Grant, J.A., 1986. The Isocon diagram - a simple solution to Gresens' equation for metasomatic alteration. Economic Geology, V81, pp. 1976-1982.

Gregory, P.W., Hartley, J.S. and Wills, K.J.A., 1990. Thalanga zinc-lead-copper-silver deposit. in: Geology of the mineral deposits of Australia and Papua-New Guinea. (ed: F.E. Hughes) pp. 1527-1537. AIMM, Melbourne.

Hill, A.P., 1991. Structure and metal zonation of the Thalanga Zn-Pb-Cu deposit. In: Geological controls on VMS mineralisation in the Mt Windsor Volcanic Belt (eds: J. Pongratz and R.R. Large), CODES / University of Tasmania, Mount Windsor Project Research Report No. 2, pp. 147-169.

Hunns, S.R., Khin Zaw, Large, R.R., Dean, A.J., Ryan, C.G. and McPhie, J., 1994. Preliminary geochemical results constraining the formation of the Mt Chalmers volcanic hosted massive sulfide deposit. Abstracts of (GSA?) Symposium: New developments in geology and metallogeny: Northern Tasman Orogenic Zone; Townsville, QLD, February 1994.

Khin Zaw and Large, R.R., 1992. The precious metal rich South Hercules mineralization, Western Tasmania: a possible sub-sea floor replacement volcanic hosted massive sulfide deposit. Economic Geology, V87, pp. 931-952.

Large, R.R., 1992. Australian volcanic hosted massive sulphide deposits: Features, styles and genetic models. Economic Geology, V87, pp. 471-510.

Lees, T., Khin Zaw, Large, R.R., and Huston, D.L., 1990. Rosebery and Hercules copper-lead-zinc deposits. in: Geology of the mineral deposits of Australia and Papua-New Guinea. (ed: F.E. Hughes) pp. 1241-1247. AIMM, Melbourne.

MacLean, W.H. and Kranidiotis, P., 1987. Immobile elements as monitors of mass transfer in hydrothermal alteration: Phelps Dodge massive sulfide deposit, Matagami, Quebec. Economic Geology, V82, pp. 951-962.

MacLean, W.H. and Barrett, T.J., 1993. Lithogeochemical techniques using immobile elements. Journal of Geochemical Exploration, V48, pp. 109-133.

Offler, R. and Whitford, D.J. 1992. Wall rock alteration and metamorphism of a volcanic hosted massive sulfide deposit at Que River, Tasmania: Petrology and Mineralogy. Economic Geology, V87, pp. 686-705.

Orth, K. and Hill, A.P., 1994. Textures and origins of carbonate associated with the Rosebery VHMS deposit. Abstracts of GSA Symposium: "Contentious issues in Tasmanian geology" GSA Tas. Division, Hobart, November, 1994.

Rivers, C.J., 1985. An investigation of the effects of hydrothermal alteration in the footwall rocks of the Thalanga volcanogenic massive sulphide deposit, North Queensland. Unpublished; BSc. Hons. thesis, James Cook University, North Queensland.

Sainty, R.A. and Hill, A.P., (in prep). Genetic link between massive sulphide and quartz porphyry host rocks at the Thalanga VMS deposit; Mt Windsor Volcanic Belt, Queensland.

Skirrow, R.G. and Franklin, J.M., 1994. Silicification and metal leaching in semiconformable alteration beneath the Chisel Lake massive sulfide deposit, Snow Lake, Manitoba. Economic Geology, V89, pp. 31-50.

Stolz, A.J., 1989. Stratigraphic relationships and geochemistry of the Mt Windsor Volcanics. Mount Windsor Project Research Report No:1, pp.1-50. CODES; University of Tasmania.

Stolz, A.J., 1991. Stratigraphy and geochemistry of the Mt Windsor Volcanics and associated Exhalites. Mount Windsor Project Research Report No: 2, pp. 23-83. CODES; University of Tasmania.

Stolz, A.J., 1994. Geochemistry and Nd isotope character of the Mt Windsor Volcanics: implications for the tectonic setting of Cambro-Ordovician VHMS mineralisation. Abstracts of (GSA?) Symposium: New developments in geology and metallogeny: Northern Tasman Orogenic Zone; Townsville, QLD, February 1994.

Turner, R.J.W., Ames, D.E., Franklin, J.M., Goodfellow, W.D., Leitch, C.H.B. and Höy, T. 1993. Character of active hydrothermal mounds and nearby altered hemipelagic sediments in the hydrothermal areas of Middle Valley, Northern Juan de Fuca Ridge: data on shallow cores. Canadian Mineralogist, V31, pp. 973-995.

Wills, K.J.A., 1985. Thalanga Comprehensive Study - Final Report. Pennaroya (Australia) P/L, unpublished report No: 1551/10.

## 10 APPENDICES

**<u>Appendix I</u>** **Analytical Data**

- I-a Sources of Analytical Data
- I-b Manipulation of Analytical data
- I-c ALS analytical methods
- I-d Table 1, Major and trace element analyses.
  Table 3, Compositions of precursors and means of rhyolite and pseudo-exhalite groups.

**<u>Appendix II</u>** **Descriptions of Rhyolite, Exhalite and Pseudo-exhalite litho-geochemical groups.**

**<u>Appendix III</u>** **QCT Normative Calculations**

- III-a Explananation of QCT Normative Calculation Procedure
- III-b QCT Normative Calculations

## APPENDIX I Analytical Data

### I-a Sources of Analytical Data

The analytical data listed in Table 1 has been amalgamated from diverse sources and analytical methods summarised as follows:

| Source | No. | Method | Elements |
|---|---|---|---|
| Wills; 1985 | 101 | XRF-fusion: | $SiO_2$, $TiO_2$, $Al_2O_3$, $Fe_2O_3$, MnO, MgO, CaO, $Na_2O$, $K_2O$, $P_2O_5$. |
| | | XRF-powder: | As, Ba, Nb, Rb, Sr, Y, Zr. |
| | | AAS | Ag, Co, Cu, Cr, Ni, Pb, V, Zn. |
| | | Gravimetric | $CO_2$, $H_2O+$. |
| | | Volumetric | FeO, S. |
| Stolz; 1989, 1991 | 44 | XRF (unspecified) | $SiO_2$, $TiO_2$, $Al_2O_3$, $Fe_2O_3$, MnO, MgO, CaO, $Na_2O$, $K_2O$, $P_2O_5$. Sc, V, Cr, Ni, Cu, Pb, Zn, Ba Th, Rb, Sr, Y, Nb, Zr. LOI. |
| Herrmann; 1994 (this study) | 120 | ICP-AES (ALS: M275) | $SiO_2$, $Al_2O_3$, $Fe_2O_3$, MnO, MgO, CaO, $Na_2O$, $K_2O$, $P_2O_5$, LOI. |
| | | Gravimetric (ALS: A06-2) | $CO_2$. |
| | | High temp. evolution: (ALS: G013) | S. |
| | | AAS (A103, G001) | Cu, Pb, Zn. |
| | | XRF powder (ALS: XRF1) | Ti, Ba, Nb, Y, Zr. |
| Herrmann; 1994 (this study) | 26 | XRF powder (ALS: XRF1) | Ti, Ba, Zr. |
| | | AAS (A103, G001) | Cu, Pb, Zn. |

Analyses from these different sources are identified in Table 1 by the initials W, S and H, (for Wills, Stolz and Herrmann respectively) in the column headed "From".

In this study, it has not been possible to track down and re-describe many of the samples of Wills (1985) and Stolz (1989, 1991) and their original rock names have been retained in the tabulation even though the chemistry may indicate that they are misnomers. Chemistry and stratigraphic setting were the main criteria in assigning samples to the litho-geochemical groups and accordingly there are some apparent anomalies. For instance: the "shaley exhalites" from holes TH5, 16 & 37 have compositional and stratigraphic affinities with dacites and are assigned to Group 12 - altered dacites rather than Groups 31-35 which include the ore associated psuedo-exhalites.

## I-b Manipulation of Analytical Data

Some manipulation of the analyses from the varied data sets has been necessary to make them compatible.

1. Wills (1985) presented "recalculated" analyses to express $FeS_2$, ZnS, $CaCO_3$, and $BaSO_4$ (which reduced the values expressed as $Fe_2O_3$ and CaO) and did not present the raw data for $CO_2$ and S. Since Stolz' (1989, 1991) and some of the samples from this (1994) study did not include the latter two components it is not possible to universally apply Wills' recalculation format.

   Instead, Wills' data has been "reverse calculated" by reversing his stated recalculation procedure to estimate the original values.
   The reversion operates on the assumptions that:
   * All Ba is in barite and Cu, Pb, Zn are contained in chalcopyrite, galena and sphalerite respectively so that (given) Ba, Cu, Pb, Zn are used to estimate the sulphur in these minerals which is added to sulphur in pyrite to arrive at total sulphur.
   * Fe from pyrite and 1.1113xFeO are added to $Fe_2O_3$ to give total Fe as $Fe_2O_3$.
   * $CO_2$ is calculated from $CaCO_3$ and the excess CaO is added to give a total CaO.
   * The value in the column headed LOI, for Wills' samples is $H_2O+$.

   The totals of major components for analyses reverted in this manner are generally within one or two percent of 100% which suggests that no major errors have been introduced.

2. Stolz' (1989, 1991) major element data was presented as "normalised to 100% anhydrous" and, since ignition losses (LOI) range upto a few percent, are not directly comparable with the other sets. Accordingly, Stolz' data has been reverse calculated for each major component (on the assumption that the original major component totals were close to 100%) by the equation:
   Co = Ca(100-LOI)/100
   where: Co = original concentration of the component in hydrous sample.
   Ca = anhydrous normalised concentration of the component.
   This has produced totals artificially close to 100%, deviating from 100% only by the combined amounts of Ba, Cu, Pb and Zn.

   This de-normalisation has not been applied to Ba, Cu, Pb, Zn, Nb, Y and Zr all of which Stolz appears to have treated as trace elements and which were, in any case, probably determined by XRF on pressed powders which had not undergone ignition loss.

3. Calculations of totals for the analyses made by ALS in 1994 requires a rather convoluted approach due to the high volatile content of carbonate rich and sulphide rich samples and the different methods of determining them. As outlined in Appendix I-c the ALS method M275 for the 10 major components involves fusion of the sample prior to dissolution and analysis by ICP-AES; $CO_2$ and S are separately determined on an unfused sample.

   The calculation of totals for these analyses is based on advice from ALS (Dunn, 1994) that:
   * $CO_2$ in carbonates and S in sulphides are evolved during fusion and are included in the LOI.
   * S in Barite is retained as sulphate in the fused sample.
   * Cu, Pb, Zn and Fe in sulphides will be oxidised during fusion and remain in the sample to weight the M275 analysis accordingly.

   The system used to calculate the totals assumes that Ba, Cu, Pb and Zn are contained simply in barite, chalcopyrite, galena and sphalerite and proceeds by adding together the concentrations of the ten major components, LOI, $BaSO_4$ (calculated from the XRF value for Ba) and CuO, PbO and ZnO (calculated from the AAS values for base metals). This produces acceptable totals for most altered volcanic rocks but rather low totals (down to ~85%) for some barite, carbonate or sulphide rich rocks suggesting that perhaps not all CO2 and S is evolved from the latter two on fusion.

4. TiO2 values for the analyses from the 1994 data set (this study) are derived by recalculation of Ti (expressed in ppm) from XRF1 analyses. The M275 method also reports TiO2 (to 0.01% precision) but comparison of the two methods indicates that M275 tends to overestimate by a factor of ~1.08 compared with the values calculated from XRF1 and consequently the M275 TiO2 analyses have been discarded.

   Some precision is lost in reporting TiO2 in increments of 0.01% since many of the rhyolites contain <0.1% TiO2 and this is a critical immobile component for alteration studies.
   Nothing can be done to remedy it in the Wills and Stolz data but it is likely that the lack of precision in their TiO2 values is a significant factor in data scatter.

## I-c ALS Analytical Methods

All geochemical samples in the 1994 data set were of unoxidised diamond drill core and were analysed by Australian Laboratory Services P/L (ALS) in their Brisbane and Charters Towers laboratories.

The elements analysed are listed in Appendix I-a and the methods used are outlined as follows, after Dunn, (1994).

M275 Sample fused with lithium tetraborate or sodium peroxide and the resultant melt dissolved in dilute acid, bulked to volume and analysed by ICP-AES. An internal standard is used to monitor solution aspiration rates and improve the accuracy of the determination.
Sodium peroxide is used if the samples contain significant base metals or pyrite. In this case Na2O has to be separately determined by ICP-AES on a mixed acid digest (Method IC587).

A06-2 CO2 determined gravimetrically following evolution from hydrochloric acid. H2S liberated from base metal sulphides is removed by scrubbing with acidic copper sulphate solution prior to collection of the CO2 on Ascarite.

G013 Sulphur determined by high temperature evolution (1350° C) and infra red detection and quantification.

XRF1 X-ray flourescence determination using a pressed powder pellet. Matrix correction is by ratioing to the Compton scatter radiation (Nb, Y, Zr) or to background (Ti). Common line overlap corrections are made where considered necessary.
The procedure is suitable for unmineralised samples but problems arise with high concentrations of base metals, barite or mineral concentrates. In these cases additional line overlap corrections may have to be made or alternate lines or diffraction crystals selected.
(eg: Ba interference on Ti and Pb interference on Zr)

A103 Mixed acid digest (perchloric, nitric, hydrochloric) and final dilution in 20% HCl. Elements determined by AAS.

**TABLE 1** Major and Trace Element Analyses - Thalanga

| Sample | Hole | Depth | Description | Group | From | SiO2 | TiO2 | Al2O3 | Fe2O3 | MnO | MgO | Cao | Na2O | K2O | P2O5 | S | CO2 | Ba | Cu | Pb | Zn | LOI | Total | Nb | Y | Zr | Ti/Zr | A.I. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | m | | | | % | % | % | % | % | % | % | % | % | % | % | % | % | % | % | % | % | % | ppm | ppm | ppm | calc | calc |
| 54608 | TH112 | 134.3 | Wk aRhy | 1 | H | 72.73 | 0.1008 | 14.98 | 1.72 | 0.06 | 1.46 | 0.38 | 0.85 | 7.15 | 0.02 | 0.05 | | 0.18 | 0.00 | 0.01 | 0.01 | 1.42 | 101.22 | 19 | 36 | 179 | 3.4 | 88 |
| 54609 | TH112 | 184.5 | Wk aRhy | 1 | H | 75.96 | 0.0929 | 12.66 | 2.08 | 0.11 | 3.04 | 0.12 | 2.28 | 2.44 | 0.02 | 0.02 | | 0.05 | 0.00 | 0.00 | 0.04 | 1.80 | 100.75 | 16 | 39 | 150 | 3.7 | 70 |
| 54616 | TH144B | 103.8 | fr Rhy | 1 | H | 75.21 | 0.0947 | 12.32 | 2.53 | 0.08 | 1.52 | 1.20 | 2.70 | 4.01 | 0.01 | 0.03 | | 0.10 | 0.00 | 0.00 | 0.01 | 0.52 | 100.35 | 15 | 30 | 160 | 3.5 | 59 |
| 54627 | TH403 | 78.5 | Wk aRhy | 1 | H | 77.03 | 0.1181 | 12.44 | 1.90 | 0.05 | 0.93 | 0.21 | 3.26 | 4.39 | 0.04 | 0.00 | | 0.15 | 0.00 | 0.00 | 0.01 | 0.59 | 101.22 | 13 | 34 | 171 | 4.1 | 61 |
| 54628 | TH403 | 145.5 | Wk aRhy | 1 | H | 78.51 | 0.1106 | 11.65 | 1.71 | 0.04 | 0.64 | 0.16 | 3.36 | 3.95 | 0.03 | 0.05 | | 0.13 | 0.00 | 0.00 | 0.00 | 0.45 | 100.83 | 12 | 32 | 160 | 4.1 | 57 |
| 54635 | TH394 | 46.8 | Wk Q aRhy | 1 | H | 81.29 | 0.0791 | 9.88 | 1.23 | 0.03 | 0.35 | 0.93 | 2.03 | 3.54 | 0.03 | 0.04 | | 0.07 | 0.00 | 0.00 | 0.00 | 0.41 | 99.93 | 10 | 23 | 135 | 3.5 | 57 |
| 54636 | TH394 | 119.4 | Wk aRhy | 1 | H | 75.83 | 0.1124 | 13.00 | 1.68 | 0.03 | 1.25 | 0.64 | 2.03 | 3.80 | 0.02 | 0.00 | | 0.05 | 0.00 | 0.00 | 0.01 | 1.07 | 99.76 | 16 | 39 | 184 | 3.7 | 66 |
| 54637 | TH394 | 213.6 | Wk aRhy | 1 | H | 79.60 | 0.0682 | 10.89 | 1.34 | 0.02 | 0.64 | 0.15 | 3.32 | 2.04 | 0.02 | 0.85 | | 0.07 | 0.00 | 0.00 | 0.00 | 1.47 | 99.69 | 13 | 38 | 128 | 3.2 | 44 |
| | TH37 | 373 | Ser Rhy | 1 | S | 72.46 | 0.1363 | 14.77 | 2.11 | 0.02 | 2.68 | 0.23 | 1.34 | 3.62 | 0.00 | | | 0.07 | 0.00 | 0.00 | 0.01 | 2.62 | 100.07 | 20 | 45 | 212 | 3.9 | 80 |
| | TH37 | 400 | Alt Rhy | 1 | S | 77.29 | 0.1383 | 12.18 | 2.01 | 0.04 | 1.00 | 0.52 | 3.37 | 2.20 | 0.00 | | | 0.00 | 0.00 | 0.00 | 0.00 | 1.25 | 100.00 | 18 | 39 | 173 | 4.8 | 45 |
| | TH37 | 460 | Alt Rhy | 1 | S | 74.89 | 0.0988 | 12.78 | 1.95 | 0.04 | 1.48 | 0.64 | 0.60 | 6.32 | 0.00 | | | 0.12 | 0.00 | 0.00 | 0.01 | 1.19 | 100.12 | 18 | 43 | 182 | 3.3 | 85 |
| | TH57 | 391 | Ser Rhy | 1 | S | 71.62 | 0.2540 | 14.41 | 2.58 | 0.09 | 1.52 | 1.19 | 3.19 | 2.80 | 0.02 | | | 0.08 | 0.00 | 0.00 | 0.01 | 2.3 | 100.08 | 20 | 47 | 257 | 5.9 | 50 |
| | TH57 | 418 | Py alt Rhy | 1 | S | 78.08 | 0.0989 | 12.91 | 1.98 | 0.05 | 0.92 | 0.92 | 4.03 | 1.95 | 0.01 | | | 0.05 | 0.00 | 0.00 | 0.01 | 1.06 | 100.06 | 21 | 47 | 169 | 3.5 | 37 |
| | TH57 | 476 | Py alt Rhy | 1 | S | 76.19 | 0.0584 | 11.59 | 2.27 | 0.08 | 2.30 | 0.69 | 1.21 | 2.66 | 0.01 | | | 0.08 | 0.02 | 0.28 | 0.30 | 2.72 | 100.64 | 19 | 35 | 127 | 2.8 | 73 |
| | TH26 | 141.8 | fr v Rhy | 1 | W | 68.40 | 0.1200 | 14.80 | 1.75 | 0.05 | 2.30 | 0.37 | 0.92 | 9.30 | 0.01 | 0.03 | 0.03 | 0.07 | 0.00 | 0.00 | 0.01 | 0.26 | 98.42 | 20 | 42 | 185 | 3.9 | 90 |
| | TH28 | 155.8 | Si aggl | 1 | W | 76.70 | 0.0800 | 11.10 | 1.91 | 0.03 | 1.16 | 0.25 | 1.35 | 5.00 | 0.01 | 0.42 | 0.15 | 0.09 | 0.00 | 0.00 | 0.00 | 0.70 | 98.95 | 16 | 32 | 120 | 4.0 | 79 |
| | TH37 | 421.0 | Si-Se Rh | 1 | W | 71.00 | 0.1000 | 14.50 | 2.60 | 0.04 | 2.35 | 0.78 | 3.00 | 3.85 | 0.01 | 0.05 | 0.20 | 0.04 | 0.00 | 0.00 | 0.01 | 0.98 | 98.50 | 22 | 34 | 195 | 3.1 | 62 |
| | TH37 | 455.9 | Si-Se Rh | 1 | W | 74.70 | 0.1000 | 12.20 | 2.33 | 0.04 | 1.74 | 0.16 | 0.40 | 6.80 | 0.01 | 0.05 | 0.10 | 0.12 | 0.00 | 0.00 | 0.01 | 0.79 | 99.55 | 18 | 28 | 185 | 3.8 | 94 |
| | TH38 | 333.3 | Si FW Rhy | 1 | W | 75.80 | 0.1000 | 11.40 | 2.32 | 0.02 | 1.06 | 0.53 | 1.62 | 4.15 | 0.02 | 1.20 | 0.05 | 0.17 | 0.00 | 0.01 | 0.02 | 0.45 | 98.91 | 20 | 34 | 160 | 3.3 | 71 |
| | TH51 | 29.3 | Se Rh agg | 1 | W | 76.40 | 0.0700 | 11.30 | 1.57 | 0.06 | 2.85 | 0.42 | 2.05 | 3.30 | 0.01 | 0.44 | 0.00 | 0.08 | 0.00 | 0.02 | 0.10 | 0.70 | 99.39 | 16 | 28 | 115 | 3.6 | 71 |
| | TH55 | 51.8 | Sil Rhy | 1 | W | 71.90 | 0.1700 | 14.10 | 2.85 | 0.06 | 1.75 | 0.58 | 2.75 | 4.70 | 0.02 | 0.03 | 0.45 | 0.11 | 0.00 | 0.00 | 0.01 | 1.20 | 100.68 | 22 | 40 | 175 | 5.8 | 66 |
| | TH58 | 38.5 | fr FW Rhy | 1 | W | 72.80 | 0.1500 | 12.70 | 2.10 | 0.06 | 1.04 | 0.52 | 0.60 | 8.40 | 0.02 | 0.34 | 0.40 | 0.31 | 0.00 | 0.01 | 0.03 | 0.94 | 100.42 | 20 | 34 | 150 | 6.0 | 89 |
| | TH71 | 115.7 | Si gy alt | 1 | W | 75.80 | 0.0900 | 12.20 | 0.57 | 0.01 | 0.39 | 0.23 | 0.62 | 8.70 | 0.10 | 0.09 | 0.20 | 0.37 | 0.00 | 0.00 | 0.00 | 0.38 | 99.90 | 18 | 38 | 105 | 5.1 | 91 |
| | TH71 | 118.2 | Si gy PFU | 1 | W | 74.00 | 0.0800 | 13.50 | 1.73 | 0.02 | 1.36 | 0.20 | 0.39 | 6.86 | 0.02 | 0.04 | 0.15 | 0.14 | 0.00 | 0.00 | 0.01 | 0.94 | 99.44 | 20 | 34 | 140 | 3.4 | 93 |
| | TH87 | 56.5 | fr FW Rhy | 1 | W | 74.70 | 0.1300 | 12.00 | 1.94 | 0.07 | 1.83 | 0.58 | 0.55 | 6.70 | 0.02 | 0.30 | 0.45 | 0.38 | 0.00 | 0.00 | 0.01 | 0.91 | 100.56 | 16 | 29 | 110 | 7.1 | 68 |
| 54617 | TH144B | 474.8 | QSe aRhy | 2 | H | 77.70 | 0.0687 | 10.45 | 4.61 | 0.04 | 1.33 | 0.05 | 0.18 | 2.74 | 0.02 | 1.62 | | 0.06 | 0.01 | 0.00 | 0.00 | 2.90 | 100.19 | 12 | 24 | 127 | 3.1 | 95 |
| 54629 | TH403 | 415.5 | QSe aRhy | 2 | H | 79.14 | 0.0729 | 11.19 | 1.60 | 0.04 | 1.53 | 0.11 | 1.39 | 4.45 | 0.02 | 0.24 | | 0.26 | 0.01 | 0.01 | 0.01 | 1.20 | 101.32 | 14 | 33 | 130 | 3.4 | 60 |
| 54640 | TH404 | 274.2 | QSCh aRhy | 2 | H | 70.93 | 0.0716 | 11.28 | 6.14 | 0.09 | 2.51 | 0.05 | 0.23 | 2.49 | 0.02 | 1.20 | | 0.03 | 0.02 | 0.01 | 0.02 | 3.39 | 97.32 | 15 | 34 | 136 | 3.2 | 95 |
| 54642 | TH390B | 240.8 | QSCh aRhy | 2 | H | 73.55 | 0.0781 | 12.29 | 4.32 | 0.04 | 2.08 | 0.01 | 0.12 | 3.56 | 0.02 | 1.45 | | 0.05 | 0.00 | 0.00 | 0.02 | 3.10 | 99.26 | 15 | 31 | 148 | 3.2 | 88 |
| 60212 | TH407 | 134.0 | Rhy wk alt | 2 | H | 87.00 | 0.1044 | 11.80 | 7.22 | 0.11 | 4.57 | 0.35 | 0.20 | 7.21 | 0.03 | 0.00 | 0.10 | 0.23 | 0.00 | 0.00 | 0.02 | 0.38 | 100.09 | 14 | 31 | 172 | 3.6 | 98 |
| | TH57 | 384 | Sil Exh | 2 | S | 75.20 | 0.0987 | 11.21 | 3.78 | 0.03 | 1.28 | 0.80 | 0.83 | 3.40 | 0.03 | | | 0.15 | 0.02 | 0.02 | 0.12 | 3.34 | 100.30 | 15 | 41 | 157 | 3.7 | 74 |
| | TH57 | 444 | Py alt Rhy | 2 | S | 77.64 | 0.0879 | 12.08 | 1.01 | 0.00 | 2.17 | 0.38 | 0.56 | 3.72 | 0.00 | | | 0.13 | 0.00 | 0.00 | 0.01 | 2.33 | 100.15 | 17 | 34 | 131 | 4.0 | 88 |
| | TH57 | 502 | Alt Rhy | 2 | S | 73.56 | 0.1840 | 12.74 | 5.27 | 0.07 | 1.88 | 0.22 | 0.00 | 3.10 | 0.00 | | | 0.04 | 0.00 | 0.00 | 0.00 | 3.01 | 100.05 | 15 | 41 | 150 | 6.6 | 98 |
| | TH112 | 155 | Alt Rhy | 2 | S | 75.99 | 0.0889 | 12.15 | 1.84 | 0.08 | 2.45 | 0.31 | 3.04 | 2.52 | 0.00 | | | 0.07 | 0.00 | 0.00 | 0.02 | 1.58 | 100.10 | 16 | 46 | 130 | 3.2 | 80 |
| | TH112 | 183 | Alt Rhy | 2 | S | 71.71 | 0.0774 | 12.53 | 2.39 | 0.19 | 6.40 | 0.05 | 0.35 | 3.05 | 0.00 | | | 0.04 | 0.00 | 0.00 | 0.05 | 3.25 | 100.08 | 15 | 39 | 138 | 3.4 | 98 |
| | TH112 | 596 | Alt Rhy | 2 | S | 73.33 | 0.0773 | 13.48 | 1.81 | 0.03 | 2.91 | 0.74 | 1.54 | 2.66 | 0.03 | | | 0.06 | 0.00 | 0.00 | 0.01 | 3.42 | 100.06 | 18 | 40 | 158 | 2.9 | 71 |
| | TH14 | 94.6 | Se Rhy agg | 2 | W | 75.70 | 0.0700 | 11.50 | 1.97 | 0.08 | 3.75 | 0.05 | 0.20 | 4.30 | 0.01 | 0.76 | 0.00 | 0.06 | 0.00 | 0.00 | 0.18 | 1.37 | 100.00 | 16 | 32 | 110 | 3.8 | 97 |
| | TH18 | 158.3 | I Rhy HW? | 2 | W | 73.40 | 0.1000 | 11.40 | 3.00 | 0.06 | 2.95 | 1.28 | 0.11 | 3.80 | 0.03 | 0.35 | 1.00 | 0.49 | 0.01 | 0.00 | 0.04 | 1.09 | 98.11 | 12 | 26 | 80 | 7.5 | 83 |

