

AN ABSTRACT OF THE THESIS OF

Federico Cernuschi Rodillo for the degree of Master of Science in Geology presented on February 11, 2011.

Title: Geology of the Cretaceous Lascano-East Intrusive Complex: Magmatic Evolution and Mineralization Potential of the Merín Basin, Uruguay

Abstract approved:

John H. Dilles

The Cretaceous Merín aborted-rift basin of eastern Uruguay is composed of sub-alkaline Paraná-Etendeka province basaltic flows and shallow intrusives (~133 to 131 Ma), rhyolitic ignimbrites (~130 to 128 Ma) and associated mildly alkaline to alkaline intrusions and volcanic rocks (~128 to 127 Ma). Four intrusive complexes from 20 to >30 kilometers wide are identified by circular positive gravity and cospatial magnetic anomalies and are aligned in a northeast-southwest trend. Whereas the outcropping Valle Chico complex is mainly composed by mildly alkaline syenites, drilling at Lascano East revealed mostly alkaline gabbros and trachytes. The Lascano-West and San Luis concealed complexes are inferred by the location of the aeromagnetic and gravity anomalies.

Ten lithogeochemical units were identified and grouped into three rock associations. A sub-alkaline group composed of Treinta y Tres A basalts, Treinta y Tres

B basalts and gabbros, Lavalleja rhyolitic ignimbries and San Miguel granodiorite granophyres; a mildly alkaline group including the Santa Lucía basalts and gabbros, Aiguá rhyolites, Valle Chico syenites and India Muerta rhyolites; and an alkaline group including the Lascano alkaline gabbro to trachyte series and the Arrayán olivine basalts. The only observed sedimentary rocks are conglomerates grouped as the Quebracho Formation. Melting of a shallow mantle source (depleted mantle) combined with abundant crustal assimilation likely produced the diversity of the sub-alkaline magmatic rocks. The mildly alkaline and alkaline rocks were likely produced by mixing of this source with a deeper mantle source (ocean island basalt – like), or by progressively deeper mantle melting and lowering degrees of partial melting.

Hydrothermally altered and mineralized rocks were identified in the central zone of the complex where the sub-alkaline and mildly alkaline lavas are intruded by mildly alkaline to alkaline gabbros and trachyte dikes on top of inferred mafic alkaline intrusions. The mineralization and alteration can be divided into two associations. First, potassic hydrothermally altered zones and younger superimposed intermediate argillic alteration in sub-alkaline to mildly alkaline felsic rocks are cut by similarly altered Lascano alkaline series dikes. Pyrite disseminations together with pyrite, quartz-pyrite and fluorite veins in these rocks are associated with weak gold, bismuth, thallium and molybdenum anomalies. Second, local potassic alteration of mildly alkaline basalts cut by the Lascano alkaline dikes, showing sparse millimetric to one centimeter quartz-pyrite and phyllosilicate-pyrite veins associated to weak molybdenum anomalies. Local quartz-

chalcopyrite-pyrite veins and copper anomalies were detected in the contact of the basalts with one Santa Lucía mildly alkaline gabbro.

No evidence of mineralization is found in the Valle Chico complex, the only outcropping complex of the Merín basin. The only other evidence of mineralization in the basin are fluorite veins enriched in tungsten, boron and yttrium cutting the Precambrian basement near the basin edge. The lack of mineralization in the Valle Chico complex could be explained by differences in the level of erosion throughout the basin due to the interplay of subsidence caused by mafic intrusion and different crustal thicknesses at each side of the Sierra Ballena shear zone. While Valle Chico was more deeply eroded, the possibly mineralized roof wall-rocks were preserved in the concealed complexes to the East.

The Merín basin was broadly contemporaneous and close in space to the magmatism in the Luderitz and Damaraland basins in Namibia and more distal complexes in Brazil. These were possibly linked to similar melt sources, evolutionary paths, and emplacement mechanisms, related to the opening of the southern Atlantic Ocean in the Paraná – Etendeka provinces. Based on typical mineralization in complexes from Brazil and Namibia the mineralization potential of the Merín basin may also expand to niobium, zirconium, phosphate, uranium, thorium and rare earths. These ores may be related to possible concealed carbonatites or other alkaline rocks not yet discovered in the Merín basin. However, the conditions for the formation of laterites, which play an important role in the economic deposits of Brazil were probably unlikely.

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Geology of the Cretaceous Lascano-East Intrusive Complex: Magmatic Evolution and
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by
Federico Cernuschi Rodillosso

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I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

Federico Cernuschi Rodilosso, Author

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CONTRIBUTION OF AUTHORS

Dr. John H. Dilles assisted with the design of the research, field work and data interpretation for the manuscript presented in chapter 2. Dr. Adam J.R. Kent assisted with the data interpretation for lithogeochemistry and trace element modeling presented in the same chapter.

TABLE OF CONTENTS

	<u>Page</u>
Chapter 1: Introduction	1
Introduction to the thesis.....	1
Introduction to the geology of Uruguay	5
Precambrian basement	7
The Paraná Basin in Uruguay	10
Jurassic-Cretaceous rift basins.....	10
Cenozoic	12
Figures	13
References.....	16
 Chapter 2: Geology, geochemistry and geochronology of the Cretaceous Lascano-East sub-alkaline to alkaline intrusive complex and magmatic evolution of the Merín basin, Uruguay.....	 22
Abstract.....	23
Introduction.....	25
Geological setting	28
The Merín basin	30
Previous geochemical studies	32
Methods	33

TABLE OF CONTENTS (Continued)

	<u>Page</u>
Results.....	37
Geochronology.....	37
Geology.....	38
Lithogeochemistry and Petrology	46
Specific gravity and magnetic susceptibility	52
Discussion.....	52
Age of igneous rocks	52
Stratigraphy and shape of intrusions.....	56
Interpretation of the geophysical anomalies	60
Petrogenesis of igneous rocks and temporal variation.....	63
Proposed origin of igneous rocks at Lascano and the Merin basin	66
Comparison with the Paraná large igneous province and associated rift basins	68
Comparison with the Damaraland and Ludertiz complexes.....	69
Conclusions.....	74
Figures and Tables	78
References.....	102

TABLE OF CONTENTS (Continued)

	<u>Page</u>
Chapter 3: Preliminary study of the hydrothermal alteration and mineralization in the Cretaceous Lascano-East intrusive complex, Merín basin, Uruguay.....	110
Abstract.....	110
Introduction.....	112
Methods	114
Results.....	115
Alteration in felsic rocks.....	117
Alteration in mafic rocks	121
Discussion and Conclusions	122
Figures and Tables	126
References.....	139
 Chapter 4: Review of mineralization and ore deposits in Cretaceous intrusive complexes from Brazil and Namibia and mineralization potential of the Cretaceous intrusive complexes from the Merín basin, Uruguay.....	 141
Abstract.....	141
Introduction.....	142
Mineralization in sub-alkaline to alkaline anorogenic intrusive complexes.....	145
Mineralization examples from the Damaraland alkaline province	147

TABLE OF CONTENTS (Continued)

	<u>Page</u>
Granitic complexes	147
Peralkaline complexes	148
Complexes with carbonatites	149
Examples of southern Brazil	149
Complexes with carbonatites	150
Complexes with no carbonatites	150
Fluorite Mineralization in the Santa Catarina district.....	151
Discussion	152
Magmatic hydrothermal mineralization	153
Fluorite veins	154
Carbonatite potential.....	155
Erosion levels, implications for mineralization	156
Laterite potential	157
Conclusions.....	157
Figures	160
References.....	162

TABLE OF CONTENTS (Continued)

	<u>Page</u>
Chapter 5: Conclusions.....	165
Bibliography	171
Appendices.....	185

LIST OF APPENDICES

<u>Appendix</u>	<u>Page</u>
1- Drillhole collars location	186
2 – Whole rock analysis.....	187
3 – $^{40}\text{Ar}/^{39}\text{Ar}$ data	318
4 – Photographs of Merin basin rocks	322
5 – Short wave infrared spectroscopy data	336
6 – X-Ray diffraction data	339

LIST OF FIGURES

<u>Figure</u>	<u>Page</u>
1 – Simplified geologic map of Uruguay.....	13
2 – Geophysical images from Uruguay and Lascano	14
3 - Geological map of the Merín basin and its surrounding basement	78
4 – $^{40}\text{Ar}/^{39}\text{Ar}$ isotopic ages.....	84
5- Outcrop and drillhole columnar sections from the Merín basin.....	84
6- Columnar sections from drillhole data along cross section A' - A'' - A'''	85
7 – Zr versus Nb plot	86
8 – Nb/Zr versus SiO_2 plot	87
9 – Total alkalis ($\text{K}_2\text{O} + \text{Na}_2\text{O}$) versus silica (SiO_2).....	88
10- Spider diagrams of whole rock trace element compositions	89
11- $^{40}\text{Ar}/^{39}\text{Ar}$ and U/Pb isotopic ages of igneous rocks	91
12– Synthesis of the magmatic evolution	92
13- A' - A'' - A''' cross section over Lascano-East.....	93
14 – A - A' cross section over Lascano-West.....	94
15 – Reduced-to-pole airborne aeromagnetic image showing location of drillholes collars in Lascano-East	95
16AB – Nb/Zr versus La/Sm and La/Nb versus La/Y of mafic samples showing fractional and melting trends	96
16CD – Nb/Zr versus La/Sm and La/Nb versus La/Y of mafic samples showing mixing lines.....	97

LIST OF FIGURES (Continued)

<u>Figure</u>	<u>Page</u>
16EF – Nb/Zr versus La/Sm and La/Nb versus La/Y of mafic and felsic samples showing mixing lines	98
17 – Dy/Yb ratios for different mafic lithogeochemical units	99
18 – Simplified evolution of the magmatism in the Merín basin and Lascano-East complex.....	100
19 – Paleogeographical reconstruction of the breaking up of Gondwana ~133 Ma and location of intrusive complexes	101
20 – Drillhole columnar sections over Lascano-East complex showing alteration and mineralization zones.....	127
21 – Short wave infra-red spectra and XRD profiles of selected samples.....	128
22 – Scatter plots of illite versus muscovites bearing samples identified with SWIR showing different spectral features.	130
23 – K/Al versus Na/Al molar plots of fresh and altered samples of Lavalleja rhyolites.....	132
24 – Anomalies in fresh and altered samples of Lavalleja rhyolites.	133
25 – K/Al versus Na/Al molar plots of fresh and altered samples of India Muerta rhyolites and San Miguel granodiorite granophyres.	135
26 – K/Al versus Na/Al molar plots of Lascano trachytes	136
27 – Si/Zr versus $(Al/4 + Fe + Mg/2 + 3Ca/2 + 11Na/4)/Zr$ of fresh and altered whole rock samples of Santa Lucía gabbro and basalts plotted on a molar basis.	137
28 – Cu and Mo anomalies in altered samples of Santa Lucía basalts and gabbros..	138
29 – Alkaline complexes of the Damaraland alkaline province, Namibia.	160
30 – Alkaline complexes of Brazil.....	161

LIST OF TABLES

<u>Table</u>	<u>Page</u>
1 – Isotopic ages for the Merín basin.....	80
2 – Petrographic descriptions of igneous and sedimentary rocks of the Merín basin	82
3 – Physical and chemical characteristics of igneous and sedimentary rocks of the Merín basin	83
4 – Description of hydrothermally altered and mineralized zones in Lascano-East complex.....	126

LIST OF APPENDIX FIGURES

<u>Figure</u>	<u>Page</u>
A1 – ACME Labs QA/QC Statement.....	198
A2 – Rocks of the Merin basin 1.	322
A3 – Rocks of the Merin basin 2.	324
A4 – Rocks of the Merin basin 3.	326
A5 – Rocks of the Merin basin 4.	328
A6 – Rocks of the Merin basin 5.	330
A7 – Rocks of the Merin basin 6.	332
A8 – Rocks of the Merin basin 7.	334
A9 – XRD spectra of analyzed samples	340

LIST OF APPENDIX TABLES

<u>Table</u>	<u>Page</u>
A1 - Drillhole collar locations in Lascano-East complex.....	186
A2 – Detection limits of Whole rock analysis.....	187
A3 – Whole rock analysis originals and duplicats.....	190
A4 – Whole rock samples location and identified lithogeochemical unit	200
A5– Whole rock analysis from drillhole samples.....	216
A6– Whole rock analysis from surface samples.....	312
A7 – Sample 71907.....	318
A8 – Sample 80002.....	319
A9 – Sample 80006.....	320
A10 – Sample 79992.....	321
A10 – Identified minerals with SWIR	336
A11 – Identified minerals with XRD.....	339

LIST OF CD-ROM APPENDICES (Pocket)

Appendix I – Whole rock sample analysis

Appendix II – Complete $^{40}\text{Ar}/^{39}\text{Ar}$ data

Appendix III – Short Wave Infrared Spectroscopy, spectra, sample location and laboratory log

Appendix IV – XRD spectra

Appendix V – Digital copy of the thesis (pdf)

Appendix VI – Plate 1

LIST OF PLATES (Pocket)

Plate 1 – Cross section A-A'-A''-A''' Scale 1:1

Geology of the Cretaceous Lascano-East Intrusive Complex: Magmatic Evolution and Mineralization Potential of the Merín Basin, Uruguay

Chapter 1: Introduction

Introduction to the thesis

The bimodal Paraná - Etendeka large igneous province erupted during the early Cretaceous (Renne *et al.*, 1992, 1996; Turner *et al.*, 1994; Stewart *et al.*, 1996; Deckart *et al.*, 1998). This province is dominated by tholeiitic basalt with minor rhyolitic magmatism and has been linked to the Tristan da Cunha mantle plume through the Rio Grande Rise and the Walvis Ridge (O'Connor and Duncan, 1990). Contemporaneous and younger intrusive complexes are described in Brazil, Bolivia, Paraguay, Uruguay and Namibia (*e.g.* Jacupiranga in Brazil, Velasco province in Bolivia and Valle Chico in Uruguay (Darbyshire and Fletcher, 1979; Almeida, 1983; Fletcher and Beddoe-Stephens, 1987; Morbidelli *et al.*, 1995; Le Roex, 1996; Muzio 1999; Comin-Chiaramonti *et al.*, 1999, 2002; Biondi, 2003; Gomez *et al.*, 1990; Pirajno, 2009).

During this period, in eastern Uruguay, aborted rifting of the Precambrian basement resulted in the formation of the Santa Lucía and Merín basins. These basins are aligned in a northeast trend with erosional remnants between them and were grouped under the name of SaLaM (Santa Lucía-Aiguá-Merín, Rosello *et al.*, 1999, Figure 1).

The Merín basin preserves the largest volume of volcanic and intrusive rocks of the SaLaM and overlies a large, broad gravity anomaly (>80 mGal; Servicio Geográfico Militar, 1973) that is coincident with a magnetic anomaly. The anomaly is approximately

80 km long by 40 km wide, ellipsoidal in shape and trends in an east to northeast direction. High-resolution airborne gravity and magnetic images from Orosur Mining INC., show that this anomaly comprises four well-defined, 20 - 30 km wide circular features (Ellis and Turner, 2006, Figure 2). These anomalies form a trend along the Merín Basin rift axis, from Mariscala town in the southwest to the Merín lagoon near in the northeast, near the border with Brazil.

The southwestern ~ 20 km wide anomaly is coincident in shape with the outcrop area of the Valle Chico intrusive complex (Lustrino *et al.*, 2005). The two central anomalies are similar in size and are coincident with two zones of sub-circular outcrops of ignimbritic rhyolites. These two are named the Lascano-West and Lascano-East anomalies. The San Luis anomaly (after San Luis al Medio town) is the largest anomaly of the basin, reaching more than 30 km in diameter. The only known coincident outcrops are granodiorite granophyres and gabbro sills in its periphery.

Many theories have been proposed to explain both the regional gravity anomaly (known since the seventies), and the newly identified gravity and magnetic circular anomalies that constitute it. These hypotheses were based on limited surface mapping, one 500 meter drillhole (Puerto Gómez drillhole, DINAMGIE) and geophysical modeling. The interpretations range from concealed mafic intrusions similar to Bushveld or Trumpsberg (*e.g.* Reytmayer, 2001; Verosvlavksy *et al.*, 2002), several kilometers of basalt basin filling (Gomez Rifas and Masquelin, 1996) and, for the Lascano-West and Lascano-East anomalies, caldera structures within the Paraná rhyolite sequence (Rossello *et al.*, 1999; Conti, 2008). Soil coverage and sparse outcrops obscure the volcanic

stratigraphy and intrusive relationships, complicating the task of understanding the geology.

The main objective of this research is to describe the igneous rock units, determine their isotopic ages, reconstruct the volcanic stratigraphy, and outline the geometries of intrusions of Lascano-East complex.

Chapter 2 presents geochemical data, isotopic ages, and contact relations obtained from the first extensive drilling campaign in the basin over the Lascano-East anomaly between 2002 and 2008 by Orosur Mining Incorporated (OMI; formally Uruguay Mineral Exploration INC.). Reconnaissance mapping and limited geochemical surface samples from the rest of the Merín Basin were used to make correlations. Three other secondary objectives are also treated in chapter 2. First, trace element compositions of igneous rocks were studied to test possible petrogenetic processes that produced the observed magmatic diversity. Second, the geological, geophysical and geochemical data were used to propose a plausible genetic model for the Lascano-East complex in particular and the other intrusive complexes of the Merín basin in general. Finally, these results were compared with similar age and tectonic setting areas in Brazil and Namibia to propose correlations.

Drilling by OMI at this complex encountered hydrothermally altered rocks dominated by clay and other sheet silicate minerals associated with sparse disseminated pyrite, quartz-pyrite veins, and fluorite veins. Locally, these veins are associated with weakly anomalous gold. It also encountered quartz-chalcopyrite-pyrite veins associated with weak copper anomalies and quartz-pyrite veins associated with weakly, sparse

molybdenum and copper anomalies. A secondary objective of this research is to describe the hydrothermal alteration and mineralization found in the Lascano-East complex and discuss the possibility that the Merín basin may host concealed ore bodies associated with its intrusive complexes. To explore this objectives, chapter 3 presents geochemical data of whole rocks samples from drill-hole cores from Lascano-East complex. Whole rock geochemistry was used to identify alteration processes, whereas short wave infrared spectroscopy (SWIR) and X-ray diffraction (XRD) were used to identify hydrothermal minerals and construct alteration and mineralization assemblages and zones.

Chapter 4 summarizes the most important ore deposits associated with Cretaceous intrusive complexes peripheral to the Paraná and Etendeka large igneous provinces in South America and Africa. Mineralization potential is addressed by comparing the described stratigraphy, shapes of intrusions, hydrothermal alteration and mineralization types and styles with the intrusive complexes in the Merín basin.

Finally, chapter 5 summarizes the main conclusions of this thesis.

Since the geology of Uruguay might not be well known for the readers, a brief synthesis is offered at the end of this chapter. For comprehensive descriptions readers are referred to key papers and summary books in each section. A more detailed description of the geological features related to this thesis can be found in Chapter 2.

Introduction to the geology of Uruguay

Geological research in Uruguay has been restricted to a modern history. Early scientific investigation in the region began with emigrant geologists like Karl Walther in 1908, to research and teach in the recently created Agronomic Sciences College (1907, Facultad de Agronomía) of the National University (UdelaR, Universidad de la República Oriental del Uruguay) and the creation of the “National Drilling Institute” (Instituto Nacional de Perforaciones) in 1912 that would be later transformed into a geological survey (refer to Cernuschi and Morales Demarco, 2005; 2010). The later development of geological research has been limited. Even though the College of Humanities and Sciences (Facultad de Humanidades y Ciencias) was created in 1945, only a specialization in paleontology was offered through the biology degree. The geology department in the science college was created in 1976, with the first graduated geologist in the country around 1980. More recently, the graduate program in geosciences was created in 2010 in the Sciences College (Facultad de Ciencias) of UdelaR. Until 1980 formally trained geoscientists in the country were a few emigrant geologists plus some engineers or chemists with graduate studies in geosciences abroad. This tardy development of the profession had delayed the research as well as basic geological surveys in Uruguay. As an example the whole country is only mapped at 1/500,000 and only sparse areas are mapped to 1/100,000 or less (DINAMIGE).

Either as a consequence and/or as a cause of the problems stated above, the mineral exploration and related industry in Uruguay is limited and has only started expanding in the last decade. Similar to the development of the geosciences education

and research, an early start of the industrial mining was followed by periods of stagnation, especially in the exploration of metallic ores (Bossi and Navarro, 2000; DINAMIGE). The gold mining activities in Precambrian rocks began in the Minas de Corrales district in 1866 (department of Rivera, still active until present). Uruguay was shortly afterwards industrialized, by the construction of one of the first hydroelectric power plants in South America *ca.* 1875, together with 17 km of aerial tram to transport the ore (Chirico, 2005).

The extractive industry has only sustained development in Precambrian and Cenozoic limestone for the cement industry. In addition, most of the traditional mining industry is restricted to construction materials for internal consumption and to export to Buenos Aires, Argentina. Minor exploitation of dolostone (for the refractory industry), talc, clays (for the national ceramic industry) and ornamental rocks (such as marble, slates, granitoids, micrograbbros, agates and amethysts) has been active with different intensity through time and mostly with only local economic impact (*e.g.* Oyhançabal *et al.*, 2008; Bossi and Navarro, 2000; Morales Demarco *et al.*, 2010; Cernuschi, 2006) .

Energy resources were actively explored during the 1960's and 1970's with oil, gas and uranium exploration inland and oil and gas exploration offshore, but this period was followed by a stagnation of exploration.

The transition from the 20th to the 21st century is marked by an expansion of the limestone extraction and re-activation of metallic ore exploration such as gold and iron by international corporations (*e.g.* Orosur Mining INC. and Aratirí INC.), oil and gas by the national government (ANCAP, Administración Nacional de Combustibles, Alcohol y

Pórtland) associated with third parties, the revision and update of the national mining regulations (Código de Minería, www.presidencia.gub.uy), and initiatives to start an airborne geophysical survey of the whole country (DINAMIGE).

The country hosts a diverse geological record within a relatively small political boundary (176,215 km²). The main geological features are: 1) an Archean to Proterozoic basement cropping out in the south (~ 40% of the country) as well as in two small windows through the Paleozoic to Mesozoic sediments and basaltic flows of the Paraná basin in the north; 2) northeast trending Jurassic to Cretaceous aborted rifts basins associated to the opening of southern Atlantic Ocean in the southeast; and 3) sparse Cenozoic sedimentary rocks throughout the country (Figure 1).

Precambrian basement

Precambrian basement rocks crop out over most of the southern part of the country, as well as in two small windows through the Phanerozoic Paraná basin in the north. The basement comprises four different terranes separated by continental scale shear zones (Figure 1).

The Piedra Alta terrane (Bossi *et al.*, 1993) consists of three east-west metavolcanic and metasedimentary belts separated by mylonitic zones formed ~2000±100 Ma through east-west low angle thrust faults. These rocks were later intruded by an east-west gabbro-diorite dike swarm at 1700 Ma (Dalla Salda *et al.*, 1988; Cingolani *et al.*, 1997; Hartmann *et al.*, 2001; Teixeira *et al.*, 1999; Halls *et al.*, 2001).

The Paleo-proterozoic ortho- and para-amphibolites of the Tandilia terrane are separated by the sinistral mylonitic shear zone of Colonia (Bossi *et al.*, 2005). Both the

Tandilia and Piedra Alta terranes are bounded to the east by the Sarandí del Yí – Piriápolis shear zone (Bossi *et al.*, 1993). Lying to the east of this shear is the Nico Pérez Terrane.

The Nico Pérez terrane consists of a complex mixture of Archean to Cambrian rocks in a predominant north to north east structural arrangement, but its geology is not fully understood. It is probably composed of several amalgamated terranes (see Mallman *et al.*, (2004) and Bossi and Cingonali (2009) for a comprehensive review). The northern and central part of this terrane comprises: ~ 3.4 Ga mafic, ultramafic and tonalitic intrusives intercalated with metacherts metamorphized in amphibolite facies of La China complex (*e.g.* Hartmann *et al.*, 2001); ~ 2.7-3.2 Ga metaconglomerates, quartzites, gneisses, schists, metalimestones-dolostones of Las Tetras complex (*e.g.* Campal and Schipilov, 1999); and ~ 2.2 Ga granitoids (amphibolite and granulite facies) intercalated with banded iron formations of the Valentines granulitic complex (*e.g.* Bossi *et al.*, 1998). These lithologies were then intruded by the ~ 1.7 Ga Illescas rapakivi granite and several Mesoproterozoic diorites and granodiorites (*e.g.* Campal and Schipilov, 1999). The southern end of this terrane includes: metabasalt to andesite lavas and rhyolitic tuffs and breccias intercalated with meta-limestones, sandstones, siltstones and claystones, and small mafic bodies, of the Lavalleya Metamorphic complex (*e.g.* Sánchez Betucci, 1998); mylonitic granites of the Carapé complex (*e.g.* Sánchez Betucci, 1998); and stromatolitic limestones, dolostones, breccias and metaclaystones of the Mesoproterozoic Mina Verdún Group (*e.g.* Poiré *et al.*, 2005). A Neoproterozoic to Cambrian succession of low grade metamorphic conglomerates, sandstones, cherts, banded iron formations,

stromatolitic limestones and claystones of the Grupo Arroyo del Soldado (Gaucher *et al.*, 1996, 1998) overlies some of the previously mentioned rock groups. The younger rocks are Cambrian syenitic and granitic intrusives, mostly intruding the eastern margin of the terrane (*e.g.* Las Animas Complex).

The Sierra Ballena shear zone (Bossi & Campal, 1992) separates the Nico Pérez terrane from the Cuchilla Dionisio terrane (Bossi & Campal 1992) to the east. This terrane also presents a complex geological evolution not fully understood until relatively recently (refer to Bossi and Gaucher (2004) for a comprehensive review). The older rocks consists of a Paleo-proterozoic to Neo-proterozoic granulitic orthogneisses, biotite gneisses and migmatites. This is overlain by low metamorphic grade turbiditic sequences of metasediments and siltstones of ~ 1540 Ma (Preciozzi *et al.*, 1999) of the Rocha group. Both units were then intruded by several granitoids ranging from 680 to 555 Ma. Other less well known and more restricted units are described in Bossi and Gaucher (2004). Since this terrane is the basement of the Merín basin a more detailed description of its geology is offered in Chapter 2.

A proposed model suggests that the Piedra Alta and Tandilia terranes were amalgamated previous to the activation of the Sarandí del Yí – Piriápolis Shear Zone and the dextral juxtaposition with the Nico Perez terrane at ~ 1200 Ma. The Cuchilla Dionisio Terrane was then emplaced to the east through the sinistral movement of the Sierra Ballena Shear zone at ~ 530 Ma, also sinistrally reactivating the Sarandí del Yí-Piriapolis shear zone (*e.g.* Bossi & Gaucher, 2004, Figure 1).

The Paraná Basin in Uruguay

In the Paraná Basin of northern Uruguay, the basement is covered by several intra-cratonic Gondwanaland sedimentary and volcanic sequences that range from Devonian to late Cretaceous. Readers are referred to Veroslavsky *et al.* (2004, 2005, 2006) and Bossi *et al.* (1998), for a comprehensive review. The main units are marine Devonian sandstones, claystones and siltstones of the Durazno Group (Bossi, 1966); a late Carboniferous to late Permian sequence composed from base to top of glacial diamictites, rhythmites, claystones, deltaic to intracratonic marine sandstones to organic rich claystones that grade into aeolian sandstones (*e.g.* de Santa Ana *et al.*, 2006); and late Jurassic intra-continental sedimentary sequence composed of siltstones and aeolian sandstones (*e.g.* Bossi *et al.*, 1998). These units are overlain by Jurassic – Cretaceous Paraná basalt flows, which are grouped under the name of Arapey Formation (Bossi, 1966) and exceed 1000 m thickness (de Santa Ana *et al.*, 2006). Associated dikes and sills are grouped under the Cuaró, Gaspar and Itacumbú Formations (*e.g.* Bossi *et al.*, 1998; de Santa Ana *et al.*, 2006).

Sedimentation in the basin continued until late Cretaceous as alluvial and fluvial siltstones and sandstones, usually grouped under the name of Cuenca Litoral del Río Uruguay (Goso & Perea, 2003).

Jurassic-Cretaceous rift basins

In the southern edge of the Paraná basin, during the Jurassic – Cretaceous rifting of the southern Atlantic Ocean, the Santa Lucía and Merín aborted rift basins were developed in a northeast trend, and are grouped under the name of *SaLAM* (Santa Lucía

– Aiguá – Merín) lineament (Rossello *et al.*, 1999). Other rift basins, currently offshore, were also formed during that time (*e.g.* Punta del Este basin, Veroslavsky *et al.*, 2003). These basins are filled by sub-alkaline bimodal rocks that are part of the Parana-Etendeka magmatism. The basaltic tholeiitic flows are grouped as the Puerto Gómez formation (Bossi, 1966) and the rhyolitic lavas and pyroclastic are grouped as the Arequita formation (Bossi, 1966). The Valle Chico intrusive complex is the only previously recognized intrusive complex in the Merín basin (Muzio, 2000; Lustrino *et al.*, 2005). It crops out in the southwest end of the basin and was emplaced from 133 to 127 Ma (Lustrino *et al.*, 2005). It is composed of coarse-grained quartz syenites rimmed by fine- to medium-grained quartz syenites in the northeast, and quartz syenites, minor granites and monzo-granites and porphyritic trachytes in the southeast (Lustrino *et al.*, 2005). Sub-alkaline intrusive rocks are also identified in the Merín basin. The porphyritic to equigranular quartz-feldspar San Miguel granodioritic granophyres which are themselves intruded by pyroxene-plagioclase-olivine gabbro sills crops out in the northwest end of the basin near the town of 19 de Abril and locally near Lascano (Muzio *et al.*, 2009; Conti, 2008).

Most of the sedimentary infill is preserved in the Santa Lucía basin, and it is composed of alluvial deposits of red-colored, coarse polymictic conglomerates and sandy conglomerates of the Cañada Solís Formation (de Santa Ana and Ucha, 1994), lacustrine deposits of grey to black, organic-rich claystones and siltstones of the Castellanos Formation (Zambrano, 1975), and alluvial and aeolian deposits gradational with the former units and consisting of arkosic sandstones of the Migués Formation (Bossi, 1966).

Drilling in the Santa Lucía basin intercepted a thickness of more than 2000 m of these sedimentary units as well as minor intercalations of Puerto Gómez Formation basalts (de Santa Ana and Ucha, 1994).

Cenozoic

Cenozoic alluvial and fluvial claystone, siltstones and sandstones were deposited unconformably on top of the Precambrian basement, the Paraná basin deposits, and Merin basin deposits during several transgressive and regressive cycles along the margin of the Uruguay and Río de la Plata rivers and the Atlantic Ocean. During the Paleocene and Eocene several paleosols with calcrete, ferricretes and silcretes were formed throughout the region. Refer to Bossi *et al.*, 1998 and Veroslavsky *et al.*, 2006 for a comprehensive review.

Figures

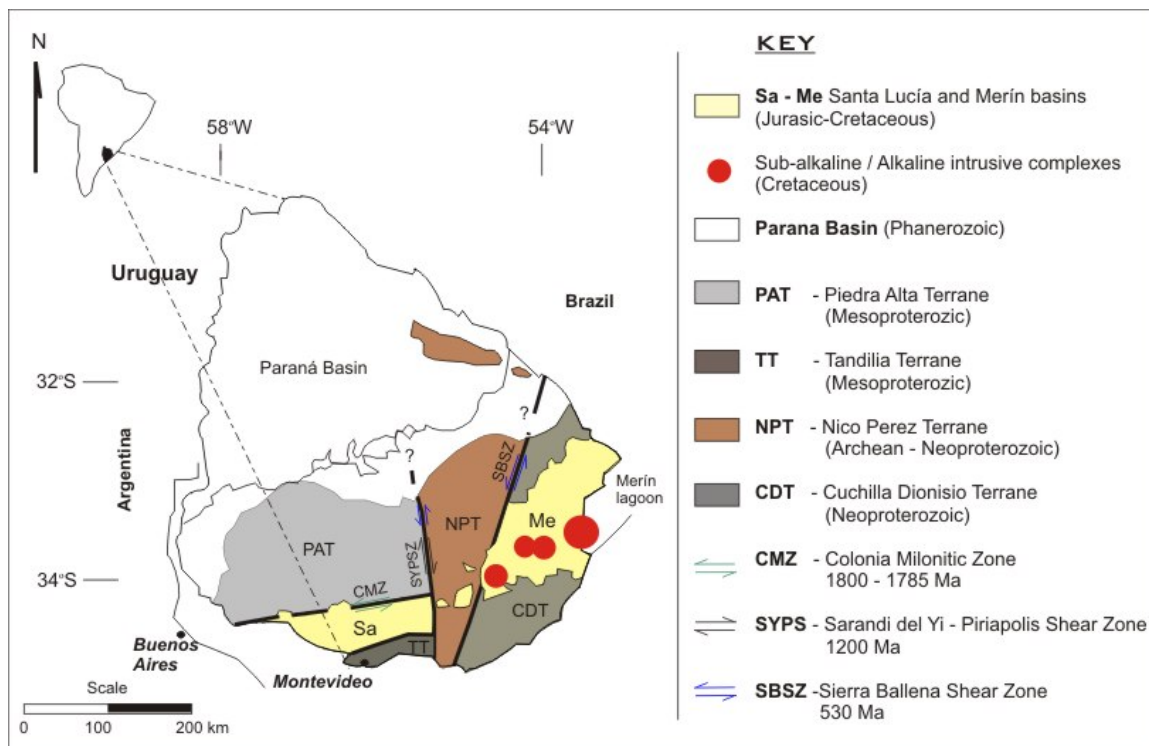


Figure 1 – Simplified geologic map of Uruguay, modified from Bossi and Ferrando (2001) and Bossi *et al.*, (2005). Location of Cretaceous intrusive complexes from this work.

Figure 2 – Geophysical images from Uruguay and Lascano. A) Bouguer anomaly map of Uruguay from regional gravimetry survey scale = 1:1,000,000 (Servicio Geográfico Militar, 1972) adapted from Ellis and Turner (2006) showing location of principal Precambrian structures, Santa Lucía and Merín basins and location of the Orosur Mining INC. airborne survey over the Merín basin. B) Reduced to pole magnetic map and C) Tzz gravity map, from airborne survey by Orosur Mining INC. adapted from Ellis and Turner (2006) showing location of interpreted intrusive complexes and location of drillhole collars over Lascano-East anomaly. OMI's geophysical images are distorted for confidentiality purposes.

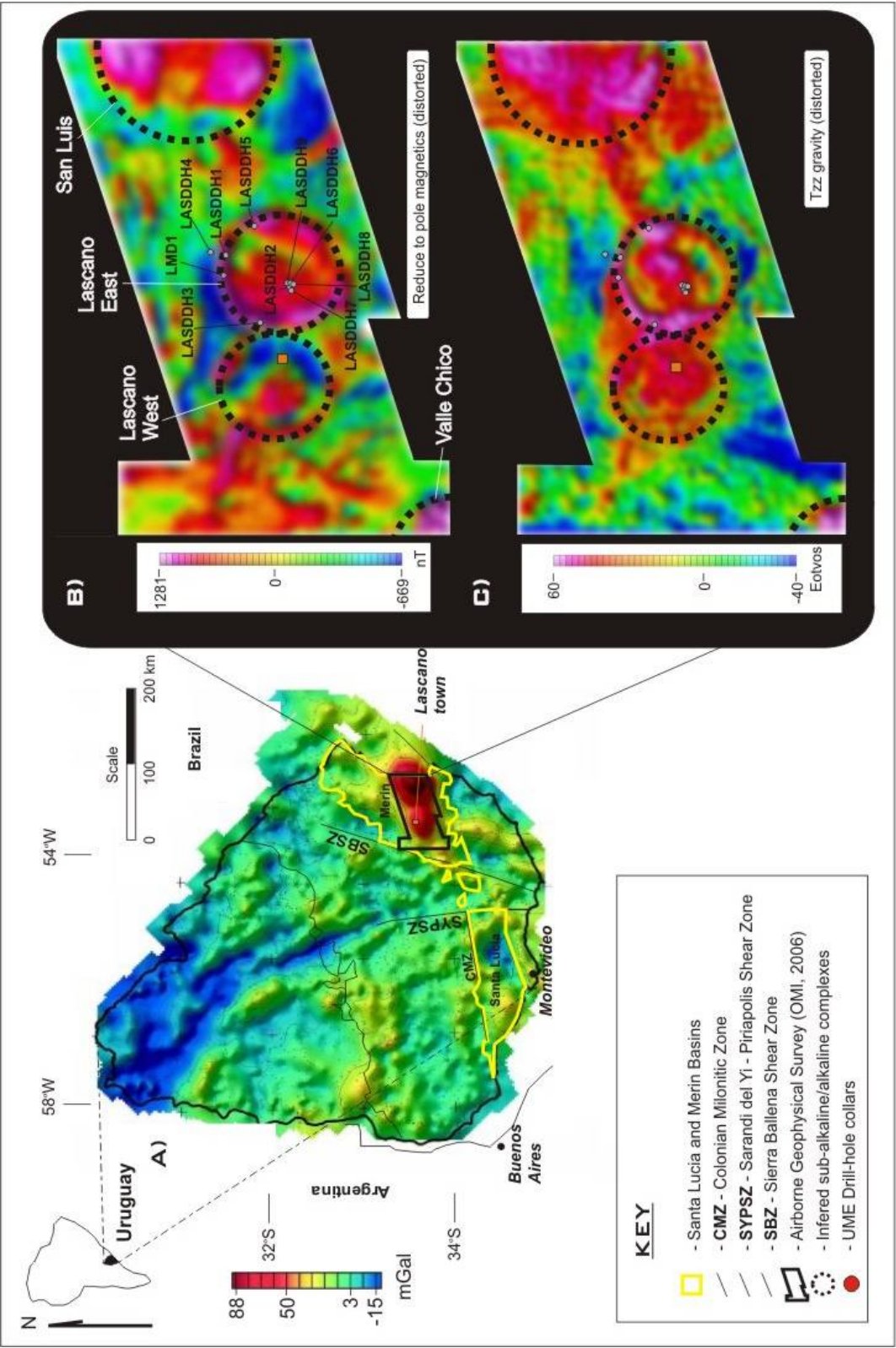


Figure 2 – Geophysical images from Uruguay and Lascano.

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GEOLOGY, GEOCHEMISTRY AND GEOCHRONOLOGY OF THE CRETACEOUS
LASCANO-EAST SUB-ALKALINE TO ALKALINE INTRUSIVE COMPLEX AND
MAGMATIC EVOLUTION OF THE MERÍN BASIN, URUGUAY

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Pending editing for submission

Chapter 2: Geology, geochemistry and geochronology of the Cretaceous Lascano-East sub-alkaline to alkaline intrusive complex and magmatic evolution of the Merín basin, Uruguay

Abstract

The Cretaceous Merín aborted-rift basin of eastern Uruguay is composed of sub-alkaline bimodal intrusive and volcanic rocks related to the Paraná-Etendeka large igneous province and associated mildly alkaline to alkaline intrusions and volcanic rocks. Four circular positive gravity and cospatial magnetic anomalies are aligned in a north-east trend from the southwest edge of the basin to the Merín lagoon in the northeast at the border with Brazil. In the southwest end, the Valle Chico complex is coincident with one of these anomalies, where a group of syenitic rocks crop out cospatially with an anomaly. The other three anomalies are overlain by sparse outcrops of Paraná sub-alkaline basalts flows, rhyolitic ignimbrites, flows and breccias, and sub-volcanic granodiorite granophyres.

The stratigraphy, age relations, intrusive geometries and airborne-magnetic and gravity response of the volcanic and intrusive rocks encountered in the subsurface of Lascano-East are consistent with the presence of a concealed sub-alkaline to alkaline ~ 133 to 127 Ma intrusive complex. We hypothesize that the Lascano-West and San Luis anomalies are caused by similar concealed intrusive complexes, rising to a total of four, the intrusive complexes identified in the Merín basin.

Ten lithogeochemical units were identified and grouped into three associations. A sub-alkaline group composed of Treinta y Tres A basalts, Treinta y Tres B basalts and

gabbros, Lavalleya rhyolite ignimbrites and San Miguel granodiorite granophyres; a mildly alkaline group including the Santa Lucía basalts and gabbros, Aiguá rhyolites, Valle Chico syenites and India Muerta rhyolites and an alkaline group including the Lascano alkaline gabbro to trachyte series and the Arrayán olivine basalts. The only sedimentary rocks are conglomerates grouped as the Quebracho Formation.

The Paraná-like sub-alkaline to mildly alkaline basaltic lavas of the Treinta y Tres and some Santa Lucía basalts erupted first, mostly between ~ 133 to 131 Ma throughout the basin. The voluminous, sub-alkaline, rhyolitic Lavalleya ignimbrite eruptions followed between ~130 to 128 Ma, and are inferred to be related to caldera collapses in Lascano-East and Lascano-West. The felsic volcanism at Valle Chico was somewhat younger and possibly dominated by the Aiguá rhyolites mostly composed by lavas (~ 128 to 127 Ma). At least some of the sub-alkaline to mildly alkaline basaltic magmatism was still active, or reactivated, during and after this period in particular in Lascano-East. These extrusive centers were then intruded by mildly alkaline and alkaline mafic to felsic rocks at ~128 to 127 Ma. While Valle Chico was dominated by the intrusion of syenites, Lascano-East was dominated by gabbros and trachytes. The alkaline dikes and sills are inferred to be part of a dike and sill complex on top of deeper mafic alkaline intrusions responsible for the gravity anomalies. The youngest and least voluminous magmatism is represented by the Arrayán olivine basalts that were emplaced synchronous to the deposition of the Quebracho conglomerates and are inferred to be younger than ~127 Ma.

Based on trace element modeling we propose that the sub-alkaline rocks were produced by partial melting of a shallow mantle source (depleted mantle) with abundant crustal assimilation whereas the mildly alkaline and alkaline rocks were produced by mixing of this source with a deeper mantle source (ocean island basalt – like), or by progressively deepening the location of the mantle melting and lowering the degrees of partial melt.

In the early Cretaceous, magmatism in the Merín basin was broadly contemporaneous and close in space to the magmatism in the Luderitz and Damaraland basins in Namibia. Magmatism in eastern Uruguay and Namibia, were possibly linked to similar melt sources, evolutionary paths, and emplacement mechanisms, related to the opening of the southern Atlantic Ocean and the Paraná – Etendeka provinces.

