densities were measured according to the method of Ham and Sharpe (1961). Mineral compositions were measured with the ARL-SEMQ electron microprobe at Virginia Polytechnic Institute. Amphibole formulas were recalculated on the

basis of 23 oxygens by the program SUPERRECAL (Rucklidge, 1971). All Fe is reported as Fe^{2+}.

MICROSTRUCTURES

Optical Microstructures

The amphibolite contains a well-developed compositional layering (mm scale) defined by domains consisting predominantly of clinoamphibole and domains of andesine and epidote. This compositional layering is locally folded into open chevron folds. Porphyroblastic biotite occurs parallel to the axial surfaces of these folds. In addition, quartz and minor amounts of tourmaline occur in the matrix. In the amphibole-rich layers, clinoamphibole occurs as larger, ellipsoidal grains (1-5 mm) in a matrix of finer (0.5 - 1 mm), needle-shaped, optically strain-free grains elongate along **c** (Fig. 2) The preferred alignment of the matrix amphibole defines a LS fabric parallel to the compositional layering (Fig. 2).

The larger ellipsoidal grains contain inclusions of quartz and may have intergrowths of biotite around the margins. Phases other than clinoamphibole show no evidence of intracrystalline strain. However, the larger clinoamphibole grains usually have slightly asymmetrical 'tails' of needle-shaped amphibole associated with them (Fig. 2) and they display a variety of microstructures that indicate significant amounts of intracrystalline strain, including undulose to patchy extinction (Figs. 3a and 3b) and commonly (100) deformation twins (Fig. 3c). In addition, these grains typically display core and mantle structures defined by a core with undulose and patchy extinction, with or without (100) deformation twins, surrounded by a mantle of margin grains and subgrains (Figs. 3a and 3b). The margin grains are more common, are typically euhedral, and are separated from the host by high-angle grain bound-

Figure 2. Photograph of amphibolite thin-section (crossed polars): Preferred alignment of matrix clinoamphibole defines LS fabric (trace of foliation marked by F). Two of the host grains analyzed in this study are marked by arrows. Note that the host grains do not form a "stress supporting framework".

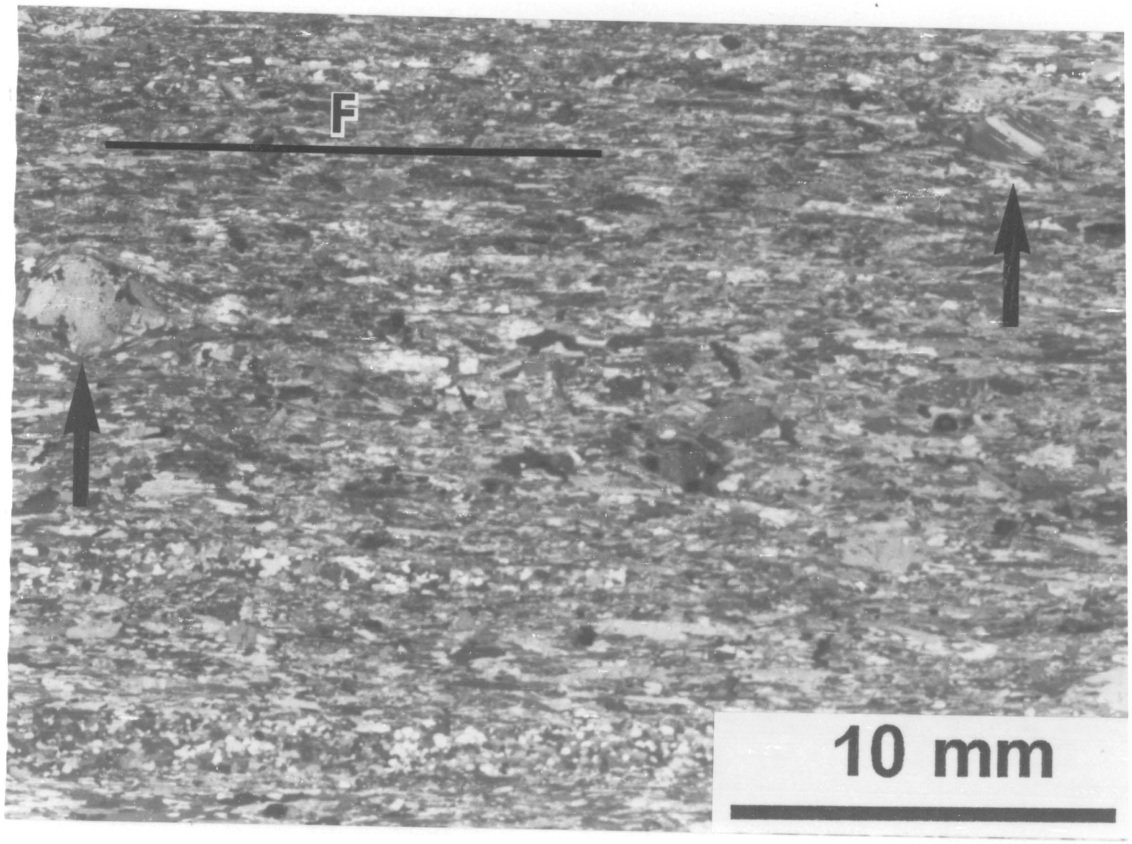
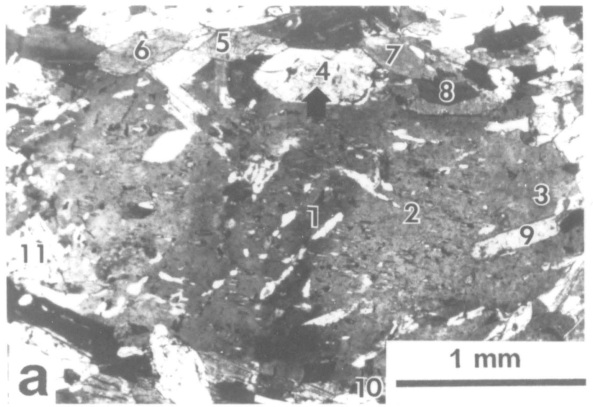
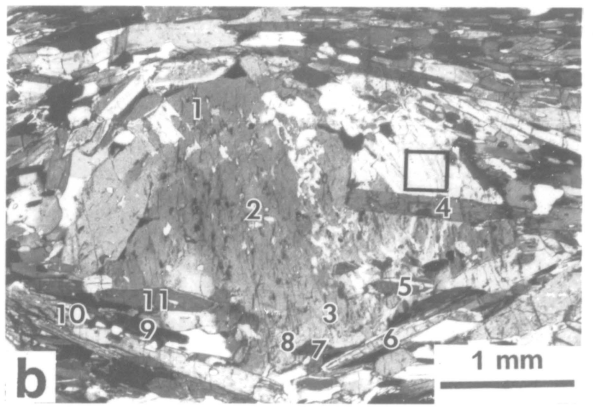
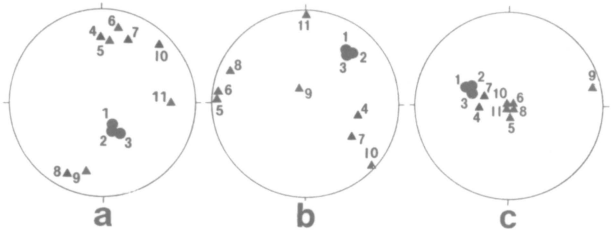

F
10 mm

Figure 3. Optical microstructures seen in clinoamphibole: a) Clinoamphibole host grain with undulose to patchy extinction surrounded by mantle of margin grains (section cut normal to matrix fabric lineation). Euhedral margin grain shown by arrow. Accompanying, equal-angle, lower hemisphere, stereographic projection showing crystal axes of the host grain and selected mantle grains demonstrate that the mantle grains and host are generaly separated by high-angle grain boundaries. b) Clinoamphibole host grain similar to that shown in (a) but section cut parallel to lineation. c) Clinoamphibole host grain with (100) deformation twin. d) Clinoamphibole host with intragranular new grains (arrowed).



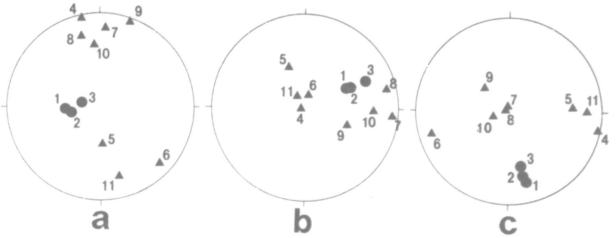




CRYSTALLOGRAPHIC AXES

● - porphyroclast

▲ - recrystallized margin grains



CRYSTALLOGRAPHIC AXES

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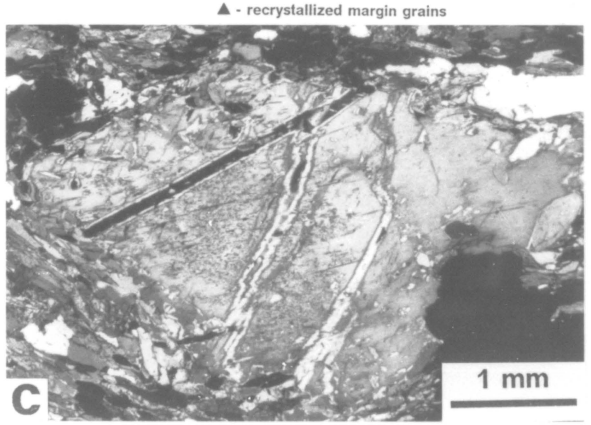
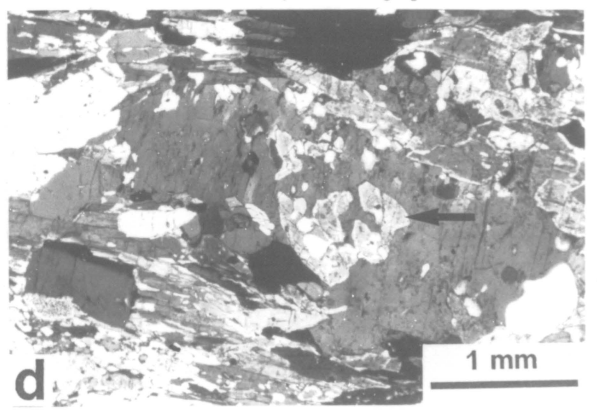




aries with no progressive misorientation of the host lattice or subgrain development proximal to the margin grain boundary. Clinoamphibole grains may also occur contained within the core of the host grain, commonly adjoining quartz inclusions (intragranular grain; Fig. 3d). However, these intragranular grains may result from sectioning the host grain perpendicular to a grain that extends into the core from the margin, such as grain #4 in figure 3b.. These intragranular grains are also separated from the host by high-angle grain boundaries. Figure 4 shows the orientation relationships between 8 host grains and their associated margin and intragranular grains; the frame of reference for the stereogram is the host grain lattice. Figure 4 illustrates that although there is no progressive misorientation of the host grain lattice proximal to the recrystallized grains, a strong correlation exists between the host lattice and the orientation of the new grains, with a concentration of new grain **c** axes near (010) of the host.

TEM Analysis

Host grain dislocation densities are locally variable within single grains. However, measurements of representative areas indicate free dislocation densities on the order of $5x10^8$ cm^{-2}. Figure 5 is a bright field mosaic of one area illustrating the variety and density of defects seen within the porphyroclast cores. Dislocations occur as both straight and curved isolated dislocations (Fig. 5) and arranged in dislocation arrays that usually define subgrains with characteristic amphibole cross-sectional shapes (Fig. 5). Some of the dislocations are dissociated (Fig. 6a) and dislocation nodes are present (Fig. 6a). Also, dislocation line directions show strong crystallographic control (Fig. 6a). Planar defects can also be seen (Fig. 5). Some of these planar defects are (100) deformation twins with straight dislocations along the twin boundaries (Fig. 6b). However, other planar defects show contrast behavior indicating that they may be stacking faults (Fig. 6c: Hirsch et al., 1965, p. 233). We are currently em-

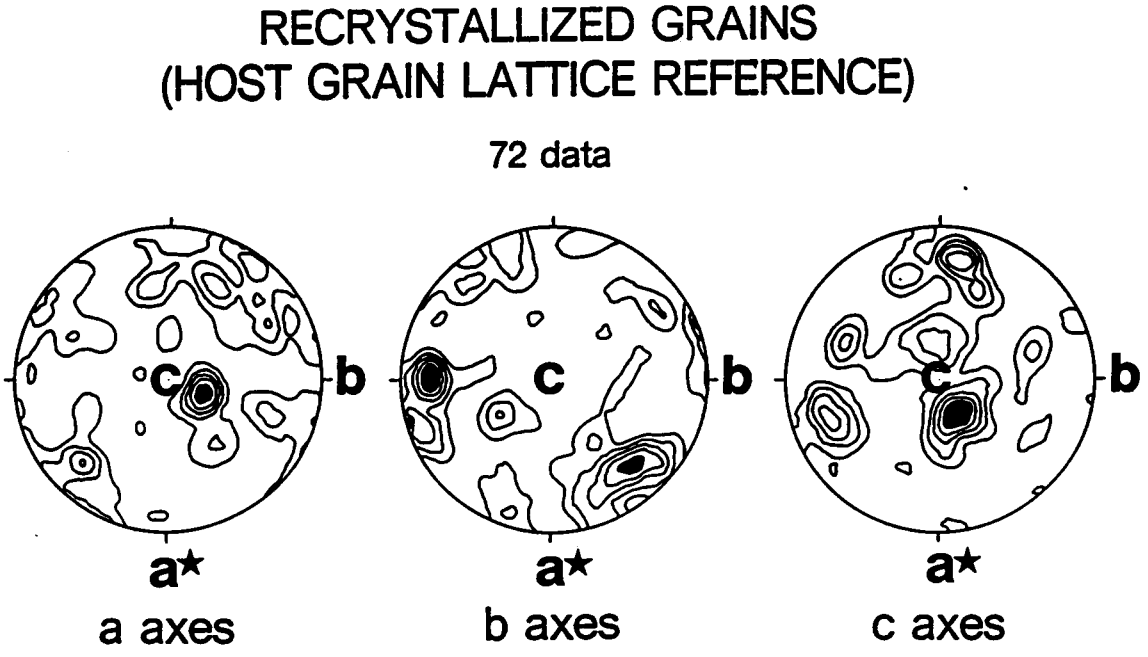


Figure 4. Orientation relationships between host and recrystallized grains: 8 host grains were measured along with their associated margin and intragranular grains. Host grain axes plotted with c vertical, b to the east and a^* down. Margin and intragranular grain a, b, and c axes are plotted separately in the host grain reference frame.

Figure 5. Bright field electron micrograph mosiac of host grain: Variety of TEM scale microstructures found illustrated. These include both straight and curved "free" dislocations (a), dislocation arrays with characteristic amphibole cross-sections (b), and planar defects (c).

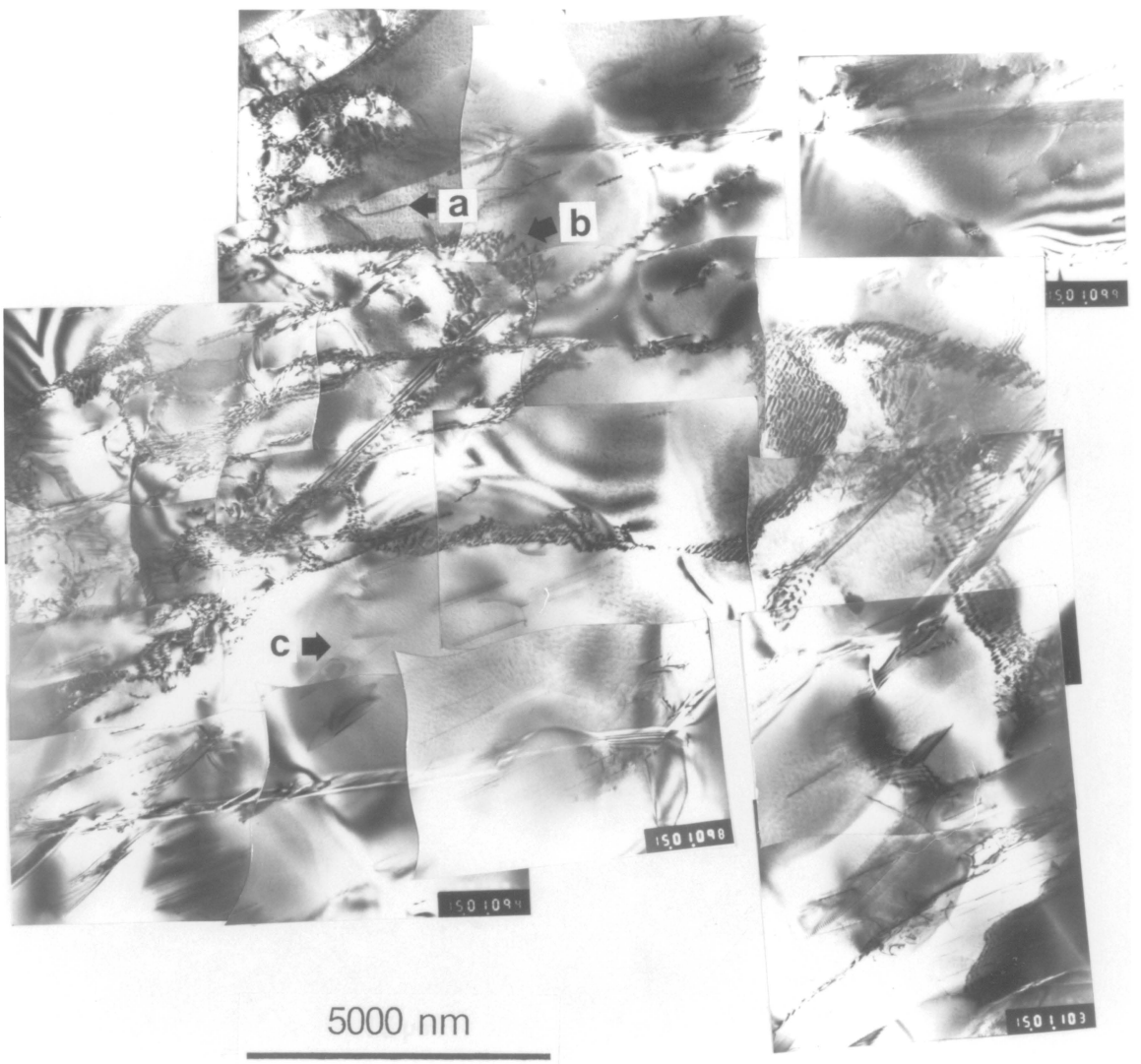
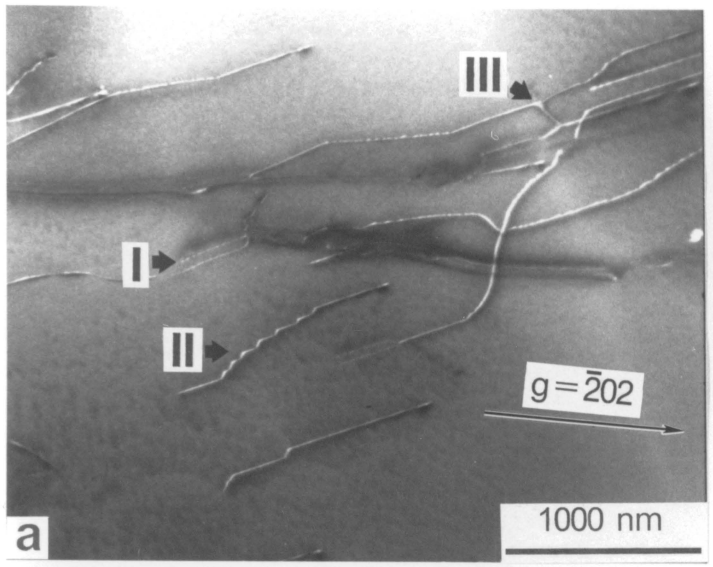
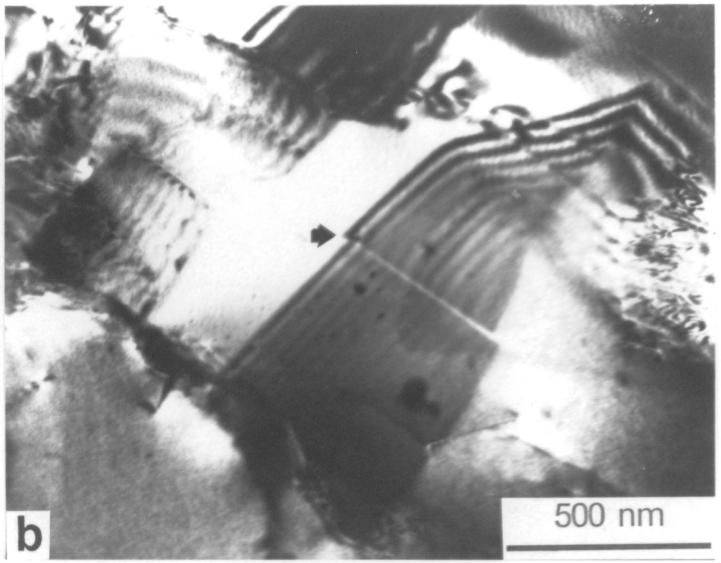
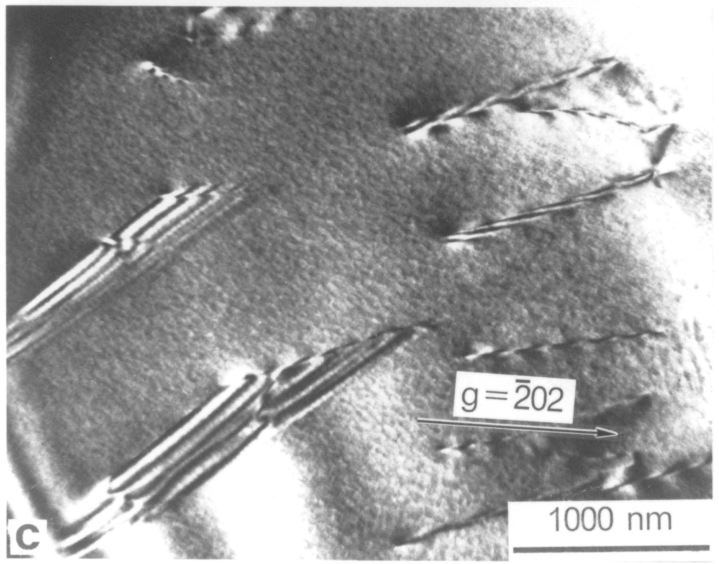

a
b
c
5000 nm

Figure 6. Detailed TEM scale microstructures: a) Dark field, weak beam electron micrograph showing dissociated dislocations (I), strong crystallogrphic control on dislocation lines (II), and dislocation nodes (III). b) Bright field image of (100) deformation twins, dislocation along twin boundary marked by arrow. c) Centered dark field image of stacking faults. d) Bright field image of complex dislocation array.


III
I
II
g = 202
1000 nm
a


500 nm
b


g = 202
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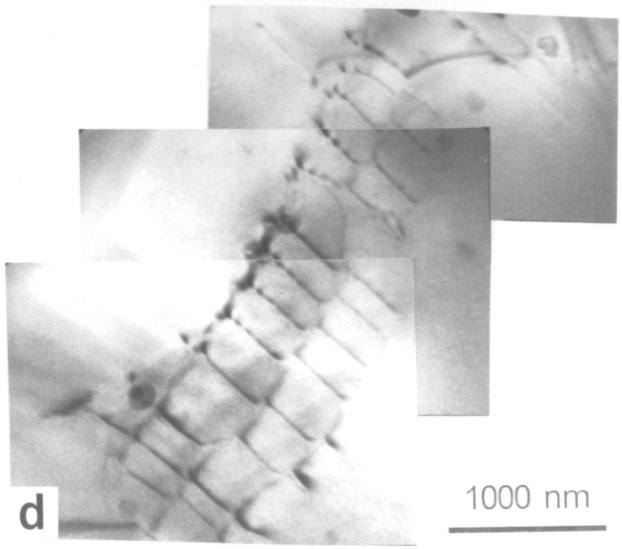
c


1000 nm
d

ploying computer simulation techniques in order to obtain more quantitative information about the crystallographic displacements associated with these linear and planar defects.

Dislocation arrays may occur as arrangements of dislocations of a single type or as more complex structures with more than one type of dislocation (Fig. 6d). These arrays accommodate general misorientations of the clinoamphibole lattice. Intragranular new grains also occur locally in the porphyroclast cores in areas characterized by high dislocation densities (Fig. 7). These new grains are euhedral with well defined boundaries and contain very few dislocations relative to the adjacent host lattice.

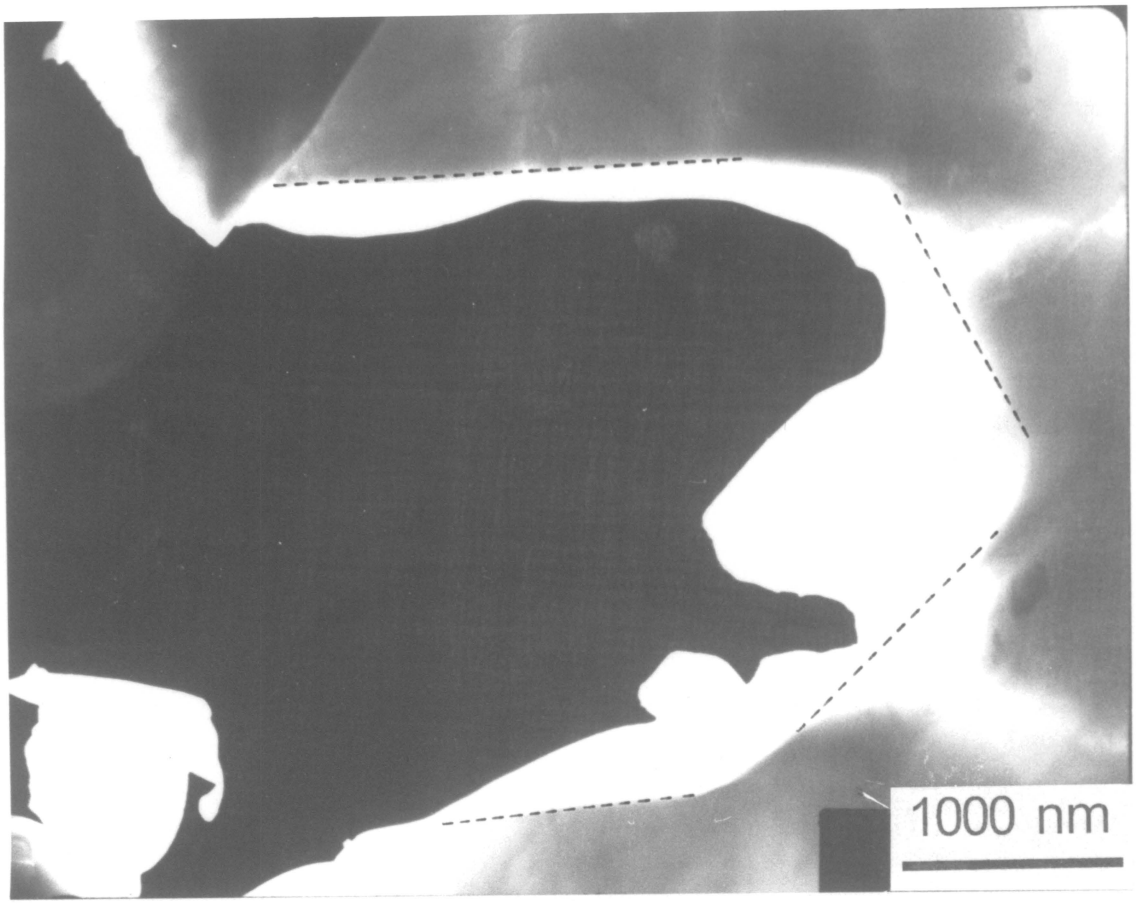
Defect densities are low in the matrix grains (below detectable levels) compared to the host grains, except in rare localized areas which show very high dislocation densities. The host grains display TEM-scale microstructures analogous to those seen optically: high defect densities resulting in undulose and patchy extinction; dislocation arrays manifested as subgrain walls; deformation twins; and intragranular grains.

CHEMICAL ANALYSIS

Clinoamphibole

The results of electron microprobe analyses of clinoamphibole host grains, intragranular grains, margin grains, and matrix grains are illustrated in figures 8 and 9. The host grain data represent point analyses and traverses in seven different grains. Most of the host grain analyses define a crude linear trend extending from actinolitic hornblende $(K_{.02}Na_{.11})$ $(Na_{.03}Ca_{1.86}Mn_{.03}Fe_{.08})$ $(Fe_{.86}Mg_{3.75}Ti_{.02}Al_{.37})$ $(Al_{.53}Si_{7.47})O_{22}(OH)_2$ (Fig. 8; point I) to tschermakitic hornblende $(K_{.06}Na_{.30})$ $(Na_{.08}Ca_{1.79}Fe_{.13})$ $(Fe_{1.21}Mg_{2.77}Ti_{.02}Al_{1.00})$ $(Si_{6.61}Al_{1.68})O_{22}(OH)_2$ (Fig. 8; point II). Some of this variability results from zoning in the host grains. However, the chemical vari-

Figure 7. Off-axis dark field image of intraganular new grain (upper half): Bright field enlargement (below) of lower grain boundary and surrounding host grain lattice shows absence of defects in new grain and high defect density in host grain.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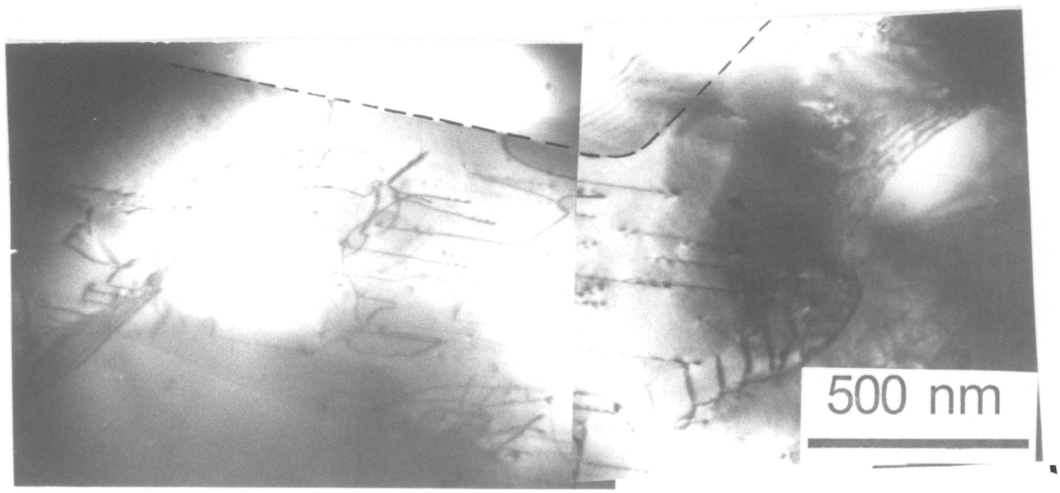
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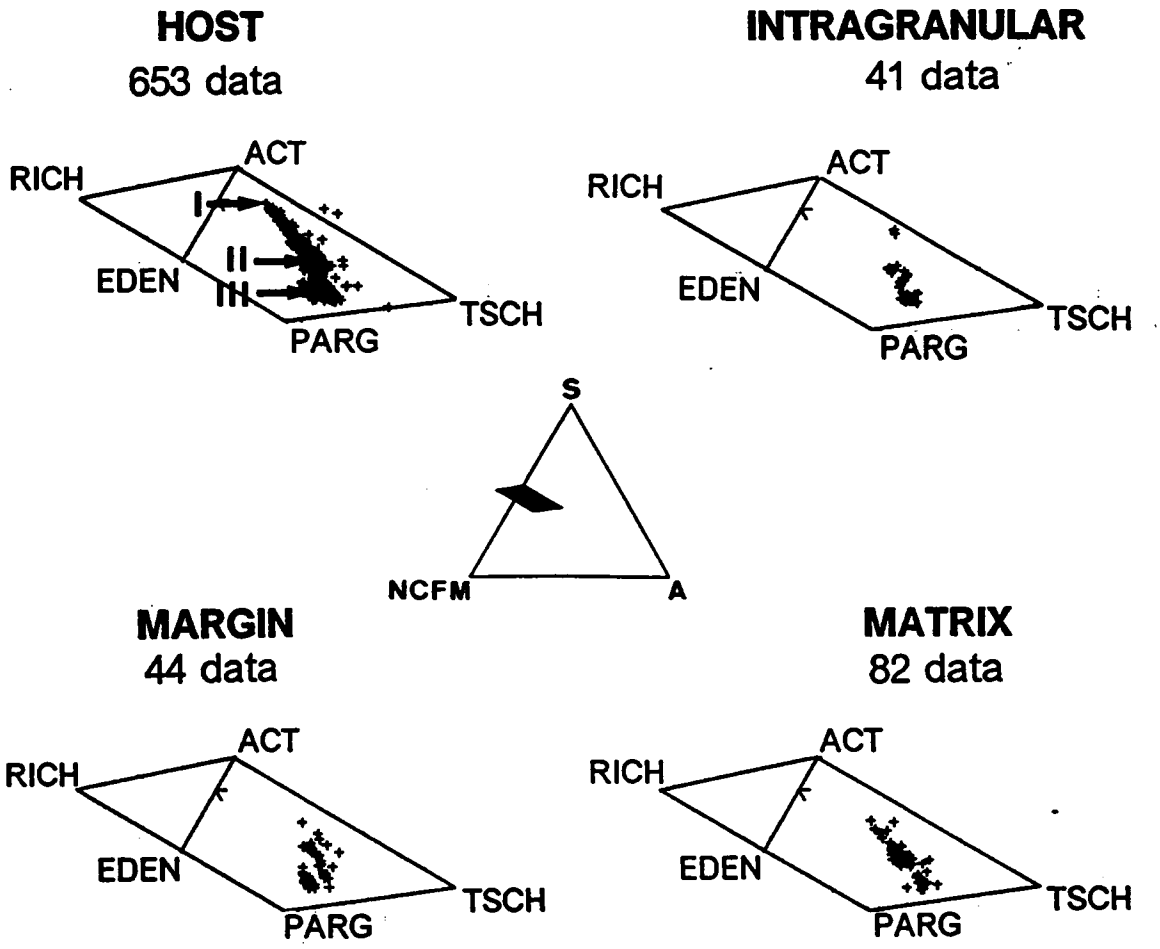


Figure 8. Compositional relationships between host and recrystallized grains: Compositions of host grains, intragranular grains, margin grains, and matrix grains (after Robinson et al., 1982). Inset triangle shows endmembers: S = Si; A = Al + Fe^{3+} + 2Ti - Na - K; NCFM = Ca + Fe^{2+} + Mn + Mg + 2Na + 2K - Ti. All Fe reported as Fe^{2+}. (ACT = actinolite; RICH = Richterite; EDEN = Edenite; PARG = Pargasite; TSCH = Tschermakite).

ability within any one host grain does not span the entire range represented by the trend on figures 8 and 9 and two of the host grains do not fall on the trend (Fig. 8; point III) and are represented by the points in figure 9 with higher FE/(FE+MG) ratios. The significant compositional differences between these analyses and those that lie on the I - II compositional trend (Fig. 8) is that they contain higher iron and lower silicon. Estimation of FE3+ using the method of Spear (1984) indicates that these grains contain higher FE3/(FE2+FE) ratios (i.e. approximately .4 versus .2) Therefore, the complete range of chemical variability is probably a result of bulk rock chemical control in addition to chemical variations within grains. The data for the matrix grains show a considerable amount of scatter but tend to cluster around compositions marked by point II (Fig. 8). The analyses for the intragranular grains and margin grains reflect in a general way the same compositional characteristics as the matrix grains. However, the margin grains around the two host grains with anomalous Fe and Si compositions also show the secondary clustering at higher Fe and lower Si compositions. The compositional trend generally reflects tschermak ($Al_2Mg_{-1}Si_{-1}$), edenite ($NaAlSi_{-1}$), and iron-magnesium ($FeMg_{-1}$) substitutions, and results in an increase of Na, Al, and Fe with a corresponding decrease in Si and Mg. Similar chemical trends have been reported from deformed clinoamphibole by Brodie (1981).

The effect of both intragranular and bulk rock chemical variability results in large compositional variations when all analyses are plotted together as in figures 8 and 9 and therefore the chemical relationships between the host grains and margin/intragranular grains are difficult to discern in these diagrams. However, the chemical relationship between host grains and margin/intragranular grains are clearly demonstrated in figures 10 and 11. Figure 10 shows a microprobe traverse across the host and margin grain shown in figure 3a. Figure 11 shows a similar traverse across the host and intragranular grain in figure 3b. Figure 10 illustrates that some of the chemical variability in the host grains results from zoning from an actinolitic core to a more tschermakitic and pargasitic rim. This zoning trend progresses into the margin grain. Microprobe traverses from host grains into intragranular grains (Fig. 11)

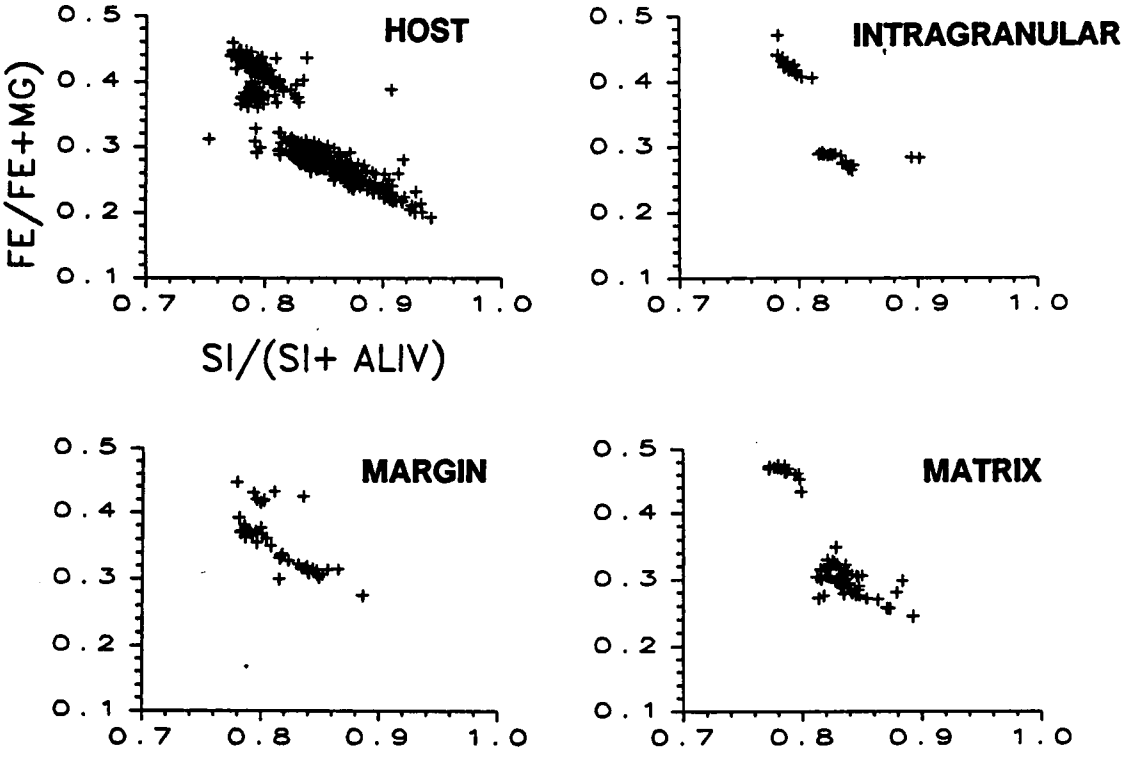


Figure 9. FE/(FE+MG) vs. SI/(SI+ALIV) variations of host grains,intragranular grains, margin grains, and matrix grains.

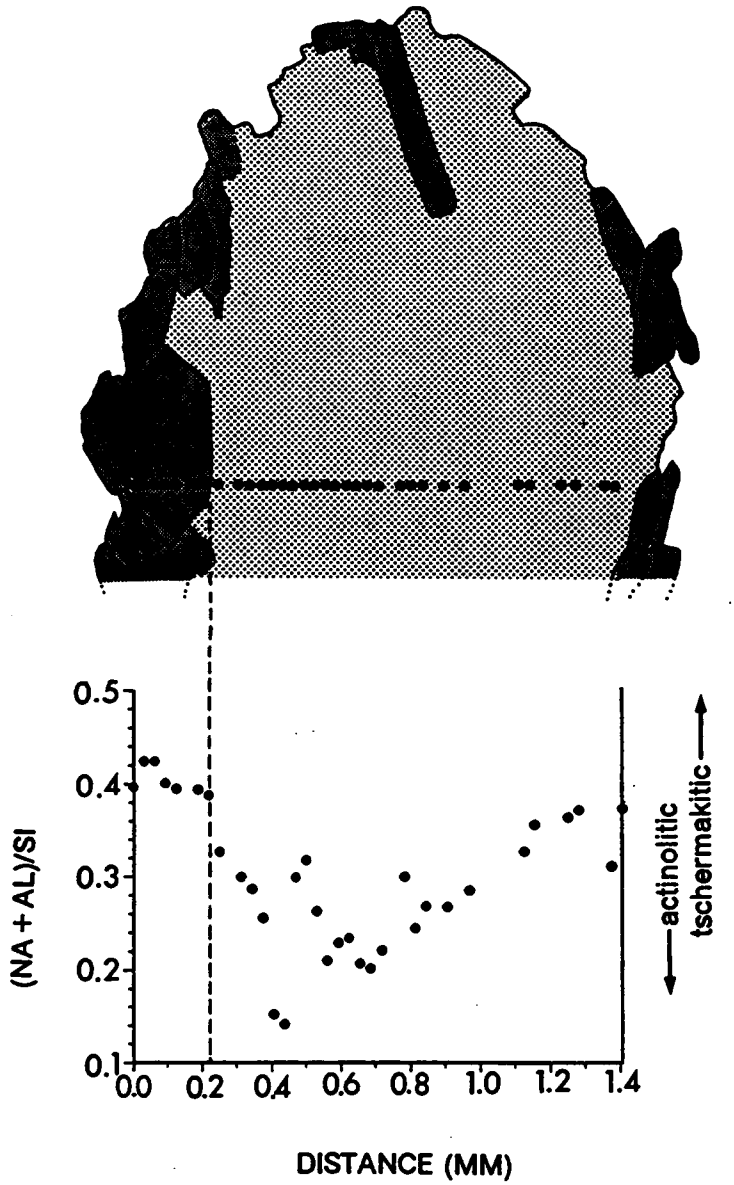


Figure 10. Electron microprobe traverse across the host and margin grain shown in figure 3a.

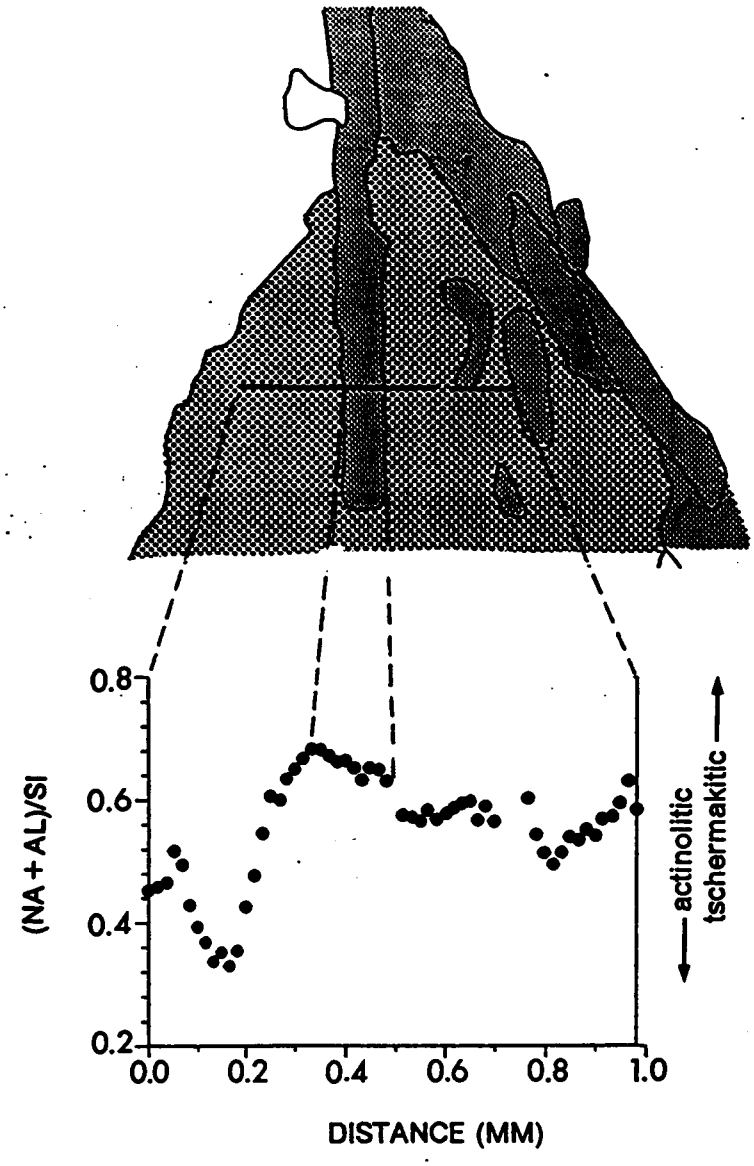


Figure 11. **Electron microprobe traverse across the host and intragranular grain shown in figure 3b.**

show similar compositional profiles in which the composition of the host shows progressively higher (NA+AL)/SI values proximal to the intragranular grain.

The compositional profiles are not smooth and the two dimensional spatial characteristics of the compositional differences can be more fully seen in backscattered electron imaging (Fig. 12). In figures 12 a, b, and c it can be seen that the compositional variation in the host grains in areas proximal to their margins and near intragranular grains has very irregular boundaries which are dendritic in nature. In contrast figure 12d shows that the matrix grains are zoned in a discontinuous manner with sharp well defined boundaries between the different compositions. Note also the inhomogeneous nature of the matrix grain core (Fig. 12d).

Plagioclase

Plagioclase is chemically zoned with An poor cores (An 30) and more An rich rims (An 40). The K content of plagioclase is less than 0.65 mol % Or.

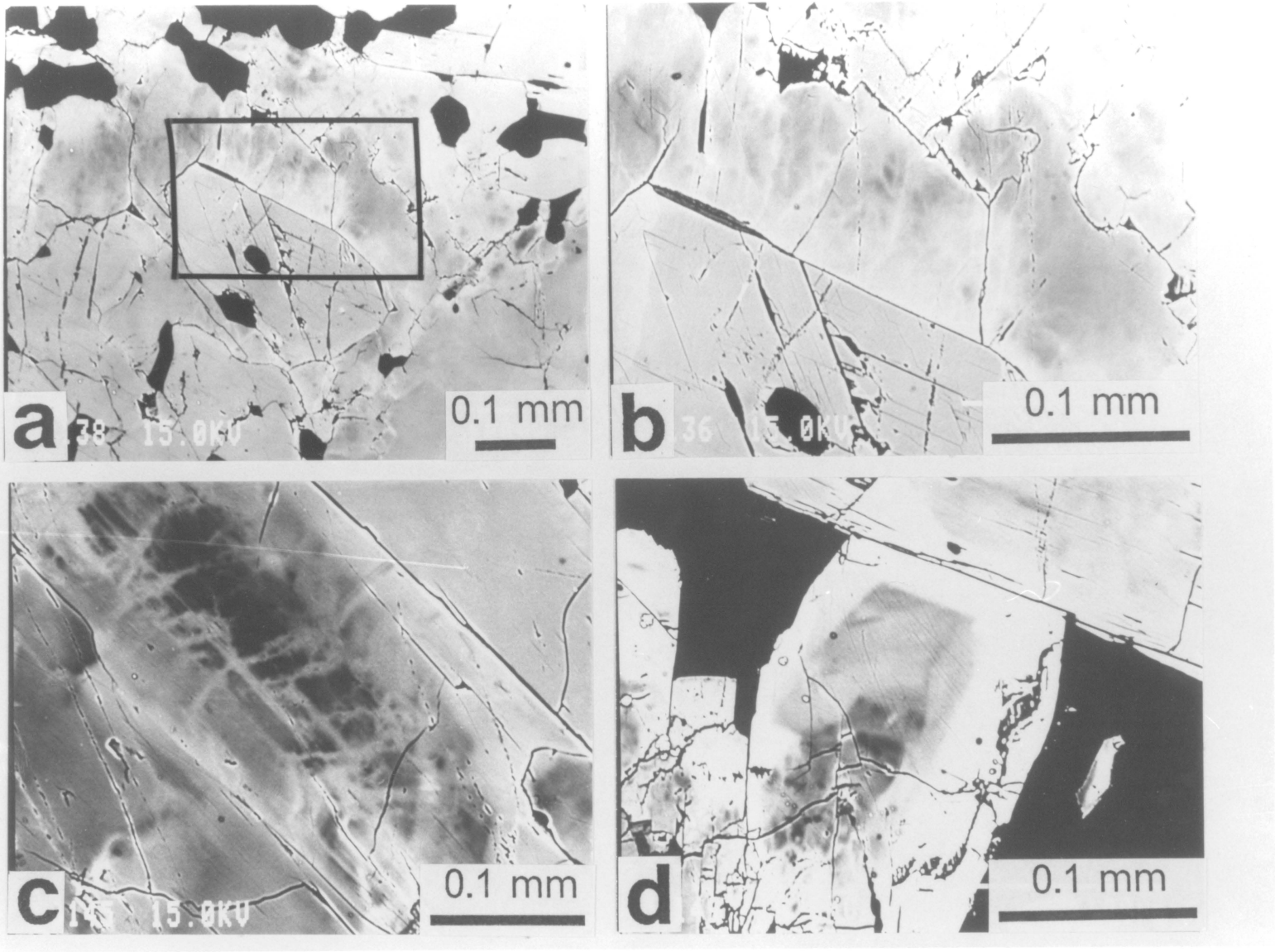
Epidote

Epidote is unzoned and contains between 11 and 17 mol. % Pistacite and up to 0.58 mol % Piedmontite.

Biotite

Biotite is unzoned with FE/(FE+MG) ratios of 0.25. ALiv content is relatively constant at 2.40 atoms/22 anions. Ti content is low and relatively constant at .05 atoms/22 anions.

Figure 12. Backscattered SEM micrographs of host and matrix grains: Spatial variations of compositional zoning in host and matrix grains illustrated. Lighter gray areas correspond to more tschermakitic compositions with higher (NA+AL)/SI ratios. a) Intragranular grain marked by arrow along with immediately surrounding host shown in figure 3d. b) Higher magnification of outlined area shown in 12a. Note poorly defined, irregular boundaries and dendritic nature of compositional zoning. c) Micrograph of area near margin of host grain outlined in figure 3b. d) Micrograph of zoned matrix grain. Note inhomogeneous nature of core area and concentric outer zoning with well defined compositional boundary with core.


a
0.1 mm
b
0.1 mm
c
0.1 mm
d
0.1 mm

RECRYSTALLIZATION MECHANISMS

The interpretation that the host grains - margin/intragranular grains actually record a recrystallization event is dependent upon the temporal relationship between the host and matrix grains. That is, are the host grains "late" with respect to the matrix (porphyroblasts), or are they "early" (porphyroclasts). There are two fairly strong pieces of independent evidence that help to resolve this temporal relationship.

(1) The defect densities recorded by the host grains are high for clinoamphibole (Morrison - Smith, 1976; Brodie, 1981; Biermann, 1983) and indicate that these grains record high strains. In contrast the matrix grains are strain free. One explanation for the large difference in defect density between the host grains and matrix is that the host grains only deformed by a dislocation-accommodated mechanism while the matrix grains deformed by grain boundary sliding and therefore do not record any intracrystalline strain. However, von Mises criterion requires that grain boundary sliding be accommodated by some other mechanism so that cracks and voids are not created (Nicolas and Poirier, 1976; p42-43). We see no evidence for any accommodating deformation mechanism or cracks and voids in the matrix and therefore consider this possibility unlikely. Another scenario is that the host grains grew very "late" in the strain history of the rock and therefore suffered only a "minor" amount of strain that is not recorded by the matrix. This seems unlikely in that the defect densities of the host grains indicate significant amounts of strain and there is no way for the stress to be transmitted through the rock and not be felt by the matrix unless the host grains form a "stress supporting" framework. Figure 2 shows that this is not the case. Therefore the high defect density differences between the host grains and matrix indicate that the host grains have experienced considerably more strain than the matrix grains and were present at an "earlier" stage in the strain history of the rock.

(2) The spatial pattern of the compositional zoning in the host grains proximal to intragranular grains and host grain margins is consistent with a diffusional origin because

similar profiles are present proximal to intragranular grains as well as margin grains. This zoning probably resulted from an attempt by the host grain to equilibrate chemically with the metamorphic environment by diffusion of chemical components from the exterior of the host grain along host grain - recrystallized grain boundaries and into the host grain lattice. The dendritic nature and poorly defined boundaries of the diffusion pattern suggest that diffusion into the host grain occurred down "high diffusivity pathways" (i.e. dislocations, dislocation arrays/subgrain boundaries, microcracks, etc.). While it is true that in dry systems intracrystalline diffusion of Al and Si in silicates is very slow (Grove, et al., 1984) experimental evidence indicates that high fluid pressure can greatly enhance the mobility of these species (Yund and Tullis, 1980; Goldsmith, 1988). In contrast the zoning pattern in the matrix grains is discontinuous with sharp, well defined boundaries separating the different compositions. This indicates that the host grains were not in chemical equilibrium with the metamorphic environment during the last stages of metamorphism and were therefore probably an "early" phase. Based on these lines of reasoning we interpret the host grains as σ_e type porphyroclasts that resulted from a high recrystallization rate relative to the rate of deformation (Passchier and Simpson, 1986).

As pointed out by Urai et al. (1986) the driving forces for recrystallization (G_{ryx}) can be accounted for by the reduction in free energy from four sources, given by the following equation:

$$G_{ryx} = G_{el} + G_{gb} + G_{ld} + G_{ch}, \qquad [1]$$

where (G_{el}) is the elastic energy in the crystal due to an external load, (G_{gb}) is the interfacial free energy, (G_{ld}) is the elastic strain energy due to lattice defects, and (G_{ch}) is the chemical free energy due to compositional metastability. Some definitions of dynamic recrystallization (e.g. Poirier and Guillopé, 1979) allow for only "minor" chemical changes to occur during recrystallization; this constraint was imposed so that dynamic recrystallization would only be defined as a mechanical phenomenon, and it requires that driving forces due to reductions in chemical free energy be insignificant. For mineral phases with relatively simple major element

chemistry, such as quartz, this constraint may be realistic in some geologic situations. However, since deformation zones are often associated with the focussed flow of chemically reactive fluids (Sinha et al., 1986), and it is unlikely that a rock will be deformed under the same metamorphic conditions that characterize the protolith assemblage, deformation of chemically complex mineral phases may also be accompanied by an attempt to change their compositions. Although, in most cases, the thermochemical data base is not sufficient to quantify the magnitude of the free energy changes associated with these reactions, chemical free energies can be orders of magnitude greater than the other terms in equation [1] (c.f. Wintsch and Dunning, 1985). Therefore, the constraint allowing only "minor" chemical differences in dynamic recrystallization makes this term at least suspect for chemically complex phases in a wide range of geologic situations. Therefore we use the term "dynamic recrystallization" in the broader sense of Urai et al. (1986).

The chemical trends exhibited by clinoamphibole in this study are in general consistent with prograde metamorphism of amphibolite (Liou et al., 1974) and indicate that recrystallization of clinoamphibole was accompanied by significant compositional changes that can be modeled by the amphibole producing reactions:

$$\underset{\textit{actinolite}}{Ca_2(Mg,Fe)_5Si_8O_{22}(OH)_2} + \underset{\textit{chlorite}}{14(Mg,Fe)_5Al_2Si_3O_{10}(OH)_8} + \underset{\textit{clinozoisite}}{24Ca_2Al_3Si_3O_{12}(OH)} \quad [2]$$

$$+ \underset{\textit{quartz}}{28SiO_2} = \underset{\textit{tschermakite}}{25Ca_2(Mg,Fe)_3Al_4Si_6O_{22}(OH)_2} + \underset{\textit{env}}{44H_2O}$$

and

$$\underset{\textit{actinolite}}{Ca_2(Mg,Fe)_5Si_8O_{22}(OH)_2} + \underset{\textit{albite}}{NaAlSi_3O_8} = \underset{\textit{edenite}}{NaCa_2(Mg,Fe)_5AlSi_7O_{22}(OH)_2} + \underset{\textit{quartz}}{4SiO_2} \quad [3]$$

In addition to a modal increase in amphibole and corresponding decrease in chlorite, plagioclase, and epidote these reactions result in amphibole compositions with higher

(NA+AL)/SI ratios and feldspar becoming more anorthitic (Robinson et al., 1985). The absence of chlorite indicates that reaction [2] has progressed to the point where chlorite has disappeared. Estimation of peak metamorphic conditions using the amphibole-plagioclase exchange thermometer of Spear (1980) on adjacent plagioclase/matrix amphibole rims gives temperatures between 520°C and 540°C. The presence of diffusion profiles in the host grains attest to the presence of chemical driving forces in that chemical potential gradients are necessary to drive the diffusion. These driving forces were probably the result of the amphibole producing reactions discussed above.

In order for recrystallization to occur it is necessary to form a new grain by some development mechanism and allow it to grow. Development mechanisms for dynamic recrystallization are discussed in Drury et al., (1985) and consist of subgrain rotation, subgrain growth, and grain boundary bulging. In order for new grains to be formed by subgrain rotation or growth it is necessary for a cumulative misorientation to develop between the host and subgrain. The lack of cumulative lattice misorientation in the host grains proximal to the recrystallized grains could have resulted from the new grain overgrowing this area during subsequent grain growth if the new grain had developed by a subgrain mechanism. However, some of the new grains have misorientations of up to 90° from the host grain lattice. If these grains were formed by a subgrain mechanism it would require extremely high misorientation gradients in the host grain lattice. Similar misorientation gradients are not preserved elsewhere which strongly suggests the lack of cumulative lattice misorientation in the host grains proximal to recrystallized grains. Therefore, the fact that the recrystallized grains are separated from the host by high angle grain boundaries is probably not consistent with formation of the new grains by either a subgrain rotation or subgrain growth mechanism. As seen in figure 7, new grains seem to occur in the host lattice in areas characterized by relatively high dislocation densities and are often associated with inclusions of quartz (Fig. 3d). These relationships indicate that new grains may have formed by heterogeneous nucleation either on inclusions or in association with lattice defects. The occurrence of specific orientation relationships between the host and new grains (Fig. 4) is consistent with this type of mechanism.

Lattice defects can act as a catalyst for nucleation by providing a strain field that reduces the activation energy for nucleation and by enhancing the diffusion process (see Larché, 1979 for review). The potential for chemical driving forces during deformation would serve to enhance the nucleation process. In fact calculations by Cahn (1970) have shown that heterogeneous nucleation is not possible when the driving force for nucleation is only strain induced. This led Etheridge and Hobbs (1974) to suggest that heterogeneous nucleation could occur if nucleation was driven by chemical as well as strain induced forces. The effect of lattice defects on nucleation of new grains in clinoamphibole in this study is currently being investigated in more detail.