**TABLE 1** **Major and Trace Element Analyses - Thalanga** (Continued)

| Sample | Hole | Depth | Description | Group | From | SiO2 | TiO2 | Al2O3 | Fe2O3 | MnO | MgO | CaO | Na2O | K2O | P2O5 | S | CO2 | Ba | Cu | Pb | Zn | LOI | Total | Nb | Y | Zr | Ti/Zr | A.I. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | m | | | | % | % | % | % | % | % | % | % | % | % | % | % | % | % | % | % | % | % | ppm | ppm | ppm | calc | calc |
| | TH18 | 169.0 | Si FW Rhy | 2 | W | 76.70 | 0.1000 | 11.90 | 2.65 | 0.02 | 1.48 | 0.12 | 0.52 | 3.80 | 0.01 | 0.68 | 0.09 | 0.09 | 0.00 | 0.01 | 0.01 | 2.30 | 100.48 | 16 | 24 | 150 | 4.0 | 89 |
| | TH26 | 41.7 | Se Rhyagg | 2 | W | 73.90 | 0.0800 | 11.70 | 2.81 | 0.08 | 3.35 | 0.78 | 0.55 | 3.80 | 0.01 | 0.69 | 0.55 | 0.23 | 0.01 | 0.05 | 0.14 | 1.05 | 99.74 | 16 | 22 | 125 | 3.8 | 85 |
| | TH26 | 282.7 | gy Rh PFU | 2 | W | 73.70 | 0.0700 | 12.60 | 1.82 | 0.06 | 4.50 | 0.09 | 0.07 | 4.10 | 0.01 | 0.22 | 0.03 | 0.07 | 0.00 | 0.00 | 0.01 | 1.76 | 99.11 | 16 | 30 | 120 | 3.5 | 98 |
| | TH37 | 342.3 | Si FW?Rh | 2 | W | 68.90 | 0.1100 | 14.00 | 3.54 | 0.01 | 1.67 | 0.26 | 0.26 | 4.70 | 0.02 | 2.06 | 0.20 | 0.35 | 0.05 | 0.04 | 1.70 | 1.47 | 99.35 | 22 | 38 | 175 | 3.8 | 92 |
| | TH38 | 156.2 | gy fl PFU | 2 | W | 64.50 | 0.1000 | 16.20 | 2.20 | 0.02 | 5.15 | 0.29 | 0.11 | 5.10 | 0.01 | 0.73 | 0.22 | 0.24 | 0.00 | 0.00 | 0.05 | 2.35 | 99.27 | 25 | 50 | 165 | 3.2 | 96 |
| 54310 | TH382A | 449.5 | alt Rhy | 4 | H | 68.06 | 0.0684 | 7.68 | 11.56 | 0.09 | 3.85 | 0.08 | 0.15 | 1.21 | 0.03 | 5.45 | | 0.85 | 0.87 | 0.00 | 0.10 | 5.40 | 100.84 | 10 | 16 | 93 | 4.4 | 98 |
| 54537 | TH404 | 282.5 | Q-Py alt Rhy | 4 | H | 69.01 | 0.0527 | 8.04 | 10.90 | 0.01 | 1.02 | 0.18 | 0.07 | 2.46 | 0.02 | 8.89 | | 0.05 | 0.02 | 0.01 | 0.02 | 8.16 | 100.08 | 10 | 19 | 102 | 3.1 | 90 |
| 54610 | TH112 | 284.5 | Q-Py alt Rhy | 4 | H | 66.42 | 0.0611 | 8.58 | 12.19 | 0.02 | 1.29 | 0.02 | 0.10 | 2.42 | 0.02 | 10.30 | | 0.05 | 0.00 | 0.00 | 0.00 | 7.56 | 98.78 | 11 | 10 | 113 | 3.2 | 97 |
| 54618 | TH144B | 512.0 | Q-Py alt Rhy | 4 | H | 70.69 | 0.0572 | 8.86 | 6.51 | 0.04 | 1.79 | 0.02 | 0.14 | 2.20 | 0.02 | 5.94 | | 0.04 | 0.02 | 0.00 | 0.01 | 5.80 | 98.34 | 12 | 21 | 117 | 2.9 | 98 |
| 54631 | TH403 | 505.5 | Q-Py alt Rhy | 4 | H | 75.79 | 0.0671 | 9.46 | 6.07 | 0.03 | 1.96 | 0.04 | 0.17 | 3.00 | 0.02 | 3.91 | | 0.07 | 0.00 | 0.00 | 0.00 | 4.46 | 101.20 | 13 | 17 | 125 | 3.2 | 96 |
| 54643 | TH390B | 301.3 | Q-Py alt Rhy | 4 | H | 71.90 | 0.0329 | 6.69 | 9.03 | 0.01 | 0.57 | 0.42 | 0.19 | 1.71 | 0.01 | 7.83 | | 0.04 | 0.00 | 0.02 | 0.01 | 7.09 | 97.75 | 8 | 11 | 83 | 2.4 | 79 |
| 61492 | W2011NED42 | 124.2 125.3 | Si Ox RhyVc | 4 | H | 69.80 | 0.1191 | 6.03 | 11.50 | 0.05 | 1.10 | 0.12 | 0.10 | 2.51 | 0.02 | 6.92 | 0.30 | 0.50 | 0.12 | 0.00 | 0.25 | 3.33 | 98.00 | 10 | 15 | 123 | 5.8 | 94 |
| 61493 | W2011NED42 | 125.3 126.3 | Si Ox RhyVc | 4 | H | 81.10 | 0.0601 | 7.00 | 5.92 | 0.03 | 0.94 | 0.09 | 0.06 | 2.30 | 0.01 | 2.81 | 0.05 | 0.25 | 0.01 | 0.03 | 0.06 | 1.88 | 99.93 | 8 | 23 | 105 | 3.4 | 98 |
| 61494 | W2011NED42 | 126.3 127.3 | Si Ox RhyVc | 4 | H | 73.40 | 0.0641 | 7.25 | 11.80 | 0.04 | 1.01 | 0.09 | 0.05 | 2.41 | 0.01 | 6.07 | 0.20 | 0.23 | 0.09 | 0.03 | 0.09 | 4.05 | 100.75 | 11 | 23 | 112 | 3.4 | 96 |
| 61496 | W2011NED42 | 131.6 133.0 | Si Ox RhyVc | 4 | H | 72.00 | 0.0742 | 9.59 | 9.16 | 0.04 | 1.32 | 0.41 | 0.14 | 2.92 | 0.02 | 5.72 | 0.05 | 0.41 | 0.02 | 0.02 | 0.12 | 3.24 | 99.80 | 13 | 24 | 137 | 3.2 | 89 |
| | TH112 | 256 | Py alt Rhy | 4 | S | 79.86 | 0.0583 | 9.59 | 3.19 | 0.02 | 1.48 | 0.02 | 0.20 | 2.79 | 0.03 | | | 0.04 | 0.00 | 0.00 | 0.00 | 2.78 | 100.08 | 12 | 42 | 107 | 3.3 | 95 |
| | TH11 | 105.5 | Py FW Rhy | 4 | W | 55.60 | 0.0200 | 4.20 | 24.31 | 0.01 | 0.29 | 0.04 | 0.06 | 1.31 | 0.02 | 19.57 | 0.03 | 0.28 | 0.00 | 0.00 | 0.00 | 0.29 | 108.05 | 7 | 1 | 46 | 2.6 | 94 |
| | TH39 | 98.0 | Py FW alt | 4 | W | 66.60 | 0.0100 | 7.60 | 12.09 | 0.05 | 3.40 | 0.12 | 0.04 | 1.41 | 0.01 | 6.05 | 0.09 | 0.03 | 0.00 | 0.00 | 0.01 | 2.40 | 99.92 | 14 | 14 | 80 | 0.7 | 97 |
| 54607 | TH112 | 115.8 | Si Rhy | 5 | H | 78.99 | 0.0854 | 10.13 | 0.52 | 0.01 | 0.09 | 0.18 | 0.35 | 8.40 | 0.02 | 0.15 | | 0.17 | 0.00 | 0.00 | 0.02 | 0.35 | 99.42 | 13 | 13 | 118 | 3.3 | 94 |
| 54630 | TH403 | 445.5 | Si aRhy | 5 | H | 85.45 | 0.0397 | 7.60 | 1.10 | 0.01 | 0.38 | 0.05 | 0.46 | 4.54 | 0.01 | 0.49 | | 0.56 | 0.03 | 0.03 | 0.01 | 1.00 | 101.64 | 8 | 20 | 91 | 2.6 | 91 |
| 54633 | TR2 | 433.5 | Si Rhy | 5 | H | 80.51 | 0.0921 | 10.58 | 1.80 | 0.03 | 0.50 | 0.06 | 0.23 | 5.30 | 0.01 | 0.97 | | 0.10 | 0.00 | 0.00 | 0.00 | 1.91 | 101.20 | 13 | 27 | 179 | 3.1 | 95 |
| 54634 | STD RH1 | STD RH1 | Si Rhy | 5 | H | 78.08 | 0.0602 | 11.35 | 1.56 | 0.03 | 0.97 | 0.80 | 0.87 | 5.96 | 0.02 | 0.31 | | 0.14 | 0.00 | 0.05 | 0.12 | 1.17 | 101.32 | 12 | 29 | 132 | 2.7 | 61 |
| 54628 | TH404 | 210.0 | Si Rhy | 5 | H | 79.29 | 0.0405 | 9.51 | 0.89 | 0.01 | 0.09 | 0.27 | 0.40 | 7.71 | 0.02 | 0.46 | | 0.17 | 0.00 | 0.00 | 0.00 | 0.70 | 99.22 | 11 | 29 | 113 | 2.2 | 92 |
| 54639 | TH404 | 251.7 | Si Rhy | 5 | H | 78.55 | 0.0842 | 11.77 | 1.20 | 0.03 | 0.71 | 0.45 | 0.79 | 5.15 | 0.01 | 0.24 | | 0.19 | 0.01 | 0.01 | 0.06 | 1.40 | 100.54 | 14 | 28 | 135 | 2.9 | 83 |
| 54641 | STD RH1 | STD RH1 | Si Rhy | 5 | H | 76.32 | 0.0672 | 11.38 | 1.53 | 0.03 | 0.94 | 0.88 | 0.82 | 5.90 | 0.02 | 0.28 | | 0.15 | 0.00 | 0.08 | 0.09 | 1.16 | 99.47 | 14 | 32 | 139 | 2.9 | 80 |
| 54645 | TH391 | 111.3 | Si Wh Rhy | 5 | H | 81.41 | 0.0332 | 7.68 | 1.16 | 0.01 | 0.28 | 0.25 | 0.23 | 5.86 | 0.02 | 0.75 | | 0.13 | 0.00 | 0.00 | 0.01 | 1.05 | 98.22 | 9 | 10 | 91 | 2.2 | 93 |
| 60222 | STD RH1 | STD RH1 | Si Rhy | 5 | H | 72.70 | 0.0701 | 11.50 | 2.30 | 0.03 | 0.99 | 0.86 | 0.82 | 5.86 | 0.01 | 0.30 | 0.80 | 0.17 | 0.00 | 0.10 | 0.21 | 1.25 | 96.57 | 15 | 35 | 140 | 3.0 | 82 |
| 61497 | STD RH1 | STD RH1 | Si Rhy | 5 | H | 75.60 | 0.0609 | 10.90 | 4.50 | 0.05 | 0.98 | 0.71 | 0.86 | 5.77 | 0.01 | 0.41 | 0.10 | 0.14 | 0.01 | 0.03 | 0.16 | 0.38 | 100.50 | 13 | 30 | 100 | 2.6 | 81 |
| | TH5 | 230.3 | Py alt Rhy | 5 | S | 83.14 | 0.0587 | 9.05 | 1.37 | 0.01 | 1.04 | 0.09 | 0.30 | 2.80 | 0.02 | | | 0.13 | 0.00 | 0.00 | 0.39 | 2.11 | 100.52 | 11 | 28 | 98 | 3.6 | 91 |
| | TH112 | 452 | Act-Si Exh | 5 | S | 85.44 | 0.0691 | 8.07 | 1.16 | 0.01 | 0.49 | 0.14 | 1.80 | 1.58 | 0.00 | | | 0.06 | 0.02 | 0.00 | 0.02 | 1.25 | 100.11 | 10 | 28 | 90 | 4.6 | 52 |
| | TH11 | 145.5 | Si gy Rhy | 5 | W | 75.50 | 0.0600 | 12.50 | 1.20 | 0.01 | 0.89 | 0.23 | 0.41 | 6.80 | 0.04 | 0.73 | 0.18 | 0.28 | 0.00 | 0.03 | 0.07 | 0.80 | 99.77 | 18 | 24 | 115 | 4.2 | 92 |
| | TH112 | 67.5 | valt v Rhy | 5 | W | 80.30 | 0.1100 | 9.15 | 0.89 | 0.02 | 0.01 | 0.33 | 0.20 | 6.05 | 0.01 | 0.44 | 0.25 | 0.16 | 0.00 | 0.00 | 0.00 | 0.19 | 100.12 | 12 | 16 | 90 | 7.3 | 94 |
| | TH16 | 229.8 | Si FW Rhy | 5 | W | 86.40 | 0.0300 | 6.25 | 1.75 | 0.01 | 0.83 | 0.09 | 0.37 | 1.76 | 0.02 | 1.75 | 0.03 | 2.33 | 0.00 | 0.02 | 0.08 | 0.37 | 102.08 | 10 | 85 | 60 | 3.0 | 65 |
| | TH33 | 282.7 | Si Rh HW | 5 | W | 80.60 | 0.1100 | 9.90 | 2.00 | 0.03 | 1.18 | 0.26 | 0.40 | 3.45 | 0.01 | 0.13 | 0.20 | 0.05 | 0.00 | 0.00 | 0.00 | 1.33 | 99.66 | 16 | 32 | 110 | 6.0 | 67 |
| | TH62 | 921.8 | alt v Rhy | 5 | W | 79.50 | 0.1000 | 9.50 | 1.14 | 0.01 | 0.07 | 0.27 | 0.42 | 7.55 | 0.01 | 0.65 | 0.15 | 0.22 | 0.00 | 0.00 | 0.01 | 0.35 | 99.89 | 14 | 22 | 90 | 6.7 | 92 |
| | TH71 | 64.9 | gy alt Rhy | 5 | W | 80.80 | 0.0400 | 6.80 | 1.96 | 0.03 | 2.20 | 0.32 | 0.36 | 3.05 | 0.01 | 1.06 | 0.15 | 0.19 | 0.00 | 0.08 | 0.17 | 0.94 | 100.17 | 14 | 9 | 85 | 2.8 | 89 |
| | TH93 | 214.6 | valt v Rhy | 5 | W | 80.50 | 0.1200 | 8.80 | 1.13 | 0.02 | 0.06 | 0.26 | 0.43 | 6.80 | 0.01 | 0.74 | 0.20 | 0.35 | 0.03 | 0.09 | 0.31 | 0.29 | 100.14 | 14 | 14 | 120 | 6.0 | 91 |
| 54611 | TH112 | 344.5 | Wk aRhy | 6 | H | 78.01 | 0.0861 | 13.21 | 1.70 | 0.03 | 2.52 | 0.40 | 2.88 | 2.40 | 0.02 | 0.02 | | 0.06 | 0.00 | 0.00 | 0.01 | 1.39 | 100.78 | 16 | 46 | 156 | 3.7 | 60 |
| 54613 | TH112 | 420.5 | Wk aRhy | 6 | H | 77.76 | 0.0874 | 11.97 | 1.66 | 0.02 | 1.68 | 0.60 | 3.54 | 1.88 | 0.02 | 0.04 | | 0.02 | 0.00 | 0.00 | 0.01 | 0.89 | 100.16 | 15 | 47 | 146 | 3.5 | 46 |