Introduction

The bimodal Paraná - Etendeka large igneous province was erupted during the early Cretaceous (Renne *et al.*, 1992, 1996; Turner *et al.*, 1994; Ernesto *et al.*, 1999, Micato *et al.*, 2003, Stewart *et al.*, 1996 and Deckart *et al.*, 1998). This province is dominated by tholeiitic basalt with minor rhyolitic magmatism and has been linked to the Tristan da Cunha mantle plume through the Rio Grande Rise and the Walvis Ridge (O'Connor and Duncan, 1990). Contemporaneous and younger intrusive complexes are described in Brazil, Bolivia, Paraguay, Uruguay and Namibia (*e.g.* Jacupiranga in Brazil, Velasco province in Bolivia and Valle Chico in Uruguay; Darbyshire and Fletcher, 1979; Almeida, 1983; Fletcher and Beddoe-Stephens, 1987; Morbidelli *et al.*, 1995; Le Roex,

1996; Muzio 1999, Comin-Chiaramonti *et al.*, 1999, 2002; Biondi, 2003; Gomez *et al.*, 1990; Pirajno, 2009).

During this period in eastern Uruguay, aborted rifting of the Precambrian basement resulted in the Formation of the Santa Lucía and Merín basins. These basins are aligned in a northeast trend with erosional remnants between them and were grouped as SaLaM (Santa Lucía-Aiguá-Merín, Rosello *et al.*, 1999, Figure 1).

The Merín basin preserves the largest volume of volcanic and intrusive rocks of the SaLaM and overlies a large, broad gravity anomaly (>80 mGal; Servicio Geográfico Militar, 1973) that is coincident with an aeromagnetic anomaly. The anomaly is approximately 80 km long by 40 km wide, ellipsoidal in shape and trends in an east to northeast direction. High-resolution airborne gravity and magnetic images from Orosur Mining INC., show that this anomaly comprises four well-defined, 20 - 30 km wide circular features (Ellis and Turner, 2006, Figure 2). These anomalies form a trend along the Merín Basin rift axis, from Mariscala town in the southwest to the Merín lagoon near in the northeast, near the border with Brazil.

The southwestern ~ 20 km wide anomaly is coincident in shape with the outcrop area of the Valle Chico intrusive complex (Lustrino *et al.*, 2005). The two central anomalies are similar in size and are coincident with two sub-circular outcrops of rhyolitic ignimbrites. These two are named the Lascano-West and Lascano-East anomalies. The San Luis anomaly (after San Luis al Medio town) is the largest anomaly of the basin, reaching more than 30 km in diameter. The only known coincident outcrops are granodiorite granophyres and gabbro sills in its periphery.

Many hypotheses have been proposed to explain both the regional gravity anomaly (known since the seventies), and the newly identified gravity and magnetic circular anomalies that constitute it. These were based on limited surface mapping, one 500 meter drillhole (Puerto Gómez drillhole, DINAMGIE, e.g. Gómez Rifas and Masquelín, 1996) and geophysical modeling. The interpretations range from concealed mafic intrusions similar to Bushveld or Trumpsberg (e.g. Reytmayer, 2001; Verosvlavksy *et al.*, 2002), several kilometers of basalt basin filling (Gomez Rifas and Masquelin, 1996) and, for the Lascano-West and Lascano-East anomalies, caldera structures within the Paraná rhyolite sequence (Rossello *et al.*, 1999; Conti, 2008). Soil cover and sparse outcrops obscure the volcanic stratigraphy and intrusive relationships, complicating the task of understanding the geology.

The purpose of the present study is to use rock geochemistry, isotopic ages, and contact relations from the first extensive drilling campaign in the basin over the Lascano-East anomaly to correlate igneous rock units, construct a volcanic stratigraphic section and outline the intrusion geometries. Reconnaissance mapping and limited geochemical surface samples from the rest of the Merín Basin were used to make correlations. Trace element compositions of igneous rocks were studied to constrain the petrogenetic processes that produced the observed magmatic diversity. The geological, geophysical and geochemical data were used to propose a plausible genetic model for the area that accounts for the geophysical anomalies. Finally, these results were compared with areas of similar age and tectonic setting in Namibia to propose correlations.

Geological setting

Precambrian basement rocks crop out over most of southern Uruguay, as well as in two small windows through the Phanerozoic Paraná basin in the north. The basement is structured by the Piedra Alta, Tandilia, Nico Pérez and Cuchilla Dionisio terranes, divided by continental scale shear zones (*e.g.* Mallman *et al.*, 2004; Bossi *et al.*, 2005; Bossi and Gaucher, 2004; Masquelin, 2006; Figure 1, refer to Chapter 1 for an extended description).

The Chuchilla Dionisio is briefly described here because it constitutes the basement of the studied area. This terrane is bounded on the west with the Nico Pérez terrane along the Sierra Ballena shear zone. Readers are referred to Bossi and Gaucher (2004) and Masquelin (2006) for a comprehensive review. The oldest rocks consist of a Paleo-Proterozoic to Neo-Proterozoic granulitic to orthogenissic core with minor biotitic gneisses and migmatites. This is overlain by low metamorphic grade turbiditic sequences of metasediments and siltstones of ~ 1540 Ma (Preciozzi *et al.*, 1999) of the Rocha group. The previous units were then intruded by several granitoids ranging from 680 to 555 Ma (*e.g.* Rocha Granite of 678 ± 14 Ma, and Aiguá Granite of 582 ± 31 Ma, U/Pb zircon; Preciozzi *et al.*, 1993). The youngest of these and volumetrically dominant in the study area of this paper is the coarse feldspar porphyritic Santa Teresa granodiorite of 556 ± 7 Ma (Rb/Sr, Umpierre and Halmann 1971). The Cerros de Aguirre Formation (Campal and Gancio, 1993) of 572 ± 8 Ma (U/Pb zircon, Hartmann *et al.*, 2002) is composed of dacites and related pyroclastic rocks and crops out as a small erosional remnant (Figure 1).

Rifting and spreading in the South Atlantic is related to the eruption of the Parana-Entandeka flood basalts. Some authors argue that the Paraná magmatic activity initiated in the northwest end of the Paraná basin between 138-135 Ma and peaked between 134 to 130 Ma, extruding a total volume of approximately 800,000 km³ (Hawkesworth *et al.*, 1992 and Stewart *et al.*, 1996). However, other authors argue that the magmatism range between 133 and 130 Ma and peaked between 133 and 132 Ma, and that the magmatic activity migrated from south to north (e.g. Renne *et al.*, 1997, Ernesto *et al.*, 1999 and Mincato *et al.*, 2003). This bimodal magmatism was dominated by tholeiitic basalts with minor rhyolitic magmatism and is proposed to be linked to the Tristan da Cunha mantle plume through the Rio Grande Rise and the Walvis Ridge (O'Connor and Duncan, 1990).

During the opening of the southern Atlantic Ocean, aborted rifting along pre-existing Precambrian weaknesses (Rossello *et al.*, 1999) thinned the crust and formed the Santa Lucía and Merín basins in southern Uruguay. These two basins may have formed a continuous series of volcanic and sedimentary rocks deposited atop the craton that connected them (Rosello *et al.* 1999; Figure 1). During this period, other aborted rift basins were formed in the eastern margin of South America and western margin of Africa. These basins are infilled by sub-alkaline bimodal rocks associated with the Parana-Etendeka magmatism but usually also preserve large volumes of rhyolitic lavas and ignimbrites as well as sub-alkaline to alkaline intrusive complexes (Kirsten *et al.*, 2001a). Such is the case of the Valle Chico complex in Uruguay (Muzio, 2000) and the Damaraland and Luderitz complexes in Namibia (Pirajno 1994). These complexes are

contemporaneous or younger than the Paraná – Etendeka magmatism and range between 133 to 126 Ma (e.g. Pirajno, 2010; Biondi, 2003).

The Merín basin

The Merín basin preserves the majority of the igneous rocks associated with the Cretaceous aborted rifts in southern Uruguay. Here, we collectively refer to the preserved early Cretaceous igneous rocks as the Merín basin sequence, although the basin also includes Cretaceous volcanoclastic sedimentary rocks and younger Cenozoic deposits. Previous work establishes an age range from ~133 Ma to 127 Ma for the igneous rocks (for a complete review of isotopic ages refer to Table 1). Most areas of low relief consist of basalts of the Puerto Gómez Formation (Bossi, 1966) of known thickness of more than 500 m (Gomez Rifas and Masquelin, 1996). These basalts consist of dark-grey to reddish, plagioclase porphyritic and glomeroporphyritic flows. The upper vesiculated levels of these flows are filled with chalcedony, quartz, gypsum, anhydrite, zeolites and calcite.

The areas of higher topographic relief commonly consist of sections up to 200 m thick of rhyolites and rhyodacites of the Arequita Formation (Bossi, 1996) that overly the Puerto Gómez Formation basalts. This unit includes quartz and/or sanidine porphyritic rhyolites flows, rheomorphically deformed rhyolitic ignimbrites, rhyolitic breccias and aphanitic rhyolite flows (Morales, 2006). In the area of Lascano town the rhyolites are predominantly pyroclastic and crop out as two sub-circular 20 km wide rings, dipping 5 to 10° towards the center of each structure. These rings were interpreted as outlining two caldera collapse structures by Rossello *et al.* (1999) and Conti (2008).

The bimodal volcanic rocks are intruded by shallow intrusive stocks and sills of similar chemical affinity that includes the porphyritic to equigranular San Miguel granodioritic granophyres. These granophyres crop out in the northwest end of the basin near the town of 19 de Abril and locally in Lascano, and are in turn intruded by pyroxene-plagioclase-olivine gabbro sills (Muzio *et al.*, 2009; Conti, 2008).

Prior to this work at Lascano, the Valle Chico complex (Muzio, 2000; Lustrino *et al.*, 2005) was the only known intrusive complex in the Merín basin. It is composed of coarse-grained quartz-syenites rimmed by fine- to medium-grained quartz syenites in the northeast and syenites, quartz syenites and porphyritic trachytes in the southeast that range from mildly alkaline to peralkaline in composition (Lustrino *et al.*, 2005). The outcrop area of this complex is coincident in shape and size with a 20 km wide circular positive gravity and magnetic anomaly. Similarly, the two interpreted calderas near Lascano are coincident with two other aeromagnetic and gravity anomalies of similar size and shape. A fourth, larger aeromagnetic and gravity anomaly is located in the northeast end of the Merín basin near the border with Brazil. These four gravity and magnetic anomalies form a northeast-southwest trend coincident with the axis of the Merín basin (Figure 2B,C).

Both the contemporaneous Paraná flows and the rift volcanics were extruded in an intra-continental arid climate. This is evidenced by the direct contact of the Paraná flows over aeolian sandstones and trapped sandstone blocks in the first flows of basalts in the Paraná basin (Bossi *et al.*, 1998). A similar climate is evidenced by the sedimentary infill of the Santa Lucía basin that is composed of red colored, coarse polymictic

conglomerates and sandy conglomerates of alluvial origin grouped as the Cañada Solís Formation (de Santa Ana and Ucha, 1994) and grey to black, organic-rich, lacustrine claystones and siltstones of the Castellanos Formation (Zambrano, 1974). This units grade into alluvial and aeolian arkosic sandstones of the Migués Formation (Bossi, 1966). The Puerto Gómez Formation basalts are intercalated with the Cañada Solís conglomerates in the Santa Lucía basin. This volcano-sedimentary succession presents a total thickness of more than 2000 meters in the Santa Lucía basin. However, only conglomerates were identified in the Merín basin of unknown thickness.

Previous geochemical studies

The extensively studied Paraná rocks are divided in two major chemical groups based on their TiO_2 content: high Ti basalts ($\text{TiO}_2 > 2 \text{ wt } \%$) and associated Chapelc6 rhyolitic lavas, and low Ti basalts ($\text{TiO}_2 < 2 \text{ wt } \%$) and associated Palmas rhyolitic lavas (Bellieni *et al.*, 1984; Bellieni *et al.*, 1986). The High Ti series dominates the northern part of the Paraná basin while the Low Ti series the southern end (Marques & Ernesto, 2004) but with no clear stratigraphic relations. These groups were divided into sub-groups based on trace element compositions by different authors (e.g. Peate *et al.*, 1992, Bellieni *et al.*, 1986, Piccirillo *et al.*, 1988). A comprehensive description of each of these subgroups can be found in Marques & Ernesto (2004).

Less research has been done in the rift basins of southern Uruguay. Gómez Rifas and Masquelin (1996) identified the presence of alkaline basalts flows and dikes in the Marmarajá hills between the Santa Lucía and Merín basins. These have a distinct trace element signature, closer to ocean island basalt than the traditional Paraná magmatism.

Gómez Rifas and Masquelin (1996) named them Marmarajá basalts as a subgroup of the Puerto Gómez Formation. Based on trace elements together with strontium and neodymium isotopes of rock samples from the Merín basin, Kirsten *et al.* (2000) divided the Puerto Gómez basalts into the Treinta y Tres and Santa Lucía basalts, and the Arequita Formation into the Lavalleja and Aiguá rhyolites (refer to Table 2 for petrographic descriptions). While the Treinta y Tres basalts are comparable to typical Paraná Low-Ti basalts, the Santa Lucía series show ocean island basalt affinity, but are less alkaline than the Marmarajá basalts, that were not sampled by Kirsten *et al.* (2000). According to Kirsten *et al.* (2001a) the Lavalleja rhyolites are mainly ignimbrites that were produced at very explosive events extruding huge volumes of magmas. According to Rossello *et al.* (1999) and Conti (2008) this volcanism produced caldera collapse and created ring-faults in Lascano-East and Lascano-West. The Aiguá rhyolites are more geographically restricted and less explosive, and are mostly observed as flows south of the Valle Chico complex (Kirsten *et al.*, 2001a).

Methods

In 2002 Orosur Mining, Inc. (formerly Uruguay Mineral Exploration, Inc.) drilled the first exploratory hole of 451 m in the Lascano area. During 2007 and 2008, an additional 7320.8 meters were drilled from 9 holes, with each drill hole between 700 and 1000 meters deep (Appendix 1). In 2006 a detailed airborne gravimetric and magnetic survey comprising 10,400 kilometers of flight line at a line spacing of 400 meters was completed by Bellgeospace and purchased by Orosur Mining INC (Figure 2). The magnetic field was measured with a Geometrics® cesium vapor magnetometer

(www.geometrics.com) and gravimetry was measured with an Air-FTG® (full-tensor gravity gradiometer, www.bellgeo.com) using a radar altimeter system for terrain corrections. A base station magnetometer was located near Punta del Este. Magnetic and gravity images used in this paper are extracted from Ellis and Turner (2006).

Reconnaissance mapping of rock sections, geochemical sampling and detailed core logging was conducted from July to December of 2008 and during November and December of 2009 at Orosur Mining INC. facilities in Uruguay.

Standard transmitted and reflected light microscopy and petrographic techniques were used to describe the mineralogy and textures of the rocks. Internal Orosur Mining INC. petrographic reports were consulted for this paper (Thompson, 2006, 2007; Oyhançabal 2006, 2007, 2008).

Magnetic susceptibility was measured throughout the entire core by Orosur Mining INC. personnel during drilling campaigns using a *KT-9 Kappameter* portable magnetic susceptibilimeter (detection limit of 1×10^{-3} SI).

Specific gravity was measured in representative samples of some of the magmatic units by measuring dry mass and mass in water with a hydrostatic scale by Orosur Mining INC. personnel during September of 2009. Specific gravity was calculated as $S.G. = \text{Mass}_{\text{air}} / (\text{Mass}_{\text{air}} - \text{Mass}_{\text{water}})$, and density was calculated as $\rho = S.G. \times \rho_{\text{water}}$, where $\rho_{\text{water}} = 1.0 \text{ g/cc}$.

For this work, 765 samples were selected from Orosur Mining INC. drilling campaigns and 36 from field work, for a total of 801 samples (Appendix 2). These were analyzed by ACME laboratories using Spectro Ciros® Vision ADS500, inductively

coupled plasma optical emission spectrometry (ICP-OES, www.spectro.com) for major elements and an Elan® 9000 inductively coupled plasma mass spectrometry (ICP-MS, www.perkinelmer.com) for rare earths and refractory elements. Dissolution consisted of lithium metaborate/tetraborate fusion followed by a dilute nitric digestion for ICP-OES and nitric acid digestion for ICP-MS. The detection limits for both methods can be found in Appendix 2. Blanks, duplicates and CANMET/USGS certified standard reference materials were analyzed by ACME between unknowns to measure background, accuracy and precision (details in Appendix 1 and <http://acmelab.com/services/quality-control/>). Additionally, 36 duplicates were randomly submitted for analysis as unknown samples for external laboratory control (Appendix 2). Major elements are measured as oxides with a 0.002 to 0.04 wt% detection limit. Trace elements detection limits vary between 0.01 and 0.5 ppm for most of the elements. Major and trace elements were plotted using *ioGAS*TM. Samples were screened for signs of hydrothermal alteration using molar ratio diagrams (Madeisky, 1993) and 523 fresh samples were selected for lithogeochemical and petrological work. Major elements were normalized to 100% volatile-free. CIPW normative compositions were estimated using Kurt Hollocher's excel program (NORM).

Linear magma mixing tests were calculated with the formula $Mix_{(A-B)} = f \cdot A + (1-f) \cdot B$ where f represents the mass fraction (0 to 1). Batch melting and equilibrium crystallization paths were calculated using the formula $C_L/C_O = 1/[D + F(1-D)]$, fractional melting using $C_L/C_O = 1/F [1 - (1 - F)^{1/D}]$ and fractional crystallization using $C_L/C_O = F^{(D-1)}$, where C_L is the concentration in the liquid, C_O is the concentration in the starting composition, F is the percent of crystallization and D is the bulk partition coefficient

(Rollinson, 1993). Average ocean island basalt (OIB, Sun 1980) together with normal and enriched middle ocean basalt (N-MORB, Sun and McDonough, 1989 and E-MORB, Klein, 2004) were selected as possible initial melt compositions. Primitive mantle (Sun and McDonough, 1989) and Depleted Mantle (Salters and Stracke, 2004) were also selected as possible initial compositions for melting calculations. Two samples from the Precambrian basement of the Merín basin were selected as possible assimilants, one sample of the 556 Ma Santa Teresa granodiorite (71986) and one sample of the Cuchilla Dionisio Proterozoic gneisses (71979). Fractional and equilibrium crystallization paths were calculated for a basaltic mineral assemblage of 50% plagioclase, 30 % clinopyroxene, 10% orthopyroxene and 10% olivine. Melting was calculated for a 50% olivine, 23% orthopyroxene and 23% clinopyroxene. Lehrzomite mantle material contains 4% aluminum phase as plagioclase or spinel or garnet. Mineral-melt partition coefficients were taken from Rollinson (1993) and Gurenko and Chaussidon (1995).

Sanidine and plagioclase separates were prepared at OSU from five samples using standard procedures (see Salisbury *et al.*, 2010). Three plagioclase concentrates and one sanidine concentrate were dated through $^{40}\text{Ar}/^{39}\text{Ar}$ with 12 to 22 heating steps, at OSU Noble Gas Mass Spectrometry lab using a Mass Analyser Products model 215-50 rare gas mass spectrometer with all-metal extraction system after irradiation in the OSU TRIGA experimental reactor (Koppers and Duncan 2003). Thin section of the rock samples were inspected for signs of alteration and select the freshest samples for age dating. Sanidine and plagioclase were identified and analyzed with a CAMECA SX-100 Electron

Microprobe (EMP) at OSU using the Electron Dispersive Spectrometer (EDS) and inspected to avoid altered samples.

Results

Following the scope of previous work by Gómez Rifas and Masquelin (1996) and Kirsten *et al.*, (2000) we recognize ten different lithogeochemical units and one sedimentary unit. These units can be grouped in three associations according to their alkalinity. The sub-alkaline units are the Treinta y Tres A basalts, Treinta y Tres B basalts and gabbros, San Miguel granodiorite granophyres and Lavalleja ignimbritic rhyolite. The mildly alkaline units are the Santa Lucía basalts, the Aiguá rhyolites, the India Muerta rhyolites and the Valle Chico syenites. The alkaline units are the Lascano series (alkaline basalts to trachytes) and the Arrayán olivine basalts. The only sedimentary rocks identified are conglomerates and sandy-conglomerates grouped under the Quebracho Formation.

Geochronology

Published isotopic ages from the Merín basin were obtained from surface rock samples from Valle Chico to Lascano-West, but no data was available from Lascano-East or other outcropping areas of the basin. Table 1 summarizes the published $^{40}\text{Ar}/^{39}\text{Ar}$ and U/Pb zircon ages, and locations are shown in Figure 3. Less precise Rb/Sr and K/Ar ages are summarized by Muzio (2004). In this work we dated four rock samples from four different lithogeochemical units from Lascano-East subsurface by $^{40}\text{Ar}/^{39}\text{Ar}$ dating of plagioclase. Plagioclase separates were dated from samples of Lavalleja rhyolite

ignimbrites, Treinta y Tres A basalts and Lascano alkaline gabbros dikes, and sanidine separates were dated from a sample of an India Muerta rhyolite dike (Table 1). Inverse isochrons ($^{36}\text{Ar}/^{39}\text{Ar}$ vs. $^{39}\text{Ar}/^{40}\text{Ar}$) were used to identify excess argon. The ages calculated with these agree within error with the plateau ages. All the plateau ages were calculated by the weighted mean age of eight or more consecutive heating steps, in all cases representing more than 60% of the released gas (Figure 4). These are the first isotopic ages from Lascano-East complex rocks, and plateau ages range between 129.09 ± 0.52 and 126.94 ± 0.89 Ma. Errors are reported with two standard deviations and range between 0.90 to 0.56 Ma. The complete $^{40}\text{Ar}/^{39}\text{Ar}$ data are shown in Appendix 3. This work presents the first isotopic age of an alkaline rock from the basin (Lascano gabbro dike) at 127.78 ± 0.90 (Figure 9).

Geology

A brief petrographic description of each lithogeochemical unit is shown in Table 2 and photographs are shown in Appendix 4. For extended petrographic descriptions of rocks of the Merín basin refer to Conti (2008), Morales (2006), Gómez Rifas and Masquelín, (1999), Lustrino *et al.* (2005), and Muzio *et al.* (2009).

A series of columnar sections based on outcrop (locations are shown in Figure 3) and drillholes are shown in figure 5 to illustrate the crosscutting relations and thickness of each unit. This figure also shows a composite stratigraphic section of the Lascano-East complex, including dikes and sills, that summarizes the observations reported here.

The Treinta y Tres A and Treinta y Tres B basalts were the only ones identified in outcrop. They form sub-outcrops to outcrops of basaltic lava flows in low relief areas and

are overlain by rhyolites in the surroundings of Valle Chico and Lascano East and West (Figures 3 and 5A). These two types of basalts show similar textures that range from equigranular to plagioclase porphyritic and less commonly pyroxene porphyritic and are in a fine grained to aphanitic groundmass with usual vesicular and brecciated flow tops. These two units share the same stratigraphic position and similar petrography, therefore they are only differentiated by their composition (see lithochemistry section). Each lava flow ranges between 3 and 10 meters in thickness. In the subsurface of Lascano-East the Treinta y Tres lavas are volumetrically dominant in the periphery of the complex. Here the composite thicknesses are up to 600 meters for the Treinta y Tres A basalts and up to 350 m for the Treinta y Tres B basalts (LASDDH1 and LASDDH3 respectively, Figure 6). In the subsurface of Lascano-East hyaloclastic fractured basalts of the Treinta y Tres A composition were observed in LASDDH4, serving as the only evidence for underwater magmatism in the Merín basin (Figure 5B).

While the Treinta y Tres A types have only been observed as lavas, the Treinta y Tres B types are also observed as fine to medium-grained equigranular gabbro sill-like bodies that intrude the San Miguel granodiorite granophyres. This cutting relation has been observed in outcrops on the northeastern edge of the basin, in the San Miguel hills (edge of the San Luis anomaly, Figure 3 and Figure 5A), and in a drillhole core from Lascano-East where the gabbro sills have thicknesses that range from 1 to 200 meters (Figure 5B- LASDDH5).

The San Miguel granodiorite granophyres were only observed in the two previously mentioned zones with the exception of one isolated outcrop in Lascano-West

surrounded by Lavalleya rhyolites (Conti, 2008; Figure 3 insert). However, the cutting relations between the rhyolites and granophyres are not exposed in this area. The granodiorites present distinct granophyric intergrowths of quartz and feldspar, but the textures vary over a few meters in the same outcrop or drillhole intercept from equigranular to plagioclase porphyritic. Thicknesses reach up to 500 meters. They are dominated by plagioclase and quartz but also contain amphibole and clinopyroxene. Both Treinta y Tres B gabbros and San Miguel granodiorites are found as xenoliths in the other unit, indicating broadly synchronous emplacement.

The Santa Lucía basalts and gabbros were not recognized in outcrop in this work but basalts of this group were reported by Kirsten *et al.* (2000) in the Merín basin, however, no precise locations were given. They are volumetrically dominant in the subsurface in the central zone of the Lascano-East anomaly (*e.g.* LASDDH2, Figure 5B), where they reach thicknesses of up to 600 m. The basalts have diagnostic coarse-grained euhedral plagioclase crystals, that in some cases show eroded edges. Equigranular gabbro sill-like bodies of 2 to 20 meters width were observed intruding the basalts in the core (*e.g.* LASDDH2, Figure 5B) and have the same chemical affinity as basalts.

The Lavalleya rhyolites comprise a diverse group dominated by quartz and/or feldspar porphyritic rhyolitic ignimbrites and rheomorphically deformed ignimbrites with fiamme, glass shards and lithic clasts. Other lithofacies include banded feldspar porphyritic rhyolites (flows or volcaniclastic-sediments), pyroclastic breccias and vitrophyres. These rocks are observed overlying the Treinta y Tres B basalts and constituting the topographically elevated zones over the two Lascano anomalies. Here,

they have outcrop thicknesses of up to 200 meters and outcrops that mimick the circular shape of geophysical anomalies (Figure 3 and 4A). In drillhole core from Lascano-East, these rhyolites were observed in several stratigraphic positions that include, 1) intercalated with Treinta y Tres A basalts (LMD1), 2) on top of Treinta y Tres A but underneath Treinta y Tres B basalts (LASDDH3), and 3) intercalated with Santa Lucía basalts (e.g. LASDDH6) (Figures 5B and 6). However the Lavalleja rhyolite contacts with the Santa Lucía basalts are usually slightly faulted and/or intruded by narrow Lascano trachyte dikes, which obscure the stratigraphic relation.

While the rheo-ignimbrites and banded plagioclase porphyritic rhyolites dominate in Lascano-West outcrops, the ignimbrites and pyroclastic breccias dominate in Lascano-East outcrops. In Lascano-West, the contact of the rheo-ignimbrites with the underlying Treinta y Tres B basalt lavas, as well as the compaction foliation of rhyolites evidenced by fiamme, dip at 2 to 10° towards the center of the geophysical anomaly (Conti, 2008; Figure 3). Because of the sparse outcrops it is difficult to estimate the stratigraphic position and thickness of each Lavalleja lithotype. However a few observations can be stated. The plagioclase porphyritic banded rhyolites seem to be thinner (up to 100 meters) and usually, but not always, crop out on top of the thicker (up to 200 meters) rheo-ignimbrites of Lascano-West. The vitrophyres were observed only in one isolated outcrop between Lascano-West and East with an exposed thickness of less than 20 meters. Up to 10 meters of pyroclastic breccias crop out on Lascano-East.

In the subsurface of Lascano-East the intercepts of Lavalleja rhyolites are dominated by the plagioclase porphyritic banded rhyolites (up to 200 meters) intercalated

with only minor volumes of quartz-plagioclase porphyritic ignimbrites and rheo-ignimbrites, whereas only one intercept of 80 meters of pyroclastic breccias was identified in LASDDH7 (Figure 6). The breccias in the drillcore present smaller clasts (up to 5 cm diameter) than the ones cropping out on Lascano-East (up to 2 meters diameter). No vitrophyres were identified in subsurface.

The Aiguá rhyolites range from feldspar and quartz porphyritic to aphanitic and crop out in the elevated topography around Aiguá town (e.g. Grutas de Salamanca) surrounding the Valle Chico syenites. Most of the outcrops present lava flow structure and individual flows reach up to 1 meter thickness. However, in some outcrops, flow structure is not evident, there are broken quartz and feldspar crystals, which suggests a pyroclastic origin of at least some of the Aiguá rhyolites. Nonetheless, no shards or fiamme were identified in these rocks. Even though this lithofacie of Aiguá rhyolites is difficult to differentiate from the Lavalleja rhyolites because both units contains feldspar and/or quartz phenocrysts, the two groups can be differentiated based on their whole rock chemistry (see lithogeochemistry chapter). Nonetheless, because only two chemical samples were collected from rhyolites around Valle Chico during this work, it is not possible to discard the presence of Lavalleja rhyolites intercalated with Aiguá rhyolites in this area. The contact of Aiguá rhyolites with the underlying Treinta y Tres (A and B) basalts and the contact between different Aiguá flows, dips between 3° and 5° to the northwest, towards the Valle Chico syenites (Figure 3). The less explosive character of these Aiguá rhyolites in comparison with the Lavalleja rhyolites has been discussed by Kirsten *et al.* (2001a). Narrow dikes of similar chemical affinity are 0.5 to 3 meters wide

and have been mapped as cutting the Valle Chico syenites. They strike east-west and northwest-southeast and dip 65° to 90° to the north or northeast (Lustrino *et al.*, 2005; Figure 3).

No Aiguá rhyolites were observed in Lascano-East, however, the India Muerta rhyolite dikes share similar chemical characteristics with the Aiguá rhyolites. The India Muerta dikes consist of euhedral quartz-sanidine porphyritic dikes and sills of apparent thicknesses in drillhole core between 20 and 100 meters. These were only identified in the subsurface of Lascano-East where they cut Lavalleja rhyolite ignimbrites (LASDDH4), Treinta y Tres B gabbros and San Miguel granophyres (LASDDH3), Treinta y Tres A basalts (LASDDH7) and Santa Lucía basalts (LASDDH6) (Figures 5B and 6).

The Valle Chico syenites are a heterogeneous group of rocks of syenitic composition that cover an area of ~ 20 km in diameter in the center of the Valle Chico geophysical anomaly (Figure 3). These are the only syenites identified in outcrop in the Merín basin, and they vary from coarse-grained syenites to quartz-syenites and fine-grained lithologies described as trachytes. According to Lustrino *et al.* (2000), most of the intrusions are mildly alkaline while the more silica-rich are commonly peralkaline. A comprehensive petrographical and chemical description can be found in Muzio *et al.* (2000) and Lustrino *et al.* (2000).

The Lascano dikes and sills include a continuous range of compositions from alkaline basalts to trachytes. The alkaline gabbros are typically the freshest of the mafic rocks in the Lascano-East subsurface and show distinct, clear, euhedral plagioclase

phenocrysts set in a very fine-grained, dark matrix of plagioclase, olivine and pyroxene, that gives the plagioclase phenocrysts a dark appearance. The trachyandesites to trachydacites are composed of a very fine-grained massive groundmass with occasional plagioclase microliths showing pilotaxitic flow textures. In this work, this series has been only identified as dikes and sills cutting most of the previously described rocks in the central subsurface of Lascano-East (Santa Lucía basalts in LASDDH2, Lavalleja rhyolites in LASDDH6, San Miguel granodiorite granophyres in LASDDH8, Figures 5B and 6). The trachyte dikes range between 10 centimeters and 15 meters wide, whereas the gabbros reach widths of up to 45 meters. In outcrop, similar trachytes were only identified where they cut the Valle Chico syenites (Figure 3). No flows of this composition have been identified in the Merín basin. However, Gómez Rifas and Masquelín (1996) described minor basalt lava flows and dikes around the Marmarajá hills, in the basin remnants between the Santa Lucía and Merín basins, of similar mineral and chemical composition and named them Marmarajá basalts (Figure 1).

The Arrayán olivine basalts present distinctive 1 to 3 mm diameter olivine phenocrysts partly altered to iddingsite. They were only identified in subsurface as flows northeast of the Lascano-East ring structure, where they are intercalated with Quebracho conglomerates and overlie the Lavalleja rhyolite ignimbrites and Treinta y Tres A basalts (LASDDH4, Figure 5B). The Arrayán flows present a thickness between 1 and 5 meters. Each intercalated group of flows varying between 20 and 50 meters thick, and the total thickness of the basalts intercalated with conglomerates reaches 120 meters.

The Quebracho Formation does not crop out in the Merín basin but was identified in the subsurface northeast of the Lascano-East anomaly, with a total thickness of 400 meters (LASDDH4, Figure 5B). The formation is composed of conglomerates and sandstones with angular to rounded mafic and felsic volcanic clasts of up to 0.5 meters. A few lenses of similar conglomerates up to 20 meters thick were identified intercalated with the top flows of the Santa Lucía basalts in the central zone of the complex (LASDDH7, Figure 6). This unit presents similar characteristics to the Cañada Solís Formation, which was defined in the Santa Lucía basin (de Santa Ana and Ucha, 1994) but lies in a lower stratigraphic position intercalated with Puerto Gómez basalts. We, therefore define the conglomerates at Lascano-East as a different unit.

Based on the cross cutting relationships some stratigraphic relations can be stated and are summarized in Figure 5C. Most of the Treinta y Tres A and B basalts are observed underlying the Lavalleja rhyolite ignimbrites but some are observed overlying them. The Treinta y Tres B gabbros and sills and the San Miguel granodiorite granophyres intrusives were only observed cutting Treinta y Tres A and B basalts and this indicates they postdate at least some of these flows. Lavalleja rhyolite ignimbrites and intercalated with Treinta y Tres A basalts were observed intercalated with the Santa Lucía basalts (LASDDH7). The Santa Lucía basalts could, thus, be considered at least in part contemporaneous with both types of Treinta y Tres basalts and at least some of the Lavalleja rhyolites. However, as pointed out before, the nature of the contacts between these two units is doubtful since it is obscured by faults and Lascano dikes. The Santa Lucía gabbros were only observed cutting the Santa Lucía basalts (LASDDH2 and 6) and

no stratigraphic position can be inferred for them, except that they postdate the Santa Lucía flows.

The India Muerta rhyolite dikes cut the Treinta y Tres A and B basalts and the Lavalleja rhyolites. The Lascano alkaline series cut all the mentioned lithologies, except the India Muerta rhyolites. These observations locate the India Muerta rhyolite dikes and Lascano alkaline series as younger units than all the previously mentioned lithologies. Nonetheless, no cross cutting relation was observed between both units, therefore their relative age cannot be stated.

The Arrayán olivine basalts were only observed intercalated with Quebracho conglomerates on top of a succession of Treinta y Tres A basalts and Lavalleja ignimbrites, outside of the inferred Lascano-East complex, which positions these two units as the youngest of the Merín basin.

In Valle Chico, the rhyolitic dikes of Aiguá composition and Lascano series trachytes were observed cutting the Valle Chico syenites. The Aiguá rhyolites were observed overlying the Treinta y Tres A and B basalts in the periphery of the Valle Chico syenites, which intrude the Treinta y Tres basalts and Aiguá rhyolite flows.

Lithogeochemistry and Petrology

The most conspicuous chemical characteristics of each of the ten groups of igneous rocks are summarized in Table 3. Refer to Appendix 2d for tabulated geochemical data.

Major element plots, although useful to characterize trends and identify rock compositions, are less reliable if the studied rocks are affected by alteration or

metamorphism. On the other hand immobile trace element are better for identifying rock trends and magmatic suites as they are more resistant to remobilization by alteration processes and likely maintain original concentrations after weak hydrothermal alteration (McLean and Barrett, 1993). The immobile and incompatible elements Nb and Zr were used on the basis of the Nb/Zr ratio to define ten igneous lithogeochemical groups for the samples studied in this work (Figure 7 and Table 3). These two elements were selected because they are found in high concentrations in most of the studied samples (up to 160 ppm Nb and 750 Zr) enabling very precise measurements of their concentrations.

Nine of the identified lithogeochemical groups have similar ranges in Nb/Zr ratio compared to previously defined magmatic units: the Treinta y Tres basalts ($\text{Nb/Zr} \sim 0.06$), Santa Lucía basalts ($0.08 > \text{Nb/Zr} < 0.2$), Lavalleya rhyolites ($0.05 > \text{Nb/Zr} < 1.2$) and Aiguá rhyolites ($0.08 > \text{Nb/Zr} < 0.23$) of Kirsten *et al.*, (2000) and the Marmarajá alkaline basalts ($0.2 > \text{Nb/Zr} < 0.28$) of Gómez Rifas and Masquelín (1996). Only the newly identified Arrayán olivine basalts, have ratios that were not reported before ($0.18 < \text{Nb/Zr} < 0.47$) (Figure 8).

Based on the geochemical characteristics of each newly defined group, together with their petrographic characteristics, geographical distribution throughout the basin and their stratigraphic positions, the previously defined chemical groups were modified and new lithogeochemical units were defined.

The Treinta y Tres basalts of Kirsten *et al.* (2000) were divided into the Treinta y Tres A basalts ($\text{Nb/Zr} = 0.051$) and the Treinta y Tres B basalts ($\text{Nb/Zr} = 0.090$), which now also include gabbro sills. The Santa Lucia basalts *sensu* Kirsten *et al.* (2000)

includes the high Nb/Zr ratios (0.143) for sub-alkaline to mildly alkaline basalts but we restricted their lower limit to higher ratios (> 0.13) than the original definition. Also, gabbro sills are included in this unit now.

The Lavalleya rhyolites of Kirsten *et al.* (2000) remain unchanged, but it is evident because of the larger number of samples studied in this work that they form a restricted group that have average Nb/Zr values of 0.065. This work presents only two samples of Agua rhyolites, and because these overlap with the Agua rhyolite group defined by Kirsten *et al.* (2000), no changes are proposed. A group of rhyolite samples form a more restricted, well-defined trend at Nb/Zr = 0.111, within the Nb/Zr range of the Agua rhyolites. Because all of these samples were obtained from rhyolitic dikes from the subsurface of Lascano-East, we define them as a new unit named India Muerta rhyolites.

Kirsten *et al.* (2000) and Lustrino *et al.* (2005), proposed a geochemical affinity between the Valle Chico syenites and the Aiguá rhyolites. Only one geochemical sample from a Valle Chico syenite was analyzed in this work and has a Nb/Zr value of 0.130, which is similar to both the Aiguá and India Muerta rhyolites.

The geochemical data also allow the characterization of the San Miguel granodiorite granophyres (Bossi, 1966), whose chemistry was not previously reported. These have a Nb/Zr ratios of 0.097. The San Miguel samples partially overlap with the Lavalleya rhyolites in the Nb versus Zr space, which suggest similarities between the two groups. The Arrayán olivine basalts, a new unit described here for the Merin basin, are characterized by the highest Nb/Zr ratios of the entire basin but have a wide dispersion ($0.232 < \text{Nb/Zr} < 0.469$, average of 0.367).

The Lascano alkaline series is newly defined here to include the most alkaline rocks of the basin (with the exception of the peralkaline rocks of the Valle Chico syenites), and ranges from alkaline gabbros to trachytes. The Lascano series has a restricted Nb/Zr ratio that average $\text{Nb/Zr} = 0.233$. Even though the chemistry of these rocks is similar to the Marmaraja basalts and basaltic dikes described by Gomez Rifas and Masquelin (1999) in the erosional remnants between the Santa Lucia and Merin basins, it is not clear that these rocks share the same stratigraphic position. Furthermore the samples in this study are restricted to dikes and sills only identified cutting the syenites in Valle Chico and in the subsurface of the central part of Lascano-East. Therefore, a new name was chosen for this unit, and the correlation with Marmarajá, although possible, is only tentative without isotopic ages.

The Nb/Zr ratios double and triple between each consecutive lithogeochemical group. The sub-alkaline groups show the lowest ratios, the mildly alkaline are intermediate, and the alkaline are characterized by the highest ratios (Figure 7 and 8).

When fresh samples of these groups are plotted in a TAS (total alkalis ($\text{Na}_2\text{O} + \text{K}_2\text{O}$) versus silica (SiO_2)) diagram, two apparent trends are evident; a sub-alkaline trend similar to the Paraná basalt-rhyolite association and an alkaline trend (Figure 9). The sub-alkaline trend shows a bimodal compositional distribution with a group of gabbro-basalt and minor basaltic-andesite and a second group of dacite, rhyolite and trachy-dacite. This trend can further be divided into two sub-trends. The first is sub-alkaline *sensu stricto* and includes the Treinta y Tres A basalts and B gabbros-basalts, the Lavalleya rhyolite ignimbrites and the San Miguel granodiorite granophyres. The second is transitional or

mildly alkaline and includes compositions that plot close to the boundary of the sub-alkaline and alkaline field and includes the Santa Lucía gabbro-basalts, the Aiguá and India Muerta rhyolites, and the Valle Chico syenites (Figure 9). These units also present Nb/Zr ratios and trace element concentrations intermediate between the sub-alkaline and alkaline groups (Figure 7 and 8). The mafic rocks of the sub-alkaline and transitional series range between 45 to 54 SiO₂ wt % and the felsic between 61 and 75 wt %.

The alkaline trend is continuous in the Lascano series and ranges from alkaline basalts to trachytes, from 46 to 64 SiO₂ wt %. The Arrayán olivine basalts range from 47 to 51 SiO₂ wt % and lie at intermediate alkali contents between the mildly alkaline Santa Lucia basalts and the Lascano alkaline basalts. The Lascano basalts through trachyandesites are the only undersaturated, nepheline-normative rocks identified in this work, whereas the Lascano trachytes are locally silica saturated. In contrast, the other alkaline unit, the Arrayan olivine basalts are undersaturated olivine – hypersthene normative. The sub-alkaline and mildly alkaline basaltic units range from undersaturated olivine – hypersthene normative to oversaturated quartz normative, and the sub-alkaline to mildly alkaline felsic rocks are oversaturated quartz normative (Table 3).

This distinction between sub-alkaline, mildly alkaline and alkaline groups can be observed in the trace element contents of each lithogeochemical group. The sub-alkaline Treinta y Tres A and B basaltic rocks, show overlapping patterns in spider plots (Figure 10A,C,D), whereas the transitional Santa Lucía basalts are relatively enriched in alkalis and alkaline earths (Cs, Rb, Ba, Sr) and high field strength elements such as Ta, Nb, La and Hf. These elements are even more enriched in the gabbros of the alkaline Lascano

basalts (Figure 10B). The Arrayán olivine basalts are the most distinct geochemical unit showing strong enrichments of alkalis, alkaline earths, and high field strength elements similar to the Lascano basalts, but show relatively strong depletions in heavy rare earths compared to all the other mafic units (Figure 10C,D). Another difference is that the Arrayán basalts are the only mafic rocks showing a positive Eu anomaly. All the other mafic units show a negative anomaly.