After new grains have developed they will then grow into the host grains. The chemical energy due to compositional differences between the new grains and their hosts, and the strain energy, can provide the driving force necessary for growth to occur by grain boundary migration. It is difficult to determine which of these driving forces is dominant. However, as noted earlier, the chemical free energies are potentially orders of magnitude greater than the strain energy. The phenomenon of chemically-induced grain boundary migration (CIGM) or diffusion-induced grain boundary migration (DIGM) has been documented in a wide range of materials including metals, ceramics, and recently in carbonates (Evans et al., 1986; Hay and Evans, 1987a; 1987b; see 1987a for a comprehensive reference list). In situations where the boundary is wet with a fluid film this type of grain boundary migration is termed liquid film migration. In view of the fact that reaction [2] produces significant quantities of environmental fluid liquid film migration may have played a significant role.

Although the exact mechanism by which these processes occur is uncertain, it appears that at least some part of the driving force can be accounted for by the "coherency strain" produced by a diffusion profile in the host lattice in front of the migrating boundary. (Hillert, 1972; Song and Yoon, 1984; Baik and Yoon, 1985; Song et al., 1985; Rhee et al., 1987; Baik and Yoon, 1987). This effect allows the boundary migration to continue even though the chemical differences between the recrystallized lattice behind the boundary and the host lattice in front of the boundary, and therefore the chemical free energy gradient, have been

reduced by lattice diffusion of chemical components into the host grain. Coherency strain appears to be a very effective mechanism, in that CIGM has been documented in materials with low misfit parameters at conditions where lattice diffusion was significant (Tashiro and Purdy, 1983; den Broeder and Nakahara, 1983; Kim et al., 1983). The compositional relationships and chemical profiles recorded in the host grains proximal to recrystallized grains are consistent with CIGM as a growth mechanism for the new grains. The euhedral nature of the recrystallized grains may also be significant in that CIGM in several instances has been documented to result in "faceted" grain boundaries (Chongmo and Hillert, 1981; Pan and Balluffi, 1982; Hay and Evans, 1987a; 1987b). A theoretical treatment of CIGM (Handwerker et al., 1985) predicts that growing grains will develop boundaries parallel to low index crystallographic planes of the host grain. It should be noted, however, that there is some evidence that the "faceting" observed in CIGM experiments is a surface artifact, not observed in bulk specimens (Hay and Evans, 1987b). In addition, euhedral new grains can also occur in other situations when chemical driving forces are insignificant, such as in strain-induced, fluid-assisted recrystallization (Urai, 1983; Spiers et al., 1986; Urai et al., 1986; Drury and van Roermund, in press). For the case of fluid assisted recrystallization, new grains develop crystallographic boundaries controlled by the lattice of the new growing grain (Drury and van Roermund, in press). Preliminary observations on the amphibole grain boundaries indicate that the boundaries are parallel to crystallographically controlled features in the host grain (cleavages in Fig. 2a, grain 4; dislocation lines in Fig. 6) suggesting that the faceting may be related to CIGM. Also, experimental studies have shown that equilibrium compositions are not usually attained by one pass of a migrating boundary (Hay and Evans, 1987a) and that a chemical signature of the host grain may still be preserved after the boundary passes a region (Sulonen, 1960). This could explain some of the chemical variability exhibited by the intragranular, margin, and matrix grains as seen by the inhomogeneous compositional variations in the matrix grain cores (Fig.12d).

CONCLUSIONS

The orientation relationships between host grains and new grains suggest that the new grains formed by a heterogeneous nucleation mechanism with further growth occurring by grain boundary migration. The possible driving forces for these processes are given by equation [1]. The substantial differences in defect density between the recrystallized grains and host grains indicate that the term G_{id} in equation [1] is significant. Free energy differences due to compositional changes associated with both continuous and discontinuous reactions were probably also present and potentially may have dominated the equation. Deformation of the clinoamphibole studied was probably accommodated by chemically-induced grain boundary migration or liquid film migration. As pointed out by Hay and Evans (1987a) this is an efficient means for minerals to change their composition at temperatures too low for lattice diffusion to be effective and is probably more common in geologic situations than previously recognized.

Chapter 2: Defect Microstructures in Naturally Deformed Clinoamphibole

INTRODUCTION

The physical and chemical properties of crystals can often be strongly influenced by their defect content. Potentially, this can result in modification of crystal behavior during geologically important processes such as nucleation (Smith, 1985), chemical reaction (Wintsch and Dunning, 1985), and diffusion (Yund et al., 1983), as well as deformation (White, 1976). Clinoamphibole is a common rock forming mineral that is useful in metamorphic studies (Spear, 1980). Its diffusion behavior with respect to both oxygen (Farver and Giletti, 1986) and argon (Harrison, 1981) has been well documented, making it a useful phase in both of these isotopic systems. The utility of clinoamphibole to both metamorphic and isotopic studies makes important both the characterization of the types of defects it can contain and the influence, if any, of these defects upon its physical and chemical properties.

Experimentally deformed clinoamphibole typically deforms by twinning on $(\bar{1}01)$ in the $C_{2/m}$ setting (Buck, 1970; Rooney et al., 1970; Rooney et al., 1975; Morrison-Smith, 1976).

Dollinger and Blacic (1975) reported slip on [001](100) based on analysis of kink bands. TEM analysis of experimentally deformed clinoamphibole by Morrison-Smith (1976) reported [001](100) as the predominant slip system, and suggested that slip on [001](010) , [100](010) and [100](001) may also be possible. In contrast, $(\bar{1}01)$ twinning is not reported from naturally deformed specimens except in environments characterized by exceedingly high strain rates (Chao, 1967; Borg, 1972). In their TEM analysis of naturally deformed clinoamphibole, Biermann and Van Roermund (1983) reported [001](100) as the predominant slip system with expanded glide loops consisting mostly of screw segments. Stacking faults on (010), and (100) deformation twins have also been reported (Biermann, 1981; Biermann and Van Roermund, 1983). In naturally deformed samples, subgrain boundaries are typically parallel to {hk0} and are reported to consist primarily of screw dislocations parallel to **c** (Biermann and Van Roermund, 1983; Brodie and Rutter, 1985). These previous TEM studies utilized the $\mathbf{g} \cdot \mathbf{b} = 0$ (Hirsch et al., 1965) invisibility criterion for Burgers vector identification, where **g** is the reciprocal lattice vector representing the diffracting planes and **b** is the dislocation Burgers vector. The $\mathbf{g} \cdot \mathbf{b} = 0$ invisibility criterion is based on the fact that for elastically isotropic crystals lattice planes parallel to the Burgers vector of a dislocation will be unstrained by the dislocation strain field. Therefore, in a diffraction contrast experiment when the sample is oriented so that only these unstrained planes are diffracting no contrast will be seen in the TEM image and the dislocation will appear "invisible". This criterion is strictly true only for pure screw dislocations since the full condition for invisibility is that $\mathbf{g} \cdot \mathbf{bxu} = 0$, where **u** is a unit vector representing the line direction of the dislocation (Hirsch et al., 1965). Also in elastically anisotropic crystals, in general, lattice planes parallel to the dislocation Burgers vector can be strained and will therefore show contrast in a diffraction contrast experiment even though the $\mathbf{g} \cdot \mathbf{bxu} = 0$ criterion is satisfied (Head et al., 1973). In these situations it may be necessary to calculate the image by computer simulation techniques (Head et al., 1973) and to compare the computer images with those obtained experimentally. In this study we present the results of a TEM study of naturally deformed clinoamphibole that confirms [001] as the primary unit

Burgers vector by computer simulation techniques, and we document glide on the, [001]{110}, [001](100), and possibly [001](010) slip systems.

Sample Description and Experimental Techniques

The clinoamphibole in this study is from a mylonitic amphibolite contained within Caledonian successions on Senja, Norway. The rock is compositionally layered, consisting of plagioclase rich domains interlayered (mm scale) with domains enriched in clinoamphibole. The matrix contains a well-developed LS fabric defined by preferred alignment of clinoamphibole needles. Within the matrix occur larger clinoamphibole grains with significant amounts of intracrystalline strain and core and mantle structures that are interpreted to be porphyroclasts. The clinoamphibole ranges in composition from actinolitic hornblende to tschermakitic hornblende. Based on amphibole compositions the last stages of deformation and metamorphism probably occurred at $\simeq 540^{\circ}$ C. and 6.5 Kb. A more detailed account of the sample location will be described in Appendix A.

TEM analysis was carried out at the Institute of Earth Sciences, State University of Utrecht, The Netherlands, using a JEOL 200C fitted with double tilt stage. Crystallographic orientations of various defects were determined by conventional trace analysis (Hirsch et al., 1965). Burgers vector determination was accomplished by diffraction contrast experiments using the two-beam technique (Hirsch et al., 1965) in conjunction with computer simulation of defect images using a version of the FORTRAN program TWODIS (Head et al., 1973), modified to accommodate crystal lattices more general than cubic. These modifications to TWODIS are described in Appendix C. The intricacies of utilizing this method for crystals with large unit cells are discussed in detail in Montardi and Mainprice (1987) and apply here. It should be noted that the clinoamphibole was found to be extremely stable in the electron beam.

All crystallographic calculations and indexing were done with the lattice parameters and equivalent positions reported for a hornblende by Trojer and Walitzi (1965). The lattice

TABLE 1: CALCULATED EXTINCTION DISTANCES FOR SELECTED DIFFRACTION CONDITIONS

g	ξ_g nm
002	38.4
$\bar{2}02$	38.4
$\bar{4}04$	82.4
020	20.3
200	25.2
110	20.9

parameters are: $\mathbf{a} = 0.986$ nm, $\mathbf{b} = 1.807$ nm, $\mathbf{c} = 0.533$ nm, $\beta = 105.5$ °. In calculating the scattering factors for each equivalent position we used the following composition and site assignments which are more representative of the clinoamphibole in our study:

$$(K_{.02}Na_{.11})(Na_{.03}Ca_{1.86}Mn_{.03}Fe_{.08})(Fe_{.86}Mg_{3.75}Ti_{.02}Al_{.37})(Al_{.53}Si_{7.47})O_{22}(OH)_2$$
$$(A) \qquad (M4) \qquad (M1,M2,M3) \qquad (T) \qquad (O).$$

Using these data, calculated extinction distances for some reflections commonly used in this study are reported in Table I. Elastic constants used for calculating defect images are those for Hornblende II (Alexandrov and Ryzhova, 1961), as reported in Birch (1966). However, Alexandrov and Ryzhova (1961) reported no composition for either Hornblende I or Hornblende II. It was found during the course of the study that Hornblende II gave the best match to observed images.

The input parameters to TWODIS are described in detail in Head et al.(1973). However, a brief description will be given below so that the images can be compared with a minimal amount of effort. The input parameters that characterize the dislocation are the Burgers vector (**b**) and dislocation line direction (**u**). **b** and **u** are specified in terms of direct lattice vectors [*hkl*]. The TEM sample is a very thin foil that can be geometrically approximated by a thin slab. The orientation of this slab with respect to the crystal lattice is characterized by the foil normal (FN), a vector normal to the surface of the slab that makes an obtuse angle with the electron flux. FN is specified in terms of a reciprocal lattice vector (*hkl*). The thickness of the slab (THICK) is specified in terms of extinction distance. Since the extinction distance is a function of, among other things, the operating two-beam diffraction condition, THICK changes with the diffraction vector, although the true thickness of the slab remains constant. The anomalous absorption coefficient (ANO) determines how the electron beam is attenuated within the foil and has the practical effect on the image of causing the defect contrast to be attenuated in the center of the foil (i.e. the center of the image) as the value of ANO is increased. ANO is determined by trial and error by comparing computed images with electron micrographs. The orientation of the specimen with respect to the electron microscope is given

by the electron beam orientation (BM) and is expressed in terms of the direct lattice vector [*hkl*] that is by convention opposite in direction to the electron flux. The diffraction condition is specified in terms of the reciprocal lattice vector $\mathbf{g} = hkl$ representing the diffracting planes and the dimensionless deviation parameter (w) that describes the distance from the exact Bragg condition for these planes. The parameters START and FINISH control the framing and magnification of the computed image.

TEM ANALYSIS

TEM analysis of clinoamphibole porphyroclasts revealed relatively high defect densities ($5x10^{8}cm^{-2}$). Figure 13 is a bright field mosaic of a representative area showing high densities of free dislocations, dislocation arrays, subgrain boundaries, and planar defects.

Free Dislocations

Most of the free dislocations consist of long straight segments. However, dark field, weak beam images (Fig. 14 arrowed a) show that even where curved segments are present the line directions show strong crystallographic control. Trace analysis of line directions (Fig.15) for free dislocations show strong point maxima that indicate most of these are subparallel to **c** or lie on planes between (110) and $(1\bar{1}0)$. In figure 15 both maxima lie on {110} indicating a strong preference for this orientation. However, the maxima also lie close to (100) which suggests that (100) is also an important glide plane. A secondary lobe lies along (010) indicating a weak preference for free dislocations to lie along this direction.

Figure 13. Bright field electron micrograph of representative area in porphyroclast: Note high defect densities. BM = [010].

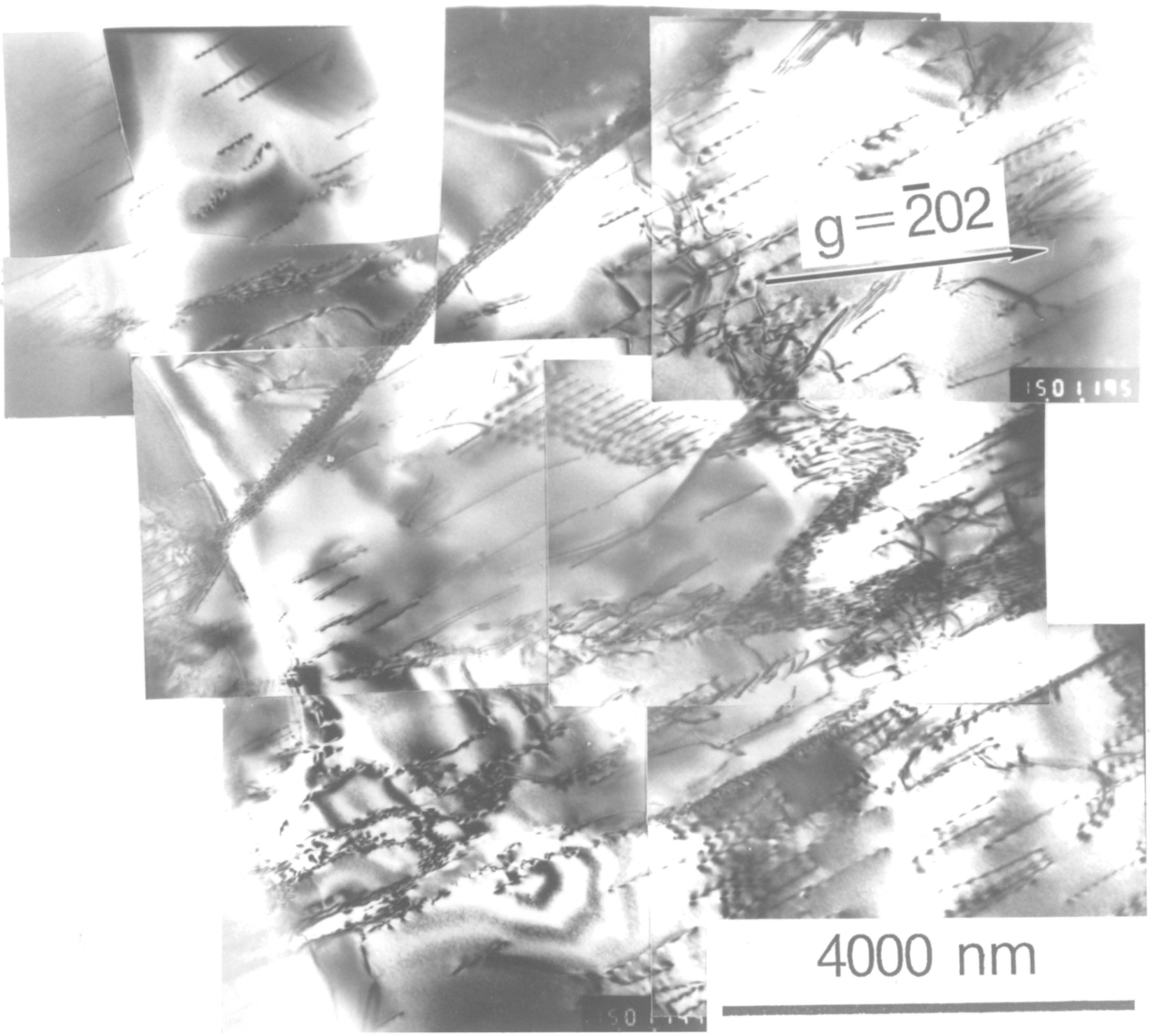
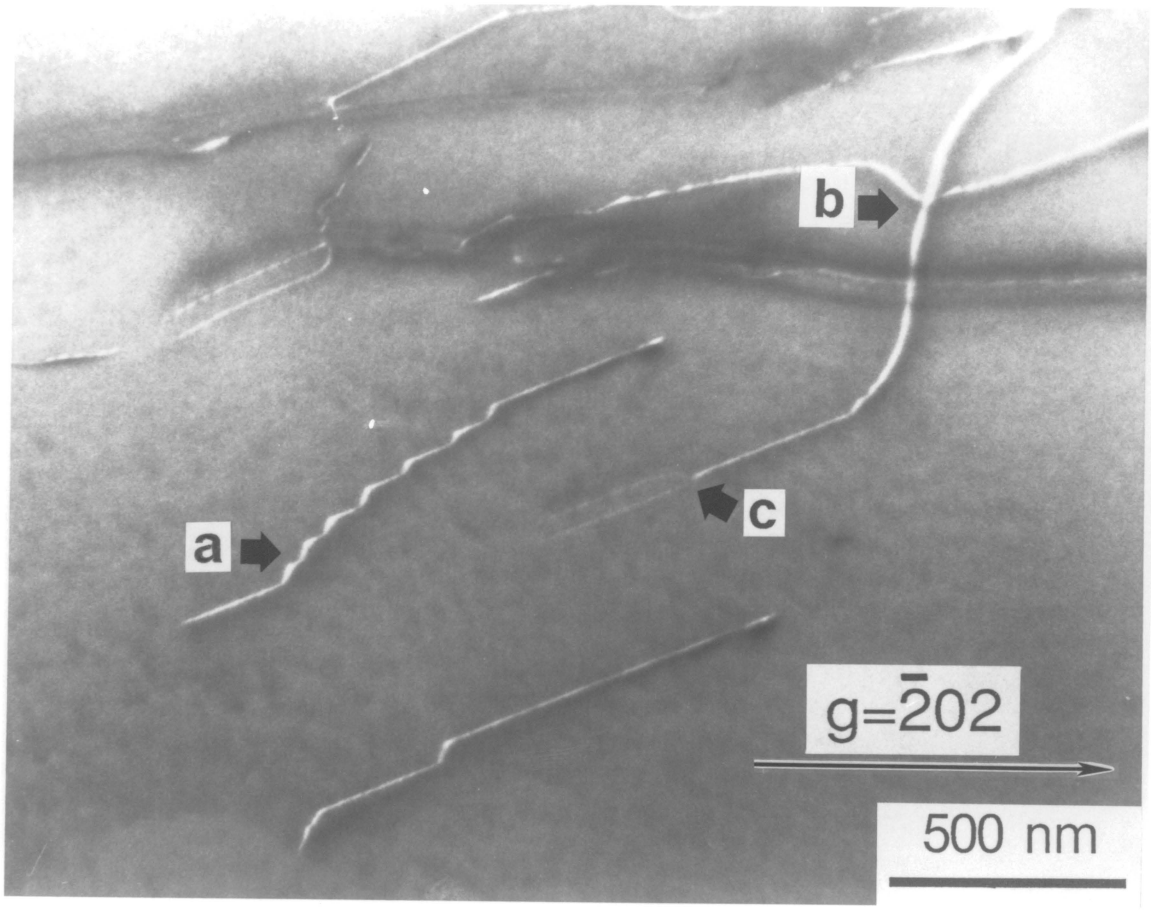

g = $\bar{2}02$
4000 nm

Figure 14. Dark field, weak beam electron micrograph of free dislocations: Strong crystallographic control on dislocation line directions (arrowed a), interaction of dislocations on different glide planes (arrowed b), and dissociation of unit dislocations (arrowed c) shown. BM = [010]; $s_g = 1.3 \times 10^{-1}$nm
'w' = 4.85.


b
a
c
g=$\bar{2}$02
500 nm

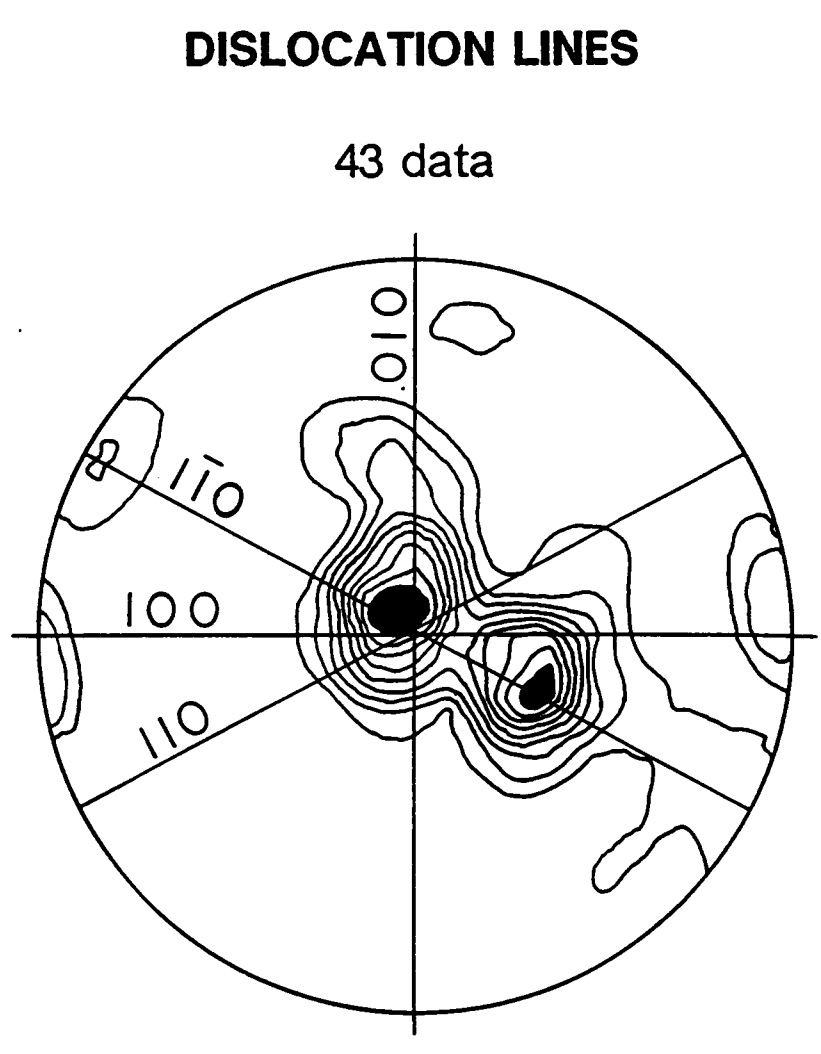


Figure 15. **Contoured, upper hemisphere, equal-area sterographic projection of dislocation line directions.**

Figure 16. Bright field electron micrograph of free dislocations: Accompanying computer simulated images for g = 202 and indicated Burgers vectors. Parameters used for computing simulated images are: u = [115] FN = (221) ANO = 0.07; START = 3.25; FINISH = 6.75; THICK = 6.25; BM = [101] w = 0.05.

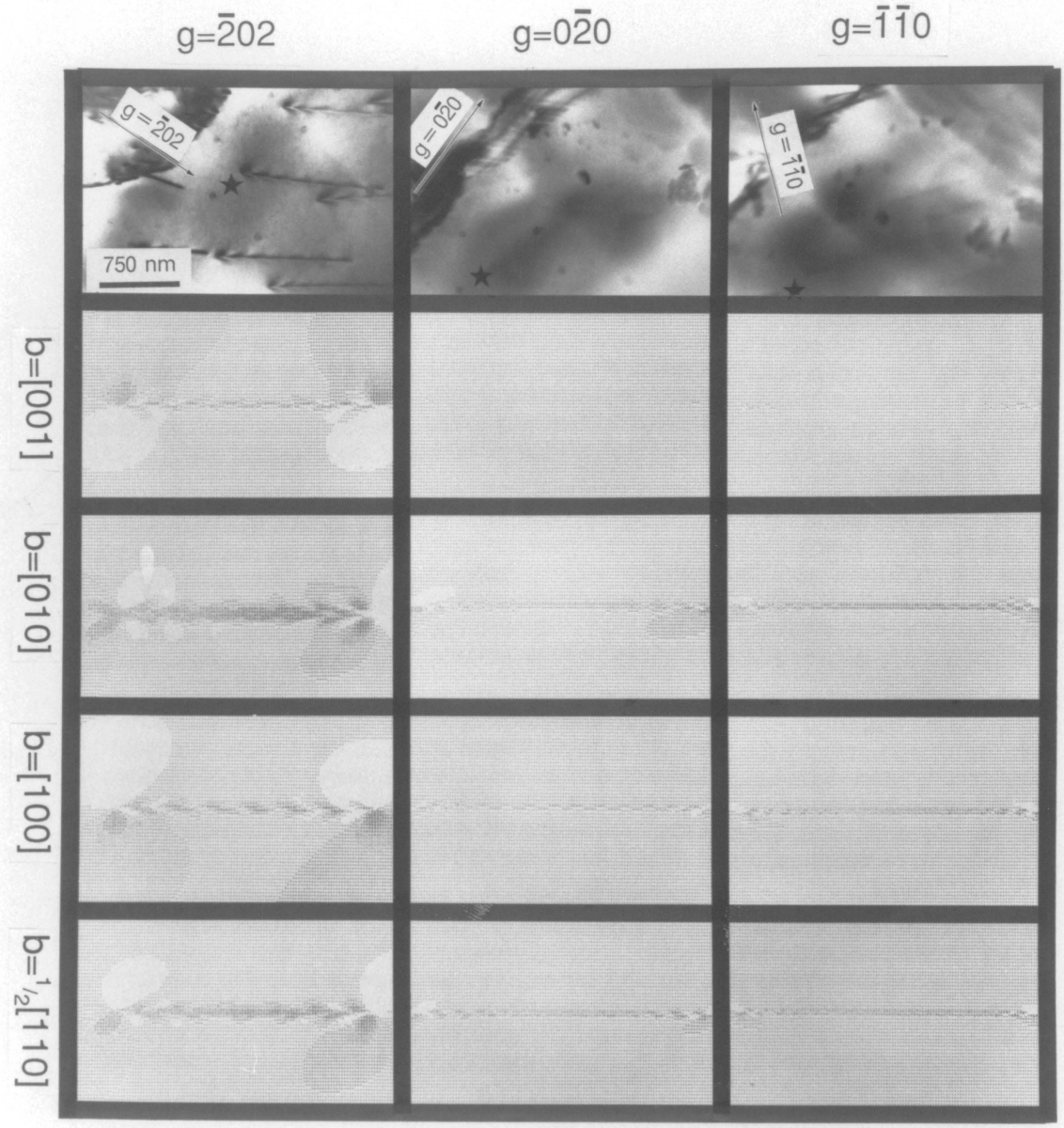
500 nm
b=[$\bar{1}$00]
b=[0$\bar{1}$0]
b=[001]
b=$^1/_2$[$\bar{1}\bar{1}$0]

Dislocations showed the most well defined contrast when imaged with $\mathbf{g} = \bar{2}02$. Figure 16 shows free dislocations imaged with $\mathbf{g} = \bar{2}02$ along with computer simulated images for all possible unit dislocations in the clinoamphibole structure. Since the left ends of the dislocations showed the most detailed contrast effects the computer simulated images were calculated with this part of the dislocation enlarged to provide maximum detail for comparison. The [010] burgers vector can be immediately excluded because the detailed character of its computed image is significantly different from the contrast in the TEM microphotograph (Fig. 16). The qualitative difference between the remaining possible burgers vectors is not as great and exclusion of any of the others based on this diffraction condition alone would be contentious.

Two-beam analyses of these dislocations for three different diffraction conditions are shown in figure 17, along with associated computer-simulated images for all possible unit dislocations in the clinoamphibole structure. It should be kept in mind that in matching computed images to the electron micrographs that it is consistent to rotate the computed image 180° about a vertical axis if necessary since this only results in changing the sign of the diffraction vector (Head et al., 1973). Also, the image width of a dislocation is approximately one third the extinction distance effective for the image diffraction conditions (Hirsch et al., 1965; p.253). So that for the diffraction conditions $\mathbf{g} = 0\bar{2}0$ and $\mathbf{g} = \bar{1}\bar{1}0$ the dislocation images appear narrower since the extinction distances for these diffraction conditions are shorter than for $\mathbf{g} = \bar{2}02$.

For $\mathbf{g} = \bar{2}02$ all experimental images show significant contrast. However, for $\mathbf{g} = 0\bar{2}0$ and $\mathbf{g} = \bar{1}\bar{1}0$, dislocations show extremely weak or no contrast in the TEM microphotographs. The computer simulated images for $\mathbf{g} = 0\bar{2}0$ and $\mathbf{g} = \bar{1}\bar{1}0$ show significant amounts of contrast for all Burgers vectors other than $\mathbf{b} = [001]$. For $\mathbf{g} = 0\bar{2}0$ and $\mathbf{g} = \bar{1}\bar{1}0$ with $\mathbf{b} = [001]$ the computer simulated images show no, or very weak contrast at the tips of the dislocations only. Therefore, matching the computed images with these diffraction conditions reveals that the [001] burgers vector is the best match between computed images and electron micrographs. The occurrence of [001] as the predominant burgers vector, considered with the dislocation

Figure 17. Bright field electron micrographs of free dislocations: Accompanying computer simulated images for indicated diffraction conditions and Burgers vectors. Parameters used for computing simulated images are: $u = [\bar{1}15]$ FN= (221) ANO= 0.07. For $g = 20\bar{2}$: START= -1.00; FINISH= 7.25; THICK= 6.25; BM= $[\bar{1}0\bar{1}]$ w= .05. For $g = 0\bar{2}0$: START= -1.00; FINISH= 12.82; THICK= 11.82; BM= $[\bar{1}0\bar{1}]$ w= .03. For $g = \bar{1}10$: START= -1.00; FINISH= 12.54; THICK= 11.54; BM= [112] w= .03. Star marks the same reference point in each photograph.


g=$\bar{2}02$
g=$0\bar{2}0$
g=$\bar{1}\bar{1}0$
g=$\bar{2}02$
g=$0\bar{2}0$
g=$\bar{1}\bar{1}0$
750 nm
b=[001]
b=[010]
b=[100]
b=$^1/_2$[1 1 0]

line directions (Fig. 15), indicates that [001]{110} is the most prominent glide system in the clinoamphibole in this study, followed closely by [001](100). These results are consistent with trace analysis of glide loops. However, glide planes intermediate between (110) and $(1\bar{1}0)$ cannot be excluded. In addition, [001](010) may be a secondary slip system, although, the occurrence of these line directions may have resulted from small amounts of dislocation climb.

Free dislocations are commonly found in pairs. Some of these dislocation pairs are dislocation dipoles (Fig. 18) that may result from interactions of dislocations on different glide planes (Fig. 14 arrowed b). Dislocations are also dissociated (Fig. 14 arrowed c) with intervening stacking faults.

Planar Defects

Planar defects are present and some of these show contrast characteristics that suggest they may be stacking faults (Fig 19; Hirsch et al.,1977). However, the interpretation of these features is complicated by the fact that they intersect extinction contours. Other planar defects include deformation microtwins, predominantly on (100) (Fig. 20) with dislocations lying along the twin plane (Fig. 20 arrowed a). Inspection of Figure 20 shows that the composition plane of the twin can occasionally curve into {110} planes (Fig. 20 arrowed b) and confirms the existence of the {110} and (100) glide planes discussed earlier.

Dislocation Arrays

Dislocation arrays (Fig. 13 and Fig. 18) form euhedral subgrain boundaries parallel to {hk0} (Fig. 21). These arrays may consist of pairs of parallel dislocations or may form nets with dislocations of more than one type. Figure 22 shows that although most of the dislocations in these complex arrays have a Burgers vector of [001], with $\mathbf{g} = 020$ some dislo-

Figure 18. **Bright field electron micrograph showing dislocation dipole (arrowed) and dislocation array (lower left corner):** Note that dislocations in dislocation array often occur in pairs. BM = [010].

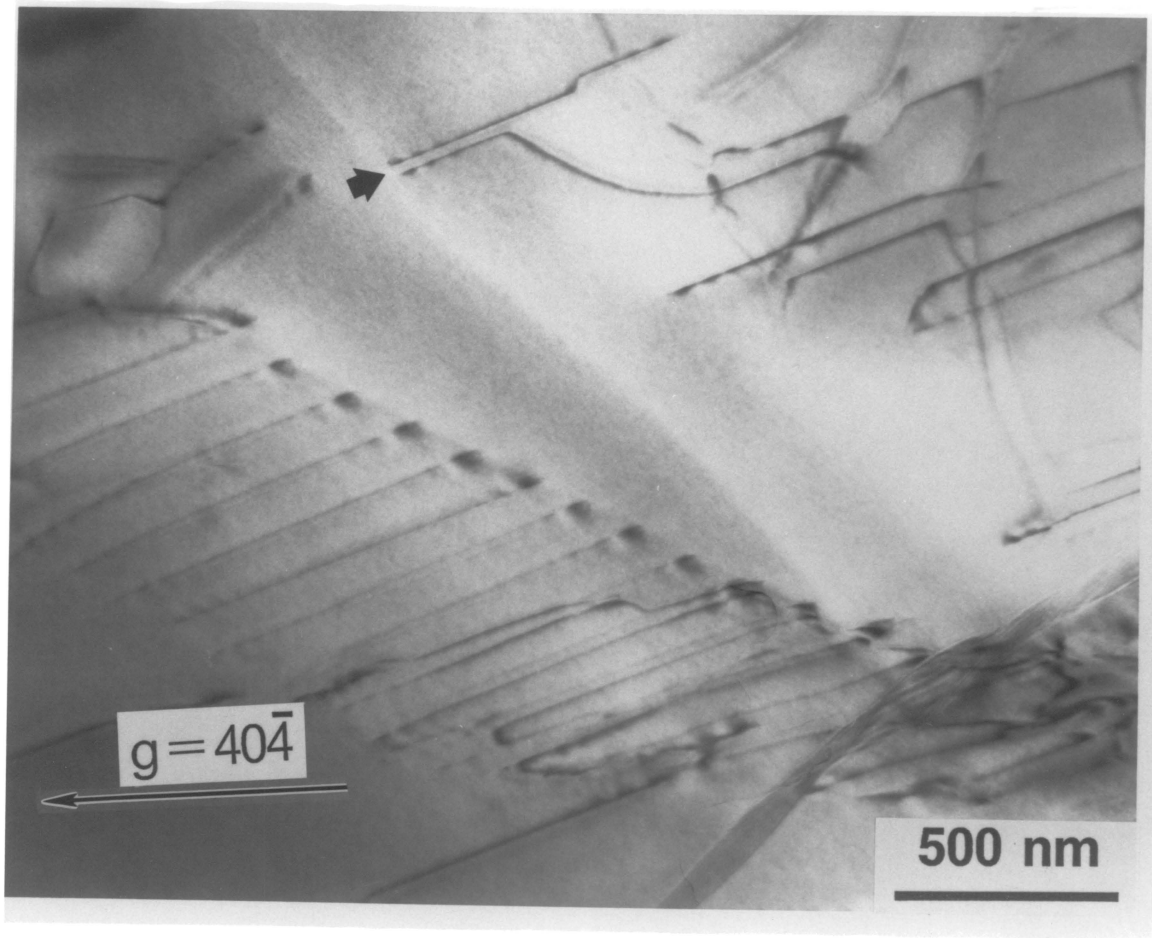

g = 40$\bar{4}$
500 nm

Figure 19. Centered dark field electron micrograph of planar defects: These exhibit contrast characteristics indicating that they may be stacking faults. BM = [010].

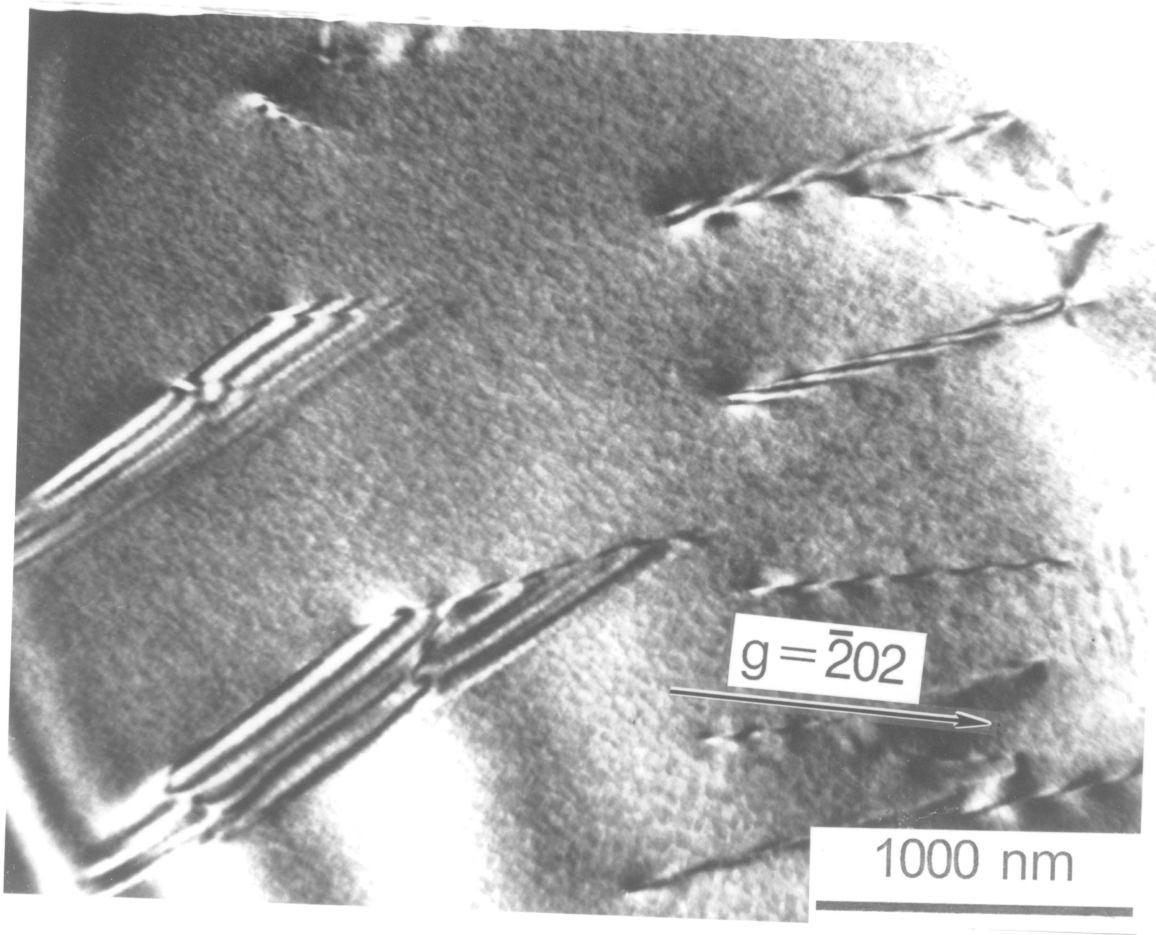

g = $\bar{2}02$
1000 nm

Figure 20. Bright field electron micrograph of (100) deformation twins: Inset SADP shows extra spots appearing in diffraction pattern for the [101] zone.

500 nm
a
b

Figure 21. Bright field electron micrograph with electron beam nearly parallel to [001]: In this orientation the subgrain boundaries are vertical indicating that they are parallel to {hk0}.

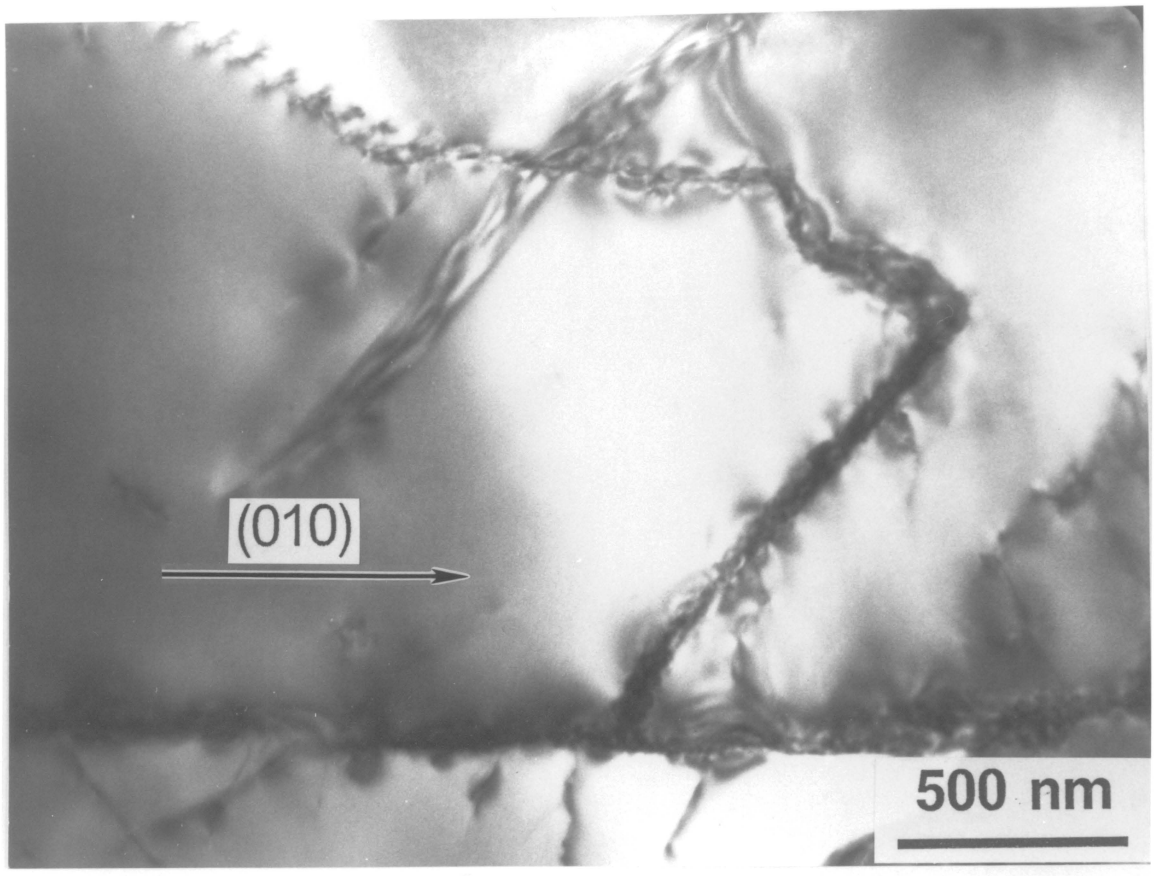
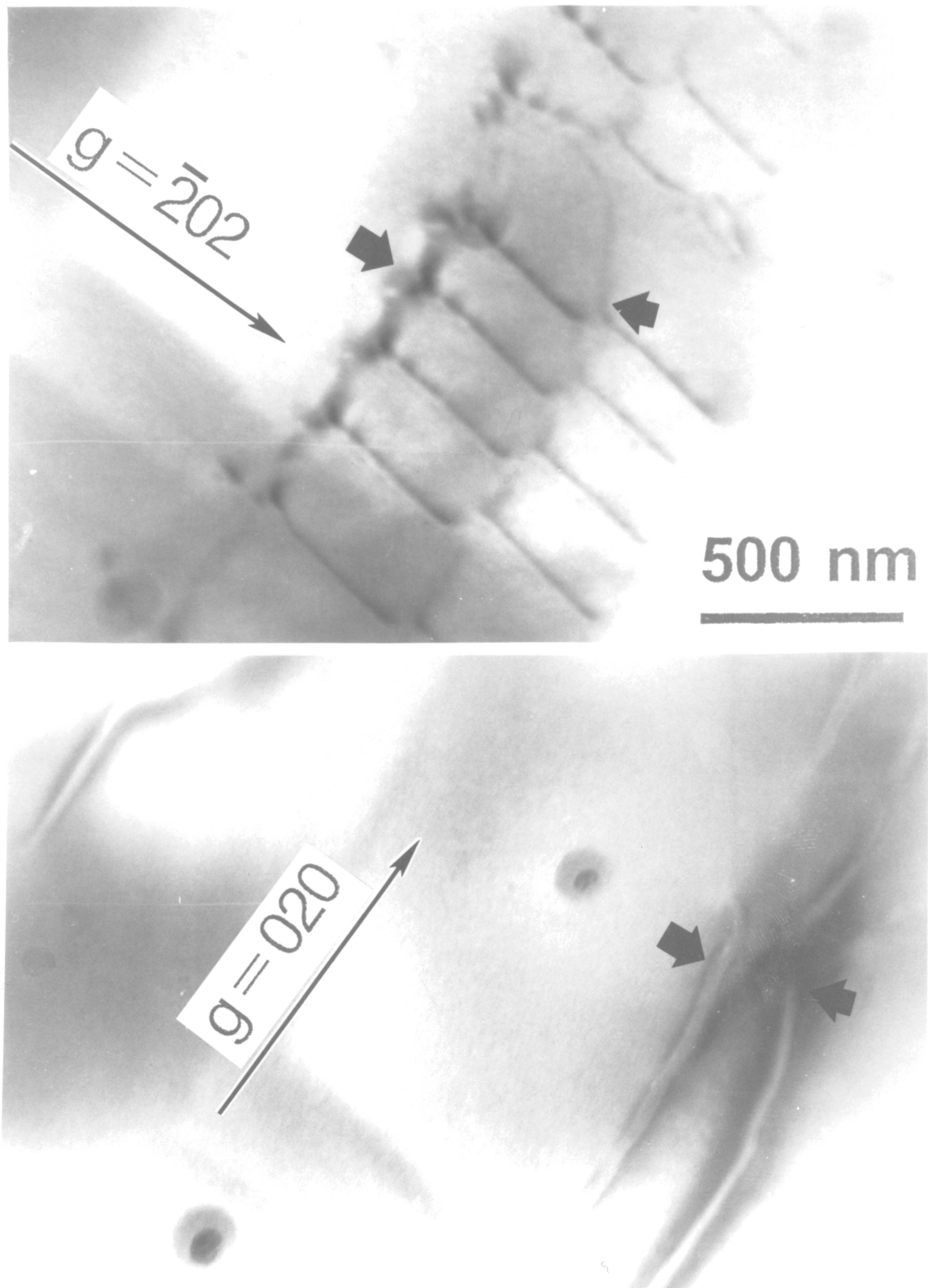

(010)
500 nm

Figure 22. **Bright field electron micrograph of dislocation array for indicated diffraction conditions:** Note that for $g = 020$ the dislocations in the center of the array show significant contrast indicating a Burgers vector other than [001]. BM = [101].


g = 202
500 nm
g = 020

cations still show significant contrast indicating the presence of another Burgers vector in these arrays, consistent with a Burgers vector component parallel to [010].

DISCUSSION

The predominance of the [001] Burgers vector in the clinoamphibole structure is consistent with **c** being the shortest unit translation (i.e. 0.533 nm for **c** compared with 0.986 nm for **a** and 1.807 nm for **b**). The fact that **c** is about half as large as **a** and one fourth as large as **b**, and that the energy of a dislocation is proportional to the square of the length of its Burgers vector (Hull and Bacon, 1984), reveals that [001] is by far the most energetically favored unit Burgers vector and the one most commonly reported (Morrison-Smith, 1976; Biermann and Van Roermund, 1983). However, Morrison-Smith (1976) also reported the possible existence of [100] as a Burgers vector for hornblende crystals that were experimentally deformed at a strain rate of 10^{-5} sec^{-1} and temperatures up to 600 degrees C.

The structure and crystal chemistry of clinoamphiboles are reviewed in detail by Hawthorne (1985). The salient points will be summarized here as a point of reference for further discussion on a possible configuration for the [001] Burgers vector. Consideration of the clinoamphibole structure projected onto (100) (Fig.23a) shows that it is characterized by "double chains" of polymerized TO_4 groups (T=Si,Al) that share corners. The long axis of this tetrahedral polymer defines the **c** crystallographic direction. Two of the tetrahedral "double chains", inverted with respect to each other, are bonded together with their apical oxygen atoms pointed inward) by a layer of 6-coordinated cations (M1,M2,M3). This is accomplished by staggering the "double chains" by $\frac{1}{3}$**c** so that the apical oxygens in the adjacent chains coordinate with the intervening cations. The coordination of these cations is then completed by addition of two monovalent anions (O3; usually OH or F) in the plane defined by the apical oxygens. This entire assembly forms the classic "I-beam" configuration, elongate along **c**.

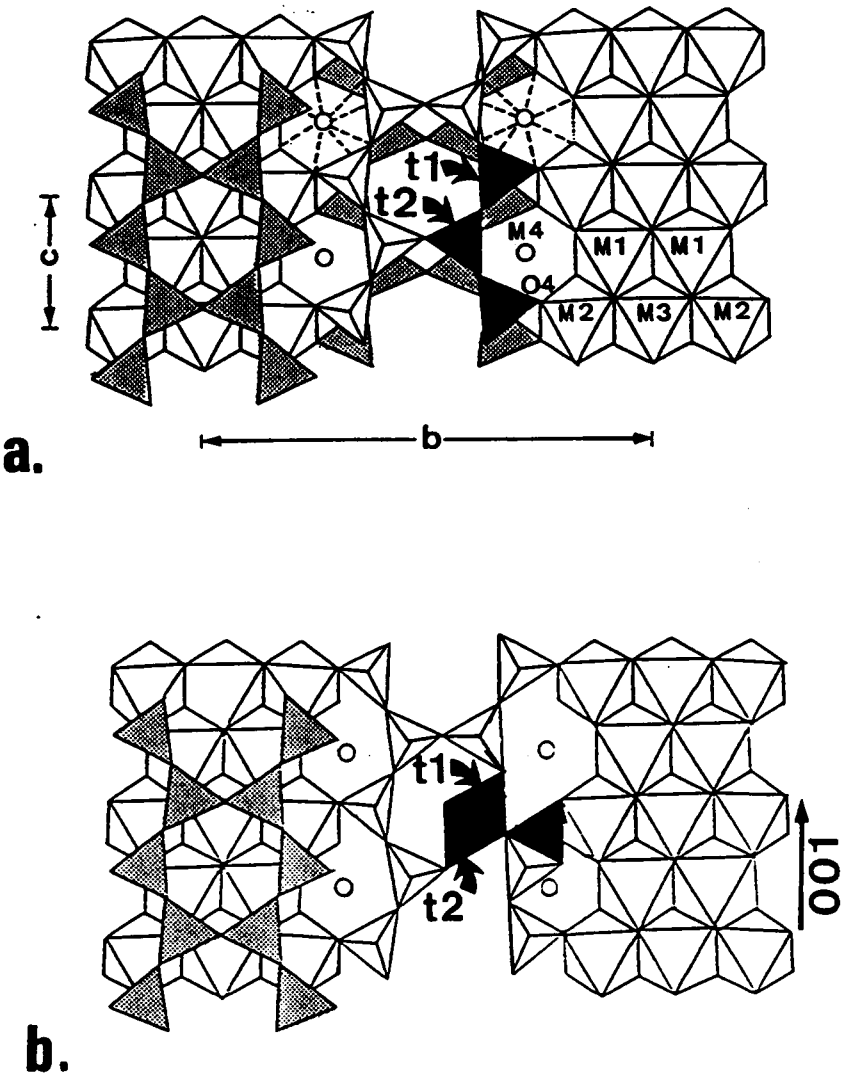


Figure 23. **Schematic illustration for possible configuration of [001] Burgers vector in the clinoamphibole structure:** (projected onto (100); adapted from Hawthorne, 1985). a. Undeformed lattice. b. Lattice with [001] Burgers vector.

These "I-beam" assemblies are bonded at their edges, alternately, by one 6-coordinated (M2) and one 8-coordinated (M4) cation, resulting in a structure of alternating, edge-linked 'I-beam' assemblies.

If the M2-O4 and M4-O4 bonds were broken and the T2 tetrahedron translated along the [001] direction (Fig. 23b) to the equivalent lattice position, this would leave the T2 tetrahedron that was originally bonded to M2B now unbonded, creating an extra half plane in the clinoamphibole structure and a dislocation defined by $\mathbf{b} = [001]$. The illustration in Figure 23b is meant to be schematic and intended only to illustrate the relative movements of the structural units. The strain associated with the [001] translation will be distributed more uniformly in the crystal lattice proximal to the dislocation core than shown in Figure 23b, as shown by the occurrence of significant contrast in the electron micrographs.

Figure 24 illustrates the "I-beam" representation of the clinoamphibole structure projected onto (001). Possible configurations for the slip plane in the (110) and (100) planes are also shown. The configurations result from jogs in the dislocation line around the "I-beams" so that only the 6-coordinated (M2) and 8-coordinated (M4) bonds are disrupted, and possibly also the 12-coordinated "A" site. For a unit dislocation this configuration seems energetically more favorable than a dislocation line passing through the layer of 6-coordinated (M1,M2,M3) cations that bond the double chains. However, dissociation of the [001] Burgers vector in this octahedral layer may be likely. It is also apparent from Figure 24 that with the dislocation line configuration illustrated, no tetrahedral bonds will be broken by movement of the dislocations. Similar arguments would apply to any glide plane between (110) and $(1\bar{1}0)$. However, the {110} glide planes should have slightly lower dislocation energies per unit length since the [110] direction is slightly longer than the [100] direction. Therefore, for dislocations with the same amount of edge or screw character, a dislocation on a {110} plane should disrupt fewer bonds per unit length than a dislocation lying on a plane closer to (100). This may be the reason for the preference for [001]{110} as the predominant glide system followed closely by [001](100). Figure 25 illustrates calculated dislocation energies using the program of Head et al. (1973; p.329) for the [001] Burgers vector. This diagram shows that dislocation

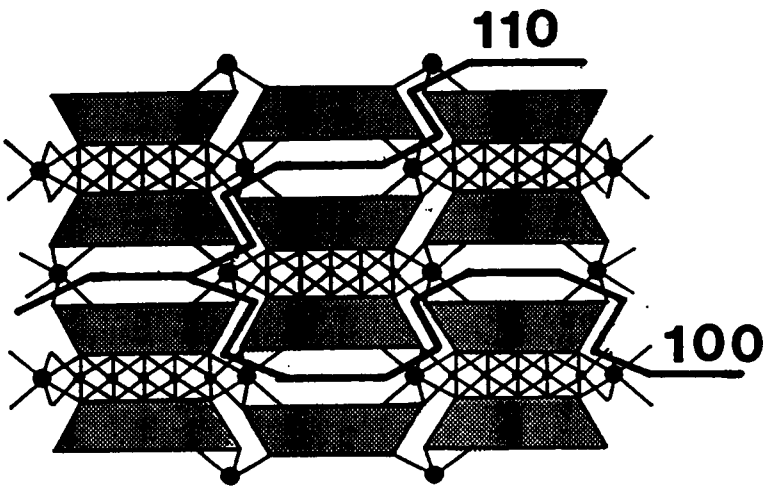


Figure 24. **Schematic illustration of possible location of slip planes in clinoamphibole structure projected onto (001):** (adapted from Hawthorne, 1985). Black dots indicate locations of M4 sites.

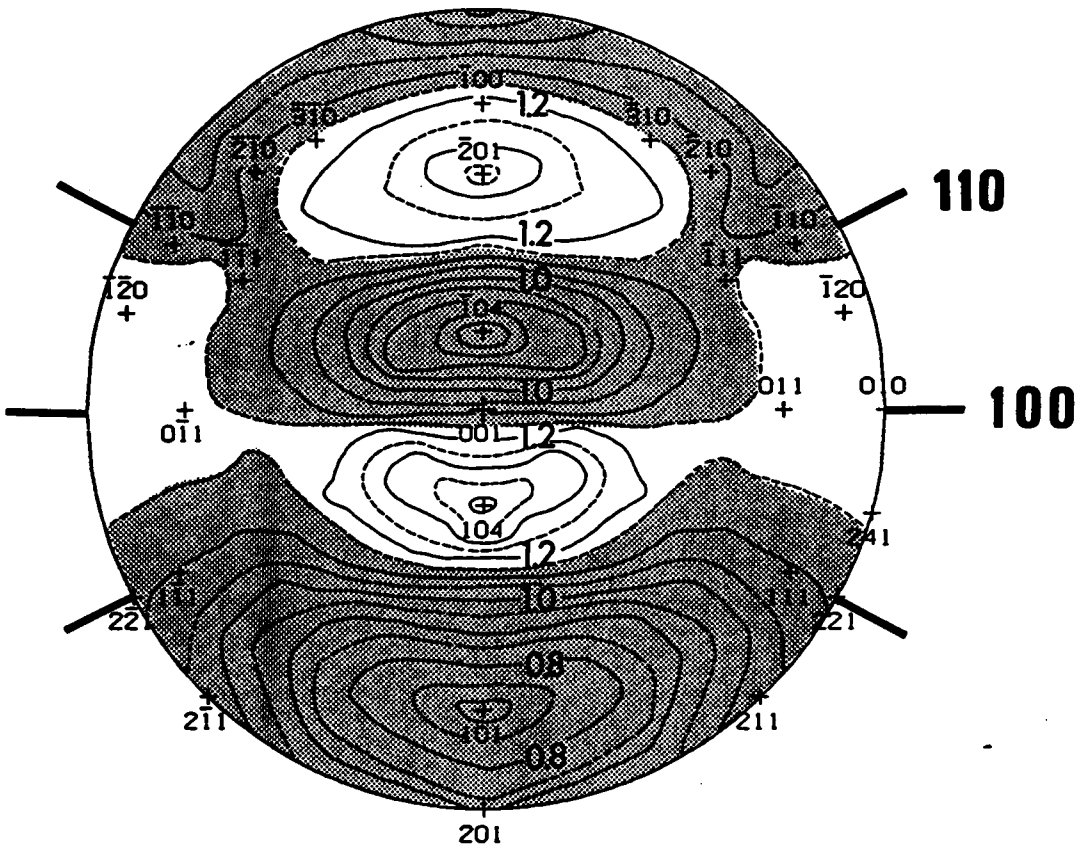


Figure 25. Contoured, upper hemisphere projection of calculated dislocation energies: Contour intervals are in terms of $\ln(r/r_0)x10^{-9}N$, where r and r_0 are the inner and outer cutoff radii respectively (see Hirth and Lothe, 1968, p.62-63). Shaded areas denote levels below 1.15.

energies become progressively less as {110} are approached from (100). The pattern is not simple, however, as dislocation energies in the (010) plane show several minima and maxima. The minimum in the $[\bar{1}04]$ orientation approximately corresponds to the maximum in dislocation line directions that is subparallel to **c**. shown in Figure 15.

CONCLUSIONS

TEM analysis has demonstrated that the clinoamphibole in this study contains a variety of defects, including: high densities of free dislocations and dislocation arrays, stacking faults, and (100) deformation microtwins. Two - beam diffraction contrast experiments in conjunction with computer simulated images indicate that the predominant unit Burgers vector is [001]. However, dislocations can be dissociated with intervening stacking faults. Dislocation glide occurs on the [001]{110}, [001](100), and possibly [001](010) slip systems in order of preference. These slip systems are consistent with a unit translation in the clinoamphibole structure resulting in breaking the bonds between the "I-beams" rather than disrupting the much stronger Si-O bonds that form the double chains. If this model is correct, it implies that the crystal chemistry of the M2 and M4 site may have significant controls on the rheological behavior of amphibole crystals, just as it does on many other physical and chemical properties (Sueno, 1973; Cameron and Papike, 1979).