**TABLE 1** Major and Trace Element Analyses - Thalanga (Continued)

| Sample | Hole | Depth m | Description | Group | From | SiO2 % | TiO2 % | Al2O3 % | Fe2O3 % | MnO % | MgO % | CaO % | Na2O % | K2O % | P2O5 % | S % | CO2 % | Ba % | Cu % | Pb % | Zn % | LOI % | Total % | Nb ppm | Y ppm | Zr ppm | Ti/Zr calc | A.I. calc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 54614 | TH112 | 592.3 | Wk aRhy | 6 | H | 80.07 | 0.0590 | 10.74 | 1.31 | 0.01 | 0.54 | 0.33 | 5.20 | 0.44 | 0.02 | 0.47 | | 0.01 | 0.00 | 0.00 | 0.00 | 0.82 | 99.55 | 12 | 41 | 125 | 2.8 | 15 |
| 54619 | TH144B | 568.3 | Si aRhy | 6 | H | 78.49 | 0.0562 | 11.04 | 1.03 | 0.01 | 0.17 | 0.31 | 3.12 | 4.39 | 0.01 | 0.14 | | 0.19 | 0.00 | 0.00 | 0.00 | 0.37 | 99.32 | 14 | 25 | 131 | 2.6 | 57 |
| 54620 | TH144B | 568.8 | Si aRhy | 6 | H | 79.89 | 0.0417 | 9.22 | 1.02 | 0.03 | 0.17 | 1.05 | 3.21 | 2.17 | 0.02 | 0.14 | | 0.08 | 0.00 | 0.00 | 0.00 | 0.68 | 97.64 | 11 | 31 | 106 | 2.4 | 35 |
| 54632 | TH404 | 308.2 | Si Rhy | 6 | H | 80.34 | 0.0737 | 11.04 | 1.35 | 0.03 | 0.82 | 0.93 | 4.37 | 0.92 | 0.02 | 0.04 | | 0.03 | 0.00 | 0.00 | 0.01 | 0.72 | 100.68 | 12 | 44 | 136 | 3.2 | 25 |
| | TH26 | 304 | Rhy | 6 | S | 79.07 | 0.0699 | 11.55 | 1.02 | 0.01 | 0.15 | 0.37 | 3.98 | 3.59 | 0.01 | | | 0.10 | 0.00 | 0.00 | 0.00 | 0.18 | 100.10 | 13 | 32 | 121 | 3.5 | 46 |
| | TH26 | 322 | Rhy | 6 | S | 78.24 | 0.0698 | 11.60 | 1.16 | 0.02 | 0.30 | 0.21 | 2.93 | 5.22 | 0.01 | | | 0.11 | 0.00 | 0.00 | 0.01 | 0.23 | 100.10 | 13 | 24 | 125 | 3.3 | 64 |
| | TH33 | 390 | Rhy | 6 | S | 79.21 | 0.0796 | 12.31 | 0.53 | 0.01 | 0.48 | 0.89 | 5.47 | 0.60 | 0.01 | | | 0.01 | 0.00 | 0.00 | 0.00 | 0.44 | 100.02 | 15 | 41 | 129 | 3.7 | 14 |
| | TH135 | 234 | Rhy | 6 | S | 71.22 | 0.0993 | 15.00 | 1.94 | 0.04 | 1.73 | 2.05 | 4.15 | 3.05 | 0.01 | | | 0.04 | 0.00 | 0.00 | 0.01 | 0.73 | 100.07 | 18 | 53 | 164 | 3.2 | 43 |
| | TH14 | 238.8 | fr v Rhy | 6 | W | 72.20 | 0.1000 | 14.50 | 1.94 | 0.02 | 1.77 | 0.89 | 4.55 | 3.15 | 0.01 | 0.04 | 0.05 | 0.06 | 0.00 | 0.00 | 0.01 | 0.54 | 99.80 | 20 | 30 | 135 | 4.4 | 47 |
| | TH14 | 285.3 | gn l Rhy | 6 | W | 78.40 | 0.0600 | 11.90 | 1.52 | 0.02 | 1.10 | 0.24 | 4.00 | 1.47 | 0.01 | 0.03 | 0.03 | 0.02 | 0.00 | 0.00 | 0.00 | 0.90 | 99.70 | 16 | 38 | 115 | 3.1 | 38 |
| | TH14 | 311.0 | gn Si Rhy | 6 | W | 75.70 | 0.0600 | 11.80 | 2.00 | 0.02 | 3.70 | 0.26 | 2.50 | 1.40 | 0.01 | 0.04 | 0.20 | 0.03 | 0.00 | 0.00 | 0.01 | 1.53 | 99.26 | 16 | 26 | 115 | 3.1 | 65 |
| | TH14 | 377.8 | Si FW Rhy | 6 | W | 77.80 | 0.0600 | 11.30 | 1.88 | 0.01 | 0.77 | 0.43 | 1.11 | 4.95 | 0.01 | 0.85 | 0.20 | 0.20 | 0.00 | 0.00 | 0.02 | 0.68 | 100.09 | 16 | 28 | 115 | 3.1 | 79 |
| | TH14 | 384.2 | v Rhy | 6 | W | 72.40 | 0.0600 | 13.60 | 2.05 | 0.02 | 0.27 | 1.15 | 5.25 | 5.20 | 0.01 | 0.10 | 0.55 | 0.15 | 0.00 | 0.00 | 0.00 | 0.22 | 101.05 | 20 | 30 | 145 | 3.3 | 48 |
| | TH26 | 299.3 | fr v Rhy | 6 | W | 72.10 | 0.1000 | 14.40 | 2.54 | 0.02 | 0.83 | 0.09 | 3.75 | 4.35 | 0.06 | 0.06 | 0.03 | 0.10 | 0.00 | 0.00 | 0.01 | 0.48 | 98.95 | 18 | 36 | 150 | 4.0 | 57 |
| | TH28 | 373.7 | alt v Rhy | 6 | W | 75.50 | 0.0700 | 12.40 | 1.94 | 0.02 | 0.25 | 0.48 | 3.60 | 4.25 | 0.02 | 0.48 | 0.35 | 0.08 | 0.00 | 0.00 | 0.00 | 0.28 | 99.70 | 18 | 22 | 130 | 3.2 | 53 |
| | TH38 | 169.8 | Si v Rhy | 6 | W | 73.70 | 0.0900 | 13.00 | 1.89 | 0.01 | 0.43 | 0.74 | 1.61 | 6.85 | 0.02 | 0.87 | 0.30 | 0.23 | 0.00 | 0.02 | 0.02 | 0.45 | 100.03 | 20 | 28 | 125 | 4.3 | 76 |
| | TH5 | 325.8 | Fr v Rhy | 6 | W | 80.10 | 0.0700 | 11.30 | 1.28 | 0.01 | 0.01 | 0.85 | 5.35 | 0.40 | 0.01 | 0.01 | 0.15 | 0.01 | 0.00 | 0.00 | 0.00 | 0.02 | 99.68 | 16 | 24 | 115 | 3.6 | 6 |
| | TH51 | 225.0 | fr v Rhy | 6 | W | 72.30 | 0.1100 | 15.40 | 1.14 | 0.02 | 0.38 | 0.90 | 5.55 | 3.80 | 0.01 | 0.13 | 0.25 | 0.14 | 0.00 | 0.00 | 0.00 | 0.42 | 100.56 | 22 | 46 | 170 | 3.9 | 39 |
| | TH51 | 234.2 | alt v Rhy | 6 | W | 78.10 | 0.0900 | 12.50 | 1.35 | 0.01 | 0.34 | 0.20 | 2.20 | 6.20 | 0.02 | 0.19 | 0.10 | 0.19 | 0.00 | 0.00 | 0.00 | 0.57 | 100.07 | 18 | 44 | 135 | 4.0 | 73 |
| 54356 | TH245 | 584.5 | QChl aRhy | 7 | H | 65.76 | 0.1198 | 12.50 | 2.87 | 0.22 | 9.71 | 0.71 | 0.13 | 3.81 | 0.02 | 0.04 | | 0.08 | 0.00 | 0.00 | 0.03 | 2.24 | 98.27 | 14 | 19 | 152 | 4.7 | 94 |
| 54357 | TH245 | 611.5 | QChl aRhy | 7 | H | 73.72 | 0.0916 | 14.24 | 1.99 | 0.11 | 3.52 | 0.05 | 0.14 | 5.25 | 0.02 | 0.15 | | 0.07 | 0.00 | 0.00 | 0.01 | 1.98 | 101.25 | 17 | 32 | 166 | 3.3 | 98 |
| 54358 | TH245 | 618.5 | QSe aRhy | 7 | H | 75.08 | 0.1203 | 13.77 | 1.49 | 0.04 | 2.32 | 0.15 | 0.18 | 4.63 | 0.02 | 0.57 | | 0.18 | 0.01 | 0.00 | 0.01 | 2.38 | 100.49 | 16 | 30 | 169 | 4.3 | 95 |
| 54359 | TH245 | 672.2 | QSe aRhy | 7 | H | 69.28 | 0.0637 | 7.87 | 7.17 | 0.02 | 2.61 | 1.89 | 0.57 | 1.20 | 0.02 | 6.26 | 0.10 | 1.71 | 0.25 | 0.01 | 0.06 | 5.76 | 99.84 | 8 | 24 | 111 | 3.4 | 60 |
| 54367 | TH245 | 676.7 | (Ac)aRhy | 7 | H | 72.53 | 0.1016 | 8.71 | 3.32 | 0.06 | 5.70 | 2.28 | 0.05 | 1.02 | 0.03 | 2.01 | 0.10 | 2.55 | 0.08 | 0.00 | 0.17 | 3.77 | 102.18 | 12 | 37 | 147 | 4.1 | 74 |
| 54368 | TH245 | 712.5 | SeChl aRhy | 7 | H | 64.81 | 0.1608 | 18.41 | 3.27 | 0.04 | 4.76 | 0.24 | 0.35 | 5.30 | 0.00 | 0.47 | 0.10 | 0.54 | 0.00 | 0.00 | 0.01 | 3.24 | 101.54 | 20 | 52 | 271 | 3.6 | 94 |
| 54612 | TH112 | 388.8 | fr FOpRhy | 7 | H | 67.01 | 0.1176 | 18.34 | 2.34 | 0.02 | 0.45 | 0.67 | 4.73 | 8.28 | 0.03 | 0.01 | | 0.08 | 0.00 | 0.00 | 0.01 | 0.67 | 100.81 | 20 | 50 | 215 | 3.3 | 55 |
| | TH5 | 282 | Py alt Rhy | 7 | S | 63.55 | 0.1536 | 19.48 | 2.49 | 0.01 | 4.31 | 0.21 | 1.59 | 4.16 | 0.00 | | | 0.04 | 0.00 | 0.00 | 0.01 | 4.02 | 100.05 | 26 | 74 | 224 | 4.1 | 82 |
| | TH5 | 313 | Chl alt Rhy | 7 | S | 74.71 | 0.0874 | 13.52 | 1.68 | 0.02 | 2.89 | 0.12 | 1.33 | 3.07 | 0.00 | | | 0.05 | 0.00 | 0.00 | 0.01 | 2.57 | 100.08 | 20.0 | 42.0 | 170.0 | 3.4 | 60 |
| | TH1 | 221.5 | FW vRH | 7 | W | 68.50 | 0.1700 | 15.40 | 2.19 | 0.07 | 3.55 | 3.15 | 4.45 | 1.72 | 0.04 | 0.09 | 0.03 | 0.08 | 0.00 | 0.00 | 0.03 | 0.45 | 99.93 | 16 | 35 | 155 | 6.6 | 41 |
| | TH1 | 225.3 | lap Rhy | 7 | W | 62.30 | 0.1000 | 17.60 | 4.38 | 0.05 | 5.05 | 0.14 | 0.18 | 8.50 | 0.01 | 1.09 | 0.10 | 0.28 | 0.00 | 0.00 | 0.07 | 2.45 | 100.28 | 22 | 48 | 165 | 3.6 | 97 |
| | TH14 | 224.8 | gy l Rhy | 7 | W | 71.30 | 0.1000 | 13.20 | 2.10 | 0.02 | 5.80 | 0.06 | 0.22 | 4.45 | 0.01 | 0.05 | 0.03 | 0.06 | 0.00 | 0.00 | 0.01 | 1.73 | 99.24 | 18 | 20 | 135 | 4.4 | 97 |
| | TH14 | 303.9 | mv l Rhy | 7 | W | 64.10 | 0.1200 | 16.70 | 2.61 | 0.02 | 4.80 | 0.22 | 1.70 | 3.80 | 0.03 | 0.03 | 0.15 | 0.05 | 0.00 | 0.00 | 0.01 | 3.34 | 99.77 | 22 | 55 | 190 | 3.8 | 92 |
| | TH14 | 379.8 | Py Ex | 7 | W | 63.50 | 0.1100 | 17.10 | 1.88 | 0.11 | 3.15 | 2.24 | 2.55 | 6.40 | 0.01 | 0.24 | 0.10 | 0.34 | 0.00 | 0.01 | 0.01 | 0.94 | 98.69 | 22 | 44 | 175 | 3.8 | 67 |
| | TH14 | 379.8 | Py exh | 7 | W | 63.50 | 0.1100 | 17.10 | 1.88 | 0.11 | 3.15 | 2.24 | 2.55 | 6.40 | 0.01 | 0.24 | 0.10 | 0.34 | 0.00 | 0.01 | 0.01 | 0.94 | 98.69 | 22 | 44 | 175 | 3.8 | 67 |
| | TH38 | 203.4 | gy fl PFU | 7 | W | 72.70 | 0.0700 | 11.50 | 2.80 | 0.13 | 5.80 | 0.14 | 0.01 | 4.35 | 0.01 | 0.57 | 0.10 | 0.10 | 0.01 | 0.00 | 0.03 | 1.23 | 99.45 | 18 | 28 | 115 | 3.6 | 99 |
| | TH5 | 279.0 | Si-gm lRh | 7 | W | 60.90 | 0.1500 | 19.30 | 2.40 | 0.02 | 4.45 | 0.26 | 1.61 | 4.15 | 0.02 | 0.07 | 0.10 | 0.04 | 0.00 | 0.00 | 0.01 | 3.00 | 99.47 | 26 | 12 | 200 | 4.5 | 82 |
| | TH5 | 289.7 | mv lap R | 7 | W | 64.30 | 0.1400 | 18.60 | 2.80 | 0.01 | 4.80 | 0.31 | 1.66 | 3.45 | 0.02 | 0.01 | 0.05 | 0.03 | 0.00 | 0.00 | 0.01 | 3.10 | 100.10 | 28 | 18 | 200 | 4.2 | 81 |
| | TH5 | 302.7 | Si-gm lRh | 7 | W | 72.80 | 0.1300 | 14.30 | 2.12 | 0.02 | 2.75 | 0.12 | 1.94 | 2.85 | 0.01 | 0.03 | 0.03 | 0.04 | 0.00 | 0.00 | 0.01 | 1.55 | 98.71 | 22 | 1 | 156 | 5.0 | 73 |
| | TH5 | 368.7 | gy lRhy | 7 | W | 68.80 | 0.1000 | 14.90 | 1.99 | 0.03 | 4.40 | 0.62 | 1.01 | 4.30 | 0.01 | 0.08 | 0.45 | 0.08 | 0.00 | 0.00 | 0.03 | 1.88 | 98.68 | 20 | 25 | 150 | 4.0 | 84 |

**TABLE 1** **Major and Trace Element Analyses - Thalanga** (Continued)

| Sample | Hole | Depth | Description | Group | From | SiO2 | TiO2 | Al2O3 | Fe2O3 | MnO | MgO | CaO | Na2O | K2O | P2O5 | S | CO2 | Ba | Cu | Pb | Zn | LOI | Total | Nb | Y | Zr | Ti/Zr | A.I. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | m | | | | % | % | % | % | % | % | % | % | % | % | % | % | % | % | % | % | % | % | ppm | ppm | ppm | calc | calc |
| | Railcut | outcrop | QFp Rhy | 9 | S | 77.59 | 0.0595 | 11.95 | 1.32 | 0.03 | 0.45 | 0.17 | 2.20 | 5.37 | 0.01 | | | 0.14 | 0.00 | 0.01 | 0.01 | 0.66 | 100.16 | 10 | 32 | 89 | 4.0 | 71 |
| | Railcut | outcrop | Qpvit Rhy | 9 | S | 75.60 | 0.1290 | 11.96 | 2.15 | 0.08 | 1.08 | 1.74 | 2.47 | 3.82 | 0.01 | | | 0.05 | 0.00 | 0.00 | 0.00 | 0.77 | 100.06 | 16 | 36 | 223 | 3.5 | 54 |
| | Railcut | outcrop | Vit Rhy | 9 | S | 79.41 | 0.1394 | 11.29 | 1.20 | 0.01 | 0.07 | 0.53 | 5.04 | 1.79 | 0.01 | | | 0.03 | 0.00 | 0.00 | 0.01 | 0.41 | 100.04 | 13 | 29 | 144 | 5.8 | 25 |
| | Railcut | outcrop | Vit Rhy | 9 | S | 79.28 | 0.1197 | 11.93 | 0.23 | 0.01 | 0.02 | 0.24 | 4.69 | 3.19 | 0.01 | | | 0.05 | 0.00 | 0.00 | 0.00 | 0.28 | 100.04 | 17 | 46 | 166 | 4.3 | 39. |
| | Railcut | outcrop | QFp Rhy | 9 | S | 70.59 | 0.0890 | 15.97 | 1.79 | 0.06 | 1.15 | 0.15 | 3.13 | 5.97 | 0.01 | | | 0.14 | 0.00 | 0.00 | 0.01 | 1.09 | 100.15 | 14 | 43 | 118 | 4.5 | 69 |
| | Railcut | outcrop | Qpvit Rhy | 9 | S | 78.54 | 0.0891 | 11.54 | 1.77 | 0.04 | 0.77 | 0.10 | 2.23 | 3.84 | 0.01 | | | 0.05 | 0.00 | 0.00 | 0.00 | 0.99 | 100.04 | 15 | 30 | 165 | 2.9 | 66 |
| | TR-102 | outcrop | Lap Rhy | 9 | W | 76.50 | 0.1200 | 12.80 | 1.64 | 0.03 | 0.52 | 0.25 | 2.45 | 4.25 | 0.01 | 0.03 | 0.10 | 0.04 | 0.00 | 0.00 | 0.00 | 0.63 | 99.42 | 18 | 26 | 170 | 4.2 | 64 |
| | TR-103 | outcrop | Lap Rhy | 9 | W | 78.30 | 0.0900 | 11.70 | 1.35 | 0.02 | 0.32 | 0.05 | 3.15 | 3.95 | 0.01 | 0.01 | 0.01 | 0.04 | 0.00 | 0.00 | 0.00 | 0.58 | 99.56 | 14 | 22 | 160 | 3.4 | 57 |
| | TR-104 | outcrop | vit Rhy | 9 | W | 78.50 | 0.1000 | 11.60 | 1.19 | 0.02 | 0.25 | 0.14 | 2.50 | 4.75 | 0.01 | 0.03 | 0.03 | 0.04 | 0.00 | 0.00 | 0.00 | 0.66 | 99.62 | 16 | 20 | 160 | 3.7 | 65 |
| | TR-105 | outcrop | vit Rhy | 9 | W | 76.30 | 0.1400 | 12.10 | 2.30 | 0.02 | 0.77 | 0.16 | 3.30 | 3.80 | 0.01 | 0.03 | 0.10 | 0.03 | 0.00 | 0.00 | 0.00 | 0.73 | 99.80 | 16 | 24 | 210 | 4.0 | 57 |
| | TR-106 | outcrop | vit Rhy | 9 | W | 73.40 | 0.1400 | 12.20 | 2.95 | 0.02 | 1.23 | 1.33 | 4.50 | 3.00 | 0.01 | 0.03 | 0.25 | 0.04 | 0.00 | 0.00 | 0.01 | 0.56 | 99.67 | 14 | 20 | 200 | 4.2 | 42 |
| 54047 | TH382A | 251.3 | fr FpDac | 10 | H | 72.54 | 0.4470 | 14.28 | 1.45 | 0.03 | 0.56 | 0.89 | 7.55 | 0.13 | 0.12 | 0.02 | | 0.00 | 0.00 | 0.00 | 0.01 | 0.46 | 100.47 | 8 | 22 | 201 | 13.3 | 8 |
| 54354 | TH245 | 528.5 | Dac | 10 | H | 70.50 | 0.4287 | 14.38 | 4.21 | 0.06 | 1.05 | 0.99 | 5.69 | 2.71 | 0.13 | 0.02 | | 0.13 | 0.01 | 0.00 | 0.01 | 0.29 | 100.68 | 10 | 21 | 168 | 15.3 | 36 |
| 54601 | TH83 | 394.3 | fol aDac | 10 | H | 79.60 | 0.3703 | 10.67 | 1.25 | 0.02 | 0.66 | 0.82 | 1.66 | 4.95 | 0.10 | 0.19 | | 0.22 | 0.00 | 0.00 | 0.01 | 0.90 | 101.40 | 5 | 20 | 135 | 16.4 | 69 |
| 54602 | TH83 | 401.3 | Dac | 10 | H | 73.10 | 0.5238 | 13.27 | 4.23 | 0.07 | 1.47 | 1.08 | 2.81 | 3.90 | 0.12 | 0.16 | | 0.17 | 0.00 | 0.00 | 0.01 | 1.17 | 102.05 | 7 | 25 | 165 | 19.0 | 58 |
| 54605 | TH84A | 556.8 | apDac | 10 | H | 75.11 | 0.3086 | 12.71 | 1.73 | 0.04 | 0.57 | 1.45 | 3.17 | 4.18 | 0.07 | 0.13 | | 0.14 | 0.00 | 0.00 | 0.01 | 0.75 | 100.35 | 9 | 25 | 185 | 10.0 | 51 |
| 54606 | TH84A | 583.3 | apDac | 10 | H | 73.39 | 0.3420 | 12.49 | 2.19 | 0.04 | 1.01 | 0.85 | 3.93 | 3.63 | 0.06 | 0.02 | | 0.12 | 0.00 | 0.00 | 0.01 | 0.58 | 98.73 | 8 | 23 | 180 | 11.4 | 49 |
| 54615 | TH112 | 645.3 | Dac | 10 | H | 74.97 | 0.4020 | 12.89 | 2.92 | 0.07 | 0.75 | 1.29 | 4.80 | 2.23 | 0.12 | 0.11 | | 0.11 | 0.00 | 0.01 | 0.01 | 0.40 | 101.05 | 7 | 19 | 149 | 16.2 | 30 |
| 54624 | TH144B | 689.6 | apDac | 10 | H | 75.55 | 0.3453 | 12.47 | 1.82 | 0.03 | 0.86 | 0.66 | 4.79 | 2.43 | 0.07 | 0.04 | | 0.06 | 0.00 | 0.02 | 0.01 | 0.50 | 99.66 | 8 | 27 | 179 | 11.6 | 38 |
| 54625 | TH144B | 724.3 | Dac | 10 | H | 74.24 | 0.3470 | 12.82 | 2.58 | 0.04 | 0.98 | 0.78 | 4.43 | 3.42 | 0.08 | 0.00 | | 0.05 | 0.00 | 0.00 | 0.01 | 0.38 | 100.17 | 8 | 25 | 183 | 11.4 | 46 |
| 60224 | W2007NED70 | 79.5 | Dac fr | 10 | H | 69.10 | 0.4604 | 13.80 | 5.09 | 0.06 | 1.14 | 1.31 | 5.33 | 2.28 | 0.12 | 0.00 | 0.60 | 0.10 | 0.02 | 0.02 | 0.03 | 0.44 | 99.41 | 25 | 38 | 166 | 16.6 | 34 |
| 61468 | W2011NED42 | 102.0 102.9 | Dacite | 10 | H | 68.60 | 0.4737 | 14.10 | 3.56 | 0.07 | 1.69 | 2.06 | 6.28 | 1.33 | 0.12 | 0.08 | 1.90 | 0.10 | 0.00 | 0.00 | 0.03 | 1.19 | 99.69 | 8 | 30 | 164 | 17.3 | 27 |
| | TH33 | 241 | Dacite | 10 | S | 71.48 | 0.4981 | 14.44 | 3.13 | 0.05 | 0.81 | 0.69 | 6.20 | 2.20 | 0.12 | | | 0.08 | 0.00 | 0.00 | 0.01 | 0.38 | 100.08 | 9.3 | 34 | 178 | 16.8 | 30 |
| | TH37 | 52 | Dacite | 10 | S | 73.02 | 0.4077 | 13.30 | 3.75 | 0.08 | 0.89 | 1.18 | 4.38 | 2.31 | 0.05 | | | 0.09 | 0.00 | 0.00 | 0.01 | 0.57 | 100.10 | 12 | 33 | 169 | 14.5 | 37 |
| | TH37 | 273 | Dacite | 10 | S | 72.01 | 0.4443 | 13.96 | 3.62 | 0.05 | 1.68 | 0.61 | 4.81 | 1.41 | 0.05 | | | 0.03 | 0.00 | 0.00 | 0.01 | 1.27 | 100.03 | 12 | 38 | 205 | 13.0 | 36 |
| | TH37 | 319 | Dacite | 10 | S | 72.45 | 0.5248 | 13.43 | 3.73 | 0.06 | 1.60 | 0.87 | 6.02 | 0.25 | 0.09 | | | 0.01 | 0.00 | 0.00 | 0.01 | 0.99 | 100.03 | 9.6 | 29 | 169 | 18.6 | 21 |
| | TH57 | 148 | Dacite | 10 | S | 72.30 | 0.4381 | 13.79 | 3.17 | 0.05 | 0.42 | 1.11 | 5.75 | 2.41 | 0.12 | | | 0.08 | 0.00 | 0.00 | 0.00 | 0.44 | 100.08 | 8.1 | 27 | 154 | 17.1 | 29 |
| | TH57 | 190 | Dacite | 10 | S | 68.08 | 0.4774 | 16.60 | 4.66 | 0.09 | 0.86 | 1.08 | 5.30 | 4.22 | 0.07 | | | 0.05 | 0.00 | 0.00 | 0.01 | 0.55 | 100.05 | 13 | 30 | 231 | 12.4 | 44 |
| | TH57 | 350 | Dacite | 10 | S | 73.88 | 0.3580 | 12.90 | 2.38 | 0.04 | 0.86 | 0.93 | 4.54 | 3.51 | 0.06 | | | 0.05 | 0.00 | 0.00 | 0.00 | 0.56 | 100.06 | 14 | 28 | 174 | 12.3 | 44 |
| | TH1 | 94.0 | alt v Da | 10 | W | 68.00 | 0.5400 | 14.70 | 3.85 | 0.07 | 1.06 | 1.33 | 6.20 | 1.95 | 0.15 | 0.66 | 0.45 | 0.12 | 0.01 | 0.00 | 0.12 | 0.46 | 99.67 | 12 | 30 | 160 | 20.2 | 29 |
| | TH1 | 137.0 | fr v Da | 10 | W | 73.70 | 0.4600 | 13.20 | 2.90 | 0.03 | 1.13 | 1.57 | 6.50 | 0.24 | 0.10 | 0.16 | 0.03 | 0.01 | 0.00 | 0.00 | 0.00 | 0.27 | 100.32 | 9 | 16 | 135 | 20.4 | 15 |
| | TH16 | 247.0 | v Da | 10 | W | 78.10 | 0.3500 | 10.80 | 1.84 | 0.02 | 0.44 | 0.88 | 5.30 | 0.40 | 0.07 | 0.20 | 0.03 | 0.02 | 0.00 | 0.00 | 0.00 | 0.48 | 99.04 | 9 | 12 | 110 | 19.1 | 12 |
| | TH18 | 138.8 | v Da | 10 | W | 60.40 | 0.6400 | 18.90 | 4.40 | 0.10 | 1.38 | 1.52 | 8.80 | 1.38 | 0.17 | 0.18 | 0.03 | 0.05 | 0.00 | 0.00 | 0.01 | 0.68 | 98.61 | 18 | 25 | 190 | 20.2 | 21 |
| | TH2 | 57.3 | fl Da agg | 10 | W | 70.50 | 0.3900 | 14.40 | 3.19 | 0.03 | 3.05 | 0.70 | 1.82 | 3.56 | 0.07 | 0.08 | 0.20 | 0.07 | 0.00 | 0.00 | 0.01 | 1.35 | 99.41 | 14 | 20 | 170 | 13.8 | 72 |
| | TH23 | 42.9 | sltd v Da | 10 | W | 80.40 | 0.2800 | 10.50 | 0.76 | 0.02 | 0.22 | 0.60 | 5.80 | 0.38 | 0.05 | 0.03 | 0.15 | 0.02 | 0.01 | 0.00 | 0.00 | 0.06 | 99.28 | 10 | 14 | 120 | 14.0 | 9 |
| | TH37 | 26.8 | lam shale | 10 | W | 65.20 | 0.6900 | 16.00 | 6.15 | 0.07 | 2.60 | 0.82 | 1.53 | 4.15 | 0.16 | 0.04 | 0.05 | 0.09 | 0.00 | 0.00 | 0.01 | 1.90 | 98.47 | 16 | 24 | 160 | 25.9 | 74 |
| | TH37 | 66.0 | l tuff s/st | 10 | W | 69.60 | 0.5000 | 13.70 | 5.70 | 0.12 | 1.51 | 0.52 | 2.85 | 3.60 | 0.11 | 0.04 | 0.05 | 0.07 | 0.00 | 0.00 | 0.01 | 1.65 | 100.03 | 16 | 22 | 180 | 16.7 | 60 |
| | TH37 | 110.8 | fg Da tuff | 10 | W | 71.30 | 0.5900 | 12.70 | 4.89 | 0.10 | 1.54 | 1.95 | 3.80 | 1.81 | 0.10 | 0.05 | 0.09 | 0.04 | 0.00 | 0.00 | 0.01 | 0.81 | 99.81 | 12 | 16 | 170 | 20.5 | 37 |
| | TH37 | 320.3 | v Da | 10 | W | 68.20 | 0.4700 | 14.70 | 5.40 | 0.07 | 2.25 | 0.78 | 5.85 | 0.44 | 0.09 | 0.08 | 0.10 | 0.01 | 0.00 | 0.00 | 0.01 | 1.90 | 100.35 | 12 | 18 | 150 | 18.8 | 29 |