Similar observations are made for the felsic rocks. The sub-alkaline Lavalleja rhyolite ignimbrites and the San Miguel granodiorite granophyres show overlapping spider plots whereas the mildly alkaline Aiguá and India Muerta rhyolites, the Valle Chico syenites and the Lascano series trachytes show an enrichment in the heavy rare earths. The mildly alkaline to alkaline felsic rocks are also enriched in high field strength elements such as Ta, Nb, La, Nd, Hf and Zr with the Lascano alkaline rocks being the most enriched (Figure 10F,G).

Two composite samples were studied for correlation purposes. One sample of a gabbro-basalt xenolith included in a San Miguel granodiorite granophyre, has trace and major element compositions that corresponds to the Treinta y Tres B gabbro-basalts, confirming the field stratigraphic relations of synchronous emplacement (as discussed before the granophyres also cut the gabbros). Three samples of basalt and rhyolite clasts from conglomerates of the Quebracho Formation in LASDDH4, have Nb/Zr ratios lying between the sub-alkaline and mildly alkaline ratios, suggesting provenance from units of that composition (Figure 7).

Specific gravity and magnetic susceptibility

The characteristic density and magnetic susceptibility of each lithogeochemical unit are summarized in Table 3. The Treinta y Tres B, Santa Lucía and Lascano gabbros have the highest density, reaching up to 2.99 g/cc. The density values of the Santa Lucía basaltic rocks are 2.67 g/cc and the gabbros are 2.99 g/cc, showing a contrast of ~ 0.30 g/cc between these rock types. All the felsic rocks show a density between 2.41 and 2.54 g/cc and are therefore lower density than gabbros by up to 0.58 g/cc.

The magnetic susceptibility is related to the content of magnetite, with and decreases with weathering of the magnetite to a mixture of hematite and limonite. All the mafic units, except the Arrayan olivine basalts, have high magnetic susceptibility reaching up to 200×10^{-3} SI, however, the Treinta y Tres B basalts and gabbros are slightly less magnetic. The felsic rocks have very low susceptibility, commonly under the detection limit of the instrument (1×10^{-3} SI). A notable exception are the Valle Chico syenites which are as magnetic as the most magnetic mafic units (200×10^{-3} SI, Ellis and Turner, 2006).

Discussion

Age of igneous rocks

The previously published isotopic ages for the Merín basin together with the ones presented in this paper, range between 133 to 127 Ma with some of the ages overlapping at two standard deviation confidence interval. Nonetheless, when the ages are plotted according the geographical distribution of their samples and their corresponding lithogeochemical unit, two groups become evident (Figure 11). First, the age of samples

of sub-alkaline to mildly alkaline basalts (Treinta y Tres A, B and Santa Lucía) from Valle Chico and from outcrops in the intermediate zone between Valle Chico and Lascano-West, range between 133 and 131 Ma. The second group ranges between 130 and 127 Ma and includes Valle Chico syenites, Aiguá rhyolites of the intermediate zone and all the dated rocks from Lascano-East and West (Lavalleja rhyolites, Treinta y Tres A basalts, India Muerta rhyolites and Lascano gabbros).

Figure 12A, shows the interpretation of these ages together with stratigraphic observations from Valle Chico and Lascano-West and -East. Two U/Pb ages for the Valle Chico syenites overlap at 128 ± 2 Ma, whereas the only available $^{40}\text{Ar}/^{39}\text{Ar}$ age is considerably older at 133 ± 2 Ma. This age was published by Stewart *et al.*, (1996) who did not publish raw data, spectra or isochrons for this sample, and it is impossible to judge the quality of the age. However, based on the stratigraphic observations presented before, we consider that it is more likely that the U/Pb ages are reflecting the real age of Valle Chico, and the suspect $^{40}\text{Ar}/^{39}\text{Ar}$ is too old and is not considered in our interpretations.

The overlapping ages of the Treinta y Tres A, B and Santa Lucía basalts between 133 and 131 Ma are older than the 130 to 128 Ma Lavalleja rhyolite ignimbrites and are congruent with most of the stratigraphic observations where most of these basalts are observed below the rhyolites. Based on cross-cutting relations presented above, the age of the San Miguel granodiorite granophyres and the Treinta y Tres B gabbro sills is inferred to be within this 130 – 128 Ma range.

In exception, one age of the Treinta y Tres A basalts at ~127 Ma from Lascano-East is younger than the Lavalleja rhyolites. This is also congruent with some stratigraphic observations where smaller volumes of the Treinta y Tres A and B and Santa Lucía basalts are observed on top of the Lavalleja rhyolites. Thus, the sub-alkaline to mildly alkaline basalts range between 133 to 127 Ma. This could be explained by a protracted magmatism of the same units (~6 Ma) or that different basalts flows with the same chemical affinity were extruded at different times in different zones of the basin. The latter seems to be the most likely hypothesis, since the 133-130 Ma ages were obtained from samples from the area from Valle Chico to Lascano-West where all the rhyolites were observed to be stratigraphically on top of basalts. And, the only 127 Ma age was obtained from a sample from Lascano-East, so far the only location in the Merín basin where basalts are observed on top of Lavalleja rhyolites (in subsurface). However, there is no evidence to support the interpretation that some of the Treinta y Tres A basalts are younger than the Lascano alkaline series. Because the only age from a gabbro dike from this series yield an age of 127.8 ± 0.9 Ma we consider that the Treinta y Tres A age of 126.9 ± 0.9 Ma is slightly too young and we consider the real age towards the older range between error (Figure 12A). As presented before, all the $^{40}\text{Ar}/^{39}\text{Ar}$ ages analyzed for this work are considered precise and accurate. No hydrothermal alteration evidence was identified in the analyzed samples, no Ca interference was identified in the measurement and the plateau age represents more than 60% of the gas released.

Based on the isotopic ages, at least for Lascano-East, the Lascano alkaline series dikes are younger than the India Muerta rhyolite dikes, however, no cross-cutting

relations were observed to confirm this interpretation. For Valle Chico, the Aiguá rhyolites overlap in age with the Valle Chico syenites. Considering that the Valle Chico is intruding the Aiguá rhyolitic lavas, and is also intruded by Aiguá composition rhyolitic dikes, a close time emplacement is suggested. The Lascano series trachytes were also observed cutting the Valle Chico syenites, and if these were emplaced at the same age than in Lascano East, it is possible to hypothesize that the Valle Chico syenites must be older than ~127 Ma.

No isotopic data was obtained for the Arrayán olivine basalts but based on the stratigraphic relations these should be younger than the Lascano alkaline series, and therefore, younger than ~127 Ma. Since these are intercalated with the Quebracho conglomerates, the age of this Formation is thought to be the same.

In Figure 12B the overlapping isotopic ages within two-standard deviation are plotted together and three groups are evident. The first group is ~133 to 131 Ma and includes four ages of the sub-alkaline and mildly alkaline basalts (Treinta y Tres A and B and Santa Lucía). Based on the stratigraphy the Treinta y Tres B gabbros and the San Miguel granodiorite granophyres are inferred to belong to this group as well. This group of units has only one age at ~127 Ma, and, as discussed above, may represent continuous protracted magmatism or younger basalts of similar chemistry restricted only to Lascano-East. The second group from ~130 to 128 Ma only includes the sub-alkaline Lavalleya rhyolite ignimbrites from Lascano-East and West. The third group from ~129 to 127 Ma, includes mildly alkaline to alkaline felsic rocks and alkaline mafic and felsic rocks (the mildly alkaline India Muerta and Aiguá rhyolites, mildly alkaline syenites of Valle Chico

and the Lascano alkaline series). A fourth group includes the Arrayán olivine basalts and the Quebracho conglomerates and is inferred to be younger than the third group. These observations can be interpreted as a progression from older, predominantly sub-alkaline to mildly alkaline magmatism, to an increasing quantity of mildly alkaline to alkaline magmatism with younger ages. However, at least part of the sub-alkaline mafic magmatism continued during the younger period of alkaline magmatism.

Stratigraphy and shape of intrusions

Several observations suggest that while the sub-alkaline Treinta y Tres A and B basalts and the Lavalleja rhyolite ignimbrites are widespread throughout the entire basin, the rest of the rocks are observed only within, or near, the exposed or inferred intrusive complexes imaged as the geophysical anomalies (Figures 3, 5 and 6).

The exposed Valle Chico complex shows a close spatial association of intrusive syenites with Aiguá rhyolites, and it is the only location in the Merín basin where these rocks are volumetrically dominant. The Aiguá rhyolites crop out only at the rim of the Valle Chico complex syenites, and the Aiguá rhyolite dikes and Lascano series trachyte dikes were only observed in outcrop cutting the Valle Chico syenites. Similarly, Lascano alkaline series rocks and India Muerta rhyolites were only observed as dikes and sills cutting sub-alkaline and mildly alkaline rocks in the sub-surface of Lascano-East. The San Miguel granodiorite granophyres and related Treinta y Tres B gabbro sills were identified in large volumes in the subsurface of Lascano-East. Moreover, these lithologies only crop out at the southern edge of the San Luis anomaly and only one isolated outcrop of the San Miguel granodiorite granophyres was identified in the Lascano-West complex

where large volumes were identified in the subsurface of Lascano-East. Lastly, despite the assertion of Kirsten *et al.* (2000) that minor volumes of Santa Lucía basalts are scattered throughout the basin, we only identified Santa Lucía basalts and gabbros in the sub-surface of the central zone of Lascano-East.

The presence of the largest volumes of Lavalleja rhyolite ignimbrites surrounding the Lascano-East and Lascano-West complexes suggests that these could have been the centers of the sub-alkaline volcanism and potentially to caldera collapse events, as proposed by Rossello *et al.* (1999) and Conti (2008). Based on the spatial distribution of the magmatic units discussed above, it is also clear that Lascano-East was the locus of some sub-alkaline intrusions (San Miguel granodiorites) as well as the mildly alkaline to alkaline volcanism and intrusions (Santa Lucía basalts and gabbros, India Muerta rhyolites and Lascano alkaline series). Similarly the Valle Chico complex may have been the locus of the Aiguá rhyolite extrusion as already suggested by Kirsten *et al.* (2000) and Lustrino *et al.* (2005), which was later intruded by the syenites and lastly by Aiguá rhyolite dikes and the Lascano trachytes.

The cross section through the Lascano-East complex (Figures 13) shows that different lithogeochemical units are found in different zones of the complex. Thus, three zones are here distinguished based on position relative to the inferred ring-faults that bounds the subcircular complexes: a central zone inside the ring, a rim zone along the ring and an external zone immediately outside the ring.

The central zone of the complex is composed of small sections of Lavalleja rhyolites and Treinta y Tres A basalts. Two sub-zones can be differentiated, the first is

preferentially intruded by the San Miguel granodiorite granophyres and the Lascano gabbro sills (LASDDH8, LASDDH9) and the second is dominated by Santa Lucía basalts intruded by gabbros of the same chemical affinity (LASDDH2, LASDDH6, LASDDH7). The latter zone is the only known area of the basin where the Santa Lucía basalts are volumetrically dominant. Both of these zones are cut by abundant Lascano dikes and sills. These observations are consistent with the hypothesis that both the mildly alkaline Santa Lucía basalts and gabbros and the Lascano alkaline intrusions are only present in the central zone at the Lascano-East complex and might be derived from magmatic feeders at depth in this area.

The eruption of hundreds of meters of Santa Lucía basalts in this area, requires that the central part of the complex was either a topographic low or a down-dropped block at the time of extrusion. Furthermore, at least some areas in the central zone register deposition of the Quebracho conglomerates during the last extrusion of the Santa Lucía basalts (LASDDH6), which suggest that this was a topographically low depositional zone. However, the lack of outcrops and limited drillholes in the area prevent testing this idea.

Local drilling into the rim of the complex has intersected 500 meters of Treinta y Tres A and B basalts and minor Lavalleja rhyolites (LASDDH1, LASDDH3, LMD1). These rocks were intruded by up to 900 meters of San Miguel granodiorite granophyres, sill-like bodies of Treinta y Tres B gabbros, and India Muerta rhyolite dikes and sills (LASDDH1, LASDDH3, LASDDH5).

The only available drillhole outside of the Lascano-East complex (LASDDH4) encountered 300 meters of Lavalleja rhyolites overlying 50 meters of Treinta y Tres basalts A, which are cut by one India Muerta rhyolite dike. These lithologic units are located in a deeper position relative to the same lithologies in the rim of the complex or in surface exposures and are overlain by more than 400 meters of Quebracho conglomerates intercalated with the Arrayán olivine basalts. These observations suggest that at least parts of the periphery of the Lascano-East complex was faulted and downdropped relative to the rim after the extrusion of the Lavalleja ignimbrites. A pair of graben boundary faults striking N290° to N80° along the north side of Lascano-East are inferred on the basis of the aeromagnetic data (Figure 15). If this interpretation is correct it would suggest the rim of the complex as the provenance area. This is reinforced by the observation that the basalt and rhyolite clasts of the Quebracho Formation have matching compositions with the sub-alkaline and mildly alkaline rocks which are the most abundant rocks of the rim of the complex (Figure 7). Because no alkaline clasts were identified in the conglomerates, it is possible that the alkaline magmas of the Lascano series did not extrude at all, or only within restricted areas in the central part of the complex but not on its rim.

A cross section through Lascano-West is shown in Figure 14. Even though no drillhole information is available from this complex, the dipping of the Lavalleja rhyolite ignimbrites are exposed and contain numerous structural attitudes that can be used as a guide to the subsurface at Lascano-East. In Lascano-West the rhyolites mimic the shape of the ring-fault and are dipping 2° to 5° towards its center. If we consider that these

complexes were the centers of huge extrusions of the Lavalleja rhyolite ignimbrites, as discussed above, the gentle inward dips of the rhyolites within the geophysically inferred ring-structure could be explained as related to the collapse of a caldera along ring-faults. However, the ring fault is not directly observed offsetting the rocks in the periphery of Lascano-West. We infer, therefore, that the outcropping rhyolites were erupted during the subsidence of the caldera floor burying the ring-fault.

If this caldera collapse hypothesis is also valid for Lascano-East, the restricted location of the Santa Lucía basalts and minor sub-alkaline basalts in the central zone of the inferred caldera, intercalated with Lavalleja rhyolites, may be explained as mafic intracaldera magmatism. After the main Lavalleja extrusion and caldera collapse, sub-alkaline to mildly-alkaline magmatism followed together with minor Lavalleja rhyolites extrusions.

Interpretation of the geophysical anomalies

The drillholes located over the positive magnetic anomaly that delineates the rim of Lascano-East complex (LMD1, LASDDH1 and 3) intercepted thick, highly magnetic Treinta y Tres A basalts. Since the geophysical modeling indicates that the large and steep gradient of aeromagnetic anomalies are the product of relatively shallowly emplaced strongly magnetic lithologies, (< 1 km, Reytmayer, 2001; Ellis and Turner, 2006), it is likely that the intercepted basalts are causing the magnetic anomaly at least in these locations. Thus, the steep magnetic gradient of the ring-like positive magnetic anomaly against the negative magnetic-gravity zone outside of the ring structure could represent a faulted contact of these rocks against the downdropped Quebracho Formation

conglomerates intercepted in LASDDH4 outside of the ring structure (Figures 13 and 15). Most of the highly magnetic basalts intercepted by drilling in the ring-structure are lava flows. Nonetheless, since the magnetic anomalies in the ring structure are broad zones and there are only three drillholes into the ring structure, the possibility of highly magnetic ring dikes that were missed by drilling cannot be completely discarded.

The gentle gradient of the aeromagnetic anomaly inwards from the ring-structure boundary could indicate the dip of the Treinta y Tres A and B basalts after faulting and tilting, which is consistent with the surface observations over Lascano-West discussed previously and is compatible with a collapse caldera hypothesis (Figures 14 and 15).

Based on the limited work in the Valle Chico complex, the source of the magnetic anomaly there is most likely a response to the highly magnetic syenites outcrops (Table 3). The concentric ring pattern of the magnetic anomaly there (Figure 15) could represent concentric intrusions of the Valle Chico syenites, which is suggested by the mapping presented by Lustrino *et al.* (2005) (Figure 3). This interpretation is also consistent with geophysical modeling by Reytmayer (2001) and Ellis and Turner (2006), who argue that the source of the aeromagnetic anomalies is limited to superficial layers at < 1 km depth.

Reytmayer (2001) calculated that the observed gravity anomaly of the Merín basin, could be explained by density contrasts of at least 0.4 g/cc. In this work we measured density contrasts that range from 0.26 to 0.58 g/cc between basalts, rhyolites, granophyres and syenites and gabbros from the Treinta y Tres B, Santa Lucía and Lascano types (Table 3). Furthermore, as pointed out above, the Santa Lucía and Lascano gabbros are restricted to the inner zones of the ring-structures, which could account for a

difference in the volume of denser rock inside versus less dense rocks outside of the complexes. Thus, the small positive circular and elongated gravity and coincident magnetic anomalies identified inside the complexes may be responding to dikes, sills and plugs of the strongly magnetic and high density Treinta y Tres B, Santa Lucía and Lascano gabbros on top of hidden, deeper intrusions. Reytmayer (2001) and Ellis and Turner (2006) estimated that the dense rocks were located deeper than 1 km and inferred that they possibly extended to the upper mantle. Thus the presence of a larger mafic intrusion, or at least a denser network of dikes and sills below the depth sampled by the drillholes, is required to fit the gravity models. An estimative of the maximum depth to the interfase with the denser rocks, can be calculated using the Bouger anomaly formula ($\Delta g = 2\pi \cdot G \cdot \Delta \rho \cdot \Delta h$). In this way, a 4 mGal anomaly could be produced by an infinite slab with a density contrast of 0.1 g/cc located at a 1 km depth. In the same way, a 16 mGal anomaly can be produced by a 0.4 g/cc contrast at a 1 km depth. To produce a ~ 80 mGal positive gravity anomaly as observed in the Merín basin with a ~ 0.4 g/cc density contrast as proposed here, a 5 km depth to denser rocks is required. Nonetheless, if we considere a progressively denser network of intrusions with increasing depth, emplaced in a cylindrically shaped zone of ~ 20 km in diameter as Lascano-East, the depth to the intruded zone would be closer to surface.

The location of a low gravity and low magnetic zone surrounding the complex around LASDDH4 is consistent with the hypothesis of a downdropped block infilled with Quebracho conglomerates and minor Arrayán basalts.

Petrogenesis of igneous rocks and temporal variation

The magmatic diversity observed in the Merín basin rocks cannot be explained by melting or crystallization of a single magma based on models presented in this research. Fractional and equilibrium crystallization of normal or enriched middle ocean ridge basalt (N-MORB and E-MORB) and ocean island basalt (OIB) sources can only explain part of the magmatic variability observed. Similarly, fractional or batch melting of primitive mantle can only explain some of the compositions (Figure 16A and B). Only some compositions of the Treinta y Tres B or Santa Lucía basalts could be explained by crystallization of an E-MORB melt of melting of a primitive mantle, and some of the Arrayán basalts by crystallizing an OIB melt.

Based on Nd and Sr isotopes, Kirsten *et al.* (2000) identified two main magmatic lineages. These authors modeled up to a 40% fractional crystallization from lithospheric mantle melts combined with crustal assimilation in order to produce the Treinta y Tres A basalts, and mixtures between melts from the Tristan plume and crustally contaminated low Ti basalts (Treinta y Tres A basalts) for the Santa Lucía basalts. For the felsic rocks they model 60 to 70% fractional crystallization of lithospheric mantle melts, and propose that an upper crustal trace element signature for the Lavalleya rhyolites may be from assimilation of Treinta y Tres A basalts. A deeper crustal geochemical signature was identified for the Aiguá rhyolites and the Valle Chico syenites similar to the Santa Lucía basalts. Similarly Lustrino *et al.* (2005), based on Nd and Sr isotopes, proposed a lower crust assimilant for the mildly alkaline rocks and an upper crust for the sub-alkaline. However, no Nd and Sr isotope data have been published for the more alkaline rocks.

Based on our trace element modeling we show that the magmatic variability identified in our geochemical data can be explained by a similar hypothesis involving multiple mantle sources and crustal assimilation. Furthermore, we found that the compositions of the newly defined lithogeochemical units can also be explained by two distinct lineages. In this scenario, The Treinta y Tres B basalts correspond to a similar magmatic lineage to the Treinta y Tres A basalts and they were produced by melts of a shallow mantle source with some crustal assimilation. On the other hand, the Lascano alkaline gabbros, and to a certain degree the Arrayán olivine basalts, are more comparable in trace elements contents to the Santa Lucía basalts and would require a deeper OIB like source and less crustal assimilation (Figure 16C and D).

These two lineages can be illustrated by mixing lines between an N-MORB source, an OIB source and two samples of possible crustal assimilants from the Merín basin (Neoproterozoic Santa Teresa granodiorite and a Neoproterozoic gneiss) (Figure 16C,D,E,F).

Mixing between a deep and a shallow mantle source (or fractionated products of these) can produce the Arrayán basalts, the Lascano alkaline series and the transitional Santa Lucía basalts with an increasing proportion of the shallow mantle source. The Aiguá, India Muerta and Valle Chico syenite samples plot close to this path and may represent the product of fractional crystallization and crustal assimilation from intermediate products of this lineage. A similar mechanism was proposed for the formation of alkaline basalts in the Brazilian offshore rifts by Mohriak *et al.*, (2002). Instead of mixing, an alternative hypothesis is that melts were generated at progressively

deeper depths (from Santa Lucía basalts to Arrayán olivine basalts) and progressively lower degrees of partial melt.

On the other hand, mixing between a shallower mantle melt and crustal assimilants could explain the variability of the subalkaline rocks. The Treinta y Tres A and B gabbros-basalts, the Lavalleja rhyolites and the San Miguel granodiorite granophyres plot in an area defined by the mixing lines between N-MORB, Neoproterozoic Santa Teresa granodiorite, and a Neoproterozoic gneiss sample. Nonetheless, these paths are only illustrative of the processes and do not pretend to explain it comprehensively, especially in the case of the more evolved rocks, which may have formed by fractionation of intermediate products. Other assimilants would be needed to explain the magmatic variability of the felsic rocks as shown by the larger dispersion of the trace element ratios of the Lavalleja rhyolites and the composition of the granophyres, which in these plots require an unrealistic 100% assimilation of the Neoproterozoic granodiorite in order to produce them (Figure 16E and F).

Based on stratigraphic relations and age dating we propose that the sub-alkaline and mildly alkaline magmatism was active prior to the alkaline magmatism. We hypothesize an evolution from a shallower mantle source (MORB-like) to a deeper source (OIB-like). Figure 17, shows that the Dy/Yb ratio increases from the sub-alkaline, to mildly alkaline, to alkaline gabbros-basalts, reaching a maximum with the youngest Arrayán olivine basalts. High Dy/Yb indicates a garnet bearing mantle source where garnet preferentially retains Y and heavy rare earths such as Yb. The similarity of trace element contents of the Arrayán olivine basalts and the present day volcanics from

Gough Island and Tristan da Cunha supports the hypothesis that an OIB source was related to this system, at least at the late stages of the magmatism in the Merín basin (Figures 10B).

Proposed origin of igneous rocks at Lascano and the Merin basin

A magmatic evolutionary model in temporal panels illustrates the possible genesis of the intrusive complexes imaged geophysically in the Merín basin, based on results from Lascano (Figure 18).

The opening of the South Atlantic and associated aborted rift of the Merin basin initiated magmatism as the sub-alkaline Treinta y Tres A and B basalts, and minor amounts of the mildly alkaline Santa Lucía basalts between 133 to 131 Ma. At some point after the first extrusion, crustal melting led to intrusion of the San Miguel granodiorite granophyres, as well as the Treinta y Tres B gabbros, intruded shallow zones principally as sill-like bodies. Rift-related asthenospheric ascent produced decompression and triggered melting to produce basaltic magmas at different depths. The shallower melts arrived to the surface first and correspond to the basalts of Treinta y Tres A and B. This magmatism evolved to produce several shallow silicic magma chambers that produced calderas and erupted to form the Lavalleja rhyolitic ignimbrites between 130 and 128 Ma. As discussed before, this early stage of sub-alkaline bimodal magmatism involved large quantities of crustal melting and assimilation to produce rhyolites, which could be explained by high heat flows during these high rates of basalt input into the upper crust. Large volumes of the Lavalleja rhyolitic ignimbrites were rapidly erupted, emptying the magmatic chambers and producing its collapse and creating ring-structures.

This collapse caused the inwards tilting of the Treinta y Tres A and B basalts and Lavalleja ignimbritic rhyolites inside the Lascano-West caldera and possibly Lascano-East. Since the collapse of the caldera was likely produced during the extrusion of the Lavalleja rhyolites, at least some of these ignimbrites were deposited over the ring-structures and flexured during the sag subsidence of the caldera floor. Less voluminous sub-alkaline basalts of Treinta y Tres A and B were extruded at this time over some of the Lavalleja rhyolites together with Santa Lucía basalts lavas inside the Lascano-East caldera, perhaps as part of the intracaldera magmatism, and were accompanied by the emplacement of chemically similar gabbro dikes and sills.

In the final stages, between 128 to 127 Ma, the India Muerta rhyolite dikes were emplaced followed by the Lascano alkaline series intrusions, as dikes, sills and plugs of alkaline gabbro to trachytes. On the basis of geophysical data, bigger mafic intrusions were probably deeply emplaced during this stage and were the source of the shallower dike and sills. This stage could have been accompanied by uplift of the central ring-faulted block due to the intrusion.

Lastly, after ~127 Ma, the Arrayán olivine basalts erupted through peripheral structures, and flooded the low topography areas formed by downdropped normally faulted blocks outside of the ring structure, together with the deposition of Quebracho conglomerates. These faults, based on the geophysical data form an east-west grabben immediately up of Lascano-East.

In the nearby Valle Chico complex, the Aiguá rhyolites were likely extruded between 128 to 127 Ma by less explosive volcanism, mostly as flows. This was

immediately followed by the emplacement of the syenites, which were intruded shortly afterwards by the Lascano trachyte dikes and rhyolitic dikes of similar affinity to the Aiguá lavas.

Comparison with the Paraná large igneous province and associated rift basins

Similarities and differences between the Merín rocks and the Paraná volcanics were discussed by Kirsten *et al.*, (2000, 2001) and the data presented in the current study are consistent with these conclusions. No high Ti groups were identified and all the sub-alkaline rocks show similar characteristics to the low Ti series of the Paraná. The chemical compositions of the mildly alkaline Santa Lucía basalts, Aiguá and India Muerta rhyolites are all very rare in the Paraná basin. No alkaline rocks are described for the Paraná basin *sensu stricto*, except in the associated intrusive complexes in the periphery of the basin. This is also evidenced by the Nb/Zr ratios of Paraná samples which do not reach more than 0.19 (Figure 8).

The closest similar aborted rift basin in South America, with alkaline intrusions related to the opening of the southern Atlantic Ocean is the Poço de Caldas – Cabo Frio alignment close to Rio de Janeiro in Brazil. This trend of alkaline complexes is younger than the complexes of the Merín basin, ranging from 82 to 53 Ma, and post-dates the Paraná-Etendeka magmatism. These have been proposed to relate to the Trindade hot spot magmatism (Sadowski and Dias Netto, 1981).

Other intrusive complexes with alkaline rocks are scattered in the periphery of the Paraná basin and some of these overlap in age with the Merín basin (Biondi, 2003). The closest one being the Piratini complex in Rio Grande do Sul, Brazil (Gomes and Comin-

Chiaramonti, 2005). Some alkaline basalts have been drilled in the Pelotas, Santos and Campos Cretaceous continental shelf rift basins of Brazil but limited stratigraphical information was published (Mohriak et al., 2002).

Comparison with the Damaraland and Luderitz complexes

Based on plate tectonic reconstructions for the South American and African plates at 133 Ma, the Luderitz alkaline province in Namibia was very close in space to the Merín basin during the early Cretaceous while the Damaraland alkaline province was ~200 km to the north (Franke *et al.*, 2007; Figure 17). Several similarities can be found in the structure, stratigraphy, geometry of intrusions, isotopic ages and geochemistry between the complexes in these locations. According to Pirjano (1994), the intrusions of the Damaraland Alkaline Province range from 133 to 124 Ma and was also associated with the Paraná – Etendeka province and Tristan da Cunha hot spot magmatism. This province is composed of 21 sub-alkaline/alkaline composite intrusions that average 20 km in diameter and intrude a Neoproterozoic basement and Etendeka sub-alkaline lavas and ignimbrites. The Luderitz complexes are less well known but similar to the Damaraland. There are three major intrusions identified and several plugs and dikes of *ca.* 133 Ma (Marsh, 1975).

The mixed saturated-undersaturated igneous rocks and carbonatite of Okenyenya complex (formerly Okonjenje) (SACS, 1980) were chosen for geological and geochemical comparison as this is one of the better studied complexes of Namibia. Even though it is smaller in diameter (*ca.* 5 km) than the Uruguayan complexes, it is mainly composed of gabbros and syenites, which are two common lithologies in the Merín basin.

According to le Roex (1996) the rocks of Okenyenya are divided into two magmatic lineages: a tholeiitic and an alkaline suite. The main groups of rocks are comparable with the ones identified in the Merín basin, with the exception that Okenyenya also include essexites, nepheline syenites and lamprophyric rocks that have not yet been identified in Uruguay. The intrusive bodies are usually circular and are enclosed by a major peripheral ring-dike of syenite in some areas. The complex has a “saucer-shape” and is intensely cut by northwest-southeast striking alkaline dikes. Most of the late alkaline rocks intrude the complex as dikes, plugs and diatremes.

The most remarkable similarity between the two areas is found within their geochemical signatures. The Nb/Zr ratios of the sub-alkaline lithologies range from 0.08 and 0.14 and overlap with the Nb/Zr ratios (0.050 and 0.097) reported in this study from the Merín basin. In contrast, the alkaline gabbros show a higher Nb/Zr ratio of 0.22, which is almost identical to the Lascano alkaline series from Merín (0.23) (Figure 8). The similarity of these chemical ratios, which are reflecting the magma sources, together with the geochronological and paleotectonic reconstruction, indicates that the magmatism in Merín, Damaraland and Luderitz was broadly contemporaneous and probably linked to similar melt sources, evolutionary paths, and emplacement mechanisms.

Some speculations about the geology of the concealed complexes in the Merín basin can be enlightened by comparison with Damaraland. First, the petrological evolution proposed in the previous section (in terms of different degrees of partial melting of progressively deeper mantle sources) is consistent to what has been proposed for at least some of the complexes of the Damaraland province by Le Roex *et al.*, (1996).

Although these authors explain the main processes based on the presence of a mantle plume, they proposed an early extrusion of tholeiitic sub-alkaline magmas by partial melting of a less enriched mantle during the higher heat flow in the main plume phase. This magmatic phase is associated with explosive volcanism and the formation of ring structures by caldera collapse. The alkaline magmatism was active approximately for up to five million years, after the initial sub-alkaline magmatism, and it is interpreted here as low degrees of partial melting of a deeper source under low heat flow with the distancing from the plume center. This alkaline magmatism forms plugs, dikes and sills that intrude the magmatic conduits of the initial tholeiitic sub-alkaline magmatism.

Second, an age progression from one alkaline complex or cluster of complexes to the next is observed in some alkaline provinces. This is the case of younger alkaline provinces such as the Cameroon Line or the Poco de Caldas-Cabo Frio alignment but it has not been demonstrated for the Damaraland or Luderitz provinces (Pirajno, 2010). Age differences between the Valle Chico zones and Lascano-East and West have been discussed in this work, however, all the mildly alkaline to alkaline intrusions seems to be contemporaneous. More isotopic ages covering the entire Merín basin would improve the understanding.

Third, it is pertinent to point out that the Damaraland complexes show positive gravity and magnetic anomalies, similar to Merín, and that these are intense, circular, steep sided (e.g. Eberle *et al.*, 2002; Bauer *et al.*, 2003). The SIMBA reflection experiment over the Messum complex is the only seismic profile of the crust at an anorogenic alkaline complex (Bauer *et al.*, 2003). The SIMBA profile shows a heavily

intruded root zone of cylindrical shape that extends to the Moho at 40 km. The authors interpret this geophysical response as a network of mafic intrusions occupying 30% of the crustal column, and which increases in volume from 20 km to the Moho. The work of Bauer *et al.*, (2003) supports the hypothesis that the gravity anomalies are caused by deep gabbroic intrusions inside each complex and that these extend deeply into the crust, as we propose for the complexes in the Merín basin.

Fourth, we can illustrate the structural and lithological variability that could compose the concealed complexes of Merín and the multiple plausible interpretations of each of the geophysical features. Contemporaneous and proximal complexes in the Damaraland present diverse lithologies that range from oversaturated complexes with granites and syenites, mixed oversaturated-undersaturated with carbonatites and undersaturated with carbonatites (Kinnaird and Bowden, 1991). Also, the intricate intrusive structures of the complexes are evident even in smaller complexes such as Okenyenya. Therefore the lithological and emplacement differences between the Valle Chico and Lascano-East complexes are understood in the same way that the differences are described for complexes in the Damaraland, which are separated by similar distances. In the same way, the two inferred complexes in Merín, Lascano-East and San Miguel, could be composed by different lithologies to the ones identified in the rest of the Merín basin.

Lastly, we can speculate a possible explanation of why most of the complexes in Merín are concealed at depth. The Cretaceous rocks in the eastern area of Uruguay have an average altitude of 30 meters above sea level and reach approximately 250 meters at

the highest landforms (*e.g.* Grutas de Salamanca). The Precambrian outcrops in the faulted edge of the basin comprise the highest landforms reaching 540 m (*e.g.* Cerro Catedral). On the other hand, Namibia has an altitude of up to 3473 meters and the plateaus average ~3000 meters above sea level (Moore *et al.*, 2009). In contrast to the Merín basin, the complexes in Damaraland comprise the elevated landforms. According to Moore *et al.*, (2009) the uplift of the southern African crust was a consequence of the change of the pole of rotation during the opening of the Atlantic Ocean. The South American plate did not experience this uplift, or at least not with this intensity. The lack of uplift would have preserved the Merín basin as a topographic depression and possibly preserved the complexes at shallower crustal levels compared to Namibia. An exception to this would be the Valle Chico complex, where syenites are cropping out.

An alternative, or complementary, hypothesis to this could be argued based on mass excess in the crust. Reytmayer (2001) estimated that the gravity anomaly could have produced crustal flexure and subsidence on the order of hundreds of meters for the entire Merín basin. This could be the case of Lascano East, West and San Luis complexes, which intruded in the central rift areas and also produced more intense gravity anomalies. On the other hand, because the Valle Chico complex is emplaced partially over a major crustal structure (the Sierra Ballena Shear Zone), which forms a boundary with the possibly thicker crustal block of the Nico Pérez terrane (Introcaso and Martínez, 2002), this area could have experienced less subsidence.

Conclusions

The stratigraphy, age relations, intrusive geometries and airborne magnetic and gravity response of the volcanic and intrusive rocks encountered in the subsurface of Lascano-East are best explained as a concealed sub-alkaline to alkaline ~ 133 to 127 Ma magmatic intrusive complex. This is the second intrusive complex recognized in the Merín basin after the outcropping syenites of the Valle Chico complex. Based on the similarity of the intensity and geometries of the geophysical anomalies and their alignment with the basin axis, we hypothesize that the Lascano-West and San Luis anomalies are caused by similar concealed intrusive complexes, raising to a total of four the intrusive complexes identified for the Merín basin.

Ten lithogeochemical units and one sedimentary unit were identified based on trace element chemistry, petrography, observed modes of emplacement and cross cutting relations. The stratigraphy, geometry of intrusions and age of magmatism were constrained by outcrop and subsurface observations, construction of cross sections and $^{40}\text{Ar}/^{39}\text{Ar}$ dating. These units were grouped into three associations according to their chemistry. A sub-alkaline group, composed of Treinta y Tres A basalts, Treinta y Tres B basalts and gabbros, Lavalleja rhyolite ignimbrites and San Miguel granodiorite granophyres, a mildly alkaline group including the Santa Lucía basalts and gabbros, Aiguá rhyolites, Valle Chico syenites and India Muerta rhyolites and an alkaline group including the Lascano alkaline gabbro to trachyte series and the Arrayán olivine basalts. The only sedimentary rocks identified in the basin are conglomerates composed

exclusively of sub-alkaline to mildly alkaline basalt and rhyolite clasts that were grouped as the Quebracho Formation.

The sub-alkaline to mildly alkaline basaltic lavas (Treinta y Tres A, B and Santa Lucía) are similar to and present the same ages as the widespread Paraná magmatism, extruded first, mostly between ~133 to 131 Ma throughout the entire basin. Based on cross cutting relations the dikes and sills of similar composition are inferred to have been broadly emplaced during the same period (Treinta y Tres B gabbros, San Miguel granodiorite granophyres and maybe some of the Santa Lucía gabbros).

The associated voluminous sub-alkaline Lavalleya ignimbritic rhyolite extrusions followed between ~130 to 128 Ma, probably producing caldera collapse at least in Lascano-East and West. The felsic volcanism at Valle Chico was a bit younger and was possibly dominated by the less explosive Aiguá rhyolites (~ 128 to 127 Ma). At least some of the sub-alkaline basaltic magmatism was still active, or reactivated during and after this period as the Treinta y Tres A, B lavas and Santa Lucía lavas and intrusions.

The extrusive centers that were formed by the rhyolitic eruptions were then intruded by mildly alkaline and alkaline mafic to felsic rocks between ~128 to 127 Ma. Whereas Valle Chico was dominated by the intrusion of syenites, Lascano-East was dominated by gabbros and trachytes. The alkaline dikes and sills are inferred to be part of a dike and sill complex on top of deeper mafic alkaline intrusions responsible for the gravity anomalies. The density contrast measured for the gabbro dikes and sills in this work show at least a 0.4 g/cc density contrast with the rest of the rocks which is

coincident with the estimated contrast necessary to satisfy previous geophysical models and suggests that these are responsible for the gravity anomalies.

The youngest and least voluminous magmatism is represented by the Arrayán olivine basalts that were emplaced synchronously to the deposition of the Quebracho conglomerates in an inferred normal-fault bounded graben, and are inferred to be younger than ~127 Ma.

Based on limited trace element modeling we propose that a shallow mantle source produced normal middle ocean ridge basalt that with abundant crustal assimilation in turn generated the sub-alkaline magmatic rocks. In contrast, the mildly alkaline and alkaline igneous rocks were produced by mixing of MORB-like melts with a deeper mantle source that generated ocean island basalt – like melts, or by progressively deepening of the mantle melting source and lessening of the degree of partial melting.

Geochronological and paleotectonic reconstructions indicate that the magmatism in the Merín basin was broadly contemporaneous and close in space to the magmatism on the African side of the south Atlantic rift, in Luderitz basin in Namibia, and in the Damaraland basin about 200 km to the north. The similarity of the stratigraphy and geochemistry of the rocks in the Namibian intrusions, might indicate that they were linked to similar melt sources, evolutionary paths, and emplacement mechanisms associated to the Paraná – Etendeka provinces and the opening of the southern Atlantic ocean.

The complexes in the Damaraland province, despite being contemporaneous with Merín ring complexes, are constituted by different rocks in different structural

arrangements. Similar lithological variations as the better exposed complexes in Namibia, could explain the dominance of mildly alkaline syenites in Valle Chico versus the alkaline gabbros to trachytes dikes found in the Lascano-East complex, and suggest that both the Lascano-West and San Miguel concealed complexes could be composed of different rock types.

Contrary to the case of the Nambian alkaline complexes, those in Uruguay are largely concealed at depth and the overlying volcanic sequence they intrude is preserved. This is consistent with Africa experiencing uplift after the Gondwana break up whereas South America remained more stable and low-lying. However, variations in the level of exposure are recognized in the Merín basin and subsidence of the basin due to the emplacement of mafic intrusions may have played a role as well.

Figures and Tables

Figure 3 - Geologic map of Merín basin and its surrounding basement, modified from Bossi & Ferrando, 2001; Lustrino *et al.*, 2005; Morales, 2006; Conti, 2008 and Muzio *et al.*, 2009. Showing interpreted intrusive complexes location: Valle Chico, Lascano-West, Lascano-East and San Luis. Insert of Lascano-West and East showing location of Orosur Mining INC. drillholes collars. Coordinate system in Gauss-Kruger, Datum Yacaré.

