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# Review of the Petrology of the Auckland Volcanic Field

**I.E.M. Smith, L.E. McGee, and J.M. Lindsay**

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# Review of the Petrology of the Auckland Volcanic Field

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# INTRODUCTION

Research has long shown that the petrology of suites of volcanic rock can be used to define and understand the fundamental parameters of the magmatic systems that feed volcanoes. The geochemistry of volcanic rocks provides information about the nature of the source rocks, depths and amounts of melting, the processes that act on magmas as they rise to the surface and, most importantly, the rates of these processes. In turn, the answers to fundamental petrological questions can provide input to important questions concerning volcano hazard scenarios and hazard mitigation challenges.

The multi-disciplinary DEVORA research programme, launched in 2008, is a GNS Science – University of Auckland collaboration with the aim of **DE**termining **VO**lcanic **R**isk in **A**uckland. One of its main themes is the development of an integrated geological model for the Auckland Volcanic Field (AVF) by investigating the physical controls on magma generation, ascent and eruption though detailed structural and petrological investigations. A key data set underpinning this theme is a comprehensive geochemical database for the rocks of the AVF. This report, *Review of the Petrology of the Auckland Volcanic Field*, is a synthesis and commentary of all petrological and geochemical data currently available for the AVF. It represents one of several reports carried out as part of the ‘synthesis’ phase of DEVORA, whereby existing data from previous work is collated and summarised, so that gaps in current knowledge can be appropriately addressed.

In this report we utilise published and unpublished sources to summarise the petrological data available up to May 2009, and identify where new data and approaches will improve our understanding of the magmatic system which feeds the field.

# THE NATURE OF THE AUCKLAND VOLCANIC FIELD

Small-scale basaltic volcanism, with individual eruptions widely, but irregularly, spaced in time and with volumes rarely exceeding 1 $km^3$, is the defining characteristic of many monogenetic volcanic fields worldwide (Connor and Conway 2000; Walker 2000; Valentine et al. 1996). The AVF, a typical example of such a field, is the surface expression of a magmatic system that has been active for about 250,000 years (Shane and Sandiford 2003; Cassata et al. 2008). The magmas that have been produced during this time are entirely basaltic although there is significant compositional variation within this spectrum.

Small scale basaltic systems of the Auckland type can be referred to as SIPs (Small Igneous Provinces) and represent the small scale complement to the much better known Large Igneous Provinces (LIPs). Whereas LIPs and intermediate scale basaltic systems such as the oceanic basalt volcano chains (e.g. Hawaii, Samoa, Louisville) are typically linked to mantle plumes, the origin of SIPs and TIPs is much more problematic.

The defining characteristics of SIPs generally, are:

- Extremely low rates of magma production
- Eruption of discrete batches of magma
- Dispersed plumbing system
- Relative longevity (up to $10^7$ years)

In Auckland these characteristics are expressed as a field of ~50 vents of late Pleistocene to Recent age within an area of approximately 360 $km^2$ centred on Auckland City (Kermode 1992; Allen & Smith 1994; Fig. 1). The total volume erupted in the field is about 3.4 $km^3$ dense rock equivalent (DRE) (Allen & Smith 1994). Individual eruptions mostly represent magma volumes in the range 0.01-0.05 $km^3$, but some younger eruptions have been larger (up to 0.3 $km^3$ DRE) and the most recent, that of Rangitoto about 600 years ago, was, by a significant margin, the largest (~2 $km^3$ DRE). This volcano thus represents 59% of the total magma erupted in the field. The geology and petrology of the Auckland field has been outlined by Searle (1961a), Heming & Barnet (1986) and Kermode (1992) while its relationship to other Quaternary basaltic volcanism in northern New Zealand has been discussed by Heming (1980), Weaver & Smith (1989), Smith et al. (1983), and Hoernle et al. (2006).

Individual eruptive centres in the Auckland field offer an opportunity to examine the nature of small magma batches within the framework of a magmatic system with well defined spatial and temporal boundaries, a framework that is not present when viewing the field as a whole. Detailed petrological studies of Crater Hill volcano reveals a pattern of zoning from earlier, more-fractionated to later, less-fractionated compositions in the material erupted (Smith et al. 2008), and a similar pattern is emerging in studies of other centres. These chemical variations were not identified in previous studies (Searle 1961a; Heming & Barnet 1986), possibly because in these studies individual volcanoes were represented by only small numbers of samples. However, it has been shown that interpretation of such compositional variations can provide information about the way magmatic systems behave and this can inform hazard scenarios (Smith et al. 2008).

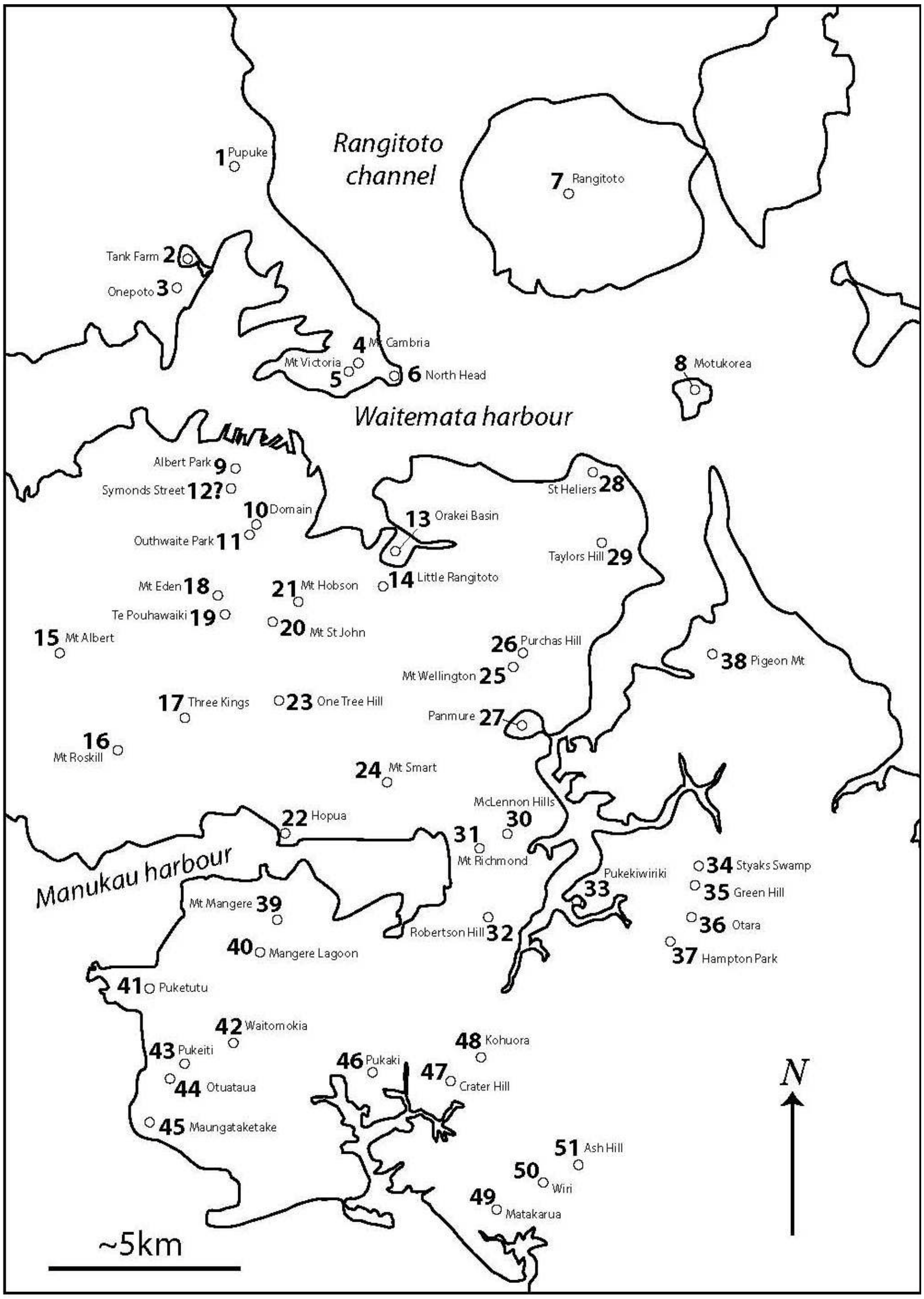


**Figure 1. Simplified map of Auckland with volcanic centres. Alternative names for the various centres are given in Table 1.**

## SUMMARY OF PREVIOUS WORK

Three main periods of investigation into the nature of the Auckland Field can be recognised:

1. Early mapping in which the general outlines of the field were defined and it was recognised as a system of basaltic volcanoes. A widely recognised product of this period is the map by Hochstetter (1864) in which the general outlines of the field, still recognised today, were defined for the first time. Other contributions from this period are Heaphy (1860) and Dieffenbach (1843).

2. Mapping, including descriptive volcanology and petrology, in the period from 1950 to 1990. In this period, a more detailed description of the individual volcanic centres in the field was produced, culminating in Searle's (1964) book 'City of Volcanoes'. This phase of mapping laid the foundation for all modern studies of the 50+ eruptive centres in the AVF and the general recognition of the main petrological features of the field. More recent published maps of the Auckland area by Kermode (1992) and Edbrooke (2001) build on the framework established by Searle (1964). Understanding of the petrology of the Auckland volcanoes through petrographic descriptions built on Searle's (1964) descriptions of individual volcanoes. Searle (1959; 1961a; 1961b; 1964; 1965) recognized that the basalts of the Auckland Field are alkali olivine basalts with a relatively simple mineral assemblage of phenocrysts of olivine, and, less commonly, clinopyroxene in a groundmass of plagioclase, clinopyroxene, subordinate olivine and iron-titanium oxides. Following this, Heming & Barnet (1986) provided chemical analyses that showed the dominance of alkaline basaltic compositions. These general compositional features of the field were also described by Sano (1991).

3. Work since the early 1990s can be considered the modern volcanological/geochemical period. During this period, fundamental mapping of individual centres continued, but there were also a large number of studies involving geochemical and mineralogical data derived from sophisticated analytical techniques. Much of this work is presented in unpublished MSc theses at the University of Auckland (see Appendix 1). Studies from this period that focus on petrology and geochemistry of the AVF include Bryner et al. (1991); Rout (1991); Rogan (1992); Smith (1992); Sano (1994); Nowak (1995); Allen et al. (1996); Miller (1996); Huang et al. (1997); Franklin (1999); Hookway (2000); Jones (2007); Spargo (2007); Smith et al. (2008); Needham (2009) and Eade (2009). The important conceptual change in the understanding of the AVF that characterises this most recent phase is the recognition that it represents the surface manifestation of a deep-seated, small-scale magmatic system that is rooted in mantle processes (e.g. Smith et al. 2008).

## PETROGRAPHY OF AUCKLAND'S BASALTS

Most of the published petrographic information that exists on the AVF was completed by E. Searle in a series of papers from 1959-1965 (Searle 1959; 1961a; 1961b; 1964; 1965). Work on specific centres is presented in MSc theses (see Appendix 1) and in Heming & Barnet (1986) and Smith et al. (2008). Thin sections available in the University of Auckland collection are listed in Table 2.

Most of the rocks in the AVF are classified as olivine-rich alkali basalts and basanites, being composed of olivine, clinopyroxene, feldspar and minor apatite and Fe-Ti oxides. The most abundant phenocrysts are olivine, with subordinate smaller clinopyroxene (Searle 1961a;

Heming & Barnet 1986). Groundmass mineralogy is plagioclase, clinopyroxene, subordinate olivine and accessory Fe-Ti oxides. Groundmass textures are generally fine-grained to glassy, with most vesicularity being in the upper parts of flows (Searle 1961a). Nepheline has been found in more unsaturated rocks in the Domain tuff and has been interpreted as a late stage differentiate of the alkali basalt (Searle 1961a); however this appears to be the only reported occurrence of this mineral in the AVF so far.

Other, rarer mineral phases include amphibole (cummingtonite) found in basalts at the Three Kings volcano associated with the dyke system seen to intrude scoria at the complex (Searle 1961a). In addition, sparse biotite occurs in the groundmass in lavas such as at Mt Wellington and Pigeon Mt (Heming & Barnet 1986).

Thus far, no mantle xenoliths have been recognised in any volcanic rocks of the AVF. However xenocrystic olivines have been identified in Lake Pupuke lavas with a Cr-spinel composition suggestive of subduction related origins (Spargo 2007). Similar features can also be seen in Onepoto bombs (Searle 1961a), which suggests that further analysis/field investigation of the North Shore volcanoes could lead to the discovery of further mantle-derived material. This has potential uses in establishing the characteristics of the mantle source region.

The only other known xenoliths are the meta-gabbroic inclusions found in the tuff of St Heliers volcano (Jones 2007; Rodgers et al. 1975). These apparently represent middle to lower crustal lithologies that have been linked to the Maitai terrain representing a suture between underlying greywacke basement terrains (Jones 2007). Many of the AVF lava flows contain vesicular segregations as veins, rounded patches and vesicles (Rogan et al. 1996) which represent highly fractionated material that separates from a crystal mush when lava flows are 50% or more crystallised.

| Number | European name | Maori name | Alternative names |
|---|---|---|---|
| 1 | | *Pupuke* | Lake Pupuke |
| 2 | *Tank Farm* | | |
| 3 | | *Onepoto* | |
| 4 | *Mt Cambria* | Takararo | |
| 5 | *Mt Victoria* | Takarunga | |
| 6 | *North Head* | Takapuna | |
| 7 | | *Rangitoto* | |
| 8 | *Brown's Island* | Motukorea | |
| 9 | *Albert Park* | | |
| 10 | *Domain* | Pukekaroa | |
| 11 | *Outhwaite Park* | | |
| 12 | *Symonds Street* | | |
| 13 | | *Orakei Basin* | |
| 14 | *Little Rangitoto* | Maungarahiri | |
| 15 | *Mt Albert* | Owairaka | |
| 16 | *Mt Roskill* | Puketapapa | |
| 17 | *Three Kings* | Te Tatua a Riukiuta | |
| 18 | *Mt Eden* | Maungawhau | |
| 19 | | *Te Pouhawaiki* | Epsom Avenue |
| 20 | *Mt St John* | Tikikopuke | |
| 21 | *Mt Hobson* | Remuera | |
| 22 | *Hopua* | Onehunga | Gloucester Park |
| 23 | *One Tree Hill* | Maungakiekie | |
| 24 | *Mt Smart* | Rarotonga | |
| 25 | *Mt Wellington* | Maungarei | |
| 26 | *Purchas Hill* | Te Tauoma | |
| 27 | *Panmure* | Wai Makoia | |
| 28 | *St Heliers* | Te Pane O Horoiwi | |
| 29 | *Taylors Hill* | Te Taurere | |
| 30 | *McLennan Hills* | Te Aponga O Tainui | |
| 31 | *Mt Richmond* | Otahuhu | |
| 32 | *Robertson Hill* | Sturge's Park | Mt Robertson |
| 33 | | *Pukekiwiriki* | Pukewairiki |
| 34 | *Styaks Swamp* | | |
| 35 | *Green Hill* | Matanginui | |
| 36 | *Otara* | Te Puke O Tara | |
| 37 | *Hampton Park* | | |
| 38 | *Pigeon Mt* | Pakurangarahihi | |
| 39 | *Mt Mangere* | | |
| 40 | *Mangere Lagoon* | | |
| 41 | Weekes Island | *Puketutu* | |
| 42 | Gabriel Hill | *Waitomokia* | Oruarangi |
| 43 | | *Pukeiti* | |
| 44 | | *Otuataua* | |
| 45 | Ellet's Mt | *Maungataketake* | Ihumatao |
| 46 | | *Pukaki* | |
| 47 | *Crater Hill* | | |
| 48 | | *Kohuora* | |
| 49 | *McLaughlin's* | Matakarua | Matukutureia |
| 50 | *Wiri* | Manurewa | Matukutururu |
| 51 | *Ash Hill* | | |
| | | | |

**Table 1. The new volcano numbering system used in this report (see Fig. 1 for locations). All names by which the volcanoes are known are listed; names in *italics* are the conventional ones.**

# THE GEOCHEMICAL DATABASE FOR THE AVF

A considerable amount of geochemical data is available for the rocks of the AVF. This has been amassed by numerous authors at different times over the last 50 years. During the last 5 years, many of these samples have been re-analysed using modern techniques, to enable them to be compared with new samples in an analytically up-to-date chemical database. A central aim of this report is to compile this information into a usable form which can be added to in the future. A summary of the coverage of the database is presented in Appendix 2; the database itself is housed at the University of Auckland. Enquiries regarding the database can be made to Ian Smith. Current and planned work under the DEVORA umbrella will fill gaps in this database to provide the basis for a modern comprehensive understanding of the magmatic system that feeds the field.

As part of the organisational structure of the database, individual volcanoes in the Auckland field have been designated a number (Fig. 1; Table 1). This was done initially by Allen and Smith (1994), who numbered volcanoes in a relative order of eruption age according to the best information available at the time. Here we replace this scheme with by a numbering system in which volcanoes in the field are numbered from north to south. In this new scheme, volcanoes that are clustered together geographically have consecutive numbers; thus the North Shore volcanoes are numbered 1 through 6, even though Rangitoto (7) is further north than most of these centres (Fig. 1; Table 1). This geographic numbering system removes the focus on the ages of the Auckland centres, as these are not well-constrained for most centres (see Lindsay & Leonard, 2009).

## ANALYTICAL TECHNIQUES

In early work, samples from the AVF were analysed for major elements and some trace elements by X-ray fluorescence spectrometry (XRF). Over the years, different instruments in various laboratories have been used. In order to achieve consistency many of these older samples have been reanalysed by a combination of XRF and laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS). While XRF remains the technique of choice for major elements and is still regarded as reliable for some of the more abundant trace elements, it has been superseded by LA-ICP-MS for trace element analysis because it offers a greater range of elements to far lower detection limits.

In addition to whole rock compositional data, there are a limited amount of mineral analyses (mainly in student theses) that have been obtained using the electron microprobe (EPMA) housed in the School of Geography, Geology and Environmental Science (now School of Environment) at The University of Auckland.