**TABLE 1** Major and Trace Element Analyses - Thalanga (Continued)

| Sample | Hole | Depth | Description | Group | From | SiO2 | TiO2 | Al2O3 | Fe2O3 | MnO | MgO | CaO | Na2O | K2O | P2O5 | S | CO2 | Ba | Cu | Pb | Zn | LOI | Total | Nb | Y | Zr | Ti/Zr | A.I. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | m | | | | % | % | % | % | % | % | % | % | % | % | % | % | % | % | % | % | % | % | ppm | ppm | ppm | calc | calc |
| | TH38 | 338.5 | fr v da | 10 | W | 72.00 | 0.4400 | 14.00 | 2.75 | 0.04 | 0.82 | 1.09 | 7.50 | 0.39 | 0.11 | 0.05 | 0.05 | 0.01 | 0.00 | 0.00 | 0.00 | 0.40 | 99.86 | 10 | 18 | 140 | 18.8 | 12 |
| | TH38 | 406.4 | agg Da? | 10 | W | 73.70 | 0.3300 | 13.50 | 2.71 | 0.03 | 1.43 | 0.88 | 4.80 | 1.67 | 0.04 | 0.03 | 0.10 | 0.02 | 0.00 | 0.00 | 0.01 | 0.91 | 99.98 | 12 | 18 | 170 | 11.6 | 36 |
| | TH5 | 29.3 | Da aggl | 10 | W | 70.20 | 0.4100 | 14.10 | 4.25 | 0.05 | 2.30 | 0.94 | 2.90 | 3.20 | 0.06 | 0.10 | 0.05 | 0.07 | 0.00 | 0.00 | 0.01 | 0.96 | 99.60 | 14 | 30 | 180 | 13.7 | 59 |
| | TH5 | 139.0 | HW v Da | 10 | W | 67.30 | 0.5300 | 15.30 | 5.00 | 0.06 | 1.81 | 1.55 | 5.80 | 1.62 | 0.12 | 0.12 | 0.03 | 0.10 | 0.00 | 0.00 | 0.01 | 0.44 | 99.89 | 12 | 26 | 150 | 21.2 | 32 |
| | TH71 | 127.2 | v Da | 10 | W | 70.10 | 0.4900 | 14.30 | 3.56 | 0.05 | 1.64 | 1.41 | 7.20 | 0.46 | 0.11 | 0.02 | 0.25 | 0.02 | 0.00 | 0.00 | 0.00 | 0.54 | 100.15 | 12 | 18 | 155 | 19.0 | 20 |
| | TH71 | 287.1 | Da agg | 10 | W | 62.60 | 0.4200 | 16.20 | 6.20 | 0.07 | 4.25 | 1.08 | 4.40 | 2.20 | 0.08 | 0.05 | 0.25 | 0.04 | 0.00 | 0.00 | 0.01 | 1.84 | 99.67 | 12 | 16 | 165 | 15.3 | 54 |
| | TH9 | 49.0 | Chl HW alt | 10 | W | 54.60 | 0.4100 | 15.90 | 9.82 | 0.12 | 8.30 | 1.37 | 2.15 | 5.64 | 0.04 | 0.04 | 0.10 | 0.13 | 0.00 | 0.00 | 0.02 | 1.66 | 100.29 | 10 | 12 | 150 | 16.4 | 80 |
| | TH9 | 81.1 | Chl PM agg | 10 | W | 73.90 | 0.3200 | 12.50 | 2.80 | 0.03 | 2.55 | 0.74 | 4.15 | 1.55 | 0.05 | 0.06 | 0.03 | 0.12 | 0.00 | 0.00 | 0.01 | 1.01 | 99.82 | 12 | 18 | 145 | 13.2 | 46 |
| 54048 | TH382A | 258.8 | Chl alt Dac | 12 | H | 58.48 | 0.6539 | 19.09 | 9.50 | 0.13 | 3.98 | 1.12 | 7.01 | 0.21 | 0.15 | 0.00 | | 0.00 | 0.00 | 0.00 | 0.02 | 2.86 | 101.00 | 10 | 35 | 230 | 17.0 | 34 |
| 54049 | TH382A | 323.0 | Si alt Dac | 12 | H | 79.22 | 0.3103 | 11.26 | 0.68 | 0.01 | 0.07 | 0.59 | 5.60 | 1.13 | 0.07 | 0.04 | | 0.05 | 0.01 | 0.00 | 0.01 | 0.18 | 98.24 | 8 | 34 | 175 | 10.6 | 16 |
| 54355 | TH245 | 568.8 | pk alt Dac | 12 | H | 70.13 | 0.4454 | 13.74 | 3.20 | 0.09 | 0.76 | 1.84 | 2.32 | 3.57 | 0.13 | 0.30 | 1.70 | 0.48 | 0.01 | 0.01 | 0.02 | 3.39 | 100.47 | 8 | 15 | 164 | 16.3 | 51 |
| 60225 | W2007NED70 | 80.4 | Dac EpQ | 12 | H | 64.50 | 0.3403 | 10.80 | 7.28 | 0.27 | 1.51 | 13.20 | 0.08 | 0.21 | 0.10 | 0.00 | 1.30 | 0.02 | 0.02 | 0.04 | 0.05 | 1.69 | 100.12 | 7 | 31 | 140 | 14.6 | 11 |
| | Costeans | surface | Chl alt Dac | 12 | S | 65.16 | 0.4903 | 15.65 | 5.67 | 0.04 | 4.26 | 0.27 | 2.02 | 2.53 | 0.04 | | | 0.07 | 0.01 | 0.00 | 0.01 | 3.87 | 100.08 | 12 | 47 | 202 | 14.6 | 75 |
| | TH5 | 146.2 | Snaly Exh | 12 | S | 53.87 | 0.5757 | 16.90 | 5.79 | 0.13 | 6.07 | 2.98 | 2.80 | 5.16 | 0.15 | | | 0.88 | 0.00 | 0.00 | 0.04 | 4.05 | 99.38 | 12 | 31 | 188 | 18.4 | 66 |
| | TH57 | 169 | Alt Dac? | 12 | S | 73.61 | 0.3343 | 13.10 | 3.12 | 0.05 | 2.33 | 0.69 | 2.85 | 2.17 | 0.05 | | | 0.03 | 0.03 | 0.00 | 0.01 | 1.69 | 100.04 | 10 | 27 | 172 | 11.7 | 56 |
| | TH16 | 242.8 | Tc Sh exh | 12 | W | 68.20 | 0.2800 | 14.40 | 6.00 | 0.05 | 4.10 | 0.63 | 1.24 | 4.50 | 0.06 | 0.48 | 0.15 | 0.38 | 0.01 | 0.00 | 0.03 | 1.27 | 99.77 | 16 | 24 | 150 | 11.2 | 82 |
| | TH37 | 336.1 | sh exh | 12 | W | 54.30 | 0.3900 | 16.20 | 10.71 | 0.16 | 6.20 | 1.52 | 2.00 | 5.50 | 0.02 | 0.09 | 0.50 | 0.38 | 0.00 | 0.00 | 0.02 | 2.10 | 100.10 | 14 | 9 | 175 | 13.4 | 77 |
| | TH5 | 147.0 | sh Ba exh | 12 | W | 54.90 | 0.0900 | 5.10 | 4.55 | 0.04 | 3.30 | 1.03 | 0.22 | 2.15 | 0.10 | 8.94 | 0.80 | 16.50 | 0.04 | 0.00 | 0.20 | 0.53 | 96.50 | 6 | 4 | 50 | 10.8 | 81 |
| 54604 | TH83 | 433.3 | HWF sst | 13 | H | 74.53 | 0.3066 | 14.17 | 2.66 | 0.04 | 2.72 | 0.50 | 1.75 | 3.25 | 0.06 | 0.00 | | 0.04 | 0.00 | 0.00 | 0.00 | 2.06 | 102.12 | 10 | 26 | 197 | 9.4 | 73 |
| 60203 | E3202S031 | 53.0 | HWF | 13 | H | 66.00 | 0.2219 | 14.60 | 6.69 | 0.07 | 4.00 | 0.43 | 1.11 | 3.33 | 0.04 | 0.14 | | 0.13 | 0.00 | 0.00 | 0.05 | 1.96 | 100.74 | 15 | 39 | 206 | 6.4 | 83 |
| 60205 | TH270 | 393.5 | HWF | 13 | H | 71.60 | 0.2936 | 12.40 | 6.39 | 0.07 | 2.83 | 0.30 | 1.30 | 2.74 | 0.06 | 0.02 | | 0.06 | 0.00 | 0.00 | 0.13 | 0.41 | 100.67 | 10 | 24 | 170 | 10.4 | 78 |
| 60204 | E3202S031 | 54.8 | Clast HWF | 14 | H | 76.00 | 0.2235 | 11.00 | 5.13 | 0.04 | 0.49 | 1.65 | 4.89 | 0.50 | 0.53 | 0.12 | | 0.06 | 0.00 | 0.00 | 0.00 | 0.44 | 101.01 | 7 | 32 | 130 | 10.3 | 13 |
| 60206 | TH270 | 393.2 | Clast,HWF | 14 | H | 77.30 | 0.2669 | 10.20 | 4.69 | 0.04 | 0.67 | 2.18 | 3.02 | 0.64 | 0.05 | 0.01 | | 0.05 | 0.00 | 0.00 | 0.00 | 0.39 | 99.55 | 8 | 31 | 151 | 10.6 | 20 |
| 54621 | TH144B | 575.3 | QFP | 15 | H | 78.04 | 0.1440 | 11.56 | 1.84 | 0.02 | 0.34 | 0.43 | 4.11 | 2.58 | 0.04 | 0.18 | | 0.09 | 0.00 | 0.00 | 0.00 | 0.65 | 99.93 | 12 | 34 | 162 | 5.3 | 39 |
| 54622 | TH144B | 656.8 | QFP | 15 | H | 75.77 | 0.1952 | 13.02 | 2.52 | 0.04 | 0.90 | 0.75 | 5.25 | 1.56 | 0.06 | 0.00 | | 0.05 | 0.00 | 0.00 | 0.01 | 0.54 | 100.72 | 14 | 44 | 200 | 5.8 | 29 |
| 54646 | TH391 | 238.7 | fr QFP | 15 | H | 75.59 | 0.2352 | 13.60 | 2.98 | 0.03 | 0.18 | 2.04 | 4.63 | 1.75 | 0.07 | 0.00 | | 0.07 | 0.00 | 0.00 | 0.01 | 0.32 | 101.55 | 10 | 23 | 157 | 9.0 | 22 |
| 54647 | TH391 | 249.8 | Ep aQFP | 15 | H | 74.98 | 0.2068 | 12.12 | 3.64 | 0.06 | 0.16 | 2.74 | 3.11 | 2.62 | 0.07 | 0.00 | | 0.10 | 0.00 | 0.00 | 0.01 | 0.78 | 100.84 | 11 | 23 | 149 | 8.3 | 34 |
| 54648 | TR2 | 250.5 | QFP | 15 | H | 72.62 | 0.2819 | 12.25 | 3.09 | 0.13 | 3.25 | 0.54 | 2.60 | 3.90 | 0.06 | 0.60 | | 0.17 | 0.00 | 0.00 | 0.01 | 1.40 | 100.45 | 8 | 16 | 142 | 11.9 | 69 |
| | TH24 | 420.4 | QE xt | 15 | W | 77.00 | 0.2800 | 11.90 | 1.98 | 0.05 | 1.42 | 0.83 | 3.84 | 1.42 | 0.05 | 0.21 | 0.25 | 0.25 | 0.01 | 0.01 | 0.03 | 0.64 | 99.97 | 10 | 14 | 105 | 16.0 | 39 |
| | TH30 | 412.6 | QE xt | 15 | W | 63.00 | 0.3100 | 18.20 | 4.60 | 0.04 | 2.60 | 0.71 | 2.75 | 4.85 | 0.06 | 0.03 | 0.30 | 0.11 | 0.00 | 0.00 | 0.01 | 2.07 | 99.84 | 22 | 34 | 230 | 8.1 | 69 |
| | TH4 | 85.2 | QE xt | 15 | W | 73.90 | 0.3200 | 13.20 | 2.45 | 0.07 | 1.22 | 1.29 | 3.20 | 2.35 | 0.07 | 0.33 | 0.15 | 0.22 | 0.01 | 0.02 | 0.00 | 0.92 | 99.72 | 12 | 12 | 130 | 14.8 | 44 |
| | TH62 | 49.0 | fr QE xt | 15 | W | 71.90 | 0.3900 | 13.70 | 3.15 | 0.07 | 0.80 | 1.32 | 6.20 | 1.07 | 0.07 | 0.03 | 0.05 | 0.05 | 0.01 | 0.00 | 0.01 | 0.30 | 98.42 | 10 | 12 | 125 | 18.7 | 20 |
| | TH64 | 410.9 | QE Rhy | 15 | W | 70.40 | 0.2900 | 12.00 | 1.87 | 0.04 | 0.74 | 1.74 | 4.45 | 0.64 | 0.07 | 1.18 | 0.40 | 2.45 | 0.04 | 0.08 | 0.21 | 0.77 | 97.57 | 12 | 12 | 85 | 20.5 | 20 |
| 61469 | W2011NED42 | 102.9 104.0 | QEV Bx | 16 | H | 58.70 | 0.2952 | 13.40 | 8.37 | 0.16 | 3.82 | 1.26 | 1.73 | 4.25 | 0.08 | 2.93 | 2.00 | 2.06 | 0.12 | 0.33 | 1.25 | 4.22 | 98.79 | 11 | 27 | 159 | 8.9 | 73 |
| 61470 | W2011NED42 | 104.0 105.0 | QEV Bx | 16 | H | 62.90 | 0.1525 | 17.00 | 5.12 | 0.11 | 3.36 | 0.25 | 0.64 | 5.73 | 0.08 | 1.08 | 1.70 | 0.95 | 0.03 | 0.09 | 0.54 | 2.86 | 100.60 | 19 | 36 | 221 | 4.1 | 91 |
| 61471 | W2011NED42 | 105.0 106.3 | QEV Bx | 16 | H | 64.40 | 0.1516 | 14.40 | 6.09 | 0.19 | 3.48 | 1.86 | 1.73 | 3.80 | 0.07 | 1.55 | 1.80 | 0.75 | 0.32 | 0.49 | 0.49 | 2.37 | 101.34 | 16 | 33 | 208 | 4.4 | 67 |
| 54050 | TH384 | 90.6 | M.Andesite | 17 | H | 50.45 | 0.4921 | 16.79 | 9.96 | 0.17 | 8.47 | 6.57 | 4.09 | 2.21 | 0.08 | 0.00 | | 0.10 | 0.01 | 0.00 | 0.01 | 1.13 | 100.60 | 1 | 1 | 38 | 81.9 | 50 |
| 54623 | TH144B | 685.3 | M.Andesite | 17 | H | 52.46 | 0.4420 | 15.50 | 6.94 | 0.25 | 9.39 | 8.60 | 2.52 | 2.09 | 0.10 | 0.00 | | 0.02 | 0.03 | 0.00 | 0.01 | 1.21 | 101.56 | 2 | 1 | 36 | 73.6 | 51 |
| 60209 | TH407 | 279.8 | And:EpQCa | 17 | H | 41.60 | 0.2636 | 12.80 | 10.40 | 0.40 | 5.74 | 22.80 | 0.96 | 0.11 | 0.08 | 0.09 | 3.90 | 0.01 | 0.01 | 0.00 | 0.00 | 4.57 | 99.98 | 2 | 8 | 28 | 60.7 | 20 |

**TABLE 1** Major and Trace Element Analyses - Thalanga (Continued)

| Sample | Hole | Depth m | Description | Group | From | SiO2 % | TiO2 % | Al2O3 % | Fe2O3 % | MnO % | MgO % | Cao % | Na2O % | K2O % | P2O5 % | S % | CO2 % | Ba % | Cu % | Pb % | Zn % | LOI % | Total % | Nb ppm | Y ppm | Zr ppm | Ti/Zr calc | A.I. calc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 60210 | TH407 | 290.2 | And fr | 17 | H | 48.80 | 0.5188 | 15.10 | 13.40 | 0.22 | 8.16 | 8.71 | 3.24 | 1.18 | 0.09 | 0.02 | 0.20 | 0.09 | 0.04 | 0.00 | 0.01 | 0.91 | 100.55 | 1 | 4 | 38 | 81.8 | 44 |
| | TH9 | 57.3 | And | 17 | S | 52.61 | 0.3953 | 14.66 | 7.66 | 0.37 | 8.08 | 11.05 | 3.28 | 0.63 | 0.11 | | | 0.07 | 0.01 | 0.00 | 0.05 | 1.18 | 100.13 | 1 | 10 | 31 | 78.4 | 38 |
| | TH23 | 122 | And | 17 | S | 51.62 | 0.4239 | 14.40 | 8.66 | 0.18 | 9.92 | 8.24 | 3.27 | 1.75 | 0.11 | | | 0.10 | 0.02 | 0.00 | 0.01 | 1.42 | 100.12 | 2.1 | 10 | 34 | 74.7 | 50 |
| | TH37 | 308 | Basalt | 17 | S | 50.34 | 0.7174 | 15.29 | 10.93 | 0.33 | 6.82 | 9.18 | 3.41 | 1.15 | 0.10 | | | 0.16 | 0.00 | 0.00 | 0.03 | 1.73 | 100.20 | 1.9 | 14 | 37 | 116.2 | 39 |
| | TH57 | 174 | Basalt | 17 | S | 49.88 | 0.7902 | 19.10 | 9.92 | 0.33 | 4.79 | 8.29 | 4.20 | 1.32 | 0.17 | | | 0.03 | 0.00 | 0.00 | 0.02 | 1.23 | 100.04 | 2.2 | 25 | 30 | 143.5 | 33 |
| | TH57 | 208 | Basalt | 17 | S | 48.27 | 0.7555 | 17.66 | 10.63 | 0.39 | 6.83 | 7.26 | 3.70 | 2.32 | 0.10 | | | 0.03 | 0.00 | 0.00 | 0.00 | 1.88 | 100.05 | 1.8 | 13 | 31 | 146.1 | 45 |
| | TH57 | 215 | Basalt | 17 | S | 47.27 | 0.7223 | 16.90 | 10.93 | 0.48 | 6.63 | 10.47 | 3.25 | 1.14 | 0.10 | | | 0.01 | 0.00 | 0.00 | 0.02 | 1.06 | 99.04 | 1.5 | 15 | 32 | 135.3 | 38 |
| | TH1 | 82.3 | And dyke | 17 | W | 50.20 | 0.8100 | 16.00 | 9.88 | 0.26 | 6.75 | 8.54 | 3.45 | 1.85 | 0.16 | 0.37 | 0.45 | 0.12 | 0.00 | 0.00 | 0.02 | 1.51 | 100.39 | 5 | 9 | 42 | 115.6 | 42 |
| | TH2 | 44.3 | And pycl? | 17 | W | 52.80 | 0.5300 | 15.30 | 9.14 | 0.24 | 6.80 | 8.63 | 4.30 | 0.72 | 0.07 | 0.03 | 0.25 | 0.03 | 0.00 | 0.00 | 0.01 | 1.02 | 99.86 | 4 | 4 | 22 | 144.4 | 37 |
| | TH21 | 202.3 | And dyke | 17 | W | 48.90 | 0.7800 | 16.80 | 9.74 | 0.20 | 6.35 | 9.10 | 3.30 | 1.96 | 0.17 | 0.09 | 0.06 | 0.05 | 0.00 | 0.00 | 0.01 | 1.56 | 100.04 | 7 | 8 | 50 | 93.5 | 40 |
| | TH23 | 122.6 | And pycl? | 17 | W | 50.40 | 0.5000 | 14.30 | 8.94 | 0.19 | 10.10 | 8.45 | 3.40 | 1.78 | 0.12 | 0.04 | 0.05 | 0.08 | 0.01 | 0.00 | 0.00 | 1.67 | 100.04 | 3 | 3 | 30 | 99.9 | 50 |
| | TH24 | 231.1 | And pycl? | 17 | W | 48.30 | 0.4800 | 14.30 | 9.54 | 0.35 | 8.95 | 11.35 | 2.75 | 0.95 | 0.10 | 0.03 | 0.36 | 0.03 | 0.00 | 0.00 | 0.01 | 1.38 | 99.86 | 4 | 2 | 30 | 95.9 | 41 |
| | TH25 | 405.3 | And pycl? | 17 | W | 51.00 | 0.6500 | 16.10 | 9.64 | 0.26 | 7.40 | 7.94 | 3.85 | 1.70 | 0.09 | 0.03 | 0.75 | 0.04 | 0.00 | 0.00 | 0.02 | 1.50 | 100.97 | 6 | 4 | 26 | 149.9 | 44 |
| | TH29 | 149.0 | And pycl? | 17 | W | 50.20 | 0.4800 | 14.10 | 8.99 | 0.15 | 9.45 | 11.19 | 2.90 | 0.90 | 0.10 | 0.03 | 0.70 | 0.03 | 0.01 | 0.00 | 0.00 | 1.79 | 101.02 | 4 | 3 | 30 | 95.9 | 42 |
| | TH30 | 249.6 | And dyke | 17 | W | 48.10 | 0.7800 | 14.60 | 11.28 | 0.24 | 9.10 | 9.24 | 2.05 | 2.06 | 0.13 | 0.05 | 0.80 | 0.03 | 0.00 | 0.00 | 0.01 | 2.57 | 101.03 | 6 | 8 | 50 | 93.5 | 50 |
| | TH6 | 103.3 | And dyke | 17 | W | 50.30 | 0.6300 | 15.30 | 10.10 | 0.19 | 9.05 | 7.45 | 3.30 | 2.30 | 0.08 | 0.29 | 0.05 | 0.04 | 0.00 | 0.00 | 0.01 | 1.34 | 100.44 | 5 | 4 | 34 | 111.1 | 51 |
| | TH71 | 360.0 | And agg | 17 | W | 54.80 | 0.4900 | 16.00 | 8.41 | 0.12 | 6.05 | 6.05 | 5.05 | 1.44 | 0.03 | 0.03 | 0.30 | 0.02 | 0.01 | 0.00 | 0.00 | 0.75 | 99.54 | 5 | 3 | 60 | 49.0 | 40 |
| | TH9 | 55.2 | And pycl? | 17 | W | 51.40 | 0.4700 | 14.30 | 8.39 | 0.33 | 9.20 | 10.43 | 3.35 | 0.81 | 0.10 | 0.03 | 0.10 | 0.05 | 0.01 | 0.00 | 0.01 | 0.95 | 99.94 | 5 | 2 | 28 | 100.6 | 42 |
| 54600 | TH83 | 422.3 | MDiorite | 18 | H | 65.09 | 0.6172 | 15.18 | 6.75 | 0.10 | 3.90 | 1.30 | 3.96 | 2.48 | 0.11 | 0.00 | | 0.08 | 0.01 | 0.00 | 0.01 | 1.67 | 101.33 | 7 | 10 | 123 | 30.1 | 55 |
| 54626 | TH132 | 121.4 | MDiorite | 18 | H | 57.11 | 0.8207 | 18.40 | 7.82 | 0.15 | 2.89 | 6.67 | 3.15 | 2.17 | 0.22 | 0.06 | 0.05 | 0.09 | 0.01 | 0.00 | 0.01 | 1.57 | 101.14 | 7 | 14 | 104 | 47.3 | 34 |
| | TH57 | 162 | Andesite | 18 | S | 59.83 | 0.7893 | 16.04 | 6.50 | 0.14 | 3.84 | 6.46 | 3.58 | 1.20 | 0.17 | | | 0.04 | 0.00 | 0.00 | 0.01 | 1.34 | 100.04 | 11 | 24 | 106 | 45.1 | 30 |
| | TH6 | 148.8 | MDiorite | 18 | W | 51.40 | 1.0600 | 17.90 | 10.80 | 0.17 | 4.15 | 6.75 | 2.75 | 2.25 | 0.25 | 0.24 | 0.40 | 0.10 | 0.01 | 0.00 | 0.05 | 1.72 | 100.00 | 7 | 12 | 75 | 84.7 | 40 |
| | TH28 | 199.5 | MDiorite | 18 | W | 49.40 | 0.8200 | 17.50 | 9.44 | 0.21 | 5.40 | 7.87 | 2.70 | 3.20 | 0.18 | 0.06 | 0.55 | 0.07 | 0.00 | 0.00 | 0.01 | 2.50 | 99.91 | 6 | 10 | 50 | 98.3 | 45 |
| | TH43 | 165.9 | MDiorite | 18 | W | 49.90 | 0.8800 | 18.50 | 9.89 | 0.24 | 4.55 | 8.64 | 1.66 | 2.95 | 0.19 | 0.17 | 0.30 | 0.05 | 0.00 | 0.00 | 0.02 | 2.57 | 100.51 | 7 | 12 | 50 | 105.5 | 42 |
| | TH46 | 269.3 | MDiorite | 18 | W | 48.30 | 0.9200 | 15.10 | 11.88 | 0.24 | 7.65 | 8.72 | 1.46 | 2.00 | 0.18 | 0.11 | 0.55 | 0.07 | 0.01 | 0.00 | 0.04 | 2.37 | 99.60 | 8 | 9 | 65 | 84.9 | 49 |
| | TH56 | 301.1 | MDiorite | 18 | W | 46.20 | 0.8700 | 18.80 | 10.80 | 0.29 | 4.60 | 9.35 | 0.30 | 2.75 | 0.02 | 0.27 | 0.15 | 0.04 | 0.01 | 0.01 | 0.01 | 3.80 | 100.07 | 8 | 10 | 60 | 86.9 | 43 |
| 60223 | TH40 | 231.8 | Qtz-Mt | 21 | H | 91.30 | 0.0008 | 0.07 | 5.96 | 0.01 | 0.03 | 0.20 | 0.00 | 0.01 | 0.02 | 0.06 | 0.70 | 0.03 | 0.00 | 0.02 | 0.01 | -0.04 | 97.66 | 1 | 1 | 5 | 1.0 | 17 |
| | TH40 | 231 | Qtz-Mt | 21 | W | 91.90 | 0.0400 | 0.41 | 4.70 | 0.04 | 0.26 | 1.35 | 0.01 | 0.03 | 0.03 | 0.36 | 1.95 | 0.00 | 0.01 | 0.00 | 0.00 | 0.42 | 100.61 | 3 | 1 | 10 | 24.0 | 18 |
| 60221 | TH5 | 158.0 | Sil Rhy | 22 | H | 69.90 | 0.0854 | 2.33 | 2.06 | 0.01 | 0.50 | 0.61 | 0.04 | 0.72 | 0.38 | 3.69 | 0.30 | 10.10 | 0.05 | 1.33 | 0.05 | 0.74 | 98.08 | 2 | 5 | 52 | 7.5 | 65 |
| 60227 | E3184SD31 | 165.1 | Sil Rhy-Mt | 22 | H | 84.20 | 0.0365 | 6.38 | 2.61 | 0.01 | 0.72 | 0.78 | 0.12 | 1.93 | 0.54 | 0.04 | 1.60 | 0.16 | 0.00 | 0.01 | 0.03 | 0.99 | 98.62 | 8 | 38 | 81 | 2.7 | 75 |
| | TH5 | 151 | Silic exh | 22 | W | 91.80 | 0.0200 | 2.35 | 0.53 | 0.01 | 0.26 | 0.13 | 0.01 | 0.77 | 0.01 | 0.56 | 0.09 | 2.15 | 0.00 | 0.00 | 0.01 | 0.12 | 98.82 | 5 | 12 | 4 | 30.0 | 89 |
| 54014 | TH384 | 104.8 | QMt-BaChl | 23 | H | 22.40 | 0.1081 | 0.88 | 4.98 | 0.02 | 0.86 | 0.46 | 0.04 | 0.20 | 0.09 | 10.80 | 0.40 | 30.50 | 0.33 | 2.12 | 1.49 | 0.74 | 87.16 | 1 | 1 | 5 | 129.6 | 68 |
| 54016 | TH384 | 108.4 | QMt-BaChl | 23 | H | 30.80 | 0.1088 | 2.62 | 5.32 | 0.04 | 2.20 | 1.50 | 0.28 | 0.58 | 0.07 | 7.69 | 0.50 | 25.90 | 0.23 | 0.09 | 0.17 | 1.29 | 89.42 | 1 | 1 | 14 | 46.6 | 61 |
| 54022 | TH384 | 110.8 | AcMtChlCa | 23 | H | 24.60 | 0.0964 | 7.58 | 10.90 | 0.24 | 14.80 | 6.01 | 0.10 | 0.38 | 0.31 | 5.97 | 2.80 | 12.50 | 0.34 | 0.27 | 0.78 | 5.39 | 83.32 | 5 | 21 | 88 | 6.6 | 71 |
| 54023 | TH384 | 111.8 | AcMtChlCa | 23 | H | 19.10 | 0.0362 | 5.55 | 6.53 | 0.49 | 13.20 | 19.40 | 0.07 | 0.06 | 0.28 | 6.67 | 12.40 | 4.60 | 0.42 | 0.92 | 6.05 | 9.41 | 89.75 | 5 | 21 | 78 | 2.9 | 41 |
| 54035 | TH384 | 129.5 | ChlCb(Ac) | 23 | H | 18.60 | 0.0180 | 6.24 | 3.12 | 0.25 | 14.30 | 29.90 | 0.05 | 0.02 | 0.07 | 0.57 | 19.20 | 0.08 | 0.10 | 0.39 | 1.39 | 24.90 | 99.80 | 9 | 23 | 92 | 1.2 | 32 |
| 71071 | TH419 | 194.8 195.1 | Chl Cc Ba Ep | 23 | H | | 0.0812 | | | | | | | | | | | 15.80 | 1.12 | 3.72 | 1.05 | | | | | 129 | 2.8 | |
| 71072 | TH419 | 195.1 196.1 | Qtz Mt Ba | 23 | H | | 0.0919 | | | | | | | | | | | 18.70 | 0.27 | 0.97 | 0.61 | | | | | 59 | 9.3 | |
| 60211 | TH407 | 133.5 | RhyAcCa | 26 | H | 62.90 | 0.0639 | 13.10 | 6.45 | 0.19 | 3.98 | 6.08 | 0.57 | 5.36 | 0.03 | 0.00 | 0.60 | 0.25 | 0.00 | 0.01 | 0.00 | 0.73 | 99.93 | 16 | 77 | 190 | 2.6 | 58 |