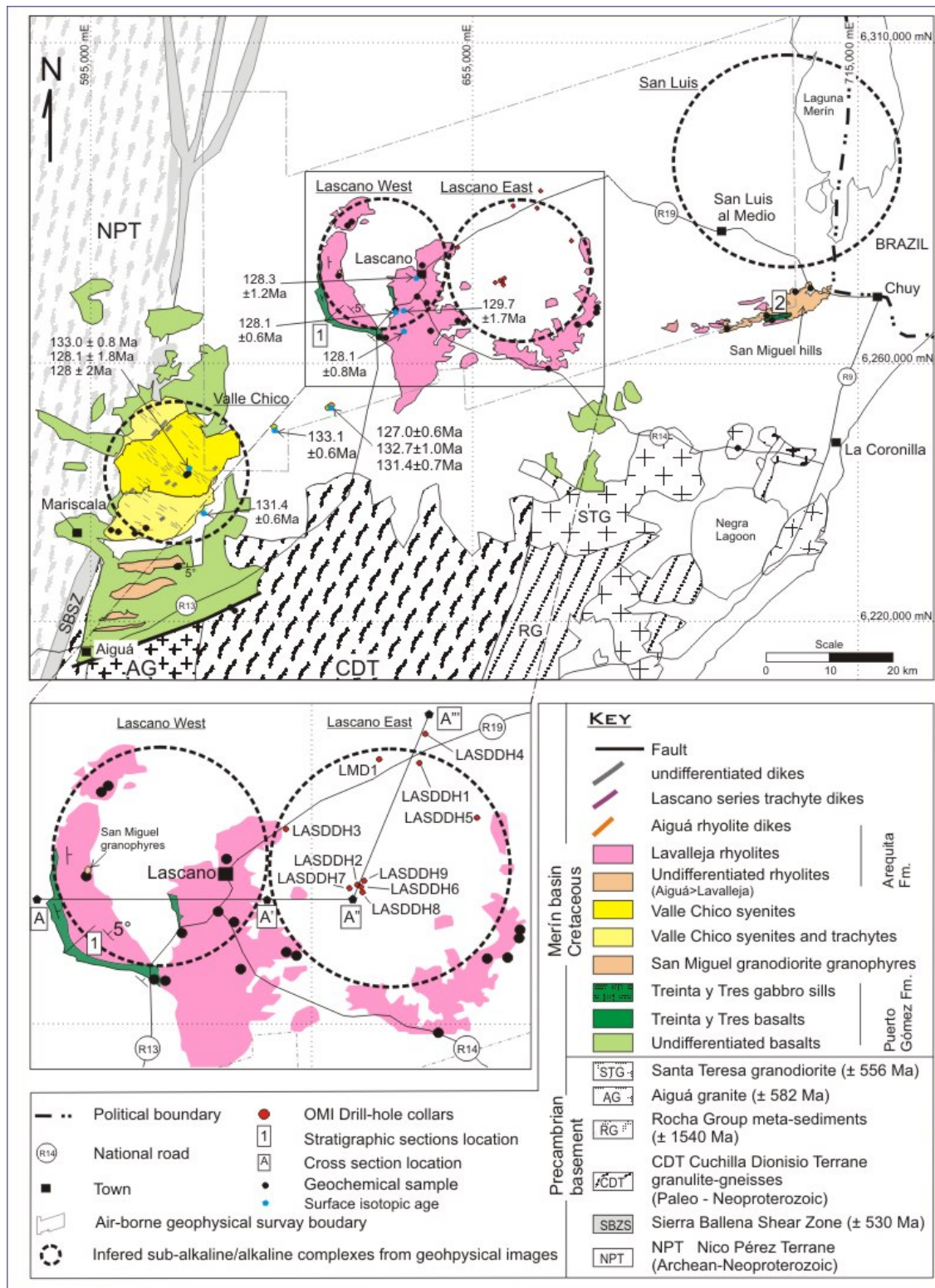


Figure 3 – Geologic map of Merín basin and its surrounding basement

TABLE 1 - ISOTOPIC AGES FOR THE MERÍN BASIN

Formation	Lithochemical unit	Location	Sample number	Method	Mineral	Plateau Age / Concordia	MSWD	Author
	Lascano series gabbro	LASDDH7 219.10 - 219.50 m	80002	40Ar/39Ar	plg	127.8 ± 0.9	0.57	this paper
	Valle Chico Syenites	611045E 6244062N	93-L-59	40Ar/39Ar	?	133.0 ± 0.8	1.0	Stewart <i>et al.</i> , 1996
		?	Mar-55	U/Pb concordia	zirc	128.1 ± 1.8	n/d	Lustrino <i>et al.</i> , 2005
		?	VC-93	U/Pb concordia	zirc	128 ± 2	n/d	Muzio <i>et al.</i> , 1999
Arequita	India Muerta rhyolites	LASDDH1 406.7 - 407.2 m	80006	40Ar/39Ar	san	129.1 ± 0.5	0.31	this paper
	Aiguá rhyolites	632827E 6253353N	93L28	40Ar/39Ar	san	127.0 ± 0.6	1.00	Stewart <i>et al.</i> , 1996
	Lavalleja rhyolites	LASDDH4 636.7 - 637.3 m	79992	40Ar/39Ar	plg	129.0 ± 0.6	0.18	this paper
		643981E 6268555N	93L107	40Ar/39Ar	san	128.1 ± 0.6	1.7	Kirsten <i>et al.</i> , 2001
		642680E 6268353N	93L105	40Ar/39Ar	san	129.7 ± 1.7	0.7	
		646009E 6273850N	93L112	40Ar/39Ar	san	128.3 ± 1.2	0.3	
		644024E 6265226N	93L118	40Ar/39Ar	san	128.1 ± 0.8	2.3	
	High Nb basalts [Santa Lucía / Treinta y Tres (B)]	632827E 6253353N	93L53	40Ar/39Ar	plg	131.4 ± 0.7	1.5	Stewart <i>et al.</i> , 1996
		632827E 6253353N	93L47	40Ar/39Ar	plg	132.7 ± 1.0	1.0	Stewart <i>et al.</i> , 1996
		LMD1 433.7 - 434.7 m	71907	40Ar/39Ar	plg	126.9 ± 0.9	0.04	this paper
		624150E 6249923N	93L93	40Ar/39Ar	plg	133.1 ± 0.6	1.60	Stewart <i>et al.</i> , 1996
Puerto Gómez	undifferentiated subalkaline andesite	613479E 6237084N	93L42	40Ar/39Ar	plg	131.4 ± 0.6	2.0	Kirsten <i>et al.</i> , 2001

Isotopic ages reported with 2stddev. Abbreviations: plg (plagioclase), san (sanidine), zirc (zircon), n/d (no data), MSWD (Mean Standard Weighted Deviation)

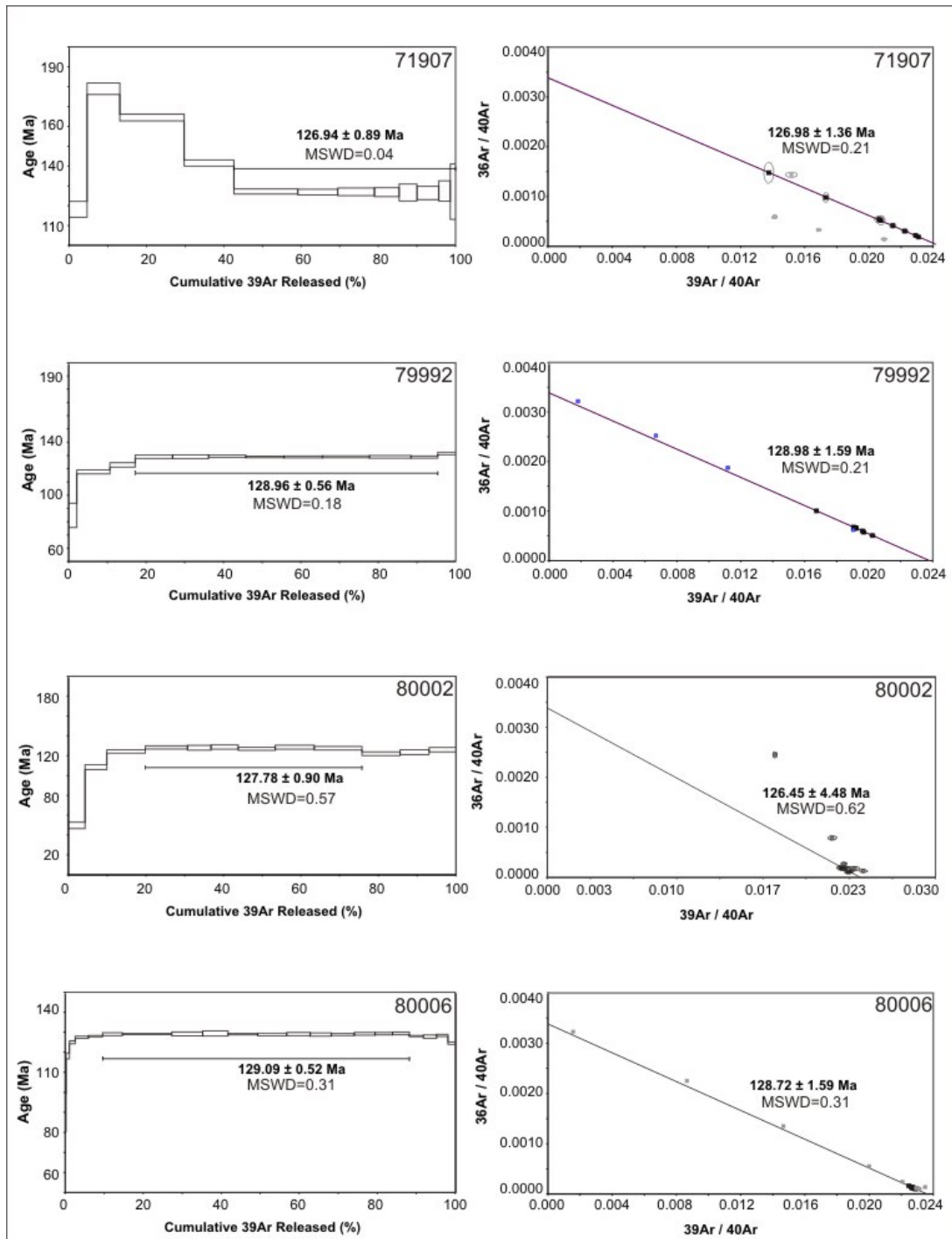


Figure 4 – $^{40}\text{Ar}/^{39}\text{Ar}$ isotopic ages presented in this paper showing $^{40}\text{Ar}/^{39}\text{Ar}$ plateau ages and inverse isochrons. Errors reported with 2 standard deviations.

TABLE 2 - PETROGRAPHIC DESCRIPTIONS OF IGNEOUS AND SEDIMENTARY ROCKS OF THE MERIN BASIN

Formation	Lithochemical unit	Rock Type	Mineralogy	Texture	Thickness	Magmatic lineage	Emplacement type	Photos appendix 4
Quebracho	N/A	Conglomerates, sandstones.	N/A	60%, 3mm-30cm clasts (60% basalt, 40% rhyolite). Clast-supported. 20% 0.3 mm angular sandy matrix (qtz>ilthie>px>plg). 20% ceolitic matrix. Fining upwards in metric cycles.	up to 400 m	clasts: sub-alkaline to mildly alkaline	N/A	5 (e,g,h)
Arequita	Arrayán olivine basalts	basalts	40% cpx, 20% ol, 30% plg, 5% mgt, 4% hm, ap <1%	10% 1-5 mm of phen, sparse 1 mm plg phen. 0.05-0.3 mm matrix. Variditic txt. Sparse 1-20 mm vugs.	flows 1-10 m, > 200 m	alkaline	lavas	5 (e,f)
	Lascamo alkaline series	trachyandesites to trachydacites	65 - 77 % plg, 25% k-fd, 1 -9% qtz, < 1% mgt, 1% ap.	20%, 0.5 - 4 mm K-fd/plg phen. 0.01 - 0.1 ground mass with 0.1-0.5 k-fd and plg microlites. Often pilotaxitic banding.	up to 15 m	alkaline	dikes, sills	3(b); 4(d,e,g,i)
		trachybasalts / gabbro	75% plg, 14% px, 2% kft, 5% mgt, 1% ap.	15%, 0.5 - 6 mm plg/px ppy, 0.1 - 0.5 ground mass	up to 10 m			4 (f), 5(d)
	Valle Chico Syenites	syenites, qtz-syenites, granites, trachytes	70% K-fd, 10 plg, 2 to 10% qtz, 1 to 5% px, 0 to 5% amph, 1% bt, 1% mgt.	0.5-20 mm equigranular	?	mildly alkaline locally peralkaline	ring-intrusive? sills?	4 (h,i)
	Aigüa rhyolites (Kirsten <i>et al.</i> , 2000)	rhyolites	10% qtz, 25% sa, 10% plg, <1% ap, 54% aph. matrix.	40% 1-10 mm sa+px ppy in aphanitic matrix. Thin flows are usually aphanitic.	individual flows ± 1 m	mildly alkaline	dikes, flows.	1 (a)
	India Muerta rhyolites	rhyolites	15% qtz, 20% sa, 10% plg, <1% ap, 54% aph. matrix.	15%, 0.2-3 mm qtz ppy and/or 30% 1-20 mm sa ppy in aphanitic matrix.	2 to 100 m	mildly alkaline	dikes, sills, domes?	1 (h,i)
	Lavallaga rhyolites (Kirsten <i>et al.</i> , 2000)	rhyolitic ignimbrites and rheo-ignimbrites	5% 0.2-3 mm qtz and 5% 1-3 mm plg phen. Shards, lithoclasts and elongated pumice clasts.	up to 200 m			ignimbrites, dikes, breccias	1(h,c,f); 2(a,b); 3(a)
		banded rhyolites	10% qtz, 15% sa, 15% plg, <1% ap, <1% zir, 53% aph. matrix.	up to 20% 1-3 mm plg phen.	up to 100 m	sub-alkaline		1(d,g)
		aphanitic		Aphanitic to vitrophyric. Sparse plg-san phen.	<20 m			2(c)
	San Miguel granodiorite granophyres	pyroclastic breccias		Angular clasts < 2 m	up to 80 m			2c
Puerto Gómez		granodiorites	70% plg, 20% qtz, 5% cpx, 5% amph, <1% mgt, <1% ap.	10% 2-5 mm plg phen in 0.3 to 1 mm matrix with plg-qtz granophyric intergrowths. 0.1 to 1 mm eq. Granophyric plg-qtz intergrowths.	>700 m	sub-alkaline	sills, domes?	3(c,d,e,f,g)
	Santa Lucía basalts and gabbros (modified from Kirsten <i>et al.</i> , 2000)	basalts	58% plg, 30% cpx, 5% ol, 6% mgt, 1% ap.	20% plg ppy (10%, 5 - 10 mm xenocrysts, euhedral plg and 10%, 3-5 mm plug). 0.1-1 mm interstitial plg, ol, cpx, mgt, ap. Oph texture. Up to 10% ceolite filled vugs.	flows 5-15m >600 m		lavas	5(c)
		gabbros	58% plg, 26% cpx, 5% ol, 10% mgt, 1% ap.	up to 3 mm subhedral plg and interstitial subhedral px and ol. Common mgt/hm euhedral crystals forming in tabular interstitial zones.	up to 200 m	mildly alkaline	dikes, sills	5(a,b)
	Treinta y Tres B basalts and gabbros (modified from Kirsten <i>et al.</i> , 2000)	basalts	60% plg, 25% cpx, 10% ol, 1% ap, 5% mgt.	Aph or 1-10 mm plg phen. Occasional px 1-5 mm phenos. 0.1 - 1 mm int. to s-oph matrix. Up to 10% ceolite filled vugs. Occasional cumular 1mm eq.	flows 3-10m >800 m		lavas	4(a,c)
		gabbros	60% plg, 25% cpx+opx, 10% ol, 1% ap, 5% mgt	up to 3 mm cumular equigranular	up to 350 m	sub-alkaline	dikes, sills	3(d,e); 4(c)
	Treinta y Tres A basalts (modified from Kirsten <i>et al.</i> , 2000)	basalts	45% plg, 45% mesostasis, 5% cpx, 5% mgt.	Aph or 1-15mm plg ppy/gpy in 0.1 - 0.2 mm matrix with vitreous mesostasis, 20 mm voids.	flows 3-10 m >600 m	sub-alkaline	lavas	4(e,f,g,h)

Abbreviations: ap (apatite), bi (biotite), cpx (clinopyroxene), mgt (magnetite), ol (olivine), plg (plagioclase), san (sanidine), k-fd (potassic feldspar), qtz (quartz), zir (zircon), ppy (porphyritic), eq (equigranular) (aphanitic), gpy (glomeroporphyritic), phen (phenocrysts), oph (ophitic), s-oph (sub-ophitic).

TABLE 3 - PHYSICAL AND CHEMICAL CHARACTERISTICS OF IGNEOUS AND SEDIMENTARY ROCKS OF THE MERIN BASIN

Formation	Lithogeochemical group	Rock Type	Na ₂ O			CIPW norm	Magmatic lineage	Density		Mag. sucept. (x 10 ⁻³ SI)
			SiO ₂ wt% min max	+ K ₂ O wt% min max	Nb/Zr avg min max			Sample	(g/cc)	
Quebracho	N/A	Conglomerates, sandstones.	N/A	N/A	clasts 0.06 0.16	N/A	clasts: sub-alkaline to mildly alkaline	N/D	N/D	< 15
Arequita	Arrayán olivine basalts	basalts	47.77 50.82	3.42 4.87	<u>0.367</u> 0.232 0.469	undersaturated ol - hyp. nepheline normative	alkaline	N/D	N/D	< 15
	Lascano alkaline series	trachyandesites to trachydacites	54.77 63.70	8.61 11.89	<u>0.233</u> 0.197		alkaline	71951	2.54	< 15
		trachybasalts	44.07	3.18	0.279			80002	2.99	80 - 110
		/gabbro	51.46	6.94						
	Valle Chico syenites	syenites, qtz-syenites, syenogranites	59.85 - 61.15	8.38 8.88	<u>0.130</u> 0.120 0.148	oversaturated, quartz normative	mildly alkaline to peralkaline	71954	2.41	25 - 200
	Aiguá rhyolites	rhyolites	61.0 79.0	8.40 12.2	<u>0.15</u> 0.20		midly alkaline	71959	2.54	N/D
	India Muerta rhyolites	rhyolites	67.32 73.54	7.78 10.57	<u>0.111</u> 0.089 0.166		midly alkaline	N/D	N/D	< 10
	Lavalleya rhyolites	rhyolitic ignimbrites and rheo-ignimbrites banded rhyolites aphanitic breccias	67.21 76.94	6.34 9.11	<u>0.065</u> 0.052 0.133		sub-alkaline	71959	2.54	< 10
					N/D			N/D		
	San Miguel granodiorite granophyres	granodiorites	65.53 - 70.30	7.06 9.61	<u>0.097</u> 0.064 0.097		sub-alkaline	71956	2.46	< 8
	Puerto Gómez	Santa Lucía basalts and gabbros	basalts/gabbros	46.29 52.38	2.41 5.02		<u>0.143</u> 0.123 0.169	undersaturated olivine - hypersilene normative to oversaturated, quartz normative	midly alkaline	basalt 73082 gabbro 73088
Treinta y Tres B basalts and gabbros		basalts/gabbros	48.23 54.42	2.10 4.27	<u>0.09</u> 0.058 0.120	sub-alkaline	N/D gabbro 71968		N/D 2.93	40 - 60
Treinta y Tres A basalts		basalts	49.24 53.81	2.89 4.05	<u>0.051</u> 0.043 0.058	sub-alkaline	N/D		N/D	100 - 200

Abbreviations: N/A (not applicable), N/D (no data), mag. sucept. (magnetic susceptibility)

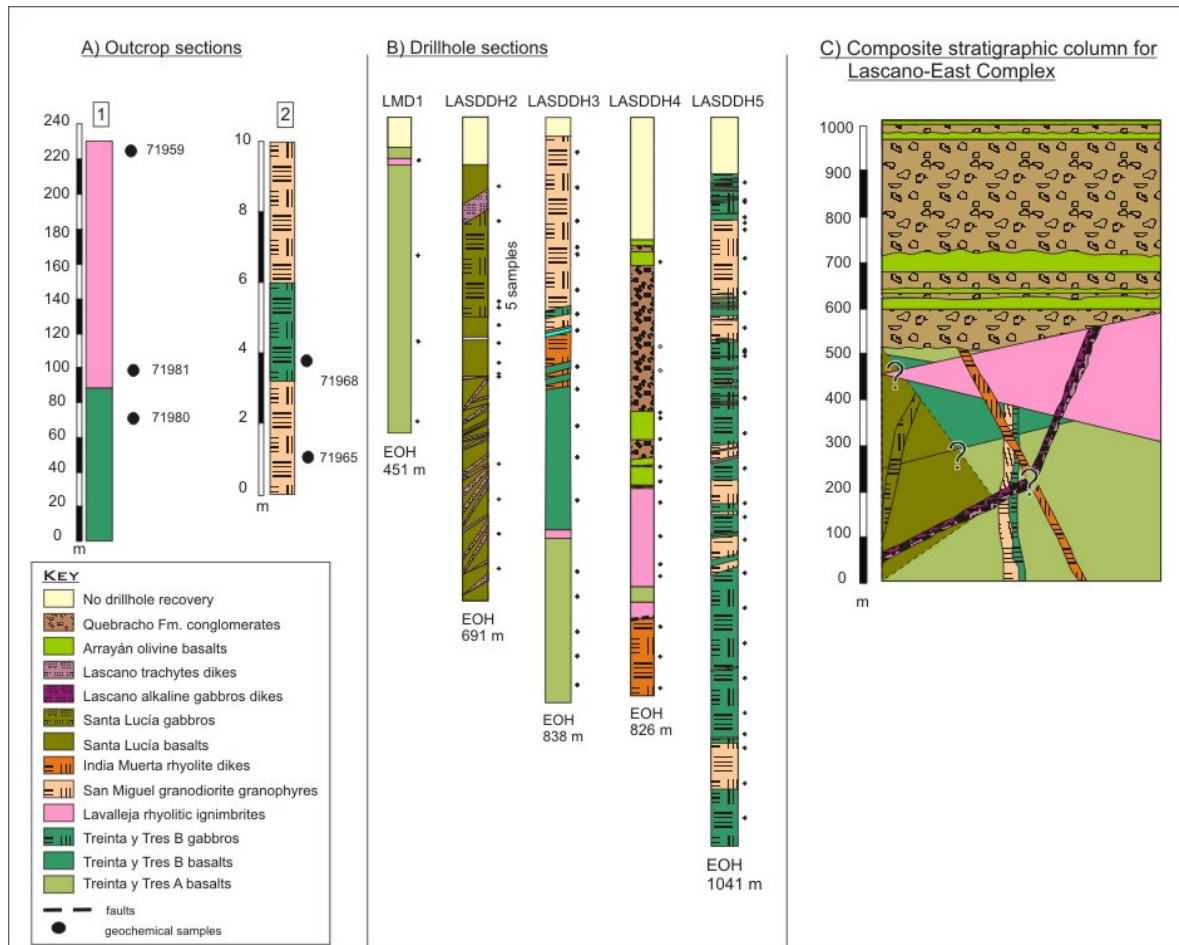


Figure 5- Outcrop and drillhole columnar sections from the Merín basin. A) Outcrop sections from Lascano-West (1) and San Miguel (2), B) drillhole core columnar sections from Lascano-East, C) composite stratigraphic section for Lascano-East from drillhole core logs and outcrop observations. Locations of columnar sections are shown in Figure 3.

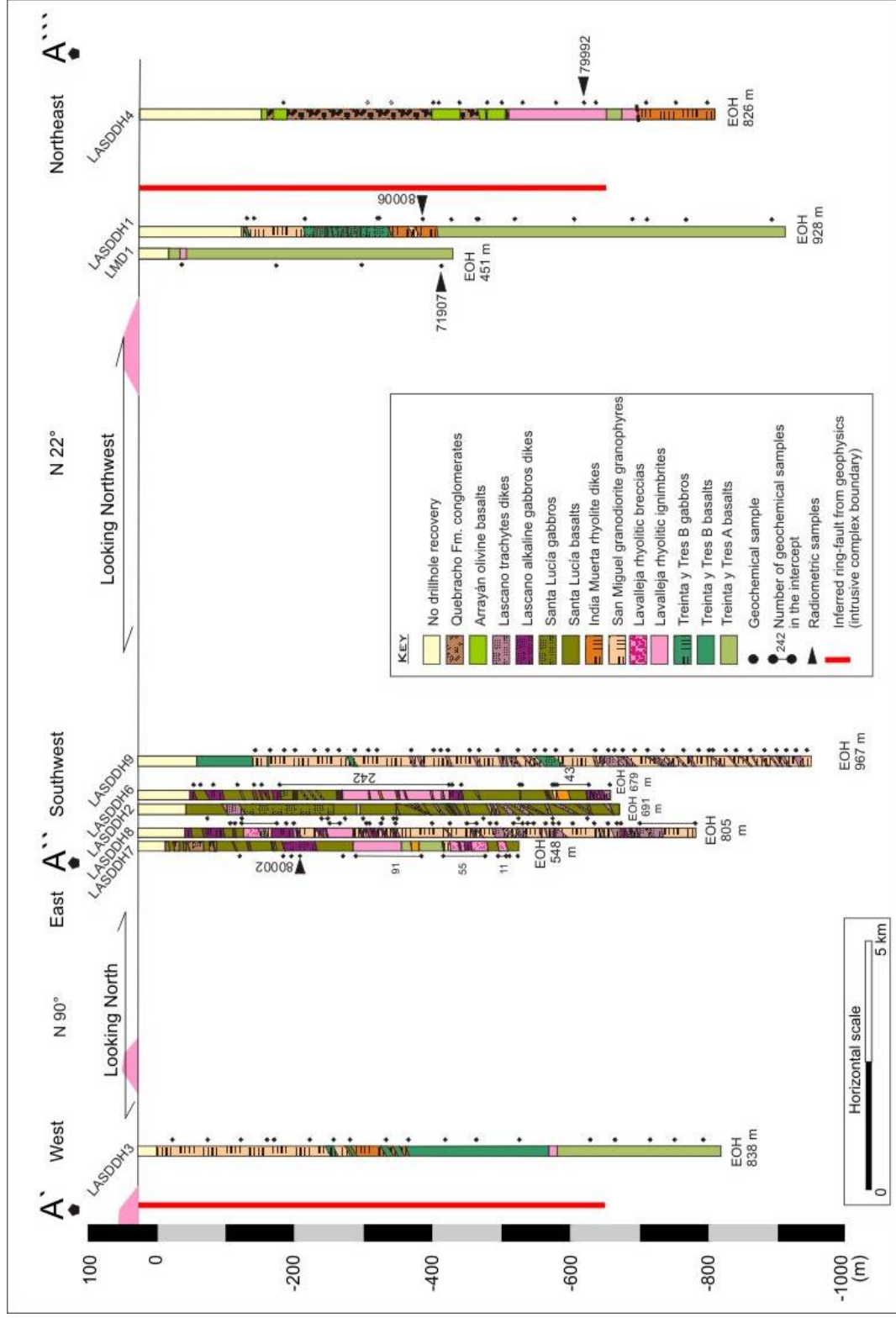


Figure 6 - Columnar sections from drill hole data along cross section A' - A'' - A''' through Lascano-East (Figure 3, insert) showing location of geochemical and age samples analyzed in this work.

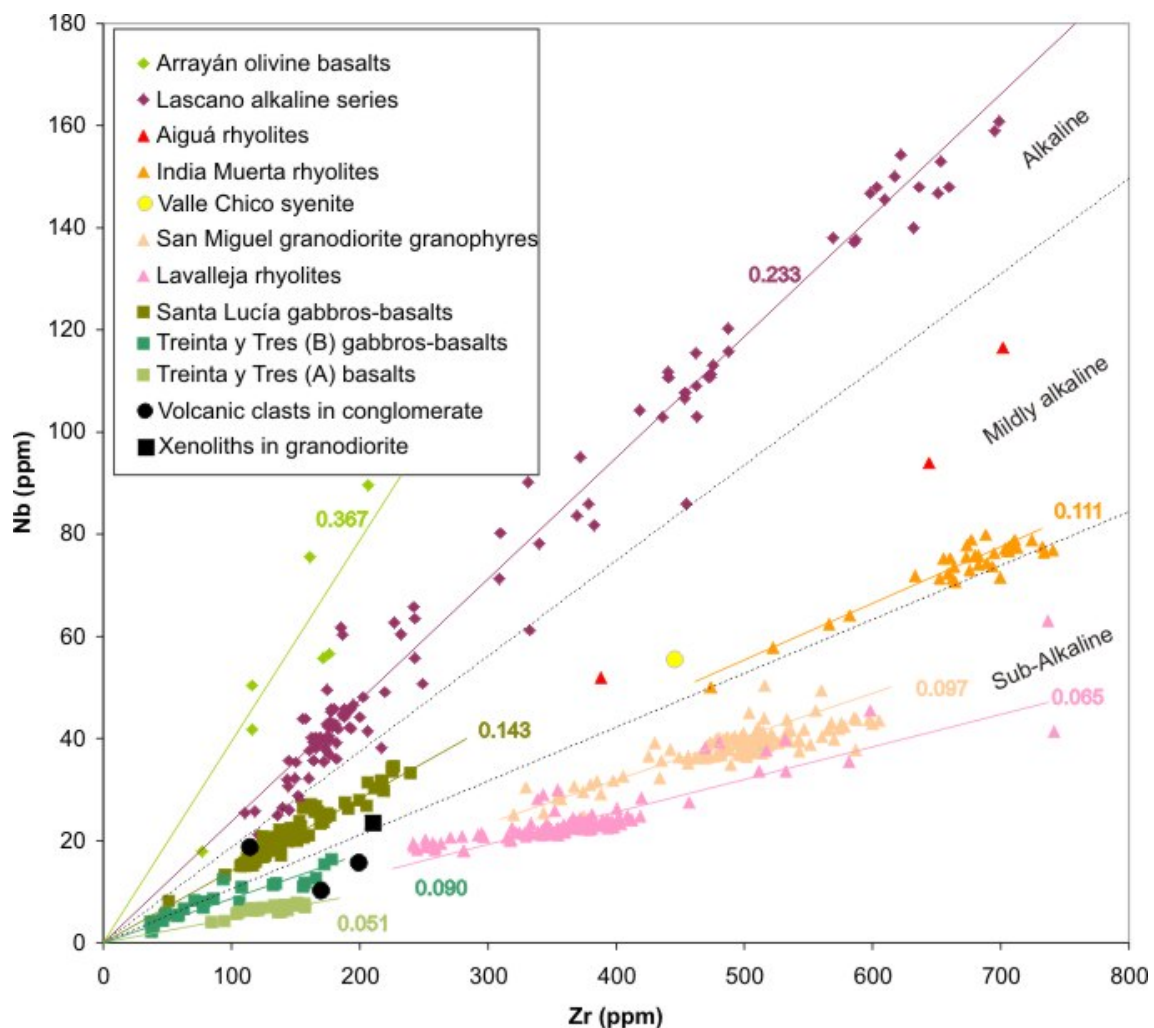


Figure 7 – Zr versus Nb plot of fresh and unaltered rock samples displays linear compositional trends that distinguish several different lithogeochemical units within the igneous rocks of the Merín basin. Three compositional fields are shown as sub-alkaline, mildly alkaline and alkaline. Only fresh samples were plotted. Volcanic clasts in the Quebracho Formation conglomerates have mafic compositions within the sub-alkaline and transitional groups. Mafic xenoliths in the San Miguel granodiorite granophyre plot close to the Treinta y Tres B gabbros-basalts.

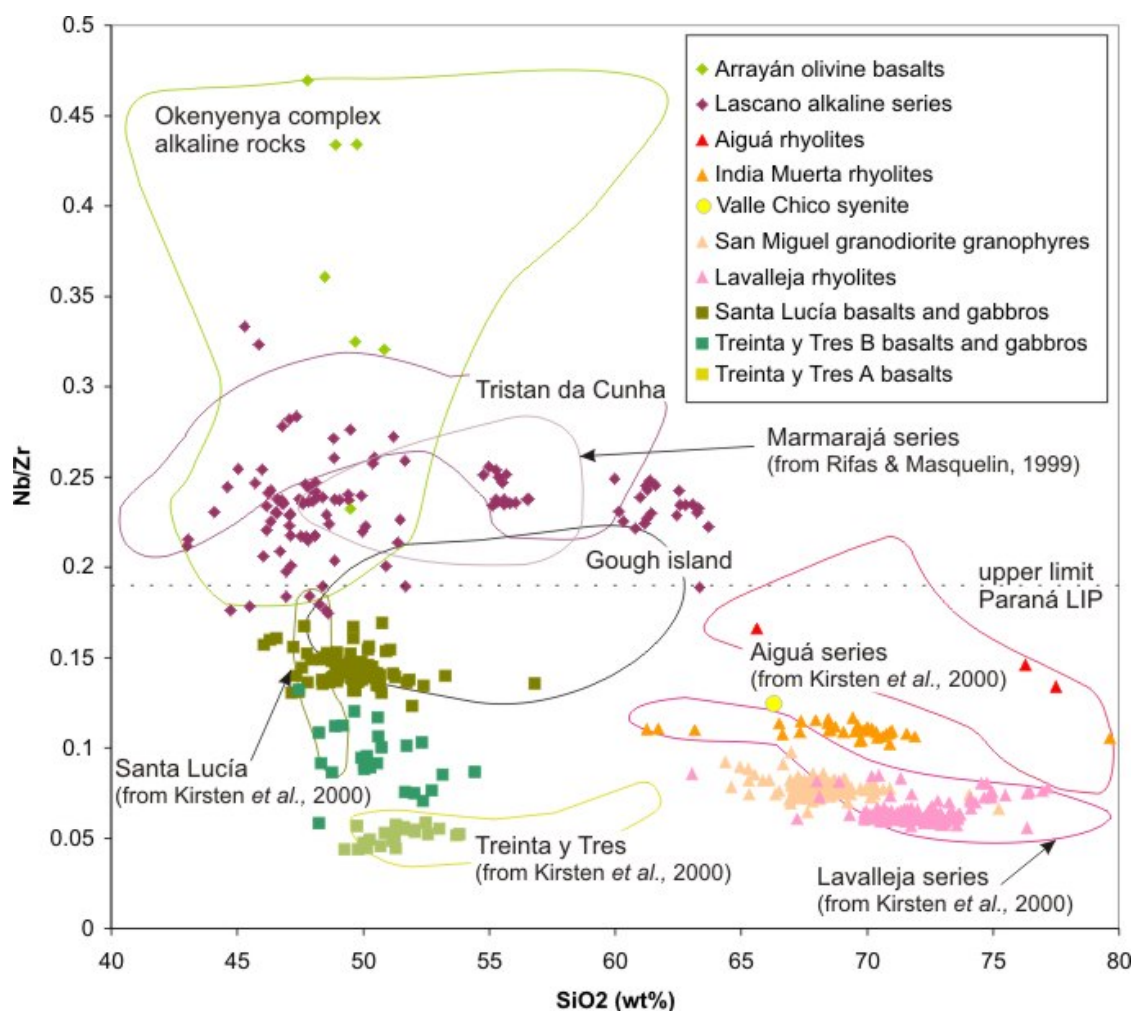


Figure 8 – Nb/Zr versus SiO₂ plot of fresh whole rock samples presented in this work and comparison with compositional fields of samples from Kirsten *et al.* (2000) and Gomez Rifas & Masquelin (1999). Sub-alkaline and mildly alkaline rocks from Merín basin plot below the maximum Nb/Zr ratio for Paraná samples (from <http://georoc.mpch-mainz.gwdg.de/georoc/>). Mildly alkaline Santa Lucía basalts overlap with Gough island basalts (le Roex, 1985). Marmarajá alkaline gabbros and a few Arrayán alkaline olivine basalts overlap with Tristan da Cunha basalts (le Roex *et al.*, 1990). Both alkaline groups of basalts overlap with gabbro-basalts from Okenyanya complex from the Damaraland province, Namibia (le Roex *et al.*, 1996).

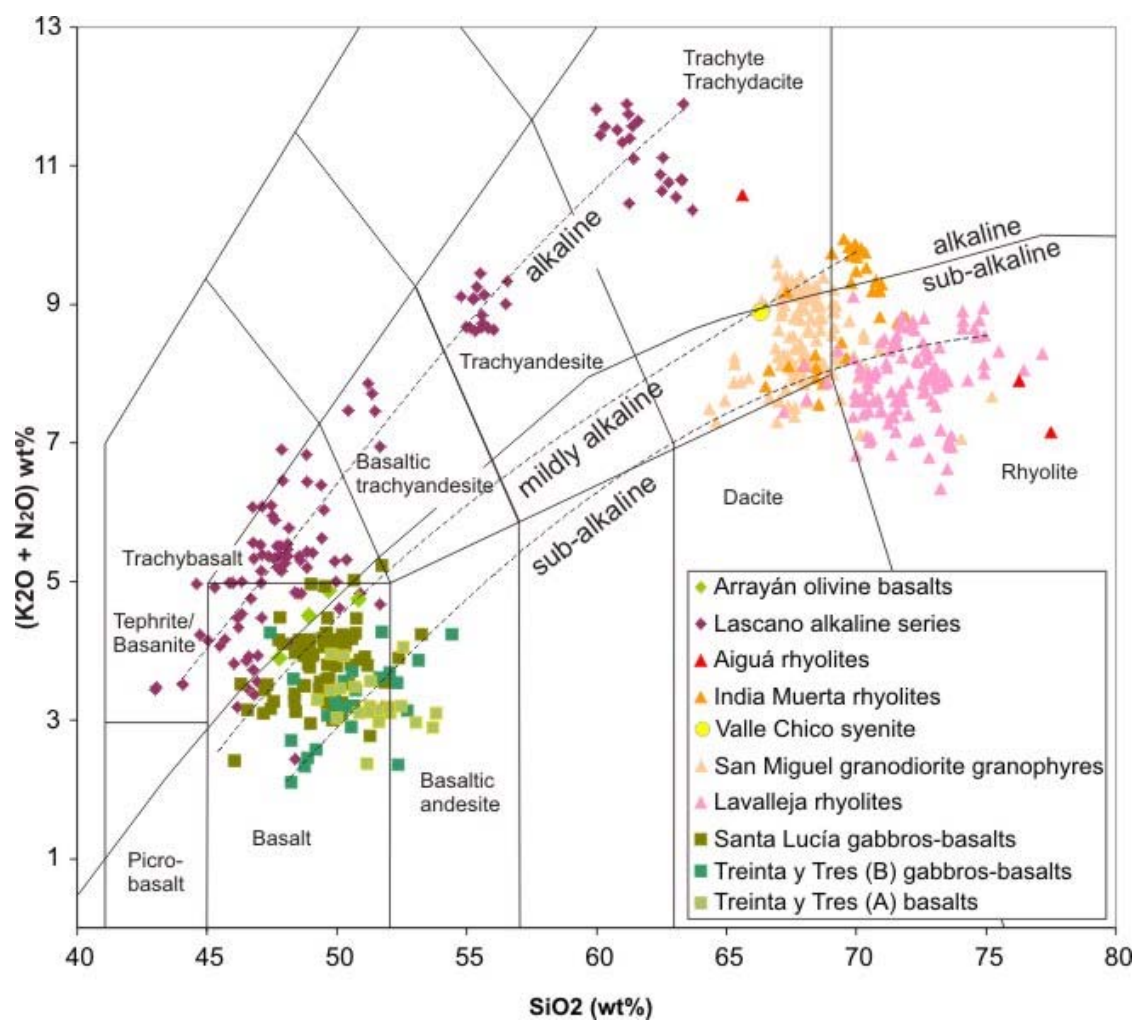


Figure 9 – Total alkalis ($K_2O + Na_2O$) versus silica (SiO_2) (Le Maitre *et al.*, 1989) showing the alkaline/sub-alkaline boundary (Irvine and Bargar, 1981). Two apparent trends are shown by the dashed lines: a bimodal sub-alkaline to mildly alkaline trend and a continuous alkaline trend.

Figure 10- Spider diagrams of whole rock trace element compositions for each lithogeochemical groups are plotted normalized to primordial mantle (A, B, E, F, McDonough *et al.*, 1992) and E-MORB (C, D, G, Sun and McDonough, 1989). The fields represent the variability of all the studied samples for each group (Valle Chico syenites, Aiguá rhyolites and Lavalleja rhyolites includes samples from Kirsten *et al.*, 2000) B)Tristán da Cunha samples from le Roex *et al.*, (1990), Gough island samples from le Roex *et al.* (1985) and Okenyenya gabbros-basalts samples from le Roex *et al.*, (1996).