### XRF

Rock samples are prepared for XRF analysis in a uniform manner to ensure internal consistency. Clean rock fragments are soaked in distilled water, rinsed and dried. These clean fragments are crushed between tungsten carbide plates and a 100g aliquot of each sample ground to <200 mesh in a tungsten carbide ring grinder. Samples are prepared for XRF analysis as fused glass discs. The flux used is La-free 1220 flux from Spectrochem. Major and trace element concentrations are determined by X-ray fluorescence using standard techniques using a SRS3000 spectrometer. Matrix correction procedures for major elements follows (Norrish & Hutton 1969). A suite of 36 international standards is used for calibration. Data reduction uses

Siemens SPECTRA 3000 software; the Compton scatter of X-ray tube line Rh $K\beta_1$ is used to correct for mass attenuation and appropriate corrections are used for those elements analysed at energies below the Fe absorption edge. Precision is better than 1% for Sr and Zr, 1-3% for V, Cr, Zn and Y, 3-5% for Ba, 5-10% for Rb and Nb, 10-20% for Pb and more than 20% for La and Th. Detection limits are <2ppm for Rb, Sr, Y, Zr and Nb, 2-5ppm for V, Cr, Zn, La, Pb, and Th, and 5-10ppm for Ba.

LA-ICP-MS

Many of the samples in the AVF database have been analysed for trace element abundances using laser ablation inductively coupled mass spectrometry in the Research School of Earth Sciences at the Australian National University. These determinations used the same fused glass preparations as for X-ray fluorescence. Internal and external standards were used for calibration. EXCIMER laser systems, operating deep in the ultra-violet spectrum at a wavelength of 193nm and capable of ablating silicate, oxide and sulphide phases, are used in tandem with the ICP-MS instruments for precision microsampling and analysis of more than 50 elements. Detection limits scale with the ablation site dimensions, and can be tailored to range from sub ppb levels on large ablation sites (100-200 µm) through to low ppm levels on small sites (10-15 µm). The EXCIMER UV laser ablation system presents a breakthrough in the analysis of those elements which display "volatile" behaviour when more conventional IR and UV laser systems are employed. This extends the application of laser ICP-MS to the quantitative analysis of elements previously difficult to measure, in particular the many sulphide associated "ore metals".

EMPA

Glass and mineral compositions are determined by energy dispersive spectrometry methods using a JEOL JXA-840A electron microprobe at the University of Auckland. The analytical spectra are collected using a Princeton Gamma Tech Prism 2000 Si(Li) EDS X-ray detector. An accelerating voltage of 15kV, beam current of 600pA and 100 seconds live time count are used. A 15µm defocused beam is used for glass analyses to minimise loss of sodium and a 2µm focused beam was used for mineral analyses. Calibration of the analyses used a suite of Astimex$^{TM}$ mineral standards. The following elements are above detection limits, typical errors for rhyolitic compositions are in brackets $SiO_2$ (<$\pm$ 0.13%), $TiO_2$ (<$\pm$ 0.10%), $Al_2O_3$ (<$\pm$ 0.75%), FeO (<$\pm$ 2.5%), MnO (<$\pm$ 25%), MgO (<$\pm$ 10%), CaO (<$\pm$ 2.5%), $Na_2O$ (<$\pm$ 1.5%), $K_2O$ (<$\pm$ 2%), Cl (<$\pm$ 10%). The error associated with analyses depends on elemental abundance and are reduced at higher concentrations.

## ORGANIZATION OF THE DATABASE

Over the years, petrological data has been collected as part of student theses and as the basis of staff research, mainly at the University of Auckland. At different times the system used to number samples has varied, as different people and different techniques have been used. Many samples have been catalogued in the University of Auckland petrological collection; these are typically designated as 5 digit numbers with the prefix AU. In addition, there are samples with various field numbers that have been collected by different people. In order to provide a consistent referencing point from this point forward, we compile all samples that have been chemically analysed under a numbering system using a prefix of AVF-, with links to other numbering systems (Appendix 2).

Because geochemical data from the AVF have been collected over a significant number of years and by different techniques which are subject to evolutionary changes in fundamental parameters such as detection limit and precision, there are difficulties in creating a database that is both inclusive and comparative. To be inclusive all chemical analyses of samples from the AVF are part of the database. A list of the samples in the database is presented in Appendix 2.

## DISCUSSION OF THE DATABASE

There is already an extensive amount of geochemical data available from the rocks of the AVF; for the most part this is whole rock geochemical analyses for both major and trace elements (Table 2). Despite this, the summary of what is available presented in Table 2 highlights clearly that 14 of the ca. 50 centres of the AVF have no geochemical data at all (Tank Farm, Onepoto, Albert Park, Symonds St, Orakei Basin, Te Pouhawaiki, Robertson Hill, Pukekiwiriki, Styaks Swamp, Mangere Lagoon, Pukaki, Kohuora, Matakarua, and Ash Hill). An attempt should be made during future studies to obtain surface or borehole samples from these volcanoes to complete the overall geochemical coverage of the field.

During the period from which geochemical data are available (1960 – present) there have been very significant advances in analytical techniques initially with the development of instrumental methods of analysis (XRF, EMPA) and more recently with the evolution of rapid methods of mass spectrometry. Many of the samples that have been analysed in recent years have been reanalyzed by modern XRF methods in order to build an internally consistent data set. Although XRF is capable of producing high quality data for more abundant trace elements it does have limitations for elements at concentrations <~2-5ppm and thus some of the petrologically more important trace elements cannot be determined by this technique.

In recent years ICP-MS has provided an excellent method for analyzing trace elements to concentrations as low as 0.5ppm. In building the Auckland database glass discs produced for XRF analysis have been used for trace element analysis. This approach has several advantages:

- The fusion process ensures that the sample is totally dissolved.
- The same preparation is used for all analysis.
- The technique produces a large number of analyses extremely quickly.

In the next section, we summarise the general characteristics of the AVF based on the existing database, and in the final section we discuss some of the areas we have highlighted for future work.

| Volcano no. | Volcano | No. analyses | XRF | ICP-MS | Thin sections | Reference |
|---|---|---|---|---|---|---|
| 1 | Pupuke | 67 | 67 | 67 | 28 | Spargo 2007 |
| 2 | Tank Farm | 0 | 0 | 0 | | |
| 3 | Onepoto | 0 | 0 | 0 | | |
| 4 | Mt Cambria | 1 | 1 | 1 | | Smith |
| 5 | Mt Victoria | 3 | 3 | 3 | | Huang et al 1997; Smith |
| 6 | North Head | 1 | 1 | 0 | | Smith |
| 7 | Rangitoto | 81 | 81 | 81 | 9 | Smith, Needham 2009, Hookway 2000 |
| 8 | Motukorea | 17 | 17 | 17 | | Huang et al 1997; Bryner et al 1991 |
| 9 | Albert Park | 0 | 0 | 0 | | |
| 10 | Domain | 2 | 2 | 0 | 3 | Huang et al 1997; Heming; Smith |
| 11 | Outhwaite Park | 10 | 10 | 10 | | Smith |
| 12 | Symonds Street | 0 | 0 | 0 | | |
| 13 | Orakei Basin | 0 | 0 | 0 | 1 | |
| 14 | Little Rangitoto | 17 | 16 | 1 | | Heming; Franklin 1999 |
| 15 | Mt Albert | 4 | 0 | 4 | | Smith |
| 16 | Mt Roskill | 3 | 0 | 3 | | Smith |
| 17 | Three Kings | 32 | 32 | 1 | | Smith; Eade 2009 |
| 18 | Mt Eden | 17 | 1 | 16 | 1 | Huang et al 1997; Smith |
| 19 | Te Pouhawaiki | 0 | 0 | 0 | | |
| 20 | Mt St John | 15 | 15 | 15 | | Eade 2009 |
| 21 | Mt Hobson | 2 | 1 | 1 | | Smith |
| 22 | Hopua | 1 | 1 | 1 | | Smith |
| 23 | One Tree Hill | 2 | 2 | 2 | | Smith; Eade 2009 |
| 24 | Mt Smart | 1 | 1 | 1 | | Smith |
| 25 | Mt Wellington | 19 | 19 | 19 | 1 | Huang et al 1997; Smith |
| 26 | Purchas Hill | 18 | 18 | 18 | | Smith |
| 27 | Panmure | 1 | 1 | 1 | | Smith |
| 28 | St Heliers | 1 | 0 | 1 | | Smith |
| 29 | Taylors Hill | 2 | 2 | 2 | | Smith |
| 30 | McLennon Hills | 6 | 6 | 6 | | Miller 1996; Eade 2009 |
| 31 | Mt Richmond | 2 | 2 | 2 | | Smith |
| 32 | Robertson Hill | 0 | 0 | 0 | | |
| 33 | Pukekiwiriki | 0 | 0 | 0 | 3 | |
| 34 | Styaks Swamp | 0 | 0 | 0 | | |
| 35 | Green Hill | 3 | 3 | 1 | | Smith; Miller 1996 |
| 36 | Otara | 9 | 9 | 0 | 1 | Miller 1996 |
| 37 | Hampton Park | 4 | 4 | 0 | 2 | |
| 38 | Pigeon Mt | 1 | 1 | 1 | | Smith |
| 39 | Mangere | 6 | 6 | 1 | 2 | Smith |
| 40 | Mangere Lagoon | 0 | 0 | 0 | | |
| 41 | Puketutu | 11 | 11 | 1 | 4 | Heming; Miller 1996 |
| 42 | Waitomokia | 1 | 1 | 1 | | Smith |
| 43 | Pukeiti | 1 | 1 | 1 | | Smith |
| 44 | Otuataua | 1 | 1 | 1 | | Heming |
| 45 | Maungataketake | 15 | 15 | 15 | 1 | Smith |
| 46 | Pukaki | 0 | 0 | 0 | | |
| 47 | Crater Hill | 64 | 64 | 64 | | Smith et al 2008 |
| 48 | Kohuora | 0 | 0 | 0 | | |
| 49 | Matakarua | 0 | 0 | 0 | | |
| 50 | Wiri | 12 | 12 | 12 | 14 | Smith |
| 51 | Ash Hill | 0 | 0 | 0 | | |

**Table 2. Auckland centres with numbers of analyses as of May 2009; names without dates indicate unpublished data from collectors.**

# GENERAL GEOCHEMICAL CHARACTERISTICS OF THE AVF

All of the magmas that have erupted from Auckland's volcanoes are basaltic. Most commonly these have been alkali olivine basalts in the compositional range 39-48 wt% $SiO_2$. However the most voluminous magma type produced in the field is transitional to tholeiitic, 48-50 wt% $SiO_2$ erupted during the second stage of the most recent eruption that produced Rangitoto Volcano.

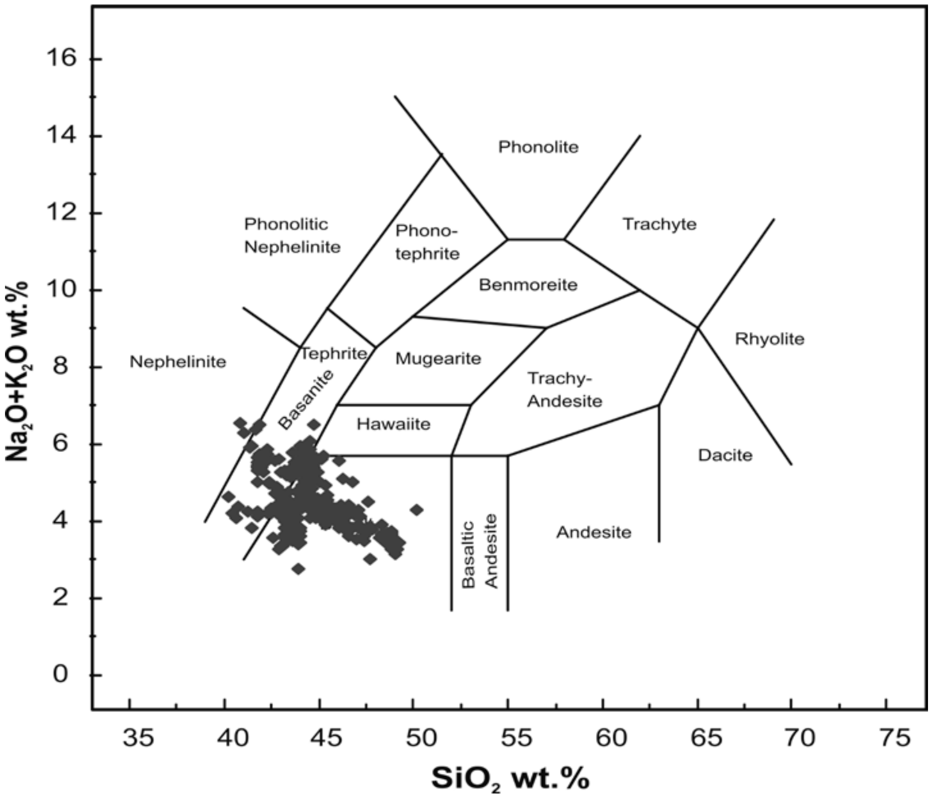


**Figure 2. Total alkalis vs. silica diagram illustrating the range in compositions shown by samples from the Auckland Volcanic Field (classification scheme from Cox et al. 1979).**

The classification of Auckland basalts is illustrated on a total alkali- silica diagram (Fig. 2). In terms of this classification AVF rocks range from basalt through alkali basalt to nephelinite. In terms of a normative classification they range from the nephelinite- basanite- alkali basalt spectrum through to compositions that are transitional to tholeiite (although only the most recently erupted lavas from Rangitoto fall into the latter category).

In general the compositional range exhibited by volcanic centres of the Auckland field is comparable to that of the South Auckland Field (Cook et al. 2005; Fig. 3). The South Auckland Volcanic Field is centred about 40 km south of the AVF and at 0.5-1.5 Ma, is only slightly older. However, AVF samples are very different to those of the basaltic volcanic fields in Northland (Ashcroft 1986; Smith et al. 1993; Fig. 3). The Northland fields were initiated ~10 Myr-ago and have continued activity until at least 60 kyr-ago. Thus although they overlap in time with the AVF the Northland fields are spatially separate and clearly represent a different volcano-tectonic association.

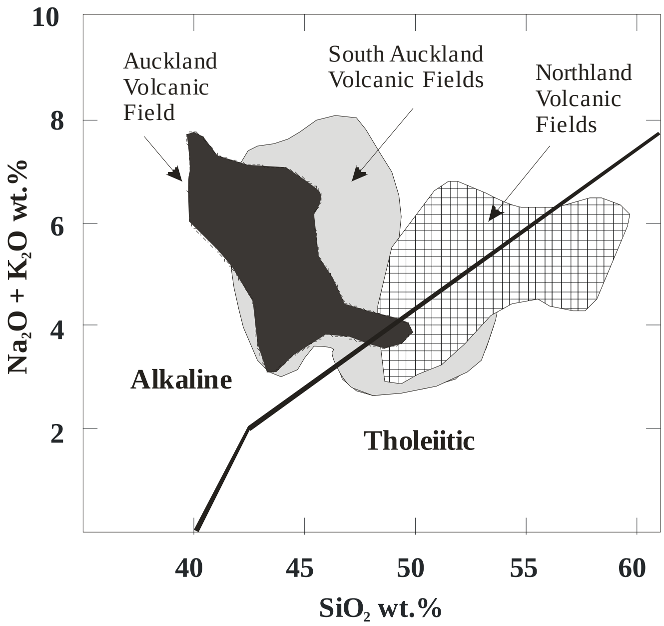


**Figure 3. Alkali silica diagram illustrating the differences between the Auckland, South Auckland and Northland Volcanic Fields. South Auckland data from Cook et al. (2005). Northland data from Smith et al. (1993).**

As with the South Auckland and Northland volcanic fields, the AVF is characterised as an intraplate basalt association on the basis of its chemical compositions (Fig. 4). In their general trace element characteristics, Auckland basalts exhibit mantle-normalized incompatible element profiles that are typical of basalt compositions in intraplate tectonic environments, although elemental abundances are generally lower than those of the average oceanic basalt defined by Sun & McDonough (1989). However, there are pronounced negative U and Pb anomalies that are yet to be explained (Fig. 5). Importantly there is no trace of a residual subduction zone geochemical signature from the lower Miocene subduction episode in the Auckland area. (Fig. 5)

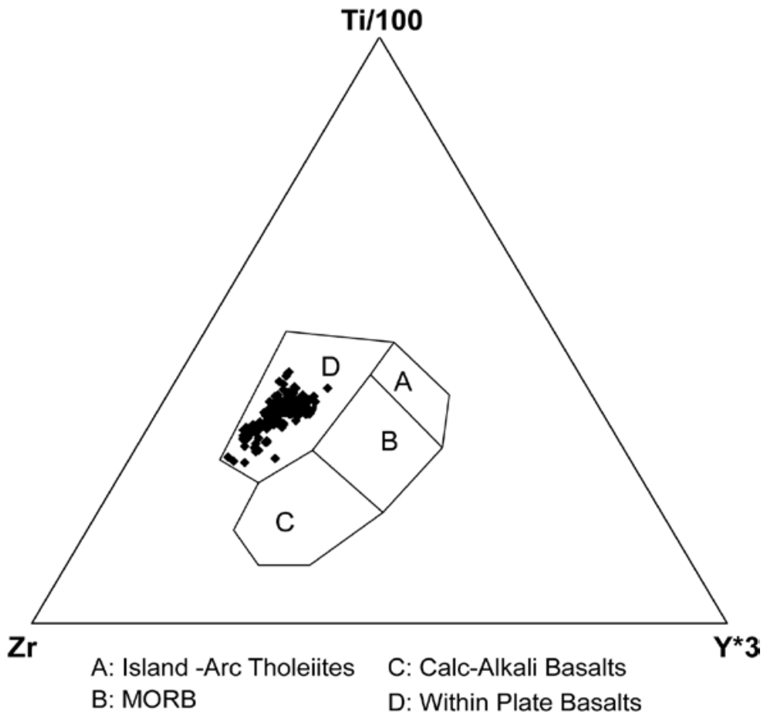


**Figure 4. Chemical discriminant diagram characterising the rocks of the Auckland Volcanic Field as an intraplate igneous association (after Pearce & Cann 1973)**