**TABLE 1** Major and Trace Element Analyses - Thalanga (Continued)

| Sample | Hole | Depth | Description | Group | From | SiO2 | TiO2 | Al2O3 | Fe2O3 | MnO | MgO | Cao | Na2O | K2O | P2O5 | S | CO2 | Ba | Cu | Pb | Zn | LOI | Total | Nb | Y | Zr | Ti/Zr | A.I. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | m | | | | % | % | % | % | % | % | % | % | % | % | % | % | % | % | % | % | % | % | ppm | ppm | ppm | calc | calc |
| 60226 | E3184SD31 | 123.3 | TrCa alt Rhy | 26 | H | 51.00 | 0.0951 | 20.10 | 2.62 | 0.15 | 6.89 | 15.20 | 1.89 | 0.37 | 0.04 | 0.01 | 1.30 | 0.08 | 0.03 | 0.02 | 0.09 | 1.38 | 100.04 | 9 | 94 | 251 | 2.3 | 30 |
| 54360 | TH245 | 672.5 | Chl-(Tr) | 31 | H | 35.72 | 0.1009 | 11.05 | 6.00 | 0.12 | 18.74 | 3.81 | 0.18 | 4.24 | 0.10 | 6.86 | 0.40 | 2.62 | 0.60 | 0.60 | 5.21 | 4.95 | 97.35 | 13 | 1 | 186 | 3.3 | 85 |
| 54366 | TH245 | 676.2 | Chl-(Tr) | 31 | H | 44.57 | 0.1353 | 13.06 | 3.88 | 0.15 | 17.67 | 6.76 | 0.18 | 3.48 | 0.04 | 1.66 | 0.30 | 3.83 | 0.15 | 0.02 | 0.59 | 3.23 | 100.60 | 16 | 25 | 228 | 3.6 | 75 |
| 61491 | W2011NED42 | 123.9 124.2 | Ser schist | 31 | H | 48.10 | 0.3403 | 28.30 | 4.65 | 0.06 | 3.19 | 0.12 | 0.33 | 8.75 | 0.03 | 1.28 | 0.20 | 1.37 | 0.06 | 0.29 | 2.14 | 3.63 | 102.88 | 8 | 15 | 402 | 5.1 | 96 |
| 61495 | W2011NED42 | 131.2 131.6 | Chl(ser) Sch | 31 | H | 38.40 | 0.1575 | 18.80 | 9.04 | 0.19 | 17.90 | 0.26 | 0.16 | 9.16 | 0.02 | 4.94 | 0.10 | 0.48 | 0.08 | 0.00 | 0.11 | 5.52 | 100.66 | 26 | 51 | 292 | 3.2 | 98 |
| | TH56A | 297.5 | sh exh | 31 | W | 30.60 | 0.1700 | 15.60 | 6.25 | 0.17 | 22.60 | 0.97 | 0.46 | 3.65 | 0.08 | 5.13 | 0.35 | 1.42 | 0.38 | 1.40 | 3.00 | 6.87 | 99.10 | 22 | 1 | 200 | 5.1 | 95 |
| 54644 | TH390B | 330.2 | Chl -Tr | 32 | H | 42.12 | 0.0802 | 14.00 | 7.87 | 0.22 | 19.57 | 3.11 | 0.02 | 0.78 | 0.03 | 4.63 | | 0.02 | 0.12 | 0.00 | 1.50 | 10.10 | 99.96 | 10 | 32 | 171 | 2.8 | 87 |
| 54364 | TH245 | 675.3 | Tr-Cb | 33 | H | 49.54 | 0.0045 | 1.77 | 1.21 | 0.20 | 18.50 | 20.95 | 0.13 | 0.06 | 0.03 | 0.09 | 6.00 | 0.32 | 0.00 | 0.02 | 0.09 | 6.93 | 100.00 | 1 | 2 | 21 | 1.3 | 47 |
| 54365 | TH245 | 675.8 | Tr-Chl-Cb-Di | 33 | H | 40.91 | 0.0390 | 7.81 | 2.31 | 0.17 | 13.05 | 17.65 | 0.26 | 0.84 | 0.05 | 2.72 | 4.10 | 3.74 | 0.07 | 0.00 | 0.61 | 4.34 | 94.64 | 8 | 24 | 82 | 2.9 | 44 |
| 54482 | TH390B | 321.5 | Tr(Chl) | 33 | H | 48.77 | 0.0545 | 7.91 | 2.95 | 0.33 | 26.86 | 8.79 | 0.05 | 0.01 | 0.04 | 0.52 | 0.10 | 0.07 | 0.04 | 0.06 | 0.20 | 5.26 | 101.51 | 8 | 45 | 100 | 3.3 | 75 |
| 60987 | W2003NWD14 | 67.0 68.5 | Chl-Tr 10%Sp | 33 | H | | 0.0909 | | | | | | | | | | | 5.16 | 1.29 | 2.13 | 4.91 | | | | | 148 | 3.7 | |
| 61345 | TH408 | 406.3 406.6 | Chl-Tr 5%GnCpPy | 33 | H | | 0.1413 | | | | | | | | | | | 1.36 | 0.25 | 0.43 | 1.73 | | | | | 178 | 4.8 | |
| 61475 | W2011NED42 | 108.7 110.2 | Chl-Tr | 33 | H | 40.80 | 0.1103 | 8.47 | 5.37 | 0.47 | 18.00 | 11.20 | 0.26 | 2.53 | 0.19 | 3.59 | 3.20 | 1.01 | 0.62 | 0.15 | 3.21 | 11.70 | 105.75 | 7 | 8 | 95 | 7.0 | 64 |
| 70648 | TH134D | 554.5 555.1 | Tr/Ac (ZoEpCb) | 33 | H | | 0.1148 | | | | | | | | | | | 0.20 | 0.00 | 0.00 | 0.08 | | | | | 162 | 4.2 | |
| 54363 | TH245 | 674.5 | Cc-Tr | 34 | H | 32.19 | 0.0073 | 2.80 | 1.16 | 0.18 | 14.85 | 26.42 | 0.06 | 0.49 | 0.04 | 0.31 | 15.70 | 0.76 | 0.03 | 0.02 | 0.37 | 16.30 | 96.31 | 3 | 6 | 38 | 1.2 | 37 |
| 60985 | W2003NWD14 | 63.5 65.4 | Tr-Chl-Cb | 34 | H | | 0.0764 | | | | | | | | | | | 0.75 | 0.16 | 0.87 | 1.34 | | | | | 133 | 3.4 | |
| 60986 | W2003NWD14 | 65.4 67.0 | TrChlCb 20%Sp | 34 | H | | 0.0499 | | | | | | | | | | | 0.74 | 1.86 | 4.28 | 12.80 | | | | | 136 | 2.2 | |
| 61476 | W2011NED42 | 110.2 111.2 | Tr-Chl-(Cb) | 34 | H | 33.10 | 0.0595 | 6.48 | 4.82 | 0.57 | 19.00 | 15.60 | 0.13 | 0.58 | 0.15 | 4.82 | 7.10 | 0.87 | 0.75 | 0.42 | 2.38 | 5.86 | 92.18 | 6 | 13 | 89 | 4.0 | 55 |
| 61477 | W2011NED42 | 111.2 112.4 | Tr-Chl-(Cb) | 34 | H | 34.90 | 0.0417 | 5.08 | 5.06 | 0.32 | 20.40 | 11.90 | 0.01 | 0.16 | 0.25 | 6.69 | 4.20 | 1.89 | 1.84 | 1.60 | 3.20 | 8.12 | 97.46 | 3 | 17 | 92 | 2.7 | 63 |
| 61479 | W2011NED42 | 112.9 113.7 | Tr-Chl-(Do) | 34 | H | 41.50 | 0.0110 | 2.42 | 2.28 | 0.40 | 22.60 | 12.80 | 0.03 | 0.04 | 0.30 | 3.84 | 4.90 | 1.48 | 0.61 | 1.24 | 3.06 | 8.24 | 99.04 | 3 | 6 | 62 | 1.1 | 64 |
| 61483 | W2011NED42 | 117.4 117.9 | Tr-Chl-Sp-Cb | 34 | H | 18.60 | 0.0118 | 2.50 | 14.30 | 0.77 | 13.60 | 8.62 | 0.88 | 0.00 | 0.17 | 17.01 | 6.10 | 2.71 | 1.25 | 3.80 | 10.10 | 11.30 | 93.59 | 1 | 10 | 110 | 0.6 | 59 |
| | TH43A | 405.8 | Ac-Cb exh | 34 | W | 43.20 | 0.1200 | 5.55 | 3.68 | 0.32 | 17.90 | 13.14 | 0.53 | 1.37 | 0.10 | 2.23 | 4.48 | 1.58 | 0.10 | 0.40 | 2.80 | 2.33 | 99.82 | 7 | 1 | 32 | 22.5 | 59 |
| 54361 | TH245 | 672.8 | CcTr (BaSp) | 35 | H | 12.38 | 0.0382 | 1.32 | 1.42 | 0.18 | 5.64 | 29.66 | 0.00 | 0.08 | 0.04 | 7.47 | 20.00 | 8.73 | 0.21 | 0.02 | 4.01 | 13.90 | 84.77 | 2 | 1 | 62 | 3.7 | 16 |
| 54362 | TH245 | 673.5 | CcTr (BaSp) | 35 | H | 19.87 | 0.0222 | 3.67 | 2.59 | 0.11 | 11.77 | 24.44 | 0.00 | 0.05 | 0.09 | 5.40 | 16.00 | 4.50 | 0.36 | 0.56 | 3.54 | 11.70 | 87.43 | 5 | 2 | 78 | 1.7 | 33 |
| 61478 | W2011NED42 | 112.4 112.9 | Do-Cc(Tr-Chl) | 35 | H | 11.20 | 0.0067 | 1.13 | 1.71 | 0.64 | 17.80 | 29.30 | 0.00 | 0.05 | 0.78 | 1.44 | 29.40 | 0.58 | 0.46 | 0.57 | 0.95 | 19.40 | 85.39 | 2 | 10 | 29 | 1.4 | 38 |
| 61480 | W2011NED42 | 113.7 114.6 | Do-Cc(Tr-Chl) | 35 | H | 12.40 | 0.0008 | 1.74 | 0.67 | 1.58 | 15.60 | 33.00 | 0.00 | 0.06 | 0.09 | 0.29 | 28.50 | 0.38 | 0.09 | 0.07 | 0.89 | 23.40 | 90.48 | 2 | 1 | 18 | 0.3 | 32 |
| 61481 | W2011NED42 | 114.6 115.8 | Do-Tr-(Sp) | 35 | H | 25.70 | 0.0095 | 3.98 | 2.99 | 1.21 | 20.30 | 13.50 | 0.90 | 0.00 | 0.27 | 5.59 | 10.40 | 0.33 | 0.57 | 3.05 | 7.47 | 6.57 | 89.29 | 2 | 1 | 106 | 0.5 | 59 |
| 61482 | W2011NED42 | 115.8 117.4 | Tr-Chl-Do | 35 | H | 37.50 | 0.0172 | 4.30 | 1.41 | 1.16 | 25.60 | 14.90 | 0.07 | 0.00 | 0.11 | 0.38 | 9.70 | 0.04 | 0.24 | 0.04 | 0.94 | 12.90 | 99.55 | 1 | 11 | 35 | 2.9 | 63 |
| | TH40 | 260.8 | Cb exh | 35 | W | 34.00 | 0.2600 | 7.05 | 2.79 | 0.21 | 1.70 | 31.39 | 1.77 | 0.97 | 0.16 | 0.04 | 20.01 | 0.08 | 0.00 | 0.00 | 0.01 | 0.41 | 100.85 | 4 | 6 | 30 | 52.0 | 7 |
| 61346 | TH408 | 406.6 408.0 | QEVBx[EpQCb] | 37 | H | | 0.1565 | | | | | | | | | | | 1.64 | 0.05 | 0.39 | 1.57 | | | | | 217 | 4.3 | |
| 61347 | TH408 | 408.0 409.3 | QEVBx[EpQCb] | 37 | H | | 0.1611 | | | | | | | | | | | 0.70 | 0.04 | 0.33 | 0.30 | | | | | 260 | 3.7 | |
| 70645 | TH134D | 553.0 553.3 | SM:80%Ba;PySp(Gn) | 41 | H | | 0.1286 | | | | | | | | | | | 37.90 | 0.15 | 1.27 | 3.80 | | | | | 84 | 9.2 | |
| 71064 | TH419 | 189.0 190.0 | SM Ba 10%PyCpSpGn | 41 | H | | 0.1134 | | | | | | | | | | | 17.90 | 1.34 | 0.66 | 2.02 | | | | | 159 | 4.3 | |
| 71065 | TH419 | 190.0 190.6 | SM Ba 10%PyCpSpGn | 41 | H | | 0.1068 | | | | | | | | | | | 23.20 | 2.43 | 0.82 | 3.10 | | | | | 116 | 5.5 | |
| 71066 | TH419 | 190.6 191.2 | SM Ba Sp~25% sulph | 41 | H | | 0.0909 | | | | | | | | | | | 39.49 | 1.85 | 3.60 | 13.30 | | | | | 88 | 6.2 | |
| 71067 | TH419 | 191.2 192.1 | SM Ba <5% sulphide | 41 | H | | 0.1176 | | | | | | | | | | | 17.08 | 0.94 | 0.73 | 1.76 | | | | | 154 | 4.6 | |
| 61472 | W2011NED42 | 106.3 107.0 | Sp-Gn-Py | 43 | H | 20.20 | 0.0265 | 3.54 | 2.63 | 0.32 | 0.40 | 5.12 | 0.64 | 0.72 | 0.14 | 18.16 | 4.60 | 1.09 | 0.36 | 17.40 | 32.60 | 8.39 | 103.75 | 12 | 1 | 370 | 0.4 | 16 |
| 61473 | W2011NED42 | 107.0 108.2 | Sp-Gn-Py | 43 | H | 8.07 | 0.0008 | 1.60 | 7.71 | 0.17 | 1.40 | 1.36 | 0.18 | 0.48 | 0.24 | 27.45 | 0.30 | 0.76 | 0.78 | 17.60 | 32.80 | 7.45 | 90.72 | 6 | 1 | 477 | 0.0 | 55 |
| 61474 | W2011NED42 | 108.2 108.7 | Sp-Gn-Cp-Py | 43 | H | 9.69 | 0.0157 | 1.85 | 8.10 | 0.25 | 5.31 | 1.98 | 0.40 | 0.10 | 0.34 | 22.57 | 0.05 | 6.11 | 5.09 | 12.30 | 26.60 | 6.11 | 97.26 | 7 | 1 | 317 | 0.3 | 69 |

**TABLE 1** **Major and Trace Element Analyses - Thalanga** (Continued)

| Sample | Hole | Depth | Description | Group | From | SiO2 | TiO2 | Al2O3 | Fe2O3 | MnO | MgO | Cao | Na2O | K2O | P2O5 | S | CO2 | Ba | Cu | Pb | Zn | LOI | Total | Nb | Y | Zr | Ti/Zr | A.I. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | m | | | | % | % | % | % | % | % | % | % | % | % | % | % | % | % | % | % | % | % | ppm | ppm | ppm | calc | calc |
| 60984 | W2003NWD14 | 62.2 63.5 | SM(QEV fol) 40%Sp | 43 | H | | 0.0826 | | | | | | | | | | | 4.89 | 0.53 | 11.20 | 21.90 | | | | | 366 | 1.4 | |
| 60988 | W2003NWD14 | 68.5 69.2 | MS SpPy(Cp) | 43 | H | | 0.0309 | | | | | | | | | | | 0.68 | 4.53 | 10.20 | 21.90 | | | | | 265 | 0.7 | |
| 61341 | TH408 | 404.6 405.0 | MS SpPyBa(GnCp) | 43 | H | | 0.0324 | | | | | | | | | | | 7.10 | 4.28 | 5.20 | 15.20 | | | | | 104 | 1.9 | |
| 61342 | TH408 | 405.0 406.0 | MS SpPyBa(GnCp) | 43 | H | | 0.0392 | | | | | | | | | | | 13.20 | 0.26 | 9.00 | 32.80 | | | | | 163 | 1.4 | |
| 61344 | TH408 | 406.1 406.3 | CpGn(SpPy)(ChlTr) | 43 | H | | 0.0310 | | | | | | | | | | | 9.92 | 0.34 | 7.70 | 23.80 | | | | | 163 | 1.1 | |
| 70643 | TH134D | 552.0 552.7 | MS PySp(GnBaCpChl] | 43 | H | | 0.0465 | | | | | | | | | | | 8.40 | 0.30 | 5.90 | 14.80 | | | | | 236 | 1.2 | |
| 70644 | TH134D | 552.7 553.0 | MS PySp(GnBaCpChl] | 43 | H | | 0.0666 | | | | | | | | | | | 4.54 | 2.43 | 1.00 | 9.35 | | | | | 147 | 2.7 | |
| 71068 | TH419 | 192.1 193.3 | MS: Sp Py Cp Ba (Mt) | 43 | H | | 0.0445 | | | | | | | | | | | 22.00 | 7.60 | 1.45 | 14.80 | | | | | 67 | 4.0 | |
| 71069 | TH419 | 193.3 194.3 | MS: Sp Gn Cp Ba (Mt) | 43 | H | | 0.0629 | | | | | | | | | | | 19.50 | 3.42 | 6.89 | 14.10 | | | | | 196 | 1.9 | |
| 71070 | TH419 | 194.3 194.8 | MS: Sp Gn Cp Ba (Mt) | 43 | H | | 0.0494 | | | | | | | | | | | 14.80 | 2.65 | 5.40 | 9.14 | | | | | 183 | 1.6 | |
| 61484 | W2011NED42 | 117.9 118.5 | Tr-Chl-Py | 45 | H | 22.40 | 0.0422 | 7.39 | 27.90 | 0.33 | 16.00 | 2.78 | 0.09 | 0.44 | 0.27 | 23.26 | 1.20 | 0.00 | 0.45 | 0.58 | 2.80 | 19.30 | 101.62 | 6 | 12 | 66 | 3.8 | 85 |
| 61485 | W2011NED42 | 118.5 119.3 | MPy | 45 | H | 12.20 | 0.0582 | 5.25 | 41.40 | 0.15 | 7.58 | 1.04 | 0.04 | 1.00 | 0.05 | 33.84 | 1.20 | 2.30 | 0.18 | 0.53 | 1.96 | 25.90 | 101.81 | 4 | 28 | 82 | 4.3 | 89 |
| 61486 | W2011NED42 | 119.3 120.0 | MPy-Chl-(Sp) | 45 | H | 22.00 | 0.1868 | 4.00 | 22.40 | 0.18 | 13.10 | 1.28 | 0.34 | 3.74 | 0.06 | 17.75 | 1.30 | 0.86 | 0.53 | 1.07 | 4.48 | 15.40 | 91.54 | 17 | 54 | 247 | 4.5 | 91 |
| 61487 | W2011NED42 | 120.0 121.0 | MPy-Chl-(Sp) | 45 | H | 24.50 | 0.1718 | 12.70 | 23.60 | 0.15 | 11.10 | 1.33 | 0.32 | 4.76 | 0.04 | 19.15 | 2.00 | 0.00 | 0.97 | 0.68 | 4.58 | 14.40 | 100.72 | 15 | 26 | 213 | 4.8 | 91 |
| 61488 | W2011NED42 | 121.0 122.0 | MPy-Chl-(Sp) | 45 | H | 16.70 | 0.1503 | 9.95 | 33.80 | 0.16 | 11.60 | 0.93 | 0.52 | 1.81 | 0.03 | 25.92 | 1.80 | 0.39 | 0.34 | 1.08 | 3.25 | 20.80 | 102.74 | 15 | 23 | 176 | 5.1 | 90 |
| 61489 | W2011NED42 | 122.0 123.0 | MPy-Chl-(Sp) | 45 | H | 17.70 | 0.1149 | 9.78 | 29.20 | 0.16 | 14.60 | 0.19 | 0.34 | 2.13 | 0.04 | 23.39 | 1.80 | 0.27 | 0.18 | 1.10 | 4.76 | 19.90 | 101.95 | 10 | 1 | 188 | 3.7 | 97 |
| 61490 | W2011NED42 | 123.0 123.9 | MPy-Chl-(Sp) | 45 | H | 12.60 | 0.0644 | 5.38 | 37.50 | 0.12 | 8.01 | 0.18 | 0.38 | 2.27 | 0.07 | 30.82 | 0.00 | 0.25 | 0.16 | 3.00 | 8.56 | 21.00 | 102.09 | 15 | 66 | 159 | 2.4 | 95 |
| 60989 | W2003NWD14 | 69.2 70.0 | MPy 80% | 45 | H | | 0.0784 | | | | | | | | | | | 0.63 | 0.69 | 0.08 | 0.53 | | | | | 129 | 3.6 | |
| 70642 | TH134D | 551.2 552.0 | MPy 70%Py | 45 | H | | 0.0652 | | | | | | | | | | | 0.06 | 3.59 | 0.34 | 1.62 | | | | | 112 | 3.5 | |