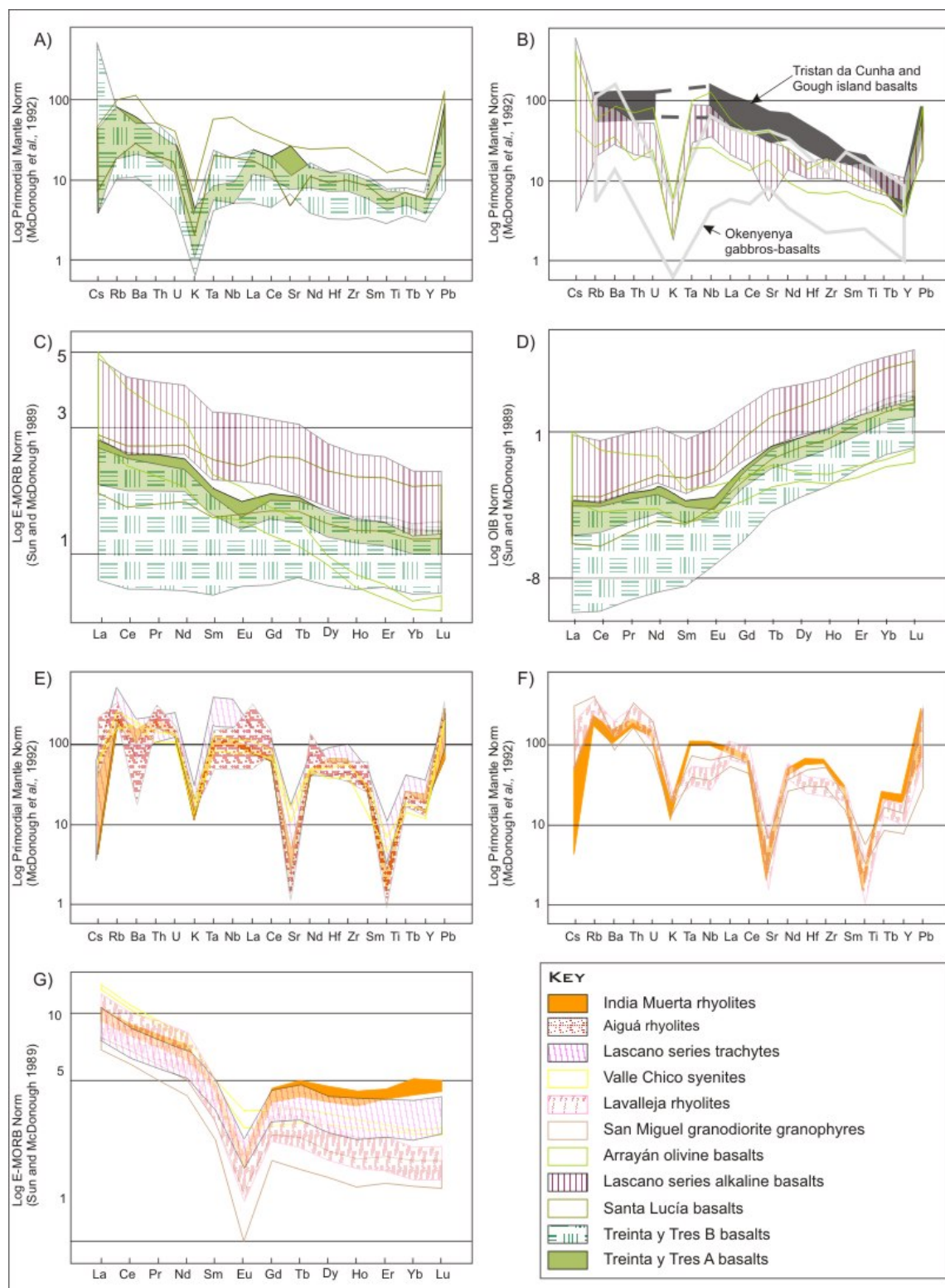


Figure 10- Spider diagrams

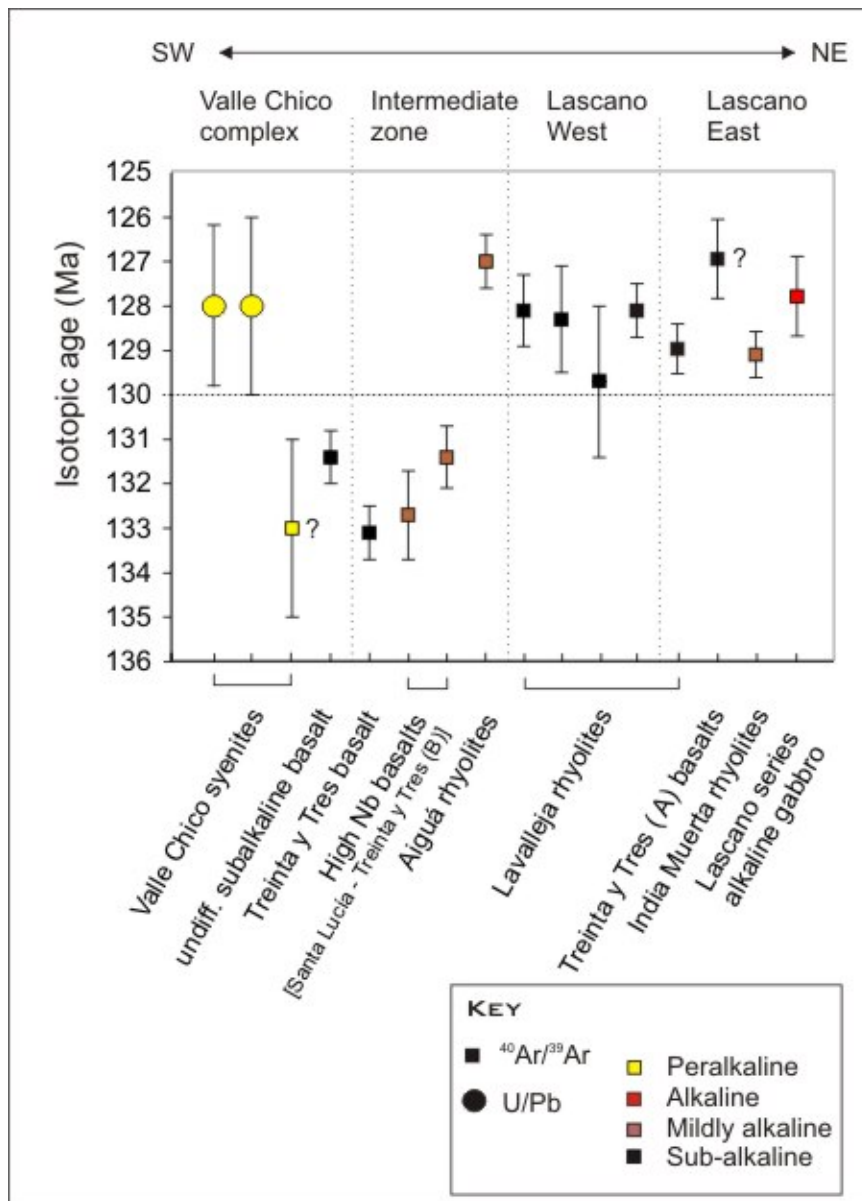


Figure 11- $^{40}\text{Ar}/^{39}\text{Ar}$ and U/Pb isotopic ages of igneous rocks from different locations in the Merín basin presented in this paper and from Kirsten *et al.*, (2001), Stewart *et al.*, (1996), Muzio *et al.*, (1999) and Lustrino *et al.*, (2005).

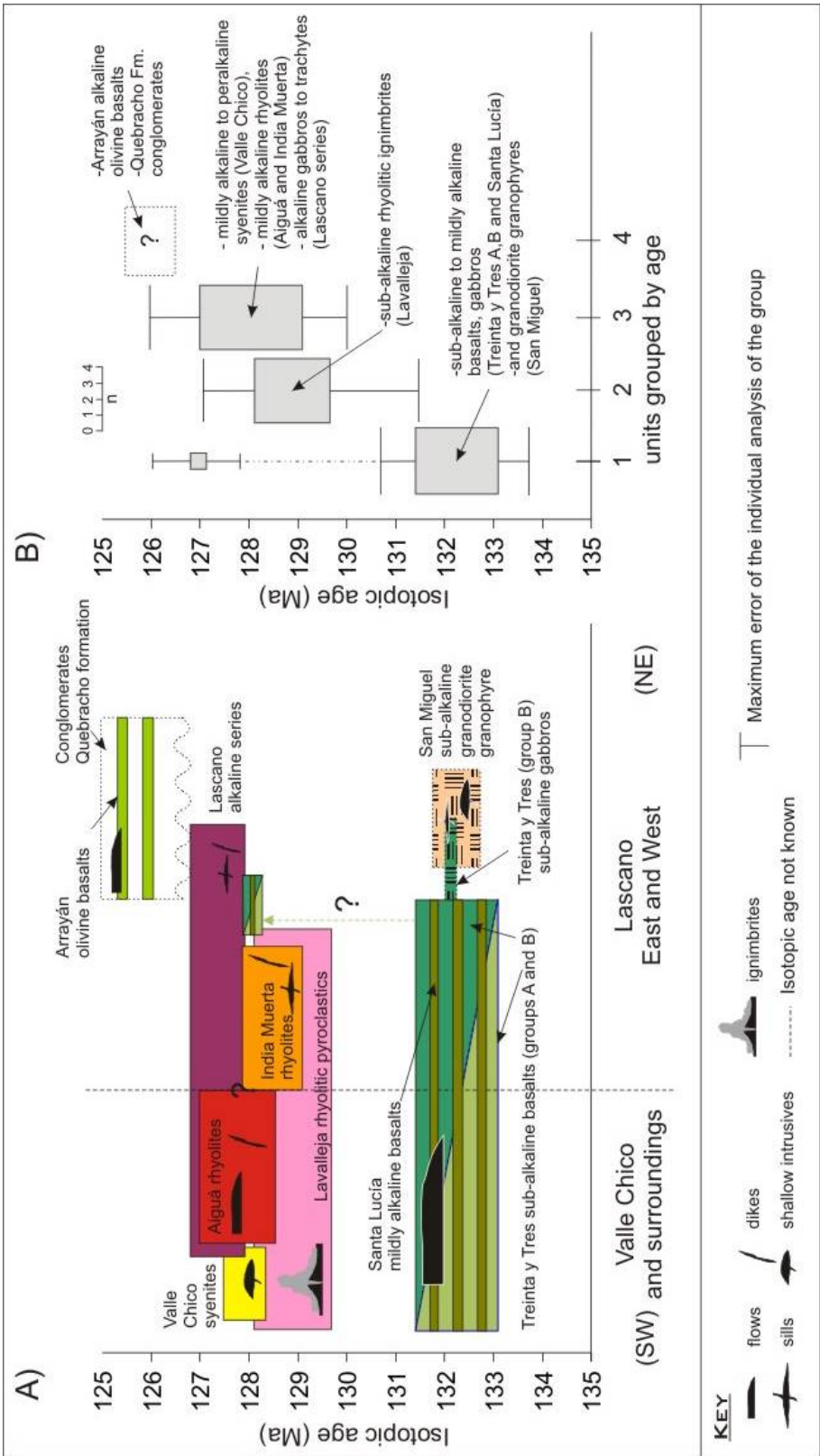


Figure 12–A) Synthesis of the magmatic evolution of igneous rocks in the Merín basin according to their geographic distribution, showing emplacement styles and relative age of lithogeochemical units based on cross-cutting relations calibrated according to available isotopic ages. B) isotopic ages grouped by overlapping two standard deviation range.

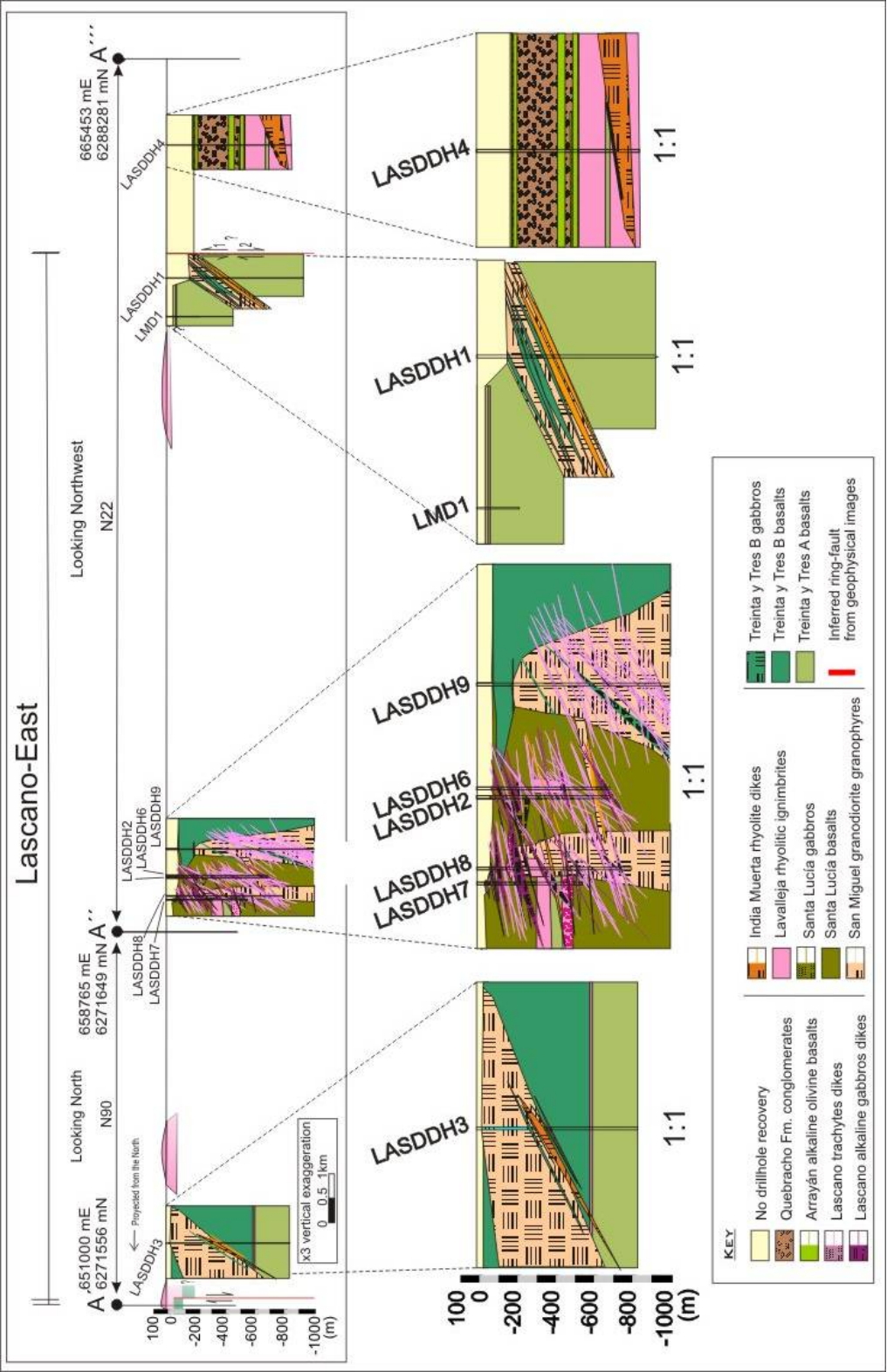


Figure 13- A' - A'' - A''' cross section over Lascano-East (Figure 3, insert) showing interpreted geology (x3 vertical exaggeration). Inserts are shown with no vertical exaggeration. Dip direction in drillholes is arbitrary since the core was not oriented.

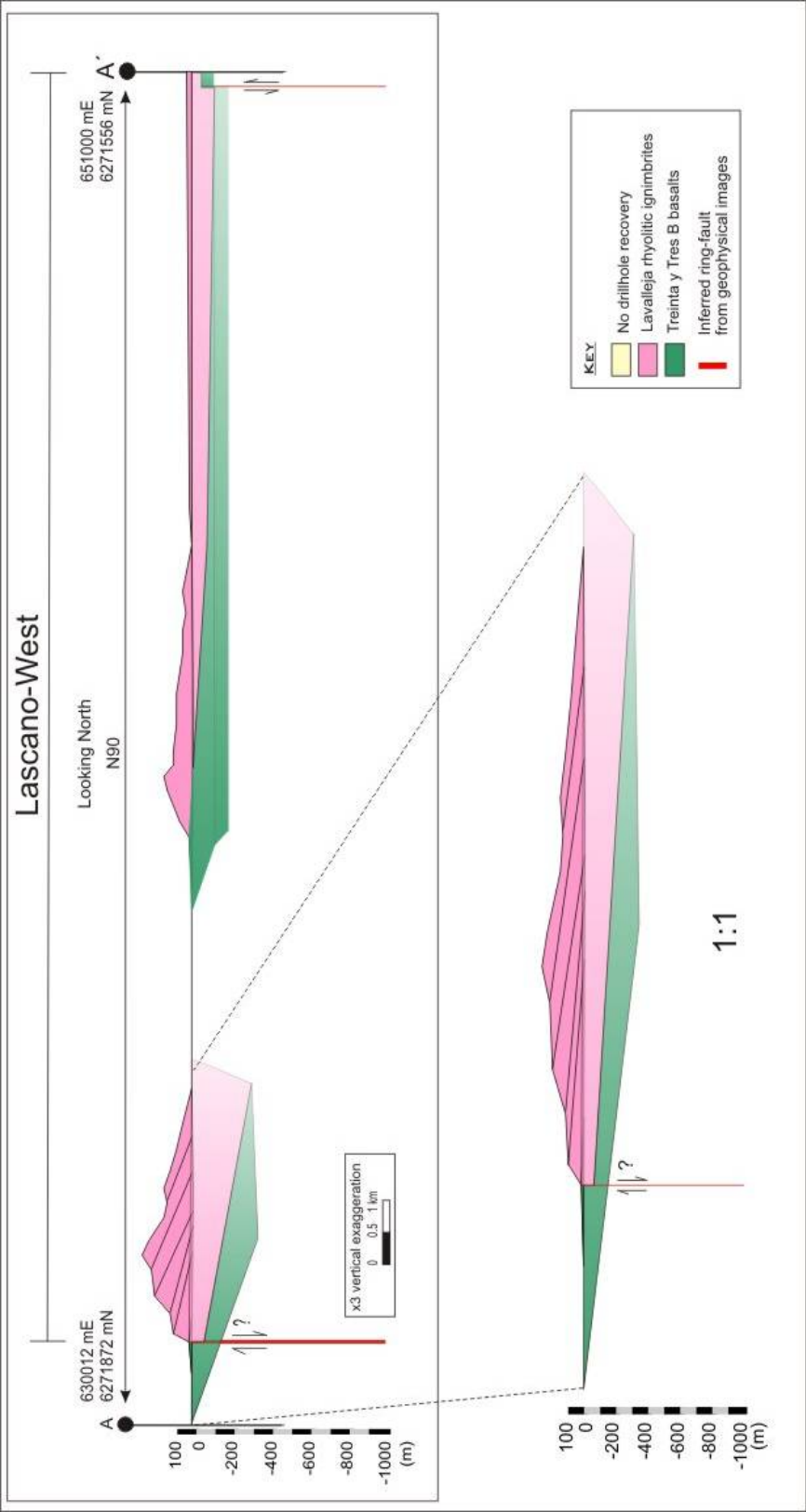


Figure 14 - A - A' cross section over Lascano-West (Figure 3, insert) showing interpreted geology (x3 vertical exaggeration). Inserts are shown with no vertical exaggeration.

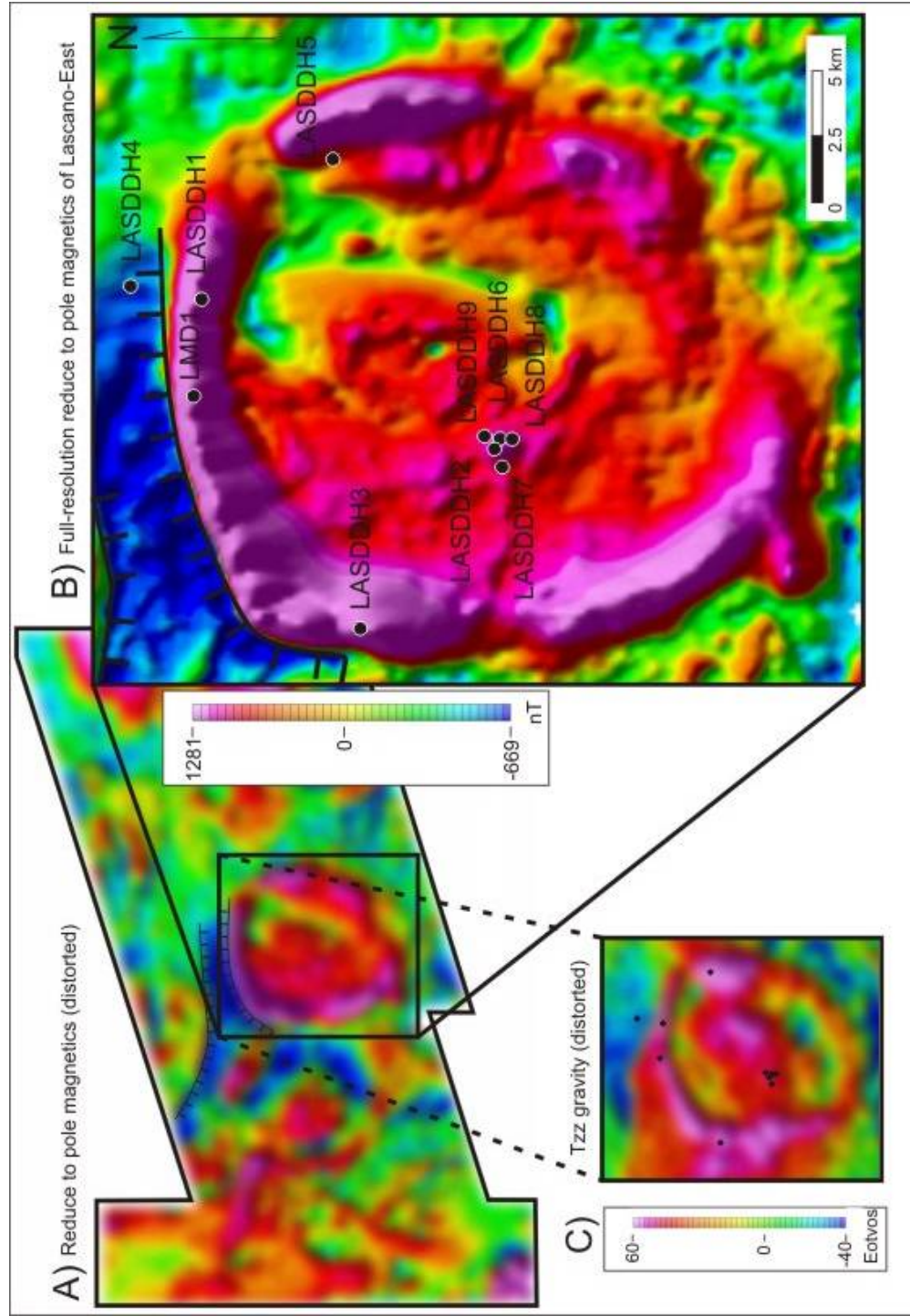


Figure 15 -Reduced-to-pole airborne aeromagnetic image showing the location of drillhole collars in Lascano-East A) Low-resolution reduce-to-pole airborne aeromagnetic image from Orosur Mining INC. (Location of geophysical survey shown in Figures 2 and 3). B) Full-resolution aeromagnetic image enlarged for Lascano-East showing location of drillholes C) Low-resolution aerogravimetric image for Lascano-East

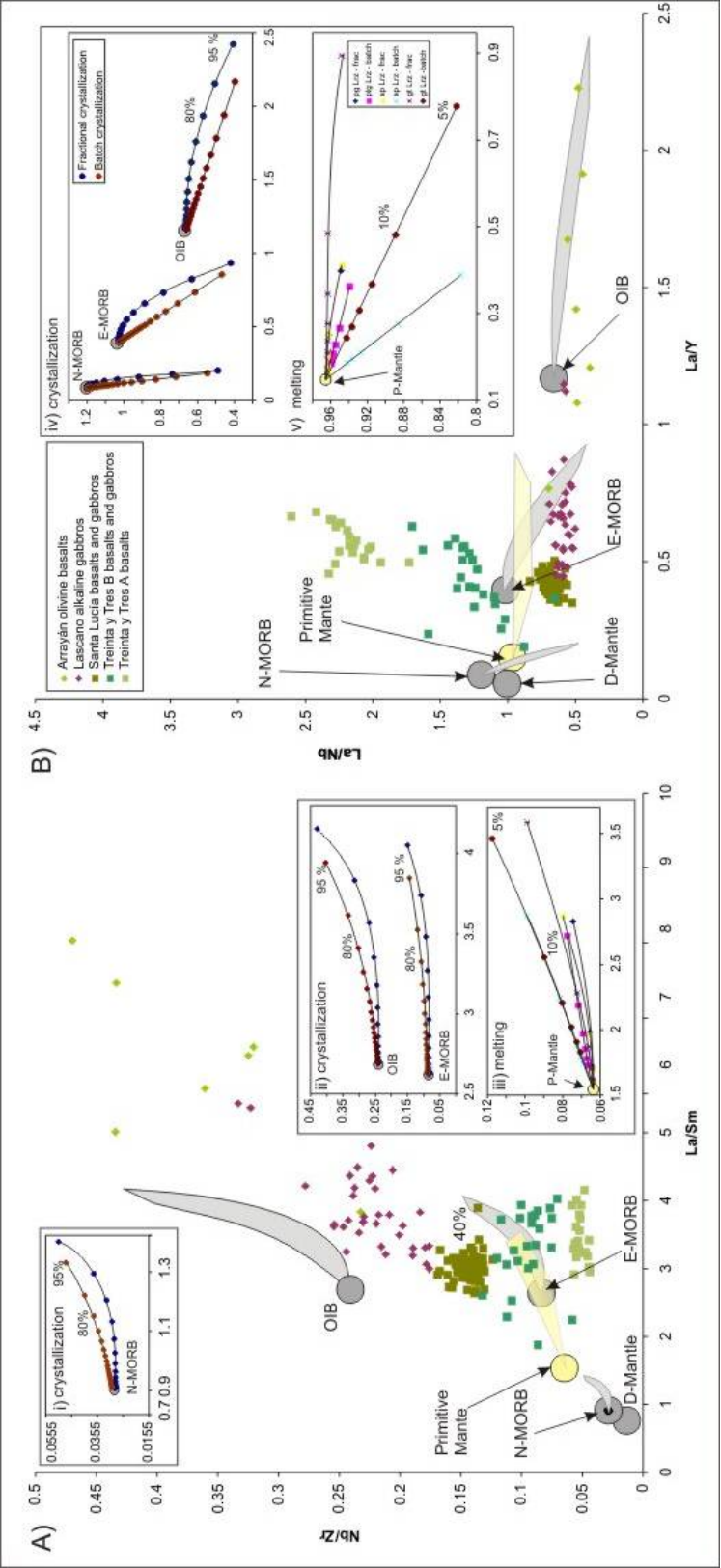


Figure 16AB – Nb/Zr versus La/Sm and La/Nb versus La/Y of mafic samples showing fractional and melting trends A) Nb/Zr versus La/Sm and B) La/Nb versus La/Y showing whole rock composition of fresh mafic rocks samples from the Merín basin. Yellow field shows the envelope of fractional and batch melting trends of a plagioclase, spinel or garnet herzolites from a primitive mantle composition (melting lines for each test shown in inserts at 5% increments). Grey fields shows the envelope of fractional and equilibrium crystallization trends of an average basalt from a N-MORB, E-MORB and OIB composition (crystallization lines for each test are shown in inserts at 5% increments). Melting and crystallizing from a unique source cannot explain the magmatic diversity found in the Merín basin.

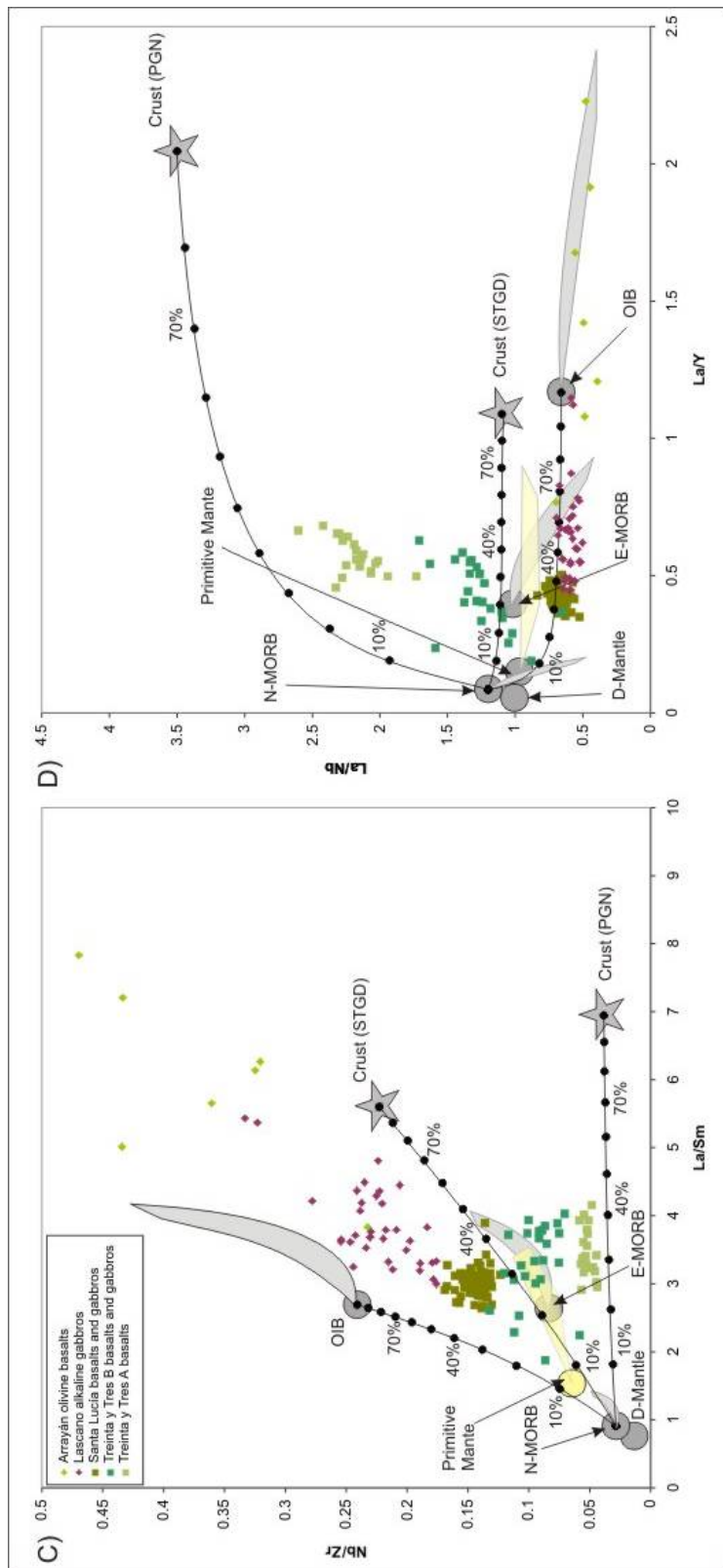


Figure 16CD – Nb/Zr versus La/Sm and La/Nb versus La/Y of mafic samples showing mixing lines C) Nb/Zr versus La/Sm and D) La/Nb versus La/Y showing the same samples and fields than in A and B. Mixing lines between N-MORB, OIB and possible crustal assimilants that could explain some of the magmatic variability of Merín basin. Mixing lines are shown at 10% increments. STGD (Neoproterozoic, Santa Teresa granodiorite) and PGN (Proterozoic gneiss from Cuchilla Dionisio terrane).

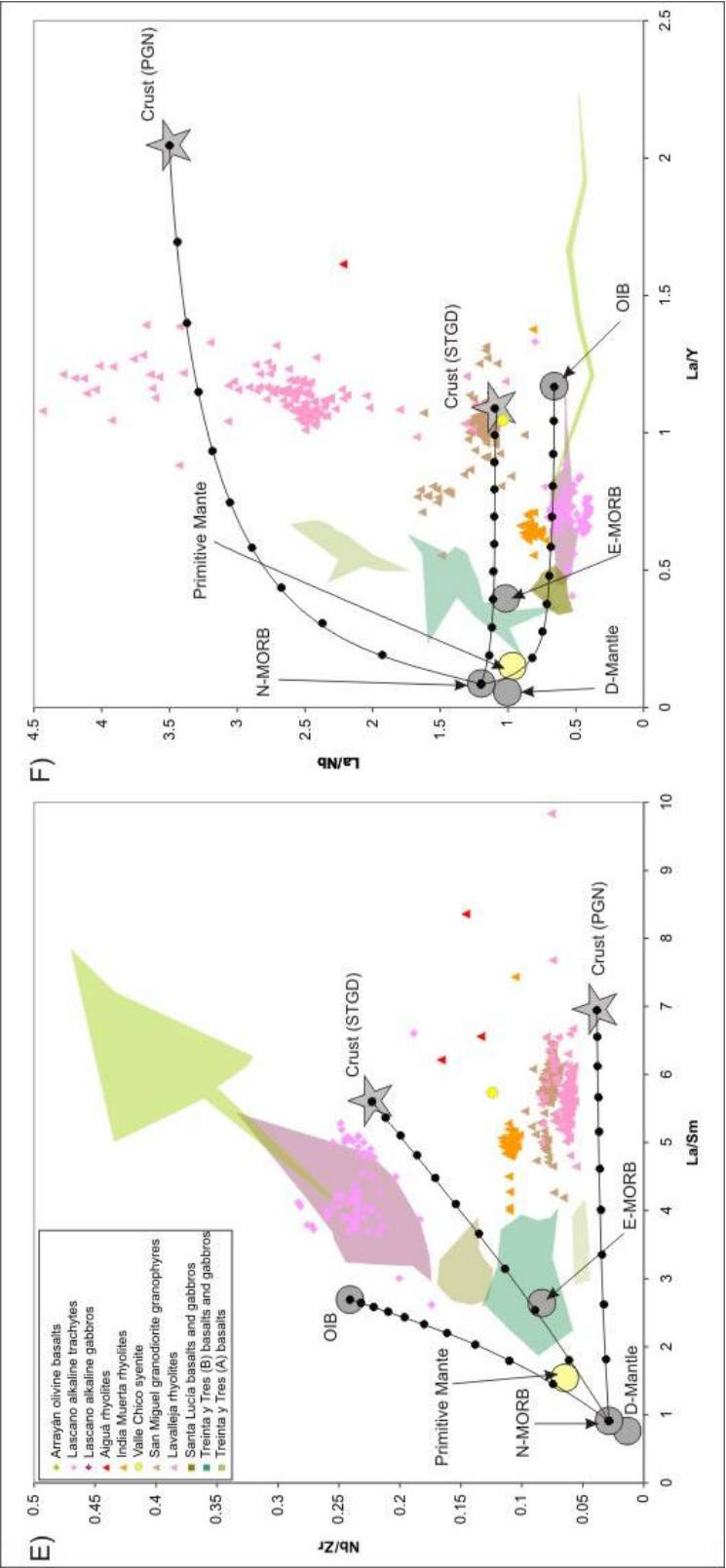


Figure 16EF – Nb/Zr versus La/Sm and La/Nb versus La/Y of mafic and felsic samples showing mixing lines E) Nb/Zr versus La/Sm and F) La/Nb versus La/Y showing the same mixing lines shown in B and C. Mafic samples shown in A,B,C and D are now shown as fields. Fresh samples of felsic rocks are added to this plot.

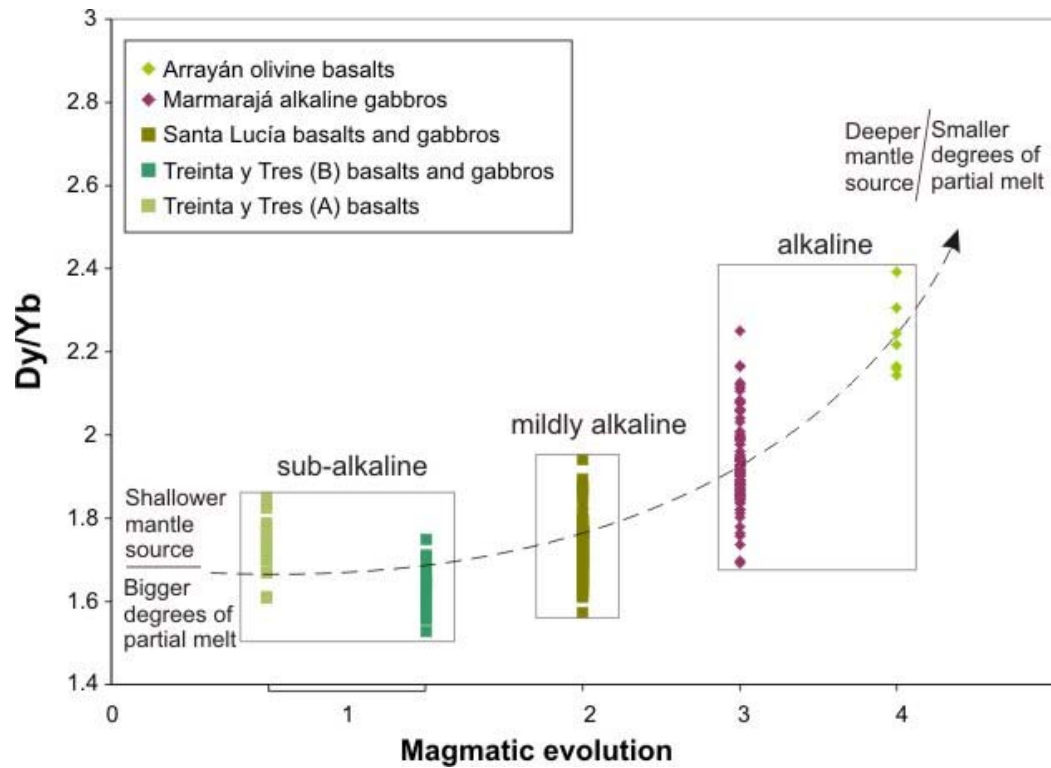


Figure 17 – Dy/Yb ratio for different mafic lithogeochemical units grouped according to their alkalinity shows the hypothesis that this trend reflects a progressive deepening of the mantle source and/or smaller degrees of partial melting from the sub-alkaline gabbro-basalts to the younger alkaline gabbro-basalts.

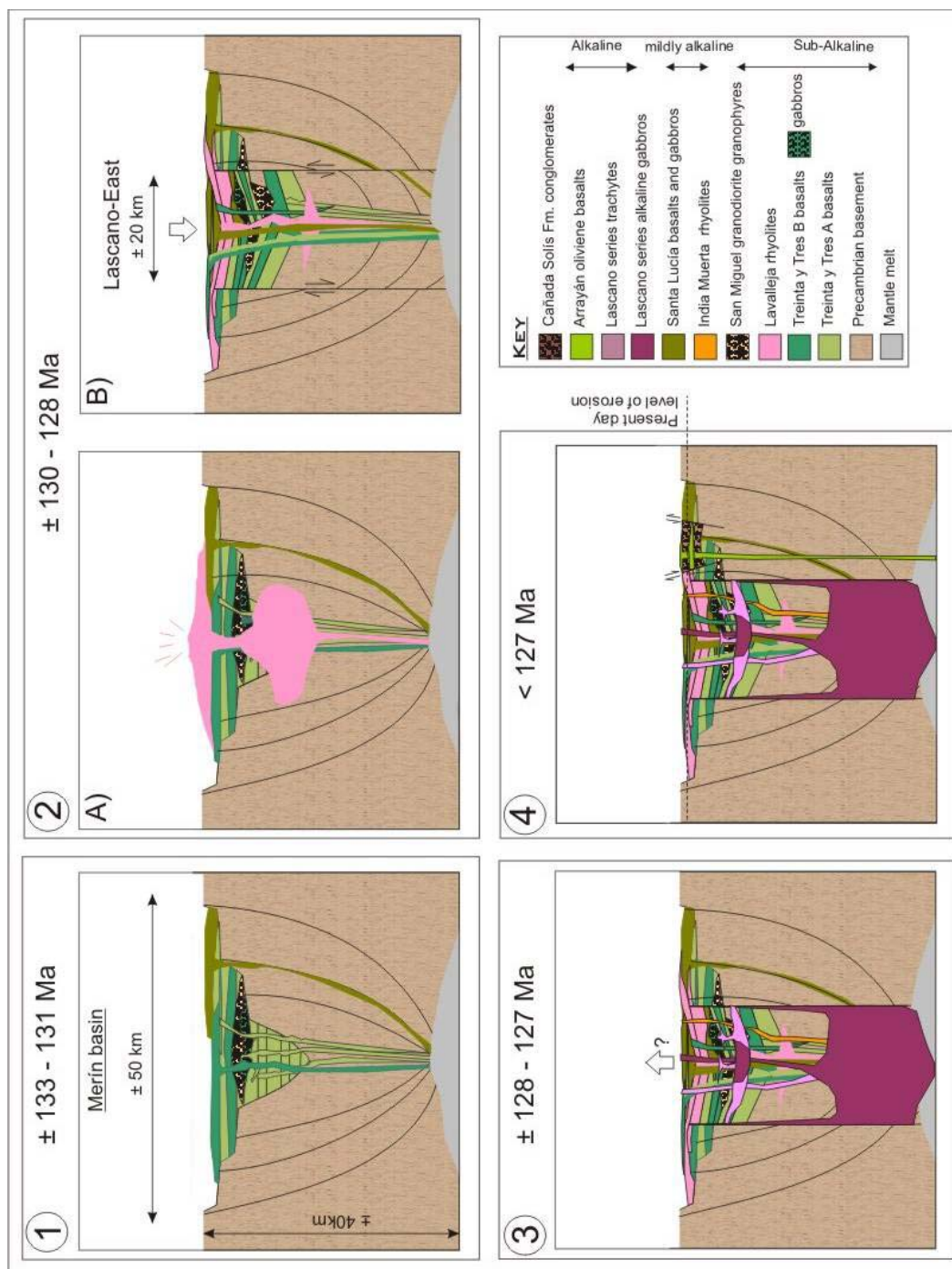


Figure 18 – Simplified evolution of the magmatism in the Merín basin and Lascano-East represented in temporal panels. 1) initial stages of magmatism in the Merín basin and 2-4) in Lascano-East complex.

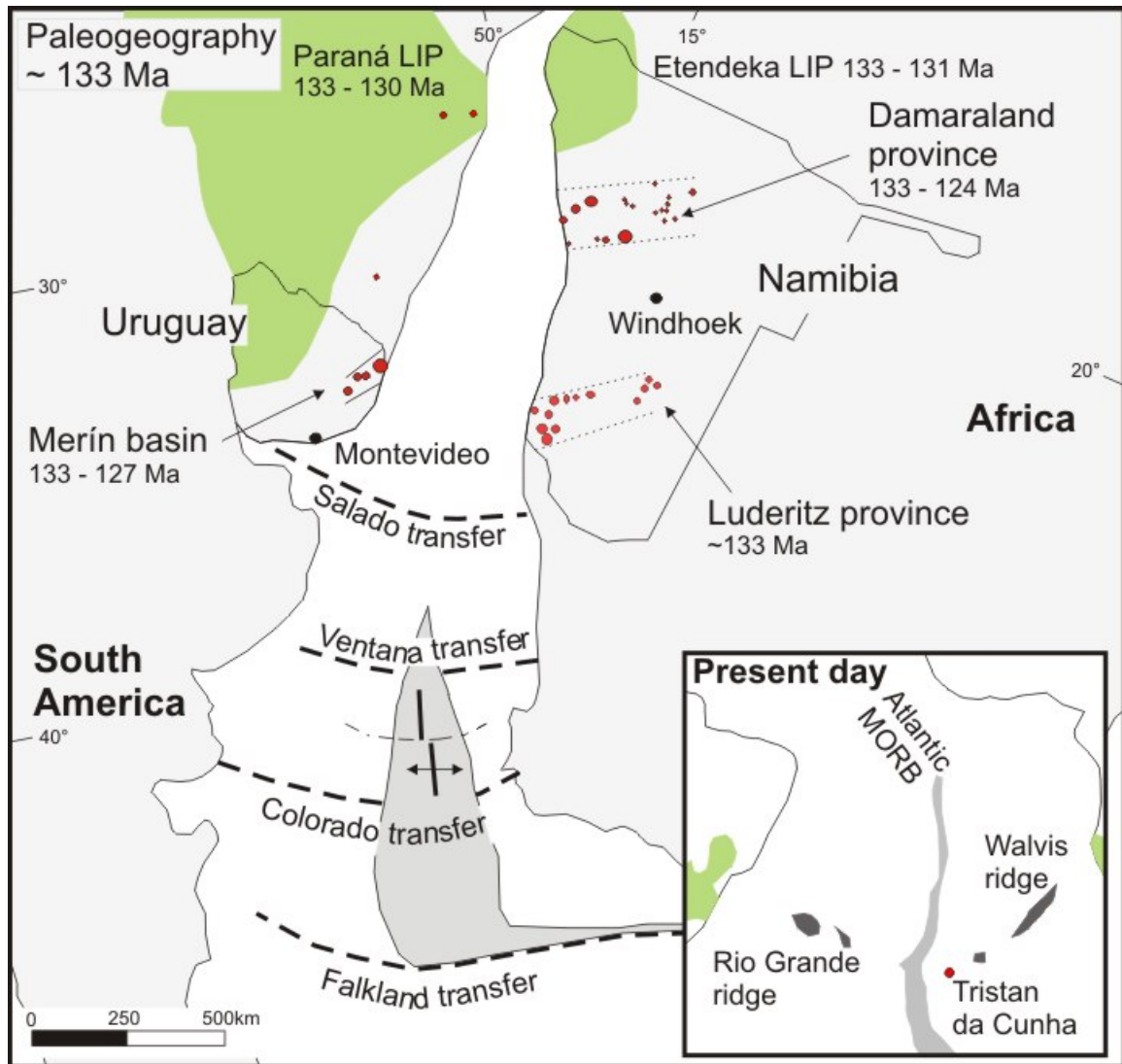


Figure 19 – Paleogeographical reconstruction of the breaking up of Gondwana ~133 Ma. taken from Jokat *et al.* (2003), McDonald *et al.* (2003) and Franke *et al.* (2007) (Azimuthal equal area projection centered at 40° S, 0° E) showing Paraná and Etendeka large igneous provinces, Merín basin and inferred intrusive complexes in Uruguay, Damaraland intrusive complexes (location from Google Earth, Milner and le Roex (1996) and Pirajno (2010) and Luderitz intrusive complexes (locations from Pirajno (1994)). Ticks show present day latitude and longitude in WGS84. Insert shows present day geography.