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Appendix A. Sample Location and Geologic Setting

The amphibolite described in this study occurs as part of the Senja Nappe on the island of Senja, Norway (Fig. 1). The Senja Nappe is composed dominantly of amphibolite facies carbonate and pelitic units. The amphibolite occurs as small isolated bodies within these units.

Metamorphism and deformation of the Senja, Nappe occurred during Ordovician orogenic activity as recorded by argon retention in amphibole. $^{40}Ar/^{39}$ incremental release spectra are discordant but record total gas ages from 480 m.y. to 440 m.y. $^{40}Ar/^{39}Ar$ release spectra for biotite from the same sample give middle Devonian ages with 380 m.y. plateau.

The sample locality occurs as a small road cut on the south side of highway 86 (Fig. 26) near Vegstad. At this locality the amphibolite is dark green to black with white mm to cm scale laminations of plagioclase rich layers. Porphyroclasts as large as 1 cm can sometimes be seen in handsample and usually occur as buttons on the foliation surfaces.

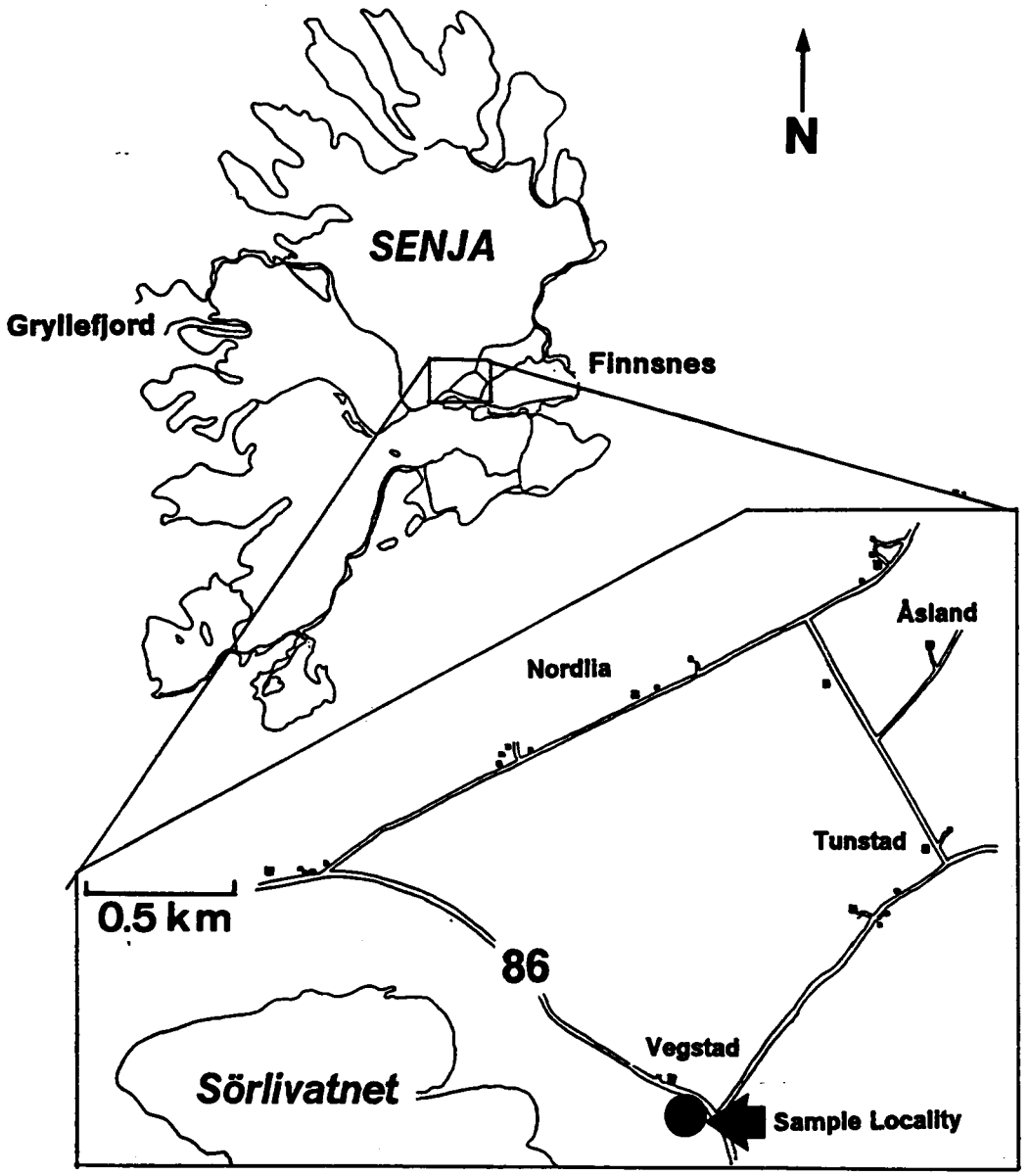

Figure 26. Location map for amphibolite outcrop on Senja, Norway.

Appendix B. AMPHAX: A FORTRAN Program for Calculating the Lower Hemisphere Stereographic Projections of the Crystallographic Axes of Clinoamphibole from Universal Stage Measurement

INTRODUCTION

Complete petrofabric analysis of rocks in thin section requires determination of the orientation of the crystallographic axes of the component minerals. These orientations are typically displayed in lower hemisphere sterographic projection (Turner and Weiss, 1963). A microscope fitted with a universal stage can be used for this purpose. For uniaxial minerals, such as quartz, the process for determining at least the **c** crystallographic axis is straightforward, it is coincident with the optic axis of the mineral.

However, the process for biaxial minerals is more problematic. In this situation, the universal stage is used to determine the principal axes of the optical indicatrix and the crystallographic axes are fixed relative to the indicatrix using some fiducal marker such as a cleavage. This can be accomplished with the aid of a stereonet, but the process is tedious. The program AMPHAX was designed to calculate the lower-hemisphere stereographic projection of the crystallographic axes of clinoamphibole from universal stage measurements using an assumed β angle. AMPHAX is written in FORTRAN 77 for an IBM mainframe where input - output devices are externally defined, but it should be easily adaptable to other systems in that the storage or time requirements are not severe.

THE PROGRAM

Input

The operation of the universal stage to determine the principal axes of the optical indicatrix (X,Y,Z) for albite is described in Turner and Weiss (1963). The process is essentially the same for clinoamphibole, except that most clinoamphiboles are optically negative.

A sample input file for AMPHAX is shown in Figure 27. Data were collected from a mylonitic amphibolite (approx. 75% amphibole) and represent orientations of porphyroclasts and associated recrystallized grains. The first line of the input file is the title describing the data set. The second line contains labels for the data fields for convenience. Field 1 (S#) is simply a sample number for enumerating data points. Field 28 (TP) allows grouping the data into sets (i.e. 1=porphyroclast; 2=recrystallized grain).

S#	TP	SCAN35 B 1 CLEAVAGE	X	Y	Z
1	1	271+27		321-18	239+22
2	1	271+27		318-18	240+24
3	1	299+32		320-19	238+24
5	2	070+17	014-21	077+32	
8	2	274-09	357-22	088-03	
9	2	236+04	349-19	262+03	
10	2	086-08	336-22	236-29	
11	2	039-01	334+14	066-12	
12	2	096-05	346+17		083+12
13	2	077-06	314-09	045+04	
16	2	213-05	271-15	181+03	

Figure 27. Sample AMPHAX input file.

For example I use the output from AMPHAX as input to another program that plots stereographic projections, and TP is used to control the symbol plotted for a particular point. Field 3 (CLEAVAGE) contains the universal stage measurement of a pole to a {110} cleavage. The rest of the fields contain the universal stage measurements of the principal axes of the optical indicatrix. It is usually only possible to measure two of the axes, so that one of these fields is blank. The data format for the pole to cleavage and principal axes of the indicatrix are very similar to that described in Turner and Weiss (1963). The first three integers describe the azimuth measured on the A_1 axis and the last two integers describe the tilt angle on either the North-South axis, if a principal axis is measured, or the East-West axis if a pole to cleavage is measured. Turner and Weiss (1963) use arrows to indicate the sense of tilt on these axes. These arrows are replaced by a positive sign for either upward or right-pointing arrows or a negative sign for downward or left-pointing arrows.

Operation

During the execution of AMPHAX it is necessary for the program to convert the universal stage measurements for the poles to cleavage and the measured principal axes to angular coordinates representing their lower-hemisphere projections. This conversion is accomplished by subroutine CLEVRT and subroutine AXCVRT respectively. It is also necessary for vectors describing the principal axes and crystallographic axes to be transformed between angular and cartesian coordinates. These transformations are done by subroutine VECTRN, for transformation from angular to cartesian coordinates, and subroutine TRNVEC, for transformation from cartesian to angular coordinates. Since only the directions of the various vectors are necessary for the stereographic projection AMPHAX operates with all vectors normalized to unit length. This is only for convenience and simplifies the transformations. AMPHAX begins by reading the title for the data set

and prompting input for the crystallographic beta angle (β). After writing the output heading AMPHAX scans the first line of data and determines which of the X,Y, or Z principal axes were not measured. AMPHAX then rereads the line of data and takes the appropriate cross product of the measured axes in order to determine the third. The angle between the two measured principal axes is also calculated and if not found to be 90 ± 10 degrees the X,Y, and Z for this cycle is output along with a warning message.

If the measured principal axes are found to be orthogonal, within the specified limits, then AMPHAX continues to calculate the crystallographic axes. Figure 2 illustrates the relationship between the principal axes of the optical indicatrix and the crystallographic axes of clinoamphibole. The Y principal axis is coincident with crystallographic **b**. In order to calculate **c**, AMPHAX takes the cross product of the pole to the measured {110} cleavage and the Y axis. Since the distinction between positive and negative indicatrix axes are not determined by the universal stage, AMPHAX fixes the measured Z axis positive and makes the other axes consistent with this. First, AMPHAX makes the direction of positive **c** consistent with the positive sense of Z. This is accomplished by calculating the angle between positive Z and positive **c**. If this angle is found to be greater than 90 degrees the sign of **c** is reversed. Now the angle between X and **c** is calculated and if found to be less than 90 degrees the sign of X and Y are reversed, which is the same as rotating the optical indicatrix 180 degrees about the Z axis. At this point the sign of the principal axes of the optical indicatrix and the crystallographic axes are consistent.

Once **b** and **c** have been determined the location of the **a** axis is uniquely fixed assuming a known β angle. This angle is composition dependent. However, beta angles of natural clinoamphiboles exhibit a range of only a few degrees (Colville et al., 1966), so that any error in the assumed β angle will not introduce a large error in the location of the **a** axis. In order to determine **a** AMPHAX calculates $\mathbf{a}^*$ by taking the cross product of **b** and **c**. Once $\mathbf{a}^*$ is determined the following transformation matrix is established:

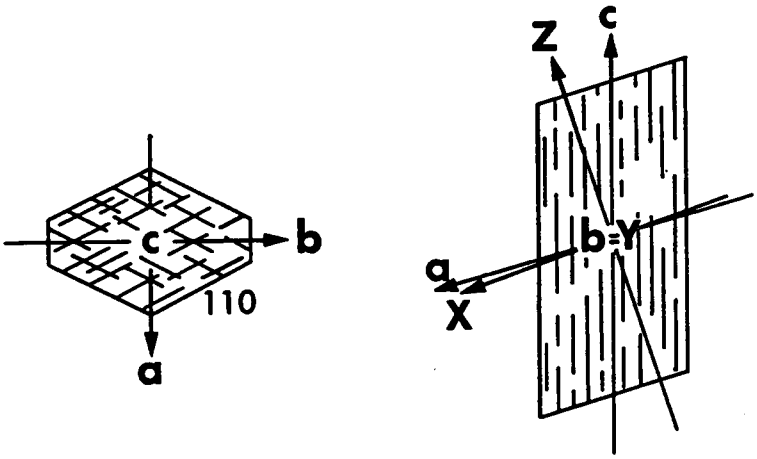

Figure 28. Optical orientations for clinoamphibole: Relationship between the principal axes of the optical indicatrix (X,Y,Z) and the crystallographic axes (a, b, c) for clinoamphibole (adapted from Kerr, 1977).

$$\begin{bmatrix} ASTR(1) & Y(1) & C(1) \\ ASTR(2) & Y(2) & C(2) \\ ASTR(3) & Y(3) & C(3) \end{bmatrix},$$

where ASTR,Y, and C are the cartesian vector representation of **a***, **b**, and **c** crystallographic axes in the universal stage reference. This matrix will transform any cartesian representation of a vector in the clinoamphibole structure to its cartesian representation in the universal stage reference frame. The cartesian representation for the **a** axis in the clinoamphibole reference is:

$$\begin{bmatrix} \cos(\beta - 90) \\ 0 \\ \sin(\beta - 90) \end{bmatrix}.$$

Note that the central column of the transformation matrix is unused but included as comment statements in the program for completeness. This transformation is carried out and the coordinates in the universal stage reference are calculated. AMPHAX then outputs the results and begins a new cycle by reading the next line of data.

Output

A sample output from AMPHAX is illustrated in Figure 29. It contains, in addition to the angular coordinates for the lower hemisphere stereographic projections of the X, Y, and Z principal axes of the optical indicatrix and the crystallographic axes, several checks on the input data quality. These include the angle between the two measured indicatrix axes (MEA.<), the angle between the **b** axis and the pole to cleavage (B<CL), and the angle between **c** and X (C<X). The angle between the two measured principal

SCAN35 B 1

BETA=105.0DEG.

PT	TP	CLV	XOA	YOA	ZOA	MEA.<
1	1	269. 27.	-255. 61.	129. 18.	31. 22.	89.6
2	1	269. 27.	-254. 58.	132. 18.	30. 24.	86.8
3	1	241. 32.	-255. 59.	130. 19.	32. 24.	89.3
5	2	110. 17.	- 76. 21.	-193. 32.	323. 46.	80.2
8	2	86. 9.	- 93. 22.	- 2. 3.	-265. 68.	89.8
9	2	304. 4.	-101. 19.	- 8. 3.	-269. 71.	88.1
10	2	274. 8.	-114. 22.	-214. 29.	-351. 53.	87.7
11	2	321. 1.	-296. 14.	- 24. 12.	-155. 72.	85.2
12	2	264. 5.	-284. 17.	- 65. 68.	-187. 12.	86.9
13	2	283. 6.	-136. 9.	-225. 4.	-339. 80.	88.4
16	2	147. 5.	-179. 15.	- 89. 3.	-348. 75.	89.2

A	B	C	B<CL	C<X
-251. 58.	129. 18.	24. 39.	120.6	108.
-251. 56.	132. 18.	25. 41.	118.6	107.
-243. 48.	130. 19.	17. 49.	96.6	118.
- 88. 22.	-193. 32.	353. 56.	75.3	111.
- 93. 24.	- 2. 3.	-253. 81.	83.6	103.
- 99. 12.	- 8. 3.	-143. 86.	63.9	112.
-112. 20.	-214. 29.	- 18. 60.	60.0	106.
-292. 10.	- 24. 12.	-227. 77.	63.4	108.
-282. 18.	- 65. 68.	-173. 7.	105.4	107.
-134. 10.	-225. 4.	- 94. 84.	57.8	103.
-180. 19.	- 89. 3.	-322. 85.	57.9	101.

Figure 29. Sample AMPHAX output file.

axes should always be 90 degrees as the principal axes of the optical indicatrix are orthogonal. In practice it has been found that usually this angle can be measured with the universal stage to within 5 degrees. Since the **b** axis bisects the 60 degree angle formed by the intersection of {110} cleavages B<C should allways be near 60 degrees or 120 degrees. Also, the relationship between the optical indicatrix and the crystallographic axes constrains the angle between **c** and X to be greater than 90 degrees and this angle should be near β, since X and **a** are within a few degrees of each other. Also, a negative sign preceding the angular coordinate of an axis indicates that the positive direction of this axis would have plotted on the upper hemisphere. This convention is included so that it is possible to keep track of the sign of the various axes (c.f. Wenk, 1986).

COMMENTS

As previously stated the orientations of the principal axes of the optical indicatrix can be consistently determined within 5 degrees with the universal stage. Since **b** is coincident with Y then **b** ,X, Y, and Z can all be determined to within 5 degrees. However, in practice it has been found that it is difficult to determine the orientations of {110} cleavages with the universal stage because it is sometimes difficult to decide when the cleavage is in a vertical orientation. The error in this measurement will introduce a corresponding error in the orientations of **c** and **a**. However, these errors can be evaluated by the checks in the output file discussed previously.

FORTRAN Code for AMPHAX

```
C THIS PROGRAM DETERMINES THE PRIMARY AXES (X,Y,Z) OF THE OPTICAL
C  INDICATRIX FOR CLINOAMPHIBOLE FROM U-STAGE MEASUREMENTS AND
C  CALCULATES THE LOWER HEMISPHERE STEREOGRAPHIC PROJECTION OF
C  THE CRYSTALLOGRAPHIC AXES.
C-------------------------------------------------------
C              FILE DEFINITIONS
C
C     FILE 1 : INPUT FILE CONTAINING U-STAGE DATA
C     FILE 10: OUTPUT FILE CONTAINING ANGULAR COORDINATES OF THE
C              CRYSTALLOGRAPHIC AXES
C
C-------------------------------------------------------
      CHARACTER BLK(6)*6,TITLE*30,DUM*30,XSGN*1,YSGN*1,ZSGN*1,ASGN*1,
     * CSGN*1,CLSGN*1
      REAL YA,YEW,YRHO,YPHI,ZA,ZEW,ZRHO,ZPHI,XA,XEW,XRHO,XPHI,
     * AMATRX(3,3),C(3),X(3),Y(3),Z(3),CL(3),A(3),BETA,PI,CLVA,CLVD,
     * ASTR(3),ZANGC,RAD,XNAGR,RHOCL,PHICL,XMAG,YMAG,ZMAG,CMAG,CLMAG,
     * YDCL,ZDC,ZAC,CLB,CDX,CAX
      COMMON XNAGR,RAD,SIGN
      DATA XSGN,YSGN,ZSGN,CLSGN,ASGN,CSGN /6*' '/
C
      PI=ACOS(-1.)
      RAD=360./(2*PI)
C READ INPUT FILE TITLE
      READ (1,1) TITLE
1     FORMAT(A30)
      READ(1,1) DUM
      PRINT*, '    INPUT BETA ANGLE'
      READ(5,*) BETA
C
C WRITE HEADING FOR OUTPUT FILE
      WRITE(10,1) TITLE
      WRITE(10,2) BETA
2     FORMAT('BETA=',F5.1,'DEG.')
      BETA=BETA/RAD
      WRITE(10,3)
3     FORMAT(' PT ',1X,'TP',6X,'CLV',9X,'XOA',9X,'YOA',9X,'ZOA',
     * 9X,'MEA.<',8X,' A ',8X,' B ',10X,' C ',6X,'B<CL   C<X')
      WRITE(10,4)
4     FORMAT('____',1X,'__',8(4X,'________'),4X,'_____',2X,'____')
C
C READ FIRST LINE OF DATA AND DETERMINE WHICH INDICATRIX AXIS TO
C  CALCULATE
5     READ(1,6) (BLK(K),K=1,6)
6     FORMAT(A6,A2,4X,4(A6,5X))
      DO 7 I=1,6
      IF(BLK(I).EQ.'      ') GOTO 8
7     CONTINUE
```

```
8     IF(BLK(1).EQ.'      ') GOTO 20
C BACKSPACE INPUT AND READ DATA
      BACKSPACE 1
      READ(1,9) CLVA,CLVD,XA,XEW,YA,YEW,ZA,ZEW
9      FORMAT(12X,4(2(F3.0),5X))
C
C CALCULATE ANGULAR AND CARTESIAN COORDINATES OF Y AND Z PRINCIPAL
C   AXES AND DETERMINE Z
      IF(I.EQ.4) THEN
       CALL AXCVT(YA,YEW,YRHO,YPHI)
       CALL VECTRN(YRHO,YPHI,Y)
       CALL AXCVT(ZA,ZEW,ZRHO,ZPHI)
       CALL VECTRN(ZRHO,ZPHI,Z)
       CALL CROSS(Y,Z,X)
       CALL TRNVEC(X,XRHO,XPHI)
       END IF
C
C CALCULATE ANGULAR AND CARTESIAN COORDINATES OF X AND Z PRINCIPAL
C   AXES AND DETERMINE Y
      IF(I.EQ.5) THEN
       CALL AXCVT(XA,XEW,XRHO,XPHI)
       CALL VECTRN(XRHO,XPHI,X)
       CALL AXCVT(ZA,ZEW,ZRHO,ZPHI)
       CALL VECTRN(ZRHO,ZPHI,Z)
       CALL CROSS(Z,X,Y)
       CALL TRNVEC(Y,YRHO,YPHI)
      END IF
C
C CALCULATE ANGULAR AND CARTESIAN COORDINATES OF X AND Y PRINCIPAL
C   AXES AND DETERMINE Z
      IF(I.EQ.6) THEN
       CALL AXCVT(XA,XEW,XRHO,XPHI)
       CALL VECTRN(XRHO,XPHI,X)
       CALL AXCVT(YA,YEW,YRHO,YPHI)
       CALL VECTRN(YRHO,YPHI,Y)
       CALL CROSS(X,Y,Z)
       CALL TRNVEC(Z,ZRHO,ZPHI)
      END IF
C
C DETERMINE ANGLE BETWEEN MEASURED AXES
      AMD=ASIN(XNAGR)*RAD
C
C CALCULATE ANGULAR AND CARTESIAN COORDINATES OF POLE TO CLEAVAGE
      CALL CLEVRT(CLVA,CLVD,RHOCL,PHICL)
      CALL VECTRN(RHOCL,PHICL,CL)
C
C TEST MEASURED ANGLE BETWEEN PRINCIPAL AXES FOR ORTHOGANALITY AND IF
C   NOT ORTHOGONAL WRITE OUTPUT WITH WARNING
      IF(AMD.LT.80.0.OR.AMD.GT.100.) THEN
       WRITE(10,10) BLK(1),BLK(2),RHOCL,PHICL,XRHO,XPHI,YRHO,
     *    YPHI,ZRHO,ZPHI,AMD
10    FORMAT(A6,A2,4(4X,2F4.0),5X,F5.1,2X,
     * '******* MEASURED OPTIC AXES NOT ORTHOGONAL')
      GOTO 5
```

```
      END IF
C
C NORMALIZE CARTESIAN VECTORS
      XMAG=SQRT(X(1)**2+X(2)**2+X(3)**2)
      YMAG=SQRT(Y(1)**2+Y(2)**2+Y(3)**2)
      ZMAG=SQRT(Z(1)**2+Z(2)**2+Z(3)**2)
      CLMAG=SQRT(CL(1)**2+CL(2)**2+CL(3)**2)
      DO 11 I=1,3
      CL(I)=CL(I)/CLMAG
      X(I)=X(I)/XMAG
      Y(I)=Y(I)/YMAG
11    Z(I)=Z(I)/ZMAG
C
C CROSS Y AND POLE TO CLEAVAGE TO DETERMINE C AXIS
       CALL CROSS(Y,CL,C)
C
C NORMALIZE C AXIS CARTESIAN VECTOR
      CMAG=SQRT(C(1)**2+C(2)**2+C(3)**2)
      DO 12 I=1,3
12    C(I)=C(I)/CMAG
C
C CALCULATE THE ANGLE BETWEEN Y AND POLE TO CLEAVAGE AND THE ANGLE
C   BETWEEN Z AND C
      YDCL=0.
      ZDC=0.0
      DO 13 I=1,3
      YDCL=YDCL+Y(I)*CL(I)
13    ZDC=ZDC+Z(I)*C(I)
      CLB=ACOS(YDCL)*RAD
      ZAC=ACOS(ZDC)*RAD
C
C MAKE SIGN OF Z AND C CONSISTENT
      IF(ZAC.GT.90..OR.ZAC.LT.-90.) THEN
       DO 14 I=1,3
14       C(I)=-C(I)
      END IF
C
C CALCULATE ANGULAR COORDINATES OF C AXIS
      CALL TRNVEC(C,CRHO,CPHI)
C
C CALCULATE ANGLE BETWEEN X AND C
      CDX=0.
      DO 15 I=1,3
15      CDX=CDX+X(I)*C(I)
      CAX=ACOS(CDX)*RAD
C
C MAKE SIGNS OF X AND Y CONSISENT
      IF(CAX.LT.90.) THEN
        DO 16 I=1,3
          X(I)=-X(I)
16         Y(I)=-Y(I)
C
C CALCULATE ANGLE BETWEEN NEW X AND C
       CDX=0.
       DO 17 I=1,3
17       CDX=CDX+X(I)*C(I)
```

```
      CAX=ACOS(CDX)*57.2958
      END IF
C
C CALCULATE A AXIS
C  CALCULATE A*
      CALL CROSS(Y,C,ASTR)
      AMATRX(1,1)=ASTR(1)
C     AMATRX(1,2)=Y(1)
      AMATRX(1,3)=C(1)
      AMATRX(2,1)=ASTR(2)
C     AMATRX(2,2)=Y(2)
      AMATRX(2,3)=C(2)
      AMATRX(3,1)=ASTR(3)
C     AMATRX(3,2)=Y(3)
      AMATRX(3,3)=C(3)
      DO 18 I=1,3
18    A(I)=AMATRX(I,1)*COS(BETA-PI/2.)-AMATRX(I,3)*SIN(BETA-PI/2.)
C
C CALCULATE ANGULAR COORDINATES OF A AXIS
      CALL TRNVEC(A,ARHO,APHI)
C
C ASSIGN VECTOR SENSE
      IF(X(3).LT.0.) XSGN='-'
      IF(Y(3).LT.0.) YSGN='-'
      IF(Z(3).LT.0.) ZSGN='-'
      IF(CL(3).LT.0.) CLSGN='-'
      IF(A(3).LT.0.) ASGN='-'
      IF(C(3).LT.0.) CSGN='-'
C WRITE OUTPUT
       WRITE(10,19) BLK(1),BLK(2),CLSGN,RHOCL,PHICL,XSGN,XRHO,XPHI,
     *   YSGN,YRHO,YPHI,ZSGN,ZRHO,ZPHI,AMD,ASGN,ARHO,APHI,
     * YSGN,YRHO,YPHI,CSGN,CRHO,CPHI,CLB,CAX
19    FORMAT(A6,A2,4(3X,A1,2F4.0),5X,F5.1,2X,3(3X,A1,2F4.0),3X,F5.1,
     * 2X,F4.0)
      GOTO 5
20    CONTINUE
      STOP
      END


C SUBROUTINE TO CONVERT CLEAVAGE DATA TO ANGULAR COORDINATES
      SUBROUTINE CLEVRT(CLVA,CLVD,RHOCL,PHICL)
       IF(CLVD.GE.0.0) THEN
          RHOCL=540-CLVA
        ELSE
          RHOCL=360-CLVA
        END IF
       PHICL=ABS(CLVD)
      IF(RHOCL.GT.360.) RHOCL=RHOCL-360.
      RETURN
      END
C
C SUBROUTINE TO CONVERT OPTIC AXIES TO ANGULAR COORDINATES
      SUBROUTINE AXCVT(A,EW,RHO,PHI)
       IF(EW.GE.0.0) THEN
       RHO=630-A
```

```
      ELSE
      RHO=450-A
      END IF
      PHI=ABS(EW)
      IF(RHO.GT.360.0) RHO=RHO-360.0
     RETURN
     END
C
C SUBROUTINE TO CALCULATE CROSS PRODUCT OF TWO VECTORS
      SUBROUTINE CROSS (F,S,T)
      REAL RO(3,3),F(3),S(3),T(3)
      DO 1 I=1,3
        RO(1,I)=F(I)
1       RO(2,I)=S(I)
      RO(3,1)=RO(1,2)*RO(2,3)-RO(1,3)*RO(2,2)
      RO(3,2)=RO(1,3)*RO(2,1)-RO(1,1)*RO(2,3)
      RO(3,3)=RO(1,1)*RO(2,2)-RO(1,2)*RO(2,1)
      DO 2 I=1,3
2       T(I)=RO(3,I)
      RETURN
      END
C
C SUBROUTINE TO TRANSFORM VECTOR FROM ANGULAR TO CARTESIAN COORDS.
      SUBROUTINE VECTRN(RHO, PHI,R)
        DIMENSION R(3)
        RHO=RHO/57.29577951
        PHI=PHI/57.29577951
        R(1)=COS(RHO)*COS(PHI)
        R(2)=SIN(RHO)*COS(PHI)
        R(3)=SIN(PHI)
        RHO=RHO*57.29577951
        PHI=PHI*57.29577951
      RETURN
      END
C
C SUBROUTINE TO TRANSFORM VECTORS FROM CARTESIAN TO ANGULAR COORDS.
      SUBROUTINE TRNVEC(R,RHO,PHI)
      REAL R(3)
      COMMON XNAGR,RAD
      XNAGR=SQRT(R(1)**2+R(2)**2+R(3)**2)
      IF(XNAGR.EQ.0.) GOTO 2
      DO 1 I=1,3
1       R(I)=R(I)/XNAGR
      PHI=ASIN(R(3))
      PHI=PHI*57.29577951
      IF(R(1).NE.0.0) THEN
      RHO=ATAN(R(2)/R(1))*RAD
      IF(R(1).LT.0.) RHO=RHO+180.
      ELSE
      RHO=90.0
      END IF
      IF(PHI.LT.0.0) RHO=RHO+180.0
      IF(RHO.LT.0.0) RHO=RHO+360.0
      IF(PHI.LT.0.0) PHI=-PHI
      IF(RHO.GT.360.) RHO=RHO-360.
2     CONTINUE
```

```
RETURN
END
```

Appendix C. Modifications to the FORTRAN Program TWODIS for General Crystal Systems

INTRODUCTION

The FORTRAN program TWODIS (Head et al., 1973) was created to calculate two-beam, diffraction contrast electron micrographs of crystallographic defects, particularly for the case of anisotropic elasticity. TWODIS was originally written for only cubic symmetry and modifications are described in Head et al. (1973) to adapt the program to tetragonal and hexagonal systems. However, many common rock forming minerals belong to crystal systems with symmetry properties different from the special cases listed above. Therefore, for earth science applications a modification to TWODIS that will accommodate all symmetry classes would be useful. A set of four FORTRAN subroutines that will adapt TWODIS to any crystal system will be described below. These subroutines transform crystal direct and reciprocal lattice vectors to a cartesian reference frame of standard orientation (Head et al., 1973; p.345) that is subsequently used by TWODIS for further calculations.

The subroutines are: (1) AMATRI, a subroutine to calculate the elements of the transformation matrix; (2) INVERS, a subroutine to calculate the reciprocal lattice parameters of the crystal; (3) ATRANS, a subroutine to transform reciprocal lattice vectors to the standard cartesian reference; (4) TRANSA, a subroutine to transform direct lattice vectors to the standard cartesian reference. In addition to these four subroutines it is necessary to modify the input to TWODIS to include the lattice parameters and all needed elastic constants for the crystal under study. Also a few statements will need to be added to the main program in order to call the requisite subroutines. The modifications to TWODIS input are described in Head et al. (1973) and will not be discussed further.

Subroutine AMATRI

Subroutine AMATRI calculates the elements of the matrix that transforms reciprocal lattice vectors to the standardized cartesian reference (see Boisen and Gibbs, 1985; p.74-75). The inputs to AMATRI are the direct lattice parameters (a, b, c, α, β, γ) and are transferred from the main program through the argument list as AA, BB, CC, ALP, BET, and GAM. The output is returned to the main program through the 3x3 array AMATRIX.

Subroutine INVERS

Subroutine INVERS is called by subroutine AMATRI in order to calculate the reciprocal lattice parameters for the crystal. A detailed explanation of the equations used by INVERS is given in Boisen and Gibbs (1985; p. 51-56). Inputs to INVERS are the direct lattice parameters of the crystal(a, b, c, α, β, γ) and are transferred from AMATRI through the argument list with variables A, B, C, ALP, BET, GAM. The outputs from INVERS are the reciprocal lattice parameters (a * b * c *) and (sin α *, cos α *, sin γ *, cos γ *) and are transferred through the argument list by variables ASTR, BSTR, CSTR, SALSTR, CALSTR, SGASTR, CGASTR).

Subroutine ATRANS

ATRANS transforms the reciprocal lattice vectors for the crystal to the standard cartesian reference. This subroutine simply carries out the matrix multiplication, **C** = **AR**, where **A** is the AMATRIX, **R** is the reciprocal lattice vector, and **C** is the vector representation of the reciprocal lattice vector in the cartesian reference. The inputs to ATRANS are the transformation matrix (AMATRIX) and the reciprocal lattice vector to be transformed (VEC). The cartesian representation of the reciprocal lattice vector is returned to the main program through the 3 element array R.

Subroutine TRANSA

TRANSA transforms direct lattice vectors to the standard cartesian reference. This is accomplished by carrying out the matrix multiplication, $\mathbf{C} = [\mathbf{A}^{-1}]^T\mathbf{D}$ where $[\mathbf{A}^{-1}]^T$ is the transposed inverse of the transformation matrix AMATRIX (AINV), **D** is the direct lattice vector to be transformed, and **C** is the cartesian representation of the direct lattice vector. Input to TRANSA includes $[\mathbf{A}^{-1}]$ which is transferred from the main program through the argument list. This requires that the main program determine $[\mathbf{A}^{-1}]$. Most computer facilities have efficient subroutines for finding the inverse of matrices. However, if this is not available algorithms and FORTRAN code can be found in elementary FORTRAN texts (c.f. Borse, 1985).

FORTRAN Code to be Added to Main Program TWODIS

The following FORTRAN statements replace the orginal TWODIS statements TWO540-TWO620.

```
C TRANSFORM GEOMETRY TO CARTESIAN REFERENCE----------
      CALL AMATRI(AMATRIX,AA,BB,CC,ALP,BET,GAM)
250   CQ(J)=LQ(J)
      DO 260 K=1,3
260   CFP(J,K)=LFP(J,K)
      XCB2(J)=FLOAT(LB2(J))/FLOAT(LD2)
      XCB(J)=FLOAT(LB(J))/FLOAT(LD)
      XCU(J)=LU(J)
      XCG(J)=LG(J)
      XCBM(J)=LBM(J)
270   XCFN(J)=LFN(J)
      CALL TRANSA(AINV,XCB2,CB2)
      CALL TRANSA(AINV,XCB,CB)
      CALL TRANSA(AINV,XCU,CU)
      CALL ATRANS(AMATRX,XCG,CG)
```

```
      CALL ATRANS(AINV,XCBM,CBM)
      CALL ATRANS(AMATRX,XCFN,CFN)
      DO 272 J=1,3
      DO 271 I=1,3
271     XCFP(I)=CFP(I,J)
       CALL ATRANS(AMATRX,XCFP,TCFP)
      DO 272 K=1,3
272   CFP(K,J)=TCFP(K)
```

FORTRAN Code for Subroutine AMATRI

```
C  SUBROUTINE TO FILL TRANSFORMATION MATRIX(AMATRX)
      SUBROUTINE AMATRI(AMATRX,A,B,C,ALP,BET,GAM)
      REAL AMATRX(3,3)
      CALL INVERS(A,B,C,ALP,BET,GAM,ASTR,BSTR,CSTR,SALSTR,CALSTR,
     1SGASTR,CGASTR)
      AMATRX(1,1)=ASTR*SGASTR
      AMATRX(1,2)=ASTR*CGASTR
      AMATRX(1,3)=0.0
      AMATRX(2,1)=0.0
      AMATRX(2,2)=BSTR
      AMATRX(2,3)=0.0
      AMATRX(3,1)=-CSTR*COS(BET)*SALSTR
      AMATRX(3,2)=CSTR*CALSTR
      AMATRX(3,3)=1.0/C
      RETURN
      END
```

FORTRAN Code for Subroutine INVERS

```
C SUBROUTINE TO CALCULATE INVERSE LATTICE PARAMETERS
      SUBROUTINE INVERS(A,B,C,ALP,BET,GAM,ASTR,BSTR,CSTR,SALSTR,CALSTR,
     1SGASTR,CGASTR)
      CALSTR=(COS(BET)*COS(GAM)-COS(ALP))/(SIN(BET)*SIN(GAM))
       ALSTR=ACOS(CALSTR)
      CGASTR=(COS(ALP)*COS(BET)-COS(GAM))/(SIN(ALP)*SIN(BET))
       GASTR=ACOS(CGASTR)
      SGASTR=SIN(GASTR)
```

```
      SALSTR=SIN(ALSTR)
      VOL=A*B*C*SIN(ALP)*SIN(BET)*SALSTR
      ASTR=B*C*SIN(ALP)/VOL
      BSTR=C*A*SIN(BET)/VOL
      CSTR=A*B*SIN(GAM)/VOL
      RETURN
      END
```

FORTRAN Code for Subroutine ATRANS

```
C SUBROUTINE TO TRANSFORM RECIP. LAT. VECTORS TO CARTESIAN COORDS.
      SUBROUTINE ATRANS(AMATRX,VEC,R)
       REAL AMATRX(3,3), VEC(3), R(3)
       DO 1 I=1,3
1        R(I)=0.0
       DO 2 I=1,3
         DO 2 J=1,3
2          R(I)=R(I)+VEC(J)*AMATRX(J,I)
       RETURN
       END
```

FORTRAN Code for Subroutine TRANSA

```
C SUBROUTINE TO TRANSFORM LATTICE VECTORS TO CARTESIAN COORDS.
      SUBROUTINE TRANSA(AINV,VEC,R)
       REAL AINV(3,3),VEC(3),R(3)
       DO 1 I=1,3
1        R(I)=0.0
       DO 2 I=1,3
         DO 2 J=1,3
2          R(I)=R(I)+VEC(J)*AINV(I,J)
       RETURN
       END
```

Appendix D. Electron Microprobe Analyses

AMPHIBOLE HOST GRAIN P-1

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-1-HOST

	1	2	3	4	5	6	7	8
SIO2	42.68	42.82	42.95	42.38	43.30	43.05	42.58	43.21
A2O3	14.86	14.64	14.89	14.95	14.72	15.12	15.27	14.53
TIO2	0.45	0.47	0.50	0.50	0.51	0.52	0.49	0.48
FEO	13.12	13.21	12.94	13.15	12.99	13.26	12.98	12.93
MNO	0.29	0.25	0.24	0.23	0.27	0.25	0.26	0.24
MGO	12.48	12.21	12.39	12.86	12.42	12.41	12.29	12.38
CAO	11.32	11.70	11.72	11.35	11.79	11.71	11.66	11.58
NA2O	1.84	1.49	1.68	1.67	1.52	1.56	1.34	1.37
K2O	0.36	0.33	0.34	0.32	0.32	0.33	0.32	0.32
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.04	2.03	2.04	2.04	2.05	2.05	2.04	2.03
SUM	99.44	99.15	99.69	99.45	99.89	100.26	99.23	99.07
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.44	99.15	99.69	99.45	99.89	100.26	99.23	99.07

SI	6.282	*	6.318	*	6.297	*	6.237	*	6.331	*	6.279	*	6.266	*	6.361	*
AL	1.718	8.000	1.682	8.000	1.703	8.000	1.763	8.000	1.669	8.000	1.721	8.000	1.734	8.000	1.639	8.000
AL	0.859	*	0.863	*	0.870	*	0.829	*	0.867	*	0.878	*	0.914	*	0.881	*
TI	0.050	*	0.052	*	0.055	*	0.055	*	0.056	*	0.057	*	0.054	*	0.053	*
FE	1.615	*	1.630	*	1.587	*	1.618	*	1.588	*	1.617	*	1.597	*	1.592	*
MN	0.036	*	0.031	*	0.030	*	0.029	*	0.033	*	0.031	*	0.032	*	0.030	*
MG	2.738	5.297	2.685	5.262	2.708	5.249	2.821	5.352	2.707	5.251	2.698	5.282	2.696	5.294	2.716	5.273
CA	1.785	*	1.850	*	1.841	*	1.790	*	1.847	*	1.830	*	1.838	*	1.826	*
NA	0.525	*	0.426	*	0.478	*	0.476	*	0.431	*	0.441	*	0.382	*	0.391	*
K	0.068	*	0.062	*	0.064	*	0.060	*	0.060	*	0.061	*	0.060	*	0.060	*
BA	0.000	2.378	0.000	2.338	0.000	2.382	0.000	2.326	0.000	2.337	0.000	2.333	0.000	2.281	0.000	2.277
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-1-HOST

	9	10	11	12	13	14	15	16
SIO2	42.35	42.69	43.04	43.33	42.51	42.75	42.79	42.53
A2O3	15.03	15.47	14.83	14.50	14.35	14.55	14.45	14.45
TIO2	0.47	0.51	0.49	0.47	0.51	0.49	0.51	0.53
FEO	12.74	13.14	13.21	13.24	13.14	13.12	13.31	13.26
MNO	0.25	0.26	0.27	0.26	0.27	0.29	0.25	0.27
MGO	12.22	12.19	12.18	12.51	12.40	12.42	12.46	12.34
CAO	11.79	11.63	11.69	11.54	11.51	11.67	11.69	11.52
NA2O	1.46	1.58	1.56	1.64	1.60	1.70	1.60	1.65
K2O	0.32	0.35	0.33	0.32	0.32	0.30	0.32	0.32
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.02	2.05	2.04	2.05	2.02	2.03	2.03	2.02
SUM	98.65	99.87	99.64	99.86	98.63	99.32	99.41	98.89
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	98.65	99.87	99.64	99.86	98.63	99.32	99.41	98.89

SI	6.271	*	6.250	*	6.317	*	6.344	*	6.310	*	6.301	*	6.305	*	6.300	*
AL	1.729	8.000	1.750	8.000	1.683	8.000	1.656	8.000	1.690	8.000	1.699	8.000	1.695	8.000	1.700	8.000
AL	0.894	*	0.919	*	0.881	*	0.845	*	0.820	*	0.829	*	0.814	*	0.823	*
TI	0.052	*	0.056	*	0.054	*	0.052	*	0.057	*	0.054	*	0.057	*	0.059	*
FE	1.578	*	1.609	*	1.621	*	1.621	*	1.631	*	1.617	*	1.640	*	1.643	*
MN	0.031	*	0.032	*	0.034	*	0.032	*	0.034	*	0.036	*	0.031	*	0.034	*
MG	2.697	5.253	2.660	5.277	2.664	5.255	2.730	5.280	2.743	5.286	2.729	5.285	2.737	5.278	2.725	5.283
CA	1.871	*	1.824	*	1.838	*	1.810	*	1.831	*	1.843	*	1.846	*	1.828	*
NA	0.419	*	0.448	*	0.444	*	0.466	*	0.460	*	0.486	*	0.457	*	0.474	*
K	0.060	*	0.065	*	0.062	*	0.060	*	0.061	*	0.056	*	0.060	*	0.060	*
BA	0.000	2.350	0.000	2.338	0.000	2.344	0.000	2.335	0.000	2.352	0.000	2.385	0.000	2.363	0.000	2.363
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-1-HOST

	17	18	19	20	21	22	23	24
SIO2	42.69	42.40	43.11	42.90	42.96	43.52	42.63	43.03
A2O3	14.20	14.03	14.02	13.95	13.85	14.22	14.75	13.99
TIO2	0.51	0.50	0.53	0.51	0.48	0.53	0.51	0.52
FEO	13.32	13.52	13.23	13.34	13.65	13.60	13.45	13.32
MNO	0.26	0.25	0.21	0.24	0.27	0.24	0.26	0.26
MGO	12.59	12.32	12.39	12.30	12.27	12.40	12.15	12.31
CAO	11.67	11.55	11.65	11.59	11.50	11.64	11.34	11.51
NA2O	1.64	1.60	1.60	1.69	1.62	1.64	1.60	1.56
K2O	0.32	0.32	0.31	0.32	0.32	0.32	0.32	0.32
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.03	2.01	2.03	2.02	2.02	2.05	2.03	2.02
SUM	99.23	98.50	99.08	98.86	98.94	100.16	99.04	98.84
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.23	98.50	99.08	98.86	98.94	100.16	99.04	98.84

SI	6.307	*	6.317	*	6.366	*	6.358	*	6.368	*	6.363	*	6.302	*	6.371	*
AL	1.693	8.000	1.683	8.000	1.634	8.000	1.642	8.000	1.632	8.000	1.637	8.000	1.698	8.000	1.629	8.000
AL	0.779	*	0.780	*	0.806	*	0.794	*	0.787	*	0.813	*	0.871	*	0.812	*
TI	0.057	*	0.056	*	0.059	*	0.057	*	0.054	*	0.058	*	0.057	*	0.058	*
FE	1.646	*	1.685	*	1.634	*	1.653	*	1.692	*	1.663	*	1.663	*	1.649	*
MN	0.033	*	0.032	*	0.026	*	0.030	*	0.034	*	0.030	*	0.033	*	0.033	*
MG	2.772	5.287	2.736	5.289	2.727	5.252	2.717	5.252	2.711	5.278	2.702	5.266	2.677	5.300	2.717	5.269
CA	1.847	*	1.844	*	1.843	*	1.840	*	1.826	*	1.823	*	1.796	*	1.826	*
NA	0.470	*	0.462	*	0.458	*	0.486	*	0.466	*	0.465	*	0.459	*	0.448	*
K	0.060	*	0.061	*	0.058	*	0.060	*	0.061	*	0.060	*	0.060	*	0.060	*
BA	0.000	2.377	0.000	2.367	0.000	2.360	0.000	2.387	0.000	2.353	0.000	2.348	0.000	2.315	0.000	2.334
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-1-HOST

	25	26	27	28	29	30	31	32
SIO2	43.56	42.88	43.54	42.56	43.66	44.15	43.35	43.15
A2O3	13.73	13.81	12.79	13.44	13.47	13.00	13.47	13.74
TIO2	0.51	0.48	0.54	0.51	0.51	0.50	0.50	0.52
FEO	13.45	13.56	13.68	14.05	13.60	13.42	13.51	13.82
MNO	0.22	0.28	0.27	0.28	0.29	0.25	0.27	0.25
MGO	12.71	12.45	12.58	12.65	12.54	12.95	12.48	12.94
CAO	11.56	11.48	11.52	11.31	11.54	11.48	11.51	10.69
NA2O	1.60	1.57	1.51	1.58	1.66	1.52	1.51	1.47
K2O	0.29	0.29	0.27	0.29	0.29	0.24	0.28	0.32
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.04	2.02	2.02	2.01	2.04	2.04	2.02	2.03
SUM	99.67	98.82	98.72	98.68	99.60	99.55	98.90	98.93
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.67	98.82	98.72	98.68	99.60	99.55	98.90	98.93

SI	6.395	*	6.361	*	6.465	*	6.343	*	6.422	*	6.480	*	6.417	*	6.382	*
AL	1.605	8.000	1.639	8.000	1.535	8.000	1.657	8.000	1.578	8.000	1.520	8.000	1.583	8.000	1.618	8.000
AL	0.770	*	0.775	*	0.702	*	0.703	*	0.756	*	0.729	*	0.767	*	0.776	*
TI	0.056	*	0.054	*	0.060	*	0.057	*	0.056	*	0.055	*	0.056	*	0.058	*
FE	1.651	*	1.682	*	1.699	*	1.751	*	1.673	*	1.647	*	1.672	*	1.709	*
MN	0.027	*	0.035	*	0.034	*	0.035	*	0.036	*	0.031	*	0.034	*	0.031	*
MG	2.781	5.287	2.753	5.299	2.784	5.279	2.810	5.357	2.749	5.271	2.833	5.295	2.754	5.282	2.852	5.427
CA	1.818	*	1.825	*	1.833	*	1.808	*	1.819	*	1.805	*	1.826	*	1.694	*
NA	0.455	*	0.452	*	0.435	*	0.457	*	0.473	*	0.433	*	0.433	*	0.422	*
K	0.054	*	0.055	*	0.051	*	0.055	*	0.054	*	0.045	*	0.053	*	0.060	*
BA	0.000	2.328	0.000	2.331	0.000	2.318	0.000	2.318	0.000	2.346	0.000	2.283	0.000	2.312	0.000	2.176
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-1-HOST

	33	34	35	36	37	38	39	40
SIO2	42.56	42.83	42.79	42.79	42.47	42.35	42.49	42.44
A2O3	14.25	14.58	14.47	14.12	14.52	14.48	14.32	14.34
TIO2	0.51	0.49	0.52	0.53	0.55	0.52	0.50	0.53
FEO	14.05	14.48	13.93	13.67	13.79	13.63	13.84	14.13
MNO	0.26	0.28	0.25	0.25	0.30	0.27	0.27	0.29
MGO	12.38	11.31	12.03	11.92	11.97	11.88	11.73	11.89
CAO	11.21	11.44	11.51	11.35	11.39	11.38	11.43	11.33
NA2O	1.54	1.50	1.68	1.70	1.64	1.79	1.64	1.68
K2O	0.31	0.35	0.32	0.32	0.33	0.31	0.32	0.31
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.02	2.02	2.03	2.02	2.02	2.01	2.01	2.02
SUM	99.09	99.28	99.53	98.67	98.98	98.62	98.55	98.96
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.09	99.28	99.53	98.67	98.98	98.62	98.55	98.96

SI	6.307	*	6.343	*	6.313	*	6.359	*	6.299	*	6.303	*	6.330	*	6.306	*
AL	1.693	8.000	1.657	8.000	1.687	8.000	1.641	8.000	1.701	8.000	1.697	8.000	1.670	8.000	1.694	8.000
AL	0.795	*	0.887	*	0.828	*	0.832	*	0.837	*	0.842	*	0.844	*	0.817	*
TI	0.057	*	0.055	*	0.058	*	0.059	*	0.061	*	0.058	*	0.056	*	0.059	*
FE	1.741	*	1.793	*	1.719	*	1.699	*	1.710	*	1.696	*	1.724	*	1.756	*
MN	0.033	*	0.035	*	0.031	*	0.031	*	0.038	*	0.034	*	0.034	*	0.036	*
MG	2.734	5.360	2.496	5.266	2.645	5.281	2.640	5.262	2.646	5.292	2.635	5.266	2.605	5.264	2.633	5.302
CA	1.780	*	1.815	*	1.819	*	1.807	*	1.810	*	1.815	*	1.824	*	1.804	*
NA	0.442	*	0.431	*	0.481	*	0.490	*	0.472	*	0.516	*	0.474	*	0.484	*
K	0.059	*	0.066	*	0.060	*	0.061	*	0.062	*	0.059	*	0.061	*	0.059	*
BA	0.000	2.281	0.000	2.312	0.000	2.360	0.000	2.358	0.000	2.344	0.000	2.390	0.000	2.359	0.000	2.347
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-1-HOST

	41	42	43	44	45	46	47	48
SIO2	42.60	42.70	43.26	43.00	43.09	43.22	42.71	42.95
A2O3	14.68	14.54	14.06	13.83	13.40	14.11	14.39	14.29
TIO2	0.52	0.54	0.51	0.50	0.50	0.51	0.53	0.50
FEO	13.79	13.49	13.30	13.40	13.14	13.22	13.41	13.04
MNO	0.28	0.27	0.31	0.29	0.26	0.27	0.27	0.27
MGO	11.79	12.08	12.32	12.18	12.83	12.18	12.52	12.48
CAO	11.34	11.51	11.47	11.53	11.51	11.46	11.55	11.42
NA2O	1.68	1.73	1.77	1.65	1.65	1.62	1.67	1.61
K2O	0.36	0.33	0.31	0.30	0.26	0.30	0.32	0.31
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.02	2.03	2.03	2.02	2.02	2.03	2.03	2.03
SUM	99.06	99.22	99.34	98.70	98.66	98.92	99.40	98.90
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.06	99.22	99.34	98.70	98.66	98.92	99.40	98.90

SI	6.309	*	6.309	*	6.374	*	6.382	*	6.392	*	6.387	*	6.298	*	6.347	*
AL	1.691	8.000	1.691	8.000	1.626	8.000	1.618	8.000	1.608	8.000	1.613	8.000	1.702	8.000	1.653	8.000
AL	0.872	*	0.841	*	0.815	*	0.801	*	0.734	*	0.844	*	0.799	*	0.835	*
TI	0.058	*	0.060	*	0.057	*	0.056	*	0.056	*	0.057	*	0.059	*	0.056	*
FE	1.708	*	1.667	*	1.639	*	1.663	*	1.630	*	1.634	*	1.654	*	1.611	*
MN	0.035	*	0.034	*	0.039	*	0.036	*	0.033	*	0.034	*	0.034	*	0.034	*
MG	2.603	5.275	2.660	5.262	2.706	5.255	2.695	5.252	2.837	5.289	2.683	5.251	2.752	5.297	2.749	5.284
CA	1.800	*	1.822	*	1.811	*	1.834	*	1.829	*	1.815	*	1.825	*	1.808	*
NA	0.482	*	0.496	*	0.506	*	0.475	*	0.475	*	0.464	*	0.477	*	0.461	*
K	0.068	*	0.062	*	0.058	*	0.057	*	0.049	*	0.057	*	0.060	*	0.058	*
BA	0.000	2.350	0.000	2.380	0.000	2.375	0.000	2.365	0.000	2.353	0.000	2.335	0.000	2.363	0.000	2.328
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-1-HOST

	49	50	51	52	53	54	55	56
SIO2	42.61	42.54	42.32	42.34	42.30	42.25	42.49	42.66
A2O3	14.59	15.07	14.86	15.06	14.60	15.00	14.67	14.92
TIO2	0.49	0.49	0.50	0.49	0.50	0.49	0.51	0.52
FEO	13.39	12.76	13.18	13.37	13.23	13.13	13.18	12.87
MNO	0.28	0.24	0.26	0.24	0.25	0.23	0.27	0.25
MGO	12.26	12.66	12.01	12.09	12.30	12.39	12.18	12.36
CAO	11.48	11.18	11.48	11.59	11.51	11.46	11.53	11.53
NA2O	1.66	1.35	1.60	1.55	1.55	1.48	1.60	1.65
K2O	0.35	0.31	0.31	0.35	0.32	0.31	0.34	0.31
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.03	2.03	2.02	2.03	2.02	2.02	2.02	2.03
SUM	99.14	98.63	98.54	99.11	98.58	98.76	98.79	99.10
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.14	98.63	98.54	99.11	98.58	98.76	98.79	99.10

SI	6.299	*	6.284	*	6.285	*	6.259	*	6.284	*	6.257	*	6.296	*	6.288	*
AL	1.701	8.000	1.716	8.000	1.715	8.000	1.741	8.000	1.716	8.000	1.743	8.000	1.704	8.000	1.712	8.000
AL	0.840	*	0.908	*	0.886	*	0.882	*	0.840	*	0.874	*	0.858	*	0.880	*
TI	0.054	*	0.054	*	0.056	*	0.054	*	0.058	*	0.055	*	0.057	*	0.058	*
FE	1.655	*	1.576	*	1.637	*	1.653	*	1.644	*	1.626	*	1.633	*	1.587	*
MN	0.035	*	0.030	*	0.033	*	0.030	*	0.031	*	0.029	*	0.034	*	0.031	*
MG	2.701	5.286	2.788	5.356	2.659	5.270	2.664	5.283	2.724	5.295	2.735	5.319	2.690	5.272	2.716	5.271
CA	1.818	*	1.770	*	1.827	*	1.836	*	1.832	*	1.818	*	1.831	*	1.821	*
NA	0.476	*	0.387	*	0.461	*	0.444	*	0.446	*	0.425	*	0.460	*	0.472	*
K	0.066	*	0.058	*	0.059	*	0.066	*	0.061	*	0.059	*	0.064	*	0.058	*
BA	0.000	2.360	0.000	2.215	0.000	2.346	0.000	2.346	0.000	2.339	0.000	2.302	0.000	2.355	0.000	2.351
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-1-HOST

	57	58	59	60	61
SIO2	43.50	42.19	43.11	42.56	42.06
A2O3	14.39	14.81	16.68	14.75	14.98
TIO2	0.48	0.50	0.45	0.50	0.50
FEO	12.85	12.96	12.35	12.87	13.07
MNO	0.26	0.24	0.25	0.26	0.25
MGO	12.82	12.33	11.92	12.22	12.26
CAO	11.59	11.57	10.68	11.57	11.56
NA2O	1.65	1.56	1.43	1.64	1.67
K2O	0.30	0.33	0.95	0.32	0.32
BAO	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00
H2O	2.05	2.02	2.06	2.02	2.02
SUM	99.89	98.51	99.88	98.71	98.69
-O= F+CL	0.00	0.00	0.00	0.00	0.00
SUM	99.89	98.51	99.88	98.71	98.69

SI	6.354	*	6.266	*	6.270	*	6.302	*	6.242	*
AL	1.646	8.000	1.734	8.000	1.730	8.000	1.698	8.000	1.758	8.000
AL	0.831	*	0.858	*	1.129	*	0.875	*	0.861	*
TI	0.053	*	0.056	*	0.049	*	0.056	*	0.056	*
FE	1.570	*	1.610	*	1.502	*	1.594	*	1.622	*
MN	0.032	*	0.030	*	0.031	*	0.033	*	0.031	*
MG	2.791	5.277	2.730	5.264	2.584	5.295	2.697	5.254	2.712	5.283
CA	1.814	*	1.841	*	1.664	*	1.835	*	1.838	*
NA	0.467	*	0.449	*	0.403	*	0.471	*	0.481	*
K	0.056	*	0.063	*	0.176	*	0.060	*	0.061	*
BA	0.000	2.337	0.000	2.353	0.000	2.244	0.000	2.367	0.000	2.379
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

57 697 AMSCAN
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60 702 AMSCAN
61 703 AMSCAN

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-1-MARG

	1	2	3	4	5	6	7	8
SIO2	43.77	42.36	43.24	42.95	42.48	43.23	43.16	43.52
A2O3	15.01	15.09	15.00	14.18	15.57	14.36	14.28	14.22
TIO2	0.46	0.45	0.47	0.46	0.44	0.41	0.43	0.50
FEO	13.04	13.11	13.15	13.13	13.60	13.32	13.24	12.80
MNO	0.31	0.30	0.27	0.24	0.28	0.27	0.29	0.31
MGO	12.37	11.96	12.48	12.72	11.83	12.61	12.28	12.38
CAO	11.14	11.10	11.30	11.31	11.11	10.96	10.58	11.24
NA2O	1.89	1.80	1.78	1.80	1.86	1.80	1.92	1.71
K2O	0.36	0.39	0.34	0.30	0.36	0.38	0.33	0.37
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.06	2.02	2.05	2.03	2.04	2.04	2.02	2.04
SUM	100.41	98.58	100.08	99.12	99.57	99.38	98.53	99.09
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	100.41	98.58	100.08	99.12	99.57	99.38	98.53	99.09