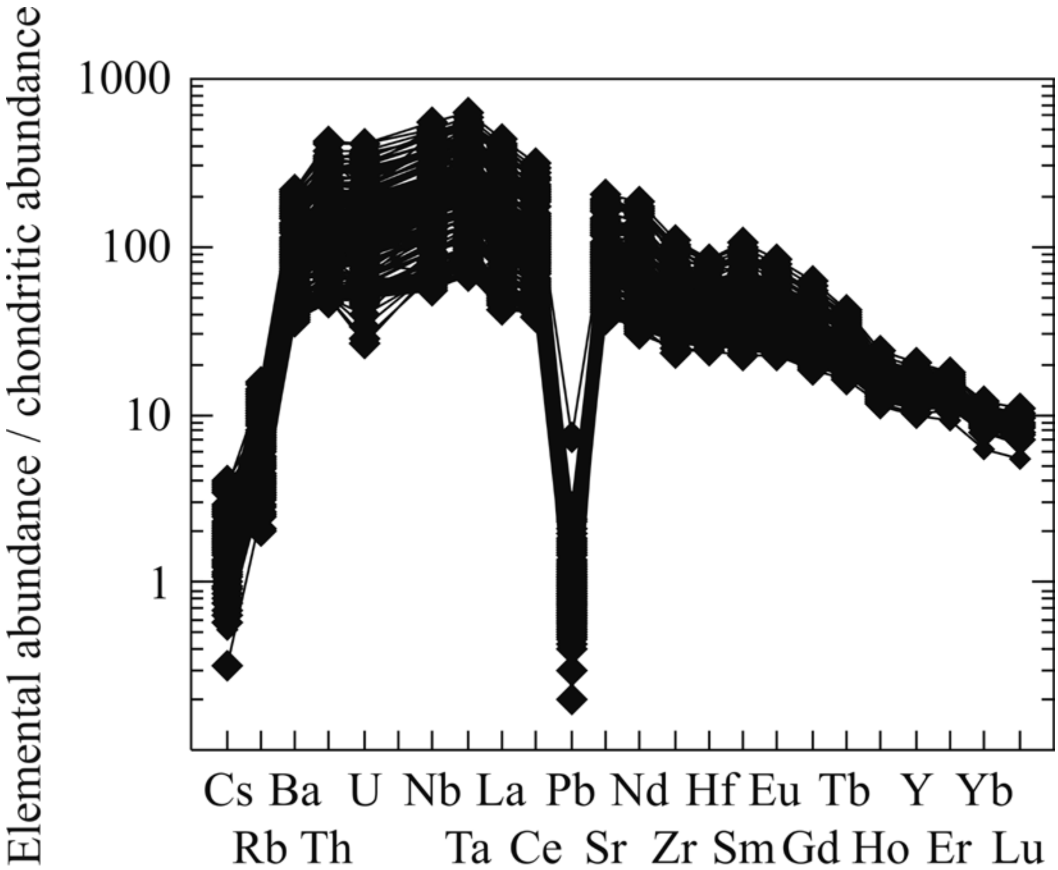


**Figure 5. Normalised multi-element plot for the AVF illustrating general trace element characteristics. Elements are normalised to primitive mantle composition of Sun & McDonough (1989).**

Taken as a whole, there is a significant range of compositions in the Auckland field. A relatively small proportion of analyses from Auckland have total MgO and Mg# values sufficiently high (Mg# >65) that they may be interpreted as primary, or close to primary, melts of a peridotitic source (Fig. 6). An explanation for this range of compositions is one of the important questions for the future research undertaken in the AVF. Furthermore, it appears that there is a range of primary melt compositions in the field so that there are apparently two processes operating: one that produces a variety of primary or parental magmas and a second that modifies these to produce the spectrum of compositions observed at some individual volcanoes (see discussion below).

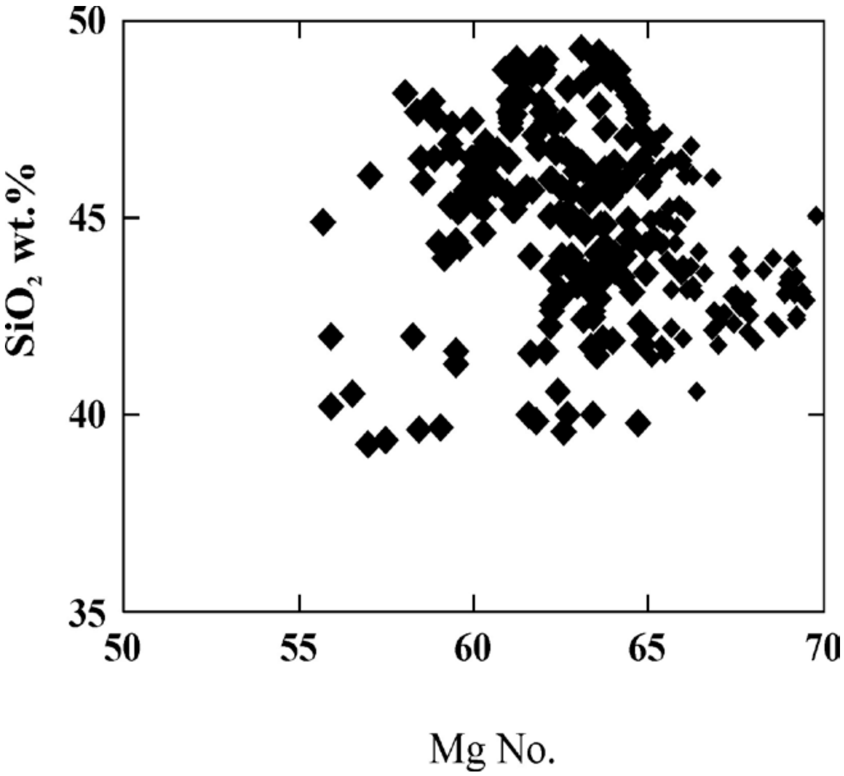


**Figure 6. Plot of Mg Number (mol% MgO/(MgO+FeO) vs. $SiO_2$ for the Auckland Volcanic Field.**

In all Auckland volcanoes for which there are multiple analysed samples there is a significant range in chemical compositions. For volcanoes where the stratigraphic position of samples has been clearly established (e.g. Crater Hill; Smith et al. 2008) the more evolved compositions have been collected from stratigraphically lower deposits and more primitive samples from upper stratigraphic levels. Thus as Auckland eruptions have proceeded, the magma supplied to the vent appears to have systematically varied in composition.

The relatively primitive compositions from individual centres are to an extent unique; in several well-studied volcanoes the compositional range trends away from the primitive composition toward more evolved compositions along broadly comparable trajectories.

In only one Auckland volcano, Crater Hill, has this variation been interpreted in any detail. For this volcano a model has been developed in which primitive magmas are fractionated as they leave their source and subsequently rise as a fractionated magma column (Fig. 7; Smith et al., 2008). Preliminary work on other centres in the AVF suggests that this is a model that can be applied more generally. However for some of the larger centres in the field the geochemical trends are more complicated suggesting that there was more than one batch of magma involved in the evolution of the volcano (e.g. at Three Kings, Rangitoto and Pupuke volcanoes).

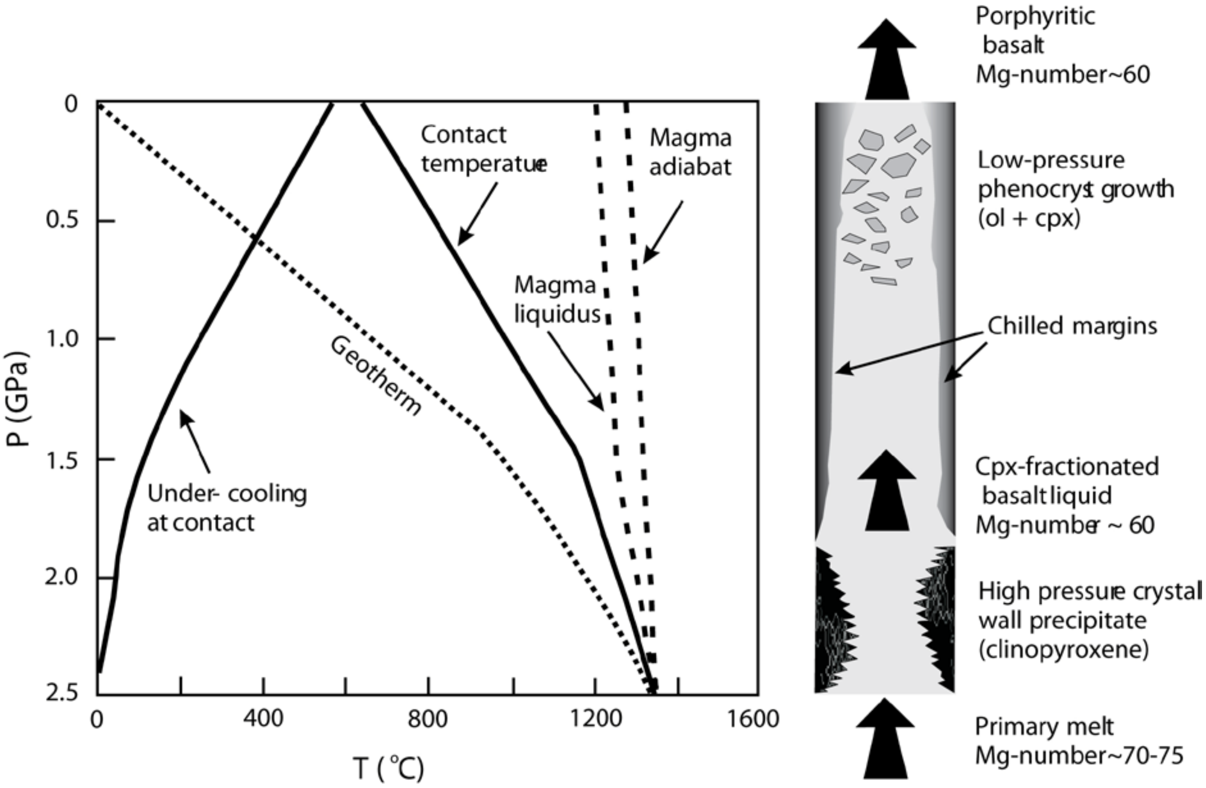


**Figure 7. Schematic illustration of the dynamic fractional crystallization model proposed in Smith et al. (2008) to explain the compositional variations observed in the Crater Hill sequence. The graph shows the liquidus temperature and thermal environment of a primary melt in the depth (pressure) interval between its depth of segregation and the surface. The inflection in the liquidus of the magma is where the liquidus phase changes from clinopyroxene to olivine.**

## WHERE TO FROM HERE?

From the geochemical work that has been done on samples of the Auckland Volcanic Field it is clear that some eruptive sequences follow the relatively simple variation trends as demonstrated by the Crater Hill sequence described by Smith et al. (2008). Motukorea and Purchas Hill are centres for which there is sufficient data to support this statement and suggest that there is a petrological model that can be more widely applied. However, the recent MSc thesis by Spargo (2007) on Pupuke shows a more complicated picture of geochemical variation which suggests a more complicated set of processes acting on the magmas as they rise to the surface (Spargo et al. 2007). Furthermore, recent work on Rangitoto by Needham (2009) has revealed a two stage history with the rise of typical alkaline magmas preceding a much larger eruption of transitional and tholeiitic magma of a composition not previously erupted in the Auckland field. The next phase of geochemical investigation into the AVF needs to identify and explain the existence of these multiple variation trends in some of Auckland's volcanoes and model the relationship between the two distinct magmas at Rangitoto.

The main fundamental questions that can be addressed in future work involving geochemical and petrological data are:

- At what depths have the magmas originated?
- What are the controlling factors on melt generation, and separation from source?
- What processes can account for the compositional ranges observed in individual centres?
- What individual volcanoes are the sources for the numerous as-yet-unidentified lava flows and ash deposits encountered in boreholes and sediment cores, respectively?

The answers to these questions address the fundamental parameters of the Auckland system and in turn these have the potential to feed into volcano hazard scenarios and mitigation plans. Below we address what has been learned so far towards answering these questions, where the gaps are, and what specific approaches can be taken to fill the gaps.

## DEPTH OF ORIGIN

There are several well established models that provide an estimation of the depth from which basaltic magmas arise. A fundamental assumption is that the source material is mantle peridotite (lherzolite). The identification of Auckland basalts as typical intraplate basalts together with existing isotope ratio data that compares their source with that of the newer Victorian basalts (e.g. Demidjuk et al. 2007) indicates that this assumption is valid. Variation in the composition of primitive magmas in the Auckland field, i.e. magmas with Mg# appropriate to equilibration with mantle peridotite, is interpreted in terms of variation in depth (pressure) and degree of partial melting. Two recent geophysical and petrological studies independently suggest depths of ~80 km (Horspool et al. 2006; Smith et al. 2008). Recent work on Rangitoto lavas suggests two sets of conditions leading to the production of alkali basalt and then tholeiitic basalt; this study found deeper depths of origin (~60km) for the alkali basalt, and a shallower origin for the tholeiites through major element correlation with pressures of formation (Needham 2009). Trace elements and U-series isotopes were also used to deduce higher degrees of melting for the tholeiites compared to the alkali basalts (McGee et al. in prep).

Further geochemical data are needed to look at formation pressures, depths and degrees of melting throughout the field, to see if similar processes are at work more broadly, or if each centre must be taken as a completely separate system.

## VARIATION WITHIN CENTRES AND CORRELATION WITH UNKNOWNS

Each analysed Auckland volcano is compositionally unique and each shows a compositional range that follows a consistent trajectory. The simplest pattern of variation is from low-Si, low-Mg, high-incompatible element compositions in the earliest erupted products toward relatively high-Si, high-Mg, low incompatible element compositions at the end of eruptions. There are a significant number of Auckland centres which have moderate to good exposures which are suitable for detailed sampling as the basis for defining temporal compositional trends of the type described for Crater Hill by Smith et al. (2008). Of these, Motokorea offers the best opportunity for a near complete stratigraphic sequence. It has been studied by Bryner (1991) and appears to show a Crater Hill-like variation pattern in major and trace element chemistry with respect to the eruptive sequence. Comprehensive re-sampling with an emphasis on collecting vesiculated juvenile clasts will test the model developed from studies of Crater Hill. Sampling and analysis of material from partial sequences from Purchas Hill, Orakei Basin, Panmure Basin, Waitomokia and Maungataketake will also help to elucidate the inner workings of the field. Some of this additional, in-depth sampling has been done since the DEVORA project started and plans are in hand to complete the work over the next two years.

Because the most primitive composition from any particular volcano is compositionally unique, the range described by a given volcano is also to an extent unique, although the composition of an individual sample within the range may not be. This means that it is not possible to uniquely define the origin of an individual specimen to an individual volcano. This aspect of AVF compositional variations will create a challenge for correlation of basaltic tephra layers in cores with individual volcanoes, although the compositional database arising from this project will provide a framework for such studies.

## GAPS AND RECOMMENDATIONS FOR FUTURE WORK

At least 14 of the ca. 50 volcanoes of the AVF do not have any geochemical data at all. Some of these centres have little or no exposure and thus will not be able to contribute to the questions raised. Others have limited exposure (for example through boreholes) and can contribute only generally to our understanding of the Auckland field. Despite this, these centres need to be sampled as far as possible in order to completely define the range of chemical compositions in the field.

Once these gaps in the geochemical database have been filled as much as possible, overall trends and abnormalities in the field can be studied, and centres suitable for further, in-depth analyses (e.g. isotopes and mineral studies) identified in order to focus on the plumbing system and magmatic processes operating under the AVF. Based on the current data, obvious targets for more detailed study are Three Kings, Pupuke, Motukorea, Mt Wellington, Purchas Hill, Orakei Basin, Panmure Basin, Waitomokia and Maungataketake. In these cases broad geochemical frameworks already exist, and hint a possible complex relationships between the various eruptive products.

The main objectives for the next phase of research should be:

- To use the variety of chemical compositions within and between individual Auckland volcanoes to constrain melting models and dynamic magma rise rates (e.g. Williams & Gill 1989)
- To correlate and interpret the range and variety of eruptive deposits from Auckland volcanoes with their geochemical compositions
- To use the geochemical database to provide a framework for correlating unknown borehole and tephra samples with their source volcanoes
- To review the composition of phenocrysts in AVF rocks to establish the extent to which they are in equilibrium with their hosts, and whether the field is generally homogeneous in its mineralogy, or whether in fact each volcano shows unique mineralogical and textural characteristics
- To identify antecrysts (crystals that are not in equilibrium with their hosts) to gain an insight into magma ascent dynamics
- To identify xenocrysts and, using compositional gradients at their margins, estimate the timescales involved in their incorporation within the magmatic host. Current literature suggests that it might be possible to resolve timescales of the order of weeks between when magmas picked up xenocrysts and the time that they are erupted (e.g. Blake et al. 2006). While xenoliths and xenocrysts are rare in the AVF, potentially exciting material has been collected from some centres such as Pupuke.

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# APPENDIX 1. THESES ON ASPECTS OF GEOCHEMISTRY OF THE AUCKLAND VOLCANIC FIELD

The following is a list of BSc honours dissertations, MSc theses and PhD theses that have addressed aspects of the Auckland Volcanic Field. These are arranged according to year of submission.

### BSc Hons


Sibson, R. H., 1968. Late Pleistocene volcanism in the East Tamaki district. Auckland, The University of Auckland.

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### MSc


Wong, P. C. N., 1946. Some aspects of the Post-Tertiary volcanic phenomena at Auckland. The University of Auckland

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Russell, W. J., 1976. Aspects of the geology and hydrology of the Western Springs watershed, The University of Auckland. Auckland

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Juggernaut, L. S., 2008. Paleolimnology of an Auckland maar crater paleolake Hopua Maar (Gloucester Park), Onehunga Auckland. The University of Auckland.