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Chapter 3: Preliminary study of the hydrothermal alteration and mineralization in the Cretaceous Lascano-East intrusive complex, Merín basin, Uruguay

Abstract

Recent drilling at the Lascano-East intrusive complex by Orosur Mining Incorporated encountered hydrothermally altered rocks with sparse disseminated and vein pyrite and rare chalcopyrite associated with weakly anomalous copper and gold concentrations in whole rock samples. These are the first indications of mineralization in an intrusive complex from the Merín basin, since none has been recognized in the outcropping Valle Chico complex.

We describe the hydrothermal alteration assemblages and associated mineralization in relation to their stratigraphic location and affected rocks, using trace element geochemistry, short wave infrared spectroscopy and X-ray diffractometry.

The hydrothermally altered and mineralized rocks are localized in the central zone of the complex (e.g. drillhole LASDDH2) and can be divided into two different associations with regard to alteration type, wall-rock type, and associated anomalous trace elements contents. The first hydrothermal association is characterized by potassic alteration zones and younger superimposed intermediate argillic alteration in subalkaline to mildly alkaline felsic rocks in drillholes LASDDH2,6,7 and 8 where these rocks are cut by abundant Lascano alkaline series dikes. The trachyte dikes of this series show the same superimposed hydrothermal events as the intruded rocks, and the intensity of the

potassic alteration grades from the dike walls towards the center. Pyrite disseminations together with pyrite, quartz-pyrite and fluorite veins cut the altered Lavallega rhyolitic ignimbrites and have local weak gold (11 ppb), bismuth (8 ppm), thallium (7 ppm) and molybdenum (6.5 ppm) anomalies.

The second association is characterized by local potassic alteration of Santa Lucía basalts as K-feldspar rims around plagioclase phenocrysts and sparse fine grained hydrothermal potassic feldspar replacing the aphanitic grain matrix in drillholes LASDDH2 and 6. These rocks are also cut by the altered Lascano alkaline series dikes, however, in contrast with the altered felsic rocks, this zone is capped by a Santa Lucía gabbro intruded into the Santa Lucía basalts. In a narrow, two meter thick zone, millimetric to one centimeter quartz-chalcopyrite-pyrite veins cut through this contact and is included in a 5 meter intercept with up to 813 ppm copper anomalies. Below this contact, sparse millimetric to one centimeter quartz-pyrite veins cut the altered Santa Lucía basalts including weak molybdenum anomalies (up to 14 ppm) in LASDDH6.

Both alteration-mineralization types are located in the central zone of the complex, which is the only area where the sub-alkaline and mildly alkaline lavas are intruded by the transitional Santa Lucía gabbro sills and Lascano alkaline series gabbro to trachyte dikes. This observation suggests that the alteration might be linked to these intrusions. In any case, it is clear that hydrothermal and mineralizing fluids circulated along the contacts of these dikes and sills, as is evidenced by the alteration front in the trachytes dike walls as well as by the quartz-chalcopyrite veins in the Santa Lucía gabbro sill contact.

Introduction

The Cretaceous Lascano-East intrusive complex is located in the central part of the Merín rift basin (Chapter 2, Figure 3). It is composed of a series of sub-alkaline, mildly alkaline and alkaline dikes and sills intruding the sub-alkaline Paraná flood related-tholeiitic basalts and ignimbritic rhyolites. These rocks range in age from 133 to 126 Ma and their stratigraphy, intrusion geometry, isotopic ages and geochemistry are described in Chapter 2.

The Valle Chico complex is composed of a group of mildly alkaline and locally peralkaline syenites and it crops out in the southwestern end of the basin. Two other complexes, Lascano-West and San Luis are inferred through interpretation of airborne gravity and magnetic-field maps (Chapter 2, Figure 2).

The complexes in the Merín basin share similar lithologies, emplacement styles, ages and magmatic sources to the Damaraland and Luderitz alkaline complexes in Namibia, Africa, and to complexes in the Paraná basin in eastern Brazil. The better exposed and studied intrusive complexes of Brazil and Namibia have local anomalous enrichments of rare earths, tin, tungsten, fluorine, thorium, uranium, niobium, zirconium, titanium, strontium, iron, hafnium, phosphate, fluorine and barium. These anomalous concentrations range from sub-economic, as in the Erongo and Brandberg complexes in the Damaraland province (rare earths, uranium, niobium, zirconium, tungsten, tin and fluorine, Pirajno, 2009) to economic deposits of niobium, phosphate and rare earths in Araxá and Jacupiranga, Brazil (Biondi, 2003). This mineralization is mainly

associated with the alkaline magmatism and in most cases linked to the presence of carbonatites (Pirajno, 2009).

Ten drillholes into the Lascano-East complex encountered hydrothermally altered rocks dominated by clay and other sheet silicate minerals that are associated with sparse disseminated pyrite, quartz-pyrite veins, and fluorite veins. Locally, these veins are associated with weakly anomalous gold. Drilling also encountered one narrow zone of quartz-chalcopyrite-pyrite veins associated with weak copper anomalies and quartz-pyrite veins associated with weakly, sparse molybdenum and copper anomalies. Both of these were intercepted by drill-holes in the central area of the complex (LASDDH2, 6, 7, 8 and 9) (Chapter 2, Figure 10).

The present work examined whole rock samples from the 10 drill-hole cores from the Lascano-East intrusive complex through trace element geochemical analyses, short wave infrared spectroscopy (SWIR) and X-ray diffraction (XRD). The geochemistry was used to identify metasomatic gain and losses, whereas SWIR and XRD were used to identify hydrothermal minerals and construct alteration and mineralization assemblages and zones. Magmatic events that may have produced this alteration were identified based on the stratigraphic location of the altered and mineralized zones. An outcome of the understanding of the genetic processes of this study is in the prediction of potential mineral deposits concealed below the surface at Lascano-East.

Methods

Reconnaissance mapping of rock sections, geochemical sampling and detailed core logging was conducted from July to December of 2008 and during November and December of 2009 at Orosur Mining INC. facilities in Uruguay. We use the same geochemical data set in this chapter as that of Chapter 2. Major and trace elements were plotted using *ioGAS*TM. Samples were studied for signs of hydrothermal alteration using molar ratio diagrams (Madeisky, 1993). Rock chips of 984 samples were analyzed to identify hydrous minerals using Short Wave Infrared Spectroscopy (SWIR) (Thompson *et al.* 1999). A total of 1035 measurements including duplicates were completed at the University of British Columbia, Canada, during April of 2010 using a TerraSpecTM device from Analytical Spectral Devices Inc (Appendix 5). Reflected infrared radiation was measured between 400 to 2500 nm, and a calibration was performed every 50 minutes. The spectra were analyzed with the aid of The Spectral GeologistTM software which was used to identify the wavelength of each characteristic absorption and compare the obtained spectra with reference standards (refer to Clark *et al.*, 2007, Thompson *et al.*, 1999 and Goetz *et al.*, 2009, for more details). From this set, only 262 samples show absorption features that enable reliable mineral identification. Most of the samples with absorption peaks too small to produce clear identification were dark-colored gabbros and basalts. From the set of samples analyzed by SWIR, seven samples were analyzed using X-Ray Diffraction at Oregon State University, using a Philips XRG 3100 with Datascan 3.1 digital data collection (Appendix 6). Scans were performed between 5 to 60 degrees at 0.04 degree steps and 1.5 seconds per step. Jade TM 5.0 software was used for mineral

identification using peak-fitting to confirm the mineral identifications made with The Spectral Geologist™.

Limited standard transmitted and reflected light microscopy and petrographic techniques were used to identify hydrothermal and ore minerals. Internal Orosur Mining INC. petrographic reports were also consulted for this paper (Thompson, 2007; Oyhançabal 2002 - 2009). Staining with sodium cobaltinitrite was used to identify K-feldspar on selected samples (Bailey and Stevens, 1960).

Results

The hydrothermally altered and mineralized rocks are only located in the subsurface of the central zone of the complex drillholes (LASDDH2,6,7 and 8) where the sub-alkaline and mildly alkaline volcanics are intruded by a transitional Santa Lucía gabbro sill and several dikes of the Lascano alkaline series (Figure 20). Illite, muscovite, kaolinite and montmorillonite were identified in rock chips analyzed with SWIR. Kaolinite and montmorillonite were reliably identified through SWIR spectra and confirmed by X-ray diffraction (Figure 21E,F,G,H). However, differentiating illite from muscovite is difficult using either SWIR or XRD. Spacing of the (001) plane in both minerals is close to 10 Å which produces overlapping XRD reflection peaks ($8.6^\circ < 2\theta < 8.8^\circ$). Correctly discriminating both minerals is based on accurately measuring the full width at half the maximum value (FWHM) of this peak. While illites have a rather wide peak ($\Delta 2\theta > 3^\circ$), muscovites present a narrower peak ($\Delta 2\theta < 0.27^\circ$) (Meunier and Velde, 2004). Nonetheless, in the analyzed samples, the strongest XRD peaks correspond to

quartz, and therefore the peaks produced by illite and/or muscovite are very small with the result that it is difficult to correctly identifying these small variations. The same results were obtained by analyzing whole rock powders as by powders from scraping phyllosilicates out of phenocrysts or the altered matrix. Consequently, the XRD results were not conclusive to discriminate illite from muscovite (Figure 21B,D).

SWIR spectra are also very similar for illite and muscovite and only minor changes in relative troughs absorption depths, widths and small shifts in troughs positions allow discrimination (Figure 22F). From the illite-muscovite identified samples, we discriminated 12 samples as “muscovites”. These present lower 1900nm troughs (0.10 to 0.20 reflectivity intensity), wider (34 to 42 nm) and deeper (0.04 to 0.09 reflectivity intensity) 2350nm troughs, wider 2200 nm troughs (32.5 to 35.5 nm) and higher sericite crystallinity index (0.8 to 1.4) compared to the rest of the samples that were identified as illites (Figure 21A,B,C). The “muscovites” have shallower 1900 nm troughs (less water), wider 2200 nm troughs as well as wide and deep 2350 nm troughs. Even though the sericite crystallinity index (2200nm trough absorption depth / 1900nm trough absorption depth) of the muscovites is higher than the illites, these are not as high as expected for most typical muscovites, raising some doubts about the accuracy of the identification. On the other hand, all the samples where “muscovite” was identified were taken from the same intercept of Lavalleya rhyolitic breccias in the same drillhole (LASDDH7) whereas the illite-bearing samples are widespread through all the Lavalleya ignibritic rhyolites in LASDDH6,7 and 8. This argues for a different spatial distribution of the “muscovites” versus illites. Furthermore, while the illite-bearing samples have a big range in K₂O in

whole rock samples (2 to 7.8 wt%), the “muscovite”- bearing samples are restricted to relatively high K₂O concentrations (4 to 6.8%) (Figure 22E). From these differences in the distribution and composition, together with the SWIR spectral differences stated above, it is reasonable to expect that mineralogical differences could exist between these two groups of samples. As a result, we decided to differentiate the “muscovites” from the illites. We identify the “muscovites” as low temperature phengitic muscovites because the 2200 nm absorption wavelengths fall in the high end of the muscovite range (2195 to 2215), between 2200 and 2013 nm (Figure 22d).

The spatial distribution of the identified minerals is reported below.

Montmorillonite is thought to represent widespread low temperature alteration that affects most of the lithologies and it is not restricted to the main hydrothermally altered zone, so it was left out of the discussion (Figure 20).

We refer to potassic alteration as gain of potassium and loss of calcium and sodium and intermediate argillic alteration as the loss of potassium, sodium and calcium. However, mineralogical assemblages were not precisely constructed and the altered rocks were cataloged into these alteration types based on their whole rock chemistry. Results are summarized in Table 4 and divided in the text below into separate groups for felsic and mafic composition wall rock.

Alteration in felsic rocks

The most evidently hydrothermally altered rock type is the Lavalleya rhyolitic ignimbrites and breccias. These are altered to white, gray and green clays that contain 0.1 to 2 vol. % pyrite in veins, disseminations, fracture coatings and growth in devitrification

textures (Appendix 4 Figure 7E). The alteration is typically patchy, affecting only the aphanitic matrix and/or the plagioclase phenocrysts (Appendix 4 Figure 7C,D,F).

Millimetric quartz veins and fluorite veins were identified in these rocks, however, the relation with the alteration is not clear as no selvages are present on veins (Appendix 4 Figure 7C,G).

Potassic alteration and intermediate argillic alteration were identified by K/Al versus Na/Al molar ratio plots (Figure 23A). Fresh samples of Lavallega rhyolites plot as a cluster in a central position indicating the original mineralogy as a mixture of plagioclase (*ca.* Anorthite 25) and K-feldspar. The potassic alteration (gain of potassium and loss of calcium and sodium) is evidenced by the displacement of some of the altered samples to higher K/Al and lower Na/Al ratios, in the direction towards the K-feldspar composition (Figures 23,25 and 26). However, there is no evidence that this alteration was especially intense, as there are no samples that show a complete loss of sodium in exchange for potassium. There is evidence for intermediate argillic alteration (loss of potassium, sodium, and calcium) in the altered samples that plot at lower K/Al and Na/Al ratios relatively to the fresh sample cluster, in the direction towards the illite and kaolinite compositions (Figures 23, 25, 26 and 27). Nonetheless, most of the intermediate argillica altered samples lie along a line from higher K/Al and lower Na/Al ratios than the fresh samples, in the direction towards K/Al and $Na/Al \rightarrow 0$, and form a trend towards complete potassium and sodium depletion. This suggests that these intermediate argillic altered samples had been previously enriched in potassium relative to sodium, likely during potassic alteration, before losing potassium and sodium during the intermediate

argillic alteration event. This observation indicates that the intermediate argillic alteration occurred later in time than the potassic alteration.

The mean gold content of the unaltered Lavalleya rhyolites is taken as < 2 ppb (0.63 ± 1.21 ppb, 2 stdev) based on all the analyzed samples (1 meter length assay) whereas in three hydrothermally altered zones with quartz-pyrite veins and pyrite disseminations, gold has slightly anomalous values between 2.5 and 11 ppb. Some of these altered rhyolites are also enriched in thallium (1 to 7 ppb), bismuth (1.5 to 8 ppm) and molybdenum (1.5 to 6 ppm), but all these are not always simultaneously anomalous in the same samples. The altered samples also have higher LOI values (lost on ignition, up to 13.5 wt%), which indicate the presence of relatively high abundances of hydrous minerals compared to the fresh samples. Similarly, the altered samples have high sulfur contents (up to 4 wt%), which reflect higher sulfide mineral contents than the fresh rocks (Figure 24).

Other felsic rocks in the central area register similar hydrothermal alteration but were not associated with trace elements anomalies. Potassic and intermediate argillic alteration were identified in the India Muerta rhyolites, and the same temporal evolution can be inferred (Figure 25A). No potassic alteration was identified in the San Miguel granodiorites granophyres with this method, however, intermediate argillic alteration was determined. A few samples of the granodiorites are displaced towards lower K/Na than the inferred primary composition cluster indicating the possibility of sodic alteration (Figure 25B). Nonetheless, there are no petrographic observation of sodic alteration,

which suggests that the variation in these samples is due to different primary igneous K/Na ratios.

For the Lascano series dikes, the trachyandesites register only potassic alteration whereas the trachydacites register potassic and intermediate argillic alteration (Figure 26). However, the limited amounts of altered samples do not allow inferring the relative timing of the alteration events. Sodium cobaltinitrite staining in core slabs shows that most of the hydrothermal potassic feldspar is concentrated at the dike contacts, whereas the center of the dikes remain unaltered or present patchy alteration (Appendix 4, Figure 7A,B).

Illite was only identified in Lavalleja and India Muerta rhyolites, San Miguel granodiorite granophyres and Lascano trachytes in the hydrothermally altered zone in the center of the complex. Some of these samples might also contain some kaolinite that was not identified through SWIR but identified by the XRD results in one of the illite bearing samples (Figure 21D). Phengitic muscovites were also only identified in the hydrothermally altered zone in the center of the complex and are restricted to Lavalleja rhyolite breccias in LASDDH7 between 400 and 550 meters depth (Figure 20).

Kaolinite was identified in Lavalleja rhyolites and reaches a maximum depth of 420 meters in LASDHH6 in the center of the hydrothermally altered zone. Kaolinite was also identified in the single hole drilled outside of the ring complex (LASDDH4), to a depth of 826 meters, in India Muerta rhyolites.

Alteration in mafic rocks

Hydrothermal K-feldspar rims were locally identified as overgrowths around plagioclase phenocrysts via staining by sodium cobaltinitrite in the Santa Lucía basalts below the contact with a Santa Lucía gabbro sill, between 298 and 450 m sill in LASDH2, and between 210 and 270 in LASDDH6 (Figure 20, Appendix 4 Figure 8E,F). At least some of these rims are composed of fine-grained adularia crystals as reported by Thompson, 2007. Millimetric quartz-phyllsilicates, quartz-carbonate, quartz-pyrite and phyllsilicates-pyrite veins are common in these zones both in the sills and lavas, however, the relation with the alteration is not obvious (Appendix 4 Figure 8A,C,D). One two-centimeter wide quartz-chalcopyrite-pyrite vein was identified in LASDDH2 (298.9 m) and one millimetric vein in LASDDH6 (220 m) in the contact between the Santa Lucía gabbro sill and the Santa Lucía basaltic lavas, together with several quartz-pyrite millimetric veins (Appendix 4, Figure 8B). The veins containing chalcopyrite are responsible for local copper anomalies. The mean copper of fresh Santa Lucía gabbros and basalts is 130 ppm (stdev = 96 ppm). Two samples from the contact contain 677 ppm Cu (LASDDH6, sample 73135 from 220.23 to 221.23 m) and 813 ppm Cu (LASDDH2, sample 121970 from 297.95 to 298.95 m). Other slightly anomalous samples are near this contact zone (256 ppm Cu in sample 71974, from 299.4 to 300.5 m in LASDDH2, and 316, 254, 294 ppm in samples 73124, 73125 and 73127 respectively, and between 210 to 215 m in LASDDH6). These anomalous copper samples do not present any other anomalous metal contents.

Despite the K-feldspar rims around the plagioclase phenocrysts, there are no striking geochemical changes were identified using molar ratio element plots in the samples from these intercepts. Most of the variability of the samples of the Santa Lucía series gabbros and basalts can be explained by plagioclase-pyroxene-olivine fractionation. Nonetheless, a few samples are displaced from the fractionation trend and show mobilization of Si, Mg, Fe, Al and/or Na (Figure 27). Four of the eight altered samples identified with this method, also show signs of potassium gain in a molar K/Al versus Na/Al diagram, likely as a result of illite alteration (Figure 27). Three of these samples are located below the contact with the Santa Lucía gabbro sill in LASDDH6 from 288 to 292 m (samples 73210, 73211 and 73212 respectively). Four samples of Santa Lucía basalts below this contact in LASDDH6 (210 to 300 m) are slightly anomalous in molybdenum and range between 4 to 14 ppm (fresh samples mean concentration is 1 ppm, stdev = 1.97 ppm) (Figure 20). No molybdenum anomalies were identified in LASDDH2.

No hydrothermal minerals were identified in hydrothermally altered samples of Santa Lucía basalts using SWIR with the exception of the younger, widespread montmorillonite described above.

Discussion and Conclusions

Evidence of potassic alteration affecting the central zone of the complex was identified through geochemistry in the Santa Lucía basalts, Lavalleja and India Muerta rhyolites and Lascano trachytes. However, detailed petrographic work is lacking and would be necessary to define the hydrothermal mineral assemblage and catalog the

alteration mineralogically (refer to Meyer and Hemley 1967). In the case of the Santa Lucía basalts, if the alteration rims around plagioclase are indeed constituted only by adularia, the chemically detected gain of potassium would correspond to a low temperature, low sulfidation epithermal system ($>240^{\circ}\text{C}$, potassic adularia - sericite alteration, Simmons *et al.*, 2005) and not to a higher temperature Cu-porphyry style alteration ($> 400^{\circ}\text{C}$, K-silicate alteration, Seedorff *et al.*, 2005). Since no hydrothermal biotite was identified in the first pass petrographic study, the lower temperature scenario is more likely. If this is the case, the chemically detected gain of potassium in the Lavalleja rhyolites could be explained as adularia + illite, instead of only K-feldspar, and are consistent with the observation that no samples reach a complete K for Na exchange (Figure 23).

The intermediate argillic alteration was chemically identified in the felsic rocks as affecting both fresh rocks and previously potassically altered rocks. The presence of illite and smectites identified through SWIR in the felsic rocks, suggest that hydrothermal fluid temperatures at this stage could have reached up to 220°C (Seedorff *et al.*, 2005). If the identification of phengitic muscovite is correct, fluids at this stage could have reached higher temperatures $\sim 300^{\circ}\text{C}$ or more. Kaolinite was not only identified associated with the central magmatic hydrothermal zone and it might have also formed by low temperature weathering during magmatism when topography was high and the water table was low, enabling acidic waters to reach deeper zones through fractures (Simmons *et al.*, 2005).

Weakly and sparsely mineralized zones are associated with the hydrothermally altered rocks and are divided into two groups (Figure 20). First, anomalous Au, Tl, Bi and Mo intercepts in potassically and intermediate argillically altered Lavalleja rhyolite ignimbrites and breccias. The anomalies in these rocks are related to higher concentrations of pyrite disseminations and quartz-pyrite veins. Second, anomalous copper intercepts with the contact between a Santa Lucía gabbro sill intruding Santa Lucía basaltic lavas. The anomalous intercepts there are related to millimetric to one centimeter quartz-chalcopyrite-pyrite veins cutting through the contact. This zone is followed by weakly anomalous copper and molybdenum intercepts in potassically altered Santa Lucía basalts, down-hole in LASDDH6.

These hydrothermally altered and associated weakly mineralized zones were only identified in the central zone of the complex where most of the dikes and sills of the complex are observed. The Lavalleja rhyolite ignimbrites and breccias, together with minor surrounding India Muerta rhyolites and San Miguel granodiorite granophyres, are intruded by the Lascano series alkaline trachytes. The Santa Lucía basalts are intruded first by a mildly alkaline Santa Lucía gabbro sill and second by the Lascano series alkaline dikes (Figure 20). These dikes and sills were only identified in this area of the complex, which suggests that they could be linked to the hydrothermal alteration and the mineralization. Furthermore, the Lascano dikes show evidence of potassic alteration increasing in intensity towards the dike walls. This suggests that these dikes were associated to the release of the magmatic hydrothermal fluids or at least served as structures where the hydrothermal fluids circulated through. Similarly, the fact that the

only quartz-chalcopyrite-pyrite veins and resulting copper anomalous zones are in the contact of the Santa Lucía gabbro sill with the Santa Lucía basalts, suggest that the mineralization might be related to the sill intrusions.

The Santa Lucía and Lascano rock types are mildly alkaline and alkaline, respectively, and share trace element geochemistry compositions and are inferred to be part of the youngest magmatic activity of the complex. In Chapter 2 we hypothesize that these could be part of a dike and sill complex on top of a deeper and inferred larger alkaline intrusion. Accordingly, the altered zones could be related to hydrothermal magmatic system associated with dikes and sills emanating from a mildly to alkaline intrusive cupola related to the Santa Lucía and Lascano rocks. The presence of fluorite and fluorite-quartz veins in the altered Lavalleya rhyolites is consistent with an alkaline source for the hydrothermal fluids. However, the temporal relation of these veins with the alteration is not yet understood. The older, potassic alteration may be related to the dike emplacement and early release of hydrothermal magmatic fluids. The later, intermediate argillic alteration is, then, related to the subsequent decrease of fluid temperature

Figures and Tables

TABLE 4 - DESCRIPTION OF HYDROTHERMALLY ALTERED AND MINERALIZED ZONES IN LASCANO-EAST

Alteration	New added minerals	Host rocks	Alteration Style	Alteration location	Associated veins and disseminations	Anomalies location	Background mean $\pm 3\sigma$	Anomalous concentration	Figure in appendix 4
K-alteration (1) and superimposed Intermediate argillic alteration (2) in felsic rocks.	(1) K-feldspar or adularia?	>Lavalleja rhyolites >Lascano trachyte dikes <India Muerta rhyolites	*Plagioclase phenocrysts replacement by phyllosilicates *patchy replacement of groundmass *Intense K-alteration front in Lascano dikes contacts	sparse in LASDDH2, 6, 7, 8 where the affected lithologies are present (Figure 20)	*0.5-3 mm Fluorite *0.5-5 mm quartz, quartz-pyrite, quartz-carbonate-pyrite(0.1-1%) *0.1-0.5 mm carbonate, chalcedony *0.1-1% pyrite disseminations and growth in devitrification textures	Sparse in Lavalleja rhyolites LASDDH2, 6, 7, 8 where the affected lithologies are present (Figure 20)	Au = 4.2 ppb Mo = 2.6 ppm TI = 1 ppm	2.5<Au>11 ppb 1.5<Mo>6.5 ppb 1<TI>7 ppb	6
	(2) Illite, chlorite, kaolinite, phengitic sericite?	>Lavalleja rhyolites >Lascano trachyte dikes <India Muerta rhyolites <<San Miguel granodiorite granophyres					Bi = 3.2 ppm S = 2.1 wt%	1.5<Bi>8 ppb S up to 4 wt%	
							LOI = 8.2 wt%	LOI up to 13.5 wt%	
K-alteration in mafic rocks.	K-feldspar or adularia?, chlorite	Santa Lucia basalts	*Local K-feldspar or adularia ? overgrown rims around plagioclase phenocrysts. *Fine grained K-feldspar in interstices.	LASDDH2, 298-450m LASDDH6, 210-270m (Figure 20))	*1-20mm quartz-pyrite(10%) chalcopyrite(15%)	In Santa Lucia gabbro sill contact with Santa Lucia basalts LASDDH2, 298-300m, LASDDH6, 210-221m (Figure 20)	Cu 418 ppm	LASDDH2 256-813ppm LASDDH6 254-677ppm	7
					*1-6 mm quartz-phyllosilicates, *quartz-carbonate, *quartz-pyrite, *phyllosilicates-pyrite (0.1-10%)		Mo 5.97 ppm	4>Mo<14 ppm	

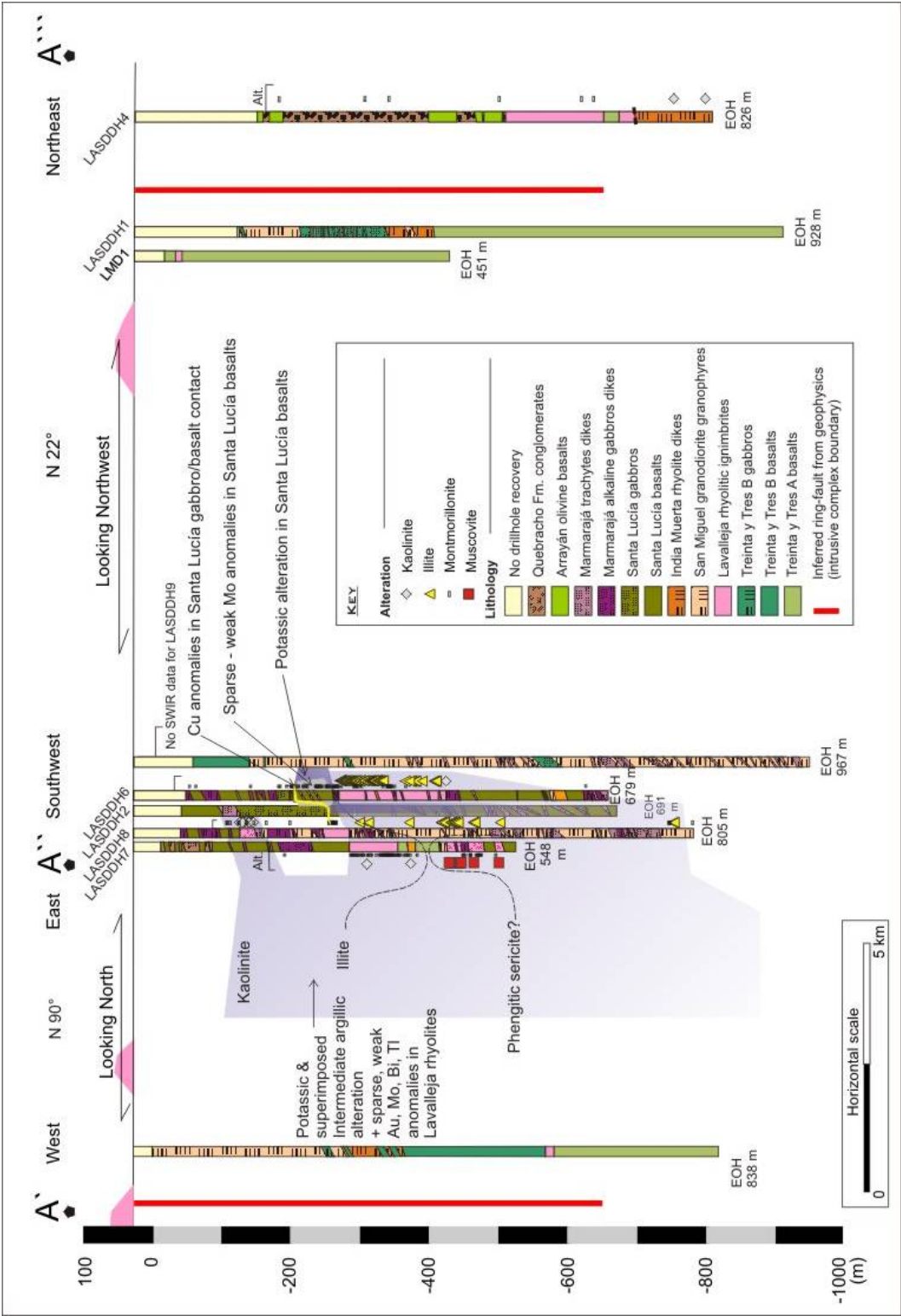


Figure 20 -Drillhole columnar sections over Lascano-East complex showing alteration and mineralization zones in the central zone of the complex

Figure 21 – Short wave infra-red (SWIR) spectra (A, C, E, G) and X-ray diffraction (XRD) profiles (B, D, F, H) of selected samples. SWIR spectra from Lascano-East complex samples are shown in black with absorption troughs wave length noted in black. Spectra of reference minerals (taken from Specwin library, www.pimausa.com, Thompson *et al.*, 1999) are shown in blue and green. XRD diagnostic peaks of identified minerals are shown in red (matching the mineral identified with SWIR) and black (other minerals present in the sample). A, B) Possible phengitic muscovite in Lavalleya rhyolitic breccias (71426/LAS478) C,D) Illite in Lavalleya rhyolitic ignimbrites (73241/LAS850). E,F) Kaolinite in Lavalleya rhyolitic ignimbrites (71501/LAS549) G,H) Montmorillonite in Marmarajá alkaline gabbro (71943/LAS529).

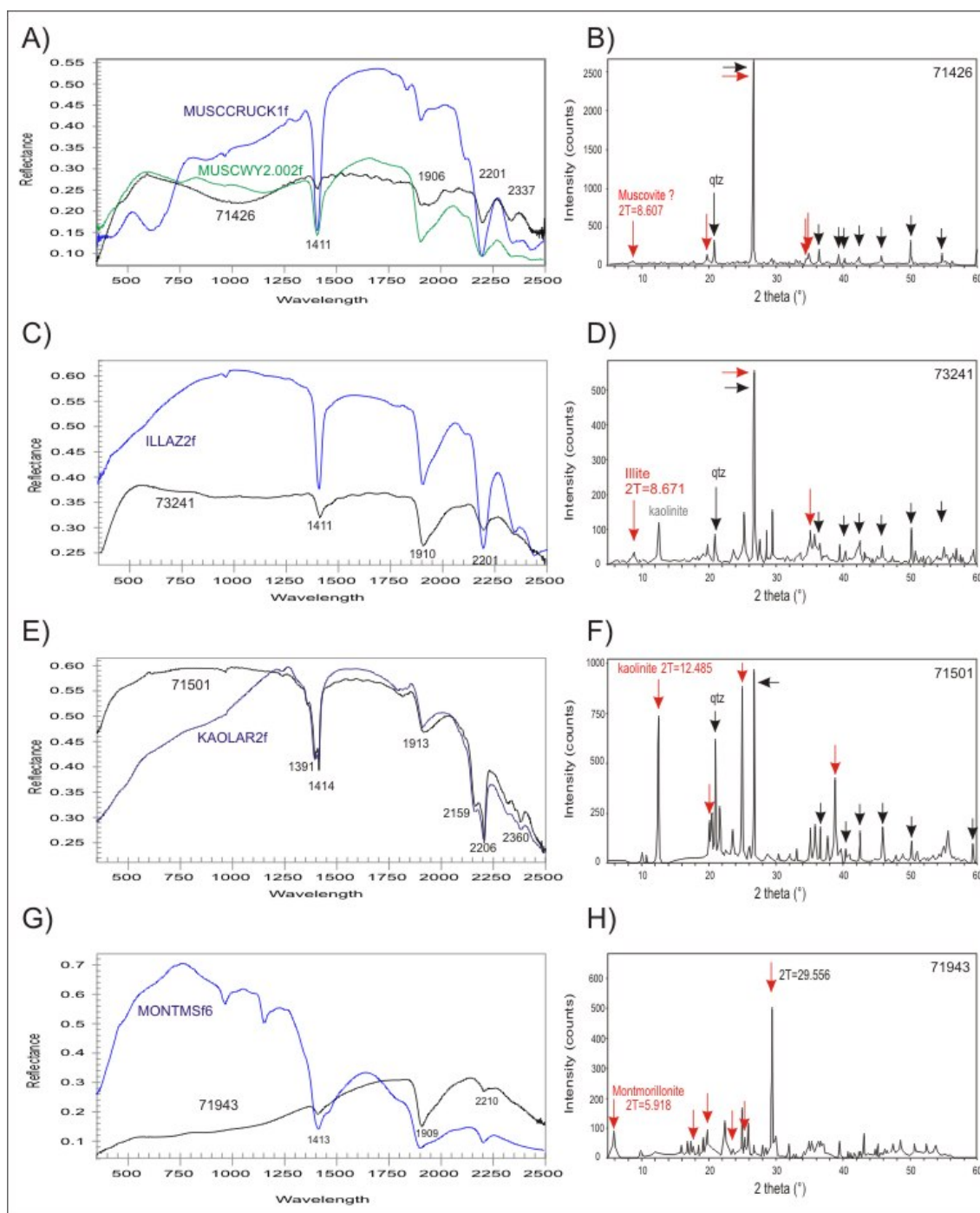


Figure 21 – Short wave infra-red spectra (wavelength in nm) and XRD spectra of selected samples (2 theta in degrees).

Figure 22 – Scatter plots of illite (grey) versus muscovites (black) bearing samples identified with SWIR showing different spectral features. A) Width of the 2300 nm trough versus the depth of the 1900 nm trough, showing that “muscovites” have lower 1900 nm trough and wider 2350 trough than most illites. B) Depth of the 2300 nm trough versus the depth of the 1900 nm trough, showing that “muscovites” have shallower 1900 nm troughs and deeper 2350 trough than most illites. C) Sericite crystallinity index (2200nm/1900nm troughs) versus width of the 2200 nm trough, showing that the “muscovites” have higher sericite index and wider 2200 troughs than most illites, which presents a bigger dispersion. D) Sericite crystallinity index versus wavelength of the 2200 trough, showing that the wavelength of the 2200 nm trough of “muscovites” range from 2202 to 2213 nm while the illites range from 2185 to 2214 nm. The high wavelength of the “muscovites” suggest that these are low temperature phengitic muscovites. E) Whole rock SiO₂ (wt%) versus K₂O (wt%) of Lavalleya rhyolites plotted according to the presence of muscovite and illite identified with SWIR. While illites bearing samples present a wider range of K₂O (2 to 7.8 wt%), the phengitic muscovite bearing samples are restricted to the upper range (4 to 6.8 wt%). F) Short wave infra-red spectra of reference muscovite and illite to illustrate the absorption features plotted in previous plots.

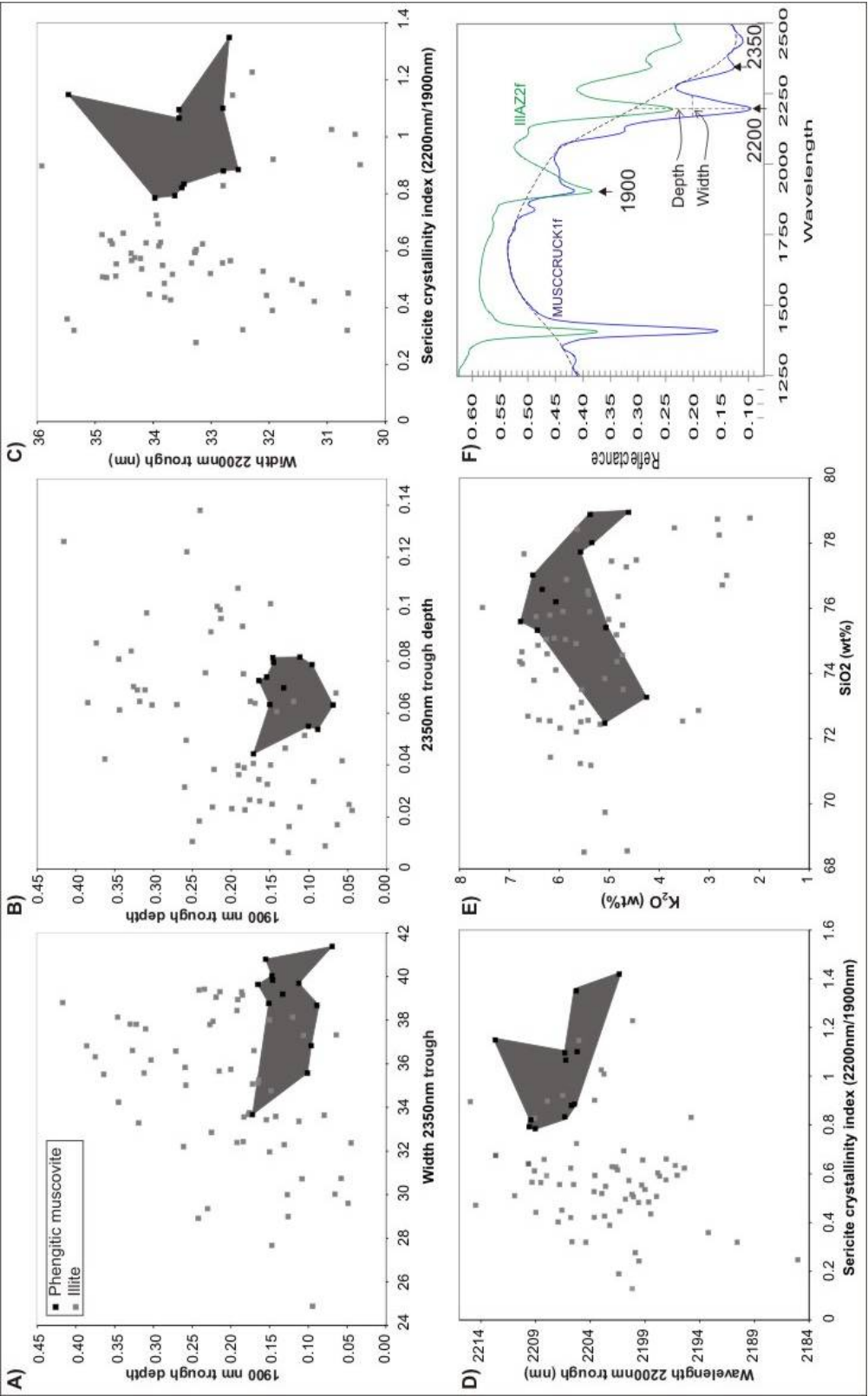


Figure 22 – Scatter plots of illite (grey) versus muscovites (black) bearing samples identified with SWIR showing different spectral features. Through depth are in units of reflectance.