**TABLE 3.** **Compositions of Precursors and Means of Rhyolite and psuedo-exhalite Groups**

| VALUE | n= | Description | Gp | SiO2 | TiO2 | Al2O3 | Fe2O3 | MnO | MgO | CaO | Na2O | K2O | P2O5 | S | CO2 | Ba | Cu | Pb | Zn | LOI | Total | Nb | Y | Zr | Ti/Zr | A.I. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | % | % | % | % | % | % | % | % | % | % | % | % | % | % | % | % | % | % | ppm | ppm | ppm | calc | calc |
| **Compositions of "Precursors 1, 6 and 9"** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MEAN | n=4 | Precursor 1 TH37-401,54616,54627,54628 | 1 | 77.01 | 0.12 | 12.15 | 2.04 | 0.05 | 1.02 | 0.52 | 3.17 | 3.64 | 0.02 | 0.02 | 0.10 | 0.09 | 0.00 | 0.00 | 0.01 | 0.70 | 100.60 | 14 | 34 | 166 | 4.2 | 55 |
| MEAN | n=3 | Precursor 6 TH14-238.8,26-299.3,51-255.0 | 6 | 72.20 | 0.10 | 14.77 | 1.88 | 0.02 | 0.99 | 0.63 | 4.62 | 3.77 | 0.03 | 0.08 | 0.11 | 0.10 | 0.00 | 0.00 | 0.01 | 0.48 | 99.78 | 20 | 37 | 152 | 4.1 | 48 |
| MEAN | n=6 | Precursor 9 TR102-106 & TH15 | 9 | 77.05 | 0.12 | 12.05 | 1.61 | 0.02 | 0.52 | 0.36 | 3.43 | 3.82 | 0.01 | 0.02 | 0.08 | 0.04 | 0.00 | 0.00 | 0.01 | 0.58 | 99.72 | 16 | 26 | 178 | 4.0 | 54 |
| **Mean Compositions and Standard Deviations of Rhyolite Groups 1 to 9.** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MEAN | n=25 | Weakly altered Rhyolite | 1 | 75.53 | 0.11 | 12.70 | 1.96 | 0.05 | 1.49 | 0.51 | 1.98 | 4.67 | 0.02 | 0.21 | | 0.12 | 0.00 | 0.01 | 0.02 | 0.89 | 99.56 | 17 | 36 | 161 | 4.1 | 71 |
| MEAN | n=18 | Moderately altered Rhyolite | 2 | 73.77 | 0.09 | 12.55 | 3.05 | 0.06 | 3.52 | 0.31 | 0.57 | 3.56 | 0.01 | 0.95 | | 0.15 | 0.01 | 0.01 | 0.14 | 1.75 | 99.06 | 16 | 34 | 138 | 3.9 | 90 |
| MEAN | n=13 | Strongly altered Rhy>5%Py | 4 | 70.96 | 0.06 | 7.92 | 10.49 | 0.03 | 1.54 | 0.13 | 0.11 | 2.21 | 0.02 | 7.62 | | 0.22 | 0.08 | 0.01 | 0.05 | 0.89 | 99.39 | 11 | 18 | 103 | 3.2 | 95 |
| MEAN | n=19 | Silicified "White" Rhyolite | 5 | 80.11 | 0.07 | 9.72 | 1.54 | 0.02 | 0.67 | 0.32 | 0.56 | 5.39 | 0.01 | 0.55 | | 0.30 | 0.01 | 0.03 | 0.09 | 0.59 | 99.31 | 13 | 26 | 112 | 3.8 | 88 |
| MEAN | n=21 | Silicic 'HW' Rhyolite | 6 | 76.13 | 0.08 | 12.62 | 1.55 | 0.02 | 0.78 | 0.65 | 3.82 | 3.36 | 0.02 | 0.21 | | 0.09 | 0.00 | 0.00 | 0.01 | 0.52 | 99.56 | 16 | 35 | 137 | 3.4 | 48 |
| MEAN | n=19 | Ser-Chl altd 'HW' Rhyolite | 7 | 69.07 | 0.12 | 14.97 | 2.68 | 0.05 | 4.39 | 0.70 | 1.20 | 3.85 | 0.02 | 0.68 | | 0.33 | 0.02 | 0.00 | 0.03 | 1.80 | 98.53 | 19 | 34 | 169 | 4.1 | 82 |
| MEAN | n=11 | Railway cutting Rhyolite | 9 | 77.05 | 0.11 | 12.33 | 1.63 | 0.03 | 0.61 | 0.45 | 3.26 | 3.99 | 0.01 | 0.02 | | 0.06 | 0.00 | 0.00 | 0.00 | 0.69 | 99.76 | 15 | 30 | 166 | 4.1 | 56 |
| STDEV | n=25 | Weakly altered Rhyolite | 1 | 2.81 | 0.04 | 1.37 | 0.48 | 0.02 | 0.75 | 0.31 | 1.17 | 2.17 | 0.02 | 0.33 | | 0.09 | 0.00 | 0.05 | 0.06 | 0.49 | 0.68 | 4 | 6 | 34 | 1.1 | 18 |
| STDEV | n=18 | Moderately altered Rhyolite | 2 | 5.15 | 0.02 | 1.70 | 1.40 | 0.05 | 3.29 | 0.34 | 0.77 | 0.81 | 0.01 | 0.55 | | 0.13 | 0.01 | 0.01 | 0.39 | 0.74 | 1.39 | 3 | 9 | 24 | 1.2 | 11 |
| STDEV | n=13 | Strongly altered Rhy>5%Py | 4 | 6.76 | 0.03 | 1.51 | 5.01 | 0.02 | 1.03 | 0.14 | 0.06 | 0.61 | 0.01 | 4.30 | | 0.25 | 0.24 | 0.01 | 0.07 | 1.97 | 3.06 | 2 | 10 | 24 | 1.1 | 6 |
| STDEV | n=19 | Silicified "White" Rhyolite | 5 | 3.75 | 0.03 | 1.64 | 0.84 | 0.01 | 0.54 | 0.25 | 0.38 | 2.05 | 0.01 | 0.32 | | 0.50 | 0.01 | 0.03 | 0.11 | 0.37 | 0.93 | 2 | 16 | 27 | 1.6 | 10 |
| STDEV | n=21 | Silicic 'HW' Rhyolite | 6 | 3.71 | 0.02 | 2.02 | 0.50 | 0.01 | 0.85 | 0.46 | 1.27 | 2.04 | 0.01 | 0.28 | | 0.07 | 0.00 | 0.00 | 0.01 | 0.33 | 0.83 | 3 | 10 | 26 | 0.5 | 21 |
| STDEV | n=19 | Ser-Chl altd 'HW' Rhyolite | 7 | 4.69 | 0.03 | 3.52 | 1.29 | 0.05 | 1.73 | 0.94 | 1.20 | 1.54 | 0.01 | 1.53 | | 0.66 | 0.06 | 0.00 | 0.04 | 0.99 | 1.60 | 5 | 17 | 37 | 0.8 | 16 |
| STDEV | n=11 | Railway cutting Rhyolite | 9 | 2.65 | 0.03 | 1.32 | 0.71 | 0.02 | 0.43 | 0.57 | 1.03 | 1.16 | 0.00 | 0.01 | | 0.04 | 0.00 | 0.00 | 0.00 | 0.24 | 0.30 | 2 | 9 | 39 | 0.8 | 14 |
| **Mean Compositions of pseudo-exhalite and pyrite samples in Groups 22 to 35, and 45.** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MEAN | n=3 | Qtzite +/- Ba, Mt with relict Rhy fabric | 22 | 81.97 | 0.04 | 3.69 | 1.73 | 0.01 | 0.49 | 0.50 | 0.06 | 1.14 | 0.31 | 1.43 | 0.66 | 4.14 | 0.02 | 0.45 | 0.03 | 0.62 | 97.84 | 5 | 18 | 46 | 13.4 | 76 |
| MEAN | n=2 | Act-Ep-Czo-Cb altered Rhyolite | 26 | 56.95 | 0.09 | 16.60 | 4.53 | 0.17 | 5.43 | 10.64 | 1.23 | 2.87 | 0.04 | 0.01 | 0.95 | 0.16 | 0.02 | 0.01 | 0.05 | 1.06 | 99.98 | 12 | 86 | 220 | 2.5 | 44 |
| MEAN | n=5 | Chlorite schist | 31 | 39.48 | 0.18 | 17.36 | 5.96 | 0.14 | 16.02 | 2.38 | 0.26 | 5.86 | 0.05 | 3.97 | 0.27 | 1.94 | 0.25 | 0.46 | 2.21 | 4.84 | 100.12 | 17 | 19 | 262 | 4.0 | 90 |
| MEAN | n=1 | Chl>Trem, <5%Cb | 32 | 42.12 | 0.08 | 14.00 | 7.87 | 0.22 | 19.57 | 3.11 | 0.02 | 0.78 | 0.03 | 4.63 | 0.00 | 0.02 | 0.12 | 0.00 | 1.50 | 10.10 | 99.96 | 10 | 32 | 171 | 2.8 | 87 |
| MEAN | n=4 | Trem>Chl, <5%Cb | 33 | 45.01 | 0.08 | 6.49 | 2.96 | 0.29 | 19.10 | 14.65 | 0.17 | 0.86 | 0.08 | 1.73 | 3.35 | 1.69 | 0.32 | 0.40 | 1.55 | 7.06 | 100.47 | 6 | 20 | 112 | 3.9 | 57 |
| MEAN | n=6 | Trem+Chl; 5-50%Cb | 34 | 33.92 | 0.05 | 4.14 | 5.22 | 0.43 | 18.06 | 14.75 | 0.27 | 0.44 | 0.17 | 5.82 | 7.08 | 1.35 | 0.82 | 1.58 | 4.51 | 8.69 | 96.40 | 4 | 9 | 86 | 4.7 | 56 |
| MEAN | n=7 | Cb>Trem+Chl | 35 | 21.86 | 0.05 | 3.31 | 1.94 | 0.73 | 14.06 | 25.17 | 0.39 | 0.17 | 0.22 | 2.94 | 19.14 | 2.09 | 0.28 | 0.62 | 2.54 | 12.61 | 91.11 | 3 | 5 | 51 | 8.9 | 35 |
| MEAN | n=7 | Massive pyrite | 45 | 18.30 | 0.11 | 7.78 | 30.83 | 0.18 | 11.71 | 1.10 | 0.29 | 2.31 | 0.08 | 24.88 | 1.33 | 0.58 | 0.40 | 1.15 | 4.34 | 19.53 | 100.35 | 12 | 30 | 162 | 4.1 | 91 |
| MEAN | n=18 | Weighted Mean composition of Groups 32 to 35 | | 32.15 | 0.06 | 4.89 | 3.59 | 0.50 | 16.82 | 18.13 | 0.28 | 0.45 | 0.16 | 3.73 | 10.55 | 1.64 | 0.46 | 0.85 | 2.92 | 9.93 | 95.45 | 4.17 | 10.89 | 83.17 | 6.06 | 50.06 |
| MEAN | n=14 | Mean composition of samples in Groups 33, 34 & 35 which balance well in QCT Norms. | | 31.65 | 0.04 | 4.04 | 2.67 | 0.55 | 18.20 | 18.97 | 0.16 | 0.39 | 0.18 | 3.05 | 11.41 | 1.61 | 0.42 | 0.59 | 2.37 | 10.90 | 94.93 | 3.71 | 8.86 | 61.21 | 3.82 | 50.32 |

## APPENDIX II Descriptions of Rhyolite, Exhalite and Psuedo-exhalite Litho- geochemical Groups

Appendix II contains details of the occurrence, mineralogy and textures of the Rhyolite Groups 1-9 and exhalite, psuedo-exhalite and sulphide assemblages in Groups 21-45. Table 2, from Section 4 of the text, is a summary of the litho-geochemical groups; it is reproduced here for convenient reference.

Table 2 Litho-geochemical Groups

| Group | n= | Description |
|---|---|---|
| | | RHYOLITES |
| 1 | 25 | Least altered-weakly altered footwall rhyolites, <1% pyrite. |
| 2 | 18 | Moderately Qtz-sericite-chlorite altered footwall rhyolites with mottled, foliated or pseudo-fiamme fabrics; 1-4% pyrite. |
| 4 | 13 | Intensely altered footwall rhyolites [QSeChlPy] commonly with pyrite stringers; >4% pyrite. |
| 5 | 19 | Siliceous White and Grey Rhyolites in footwall [Q]; low Na, high K; usually low pyrite. |
| 6 | 21 | Siliceous QFpR and Buff Rhyolite in hangingwall settings; >1% Na2O, variable Na/K, low pyrite. |
| 7 | 20 | Foliated Buff and [Chl-Ser] altd Rhyolite in hangingwall settings; Si depleted?, low pyrite. |
| 9 | 11 | Railway cutting (outcrop) Rhyolites. |
| | | DACITES, HWF, QFP-QEV and MAFICS |
| 10 | 36 | Fresh looking Fs phyric or aphyric Dacites. |
| 12 | 10 | Pervasively altered Dacites. |
| 13 | 3 | Hangingwall Fragmental unit (HWF) - bulk rock. |
| 14 | 2 | Clasts from within HWF unit. |
| 15 | 9 | QFP or undifferentiated "Qtz eye" rocks. |
| 16 | 3 | QEV Breccias and volcaniclastic sediments. |
| 17 | 21 | Undifferentiated Mafic rocks; mainly hangingwall (TCF) meta-Andesites. |
| 18 | 8 | Microdiorite. |
| | | QTZ-MAGNETITE-BARITE ROCKS |
| 21 | 3 | Magnetite-quartzite. |
| 22 | 3 | Quartz dominant: Qtz-Ba, Qtz-Mt with relict rhyolitic fabrics (e.g. TH5, 158.0m). |
| 23 | 6 | Qtz-Ba-Mt-Chl-Act+/-Cb+/-Sulphides; in very variable proportions. |
| | | ALTERITES (not in favourable horizon) |
| 26 | 2 | Ac-Ep/Czo-Qtz+/-Cb alteration of rhyolite. |
| | | CARBONATE-TREMOLITE-CHLORITE ASSEMBLAGES |
| 31 | 5 | Chl-(Phl-Ser) schist (+/- pyrite, sulphides). |
| 32 | 2 | Chlorite > tremolite; <5% carbonate |
| 33 | 7 | Tremolite > chlorite; <5% carbonate |
| 34 | 6 | Tremolite + chlorite (variable); 5-50% carbonate |
| 35 | 10 | Carbonate >50% > tremolite + chlorite |
| 37 | 2 | Ep-Cb > Ac; mainly in QEV in mid-upper parts of favourable horizon. |
| | | SULPHIDES |
| 41 | 5 | Massive to semi massive Barite >> Sulphides +/- minor Cb. |
| 43 | 12 | Massive Sulphide, Sp+Gn > Py+Cp. |
| 45 | 8 | Massive pyrite, +/- minor Cp, Sp. |
| 28 | 291 analyses. | |

Group 1: Weakly altered FW Rhyolites

This group includes rhyolites in the outer zone of footwall alteration, generally occurring at least several tens of metres up to a couple of hundred metres away from ore lenses. The freshest examples contain relict plagioclase phenocrysts but many have suffered partial feldspar destructive alteration and have moderately foliated fabrics with up to 10-20% fine sericite and subordinate phlogopite in the matrix. Most are weakly porphyritic with 3-5% disseminated quartz phenocrysts (and a similar content of plagioclase phenocrysts when present). The quartz phenocrysts are normally well preserved with sharp outlines and minor internal recrystallisation. These rocks usually contain <1% disseminated pyrite. Typical examples are pictured in Figure 20. Pseudo-fragmental alteration fabrics are common and generally difficult to distinguish from possible true volcaniclastic fabrics.

Group 2: Moderately altered FW Rhyolites

Rocks in this category have undergone total feldspar alteration and usually contain >20% phyllosilicates (sericite, chlorite and phlogopite in decreasing order of abundance) and 1-4% disseminated pyrite. They occupy the intermediate zones of footwall alteration. At East Thalanga they are widespread between the weakly altered outer zone and the more proximal pyritic stringer zone and at West Thalanga may immediately underlie the, presumably more distal, updip parts of the ore lens.

Group 2 rhyolites exhibit a variety of textures including schistose, wispy pseudo-fiamme and blotchy/mottled types. The latter, depicted in Figure 21 (upper core), is very common at East Thalanga and consists of fuzzy ellipsoidal blotches, upto a few centimetres across, of fine meshwork aggregates of >50% chlorite, sericite and phlogopite scattered or crowded in a more siliceous matrix of fine granuloblastic quartz containing <20% phyllosilicates. Small porphyroblasts of pink garnet sometimes occur in the blotches. Relict quartz phenocrysts are evenly distributed throughout the blotches and the matrix and are usually strongly internally recrystallised and mantled with rims of finer granuloblastic quartz. This fabric appears to be a metamorphically modified form of domainal phyllosilicate alteration which may have nucleated on primary feldspar phenocrysts in formerly coherent rhyolite. Coarse to fine rhyolitic volcaniclastic breccias probably occur, especially at West Thalanga, but the majority of Group 2 rocks are thought to be altered coherent lavas.

Group 4: Intensely altered FW Rhyolites and stringer pyrite mineralisation

Group 4 altered rhyolites are characterised by 4-20% pyrite, strong silicification and <20% phyllosilicates. The pyrite occurs as disseminations and intersecting/anastomosing veinlets and veins often containing minor chalcopyrite. The alteration has a tendency to "detexture" primary volcanic features and in thin section these rocks appear as fine granuloblastic arrangements of quartz, transected by veins of pyrite, quartz and minor chlorite, with subordinate interstitial shreds of sericite>>chlorite and scattered, partly consumed relict phenocrysts of quartz . They are restricted to apparently stratiform zones of upto about 70m thickness immediately stratigraphically underlying the ore lenses and in possible footwall "feeder" zones which, in the Central and East Thalanga area, appear to dip steeply to the north at an acute angle to the favourable horizon.


Figure 20. Sawn core specimens of weakly altered quartz-feldspar phyric rhyolites typical of Group 1.


Figure 21. Upper specimen: blotchy chlorite fabric in moderately altered, formerly coherent? rhyolite typical of Group 2; very common in East Thalanga footwall.
Lower specimen: intensely silicified, "de-textured" rhyolitic rock with pyritic stringers; characteristic of Group 4 in footwall stringer zone.

In this thesis, these zones are referred to by the acronym "FWSZ" (for: footwall stringer zone). Figure 21 (lower core) depicts a typical sample from East Thalanga. This style of alteration is well developed and extensive at Central, Vomacka, East and Far East Thalanga but is restricted to a thin zone of <10m in the footwall of most of West Thalanga where it appears to intensify down dip and may indicate the presence of a footwall feeder zone along the present down dip fringe of the lens.

Group 5: Siliceous white/grey Footwall Rhyolites:

Group5 includes, and is typified by, the so called "White Rhyolite" which occurs as an elongate lozenge shaped lens at the footwall contact in the upper levels of the East Thalanga orebody. Megascopically and chemically similar rocks also occur elsewhere in the footwall at East, Central and West Thalanga (eg: at Central Thalanga some 200m stratigraphically below the sulphide lens in the upper 100m of TH112) and prominently in several holes at Thalanga Range 2km west of the mine.

In hand specimen they are massive, homogenous, white to pale grey, and rarely pinkish grey, siliceous cherty looking rocks sometimes with very sparse, small quartz and feldspar phenocrysts/crystals and poorly developed foliation reflecting very low phyllosilicate composition. They may contain a trace (<0.5%) of ultrafine disseminated pyrite and rare pyrite-quartz veinlets; the typical appearance is depicted in Figure 22.

Some examples show traces of relict fine flow? banding. The compositional and textural homogeneity suggest that the precursors were coherent flows although the high silica contents (75-87% $SiO_2$) indicate that they have not been impervious to silicification.

In thin section (of sample no. 54645 from TH 391, 111.3m) the matrix is seen to be a fine (10-60$\mu$m) mosaic of quartz and Kfeldspar?, <2% fine (20-50$\mu$m) sericite and 1-2%, 0.5-2mm well preserved sharp edged phenocrysts of quartz and rare, rather corroded or recrystallized albitic plagioclase. This rock has nearly 6% $K_2O$ and 8% $Al_2O_3$ and must contain considerable K-feldspar to accomodate these components (which are not accounted for by the low sericite) even though the K-feldspar is difficult to resolve in the fine matrix.

Group 6: Siliceous Hangingwall Rhyolites

Group6 is dominated by relatively unaltered, siliceous, poorly foliated rhyolites of the Central to West Thalanga area which appear to occur in hangingwall settings; i.e. they lie southward of the downdip projection of the favourable horizon as recognised at shallow levels. It includes some examples of the so called "Buff" rhyolite which appears to mark the eastern limit of the West Thalanga lens and also some from TH144B (below East Thalanga) which lie in a wedge between the footwall stringer zone and a thick unit of QEV and QFP presumably representing the favourable horizon. In Central and West Thalanga the southward incursion of rhyolites is attributable to faulting; ie: these are slices of relatively unaltered footwall rhyolite which have been emplaced by major normal dip-slip and subordinate dextral strike-slip on steeply north dipping ENE trending faults or shears which cut the sequence at a low angle to stratigraphic layering and are responsible for repetitions of the favourable horizon, (Hill, 1991; Berry, 1989).


Figure 22. Sawn core specimens of silicified "white" rhyolite from footwall of East Thalanga area, exemplary of Group 5. Similar rocks occur in Central andWest Thalanga footwall, sometimes well down in the stratigraphic sequence below the favourable horizon


Figure 23. Four core specimens illustrating Group 6 siliceous "hanging wall" rhyolites; the specimen at right (TH26-376.4m) is typical of "Buff Rhyolite". These rocks are chemically similar to least altered footwall rhyolites and are interpreted to be structurally emplaced parts from the footwall. Some e.g. at left, superficially resemble felspar phyric dacite.

The precise position of such faults is dificult to pinpoint in drill core (where rhyolite contacts rhyolite) and this may be due to the obscuring effect of post faulting metamorphism. Hill (1991) referred to them as D3 brittle-ductile shears and suggested they preceded regional metamorphism although this seems inconsistent with the metamorphism being associated with D2.

The Group 6 rhyolites are mostly porphyritic (<5% phenocrysts) with evenly scattered small phenocrysts of quartz and fresh plagioclase in a flinty siliceous dark to pale grey or pinkish-grey to pinkish-buff matrix. Some typical examples are depicted in Figure 23. Most are coherent flow units with some pseudoclastic silicification overprints. The dark grey varieties superficially resemble hangingwall dacite and often display the patchy or fracture controlled pink and green epidote-albite alteration characteristic of the latter. They have relatively (for Thalanga) high alkali contents, high Na/K ratios and low phyllosilicates and foliation which reflects the preservation of feldspar and , as for most other felsic volcanic groups, have a fairly broad range of $SiO_2$ contents (67-80%) suggesting some silicification.

Group 7: Foliated Hangingwall Rhyolites

Group 7 altered rhyolites are closely associated with Group 6 but differ by having well developed schistosity and wispy pseudofiamme fabrics attributable to essentially pervasive sericite-chlorite alteration. They retain well preserved, evenly distributed relict feldspar and quartz phenocrysts which, together with their occurrence as foliated zones within or at the margins of Group 6 coherent rhyolites, strongly suggests that they were formed by pervasive phyllosilicate alteration of the matrix of the latter. This alteration style, although pervasive, is not generally associated with addition of pyrite or severe Na depletion - it may be equivalent to the outer zones of weak footwall alteration (Group 1) but differs in producing a lower range of $SiO_2$ (62-76%). Examples are illustrated in Figure 24.

Group 9: Railway cutting Rhyolites:

This group comprises rocks of the Mt Windsor Fmn. sampled by Wills (1985) and Stolz (1991), from the railway cutting about 5km west of Thalanga Mine.
I have not examined them and cannot offer a description but they may be presumed to be well outside the Thalanga footwall alteration system and possibly equivalent to Group 1.

Group 21 Magnetite-Quartzites.