Ashenden, C. L., 2009. A velocity model for Auckland, using seismic and complementary methods. University of Auckland.

Eade, J. E., 2009. Petrology and correlation of lava flows from the central part of the Auckland Volcanic Field. University of Auckland.

Needham, A. J., 2009. The eruptive history of Rangitoto Island, Auckland Volcanic Field, New Zealand. University of Auckland.

**PhD**

Huang, Y., 1995. U-Th-Pb Fractionation in Selected Carbonate and Silicate Systems, The Open University.

Sano, T., 1991. The petrological study of the Auckland volcanic field, New Zealand, Unpublished PhD thesis, Shiznoka University.

**DSc**

Searle, E.J., 1961. Studies in the Auckland volcanic field. University of Auckland

## APPENDIX 2. SAMPLE DATABASE FOR THE AUCKLAND VOLCANIC FIELD

Samples for which geochemical analyses are available are indicated.

| AVF no | Volcano | No | AV no | A no | Other numbers | Collection no | Collector | XRF data* | ICP-MS data* | Paper/thesis |
|---|---|---|---|---|---|---|---|---|---|---|
| AVF-001 | Domain | 10 | | | | 30659 | Heming | y | | |
| AVF-002 | Mt Eden | 18 | | | | 30690 | Heming | | | |
| AVF-003 | Domain | 10 | AV247 | A193 | AK110 | 47231 | Smith | y | y | |
| AVF-004 | Domain | 10 | AV248 | A194 | AK111 | 47232 | Smith | y | y | |
| AVF-005 | Domain | 10 | AV249 | A195 | AK112 | 47233 | Smith | | | |
| AVF-006 | Domain | 10 | AV250 | A196 | AK113 | 47234 | Smith | y | y | |
| AVF-007 | Domain | 10 | AV251 | A197 | AK114 | 47235 | Smith | | | |
| AVF-008 | Domain | 10 | AV252 | A198 | AK115 | 47236 | Smith | | | |
| AVF-009 | Domain | 10 | AV253 | A199 | AK116 | 47237 | Smith | | | |
| AVF-010 | Domain | 10 | AV254 | A200 | AK117 | 47238 | Smith | | | |
| AVF-011 | Domain | 10 | AV255 | A201 | AK118 | | Smith | | | |
| AVF-012 | Domain | 10 | AV256 | A202 | AK119 | | Smith | | | |
| AVF-013 | Duders | 4 | AV257 | A203 | AK120 | | Smith | | | |
| AVF-014 | Domain | 10 | AV392 | | | | Smith (Oct 99) | y | y | |
| AVF-015 | Domain? | 10 | AV419 | | | | Smith (Jan 00) | | | |
| AVF-016 | Domain | 10 | AV426 | | | | Smith/Shane (May 01) | | | |
| AVF-017 | Domain? | 10 | AV427 | | | 44702 | Kermode | | | |
| AVF-018 | Outhwaite Park | 11 | AV428 | | | 44703 | Kermode | | | |
| AVF-019 | Domain | 10 | AV468 | | DM1 | | | y | y | |
| AVF-020 | Domain | 10 | AV469 | | DM2 | | | y | y | |
| AVF-021 | Domain | 10 | AV470 | | DM3 | | | y | y | |
| AVF-022 | Domain | 10 | AV507 | | CG1 | | | | | |
| AVF-023 | Domain | 10 | AV508 | | CG2 | | | | | |
| AVF-024 | Domain | 10 | AV509 | | CG3 | | | | | |
| AVF-025 | Domain | 10 | AV510 | | CG4 | | | | | |
| AVF-026 | Domain | 10 | AV511 | | CG5 | | | | | |
| AVF-027 | Domain | 10 | AV512 | | CG6 | | | | | |
| AVF-028 | Domain | 10 | AV513 | | CG7 | | | | | |
| AVF-029 | Domain | 10 | AV514 | | CG8 | | | | | |
| AVF-030 | Domain | 10 | AV515 | | CG9 | | | | | |
| AVF-031 | Domain? | 10 | AV420 | | | | Smith (Jan 01) | y | y | |
| AVF-032 | Albert Park | 9 | AV070 | A26 | | 30658 | Heming | | | |
| AVF-033 | Albert Park | 9 | AV173 | A123 | AK65 | 47168 | | | | |
| AVF-034 | Albert Park | 9 | AV174 | A124 | AK66 | 47169 | | y | y | |
| AVF-035 | Albert Park | 9 | AV175 | A125 | AK67 | 47170 | | y | y | |
| AVF-036 | Albert Park | 9 | AV176 | A126 | AK68 | 47171 | | y | y | |
| AVF-037 | St Helliers | 28 | AV486 | | SH1 | | | | | |
| AVF-038 | | | | | | | | | | |
| AVF-039 | | | | | | | | | | |
| AVF-040 | Pupuke | 1 | AV065 | A21 | | 30653 | Heming | y | | |
| AVF-041 | Pupuke | 1 | AV137 | A87 | | 43998 | Allen | y | | Allen 1992 |
| AVF-042 | Pupuke | 1 | AV138 | A88 | | 43999 | Allen | y | | Allen 1992 |
| AVF-043 | Pupuke | 1 | AV139 | A89 | | 44000 | Allen | y | | Allen 1992 |
| AVF-044 | Pupuke | 1 | AV140 | A90 | | 44001 | Allen | y | | Allen 1992 |
| AVF-045 | Pupuke | 1 | AV141 | A91 | | 44002 | Allen | y | | Allen 1992 |
| AVF-046 | Pupuke | 1 | AV142 | A92 | | 44003 | Allen | y | | Allen 1992 |
| AVF-047 | Pupuke | 1 | AV143 | A93 | | 44004 | Allen | y | | Allen 1992 |
| AVF-048 | Pupuke | 1 | AV144 | A94 | | 44005 | Allen | y | | Allen 1992 |
| AVF-049 | Pupuke | 1 | AV145 | A95 | | 44006 | Allen | y | | Allen 1992 |
| AVF-050 | Pupuke | 1 | AV146 | A96 | | 44007 | Allen | y | | Allen 1992 |
| AVF-051 | Pupuke | 1 | AV147 | A97 | | 44008 | Allen | y | | Allen 1992 |
| AVF-052 | Pupuke | 1 | AV148 | A98 | | 44009 | Allen | y | | Allen 1992 |
| AVF-053 | Pupuke | 1 | AV149 | A99 | | 44010 | Allen | y | | Allen 1992 |
| AVF-054 | Pupuke | 1 | AV150 | A100 | | 44011 | Allen | y | | Allen 1992 |
| AVF-055 | Pupuke | 1 | AV151 | A101 | | 41012 | Allen | y | | Allen 1992 |
| AVF-056 | Pupuke | 1 | AV152 | A102 | | 41013 | Allen | y | | Allen 1992 |
| AVF-057 | Pupuke | 1 | AV153 | A103 | | 41014 | Allen | y | y | Allen 1992 |
| AVF-058 | Pupuke | 1 | AV156 | A106 | P1 | 47105 | Allen | y | y | Allen 1992 |
| AVF-059 | Pupuke | 1 | AV157 | A107 | P2 | 47106 | Allen | y | y | Allen 1992 |
| AVF-060 | Pupuke | 1 | AV158 | A108 | P3 | 47107 | Allen | y | y | Allen 1992 |
| AVF-061 | Pupuke | 1 | AV159 | A109 | P4 (M1A) | 47108 | Allen | y | y | Allen 1992 |
| AVF-062 | Pupuke | 1 | AV160 | A110 | P5 (M1B(i)) | 47109 | Allen | y | y | Allen 1992 |
| AVF-063 | Pupuke | 1 | AV161 | A111 | P6 (M1B(ii)) | 47110 | Allen | y | y | Allen 1992 |
| AVF-065 | Pupuke | 1 | AV163 | A113 | P8 (M5) | 47112 | Allen | y | y | Allen 1992 |
| AVF-066 | Pupuke | 1 | AV164 | A114 | P9 (M7) | 47113 | Allen | y | y | Allen 1992 |
| AVF-067 | Pupuke | 1 | AV165 | A115 | P10 (M9) | 47114 | Allen | y | y | Allen 1992 |
| AVF-068 | Pupuke | 1 | AV166 | A116 | P11 (M13) | 47115 | Allen | y | y | Allen 1992 |
| AVF-069 | Pupuke | 1 | AV167 | A117 | P12 (I12(i)) | 47116 | Allen | y | y | Allen 1992 |
| AVF-070 | Pupuke | 1 | AV168 | A118 | P13 (I12(ii)) | 47117 | Allen | y | y | Allen 1992 |
| AVF-071 | Pupuke | 1 | AV169 | A119 | P14 (AA10C) | 47118 | Allen | y | y | Allen 1992 |
| AVF-072 | Pupuke | 1 | AV170 | A120 | P15 (AA10A) | 47119 | Allen | y | y | Allen 1992 |
| AVF-073 | Pupuke | 1 | AV171 | A121 | P16 (AA10B) | 47120 | Allen | y | y | Allen 1992 |
| AVF-074 | Pupuke | 1 | AV172 | A122 | P17 (AA10D) | 47121 | Allen | y | y | Allen 1992 |
| AVF-075 | Pupuke | 1 | AV401 | | LP2 | | Smith (Nov 2 99) | | | |
| AVF-076 | Pupuke | 1 | AV402 | | LP3 | | Smith (Nov 2 99) | | | |
| AVF-077 | Pupuke | 1 | AV403 | | LP4 | | Smith (Nov 2 99) | | | |
| AVF-078 | Pupuke | 1 | AV404 | | LP5 | | Smith (Nov 2 99) | | | |
| AVF-079 | Pupuke | 1 | AV405 | | LP6 | | Smith (Nov 2 99) | | | |
| AVF-080 | Pupuke | 1 | AV406 | | LP7 | | Smith (Nov 2 99) | | | |
| AVF-081 | Pupuke | 1 | AV407 | | LP8 | | Smith (Nov 2 99) | | | |
| AVF-082 | Pupuke | 1 | AV408 | | LP12 | | Smith (Nov 2 99) | | | |

| AVF no | Volcano | No | AV no | A no | Other numbers | Collection no | Collector | XRF data* | ICP-MS data* | Paper/thesis |
|---|---|---|---|---|---|---|---|---|---|---|
| **AVF-083** | Pupuke | 1 | AV409 | | LP13 | | Smith (Nov 2 99) | | | |
| **AVF-084** | Pupuke | 1 | AV425 | | PLF | | Smith/Shane (May 01) | | | |
| **AVF-085** | Pupuke | 1 | AV487 | | | | | | | |
| **AVF-086** | Pupuke | 1 | AV488 | | | | | | | |
| **AVF-087** | Pupuke | 1 | AV489 | | | | | | | |
| **AVF-088** | Pupuke | 1 | AV490 | | | | | | | |
| **AVF-089** | Pupuke | 1 | AV491 | | | | | | | |
| **AVF-090** | Pupuke | 1 | AV492 | | | | | | | |
| **AVF-091** | Pupuke | 1 | AV493 | | | | | | | |
| **AVF-092** | Pupuke | 1 | AV494 | | | | | | | |
| **AVF-093** | Pupuke | 1 | AV495 | | | | | | | |
| **AVF-094** | Pupuke | 1 | AV496 | | | | | | | |
| **AVF-095** | Pupuke | 1 | AV497 | | | | | | | |
| **AVF-096** | Pupuke | 1 | AV498 | | | | | | | |
| **AVF-098** | Pupuke | 1 | AV500 | | | | | | | |
| **AVF-099** | Pupuke | 1 | | | ss1 | 58611 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-100** | Pupuke | 1 | | | ss2 | 58612 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-101** | Pupuke | 1 | | | ss3 | 58613 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-102** | Pupuke | 1 | | | ss4 | 58614 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-103** | Pupuke | 1 | | | ss5 | 58615 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-104** | Pupuke | 1 | | | ss6 | 58616 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-105** | Pupuke | 1 | | | ss8 | 58618 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-106** | Pupuke | 1 | | | ss9 | 58619 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-107** | Pupuke | 1 | | | ss11 | 58621 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-108** | Pupuke | 1 | | | ss12 | 58622 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-109** | Pupuke | 1 | | | ss13 | 58623 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-110** | Pupuke | 1 | | | ss14 | 58624 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-111** | Pupuke | 1 | | | ss15 | 58625 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-112** | Pupuke | 1 | | | ss16 | 58626 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-113** | Pupuke | 1 | | | ss17 | 58627 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-114** | Pupuke | 1 | | | ss18 | 58628 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-115** | Pupuke | 1 | | | ss19 | 58629 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-116** | Pupuke | 1 | | | ss20 | 58630 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-117** | Pupuke | 1 | | | ss23 | 58633 | Spargo 06 | | | Spargo 2007 |
| **AVF-118** | Pupuke | 1 | | | ss24 | 58634 | Spargo 06 | | | Spargo 2007 |
| **AVF-119** | Pupuke | 1 | | | ss25 | 58635 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-120** | Pupuke | 1 | | | ss26 | 58636 | Spargo 06 | | | Spargo 2007 |
| **AVF-121** | Pupuke | 1 | | | ss27 | 58637 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-122** | Pupuke | 1 | | | ss28 | 58638 | Spargo 06 | | | Spargo 2007 |
| **AVF-123** | Pupuke | 1 | | | ss29 | 58639 | Spargo 06 | | | Spargo 2007 |
| **AVF-124** | Pupuke | 1 | | | ss30 | 58640 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-125** | Pupuke | 1 | | | ss31 | 58641 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-126** | Pupuke | 1 | | | ss32 | 58642 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-127** | Pupuke | 1 | | | ss33 | 58643 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-128** | Pupuke | 1 | | | ss36 | 58644 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-131** | Pupuke | 1 | | | ss42 | 58647 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-132** | Pupuke | 1 | | | ss43 | 58648 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-133** | Pupuke | 1 | | | ss44 | 58649 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-134** | Pupuke | 1 | | | ss45 | 58650 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-135** | Pupuke | 1 | | | ss46 | 58651 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-136** | Pupuke | 1 | | | ss47 | 58652 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-137** | Pupuke | 1 | | | ss48 | 58653 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-138** | Pupuke | 1 | | | ss49 | 58654 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-139** | Pupuke | 1 | | | ss50 | 58655 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-140** | Pupuke | 1 | | | ss52 | 58656 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-141** | Pupuke | 1 | | | ss53 | 58657 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-142** | Pupuke | 1 | | | ss54 | 58658 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-143** | Pupuke | 1 | | | ss55 | 58659 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-144** | Pupuke | 1 | | | ss58 | 58661 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-145** | Pupuke | 1 | | | ss59 | 58662 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-146** | Pupuke | 1 | | | ss60 | 58663 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-147** | Pupuke | 1 | | | ss62 | 58664 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-148** | Pupuke | 1 | | | ss63 | 58665 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-149** | Pupuke | 1 | | | ss64 | 58666 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-150** | Pupuke | 1 | | | ss65 | 58667 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-151** | Pupuke | 1 | | | ss67 | 58668 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-152** | Pupuke | 1 | | | ss68 | 58669 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-153** | Pupuke | 1 | | | ss69 | 58670 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-154** | Pupuke | 1 | | | ss70 | 58671 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-155** | Pupuke | 1 | | | ss71 | 58672 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-156** | Pupuke | 1 | | | ss72 | 58673 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-157** | Pupuke | 1 | | | ss75 | 58674 | Spargo 06 | | | Spargo 2007 |
| **AVF-158** | Pupuke | 1 | | | ss76 | 58675 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-159** | Pupuke | 1 | | | ss77 | 58676 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-160** | Pupuke | 1 | | | ss79 | 58677 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-161** | Pupuke | 1 | | | ss80 | 58678 | Spargo 06 | | | Spargo 2007 |
| **AVF-162** | Pupuke | 1 | | | ss89 | 58679 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-164** | Pupuke | 1 | | | ss91 | 58681 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-165** | Pupuke | 1 | | | ss93 | 58682 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-166** | Pupuke | 1 | | | ss96 | 58683 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-167** | Pupuke | 1 | | | ss97 | 58684 | Spargo 06 | y | y | Spargo 2007 |