SI	6.356	*	6.285	*	6.311	*	6.338	*	6.250	*	6.359	*	6.394	*	6.404	*
AL	1.644	8.000	1.715	8.000	1.689	8.000	1.662	8.000	1.750	8.000	1.641	8.000	1.606	8.000	1.596	8.000
AL	0.925	*	0.924	*	0.891	*	0.804	*	0.949	*	0.848	*	0.887	*	0.870	*
TI	0.050	*	0.050	*	0.052	*	0.051	*	0.049	*	0.045	*	0.048	*	0.055	*
FE	1.584	*	1.627	*	1.605	*	1.620	*	1.673	*	1.639	*	1.640	*	1.575	*
MN	0.038	*	0.038	*	0.033	*	0.030	*	0.035	*	0.034	*	0.036	*	0.039	*
MG	2.678	5.275	2.645	5.283	2.715	5.296	2.798	5.303	2.594	5.300	2.765	5.330	2.712	5.324	2.715	5.255
CA	1.733	*	1.765	*	1.767	*	1.788	*	1.751	*	1.727	*	1.679	*	1.772	*
NA	0.532	*	0.518	*	0.504	*	0.515	*	0.531	*	0.513	*	0.552	*	0.488	*
K	0.067	*	0.074	*	0.063	*	0.056	*	0.068	*	0.071	*	0.062	*	0.069	*
BA	0.000	2.332	0.000	2.356	0.000	2.334	0.000	2.360	0.000	2.349	0.000	2.312	0.000	2.293	0.000	2.330
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-1-MARG

	9	10	11	12	13	14	15	16
SIO2	42.24	43.10	44.98	44.29	43.59	43.37	43.41	43.02
A2O3	14.69	14.94	12.96	13.65	13.76	15.26	14.22	14.72
TIO2	0.57	0.50	0.41	0.40	0.46	0.46	0.42	0.48
FEO	13.02	12.86	12.29	12.62	12.80	13.31	12.54	12.96
MNO	0.25	0.26	0.28	0.29	0.28	0.26	0.26	0.29
MGO	12.46	12.66	13.61	13.15	12.68	12.38	12.77	12.39
CAO	11.49	11.79	11.67	11.33	11.11	11.61	11.76	11.39
NA2O	1.80	1.60	1.43	1.66	1.72	1.73	1.68	1.80
K2O	0.34	0.32	0.30	0.31	0.36	0.32	0.30	0.37
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.02	2.05	2.06	2.05	2.03	2.06	2.04	2.04
SUM	98.88	100.08	99.99	99.75	98.79	100.76	99.40	99.46
O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	98.88	100.08	99.99	99.75	98.79	100.76	99.40	99.46

SI	6.258	*	6.290	*	6.532	*	6.461	*	6.433	*	6.292	*	6.369	*	6.321	*
AL	1.742	8.000	1.710	8.000	1.468	8.000	1.539	8.000	1.567	8.000	1.708	8.000	1.631	8.000	1.679	8.000
AL	0.822	*	0.859	*	0.750	*	0.808	*	0.826	*	0.901	*	0.828	*	0.870	*
TI	0.064	*	0.055	*	0.045	*	0.044	*	0.051	*	0.050	*	0.046	*	0.053	*
FE	1.613	*	1.570	*	1.493	*	1.540	*	1.580	*	1.615	*	1.539	*	1.593	*
MN	0.031	*	0.032	*	0.034	*	0.036	*	0.035	*	0.032	*	0.032	*	0.036	*
MG	2.751	5.281	2.754	5.270	2.946	5.268	2.859	5.286	2.789	5.281	2.677	5.275	2.793	5.238	2.714	5.266
CA	1.824	*	1.843	*	1.816	*	1.771	*	1.757	*	1.805	*	1.849	*	1.793	*
NA	0.517	*	0.453	*	0.403	*	0.470	*	0.492	*	0.487	*	0.478	*	0.513	*
K	0.064	*	0.060	*	0.056	*	0.058	*	0.068	*	0.059	*	0.056	*	0.069	*
BA	0.000	2.405	0.000	2.356	0.000	2.274	0.000	2.298	0.000	2.317	0.000	2.350	0.000	2.383	0.000	2.375
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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10 599 AM SCA
11 600 AM SCA
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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-1-MARG

	17
SIO2	42.47
A2O3	14.81
TIO2	0.56
FEO	13.11
MNO	0.24
MGO	12.45
CAO	11.33
NA2O	1.84
K2O	0.32
BAO	0.00
CL	0.00
F	0.00
H2O	2.03
SUM	99.16
-O= F+CL	0.00
SUM	99.16

SI	6.269	*
AL	1.731	8.000
AL	0.845	*
TI	0.062	*
FE	1.618	*
MN	0.030	*
MG	2.739	5.294
CA	1.792	*
NA	0.527	*
K	0.060	*
BA	0.000	2.379
CL	0.000	*
F	0.000	*
H	2.000	2.000
O	24.000	*

17 606 AMSCAN

AMPHIBOLE HOST GRAIN P-2

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-2-HOST

	1	2	3	4	5	6	7	8
SIO2	46.03	48.57	46.24	46.57	45.91	47.85	46.11	46.04
A2O3	13.87	11.66	13.21	12.99	13.56	11.56	13.56	13.05
TIO2	0.10	0.10	0.10	0.11	0.10	0.11	0.10	0.10
FEO	10.23	9.56	10.30	10.06	9.96	9.72	10.19	10.06
MNO	0.28	0.23	0.23	0.23	0.23	0.27	0.22	0.24
MGO	13.62	14.82	13.59	13.86	13.64	14.90	13.47	13.69
CAO	11.87	11.83	11.90	11.80	11.95	11.95	11.73	11.95
NA2O	1.37	1.10	1.18	1.13	1.27	1.11	1.19	1.16
K2O	0.37	0.24	0.48	0.36	0.36	0.25	0.57	0.36
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.09	2.11	2.07	2.08	2.07	2.10	2.07	2.06
SUM	99.83	100.22	99.30	99.19	99.05	99.82	99.21	98.71
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.83	100.22	99.30	99.19	99.05	99.82	99.21	98.71

SI	6.612	*	6.892	*	6.678	*	6.715	*	6.638	*	6.840	*	6.661	*	6.682	*
AL	1.388	8.000	1.108	8.000	1.322	8.000	1.285	8.000	1.362	8.000	1.160	8.000	1.339	8.000	1.318	8.000
AL	0.960	*	0.842	*	0.926	*	0.922	*	0.949	*	0.787	*	0.969	*	0.913	*
TI	0.011	*	0.011	*	0.011	*	0.012	*	0.011	*	0.012	*	0.011	*	0.011	*
FE	1.229	*	1.135	*	1.244	*	1.213	*	1.204	*	1.162	*	1.231	*	1.221	*
MN	0.034	*	0.028	*	0.028	*	0.028	*	0.028	*	0.033	*	0.027	*	0.030	*
MG	2.916	5.150	3.135	5.149	2.925	5.135	2.979	5.154	2.940	5.132	3.174	5.167	2.900	5.138	2.961	5.136
CA	1.827	*	1.799	*	1.841	*	1.823	*	1.851	*	1.830	*	1.815	*	1.858	*
NA	0.382	*	0.303	*	0.330	*	0.316	*	0.358	*	0.308	*	0.333	*	0.326	*
K	0.068	*	0.043	*	0.088	*	0.066	*	0.066	*	0.046	*	0.105	*	0.067	*
BA	0.000	2.276	0.000	2.145	0.000	2.260	0.000	2.205	0.000	2.274	0.000	2.183	0.000	2.254	0.000	2.251
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-2-HOST

	9	10	11	12	13	14	15	16
SIO2	46.19	47.59	46.52	46.58	47.03	45.65	45.84	46.87
A2O3	13.53	11.65	13.45	12.97	12.29	13.89	13.14	13.14
TIO2	0.11	0.10	0.11	0.10	0.10	0.10	0.10	0.10
FEO	10.02	9.59	10.17	9.86	9.67	10.06	9.83	9.82
MNO	0.27	0.26	0.23	0.27	0.24	0.26	0.25	0.26
MGO	13.92	14.51	13.50	14.11	14.41	13.53	13.67	14.27
CAO	11.88	12.01	11.76	11.98	12.15	11.71	11.93	11.85
NA2O	1.28	1.10	1.26	1.28	1.23	1.38	1.05	1.28
K2O	0.34	0.26	0.41	0.30	0.26	0.29	0.30	0.28
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.08	2.08	2.08	2.08	2.09	2.07	2.06	2.10
SUM	99.62	99.15	99.49	99.53	99.46	98.94	98.17	99.97
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.62	99.15	99.49	99.53	99.46	98.94	98.17	99.97

SI	6.639	*	6.845	*	6.692	*	6.695	*	6.757	*	6.608	*	6.679	*	6.698	*
AL	1.361	8.000	1.155	8.000	1.308	8.000	1.305	8.000	1.243	8.000	1.392	8.000	1.321	8.000	1.302	8.000
AL	0.931	*	0.820	*	0.972	*	0.892	*	0.838	*	0.978	*	0.935	*	0.911	*
TI	0.012	*	0.011	*	0.012	*	0.011	*	0.011	*	0.011	*	0.011	*	0.011	*
FE	1.204	*	1.154	*	1.223	*	1.185	*	1.162	*	1.218	*	1.198	*	1.174	*
MN	0.033	*	0.032	*	0.028	*	0.033	*	0.029	*	0.032	*	0.031	*	0.031	*
MG	2.982	5.163	3.111	5.127	2.894	5.129	3.023	5.144	3.086	5.125	2.919	5.158	2.969	5.143	3.040	5.166
CA	1.830	*	1.851	*	1.812	*	1.845	*	1.870	*	1.816	*	1.862	*	1.814	*
NA	0.357	*	0.307	*	0.351	*	0.357	*	0.343	*	0.387	*	0.297	*	0.355	*
K	0.062	*	0.048	*	0.075	*	0.055	*	0.048	*	0.054	*	0.056	*	0.051	*
BA	0.000	2.249	0.000	2.205	0.000	2.239	0.000	2.257	0.000	2.261	0.000	2.257	0.000	2.215	0.000	2.220
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-2-HOST

	17	18	19	20	21	22	23	24
SIO2	47.54	45.99	46.53	46.33	48.65	46.10	45.67	47.56
A2O3	12.15	13.90	13.11	12.61	11.31	13.40	13.35	12.56
TIO2	0.10	0.10	0.10	0.10	0.07	0.10	0.09	0.09
FEO	9.59	10.16	9.92	9.88	9.49	10.09	10.02	9.78
MNO	0.23	0.26	0.24	0.26	0.23	0.29	0.21	0.28
MGO	14.63	13.67	13.90	14.60	14.91	13.76	13.80	14.71
CAO	12.20	11.36	11.96	11.95	12.17	11.38	12.00	11.91
NA2O	1.15	1.39	1.06	1.31	1.03	1.41	1.03	1.20
K2O	0.24	0.34	0.29	0.25	0.22	0.30	0.30	0.23
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.10	2.08	2.08	2.08	2.11	2.07	2.06	2.11
SUM	99.93	99.25	99.19	99.37	100.19	98.90	98.53	100.43
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.93	99.25	99.19	99.37	100.19	98.90	98.53	100.43

SI	6.788	*	6.630	*	6.704	*	6.677	*	6.910	*	6.669	*	6.637	*	6.758	*
AL	1.212	8.000	1.370	8.000	1.296	8.000	1.323	8.000	1.090	8.000	1.331	8.000	1.363	8.000	1.242	8.000
AL	0.833	*	0.992	*	0.930	*	0.819	*	0.803	*	0.953	*	0.924	*	0.860	*
TI	0.011	*	0.011	*	0.011	*	0.011	*	0.007	*	0.011	*	0.010	*	0.010	*
FE	1.145	*	1.225	*	1.195	*	1.191	*	1.127	*	1.221	*	1.218	*	1.162	*
MN	0.028	*	0.032	*	0.029	*	0.032	*	0.028	*	0.036	*	0.026	*	0.034	*
MG	3.114	5.130	2.937	5.197	2.985	5.150	3.136	5.189	3.156	5.122	2.967	5.187	2.989	5.167	3.115	5.181
CA	1.868	*	1.755	*	1.846	*	1.845	*	1.852	*	1.764	*	1.869	*	1.813	*
NA	0.318	*	0.389	*	0.296	*	0.366	*	0.284	*	0.395	*	0.290	*	0.331	*
K	0.044	*	0.063	*	0.053	*	0.046	*	0.040	*	0.055	*	0.056	*	0.042	*
BA	0.000	2.229	0.000	2.206	0.000	2.196	0.000	2.257	0.000	2.175	0.000	2.215	0.000	2.214	0.000	2.185
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-2-HOST

	25	26	27	28	29	30	31	32
SIO2	48.72	45.78	46.02	47.45	48.70	45.60	47.51	49.05
A2O3	10.78	13.60	13.15	12.22	10.17	13.63	11.95	9.76
TIO2	0.08	0.10	0.10	0.10	0.07	0.10	0.11	0.05
FEO	9.41	10.13	9.91	9.50	9.06	10.07	9.83	8.94
MNO	0.22	0.29	0.23	0.28	0.20	0.24	0.20	0.22
MGO	15.44	13.72	14.02	14.59	15.69	13.61	14.62	15.88
CAO	12.27	11.34	12.02	11.78	12.29	11.48	11.91	12.31
NA2O	0.91	1.45	1.06	1.17	0.97	1.44	1.16	0.87
K2O	0.20	0.30	0.29	0.37	0.18	0.27	0.32	0.18
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.11	2.07	2.07	2.09	2.09	2.06	2.09	2.10
SUM	100.14	98.78	98.87	99.55	99.42	98.50	99.70	99.36
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	100.14	98.78	98.87	99.55	99.42	98.50	99.70	99.36

SI	6.924	*	6.636	*	6.661	*	6.796	*	6.964	*	6.628	*	6.805	*	7.011	*
AL	1.076	8.000	1.364	8.000	1.339	8.000	1.204	8.000	1.036	8.000	1.372	8.000	1.195	8.000	0.989	8.000
AL	0.729	*	0.959	*	0.903	*	0.859	*	0.678	*	0.963	*	0.821	*	0.655	*
TI	0.009	*	0.011	*	0.011	*	0.011	*	0.008	*	0.011	*	0.012	*	0.005	*
FE	1.118	*	1.228	*	1.199	*	1.138	*	1.083	*	1.224	*	1.177	*	1.069	*
MN	0.026	*	0.036	*	0.028	*	0.034	*	0.024	*	0.030	*	0.024	*	0.027	*
MG	3.270	5.153	2.964	5.198	3.024	5.166	3.115	5.156	3.344	5.137	2.949	5.176	3.121	5.156	3.383	5.139
CA	1.868	*	1.761	*	1.864	*	1.808	*	1.883	*	1.788	*	1.828	*	1.885	*
NA	0.251	*	0.408	*	0.297	*	0.325	*	0.269	*	0.406	*	0.322	*	0.241	*
K	0.036	*	0.055	*	0.054	*	0.068	*	0.033	*	0.050	*	0.058	*	0.033	*
BA	0.000	2.155	0.000	2.224	0.000	2.215	0.000	2.200	0.000	2.185	0.000	2.244	0.000	2.208	0.000	2.159
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-2-HOST

	33	34	35	36	37	38	39	40
SIO2	46.27	49.22	45.99	48.94	46.29	46.73	48.63	46.97
A2O3	13.50	9.99	13.46	9.53	13.49	13.16	9.89	12.76
TIO2	0.10	0.07	0.10	0.07	0.09	0.09	0.06	0.09
FEO	10.18	8.88	10.20	8.90	10.16	10.02	8.97	8.94
MNO	0.26	0.23	0.24	0.25	0.25	0.21	0.25	0.25
MGO	13.86	15.94	13.84	16.11	13.99	13.98	15.94	14.29
CAO	11.48	12.36	11.60	12.39	11.73	12.07	12.20	11.88
NA2O	1.41	0.95	1.33	0.90	1.38	1.07	0.96	1.25
K2O	0.29	0.18	0.27	0.17	0.27	0.30	0.20	0.29
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.08	2.11	2.07	2.09	2.09	2.09	2.09	2.09
SUM	99.43	99.93	99.10	99.35	99.74	99.72	99.19	99.81
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.43	99.93	99.10	99.35	99.74	99.72	99.19	99.81

SI	6.659	*	6.994	*	6.645	*	7.002	*	6.646	*	6.700	*	6.971	*	6.727	*
AL	1.341	8.000	1.006	8.000	1.355	8.000	0.998	8.000	1.354	8.000	1.300	8.000	1.029	8.000	1.273	8.000
AL	0.949	*	0.666	*	0.937	*	0.609	*	0.928	*	0.923	*	0.642	*	0.881	*
TI	0.011	*	0.007	*	0.011	*	0.008	*	0.010	*	0.010	*	0.006	*	0.010	*
FE	1.225	*	1.055	*	1.233	*	1.065	*	1.220	*	1.201	*	1.075	*	1.191	*
MN	0.032	*	0.028	*	0.029	*	0.030	*	0.030	*	0.026	*	0.030	*	0.030	*
MG	2.973	5.190	3.376	5.133	2.981	5.190	3.435	5.147	2.994	5.181	2.988	5.147	3.406	5.160	3.051	5.162
CA	1.770	*	1.882	*	1.796	*	1.899	*	1.804	*	1.854	*	1.874	*	1.823	*
NA	0.393	*	0.262	*	0.373	*	0.250	*	0.384	*	0.297	*	0.267	*	0.347	*
K	0.053	*	0.033	*	0.050	*	0.031	*	0.049	*	0.055	*	0.037	*	0.053	*
BA	0.000	2.217	0.000	2.176	0.000	2.218	0.000	2.180	0.000	2.238	0.000	2.206	0.000	2.177	0.000	2.223
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-2-HOST

	41	42	43	44	45	46	47	48
SIO2	46.66	47.70	46.87	48.32	47.30	46.80	45.90	46.66
A2O3	13.00	11.04	12.88	11.11	11.71	12.98	13.83	12.85
TIO2	0.10	0.09	0.08	0.08	0.08	0.10	0.10	0.10
FEO	9.91	9.50	10.03	9.46	9.53	9.95	9.75	9.71
MNO	0.25	0.26	0.25	0.25	0.26	0.28	0.20	0.24
MGO	13.82	15.23	14.45	14.48	14.75	14.52	13.66	14.22
CAO	12.16	12.12	11.78	11.96	12.19	11.82	11.70	12.09
NA2O	1.14	1.01	1.17	1.03	1.16	1.23	1.06	1.17
K2O	0.29	0.21	0.35	0.27	0.25	0.32	0.57	0.28
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.08	2.08	2.09	2.09	2.08	2.10	2.07	2.08
SUM	99.41	99.24	99.95	99.05	99.31	100.10	98.84	99.40
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.41	99.24	99.95	99.05	99.31	100.10	98.84	99.40

SI	6.713	*	6.856	*	6.706	*	6.942	*	6.802	*	6.687	*	6.639	*	6.708	*
AL	1.287	8.000	1.144	8.000	1.294	8.000	1.058	8.000	1.198	8.000	1.313	8.000	1.361	8.000	1.292	8.000
AL	0.917	*	0.726	*	0.878	*	0.823	*	0.786	*	0.873	*	0.996	*	0.885	*
TI	0.011	*	0.010	*	0.009	*	0.009	*	0.009	*	0.011	*	0.011	*	0.011	*
FE	1.192	*	1.142	*	1.200	*	1.137	*	1.146	*	1.189	*	1.179	*	1.167	*
MN	0.030	*	0.032	*	0.030	*	0.030	*	0.032	*	0.034	*	0.025	*	0.029	*
MG	2.963	5.114	3.263	5.172	3.082	5.198	3.101	5.099	3.161	5.134	3.092	5.199	2.945	5.156	3.047	5.140
CA	1.874	*	1.866	*	1.806	*	1.841	*	1.878	*	1.810	*	1.813	*	1.862	*
NA	0.318	*	0.281	*	0.325	*	0.287	*	0.323	*	0.341	*	0.297	*	0.326	*
K	0.053	*	0.038	*	0.064	*	0.049	*	0.046	*	0.058	*	0.105	*	0.051	*
BA	0.000	2.246	0.000	2.186	0.000	2.194	0.000	2.177	0.000	2.247	0.000	2.209	0.000	2.216	0.000	2.240
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-2-HOST

	49	50	51	52	53	54	55	56
SIO2	47.32	46.53	46.29	46.40	46.37	45.94	46.46	46.05
A2O3	12.54	13.70	13.34	13.54	13.47	14.41	13.07	13.67
TIO2	0.10	0.09	0.10	0.09	0.10	0.10	0.11	0.09
FEO	10.03	10.07	10.09	10.12	10.27	10.16	10.15	10.35
MNO	0.25	0.27	0.25	0.22	0.28	0.24	0.25	0.21
MGO	14.19	13.93	13.73	14.07	13.72	13.64	14.21	13.74
CAO	11.69	11.95	11.61	11.94	11.90	11.46	12.18	12.27
NA2O	1.25	1.36	1.26	1.14	1.40	1.21	1.16	1.18
K2O	0.36	0.29	0.53	0.38	0.30	0.67	0.28	0.35
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.09	2.10	2.08	2.09	2.09	2.09	2.09	2.09
SUM	99.82	100.29	99.28	99.99	99.90	99.92	99.96	100.00
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.82	100.29	99.28	99.99	99.90	99.92	99.96	100.00

SI	6.773	*	6.641	*	6.678	*	6.644	*	6.654	*	6.587	*	6.661	*	6.610	*
AL	1.227	8.000	1.359	8.000	1.322	8.000	1.356	8.000	1.346	8.000	1.413	8.000	1.339	8.000	1.390	8.000
AL	0.889	*	0.946	*	0.946	*	0.928	*	0.932	*	1.021	*	0.869	*	0.922	*
TI	0.011	*	0.010	*	0.011	*	0.010	*	0.011	*	0.011	*	0.012	*	0.010	*
FE	1.201	*	1.202	*	1.217	*	1.212	*	1.232	*	1.218	*	1.217	*	1.242	*
MN	0.030	*	0.033	*	0.031	*	0.027	*	0.034	*	0.029	*	0.030	*	0.026	*
MG	3.028	5.158	2.964	5.154	2.952	5.157	3.003	5.179	2.934	5.143	2.915	5.194	3.037	5.164	2.940	5.140
CA	1.793	*	1.827	*	1.795	*	1.832	*	1.830	*	1.760	*	1.871	*	1.887	*
NA	0.347	*	0.378	*	0.352	*	0.316	*	0.390	*	0.336	*	0.322	*	0.328	*
K	0.066	*	0.053	*	0.098	*	0.069	*	0.055	*	0.123	*	0.051	*	0.064	*
BA	0.000	2.205	0.000	2.257	0.000	2.244	0.000	2.218	0.000	2.274	0.000	2.219	0.000	2.245	0.000	2.280
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-2-HOST

	57	58	59	60	61	62	63	64
SIO2	45.93	45.77	46.96	46.20	46.03	46.33	45.01	46.06
A2O3	14.08	14.37	12.98	14.40	13.85	13.05	14.32	13.91
TIO2	0.10	0.11	0.10	0.11	0.08	0.10	0.09	0.09
FEO	10.09	10.25	9.90	10.21	10.34	9.94	10.25	10.24
MNO	0.27	0.24	0.20	0.24	0.24	0.23	0.24	0.24
MGO	13.69	13.31	14.09	13.78	13.44	13.95	13.82	13.60
CAO	11.94	11.48	12.10	11.89	11.59	12.17	12.08	11.88
NA2O	1.34	1.20	1.13	1.38	1.27	1.09	1.38	1.25
K2O	0.31	0.67	0.31	0.35	0.50	0.29	0.36	0.37
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.09	2.08	2.09	2.10	2.08	2.08	2.08	2.08
SUM	99.84	99.48	99.86	100.66	99.42	99.23	99.63	99.72
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.84	99.48	99.86	100.66	99.42	99.23	99.63	99.72

SI	6.591	*	6.595	*	6.720	*	6.575	*	6.637	*	6.682	*	6.496	*	6.618	*
AL	1.409	8.000	1.405	8.000	1.280	8.000	1.425	8.000	1.363	8.000	1.318	8.000	1.504	8.000	1.382	8.000
AL	0.972	*	1.035	*	0.909	*	0.990	*	0.990	*	0.900	*	0.932	*	0.974	*
TI	0.011	*	0.012	*	0.011	*	0.012	*	0.009	*	0.011	*	0.010	*	0.010	*
FE	1.211	*	1.235	*	1.185	*	1.215	*	1.247	*	1.199	*	1.237	*	1.231	*
MN	0.033	*	0.029	*	0.024	*	0.029	*	0.029	*	0.028	*	0.029	*	0.029	*
MG	2.928	5.155	2.859	5.170	3.005	5.134	2.923	5.169	2.888	5.163	2.999	5.137	2.973	5.181	2.913	5.156
CA	1.836	*	1.772	*	1.855	*	1.813	*	1.790	*	1.881	*	1.868	*	1.829	*
NA	0.373	*	0.335	*	0.314	*	0.381	*	0.355	*	0.305	*	0.386	*	0.348	*
K	0.057	*	0.123	*	0.057	*	0.064	*	0.092	*	0.053	*	0.066	*	0.068	*
BA	0.000	2.265	0.000	2.231	0.000	2.225	0.000	2.257	0.000	2.237	0.000	2.239	0.000	2.320	0.000	2.245
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-2-HOST

	65	66	67	68	69	70	71	72
SIO2	46.43	45.52	45.66	46.48	44.97	46.05	46.93	46.99
A2O3	12.90	14.87	13.45	12.66	14.62	13.75	12.74	13.11
TIO2	0.09	0.10	0.10	0.10	0.08	0.10	0.08	0.08
FEO	9.93	10.24	10.34	9.84	10.15	9.93	9.77	10.58
MNO	0.23	0.25	0.23	0.25	0.26	0.24	0.23	0.26
MGO	14.21	13.64	13.71	14.24	13.52	14.07	14.40	13.76
CAO	12.26	11.90	11.80	12.04	11.73	11.72	12.36	12.30
NA2O	1.10	1.31	1.19	1.06	1.34	1.13	1.10	1.16
K2O	0.27	0.36	0.38	0.28	0.41	0.43	0.26	0.35
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.08	2.09	2.07	2.07	2.07	2.08	2.09	2.10
SUM	99.50	100.28	98.93	99.02	99.15	99.50	99.96	100.69
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.50	100.28	98.93	99.02	99.15	99.50	99.96	100.69

SI	6.680	*	6.509	*	6.623	*	6.712	*	6.509	*	6.621	*	6.712	*	6.697	*
AL	1.320	8.000	1.491	8.000	1.377	8.000	1.288	8.000	1.491	8.000	1.379	8.000	1.288	8.000	1.303	8.000
AL	0.867	*	1.015	*	0.922	*	0.867	*	1.003	*	0.951	*	0.859	*	0.899	*
TI	0.010	*	0.011	*	0.011	*	0.011	*	0.009	*	0.011	*	0.009	*	0.009	*
FE	1.195	*	1.225	*	1.254	*	1.188	*	1.229	*	1.194	*	1.169	*	1.261	*
MN	0.028	*	0.030	*	0.028	*	0.031	*	0.032	*	0.029	*	0.028	*	0.031	*
MG	3.047	5.147	2.907	5.188	2.964	5.179	3.065	5.162	2.917	5.189	3.015	5.200	3.070	5.134	2.923	5.122
CA	1.890	*	1.823	*	1.834	*	1.863	*	1.819	*	1.805	*	1.894	*	1.878	*
NA	0.307	*	0.363	*	0.335	*	0.297	*	0.376	*	0.315	*	0.305	*	0.321	*
K	0.050	*	0.066	*	0.070	*	0.052	*	0.076	*	0.079	*	0.047	*	0.064	*
BA	0.000	2.246	0.000	2.252	0.000	2.239	0.000	2.211	0.000	2.271	0.000	2.199	0.000	2.247	0.000	2.262
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-2-HOST

	73	74	75	76	77	78	79	80
SIO2	46.59	47.20	46.09	45.84	46.94	47.17	47.01	46.45
A2O3	13.26	12.42	13.15	13.31	12.87	12.62	12.99	13.33
TIO2	0.08	0.08	0.10	0.09	0.08	0.08	0.08	0.09
FEO	9.93	9.71	10.15	9.86	9.77	9.57	9.86	9.82
MNO	0.24	0.26	0.26	0.22	0.20	0.20	0.24	0.25
MGO	13.90	14.44	14.07	14.09	14.25	14.53	14.42	14.08
CAO	12.28	12.19	12.36	12.31	12.08	12.16	12.27	12.20
NA2O	1.17	1.05	1.19	1.17	1.09	1.05	1.19	1.13
K2O	0.30	0.28	0.30	0.33	0.31	0.28	0.29	0.32
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.09	2.09	2.08	2.08	2.09	2.09	2.10	2.09
SUM	99.84	99.72	99.75	99.29	99.68	99.73	100.45	99.76
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.84	99.72	99.75	99.29	99.68	99.73	100.45	99.76

SI	6.678	*	6.760	*	6.632	*	6.618	*	6.725	*	6.746	*	6.693	*	6.661	*
AL	1.322	8.000	1.240	8.000	1.368	8.000	1.382	8.000	1.275	8.000	1.254	8.000	1.307	8.000	1.339	8.000
AL	0.918	*	0.856	*	0.861	*	0.882	*	0.898	*	0.873	*	0.873	*	0.914	*
TI	0.009	*	0.009	*	0.011	*	0.010	*	0.009	*	0.009	*	0.009	*	0.010	*
FE	1.190	*	1.163	*	1.221	*	1.190	*	1.171	*	1.145	*	1.174	*	1.178	*
MN	0.029	*	0.032	*	0.032	*	0.027	*	0.024	*	0.024	*	0.029	*	0.030	*
MG	2.970	5.116	3.082	5.141	3.017	5.143	3.032	5.141	3.043	5.145	3.097	5.148	3.060	5.145	3.010	5.141
CA	1.886	*	1.870	*	1.905	*	1.904	*	1.854	*	1.863	*	1.872	*	1.874	*
NA	0.325	*	0.292	*	0.332	*	0.327	*	0.303	*	0.291	*	0.329	*	0.314	*
K	0.055	*	0.051	*	0.055	*	0.061	*	0.057	*	0.047	*	0.053	*	0.059	*
BA	0.000	2.266	0.000	2.213	0.000	2.292	0.000	2.292	0.000	2.214	0.000	2.202	0.000	2.253	0.000	2.247
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-2-HOST

	81	82	83	84	85	86	87	88
SIO2	45.82	46.75	46.65	46.19	46.73	46.95	46.32	46.86
A2O3	13.21	12.55	12.31	13.40	13.10	12.40	13.57	12.90
TIO2	0.10	0.10	0.09	0.09	0.10	0.09	0.09	0.08
FEO	9.84	9.76	9.83	9.69	9.79	9.81	9.96	9.77
MNO	0.25	0.21	0.26	0.25	0.24	0.25	0.22	0.21
MGO	14.22	14.54	14.66	14.00	14.30	14.45	13.89	14.41
CAO	12.13	12.17	12.29	12.11	12.21	12.30	12.11	12.26
NA2O	1.12	1.03	1.09	1.14	1.14	1.07	1.15	1.10
K2O	0.30	0.30	0.26	0.30	0.28	0.26	0.30	0.28
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.07	2.08	2.08	2.08	2.09	2.09	2.09	2.10
SUM	99.06	99.49	99.52	99.25	99.98	99.67	99.70	99.96
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.06	99.49	99.52	99.25	99.98	99.67	99.70	99.96

SI	6.626	*	6.717	*	6.711	*	6.654	*	6.682	*	6.737	*	6.647	*	6.700	*
AL	1.374	8.000	1.283	8.000	1.289	8.000	1.346	8.000	1.318	8.000	1.263	8.000	1.353	8.000	1.300	8.000
AL	0.877	*	0.842	*	0.798	*	0.928	*	0.890	*	0.833	*	0.942	*	0.874	*
TI	0.011	*	0.011	*	0.010	*	0.010	*	0.011	*	0.010	*	0.010	*	0.009	*
FE	1.190	*	1.173	*	1.183	*	1.167	*	1.171	*	1.177	*	1.195	*	1.168	*
MN	0.031	*	0.026	*	0.032	*	0.031	*	0.029	*	0.030	*	0.027	*	0.025	*
MG	3.065	5.173	3.114	5.164	3.143	5.165	3.006	5.142	3.048	5.148	3.090	5.141	2.971	5.145	3.071	5.147
CA	1.879	*	1.873	*	1.894	*	1.869	*	1.871	*	1.891	*	1.862	*	1.878	*
NA	0.314	*	0.287	*	0.304	*	0.318	*	0.316	*	0.298	*	0.320	*	0.305	*
K	0.055	*	0.055	*	0.048	*	0.055	*	0.051	*	0.048	*	0.055	*	0.051	*
BA	0.000	2.249	0.000	2.215	0.000	2.246	0.000	2.243	0.000	2.238	0.000	2.236	0.000	2.237	0.000	2.234
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-2-HOST

	89	90	91	92	93	94	95	96
SIO2	46.37	46.91	45.60	46.29	47.22	46.27	45.96	46.39
A2O3	12.59	12.61	13.49	12.53	12.45	12.61	13.68	12.73
TIO2	0.09	0.08	0.09	0.09	0.07	0.10	0.08	0.09
FEO	9.82	9.78	10.08	9.92	9.67	9.86	9.96	9.73
MNO	0.23	0.22	0.21	0.24	0.25	0.23	0.23	0.23
MGO	14.34	14.45	14.10	14.27	14.59	14.34	13.99	14.40
CAO	12.17	12.19	12.24	12.18	12.14	12.35	12.01	12.11
NA2O	1.05	1.15	1.15	1.08	1.07	1.18	1.14	1.09
K2O	0.30	0.26	0.34	0.29	0.29	0.27	0.31	0.28
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.07	2.09	2.07	2.07	2.09	2.08	2.08	2.08
SUM	99.03	99.74	99.37	98.96	99.84	99.29	99.44	99.13
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.03	99.74	99.37	98.96	99.84	99.29	99.44	99.13

SI	6.701	*	6.723	*	6.586	*	6.699	*	6.753	*	6.678	*	6.616	*	6.692	*
AL	1.299	8.000	1.277	8.000	1.414	8.000	1.301	8.000	1.247	8.000	1.322	8.000	1.384	8.000	1.308	8.000
AL	0.844	*	0.853	*	0.881	*	0.836	*	0.851	*	0.823	*	0.937	*	0.856	*
TI	0.010	*	0.009	*	0.010	*	0.010	*	0.008	*	0.011	*	0.009	*	0.010	*
FE	1.187	*	1.172	*	1.217	*	1.201	*	1.156	*	1.190	*	1.199	*	1.174	*
MN	0.028	*	0.027	*	0.026	*	0.029	*	0.030	*	0.028	*	0.028	*	0.028	*
MG	3.089	5.158	3.087	5.147	3.035	5.169	3.078	5.154	3.110	5.155	3.085	5.137	3.002	5.174	3.096	5.165
CA	1.884	*	1.872	*	1.894	*	1.889	*	1.860	*	1.910	*	1.852	*	1.872	*
NA	0.294	*	0.320	*	0.322	*	0.303	*	0.297	*	0.330	*	0.318	*	0.305	*
K	0.055	*	0.048	*	0.063	*	0.054	*	0.053	*	0.050	*	0.057	*	0.052	*
BA	0.000	2.234	0.000	2.239	0.000	2.279	0.000	2.245	0.000	2.210	0.000	2.290	0.000	2.227	0.000	2.228
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-2-HOST

	97	98	99	100	101	102	103	104
SIO2	46.71	46.44	46.05	46.91	47.49	45.37	46.00	47.09
A2O3	12.51	12.77	13.16	12.18	12.26	13.51	13.54	12.08
TIO2	0.10	0.09	0.10	0.08	0.08	0.09	0.08	0.08
FEO	9.81	10.03	9.90	9.56	9.51	10.17	9.90	9.59
MNO	0.22	0.25	0.21	0.23	0.22	0.23	0.25	0.23
MGO	14.41	14.14	14.19	14.56	14.43	13.96	14.16	14.76
CAO	12.15	12.28	12.21	12.13	12.15	12.24	12.25	12.18
NA2O	1.04	1.18	1.13	1.08	1.05	1.21	1.14	1.07
K2O	0.27	0.28	0.29	0.26	0.28	0.30	0.28	0.27
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.08	2.08	2.08	2.08	2.09	2.07	2.08	2.09
SUM	99.30	99.54	99.32	99.07	99.56	99.15	99.68	99.44
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.30	99.54	99.32	99.07	99.56	99.15	99.68	99.44

SI	6.725	*	6.686	*	6.641	*	6.761	*	6.799	*	6.573	*	6.610	*	6.764	*
AL	1.275	8.000	1.314	8.000	1.359	8.000	1.239	8.000	1.201	8.000	1.427	8.000	1.390	8.000	1.236	8.000
AL	0.847	*	0.853	*	0.877	*	0.830	*	0.868	*	0.880	*	0.902	*	0.808	*
TI	0.011	*	0.010	*	0.011	*	0.009	*	0.009	*	0.010	*	0.009	*	0.009	*
FE	1.181	*	1.208	*	1.194	*	1.152	*	1.139	*	1.232	*	1.190	*	1.152	*
MN	0.027	*	0.030	*	0.026	*	0.028	*	0.027	*	0.028	*	0.030	*	0.028	*
MG	3.092	5.158	3.034	5.135	3.050	5.158	3.128	5.147	3.079	5.121	3.015	5.165	3.033	5.164	3.160	5.156
CA	1.874	*	1.894	*	1.887	*	1.873	*	1.864	*	1.900	*	1.886	*	1.874	*
NA	0.290	*	0.329	*	0.316	*	0.302	*	0.291	*	0.340	*	0.318	*	0.298	*
K	0.050	*	0.051	*	0.053	*	0.048	*	0.051	*	0.055	*	0.051	*	0.049	*
BA	0.000	2.214	0.000	2.275	0.000	2.256	0.000	2.223	0.000	2.206	0.000	2.295	0.000	2.255	0.000	2.222
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-2-HOST

	105	106	107	108	109	110	111	112
SIO2	46.17	45.86	49.60	46.04	47.17	46.26	46.53	45.62
A2O3	14.00	12.95	10.86	13.78	12.30	13.40	12.67	13.46
TIO2	0.10	0.10	0.08	0.09	0.07	0.07	0.08	0.08
FEO	9.98	9.83	9.20	10.00	9.67	10.02	9.72	9.94
MNO	0.21	0.22	0.22	0.22	0.23	0.24	0.23	0.23
MGO	13.81	14.14	14.43	13.91	14.34	13.93	14.44	14.05
CAO	12.18	12.09	11.80	12.18	12.08	12.22	12.36	12.20
NA2O	1.22	1.19	0.99	1.25	1.03	1.20	1.10	1.16
K2O	0.30	0.28	0.24	0.31	0.25	0.31	0.28	0.29
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.09	2.06	2.11	2.09	2.08	2.09	2.08	2.07
SUM	100.06	98.72	99.53	99.85	99.22	99.74	99.49	99.10
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	100.06	98.72	99.53	99.85	99.22	99.74	99.49	99.10

SI	6.605	*	6.653	*	7.057	*	6.606	*	6.783	*	6.645	*	6.692	*	6.600	*
AL	1.395	8.000	1.347	8.000	0.943	8.000	1.394	8.000	1.217	8.000	1.355	8.000	1.308	8.000	1.400	8.000
AL	0.965	*	0.867	*	0.877	*	0.936	*	0.867	*	0.913	*	0.839	*	0.894	*
TI	0.011	*	0.011	*	0.009	*	0.010	*	0.008	*	0.008	*	0.009	*	0.009	*
FE	1.194	*	1.193	*	1.095	*	1.200	*	1.163	*	1.204	*	1.169	*	1.203	*
MN	0.025	*	0.027	*	0.027	*	0.027	*	0.028	*	0.029	*	0.028	*	0.028	*
MG	2.945	5.140	3.058	5.155	3.060	5.067	2.975	5.147	3.073	5.139	2.982	5.136	3.096	5.141	3.029	5.163
CA	1.867	*	1.879	*	1.799	*	1.869	*	1.861	*	1.881	*	1.905	*	1.891	*
NA	0.338	*	0.335	*	0.273	*	0.348	*	0.287	*	0.334	*	0.307	*	0.325	*
K	0.055	*	0.052	*	0.044	*	0.057	*	0.046	*	0.057	*	0.051	*	0.054	*
BA	0.000	2.260	0.000	2.266	0.000	2.115	0.000	2.274	0.000	2.194	0.000	2.272	0.000	2.263	0.000	2.270
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-2-HOST

	113	114	115	116	117	118	119	120
SIO2	46.33	45.83	45.69	46.20	45.73	46.16	46.21	46.57
A2O3	13.23	13.15	13.71	12.82	13.48	12.77	13.08	12.82
TIO2	0.08	0.08	0.09	0.10	0.08	0.08	0.10	0.09
FEO	9.77	9.86	9.89	9.91	9.98	9.76	9.90	9.61
MNO	0.24	0.23	0.24	0.23	0.26	0.24	0.21	0.20
MGO	14.52	14.19	13.94	14.13	13.83	14.49	14.24	14.35
CAO	12.14	12.10	12.09	12.25	12.16	12.04	12.21	11.99
NA2O	1.15	1.15	1.15	1.13	1.15	1.10	1.16	1.12
K2O	0.27	0.31	0.32	0.29	0.30	0.32	0.28	0.30
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.09	2.07	2.07	2.07	2.07	2.07	2.08	2.08
SUM	99.82	98.97	99.19	99.13	99.04	99.03	99.47	99.13
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.82	98.97	99.19	99.13	99.04	99.03	99.47	99.13

SI	6.640	*	6.634	*	6.598	*	6.676	*	6.618	*	6.671	*	6.652	*	6.709	*
AL	1.360	8.000	1.366	8.000	1.402	8.000	1.324	8.000	1.382	8.000	1.329	8.000	1.348	8.000	1.291	8.000
AL	0.874	*	0.877	*	0.930	*	0.859	*	0.917	*	0.845	*	0.871	*	0.885	*
TI	0.009	*	0.009	*	0.010	*	0.011	*	0.009	*	0.009	*	0.011	*	0.010	*
FE	1.171	*	1.194	*	1.194	*	1.198	*	1.208	*	1.180	*	1.192	*	1.158	*
MN	0.029	*	0.028	*	0.029	*	0.028	*	0.032	*	0.029	*	0.026	*	0.024	*
MG	3.102	5.185	3.061	5.168	3.000	5.164	3.043	5.139	2.983	5.148	3.121	5.184	3.056	5.155	3.081	5.158
CA	1.864	*	1.877	*	1.870	*	1.897	*	1.885	*	1.864	*	1.883	*	1.851	*
NA	0.320	*	0.323	*	0.322	*	0.317	*	0.323	*	0.308	*	0.324	*	0.313	*
K	0.049	*	0.057	*	0.059	*	0.053	*	0.055	*	0.059	*	0.051	*	0.055	*
BA	0.000	2.233	0.000	2.256	0.000	2.251	0.000	2.267	0.000	2.263	0.000	2.231	0.000	2.258	0.000	2.218
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-2-HOST

	121	122	123	124	125	126	127	128
SIO2	45.75	46.73	46.15	46.11	44.58	46.86	46.13	45.08
A2O3	13.50	12.23	13.21	12.75	14.11	12.08	12.62	14.64
TIO2	0.09	0.09	0.08	0.09	0.09	0.08	0.08	0.10
FEO	9.93	9.70	9.90	9.82	10.27	9.60	9.92	10.00
MNO	0.22	0.21	0.23	0.25	0.25	0.24	0.31	0.26
MGO	13.77	14.50	13.98	14.11	13.80	14.83	14.09	13.90
CAO	12.03	12.10	12.14	12.06	11.73	12.04	12.04	11.54
NA2O	1.26	1.17	1.14	1.08	1.38	1.06	1.10	1.39
K2O	0.32	0.29	0.29	0.30	0.34	0.35	0.30	0.33
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.07	2.08	2.08	2.06	2.05	2.08	2.06	2.08
SUM	98.94	99.10	99.20	98.63	98.60	99.22	98.65	99.32
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	98.94	99.10	99.20	98.63	98.60	99.22	98.65	99.32

SI	6.625	*	6.742	*	6.660	*	6.690	*	6.500	*	6.749	*	6.698	*	6.504	*
AL	1.375	8.000	1.258	8.000	1.340	8.000	1.310	8.000	1.500	8.000	1.251	8.000	1.302	8.000	1.496	8.000
AL	0.928	*	0.822	*	0.906	*	0.870	*	0.925	*	0.800	*	0.857	*	0.993	*
TI	0.010	*	0.010	*	0.009	*	0.010	*	0.010	*	0.009	*	0.009	*	0.011	*
FE	1.203	*	1.170	*	1.195	*	1.192	*	1.252	*	1.156	*	1.205	*	1.207	*
MN	0.027	*	0.026	*	0.028	*	0.031	*	0.031	*	0.029	*	0.038	*	0.032	*
MG	2.972	5.140	3.118	5.146	3.007	5.144	3.052	5.154	2.999	5.217	3.184	5.178	3.049	5.157	2.989	5.231
CA	1.868	*	1.871	*	1.877	*	1.875	*	1.833	*	1.858	*	1.873	*	1.784	*
NA	0.354	*	0.327	*	0.319	*	0.304	*	0.390	*	0.296	*	0.310	*	0.389	*
K	0.059	*	0.053	*	0.053	*	0.056	*	0.063	*	0.064	*	0.056	*	0.061	*
BA	0.000	2.279	0.000	2.251	0.000	2.249	0.000	2.234	0.000	2.286	0.000	2.218	0.000	2.238	0.000	2.233
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-2-HOST

	129	130	131	132	133	134	135	136
SIO2	46.71	46.39	46.78	47.33	46.21	46.20	45.93	45.97
A2O3	12.39	12.48	12.98	12.09	12.60	12.33	12.84	12.94
TIO2	0.07	0.08	0.08	0.08	0.09	0.09	0.09	0.09
FEO	9.64	9.67	9.72	9.60	9.68	9.75	9.72	9.93
MNO	0.22	0.22	0.24	0.24	0.23	0.23	0.25	0.23
MGO	14.48	14.48	14.21	14.78	14.20	14.49	14.35	14.28
CAO	11.93	12.09	11.77	12.17	12.05	12.23	12.08	12.13
NA2O	1.09	1.05	1.04	1.03	1.10	1.05	1.10	1.06
K2O	0.44	0.27	0.46	0.26	0.38	0.27	0.28	0.30
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.08	2.07	2.08	2.09	2.06	2.07	2.07	2.07
SUM	99.05	98.80	99.36	99.67	98.60	98.71	98.71	99.00
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.05	98.80	99.36	99.67	98.60	98.71	98.71	99.00

SI	6.741	*	6.712	*	6.722	*	6.777	*	6.705	*	6.701	*	6.660	*	6.652	*
AL	1.259	8.000	1.288	8.000	1.278	8.000	1.223	8.000	1.295	8.000	1.299	8.000	1.340	8.000	1.348	8.000
AL	0.847	*	0.840	*	0.920	*	0.817	*	0.860	*	0.808	*	0.854	*	0.858	*
TI	0.008	*	0.009	*	0.009	*	0.009	*	0.010	*	0.010	*	0.010	*	0.010	*
FE	1.163	*	1.170	*	1.168	*	1.150	*	1.175	*	1.183	*	1.179	*	1.202	*
MN	0.027	*	0.027	*	0.029	*	0.029	*	0.028	*	0.028	*	0.031	*	0.028	*
MG	3.115	5.160	3.123	5.168	3.044	5.170	3.155	5.159	3.071	5.143	3.133	5.161	3.101	5.175	3.080	5.177
CA	1.845	*	1.874	*	1.812	*	1.867	*	1.873	*	1.901	*	1.877	*	1.881	*
NA	0.305	*	0.295	*	0.290	*	0.286	*	0.309	*	0.295	*	0.309	*	0.297	*
K	0.081	*	0.050	*	0.084	*	0.047	*	0.070	*	0.050	*	0.052	*	0.055	*
BA	0.000	2.230	0.000	2.219	0.000	2.186	0.000	2.201	0.000	2.253	0.000	2.246	0.000	2.238	0.000	2.233
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-2-HOST

	137	138	139	140	141	142	143	144
SIO2	45.80	45.93	46.15	45.72	46.23	46.00	46.10	45.49
A2O3	13.36	12.63	12.69	13.09	13.02	13.20	12.92	13.43
TIO2	0.08	0.09	0.09	0.08	0.08	0.10	0.08	0.09
FEO	9.81	9.99	9.97	9.87	9.81	9.98	9.73	10.07
MNO	0.24	0.23	0.24	0.23	0.23	0.26	0.24	0.24
MGO	13.94	14.21	14.34	14.22	14.54	14.13	14.34	14.05
CAO	12.09	12.12	12.07	12.03	12.08	12.18	12.14	12.11
NA2O	1.19	1.12	1.16	1.11	1.17	1.15	1.18	1.16
K2O	0.30	0.31	0.29	0.30	0.30	0.31	0.31	0.32
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.07	2.06	2.07	2.06	2.08	2.08	2.07	2.07
SUM	98.88	98.69	99.07	98.71	99.54	99.39	99.11	99.03
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	98.88	98.69	99.07	98.71	99.54	99.39	99.11	99.03

SI	6.632	*	6.672	*	6.675	*	6.634	*	6.648	*	6.634	*	6.659	*	6.591	*
AL	1.368	8.000	1.328	8.000	1.325	8.000	1.366	8.000	1.352	8.000	1.366	8.000	1.341	8.000	1.409	8.000
AL	0.912	*	0.834	*	0.837	*	0.872	*	0.854	*	0.877	*	0.858	*	0.885	*
TI	0.009	*	0.010	*	0.010	*	0.009	*	0.009	*	0.011	*	0.009	*	0.010	*
FE	1.188	*	1.214	*	1.206	*	1.198	*	1.180	*	1.204	*	1.175	*	1.220	*
MN	0.029	*	0.028	*	0.029	*	0.028	*	0.028	*	0.032	*	0.029	*	0.029	*
MG	3.009	5.147	3.077	5.163	3.091	5.173	3.076	5.183	3.117	5.187	3.037	5.161	3.087	5.159	3.034	5.178
CA	1.876	*	1.886	*	1.870	*	1.870	*	1.861	*	1.882	*	1.879	*	1.880	*
NA	0.334	*	0.315	*	0.325	*	0.312	*	0.326	*	0.322	*	0.330	*	0.326	*
K	0.055	*	0.057	*	0.053	*	0.056	*	0.055	*	0.057	*	0.057	*	0.059	*
BA	0.000	2.265	0.000	2.259	0.000	2.249	0.000	2.238	0.000	2.242	0.000	2.261	0.000	2.266	0.000	2.265
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-2-HOST

	145	146	147	148	149	150	151
SIO2	46.19	45.29	46.89	45.55	46.24	46.84	46.39
A2O3	12.73	14.04	12.34	12.68	13.42	12.09	12.27
TIO2	0.08	0.09	0.10	0.10	0.09	0.09	0.10
FEO	9.87	9.97	9.67	9.87	10.08	9.59	9.67
MNO	0.21	0.24	0.23	0.25	0.24	0.24	0.21
MGO	14.40	13.79	14.43	14.43	14.02	14.66	14.69
CAO	12.09	11.80	11.92	12.07	11.54	12.12	11.91
NA2O	1.15	1.17	1.10	1.21	1.19	1.07	1.05
K2O	0.31	0.45	0.27	0.38	0.58	0.25	0.33
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.07	2.07	2.08	2.06	2.08	2.08	2.07
SUM	99.10	98.91	99.03	98.60	99.48	99.03	98.69
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.10	98.91	99.03	98.60	99.48	99.03	98.69

SI	6.674	*	6.564	*	6.759	*	6.631	*	6.657	*	6.757	*	6.720	*
AL	1.326	8.000	1.436	8.000	1.241	8.000	1.369	8.000	1.343	8.000	1.243	8.000	1.280	8.000
AL	0.842	*	0.962	*	0.856	*	0.806	*	0.934	*	0.812	*	0.814	*
TI	0.009	*	0.010	*	0.011	*	0.011	*	0.010	*	0.010	*	0.011	*
FE	1.193	*	1.208	*	1.166	*	1.202	*	1.214	*	1.157	*	1.171	*
MN	0.026	*	0.029	*	0.028	*	0.031	*	0.029	*	0.029	*	0.026	*
MG	3.101	5.171	2.979	5.188	3.101	5.161	3.131	5.181	3.008	5.195	3.152	5.159	3.172	5.194
CA	1.872	*	1.832	*	1.841	*	1.883	*	1.780	*	1.873	*	1.848	*
NA	0.322	*	0.329	*	0.307	*	0.342	*	0.332	*	0.299	*	0.295	*
K	0.057	*	0.083	*	0.050	*	0.071	*	0.107	*	0.046	*	0.061	*
BA	0.000	2.251	0.000	2.244	0.000	2.198	0.000	2.295	0.000	2.219	0.000	2.218	0.000	2.204
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-2-INTRAGRANULAR

	1	2	3	4	5	6	7	8
SIO2	47.31	47.28	45.51	47.43	45.85	46.09	47.25	45.80
A2O3	12.48	12.23	14.28	12.47	14.46	13.92	12.24	14.20
TIO2	0.10	0.10	0.10	0.10	0.10	0.09	0.08	0.08
FEO	9.72	9.60	10.07	9.80	10.03	9.92	9.91	10.22
MNO	0.26	0.22	0.24	0.26	0.22	0.22	0.27	0.26
MGO	15.02	15.05	13.66	14.97	13.82	13.70	14.89	13.99
CAO	11.73	11.66	11.70	11.80	11.74	11.51	11.73	11.77
NA2O	1.23	1.27	1.43	1.28	1.43	0.95	1.27	1.44
K2O	0.29	0.28	0.34	0.27	0.34	0.73	0.26	0.33
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.10	2.10	2.08	2.11	2.09	2.08	2.10	2.09
SUM	100.24	99.79	99.41	100.49	100.08	99.21	100.00	100.18
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	100.24	99.79	99.41	100.49	100.08	99.21	100.00	100.18

SI	6.737	*	6.759	*	6.561	*	6.740	*	6.559	*	6.644	*	6.753	*	6.557	*
AL	1.263	8.000	1.241	8.000	1.439	8.000	1.260	8.000	1.441	8.000	1.356	8.000	1.247	8.000	1.443	8.000
AL	0.831	*	0.819	*	0.987	*	0.829	*	0.997	*	1.009	*	0.814	*	0.952	*
TI	0.011	*	0.011	*	0.011	*	0.011	*	0.011	*	0.010	*	0.009	*	0.009	*
FE	1.158	*	1.148	*	1.214	*	1.165	*	1.200	*	1.196	*	1.184	*	1.224	*
MN	0.031	*	0.027	*	0.029	*	0.031	*	0.027	*	0.027	*	0.033	*	0.032	*
MG	3.188	5.219	3.207	5.211	2.935	5.176	3.171	5.206	2.947	5.181	2.944	5.185	3.172	5.211	2.985	5.201
CA	1.790	*	1.786	*	1.807	*	1.797	*	1.799	*	1.778	*	1.796	*	1.805	*
NA	0.340	*	0.352	*	0.400	*	0.353	*	0.397	*	0.266	*	0.352	*	0.400	*
K	0.053	*	0.051	*	0.063	*	0.049	*	0.062	*	0.134	*	0.047	*	0.060	*
BA	0.000	2.182	0.000	2.189	0.000	2.269	0.000	2.198	0.000	2.258	0.000	2.177	0.000	2.195	0.000	2.265
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-2-INTRAGRANULAR

	9	10	11	12	13	14	15	16
SIO2	47.29	46.01	46.11	46.64	45.52	46.71	45.60	45.67
A2O3	12.42	14.05	14.45	12.75	14.20	13.05	14.25	14.56
TIO2	0.09	0.09	0.08	0.10	0.10	0.09	0.10	0.09
FEO	9.85	10.02	9.80	9.85	10.13	9.70	9.93	9.60
MNO	0.27	0.23	0.23	0.22	0.28	0.27	0.24	0.20
MGO	14.95	13.94	13.61	14.61	14.01	14.15	13.73	13.27
CAO	11.69	11.71	11.03	11.69	11.84	11.33	11.65	11.13
NA2O	1.23	1.35	1.07	1.30	1.38	1.19	1.35	1.14
K2O	0.28	0.32	0.95	0.35	0.32	0.81	0.35	1.00
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.10	2.09	2.08	2.09	2.09	2.08	2.08	2.07
SUM	100.17	99.81	99.41	99.60	99.87	99.38	99.28	98.73
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	100.17	99.81	99.41	99.60	99.87	99.38	99.28	98.73

SI	6.742	*	6.597	*	6.627	*	6.697	*	6.539	*	6.720	*	6.574	*	6.612	*
AL	1.258	8.000	1.403	8.000	1.373	8.000	1.303	8.000	1.461	8.000	1.280	8.000	1.426	8.000	1.388	8.000
AL	0.829	*	0.971	*	1.074	*	0.854	*	0.942	*	0.932	*	0.995	*	1.096	*
TI	0.010	*	0.010	*	0.009	*	0.011	*	0.011	*	0.010	*	0.011	*	0.010	*
FE	1.174	*	1.201	*	1.178	*	1.183	*	1.217	*	1.167	*	1.197	*	1.162	*
MN	0.033	*	0.028	*	0.028	*	0.027	*	0.034	*	0.033	*	0.029	*	0.025	*
MG	3.177	5.223	2.979	5.189	2.916	5.205	3.127	5.201	3.000	5.204	3.034	5.176	2.950	5.183	2.864	5.156
CA	1.786	*	1.799	*	1.699	*	1.798	*	1.822	*	1.746	*	1.800	*	1.726	*
NA	0.340	*	0.375	*	0.298	*	0.362	*	0.384	*	0.332	*	0.377	*	0.320	*
K	0.051	*	0.059	*	0.174	*	0.064	*	0.059	*	0.149	*	0.064	*	0.185	*
BA	0.000	2.177	0.000	2.233	0.000	2.171	0.000	2.224	0.000	2.265	0.000	2.227	0.000	2.241	0.000	2.231
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-2-INTRAGRANULAR

	17	18	19	20	21
SIO2	50.35	45.12	46.35	50.33	47.15
A2O3	10.94	13.84	13.79	10.44	12.84
TIO2	0.06	0.09	0.08	0.07	0.07
FEO	9.58	10.00	9.69	9.49	9.57
MNO	0.25	0.26	0.24	0.23	0.24
MGO	13.56	13.83	13.57	13.54	14.38
CAO	11.09	11.92	11.41	11.03	11.26
NA2O	0.95	1.27	1.08	0.86	1.02
K2O	0.63	0.32	0.77	0.62	0.72
BAO	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00
H2O	2.11	2.06	2.08	2.09	2.09
SUM	99.52	98.71	98.06	98.70	99.34
-O= F+CL	0.00	0.00	0.00	0.00	0.00
SUM	99.52	98.71	99.06	98.70	99.34

SI	7.158	*	6.558	*	6.684	*	7.209	*	6.767	*
AL	0.842	8.000	1.442	8.000	1.316	8.000	0.791	8.000	1.233	8.000
AL	0.991	*	0.928	*	1.027	*	0.971	*	0.938	*
TI	0.006	*	0.010	*	0.009	*	0.008	*	0.008	*
FE	1.139	*	1.215	*	1.169	*	1.137	*	1.149	*
MN	0.030	*	0.032	*	0.029	*	0.028	*	0.029	*
MG	2.874	5.040	2.996	5.181	2.917	5.150	2.891	5.033	3.076	5.200
CA	1.689	*	1.856	*	1.763	*	1.693	*	1.731	*
NA	0.262	*	0.358	*	0.302	*	0.239	*	0.284	*
K	0.114	*	0.059	*	0.142	*	0.113	*	0.132	*
BA	0.000	2.065	0.000	2.273	0.000	2.206	0.000	2.045	0.000	2.147
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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AMPHIBOLE HOST GRAIN P-3