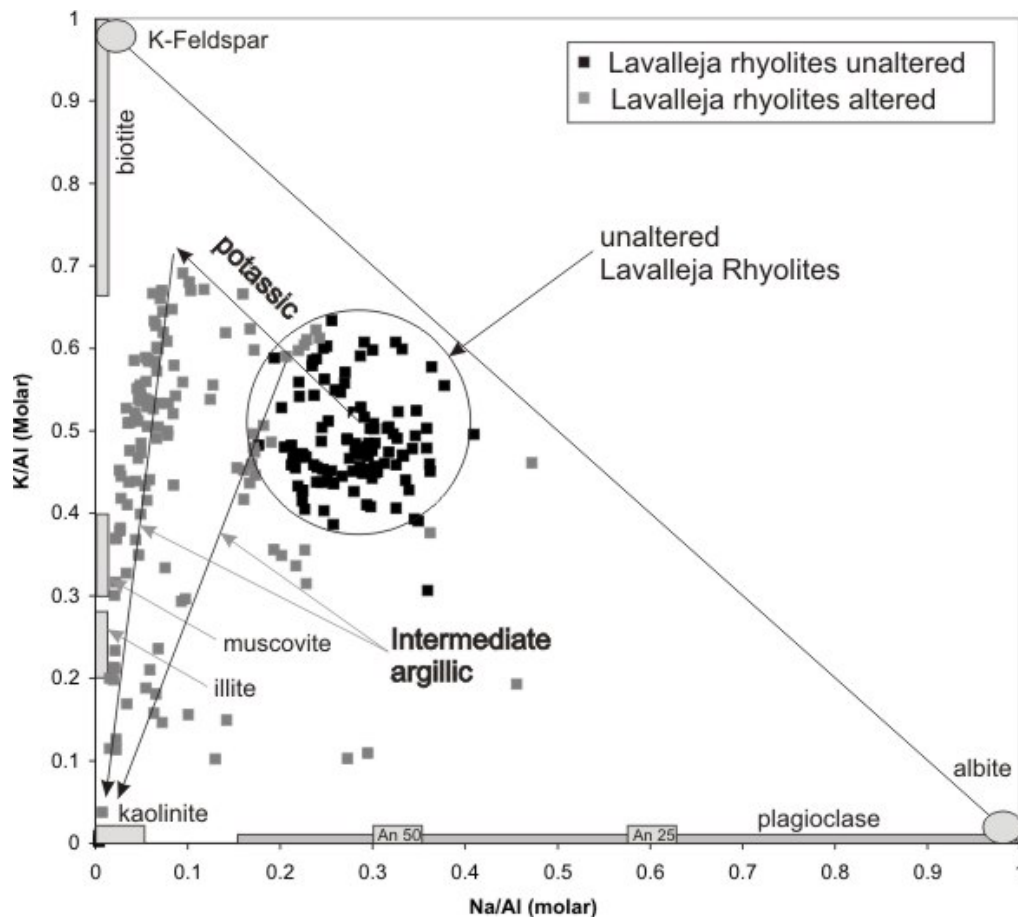


Figure 23 – K/AI versus Na/AI molar plots of fresh and altered samples of Lavalleja rhyolites. Altered samples are scattered trough LASDDH2,6,7, and 8. Fresh samples plots in a cluster in a central position. One group of altered samples are displaced towards higher K/Na ratios (K-alteration) and another group of altered samples form a trend from this position to the illite and kaolinite fields, indicating loss of K and Na (intermediate argillic alteration of previously K-altered rocks). The rest of the altered samples plots between the fresh samples and the illite and kaolinite fields (intermediate argillic alteration of fresh rocks).

Figure 24 – Anomalies in fresh and altered samples of Lavalleya rhyolites. Fresh (black) and altered (grey) samples from Figure 21. Dashed lines indicates mean composition of fresh samples plus three standard deviation. Most of the anomalous samples are observed in the altered samples. However the samples that are anomalous in one element are not necessarily anomalous in the others. Anomalous samples are scattered through Lavalleya rhyolites intercepts in LASDDH2, 6, 7 and 8. **A)** SiO_2 (wt%) versus loss of ignition (LOI wt%). **B)** SiO_2 (wt%) versus Au (ppb). One sample of 72 ppb was considered unreliable since no correlation between the anomalous value and alteration or sulfide content was observed). **C)** SiO_2 (wt%) versus Mo (ppm). **D)** SiO_2 (wt%) versus Bi (ppm). **E)** SiO_2 (wt%) versus Tl (ppm). **F)** SiO_2 (wt%) versus S (wt%).

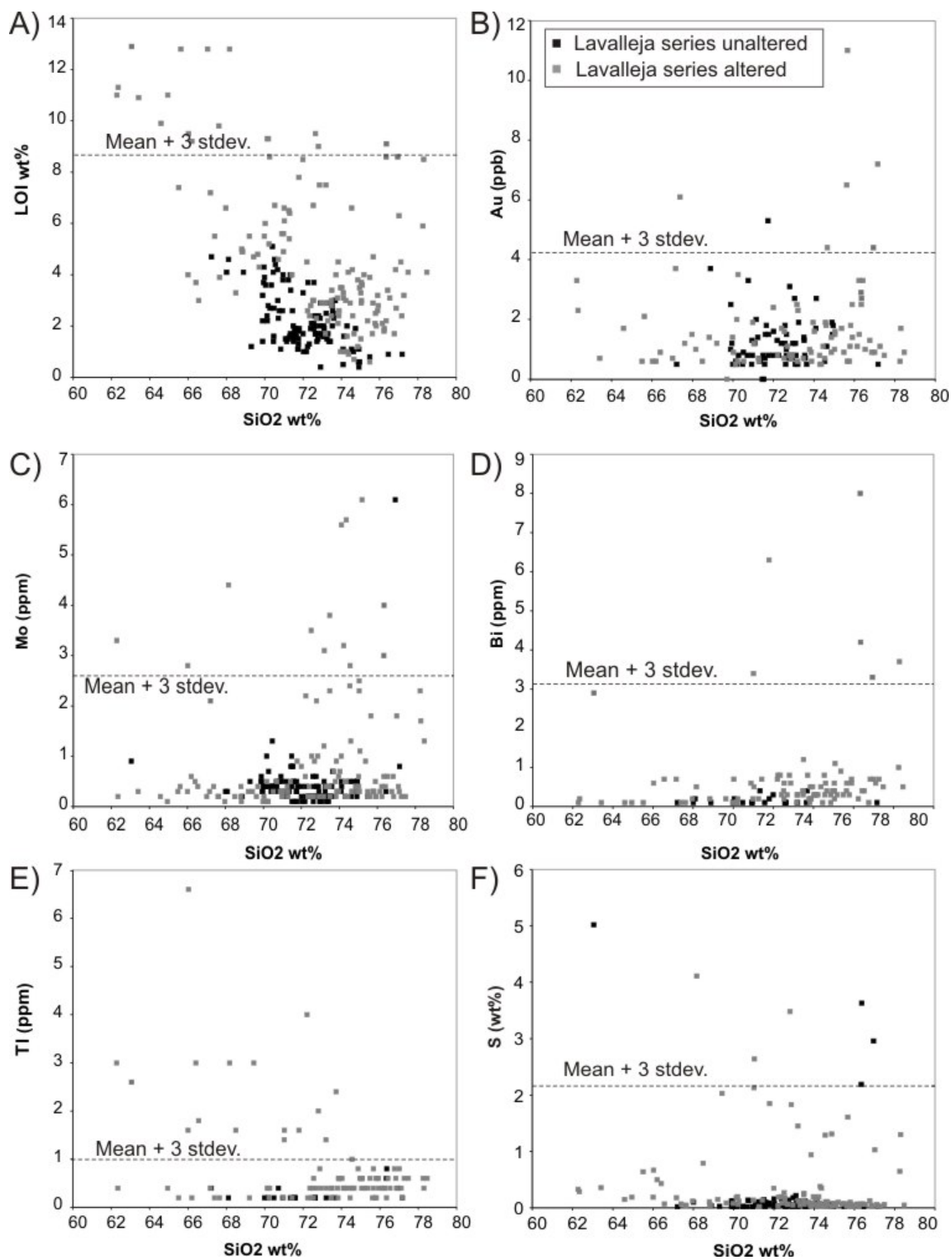


Figure 24 – Anomalies in fresh and altered samples of Lavalleja rhyolites.

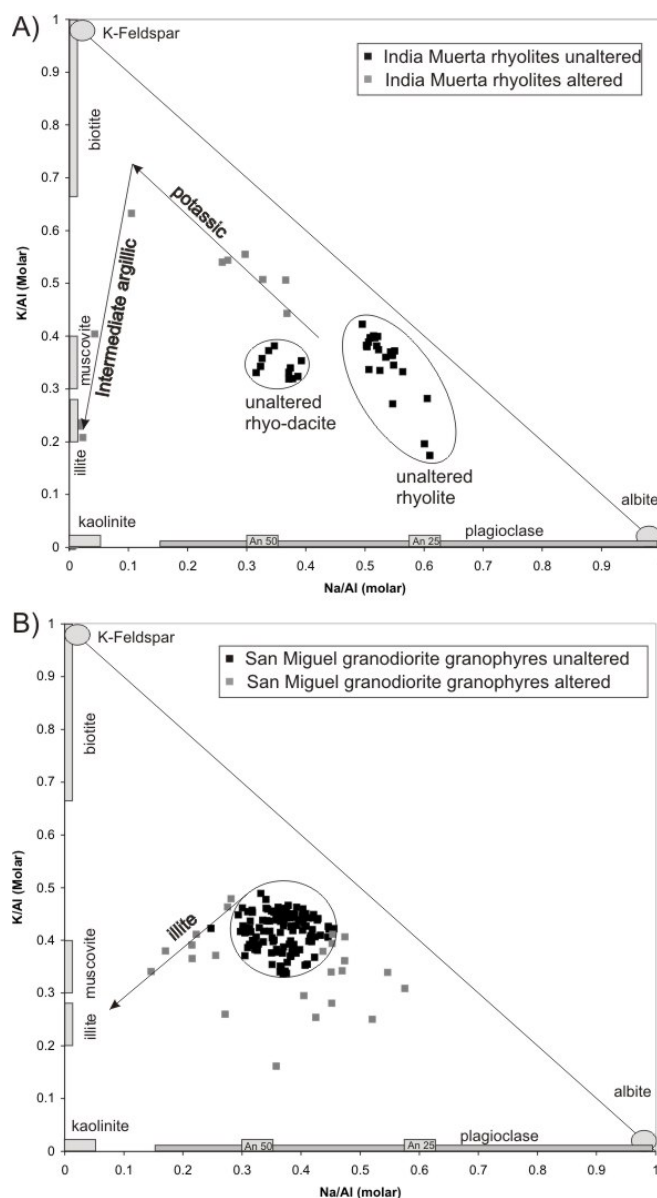


Figure 25 – K/Al versus Na/Al molar plots of fresh and altered samples of India Muerta rhyolites and San Miguel granodiorite granophyres A) Fresh samples (black) of the India Muerta rhyolites and rhyodacites plots in two clusters according to their composition. Altered samples (grey) are displaced towards a higher K/Na composition (K-alteration) and two samples plots towards the illite composition (intermediate argillic alteration). B) K/Al versus Na/Al molar plots of fresh and altered samples of San Miguel granodiorite granophyres. Altered samples are scattered through LASDDH8 and 9. Fresh samples in black plot in a cluster while altered samples in grey, are displaced towards the illite field (intermediate argillic alteration).

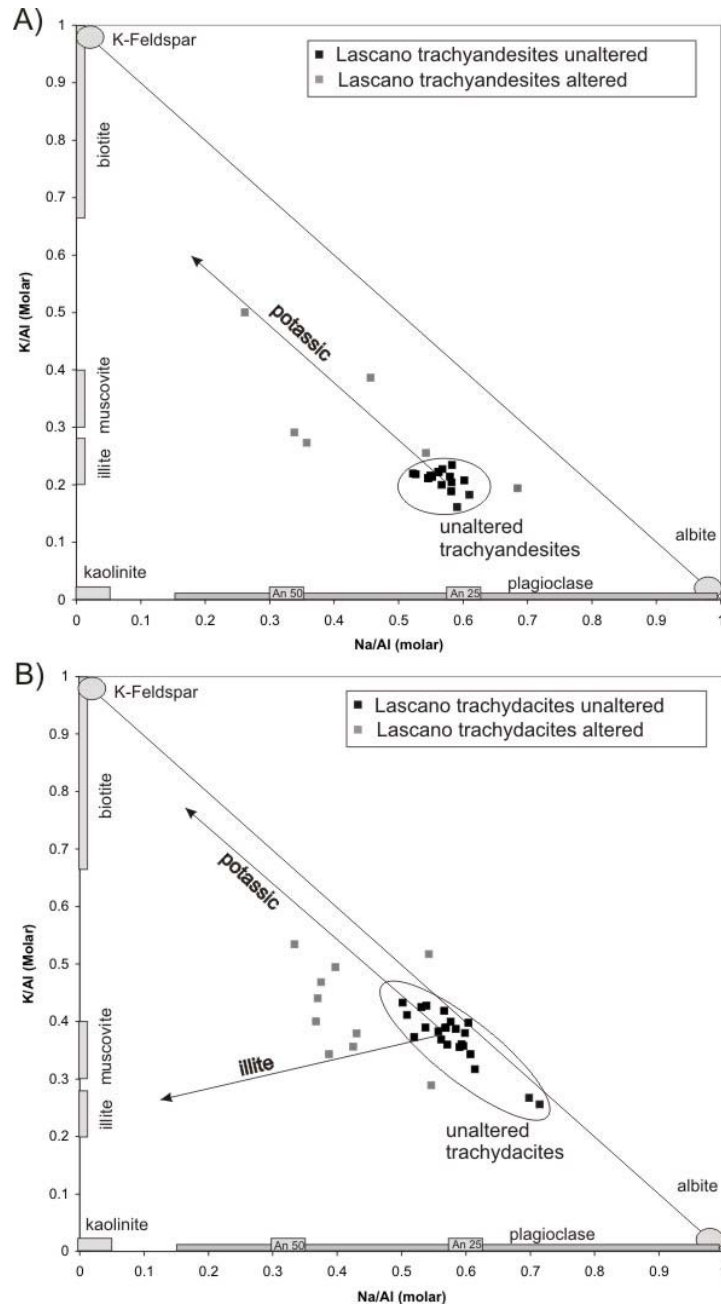


Figure 26 – K/Al versus Na/Al molar plots of Lascano trachytes. Fresh (black) and altered samples (grey). Altered samples are scattered through LASDDH2,6,7,8 and 9. A) Lascano trachyandesites samples in black plot in a cluster while altered samples in grey and are displaced towards the K-feldspar field (potassic alteration) B) Lascano trachydacites in black plotting in a cluster while altered samples in grey are displaced towards the K-feldspar field (potassic alteration) and the illite field (intermediate argillic alteration).

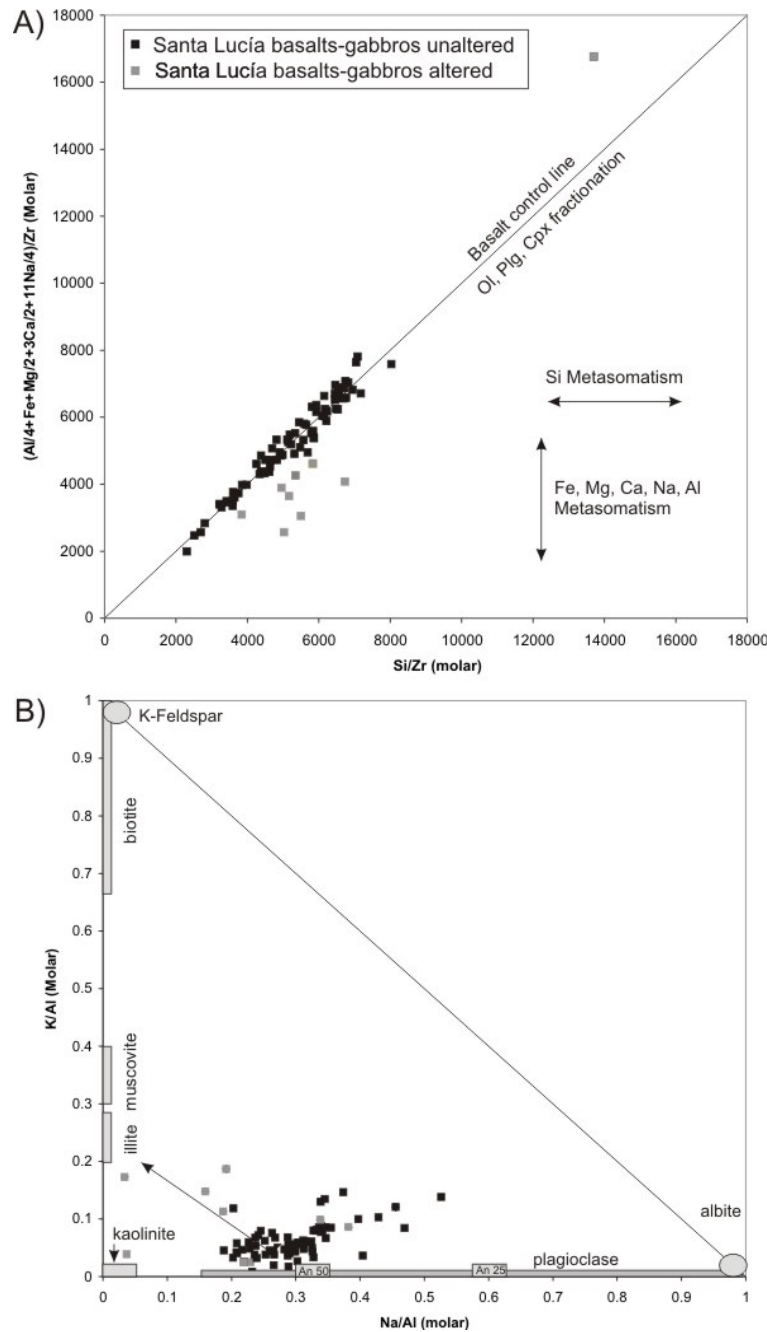


Figure 27 – Fresh (black) and altered (grey) whole rock samples of Santa Lucía gabbro and basalts plotted on a molar basis. A) Si/Zr versus $(Al/4 + Fe + Mg/2 + 3Ca/2 + 11Na/4)/Zr$ (Madeisky, 1993). Fresh samples plots over a clinopyroxene + olivine + plagioclase fractionation line while altered show possible Si, Fe, Ca, Mg, Na and Al metasomatism. The altered samples are scattered in LASDDH2, 6, 7 and 8. B) K/Al versus Na/Al showing some of the altered samples with a trend towards Illite and kaolinite compositions (intermediate argillic alteration).

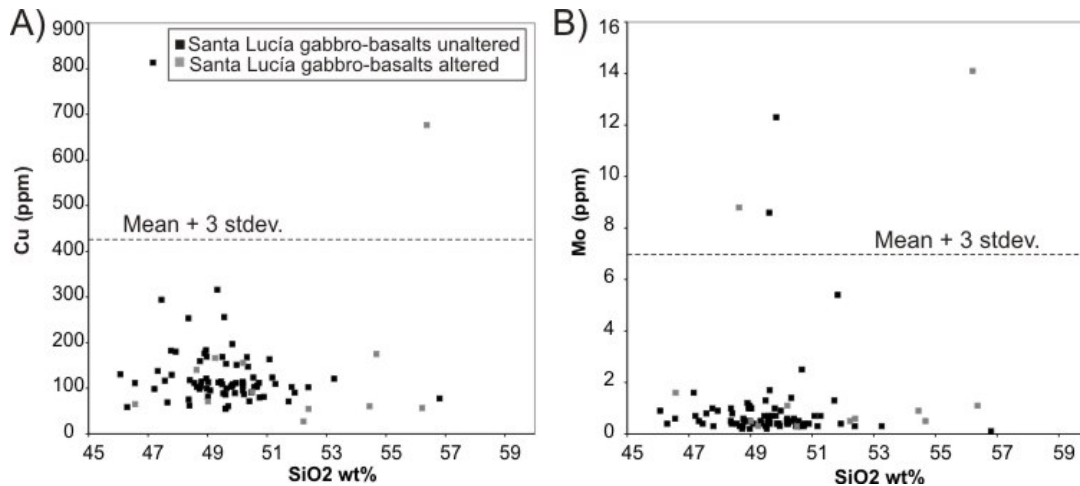


Figure 28 – Cu and Mo anomalies in altered samples of Santa Lucía basalts and gabbros. Fresh (black) and altered (grey) samples of Santa Lucía gabbros and basalts. Altered samples were identified by molar plot showed in Figure 27A. Dashed lines indicates mean composition of fresh samples plus three standard deviations. A) SiO₂ (wt%) versus Cu (ppm). The two anomalous samples corresponds to the contact of a Santa Lucía gabbro sill with a Santa Lucía basalt in LASDDH2 (sample 121970 from 297.95 to 298.95 m) and LASDDH6 (sample 73135 from 220.23 to 221.23 m) and reach 813 ppm and 677 ppm respectively. B) SiO₂ (wt%) versus Mo (ppm). Anomalous Mo reaches 14 ppm. The anomalous samples correspond to Santa Lucía basalts in LASDDH6 between 200 and 300 meters, below the anomalous Cu intercept.

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Chapter 4: Review of mineralization and ore deposits in Cretaceous intrusive complexes from Brazil and Namibia and mineralization potential of the Cretaceous intrusive complexes from the Merín basin, Uruguay

Abstract

Although the observation that no important mineralization and alteration is evident in the outcropping Valle Chico complex, the other concealed intrusive complexes and other areas of the Merín basin have potential of hosting economic ore deposits. This potential is based on the weak mineralization and hydrothermal alteration found in Lascano-East, fluorite veins cutting the Precambrian rocks in the basin edge, and the comparison with similar age mineralized complexes, located in the Paraná –Etendeka province in Namibia and Brazil. The potential mineralization can be divided into, but not restricted to, three main types: 1) gold, copper and molybdenum in the wall-rock roof of Lascano-East alkaline intrusions 2) fluorite, tungsten, boron and yttrium in fluorite veins in the basin edge 3) niobium, zirconium, phosphate, uranium, thorium and rare earths in possible concealed carbonatites or other alkaline rocks.

It is reasonable to expect a wider concealed lithological diversity in the complexes of Merín basin than what is currently exposed or drilled, and based on comparison with similar complexes in Brazil and Namibia, it is possible to speculate about the presence of carbonatites intruding restricted areas inside some of the complexes. Furthermore, some geophysical features, as the central part of the San Luis anomaly could be interpreted as a concealed carbonatite.

The erosion levels of the Merín basin are shallower than over most of the mineralized complexes in Namibia, with the possible exception of the Valle Chico complex. This phenomenon could explain the lack of mineralization and alteration in Valle Chico. Limited erosion might have enabled the preservation of the hydrothermally altered roof wall rocks that could host dissemination and vein mineralization in the other complexes of the Merín basin. On the other hand, if carbonatites are indeed concealed in the basin, the shallow erosion could prevent reaching and economical mining of the usually more mineralized ferro-carbonatites.

Weather and relief conditions to form laterites were probably not present over the complexes of the Merín basin. Therefore, it is not likely to expect this type of supergene enrichment of high economic importance in the Brazilian complexes.

Introduction

The intrusive complexes of the Merín basin in Uruguay share similar lithologies, emplacement styles, ages and magmatic sources to the Damaraland and Luderitz complexes in Namibia, Africa, and to those in eastern Brazil (see Chapter 2). The better exposed and studied intrusive complexes of Brazil and Namibia have anomalous amounts of rare earth elements, tin, tungsten, fluorine, thorium, uranium, niobium, zirconium, titanium, strontium, iron, hafnium, phosphate, fluorine and barium. These amounts range from sub-economic, as in the Erongo and Brandberg complexes in Damaraland province (rare earths, uranium, niobium, zirconium, tungsten, tin and fluorine, Pirajno, 2009) to economic like uranium in the Osamu Utsumi mine in Poço de Caldas complex (Lapido-Loureiro and Do Santos, 1988) and niobium, phosphate and rare earths in Araxá and

Jacupiranga, Brazil (Biondi, 2003). This mineralization is mainly associated with alkaline magmatism and in most cases linked to the presence of carbonatites (Pirajno, 2009).

The most exposed intrusive complex of the basin, the Valle Chico complex, does not show compelling evidence of mineralization on the surface except for a few two millimeter wide quartz veins cutting the syenites parallel to a trachyte dike with slightly anomalous gold (~20 ppb, Appendix 2).

Evidence of hydrothermal alteration and weak mineralization has been found elsewhere in the Merín basin. Drilling at Lascano-East complex encountered low temperature potassic alteration (K-feldspar after plagioclase) and intermediate argillic alteration (illite, chlorite and kaolinite) in basalts and rhyolites in the center of the complex where mildly alkaline to alkaline dikes and sills cut the sub-alkaline and mildly alkaline volcanic rocks (LASDDH2, 6, 7, 8 and 9, see Chapter 3). The altered rhyolites are associated with sparse disseminated pyrite, quartz-pyrite veins, and fluorite veins with sparse weakly anomalous gold, thallium, molybdenum and bismuth. The altered basalts present quartz-chalcopyrite-pyrite veins associated with weak copper anomalies and quartz-pyrite veins associated with weakly, sparse molybdenum.

The other mineralized zone in the Merín basin is the fluorite-quartz-manganese veins (Bossi, 1978) of the Florencia mine (ca. 4500 tonnes at 80% CaF_2 , Bosse *et al.*, 1982). These veins cut the Precambrian granite-gneiss basement near the southern faulted edge of the basin (Figure 2, Chapter 2), and some authors linked them to the Merín Cretaceous magmatism (Gómez Rifas and Pérez-Peirano, 1992; Rossello *et al.*, 2000; Aubet, 2004). At least some of these veins are enriched in yttrium (ca. 0.5%, Rossini and

Arana, 2000), tungsten and boron (up to 100 and 4434 ppm respectively, Appendix 2).

Quartz veins of tabular calcite blades replaced by silica and gossan rolled clast were identified close to this contact during this research. Some barite veins were also identified in proximity of the fluorite veins (Rossini and Arana, 2000).

The first part of this chapter summarizes the ore deposit forming processes documented for similar age intrusive complexes related to the Paraná-Etendeka magmatism and/or the opening of the Southern Atlantic Ocean from Namibia and Brazil. Other alkaline provinces of different ages in Africa and elsewhere present a wider range of mineralizations and ore grades but are not discussed in this chapter. Refer to Pirajno (1994, 2009), Bowden (1985) and Biondi (2003) for comprehensive descriptions.

This section is followed by a summary of the main sub-economic to economic ores found in these complexes that illustrates common mineralization types, grades and reserves. This is followed by a discussion that explores the mineralization potential of the intrusive complexes in the Merín basin. It is based on a comparison of the local stratigraphy, shapes of intrusions, hydrothermal alteration and mineralization types and styles with the previously presented mineralized complexes in Brazil and Africa. The discussion attempts to identify favorable locations and types of ore that could have been formed and preserved.

Mineralization in sub-alkaline to alkaline anorogenic intrusive complexes

According to Bowden (1985), Biondi (2003) and Pirajno (2009) mineralization in sub-alkaline to alkaline intrusive complexes can be cataloged into three ore-forming processes: primary magmatic, magmatic-hydrothermal and supergene enrichment.

Primary magmatic enrichment is restricted to carbonatites that host disseminations and veins of magnetite, apatite, zirconium, pyrochlore, ankerite, etc. that produce anomalous concentrations of rare earth elements, Nb, U, Th, Ti and P. In some cases the carbonatites themselves constitute a non metallic ore and are used to extract carbonate for the cement industry. Pirajno (1994) speculated the potential of hosting Ni, Cu, PGEs and Au in layered mafic-ultramafic rocks such as in the Okenyenya complex, Namibia, but no direct evidence has been found.

The magmatic-hydrothermal fluids released at late stages from the alkaline and carbonatite intrusions commonly produce sodic and potassic alteration, which is known as fenitization. The mineralization concentrates in disseminations, veins and breccia matrix in the roof and wall-rock of the intrusions and varies depending on the composition of rocks within the complex. This can be divided into two types: 1) saturated to oversaturated complexes which tend to be mineralized in Sn, W, U, Mo, Bi, As, Y, Li, Ta, Zr, La, Ce and Nb and, 2) undersaturated complexes that tend to be mineralized in Sr, Ba, Th, Nb, Ti, Fe and P.

According to Kinnarid and Bowden (1991), saturated-oversaturated complexes present four types of mineralization: 1) pegmatitic pods (Be and U) 2) disseminations in hydrothermally altered rocks on the roof of subvolcanic intrusions (Ta, Nb, Th and rare

earths) 3) hydrothermal stockworks, veins and sheeted veins (Sn, W, Mo, Pb and Zn) and, 4) greisen deposits (Sn, W and Bi) (*e.g.* sub-economic mineralizations of the Erongo complex in Namibia, Pirajno, 1994).

The undersaturated mineralization is mainly related to carbonatites and is described as disseminations, veins, lenses and replacement bodies (Cu, Fe, P, F, Ba, Nb, U, Sr, Au, Pb, Zn and rare earths). However, it is common that undersaturated complexes are associated with saturated complexes (*e.g.* Okorusu, Kalkfeld, and Ondurakorume in Namibia (Pirajno, 2009), and Araxá and Catalao I in Brazil (Biondi, 2003)).

A few occurrences are formally described as low sulfidation epithermal alteration-mineralization, in young and well-preserved complexes, such as in the Auas province and the Regenstein complex in Namibia and the Kruidfontein complex in South Africa (Pirajno, 2009). Nonetheless, some of described alteration assemblages that are peripheral to the fenitization (illite, (sericite?), kaolinite, calcite, quartz) could be also thought of as epithermal alteration.

Supergene enrichment usually plays an important role in concentrating the grade of primary magmatic and magmatic-hydrothermal deposits in some of the mineralized complexes. The most important process is lateritic enrichment of carbonatites in tropical weather such as the case of Osamu Otsumi mine in Poço de Caldas, Brazil (Lapido Loureiro and Santos Barrios, 1988). Similarly, other elluvium and some alluvial concentrations are found around eroded granitic cupulas, such as in the case of Spitzkoppe complex in Namibia (Pirajno, 1994).

Other significant resources associated with intrusive complexes are diamantiferous kimberlites. Even though some of the African kimberlites are Cretaceous (120 to 80 Ma Haggerty, 1997) they are not directly linked to the intrusive complexes. Because no evidence of kimberlites was reported for Uruguay, kimberlites will be left out of the discussion.

Mineralization examples from the Damaraland alkaline province

The Damaraland province is comprised of 21 complexes, *ca.* 20 km wide that forms a 350 km northeast trend from the Atlantic coast to the inland (Figure 29). The stratigraphic, temporal, and geochemical and tectonic similarities with the Merín complexes were discussed in Chapter 2. The complexes of Luderitz were probably emplaced closer to the Merín basin (Figure 19, Chapter 2), but since Luderitz is a less well-known province, this review will focus on the Damaraland province.

The Damaraland complexes can be divided into four petrological types: 1) granitic (Brandberg, Erongo, Gross and Klein Spitzkoppe, Otijhorongo), 2) layered-basic (Cape Cross, Messum, Doros and Okenyeya), 3) peralkaline (Paresis and Etaneno) and, 3) carbonatitic (Okorusu, Kalkfeld, Ondurakorume, Osongombo and Kwaggaspan) (Kinnaird and Bowden, 1991).

Granitic complexes

The Brandberg granitic complex contains Zr, U, and rare earth-bearing pyrochlore disseminations (1% Zr, 0.3% Nb₂O₅, 0.2% Y₂O₃) in small ring granitic intrusions inside

the complex (*e.g.* Amis Valley) together with some pegmatitic veins with fluorite, pyrochlore and monazite (Pirajno, 1994).

Be-Sn mineralization is present in quartz-albite veins near Anibib, together with W (0.3% WO₃) in ferberite, scheelite and sulphides in quartz-topaz-sericite-tourmaline altered wall rock (greisen granitoids) within the Krantzberg mine. These disseminations are thought to be produced by replacement during hydrothermal alteration of the wall rock in the apical zone of the Erongo granite. Other anomalies in the complex are low grade uranium mineralization concentrated by weathering in joints of the Erongo granite and, fluorite dissemination in rhyolite tuffs associated with the complex. Also, a few anomalous rock samples from the Erongo granite contained 0.11 g/t, 0.12 and 0.2 g/t gold (Burnett, 1997).

Peralkaline complexes

Peralkaline complexes like Etaneo and Paresis show extensively silicified and altered quartz-sericite-pyrite rocks. According to Pirajno (1990) these could represent eroded areas of extensively hydrothermal alteration zones in the roof of the intrusion before its denudation. Until present, there is no evidence of mineralization but it is possible that the mineralized wall-rock has also been eroded. However, hydrothermally altered basaltic dikes associated with the Paresis Igneous Complex present weakly anomalous Au values of 153 ppb, 160 ppb and 210 ppb (Burnett, 1997).

Complexes with carbonatites

The Okorusu carbonatitic complex contains zones with veins, replacement bodies and, disseminations of F, P and limonitic Fe hosted in potassically altered rocks (6×10^6 tonnes of 56% CaF_2 and 0.5% P_2O_5 , Premoli, 1993). The Osongombe complex represents a magnetite-apatite-barite-monazite-strontiatite-pyrochlore-pyrite carbonatite plug (0.5% Th and up to 7% P_2O_5 , Verwoerd, 1967). The Ondumakorume complex hosts pyrochlore, apatite and strontianite (0.24% Nb_2O_5 , 3% rare earth oxides, 2.5% SrCO_3 , and unreported anomalous U, Th, Von Backstrom 1974). Uraniferous calcrete and gypcretes in paleochannels in the area of this complex contain sub-economic to economic reserves and may be linked to the Damaraland intrusions (Roesener and Schrueder, 1997).

Examples of southern Brazil

Brazil hosts several intrusive complexes that range in age from Mesoproterozoic to Cretaceous (Figure 30). In this chapter we review the mineralization of some of the Cretaceous complexes. Most of the complexes were genetically linked to the Paraná floods and the opening of the southern Atlantic Ocean (*e.g.* Biondi, 2003). However, some of the complexes are younger than the ones in the Merín basin in Uruguay, including the Poço de Caldas-Cabo Frio alignment of complexes (80-50 Ma, Sadowski e Dias Netto, 1981). Possibly, these were emplaced when the Atlantic Ocean rifting and magmatism had migrated north.

Complexes with carbonatites

Brazil has 21 active carbonatite mines associated with alkaline intrusive complexes of ages that range from Mesoproterozoic to Cretaceous. The average reserves of each of these reach 60 M tonnes with 0.58% Nb₂O₃ and 0.35% rare earth oxides (Biondi, 2003).

The most important examples of mineralized Cretaceous carbonatites are the Jacupiranga mine in Sao Paulo (155 to 130 Ma, German *et al.*, 1987) that contains 80 M tonnes of 5.3% P₂O₅ and probable reserves of carbonates for clinker and the Anitápolis mine in Santa Catarina of similar age (Gomez *et al.*, 1990) with similar reserves. This complex also presents 2.2 M tonnes of 1.39% Ni in supergene enrichments over ultrabasic – alkaline rocks (Biondi, 2003). Other Cretaceous complexes with important reserves in carbonatites are younger than the Uruguayan complexes. The Araxá complex in Minas Gerais mine (97 – 77 Ma, Issa Filho *et al.*, 1984; Gomez *et al.*, 1990), for example, has 462 M tonnes of 2.5% Nb₂O₅ and 560 M tonnes of 11.8% P₂O₅ and 80,000 tonnes of 15.5% rare earth oxides.

Complexes with no carbonatites

Poço de Caldas is a 30 km diameter caldera intruded by alkaline rocks (nepheline syenites and phonolites among others) with associated flows, tuffs, breccias of similar compositions erupted through at least five conduits in the complex. U, Zr and Mo mineralization is located in dikes and disseminations in potassically altered and argillized breccias with pyrite disseminations near the extrusive conduits (Mina do Agostinho and Mina Usamu Utsumi, Biondi, 2003). The U is concentrated in disseminated uraninite and

zirconium. Laterites concentrated the dispersed uranium in redox fronts and uranium crystallized as pitchblende nodules. Estimated reserves reach 21,800 tonnes U_3O_8 in the Osamu Utsumi mine, 5,000 tonnes in Campo do Agostinho, 25,000 tonnes MoO_3 in Campo do Agostinho and 172,400 tonnes ZrO_2 in Osamu Utsumi.

The deposit of Morro de Ferro, also in Poço de Caldas hosts Th and rare earths in metric to centimetric (stockwork) magnetite veins with allanite, bastnaesite, thorium-bastnaesite, monazite, coffinite, torogumite, cerianite and fersunte (Lapido-Loureiro and Do Santos, 1988) cutting through argillized and pyritized alkaline intrusive and volcanic rocks. Later lateritization concentrated the grade of the deposit to 3.9% of rare earth oxides (Ce, La, Nd and Pr) and 1.14% of ThO_2 and Nb.

Alcoa, Curimbaba and other small mines in Poço de Caldas contain bauxite over carbonatite rocks with reserves of 50 M tonnes of 46% Al_2O_3 . The Agostinho mine has 5,000 tonnes of U_3O_8 as well as significant Mo mineralization (Biondi, 2003).

The Tanguá-Rio Bonito mine in Rio de Janeiro (estimated in 100-120Ma, Biondi, 2003) in a peralkaline syenitic intrusive complex has metric to centimetric fluorite veins following the concentric contacts of the intrusions with proven reserves of 0.18 M tonnes of 45% CaF_2 .

Fluorite Mineralization in the Santa Catarina district

A total of 36 fluorite veins have been identified within the Santa Catarina district.

3.1 Mtonnes of reserves have been calculated for the area, including 50-80% fluorite (Figure 30, Dardenne *et al.*, 1997)

Veins are located in shears and normal faults cutting both Precambrian greenschist granitoids and the unconformably overlaying Carboniferous - Permian glacial diamictites, siltstones, organic rich claystones of the Itararé group of the Paraná basin (Biondi, 2003) (San Gregorio – Tres Islas Formations in Uruguay). The rocks and fluorite veins are both cut by Cretaceous Serra Geral basaltic dikes (Arapey and Cuaró formations in Uruguay). Based on these cutting relations, Ferreira *et al.*, (1997) estimated the mineralization age between 160 to 135 Ma. The role of the Cretaceous magmatism is debated between the source of the mineralization itself and the source of the fluids that leached the fluorine out of wall-rocks (Biondi, 2003).

Discussion

The Jurassic-Cretaceous intrusive complexes associated with the opening of the southern Atlantic Ocean in Brazil and Namibia contains ore deposits of mainly of U, Th, Nb, Zr, P, F, Mo and rare earths. In some cases, the abundant concentrations and volumes may enable economic exploitation.

The weak Au, Cu and Mo anomalies detected in the subsurface of Lascano-East do not constitute the main known ores in the reviewed mineralized complexes. The weak Au anomalies are between the reported ranges for altered rocks in some complexes such as Erongo or Paresis. However, no economic Au occurrences are reported. Mo mineralization is not very common, but one example of an economic ore is found in the Poço de Caldas complex. Cu anomalies are not reported in any of the mineralized complexes reviewed in this paper. Even though there are no compelling explanations for

this, one possible hypothesis is that this type of mineralization was eroded in the mineralized complexes elsewhere, as discussed below.

The alkaline rocks of the Merín basin are rich in Nb, Zr and some rare earth elements which are common ores elsewhere (up to 161 ppm Nb, 865 ppm Zr, 102 ppm La, 96 ppm Nd, see Appendix 2). No economic grades, however, were intercepted in Lascano-East during OMI drilling-campaigns. U, Th and P are the other most common ores in the reviewed complexes, but no anomalies were detected in this work (up to 11 ppm U, 33 ppm U and 1.1wt% P₂O₅, see Appendix 2). However, these other ores are usually hosted in carbonatites or in the periphery of small alkaline intrusive centers inside the complexes, and their presence in the Merín basin cannot be ruled out as discussed below. F and W are also common ores in the reviewed complexes, and their presence in Merín is also reviewed below.

Magmatic hydrothermal mineralization

The presence of potassic and sodic alteration (fenitization) together with “argillized and pyritized” (sericitic or intermediate argillic alteration?) rocks including disseminations and vein mineralization of diverse metals is a common feature in saturated and under-saturated Jurassic-Cretaceous intrusive complexes of Brazil and Namibia. Hydrothermal alteration and mineralization occurs in the wall-rock roof of small alkaline intrusions of various compositions or around vents inside the complexes. In this sense, it is possible to speculate that the low temperature potassic alteration and intermediate argillic alteration associated with weak Cu, Mo and Au mineralization affecting the roof wall-rocks in Lascano-East complex could be related to magmatic hydrothermal systems

on top of the mildly alkaline to alkaline intrusions. Furthermore, the altered and mineralized rocks were only detected in the central part of the complex where a mildly alkaline basaltic sill (Santa Lucía gabbro) and alkaline dikes and sills (gabbro to trachytes of the Marmarajá series) cut through the sub-alkaline to transitional volcanic wall-rocks. These observations reinforce the idea that this area is located on top or close to a mildly alkaline to alkaline intrusive center.

Nonetheless, as illustrated by the examples in Namibia and Brazil, the hydrothermal alteration assemblages, mineralization styles and main ore minerals vary widely inside the same intrusive complexes over small lateral distances depending on the intrusive lithology, wall-rock composition and structural setting (*e.g.* pipes, dikes, ring-dikes). It is important to point out that the lithologies, hydrothermal alteration and weak mineralization found in the Lascano-East complex are not necessarily representative of the diversity that might be concealed in the rest of the complex or in the other complexes of the basin. The lack of outcrops in most of the complexes and only sparse drillholes over the buried Lascano-East complex may suggest that other alteration-mineralization assemblages might be concealed in the basin. Other intrusive or vent features inside or in the periphery of the complex might be potential exploration targets for Au, Mo and Cu, but also for more traditional mineralization in intrusive complexes such as Nb, U, Th, F, P, Sn, W, and rare earths.

Fluorite veins

Fluorite-quartz-manganese veins and quartz veins enriched in Y, W and Ba (up to 0.5%, 100 and 4434 ppm respectively) are described close to the Valle Chico complex in

the south of the Merin basin. Even though these elements are not reported as ores in the Santa Catarina fluorite veins, they are common commodities in intrusive complexes of Namibia and Brazil. Millimetric fluorite veins were also found in the central drilling area of Lascano-East (see Chapter 3) cutting through subalkaline rhyolites and granodiorite granophyres. Their presence may indicate a potential for bigger concealed fluorite veins systems like the ones in Santa Catarina district in Brazil to exist throughout the basin and its basement.

Carbonatite potential

As discussed in Chapter 2, it is expected that there is a larger lithological diversity in the non-outcropping and un-explored complexes of the Merín basin. On the one hand the Valle Chico complex is mostly composed by syenites with no alkaline gabbros identify there, on the other hand, mildly alkaline to alkaline gabbros and basalts are fairly common in the Lascano-East complex but no syenites were identified until present. Similarly, a wider lithological diversity is observed in the better exposed complexes of Brazil and Namibia, where more undersaturated rocks are present, including carbonatites.

In this sense, even though no direct geological evidence of carbonatites was found until present, the possibility of concealed carbonatites remains possible, especially since their reduced size relative to the complex complicates the chances to detect them under sediment and soil coverage. Furthermore, the “bulls eye” shaped magnetic low core surrounded by two “half moon” magnetic highs of the San Miguel anomaly (Figure 3, Chapter 2), could be indicative of a carbonatite core surrounded by mafic alkaline rocks. This is a typical cutting relationship in alkaline complexes with carbonatites around the

world such as the Thor Lake, Canada (Trueman in Heffernan, 2009; Castor and Hedrick, 2006) that produce similar patterns in geophysical surveys.