| AVF no | Volcano | No | AV no | A no | Other numbers | Collection no | Collector | XRF data* | ICP-MS data* | Paper/thesis |
|---|---|---|---|---|---|---|---|---|---|---|
| **AVF-168** | Pupuke | 1 | | | ss98 | 58685 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-169** | Pupuke | 1 | | | ss99 | 58686 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-170** | Pupuke | 1 | | | ss101 | 58687 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-171** | Pupuke | 1 | | | ss102 | 58688 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-172** | Pupuke | 1 | | | ss105 | 58689 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-173** | Pupuke | 1 | | | ss107 | 58690 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-174** | Pupuke | 1 | | | ss108 | 58691 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-175** | Pupuke | 1 | | | ss109 | 58692 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-176** | Pupuke | 1 | | | ss110 | 58693 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-177** | Pupuke | 1 | | | ss111 | 58694 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-178** | Pupuke | 1 | | | ss112 | 58695 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-179** | Pupuke | 1 | | | ss113 | 58696 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-180** | Pupuke | 1 | | | ss114 | 58697 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-181** | Pupuke | 1 | | | ss115 | 58698 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-182** | Pupuke | 1 | | | ss117 | 58700 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-183** | Pupuke | 1 | | | ss118 | 58701 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-184** | Pupuke | 1 | | | ss119 | 58702 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-185** | Pupuke | 1 | | | ss120 | 58703 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-186** | Pupuke | 1 | | | ss121 | 58704 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-187** | Pupuke | 1 | | | ss122 | 58705 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-188** | Pupuke | 1 | | | ss123 | 58706 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-189** | Pupuke | 1 | | | ss124 | 58707 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-190** | Pupuke | 1 | | | ss125 | 58708 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-191** | Pupuke | 1 | | | ss126 | 58709 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-192** | Pupuke | 1 | | | ss127 | 58710 | Spargo 06 | | | Spargo 2007 |
| **AVF-193** | Pupuke | 1 | | | ss128 | 58711 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-194** | Pupuke | 1 | | | ss129 | 58712 | Spargo 06 | y | y | Spargo 2007 |
| **AVF-195** | Pupuke | 1 | | | ss130 | 58713 | Spargo 06 | | | Spargo 2007 |
| **AVF-197** | Mt Victoria | 5 | AV067 | A23 | | 30655 | Heming | y | y | |
| **AVF-198** | Mt Victoria | 5 | AV068 | A24 | | 30656 | Heming | y | y | |
| **AVF-199** | North Head | 4 | AV069 | A25 | | 30657 | Heming | y | y | |
| **AVF-200** | North Head | 4 | AV410 | | NH2 | | Smith (Nov 2 99) | | | |
| **AVF-201** | North Head | 4 | AV411 | | NH3 | | Smith (Nov 2 99) | | | |
| **AVF-202** | North Head | 4 | AV412 | | NH5 | | Smith (Nov 2 99) | | | |
| **AVF-203** | North Head | 4 | AV413 | | NH6 | | Smith (Nov 2 99) | | | |
| **AVF-204** | North Head | 4 | AV501 | | NH1 | | Smith (Nov 2 99) | | | |
| **AVF-205** | North Head | 4 | AV502 | | NH2 | | Smith (Nov 2 99) | | | |
| **AVF-206** | North Head | 4 | AV503 | | | | Smith (Nov 2 99) | | | |
| **AVF-207** | North Head | 4 | AV504 | | | | Smith (Nov 2 99) | | | |
| **AVF-208** | North Head | 4 | AV505 | | | | Smith (Nov 2 99) | | | |
| **AVF-209** | North Head | 4 | AV506 | | | | Smith (Nov 2 99) | | | |
| **AVF-210** | Mt Albert | 15 | AV079 | A35 | | 30669 | Heming | y | y | |
| **AVF-211** | Mt Eden | 18 | AV100 | A56 | | 30695 | Heming | y | y | |
| **AVF-212** | Mt Roskill | 16 | AV080 | A36 | | 30670 | Heming | y | y | |
| **AVF-213** | Panmure | 27 | AV083 | A39 | | 30673 | Heming | y | y | |
| **AVF-214** | Panmure | 27 | AV397 | | PB3 | | Smith (Oct 00) | | | |
| **AVF-215** | Panmure | 27 | AV398 | | PB4 | | Smith (Oct 00) | | | |
| **AVF-216** | Panmure | 27 | AV399 | | PB5 | | Smith (Oct 00) | | | |
| **AVF-217** | Panmure | 27 | AV400 | | PB6 | | Smith (Oct 00) | | | |
| **AVF-218** | Panmure | 27 | AV480 | | PB1 | | | y | y | |
| **AVF-219** | Panmure | 27 | AV481 | | | | | | | |
| **AVF-220** | Panmure | 27 | AV482 | | | | | | | |
| **AVF-221** | Panmure | 27 | AV483 | | | | | | | |
| **AVF-222** | Panmure | 27 | AV484 | | | | | | | |
| **AVF-223** | Panmure | 27 | AV485 | | | | | | | |
| **AVF-224** | McLennan Hills | 30 | AV280 | | MCL2 | 46686 | Miller | | | Miller 1996 |
| **AVF-225** | McLennan Hills | 30 | AV281 | | MCL3 | 46687 | Miller | | | Miller 1996 |
| **AVF-226** | McLennan Hills | 30 | AV282 | | MCL1 | 46685 | Miller | | | Miller 1996 |
| **AVF-227** | Mt Richmond | 31 | AV086 | | | 30676 | Heming | y | | |
| **AVF-228** | Mt Richmond | 31 | AV087 | | | 30677 | Heming | y | | |
| **AVF-230** | | | | | | | | | | |
| **AVF-231** | | | | | | | | | | |
| **AVF-232** | Waitomokia | 42 | AV091 | | | 30682 | Heming | y | | |
| **AVF-233** | Waitomokia | 42 | AV388 | | | | Smith (Sep 99) | | | |
| **AVF-234** | Waitomokia | 42 | AV389 | | | | Smith (Sep 99) | | | |
| **AVF-235** | Waitomokia | 42 | AV390 | | | | Smith (Sep 99) | | | |
| **AVF-236** | Waitomokia | 42 | AV391 | | | | Smith (Sep 99) | | | |
| **AVF-237** | Maungataketake | 45 | AV094 | A50 | | | Heming | y | y | |
| **AVF-238** | Maungataketake | 45 | AV212 | A158 | IS94/1 | | | y | y | |
| **AVF-239** | Maungataketake | 45 | AV213 | A159 | IS94/2 | | | y | y | |
| **AVF-240** | Maungataketake | 45 | AV214 | A160 | IS94/3 | | | y | y | |
| **AVF-241** | Maungataketake | 45 | AV215 | A161 | IS94/4 | | | y | y | |
| **AVF-242** | Maungataketake | 45 | AV216 | A162 | IS94/5 | | | y | y | |
| **AVF-243** | Maungataketake | 45 | AV217 | A163 | IS94/6 | | | y | y | |
| **AVF-244** | Maungataketake | 45 | AV218 | A164 | IS94/7 | | | y | y | |
| **AVF-245** | Maungataketake | 45 | AV219 | A165 | IS94/8 | | | y | y | |
| **AVF-246** | Maungataketake | 45 | AV220 | A166 | IS94/9 | | | y | y | |
| **AVF-247** | Maungataketake | 45 | AV221 | A167 | IS94/10 | | | y | y | |
| **AVF-248** | Maungataketake | 45 | AV222 | A168 | IS94/11 | | | y | y | |
| **AVF-249** | Maungataketake | 45 | AV223 | A169 | IS94/12 | | | y | y | |

| AVF no | Volcano | No | AV no | A no | Other numbers | Collection no | Collector | XRF data* | ICP-MS data* | Paper/thesis |
|---|---|---|---|---|---|---|---|---|---|---|
| AVF-250 | Maungataketake | 45 | AV224 | A170 | IS94/13 | | | y | y | |
| AVF-251 | Maungataketake | 45 | AV225 | A171 | IS94/14 | | | | | |
| AVF-252 | Maungataketake | 45 | AV226 | A172 | IS94/15 | | | y | y | |
| AVF-253 | Pukeiti | 43 | AV092 | A48 | | 30683 | Heming | y | y | |
| AVF-254 | Otuataua | 44 | AV093 | A49 | | 30684 | Heming | y | y | |
| AVF-255 | Otuataua | 44 | AV095 | A51 | | 30687 | Heming | y | y | |
| AVF-256 | Matakarua | 49 | | | | 30686 | | | | |
| AVF-257 | | | | | | | | | | |
| AVF-258 | | | | | | | | | | |
| AVF-259 | Crater Hill | 47 | AV001 | | AK110, 97CH1 | 47125 | Wilson | y | y | Smith et al 2008 |
| AVF-260 | Crater Hill | 47 | AV002 | | AK111, 97/Ch20/01 | 47126 | Wilson | y | y | Smith et al 2008 |
| AVF-261 | Crater Hill | 47 | AV003 | | AK112, 97/CH20/02 | 47127 | Wilson | y | y | Smith et al 2008 |
| AVF-263 | Crater Hill | 47 | AV005 | | AK114, 97CH/21/1 | 47129 | Wilson | y | y | Smith et al 2008 |
| AVF-264 | Crater Hill | 47 | AV006 | | AK115, 97/M2a/01 | 47130 | Wilson | y | y | Smith et al 2008 |
| AVF-265 | Crater Hill | 47 | AV007 | | AK116, 97/M2a/02 | 47131 | Wilson | y | y | Smith et al 2008 |
| AVF-266 | Crater Hill | 47 | AV008 | | AK117, 97/M2a/03 | 47132 | Wilson | y | y | Smith et al 2008 |
| AVF-267 | Crater Hill | 47 | AV009 | | AK118, 97/M2a/04 | 47133 | Wilson | y | y | Smith et al 2008 |
| AVF-268 | Crater Hill | 47 | AV010 | | AK119, 97M2b/01 | 47134 | Wilson | y | y | Smith et al 2008 |
| AVF-269 | Crater Hill | 47 | AV011 | | AK120, 97M2b/01 | 47135 | Wilson | y | y | Smith et al 2008 |
| AVF-270 | Crater Hill | 47 | AV012 | | AK121, 97/M2b/03 | 47136 | Wilson | y | y | Smith et al 2008 |
| AVF-271 | Crater Hill | 47 | AV013 | | AK122, 97/M2b/04 | 47137 | Wilson | y | y | Smith et al 2008 |
| AVF-272 | Crater Hill | 47 | AV014 | | AK123, 97/M2b/05 | 47138 | Wilson | y | y | Smith et al 2008 |
| AVF-273 | Crater Hill | 47 | AV015 | | AK124, 97/M2b/06 | 47139 | Wilson | y | y | Smith et al 2008 |
| AVF-274 | Crater Hill | 47 | AV016 | | AK125,97/M2c/01 | 47140 | Wilson | y | y | Smith et al 2008 |
| AVF-275 | Crater Hill | 47 | AV017 | | AK126, 97/M2c/02 | 47141 | Wilson | y | y | Smith et al 2008 |
| AVF-276 | Crater Hill | 47 | AV018 | | AK127, 97/M2c/03 | 47142 | Wilson | y | y | Smith et al 2008 |
| AVF-277 | Crater Hill | 47 | AV019 | | AK128, 97/M2c/04 | 47143 | Wilson | y | y | Smith et al 2008 |
| AVF-278 | Crater Hill | 47 | AV020 | | AK129, 97/M3a/1 | 47144 | Wilson | y | y | Smith et al 2008 |
| AVF-279 | Crater Hill | 47 | AV021 | | AK130, 97/M3a/2 | 47145 | Wilson | y | y | Smith et al 2008 |
| AVF-280 | Crater Hill | 47 | AV022 | | AK131, 97/M3b/01 | 47146 | Wilson | y | y | Smith et al 2008 |
| AVF-281 | Crater Hill | 47 | AV023 | | AK132, 97/M3b/2 | 47147 | Wilson | y | y | Smith et al 2008 |
| AVF-282 | Crater Hill | 47 | AV024 | | AK133, 97/M3b/3 | 47148 | Wilson | y | y | Smith et al 2008 |
| AVF-283 | Crater Hill | 47 | AV025 | | AK134, 97/M3c/1 | 47149 | Wilson | y | y | Smith et al 2008 |
| AVF-284 | Crater Hill | 47 | AV026 | | AK135, 97/M3c/2 | 47150 | Wilson | y | y | Smith et al 2008 |
| AVF-285 | Crater Hill | 47 | AV027 | | AK136, 97/M3c/3 | 47151 | Wilson | y | y | Smith et al 2008 |
| AVF-286 | Crater Hill | 47 | AV028 | | AK137, 97/M3c/4 | 47152 | Wilson | y | y | Smith et al 2008 |
| AVF-287 | Crater Hill | 47 | AV029 | | AK138, 97/M3c/5 | 47153 | Wilson | y | y | Smith et al 2008 |
| AVF-288 | Crater Hill | 47 | AV030 | | AK139, 97/M3c/6 | 47154 | Wilson | y | y | Smith et al 2008 |
| AVF-289 | Crater Hill | 47 | AV031 | | AK140, 97/M4/1 | 47155 | Wilson | y | y | Smith et al 2008 |
| AVF-290 | Crater Hill | 47 | AV032 | | AK141, 97/M4/2 | 47156 | Wilson | y | y | Smith et al 2008 |
| AVF-291 | Crater Hill | 47 | AV033 | | AK142, 97/M4/3 | 47157 | Wilson | y | y | Smith et al 2008 |
| AVF-292 | Crater Hill | 47 | AV034 | | AK143, 97/M4/4 | 47158 | Wilson | y | y | Smith et al 2008 |
| AVF-293 | Crater Hill | 47 | AV035 | | AK144,97/M4/05 | 47159 | Wilson | y | y | Smith et al 2008 |
| AVF-294 | Crater Hill | 47 | AV036 | | AK145, 97/M4/06 | 47160 | Wilson | y | y | Smith et al 2008 |
| AVF-295 | Crater Hill | 47 | AV037 | | AK146, 97/M4/07 | 47161 | Wilson | y | y | Smith et al 2008 |
| AVF-297 | Crater Hill | 47 | AV039 | | AK148, 97/p2/02 | 47163 | Wilson | y | y | Smith et al 2008 |
| AVF-298 | Crater Hill | 47 | AV040 | | AK149, 97/P2/03 | 47164 | Wilson | y | y | Smith et al 2008 |
| AVF-299 | Crater Hill | 47 | AV041 | | AK150, 97/P2/04 | 47165 | Wilson | y | y | Smith et al 2008 |
| AVF-300 | Crater Hill | 47 | AV042 | | AK151, 97/P2/05 | 47166 | Wilson | y | y | Smith et al 2008 |
| AVF-301 | Crater Hill | 47 | AV043 | | AK152, 97/P2/06 | 47167 | Wilson | y | y | Smith et al 2008 |
| AVF-302 | Crater Hill | 47 | AV044 | A1 | CH29 | 39359 | Wilson | y | y | Smith et al 2008 |
| AVF-303 | Crater Hill | 47 | AV045 | A2 | CH27 | 39360 | Wilson | y | y | Smith et al 2008 |
| AVF-304 | Crater Hill | 47 | AV046 | A3 | CH7 | 39361 | Wilson | y | y | Smith et al 2008 |
| AVF-305 | Crater Hill | 47 | AV047 | A4 | CH8 | 39362 | Wilson | y | y | Smith et al 2008 |
| AVF-306 | Crater Hill | 47 | AV048 | A5 | CH9 | 39363 | Wilson | y | y | Smith et al 2008 |
| AVF-307 | Crater Hill | 47 | AV049 | A6 | CH20 | 39364 | Wilson | y | y | Smith et al 2008 |
| AVF-308 | Crater Hill | 47 | AV050 | A7 | CH4 | 39365 | Wilson | y | y | Smith et al 2008 |
| AVF-309 | Crater Hill | 47 | AV051 | A8 | CH10 | 39366 | Wilson | y | y | Smith et al 2008 |
| AVF-310 | Crater Hill | 47 | AV052 | A9 | CH15 | 39367 | Wilson | y | y | Smith et al 2008 |
| AVF-311 | Crater Hill | 47 | AV053 | A10 | CH5 | 39368 | Wilson | y | y | Smith et al 2008 |
| AVF-312 | Crater Hill | 47 | AV054 | A11 | CH34 | 39369 | Wilson | y | y | Smith et al 2008 |
| AVF-313 | Crater Hill | 47 | AV055 | A12 | CH1 | 39370 | Wilson | y | y | Smith et al 2008 |
| AVF-314 | Crater Hill | 47 | AV056 | A13 | CH33 | 39371 | Wilson | y | y | Smith et al 2008 |
| AVF-315 | Crater Hill | 47 | AV057 | A14 | CH3 | 39372 | Wilson | y | y | Smith et al 2008 |
| AVF-316 | Crater Hill | 47 | AV058 | A15 | CH6 | 39373 | Wilson | y | y | Smith et al 2008 |
| AVF-317 | Crater Hill | 47 | AV059 | A16 | | 39374 | Wilson | y | | |
| AVF-318 | Crater Hill | 47 | AV060 | A17 | CH30 | 39375 | Wilson | y | | |
| AVF-319 | Crater Hill | 47 | AV061 | A18 | | 39376 | Wilson | y | | |
| AVF-320 | Crater Hill | 47 | AV062 | A19 | | 43361 | Wilson | | | |
| AVF-321 | Crater Hill | 47 | AV063 | A20 | | 43364 | Wilson | | | |
| AVF-322 | Crater Hill | 47 | AV064 | A21 | | 44068 | Wilson | | | |
| AVF-323 | Crater Hill | 47 | AV078 | A34 | | 30368 | Heming | | | |
| AVF-324 | Crater Hill | 47 | AV414 | | CH11 | | Wilson | | | |
| AVF-325 | Crater Hill | 47 | AV415 | | CH13 | | Wilson | | | |
| AVF-326 | Crater Hill | 47 | AV416 | | CH14 | | Wilson | | | |
| AVF-327 | Crater Hill | 47 | AV417 | | CH32 | | Wilson | | | |
| AVF-328 | Wiri | 50 | AV122 | A75 | | 43931 | | y | y | |
| AVF-330 | Wiri | 50 | AV124 | A77 | | 43933 | | y | y | |
| AVF-331 | Wiri | 50 | AV125 | A78 | | 43934 | | y | y | |
| AVF-332 | Wiri | 50 | AV128 | A79 | | 43937 | | y | y | |
| AVF-333 | Wiri | 50 | AV129 | A80 | | 43938 | | y | y | |