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-3-HOST

	1	2	3	4	5	6	7	8
SIO2	42.52	41.99	42.30	41.72	44.56	43.22	43.20	45.76
A2O3	16.15	16.24	15.99	16.05	17.27	16.37	16.25	14.53
TIO2	0.45	0.46	0.42	0.44	0.52	0.42	0.41	0.43
FEO	14.69	14.72	14.66	14.58	12.72	13.83	13.86	13.88
MNO	0.27	0.32	0.32	0.31	0.25	0.26	0.32	0.28
MGO	10.20	10.30	10.44	10.42	9.26	10.00	10.36	10.07
CAO	11.44	11.48	11.54	11.38	9.77	10.28	10.13	10.64
NA2O	1.40	1.45	1.45	1.48	2.33	1.81	1.70	1.17
K2O	0.50	0.54	0.51	0.51	0.82	0.78	0.77	0.37
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.03	2.02	2.03	2.01	2.06	2.03	2.03	2.05
SUM	99.65	99.52	99.66	98.90	99.56	99.00	99.03	99.18
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.65	99.52	99.66	98.90	99.56	99.00	99.03	99.18

SI	6.272	*	6.216	*	6.249	*	6.214	*	6.473	*	6.373	*	6.367	*	6.683	*
AL	1.728	8.000	1.784	8.000	1.751	8.000	1.786	8.000	1.527	8.000	1.627	8.000	1.633	8.000	1.317	8.000
AL	1.079	*	1.049	*	1.032	*	1.031	*	1.429	*	1.218	*	1.190	*	1.184	*
TI	0.050	*	0.051	*	0.047	*	0.049	*	0.057	*	0.047	*	0.045	*	0.047	*
FE	1.812	*	1.822	*	1.811	*	1.816	*	1.545	*	1.706	*	1.708	*	1.695	*
MN	0.034	*	0.040	*	0.040	*	0.039	*	0.031	*	0.032	*	0.040	*	0.035	*
MG	2.243	5.218	2.273	5.235	2.299	5.229	2.313	5.249	2.005	5.066	2.198	5.200	2.276	5.260	2.192	5.153
CA	1.808	*	1.821	*	1.827	*	1.816	*	1.521	*	1.624	*	1.600	*	1.665	*
NA	0.400	*	0.416	*	0.415	*	0.427	*	0.656	*	0.517	*	0.486	*	0.331	*
K	0.094	*	0.102	*	0.096	*	0.097	*	0.152	*	0.147	*	0.145	*	0.069	*
BA	0.000	2.302	0.000	2.339	0.000	2.338	0.000	2.340	0.000	2.329	0.000	2.288	0.000	2.230	0.000	2.065
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-3-HOST

	9	10	11	12	13	14	15	16
SIO2	43.14	43.21	43.38	43.29	43.00	41.90	42.78	42.93
A2O3	14.61	14.73	14.72	15.11	15.50	16.01	14.98	15.06
TIO2	0.50	0.46	0.40	0.43	0.44	0.44	0.44	0.40
FEO	13.97	14.18	14.15	14.30	14.27	14.81	14.25	14.37
MNO	0.32	0.33	0.27	0.32	0.30	0.31	0.28	0.32
MGO	10.91	11.16	10.99	11.06	10.59	10.27	10.63	10.38
CAO	11.31	11.29	11.33	11.32	11.35	11.28	11.62	11.52
NA2O	1.34	1.33	1.39	1.42	1.43	1.47	1.29	1.38
K2O	0.38	0.36	0.37	0.41	0.48	0.53	0.42	0.44
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.02	2.03	2.03	2.04	2.03	2.01	2.01	2.02
SUM	98.50	99.08	99.03	99.70	99.39	99.03	98.70	98.82
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	98.50	99.08	99.03	99.70	99.39	99.03	98.70	98.82

SI	6.412	*	6.389	*	6.414	*	6.365	*	6.344	*	6.235	*	6.361	*	6.378	*
AL	1.588	8.000	1.611	8.000	1.586	8.000	1.635	8.000	1.656	8.000	1.765	8.000	1.639	8.000	1.622	8.000
AL	0.971	*	0.956	*	0.979	*	0.983	*	1.039	*	1.042	*	0.986	*	1.015	*
TI	0.056	*	0.051	*	0.044	*	0.048	*	0.049	*	0.049	*	0.049	*	0.045	*
FE	1.737	*	1.753	*	1.750	*	1.758	*	1.761	*	1.843	*	1.772	*	1.785	*
MN	0.040	*	0.041	*	0.034	*	0.040	*	0.037	*	0.039	*	0.035	*	0.040	*
MG	2.417	5.221	2.460	5.262	2.422	5.229	2.424	5.253	2.329	5.215	2.278	5.251	2.356	5.199	2.299	5.183
CA	1.801	*	1.789	*	1.795	*	1.783	*	1.794	*	1.798	*	1.851	*	1.834	*
NA	0.386	*	0.381	*	0.398	*	0.405	*	0.409	*	0.424	*	0.372	*	0.398	*
K	0.072	*	0.068	*	0.070	*	0.077	*	0.090	*	0.101	*	0.080	*	0.083	*
BA	0.000	2.259	0.000	2.238	0.000	2.263	0.000	2.265	0.000	2.293	0.000	2.323	0.000	2.303	0.000	2.315
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-3-HOST

	17	18	19	20	21	22	23	24
SIO2	42.55	44.60	44.94	44.86	43.99	42.59	42.20	44.19
A2O3	15.52	13.09	12.55	12.60	14.45	15.26	15.19	13.52
TIO2	0.41	0.38	0.36	0.35	0.40	0.44	0.44	0.40
FEO	14.26	13.54	13.25	13.23	14.01	14.15	14.83	13.73
MNO	0.27	0.31	0.27	0.32	0.30	0.29	0.29	0.31
MGO	10.78	12.01	12.35	12.41	11.48	10.82	10.41	11.94
CAO	11.40	11.49	11.57	11.55	11.43	11.45	11.50	11.33
NA2O	1.27	1.15	1.09	1.10	1.26	1.33	1.39	1.27
K2O	0.44	0.35	0.30	0.29	0.34	0.40	0.39	0.33
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.02	2.03	2.03	2.03	2.04	2.02	2.01	2.03
SUM	98.92	98.95	98.71	98.74	99.70	98.75	98.65	99.05
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	98.92	98.95	98.71	98.74	99.70	98.75	98.65	99.05

SI	6.310	*	6.573	*	6.627	*	6.615	*	6.449	*	6.328	*	6.303	*	6.515	*
AL	1.690	8.000	1.427	8.000	1.373	8.000	1.385	8.000	1.551	8.000	1.674	8.000	1.697	8.000	1.485	8.000
AL	1.021	*	0.847	*	0.808	*	0.804	*	0.945	*	0.997	*	0.976	*	0.864	*
TI	0.046	*	0.042	*	0.040	*	0.039	*	0.044	*	0.049	*	0.049	*	0.044	*
FE	1.768	*	1.669	*	1.634	*	1.631	*	1.718	*	1.758	*	1.852	*	1.693	*
MN	0.034	*	0.039	*	0.034	*	0.040	*	0.037	*	0.036	*	0.037	*	0.039	*
MG	2.383	5.252	2.638	5.235	2.714	5.230	2.727	5.242	2.508	5.252	2.396	5.236	2.317	5.231	2.624	5.263
CA	1.811	*	1.814	*	1.828	*	1.825	*	1.795	*	1.822	*	1.840	*	1.790	*
NA	0.365	*	0.329	*	0.312	*	0.314	*	0.358	*	0.383	*	0.402	*	0.363	*
K	0.083	*	0.066	*	0.056	*	0.055	*	0.064	*	0.076	*	0.074	*	0.062	*
BA	0.000	2.260	0.000	2.209	0.000	2.196	0.000	2.194	0.000	2.217	0.000	2.281	0.000	2.317	0.000	2.215
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-3-HOST

	25	26	27	28	29	30	31	32
SIO2	43.97	42.76	42.17	42.16	42.20	42.02	41.65	41.87
A2O3	13.03	15.44	16.38	15.60	15.50	16.66	16.79	16.74
TIO2	0.39	0.41	0.46	0.44	0.44	0.41	0.46	0.43
FEO	13.67	14.03	14.78	14.34	14.45	14.72	14.87	14.84
MNO	0.26	0.27	0.32	0.30	0.27	0.29	0.30	0.29
MGO	12.24	11.04	10.45	10.45	10.56	10.43	9.82	10.63
CAO	11.43	11.50	11.17	11.47	11.48	11.45	11.48	11.06
NA2O	1.17	1.38	1.54	1.39	1.38	1.46	1.40	1.46
K2O	0.34	0.41	0.51	0.44	0.41	0.52	0.53	0.53
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.02	2.03	2.03	2.01	2.01	2.03	2.02	2.03
SUM	98.52	99.27	99.81	98.60	98.70	99.99	99.32	99.88
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	98.52	99.27	99.81	98.60	98.70	99.99	99.32	99.88

SI	6.522	*	6.313	*	6.218	*	6.284	*	6.285	*	6.186	*	6.180	*	6.170	*
AL	1.478	8.000	1.687	8.000	1.782	8.000	1.716	8.000	1.715	8.000	1.814	8.000	1.820	8.000	1.830	8.000
AL	0.800	*	1.000	*	1.064	*	1.024	*	1.006	*	1.076	*	1.116	*	1.076	*
TI	0.044	*	0.046	*	0.051	*	0.049	*	0.049	*	0.045	*	0.051	*	0.048	*
FE	1.696	*	1.732	*	1.823	*	1.788	*	1.800	*	1.812	*	1.845	*	1.829	*
MN	0.033	*	0.034	*	0.040	*	0.038	*	0.034	*	0.036	*	0.038	*	0.036	*
MG	2.706	5.278	2.430	5.241	2.297	5.274	2.322	5.221	2.344	5.233	2.289	5.259	2.172	5.222	2.335	5.323
CA	1.816	*	1.819	*	1.765	*	1.832	*	1.832	*	1.806	*	1.825	*	1.746	*
NA	0.336	*	0.395	*	0.440	*	0.402	*	0.399	*	0.417	*	0.403	*	0.417	*
K	0.064	*	0.077	*	0.096	*	0.084	*	0.078	*	0.098	*	0.100	*	0.100	*
BA	0.000	2.217	0.000	2.291	0.000	2.301	0.000	2.317	0.000	2.308	0.000	2.320	0.000	2.328	0.000	2.263
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-3-HOST

	33	34	35	36	37	38	39	40
SIO2	42.46	45.52	41.77	42.16	42.36	42.81	43.43	42.73
A2O3	16.33	12.16	15.96	15.80	15.90	15.54	16.13	14.98
TIO2	0.41	0.32	0.41	0.42	0.42	0.37	0.39	0.38
FEO	14.36	14.52	14.63	14.76	14.66	14.75	13.95	14.33
MNO	0.29	0.29	0.33	0.36	0.32	0.36	0.29	0.32
MGO	10.71	12.10	10.63	10.61	10.82	10.99	10.91	11.05
CAO	11.19	11.55	10.90	11.00	11.34	10.91	10.53	11.22
NA2O	1.56	1.18	1.62	1.62	1.51	1.59	1.34	1.45
K2O	0.52	0.36	0.45	0.47	0.49	0.45	1.01	0.38
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.04	2.05	2.01	2.02	2.03	2.03	2.05	2.02
SUM	99.87	100.05	98.71	99.22	99.85	99.80	100.03	98.86
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.87	100.05	98.71	99.22	99.85	99.80	100.03	98.86

SI	6.242	*	6.660	*	6.227	*	6.256	*	6.243	*	6.304	*	6.348	*	6.344	*
AL	1.758	8.000	1.340	8.000	1.773	8.000	1.744	8.000	1.757	8.000	1.696	8.000	1.652	8.000	1.656	8.000
AL	1.070	*	0.757	*	1.031	*	1.018	*	1.005	*	1.000	*	1.126	*	0.965	*
TI	0.045	*	0.035	*	0.046	*	0.047	*	0.047	*	0.041	*	0.043	*	0.042	*
FE	1.765	*	1.777	*	1.824	*	1.832	*	1.807	*	1.816	*	1.705	*	1.779	*
MN	0.036	*	0.036	*	0.042	*	0.045	*	0.040	*	0.045	*	0.036	*	0.040	*
MG	2.347	5.264	2.639	5.244	2.362	5.305	2.347	5.288	2.377	5.275	2.412	5.315	2.377	5.286	2.445	5.272
CA	1.762	*	1.811	*	1.741	*	1.749	*	1.791	*	1.721	*	1.649	*	1.785	*
NA	0.445	*	0.335	*	0.468	*	0.466	*	0.431	*	0.454	*	0.380	*	0.417	*
K	0.097	*	0.067	*	0.086	*	0.089	*	0.092	*	0.085	*	0.188	*	0.072	*
BA	0.000	2.305	0.000	2.213	0.000	2.295	0.000	2.304	0.000	2.314	0.000	2.260	0.000	2.217	0.000	2.274
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-3-HOST

	41	42	43	44	45	46	47	48
SIO2	42.62	43.23	44.48	44.02	43.83	50.87	42.98	42.93
A2O3	15.39	15.10	13.93	14.14	13.87	11.87	15.03	15.19
TIO2	0.41	0.39	0.37	0.38	0.37	0.30	0.42	0.42
FEO	14.77	14.83	14.23	13.98	13.95	12.06	14.34	14.40
MNO	0.36	0.35	0.35	0.31	0.35	0.32	0.30	0.31
MGO	10.82	11.07	11.82	11.76	11.82	10.65	11.15	10.65
CAO	10.88	11.04	11.08	11.33	11.13	9.94	11.54	11.55
NA2O	1.54	1.58	1.46	1.38	1.46	1.10	1.26	1.30
K2O	0.40	0.38	0.32	0.35	0.32	0.24	0.37	0.40
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.02	2.04	2.05	2.04	2.03	2.10	2.03	2.02
SUM	99.21	100.01	100.09	99.69	99.13	99.45	99.42	99.17
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.21	100.01	100.09	99.69	99.13	99.45	99.42	99.17

SI	6.314	*	6.351	*	6.497	*	6.457	*	6.468	*	7.255	*	6.343	*	6.353	*
AL	1.686	8.000	1.649	8.000	1.503	8.000	1.543	8.000	1.532	8.000	0.745	8.000	1.657	8.000	1.647	8.000
AL	1.000	*	0.966	*	0.895	*	0.901	*	0.879	*	1.249	*	0.956	*	1.002	*
TI	0.046	*	0.043	*	0.041	*	0.042	*	0.041	*	0.032	*	0.047	*	0.047	*
FE	1.830	*	1.822	*	1.738	*	1.715	*	1.721	*	1.438	*	1.770	*	1.782	*
MN	0.045	*	0.044	*	0.043	*	0.039	*	0.044	*	0.039	*	0.037	*	0.039	*
MG	2.389	5.310	2.424	5.299	2.574	5.291	2.571	5.268	2.600	5.285	2.264	5.022	2.453	5.263	2.349	5.219
CA	1.727	*	1.738	*	1.734	*	1.781	*	1.760	*	1.519	*	1.825	*	1.831	*
NA	0.442	*	0.450	*	0.413	*	0.392	*	0.418	*	0.304	*	0.361	*	0.373	*
K	0.076	*	0.071	*	0.060	*	0.065	*	0.060	*	0.044	*	0.070	*	0.076	*
BA	0.000	2.245	0.000	2.259	0.000	2.207	0.000	2.239	0.000	2.238	0.000	1.867	0.000	2.255	0.000	2.280
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-3-HOST

	49	50	51	52	53	54	55	56
SIO2	43.25	42.92	42.63	42.83	42.79	43.06	42.83	43.45
A2O3	15.30	15.09	15.34	15.18	14.97	14.46	14.36	14.52
TIO2	0.42	0.41	0.42	0.43	0.43	0.39	0.40	0.39
FEO	14.50	14.15	14.27	14.48	14.64	14.53	14.63	14.07
MNO	0.27	0.29	0.30	0.32	0.32	0.39	0.37	0.29
MGO	10.67	10.89	10.97	10.52	10.84	11.62	11.54	11.60
CAO	11.52	11.66	11.47	11.57	11.40	10.90	10.98	11.41
NA2O	1.31	1.30	1.30	1.32	1.37	1.56	1.49	1.30
K2O	0.43	0.40	0.40	0.39	0.43	0.39	0.40	0.40
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.04	2.02	2.02	2.02	2.02	2.03	2.02	2.03
SUM	99.71	99.13	99.12	99.06	99.21	99.33	99.02	99.46
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.71	99.13	99.12	99.06	99.21	99.33	99.02	99.46

SI	6.363	*	6.350	*	6.311	*	6.350	*	6.342	*	6.368	*	6.361	*	6.398	*
AL	1.637	8.000	1.650	8.000	1.689	8.000	1.650	8.000	1.658	8.000	1.632	8.000	1.639	8.000	1.602	8.000
AL	1.016	*	0.981	*	0.987	*	1.002	*	0.956	*	0.888	*	0.874	*	0.917	*
TI	0.048	*	0.046	*	0.047	*	0.048	*	0.048	*	0.043	*	0.045	*	0.043	*
FE	1.784	*	1.751	*	1.767	*	1.795	*	1.815	*	1.797	*	1.817	*	1.733	*
MN	0.034	*	0.036	*	0.038	*	0.040	*	0.040	*	0.049	*	0.047	*	0.036	*
MG	2.340	5.220	2.401	5.215	2.421	5.259	2.325	5.210	2.395	5.254	2.562	5.339	2.555	5.337	2.546	5.275
CA	1.816	*	1.848	*	1.819	*	1.838	*	1.810	*	1.727	*	1.747	*	1.800	*
NA	0.374	*	0.373	*	0.373	*	0.379	*	0.394	*	0.447	*	0.429	*	0.371	*
K	0.081	*	0.075	*	0.076	*	0.074	*	0.081	*	0.074	*	0.076	*	0.075	*
BA	0.000	2.270	0.000	2.297	0.000	2.268	0.000	2.291	0.000	2.285	0.000	2.248	0.000	2.252	0.000	2.246
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-3-HOST

	57	58	59	60	61	62	63	64
SIO2	42.66	43.28	45.65	42.79	42.26	42.18	42.72	42.71
A2O3	15.30	14.77	18.24	14.96	15.62	16.60	14.88	15.13
TIO2	0.42	0.41	0.42	0.41	0.41	0.44	0.41	0.41
FEO	14.49	14.38	11.12	14.24	14.33	14.16	14.27	14.68
MNO	0.30	0.32	0.26	0.36	0.31	0.31	0.34	0.35
MGO	11.06	11.22	9.53	11.20	10.98	10.41	11.22	11.11
CAO	11.00	10.89	7.14	11.01	11.24	11.35	10.89	10.65
NA2O	1.46	1.53	0.80	1.50	1.49	1.44	1.58	1.59
K2O	0.42	0.43	3.94	0.42	0.40	0.46	0.42	0.44
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.02	2.03	2.07	2.02	2.02	2.03	2.02	2.02
SUM	99.13	99.26	99.17	98.91	99.06	99.38	98.75	99.09
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.13	99.26	99.17	98.91	99.06	99.38	98.75	99.09

SI	6.317	*	6.392	*	6.610	*	6.346	*	6.266	*	6.225	*	6.348	*	6.331	*
AL	1.683	8.000	1.608	8.000	1.390	8.000	1.654	8.000	1.734	8.000	1.775	8.000	1.652	8.000	1.669	8.000
AL	0.986	*	0.962	*	1.722	*	0.961	*	0.996	*	1.112	*	0.954	*	0.974	*
TI	0.047	*	0.046	*	0.046	*	0.046	*	0.046	*	0.049	*	0.046	*	0.046	*
FE	1.794	*	1.776	*	1.347	*	1.766	*	1.777	*	1.748	*	1.773	*	1.820	*
MN	0.038	*	0.040	*	0.032	*	0.045	*	0.039	*	0.039	*	0.043	*	0.044	*
MG	2.441	5.306	2.470	5.293	2.057	5.203	2.476	5.294	2.427	5.284	2.290	5.237	2.485	5.301	2.455	5.339
CA	1.745	*	1.723	*	1.108	*	1.750	*	1.786	*	1.795	*	1.734	*	1.691	*
NA	0.419	*	0.438	*	0.225	*	0.431	*	0.428	*	0.412	*	0.455	*	0.457	*
K	0.079	*	0.081	*	0.728	*	0.079	*	0.076	*	0.087	*	0.080	*	0.083	*
BA	0.000	2.244	0.000	2.242	0.000	2.060	0.000	2.260	0.000	2.290	0.000	2.293	0.000	2.269	0.000	2.232
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-3-HOST

	65	66	67	68	69	70	71	72
SIO2	42.02	42.57	42.11	42.44	42.21	42.56	41.99	42.87
A2O3	15.71	15.83	16.40	15.68	16.14	16.05	16.14	15.80
TIO2	0.41	0.45	0.46	0.40	0.40	0.42	0.39	0.40
FEO	14.53	14.37	14.55	14.65	14.64	14.46	14.70	14.50
MNO	0.27	0.29	0.31	0.28	0.32	0.28	0.32	0.32
MGO	10.51	10.55	10.41	10.66	10.74	10.63	10.73	10.95
CAO	11.42	11.45	11.35	11.51	11.47	11.32	11.14	11.23
NA2O	1.41	1.34	1.38	1.41	1.50	1.48	1.53	1.52
K2O	0.42	0.46	0.49	0.51	0.48	0.50	0.47	0.44
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.01	2.03	2.03	2.03	2.03	2.03	2.02	2.04
SUM	98.71	99.34	99.49	99.57	99.93	99.73	99.43	100.07
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	98.71	99.34	99.49	99.57	99.93	99.73	99.43	100.07

SI	6.261	*	6.290	*	6.222	*	6.273	*	6.218	*	6.267	*	6.215	*	6.289	*
AL	1.739	8.000	1.710	8.000	1.778	8.000	1.727	8.000	1.782	8.000	1.733	8.000	1.785	8.000	1.711	8.000
AL	1.020	*	1.047	*	1.077	*	1.004	*	1.020	*	1.052	*	1.031	*	1.020	*
TI	0.046	*	0.050	*	0.051	*	0.044	*	0.044	*	0.047	*	0.043	*	0.044	*
FE	1.811	*	1.776	*	1.798	*	1.811	*	1.804	*	1.781	*	1.820	*	1.779	*
MN	0.034	*	0.036	*	0.039	*	0.035	*	0.040	*	0.035	*	0.040	*	0.040	*
MG	2.334	5.245	2.324	5.232	2.293	5.257	2.348	5.243	2.358	5.266	2.333	5.248	2.367	5.301	2.394	5.277
CA	1.823	*	1.813	*	1.797	*	1.823	*	1.810	*	1.786	*	1.767	*	1.765	*
NA	0.407	*	0.384	*	0.395	*	0.404	*	0.428	*	0.423	*	0.439	*	0.432	*
K	0.080	*	0.087	*	0.092	*	0.096	*	0.090	*	0.094	*	0.089	*	0.082	*
BA	0.000	2.310	0.000	2.283	0.000	2.284	0.000	2.323	0.000	2.329	0.000	2.302	0.000	2.295	0.000	2.280
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-3-HOST

	73	74	75	76	77	78	79	80
SIO2	42.26	42.87	43.24	42.70	43.28	43.58	43.51	43.10
A2O3	15.32	15.56	14.93	15.28	14.81	14.46	14.49	14.74
TIO2	0.40	0.39	0.36	0.35	0.37	0.36	0.34	0.34
FEO	14.39	14.53	14.45	14.43	14.42	14.14	14.08	14.35
MNO	0.30	0.32	0.33	0.34	0.35	0.36	0.32	0.34
MGO	10.90	10.89	11.15	11.17	11.50	11.55	11.35	11.49
CAO	11.37	11.10	10.95	10.61	11.04	11.10	11.27	11.33
NA2O	1.47	1.56	1.53	1.58	1.47	1.48	1.47	1.46
K2O	0.45	0.46	0.40	0.43	0.37	0.36	0.39	0.36
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.01	2.03	2.03	2.02	2.04	2.03	2.03	2.03
SUM	98.87	99.71	99.37	98.91	99.65	99.42	99.25	99.54
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	98.87	99.71	99.37	98.91	99.65	99.42	99.25	99.54

SI	6.285	*	6.313	*	6.380	*	6.331	*	6.369	*	6.418	*	6.421	*	6.356	*
AL	1.715	8.000	1.687	8.000	1.620	8.000	1.669	8.000	1.631	8.000	1.582	8.000	1.579	8.000	1.644	8.000
AL	0.971	*	1.013	*	0.976	*	1.001	*	0.937	*	0.928	*	0.940	*	0.917	*
TI	0.045	*	0.043	*	0.040	*	0.039	*	0.041	*	0.040	*	0.038	*	0.038	*
FE	1.790	*	1.789	*	1.783	*	1.789	*	1.775	*	1.742	*	1.738	*	1.770	*
MN	0.038	*	0.040	*	0.041	*	0.043	*	0.044	*	0.045	*	0.040	*	0.042	*
MG	2.416	5.259	2.390	5.275	2.452	5.293	2.469	5.340	2.523	5.319	2.535	5.289	2.496	5.252	2.525	5.292
CA	1.812	*	1.751	*	1.731	*	1.685	*	1.741	*	1.751	*	1.782	*	1.790	*
NA	0.424	*	0.445	*	0.438	*	0.454	*	0.419	*	0.423	*	0.421	*	0.417	*
K	0.085	*	0.086	*	0.075	*	0.081	*	0.069	*	0.068	*	0.073	*	0.068	*
BA	0.000	2.321	0.000	2.283	0.000	2.244	0.000	2.221	0.000	2.230	0.000	2.242	0.000	2.276	0.000	2.275
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-3-HOST

	81	82	83	84	85	86	87	88
SIO2	43.28	42.68	41.76	43.22	42.73	43.02	43.34	42.82
A2O3	14.83	14.71	15.56	14.54	14.83	14.32	14.78	15.23
TIO2	0.36	0.37	0.35	0.38	0.35	0.37	0.37	0.39
FEO	14.45	14.47	15.21	14.22	14.24	14.35	14.34	14.39
MNO	0.31	0.28	0.37	0.30	0.32	0.33	0.36	0.37
MGO	11.42	11.32	11.81	11.39	11.42	11.40	11.31	11.20
CAO	11.30	11.34	10.29	11.30	11.39	11.38	11.14	11.11
NA2O	1.46	1.42	1.42	1.38	1.44	1.42	1.49	1.51
K2O	0.37	0.35	0.36	0.38	0.38	0.38	0.37	0.41
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.04	2.02	2.02	2.03	2.02	2.02	2.03	2.03
SUM	99.82	98.96	99.15	99.14	99.12	98.99	99.53	99.46
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.82	98.96	99.15	99.14	99.12	98.99	99.53	99.46

		*		*		*		*		*		*		*		*
SI	6.363	*	6.338	*	6.204	*	6.391	*	6.330	*	6.384	*	6.384	*	6.320	*
AL	1.637	8.000	1.662	8.000	1.796	8.000	1.609	8.000	1.670	8.000	1.616	8.000	1.616	8.000	1.680	8.000
AL	0.932	*	0.912	*	0.927	*	0.925	*	0.919	*	0.888	*	0.950	*	0.969	*
TI	0.040	*	0.041	*	0.039	*	0.042	*	0.039	*	0.041	*	0.041	*	0.043	*
FE	1.777	*	1.797	*	1.890	*	1.759	*	1.764	*	1.781	*	1.767	*	1.776	*
MN	0.039	*	0.035	*	0.047	*	0.038	*	0.040	*	0.041	*	0.045	*	0.046	*
MG	2.502	5.289	2.505	5.291	2.615	5.518	2.511	5.274	2.522	5.284	2.521	5.272	2.483	5.285	2.464	5.299
CA	1.780	*	1.804	*	1.638	*	1.790	*	1.808	*	1.809	*	1.758	*	1.757	*
NA	0.416	*	0.409	*	0.409	*	0.396	*	0.414	*	0.409	*	0.426	*	0.432	*
K	0.069	*	0.066	*	0.068	*	0.072	*	0.072	*	0.072	*	0.070	*	0.077	*
BA	0.000	2.265	0.000	2.279	0.000	2.115	0.000	2.258	0.000	2.293	0.000	2.290	0.000	2.253	0.000	2.266
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-3-HOST

	89	90	91	92	93	94	95	96
SIO2	42.59	44.21	43.79	43.80	43.90	44.03	42.23	43.16
A2O3	14.66	14.38	13.54	14.30	14.02	13.80	15.70	15.00
TIO2	0.39	0.38	0.37	0.38	0.39	0.37	0.43	0.41
FEO	14.37	13.86	13.76	13.89	13.99	13.80	14.35	14.08
MNO	0.37	0.29	0.33	0.28	0.30	0.30	0.25	0.30
MGO	11.40	11.65	11.78	11.68	11.95	12.08	10.41	11.05
CAO	10.97	11.57	11.30	11.53	11.34	11.48	11.49	11.50
NA2O	1.46	1.30	1.33	1.37	1.32	1.31	1.32	1.40
K2O	0.37	0.37	0.34	0.40	0.37	0.36	0.43	0.39
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.01	2.05	2.02	2.04	2.04	2.04	2.01	2.03
SUM	98.59	100.06	98.56	99.67	99.62	99.57	98.62	99.32
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	98.59	100.06	98.56	99.67	99.62	99.57	98.62	99.32

		*		*		*		*		*		*		*		*
SI	6.344	*	6.456	*	6.496	*	6.431	*	6.447	*	6.466	*	6.288	*	6.368	*
AL	1.656	8.000	1.544	8.000	1.504	8.000	1.569	8.000	1.553	8.000	1.534	8.000	1.712	8.000	1.632	8.000
AL	0.917	*	0.930	*	0.863	*	0.905	*	0.874	*	0.854	*	1.043	*	0.976	*
TI	0.044	*	0.042	*	0.041	*	0.042	*	0.043	*	0.041	*	0.048	*	0.045	*
FE	1.790	*	1.693	*	1.707	*	1.705	*	1.718	*	1.695	*	1.787	*	1.737	*
MN	0.047	*	0.036	*	0.041	*	0.035	*	0.037	*	0.037	*	0.032	*	0.037	*
MG	2.531	5.328	2.536	5.236	2.605	5.258	2.556	5.243	2.616	5.288	2.644	5.271	2.310	5.220	2.430	5.226
CA	1.751	*	1.810	*	1.796	*	1.814	*	1.784	*	1.806	*	1.833	*	1.818	*
NA	0.422	*	0.368	*	0.383	*	0.390	*	0.376	*	0.373	*	0.381	*	0.400	*
K	0.070	*	0.069	*	0.064	*	0.075	*	0.069	*	0.067	*	0.082	*	0.073	*
BA	0.000	2.243	0.000	2.247	0.000	2.243	0.000	2.279	0.000	2.230	0.000	2.247	0.000	2.296	0.000	2.292
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-3-HOST

	97	98	99	100	101	102	103	104
SIO2	41.74	42.92	42.76	42.65	41.52	42.08	42.04	42.08
A2O3	16.07	15.16	15.36	15.08	16.56	15.48	16.46	16.38
TIO2	0.46	0.39	0.41	0.38	0.45	0.46	0.41	0.41
FEO	14.69	14.45	14.34	14.54	14.66	14.53	14.68	14.54
MNO	0.29	0.35	0.32	0.34	0.27	0.34	0.32	0.32
MGO	10.20	11.24	11.09	11.13	10.19	10.77	10.60	10.59
CAO	11.36	11.23	11.26	10.86	11.34	11.02	11.34	11.21
NA2O	1.53	1.49	1.45	1.52	1.32	1.56	1.51	1.57
K2O	0.48	0.43	0.43	0.45	0.48	0.48	0.48	0.48
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.01	2.03	2.03	2.02	2.01	2.01	2.03	2.03
SUM	98.83	99.69	99.45	98.97	98.80	98.73	99.87	99.61
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	98.83	99.69	99.45	98.97	98.80	98.73	99.87	99.61

SI	6.223	*	6.323	*	6.311	*	6.330	*	6.185	*	6.271	*	6.196	*	6.212	*
AL	1.777	8.000	1.677	8.000	1.689	8.000	1.670	8.000	1.815	8.000	1.729	8.000	1.804	8.000	1.788	8.000
AL	1.046	*	0.955	*	0.983	*	0.967	*	1.091	*	0.989	*	1.054	*	1.062	*
TI	0.052	*	0.043	*	0.046	*	0.042	*	0.050	*	0.052	*	0.045	*	0.046	*
FE	1.831	*	1.780	*	1.770	*	1.805	*	1.828	*	1.811	*	1.809	*	1.795	*
MN	0.037	*	0.044	*	0.040	*	0.043	*	0.034	*	0.043	*	0.040	*	0.040	*
MG	2.266	5.232	2.468	5.290	2.440	5.278	2.462	5.319	2.262	5.284	2.392	5.287	2.328	5.277	2.330	5.273
CA	1.814	*	1.773	*	1.781	*	1.727	*	1.810	*	1.759	*	1.791	*	1.773	*
NA	0.442	*	0.426	*	0.415	*	0.437	*	0.381	*	0.451	*	0.431	*	0.449	*
K	0.091	*	0.081	*	0.081	*	0.085	*	0.091	*	0.091	*	0.090	*	0.090	*
BA	0.000	2.348	0.000	2.279	0.000	2.276	0.000	2.249	0.000	2.282	0.000	2.301	0.000	2.312	0.000	2.313
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-3-HOST

	105	106	107	108	109	110	111	112
SIO2	42.37	43.32	42.35	42.13	42.61	43.61	42.53	43.24
A2O3	15.74	13.94	15.44	15.17	14.49	14.64	16.04	14.62
TIO2	0.39	0.35	0.40	0.37	0.36	0.35	0.37	0.35
FEO	14.77	14.47	14.63	14.41	14.33	14.13	14.61	14.72
MNO	0.30	0.36	0.35	0.32	0.38	0.38	0.31	0.35
MGO	10.75	11.34	10.97	11.00	11.48	11.38	10.90	11.14
CAO	11.13	11.26	11.18	11.15	10.96	11.03	11.08	10.75
NA2O	1.55	1.38	1.58	1.55	1.52	1.56	1.59	1.55
K2O	0.47	0.42	0.45	0.43	0.38	0.38	0.46	0.40
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.03	2.02	2.02	2.01	2.01	2.04	2.04	2.02
SUM	99.50	98.86	99.37	98.54	98.52	99.50	99.93	99.14
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.50	98.86	99.37	98.54	98.52	99.50	99.93	99.14

SI	6.266	*	6.437	*	6.273	*	6.289	*	6.353	*	6.417	*	6.254	*	6.402	*
AL	1.734	8.000	1.563	8.000	1.727	8.000	1.711	8.000	1.647	8.000	1.583	8.000	1.746	8.000	1.598	8.000
AL	1.010	*	0.877	*	0.968	*	0.957	*	0.899	*	0.956	*	1.033	*	0.953	*
TI	0.043	*	0.039	*	0.045	*	0.042	*	0.040	*	0.039	*	0.041	*	0.039	*
FE	1.827	*	1.798	*	1.812	*	1.799	*	1.787	*	1.739	*	1.797	*	1.823	*
MN	0.038	*	0.045	*	0.044	*	0.040	*	0.048	*	0.047	*	0.039	*	0.044	*
MG	2.370	5.287	2.511	5.271	2.422	5.290	2.447	5.286	2.551	5.325	2.496	5.276	2.389	5.299	2.458	5.317
CA	1.764	*	1.793	*	1.774	*	1.783	*	1.751	*	1.739	*	1.746	*	1.705	*
NA	0.444	*	0.398	*	0.454	*	0.449	*	0.439	*	0.445	*	0.453	*	0.445	*
K	0.089	*	0.080	*	0.085	*	0.082	*	0.072	*	0.071	*	0.086	*	0.076	*
BA	0.000	2.297	0.000	2.270	0.000	2.313	0.000	2.314	0.000	2.263	0.000	2.255	0.000	2.285	0.000	2.226
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-3-HOST

	113	114	115	116	117	118	119	120
SIO2	42.89	43.69	42.83	42.72	42.58	43.31	42.88	42.56
A2O3	14.59	14.42	14.81	14.69	15.44	15.75	15.18	15.81
TIO2	0.33	0.34	0.35	0.35	0.37	0.34	0.37	0.38
FEO	14.56	14.44	14.23	14.39	14.52	14.24	14.55	14.38
MNO	0.36	0.36	0.29	0.33	0.33	0.29	0.32	0.31
MGO	11.53	11.50	11.30	11.40	11.14	11.02	11.17	10.78
CAO	10.74	11.02	11.45	11.49	11.29	11.35	11.21	11.47
NA2O	1.58	1.54	1.40	1.39	1.50	1.43	1.44	1.44
K2O	0.35	0.36	0.39	0.39	0.38	0.39	0.36	0.43
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.02	2.04	2.02	2.02	2.03	2.05	2.03	2.03
SUM	98.95	99.71	99.07	99.17	99.58	100.17	99.51	99.59
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	98.95	99.71	99.07	99.17	99.58	100.17	99.51	99.59

		*		*		*		*		*		*		*		*
SI	6.364		6.423		6.346		6.333		6.284		6.330		6.327		6.276	
AL	1.636	8.000	1.577	8.000	1.654	8.000	1.667	8.000	1.716	8.000	1.670	8.000	1.673	8.000	1.724	8.000
AL	0.915	*	0.922	*	0.931	*	0.899	*	0.970	*	1.043	*	0.966	*	1.024	*
TI	0.037	*	0.038	*	0.039	*	0.039	*	0.041	*	0.037	*	0.041	*	0.042	*
FE	1.807	*	1.775	*	1.763	*	1.784	*	1.792	*	1.741	*	1.795	*	1.773	*
MN	0.045	*	0.045	*	0.036	*	0.041	*	0.041	*	0.036	*	0.040	*	0.039	*
MG	2.550	5.354	2.520	5.299	2.495	5.265	2.519	5.282	2.451	5.295	2.401	5.258	2.457	5.299	2.370	5.248
CA	1.707	*	1.736	*	1.818	*	1.825	*	1.785	*	1.777	*	1.772	*	1.812	*
NA	0.455	*	0.439	*	0.402	*	0.400	*	0.429	*	0.405	*	0.412	*	0.412	*
K	0.066	*	0.068	*	0.074	*	0.074	*	0.072	*	0.073	*	0.068	*	0.081	*
BA	0.000	2.228	0.000	2.242	0.000	2.293	0.000	2.298	0.000	2.286	0.000	2.255	0.000	2.252	0.000	2.305
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-3-HOST

	121	122	123	124	125	126	127	128
SIO2	42.29	42.18	42.58	42.20	42.79	42.86	42.25	42.32
A2O3	15.67	15.82	15.24	15.27	14.63	14.85	15.08	15.27
TIO2	0.42	0.43	0.36	0.40	0.38	0.37	0.40	0.41
FEO	14.48	14.67	14.26	14.26	14.21	14.22	14.55	14.57
MNO	0.35	0.29	0.28	0.28	0.31	0.35	0.35	0.33
MGO	10.86	10.66	11.27	10.92	11.29	11.22	11.19	10.97
CAO	11.22	11.47	11.48	11.45	11.30	11.22	11.15	11.13
NA2O	1.45	1.42	1.43	1.37	1.48	1.47	1.55	1.60
K2O	0.44	0.47	0.40	0.42	0.38	0.38	0.37	0.38
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.02	2.02	2.03	2.01	2.02	2.02	2.01	2.02
SUM	99.20	99.43	99.33	98.58	98.79	98.96	98.90	99.00
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.20	99.43	99.33	98.58	98.79	98.96	98.90	99.00

		*		*		*		*		*		*		*		*
SI	6.286		6.245		6.296		6.290		6.359		6.354		6.286		6.288	
AL	1.734	8.000	1.755	8.000	1.704	8.000	1.710	8.000	1.641	8.000	1.646	8.000	1.714	8.000	1.712	8.000
AL	1.003	*	1.005	*	0.951	*	0.972	*	0.920	*	0.949	*	0.930	*	0.962	*
TI	0.047	*	0.048	*	0.040	*	0.045	*	0.042	*	0.041	*	0.045	*	0.046	*
FE	1.794	*	1.816	*	1.763	*	1.778	*	1.766	*	1.763	*	1.810	*	1.811	*
MN	0.044	*	0.036	*	0.035	*	0.035	*	0.039	*	0.044	*	0.044	*	0.042	*
MG	2.399	5.286	2.352	5.258	2.484	5.274	2.426	5.256	2.501	5.268	2.479	5.276	2.481	5.310	2.430	5.289
CA	1.781	*	1.819	*	1.819	*	1.829	*	1.799	*	1.782	*	1.777	*	1.772	*
NA	0.417	*	0.408	*	0.410	*	0.396	*	0.426	*	0.423	*	0.447	*	0.461	*
K	0.083	*	0.089	*	0.075	*	0.080	*	0.072	*	0.072	*	0.070	*	0.072	*
BA	0.000	2.281	0.000	2.316	0.000	2.304	0.000	2.304	0.000	2.298	0.000	2.277	0.000	2.295	0.000	2.305
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-3-HOST

	129	130	131	132	133	134	135	136
SIO2	43.71	43.93	43.22	45.07	44.65	43.54	41.66	42.21
A2O3	14.27	13.50	14.30	12.23	12.59	13.82	16.46	15.95
TIO2	0.33	0.36	0.37	0.32	0.34	0.37	0.45	0.44
FEO	14.12	14.12	13.98	13.36	13.57	13.85	14.68	14.51
MNO	0.33	0.34	0.33	0.33	0.32	0.35	0.29	0.31
MGO	11.80	11.88	11.78	12.86	12.35	11.79	10.34	10.49
CAO	10.93	10.97	11.45	11.24	11.27	11.12	11.24	11.08
NA2O	1.44	1.40	1.38	1.29	1.24	1.34	1.56	1.61
K2O	0.34	0.35	0.34	0.26	0.31	0.34	0.54	0.48
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.03	2.02	2.03	2.04	2.03	2.02	2.02	2.02
SUM	99.30	98.87	99.18	99.00	98.67	98.54	99.24	99.10
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.30	98.87	99.18	99.00	98.67	98.54	99.24	99.10

SI	6.438	*	6.501	*	6.387	*	6.631	*	6.601	*	6.463	*	6.184	*	6.261	*
AL	1.562	8.000	1.499	8.000	1.613	8.000	1.369	8.000	1.399	8.000	1.537	8.000	1.816	8.000	1.739	8.000
AL	0.915	*	0.856	*	0.877	*	0.751	*	0.794	*	0.880	*	1.064	*	1.049	*
TI	0.037	*	0.040	*	0.041	*	0.035	*	0.038	*	0.041	*	0.050	*	0.049	*
FE	1.739	*	1.748	*	1.728	*	1.644	*	1.678	*	1.719	*	1.822	*	1.800	*
MN	0.041	*	0.043	*	0.041	*	0.041	*	0.040	*	0.044	*	0.036	*	0.039	*
MG	2.591	5.323	2.621	5.307	2.595	5.283	2.820	5.292	2.721	5.271	2.608	5.293	2.288	5.261	2.319	5.256
CA	1.725	*	1.739	*	1.813	*	1.772	*	1.785	*	1.768	*	1.788	*	1.761	*
NA	0.411	*	0.402	*	0.395	*	0.368	*	0.355	*	0.386	*	0.449	*	0.463	*
K	0.084	*	0.068	*	0.084	*	0.049	*	0.058	*	0.064	*	0.102	*	0.091	*
BA	0.000	2.200	0.000	2.207	0.000	2.272	0.000	2.189	0.000	2.199	0.000	2.218	0.000	2.339	0.000	2.315
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-3-HOST

	137	138	139	140	141	142
SIO2	42.15	43.48	42.44	42.57	42.83	42.52
A2O3	15.63	14.88	15.44	15.16	15.30	15.50
TIO2	0.41	0.38	0.42	0.39	0.42	0.44
FEO	14.14	14.35	14.83	14.65	14.34	14.45
MNO	0.31	0.33	0.38	0.37	0.35	0.37
MGO	10.91	11.22	11.14	11.13	11.14	10.59
CAO	11.09	10.96	10.86	10.68	10.93	10.98
NA2O	1.45	1.49	1.53	1.64	1.55	1.58
K2O	0.44	0.40	0.45	0.40	0.43	0.45
BAO	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.01	2.04	2.03	2.02	2.03	2.02
SUM	98.54	99.53	99.52	99.01	99.32	98.90
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00
SUM	98.54	99.53	99.52	99.01	99.32	98.90

SI	6.276	*	6.399	*	6.275	*	6.318	*	6.326	*	6.315	*				
AL	1.724	8.000	1.601	8.000	1.725	8.000	1.682	8.000	1.674	8.000	1.685	8.000				
AL	1.018	*	0.979	*	0.966	*	0.969	*	0.989	*	1.027	*				
TI	0.046	*	0.042	*	0.047	*	0.044	*	0.047	*	0.049	*				
FE	1.761	*	1.766	*	1.834	*	1.818	*	1.771	*	1.795	*				
MN	0.039	*	0.041	*	0.048	*	0.047	*	0.044	*	0.047	*				
MG	2.421	5.285	2.461	5.289	2.455	5.349	2.462	5.340	2.452	5.303	2.344	5.261				
CA	1.769	*	1.728	*	1.721	*	1.698	*	1.730	*	1.747	*				
NA	0.419	*	0.425	*	0.439	*	0.472	*	0.444	*	0.455	*				
K	0.084	*	0.075	*	0.085	*	0.076	*	0.081	*	0.085	*				
BA	0.000	2.271	0.000	2.228	0.000	2.244	0.000	2.246	0.000	2.254	0.000	2.287				
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*				
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*				
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000				
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*				

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-3-INTRAGRANULAR

	1	2	3	4	5	6	7	8
SIO2	42.46	43.24	43.68	43.34	43.35	42.59	43.08	42.17
A2O3	15.55	14.60	13.38	14.15	14.79	15.18	15.13	15.73
TIO2	0.46	0.39	0.38	0.38	0.39	0.43	0.44	0.41
FEO	14.51	14.07	14.09	14.34	14.43	14.63	14.07	16.07
MNO	0.25	0.26	0.30	0.34	0.32	0.32	0.26	0.32
MGO	10.49	11.31	11.58	11.70	11.48	11.03	10.70	10.13
CAO	11.49	11.44	11.52	10.93	10.88	11.14	11.58	10.93
NA2O	1.46	1.43	1.31	1.39	1.57	1.59	1.23	1.32
K2O	0.48	0.37	0.32	0.38	0.39	0.44	0.41	0.44
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.02	2.03	2.01	2.02	2.04	2.02	2.02	2.02
SUM	99.17	99.14	98.57	98.97	99.64	99.37	98.92	99.54
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.17	99.14	98.57	98.97	99.64	99.37	98.92	99.54

SI	6.296	*	6.391	*	6.494	*	6.419	*	6.378	*	6.305	*	6.377	*	6.264	*
AL	1.704	8.000	1.609	8.000	1.506	8.000	1.581	8.000	1.622	8.000	1.695	8.000	1.623	8.000	1.736	8.000
AL	1.012	*	0.934	*	0.838	*	0.889	*	0.943	*	0.953	*	1.017	*	1.017	*
TI	0.051	*	0.043	*	0.042	*	0.042	*	0.043	*	0.048	*	0.049	*	0.046	*
FE	1.799	*	1.739	*	1.752	*	1.776	*	1.776	*	1.811	*	1.742	*	1.996	*
MN	0.031	*	0.033	*	0.038	*	0.043	*	0.040	*	0.040	*	0.033	*	0.040	*
MG	2.318	5.213	2.492	5.241	2.566	5.236	2.583	5.333	2.518	5.319	2.434	5.285	2.361	5.201	2.243	5.342
CA	1.825	*	1.812	*	1.835	*	1.734	*	1.715	*	1.767	*	1.837	*	1.739	*
NA	0.420	*	0.410	*	0.378	*	0.399	*	0.448	*	0.456	*	0.353	*	0.380	*
K	0.091	*	0.070	*	0.061	*	0.072	*	0.073	*	0.083	*	0.077	*	0.083	*
BA	0.000	2.336	0.000	2.291	0.000	2.273	0.000	2.205	0.000	2.236	0.000	2.306	0.000	2.267	0.000	2.203
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-3-INTRAGRANULAR

	9	10	11	12	13	14	15	16
SIO2	43.00	42.64	42.59	43.24	42.90	42.48	42.61	42.50
A2O3	15.39	14.85	15.06	14.79	14.95	15.13	15.41	15.60
TIO2	0.41	0.39	0.40	0.41	0.40	0.42	0.42	0.42
FEO	14.71	14.58	14.78	14.22	14.53	14.45	14.41	14.63
MNO	0.35	0.33	0.31	0.36	0.32	0.33	0.34	0.38
MGO	11.20	11.26	11.24	11.16	11.35	11.09	11.06	10.83
CAO	10.63	10.69	10.65	11.08	10.94	11.06	11.11	10.81
NA2O	1.53	1.68	1.63	1.48	1.56	1.46	1.47	1.64
K2O	0.41	0.42	0.43	0.41	0.42	0.45	0.44	0.44
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.04	2.02	2.02	2.03	2.03	2.02	2.03	2.02
SUM	99.67	98.86	99.11	99.18	99.40	98.89	99.30	99.27
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.67	98.86	99.11	99.18	99.40	98.89	99.30	99.27

SI	6.329	*	6.338	*	6.318	*	6.390	*	6.338	*	6.312	*	6.301	*	6.292	*
AL	1.671	8.000	1.662	8.000	1.682	8.000	1.610	8.000	1.662	8.000	1.688	8.000	1.699	8.000	1.708	8.000
AL	0.999	*	0.939	*	0.950	*	0.965	*	0.941	*	0.961	*	0.986	*	1.013	*
TI	0.045	*	0.044	*	0.045	*	0.046	*	0.044	*	0.047	*	0.047	*	0.047	*
FE	1.811	*	1.812	*	1.834	*	1.757	*	1.795	*	1.796	*	1.782	*	1.811	*
MN	0.044	*	0.042	*	0.039	*	0.045	*	0.040	*	0.042	*	0.043	*	0.048	*
MG	2.457	5.356	2.495	5.332	2.485	5.352	2.458	5.271	2.499	5.320	2.456	5.301	2.438	5.296	2.390	5.308
CA	1.676	*	1.703	*	1.693	*	1.754	*	1.732	*	1.761	*	1.760	*	1.715	*
NA	0.437	*	0.484	*	0.469	*	0.424	*	0.447	*	0.421	*	0.421	*	0.471	*
K	0.077	*	0.080	*	0.081	*	0.077	*	0.079	*	0.085	*	0.083	*	0.083	*
BA	0.000	2.190	0.000	2.266	0.000	2.243	0.000	2.256	0.000	2.258	0.000	2.267	0.000	2.265	0.000	2.268
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-3-INTRAGRANULAR

	17	18	19	20
SIO2	42.99	42.71	42.76	42.11
A2O3	15.31	15.49	14.79	15.88
TIO2	0.49	0.39	0.44	0.44
FEO	14.05	14.51	14.30	14.66
MNO	0.31	0.35	0.32	0.32
MGO	10.63	10.80	10.91	10.46
CAO	10.94	10.74	11.27	11.10
NA2O	1.41	1.52	1.40	1.46
K2O	0.65	0.42	0.44	0.48
BAO	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00
H2O	2.02	2.02	2.01	2.01
SUM	98.80	98.95	98.64	98.92
-O= F+CL	0.00	0.00	0.00	0.00
SUM	98.80	98.95	98.64	98.92

SI	6.373	*	6.331	*	6.364	*	6.261	*
AL	1.627	8.000	1.669	8.000	1.636	8.000	1.739	8.000
AL	1.048	*	1.036	*	0.958	*	1.043	*
TI	0.055	*	0.043	*	0.049	*	0.049	*
FE	1.742	*	1.799	*	1.780	*	1.823	*
MN	0.039	*	0.044	*	0.040	*	0.040	*
MG	2.349	5.232	2.386	5.308	2.420	5.248	2.318	5.273
CA	1.738	*	1.706	*	1.797	*	1.768	*
NA	0.405	*	0.437	*	0.404	*	0.421	*
K	0.123	*	0.079	*	0.084	*	0.091	*
BA	0.000	2.266	0.000	2.222	0.000	2.285	0.000	2.280
CL	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*

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AMPHIBOLE HOST GRAIN P-4

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-4-HOST

	1	2	3	4	5	6	7	8
SIO2	44.10	46.68	47.99	47.04	47.38	45.85	48.16	48.74
A2O3	17.61	13.29	12.81	12.49	12.65	13.88	12.60	10.80
TIO2	0.14	0.12	0.13	0.12	0.13	0.13	0.12	0.12
FEO	9.73	10.07	10.14	9.99	10.06	9.58	9.47	9.39
MNO	0.24	0.21	0.24	0.24	0.26	0.24	0.23	0.25
MGO	12.26	13.69	13.97	13.88	14.08	13.65	14.53	14.87
CAO	11.76	12.37	12.33	12.37	12.41	12.09	12.21	12.38
NA2O	1.17	1.18	1.10	1.13	1.10	1.10	1.09	1.00
K2O	0.34	0.30	0.30	0.27	0.27	0.25	0.24	0.21
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.09	2.09	2.12	2.09	2.10	2.07	2.12	2.10
SUM	99.44	100.00	101.13	99.62	100.44	98.84	100.77	99.86
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.44	100.00	101.13	99.62	100.44	98.84	100.77	99.86

SI	6.335	*	6.684	*	6.780	*	6.757	*	6.749	*	6.625	*	6.802	*	6.948	*
AL	1.665	8.000	1.316	8.000	1.220	8.000	1.243	8.000	1.251	8.000	1.375	8.000	1.198	8.000	1.052	8.000
AL	1.316	*	0.926	*	0.912	*	0.871	*	0.872	*	0.988	*	0.899	*	0.762	*
TI	0.015	*	0.013	*	0.014	*	0.013	*	0.014	*	0.014	*	0.013	*	0.013	*
FE	1.169	*	1.206	*	1.198	*	1.200	*	1.198	*	1.158	*	1.119	*	1.119	*
MN	0.029	*	0.025	*	0.029	*	0.029	*	0.031	*	0.029	*	0.028	*	0.030	*
MG	2.625	5.154	2.922	5.092	2.942	5.095	2.972	5.086	2.989	5.105	2.940	5.129	3.059	5.117	3.159	5.083
CA	1.810	*	1.898	*	1.866	*	1.904	*	1.894	*	1.872	*	1.848	*	1.891	*
NA	0.326	*	0.328	*	0.301	*	0.315	*	0.304	*	0.308	*	0.298	*	0.276	*
K	0.062	*	0.055	*	0.054	*	0.049	*	0.049	*	0.046	*	0.043	*	0.038	*
BA	0.000	2.198	0.000	2.280	0.000	2.222	0.000	2.268	0.000	2.247	0.000	2.226	0.000	2.189	0.000	2.205
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-4-HOST

	9	10	11	12	13	14	15	16
SIO2	48.55	49.02	48.62	49.28	49.85	49.99	49.32	48.14
A2O3	10.93	11.32	11.01	10.44	10.02	9.95	9.97	11.32
TIO2	0.11	0.13	0.12	0.12	0.13	0.12	0.12	0.14
FEO	9.48	9.63	9.49	9.29	9.03	8.88	8.98	9.42
MNO	0.23	0.23	0.26	0.28	0.22	0.25	0.22	0.20
MGO	14.99	14.92	14.90	15.21	15.93	15.83	15.61	15.11
CAO	12.19	12.43	12.39	12.48	12.44	12.38	12.43	12.33
NA2O	1.03	1.05	1.03	1.02	0.99	0.88	0.90	0.98
K2O	0.20	0.23	0.22	0.20	0.18	0.16	0.19	0.22
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.10	2.13	2.11	2.11	2.13	2.13	2.11	2.10
SUM	99.81	101.09	100.15	100.43	100.92	100.57	99.85	99.96
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.81	101.09	100.15	100.43	100.92	100.57	99.85	99.96

SI	6.925	*	6.908	*	6.917	*	6.981	*	7.013	*	7.045	*	7.014	*	6.861	*
AL	1.075	8.000	1.092	8.000	1.083	8.000	1.019	8.000	0.987	8.000	0.955	8.000	0.986	8.000	1.139	8.000
AL	0.762	*	0.787	*	0.763	*	0.724	*	0.674	*	0.697	*	0.685	*	0.762	*
TI	0.012	*	0.014	*	0.013	*	0.013	*	0.014	*	0.013	*	0.013	*	0.015	*
FE	1.131	*	1.135	*	1.129	*	1.101	*	1.062	*	1.047	*	1.068	*	1.123	*
MN	0.028	*	0.027	*	0.031	*	0.034	*	0.026	*	0.030	*	0.027	*	0.024	*
MG	3.187	5.120	3.134	5.097	3.160	5.096	3.211	5.082	3.340	5.116	3.325	5.111	3.309	5.101	3.210	5.134
CA	1.863	*	1.877	*	1.889	*	1.894	*	1.875	*	1.869	*	1.894	*	1.883	*
NA	0.285	*	0.287	*	0.284	*	0.280	*	0.270	*	0.240	*	0.248	*	0.271	*
K	0.036	*	0.041	*	0.040	*	0.036	*	0.032	*	0.029	*	0.034	*	0.040	*
BA	0.000	2.184	0.000	2.205	0.000	2.213	0.000	2.210	0.000	2.177	0.000	2.138	0.000	2.177	0.000	2.184
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-4-HOST

	17	18	19	20	21	22	23	24
SIO2	48.82	48.71	49.55	49.11	49.27	49.18	48.84	48.98
A2O3	10.37	10.77	10.52	10.74	10.66	10.50	11.07	10.55
TIO2	0.13	0.12	0.12	0.12	0.13	0.12	0.13	0.13
FEO	9.37	9.41	9.31	9.38	9.38	9.41	9.30	9.34
MNO	0.23	0.23	0.23	0.23	0.23	0.24	0.23	0.26
MGO	14.97	15.03	15.28	15.08	15.38	15.41	15.00	15.24
CAO	12.51	12.44	12.43	12.51	12.56	12.55	12.46	12.54
NA2O	1.00	1.00	0.99	0.96	0.97	0.98	0.96	0.95
K2O	0.20	0.20	0.19	0.21	0.20	0.22	0.22	0.22
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.10	2.10	2.12	2.11	2.12	2.12	2.11	2.11
SUM	99.70	100.01	100.74	100.45	100.90	100.73	100.32	100.32
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.70	100.01	100.74	100.45	100.90	100.73	100.32	100.32

SI	6.974	*	6.935	*	6.990	*	6.956	*	6.949	*	6.953	*	6.926	*	6.952	*
AL	1.026	8.000	1.065	8.000	1.010	8.000	1.044	8.000	1.051	8.000	1.047	8.000	1.074	8.000	1.048	8.000
AL	0.719	*	0.742	*	0.739	*	0.749	*	0.721	*	0.702	*	0.775	*	0.716	*
TI	0.014	*	0.013	*	0.013	*	0.013	*	0.014	*	0.013	*	0.014	*	0.014	*
FE	1.119	*	1.120	*	1.098	*	1.111	*	1.106	*	1.113	*	1.103	*	1.109	*
MN	0.028	*	0.028	*	0.027	*	0.028	*	0.027	*	0.029	*	0.028	*	0.031	*
MG	3.187	5.067	3.190	5.093	3.213	5.091	3.184	5.084	3.233	5.102	3.247	5.104	3.170	5.090	3.224	5.094
CA	1.915	*	1.898	*	1.879	*	1.899	*	1.898	*	1.901	*	1.893	*	1.907	*
NA	0.277	*	0.276	*	0.271	*	0.264	*	0.265	*	0.269	*	0.264	*	0.261	*
K	0.036	*	0.036	*	0.034	*	0.038	*	0.036	*	0.040	*	0.040	*	0.040	*
BA	0.000	2.228	0.000	2.210	0.000	2.184	0.000	2.200	0.000	2.199	0.000	2.209	0.000	2.197	0.000	2.208
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-4-HOST