Rocks of this category, in the Thalanga area, are essentially meta-quartzites containing minor magnetite and little else. A thin section from TH40, 231.8m shows a fine granuloblastic mosaic of 50-300$\mu$ quartz, quite massive and without layering or foliation, dusted with about 5% of 2-100$\mu$ euhedral magnetite. There are traces of carbonate, epidote, dark green chlorite and pyrite in rare veinlets upto 1.5mm wide.
The best examples occur with stratified dacitic volcaniclastic sandstones in the hanging wall sequence some 100-150m stratigraphically above the favourable horizon west of the mine in TH37, TH40 and a few lenticular surface oucrops upto a few metres thick along the

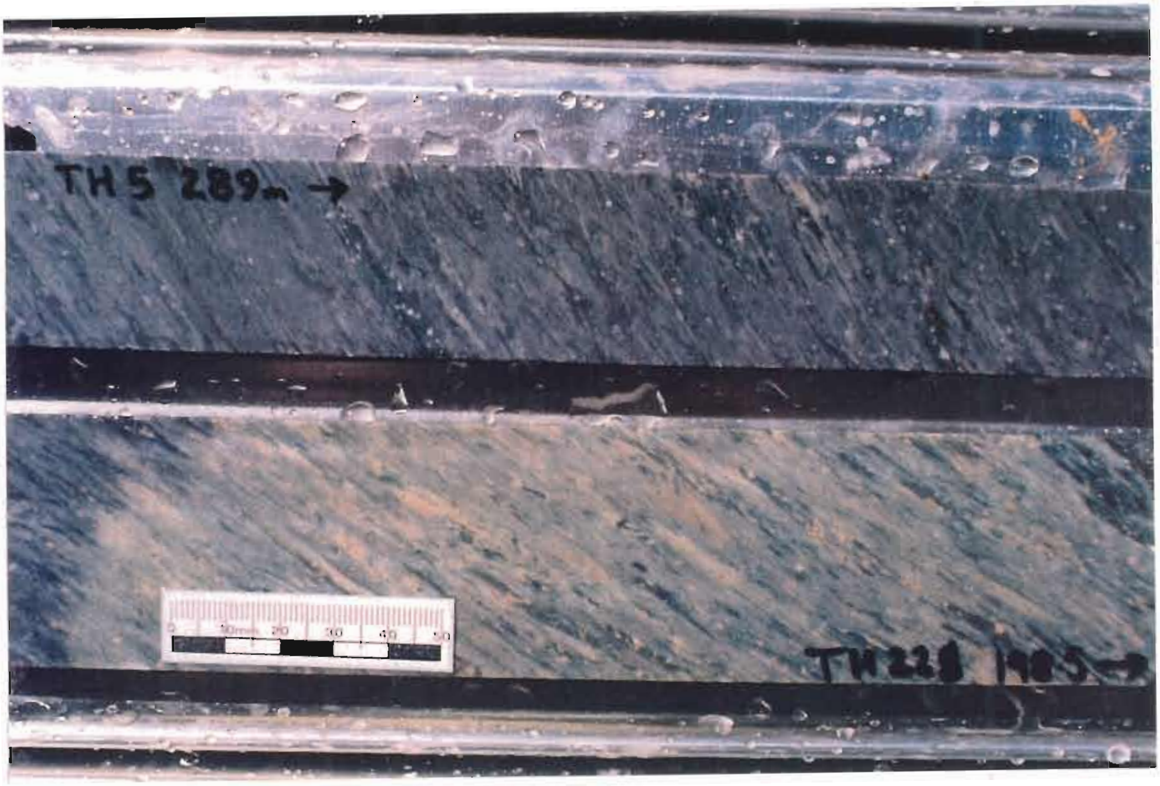



Figure 24. Group 7 type altered rhyolites showing characteristic strong foliation and thin, wispy lenticular zones of chloritic material (pseudo-fiamme) and surprisingly well preserved relict plagioclase phenocrysts (pale 1-2mm spots).


Figure 25. Magnetite-quartzites from TH40. The section beneath the scale rule is massive, fine grained meta-quartzite with accessory magnetite which occurs in core segments upto a couple of metres in length; dark grey rounded clasts in the volcaniclastic breccia above the scale are similar material.

southern slope of Thalanga Range. It is noteworthy that in these holes the magnetite-quartzite occurs as massive bands presumed to be beds, and as clasts within coarse mass flow volcaniclastic sediments (Figure 25) and that the associated volcaniclastics sediments also contain minor magnetite suggesting a source of detrital magnetite or exhalative hematite.

Similar rounded-irregular clasts, usually <100mm, rarely upto 500mm and often with fuzzy boundaries, are present in minor amounts in the quartz-eye volcaniclastic unit associated with ore in West Thalanga (usually towards the stratigraphic top of the unit and in the updip parts which appear to represent the more distal parts of the mineralised lens) and, rarely, in similar settings in Vomacka and East Thalanga. Duhig et al, (1992) also found lenses of magnetite-quartzite at the favourable horizon 2km west of the mine and at the Puddler Creek Fmn - Mt Windsor Fmn contact on either side of the Flinders Highway.

<u>Group 22</u> Quartzite (+/- barite, magnetite) with relict rhyolitic fabric.

Group 22 rocks somewhat resemble the magnetite-quartzites in being fundamentally composed of fine (20-100$\mu$) aggregates of granuloblastic quartz, sometimes with traces of magnetite and/or barite, but differ by containing ~5% fine sericite/phlogopite/biotite and very sparse relict quartz phenocrysts; they are like the siliceous "white" rhyolites (Group 5) in appearance except for the lack of feldspars. They occur in the immediate hanging wall of the Vomacka ore lens in hole number E3184SD31 and below the dacite contact in the interval 148.9-168.8m of TH5 near the Central lens; in both cases in proximity to southward offsets of the dacite contact thought to be caused by brittle-ductile (D3) faulting. Wills (1985) classed the latter example as siliceous exhalite and Stolz (1991) noted fine banding of quartz and barite rich layers and suggested a similarity to modern sea-floor "white smoker" deposits. My re-examination of this core, however, indicated that most of the barite (with minor magnetite and galena) occurs in irregular brittle style veins which predate the intrusion of a narrow microdiorite dyke. Petrographic inspection shows the sparsely scattered quartz grains to be around 1.5mm diameter with the internal recrystallisation and narrow mantle of 100-200$\mu$ granular quartz which is typical in the altered footwall rhyolites.

<u>Group 23</u> Quartz-Magnetite-Barite-Chlorite-Actinolite-Sulphide-Carbonate.

Inhomogenous assemblages of quartz-barite-magnetite-chlorite-actinolite +/- carbonate-sulphides may be transitional between (or perhaps mechanical mixtures of) Group 21: magnetite-quartzite and the Tremolite-chlorite rich assemblages. They occur in similar settings to the former (associated with the upper, distal? parts of the ore lenses) and are best known from TH384. Thin section examination of samples from TH384 shows patches of fine granuloblastic quartzite and magnetite-quartzite with barite as small disseminated grains, coarse blady crystals apparently growing inwards from the margins of magnetite-quartzite patches/clasts or in irregular discontinuous veinlets. These are interspersed with irregular patches resembling interfragment matrix of highly variable amounts of barite, magnetite, green (presumably Fe rich) chlorite, actinolite, minor chalcopyrite and sphalerite and scattered quartz crystals which closely resemble volcanic phenocrysts. There is textural evidence to suggest that coarse magnetite grains are fractured and partly replaced/embayed by chlorite-barite; barite occurs in pressure shadows of magnetite-quartzite clasts? and appears to have been mobile during deformation. Carbonate is prominent in some samples as ragged vein like bands replacing actinolite and chlorite.

Groups 26 & 37 Actinolite-epidote-clinozoisite-quartz-(carbonate) altered volcanics. Group 26 rocks are patchy but fairly common and widespread in the outer, otherwise weakly altered parts of the footwall alteration system. The typical assemblage consists of small sheaf like bunches of actinolite and patches and trains of poorly crystallised, blurry, whitish clinozoisite-epidote-carbonate, replacing the matrix of otherwise weakly quartz-sericite-phlogopite altered rhyolite; generally preserving the primary quartz, and sometimes also plagioclase, phenocrysts. Textural evidence shows that this assemblage has formed by partial replacement, or alteration, of rhyolite. It usually is not associated with significant base metal or iron sulphides. Alteration of this type occurs in varying intensity from scattered small "clouds" and veinlet associated selvedges to semi-pervasive patches over short intervals; e.g. Figure 26. Texturally and mineralogically similar patchy, apparently fracture controlled, quartz-epidote-carbonate-actinolite alteration (for which Wills, 1985 coined the acronym: "quedap") is widespread in dacites, dacitic volcaniclastic sediments and andesites in the hanging wall sequence.

In the favourable horizon at West Thalanga similar assemblages, of more massive-pervasive nature replace rhyolitic or quartz-eye volcaniclastics in the stratigraphically upper parts overlying the sulphide lens (eg: TH408 and in pre-production drill holes intersecting the horizon at around 600RL on Sections 20030E and 20050E). These are separately classified as Group 37 merely to distinguish them from Group 26 which is unequivocally in the footwall.

Group 26 & 37 assemblages have some chemical similarity to chlorite-tremolite-carbonate etc. assemblages of Groups 32 to 35 but the distinction is that the former categories show transitions to less altered volcanics, or relict volcanic textures, which are not present in the latter.

Group31 Chlorite Schists.

Fine grained schists composed dominantly of dark chlorite with very subordinate phlogopite-sericite, spotty clinozoisite, tremolite/actinolite and pyrite, are common in two types of settings:

* as narrow margins to zones of massive tremolite-chlorite+/-carbonate within rhyolite, (eg: TH245, 672.2-676.7m, Figures 5 & 18 in text of thesis).

* as narrow zones or envelopes near the base of massive sulphides and massive pyrite lenses, sometimes separating the sulphides from the usually strongly silicified- pyritic altered rhyolitic footwall rocks, (eg: W2011NED42, 124-124.2m; Figure19 in text of thesis).

Due to the high phyllosilicate content these zones have focussed deformational strain and are often rather sheared with a fissile or broken texture. Wills, (1985) referred to them as "shaly exhalites".

Groups 32, 33, 34 & 35 Chlorite-tremolite-carbonate rocks. (CTCs)

Groups 32, 33, 34 and 35 are described together as they represent a mineralogical continuum with the subdivisions arbitrarily based on estimates of modal proportions.
The sudivisions are:

| | |
|---|---|
| Group 32 | chlorite > tremolite; <5% carbonate |
| Group 33 | tremolite > chlorite; <5% carbonate |
| Group 34 | tremolite + chlorite (variable); 5-50% carbonate |
| Group 35 | carbonate >50% > tremolite + chlorite. |

Within this suite there are both abrupt and gradational changes in mineral proportions and near mono-mineralic varieties of the main phases are common. Variations seem stratigraphically and laterally non systematic except for a tendency for chlorite rich types to occur at the outer margins and carbonate rich types to occupy the core zones of CTC units or lenses.
Variable amounts of barite, sphalerite, chalcopyrite, galena, pyrite (and rarely diopside) are associated phases, especially with tremolite and carbonate rich types which may contain up to ~10% Zn and are mined as "semi-massive" ore.

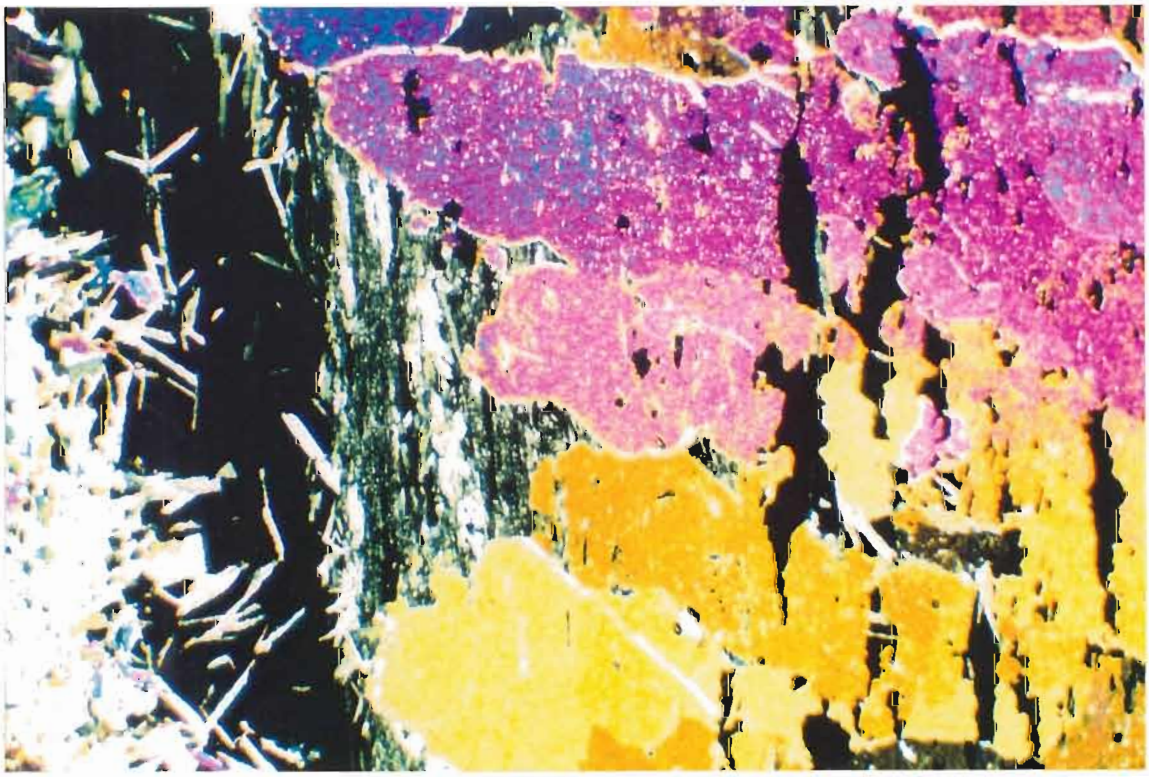
Chlorite-tremolite-carbonate rocks are virtually ubiquitous associates of sulphide ore in the Central and West Thalanga lenses and are also known intra rhyolite below the West Thalanga orebody where the favourable horizon and dacite contact are displaced southwards, (Figure 5). A semi-continuous layer of chlorite-tremolite-carbonate (CTC) a few metres thick generally constitutes the middle layer of the favourable horizon, in West Thalanga, lying between the pyritic or base metal massive sulphide lenses on the footwall and the thin unit of "quartz-eye" volcaniclastics below the dacite contact. However, this setup is not universal and in places there appear to be multiple thin layers of sulphides and CTCs, sometimes with CTCs adjacent to the footwall contact (as on Section 20110E above 700RL) or the sequence may be reversed (as in W2011NED31 where CTCs lie on the footwall contact against silicified rhyolites and are succeeded by nearly 15m of sphalerite rich massive sulphide). Correlation between drill holes is generally difficult and underground faces often display a metre scale lenticularity of sulphides and CTCs which, one suspects, may be largely structurally imposed.

Figure 26. Band or patch of semi pervasive pale clinozoisite-carbonate and dark green actinolite alteration in otherwise weakly quartz-sericite altered footwall rhyolite; core from TH407, 133.6m, West Thalanga Extended.


Figure 27. Core specimens from TH390B in footwall of East Thalanga deposit (Fig. 3 of text). Upper: massive felted chlorite (dark) with irregular bands of pale green-white tremolite. Lower: massive felted chlorite-phlogopite with scattered bunches of fibrous tremolite, gradational into relict rhyolite with incipient clinozoisite-actinolite alteration.

The chlorite rich types consist of near massive fine, felted, light greenish grey, presumably Mg rich chlorite (megascopically resembling talc) with scattered to abundant euhedral narrow prisms of pale green tremolite up to several centimetres in length. The tremolite is nearly always randomly oriented despite a moderate foliation in the felted chlorite matrix (Figure 27) and appears to have crystallised after the peak of deformational strain - it is difficult to envisage crystals of this shape resisting formation of nematoblastic or decussate textures if subjected to the same stress which has produced quite strong foliation of micas in siliceous altered footwall rhyolites. In some specimens (eg: Figures 28 a & b. photmicrograph of 61483) ragged blebs of sulphides, in lensoidal trains parallel to the main foliation, are included within large tremolite prisms which have grown transverse to foliation giving the impression that the sulphide and chlorite defined some pre-existing fine layering or foliation and that tremolite is a replacive phase. With increasing tremolite content the chlorite becomes interstitial to minor in a coarse framework of interpenetrating tremolite prisms of random orientation. Tremolite in these rocks is colourless and non pleochroic in thin section which is interpreted to indicate a higher Mg/Fe ratio than in the typically dark green pleochroic green actinolite occurring in the Group 26 and 37 assemblages.
Diopside has been identified in only one sample (54365) where it occurs as coarse euhedral prisms in association with barite and quartz and is partly replaced along cleavage planes by carbonate-tremolite in what appears to be a retrograde reaction.

Carbonate exists in extremely variable proportions in forms including semi pervasive granular patches, coarse, sparry cross cutting veins and anastomosing marbly vein networks which clearly corrode and replace tremolite and chlorite and also sulphides, where present (Figures 29, 30 & 31). Carbonate is white to pale grey and sometimes pinkish; a large proportion appears to be calcite (effervescent in dilute HCl) but significant non-effervescent (dolomite?) is present in some samples.
In Sample No: 61478 (W2011NED42, 112.4-112.9m; Figure 31) pale grey, semi opaque, (non effervescent) dolomite, as ragged cauliflower like clumps and equant crowded rhombs of up to 8mm diameter, with interstitial and veiny white calcite together constitute about 80% of the rock and enclose ragged relict "islands" of chlorite-tremolite which are rimmed by fine sparry calcite. This pseudo-fragmental appearance of intersecting and anastomosing veins around relict patches of chlorite-tremolite progressing to a marbled rexture with increasing carbonate, is the most typical fabric in the carbonate rich CTCs; it suggests considerable introduction, or at least mobility, of carbonate late in the metamorphic crystallisation sequence. The cauliflower like, mottled or fine nodular carbonate fabric is also fairly common in West Thalanga and it megascopically resembles specimens of rocks reputed to be chlorite-carbonate altered host volcanics at the Hercules and Hellyer massive sulphide deposits in western Tasmania (cf. Figure 4E/4 of Gemmell and Large, 1992). In the upper levels of West Thalanga a strong planar fabric formed by elongate lenses of carbonate a few millimetres thick separated by thinner lamellae of chlorite is locally prominent; this may have developed by extreme flattening or shearing of the nodular and marbled types.



Figures 28 a & b. Micrographs of specimen from sample no. 61483 in W2011NED42, 117.8mshowing S2 parallel blebs of sphalerite preserved within transverse coarse prisms of tremolite. Plane and cross polarized light; long side of frame = 5mm.

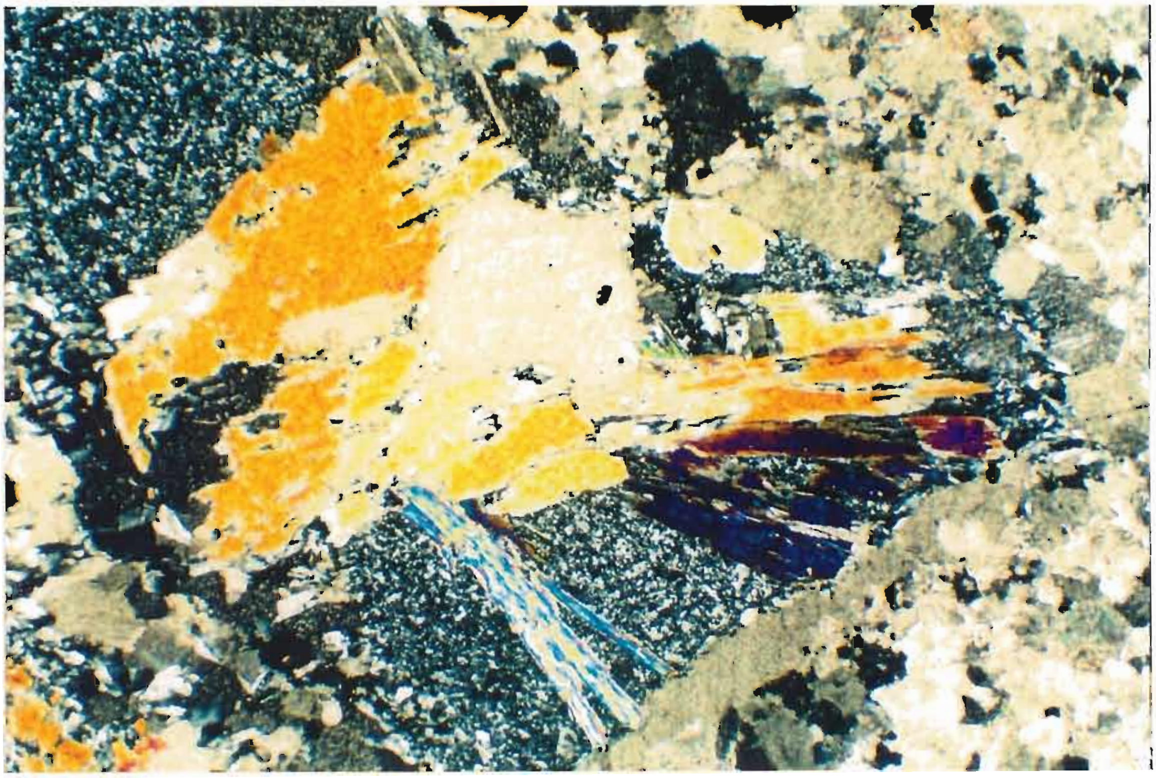


Figure 29. Micrograph of sample 61482 (W2011NED42, 116.5m). Massive sutured granular and veiny carbonate replacing tremolite and chlorite. Long edge of frame = 5mm.

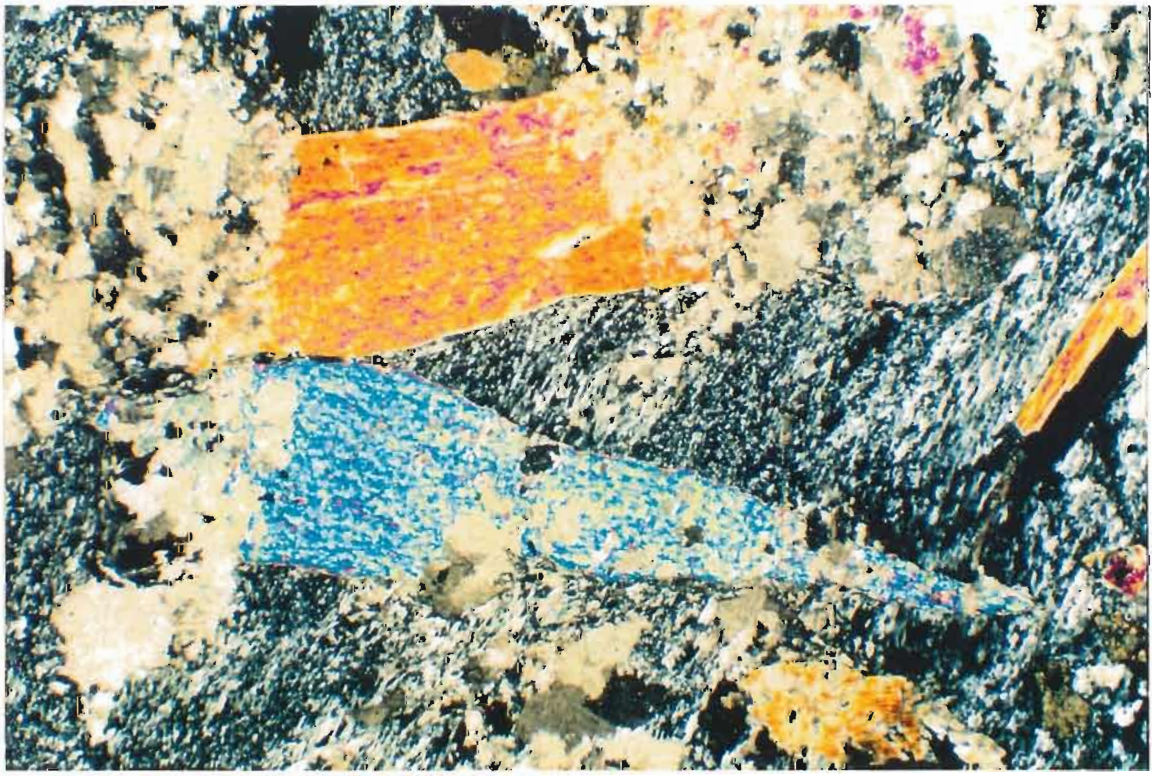
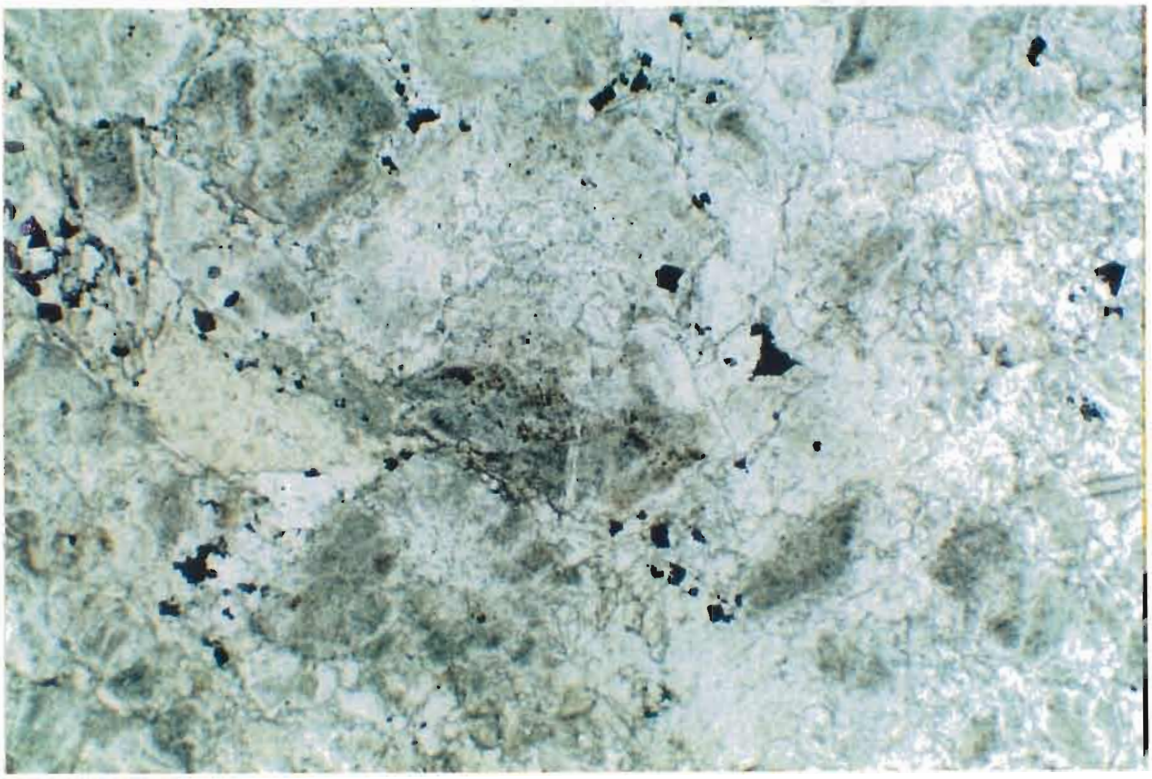


Figure 30. Micrograph of sample 61480 (W2011NED42, 114.5m). Coarse prisms of tremolite partly corroded and replaced by granular carbonate. Long edge of frame = 5mm.