| AVF no | Volcano | No | AV no | A no | Other numbers | Collection no | Collector | XRF data* | ICP-MS data* | Paper/thesis |
|---|---|---|---|---|---|---|---|---|---|---|
| AVF-334 | Wiri | 50 | AV130 | A81 | | 43939 | | y | y | |
| AVF-335 | Wiri | 50 | AV131 | A82 | | 43940 | | y | y | |
| AVF-336 | Wiri | 50 | AV132 | A83 | | 43941 | | y | y | |
| AVF-337 | Wiri | 50 | AV133 | A84 | | 43942 | | y | y | |
| AVF-338 | Wiri | 50 | AV134 | A85 | | 43943 | | y | y | |
| AVF-339 | Wiri | 50 | AV135 | A86 | | 43944 | | y | y | |
| AVF-340 | Wiri | 50 | AV418 | | | | | | | |
| AVF-341 | Puketutu | 41 | AV090 | A46 | | 30681 | Heming | y | y | |
| AVF-342 | Puketutu | 41 | AV283 | | PUKE13 | 46704 | Miller | y | | Miller 1996 |
| AVF-343 | Puketutu | 41 | AV284 | | PUKE1 | 46697 | Miller | y | | Miller 1996 |
| AVF-344 | Puketutu | 41 | AV285 | | PUKE14 | 46705 | Miller | y | | Miller 1996 |
| AVF-345 | Puketutu | 41 | AV286 | | PUKE4 | 46699 | Miller | y | | Miller 1996 |
| AVF-346 | Puketutu | 41 | AV287 | | PUKE2 | 46698 | Miller | y | | Miller 1996 |
| AVF-347 | Puketutu | 41 | AV288 | | PUKE12 | 46703 | Miller | y | | Miller 1996 |
| AVF-348 | Puketutu | 41 | AV289 | | PUKE7 | 46700 | Miller | y | | Miller 1996 |
| AVF-349 | Puketutu | 41 | AV290 | | PUKE10 | 46702 | Miller | y | | Miller 1996 |
| AVF-350 | Puketutu | 41 | AV291 | | PUKE8 | 46701 | Miller | y | | Miller 1996 |
| AVF-351 | Puketutu | 41 | AV292 | | PUKE16 | 46706 | Miller | y | | Miller 1996 |
| AVF-352 | Pigeon Mt | 38 | AV074 | A30 | | 30664 | Heming | y | y | |
| AVF-353 | Taylors Hill | 29 | AV073 | A29 | | 30662 | Heming | y | y | |
| AVF-354 | | | | | | | | | | |
| AVF-355 | Mt Smart | 24 | AV084 | A40 | | 30674 | Heming | y | y | |
| AVF-356 | | | | | | | | | | |
| AVF-357 | Green Hill | 35 | AV088 | A44 | | 30679 | Heming | y | y | |
| AVF-358 | Green Hill | 35 | AV293 | | GRN1 | 46674 | Miller | y | | Miller 1996 |
| AVF-359 | Green Hill | 35 | AV294 | | GRN2 | 46675 | Miller | y | | Miller 1996 |
| AVF-360 | Otara Hill | 36 | AV295 | | OT9 | 46692 | Miller | y | | Miller 1996 |
| AVF-361 | Otara Hill | 36 | AV296 | | OT14 | | Miller | y | | Miller 1996 |
| AVF-364 | Otara Hill | 36 | AV299 | | OT6 | 46690 | Miller | y | | Miller 1996 |
| AVF-365 | Otara Hill | 36 | AV300 | | OT16 | 46695 | Miller | y | | Miller 1996 |
| AVF-366 | Otara Hill | 36 | AV301 | | OT2 | 46688 | Miller | y | | Miller 1996 |
| AVF-367 | Otara Hill | 36 | AV302 | | OT15 | 46694 | Miller | y | | Miller 1996 |
| AVF-368 | Otara Hill | 36 | AV303 | | OT8 | 46691 | Miller | y | | Miller 1996 |
| AVF-369 | Otara Hill | 36 | AV304 | | OT17 | 46696 | Miller | y | | Miller 1996 |
| AVF-370 | Hampton Park | 37 | AV305 | | HP2 | 46677 | Miller | y | | Miller 1996 |
| AVF-371 | Hampton Park | 37 | AV306 | | HP4 | 46679 | Miller | y | | Miller 1996 |
| AVF-372 | Hampton Park | 37 | AV307 | | HP3 | 46678 | Miller | y | | Miller 1996 |
| AVF-373 | Hampton Park | 37 | AV308 | | HP1 | 46676 | Miller | y | | Miller 1996 |
| AVF-374 | | | | | | | | | | |
| AVF-375 | Mangere | 39 | AV089 | A45 | | 30680 | Heming | y | y | |
| AVF-376 | Mt Albert | 15 | AV099 | A55 | | 30694 | Heming | y | y | |
| AVF-377 | Mangere? | 39 | AV271 | | | | Kermode | | | |
| AVF-378 | Mangere? | 39 | AV272 | | | | Kermode | | | |
| AVF-379 | Mangere? | 39 | AV273 | | | | Kermode | | | |
| AVF-380 | Mangere? | 39 | AV274 | | | | Kermode | | | |
| AVF-381 | Mangere?? | 39 | AV275 | | | | Kermode | | | |
| AVF-382 | Mangere?? | 39 | AV276 | | | | Kermode | | | |
| AVF-383 | Mangere?? | 39 | AV277 | | | | Kermode | | | |
| AVF-384 | Mangere | 39 | AV309 | | MAN5 | | Miller | y | | Miller 1996 |
| AVF-385 | Mangere | 39 | AV310 | | MAN1 | | Miller | y | | Miller 1996 |
| AVF-386 | Mangere | 39 | AV311 | | MAN2 | | Miller | y | | Miller 1996 |
| AVF-387 | Mangere | 39 | AV312 | | MAN3 | | Miller | y | | Miller 1996 |
| AVF-388 | Mangere | 39 | AV313 | | MAN4 | | Miller | y | | Miller 1996 |
| AVF-389 | One Tree hill | 23 | AV082 | A38 | | 30672 | Heming | y | y | |
| AVF-390 | One Tree Hill | 23 | AV270 | | | | Kermode | | | |
| AVF-391 | One Tree Hill | 23 | AV430 | | ONB1 | | Smith 02 | y | y | |
| AVF-392 | One Tree Hill | 23 | AV431 | | ONB2 | | Smith 02 | y | y | |
| AVF-393 | One Tree Hill | 23 | AV432 | | ONB3 | | Smith 02 | y | y | |
| AVF-394 | 3 Kings | 17 | AV081 | A37 | | 30671 | Heming | y | y | |
| AVF-395 | 3 Kings | 17 | AV102 | A58 | | 30699 | Heming | y | | |
| AVF-397 | Hopua | 22 | AV085 | A41 | | 30675 | Heming | y | y | |
| AVF-398 | Te Pouhawaiki | | AV349 | | | | Franklin | y | | Franklin 1999 |
| AVF-399 | Te Pouhawaiki | | AV350 | | | | Franklin | y | | Franklin 1999 |
| AVF-400 | Te Pouhawaiki | | AV351 | | | | Franklin | y | | Franklin 1999 |
| AVF-401 | Te Pouhawaiki | 19 | AV352 | | | 48377 | Franklin | y | | Franklin 1999 |
| AVF-402 | Te Pouhawaiki | 19 | AV353 | | | 48378 | Franklin | y | | Franklin 1999 |
| AVF-403 | Te Pouhawaiki | 19 | AV354 | | | 48379 | Franklin | y | | Franklin 1999 |
| AVF-404 | Te Pouhawaiki | 19 | AV355 | | | 48380 | Franklin | y | | Franklin 1999 |
| AVF-405 | Te Pouhawaiki | 19 | AV356 | | | 48381 | Franklin | y | | Franklin 1999 |
| AVF-406 | Te Pouhawaiki | 19 | AV357 | | | 48382 | Franklin | y | | Franklin 1999 |
| AVF-407 | Te Pouhawaiki | 19 | AV358 | | | 48383 | Franklin | y | | Franklin 1999 |
| AVF-408 | Te Pouhawaiki | 19 | AV359 | | | 48384 | Franklin | y | | Franklin 1999 |
| AVF-409 | Te Pouhawaiki | 19 | AV360 | | | 48385 | Franklin | y | | Franklin 1999 |
| AVF-410 | Te Pouhawaiki | 19 | AV361 | | | 48386 | Franklin | y | | Franklin 1999 |
| AVF-411 | Mt Eden | 18 | AV072 | A28 | | 30660 | Heming | y | y | |
| AVF-412 | Hobson | 21 | AV097 | A53 | | 30691 | Heming | y | y | |
| AVF-413 | 3 Kings/Mt Eden? | 17 | AV101 | A57 | | 30697 | Heming | y | y | |
| AVF-414 | Mt Eden | 18 | AV240 | A186 | AK103 | 47224 | | | | |
| AVF-415 | Mt Eden | 18 | AV241 | A187 | AK104 | 47225 | | | | |
| AVF-416 | Mt Eden | 18 | AV269 | | | | Smith/Shane | y | y | |
| AVF-417 | Mt Eden | 18 | AV362 | | | 48387 | Franklin | y | | Franklin 1999 |

| AVF no | Volcano | No | AV no | A no | Other numbers | Collection no | Collector | XRF data* | ICP-MS data* | Paper/thesis |
|---|---|---|---|---|---|---|---|---|---|---|
| **AVF-418** | Mt Eden | 18 | AV363 | | | 48388 | Franklin | y | | Franklin 1999 |
| **AVF-419** | Mt Eden | 18 | AV364 | | | 48389 | Franklin | y | | Franklin 1999 |
| **AVF-420** | Mt Eden | 18 | AV365 | | | 48390 | Franklin | y | | Franklin 1999 |
| **AVF-421** | Mt Eden | 18 | AV366 | | | 48391 | Franklin | y | | Franklin 1999 |
| **AVF-422** | Mt Eden | 18 | AV367 | | | 48392 | Franklin | y | | Franklin 1999 |
| **AVF-423** | Mt Eden | 18 | AV368 | | | 48393 | Franklin | y | | Franklin 1999 |
| **AVF-424** | Mt Eden | 18 | AV369 | | | 48394 | Franklin | y | | Franklin 1999 |
| **AVF-425** | Mt Eden | 18 | AV370 | | | 48395 | Franklin | y | | Franklin 1999 |
| **AVF-426** | Mt Eden | 18 | AV371 | | | 48396 | Franklin | y | | Franklin 1999 |
| **AVF-427** | Mt Eden | 18 | AV429 | | | | Smith 02 | | | |
| | | | | | | | | | | Franklin 1999 |
| **AVF-428** | Mt St John | 20 | AV380 | | | 48405 | Franklin | y | | |
| **AVF-431** | Mt St John | 20 | AV383 | | | 48408 | Franklin | y | | MSc thesis |
| **AVF-432** | Mt St John | 20 | AV384 | | | 48409 | Franklin | y | | MSc thesis |
| **AVF-433** | Mt St John | 20 | AV385 | | | 48410 | Franklin | y | | MSc thesis |
| **AVF-434** | Mt St John | 20 | AV386 | | | 48411 | Franklin | y | | MSc thesis |
| **AVF-435** | Mt St John | 20 | AV387 | | | 48412 | Franklin | y | | MSc thesis |
| **AVF-436** | Mt Hobson | 21 | AV077 | | | 30667 | Heming | y | y | |
| **AVF-437** | Mangere | 39 | AV098 | | | 30692 | Heming | y | y | |
| **AVF-438** | Mt Hobson | 21 | AV372 | | | | Franklin | y | | MSc thesis |
| **AVF-439** | Mt Hobson | 21 | AV373 | | | | Franklin | y | | MSc thesis |
| **AVF-440** | Mt Hobson | 21 | AV374 | | | | Franklin | y | | MSc thesis |
| **AVF-441** | Mt Hobson | 21 | AV375 | | | | Franklin | y | | MSc thesis |
| **AVF-442** | Mt Hobson | 21 | AV376 | | | | Franklin | y | | MSc thesis |
| **AVF-443** | Mt Hobson | 21 | AV377 | | | | Franklin | y | | MSc thesis |
| **AVF-444** | Mt Hobson | 21 | AV378 | | | | Franklin | y | | MSc thesis |
| **AVF-445** | Mt Hobson | 21 | AV379 | | | | Franklin | y | | MSc thesis |
| **AVF-446** | Orakei | 13 | AV229 | A175 | IS91/1 | | Smith? | y | | |
| **AVF-447** | Orakei | 13 | AV230 | A176 | IS91/2 | | Smith? | | | |
| **AVF-448** | Orakei | 13 | AV231 | A177 | IS91/3 | | Smith? | | | |
| **AVF-449** | Orakei | 13 | AV362 | | | | Franklin | y | | MSc thesis |
| **AVF-450** | Orakei | 13 | AV363 | | | | Franklin | y | | MSc thesis |
| **AVF-451** | Orakei | 13 | AV364 | | | | Franklin | y | | MSc thesis |
| **AVF-452** | Orakei | 13 | AV365 | | | | Franklin | y | | MSc thesis |
| **AVF-453** | Orakei | 13 | AV366 | | | | Franklin | y | | MSc thesis |
| **AVF-454** | Orakei | 13 | AV367 | | | | Franklin | y | | MSc thesis |
| **AVF-455** | Orakei | 13 | AV368 | | | | Franklin | y | | MSc thesis |
| **AVF-456** | Orakei | 13 | AV369 | | | | Franklin | y | | MSc thesis |
| **AVF-457** | Orakei | 13 | AV370 | | | | Franklin | y | | MSc thesis |
| **AVF-458** | Orakei | 13 | AV371 | | | | Franklin | y | | MSc thesis |
| **AVF-459** | Orakei | 13 | AV372 | | | 48349 | Franklin | y | | MSc thesis |
| **AVF-460** | Orakei | 13 | AV373 | | | 48350 | Franklin | y | | MSc thesis |
| **AVF-461** | Orakei | 13 | AV374 | | | 48351 | Franklin | y | | MSc thesis |
| **AVF-463** | Orakei | 13 | AV376 | | | 48353 | Franklin | y | | MSc thesis |
| **AVF-464** | Orakei | 13 | AV377 | | | 48354 | Franklin | y | | MSc thesis |
| **AVF-465** | Orakei | 13 | AV378 | | | 48355 | Franklin | y | | MSc thesis |
| **AVF-466** | Orakei | 13 | AV379 | | | 48356 | Franklin | y | | MSc thesis |
| **AVF-467** | Orakei | 13 | AV380 | | | 48357 | Franklin | y | | MSc thesis |
| **AVF-468** | Orakei | 13 | AV381 | | | 48358 | Franklin | y | | MSc thesis |
| **AVF-469** | Orakei | 13 | AV471 | | OB1 | | | | | |
| **AVF-470** | Orakei | 13 | AV472 | | OB2 | | | y | y | |
| **AVF-471** | Little Rangitoto | 14 | AV076 | A32 | | 30666 | Heming | y | y | |
| **AVF-472** | Little Rangitoto | 14 | AV334 | | | 48359 | Franklin | y | | MSc thesis |
| **AVF-473** | Little Rangitoto | 14 | AV335 | | | 48360 | Franklin | y | | MSc thesis |
| **AVF-474** | Little Rangitoto | 14 | AV336 | | | 48361 | Franklin | y | | MSc thesis |
| **AVF-475** | Little Rangitoto | 14 | AV337 | | | 48362 | Franklin | y | | MSc thesis |
| **AVF-476** | Little Rangitoto | 14 | AV338 | | | 48363 | Franklin | y | | MSc thesis |
| **AVF-477** | Little Rangitoto | 14 | AV339 | | | 48364 | Franklin | y | | MSc thesis |
| **AVF-478** | Little Rangitoto | 14 | AV340 | | | 48365 | Franklin | y | | MSc thesis |
| **AVF-479** | Little Rangitoto | 14 | AV341 | | | 48366 | Franklin | y | | MSc thesis |
| **AVF-480** | Little Rangitoto | 14 | AV342 | | | 48367 | Franklin | y | | MSc thesis |
| **AVF-481** | Little Rangitoto | 14 | AV343 | | | 48368 | Franklin | y | | MSc thesis |
| **AVF-482** | Little Rangitoto | 14 | AV344 | | | 48369 | Franklin | y | | MSc thesis |
| **AVF-483** | Little Rangitoto | 14 | AV345 | | | 48370 | Franklin | y | | MSc thesis |
| **AVF-484** | Little Rangitoto | 14 | AV346 | | | 48371 | Franklin | y | | MSc thesis |
| **AVF-485** | Little Rangitoto | 14 | AV347 | | | 48372 | Franklin | y | | MSc thesis |
| **AVF-486** | Little Rangitoto | 14 | AV348 | | | 48373 | Franklin | y | | MSc thesis |
| **AVF-487** | Purchas Hill | 26 | AV232 | A178 | IS91/4 | 44707 | Smith? | y | y | |
| **AVF-488** | Purchas Hill | 26 | AV233 | A179 | IS91/5 | 44708 | Smith? | y | y | |
| **AVF-489** | Purchas Hill | 26 | AV234 | A180 | IS91/6 | 44709 | Smith? | y | y | |
| **AVF-490** | Purchas Hill | 26 | AV235 | A181 | IS91/7 | 44710 | Smith? | y | y | |
| **AVF-491** | Purchas Hill | 26 | AV236 | A182 | IS91/8 | 44711 | Smith? | y | y | |
| **AVF-493** | Mt Wellington | 25 | AV516 | | | 30665 | BWH 03 | | | |
| **AVF-494** | Mt Wellington | 25 | AV075 | A31 | | | Heming | y | y | |
| **AVF-495** | Mt Wellington | 25 | AV237 | A183 | AK100 | 47221 | | | | |
| **AVF-496** | Mt Wellington | 25 | AV238 | A184 | AK101 | 47222 | | | | |
| ***AVF-498*** | *Mt Wellington* | *25* | *AV243* | *A189* | *AK106* | *47227* | | *y* | *y* | |
| **AVF-499** | Mt Wellington | 25 | AV243 | A189 | AK106 | 47227 | | | | |
| **AVF-500** | Mt Wellington | 25 | AV244 | A190 | AK107 | 47228 | | | | |