	25	26	27	28	29	30	31	32
SIO2	49.07	48.53	49.23	50.47	49.83	48.38	49.40	49.69
A2O3	10.78	11.36	10.94	8.98	10.30	10.78	10.32	10.12
TIO2	0.11	0.12	0.11	0.11	0.12	0.12	0.12	0.12
FEO	9.32	9.41	9.47	9.00	9.23	9.47	9.45	9.32
MNO	0.23	0.26	0.25	0.25	0.23	0.23	0.26	0.26
MGO	15.11	14.87	15.27	16.44	15.46	14.99	15.42	15.75
CAO	12.43	12.33	12.53	12.61	12.46	12.44	12.49	12.48
NA2O	0.98	0.95	0.92	0.82	0.88	0.98	1.02	0.92
K2O	0.20	0.23	0.21	0.15	0.19	0.20	0.19	0.19
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.11	2.11	2.13	2.13	2.13	2.10	2.12	2.13
SUM	100.34	100.17	101.06	100.96	100.83	99.69	100.79	100.98
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	100.34	100.17	101.06	100.96	100.83	99.69	100.79	100.98

SI	6.955	*	6.896	*	6.933	*	7.094	*	7.017	*	6.917	*	6.978	*	6.997	*
AL	1.045	8.000	1.104	8.000	1.067	8.000	0.906	8.000	0.983	8.000	1.083	8.000	1.022	8.000	1.003	8.000
AL	0.756	*	0.798	*	0.749	*	0.582	*	0.726	*	0.733	*	0.696	*	0.677	*
TI	0.012	*	0.013	*	0.012	*	0.012	*	0.013	*	0.013	*	0.013	*	0.013	*
FE	1.105	*	1.118	*	1.115	*	1.058	*	1.087	*	1.132	*	1.116	*	1.098	*
MN	0.028	*	0.031	*	0.030	*	0.030	*	0.027	*	0.028	*	0.031	*	0.031	*
MG	3.192	5.092	3.149	5.110	3.205	5.111	3.444	5.125	3.245	5.098	3.195	5.101	3.247	5.102	3.306	5.124
CA	1.888	*	1.877	*	1.891	*	1.899	*	1.880	*	1.906	*	1.890	*	1.883	*
NA	0.269	*	0.262	*	0.251	*	0.223	*	0.240	*	0.272	*	0.279	*	0.251	*
K	0.036	*	0.042	*	0.038	*	0.027	*	0.034	*	0.036	*	0.034	*	0.034	*
BA	0.000	2.193	0.000	2.181	0.000	2.180	0.000	2.149	0.000	2.154	0.000	2.214	0.000	2.204	0.000	2.168
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-4-HOST

	33	34	35	36	37	38	39	40
SIO2	49.18	49.35	48.98	49.01	48.66	48.69	47.23	45.95
A2O3	10.65	10.19	10.90	10.63	11.41	11.40	13.61	14.51
TIO2	0.12	0.12	0.11	0.11	0.12	0.11	0.12	0.13
FEO	9.00	9.19	9.34	9.37	9.66	9.79	10.35	10.55
MNO	0.23	0.25	0.26	0.25	0.24	0.28	0.24	0.25
MGO	15.36	15.31	15.51	15.47	14.83	14.84	13.84	13.01
CAO	12.39	12.27	12.50	12.57	12.57	12.42	12.42	12.15
NA2O	0.87	0.85	0.91	1.02	1.03	1.02	1.13	1.19
K2O	0.19	0.41	0.21	0.23	0.24	0.21	0.29	0.35
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.11	2.11	2.12	2.12	2.12	2.12	2.12	2.09
SUM	100.10	100.05	100.84	100.78	100.88	100.88	101.35	100.18
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	100.10	100.05	100.84	100.78	100.88	100.88	101.35	100.18

SI	6.973	*	7.013	*	6.913	*	6.929	*	6.880	*	6.884	*	6.673	*	6.582	*
AL	1.027	8.000	0.987	8.000	1.087	8.000	1.071	8.000	1.120	8.000	1.116	8.000	1.327	8.000	1.418	8.000
AL	0.752	*	0.720	*	0.726	*	0.700	*	0.781	*	0.783	*	0.939	*	1.031	*
TI	0.013	*	0.013	*	0.012	*	0.012	*	0.013	*	0.012	*	0.013	*	0.014	*
FE	1.067	*	1.092	*	1.102	*	1.108	*	1.142	*	1.158	*	1.223	*	1.264	*
MN	0.028	*	0.030	*	0.031	*	0.030	*	0.029	*	0.034	*	0.029	*	0.030	*
MG	3.246	5.105	3.243	5.097	3.263	5.134	3.260	5.109	3.125	5.089	3.127	5.113	2.915	5.119	2.778	5.117
CA	1.882	*	1.868	*	1.890	*	1.904	*	1.904	*	1.881	*	1.880	*	1.865	*
NA	0.239	*	0.234	*	0.249	*	0.280	*	0.282	*	0.280	*	0.310	*	0.330	*
K	0.034	*	0.074	*	0.038	*	0.041	*	0.043	*	0.038	*	0.052	*	0.064	*
BA	0.000	2.156	0.000	2.177	0.000	2.177	0.000	2.225	0.000	2.230	0.000	2.199	0.000	2.242	0.000	2.259
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-4-HOST

	41	42	43	44	45	46	47	48
SIO2	46.31	46.57	46.30	47.27	47.19	46.54	46.77	47.15
A2O3	12.71	13.49	13.75	13.13	12.96	14.27	13.00	12.90
TIO2	0.13	0.12	0.13	0.13	0.12	0.11	0.11	0.12
FEO	10.71	10.59	10.06	10.10	9.95	9.94	10.16	10.13
MNO	0.25	0.25	0.23	0.25	0.25	0.27	0.25	0.23
MGO	13.74	13.34	13.09	13.85	13.93	13.64	13.94	14.05
CAO	12.26	11.99	12.20	12.45	12.46	12.31	12.39	12.42
NA2O	1.08	1.14	1.09	1.19	1.16	1.20	1.25	1.14
K2O	0.34	0.31	0.29	0.28	0.27	0.30	0.29	0.28
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.08	2.09	2.08	2.11	2.10	2.11	2.09	2.10
SUM	99.61	99.89	99.22	100.76	100.39	100.69	100.25	100.52
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.61	99.89	99.22	100.76	100.39	100.69	100.25	100.52

SI	6.685	*	6.683	*	6.675	*	6.714	*	6.724	*	6.612	*	6.688	*	6.715	*
AL	1.315	8.000	1.317	8.000	1.325	8.000	1.286	8.000	1.276	8.000	1.388	8.000	1.312	8.000	1.285	8.000
AL	0.847	*	0.964	*	1.011	*	0.912	*	0.900	*	1.001	*	0.878	*	0.880	*
TI	0.014	*	0.013	*	0.014	*	0.014	*	0.013	*	0.012	*	0.012	*	0.013	*
FE	1.293	*	1.271	*	1.213	*	1.200	*	1.186	*	1.181	*	1.215	*	1.207	*
MN	0.031	*	0.030	*	0.028	*	0.030	*	0.030	*	0.032	*	0.030	*	0.028	*
MG	2.956	5.140	2.853	5.132	2.813	5.078	2.932	5.088	2.958	5.087	2.888	5.114	2.971	5.106	2.983	5.110
CA	1.896	*	1.843	*	1.884	*	1.895	*	1.902	*	1.874	*	1.898	*	1.895	*
NA	0.302	*	0.317	*	0.305	*	0.328	*	0.320	*	0.331	*	0.347	*	0.315	*
K	0.063	*	0.057	*	0.053	*	0.051	*	0.049	*	0.054	*	0.053	*	0.051	*
BA	0.000	2.261	0.000	2.217	0.000	2.242	0.000	2.273	0.000	2.272	0.000	2.259	0.000	2.298	0.000	2.261
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-4-HOST

	49	50	51	52	53	54	55	56
SIO2	47.10	46.70	47.00	43.82	46.93	46.34	46.56	46.53
A2O3	14.61	13.79	13.93	16.54	14.37	13.69	13.71	14.20
TIO2	0.14	0.12	0.13	0.11	0.12	0.13	0.14	0.13
FEO	10.01	10.22	10.38	9.63	10.14	10.37	10.52	10.56
MNO	0.25	0.24	0.22	0.21	0.21	0.24	0.24	0.25
MGO	13.36	13.89	13.60	13.17	13.38	13.56	13.34	13.30
CAO	12.38	12.46	12.46	11.78	12.30	12.37	12.38	12.38
NA2O	1.09	1.20	1.19	1.09	1.12	1.21	1.17	1.34
K2O	0.31	0.31	0.30	0.29	0.30	0.32	0.31	0.35
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.13	2.11	2.12	2.07	2.12	2.09	2.10	2.11
SUM	101.38	101.04	101.33	98.71	100.99	100.32	100.47	101.13
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	101.38	101.04	101.33	98.71	100.99	100.32	100.47	101.13

SI	6.635	*	6.625	*	6.646	*	6.348	*	6.642	*	6.628	*	6.649	*	6.606	*
AL	1.365	8.000	1.375	8.000	1.354	8.000	1.652	8.000	1.358	8.000	1.372	8.000	1.351	8.000	1.394	8.000
AL	1.061	*	0.930	*	0.967	*	1.171	*	1.039	*	0.936	*	0.956	*	0.982	*
TI	0.015	*	0.013	*	0.014	*	0.012	*	0.013	*	0.014	*	0.015	*	0.014	*
FE	1.179	*	1.212	*	1.227	*	1.167	*	1.200	*	1.240	*	1.256	*	1.254	*
MN	0.030	*	0.029	*	0.026	*	0.026	*	0.025	*	0.029	*	0.029	*	0.030	*
MG	2.805	5.090	2.937	5.121	2.866	5.101	2.844	5.219	2.823	5.100	2.891	5.110	2.840	5.096	2.815	5.094
CA	1.869	*	1.894	*	1.888	*	1.828	*	1.865	*	1.896	*	1.894	*	1.880	*
NA	0.298	*	0.330	*	0.326	*	0.306	*	0.307	*	0.336	*	0.324	*	0.369	*
K	0.056	*	0.056	*	0.054	*	0.054	*	0.054	*	0.058	*	0.056	*	0.063	*
BA	0.000	2.222	0.000	2.280	0.000	2.268	0.000	2.188	0.000	2.227	0.000	2.290	0.000	2.275	0.000	2.312
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-4-HOST

	57	58	59	60	61	62	63	64
SIO2	46.91	47.92	48.42	48.12	48.82	48.93	48.10	47.56
A2O3	13.18	11.69	11.27	11.04	11.44	10.56	11.77	12.60
TIO2	0.13	0.10	0.12	0.11	0.11	0.11	0.11	0.14
FEO	10.27	9.64	9.33	9.55	9.20	9.35	9.81	10.01
MNO	0.22	0.24	0.25	0.23	0.21	0.25	0.24	0.26
MGO	14.13	14.91	14.79	14.99	15.52	15.27	14.57	14.11
CAO	12.47	12.44	12.37	12.55	12.38	12.38	12.50	12.41
NA2O	1.12	1.02	1.04	0.95	1.05	1.03	1.06	1.08
K2O	0.29	0.24	0.20	0.21	0.21	0.21	0.25	0.27
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.11	2.10	2.10	2.10	2.13	2.11	2.11	2.11
SUM	100.83	100.30	99.89	99.85	101.07	100.20	100.52	100.55
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	100.83	100.30	99.89	99.85	101.07	100.20	100.52	100.55

SI	6.669	*	6.819	*	6.900	*	6.876	*	6.870	*	6.952	*	6.834	*	6.763	*
AL	1.331	8.000	1.181	8.000	1.100	8.000	1.124	8.000	1.130	8.000	1.048	8.000	1.166	8.000	1.237	8.000
AL	0.877	*	0.780	*	0.793	*	0.735	*	0.766	*	0.720	*	0.805	*	0.874	*
TI	0.014	*	0.011	*	0.013	*	0.012	*	0.012	*	0.012	*	0.012	*	0.015	*
FE	1.221	*	1.147	*	1.112	*	1.141	*	1.083	*	1.111	*	1.166	*	1.190	*
MN	0.026	*	0.029	*	0.030	*	0.028	*	0.025	*	0.030	*	0.029	*	0.031	*
MG	2.994	5.132	3.163	5.129	3.142	5.089	3.193	5.109	3.255	5.141	3.234	5.106	3.086	5.096	2.991	5.101
CA	1.899	*	1.897	*	1.889	*	1.921	*	1.866	*	1.885	*	1.903	*	1.891	*
NA	0.309	*	0.281	*	0.287	*	0.263	*	0.286	*	0.284	*	0.292	*	0.298	*
K	0.053	*	0.044	*	0.036	*	0.038	*	0.038	*	0.038	*	0.045	*	0.049	*
BA	0.000	2.261	0.000	2.222	0.000	2.212	0.000	2.223	0.000	2.191	0.000	2.206	0.000	2.240	0.000	2.237
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-4-HOST

	65	66	67	68	69	70	71	72
SIO2	46.99	47.32	47.71	47.03	47.75	44.71	47.17	48.44
A2O3	13.27	12.79	11.88	12.23	12.28	14.43	12.47	11.64
TIO2	0.13	0.11	0.11	0.13	0.12	0.15	0.13	0.14
FEO	10.14	9.56	9.40	10.02	9.98	10.91	9.88	9.69
MNO	0.27	0.20	0.25	0.27	0.27	0.26	0.23	0.28
MGO	14.03	15.05	14.47	14.02	14.66	12.88	14.31	14.78
CAO	12.37	12.05	12.16	12.41	12.32	12.11	12.37	12.17
NA2O	1.21	1.11	0.97	1.10	1.16	1.40	1.22	1.18
K2O	0.29	0.24	0.21	0.25	0.23	0.37	0.28	0.22
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.11	2.11	2.09	2.08	2.11	2.06	2.10	2.11
SUM	100.81	100.54	99.25	99.54	100.88	99.28	100.16	100.65
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	100.81	100.54	99.25	99.54	100.88	99.28	100.16	100.65

SI	6.677	*	6.712	*	6.844	*	6.764	*	6.767	*	6.497	*	6.739	*	6.862	*
AL	1.323	8.000	1.288	8.000	1.156	8.000	1.236	8.000	1.233	8.000	1.503	8.000	1.261	8.000	1.138	8.000
AL	0.899	*	0.849	*	0.852	*	0.837	*	0.818	*	0.968	*	0.839	*	0.805	*
TI	0.014	*	0.012	*	0.012	*	0.014	*	0.013	*	0.016	*	0.014	*	0.015	*
FE	1.205	*	1.134	*	1.128	*	1.205	*	1.183	*	1.326	*	1.180	*	1.148	*
MN	0.032	*	0.024	*	0.030	*	0.033	*	0.032	*	0.032	*	0.028	*	0.034	*
MG	2.971	5.121	3.182	5.201	3.094	5.116	3.006	5.095	3.097	5.143	2.790	5.132	3.047	5.108	3.121	5.122
CA	1.883	*	1.831	*	1.869	*	1.912	*	1.871	*	1.886	*	1.894	*	1.847	*
NA	0.333	*	0.305	*	0.270	*	0.307	*	0.319	*	0.394	*	0.338	*	0.324	*
K	0.053	*	0.043	*	0.038	*	0.046	*	0.042	*	0.069	*	0.051	*	0.040	*
BA	0.000	2.269	0.000	2.180	0.000	2.177	0.000	2.265	0.000	2.231	0.000	2.349	0.000	2.282	0.000	2.211
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-4-HOST

	73	74	75	76	77
SIO2	48.63	48.89	49.04	47.33	45.62
A2O3	11.35	11.18	10.44	13.04	13.59
TIO2	0.15	0.16	0.15	0.13	0.14
FEO	9.74	9.43	9.25	9.83	10.25
MNO	0.25	0.27	0.27	0.26	0.25
MGO	14.82	15.03	15.56	14.38	13.40
CAO	12.29	12.10	12.15	12.28	12.20
NA2O	1.18	1.14	1.15	1.23	1.16
K2O	0.25	0.23	0.21	0.28	0.29
BAO	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00
H2O	2.12	2.12	2.11	2.11	2.07
SUM	100.78	100.55	100.33	100.87	98.97
-O= F+CL	0.00	0.00	0.00	0.00	0.00
SUM	100.78	100.55	100.33	100.87	98.97

SI	6.884	*	6.919	*	6.954	*	6.707	*	6.615	*
AL	1.116	8.000	1.081	8.000	1.046	8.000	1.293	8.000	1.385	8.000
AL	0.778	*	0.783	*	0.699	*	0.884	*	0.937	*
TI	0.016	*	0.017	*	0.016	*	0.014	*	0.015	*
FE	1.153	*	1.116	*	1.097	*	1.165	*	1.243	*
MN	0.030	*	0.032	*	0.032	*	0.031	*	0.031	*
MG	3.127	5.104	3.170	5.119	3.289	5.133	3.037	5.131	2.896	5.122
CA	1.864	*	1.835	*	1.846	*	1.864	*	1.895	*
NA	0.324	*	0.313	*	0.316	*	0.338	*	0.326	*
K	0.045	*	0.042	*	0.038	*	0.051	*	0.054	*
BA	0.000	2.233	0.000	2.189	0.000	2.200	0.000	2.253	0.000	2.275
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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AMPHIBOLE HOST GRAIN P-5

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-5-TRAV

	1	2	3	4	5	6	7	8
SIO2	48.25	47.91	48.62	48.23	47.75	49.59	47.30	46.90
A2O3	12.23	12.61	11.88	12.23	12.80	12.28	12.85	12.42
TIO2	0.12	0.12	0.12	0.12	0.13	0.11	0.12	0.14
FEO	10.05	10.11	9.97	10.16	10.08	9.88	10.24	10.24
MNO	0.21	0.23	0.25	0.27	0.24	0.26	0.22	0.23
MGO	14.10	14.22	14.42	14.40	13.94	13.52	13.80	13.62
CAO	12.24	12.33	12.23	12.27	12.42	11.78	12.27	12.16
NA2O	1.00	1.02	1.09	1.11	0.96	1.01	1.05	1.09
K2O	0.26	0.25	0.18	0.24	0.27	0.27	0.29	0.28
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.11	2.12	2.12	2.12	2.11	2.13	2.10	2.07
SUM	100.57	100.92	100.88	101.15	100.70	100.83	100.24	99.15
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	100.57	100.92	100.88	101.15	100.70	100.83	100.24	99.15

SI	6.844	*	6.781	*	6.871	*	6.813	*	6.773	*	6.977	*	6.750	*	6.772	*
AL	1.156	8.000	1.219	8.000	1.129	8.000	1.187	8.000	1.227	8.000	1.023	8.000	1.250	8.000	1.228	8.000
AL	0.888	*	0.884	*	0.850	*	0.848	*	0.913	*	1.013	*	0.911	*	0.885	*
TI	0.013	*	0.013	*	0.013	*	0.013	*	0.014	*	0.012	*	0.013	*	0.015	*
FE	1.192	*	1.197	*	1.178	*	1.200	*	1.196	*	1.163	*	1.222	*	1.236	*
MN	0.025	*	0.028	*	0.030	*	0.032	*	0.029	*	0.031	*	0.027	*	0.028	*
MG	2.981	5.099	3.000	5.121	3.038	5.108	3.032	5.125	2.947	5.098	2.835	5.054	2.935	5.108	2.931	5.096
CA	1.860	*	1.870	*	1.852	*	1.857	*	1.888	*	1.776	*	1.876	*	1.881	*
NA	0.275	*	0.280	*	0.299	*	0.304	*	0.264	*	0.276	*	0.291	*	0.305	*
K	0.047	*	0.045	*	0.032	*	0.043	*	0.049	*	0.048	*	0.053	*	0.052	*
BA	0.000	2.182	0.000	2.195	0.000	2.183	0.000	2.204	0.000	2.200	0.000	2.100	0.000	2.219	0.000	2.238
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-5-TRAV

	9	10	11	12	13	14	15	16
SIO2	47.78	47.98	47.94	48.00	48.23	47.98	49.26	47.77
A2O3	12.26	12.58	12.31	12.94	12.52	13.02	11.03	12.85
TIO2	0.13	0.12	0.13	0.15	0.14	0.14	0.12	0.13
FEO	9.95	10.24	9.85	10.06	9.85	10.16	9.51	9.94
MNO	0.22	0.24	0.24	0.22	0.23	0.24	0.26	0.23
MGO	14.00	13.84	13.93	13.97	14.07	13.75	15.15	14.05
CAO	12.39	12.27	12.27	12.36	12.56	12.28	12.50	12.32
NA2O	1.01	1.03	0.98	1.02	0.99	1.04	0.90	0.95
K2O	0.26	0.27	0.26	0.29	0.27	0.28	0.20	0.29
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.10	2.11	2.10	2.12	2.12	2.12	2.13	2.11
SUM	100.10	100.68	100.01	101.13	100.98	101.01	101.06	100.64
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	100.10	100.68	100.01	101.13	100.98	101.01	101.06	100.64

SI	6.816	*	6.808	*	6.836	*	6.775	*	6.814	*	6.781	*	6.936	*	6.773	*
AL	1.184	8.000	1.192	8.000	1.164	8.000	1.225	8.000	1.186	8.000	1.219	8.000	1.064	8.000	1.227	8.000
AL	0.877	*	0.911	*	0.904	*	0.928	*	0.898	*	0.950	*	0.766	*	0.920	*
TI	0.014	*	0.013	*	0.014	*	0.016	*	0.015	*	0.015	*	0.013	*	0.014	*
FE	1.187	*	1.215	*	1.175	*	1.188	*	1.164	*	1.201	*	1.120	*	1.179	*
MN	0.027	*	0.029	*	0.029	*	0.026	*	0.028	*	0.029	*	0.031	*	0.028	*
MG	2.977	5.081	2.927	5.095	2.960	5.082	2.939	5.097	2.963	5.067	2.897	5.091	3.179	5.109	2.969	5.110
CA	1.894	*	1.865	*	1.874	*	1.869	*	1.901	*	1.860	*	1.886	*	1.872	*
NA	0.279	*	0.283	*	0.271	*	0.279	*	0.271	*	0.285	*	0.246	*	0.261	*
K	0.047	*	0.049	*	0.047	*	0.052	*	0.049	*	0.050	*	0.036	*	0.052	*
BA	0.000	2.220	0.000	2.198	0.000	2.193	0.000	2.201	0.000	2.221	0.000	2.195	0.000	2.167	0.000	2.185
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-5-TRAV

	17	18	19	20	21	22	23	24
SIO2	47.95	47.92	47.98	49.72	47.74	42.05	46.94	47.51
A2O3	12.37	12.42	11.76	10.39	12.10	21.34	13.40	13.02
TIO2	0.14	0.14	0.13	0.10	0.12	0.13	0.14	0.14
FEO	10.05	9.91	9.72	9.52	10.00	9.51	10.18	10.23
MNO	0.23	0.26	0.22	0.24	0.22	0.25	0.31	0.20
MGO	14.06	14.02	14.42	15.11	14.32	11.76	13.96	13.71
CAO	12.31	12.25	12.39	12.53	12.39	10.55	11.62	12.30
NA2O	1.01	1.06	1.06	0.92	1.01	1.31	1.41	0.99
K2O	0.30	0.29	0.24	0.18	0.24	0.31	0.26	0.29
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.11	2.11	2.10	2.12	2.10	2.09	2.10	2.11
SUM	100.53	100.38	100.02	100.83	100.24	99.30	100.32	100.50
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	100.53	100.38	100.02	100.83	100.24	99.30	100.32	100.50

SI	6.812	*	6.814	*	6.845	*	7.012	*	6.805	*	6.026	*	6.691	*	6.756	*
AL	1.188	8.000	1.186	8.000	1.155	8.000	0.988	8.000	1.195	8.000	1.974	8.000	1.309	8.000	1.244	8.000
AL	0.883	*	0.895	*	0.822	*	0.739	*	0.837	*	1.630	*	0.942	*	0.938	*
TI	0.015	*	0.015	*	0.014	*	0.011	*	0.013	*	0.014	*	0.015	*	0.015	*
FE	1.194	*	1.178	*	1.160	*	1.123	*	1.192	*	1.140	*	1.214	*	1.217	*
MN	0.028	*	0.031	*	0.027	*	0.029	*	0.027	*	0.030	*	0.037	*	0.024	*
MG	2.977	5.097	2.971	5.091	3.066	5.089	3.176	5.077	3.042	5.111	2.512	5.326	2.966	5.174	2.906	5.100
CA	1.874	*	1.866	*	1.894	*	1.893	*	1.892	*	1.620	*	1.775	*	1.874	*
NA	0.278	*	0.292	*	0.293	*	0.252	*	0.279	*	0.364	*	0.390	*	0.273	*
K	0.054	*	0.053	*	0.044	*	0.032	*	0.044	*	0.057	*	0.047	*	0.053	*
BA	0.000	2.206	0.000	2.211	0.000	2.231	0.000	2.177	0.000	2.215	0.000	2.041	0.000	2.212	0.000	2.200
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

17 97 AM35B1
18 98 AM35B1
19 99 AM35B1
20 100 AM35B1
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22 102 AM35B1
23 103 AM35B1
24 104 AM35B1

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-5-TRAV

	25	26	27	28	29	30	31	32
SIO2	47.28	47.67	48.23	49.80	48.15	48.51	47.32	46.61
A2O3	12.90	12.98	12.07	10.08	12.15	11.36	13.38	13.81
TIO2	0.13	0.13	0.12	0.11	0.12	0.11	0.12	0.14
FEO	10.12	10.28	9.91	9.32	9.78	9.81	10.13	10.82
MNO	0.24	0.26	0.24	0.24	0.25	0.22	0.23	0.26
MGO	14.13	13.92	14.48	15.52	14.61	15.15	13.91	13.59
CAO	12.18	12.33	12.28	12.27	12.42	12.19	12.16	12.07
NA2O	1.11	1.14	1.04	0.91	1.07	1.01	1.14	1.32
K2O	0.28	0.30	0.25	0.17	0.24	0.21	0.28	0.34
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.10	2.12	2.11	2.12	2.12	2.12	2.11	2.11
SUM	100.47	101.13	100.73	100.54	100.91	100.69	100.78	101.07
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	100.47	101.13	100.73	100.54	100.91	100.69	100.78	101.07

SI	6.729	*	6.745	*	6.831	*	7.033	*	6.810	*	6.870	*	6.710	*	6.626	*
AL	1.271	8.000	1.255	8.000	1.169	8.000	0.967	8.000	1.190	8.000	1.130	8.000	1.290	8.000	1.374	8.000
AL	0.893	*	0.909	*	0.846	*	0.711	*	0.835	*	0.765	*	0.946	*	0.939	*
TI	0.014	*	0.014	*	0.013	*	0.012	*	0.013	*	0.012	*	0.013	*	0.015	*
FE	1.205	*	1.216	*	1.174	*	1.101	*	1.157	*	1.162	*	1.201	*	1.286	*
MN	0.029	*	0.031	*	0.029	*	0.029	*	0.030	*	0.026	*	0.028	*	0.031	*
MG	2.998	5.138	2.936	5.106	3.057	5.118	3.267	5.119	3.080	5.114	3.198	5.163	2.940	5.128	2.879	5.151
CA	1.857	*	1.869	*	1.864	*	1.857	*	1.882	*	1.850	*	1.848	*	1.838	*
NA	0.306	*	0.313	*	0.286	*	0.249	*	0.293	*	0.277	*	0.313	*	0.364	*
K	0.051	*	0.054	*	0.045	*	0.031	*	0.043	*	0.038	*	0.051	*	0.062	*
BA	0.000	2.215	0.000	2.236	0.000	2.194	0.000	2.136	0.000	2.219	0.000	2.165	0.000	2.212	0.000	2.264
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

25 105 AM35B1
26 106 AM35B1
27 107 AM35B1
28 108 AM35B1
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31 112 AM35B1
32 113 AM35B1

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-5-TRAV

	33	34	35	36	37	38	39	40
SIO2	45.15	46.27	46.42	48.07	47.84	47.55	46.47	45.67
A2O3	14.71	14.43	14.53	12.17	12.82	12.92	13.31	14.36
TIO2	0.14	0.14	0.13	0.11	0.11	0.13	0.13	0.12
FEO	11.02	10.79	10.75	9.89	10.28	10.37	10.05	10.61
MNO	0.30	0.27	0.27	0.28	0.24	0.24	0.24	0.26
MGO	13.07	13.20	13.75	14.32	13.91	13.66	13.25	13.40
CAO	11.60	11.95	11.27	12.16	12.31	12.36	12.09	11.94
NA2O	1.48	1.44	1.40	1.04	1.11	1.12	1.20	1.51
K2O	0.38	0.36	0.36	0.27	0.28	0.30	0.33	0.36
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.08	2.11	2.11	2.11	2.12	2.11	2.08	2.09
SUM	99.93	100.95	100.99	100.42	101.02	100.76	99.15	100.32
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.93	100.95	100.99	100.42	101.02	100.76	99.15	100.32

SI	6.508	*	6.585	*	6.586	*	6.830	*	6.772	*	6.755	*	6.707	*	6.546	*
AL	1.492	8.000	1.415	8.000	1.414	8.000	1.170	8.000	1.228	8.000	1.245	8.000	1.293	8.000	1.454	8.000
AL	1.006	*	1.004	*	1.016	*	0.867	*	0.910	*	0.918	*	0.971	*	0.972	*
TI	0.015	*	0.015	*	0.014	*	0.012	*	0.012	*	0.014	*	0.014	*	0.013	*
FE	1.328	*	1.284	*	1.276	*	1.175	*	1.217	*	1.232	*	1.213	*	1.272	*
MN	0.037	*	0.033	*	0.032	*	0.034	*	0.029	*	0.029	*	0.029	*	0.032	*
MG	2.808	5.194	2.800	5.136	2.908	5.245	3.032	5.120	2.935	5.102	2.893	5.085	2.850	5.078	2.863	5.151
CA	1.791	*	1.822	*	1.713	*	1.851	*	1.867	*	1.881	*	1.870	*	1.834	*
NA	0.414	*	0.397	*	0.385	*	0.286	*	0.305	*	0.308	*	0.336	*	0.420	*
K	0.070	*	0.065	*	0.065	*	0.049	*	0.051	*	0.054	*	0.061	*	0.066	*
BA	0.000	2.275	0.000	2.285	0.000	2.164	0.000	2.186	0.000	2.222	0.000	2.244	0.000	2.266	0.000	2.319
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

33 114 AM35B1
34 115 AM35B1
35 116 AM35B1
36 120 AM35B1
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39 123 AM35B1
40 124 AM35B1

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-5-TRAV

	41	42	43	44	45	46	47	48
SIO2	48.50	48.30	48.16	47.18	46.28	46.94	47.66	47.87
A2O3	12.14	12.02	12.61	13.77	13.05	13.50	12.92	12.94
TIO2	0.11	0.12	0.13	0.14	0.14	0.13	0.13	0.13
FEO	10.30	10.00	10.14	10.38	10.28	10.34	10.00	10.06
MNO	0.27	0.25	0.28	0.30	0.25	0.25	0.22	0.22
MGO	14.52	14.58	14.34	13.90	13.69	13.76	14.25	13.99
CAO	11.47	11.52	11.44	11.58	11.98	12.39	12.51	12.47
NA2O	1.30	1.35	1.40	1.54	1.22	1.16	1.03	1.07
K2O	0.22	0.21	0.24	0.28	0.31	0.31	0.27	0.27
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.12	2.11	2.12	2.12	2.07	2.11	2.12	2.12
SUM	100.95	100.46	100.86	101.19	99.27	100.89	101.11	101.14
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	100.95	100.46	100.86	101.19	99.27	100.89	101.11	101.14

SI	6.852	*	6.852	*	6.809	*	6.672	*	6.683	*	6.668	*	6.736	*	6.761	*
AL	1.148	8.000	1.148	8.000	1.191	8.000	1.328	8.000	1.317	8.000	1.332	8.000	1.264	8.000	1.239	8.000
AL	0.873	*	0.861	*	0.910	*	0.966	*	0.904	*	0.928	*	0.888	*	0.915	*
TI	0.012	*	0.013	*	0.014	*	0.015	*	0.015	*	0.014	*	0.014	*	0.014	*
FE	1.217	*	1.186	*	1.199	*	1.228	*	1.241	*	1.228	*	1.182	*	1.188	*
MN	0.032	*	0.030	*	0.034	*	0.036	*	0.031	*	0.030	*	0.026	*	0.026	*
MG	3.057	5.191	3.083	5.174	3.022	5.179	2.930	5.174	2.947	5.137	2.913	5.113	3.002	5.113	2.945	5.089
CA	1.736	*	1.751	*	1.733	*	1.754	*	1.854	*	1.886	*	1.894	*	1.887	*
NA	0.356	*	0.371	*	0.384	*	0.422	*	0.342	*	0.319	*	0.282	*	0.293	*
K	0.040	*	0.038	*	0.043	*	0.051	*	0.057	*	0.056	*	0.049	*	0.049	*
BA	0.000	2.132	0.000	2.160	0.000	2.160	0.000	2.227	0.000	2.252	0.000	2.261	0.000	2.225	0.000	2.229
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

41 126 AM35B1
42 127 AM35B1
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48 133 AM35B1

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-5-TRAV

	49	50	51	52	53	54	55	56
SIO2	47.30	50.08	53.95	48.73	48.08	47.54	51.25	48.00
A2O3	12.76	9.55	4.94	11.59	12.70	13.42	7.94	11.74
TIO2	0.15	0.10	0.09	0.12	0.13	0.14	0.08	0.11
FEO	10.22	9.16	7.84	9.82	10.12	10.25	8.68	9.55
MNO	0.24	0.25	0.26	0.22	0.24	0.24	0.25	0.23
MGO	14.00	15.95	18.45	14.80	14.22	13.68	16.99	14.79
CAO	12.31	12.44	12.45	12.35	12.28	12.31	12.43	12.24
NA2O	1.08	0.87	0.49	1.00	1.10	1.13	0.69	0.97
K2O	0.28	0.17	0.07	0.24	0.26	0.32	0.13	0.24
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.10	2.12	2.15	2.12	2.12	2.12	2.13	2.10
SUM	100.44	100.69	100.69	100.99	101.25	101.15	100.57	99.97
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	100.44	100.69	100.69	100.99	101.25	101.15	100.57	99.97

SI	6.740	*	7.061	*	7.525	*	6.878	*	6.782	*	6.722	*	7.208	*	6.842	*
AL	1.260	8.000	0.939	8.000	0.475	8.000	1.122	8.000	1.218	8.000	1.278	8.000	0.792	8.000	1.158	8.000
AL	0.882	*	0.648	*	0.337	*	0.806	*	0.893	*	0.957	*	0.524	*	0.814	*
TI	0.016	*	0.011	*	0.009	*	0.013	*	0.014	*	0.015	*	0.008	*	0.012	*
FE	1.218	*	1.080	*	0.914	*	1.159	*	1.194	*	1.212	*	1.021	*	1.138	*
MN	0.029	*	0.030	*	0.031	*	0.026	*	0.029	*	0.029	*	0.030	*	0.028	*
MG	2.973	5.118	3.352	5.121	3.836	5.127	3.114	5.118	2.990	5.118	2.883	5.096	3.562	5.146	3.142	5.134
CA	1.879	*	1.879	*	1.860	*	1.868	*	1.856	*	1.865	*	1.873	*	1.869	*
NA	0.298	*	0.238	*	0.133	*	0.274	*	0.301	*	0.310	*	0.188	*	0.268	*
K	0.051	*	0.031	*	0.012	*	0.043	*	0.047	*	0.058	*	0.023	*	0.044	*
BA	0.000	2.229	0.000	2.148	0.000	2.005	0.000	2.185	0.000	2.203	0.000	2.232	0.000	2.085	0.000	2.181
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

49 134 AM35B1
50 135 AM35B1
51 136 AM35B1
52 137 AM35B1
53 138 AM35B1
54 139 AM35B1
55 140 AM35B1
56 141 AM35B1

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-5-TRAV

	57	58	59	60	61	62	63	64
SIO2	47.85	49.31	48.65	49.56	48.82	48.04	48.79	49.65
A2O3	12.93	10.86	11.22	11.34	11.17	12.23	11.73	10.11
TIO2	0.13	0.11	0.12	0.11	0.12	0.13	0.12	0.12
FEO	10.07	9.55	9.41	9.55	9.65	9.87	9.82	9.43
MNO	0.24	0.25	0.26	0.25	0.24	0.25	0.24	0.23
MGO	13.94	15.00	15.41	14.59	15.12	14.30	14.44	15.65
CAO	12.38	12.30	12.32	12.27	12.33	12.35	12.34	12.29
NA2O	1.15	1.08	0.99	1.01	0.95	1.03	1.05	1.01
K2O	0.29	0.19	0.21	0.22	0.23	0.26	0.25	0.18
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.12	2.12	2.12	2.13	2.12	2.11	2.12	2.12
SUM	101.10	100.77	100.71	101.03	100.75	100.57	100.90	100.79
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	101.10	100.77	100.71	101.03	100.75	100.57	100.90	100.79

SI	6.763	*	6.963	*	6.879	*	6.970	*	6.903	*	6.817	*	6.891	*	7.005	*
AL	1.237	8.000	1.037	8.000	1.121	8.000	1.030	8.000	1.097	8.000	1.183	8.000	1.109	8.000	0.995	8.000
AL	0.917	*	0.769	*	0.748	*	0.849	*	0.764	*	0.862	*	0.844	*	0.685	*
TI	0.014	*	0.012	*	0.013	*	0.012	*	0.013	*	0.014	*	0.013	*	0.013	*
FE	1.190	*	1.128	*	1.113	*	1.123	*	1.141	*	1.171	*	1.160	*	1.113	*
MN	0.029	*	0.030	*	0.031	*	0.030	*	0.029	*	0.030	*	0.029	*	0.027	*
MG	2.937	5.086	3.157	5.096	3.248	5.152	3.058	5.072	3.187	5.134	3.025	5.102	3.040	5.085	3.291	5.129
CA	1.875	*	1.861	*	1.866	*	1.849	*	1.868	*	1.878	*	1.867	*	1.858	*
NA	0.315	*	0.296	*	0.271	*	0.275	*	0.260	*	0.283	*	0.288	*	0.276	*
K	0.052	*	0.034	*	0.038	*	0.039	*	0.041	*	0.047	*	0.045	*	0.032	*
BA	0.000	2.242	0.000	2.191	0.000	2.176	0.000	2.164	0.000	2.170	0.000	2.208	0.000	2.200	0.000	2.166
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

57 142 AM35B1
58 143 AM35B1
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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-5-TRAV

	65	66	67	68	69	70	71	72
SIO2	49.68	49.01	49.23	48.79	49.45	48.62	48.17	49.29
A2O3	10.60	11.50	10.48	11.23	11.08	11.47	11.68	10.77
TIO2	0.13	0.13	0.12	0.14	0.13	0.14	0.13	0.15
FEO	9.30	9.88	9.71	9.52	9.64	9.69	9.76	9.62
MNO	0.28	0.25	0.24	0.24	0.25	0.25	0.23	0.25
MGO	15.35	14.64	14.99	14.78	15.09	14.91	14.68	15.28
CAO	12.32	12.38	12.25	12.35	12.31	12.43	12.26	12.40
NA2O	0.97	1.03	0.96	0.91	0.97	0.96	1.01	0.94
K2O	0.19	0.24	0.19	0.20	0.23	0.23	0.26	0.21
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.13	2.13	2.11	2.11	2.13	2.12	2.11	2.13
SUM	100.95	101.19	100.28	100.27	101.28	100.82	100.29	101.04
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	100.95	101.19	100.28	100.27	101.28	100.82	100.29	101.04

		*		*		*		*		*		*		*		*
SI	6.991		6.904		6.989		6.923		6.947		6.875		6.851		6.946	
AL	1.009	8.000	1.096	8.000	1.011	8.000	1.077	8.000	1.053	8.000	1.125	8.000	1.149	8.000	1.054	8.000
AL	0.748	*	0.814	*	0.742	*	0.801	*	0.781	*	0.786	*	0.809	*	0.734	*
TI	0.014	*	0.014	*	0.013	*	0.015	*	0.014	*	0.015	*	0.014	*	0.016	*
FE	1.094	*	1.164	*	1.153	*	1.130	*	1.132	*	1.146	*	1.161	*	1.134	*
MN	0.033	*	0.030	*	0.029	*	0.029	*	0.030	*	0.030	*	0.028	*	0.030	*
MG	3.219	5.109	3.074	5.095	3.172	5.108	3.126	5.101	3.160	5.116	3.142	5.119	3.112	5.124	3.209	5.123
CA	1.857	*	1.869	*	1.863	*	1.878	*	1.853	*	1.883	*	1.868	*	1.872	*
NA	0.265	*	0.281	*	0.264	*	0.250	*	0.264	*	0.263	*	0.279	*	0.257	*
K	0.034	*	0.043	*	0.034	*	0.036	*	0.041	*	0.041	*	0.047	*	0.038	*
BA	0.000	2.156	0.000	2.193	0.000	2.162	0.000	2.164	0.000	2.158	0.000	2.188	0.000	2.194	0.000	2.167
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-5-TRAV

	73	74	75	76	77	78	79	80
SIO2	48.43	48.64	50.07	50.21	50.45	48.15	49.03	47.87
A2O3	11.72	11.37	10.21	9.72	9.16	12.14	10.87	12.95
TIO2	0.14	0.13	0.13	0.13	0.08	0.12	0.12	0.13
FEO	9.81	9.25	9.34	9.23	9.14	10.18	9.45	10.26
MNO	0.26	0.25	0.23	0.26	0.24	0.23	0.29	0.23
MGO	14.64	14.88	15.53	15.78	15.97	14.34	14.97	13.89
CAO	12.35	12.34	12.44	12.35	12.41	12.28	12.21	12.31
NA2O	1.01	0.92	0.94	0.91	0.84	1.07	1.02	1.10
K2O	0.26	0.20	0.19	0.18	0.17	0.27	0.22	0.30
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.12	2.11	2.13	2.13	2.12	2.12	2.11	2.12
SUM	100.74	100.09	101.21	100.90	100.58	100.90	100.29	101.16
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	100.74	100.09	101.21	100.90	100.58	100.90	100.29	101.16

		*		*		*		*		*		*		*		*
SI	6.858		6.908		7.026		7.064		7.115		6.819		6.955		6.765	
AL	1.142	8.000	1.092	8.000	0.974	8.000	0.936	8.000	0.885	8.000	1.181	8.000	1.045	8.000	1.235	8.000
AL	0.814	*	0.811	*	0.714	*	0.675	*	0.637	*	0.846	*	0.772	*	0.921	*
TI	0.015	*	0.014	*	0.014	*	0.014	*	0.008	*	0.013	*	0.013	*	0.014	*
FE	1.162	*	1.099	*	1.096	*	1.086	*	1.078	*	1.206	*	1.121	*	1.213	*
MN	0.031	*	0.030	*	0.027	*	0.031	*	0.029	*	0.028	*	0.035	*	0.028	*
MG	3.090	5.112	3.150	5.103	3.248	5.100	3.309	5.114	3.357	5.109	3.027	5.119	3.165	5.106	2.926	5.101
CA	1.874	*	1.878	*	1.870	*	1.861	*	1.875	*	1.863	*	1.856	*	1.864	*
NA	0.277	*	0.253	*	0.256	*	0.248	*	0.230	*	0.294	*	0.281	*	0.301	*
K	0.047	*	0.036	*	0.034	*	0.032	*	0.031	*	0.049	*	0.040	*	0.054	*
BA	0.000	2.198	0.000	2.167	0.000	2.160	0.000	2.142	0.000	2.135	0.000	2.206	0.000	2.176	0.000	2.219
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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74 160 AM35B1
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80 166 AM35B1

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-5-TRAV

	81	82	83	84	85	86	87	88
SIO2	47.09	47.18	47.55	46.89	47.95	48.82	48.68	50.08
A2O3	13.11	13.07	12.67	14.01	12.05	11.27	11.41	10.10
TIO2	0.14	0.15	0.13	0.14	0.13	0.11	0.13	0.12
FEO	10.36	10.31	10.11	10.21	10.02	9.82	10.23	9.34
MNO	0.25	0.25	0.22	0.26	0.24	0.27	0.23	0.23
MGO	13.74	13.92	14.09	13.86	14.66	15.19	14.21	15.67
CAO	12.31	12.31	12.13	12.09	12.31	12.19	12.38	12.38
NA2O	1.20	1.12	1.15	1.14	1.12	0.94	1.01	0.97
K2O	0.30	0.31	0.27	0.29	0.25	0.27	0.26	0.16
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.10	2.11	2.11	2.12	2.11	2.12	2.11	2.13
SUM	100.60	100.73	100.42	101.01	100.84	101.00	100.65	101.18
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	100.60	100.73	100.42	101.01	100.84	101.00	100.65	101.18

SI	6.708	*	6.709	*	6.767	*	6.640	*	6.796	*	6.890	*	6.908	*	7.029	*
AL	1.292	8.000	1.291	8.000	1.233	8.000	1.360	8.000	1.204	8.000	1.110	8.000	1.092	8.000	0.971	8.000
AL	0.908	*	0.899	*	0.891	*	0.978	*	0.809	*	0.765	*	0.816	*	0.700	*
TI	0.015	*	0.016	*	0.014	*	0.015	*	0.014	*	0.012	*	0.014	*	0.013	*
FE	1.234	*	1.226	*	1.203	*	1.209	*	1.188	*	1.159	*	1.214	*	1.096	*
MN	0.030	*	0.030	*	0.027	*	0.031	*	0.029	*	0.032	*	0.028	*	0.027	*
MG	2.917	5.104	2.950	5.121	2.989	5.123	2.925	5.158	3.097	5.136	3.196	5.163	3.006	5.078	3.278	5.114
CA	1.879	*	1.875	*	1.849	*	1.834	*	1.869	*	1.843	*	1.882	*	1.862	*
NA	0.331	*	0.309	*	0.317	*	0.313	*	0.308	*	0.257	*	0.278	*	0.264	*
K	0.055	*	0.056	*	0.049	*	0.052	*	0.045	*	0.049	*	0.047	*	0.029	*
BA	0.000	2.265	0.000	2.240	0.000	2.216	0.000	2.200	0.000	2.222	0.000	2.149	0.000	2.207	0.000	2.154
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-5-TRAV

	89	90
SIO2	51.51	52.33
A2O3	8.37	7.01
TIO2	0.08	0.08
FEO	9.02	8.46
MNO	0.24	0.24
MGO	16.50	17.18
CAO	12.36	12.43
NA2O	0.91	0.74
K2O	0.11	0.08
BAO	0.00	0.00
CL	0.00	0.00
F	0.00	0.00
H2O	2.14	2.14
SUM	101.24	100.69
-O= F+CL	0.00	0.00
SUM	101.24	100.69

SI	7.203	*	7.332	*
AL	0.797	8.000	0.668	8.000
AL	0.582	*	0.490	*
TI	0.008	*	0.008	*
FE	1.055	*	0.991	*
MN	0.028	*	0.028	*
MG	3.439	5.113	3.588	5.106
CA	1.852	*	1.866	*
NA	0.247	*	0.201	*
K	0.020	*	0.014	*
BA	0.000	2.118	0.000	2.081
CL	0.000	*	0.000	*
F	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*

89 177 AM35B1
90 178 AM35B1

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-5-HOST

	1	2	3	4	5	6	7	8
SIO2	47.10	46.21	46.85	45.90	46.53	46.19	45.59	46.74
A2O3	13.15	14.29	13.57	13.88	13.44	13.97	14.81	14.36
TIO2	0.13	0.17	0.13	0.16	0.14	0.13	0.14	0.16
FEO	10.30	10.88	10.27	10.70	10.31	10.58	10.69	10.52
MNO	0.22	0.25	0.26	0.26	0.25	0.27	0.26	0.28
MGO	13.80	13.45	13.46	13.35	13.85	13.56	13.06	13.76
CAO	12.06	12.06	12.02	12.08	11.95	11.87	11.79	11.44
NA2O	1.29	1.23	1.34	1.24	1.30	1.38	1.44	1.51
K2O	0.35	0.36	0.34	0.33	0.35	0.31	0.37	0.32
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.10	2.11	2.10	2.08	2.09	2.09	2.09	2.12
SUM	100.50	101.01	100.34	99.98	100.21	100.35	100.24	101.21
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	100.50	101.01	100.34	99.98	100.21	100.35	100.24	101.21

		*		*		*		*		*		*		*		*
SI	6.711		6.575		6.686		6.598		6.655		6.606		6.534		6.612	
AL	1.289	8.000	1.425	8.000	1.314	8.000	1.402	8.000	1.345	8.000	1.394	8.000	1.466	8.000	1.388	8.000
AL	0.919	*	0.971	*	0.969	*	0.949	*	0.921	*	0.960	*	1.036	*	1.006	*
TI	0.014	*	0.018	*	0.014	*	0.017	*	0.015	*	0.014	*	0.015	*	0.017	*
FE	1.227	*	1.295	*	1.226	*	1.286	*	1.233	*	1.265	*	1.281	*	1.245	*
MN	0.027	*	0.030	*	0.031	*	0.032	*	0.030	*	0.033	*	0.032	*	0.034	*
MG	2.931	5.118	2.852	5.167	2.863	5.103	2.860	5.145	2.953	5.152	2.891	5.163	2.790	5.154	2.901	5.203
CA	1.841	*	1.839	*	1.838	*	1.860	*	1.831	*	1.819	*	1.811	*	1.734	*
NA	0.356	*	0.339	*	0.371	*	0.346	*	0.361	*	0.383	*	0.400	*	0.414	*
K	0.064	*	0.065	*	0.062	*	0.061	*	0.064	*	0.057	*	0.068	*	0.058	*
BA	0.000	2.261	0.000	2.243	0.000	2.271	0.000	2.267	0.000	2.256	0.000	2.258	0.000	2.278	0.000	2.206
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-5-HOST

	9	10	11	12	13	14	15	16
SIO2	44.77	49.34	46.28	46.81	47.68	47.79	46.67	46.53
A2O3	17.39	10.90	14.03	14.30	13.22	12.95	13.87	13.48
TIO2	0.14	0.13	0.14	0.17	0.12	0.14	0.16	0.15
FEO	10.87	9.76	10.52	10.40	10.22	10.25	10.44	10.26
MNO	0.25	0.29	0.29	0.26	0.26	0.22	0.28	0.27
MGO	12.49	15.38	13.74	13.90	14.01	14.34	14.01	14.03
CAO	11.58	11.75	11.35	11.35	12.03	12.05	11.39	11.27
NA2O	1.39	1.15	1.54	1.56	1.32	1.26	1.56	1.44
K2O	0.39	0.22	0.28	0.31	0.30	0.28	0.28	0.28
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.12	2.13	2.10	2.12	2.12	2.12	2.11	2.09
SUM	101.39	101.05	100.27	101.18	101.28	101.40	100.77	99.80
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	101.39	101.05	100.27	101.18	101.28	101.40	100.77	99.80

		*		*		*		*		*		*		*		*
SI	6.340		6.948		6.614		6.619		6.731		6.738		6.632		6.668	
AL	1.660	8.000	1.052	8.000	1.386	8.000	1.381	8.000	1.269	8.000	1.262	8.000	1.368	8.000	1.332	8.000
AL	1.242	*	0.757	*	0.977	*	1.001	*	0.930	*	0.889	*	0.955	*	0.945	*
TI	0.015	*	0.014	*	0.015	*	0.018	*	0.013	*	0.015	*	0.017	*	0.016	*
FE	1.287	*	1.149	*	1.257	*	1.230	*	1.207	*	1.209	*	1.241	*	1.230	*
MN	0.030	*	0.035	*	0.035	*	0.031	*	0.031	*	0.026	*	0.034	*	0.033	*
MG	2.636	5.210	3.228	5.183	2.927	5.211	2.929	5.210	2.948	5.128	3.014	5.153	2.967	5.214	2.997	5.220
CA	1.757	*	1.773	*	1.738	*	1.719	*	1.820	*	1.820	*	1.734	*	1.730	*
NA	0.382	*	0.314	*	0.427	*	0.428	*	0.361	*	0.344	*	0.430	*	0.400	*
K	0.070	*	0.040	*	0.051	*	0.056	*	0.054	*	0.050	*	0.051	*	0.051	*
BA	0.000	2.209	0.000	2.126	0.000	2.216	0.000	2.203	0.000	2.235	0.000	2.215	0.000	2.215	0.000	2.182
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-5-HOST

	17	18	19	20	21	22	23	24
SIO2	46.71	51.25	47.15	45.64	46.09	47.37	46.59	46.90
A2O3	14.14	8.53	13.82	13.13	14.45	13.10	14.32	13.91
TIO2	0.12	0.10	0.16	0.15	0.14	0.14	0.16	0.14
FEO	10.04	8.99	10.61	10.31	10.70	10.15	10.59	10.55
MNO	0.23	0.29	0.28	0.29	0.24	0.24	0.29	0.25
MGO	13.71	16.92	13.84	13.71	13.42	14.05	13.51	13.47
CAO	12.08	11.84	11.35	11.68	12.10	12.15	11.44	12.08
NA2O	1.11	0.93	1.66	1.32	1.35	1.22	1.51	1.36
K2O	0.28	0.14	0.27	0.30	0.39	0.29	0.29	0.38
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.11	2.14	2.12	2.06	2.10	2.11	2.11	2.11
SUM	100.53	101.13	101.26	98.59	100.98	100.82	100.81	101.13
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	100.53	101.13	101.26	98.59	100.98	100.82	100.81	101.13

SI	6.639	*	7.170	*	6.667	*	6.643	*	6.559	*	6.720	*	6.619	*	6.650	*
AL	1.361	8.000	0.830	8.000	1.333	8.000	1.357	8.000	1.441	8.000	1.280	8.000	1.381	8.000	1.350	8.000
AL	1.007	*	0.577	*	0.970	*	0.896	*	0.982	*	0.910	*	1.017	*	0.975	*
TI	0.013	*	0.011	*	0.017	*	0.016	*	0.015	*	0.015	*	0.017	*	0.015	*
FE	1.193	*	1.052	*	1.255	*	1.255	*	1.273	*	1.204	*	1.258	*	1.251	*
MN	0.028	*	0.034	*	0.034	*	0.036	*	0.029	*	0.029	*	0.035	*	0.030	*
MG	2.904	5.145	3.528	5.202	2.917	5.192	2.975	5.177	2.847	5.146	2.971	5.128	2.861	5.188	2.847	5.118
CA	1.840	*	1.775	*	1.720	*	1.822	*	1.845	*	1.847	*	1.741	*	1.832	*
NA	0.306	*	0.252	*	0.455	*	0.373	*	0.372	*	0.336	*	0.416	*	0.374	*
K	0.051	*	0.025	*	0.049	*	0.056	*	0.071	*	0.052	*	0.053	*	0.069	*
BA	0.000	2.196	0.000	2.052	0.000	2.223	0.000	2.250	0.000	2.288	0.000	2.235	0.000	2.210	0.000	2.275
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-5-HOST

	25	26	27	28	29	30	31	32
SIO2	47.35	50.51	46.57	46.89	47.10	45.27	46.59	47.35
A2O3	13.38	9.01	14.16	13.56	13.66	14.71	13.71	13.44
TIO2	0.16	0.12	0.14	0.14	0.16	0.14	0.13	0.15
FEO	10.34	9.29	10.48	10.48	10.14	10.42	10.40	10.31
MNO	0.25	0.27	0.31	0.24	0.24	0.28	0.27	0.25
MGO	13.95	16.24	13.62	13.80	13.80	13.27	13.53	13.93
CAO	11.59	11.94	11.48	11.89	12.16	11.90	11.89	12.04
NA2O	1.18	0.98	1.51	1.29	1.19	1.35	1.33	1.31
K2O	0.66	0.16	0.29	0.36	0.33	0.38	0.35	0.33
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.11	2.13	2.11	2.11	2.11	2.08	2.10	2.12
SUM	100.97	100.65	100.67	100.76	100.89	99.80	100.30	101.23
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	100.97	100.65	100.67	100.76	100.89	99.80	100.30	101.23

SI	6.713	*	7.119	*	6.626	*	6.669	*	6.677	*	6.516	*	6.657	*	6.695	*
AL	1.287	8.000	0.881	8.000	1.374	8.000	1.331	8.000	1.323	8.000	1.484	8.000	1.343	8.000	1.305	8.000
AL	0.948	*	0.616	*	0.899	*	0.941	*	0.959	*	1.011	*	0.966	*	0.934	*
TI	0.017	*	0.013	*	0.015	*	0.015	*	0.017	*	0.015	*	0.014	*	0.016	*
FE	1.226	*	1.095	*	1.247	*	1.246	*	1.202	*	1.254	*	1.243	*	1.219	*
MN	0.030	*	0.032	*	0.037	*	0.029	*	0.029	*	0.034	*	0.033	*	0.030	*
MG	2.948	5.169	3.412	5.168	2.888	5.187	2.925	5.157	2.916	5.123	2.847	5.162	2.882	5.137	2.936	5.135
CA	1.760	*	1.803	*	1.750	*	1.812	*	1.847	*	1.835	*	1.820	*	1.824	*
NA	0.324	*	0.268	*	0.417	*	0.356	*	0.327	*	0.377	*	0.368	*	0.359	*
K	0.119	*	0.029	*	0.053	*	0.065	*	0.060	*	0.070	*	0.064	*	0.060	*
BA	0.000	2.204	0.000	2.100	0.000	2.219	0.000	2.233	0.000	2.234	0.000	2.282	0.000	2.253	0.000	2.243
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-5-HOST

	33	34	35	36	37	38	39	40
SIO2	47.69	48.54	47.86	49.24	48.12	48.73	50.43	47.90
A2O3	12.87	11.89	12.31	10.88	11.73	11.90	9.57	12.03
TIO2	0.14	0.13	0.15	0.13	0.13	0.13	0.12	0.13
FEO	10.57	9.80	10.02	9.66	10.61	9.86	9.28	10.04
MNO	0.25	0.24	0.23	0.25	0.24	0.25	0.25	0.21
MGO	13.58	14.32	14.21	15.27	14.36	14.59	15.75	14.22
CAO	12.28	12.34	12.15	12.34	12.21	12.26	12.47	12.30
NA2O	1.14	1.08	1.02	0.95	0.99	1.09	0.87	1.05
K2O	0.31	0.26	0.25	0.19	0.33	0.28	0.17	0.26
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.11	2.12	2.11	2.13	2.11	2.13	2.13	2.10
SUM	100.94	100.72	100.31	101.04	100.83	101.22	101.04	100.24
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	100.94	100.72	100.31	101.04	100.83	101.22	101.04	100.24