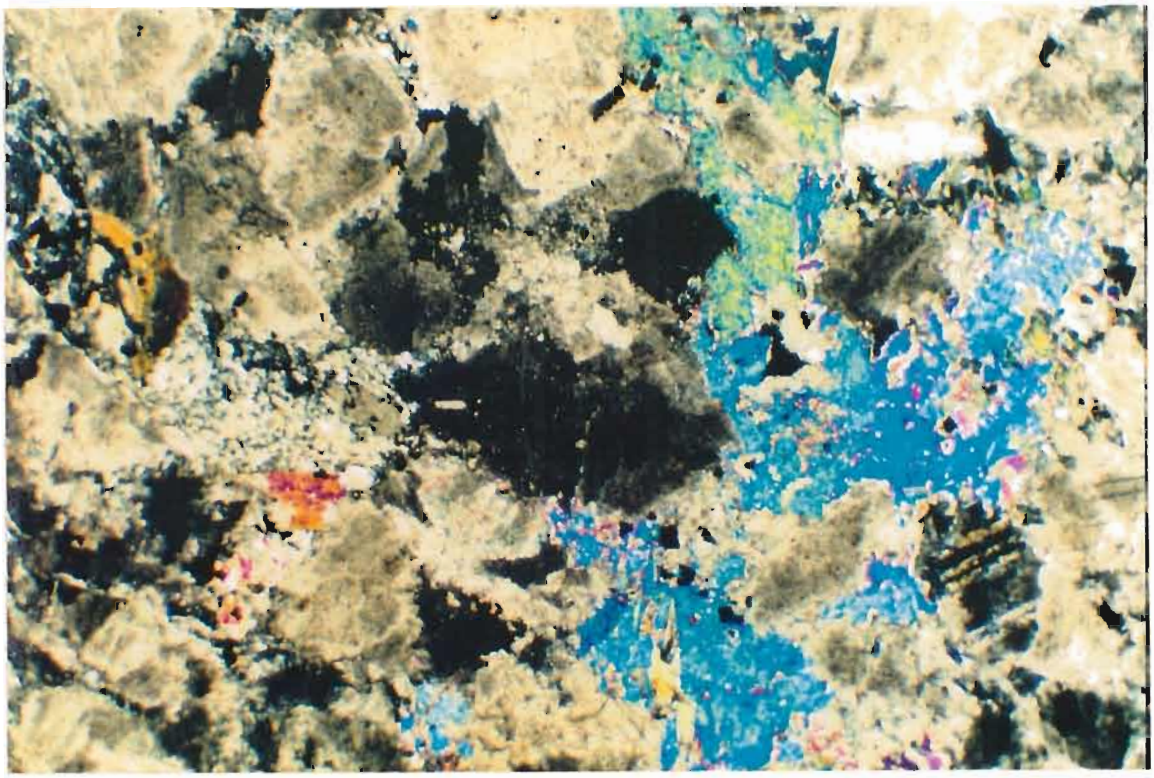


Figure 31 a & b Micrographs (plane and cross polarised light) of sample 61478 (W2011NED42, 112 .8m). Ragged "islands" of tremolite and chlorite preserved in ~80% carbonate in nodules and sutured grains; much of carbonate is dusty - crowded with fine inclusions. Long edge = 5mm.

Quartz is notably absent from the CTCs except in the sample containing diopside. Talc has been previously reported (Wills, 1985; Gregory et al, 1990) but I have not been able to identify any in thin sections and Anthea Hill (pers. comm., 1994) has micro-analysed a number of talcy looking minerals and found them to be magnesian chlorites.

This study has not incorporated detailed metamorphic petrology; however, the textural relationships observed may indicate the following crude paragenetic sequence:

diopside, chlorite, sulphides, barite
tremolite
carbonate.

Group41 Massive Barite

Barite is a fairly common minor gangue mineral (<5%) of Thalanga sulphide ores and it reaches major proportions, up to 80%, in some, possibly distal, parts of the deposit such as the up dip and western fringes of West Thalanga, the Vomacka and Far East lenses. It occurs as clear, compact massive crystalline barite of about 0.5 to 3mm grainsize with disseminated, crudely banded or splashy pyrite, sphalerite, galena, chalcopyrite and magnetite, sometimes with associated minor quartz, chlorite and sericite.

Groups 43 & 45 Massive Sulphides

These are separated for plotting purposes into:

Group43 sphalerite + galena > pyrite + chalcopyrite
Group45 massive pyrite >> minor chalcopyrite + sphalerite.

Sphalerite+galena rich type has a very variable gangue assemblage including tremolite, carbonate, chlorite, quartz and barite.

Massive pyrite type has a more restricted gangue assemblage dominated by chlorite-phlogopite with minor quartz, K-Ba feldspar? and clinozoisite but little or no carbonate.

Massive pyrite is most commonly near the footwall contact of the favourable horizon but in parts of West Thalanga also occurs within chlorite-tremolite-carbonate as metre scale, layer parallel lenses which may have been structurally emplaced as they appear to be enveloped by narrow shear zones.

# APPENDIX III QCT Normative Calculations

Appendix III-a sets out step wise, the procedure used in calculating the QCT Normative mineral compositions (ref: Section 7.3 of text) and their application in interpretation.

Appendix III-b tabulates, in spreadsheet format, the calculations for mean compositions of Groups 33, 34, 35 and a composite mean of Groups 32 to 35.

## III-a Explananation of QCT Normative Calculation Procedure

The QCT Norm has been devised as a test of whether the existing bulk chemical compositions of chlorite-tremolite-carbonate assemblages are chemically consistent with premetamorphic quartz-chlorite-carbonate assemblages.

Some fundamental assumptions of QCT Norm calculations are:

* That $Al_2O_3$, which has been shown to be immobile in this system, resides in chlorite before and after metamorphism and that the main changes involve quartz+dolomite transforming to tremolite+calcite+$CO_2$; any excess Mg would be expressed as dolomite in the metamorphic assemblage.
* The chlorite is an Mg rich clinochlore with an assumed composition of $(Mg_8Fe_2Al_2)(Si_6Al_2)O_{20}(OH)_{16}$. This is not entirely arbitrary, the composition is a rounded average composition of seven micro-analyses of Mg rich chlorites from the footwall, presented by Rivers (1985).
* Other phases used in the normative calculation have simple end member compositions.

| | |
|---|---|
| Dolomite | $(CaMg)(CO_3)_2$ |
| Calcite | $CaCO_3$ |
| Tremolite | $Ca_2Mg_5Si_8O_{22}(OH)_2$ |
| Quartz | $SiO_2$ |

* The molecular weight of water in the hydrous phases is ignored, it being assumed that the metamorphic system was not dry.

The calculations proceed as follows:

1 The major chemical components $SiO_2$, $Al_2O_3$, $Fe_2O_3$, MnO, MgO, CaO and $CO_2$, of an individual rock composition or Mean composition of a group of rocks, are entered in the top row in appropriate columns.
(Na2O and K2O are ignored because they total < 1% in the chlorite-tremolite-carbonate rocks under consideration. In fact, S, Ba, Cu, Pb, Zn are more significant components than the alkalis but are likewise ignored on the assumption that they exist in sulphides and barite and have no bearing on the silicate and carbonate phases. LOI is also ignored; partly because some analyses include S and $CO_2$ in LOI and it can be assumed that the hydrothermal and metamorphic systems were not dry.

2 $Fe_2O_3$ is converted to FeOequivalent by multiplying by factor 0.8999.

3 Molecular proportions are calculated by dividing the wt% of components by their molecular weights shown in the fourth row.

4 Molecular proportions of FeO and MnO are added together. This is a fudge which assumes all MnO is in chlorite. This may be invalid in view of the very manganiferous carbonates associated with Rosebery and South Hercules but MnO is a minor player (<1%) in Thalanga rocks and is unlikely to seriously affect the results.

5 Calculation begins by taking all $Al_2O_3$ and assigning it to chlorite with appropriate amounts of $SiO_2$, MgO, (FeO,MnO) according to the assumed chlorite formula $(Mg_8Fe_2Al_2)(Si_6Al_2)O_{20}(OH)_{16}$. That has the oxides in the molecular amounts of: 8MgO, 2FeO, $2Al_2O_3$ and $6SiO_2$ so for every molecule of $Al_2O_3$ there are 4 of MgO, 1 of (FeO,MnO) and 3 of $SiO_2$. Fortuitously, this distribution invariably takes care of all the (FeO+MnO) which balances neatly with $Al_2O_3$ in chlorite in every case.

6 The amount of $SiO_2$ remaining is then assigned to tremolite. Tremolite has 5MgO and 2CaO for $8SiO_2$, so 0.625 of the amount of $SiO_2$ in tremolite is taken from the remaining MgO and, with 0.25 of the CaO, is assigned to tremolite.

7 If there is excess MgO after tremolite, it is assigned to dolomite which consumes an equal amount of CaO and twice as much $CO_2$.

8 If there is excess CaO after dolomite, it is assigned to calcite with an equal amount of $CO_2$.

9 This then represents the simplified, existing, metamorphic assemblage. It is notable that in most of the compositions tested, the amounts assigned in this "follow the immobile: $Al_2O_3$" approach, balance out fairly close to the amounts available in the composition. It suggests that the assemblages are fairly simple and that the mineral compositions chosen are not unrealistic.

10 The approximate wt% quantities of the normative minerals are estimated in the right hand column "wt% min" by multiplying the (anhydrous) molecular weight of each mineral by the amount of a chemical component which exists in the mineral at the molecular ratio of 1; e.g . calcite: $CaCO_3$ has 1 CaO per molecule so: wt% calcite = amount of CaO in calcite multiplied by 100.089. In the case of chlorite and tremolite which have no components in unity a fractional factor is applied; e.g. 1chlorite has 8MgO so wt% chlorite = (amount of MgO in chlorite)÷8 multiplied by 1030.56 (anhydrous); (ref. Cox et al. 1979, p412). The Sums of wt% normative minerals for the metamorphic assemblage tend, in several cases to be rather low, <90%. This is probably due to the presence of significant base metal sulphides and barite in the samples; these components have been ignored as having no effect on silicate-carbonate assemblages but they do affect the totals. However, the low "wt% min" totals are verified by the totals of the wt% oxide components entered into the calculations.

11 The second round of calculations, for the postulated pre-metamorphic assemblage quartz-chlorite-dolomite-calcite, proceeds by similar steps. All $Al_2O_3$ is assigned to chlorite which consumes proportional amounts of FeO+MnO, $SiO_2$ and MgO. Excess $SiO_2$ then goes to quartz, excess MgO to dolomite with equal CaO, excess CaO goes to calcite. $CO_2$, in every case calculated, is present in insufficient quantity in the analyses to cover the requirement for dolomite and calcite. The deficit is geologically explained by the loss of $CO_2$ from the system during the metamorphic reaction:

$$8SiO_2 + 5CaMg(CO_3)_2 + H_2O = Ca_2Mg_5Si_8O_{22}(OH)_2 + 3CaCO_3 + 7CO_2$$

$$8Qtz + 5Do + H_2O = \text{Tremolite} + 3Cc + 7CO_2.$$

It is verified by the molecular quantities of the $CO_2$ deficit and the $SiO_2$ in normative quartz approximating to 7:8 as predicted by the equation.

12 If the metamorphism was isochemical for non-volatile components and the pre-metamorphic normative quantities balance with the amounts of components shown to be available by chemical analysis (i.e. "diffs"= 0) then the postulated simple quartz-chlorite-dolomite-calcite alteration assemblage is a valid precursor for the observed chlorite-tremolite-carbonate assemblage.

AVERAGE COMPOSITION of Groups 32, 33, 34 & 35.

| Oxides | SiO2 | Al2O3 | Fe2O3 | MnO | MgO | CaO | CO2 | |
|---|---|---|---|---|---|---|---|---|
| Wt% Ox | 32.15 | 4.89 | 3.59 | 0.50 | 16.82 | 18.13 | 10.55 | |
| **Oxides** | **SiO2** | **Al2O3** | **FeO** | **MnO** | **MgO** | **CaO** | **CO2** | **Total** |
| **Wt% Ox** | 32.15 | 4.89 | 3.23 | 0.5 | 16.82 | 18.13 | 10.55 | 86.27 |
| Mol Wt | 60.1 | 102.0 | 71.8 | 70.9 | 40.3 | 56.1 | 44.0 | |
| **Mol Prop** | 0.54 | 0.05 | 0.04 | 0.01 | 0.42 | 0.32 | 0.24 | |
| | | | 0.05 | FeO+MnO | | | | |
| **Minerals** | | | | | | | | **Wt% min** |
| Qtz | | | | | | | | 0.00 |
| Chl | 0.14 | 0.05 | 0.05 | | 0.19 | | | 24.71 |
| Trem | 0.39 | | | | 0.24 | 0.10 | | 38.84 |
| Do | | | | | 0.00 | 0.00 | 0.00 | 0.00 |
| Cc | | | | | | 0.23 | 0.23 | 22.57 |
| **sums** | 0.54 | 0.05 | 0.05 | | 0.44 | 0.32 | 0.23 | 86.13 |
| **diffs** | 0.00 | 0.00 | 0.00 | | -0.02 | 0.00 | 0.01 | |
| | | | | | | | | |
| Qtz | 0.39 | | | | | | | 23.51 |
| Chl | 0.14 | 0.05 | 0.05 | | 0.19 | | | 24.71 |
| Do | | | | | 0.23 | 0.23 | 0.45 | 41.58 |
| Cc | | | | | | 0.10 | 0.10 | 9.79 |
| **sums** | 0.54 | 0.05 | 0.05 | | 0.42 | 0.32 | 0.55 | 99.59 |
| **diffs** | 0.00 | 0.00 | 0.00 | | 0.00 | 0.00 | -0.31 | |

MEAN COMPOSITION OF Group 33

| Oxides | SiO2 | Al2O3 | Fe2O3 | MnO | MgO | CaO | CO2 | |
|---|---|---|---|---|---|---|---|---|
| Wt% Ox | 46.37 | 6.05 | 3.18 | 0.33 | 21.12 | 13.65 | 3.10 | |
| **Oxides** | **SiO2** | **Al2O3** | **FeO** | **MnO** | **MgO** | **CaO** | **CO2** | **Total** |
| **Wt% Ox** | 46.37 | 6.05 | 2.86 | 0.33 | 21.12 | 13.65 | 3.1 | 93.48 |
| Mol Wt | 60.1 | 102.0 | 71.8 | 70.9 | 40.3 | 56.1 | 44.0 | |
| **Mol Prop** | 0.77 | 0.06 | 0.04 | 0.00 | 0.52 | 0.24 | 0.07 | |
| | | | 0.04 | FeO+MnO | | | | |
| **Minerals** | | | | | | | | **Wt% min** |
| Qtz | | | | | | | | 0.00 |
| Chl | 0.18 | 0.06 | 0.04 | | 0.24 | | | 30.57 |
| Trem | 0.59 | | | | 0.37 | 0.15 | | 58.96 |
| Do | | | | | 0.00 | 0.00 | 0.00 | 0.00 |
| Cc | | | | | | 0.09 | 0.09 | 9.51 |
| **sums** | 0.77 | 0.06 | 0.04 | | 0.61 | 0.24 | 0.09 | 99.04 |
| **diffs** | 0.00 | 0.00 | 0.00 | | -0.08 | 0.00 | -0.02 | |
| | | | | | | | | |
| Qtz | 0.59 | | | | | | | 35.67 |
| Chl | 0.18 | 0.06 | 0.04 | | 0.24 | | | 30.57 |
| Do | | | | | 0.29 | 0.24 | 0.53 | 52.86 |
| Cc | | | | | | 0.00 | 0.00 | 0.00 |
| **sums** | 0.77 | 0.06 | 0.04 | | 0.52 | 0.24 | 0.53 | 119.11 |
| **diffs** | 0.00 | 0.00 | 0.00 | | 0.00 | 0.00 | -0.46 | |

MEAN COMPOSITION of Group 34

| Oxides | SiO2 | Al2O3 | Fe2O3 | MnO | MgO | CaO | CO2 | |
|---|---|---|---|---|---|---|---|---|
| Wt% Ox | 36.98 | 4.47 | 3.40 | 0.36 | 18.95 | 15.97 | 7.28 | |
| **Oxides** | **SiO2** | **Al2O3** | **FeO** | **MnO** | **MgO** | **CaO** | **CO2** | **Total** |
| **Wt% Ox** | 36.98 | 4.47 | 3.06 | 0.36 | 18.95 | 15.97 | 7.28 | 87.07 |
| Mol Wt | 60.1 | 102.0 | 71.8 | 70.9 | 40.3 | 56.1 | 44.0 | |
| **Mol Prop** | 0.62 | 0.04 | 0.04 | 0.01 | 0.47 | 0.28 | 0.17 | |
| | | | 0.05 | FeO+MnO | | | | |
| **Minerals** | | | | | | | | **Wt% min** |
| Qtz | | | | | | | | 0.00 |
| Chl | 0.13 | 0.04 | 0.04 | | 0.18 | | | 22.59 |
| Trem | 0.48 | | | | 0.30 | 0.12 | | 48.05 |
| Do | | | | | 0.00 | 0.00 | 0.00 | 0.00 |
| Cc | | | | | | 0.16 | 0.16 | 16.39 |
| **sums** | 0.62 | 0.04 | 0.04 | | 0.48 | 0.28 | 0.16 | 87.04 |
| **diffs** | 0.00 | 0.00 | 0.00 | | -0.01 | 0.00 | 0.00 | |
| | | | | | | | | |
| Qtz | 0.48 | | | | | | | 29.08 |
| Chl | 0.13 | 0.04 | 0.04 | | 0.18 | | | 22.59 |
| Do | | | | | 0.29 | 0.28 | 0.58 | 54.36 |
| Cc | | | | | | 0.00 | 0.00 | 0.00 |
| **sums** | 0.62 | 0.04 | 0.04 | | 0.47 | 0.28 | 0.58 | 106.03 |
| **diffs** | 0.00 | 0.00 | 0.00 | | 0.00 | 0.00 | -0.41 | |

MEAN COMPOSITION of Group 35

| Oxides | SiO2 | Al2O3 | Fe2O3 | MnO | MgO | CaO | CO2 | |
|---|---|---|---|---|---|---|---|---|
| Wt% Ox | 19.84 | 3.31 | 1.94 | 0.73 | 14.06 | 25.17 | 19.14 | |
| **Oxides** | **SiO2** | **Al2O3** | **FeO** | **MnO** | **MgO** | **CaO** | **CO2** | **Total** |
| **Wt% Ox** | 19.84 | 3.31 | 1.75 | 0.73 | 14.06 | 25.17 | 19.14 | 84.00 |
| Mol Wt | 60.1 | 102.0 | 71.8 | 70.9 | 40.3 | 56.1 | 44.0 | |
| **Mol Prop** | 0.33 | 0.03 | 0.02 | 0.01 | 0.35 | 0.45 | 0.43 | |
| | | | 0.03 | FeO+MnO | | | | |
| **Minerals** | | | | | | | | **Wt% min** |
| Qtz | | | | | | | | 0.00 |
| Chl | 0.10 | 0.03 | 0.03 | | 0.13 | | | 16.73 |
| Trem | 0.23 | | | | 0.15 | 0.06 | | 23.12 |
| Do | | | | | 0.07 | 0.07 | 0.15 | 13.55 |
| Cc | | | | | | 0.32 | 0.32 | 31.74 |
| **sums** | 0.33 | 0.03 | 0.03 | | 0.35 | 0.45 | 0.46 | 85.14 |
| **diffs** | 0.00 | 0.00 | 0.00 | | 0.00 | 0.00 | -0.03 | |
| | | | | | | | | |
| Qtz | 0.23 | | | | | | | 13.99 |
| Chl | 0.10 | 0.03 | 0.03 | | 0.13 | | | 16.73 |
| Do | | | | | 0.22 | 0.22 | 0.44 | 40.38 |
| Cc | | | | | | 0.23 | 0.23 | 23.00 |
| **sums** | 0.33 | 0.03 | 0.03 | | 0.35 | 0.45 | 0.67 | 94.10 |
| **diffs** | 0.00 | 0.00 | 0.00 | | 0.00 | 0.00 | -0.23 | |

Mean Composition of n=14 Samples from Groups 33, 34 & 35

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Oxides | SiO2 | Al2O3 | Fe2O3 | MnO | MgO | CaO | CO2 | |
| Wt% Ox | 31.65 | 4.04 | 2.67 | 0.55 | 18.20 | 18.97 | 11.41 | |
| **Oxides** | **SiO2** | **Al2O3** | **FeO** | **MnO** | **MgO** | **CaO** | **CO2** | **Total** |
| **Wt% Ox** | 31.65 | 4.04 | 2.40 | 0.55 | 18.2 | 18.97 | 11.41 | 87.22 |
| Mol Wt | 60.1 | 102.0 | 71.8 | 70.9 | 40.3 | 56.1 | 44.0 | |
| **Mol Prop** | 0.53 | 0.04 | 0.03 | 0.01 | 0.45 | 0.34 | 0.26 | |
| | | | 0.04 | FeO+MnO | | | | |
| **Minerals** | | | | | | | | **Wt% min** |
| Qtz | | | | | | | | 0.00 |
| Chl | 0.12 | 0.04 | 0.04 | | 0.16 | | | 20.42 |
| Trem | 0.41 | | | | 0.25 | 0.10 | | 40.50 |
| Do | | | | | 0.04 | 0.04 | 0.08 | 7.03 |
| Cc | | | | | | 0.20 | 0.20 | 19.83 |
| **sums** | 0.53 | 0.04 | 0.04 | | 0.45 | 0.34 | 0.27 | 87.78 |
| **diffs** | 0.00 | 0.00 | 0.00 | | 0.00 | 0.00 | -0.02 | |
| | | | | | | | | |
| Qtz | 0.41 | | | | | | | 24.51 |
| Chl | 0.12 | 0.04 | 0.04 | | 0.16 | | | 20.42 |
| Do | | | | | 0.29 | 0.29 | 0.59 | 54.04 |
| Cc | | | | | | 0.05 | 0.05 | 4.52 |
| **sums** | 0.53 | 0.04 | 0.04 | | 0.45 | 0.34 | 0.63 | 103.49 |
| **diffs** | 0.00 | 0.00 | 0.00 | | 0.00 | 0.00 | -0.37 | |