| AVF no | Volcano | No | AV no | A no | Other numbers | Collection no | Collector | XRF data* | ICP-MS data* | Paper/thesis |
|---|---|---|---|---|---|---|---|---|---|---|
| *AVF-501* | *Mt Wellington* | *25* | *AV245* | *A191* | *AK108* | *47228* | | | | |
| AVF-502 | Mt Wellington | 25 | AV245 | A191 | AK108 | 47229 | | | | |
| *AVF-503* | *Mt Wellington* | *25* | *AV246* | *A192* | *AK109* | *47229* | | | | |
| AVF-504 | Mt Wellington | 25 | AV246 | A192 | AK109 | 47230 | | | | |
| AVF-505 | Mt Wellington | 25 | AV278 | | | 47230 | Kermode | | | |
| AVF-506 | Mt Wellington | 25 | AV279 | | | | Kermode | | | |
| AVF-507 | Mt Wellington | 25 | AV393 | | MW2 | | Smith (Oct 00) | y | y | |
| AVF-508 | Mt Wellington | 25 | AV394 | | MW3 | | Smith (Oct 00) | | | |
| AVF-509 | Mt Wellington | 25 | AV395 | | MW5 | | Smith (Oct 00) | | | |
| AVF-510 | Mt Wellington | 25 | AV396 | | MW6 | | Smith (Oct 00) | | | |
| AVF-511 | Mt Wellington | 25 | AV421 | | RWQtop | | Smith (Aug 00) | y | y | |
| AVF-512 | Mt Wellington | 25 | AV422 | | RWQB1 | | Smith (Aug 00) | y | y | |
| AVF-513 | Mt Wellington | 25 | AV423 | | RWQB2 | | Smith (Aug 00) | y | y | |
| AVF-514 | Mt Wellington | 25 | AV424 | | RWQB3 | | Smith (Aug 00) | y | y | |
| AVF-515 | Mt Wellington | 25 | AV436 | | ALC5/1-1 | | Smith 03 | y | y | |
| AVF-516 | Mt Wellington | 25 | AV437 | | ALC5/1-2 | | | y | y | |
| AVF-517 | Mt Wellington | 25 | AV438 | | ALC5/1-3 | | | y | y | |
| AVF-518 | Mt Wellington | 25 | AV439 | | ALC5/1-4 | | | | | |
| AVF-519 | Mt Wellington | 25 | AV440 | | ALC5/1-5 | | | y | y | |
| AVF-520 | Mt Wellington | 25 | AV441 | | ALC5/1-6 | | | | | |
| AVF-521 | Mt Wellington | 25 | AV442 | | ALC5/1-7 | | | y | y | |
| AVF-522 | Mt Wellington | 25 | AV443 | | ALC5/1-8 | | | y | y | |
| AVF-523 | Mt Wellington | 25 | AV444 | | ALC5/1-9 | | | y | y | |
| AVF-524 | Mt Wellington | 25 | AV445 | | ALC5/1-10 | | | y | y | |
| AVF-525 | Mt Wellington | 25 | AV446 | | ALC5/1-11 | | | y | y | |
| AVF-526 | Mt Wellington | 25 | AV447 | | ALC5/1-12 | | | y | y | |
| AVF-527 | Mt Wellington | 25 | AV448 | | ALC5/1-13 | | | y | y | |
| AVF-528 | Mt Wellington | 25 | AV449 | | ALC5/1-14 | | | y | y | |
| AVF-529 | Mt Wellington | 25 | AV450 | | ALC5/1-15 | | | y | y | |
| AVF-531 | Mt Wellington | 25 | AV452 | | ALC5/2-1 | | | y | y | |
| AVF-532 | Mt Wellington | 25 | AV453 | | ALC5/2-2 | | | y | y | |
| AVF-533 | Mt Wellington | 25 | AV454 | | ALC5/2-3 | | | y | y | |
| AVF-534 | Mt Wellington | 25 | AV455 | | ALC5/2-4 | | | y | y | |
| AVF-535 | Mt Wellington | 25 | AV456 | | ALC5/2-5 | | | y | y | |
| AVF-536 | Mt Wellington | 25 | AV457 | | ALC5/2-6 | | | y | y | |
| AVF-537 | Mt Wellington | 25 | AV458 | | ALC5/2-7 | | | y | y | |
| AVF-538 | Mt Wellington | 25 | AV459 | | ALC5/2-8 | | | | | |
| AVF-539 | Mt Wellington | 25 | AV460 | | ALC5/2-9 | | | | | |
| AVF-540 | Mt Wellington | 25 | AV461 | | ALC5/2-10 | | | | | |
| AVF-541 | Mt Wellington | 25 | AV462 | | ALC5/2-11 | | | | | |
| AVF-542 | Mt Wellington | 25 | AV463 | | ALC5/2-12 | | | y | y | |
| AVF-543 | Mt Wellington | 25 | AV464 | | ALC5/2-13 | | | | | |
| AVF-544 | Mt Wellington | 25 | AV465 | | ALC5/2-14 | | | y | y | |
| AVF-545 | Mt Wellington | 25 | AV466 | | ALC5/2-15 | | | | | |
| AVF-546 | Mt Wellington | 25 | AV467 | | ALC5/2-16 | | | y | y | |
| AVF-547 | Mt Wellington | 25 | AV473 | | MW1 | | Shane/Smith | y | y | |
| AVF-548 | Mt Wellington | 25 | AV474 | | MW2 | | Shane/Smith | y | y | |
| AVF-549 | Mt Wellington | 25 | AV475 | | MW3 | | Shane/Smith | y | y | |
| AVF-550 | Mt Wellington | 25 | AV476 | | MW4 | | Shane/Smith | | | |
| AVF-551 | Mt Wellington | 25 | AV477 | | MW5 | | Shane/Smith | | | |
| AVF-552 | Mt Wellington | 25 | AV478 | | MW6 | | Shane/Smith | y | y | |
| AVF-553 | Mt Wellington | 25 | AV479 | | MW7 | | Shane/Smith | | | |
| AVF-554 | Motukorea | 8 | AV103 | A59 | | 43360 | Bryner | y | y | Bryner 1991 |
| AVF-555 | Motukorea | 8 | AV104 | | | 43361 | Bryner | | | Bryner 1991 |
| AVF-556 | Motukorea | 8 | AV105 | | | 43362 | Bryner | y | y | Bryner 1991 |
| AVF-557 | Motukorea | 8 | AV106 | A60 | | 43363 | Bryner | y | y | Bryner 1991 |
| AVF-558 | Motukorea | 8 | AV107 | | | 43364 | Bryner | | | Bryner 1991 |
| AVF-559 | Motukorea | 8 | AV108 | A61 | | 43365 | Bryner | y | y | Bryner 1991 |
| AVF-560 | Motukorea | 8 | AV109 | A62 | | 43366 | Bryner | y | y | Bryner 1991 |
| AVF-561 | Motukorea | 8 | AV110 | A63 | | 43367 | Bryner | y | y | Bryner 1991 |
| AVF-562 | Motukorea | 8 | AV111 | A64 | | 43368 | Bryner | y | y | Bryner 1991 |
| AVF-564 | Motukorea | 8 | AV113 | A66 | | 43370 | Bryner | y | y | Bryner 1991 |
| AVF-565 | Motukorea | 8 | AV114 | A67 | | 43371 | Bryner | y | y | Bryner 1991 |
| AVF-566 | Motukorea | 8 | AV115 | A68 | | 43372 | Bryner | y | y | Bryner 1991 |
| AVF-567 | Motukorea | 8 | AV116 | A69 | | 43373 | Bryner | y | y | Bryner 1991 |
| AVF-568 | Motukorea | 8 | AV117 | A70 | | 43374 | Bryner | y | y | Bryner 1991 |
| AVF-569 | Motukorea | 8 | AV118 | A71 | | 43375 | Bryner | y | y | Bryner 1991 |
| AVF-570 | Motukorea | 8 | AV119 | A72 | | 43376 | Bryner | y | y | Bryner 1991 |
| AVF-571 | Motukorea | 8 | AV120 | A73 | | 43377 | Bryner | y | y | Bryner 1991 |
| AVF-572 | Motukorea | 8 | AV121 | A74 | | 43378 | Bryner | y | y | Bryner 1991 |
| AVF-573 | Rangitoto | 7 | AV177 | A123 | RT1 | 47172 | AJ | y | y | |
| AVF-574 | Rangitoto | 7 | AV178 | A124 | RT2 | 47173 | AJ | y | y | |
| AVF-575 | Rangitoto | 7 | AV179 | A125 | RT3 | 47174 | AJ | | | |
| AVF-576 | Rangitoto | 7 | AV180 | A126 | RT4 | 47175 | AJ | y | y | |
| AVF-577 | Rangitoto | 7 | AV181 | A127 | RT5 | 47176 | AJ | y | y | |
| AVF-578 | Rangitoto | 7 | AV182 | A128 | RT6 | 47177 | AJ | y | y | |
| AVF-579 | Rangitoto | 7 | AV183 | A129 | RT7 | 47178 | AJ | y | y | |
| AVF-580 | Rangitoto | 7 | AV184 | A130 | RT8 | 47179 | AJ | y | y | |
| AVF-581 | Rangitoto | 7 | AV185 | A131 | RT9 | 47180 | AJ | y | y | |
| AVF-582 | Rangitoto | 7 | AV186 | A132 | RT10 | 47181 | AJ | | | |
| AVF-583 | Rangitoto | 7 | AV187 | A133 | RT11 | 47182 | AJ | y | y | |

| AVF no | Volcano | No | AV no | A no | Other numbers | Collection no | Collector | XRF data* | ICP-MS data* | Paper/thesis |
|---|---|---|---|---|---|---|---|---|---|---|
| **AVF-584** | Rangitoto | 7 | AV188 | A134 | RT12 | 47183 | AJ | y | y | |
| **AVF-585** | Rangitoto | 7 | AV189 | A135 | RT13 | 47184 | AJ | y | y | |
| **AVF-586** | Rangitoto | 7 | AV190 | A136 | RT14 | 47185 | AJ | y | y | |
| **AVF-587** | Rangitoto | 7 | AV191 | A137 | RT15 | 47186 | AJ | y | y | |
| **AVF-588** | Rangitoto | 7 | AV192 | A138 | RT16 | 47187 | AJ | y | y | |
| **AVF-589** | Rangitoto | 7 | AV193 | A139 | RT17 | 47188 | AJ | | | |
| **AVF-590** | Rangitoto | 7 | AV194 | A140 | RT18 | 47189 | AJ | y | y | |
| **AVF-591** | Rangitoto | 7 | AV195 | A141 | RT19 | 47190 | AJ | y | y | |
| **AVF-592** | Rangitoto | 7 | AV196 | A142 | RT20 | 47191 | AJ | y | y | |
| **AVF-593** | Rangitoto | 7 | AV197 | A143 | Ra21 | 47192 | Smith/JN | | y | |
| **AVF-594** | Rangitoto | 7 | AV198 | A144 | Ra22 | 47193 | Smith/JN | | y | |
| **AVF-595** | Rangitoto | 7 | AV199 | A145 | Ra23 | 47194 | Smith/JN | | y | |
| **AVF-596** | Rangitoto | 7 | AV200 | A146 | Ra24 | 47195 | Smith/JN | | y | |
| **AVF-598** | Rangitoto | 7 | AV202 | A148 | Ra26 | 47197 | Smith/JN | | y | |
| **AVF-599** | Rangitoto | 7 | AV203 | A149 | Ra27A | 47198 | Smith/JN | | y | |
| **AVF-600** | Rangitoto | 7 | AV204 | A150 | Ra27B | 47199 | Smith/JN | | y | |
| **AVF-601** | Rangitoto | 7 | | | | 47200 | | | y | |
| **AVF-602** | Rangitoto | 7 | | | | 47201 | | | y | |
| **AVF-603** | Rangitoto | 7 | | | | 47202 | | | y | |
| **AVF-604** | Rangitoto | 7 | | | | 47203 | | | y | |
| **AVF-605** | Rangitoto | 7 | | | | 47204 | | | y | |
| **AVF-606** | Rangitoto | 7 | | | | 47205 | | | y | |
| **AVF-607** | Rangitoto | 7 | | | | 47206 | | | y | |
| **AVF-608** | Rangitoto | 7 | AV517 | | MH1 | 49917 | Hookway | y | | Hookway 2000 |
| **AVF-609** | Rangitoto | 7 | AV518 | | MH2 | 49918 | Hookway | y | | Hookway 2000 |
| **AVF-610** | Rangitoto | 7 | AV519 | | MH3 | 49919 | Hookway | y | | Hookway 2000 |
| **AVF-611** | Rangitoto | 7 | AV520 | | MH4 | 49920 | Hookway | y | | Hookway 2000 |
| **AVF-612** | Rangitoto | 7 | AV521 | | MH5 | 49921 | Hookway | y | | Hookway 2000 |
| **AVF-613** | Rangitoto | 7 | AV522 | | MH6 | 49922 | Hookway | y | | Hookway 2000 |
| **AVF-614** | Rangitoto | 7 | AV523 | | MH7 | 49923 | Hookway | y | | Hookway 2000 |
| **AVF-615** | Rangitoto | 7 | AV524 | | MH8 | 49924 | Hookway | y | | Hookway 2000 |
| **AVF-616** | Rangitoto | 7 | AV525 | | MH9 | 49925 | Hookway | y | | Hookway 2000 |
| **AVF-617** | Rangitoto | 7 | AV526 | | MH10 | 49926 | Hookway | y | | Hookway 2000 |
| **AVF-618** | Rangitoto | 7 | AV527 | | MH11 | 49927 | Hookway | y | | Hookway 2000 |
| **AVF-619** | Rangitoto | 7 | AV528 | | MH12 | 49928 | Hookway | y | | Hookway 2000 |
| **AVF-620** | Rangitoto | 7 | AV529 | | MH13 | 49929 | Hookway | y | | Hookway 2000 |
| **AVF-621** | Rangitoto | 7 | AV530 | | MH14 | 49930 | Hookway | y | | Hookway 2000 |
| **AVF-622** | Rangitoto | 7 | AV531 | | MH15 | 49931 | Hookway | y | | Hookway 2000 |
| **AVF-623** | Rangitoto | 7 | AV532 | | MH16 | 49932 | Hookway | y | | Hookway 2000 |
| **AVF-624** | Rangitoto | 7 | AV533 | | MH17 | 49933 | Hookway | y | | Hookway 2000 |
| **AVF-625** | Rangitoto | 7 | AV534 | | MH18 | 49934 | Hookway | y | | Hookway 2000 |
| **AVF-626** | Rangitoto | 7 | AV535 | | MH19 | 49935 | Hookway | y | | Hookway 2000 |
| **AVF-627** | Rangitoto | 7 | AV536 | | MH20 | 49936 | Hookway | y | | Hookway 2000 |
| **AVF-628** | Rangitoto | 7 | AV537 | | MH21 | 49937 | Hookway | y | | Hookway 2000 |
| **AVF-629** | Rangitoto | 7 | AV538 | | MH22 | 49938 | Hookway | y | | Hookway 2000 |
| **AVF-630** | Rangitoto | 7 | AV539 | | MH23 | 49939 | Hookway | y | | Hookway 2000 |
| **AVF-632** | Rangitoto | 7 | AV541 | | MH25 | 49941 | Hookway | y | | Hookway 2000 |
| **AVF-633** | Rangitoto | 7 | AV542 | | MH26 | 49942 | Hookway | y | | Hookway 2000 |
| **AVF-634** | Rangitoto | 7 | AV543 | | MH27 | 49943 | Hookway | y | | Hookway 2000 |
| **AVF-635** | Rangitoto | 7 | AV544 | | MH28 | 49944 | Hookway | y | | Hookway 2000 |
| **AVF-636** | Rangitoto | 7 | AV545 | | MH29 | 49945 | Hookway | y | | Hookway 2000 |
| **AVF-637** | Rangitoto | 7 | AV546 | | MH30 | 49946 | Hookway | y | | Hookway 2000 |
| **AVF-638** | Rangitoto | 7 | AV547 | | MH31 | 49947 | Hookway | y | | Hookway 2000 |
| **AVF-639** | Rangitoto | 7 | AV548 | | MH32 | 49948 | Hookway | y | | Hookway 2000 |
| **AVF-640** | Rangitoto | 7 | AV549 | | MH33 | 49949 | Hookway | y | | Hookway 2000 |
| **AVF-641** | Rangitoto | 7 | AV550 | | MH34 | 49950 | Hookway | y | | Hookway 2000 |
| **AVF-642** | Rangitoto | 7 | AV551 | | MH35 | 49951 | Hookway | y | | Hookway 2000 |
| **AVF-643** | Rangitoto | 7 | AV552 | | MH36 | 49952 | Hookway | y | | Hookway 2000 |
| **AVF-644** | Outhwaite Park | 11 | AV258 | A204 | | | Smith | y | y | |
| **AVF-645** | Outhwaite Park | 11 | AV259 | A205 | | | Smith | y | y | |
| **AVF-646** | Outhwaite Park | 11 | AV260 | A206 | | | Smith | y | y | |
| **AVF-647** | Outhwaite Park | 11 | AV261 | A207 | | | Smith | y | y | |
| **AVF-648** | Outhwaite Park | 11 | AV262 | A208 | | | Smith | y | y | |
| **AVF-649** | Outhwaite Park | 11 | AV263 | A209 | | | Smith | y | y | |
| **AVF-650** | Outhwaite Park | 11 | AV264 | A210 | | | Smith | y | y | |
| **AVF-651** | Outhwaite Park | 11 | AV265 | A211 | | | Smith | y | y | |
| **AVF-652** | Outhwaite Park | 11 | AV266 | A212 | | | Smith | y | y | |
| **AVF-653** | Outhwaite Park | 11 | AV267 | A213 | | | Smith | y | y | |
| **AVF-654** | Outhwaite Park | 11 | AV268 | A214 | | | Smith | y | | |
| **AVF-655** | | | AV126 | | | 43935 | | y | | |
| **AVF-656** | Wiri Mt. | 50 | AV127 | | | 43936 | | y | | |
| **AVF-657** | | | AV136 | | | 43997 | | y | | |
| **AVF-658** | Little Rangitoto | 14 | AV154 | | | 44015 | | y | | |
| **AVF-659** | | | AV155 | | | 44070 | | y | | |
| **AVF-660** | Outhwaite Park | 11 | AV227 | | | 44702 | | y | | |
| **AVF-661** | Outhwaite Park | 11 | AV228 | | | 44703 | | y | | |
| **AVF-662** | | | AV433 | | | | | y | y | |
| **AVF-663** | | | AV434 | | | | | | | |
| **AVF-665** | Mt Wellington? | 25 | | | ALC-M12-3 | | | | | |
| **AVF-666** | Mt Wellington? | 25 | | | ALC-M22-1 | | | | | |
| **AVF-667** | Mt Wellington? | 25 | | | ALC-M22-3 | | | | | |