		*		*		*		*		*		*		*		*
SI	6.767	*	6.871	*	6.810	*	6.938	*	6.836	*	6.865	*	7.064	*	6.826	*
AL	1.233	8.000	1.129	8.000	1.190	8.000	1.062	8.000	1.164	8.000	1.135	8.000	0.916	8.000	1.174	8.000
AL	0.918	*	0.855	*	0.875	*	0.745	*	0.799	*	0.840	*	0.669	*	0.846	*
TI	0.015	*	0.014	*	0.016	*	0.014	*	0.014	*	0.014	*	0.013	*	0.014	*
FE	1.254	*	1.160	*	1.192	*	1.138	*	1.260	*	1.162	*	1.090	*	1.197	*
MN	0.030	*	0.029	*	0.028	*	0.030	*	0.029	*	0.030	*	0.030	*	0.025	*
MG	2.872	5.090	3.021	5.079	3.014	5.125	3.207	5.134	3.041	5.143	3.063	5.109	3.298	5.099	3.020	5.102
CA	1.867	*	1.872	*	1.852	*	1.863	*	1.858	*	1.850	*	1.877	*	1.878	*
NA	0.314	*	0.296	*	0.281	*	0.260	*	0.273	*	0.298	*	0.237	*	0.290	*
K	0.056	*	0.047	*	0.045	*	0.034	*	0.060	*	0.050	*	0.030	*	0.047	*
BA	0.000	2.237	0.000	2.215	0.000	2.179	0.000	2.157	0.000	2.191	0.000	2.198	0.000	2.144	0.000	2.215
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-5-HOST

	41	42	43	44	45	46	47	48
SIO2	48.98	48.42	51.23	49.77	49.18	48.61	51.32	49.46
A2O3	10.90	12.15	8.76	9.48	10.83	11.48	8.34	10.61
TIO2	0.13	0.14	0.11	0.12	0.14	0.13	0.11	0.12
FEO	9.80	9.86	8.99	9.51	9.80	9.99	8.81	10.10
MNO	0.21	0.25	0.21	0.25	0.29	0.25	0.24	0.23
MGO	14.88	14.46	15.93	15.81	15.01	14.47	16.52	14.85
CAO	12.31	12.30	12.41	12.40	12.35	12.38	12.38	12.43
NA2O	1.01	1.10	0.77	0.86	1.03	1.05	0.78	0.90
K2O	0.21	0.26	0.15	0.18	0.21	0.25	0.15	0.20
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.11	2.12	2.13	2.12	2.12	2.11	2.13	2.12
SUM	100.54	101.06	100.69	100.48	100.96	100.72	100.78	101.02
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	100.54	101.06	100.69	100.48	100.96	100.72	100.78	101.02

		*		*		*		*		*		*		*		*
SI	6.942	*	6.834	*	7.198	*	7.048	*	6.944	*	6.889	*	7.203	*	6.981	*
AL	1.058	8.000	1.166	8.000	0.802	8.000	0.952	8.000	1.056	8.000	1.111	8.000	0.797	8.000	1.019	8.000
AL	0.762	*	0.855	*	0.649	*	0.627	*	0.746	*	0.806	*	0.583	*	0.746	*
TI	0.014	*	0.015	*	0.012	*	0.013	*	0.015	*	0.014	*	0.012	*	0.013	*
FE	1.162	*	1.164	*	1.056	*	1.126	*	1.157	*	1.184	*	1.034	*	1.192	*
MN	0.025	*	0.030	*	0.025	*	0.030	*	0.035	*	0.030	*	0.029	*	0.027	*
MG	3.143	5.106	3.042	5.106	3.336	5.078	3.337	5.133	3.159	5.111	3.057	5.091	3.456	5.113	3.124	5.102
CA	1.869	*	1.860	*	1.868	*	1.881	*	1.868	*	1.880	*	1.862	*	1.880	*
NA	0.278	*	0.301	*	0.210	*	0.236	*	0.282	*	0.289	*	0.212	*	0.246	*
K	0.038	*	0.047	*	0.027	*	0.033	*	0.038	*	0.045	*	0.027	*	0.036	*
BA	0.000	2.185	0.000	2.208	0.000	2.105	0.000	2.150	0.000	2.188	0.000	2.214	0.000	2.101	0.000	2.162
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-5-HOST

	49	50	51	52	53	54	55	56
SIO2	49.83	50.01	51.44	50.41	50.65	52.63	52.90	53.40
A2O3	10.19	10.61	8.96	9.49	9.24	7.32	5.92	5.56
TIO2	0.13	0.14	0.13	0.13	0.13	0.10	0.12	0.07
FEO	9.72	9.40	8.92	9.87	9.17	8.59	9.19	8.56
MNO	0.25	0.25	0.22	0.25	0.28	0.26	0.23	0.23
MGO	15.51	15.37	15.97	15.49	15.99	16.73	17.04	17.73
CAO	12.40	12.30	12.51	12.32	12.38	12.37	12.63	12.71
NA2O	0.85	0.95	0.78	0.88	0.83	0.73	0.56	0.54
K2O	0.19	0.20	0.16	0.20	0.17	0.21	0.10	0.10
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.13	2.14	2.14	2.13	2.13	2.15	2.13	2.15
SUM	101.20	101.37	101.23	101.17	100.97	101.09	100.82	101.05
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	101.20	101.37	101.23	101.17	100.97	101.09	100.82	101.05

SI	7.007	*	7.005	*	7.187	*	7.090	*	7.114	*	7.346	*	7.425	*	7.456	*
AL	0.993	8.000	0.995	8.000	0.813	8.000	0.910	8.000	0.886	8.000	0.654	8.000	0.575	8.000	0.544	8.000
AL	0.696	*	0.756	*	0.662	*	0.663	*	0.644	*	0.550	*	0.404	*	0.371	*
TI	0.014	*	0.015	*	0.014	*	0.014	*	0.014	*	0.010	*	0.013	*	0.007	*
FE	1.143	*	1.101	*	1.042	*	1.161	*	1.077	*	1.003	*	1.079	*	1.000	*
MN	0.030	*	0.030	*	0.026	*	0.030	*	0.033	*	0.031	*	0.027	*	0.027	*
MG	3.251	5.133	3.209	5.111	3.326	5.089	3.247	5.115	3.348	5.115	3.480	5.074	3.565	5.088	3.690	5.095
CA	1.868	*	1.846	*	1.873	*	1.857	*	1.863	*	1.850	*	1.899	*	1.901	*
NA	0.232	*	0.258	*	0.211	*	0.240	*	0.226	*	0.198	*	0.152	*	0.146	*
K	0.034	*	0.036	*	0.029	*	0.036	*	0.030	*	0.037	*	0.018	*	0.018	*
BA	0.000	2.134	0.000	2.140	0.000	2.112	0.000	2.132	0.000	2.120	0.000	2.085	0.000	2.070	0.000	2.085
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-5-HOST

	57	58	59	60	61	62	63	64
SIO2	46.88	48.92	49.78	48.56	48.01	52.14	52.23	50.29
A2O3	12.81	10.89	10.20	11.46	12.18	7.39	7.19	9.75
TIO2	0.14	0.12	0.13	0.14	0.15	0.12	0.08	0.12
FEO	10.03	10.29	10.05	10.07	10.62	8.63	8.65	9.79
MNO	0.25	0.26	0.25	0.24	0.26	0.22	0.23	0.25
MGO	13.80	15.23	14.91	14.24	13.81	17.13	17.36	15.59
CAO	11.79	11.80	12.31	12.36	12.30	12.43	12.54	12.43
NA2O	0.93	0.95	0.92	1.01	1.06	0.64	0.69	0.91
K2O	0.31	0.19	0.20	0.24	0.25	0.12	0.13	0.19
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.08	2.12	2.12	2.11	2.11	2.14	2.15	2.14
SUM	99.02	100.87	100.87	100.43	100.75	100.96	101.25	101.46
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.02	100.87	100.87	100.43	100.75	100.96	101.25	101.46

SI	6.759	*	6.920	*	7.031	*	6.902	*	6.823	*	7.291	*	7.290	*	7.055	*
AL	1.241	8.000	1.080	8.000	0.969	8.000	1.098	8.000	1.177	8.000	0.709	8.000	0.710	8.000	0.945	8.000
AL	0.936	*	0.735	*	0.729	*	0.821	*	0.863	*	0.509	*	0.473	*	0.666	*
TI	0.015	*	0.013	*	0.014	*	0.015	*	0.016	*	0.013	*	0.008	*	0.013	*
FE	1.209	*	1.217	*	1.187	*	1.197	*	1.262	*	1.009	*	1.010	*	1.149	*
MN	0.031	*	0.031	*	0.030	*	0.029	*	0.031	*	0.026	*	0.027	*	0.030	*
MG	2.986	5.156	3.211	5.208	3.139	5.099	3.017	5.079	2.925	5.098	3.570	5.127	3.612	5.129	3.260	5.117
CA	1.821	*	1.804	*	1.863	*	1.882	*	1.873	*	1.862	*	1.875	*	1.868	*
NA	0.260	*	0.261	*	0.252	*	0.278	*	0.292	*	0.174	*	0.187	*	0.248	*
K	0.057	*	0.034	*	0.036	*	0.044	*	0.045	*	0.021	*	0.023	*	0.034	*
BA	0.000	2.138	0.000	2.098	0.000	2.151	0.000	2.204	0.000	2.210	0.000	2.057	0.000	2.085	0.000	2.150
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-5-HOST

	65	66	67	68	69	70	71	72
SIO2	49.62	51.95	49.80	50.83	48.91	50.88	48.47	49.49
A2O3	10.76	8.00	10.84	8.70	11.50	8.62	11.24	10.41
TIO2	0.15	0.11	0.13	0.11	0.14	0.12	0.17	0.14
FEO	10.00	8.69	9.76	9.39	10.48	8.90	10.25	9.92
MNO	0.23	0.21	0.25	0.24	0.25	0.26	0.25	0.23
MGO	14.75	16.86	15.07	16.22	14.33	16.72	14.44	15.08
CAO	12.39	12.36	12.22	12.46	12.41	12.50	12.40	12.41
NA2O	0.99	0.78	0.97	0.77	0.91	0.78	0.98	0.90
K2O	0.23	0.13	0.20	0.16	0.23	0.13	0.25	0.20
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.13	2.15	2.14	2.13	2.12	2.14	2.11	2.12
SUM	101.25	101.24	101.38	101.01	101.28	101.05	100.56	100.90
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	101.25	101.24	101.38	101.01	101.28	101.05	100.56	100.90

SI	6.984	*	7.247	*	6.986	*	7.144	*	6.900	*	7.136	*	6.891	*	6.989	*
AL	1.016	8.000	0.753	8.000	1.014	8.000	0.856	8.000	1.100	8.000	0.864	8.000	1.109	8.000	1.011	8.000
AL	0.768	*	0.562	*	0.778	*	0.585	*	0.812	*	0.560	*	0.774	*	0.722	*
TI	0.016	*	0.012	*	0.014	*	0.012	*	0.015	*	0.013	*	0.018	*	0.015	*
FE	1.177	*	1.014	*	1.145	*	1.104	*	1.236	*	1.044	*	1.219	*	1.172	*
MN	0.027	*	0.025	*	0.030	*	0.029	*	0.030	*	0.031	*	0.030	*	0.028	*
MG	3.094	5.083	3.506	5.118	3.151	5.117	3.398	5.127	3.013	5.107	3.495	5.143	3.060	5.101	3.174	5.110
CA	1.868	*	1.847	*	1.837	*	1.876	*	1.876	*	1.878	*	1.889	*	1.878	*
NA	0.270	*	0.211	*	0.264	*	0.210	*	0.249	*	0.212	*	0.270	*	0.246	*
K	0.041	*	0.023	*	0.036	*	0.029	*	0.041	*	0.023	*	0.045	*	0.036	*
BA	0.000	2.180	0.000	2.082	0.000	2.136	0.000	2.115	0.000	2.166	0.000	2.114	0.000	2.204	0.000	2.160
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-5-HOST

	73	74	75	76	77	78	79	80
SIO2	48.69	51.30	51.26	51.71	51.87	52.29	50.21	51.41
A2O3	12.28	8.87	8.86	8.11	7.25	7.94	10.43	8.22
TIO2	0.15	0.12	0.12	0.10	0.12	0.11	0.14	0.16
FEO	9.92	9.64	8.95	9.16	9.97	8.40	9.43	8.97
MNO	0.21	0.25	0.25	0.23	0.24	0.23	0.24	0.26
MGO	14.00	15.46	16.13	16.45	15.94	16.99	15.37	16.50
CAO	11.17	11.93	12.46	12.63	12.71	12.46	12.40	12.34
NA2O	0.82	0.74	0.83	0.75	0.60	0.77	0.90	0.85
K2O	1.17	0.58	0.15	0.17	0.15	0.13	0.21	0.14
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.11	2.13	2.14	2.14	2.13	2.16	2.14	2.14
SUM	100.52	101.02	101.15	101.45	100.98	101.48	101.47	100.99
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	100.52	101.02	101.15	101.45	100.98	101.48	101.47	100.99

SI	6.906	*	7.210	*	7.173	*	7.223	*	7.304	*	7.267	*	7.026	*	7.208	*
AL	1.094	8.000	0.790	8.000	0.827	8.000	0.777	8.000	0.696	8.000	0.733	8.000	0.974	8.000	0.792	8.000
AL	0.958	*	0.679	*	0.634	*	0.558	*	0.507	*	0.567	*	0.746	*	0.568	*
TI	0.016	*	0.013	*	0.013	*	0.011	*	0.013	*	0.011	*	0.015	*	0.017	*
FE	1.177	*	1.133	*	1.047	*	1.070	*	1.174	*	0.976	*	1.104	*	1.052	*
MN	0.025	*	0.030	*	0.030	*	0.027	*	0.029	*	0.027	*	0.028	*	0.031	*
MG	2.960	5.135	3.239	5.093	3.364	5.089	3.425	5.091	3.346	5.068	3.519	5.101	3.206	5.098	3.448	5.114
CA	1.697	*	1.796	*	1.868	*	1.890	*	1.918	*	1.855	*	1.859	*	1.854	*
NA	0.225	*	0.202	*	0.225	*	0.203	*	0.164	*	0.207	*	0.244	*	0.231	*
K	0.212	*	0.104	*	0.027	*	0.030	*	0.027	*	0.023	*	0.037	*	0.025	*
BA	0.000	2.134	0.000	2.102	0.000	2.120	0.000	2.124	0.000	2.108	0.000	2.086	0.000	2.141	0.000	2.110
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-5-HOST

	81	82	83	84	85	86	87	88
SIO2	49.14	51.71	49.07	51.57	50.13	51.78	49.88	51.48
A2O3	11.07	7.67	10.84	8.66	9.57	8.40	9.78	8.16
TIO2	0.16	0.10	0.12	0.17	0.14	0.12	0.13	0.10
FEO	9.93	8.57	9.81	9.02	9.64	8.95	9.24	9.28
MNO	0.24	0.21	0.25	0.23	0.24	0.24	0.25	0.24
MGO	14.63	17.06	15.00	16.13	15.70	16.38	15.63	16.18
CAO	12.35	12.52	12.29	12.59	12.47	12.45	12.19	12.52
NA2O	0.95	0.73	1.04	0.80	0.84	0.82	0.93	0.80
K2O	0.22	0.13	0.23	0.15	0.17	0.15	0.17	0.15
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.12	2.14	2.12	2.15	2.13	2.15	2.12	2.13
SUM	100.81	100.84	100.77	101.47	101.03	101.44	100.32	101.04
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	100.81	100.84	100.77	101.47	101.03	101.44	100.32	101.04

		*		*		*		*		*		*		*		*
SI	6.947	*	7.247	*	6.942	*	7.195	*	7.059	*	7.221	*	7.058	*	7.224	*
AL	1.053	8.000	0.753	8.000	1.058	8.000	0.805	8.000	0.941	8.000	0.779	8.000	0.942	8.000	0.776	8.000
AL	0.791	*	0.514	*	0.749	*	0.619	*	0.647	*	0.601	*	0.688	*	0.573	*
TI	0.017	*	0.011	*	0.013	*	0.018	*	0.015	*	0.013	*	0.014	*	0.011	*
FE	1.174	*	1.004	*	1.161	*	1.052	*	1.135	*	1.044	*	1.093	*	1.089	*
MN	0.029	*	0.025	*	0.030	*	0.027	*	0.029	*	0.028	*	0.030	*	0.029	*
MG	3.083	5.093	3.564	5.118	3.163	5.115	3.354	5.071	3.295	5.120	3.405	5.091	3.296	5.122	3.384	5.086
CA	1.871	*	1.880	*	1.863	*	1.882	*	1.881	*	1.860	*	1.848	*	1.882	*
NA	0.260	*	0.198	*	0.285	*	0.216	*	0.229	*	0.222	*	0.255	*	0.218	*
K	0.040	*	0.023	*	0.042	*	0.027	*	0.031	*	0.027	*	0.031	*	0.027	*
BA	0.000	2.171	0.000	2.102	0.000	2.190	0.000	2.125	0.000	2.141	0.000	2.109	0.000	2.134	0.000	2.127
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-5-HOST

	89	90	91	92	93	94	95	96
SIO2	50.80	49.85	50.13	49.31	50.63	49.57	50.70	53.67
A2O3	9.38	10.02	9.66	10.89	8.76	10.91	9.21	5.70
TIO2	0.12	0.15	0.13	0.14	0.12	0.13	0.13	0.14
FEO	9.30	9.73	9.36	10.09	9.14	9.95	9.79	8.03
MNO	0.27	0.24	0.25	0.25	0.22	0.23	0.25	0.22
MGO	15.89	15.23	15.95	14.62	16.70	14.80	15.49	17.96
CAO	12.48	12.51	12.42	12.46	11.95	12.44	12.39	12.61
NA2O	0.90	0.92	0.92	1.02	0.85	0.93	0.82	0.53
K2O	0.17	0.20	0.18	0.23	0.14	0.21	0.19	0.09
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.14	2.12	2.13	2.12	2.13	2.13	2.13	2.15
SUM	101.45	100.97	101.13	101.13	100.64	101.30	101.10	101.10
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	101.45	100.97	101.13	101.13	100.64	101.30	101.10	101.10

		*		*		*		*		*		*		*		*
SI	7.107	*	7.029	*	7.045	*	6.957	*	7.128	*	6.970	*	7.130	*	7.464	*
AL	0.893	8.000	0.971	8.000	0.955	8.000	1.043	8.000	0.872	8.000	1.030	8.000	0.870	8.000	0.536	8.000
AL	0.653	*	0.694	*	0.645	*	0.768	*	0.581	*	0.778	*	0.656	*	0.398	*
TI	0.013	*	0.016	*	0.014	*	0.015	*	0.013	*	0.014	*	0.014	*	0.015	*
FE	1.088	*	1.147	*	1.100	*	1.191	*	1.076	*	1.170	*	1.151	*	0.934	*
MN	0.032	*	0.029	*	0.030	*	0.030	*	0.026	*	0.027	*	0.030	*	0.026	*
MG	3.313	5.099	3.201	5.087	3.341	5.129	3.075	5.078	3.504	5.201	3.102	5.091	3.247	5.097	3.723	5.095
CA	1.871	*	1.890	*	1.870	*	1.884	*	1.803	*	1.874	*	1.867	*	1.879	*
NA	0.244	*	0.252	*	0.251	*	0.279	*	0.232	*	0.254	*	0.224	*	0.143	*
K	0.030	*	0.036	*	0.032	*	0.041	*	0.025	*	0.038	*	0.034	*	0.016	*
BA	0.000	2.145	0.000	2.178	0.000	2.153	0.000	2.204	0.000	2.060	0.000	2.165	0.000	2.124	0.000	2.038
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

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1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-5-HOST

	97	98	99	100	101	102	103	104
SIO2	53.38	49.22	49.83	49.50	52.80	49.44	49.84	51.78
A2O3	6.31	11.32	9.87	10.97	6.34	10.88	10.52	8.23
TIO2	0.17	0.15	0.13	0.15	0.14	0.15	0.15	0.13
FEO	8.27	9.80	9.36	9.90	8.09	9.85	9.60	8.70
MNO	0.21	0.23	0.25	0.24	0.24	0.25	0.25	0.25
MGO	17.50	15.03	15.52	14.82	17.64	14.89	15.28	16.28
CAO	12.51	12.37	12.43	12.38	12.58	12.55	12.43	12.03
NA2O	0.68	0.92	0.89	0.94	0.60	0.96	0.96	0.68
K2O	0.10	0.21	0.19	0.22	0.09	0.20	0.19	0.53
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.16	2.13	2.12	2.13	2.14	2.13	2.13	2.14
SUM	101.29	101.38	100.59	101.25	100.66	101.30	101.35	100.75
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	101.29	101.38	100.59	101.25	100.66	101.30	101.35	100.75

SI	7.419	*	6.913	*	7.041	*	6.963	*	7.387	*	6.955	*	6.994	*	7.264	*
AL	0.581	8.000	1.087	8.000	0.959	8.000	1.037	8.000	0.613	8.000	1.045	8.000	1.006	8.000	0.736	8.000
AL	0.453	*	0.787	*	0.684	*	0.781	*	0.432	*	0.759	*	0.734	*	0.625	*
TI	0.018	*	0.016	*	0.014	*	0.016	*	0.015	*	0.016	*	0.016	*	0.014	*
FE	0.961	*	1.151	*	1.106	*	1.165	*	0.947	*	1.159	*	1.127	*	1.021	*
MN	0.025	*	0.027	*	0.030	*	0.029	*	0.028	*	0.030	*	0.030	*	0.030	*
MG	3.625	5.082	3.147	5.128	3.269	5.102	3.107	5.097	3.678	5.100	3.122	5.086	3.196	5.102	3.404	5.093
CA	1.863	*	1.862	*	1.882	*	1.866	*	1.886	*	1.892	*	1.869	*	1.808	*
NA	0.183	*	0.251	*	0.244	*	0.256	*	0.163	*	0.262	*	0.261	*	0.185	*
K	0.018	*	0.038	*	0.034	*	0.039	*	0.016	*	0.036	*	0.034	*	0.095	*
BA	0.000	2.064	0.000	2.150	0.000	2.160	0.000	2.162	0.000	2.064	0.000	2.189	0.000	2.164	0.000	2.088
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

97 346 AM35B1
98 348 AM35B1
99 349 AM35B1
100 353 AM35B1
101 357 AM35B1
102 358 AM35B1
103 359 AM35B1
104 361 AM35B1

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-5-HOST

	105	106	107	108	109	110	111	112
SIO2	53.22	51.71	52.52	53.27	51.20	52.12	48.52	49.64
A2O3	5.79	8.36	7.18	6.72	8.52	7.85	11.77	10.82
TIO2	0.13	0.16	0.17	0.13	0.17	0.12	0.15	0.12
FEO	8.17	8.97	8.55	8.28	8.91	8.69	9.93	9.72
MNO	0.24	0.25	0.23	0.24	0.26	0.25	0.24	0.24
MGO	18.26	16.27	17.10	17.36	16.50	16.71	14.56	15.08
CAO	12.45	12.41	12.40	12.49	12.29	12.56	12.45	12.38
NA2O	0.57	0.67	0.69	0.60	0.83	0.75	1.05	0.95
K2O	0.09	0.14	0.18	0.10	0.16	0.14	0.25	0.22
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.15	2.14	2.15	2.16	2.14	2.15	2.12	2.13
SUM	101.07	101.08	101.17	101.35	100.98	101.34	101.04	101.30
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	101.07	101.08	101.17	101.35	100.98	101.34	101.04	101.30

SI	7.415	*	7.233	*	7.326	*	7.396	*	7.178	*	7.267	*	6.855	*	6.973	*
AL	0.585	8.000	0.767	8.000	0.674	8.000	0.604	8.000	0.822	8.000	0.733	8.000	1.145	8.000	1.027	8.000
AL	0.366	*	0.610	*	0.506	*	0.496	*	0.585	*	0.557	*	0.814	*	0.764	*
TI	0.014	*	0.017	*	0.018	*	0.014	*	0.018	*	0.013	*	0.016	*	0.013	*
FE	0.952	*	1.049	*	0.997	*	0.961	*	1.045	*	1.013	*	1.173	*	1.142	*
MN	0.028	*	0.030	*	0.027	*	0.028	*	0.031	*	0.030	*	0.029	*	0.029	*
MG	3.792	5.152	3.392	5.098	3.555	5.103	3.593	5.092	3.448	5.127	3.473	5.085	3.066	5.098	3.158	5.105
CA	1.859	*	1.860	*	1.853	*	1.858	*	1.846	*	1.876	*	1.884	*	1.863	*
NA	0.154	*	0.182	*	0.187	*	0.162	*	0.226	*	0.203	*	0.288	*	0.259	*
K	0.016	*	0.025	*	0.032	*	0.018	*	0.029	*	0.025	*	0.045	*	0.039	*
BA	0.000	2.029	0.000	2.066	0.000	2.072	0.000	2.037	0.000	2.100	0.000	2.104	0.000	2.217	0.000	2.161
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

105 362 AM35B1
106 366 AM35B1
107 367 AM35B1
108 371 AM35B1
109 372 AM35B1
110 381 AM35B1
111 384 AM35B1
112 385 AM35B1

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-5-HOST

	113	114	115	116	117	118	119	120
SIO2	47.84	47.47	47.65	47.21	47.67	46.81	49.11	47.51
A2O3	12.60	13.06	13.38	13.79	13.22	13.95	11.30	13.03
TIO2	0.15	0.14	0.14	0.14	0.13	0.13	0.12	0.12
FEO	10.42	10.25	10.44	10.55	10.37	10.53	9.86	10.31
MNO	0.25	0.24	0.21	0.24	0.25	0.26	0.26	0.24
MGO	14.19	13.82	13.76	13.43	13.71	13.53	14.86	14.01
CAO	12.40	11.94	12.41	12.42	12.28	12.47	12.35	12.15
NA2O	1.17	1.00	1.04	1.15	1.10	1.17	1.04	1.26
K2O	0.29	0.31	0.28	0.32	0.31	0.32	0.22	0.31
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.12	2.10	2.12	2.12	2.12	2.11	2.13	2.11
SUM	101.43	100.33	101.43	101.37	101.16	101.28	101.25	101.05
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	101.43	100.33	101.43	101.37	101.16	101.28	101.25	101.05

SI	6.756	*	6.757	*	6.721	*	6.675	*	6.741	*	6.631	*	6.914	*	6.729	*
AL	1.244	8.000	1.243	8.000	1.279	8.000	1.325	8.000	1.259	8.000	1.369	8.000	1.086	8.000	1.271	8.000
AL	0.853	*	0.948	*	0.945	*	0.972	*	0.944	*	0.959	*	0.788	*	0.904	*
TI	0.016	*	0.015	*	0.015	*	0.015	*	0.014	*	0.014	*	0.013	*	0.013	*
FE	1.231	*	1.220	*	1.231	*	1.247	*	1.226	*	1.247	*	1.161	*	1.221	*
MN	0.030	*	0.029	*	0.025	*	0.029	*	0.030	*	0.031	*	0.031	*	0.029	*
MG	2.987	5.116	2.932	5.144	2.893	5.109	2.830	5.093	2.890	5.103	2.857	5.108	3.118	5.111	2.958	5.125
CA	1.876	*	1.821	*	1.875	*	1.881	*	1.860	*	1.893	*	1.863	*	1.844	*
NA	0.320	*	0.276	*	0.284	*	0.315	*	0.302	*	0.321	*	0.284	*	0.346	*
K	0.052	*	0.056	*	0.050	*	0.058	*	0.056	*	0.058	*	0.040	*	0.056	*
BA	0.000	2.249	0.000	2.153	0.000	2.210	0.000	2.254	0.000	2.218	0.000	2.272	0.000	2.186	0.000	2.246
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

113 389 AM35B1
114 404 AM35B1
115 409 AM35B1
116 416 AM35B1
117 420 AM35B1
118 422 AM35B1
119 424 AM35B1
120 429 AM35B1

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-5-HOST

	121	122	123
SIO2	44.93	47.26	48.27
A2O3	15.77	13.91	12.83
TIO2	0.14	0.12	0.12
FEO	10.58	10.62	10.68
MNO	0.25	0.27	0.25
MGO	13.94	13.27	14.28
CAO	11.86	12.13	11.10
NA2O	1.45	1.38	1.02
K2O	0.37	0.39	0.42
BAO	0.00	0.00	0.00
CL	0.00	0.00	0.00
F	0.00	0.00	0.00
H2O	2.11	2.12	2.12
SUM	101.40	101.47	101.09
-O= F+CL	0.00	0.00	0.00
SUM	101.40	101.47	101.09

SI	6.373	*	6.678	*	6.812	*
AL	1.627	8.000	1.322	8.000	1.188	8.000
AL	1.009	*	0.994	*	0.945	*
TI	0.015	*	0.013	*	0.013	*
FE	1.255	*	1.255	*	1.260	*
MN	0.030	*	0.032	*	0.030	*
MG	2.947	5.257	2.795	5.089	3.004	5.252
CA	1.803	*	1.836	*	1.678	*
NA	0.399	*	0.378	*	0.279	*
K	0.067	*	0.070	*	0.076	*
BA	0.000	2.268	0.000	2.285	0.000	2.033
CL	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*

121 436 AM35B1
122 440 AM35B1
123 441 AM35B1

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-5-MARG

	1	2	3	4	5	6	7	8
SIO2	47.23	46.38	46.69	46.15	46.41	45.31	44.80	44.82
A2O3	14.25	12.84	13.15	13.87	13.61	14.88	14.67	14.87
TIO2	0.14	0.14	0.14	0.15	0.16	0.14	0.13	0.20
FEO	10.24	10.54	10.48	10.72	10.66	11.07	10.95	10.58
MNO	0.26	0.25	0.25	0.26	0.30	0.27	0.26	0.20
MGO	12.55	12.80	13.15	12.99	12.73	12.17	12.33	13.87
CAO	10.61	12.04	12.08	11.00	11.40	12.03	11.91	9.64
NA2O	1.39	1.34	1.36	1.47	1.50	1.52	1.51	0.84
K2O	0.52	0.36	0.28	0.45	0.42	0.38	0.38	1.58
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.09	2.08	2.08	2.07	2.07	2.08	2.06	2.06
SUM	99.28	98.75	99.66	99.13	99.26	99.85	99.00	98.66
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.28	98.75	99.66	99.13	99.26	99.85	99.00	98.66

SI	6.772	*	6.743	*	6.718	*	6.672	*	6.705	*	6.539	*	6.523	*	6.521	*
AL	1.228	8.000	1.257	8.000	1.282	8.000	1.328	8.000	1.295	8.000	1.461	8.000	1.477	8.000	1.479	8.000
AL	1.180	*	0.942	*	0.947	*	1.035	*	1.022	*	1.069	*	1.040	*	1.071	*
TI	0.015	*	0.015	*	0.015	*	0.016	*	0.017	*	0.015	*	0.014	*	0.022	*
FE	1.228	*	1.281	*	1.261	*	1.296	*	1.288	*	1.336	*	1.333	*	1.287	*
MN	0.032	*	0.031	*	0.030	*	0.032	*	0.037	*	0.033	*	0.032	*	0.025	*
MG	2.682	5.137	2.774	5.043	2.820	5.074	2.799	5.178	2.741	5.105	2.618	5.072	2.676	5.096	3.008	5.413
CA	1.630	*	1.875	*	1.862	*	1.704	*	1.765	*	1.860	*	1.858	*	1.503	*
NA	0.386	*	0.378	*	0.379	*	0.412	*	0.420	*	0.425	*	0.426	*	0.237	*
K	0.095	*	0.067	*	0.051	*	0.083	*	0.077	*	0.070	*	0.071	*	0.293	*
BA	0.000	2.112	0.000	2.320	0.000	2.293	0.000	2.199	0.000	2.262	0.000	2.355	0.000	2.355	0.000	2.033
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

1 186 35B1AM
2 189 35B1AM
3 190 35B1AM
4 191 35B1AM
5 192 35B1AM
6 193 35B1AM
7 194 35B1AM
8 195 35B1AM

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-5-MARG

	9	10	11	12	13	14	15	16
SIO2	47.49	45.28	46.02	48.24	49.46	46.94	46.45	47.12
A2O3	12.21	14.23	13.57	12.88	10.97	12.59	13.62	12.23
TIO2	0.15	0.15	0.15	0.14	0.13	0.15	0.15	0.14
FEO	10.52	10.76	10.53	10.27	9.23	10.44	10.62	10.51
MNO	0.23	0.23	0.28	0.27	0.27	0.28	0.28	0.25
MGO	13.37	12.35	12.77	12.54	13.68	13.28	12.81	13.60
CAO	12.47	12.29	11.87	10.99	11.31	11.82	11.74	11.87
NA2O	1.08	1.31	1.38	1.33	1.18	1.26	1.45	1.40
K2O	0.29	0.37	0.35	0.46	0.60	0.31	0.28	0.26
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.09	2.06	2.07	2.09	2.09	2.07	2.08	2.08
SUM	99.90	99.03	98.99	99.21	98.92	99.14	99.48	99.46
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.90	99.03	98.99	99.21	98.92	99.14	99.48	99.46

SI	6.814	*	6.582	*	6.673	*	6.920	*	7.088	*	6.781	*	6.695	*	6.791	*
AL	1.186	8.000	1.418	8.000	1.327	8.000	1.080	8.000	0.912	8.000	1.219	8.000	1.305	8.000	1.209	8.000
AL	0.878	*	1.020	*	0.992	*	1.097	*	0.940	*	0.924	*	1.008	*	0.868	*
TI	0.016	*	0.016	*	0.016	*	0.015	*	0.014	*	0.016	*	0.016	*	0.015	*
FE	1.262	*	1.308	*	1.277	*	1.232	*	1.106	*	1.261	*	1.280	*	1.267	*
MN	0.028	*	0.028	*	0.034	*	0.033	*	0.033	*	0.034	*	0.034	*	0.031	*
MG	2.859	5.043	2.676	5.048	2.760	5.079	2.681	5.059	2.922	5.015	2.859	5.095	2.752	5.090	2.921	5.102
CA	1.917	*	1.914	*	1.844	*	1.689	*	1.737	*	1.829	*	1.813	*	1.833	*
NA	0.300	*	0.369	*	0.388	*	0.370	*	0.328	*	0.353	*	0.405	*	0.391	*
K	0.053	*	0.069	*	0.065	*	0.084	*	0.110	*	0.057	*	0.051	*	0.048	*
BA	0.000	2.270	0.000	2.352	0.000	2.297	0.000	2.143	0.000	2.174	0.000	2.240	0.000	2.270	0.000	2.272
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

9 196 35B1AM
10 197 35B1AM
11 203 35B1AM
12 205 35B1AM
13 207 35B1AM
14 208 35B1AM
15 210 35B1AM
16 211 35B1AM

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-5-MARG

	17	18	19	20	21	22	23	24
SIO2	47.91	46.93	46.05	46.10	49.92	53.18	54.13	50.87
A2O3	13.22	13.41	13.91	13.81	9.84	8.21	5.61	6.64
TIO2	0.13	0.16	0.15	0.15	0.14	0.10	0.14	0.09
FEO	10.27	10.64	10.67	10.91	9.52	8.80	8.02	9.29
MNO	0.25	0.28	0.26	0.24	0.26	0.25	0.23	0.24
MGO	12.57	13.06	12.57	12.70	15.71	16.28	18.42	18.60
CAO	11.62	11.95	12.08	12.37	12.34	12.22	12.50	11.32
NA2O	1.35	1.45	1.33	1.36	0.94	0.80	0.53	0.36
K2O	0.32	0.33	0.33	0.37	0.18	0.14	0.10	0.07
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.10	2.09	2.07	2.08	2.13	2.17	2.17	2.11
SUM	99.74	100.30	99.42	100.09	100.98	102.15	101.85	99.59
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.74	100.30	99.42	100.09	100.98	102.15	101.85	99.59

SI	6.849	*	6.711	*	6.651	*	6.631	*	7.031	*	7.332	*	7.468	*	7.230	*
AL	1.151	8.000	1.289	8.000	1.349	8.000	1.369	8.000	0.969	8.000	0.668	8.000	0.532	8.000	0.770	8.000
AL	1.076	*	0.971	*	1.019	*	0.971	*	0.664	*	0.666	*	0.380	*	0.342	*
TI	0.014	*	0.017	*	0.016	*	0.016	*	0.015	*	0.010	*	0.015	*	0.010	*
FE	1.228	*	1.272	*	1.289	*	1.312	*	1.121	*	1.015	*	0.925	*	1.104	*
MN	0.030	*	0.034	*	0.032	*	0.029	*	0.031	*	0.029	*	0.027	*	0.029	*
MG	2.678	5.026	2.784	5.078	2.706	5.062	2.723	5.052	3.298	5.130	3.346	5.066	3.788	5.134	3.940	5.424
CA	1.780	*	1.831	*	1.869	*	1.906	*	1.862	*	1.805	*	1.848	*	1.724	*
NA	0.374	*	0.402	*	0.372	*	0.379	*	0.257	*	0.214	*	0.142	*	0.099	*
K	0.058	*	0.060	*	0.061	*	0.068	*	0.032	*	0.025	*	0.018	*	0.013	*
BA	0.000	2.212	0.000	2.293	0.000	2.303	0.000	2.353	0.000	2.151	0.000	2.044	0.000	2.007	0.000	1.836
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

17 213 35B1AM
18 214 35B1AM
19 215 35B1AM
20 216 35B1AM
21 339 AM35B1
22 340 AM35B1
23 341 AM35B1
24 342 AM35B1

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-5-MARG

	25	26	27	28
SIO2	50.02	50.85	88.82	51.40
A2O3	10.76	9.30	1.44	9.42
TIO2	0.14	0.13	0.04	0.11
FEO	9.85	9.15	2.08	9.21
MNO	0.26	0.22	0.07	0.22
MGO	14.90	16.22	3.18	16.04
CAO	12.40	12.52	2.66	12.38
NA2O	0.85	0.89	0.13	0.87
K2O	0.22	0.16	0.04	0.17
BAO	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00
H2O	2.14	2.15	2.47	2.16
SUM	101.54	101.59	100.93	101.98
-O= F+CL	0.00	0.00	0.00	0.00
SUM	101.54	101.59	100.93	101.98

SI	7.007	*	7.100	*	10.764	*	7.137	*
AL	0.993	8.000	0.900	8.000	0.000	10.764	0.863	8.000
AL	0.783	*	0.630	*	0.206	*	0.679	*
TI	0.015	*	0.014	*	0.004	*	0.011	*
FE	1.154	*	1.068	*	0.211	*	1.070	*
MN	0.031	*	0.026	*	0.007	*	0.026	*
MG	3.111	5.093	3.375	5.113	0.574	1.002	3.320	5.106
CA	1.861	*	1.873	*	0.345	*	1.842	*
NA	0.231	*	0.241	*	0.031	*	0.234	*
K	0.039	*	0.028	*	0.006	*	0.030	*
BA	0.000	2.131	0.000	2.142	0.000	0.382	0.000	2.106
CL	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*

25 343 AM35B1
26 344 AM35B1
27 345 AM35B1
28 350 AM35B1

AMPHIBOLE HOST GRAIN P-6

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-6-HOST

	1	2	3	4
SIO2	49.82	49.24	50.42	50.53
A2O3	8.98	9.67	8.11	7.58
TIO2	0.13	0.13	0.16	0.15
FEO	9.28	9.67	9.04	8.89
MNO	0.25	0.23	0.22	0.20
MGO	14.95	14.55	15.24	15.72
CAO	12.41	12.49	12.43	12.53
NA2O	0.88	0.91	0.83	0.78
K2O	0.19	0.20	0.22	0.14
BAO	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00
H2O	2.09	2.09	2.09	2.08
SUM	98.98	99.18	98.76	98.60
-O= F+CL	0.00	0.00	0.00	0.00
SUM	98.98	99.18	98.76	98.60

SI	7.151	*	7.072	*	7.241	*	7.264	*
AL	0.849	8.000	0.928	8.000	0.759	8.000	0.736	8.000
AL	0.670	*	0.709	*	0.614	*	0.548	*
TI	0.014	*	0.014	*	0.017	*	0.016	*
FE	1.114	*	1.162	*	1.086	*	1.069	*
MN	0.030	*	0.028	*	0.027	*	0.024	*
MG	3.198	5.027	3.115	5.027	3.262	5.006	3.368	5.026
CA	1.908	*	1.922	*	1.913	*	1.930	*
NA	0.245	*	0.253	*	0.231	*	0.217	*
K	0.035	*	0.037	*	0.040	*	0.026	*
BA	0.000	2.188	0.000	2.212	0.000	2.184	0.000	2.173
CL	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*

1 240 35B2AM
2 241 35B2AM
3 242 35B2AM
4 243 35B2AM

AMPHIBOLE HOST GRAIN P-7

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) P-7-HOST

	1	2	3	4
SIO2	47.32	46.79	48.16	47.28
A2O3	12.41	12.81	12.42	12.28
TIO2	0.13	0.13	0.14	0.13
FEO	10.36	10.48	10.03	10.33
MNO	0.24	0.24	0.21	0.24
MGO	13.60	13.23	13.27	13.58
CAO	12.37	12.49	12.26	12.66
NA2O	1.14	1.19	1.10	1.12
K2O	0.28	0.29	0.26	0.27
BAO	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00
H2O	2.09	2.08	2.10	2.09
SUM	99.94	99.73	99.95	99.98
-O= F+CL	0.00	0.00	0.00	0.00
SUM	99.94	99.73	99.95	99.98

SI	6.783	*	6.733	*	6.871	*	6.781	*
AL	1.217	8.000	1.267	8.000	1.129	8.000	1.219	8.000
AL	0.879	*	0.905	*	0.959	*	0.856	*
TI	0.014	*	0.014	*	0.015	*	0.014	*
FE	1.242	*	1.261	*	1.197	*	1.239	*
MN	0.029	*	0.029	*	0.025	*	0.029	*
MG	2.906	5.070	2.838	5.047	2.822	5.019	2.903	5.041
CA	1.900	*	1.926	*	1.874	*	1.945	*
NA	0.317	*	0.332	*	0.304	*	0.311	*
K	0.051	*	0.053	*	0.047	*	0.049	*
BA	0.000	2.268	0.000	2.311	0.000	2.226	0.000	2.306
CL	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*

1 253 35B3AM
2 254 35B3AM
3 255 35B3AM
4 256 35B3AM

AMPHIBOLE MATRIX GRAINS

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) MATRIX

	1	2	3	4	5	6	7	8
SIO2	45.54	46.56	45.92	45.69	46.64	46.15	49.88	45.33
A2O3	14.55	13.36	13.95	14.27	12.77	15.00	11.35	14.23
TIO2	0.13	0.14	0.13	0.14	0.15	0.16	0.16	0.12
FEO	10.99	10.40	10.98	10.62	10.59	10.44	10.16	10.98
MNO	0.27	0.27	0.25	0.23	0.26	0.27	0.26	0.24
MGO	12.52	13.18	12.72	12.55	13.36	12.73	13.41	12.90
CAO	12.02	11.99	12.13	11.73	11.91	11.83	11.31	11.42
NA2O	1.42	1.28	1.47	1.33	1.40	1.41	1.25	1.36
K2O	0.38	0.27	0.37	0.33	0.28	0.29	0.25	0.48
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.08	2.08	2.08	2.07	2.08	2.10	2.11	2.08
SUM	99.90	99.53	100.00	98.96	99.44	100.38	100.14	99.12
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.90	99.53	100.00	98.96	99.44	100.38	100.14	99.12

SI	6.564	*	6.702	*	6.613	*	6.623	*	6.731	*	6.584	*	7.070	*	6.579	*
AL	1.436	8.000	1.298	8.000	1.387	8.000	1.377	8.000	1.269	8.000	1.416	8.000	0.930	8.000	1.421	8.000
AL	1.035	*	0.968	*	0.980	*	1.060	*	0.903	*	1.105	*	0.966	*	1.013	*
TI	0.014	*	0.015	*	0.014	*	0.015	*	0.016	*	0.017	*	0.017	*	0.013	*
FE	1.325	*	1.252	*	1.322	*	1.287	*	1.278	*	1.246	*	1.204	*	1.333	*
MN	0.033	*	0.033	*	0.030	*	0.028	*	0.032	*	0.033	*	0.031	*	0.030	*
MG	2.690	5.096	2.828	5.096	2.730	5.077	2.711	5.103	2.874	5.103	2.707	5.107	2.833	5.052	2.791	5.178
CA	1.856	*	1.849	*	1.872	*	1.822	*	1.842	*	1.808	*	1.718	*	1.776	*
NA	0.397	*	0.357	*	0.410	*	0.374	*	0.392	*	0.390	*	0.344	*	0.383	*
K	0.070	*	0.050	*	0.068	*	0.061	*	0.052	*	0.053	*	0.045	*	0.089	*
BA	0.000	2.323	0.000	2.256	0.000	2.350	0.000	2.257	0.000	2.285	0.000	2.251	0.000	2.106	0.000	2.247
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

1 217 35B1AM
2 218 35B1AM
3 219 35B1AM
4 224 35B1AM
5 226 35B1AM
6 227 35B1AM
7 228 35B1AM
8 230 35B1AM

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) MATRIX

	9	10	11	12	13	14	15	16
SIO2	46.97	45.76	46.55	46.26	46.02	47.32	45.91	45.56
A2O3	12.55	13.76	13.70	14.46	13.20	12.20	14.03	14.33
TIO2	0.14	0.14	0.15	0.15	0.15	0.12	0.12	0.11
FEO	10.50	10.53	10.81	10.49	10.71	10.61	11.10	11.16
MNO	0.24	0.29	0.26	0.26	0.26	0.23	0.27	0.26
MGO	13.36	12.78	12.78	12.71	12.92	13.49	12.77	11.70
CAO	12.22	11.55	11.87	11.45	11.88	12.32	12.06	12.08
NA2O	1.31	1.47	1.35	1.44	1.54	1.13	1.50	1.43
K2O	0.30	0.29	0.34	0.27	0.33	0.33	0.37	0.40
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.08	2.06	2.09	2.09	2.06	2.08	2.08	2.06
SUM	99.67	98.63	99.90	99.57	99.07	99.83	100.21	99.09
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.67	98.63	99.90	99.57	99.07	99.83	100.21	99.09

SI	6.761	*	6.655	*	6.687	*	6.646	*	6.679	*	6.799	*	6.601	*	6.624	*
AL	1.239	8.000	1.345	8.000	1.313	8.000	1.354	8.000	1.321	8.000	1.201	8.000	1.399	8.000	1.376	8.000
AL	0.889	*	1.013	*	1.006	*	1.094	*	0.937	*	0.865	*	0.978	*	1.079	*
TI	0.015	*	0.015	*	0.016	*	0.016	*	0.016	*	0.013	*	0.013	*	0.012	*
FE	1.264	*	1.281	*	1.299	*	1.260	*	1.300	*	1.275	*	1.335	*	1.357	*
MN	0.029	*	0.036	*	0.032	*	0.032	*	0.032	*	0.028	*	0.033	*	0.032	*
MG	2.868	5.064	2.770	5.115	2.737	5.090	2.722	5.124	2.795	5.080	2.889	5.070	2.737	5.095	2.535	5.015
CA	1.885	*	1.800	*	1.827	*	1.763	*	1.847	*	1.897	*	1.858	*	1.882	*
NA	0.368	*	0.414	*	0.376	*	0.401	*	0.433	*	0.315	*	0.418	*	0.403	*
K	0.055	*	0.054	*	0.062	*	0.049	*	0.061	*	0.060	*	0.068	*	0.074	*
BA	0.000	2.305	0.000	2.268	0.000	2.265	0.000	2.213	0.000	2.342	0.000	2.272	0.000	2.344	0.000	2.359
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

9 231 35B1AM
10 246 35B2AM
11 252 35B AM
12 257 35B AM
13 260 35B AM
14 261 35B AM
15 262 35B AM
16 263 35B AM

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) MATRIX

	17	18	19	20	21	22	23	24
SIO2	45.92	46.04	47.29	45.28	45.66	45.71	46.14	47.03
A2O3	14.51	12.95	12.49	15.04	14.35	14.29	14.36	13.68
TIO2	0.13	0.12	0.14	0.14	0.16	0.16	0.12	0.15
FEO	10.41	10.50	10.52	9.90	10.52	10.45	10.30	10.40
MNO	0.26	0.23	0.23	0.24	0.25	0.32	0.25	0.28
MGO	12.21	12.95	13.51	12.60	13.46	13.44	13.32	13.99
CAO	11.86	12.29	12.43	11.20	11.53	11.32	12.26	11.58
NA2O	1.62	1.29	1.18	1.38	1.54	1.54	1.20	1.43
K2O	0.35	0.34	0.30	0.66	0.34	0.29	0.34	0.31
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.08	2.06	2.09	2.06	2.08	2.08	2.10	2.11
SUM	99.34	98.77	100.18	98.50	99.89	99.60	100.39	100.96
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.34	98.77	100.18	98.50	99.89	99.60	100.39	100.96

SI	6.629	*	6.699	*	6.770	*	6.575	*	6.561	*	6.580	*	6.590	*	6.667	*
AL	1.371	8.000	1.301	8.000	1.230	8.000	1.425	8.000	1.439	8.000	1.420	8.000	1.410	8.000	1.333	8.000
AL	1.098	*	0.919	*	0.877	*	1.149	*	0.991	*	1.004	*	1.006	*	0.952	*
TI	0.014	*	0.013	*	0.015	*	0.015	*	0.017	*	0.017	*	0.013	*	0.016	*
FE	1.257	*	1.278	*	1.260	*	1.202	*	1.264	*	1.258	*	1.230	*	1.233	*
MN	0.032	*	0.028	*	0.028	*	0.030	*	0.030	*	0.039	*	0.030	*	0.034	*
MG	2.627	5.028	2.809	5.047	2.883	5.062	2.727	5.123	2.883	5.185	2.884	5.202	2.835	5.115	2.956	5.190
CA	1.834	*	1.916	*	1.907	*	1.743	*	1.775	*	1.746	*	1.876	*	1.759	*
NA	0.453	*	0.364	*	0.328	*	0.389	*	0.429	*	0.430	*	0.332	*	0.393	*
K	0.064	*	0.063	*	0.055	*	0.122	*	0.062	*	0.053	*	0.062	*	0.056	*
BA	0.000	2.352	0.000	2.343	0.000	2.289	0.000	2.253	0.000	2.266	0.000	2.229	0.000	2.270	0.000	2.208
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

17 264 35B AM
18 265 35B AM
19 266 35B AM
20 274 35C1AM
21 59 AM35BA
22 61 AM35B1
23 64 AM35B1
24 68 AM35B1

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) MATRIX

	25	26	27	28	29	30	31	32
SIO2	46.84	46.94	46.64	46.91	46.29	46.02	45.99	50.71
A2O3	14.25	13.99	13.79	13.87	13.23	14.64	14.65	8.94
TIO2	0.13	0.15	0.14	0.14	0.13	0.13	0.12	0.11
FEO	10.29	10.51	10.51	10.51	10.57	10.73	10.74	9.28
MNO	0.30	0.28	0.32	0.29	0.30	0.28	0.26	0.31
MGO	13.81	13.57	13.56	13.22	13.45	13.24	12.85	16.10
CAO	11.55	11.81	11.50	11.74	11.85	11.88	12.18	12.03
NA2O	1.47	1.49	1.50	1.46	1.42	1.41	1.44	0.93
K2O	0.27	0.28	0.26	0.26	0.34	0.37	0.39	0.18
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.12	2.11	2.10	2.10	2.08	2.10	2.10	2.13
SUM	101.03	101.13	100.32	100.50	99.66	100.80	100.72	100.72
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	101.03	101.13	100.32	100.50	99.66	100.80	100.72	100.72

SI	6.630	*	6.649	*	6.659	*	6.683	*	6.671	*	6.558	*	6.565	*	7.141	*
AL	1.370	8.000	1.351	8.000	1.341	8.000	1.317	8.000	1.329	8.000	1.442	8.000	1.435	8.000	0.859	8.000
AL	1.007	*	0.984	*	0.979	*	1.011	*	0.918	*	1.016	*	1.030	*	0.625	*
TI	0.014	*	0.016	*	0.015	*	0.015	*	0.014	*	0.014	*	0.013	*	0.012	*
FE	1.218	*	1.245	*	1.255	*	1.252	*	1.274	*	1.279	*	1.282	*	1.093	*
MN	0.036	*	0.034	*	0.039	*	0.035	*	0.037	*	0.034	*	0.031	*	0.037	*
MG	2.914	5.189	2.865	5.144	2.886	5.174	2.807	5.120	2.889	5.131	2.812	5.155	2.734	5.091	3.380	5.146
CA	1.752	*	1.792	*	1.759	*	1.792	*	1.830	*	1.814	*	1.863	*	1.815	*
NA	0.403	*	0.409	*	0.415	*	0.403	*	0.397	*	0.390	*	0.399	*	0.254	*
K	0.049	*	0.051	*	0.047	*	0.047	*	0.062	*	0.067	*	0.071	*	0.032	*
BA	0.000	2.204	0.000	2.252	0.000	2.222	0.000	2.242	0.000	2.289	0.000	2.271	0.000	2.333	0.000	2.101
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

25 67 AM35B1
26 68 AM35B1
27 69 AM35B1
28 70 AM35B1
29 71 AM35B1
30 72 AM35B1
31 73 AM35B1
32 74 AM35B1

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) MATRIX

	33	34	35	36	37	38	39	40
SIO2	45.65	46.61	46.37	47.38	47.28	46.39	46.21	47.95
A2O3	14.39	13.70	14.09	13.56	13.29	13.40	14.60	13.15
TIO2	0.15	0.17	0.14	0.13	0.15	0.15	0.15	0.13
FEO	10.58	10.43	10.42	10.30	10.22	10.41	10.44	9.97
MNO	0.31	0.27	0.27	0.24	0.28	0.27	0.28	0.23
MGO	13.44	13.90	13.61	13.93	14.00	13.59	13.39	13.75
CAO	11.65	11.53	11.42	11.47	12.03	11.69	11.54	11.71
NA2O	1.52	1.44	1.50	1.43	1.34	1.39	1.52	1.37
K2O	0.36	0.33	0.31	0.25	0.27	0.29	0.33	0.61
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.09	2.10	2.10	2.11	2.11	2.08	2.10	2.12
SUM	100.14	100.48	100.23	100.80	100.97	99.66	100.56	100.99
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	100.14	100.48	100.23	100.80	100.97	99.66	100.56	100.99

SI	6.550	*	6.645	*	6.625	*	6.712	*	6.700	*	6.671	*	6.584	*	6.781	*
AL	1.450	8.000	1.355	8.000	1.375	8.000	1.288	8.000	1.300	8.000	1.329	8.000	1.416	8.000	1.219	8.000
AL	0.983	*	0.947	*	0.997	*	0.976	*	0.920	*	0.941	*	1.035	*	0.972	*
TI	0.016	*	0.018	*	0.015	*	0.014	*	0.016	*	0.016	*	0.016	*	0.014	*
FE	1.270	*	1.244	*	1.245	*	1.220	*	1.211	*	1.252	*	1.244	*	1.179	*
MN	0.038	*	0.033	*	0.033	*	0.029	*	0.034	*	0.033	*	0.034	*	0.028	*
MG	2.874	5.181	2.954	5.195	2.898	5.188	2.942	5.181	2.957	5.138	2.913	5.155	2.843	5.172	2.898	5.091
CA	1.791	*	1.761	*	1.748	*	1.741	*	1.827	*	1.801	*	1.762	*	1.774	*
NA	0.423	*	0.398	*	0.416	*	0.393	*	0.368	*	0.388	*	0.420	*	0.376	*
K	0.066	*	0.060	*	0.056	*	0.045	*	0.049	*	0.053	*	0.060	*	0.110	*
BA	0.000	2.280	0.000	2.219	0.000	2.220	0.000	2.179	0.000	2.244	0.000	2.242	0.000	2.241	0.000	2.260
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

33 75 AM35B1
34 76 AM35B1
35 78 AM35B1
36 181 AM35B1
37 182 AM35B1
38 183 AM35B1
39 184 AM35B1
40 185 AM35B1

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) MATRIX

	41	42	43	44	45	46	47	48
SIO2	47.88	48.54	45.30	45.75	48.96	46.60	46.26	48.03
A2O3	12.88	10.91	15.41	15.51	10.48	14.02	14.86	12.62
TIO2	0.13	0.13	0.15	0.12	0.14	0.13	0.16	0.12
FEO	9.64	9.32	10.27	10.47	9.42	10.44	10.43	10.08
MNO	0.24	0.22	0.30	0.26	0.27	0.26	0.30	0.27
MGO	14.24	15.17	13.20	12.74	15.31	13.37	13.29	14.31
CAO	12.10	11.98	11.28	11.75	12.02	12.07	11.70	12.23
NA2O	1.11	1.04	1.58	1.49	1.07	1.24	1.52	1.25
K2O	0.27	0.21	0.29	0.39	0.21	0.34	0.29	0.27
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.12	2.12	2.09	2.10	2.11	2.10	2.11	2.12
SUM	100.61	100.64	99.87	100.58	99.99	100.57	100.92	101.30
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	100.61	100.64	99.87	100.58	99.99	100.57	100.92	101.30

SI	6.780	*	6.984	*	6.496	*	6.521	*	6.967	*	6.640	*	6.567	*	6.776	*
AL	1.220	8.000	1.016	8.000	1.504	8.000	1.479	8.000	1.033	8.000	1.360	8.000	1.433	8.000	1.224	8.000
AL	0.929	*	0.797	*	1.100	*	1.127	*	0.724	*	0.994	*	1.053	*	0.874	*
TI	0.014	*	0.014	*	0.016	*	0.013	*	0.015	*	0.014	*	0.017	*	0.013	*
FE	1.142	*	1.099	*	1.232	*	1.248	*	1.121	*	1.244	*	1.238	*	1.189	*
MN	0.029	*	0.026	*	0.036	*	0.031	*	0.033	*	0.031	*	0.036	*	0.032	*
MG	3.005	5.118	3.188	5.124	2.821	5.205	2.707	5.126	3.247	5.140	2.840	5.123	2.812	5.157	3.009	5.117
CA	1.836	*	1.810	*	1.733	*	1.795	*	1.833	*	1.843	*	1.780	*	1.849	*
NA	0.305	*	0.284	*	0.439	*	0.412	*	0.295	*	0.343	*	0.418	*	0.342	*
K	0.049	*	0.038	*	0.053	*	0.071	*	0.038	*	0.062	*	0.053	*	0.049	*
BA	0.000	2.189	0.000	2.132	0.000	2.225	0.000	2.277	0.000	2.166	0.000	2.247	0.000	2.250	0.000	2.239
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

41 187 AM35B1
42 188 AM35B1
43 189 AM35B1
44 191 AM35B1
45 192 AM35B1
46 196 AM35B1
47 197 AM35B1
48 198 AM35B1

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) MATRIX

	49	50	51	52	53	54	55	56
SIO2	46.06	46.74	46.18	46.24	47.82	46.61	48.96	43.22
A2O3	15.64	13.51	14.89	13.69	13.11	12.81	11.21	16.67
TIO2	0.11	0.15	0.10	0.14	0.14	0.13	0.16	0.51
FEO	9.29	10.48	10.68	10.49	9.76	10.31	9.95	15.11
MNO	0.24	0.27	0.24	0.30	0.24	0.24	0.28	0.36
MGO	13.74	13.80	12.99	13.49	14.35	13.87	15.14	9.57
CAO	11.61	11.40	12.13	11.42	11.89	11.77	11.78	11.01
NA2O	0.94	1.43	1.44	1.48	1.11	1.27	1.24	1.65
K2O	0.24	0.26	0.39	0.27	0.26	0.28	0.23	0.48
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.11	2.10	2.11	2.08	2.12	2.08	2.12	2.05
SUM	99.98	100.14	101.15	99.60	100.80	99.37	101.07	100.63
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.98	100.14	101.15	99.60	100.80	99.37	101.07	100.63