| AVF no | Volcano | No | AV no | A no | Other numbers | Collection no | Collector | XRF data* | ICP-MS data* | Paper/thesis |
|---|---|---|---|---|---|---|---|---|---|---|
| **AVF-668** | Mt Wellington? | 25 | | | ALC-M22-4 | | | | | |
| **AVF-669** | Mt Wellington? | 25 | | | ALC-M22-6 | | | | | |
| **AVF-670** | Mt Wellington? | 25 | | | ALC-M3-2 | | | | | |
| **AVF-671** | Mt Wellington? | 25 | | | ALC-M3-4 | | | | | |
| **AVF-672** | Mt Wellington? | 25 | | | ALC-M3-6 | | | | | |
| **AVF-673** | Mt Wellington? | 25 | | | ALC-M9-1 | | | | | |
| **AVF-674** | Mt Wellington? | 25 | | | ALC-M9-2 | | | | | |
| **AVF-675** | Mt Wellington? | 25 | | | ALC-M8-1 | | | | | |
| **AVF-676** | Mt Wellington? | 25 | | | ALC-M29-2 | | | | | |
| **AVF-677** | Mt Wellington? | 25 | | | ALC-M29-4 | | | | | |
| **AVF-678** | Mt Wellington? | 25 | | | ALC-M16-2 | | | | | |
| **AVF-679** | Mt Wellington? | 25 | | | ALC-M16-4 | | | | | |
| **AVF-680** | Mt Wellington? | 25 | | | ALC-M18-2 | | | | | |
| **AVF-681** | Mt Wellington? | 25 | | | ALC-M18-3 | | | | | |
| **AVF-682** | Domain | 10 | | | | | | | | |
| **AVF-683** | Domain | 10 | | | | | | | | |
| **AVF-684** | Purchas Hill | 26 | | | B0 | | | | y | |
| **AVF-685** | Purchas Hill | 26 | | | B1 | | | | y | |
| **AVF-686** | Purchas Hill | 26 | | | B2 | | | | y | |
| **AVF-687** | Purchas Hill | 26 | | | B4 | | | | y | |
| **AVF-688** | Purchas Hill | 26 | | | B5 | | | | y | |
| **AVF-689** | Purchas Hill | 26 | | | B6core | | | | y | |
| **AVF-690** | Purchas Hill | 26 | | | B6rim | | | | y | |
| **AVF-691** | Purchas Hill | 26 | | | B7 | | | | y | |
| **AVF-692** | Purchas Hill | 26 | | | B8 | | | | y | |
| **AVF-693** | Purchas Hill | 26 | | | B12 | | | | y | |
| **AVF-694** | Purchas Hill | 26 | | | B13 | | | | y | |
| **AVF-695** | Purchas Hill | 26 | | | "upper" | | | | y | |
| **AVF-696** | Purchas Hill | 26 | | | "lower" | | | | y | |
| **AVF-697** | Mt Albert | 15 | | | HC01 | | | y | | |
| **AVF-699** | Mt Roskill | 16 | | | HC03 | | | y | | |
| **AVF-700** | Mt Roskill | 16 | | | HC04 | | | y | | |
| **AVF-701** | Mt Hobson | 21 | | | HC05 | | | y | | |
| **AVF-702** | St Heliers | 28 | | | HC06 | | | y | | |
| **AVF-703** | Mt Albert | 15 | | | HC07 | | | y | | |
| **AVF-704** | Taylors Hill | 29 | | | HC08 | | | y | | |
| **AVF-705** | Mt Hobson/Mt Mangere | 21 | | | HC09 | | | y | | |
| **AVF-706** | Mt Albert | 15 | | | HC10 | | | | | |
| **AVF-707** | Mt Roskill | 16 | | | HC11 | | | | | |
| **AVF-708** | Mt Hobson | 21 | | | HC12 | | | | | |
| **AVF-709** | Auckland Tephra? | | | | ADIS | | | | | |
| **AVF-710** | Auckland Tephra? | | | | ADIL | | | | | |
| **AVF-711** | Auckland Tephra? | | | | GP1 | | | | | |
| **AVF-712** | Auckland Tephra? | | | | GP2 | | | | | |
| **AVF-713** | Auckland Tephra? | | | | GP3 | | | | | |
| **AVF-714** | Auckland Tephra? | | | | GP5 | | | | | |
| **AVF-715** | Auckland Tephra? | | | | GP6 | | | | | |
| **AVF-716** | Auckland Tephra? | | | | GP7 | | | | | |
| **AVF-717** | Auckland Tephra? | | | | GP8 | | | | | |
| **AVF-718** | Auckland Tephra? | | | | GP9 | | | | | |
| **AVF-719** | Auckland Tephra? | | | | GP10 | | | | | |
| **AVF-720** | Auckland Tephra? | | | | GP11 | | | | | |
| **AVF-721** | Auckland Tephra? | | | | GP12 | | | | | |
| **AVF-722** | Auckland Tephra? | | | | GP13 | | | | | |
| **AVF-723** | Auckland Tephra? | | | | GP14 | | | | | |
| **AVF-724** | Auckland Tephra? | | | | GP15 | | | | | |
| **AVF-725** | Auckland Tephra? | | | | GP16 | | | | | |
| **AVF-726** | Auckland Tephra? | | | | GP17 | | | | | |
| **AVF-727** | Crater Hill? | 47 | | | GP18 | | | | | |
| **AVF-728** | | | | | GP19 | | | | | |
| **AVF-729** | | | | | GP20 | | | | | |
| **AVF-731** | Pupuke | 1 | | | SS/F/82 | | | | | |
| **AVF-732** | Pupuke | 1 | | | SS/F/83 | | | | | |
| **AVF-733** | Pupuke | 1 | | | SS/F/84 | | | | | |
| **AVF-734** | Pupuke | 1 | | | SS/F/86 | | | | | |
| **AVF-735** | Pupuke | 1 | | | SS/F/87 | | | | | |
| **AVF-736** | Pupuke | 1 | | | SS/9/85 | | | | | |
| **AVF-737** | | | | | ? | | | | | |
| **AVF-738** | | | | | ? | | | | | |
| **AVF-739** | Mt Eden | 18 | | | JE-01 | 59420 | Eade | y | y | Eade 2009 |
| **AVF-740** | Mt Eden | 18 | | | JE-02 | 59421 | Eade | y | y | Eade 2009 |
| **AVF-741** | Mt Eden | 18 | | | JE-03 | 59422 | Eade | y | y | Eade 2009 |
| **AVF-742** | Mt Eden | 18 | | | JE-04 | 59423 | Eade | y | y | Eade 2009 |
| **AVF-743** | Mt Eden | 18 | | | JE-34 | 59460 | Eade | y | y | Eade 2009 |
| **AVF-744** | Mt Eden | 18 | | | JE-35 | 59461 | Eade | y | y | Eade 2009 |
| **AVF-745** | Mt Eden | 18 | | | JE-36 | 59463 | Eade | y | y | Eade 2009 |
| **AVF-746** | Mt Eden | 18 | | | JE-44 | 59432 | Eade | y | y | Eade 2009 |
| **AVF-747** | Mt Eden | 18 | | | JE-45 | 59433 | Eade | y | y | Eade 2009 |
| **AVF-748** | Mt Eden | 18 | | | JE-46 | 59434 | Eade | y | y | Eade 2009 |
| **AVF-749** | Mt Eden | 18 | | | JE-47 | 59462 | Eade | y | y | Eade 2009 |

| AVF no | Volcano | No | AV no | A no | Other numbers | Collection no | Collector | XRF data* | ICP-MS data* | Paper/thesis |
|---|---|---|---|---|---|---|---|---|---|---|
| **AVF-750** | Mt Eden | 18 | | | JE-48 | 59464 | Eade | y | y | Eade 2009 |
| **AVF-751** | Mt Eden | 18 | | | JE-49 | 59469 | Eade | y | y | Eade 2009 |
| **AVF-752** | Mt Eden | 18 | | | JE-65 | 59439 | Eade | y | y | Eade 2009 |
| **AVF-753** | Mt Eden | 18 | | | JE-66 | 59440 | Eade | y | y | Eade 2009 |
| **AVF-754** | Three Kings | 17 | | | JE-09 | 59448 | Eade | y | y | Eade 2009 |
| **AVF-755** | Three Kings | 17 | | | JE-10 | 59450 | Eade | y | y | Eade 2009 |
| **AVF-756** | Three Kings | 17 | | | JE-11 | 59451 | Eade | y | y | Eade 2009 |
| **AVF-757** | Three Kings | 17 | | | JE-15 | 59453 | Eade | y | y | Eade 2009 |
| **AVF-758** | Three Kings | 17 | | | JE-26 | 59449 | Eade | y | y | Eade 2009 |
| **AVF-759** | Three Kings | 17 | | | JE-27 | 59452 | Eade | y | y | Eade 2009 |
| **AVF-760** | Three Kings | 17 | | | JE-28 | 59454 | Eade | y | y | Eade 2009 |
| **AVF-761** | Three Kings | 17 | | | JE-29 | 59455 | Eade | y | y | Eade 2009 |
| **AVF-762** | Three Kings | 17 | | | JE-30 | 59456 | Eade | y | y | Eade 2009 |
| **AVF-764** | Three Kings | 17 | | | JE-32 | 59458 | Eade | y | y | Eade 2009 |
| **AVF-765** | Three Kings | 17 | | | JE-33 | 59459 | Eade | y | y | Eade 2009 |
| **AVF-766** | Three Kings | 17 | | | JE-37 | 59465 | Eade | y | y | Eade 2009 |
| **AVF-767** | Three Kings | 17 | | | JE-38 | 59466 | Eade | y | y | Eade 2009 |
| **AVF-768** | Three Kings | 17 | | | JE-39 | 59467 | Eade | y | y | Eade 2009 |
| **AVF-769** | Three Kings | 17 | | | JE-40 | 59468 | Eade | y | y | Eade 2009 |
| **AVF-770** | Three Kings | 17 | | | JE-50 | 59470 | Eade | y | y | Eade 2009 |
| **AVF-771** | Three Kings | 17 | | | JE-51 | 59471 | Eade | y | y | Eade 2009 |
| **AVF-772** | Three Kings | 17 | | | JE-52 | | Eade | y | y | Eade 2009 |
| **AVF-773** | Three Kings | 17 | | | JE-53 | | Eade | y | y | Eade 2009 |
| **AVF-774** | Three Kings | 17 | | | JE-54 | | Eade | y | y | Eade 2009 |
| **AVF-775** | Three Kings | 17 | | | JE-55 | 59475 | Eade | y | y | Eade 2009 |
| **AVF-776** | Three Kings | 17 | | | JE-56 | 59476 | Eade | y | y | Eade 2009 |
| **AVF-777** | Three Kings | 17 | | | JE-57 | 59477 | Eade | y | y | Eade 2009 |
| **AVF-778** | Three Kings | 17 | | | JE-58 | 59478 | Eade | y | y | Eade 2009 |
| **AVF-779** | Three Kings | 17 | | | JE-59 | 59479 | Eade | y | y | Eade 2009 |
| **AVF-780** | Three Kings | 17 | | | JE-60 | 59480 | Eade | y | y | Eade 2009 |
| **AVF-781** | Three Kings | 17 | | | JE-62 | 59436 | Eade | y | y | Eade 2009 |
| **AVF-782** | Three Kings | 18 | | | JE-67 | 59441 | Eade | y | y | Eade 2009 |
| **AVF-783** | Three Kings | 17 | | | JE-68 | 59442 | Eade | y | y | Eade 2009 |
| **AVF-784** | Three Kings | 17 | | | JE-69 | 59443 | Eade | y | y | Eade 2009 |
| **AVF-785** | One Tree Hill | 23 | | | JE-14 | | Eade | y | y | Eade 2009 |
| **AVF-786** | Mt Richmond | 31 | | | JE-13 | | Eade | y | y | Eade 2009 |
| **AVF-787** | McLennan Hills | 30 | | | JE-05 | | Eade | y | y | Eade 2009 |
| **AVF-788** | McLennan Hills | 30 | | | JE-06 | | Eade | y | y | Eade 2009 |
| **AVF-789** | McLennan Hills | 30 | | | JE-12 | | Eade | y | y | Eade 2009 |
| **AVF-790** | Mt St John | 20 | | | JE-07 | 59444 | Eade | y | y | Eade 2009 |
| **AVF-791** | Mt St John | 20 | | | JE-08 | 59447 | Eade | y | y | Eade 2009 |
| **AVF-792** | Mt St John | 20 | | | JE-18 | 59424 | Eade | y | y | Eade 2009 |
| **AVF-793** | Mt St John | 20 | | | JE-19 | 59425 | Eade | y | y | Eade 2009 |
| **AVF-794** | Mt St John | 20 | | | JE-20 | 59426 | Eade | y | y | Eade 2009 |
| **AVF-796** | Mt St John | 20 | | | JE-22 | 59428 | Eade | y | y | Eade 2009 |
| **AVF-797** | Mt St John | 20 | | | JE-23 | 59429 | Eade | y | y | Eade 2009 |
| **AVF-798** | Mt St John | 20 | | | JE-24 | 59445 | Eade | y | y | Eade 2009 |
| **AVF-799** | Mt St John | 20 | | | JE-25 | 59446 | Eade | y | y | Eade 2009 |
| **AVF-800** | Mt St John | 20 | | | JE-42 | 59430 | Eade | y | y | Eade 2009 |
| **AVF-801** | Mt St John | 20 | | | JE-43 | 59431 | Eade | y | y | Eade 2009 |
| **AVF-802** | Mt St John | 20 | | | JE-61 | 59435 | Eade | y | y | Eade 2009 |
| **AVF-803** | Mt St John | 20 | | | JE-63 | | Eade | y | y | Eade 2009 |
| **AVF-804** | Mt St John | 20 | | | JE-64 | 59438 | Eade | y | y | Eade 2009 |
| **AVF-805** | Orakei | 13 | | | IKS801 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-806** | Orakei | 13 | | | IKS802 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-807** | Orakei | 13 | | | IKS803 | | Smith/Nemeth/Cronin | | | |
| **AVF-808** | Orakei | 13 | | | IKS804 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-809** | Orakei | 13 | | | IKS805 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-810** | Orakei | 13 | | | IKS806 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-811** | Orakei | 13 | | | IKS807 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-812** | Orakei | 13 | | | IKS808 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-813** | Orakei | 13 | | | IKS809 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-814** | Orakei | 13 | | | IKS810 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-815** | Orakei | 13 | | | IKS811 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-816** | Orakei | 13 | | | IKS812 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-817** | Orakei | 13 | | | IKS813 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-818** | Orakei | 13 | | | IKS814 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-819** | Orakei | 13 | | | IKS815 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-820** | Orakei | 13 | | | IKS816 | | Smith/Nemeth/Cronin | | | |
| **AVF-821** | Orakei | 13 | | | IKS817 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-822** | Orakei | 13 | | | IKS818 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-823** | Orakei | 13 | | | IKS819 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-824** | Orakei | 13 | | | IKS820 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-825** | Orakei | 13 | | | IKS821 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-826** | Orakei | 13 | | | IKS822 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-828** | Panmure | 27 | | | IKS824 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-829** | Panmure | 27 | | | IKS825 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-830** | Panmure | 27 | | | IKS826 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-831** | Panmure | 27 | | | IKS827 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-832** | Panmure | 27 | | | IKS828 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-833** | Panmure | 27 | | | IKS829 | | Smith/Nemeth/Cronin | y | y | |

| AVF no | Volcano | No | AV no | A no | Other numbers | Collection no | Collector | XRF data* | ICP-MS data* | Paper/thesis |
|---|---|---|---|---|---|---|---|---|---|---|
| **AVF-834** | Panmure | 27 | | | IKS830 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-835** | Panmure | 27 | | | IKS831 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-836** | Panmure | 27 | | | IKS832 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-837** | Panmure | 27 | | | IKS833 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-838** | Panmure | 27 | | | IKS834 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-839** | Panmure | 27 | | | IKS835 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-840** | Panmure | 27 | | | IKS836 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-841** | Panmure | 27 | | | IKS837 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-842** | Panmure | 27 | | | IKS838 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-843** | Panmure | 27 | | | IKS839 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-844** | Panmure | 27 | | | IKS840 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-845** | Panmure | 27 | | | IKS841 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-846** | Panmure | 27 | | | IKS842 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-847** | Panmure | 27 | | | IKS843 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-848** | Panmure | 27 | | | IKS844 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-849** | North Head | 6 | | | IKS847 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-850** | North Head | 6 | | | IKS848 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-851** | North Head | 6 | | | IKS849 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-852** | North Head | 6 | | | IKS850 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-853** | North Head | 6 | | | IKS851 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-854** | Pukekiwiri | 33 | | | IKS852 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-855** | Pukekiwiri | 33 | | | IKS853 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-856** | Pukekiwiri | 33 | | | IKS855 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-857** | Maungataketake | 45 | | | IKS856 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-858** | Maungataketake | 45 | | | IKS857 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-859** | Maungataketake | 45 | | | IKS858 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-861** | Maungataketake | 45 | | | IKS860 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-862** | Maungataketake | 45 | | | IKS861 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-863** | Maungataketake | 45 | | | IKS862 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-864** | Three kings | 17 | | | IKS863 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-865** | Three kings | 17 | | | IKS864 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-866** | Three kings | 17 | | | IKS865 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-867** | Three kings | 17 | | | IKS866 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-868** | Three kings | 17 | | | IKS867 | | Smith/Nemeth/Cronin | y | y | |
| **AVF-869** | Maungataketake | 45 | | | LMA001 | | McGee 6/11/08 | y | y | |
| **AVF-870** | Maungataketake | 45 | | | LMA002 | | McGee 6/11/08 | y | y | |
| **AVF-871** | Mt Roskill | 16 | | | LMA004 | | McGee 6/11/08 | y | y | |
| **AVF-872** | Mt Roskill | 16 | | | LMA005 | | McGee 6/11/08 | y | y | |
| **AVF-873** | Mt Smart? | | | | LMA007 | | McGee 6/11/08 | y | y | |
| **AVF-874** | Mt Richmond | 31 | | | LMA009 | | McGee 6/11/08 | y | y | |
| **AVF-875** | Albert Park | 9 | | | | | McGee 09 | y | y | |
| **AVF-876** | Pukaki | 46 | | | PUK_OG1 | | Zawalna-Geer 1/7/09 | y | y | |
| **AVF-877** | Pukaki | 46 | | | PUK_OG2 | | Zawalna-Geer 1/7/09 | y | y | |

*y = soon to be analysed (July 09)