SI	6.544	*	6.680	*	6.557	*	6.652	*	6.757	*	6.718	*	6.905	*	6.306	*
AL	1.456	8.000	1.320	8.000	1.443	8.000	1.348	8.000	1.243	8.000	1.282	8.000	1.095	8.000	1.692	8.000
AL	1.162	*	0.956	*	1.049	*	0.973	*	0.940	*	0.893	*	0.768	*	1.175	*
TI	0.012	*	0.016	*	0.011	*	0.015	*	0.015	*	0.014	*	0.017	*	0.056	*
FE	1.104	*	1.253	*	1.268	*	1.262	*	1.153	*	1.243	*	1.174	*	1.844	*
MN	0.029	*	0.033	*	0.029	*	0.037	*	0.029	*	0.029	*	0.033	*	0.045	*
MG	2.909	5.216	2.940	5.197	2.749	5.106	2.893	5.180	3.022	5.160	2.980	5.159	3.183	5.175	2.082	5.201
CA	1.767	*	1.746	*	1.845	*	1.760	*	1.800	*	1.817	*	1.780	*	1.722	*
NA	0.259	*	0.396	*	0.396	*	0.413	*	0.304	*	0.355	*	0.339	*	0.467	*
K	0.043	*	0.047	*	0.071	*	0.050	*	0.047	*	0.051	*	0.041	*	0.089	*
BA	0.000	2.070	0.000	2.189	0.000	2.312	0.000	2.223	0.000	2.151	0.000	2.224	0.000	2.161	0.000	2.278
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

49 199 AM35B1
50 200 AM35B1
51 449 AM35B1
52 475 AM35A1
53 477 AM35A1
54 478 AM35A1
55 479 AM35A1
56 15 AM3511

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) MATRIX

	57	58	59	60	61	62	63	64
SIO2	42.03	42.94	41.79	42.81	42.70	42.69	43.71	43.19
A2O3	17.01	16.58	17.27	17.47	17.70	17.00	16.10	17.24
TIO2	0.56	0.53	0.52	0.51	0.54	0.50	0.49	0.53
FEO	15.07	15.35	15.20	15.10	14.82	15.38	15.01	15.05
MNO	0.31	0.41	0.44	0.39	0.30	0.36	0.36	0.31
MGO	9.54	9.49	9.47	9.45	9.30	9.68	9.86	9.54
CAO	11.68	11.18	10.74	10.72	11.61	11.09	11.40	11.32
NA2O	1.60	1.73	1.71	1.71	1.37	1.51	1.63	1.60
K2O	0.57	0.49	0.47	0.64	0.49	0.50	0.45	0.51
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.04	2.05	2.03	2.06	2.06	2.05	2.06	2.07
SUM	100.41	100.75	99.64	100.86	100.89	100.76	101.07	101.36
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	100.41	100.75	99.64	100.86	100.89	100.76	101.07	101.36

SI	6.177	*	6.279	*	6.179	*	6.237	*	6.212	*	6.236	*	6.352	*	6.258	*
AL	1.823	8.000	1.721	8.000	1.821	8.000	1.763	8.000	1.788	8.000	1.764	8.000	1.648	8.000	1.742	8.000
AL	1.123	*	1.136	*	1.188	*	1.236	*	1.246	*	1.162	*	1.110	*	1.202	*
TI	0.062	*	0.058	*	0.058	*	0.056	*	0.059	*	0.055	*	0.054	*	0.058	*
FE	1.852	*	1.877	*	1.879	*	1.840	*	1.803	*	1.879	*	1.824	*	1.824	*
MN	0.039	*	0.051	*	0.055	*	0.048	*	0.037	*	0.045	*	0.044	*	0.038	*
MG	2.090	5.166	2.088	5.190	2.087	5.267	2.052	5.232	2.017	5.162	2.108	5.248	2.136	5.168	2.060	5.182
CA	1.839	*	1.752	*	1.701	*	1.673	*	1.810	*	1.736	*	1.775	*	1.757	*
NA	0.456	*	0.490	*	0.490	*	0.483	*	0.386	*	0.428	*	0.459	*	0.449	*
K	0.107	*	0.091	*	0.089	*	0.119	*	0.091	*	0.093	*	0.083	*	0.094	*
BA	0.000	2.402	0.000	2.333	0.000	2.280	0.000	2.275	0.000	2.287	0.000	2.257	0.000	2.318	0.000	2.301
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

57 18 AM3511
58 19 AM3511
59 20 AM3511
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63 24 AM3511
64 27 AM3511

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) MATRIX

	65	66	67	68	69	70	71	72
SIO2	43.96	42.21	43.10	44.44	44.16	43.18	47.66	47.16
A2O3	16.09	16.31	17.01	16.52	15.98	16.76	13.21	13.42
TIO2	0.50	0.51	0.50	0.42	0.50	0.52	0.12	0.13
FEO	15.16	16.11	14.92	14.18	14.82	14.89	9.89	10.21
MNO	0.36	0.36	0.40	0.33	0.36	0.39	0.25	0.30
MGO	9.88	9.95	9.68	10.39	10.04	9.62	14.34	14.27
CAO	11.15	10.03	10.80	11.08	11.54	11.09	11.98	11.95
NA2O	1.60	1.53	1.70	1.42	1.54	1.76	1.22	1.29
K2O	0.47	1.21	0.45	0.42	0.45	0.48	0.28	0.31
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.07	2.03	2.05	2.08	2.07	2.06	2.12	2.12
SUM	101.24	100.25	100.61	101.28	101.46	100.75	101.07	101.16
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	101.24	100.25	100.61	101.28	101.46	100.75	101.07	101.16

SI	6.374	*	6.238	*	6.283	*	6.394	*	6.383	*	6.294	*	6.729	*	6.673	*
AL	1.626	8.000	1.762	8.000	1.717	8.000	1.606	8.000	1.617	8.000	1.706	8.000	1.271	8.000	1.327	8.000
AL	1.123	*	1.078	*	1.205	*	1.195	*	1.104	*	1.173	*	0.926	*	0.910	*
TI	0.055	*	0.057	*	0.055	*	0.045	*	0.054	*	0.057	*	0.013	*	0.014	*
FE	1.838	*	1.991	*	1.819	*	1.706	*	1.791	*	1.815	*	1.168	*	1.208	*
MN	0.044	*	0.045	*	0.049	*	0.040	*	0.044	*	0.048	*	0.030	*	0.036	*
MG	2.135	5.195	2.192	5.362	2.103	5.231	2.228	5.214	2.163	5.157	2.090	5.183	3.018	5.154	3.009	5.177
CA	1.732	*	1.588	*	1.687	*	1.708	*	1.787	*	1.732	*	1.812	*	1.812	*
NA	0.450	*	0.438	*	0.480	*	0.396	*	0.432	*	0.497	*	0.334	*	0.354	*
K	0.087	*	0.228	*	0.084	*	0.077	*	0.083	*	0.089	*	0.050	*	0.056	*
BA	0.000	2.269	0.000	2.255	0.000	2.251	0.000	2.181	0.000	2.302	0.000	2.319	0.000	2.196	0.000	2.221
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

65 28 AM3511
66 29 AM3511
67 30 AM3511
68 32 AM3511
69 33 AM3511
70 34 AM3511
71 40 AM35A1
72 43 AM35A1

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) MATRIX

	73	74	75	76	77	78	79	80
SIO2	46.67	46.20	46.18	49.55	46.94	45.65	48.24	47.12
A2O3	13.38	13.54	13.86	9.76	13.58	14.52	12.08	13.02
TIO2	0.13	0.14	0.14	0.14	0.14	0.15	0.14	0.11
FEO	10.28	10.48	10.31	10.44	9.81	10.56	9.74	10.03
MNO	0.29	0.29	0.27	0.26	0.26	0.28	0.26	0.27
MGO	13.77	13.94	13.56	15.06	14.35	13.82	14.69	14.05
CAO	11.80	11.70	11.51	12.15	11.57	11.62	11.96	11.94
NA2O	1.32	1.48	1.12	0.94	1.30	1.51	1.21	1.26
K2O	0.32	0.31	0.29	0.30	0.27	0.29	0.25	0.34
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.09	2.09	2.08	2.11	2.11	2.10	2.12	2.10
SUM	100.05	100.17	99.32	100.71	100.33	100.50	100.69	100.24
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	100.05	100.17	99.32	100.71	100.33	100.50	100.69	100.24

SI	6.680	*	6.620	*	6.649	*	7.031	*	6.675	*	6.523	*	6.830	*	6.722	*
AL	1.320	8.000	1.380	8.000	1.351	8.000	0.969	8.000	1.325	8.000	1.477	8.000	1.170	8.000	1.278	8.000
AL	0.937	*	0.907	*	1.001	*	0.663	*	0.950	*	0.968	*	0.845	*	0.911	*
TI	0.014	*	0.015	*	0.015	*	0.015	*	0.015	*	0.016	*	0.015	*	0.012	*
FE	1.231	*	1.256	*	1.241	*	1.239	*	1.167	*	1.262	*	1.153	*	1.197	*
MN	0.035	*	0.035	*	0.033	*	0.031	*	0.031	*	0.034	*	0.031	*	0.033	*
MG	2.938	5.154	2.977	5.190	2.910	5.200	3.185	5.133	3.041	5.205	2.943	5.223	3.100	5.144	2.988	5.140
CA	1.810	*	1.796	*	1.776	*	1.847	*	1.763	*	1.779	*	1.814	*	1.825	*
NA	0.366	*	0.411	*	0.313	*	0.259	*	0.358	*	0.418	*	0.332	*	0.349	*
K	0.058	*	0.057	*	0.053	*	0.054	*	0.049	*	0.053	*	0.045	*	0.062	*
BA	0.000	2.234	0.000	2.264	0.000	2.141	0.000	2.160	0.000	2.170	0.000	2.250	0.000	2.191	0.000	2.235
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

73 44 AM35A1
74 45 AM35A1
75 46 AM35A1
76 47 AM35A1
77 51 AM35A1
78 52 AM35A1
79 53 AM35A1
80 54 AM35A1

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) MATRIX

	81	82
SIO2	45.46	46.74
A2O3	15.42	13.96
TIO2	0.11	0.11
FEO	9.22	10.02
MNO	0.24	0.27
MGO	13.89	13.82
CAO	11.66	11.74
NA2O	1.06	1.33
K2O	0.25	0.31
BAO	0.00	0.00
CL	0.00	0.00
F	0.00	0.00
H2O	2.09	2.10
SUM	99.40	100.40
-O= F+CL	0.00	0.00
SUM	99.40	100.40

SI	6.509	*	6.652	*
AL	1.491	8.000	1.348	8.000
AL	1.110	*	0.994	*
TI	0.012	*	0.012	*
FE	1.104	*	1.193	*
MN	0.029	*	0.033	*
MG	2.964	5.219	2.932	5.162
CA	1.789	*	1.790	*
NA	0.294	*	0.367	*
K	0.046	*	0.056	*
BA	0.000	2.128	0.000	2.214
CL	0.000	*	0.000	*
F	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*

81 56 AM35A1 82 59 AM35A1

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) MATRIX

	1	2	3	4	5	6	7	8
SIO2	46.16	46.39	44.76	44.79	45.90	47.14	44.57	43.86
A2O3	14.15	13.61	15.15	14.98	12.72	11.39	14.66	15.64
TIO2	0.11	0.10	0.14	0.15	0.11	0.13	0.14	0.13
FEO	11.08	10.98	12.58	12.38	11.97	11.31	12.72	12.64
MNO	0.25	0.26	0.26	0.29	0.30	0.29	0.30	0.24
MGO	12.95	13.21	11.67	11.86	12.64	13.97	11.85	11.30
CAO	12.09	11.94	11.87	11.92	11.89	11.80	11.59	11.78
NA2O	1.27	1.31	1.34	1.40	1.16	1.14	1.43	1.39
K2O	0.36	0.34	0.45	0.46	0.28	0.23	0.39	0.43
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.09	2.09	2.07	2.07	2.05	2.07	2.06	2.05
SUM	100.51	100.23	100.29	100.30	99.02	99.47	99.71	99.46
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	100.51	100.23	100.29	100.30	99.02	99.47	99.71	99.46

SI	6.607	*	6.653	*	6.476	*	6.479	*	6.698	*	6.817	*	6.493	*	6.408	*
AL	1.393	8.000	1.347	8.000	1.524	8.000	1.521	8.000	1.302	8.000	1.183	8.000	1.507	8.000	1.592	8.000
AL	0.993	*	0.953	*	1.060	*	1.033	*	0.886	*	0.759	*	1.010	*	1.100	*
TI	0.012	*	0.011	*	0.015	*	0.016	*	0.012	*	0.014	*	0.015	*	0.014	*
FE	1.326	*	1.317	*	1.522	*	1.498	*	1.461	*	1.368	*	1.550	*	1.544	*
MN	0.030	*	0.032	*	0.032	*	0.036	*	0.037	*	0.036	*	0.037	*	0.030	*
MG	2.763	5.124	2.824	5.137	2.517	5.146	2.557	5.140	2.749	5.145	3.011	5.187	2.573	5.185	2.461	5.149
CA	1.854	*	1.835	*	1.840	*	1.848	*	1.859	*	1.828	*	1.809	*	1.844	*
NA	0.352	*	0.364	*	0.376	*	0.393	*	0.328	*	0.320	*	0.404	*	0.394	*
K	0.066	*	0.062	*	0.083	*	0.085	*	0.052	*	0.042	*	0.072	*	0.080	*
BA	0.000	2.272	0.000	2.261	0.000	2.299	0.000	2.325	0.000	2.239	0.000	2.190	0.000	2.285	0.000	2.318
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

1 271 AM 351 rim
2 272 AM 351 core
3 279 AM 351 rim
4 280 AM 351 core
5 283 AM 351 rim
6 284 AM 351 core
7 285 AM 351 core
8 286 AM 351 rim

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) MATRIX

	9	10	11	12	13	14	15	16
SIO2	46.62	45.43	45.66	45.15	44.86	45.59	45.46	46.62
A2O3	13.94	14.30	14.29	13.92	14.85	14.76	14.39	12.54
TIO2	0.11	0.11	0.09	0.12	0.13	0.10	0.10	0.09
FEO	11.04	11.00	11.16	11.13	11.41	10.89	10.77	10.83
MNO	0.28	0.26	0.29	0.22	0.27	0.24	0.27	0.30
MGO	13.12	12.70	12.85	12.88	12.57	12.96	13.32	13.18
CAO	11.65	11.62	11.73	12.05	12.07	11.86	11.75	11.53
NA2O	1.46	1.42	1.43	1.29	1.41	1.47	1.38	1.36
K2O	0.33	0.34	0.37	0.37	0.38	0.38	0.36	0.26
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.10	2.07	2.08	2.06	2.07	2.09	2.08	2.06
SUM	100.65	99.25	99.95	99.19	100.02	100.34	99.88	98.77
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	100.65	99.25	99.95	99.19	100.02	100.34	99.88	98.77

SI	6.652	*	6.584	*	6.578	*	6.565	*	6.480	*	6.536	*	6.545	*	6.772	*
AL	1.348	8.000	1.416	8.000	1.422	8.000	1.435	8.000	1.520	8.000	1.464	8.000	1.455	8.000	1.228	8.000
AL	0.996	*	1.028	*	1.004	*	0.950	*	1.008	*	1.029	*	0.986	*	0.918	*
TI	0.012	*	0.012	*	0.010	*	0.013	*	0.014	*	0.011	*	0.011	*	0.010	*
FE	1.317	*	1.333	*	1.345	*	1.353	*	1.378	*	1.306	*	1.297	*	1.316	*
MN	0.034	*	0.032	*	0.035	*	0.027	*	0.033	*	0.029	*	0.033	*	0.037	*
MG	2.790	5.150	2.743	5.146	2.759	5.153	2.791	5.135	2.706	5.140	2.769	5.144	2.858	5.185	2.854	5.134
CA	1.781	*	1.804	*	1.811	*	1.877	*	1.868	*	1.822	*	1.812	*	1.794	*
NA	0.404	*	0.399	*	0.399	*	0.364	*	0.395	*	0.409	*	0.385	*	0.383	*
K	0.060	*	0.063	*	0.068	*	0.069	*	0.070	*	0.069	*	0.066	*	0.048	*
BA	0.000	2.245	0.000	2.266	0.000	2.278	0.000	2.309	0.000	2.333	0.000	2.300	0.000	2.264	0.000	2.226
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

9 291 AM 351 rim
10 292 AM 351 core
11 293 AM 351 core
12 294 AM 351 rim
13 298 AM 351 rim
14 303 AM 351 rim
15 304 AM 351 core
16 319 AM 354 core

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) MATRIX

	17	18	19	20	21	22	23	24
SIO2	46.47	46.99	46.28	46.07	45.61	45.84	45.50	45.68
A2O3	13.61	12.91	14.20	13.75	14.11	14.32	13.84	13.69
TIO2	0.14	0.12	0.13	0.10	0.11	0.10	0.15	0.14
FEO	11.07	10.73	11.04	11.04	10.95	11.12	10.57	10.23
MNO	0.25	0.28	0.25	0.27	0.23	0.22	0.20	0.24
MGO	13.30	13.70	13.52	13.65	12.81	12.93	13.39	13.79
CAO	11.97	12.30	12.12	12.18	12.10	12.02	11.78	11.62
NA2O	1.43	1.22	1.26	1.22	1.33	1.32	1.34	1.31
K2O	0.34	0.28	0.36	0.32	0.41	0.39	0.36	0.32
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.10	2.10	2.11	2.09	2.07	2.09	2.07	2.07
SUM	100.68	100.63	101.27	100.69	99.73	100.35	99.20	99.09
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	100.68	100.63	101.27	100.69	99.73	100.35	99.20	99.09

SI	6.641	*	6.706	*	6.575	*	6.588	*	6.585	*	6.577	*	6.589	*	6.607	*
AL	1.359	8.000	1.294	8.000	1.425	8.000	1.412	8.000	1.415	8.000	1.423	8.000	1.411	8.000	1.393	8.000
AL	0.933	*	0.877	*	0.952	*	0.905	*	0.986	*	0.997	*	0.951	*	0.941	*
TI	0.015	*	0.013	*	0.014	*	0.011	*	0.012	*	0.011	*	0.016	*	0.015	*
FE	1.323	*	1.281	*	1.312	*	1.320	*	1.322	*	1.334	*	1.280	*	1.237	*
MN	0.030	*	0.034	*	0.030	*	0.033	*	0.028	*	0.027	*	0.025	*	0.029	*
MG	2.833	5.135	2.914	5.119	2.863	5.170	2.909	5.178	2.757	5.105	2.765	5.134	2.890	5.163	2.973	5.196
CA	1.833	*	1.881	*	1.845	*	1.866	*	1.872	*	1.848	*	1.828	*	1.801	*
NA	0.396	*	0.338	*	0.347	*	0.338	*	0.372	*	0.367	*	0.376	*	0.367	*
K	0.062	*	0.051	*	0.065	*	0.058	*	0.076	*	0.071	*	0.066	*	0.059	*
BA	0.000	2.291	0.000	2.269	0.000	2.257	0.000	2.263	0.000	2.320	0.000	2.286	0.000	2.271	0.000	2.227
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

17 328 AM 351 rim
18 329 AM 351 core
19 338 AM 351 rim
20 339 AM 351 core
21 342 AM 351 rim
22 343 AM 351 core
23 359 AM 35C rim
24 360 AM 35C core

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) MATRIX

	25	26	27	28	29	30	31	32
SIO2	46.26	45.39	45.78	46.39	45.93	45.46	45.26	44.39
A2O3	13.01	13.85	13.40	13.56	13.27	13.77	14.85	14.49
TIO2	0.12	0.11	0.14	0.10	0.14	0.15	0.10	0.11
FEO	10.18	10.47	10.44	10.29	10.28	10.59	10.84	10.69
MNO	0.21	0.25	0.28	0.23	0.24	0.26	0.26	0.25
MGO	13.68	13.59	13.56	13.38	13.69	13.26	12.94	13.24
CAO	12.32	12.07	11.68	12.01	12.13	11.69	12.06	11.95
NA2O	1.07	1.19	1.32	1.40	1.25	1.44	1.39	1.43
K2O	0.30	0.36	0.30	0.36	0.31	0.36	0.38	0.38
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.07	2.07	2.07	2.09	2.07	2.06	2.08	2.06
SUM	99.22	99.35	98.97	99.81	99.31	99.04	100.16	98.99
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.22	99.35	98.97	99.81	99.31	99.04	100.16	98.99

SI	6.683	*	6.567	*	6.638	*	6.664	*	6.638	*	6.597	*	6.506	*	6.467	*
AL	1.317	8.000	1.433	8.000	1.362	8.000	1.336	8.000	1.362	8.000	1.403	8.000	1.494	8.000	1.533	8.000
AL	0.897	*	0.928	*	0.927	*	0.960	*	0.898	*	0.952	*	1.021	*	0.954	*
TI	0.013	*	0.012	*	0.015	*	0.011	*	0.015	*	0.016	*	0.011	*	0.012	*
FE	1.230	*	1.267	*	1.266	*	1.236	*	1.242	*	1.285	*	1.303	*	1.302	*
MN	0.026	*	0.031	*	0.034	*	0.028	*	0.029	*	0.032	*	0.032	*	0.031	*
MG	2.946	5.111	2.931	5.168	2.930	5.173	2.865	5.100	2.949	5.134	2.868	5.154	2.772	5.139	2.875	5.174
CA	1.907	*	1.871	*	1.814	*	1.849	*	1.878	*	1.818	*	1.857	*	1.865	*
NA	0.300	*	0.334	*	0.371	*	0.390	*	0.350	*	0.405	*	0.387	*	0.404	*
K	0.055	*	0.066	*	0.055	*	0.066	*	0.057	*	0.067	*	0.070	*	0.071	*
BA	0.000	2.262	0.000	2.271	0.000	2.241	0.000	2.304	0.000	2.286	0.000	2.289	0.000	2.314	0.000	2.340
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

25 366 AM 35C core
26 387 AM 35C rim
27 388 AM 35C core
28 391 AM 35C rim
29 392 AM 35C core
30 395 AM 35C core
31 396 AM 35C rim
32 399 AM 35C core

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) MATRIX

	33	34	35	36	37	38	39	40
SIO2	45.11	45.95	47.58	46.17	45.56	45.49	48.04	45.32
A2O3	14.46	13.50	10.88	13.52	13.71	13.75	10.52	13.90
TIO2	0.11	0.11	0.10	0.14	0.12	0.13	0.09	0.13
FEO	10.50	10.35	9.66	10.49	10.57	10.58	9.65	10.50
MNO	0.25	0.27	0.21	0.23	0.24	0.24	0.27	0.28
MGO	13.23	13.52	14.91	13.37	13.10	13.39	14.79	13.41
CAO	12.01	11.97	12.13	11.89	12.07	12.04	12.05	11.93
NA2O	1.24	1.27	1.03	1.24	1.20	1.22	0.97	1.24
K2O	0.39	0.28	0.19	0.30	0.34	0.31	0.24	0.37
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.07	2.07	2.07	2.08	2.06	2.07	2.07	2.07
SUM	99.37	99.29	98.76	99.43	98.97	99.22	98.69	99.15
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.37	99.29	98.76	99.43	98.97	99.22	98.69	99.15

SI	6.526	*	6.638	*	6.876	*	6.658	*	6.614	*	6.590	*	6.942	*	6.571	*
AL	1.474	8.000	1.362	8.000	1.124	8.000	1.342	8.000	1.386	8.000	1.410	8.000	1.058	8.000	1.429	8.000
AL	0.991	*	0.936	*	0.729	*	0.956	*	0.960	*	0.937	*	0.733	*	0.945	*
TI	0.012	*	0.012	*	0.011	*	0.015	*	0.013	*	0.014	*	0.010	*	0.014	*
FE	1.270	*	1.250	*	1.168	*	1.265	*	1.283	*	1.282	*	1.166	*	1.273	*
MN	0.031	*	0.033	*	0.026	*	0.028	*	0.030	*	0.029	*	0.033	*	0.034	*
MG	2.853	5.157	2.911	5.143	3.212	5.145	2.874	5.138	2.835	5.121	2.891	5.153	3.186	5.128	2.898	5.165
CA	1.862	*	1.853	*	1.878	*	1.837	*	1.877	*	1.869	*	1.866	*	1.853	*
NA	0.348	*	0.356	*	0.289	*	0.347	*	0.338	*	0.343	*	0.272	*	0.349	*
K	0.072	*	0.052	*	0.035	*	0.055	*	0.063	*	0.057	*	0.044	*	0.068	*
BA	0.000	2.281	0.000	2.260	0.000	2.202	0.000	2.239	0.000	2.278	0.000	2.269	0.000	2.182	0.000	2.270
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

33 400 AM 35C rim
34 407 AM 35C core
35 408 AM 35C rim
36 412 AM 35C core
37 413 AM 35C rim
38 418 AM 35C core
39 422 AM 35C core
40 429 AM 35C rim

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) MATRIX

	41	42	43	44	45	46	47	48
SIO2	47.66	45.72	46.73	45.51	46.93	45.86	45.84	46.25
A2O3	11.40	13.62	12.49	13.57	12.14	14.00	13.54	12.75
TIO2	0.12	0.11	0.12	0.13	0.09	0.12	0.12	0.13
FEO	9.75	10.81	10.39	10.55	10.42	10.64	10.52	11.15
MNO	0.25	0.22	0.25	0.26	0.28	0.28	0.29	0.30
MGO	15.01	13.67	13.88	13.61	14.54	13.59	13.66	14.46
CAO	12.09	12.11	11.97	11.72	11.51	11.32	11.55	11.21
NA2O	1.11	1.30	1.19	1.36	1.28	1.53	1.43	1.29
K2O	0.24	0.35	0.25	0.28	0.24	0.27	0.27	0.28
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.09	2.08	2.08	2.07	2.08	2.08	2.07	2.08
SUM	99.72	99.99	99.35	99.06	99.51	99.69	99.29	99.90
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.72	99.99	99.35	99.06	99.51	99.69	99.29	99.90

SI	6.826	*	6.583	*	6.741	*	6.600	*	6.754	*	6.599	*	6.625	*	6.656	*
AL	1.174	8.000	1.417	8.000	1.259	8.000	1.400	8.000	1.246	8.000	1.401	8.000	1.375	8.000	1.344	8.000
AL	0.751	*	0.893	*	0.863	*	0.919	*	0.813	*	0.973	*	0.931	*	0.819	*
TI	0.013	*	0.012	*	0.013	*	0.014	*	0.010	*	0.013	*	0.013	*	0.014	*
FE	1.168	*	1.302	*	1.253	*	1.280	*	1.254	*	1.280	*	1.272	*	1.342	*
MN	0.030	*	0.027	*	0.031	*	0.032	*	0.034	*	0.034	*	0.036	*	0.037	*
MG	3.204	5.166	2.934	5.167	2.984	5.145	2.942	5.187	3.119	5.230	2.915	5.216	2.943	5.194	3.102	5.313
CA	1.855	*	1.868	*	1.850	*	1.821	*	1.775	*	1.745	*	1.789	*	1.729	*
NA	0.308	*	0.363	*	0.333	*	0.382	*	0.357	*	0.427	*	0.401	*	0.360	*
K	0.044	*	0.064	*	0.046	*	0.052	*	0.044	*	0.050	*	0.050	*	0.051	*
BA	0.000	2.207	0.000	2.295	0.000	2.229	0.000	2.255	0.000	2.176	0.000	2.222	0.000	2.239	0.000	2.140
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

41 434 AM 35C core
42 435 AM 35C rim
43 438 AM 35C core
44 439 AM 35C rim
45 449 AM 35C core
46 455 AM 35C core
47 456 AM 35C rim
48 459 AM 35C core

1SUPER RECAL AMPHIBOLE ANALYSES (OH CALCULATED) MATRIX

	49
SIO2	46.48
A2O3	13.77
TIO2	0.10
FEO	10.60
MNO	0.24
MGO	12.69
CAO	11.72
NA2O	1.73
K2O	0.32
BAO	0.00
CL	0.00
F	0.00
H2O	2.08
SUM	99.73
-O= F+CL	0.00
SUM	99.73

SI	6.687	*
AL	1.313	8.000
AL	1.021	*
TI	0.011	*
FE	1.275	*
MN	0.029	*
MG	2.721	5.057
CA	1.806	*
NA	0.483	*
K	0.059	*
BA	0.000	2.348
CL	0.000	*
F	0.000	*
H	2.000	2.000
O	24.000	*

49 460 AM 35C rim

FELDSPAR

1SUPER RECAL FELDSPAR ANALYSES

	1	2	3	4	5	6	7	8
SIO2	62.44	61.52	58.71	61.63	61.09	61.73	61.20	61.15
A2O3	23.87	24.86	26.51	24.87	24.99	24.75	24.90	25.24
TIO2	0.01	0.01	0.00	0.00	0.02	0.00	0.00	0.00
FEO	0.08	0.13	0.05	0.05	0.22	0.07	0.07	0.13
MNO	0.00	0.01	-0.02	0.01	-0.01	0.00	0.00	-0.01
MGO	0.05	0.12	0.15	0.09	0.22	0.08	0.08	0.11
CAO	5.14	6.04	8.41	6.06	6.68	5.93	6.21	6.31
NA2O	8.82	8.38	6.79	8.17	7.97	8.17	8.22	8.24
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
K2O	0.04	0.03	0.06	0.04	0.04	0.10	0.06	0.05
SUM	100.45	101.10	100.66	100.92	101.22	100.83	100.74	101.22

SI	2.755	*	2.705	*	2.607	*	2.711	*	2.688	*	2.717	*	2.701	*	2.688	*
AL	1.241	*	1.288	*	1.387	*	1.289	*	1.296	*	1.284	*	1.295	*	1.308	*
TI	0.000	3.996	0.000	3.994	0.000	3.994	0.000	4.000	0.001	3.985	0.000	4.001	0.000	3.996	0.000	3.996
FE	0.003	*	0.005	*	0.002	*	0.002	*	0.008	*	0.003	*	0.003	*	0.005	*
MN	0.000	*	0.000	*	-0.001	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
MG	0.003	*	0.008	*	0.010	*	0.006	*	0.014	*	0.005	*	0.005	*	0.007	*
CA	0.243	*	0.285	*	0.400	*	0.286	*	0.315	*	0.280	*	0.294	*	0.297	*
BA	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
NA	0.754	*	0.714	*	0.585	*	0.697	*	0.680	*	0.697	*	0.703	*	0.702	*
K	0.002	1.006	0.002	1.014	0.003	0.999	0.002	0.993	0.002	1.019	0.006	0.990	0.003	1.008	0.003	1.014
O	8.000	*	8.000	*	8.000	*	8.000	*	8.000	*	8.000	*	8.000	*	8.000	*

1 269 FE 351 core
2 270 FE 351 rim
3 274 FE 351 rim
4 277 FE 351 core
5 278 FE 351 rim
6 281 FE 351 core
7 282 FE 351 rim
8 287 FE 351 rim

1SUPER RECAL FELDSPAR ANALYSES

	9	10	11	12	13	14	15	16
SIO2	61.98	60.69	62.50	58.11	58.09	57.70	58.03	58.50
A2O3	24.44	24.62	23.97	26.27	26.40	26.13	26.18	26.53
TIO2	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01
FEO	0.04	0.07	0.07	0.04	0.10	0.26	0.11	0.05
MNO	0.00	0.00	0.02	0.00	0.00	0.00	0.01	0.00
MGO	0.09	0.11	0.08	0.15	0.13	0.33	0.13	0.16
CAO	5.75	5.82	5.13	8.23	8.34	8.36	8.32	8.64
NA2O	8.20	8.17	8.76	6.90	6.82	6.79	6.72	6.72
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
K2O	0.06	0.05	0.05	0.04	0.04	0.04	0.05	0.05
SUM	100.56	99.52	100.58	99.73	99.91	99.61	99.55	100.66

SI	2.732	*	2.708	*	2.753	*	2.605	*	2.601	*	2.595	*	2.607	*	2.600	*
AL	1.269	*	1.294	*	1.244	*	1.388	*	1.393	*	1.385	*	1.386	*	1.389	*
TI	0.000	4.002	0.000	4.002	0.000	3.998	0.000	3.993	0.000	3.993	0.000	3.980	0.000	3.992	0.000	3.990
FE	0.001	*	0.003	*	0.003	*	0.001	*	0.004	*	0.010	*	0.004	*	0.002	*
MN	0.000	*	0.000	*	0.001	*	-0.001	*	0.000	*	0.000	*	0.000	*	0.000	*
MG	0.006	*	0.007	*	0.005	*	0.010	*	0.009	*	0.022	*	0.009	*	0.011	*
CA	0.272	*	0.278	*	0.242	*	0.395	*	0.400	*	0.403	*	0.400	*	0.411	*
BA	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
NA	0.701	*	0.707	*	0.748	*	0.600	*	0.592	*	0.592	*	0.585	*	0.579	*
K	0.003	0.983	0.003	0.998	0.003	1.002	0.002	1.008	0.002	1.006	0.002	1.029	0.003	1.002	0.003	1.006
O	8.000	*	8.000	*	8.000	*	8.000	*	8.000	*	8.000	*	8.000	*	8.000	*

9 289 FE 351 core
10 295 FE 351 rim
11 296 FE 351 core
12 301 FE 351 core
13 305 FE 351 core
14 306 FE 351 rim
15 327 FE 351 rim
16 337 FE 351 rim

1SUPER RECAL FELDSPAR ANALYSES

	17	18	19	20	21	22	23	24
SIO2	61.25	57.85	59.86	60.44	61.98	60.94	60.47	60.65
A2O3	24.43	26.54	25.22	24.53	24.49	24.46	24.22	24.44
TIO2	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
FEO	0.06	0.14	0.17	0.02	0.13	0.06	0.14	0.06
MNO	0.00	0.02	0.02	0.00	0.00	0.01	0.00	0.01
MGO	0.10	0.15	0.07	0.07	0.08	0.12	0.10	0.10
CAO	5.87	8.62	6.70	5.95	5.81	6.37	5.76	5.94
NA2O	8.28	6.74	7.69	8.02	8.00	8.06	7.93	7.72
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
K2O	0.05	0.04	0.07	0.06	0.04	0.06	0.07	0.05
SUM	100.04	100.09	99.79	99.08	100.54	100.08	98.69	98.97

SI	2.719	*	2.589	*	2.672	*	2.708	*	2.732	*	2.708	*	2.719	*	2.717	*
AL	1.278	*	1.400	*	1.326	*	1.295	*	1.272	*	1.281	*	1.283	*	1.290	*
TI	0.000	3.996	0.000	3.988	0.000	3.998	0.000	4.003	0.000	4.004	0.000	3.989	0.000	4.002	0.000	4.007
FE	0.002	*	0.005	*	0.006	*	0.001	*	0.005	*	0.002	*	0.005	*	0.002	*

MN	0.000	*	0.001	*	0.001	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
MG	0.007	*	0.010	*	0.005	*	0.005	*	0.005	*	0.008	*	0.007	*	0.007	*
CA	0.279	*	0.413	*	0.320	*	0.286	*	0.274	*	0.303	*	0.277	*	0.285	*
BA	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
NA	0.713	*	0.585	*	0.665	*	0.697	*	0.684	*	0.694	*	0.691	*	0.670	*
K	0.003	1.003	0.002	1.016	0.004	1.002	0.003	0.991	0.002	0.970	0.003	1.012	0.004	0.985	0.003	0.968
O	8.000	*	8.000	*	8.000	*	8.000	*	8.000	*	8.000	*	8.000	*	8.000	*

17 340 FE 351 core
18 341 FE 351 rim
19 358 FE 35C rim
20 363 FE 35C core

21 386 FE 35C rim
22 390 FE 35C rim
23 401 FE 35C rim
24 409 FE 35C rim

1SUPER RECAL FELDSPAR ANALYSES

	25	26	27	28	29	30	31	32
SIO2	60.15	57.03	58.14	59.49	61.25	57.89	60.78	58.24
A2O3	25.07	26.35	25.84	25.06	24.48	27.10	24.44	26.50
TIO2	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	0.00
FEO	0.09	0.10	0.04	0.09	0.02	0.16	0.07	0.06
MNO	0.02	-0.02	0.00	0.00	0.00	0.01	0.00	0.01
MGO	0.12	0.13	0.14	0.12	0.11	0.18	0.09	0.14
CAO	6.34	8.74	7.95	6.64	5.99	8.75	6.05	8.38
NA2O	8.12	6.48	7.02	8.01	8.00	6.64	8.29	6.89
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
K2O	0.06	0.04	0.08	0.05	0.07	0.03	0.05	0.05
SUM	99.97	98.84	99.21	99.46	99.92	100.76	99.77	100.27

SI	2.679	*	2.584	*	2.619	*	2.667	*	2.719	*	2.574	*	2.709	*	2.599	*
AL	1.316	*	1.407	*	1.372	*	1.324	*	1.281	*	1.420	*	1.283	*	1.393	*
TI	0.000	3.995	0.000	3.990	0.000	3.991	0.000	3.991	0.000	4.000	0.000	3.994	0.000	3.992	0.000	3.992
FE	0.003	*	0.004	*	0.002	*	0.003	*	0.001	*	0.006	*	0.003	*	0.002	*
MN	0.001	*	-0.001	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
MG	0.008	*	0.009	*	0.009	*	0.008	*	0.007	*	0.012	*	0.006	*	0.009	*
CA	0.303	*	0.424	*	0.384	*	0.319	*	0.285	*	0.417	*	0.289	*	0.401	*
BA	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
NA	0.701	*	0.569	*	0.613	*	0.696	*	0.689	*	0.572	*	0.716	*	0.596	*
K	0.003	1.019	0.002	1.008	0.005	1.012	0.003	1.029	0.004	0.986	0.002	1.009	0.003	1.017	0.003	1.011
O	8.000	*	8.000	*	8.000	*	8.000	*	8.000	*	8.000	*	8.000	*	8.000	*

25 420 FE 35C rim
26 424 FE 35C rim
27 425 FE 35C core
28 430 FE 35C rim

29 431 FE 35C core
30 436 FE 35C rim
31 437 FE 35C core
32 440 FE 35C rim

1SUPER RECAL FELDSPAR ANALYSES

	33	34	35	36	37	38
SIO2	57.35	59.90	60.03	59.79	60.93	60.59
A2O3	26.01	25.47	25.32	25.42	25.03	24.24
TIO2	0.00	-0.01	0.01	0.00	0.00	0.01
FEO	0.02	0.07	0.13	0.03	0.09	0.03
MNO	0.03	-0.02	0.04	0.01	0.00	0.00
MGO	0.15	0.11	0.12	0.12	0.13	0.08
CAO	8.00	6.61	6.92	7.07	6.51	5.78
NA2O	7.20	7.88	7.71	7.75	8.06	8.36
BAO	0.00	0.00	0.00	0.00	0.00	0.00
K2O	0.05	0.07	0.06	0.08	0.05	0.07
SUM	98.81	100.08	100.34	100.27	100.80	99.16

SI	2.599	*	2.665	*	2.667	*	2.659	*	2.690	*	2.715	*				
AL	1.389	*	1.335	*	1.325	*	1.332	*	1.302	*	1.280	*				
TI	0.000	3.988	0.000	4.000	0.000	3.992	0.000	3.991	0.000	3.992	0.000	3.995				
FE	0.001	*	0.003	*	0.005	*	0.001	*	0.003	*	0.001	*				
MN	0.001	*	-0.001	*	0.002	*	0.000	*	0.000	*	0.000	*				
MG	0.010	*	0.007	*	0.008	*	0.008	*	0.009	*	0.005	*				
CA	0.388	*	0.315	*	0.329	*	0.337	*	0.308	*	0.277	*				
BA	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*				
NA	0.633	*	0.680	*	0.664	*	0.668	*	0.690	*	0.726	*				
K	0.003	1.036	0.004	1.008	0.003	1.011	0.005	1.019	0.003	1.013	0.004	1.014				
O	8.000	*	8.000	*	8.000	*	8.000	*	8.000	*	8.000	*				

33 441 FE 35C core
34 452 FE 35C core
35 457 FE 35C rim

36 458 FE 35C core
37 461 FE 35C rim
38 462 FE 35C core

EPIDOTE

1SUPER RECAL EPIDOTE ANALYSES (OH CALCULATED)

	1	2	3	4	5	6	7	8
SIO2	38.92	39.25	38.91	38.65	38.83	39.17	38.37	38.71
A2O3	26.94	26.52	26.86	28.32	27.23	27.23	26.40	26.31
TIO2	0.06	0.12	0.13	0.07	0.07	0.08	0.24	0.25
MGO	0.51	0.50	0.46	0.48	0.52	0.50	0.56	0.59
MNO	0.15	0.16	0.17	0.13	0.04	0.19	0.23	0.22
CAO	24.05	24.10	24.04	24.14	24.25	24.01	23.78	23.53
K2O	0.02	0.01	0.02	0.02	0.02	0.02	0.01	0.01
NA2O	0.00	0.00	0.00	0.00	0.00	-0.02	-0.02	-0.02
F2O3	6.19	7.20	6.86	5.68	6.06	6.39	7.79	7.61
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	1.91	1.92	1.92	1.92	1.91	1.92	1.91	1.91
SUM	98.70	99.77	99.37	99.38	98.93	99.49	99.27	99.12
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	98.70	99.77	99.37	99.38	98.93	99.49	99.27	99.12

SI	3.056	*	3.059	*	3.043	*	3.009	*	3.042	*	3.052	*	3.015	*	3.040	*
AL	0.000	3.056	0.000	3.059	0.000	3.043	0.000	3.009	0.000	3.042	0.000	3.052	0.000	3.015	0.000	3.040
AL	2.493	*	2.435	*	2.475	*	2.598	*	2.514	*	2.500	*	2.445	*	2.435	*
TI	0.004	*	0.007	*	0.008	*	0.004	*	0.004	*	0.005	*	0.014	*	0.015	*
MG	0.060	*	0.058	*	0.054	*	0.056	*	0.061	*	0.058	*	0.066	*	0.069	*
FE3+	0.386	*	0.422	*	0.404	*	0.333	*	0.357	*	0.375	*	0.461	*	0.450	*
MN	0.010	2.932	0.011	2.933	0.011	2.951	0.009	2.999	0.003	2.939	0.013	2.950	0.015	3.000	0.015	2.983
CA	2.024	*	2.012	*	2.014	*	2.014	*	2.035	*	2.004	*	2.002	*	1.980	*
K	0.002	*	0.001	*	0.002	*	0.002	*	0.002	*	0.002	*	0.001	*	0.001	*
NA	-0.008	*	-0.002	*	0.000	*	-0.005	*	0.000	*	-0.003	*	-0.003	*	-0.003	*
BA	0.000	2.018	0.000	2.012	0.000	2.016	0.000	2.011	0.000	2.037	0.000	2.003	0.000	2.000	0.000	1.978
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
H	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
O	13.000	*	13.000	*	13.000	*	13.000	*	13.000	*	13.000	*	13.000	*	13.000	*

1 320 EP 351 core
2 322 EP 351 core
3 324 EP 351 core
4 325 EP 351 rim
5 330 EP 351 core
6 331 EP 351 rim
7 346 EP 351 core
8 348 EP 351 core

1SUPER RECAL EPIDOTE ANALYSES (OH CALCULATED)

	9	10	11	12	13	14	15	16
SIO2	38.39	38.16	38.64	38.56	38.36	39.15	38.54	39.06
A2O3	26.43	26.73	25.60	26.37	26.39	27.16	27.20	27.68
TIO2	0.25	0.13	0.11	0.13	0.15	0.08	0.05	0.04
MGO	0.55	0.51	0.52	0.52	0.50	0.48	0.46	0.55
MNO	0.25	0.15	0.16	0.16	0.18	0.19	0.18	0.10
CAO	23.54	23.93	23.79	23.94	23.93	24.09	24.21	24.07
K2O	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.01
NA2O	-0.02	-0.02	-0.03	-0.02	-0.03	-0.04	-0.04	-0.02
F2O3	7.31	7.67	8.43	7.60	7.34	6.35	6.02	5.66
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	1.90	1.90	1.90	1.91	1.90	1.92	1.90	1.92
SUM	98.61	99.17	99.13	99.19	98.74	99.39	98.53	99.07
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	98.61	99.17	99.13	99.19	98.74	99.39	98.53	99.07

SI	3.030	*	3.001	*	3.045	*	3.030	*	3.027	*	3.054	*	3.034	*	3.048	*
AL	0.000	3.030	0.000	3.001	0.000	3.045	0.000	3.030	0.000	3.027	0.000	3.054	0.000	3.034	0.000	3.048
AL	2.458	*	2.477	*	2.377	*	2.442	*	2.454	*	2.496	*	2.523	*	2.545	*
TI	0.015	*	0.008	*	0.007	*	0.008	*	0.009	*	0.005	*	0.003	*	0.002	*
MG	0.065	*	0.060	*	0.061	*	0.061	*	0.059	*	0.056	*	0.054	*	0.064	*
FE3+	0.434	*	0.454	*	0.500	*	0.449	*	0.436	*	0.373	*	0.357	*	0.332	*
MN	0.017	2.988	0.010	3.008	0.011	2.956	0.011	2.970	0.012	2.969	0.013	2.942	0.012	2.949	0.007	2.950
CA	1.991	*	2.016	*	2.009	*	2.016	*	2.023	*	2.013	*	2.042	*	2.012	*
K	0.001	*	0.001	*	0.001	*	0.002	*	0.002	*	0.001	*	0.001	*	0.001	*
NA	-0.003	*	-0.003	*	-0.005	*	-0.003	*	-0.005	*	-0.006	*	-0.006	*	-0.003	*
BA	0.000	1.989	0.000	2.014	0.000	2.005	0.000	2.014	0.000	2.021	0.000	2.008	0.000	2.037	0.000	2.010
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
H	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
O	13.000	*	13.000	*	13.000	*	13.000	*	13.000	*	13.000	*	13.000	*	13.000	*

9 349 EP 351 rim
10 350 EP 351 core
11 351 EP 351 rim
12 354 EP3511 rim
13 355 EP 351 core
14 416 EP 35C core
15 426 EP 35C core
16 447 EP 35C core

1SUPER RECAL EPIDOTE ANALYSES (OH CALCULATED)
17

SIO2	38.58
A2O3	27.18
TIO2	0.07
MGO	0.53
MNO	0.17
CAO	23.99
K2O	0.02
NA2O	-0.02
F2O3	6.10
BAO	0.00
CL	0.00
F	0.00
H2O	1.90
SUM	98.52
-O= F+CL	0.00
SUM	98.52

SI	3.036	*
AL	0.000	3.036
AL	2.520	*
TI	0.004	*
MG	0.062	*
FE3+	0.361	*
MN	0.011	2.959
CA	2.023	*
K	0.002	*
NA	-0.003	*
BA	0.000	2.022
CL	0.000	*
F	0.000	0.000
H	1.000	1.000
O	13.000	*

17 448 EP 35C rim

1SUPER RECAL EPIDOTE ANALYSES (OH CALCULATED)

	1	2	3	4	5	6	7	8
SIO2	39.77	39.77	39.93	40.53	39.34	39.77	39.47	38.91
A2O3	29.04	28.94	28.75	30.45	28.73	27.99	27.76	27.52
TIO2	0.08	0.08	0.09	0.13	0.09	0.17	0.15	1.48
MGO	0.12	0.10	0.06	0.04	0.10	0.11	0.08	0.08
MNO	0.16	0.17	0.17	0.14	0.20	0.18	0.22	0.20
CAO	23.85	24.06	23.79	24.21	23.55	23.68	23.79	23.79
K2O	0.02	0.02	0.01	0.02	0.02	0.02	0.02	0.02
NA2O	0.02	0.02	0.06	0.13	0.03	0.02	0.03	0.02
F2O3	5.14	6.07	5.32	3.82	6.33	7.03	7.15	7.03
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	1.95	1.96	1.95	1.99	1.95	1.95	1.94	1.95
SUM	100.15	101.19	100.13	101.46	100.34	100.92	100.61	101.00
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	100.15	101.19	100.13	101.46	100.34	100.92	100.61	101.00

SI	3.055	*	3.035	*	3.069	*	3.058	*	3.029	*	3.051	*	3.043	*	2.994	*
AL	0.000	3.055	0.000	3.035	0.000	3.069	0.000	3.058	0.000	3.029	0.000	3.051	0.000	3.043	0.006	3.000
AL	2.629	*	2.603	*	2.604	*	2.707	*	2.607	*	2.530	*	2.522	*	2.489	*
TI	0.005	*	0.005	*	0.005	*	0.007	*	0.005	*	0.010	*	0.009	*	0.086	*
MG	0.014	*	0.011	*	0.007	*	0.004	*	0.011	*	0.013	*	0.009	*	0.009	*
FE3+	0.297	*	0.349	*	0.308	*	0.217	*	0.367	*	0.406	*	0.415	*	0.407	*
MN	0.010	2.955	0.011	2.978	0.011	2.935	0.009	2.945	0.013	3.003	0.012	2.970	0.014	2.969	0.013	3.004
CA	1.963	*	1.967	*	1.959	*	1.957	*	1.943	*	1.946	*	1.965	*	1.961	*
K	0.002	*	0.002	*	0.001	*	0.002	*	0.002	*	0.002	*	0.002	*	0.002	*
NA	0.003	*	0.003	*	0.009	*	0.019	*	0.004	*	0.003	*	0.004	*	0.003	*
BA	0.000	1.968	0.000	1.972	0.000	1.969	0.000	1.978	0.000	1.949	0.000	1.951	0.000	1.971	0.000	1.966
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
H	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
O	13.000	*	13.000	*	13.000	*	13.000	*	13.000	*	13.000	*	13.000	*	13.000	*

1 53 EP35B1
2 57 EP35B1
3 62 EP35B1
4 193 EP35B1
5 194 EP35B1
6 16 EP3511
7 36 EP3511
8 37 EP3511

BIOTITE

1SUPER RECAL BIOTITE ANALYSES (H2O CALCULATED)

	1	2	3	4	5	6	7	8
SIO2	38.85	38.30	38.79	39.10	38.42	38.66	39.08	38.72
A2O3	18.74	19.37	18.94	18.75	19.47	18.82	18.66	19.46
TIO2	0.45	0.41	0.30	0.41	0.41	0.46	0.45	0.46
FEO	10.80	11.09	10.42	10.66	10.14	10.55	10.61	10.74
MNO	0.10	0.08	0.09	0.09	0.10	0.10	0.11	0.11
MGO	16.97	17.33	17.68	17.38	17.30	17.32	17.42	16.96
CAO	0.10	0.13	0.12	0.05	0.11	0.10	0.07	0.11
NA2O	0.15	0.12	0.17	0.20	0.19	0.14	0.15	0.17
K2O	8.41	7.74	8.36	8.79	8.66	8.42	8.62	8.56
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	4.13	4.13	4.15	4.16	4.14	4.13	4.15	4.16
SUM	98.70	98.70	99.02	99.59	98.94	98.70	99.32	99.45
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	98.70	98.70	99.02	99.59	98.94	98.70	99.32	99.45

SI	5.640	*	5.549	*	5.604	*	5.632	*	5.559	*	5.609	*	5.638	*	5.581	*
AL	2.360	8.000	2.451	8.000	2.396	8.000	2.368	8.000	2.441	8.000	2.391	8.000	2.362	8.000	2.419	8.000
AL	0.846	*	0.857	*	0.828	*	0.815	*	0.878	*	0.827	*	0.811	*	0.886	*
TI	0.049	*	0.045	*	0.033	*	0.044	*	0.045	*	0.050	*	0.049	*	0.050	*
FE	1.311	*	1.344	*	1.259	*	1.284	*	1.227	*	1.280	*	1.280	*	1.295	*
MN	0.012	*	0.010	*	0.011	*	0.011	*	0.012	*	0.012	*	0.013	*	0.013	*
MG	3.672	5.890	3.743	5.998	3.807	5.937	3.732	5.886	3.731	5.892	3.746	5.915	3.746	5.899	3.643	5.887
CA	0.016	*	0.020	*	0.019	*	0.008	*	0.017	*	0.016	*	0.011	*	0.017	*
NA	0.042	*	0.034	*	0.048	*	0.056	*	0.053	*	0.039	*	0.042	*	0.048	*
K	1.557	*	1.430	*	1.540	*	1.615	*	1.598	*	1.558	*	1.586	*	1.574	*
BA	0.000	1.615	0.000	1.484	0.000	1.607	0.000	1.679	0.000	1.668	0.000	1.613	0.000	1.639	0.000	1.638
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

1 371 BI 35C core
2 372 BI 35C rim
3 378 BI 35C rim
4 383 BI 35C core
5 393 BI 35C core
6 394 BI 35C rim
7 403 BI 35C core
8 404 BI 35C rim

1SUPER RECAL BIOTITE ANALYSES (H2O CALCULATED)

	9	10	11	12	13	14	15
SIO2	39.50	38.89	38.81	38.59	38.49	38.81	38.59
A2O3	18.42	19.65	19.40	19.09	19.43	18.75	18.73
TIO2	0.51	0.45	0.44	0.45	0.39	0.38	0.37
FEO	9.88	10.05	10.14	10.44	11.03	10.49	10.56
MNO	0.10	0.08	0.09	0.12	0.11	0.14	0.06
MGO	17.57	17.21	16.59	16.62	17.69	17.05	17.13
CAO	0.19	0.12	0.17	0.06	0.07	0.12	0.09
NA2O	0.19	0.20	0.20	0.13	0.17	0.19	0.17
K2O	8.30	8.44	8.66	8.99	8.35	8.63	8.78
BAO	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2O	4.15	4.17	4.13	4.12	4.17	4.12	4.12
SUM	98.81	99.26	98.63	98.61	99.90	98.68	98.60
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUM	98.81	99.26	98.63	98.61	99.90	98.68	98.60

SI	5.696	*	5.591	*	5.626	*	5.617	*	5.528	*	5.637	*	5.617	*		
AL	2.304	8.000	2.409	8.000	2.374	8.000	2.383	8.000	2.472	8.000	2.363	8.000	2.383	8.000		
AL	0.826	*	0.920	*	0.939	*	0.891	*	0.817	*	0.846	*	0.830	*		
TI	0.055	*	0.049	*	0.048	*	0.049	*	0.042	*	0.042	*	0.041	*		
FE	1.192	*	1.208	*	1.229	*	1.271	*	1.325	*	1.274	*	1.286	*		
MN	0.012	*	0.010	*	0.011	*	0.015	*	0.013	*	0.017	*	0.007	*		
MG	3.777	5.862	3.688	5.874	3.584	5.812	3.606	5.832	3.787	5.984	3.691	5.870	3.717	5.880		
CA	0.029	*	0.018	*	0.026	*	0.009	*	0.011	*	0.019	*	0.014	*		
NA	0.053	*	0.056	*	0.056	*	0.037	*	0.047	*	0.054	*	0.048	*		
K	1.527	*	1.548	*	1.601	*	1.669	*	1.530	*	1.599	*	1.630	*		
BA	0.000	1.609	0.000	1.622	0.000	1.684	0.000	1.715	0.000	1.588	0.000	1.671	0.000	1.692		
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*		
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*		
H	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000		
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*		

9 411 BI 35C
10 432 BI 35C core
11 433 BI 35C rim
12 443 BI 35C rim
13 446 BI 35C
14 453 BI 35C core
15 454 BI 35C rim

1SUPER RECAL BIOTITE ANALYSES (H2O CALCULATED)

	1	2	3	4	5	6
SIO2	39.07	40.13	39.29	39.49	48.54	39.46
A2O3	18.95	17.98	19.10	18.78	19.14	19.49
TIO2	0.49	0.44	0.52	0.51	0.29	0.49
FEO	11.14	10.88	10.94	11.01	6.89	10.62
MNO	0.11	0.13	0.12	0.10	0.06	0.13
MGO	16.36	15.58	16.35	15.80	10.44	17.56
CAO	0.06	2.29	0.05	0.08	0.77	0.05
NA2O	0.21	0.41	0.22	0.21	1.39	0.22
K2O	8.85	7.28	8.91	8.76	8.71	9.02
BAO	0.00	0.00	0.00	0.00	0.00	0.00
CL	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00
H2O	4.14	4.16	4.16	4.13	4.37	4.23
SUM	99.38	99.28	99.66	98.87	100.60	101.27
-O= F+CL	0.00	0.00	0.00	0.00	0.00	0.00
SUM	99.38	99.28	99.66	98.87	100.60	101.27

SI	5.651	*	5.784	*	5.660	*	5.728	*	6.655	*	5.590	*
AL	2.349	8.000	2.216	8.000	2.340	8.000	2.272	8.000	1.345	8.000	2.410	8.0
AL	0.881	*	0.838	*	0.903	*	0.938	*	1.747	*	0.843	*
TI	0.053	*	0.048	*	0.056	*	0.056	*	0.030	*	0.052	*
FE	1.348	*	1.311	*	1.318	*	1.336	*	0.790	*	1.258	*
MN	0.013	*	0.016	*	0.015	*	0.012	*	0.007	*	0.016	*
MG	3.527	5.823	3.347	5.559	3.511	5.803	3.416	5.757	2.133	4.707	3.708	5.8
CA	0.009	*	0.354	*	0.008	*	0.012	*	0.113	*	0.008	*
NA	0.059	*	0.115	*	0.061	*	0.059	*	0.369	*	0.060	*
K	1.633	*	1.338	*	1.637	*	1.621	*	1.523	*	1.630	*
BA	0.000	1.701	0.000	1.806	0.000	1.706	0.000	1.692	0.000	2.006	0.000	1.6
CL	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*	0.000	*
H	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.0
O	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*	24.000	*

1 198 35B1BI
2 199 35B1BI
3 200 35B1AM
4 202 35B1AM
5 223 35B1BI
6 55 35B1BI

1SUPER RECAL BIOTITE ANALYSES (H2O CALCULATED)

	7	8	9
SIO2	39.35	39.17	39.39
A2O3	19.57	19.73	19.40
TIO2	0.40	0.43	0.40
FEO	10.15	10.60	10.39
MNO	0.10	0.12	0.10
MGO	17.12	17.13	17.04
CAO	0.06	0.06	0.05
NA2O	0.24	0.20	0.24
K2O	8.70	8.82	8.90
BAO	0.00	0.00	0.00
CL	0.00	0.00	0.00
F	0.00	0.00	0.00
H2O	4.19	4.20	4.19
SUM	99.88	100.46	100.10
-O= F+CL	0.00	0.00	0.00
SUM	99.88	100.46	100.10

SI	5.627	*	5.586	*	5.634	*
AL	2.373	8.000	2.414	8.000	2.366	8.000
AL	0.925	*	0.902	*	0.903	*
TI	0.043	*	0.046	*	0.043	*
FE	1.214	*	1.264	*	1.243	*
MN	0.012	*	0.014	*	0.012	*
MG	3.649	5.843	3.641	5.868	3.633	5.834
CA	0.009	*	0.009	*	0.008	*
NA	0.067	*	0.055	*	0.067	*
K	1.587	*	1.604	*	1.624	*
BA	0.000	1.663	0.000	1.669	0.000	1.698
CL	0.000	*	0.000	*	0.000	*
F	0.000	*	0.000	*	0.000	*
H	4.000	4.000	4.000	4.000	4.000	4.000
O	24.000	*	24.000	*	24.000	*

7 65 BI35B1
8 196 BI35B1
9 195 BI35B1

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