Erosion levels, implications for mineralization

As noted by Pirajno (1994, 2009), in most of the Damaraland complexes the roof of the intrusions were eroded along with most of the hydrothermally altered wall-rocks and any existent mineralization. This is not discussed in the literature for the complexes in Brazil, but based on the geological descriptions, at least most of the Jurassic-Cretaceous complexes in Brazil do not seem to be eroded as much as in Namibia, since at least part of their roof and wall-rock are preserved (Biondi, 2003). This is a possible explanation of why there are more economic deposits in similar age complexes in Brazil than in Namibia.

As discussed in Chapter 2 the erosion levels in the Merín basin might be shallower than in Namibia, with the possible exception of the Valle Chico complex in the southwest end of the basin where erosion levels are higher. There is a degree of preservation of the intruded roof rocks in the Merín basin than in the Damaraland, which could potentially host most of the mineralized rocks. A scenario more similar to Brazil could be envisioned in this matter. In this regard, the lack of outcropping mineralization and alteration in the Valle Chico complex, the only outcropping complex of the basin, could be a consequence of the erosion of the upper part of the complex and roof wall-rocks.

If carbonatites are found concealed in the Merín basin, the erosion level of the basin could also play the opposite role in respect to the ability to reach possible ore

deposits. Based on the Brazilian carbonatites of different ages, it is common that the first carbonatitic intrusions reach the surface or shallow crustal levels, but these are mostly mineralized with phosphates and minor mineralizations associated to magnetite veins. The later intrusions are first enriched in Nb and subsequently in rare earths (mostly in ferro-carbonatites), but these are usually restricted to deeper intrusive levels (Biondi, 2003). Probably the best well known ore deposit of this type is Mountain Pass in California, USA.

Laterite potential

Tropical climate in Brazil and pronounced topography (*e.g.* a 1600 m depression of the central part of the complex in Poço de Caldas, Lapido-Loureiro and Do Santos, 1988) allowed the formation of laterites that are greater than 800 m thick. Even if tropical climate could have reigned over the Merín basin in the time between the intrusion of the complexes and the present, there is no evidence of significant paleorelief in the complexes. Furthermore, no laterites were drilled until present, restricting the chances of lateritic enrichments of hypogene mineralizations in the Merín basin, which usually play an important role in the economic mineralizations of Brazil.

Conclusions

Despite that no important mineralization and alteration is evident in the outcropping Valle Chico complex, the intrusive complexes of the Merín basin have potential of hosting economic ore deposits. The potential is based on the weak mineralization and hydrothermal alteration found in Lascano-East, fluorite veins cutting

the Precambrian wall-rocks in the basin edge, and the comparison with similar age, Paraná –Etendeka province mineralized complexes in Namibia and Brazil. In this way, the potential mineralization can be divided in, but not restricted to, three main zones: 1) Au $\pm$ Tl, Cu and Mo in the wall-rock roof of Lascano-East alkaline intrusions 2) Fl, Tu, B and Y in fluorite veins in the basin edge 3) Nb, Zr, P, U, Th and rare earths in possible concealed carbonatites or other alkaline rocks.

Based on the identification of K-alteration and intermediate argillic alteration in the Lascano-East complex with weakly anomalous Au, Tl, Cu and Mo, it is possible to think of ore deposits of these commodities associated to the mildly alkaline to alkaline emplacement of dikes and sills, possibly on top of bigger concealed intrusions. However, based on the reported magmatic-hydrothermally formed ore deposits in Namibia and Brazil, other commodities such as Nb, Zr, P, U, Th, and rare earths might be associated with similar alteration zones in other intrusive centers in Lascano-East or in other complexes of the basin. The diversity of the mineralization will be affected by the emplacement type (e.g. dikes, sills, pipes, ring-dikes), nature of the intrusive lithologies (e.g. saturated, oversaturated, degree of alkalinity) and the lithologies and structure of the wall rock (e.g. permeability, faults, brecciation). Evidence that has been presented in this chapter and Chapter 2, suggest that there may exist a wider lithological diversity in the Merín than what is currently known, and with this the chances of diverse types of mineralization.

Similarly, the presence of carbonatites could be expected intruding restricted areas inside some of the complexes. Some geophysical features, as the central part of the San

Luis anomaly could be interpreted as a carbonatite, however no direct geological evidence was found to support this speculation. F, B, Y and W mineralization in fluorite veins similar to the Santa Catarina province in Brazil seems possible in Lascano-East or cutting the Precambrian basement at the basin edge. However, the mineralization zones do not have to be restricted to these two areas.

The erosion levels of the Merín basin are shallower than over most of the mineralized complexes in Namibia. The basin is likely more similar to Brazil in this sense, maybe with the exception of the Valle Chico complex. This could play two different roles in respect to ore deposits. On the one hand it might have enabled the preservation of the hydrothermally altered roof wall rocks that could host dissemination and vein mineralization. On the other hand, if carbonatites are indeed concealed in the basin, the shallowly emplaced types are usually only economically enriched in P and F. Therefore, the shallow erosion could prevent reach of the deeper ferro-carbonatites, usually economically mineralized in Nb and rare earths. Similarly, this phenomenon could explain the lack of mineralization and alteration in Valle Chico because of its erosion.

Weather and relief conditions to form laterites were probably not present over the complexes of the Merín basin. Therefore, it is not likely to expect this type of supergene enrichment of high economic importance in the Brazilian complexes.

Figures

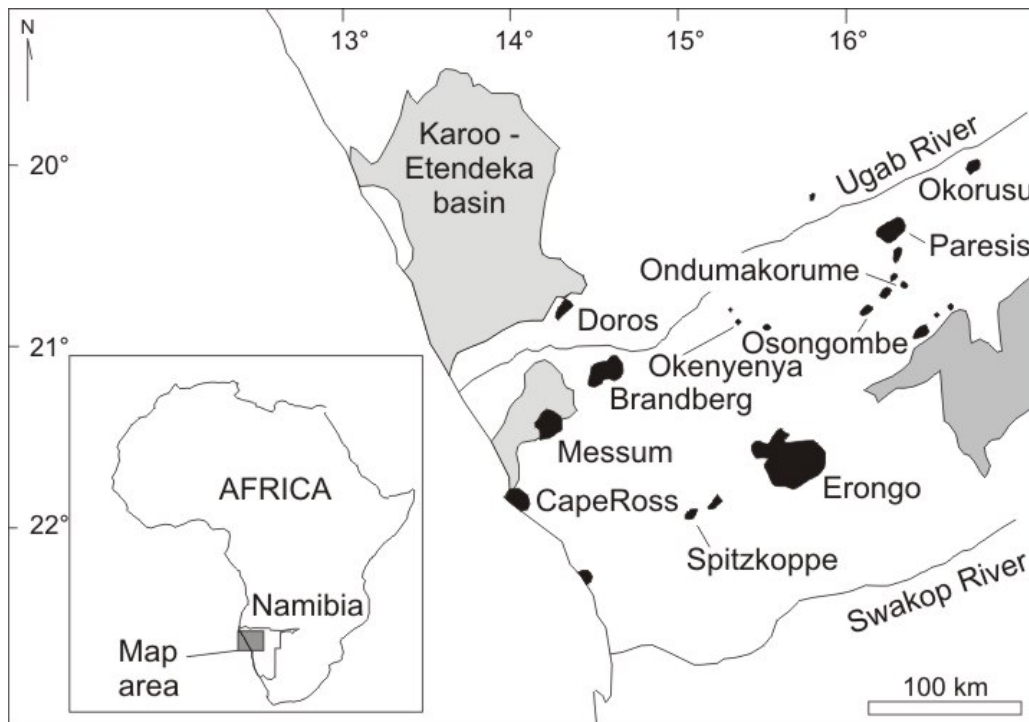


Figure 29 – Alkaline complexes of the Damaraland alkaline province, Namibia. Simplified from Pirajno (1994) and Pirajno (2009).

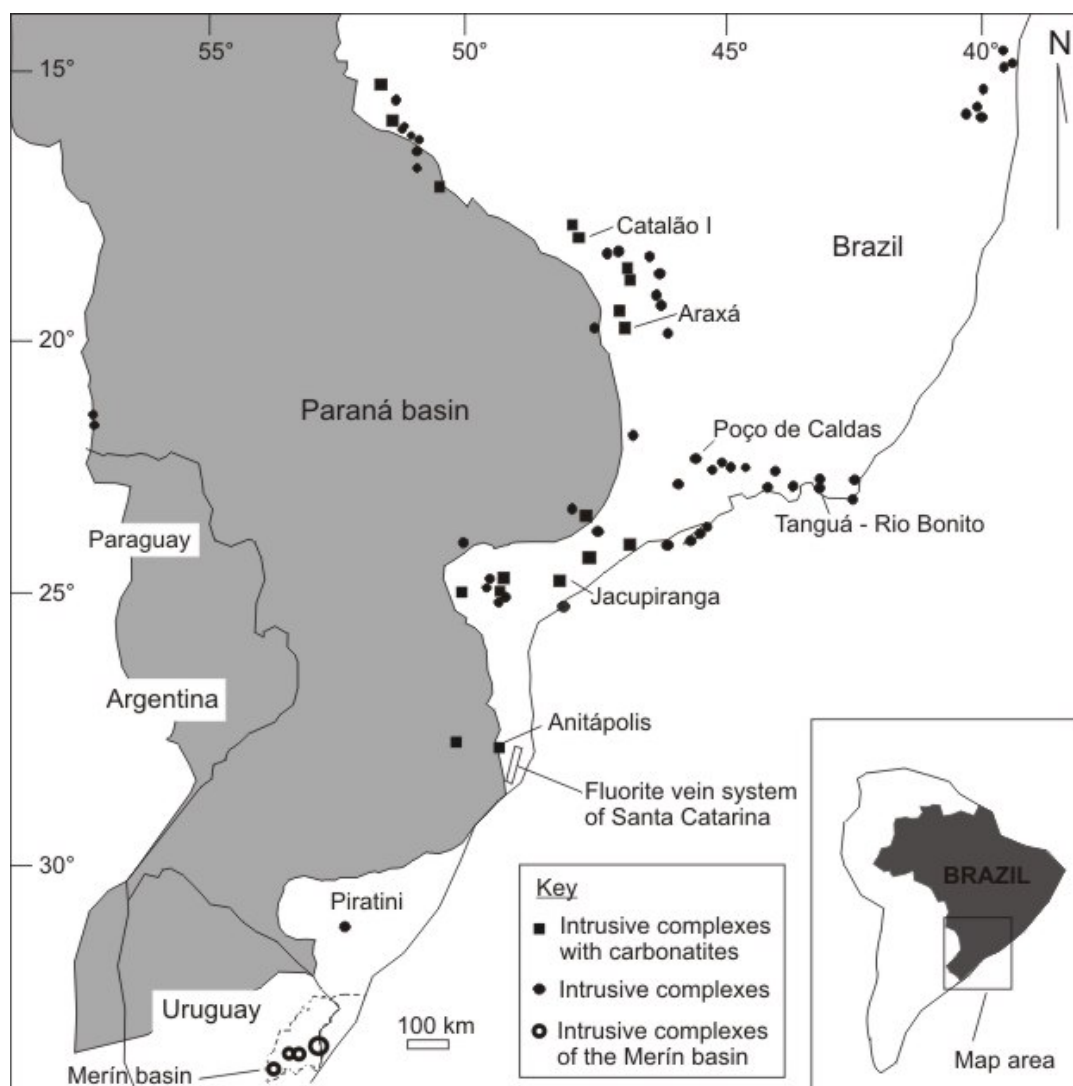


Figure 30 – Alkaline complexes of Brazil modified from Gomez *et al.*, (1990) and Biondi (2003). Showing relation with Paraná basin, Merín basin and its inferred complexes, and location of the fluorite vein system of Santa Catarina, Brazil.

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Chapter 5: Conclusions

The stratigraphy, age relations, intrusive geometries and airborne magnetic and gravity response of the volcanic and intrusive rocks encountered in the subsurface of Lascano-East are best explained as a concealed sub-alkaline to alkaline ~133 to 127 Ma intrusive complex. This is the second intrusive complex recognized in the Merín basin after the outcropping syenites of the Valle Chico complex. Based on the similarity of the intensity and geometries of the geophysical anomalies and their alignment with the basin axis, we hypothesize that the Lascano-West and San Luis anomalies are caused by similar concealed intrusive complexes, raising the total to four intrusive complexes identified within the Merín basin.

Ten lithogeochemical units were identified and grouped into three associations according to their chemistry. A sub-alkaline group, comprised of Treinta y Tres A basalts, Treinta y Tres B basalts and gabbros, Lavalleja rhyolite ignimbrites and San Miguel granodiorite granophyres; a mildly alkaline group including the Santa Lucía basalts and gabbros, Aiguá rhyolites, Valle Chico syenites and India Muerta rhyolites and an alkaline group comprised of the Lascano alkaline gabbro to trachyte series and the Arrayán olivine basalts. The only sedimentary rocks identified in the basin are conglomerates composed exclusively of sub-alkaline to mildly alkaline basalt and rhyolite clasts that were grouped as the Quebracho Formation.

The sub-alkaline to mildly alkaline basaltic lavas (Treinta y Tres A, B and Santa Lucía) associated with Paraná magmatism extruded first, mostly between ~133 to 131 Ma

throughout the entire basin. Based on cross cutting relations the dikes and sills of similar chemistry to the lavas (Treinta y Tres B gabbros, San Miguel granodiorite granophyres and maybe some of the Santa Lucía gabbros), are inferred to have been broadly emplaced during the same period.

The associated voluminous sub-alkaline Lavallega ignimbritic rhyolite extrusions followed between ~130 to 128 Ma, likely causing caldera collapse in at least Lascano-East and West regions. The felsic volcanism at Valle Chico was slightly younger and was possibly dominated by the less explosive Aiguá rhyolites (~128 to 127 Ma). At least some of the sub-alkaline basaltic magmatism was still active, or reactivated during and after this period as the Treinta y Tres A and B lavas and Santa Lucía lavas and intrusives. The extrusive centers that were formed by the rhyolitic eruptions were then intruded by mildly alkaline and alkaline mafic to felsic rocks between ~128 to 127 Ma. Whereas Valle Chico was dominated by the intrusion of syenites, Lascano-East was dominated by gabbros and trachytes. The alkaline dikes and sills are inferred to be part of a dike and sill complex on top of deeper mafic alkaline intrusions responsible for the gravity anomalies. The density contrast measured for the gabbro dikes and sills in this work show a 0.4 g/cc contrast with the rest of the rocks which is coincident with the estimated contrast necessary to satisfy previous geophysical models and suggests that these are responsible of the gravity anomalies.

The only hydrothermally altered and mineralized rocks in Lascano-East were identified in the central zone of the complex where the sub-alkaline and mildly alkaline lavas are intruded by the previously described alkaline dikes and sills on top of the

inferred mafic alkaline intrusions. Accordingly, the altered zones could be related to a hydrothermal magmatic system associated with dikes and sills emanating from a mildly to alkaline intrusive cupola related to the Santa Lucía and Lascano rocks. The presence of fluorite and fluorite-quartz veins in the altered Lavalleja rhyolites is consistent with an alkaline source for the hydrothermal fluids. However, the temporal relation of these veins with the alteration is not yet understood.

These magmatic events were followed by the extrusion of the younger and less voluminous Arrayán olivine basalts that were emplaced synchronous to the deposition of the Quebracho conglomerates, and are inferred to be younger than ~127 Ma.

Based on trace element modeling we propose that a shallow mantle source produced normal middle ocean ridge basalt that with abundant crustal assimilation in turn produced the sub-alkaline magmatic rocks, while the mildly alkaline and alkaline rocks were produced by mixing of this source with a deeper mantle source (ocean island basalt – like), or by progressively deepening of the mantle melting source and lessening degrees of partial melt.

The identified mineralization and alteration in the subsurface of Lascano-East complex can be divided in two associations. First, potassic hydrothermally altered zones and younger superimposed intermediate argillic alteration (illite, smectites and possibly phengitic muscovite) in sub-alkaline to mildly alkaline felsic rocks cut by similarly altered Lascano alkaline series dikes. Pyrite disseminations together with pyrite, quartz-pyrite and fluorite veins in these rocks are associated with weak gold, bismuth, thallium and molybdenum anomalies. Second, local potassic alteration of mildly alkaline basalts

cut by the Lascano alkaline dikes, show sparse millimetric to one centimeter quartz-pyrite and phyllosilicate-pyrite veins and are associated with weak molybdenum anomalies. Local quartz-chalcopyrite-pyrite veins and copper anomalies were detected in the contact of the basalts with one Santa Lucía mildly alkaline gabbro.

No evidence of mineralization is found in the Valle Chico complex, the only outcropping complex of the Merín basin. The only other evidence of mineralization in the basin are fluorite veins enriched in tungsten, boron and yttrium cutting the Precambrian basement near the basin edge. However, since large areas of the Merín basin are covered under Cenozoic sediments as well as modern soil, grasslands, swamp areas and lagoons that may be burying possible mineralized areas, the mineralization potential of the basin may be better assessed by the comparison with other intrusive complexes elsewhere.

Geochronological and paleotectonic reconstructions indicate that the magmatism in the Merín basin was broadly contemporaneous and close in space to the magmatism in the Luderitz basin in Namibia, and with the Damaraland basin about 200 km to the north and further away complexes in Brazil. The similarity of the stratigraphy and geochemistry of the Merín complexes with the Namibian complexes, might indicate that they were linked to similar melt sources, evolutionary paths, and emplacement mechanisms associated to the Paraná – Etendeka provinces and the opening of the southern Atlantic ocean.

Based on the known mineralization for the complexes in Namibia and Brazil, together with the observed mineralization in Lascano-East and fluorite veins in the Merín basin edge, the mineralization potential of the basin can be divided into, but not restricted

to, three main zones: 1) Au $\pm$ Tl, Cu and Mo in the wall-rock roof of Lascano-East alkaline intrusions 2) Fl, W, B and Y in fluorite veins in the basin edge 3) Nb, Zr, P, U, Th and rare earths in possible concealed carbonatites or other alkaline rocks.

Based on the lithological diversity of the Namibian and Brazilian complexes, a wider lithological diversity in the Merín than what is currently known can be expected. The presence of carbonatites intruding restricted areas inside some of the complexes is a reasonable speculation. Furthermore some geophysical features, such as the central part of the San Luis anomaly, could be interpreted as a carbonatite, however no direct geological evidence was found to support this speculation.

Similarly, these lithological variations in the better exposed complexes in Namibia and Brazil, could explain the dominance of mildly alkaline syenites in Valle Chico versus alkaline gabbros to trachytes in the Lascano-East, and suggest that both the Lascano-West and San Miguel concealed complexes could be composed of different rock types.

The erosion levels of the Merín basin are shallower than most of the mineralized complexes in Namibia. The complexes in Merín are likely more similar to those in Brazil in this sense, and a possible explanation is the generalized uplift of the African plate after Gondwana breakup. The Valle Chico complex might be the exception and is probably related to differential subsidence of the basin due to the interplay of subsidence caused by mafic intrusion emplacement and different crustal thickness at each side of the Sierra Ballena shear zone.

The level of erosion could play two different roles in respect to ore deposits. On the one hand it might have enabled the preservation of the hydrothermally altered roof wall rocks that could host dissemination and vein mineralization. On the other hand, if carbonatites are indeed concealed in the basin, the shallowly emplaced types are usually only economically enriched in P and F. Therefore, the shallow erosion could prevent reach of the deeper ferro-carbonatites, usually economically mineralized in Nb and rare earths. Similarly, this phenomenon could explain the lack of mineralization and alteration in Valle Chico because of its deeper erosion.

Weather and relief conditions that form laterites were probably not present in the complexes of the Merín basin. Therefore, it is not likely to expect this type of supergene enrichment of economic importance in the Brazilian complexes.

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APPENDICES

Appendix 1- Drillhole collars location

Table A1 – Drillhole collar locations in Lascano-East complex

HoleID	Easting	Northing	Elev	Dip	Depth
LMD1	660941	6284347	34	-90	450.85
LASDDH1	664548	6283949	30	-90	927.55
LASDDH2	659000	6272805	33	-90	690.7
LASDDH3	652402	6278004	34	-90	837.65
LASDDH4	665061	6286714	31	-90	826.3
LASDDH5	669776	6279007	29	-90	1040.5
LASDDH6	659261	6272733	30	-90	678.5
LASDDH7	658302	6272599	30	-90	547.7
LASDDH8	659300	6272202	30	-90	805.35
LASDDH9	659497	6273214	30	-90	966.55

Coordinates in Gauss Krugger, Datum Yacare

Appendix 2 – Whole rock analysis

Table A2 – Detection limits of whole rock analysis

	Group 4A Detection Limit ICP-OES	Group 4B Detection Limit ICP-MS	Upper Limit
SiO₂	0.01%	–	100%
Al₂O₃	0.01%	–	100%
Fe₂O₃	0.04%	–	100%
CaO	0.01%	–	100%
MgO	0.01%	–	100%
Na₂O	0.01%	–	100%
K₂O	0.01%	–	100%
MnO	0.01%	–	100%
TiO₂	0.01%	–	100%
P₂O₅	0.01%	–	100%
Cr₂O₃	0.002%	–	100%
LOI	0.10%	–	100%
C	0.02%	–	100%
S	0.02%	–	100%
Au	–	0.5 ppb	100 ppm
Ag	–	0.1 ppm	100 ppm
As	–	1 ppm	10000 ppm
Ba	–	1 ppm	50000 ppm
Be	–	1 ppm	10000 ppm
Bi	–	0.1 ppm	2000 ppm
Cd	–	0.1 ppm	2000 ppm
Co	–	0.2 ppm	10000 ppm
Cs	–	0.1 ppm	10000 ppm
Cu	–	0.1 ppm	10000 ppm
Ga	–	0.5 ppm	10000 ppm

Table A2 – Continued

	Group 4A Detection Limit ICP-OES	Group 4B Detection Limit ICP-MS	Upper Limit
Hf	–	0.1 ppm	10000 ppm
Hg	–	0.1 ppm	100 ppm
Mo	–	0.1 ppm	2000 ppm
Nb	–	0.1 ppm	50000 ppm
Ni	–	0.1 ppm	10000 ppm
Pb	–	0.1 ppm	10000 ppm
Rb	–	0.1 ppm	10000 ppm
Sb	–	0.1 ppm	2000 ppm
Sc	1 ppm	–	10000 ppm
Se	–	0.5 ppm	100 ppm
Sn	–	1 ppm	10000 ppm
Sr	–	0.5 ppm	50000 ppm
Ta	–	0.1 ppm	50000 ppm
Th	–	0.2 ppm	10000 ppm
Tl	–	0.1 ppm	1000 ppm
U	–	0.1 ppm	10000 ppm
V	–	8 ppm	10000 ppm
W	–	0.5 ppm	10000 ppm
Y	–	0.1 ppm	50000 ppm
Zn	–	1 ppm	10000 ppm
Zr	–	0.1 ppm	50000 ppm
La	–	0.1 ppm	50000 ppm
Ce	–	0.1 ppm	50000 ppm
Pr	–	0.02 ppm	10000 ppm
Nd	–	0.3 ppm	10000 ppm

Table A2 – Continued

	Group 4A	Group 4B	
	Detection Limit	Detection Limit	Upper Limit
	ICP-OES	ICP-MS	
Hf	–	0.1 ppm	10000 ppm
Hg	–	0.1 ppm	100 ppm
Mo	–	0.1 ppm	2000 ppm
Nb	–	0.1 ppm	50000 ppm
Ni	–	0.1 ppm	10000 ppm
Pb	–	0.1 ppm	10000 ppm
Rb	–	0.1 ppm	10000 ppm
Sb	–	0.1 ppm	2000 ppm
Sc	1 ppm	–	10000 ppm
Se	–	0.5 ppm	100 ppm
Sn	–	1 ppm	10000 ppm
Sr	–	0.5 ppm	50000 ppm
Ta	–	0.1 ppm	50000 ppm
Th	–	0.2 ppm	10000 ppm
Tl	–	0.1 ppm	1000 ppm
U	–	0.1 ppm	10000 ppm
V	–	8 ppm	10000 ppm
W	–	0.5 ppm	10000 ppm
Y	–	0.1 ppm	50000 ppm
Zn	–	1 ppm	10000 ppm
Zr	–	0.1 ppm	50000 ppm
La	–	0.1 ppm	50000 ppm
Ce	–	0.1 ppm	50000 ppm
Pr	–	0.02 ppm	10000 ppm
Nd	–	0.3 ppm	10000 ppm

Table A3 – Whole rock analysis originals and duplicates

Sample Number	Sample Type	BatchNumber	SiO2 wt%	Al2O3 wt%	Fe2O3 3 wt%	MgO w%	CaO w%	Na2O w%	K2O w%	TiO2 w%	P2O5 w%	MnO w%	Cr2O3 w%	Ni ppm	Sc ppm	LOI wt%	Ba ppm	Be ppm	Co ppm	Cs ppm
71372	Orig	SAN0800254	44.42	13.6	9.88	5.17	9.34	1.62	1.15	1.15	0.13	0.15	0.018	42	31	13	451	-1	36.4	0.7
71373	Dup	SAN0800254	44.56	13.93	9.84	5.09	9.27	1.63	1.09	1.21	0.17	0.15	0.017	42	31	12.6	437	-1	38.5	0.8
71392	Orig	SAN0800254	62.03	13.7	3.99	0.94	4.73	3.09	4.2	0.43	0.07	0.08	0.006	-20	8	6.5	1158	3	3.4	0.5
71393	Dup	SAN0800254	64.78	14.08	4.07	0.98	2.89	3.22	4.42	0.45	0.07	0.08	0.005	-20	8	4.7	989	2	3.7	0.3
71432	Orig	SAN0800254	54.19	12.7	9.47	3.25	6.13	2.14	3.02	1.4	0.27	0.15	0.027	-20	27	7	466	2	26	0.6
71433	Dup	SAN0800254	51.06	12.86	9.61	3.66	7.51	2.13	2.53	1.42	0.26	0.16	0.022	-20	28	8.5	394	2	27.6	0.8
71452	Orig	SAN0800254	68.1	12.34	7.77	0.77	1.19	0.66	4.42	0.56	0.16	0.04	0.025	-20	12	3.7	1280	3	5.4	4
71453-rep	Dup	SAN0800254	65.78	13.15	8.4	0.89	1.49	0.6	4.46	0.61	0.16	0.04	0.015	-20	13	4.1	1005	3	5.9	4.7
71453-rep	Dup	SAN0800254	65.78	13.15	8.4	0.89	1.49	0.6	4.46	0.61	0.16	0.04	0.015	-20	13	4.1	1005	3	5.9	4.7
71499	Orig	SAN0800259	75.61	13.22	2.81	0.02	0.26	0.04	0.07	0.86	0.19	-0.01	0.019	-20	4	6.9	154	-1	1.3	-0.1
71500	Dup	SAN0800259	75.34	13.14	2.67	0.02	0.24	0.05	0.05	0.98	0.17	-0.01	0.022	-20	4	7.2	111	-1	1.3	-0.1
71519	Orig	SAN0800259	59.8	16.03	7.17	0.47	2.32	5.78	5.34	0.46	0.05	0.17	0.005	-20	3	2.2	486	3	0.7	-0.1
71520	Dup	SAN0800259	59.88	16.03	7.06	0.49	2.23	5.77	5.3	0.46	0.05	0.17	0.003	-20	3	2.3	495	3	0.5	-0.1
71559	Orig	SAN0800259	66.24	13.9	4.79	1.08	2.12	2.56	5.38	0.82	0.17	0.06	0.016	-20	11	2.6	814	3	8.6	2.5
71560	Dup	SAN0800259	66.62	13.81	4.79	1.04	2.26	2.53	5.39	0.84	0.17	0.06	0.007	-20	11	2.2	762	3	8.7	2.5
71579	Orig	SAN0800259	60.48	15.61	6.9	0.43	2.59	5.18	4.17	0.43	0.06	0.18	-0.002	-20	3	3.8	377	4	0.7	0.4
71580	Dup	SAN0800259	60.26	15.81	6.97	0.4	2.43	5.42	4.18	0.43	0.04	0.18	-0.002	-20	3	3.7	366	5	0.5	0.3
71619	Orig	SAN0800259	54.42	15.7	10.72	1.44	4.35	5.24	3.14	1.35	0.46	0.26	0.006	-20	14	2.6	766	2	8.3	0.4
71620	Dup	SAN0800259	53.75	16.07	10.79	1.46	4.34	5.3	3.25	1.36	0.47	0.27	0.003	-20	14	2.7	768	3	8	0.5
71639	Orig	SAN0800259	66.45	13.44	4.83	0.87	1.82	3.42	4.94	0.78	0.17	0.05	0.071	-20	10	2.9	678	1	8.7	2.7
71640	Dup	SAN0800259	67.09	13.39	4.66	0.87	1.86	3.36	5.06	0.75	0.16	0.05	0.047	-20	9	2.5	703	2	7.9	3
71679	Orig	SAN0800259	65.88	13.36	4.77	0.81	2	3.41	5.46	0.75	0.15	0.06	0.043	-20	9	3.1	764	2	8.9	3.3
71680	Dup	SAN0800259	66.26	13.52	4.74	0.83	2.07	3.52	5.42	0.76	0.15	0.06	0.039	-20	9	2.4	764	2	9.5	3.1
71820	Orig	SAN0800303	46.5	14.8	12.48	1.71	4.73	3.34	2.05	2.64	0.57	0.21	0.006	-20	24	10.6	1074	3	19.5	5.4
71840	Orig	SAN0800303	62.89	13.06	4.46	0.92	3.26	2.24	5.78	0.74	0.14	0.07	0.028	-20	9	6.2	771	-1	7.7	2.8
71909	Orig	SAN0800292	47.6	15.11	11.54	6.6	8.05	2.75	1.06	1.31	0.16	0.16	0.027	65	33	5.4	312	-1	46.7	1.7
71910	Dup	SAN0800292	47.03	15.16	11.47	6.71	8.01	2.74	1.05	1.3	0.16	0.16	0.023	60	33	5.9	307	-1	47.2	1.9
71919	Orig	SAN0800292	44.69	14.81	12.37	3.95	7.52	4.9	1.55	2.64	0.7	0.23	0.005	-20	23	6.4	506	1	29.5	3.5
71920	Dup	SAN0800292	44.82	14.73	12.68	4.11	7.41	4.73	1.45	2.66	0.67	0.29	0.008	-20	23	6.2	491	1	30.8	3.2
73082	Orig	A723968	46.77	12.43	16.13	4.27	7.58	3.44	1.39	2.81	0.379	0.22	0.012	22	45	4.4	331	-1	41.5	0.1

Table A3 – Continued

Sample Number	Sample Type	Ga ppm	Hf ppm	Nb ppm	Rb ppm	Sn ppm	Sr ppm	Ta ppm	Th ppm	U ppm	V ppm	W ppm	Zr ppm	Y ppm	La ppm	Ce ppm	Pr ppm	Nd ppm	Sm ppm	Eu ppm	Gd ppm	Tb ppm
71372	Orig	15.8	3	6.1	37.4	1	1010	0.3	2.2	0.3	228	0.6	106.2	22.8	12.4	26.9	3.62	15.9	3.77	1.2	4.26	0.7
71373	Dup	15.7	3.2	5.6	35.6	-1	946.9	0.3	2.2	0.3	242	-0.5	110.7	23.3	12.2	27.4	3.74	16	3.79	1.2	4.27	0.73
71392	Orig	21	17	71.9	107	4	63.7	4	13	2.7	17	1	633.4	85.6	55.2	111	13.78	52.9	11	2	11.6	2.22
71393	Dup	21.7	17.8	74	113	4	62.1	4.2	13.9	2.8	20	1.1	623.1	87.5	56.8	111	13.46	53.8	11.1	1.9	11.6	2.22
71432	Orig	20	6	29.7	117	3	116.7	1.7	11.6	1.5	189	0.9	217.9	65.2	46.3	102	12.88	53.6	11.3	1.9	11.69	2
71433	Dup	21.2	6.4	34.3	95.9	3	188.5	2.1	10.4	1.6	201	1.1	233.1	64.7	40.6	87.6	11.29	45.6	10.3	1.8	10.9	1.9
71452	Orig	20.9	12.8	28.2	185	4	64.8	1.8	24.8	2	39	-0.5	460.6	71.3	75.7	155	19.08	73.8	14	2.4	12.77	2.16
71453-rep	Dup	22.5	13.1	27.6	179	3	50.9	1.8	24.1	1.9	42	1.1	466.8	60.6	71.7	142	16.86	65.6	12	2.1	10.79	1.88
71453-rep	Dup	22.5	13.1	27.6	179	3	50.9	1.8	24.1	1.9	42	1.1	466.8	60.6	71.7	142	16.86	65.6	12	2.1	10.79	1.88
71499	Orig	15.8	9.5	36.1	2.9	5	39.7	2.6	14.4	0.7	42	2.8	359.8	24.1	31.6	65.4	7.99	33.1	6.65	1	5.93	0.9
71500	Dup	15.7	9.7	36	2.4	5	39.2	2.5	13.6	0.7	42	5.1	355	23.9	31.9	65.2	8.07	34	6.58	1	6.23	0.93
71519	Orig	29.9	16	150	120	4	21.7	8.1	10	2.8	-8	0.9	617.4	85.2	60.5	120	14.33	59.9	11.9	2.3	12.24	2.4
71520	Dup	30	15.1	154	119	4	22	7.8	9.2	2.8	-8	0.9	620.1	85.4	60.5	120	14.46	59.1	11.7	2.3	12.3	2.39
71559	Orig	16.6	13.4	40	230	9	101.3	2.4	25.5	3.5	55	1.6	530.5	48.4	50.7	105	12.33	46.2	8.47	1.2	8.01	1.39
71560	Dup	15.9	14.2	40.2	231	10	97.3	2.5	23.7	3.6	54	1.4	511.3	46.6	49.2	103	11.97	42.2	8.3	1.1	7.9	1.34
71579	Orig	30.6	15.5	146	106	5	61.9	8.3	10.1	2.7	-8	0.7	636.4	86.5	60.5	117	14.14	56.5	12.2	2.3	12.59	2.4
71580	Dup	29.9	14.7	146	104	5	62.2	8.3	9.8	2.4	-8	0.8	634.2	86.4	61.2	117	14.26	55.6	12.4	2.3	13.06	2.42
71619	Orig	25.1	11.6	109	96.9	3	175.6	5.9	6.1	1.9	-8	1.7	462.7	68.6	47.3	92	11.88	49.3	11.2	3.6	11.73	2.2
71620	Dup	24.7	10.8	109	97.5	3	183.1	5.8	7.7	1.9	-8	1.3	460.1	69.1	46.5	92.4	12.01	48.1	11.3	3.6	11.83	2.22
71639	Orig	15.4	13.1	40.4	204	5	80.1	2.5	21.8	3.5	41	1.1	497.7	41.9	44.1	95.9	10.82	42.6	7.57	1	7.3	1.23
71640	Dup	15.1	13.3	38.4	212	4	79.4	2.5	20.5	3.5	39	0.9	491.3	39.6	43.1	94	10.64	39.9	7.34	1	7	1.17
71679	Orig	16.5	14.7	43.5	249	5	79.2	2.8	25.8	3	50	1.4	605.2	46.2	48.6	103	11.86	44.6	8.09	1.1	8.08	1.35
71680	Dup	16.2	14.3	42.6	243	5	77	3	26.8	3.3	51	1.3	594.9	45.7	48.1	103	11.78	43.2	7.95	1.1	7.83	1.33
71820	Orig	33.2	8	54.9	65.1	3	364.6	3.2	4.9	0.9	277	1.3	344.7	47.6	38.4	80.4	10.33	43.3	9.39	2.7	9.47	1.53
71840	Orig	15.7	14.3	42.9	240	4	81.7	2.9	22.9	2.8	40	1.2	565.2	41.9	44.8	91.4	10.62	38.7	7.23	1	6.71	1.18
71909	Orig	19.8	3.7	9.4	39.7	-1	264	0.5	3.5	0.3	255	0.6	136.5	29.2	15.1	34.3	4.43	19.7	4.43	1.4	4.78	0.88
71910	Dup	19.6	3.9	9.9	41.4	1	279.7	0.5	3.3	0.4	259	0.7	138.5	30.2	15.4	33.9	4.49	18.6	4.41	1.4	4.93	0.86
71919	Orig	20.1	4.8	45.8	41.2	2	272.6	2.7	3	0.8	242	0.7	187.9	40.3	28.1	57.1	7.4	30.7	7.18	2.6	7.57	1.26
71920	Dup	20.1	4.6	43	38.6	1	285.5	2.6	2.7	0.8	272	1	183.8	38.8	26.8	54.4	7.12	29.8	7.01	2.5	7.63	1.26
73082	Orig	19.4	6.6	33.5	28.5	1	203.1	2.1	4.4	0.8	442	1.1	235.1	55.4	22.7	50.8	7.19	30	7.49	2.3	9.01	1.57

Table A3 – Continued

Sample Number	Sample Type	Dy ppm	Ho ppm	Er ppm	Tm ppm	Yb ppm	Lu ppm	TOT/C wt%	TOT/S wt%	Mo ppm	Cu ppm	Pb ppm	Zn ppm	As ppm	Cd ppm	Sb ppm	Bi ppm	Ag ppm	Au ppb	Hg ppm	Tl ppm	Se ppm	
71372	Orig	4.09	0.93	2.57	0.39	2.45	0.38	1.03	0.06	0.1	111.7	3.8	62	0.7	0.1	-0.1	-0.1	-0.1	-0.1	0.8	-0.01	-0.1	-0.5
71373	Dup	4.2	0.94	2.67	0.42	2.5	0.38	1.02	0.07	-0.1	113.7	3.7	64	0.6	-0.1	-0.1	-0.1	-0.1	-0.1	0.8	-0.01	-0.1	-0.5
71392	Orig	13.99	2.92	9.26	1.46	9.53	1.5	0.64	0.38	1	12.9	9.2	82	-0.5	0.2	-0.1	-0.1	-0.1	-0.1	-0.5	-0.01	-0.1	-0.5
71393	Dup	13.92	2.88	9.42	1.52	9.66	1.51	0.41	0.06	0.8	17.4	9.7	85	0.6	0.2	-0.1	-0.1	-0.1	-0.1	-0.5	-0.01	-0.1	-0.5
71432	Orig	11.66	2.18	6.3	0.95	5.58	0.82	1.15	0.77	0.4	67.3	10.7	82	2.8	0.1	-0.1	-0.1	-0.1	-0.1	0.8	-0.01	-0.1	-0.5
71433	Dup	10.9	2.17	6.39	0.96	5.76	0.87	1.25	0.64	0.8	67.2	11.3	79	2.7	0.1	-0.1	-0.1	-0.1	-0.1	-0.5	-0.01	-0.1	-0.5
71452	Orig	12.09	2.47	7.09	1.11	6.69	1.01	0.15	0.62	0.3	15.5	29.5	100	2.5	-0.1	-0.1	0.3	-0.1	-0.5	-0.01	0.1	-0.5	-0.5
71453-rep	Dup	10.48	2.16	6.32	1	6.24	0.95	0.2	0.73	0.3	19.3	33.5	112	2.7	0.2	-0.1	0.3	-0.1	1.3	-0.01	-0.1	-0.5	-0.5
71453-rep	Dup	10.48	2.16	6.32	1	6.24	0.95	0.2	0.73	0.3	19.3	33.5	112	2.7	0.2	-0.1	0.3	-0.1	1.3	-0.01	-0.1	-0.5	-0.5
71499	Orig	4.66	0.97	3.01	0.5	3.06	0.45	-0.02	2.04	3.7	5.4	15.1	11	4.1	-0.1	0.1	0.9	-0.1	1.3	-0.01	0.3	-0.5	-0.5
71500	Dup	4.85	0.97	3.1	0.5	3.31	0.48	-0.02	1.85	4.2	5.2	14.6	14	3.9	-0.1	0.1	0.9	-0.1	0.7	-0.01	0.2	-0.5	-0.5
71519	Orig	13.8	3.04	8.84	1.48	9.08	1.42	0.36	-0.02	3.7	5.2	8.2	112	-0.5	0.2	-0.1	-0.1	-0.1	-0.5	-0.01	-0.1	-0.5	-0.5
71520	Dup	14.34	3.09	8.67	1.5	9.07	1.42	0.35	-0.02	3.5	5.6	7.3	114	-0.5	0.3	-0.1	-0.1	-0.1	-0.5	-0.01	-0.1	-0.5	-0.5
71559	Orig	7.68	1.63	4.92	0.77	4.72	0.72	0.11	0.07	1	18.9	9	42	5.4	-0.1	-0.1	-0.1	-0.1	2.2	-0.01	-0.1	-0.5	-0.5
71560	Dup	7.72	1.56	4.78	0.74	4.57	0.7	0.15	0.08	0.8	19.3	9.3	41	5.3	-0.1	0.1	-0.1	-0.1	-0.5	-0.01	-0.1	-0.5	-0.5
71579	Orig	14.6	3.09	9.6	1.54	9.49	1.44	0.11	-0.02	1.7	5.9	8.8	127	1.4	0.3	0.1	-0.1	-0.1	-0.5	-0.01	-0.1	1	-0.5
71580	Dup	15.09	3.2	9.59	1.54	9.55	1.46	0.08	-0.02	1.5	6	8.8	129	0.7	0.2	-0.1	-0.1	-0.1	-0.5	-0.01	-0.1	-0.5	-0.5
71619	Orig	12.28	2.55	7.69	1.2	7.09	1.1	0.03	-0.02	2.8	18.3	4.8	109	0.8	0.2	-0.1	-0.1	-0.1	1.3	-0.01	-0.1	0.5	0.5
71620	Dup	12.51	2.62	8.01	1.17	7.26	1.11	0.03	-0.02	2.7	18.2	4.8	104	0.6	0.2	-0.1	-0.1	-0.1	1.1	-0.01	-0.1	0.8	0.8
71639	Orig	7.14	1.45	4.14	0.66	4.21	0.64	0.16	0.71	2.6	26.5	15.1	43	9.9	-0.1	0.3	-0.1	-0.1	2.6	-0.01	-0.1	-0.5	-0.5
71640	Dup	6.53	1.42	4.1	0.68	4.28	0.62	0.17	0.62	2.3	23.9	15.5	41	9.2	-0.1	0.3	-0.1	-0.1	1	-0.01	-0.1	0.7	0.7
71679	Orig	7.97	1.65	4.89	0.77	4.8	0.72	0.22	1.37	1.5	24.9	15.4	55	12.7	-0.1	0.6	-0.1	-0.1	3.9	-0.01	-0.1	0.7	0.7
71680	Dup	7.82	1.64	4.9	0.75	4.74	0.72	0.24	1.4	1.3	25	15.2	47	11.5	-0.1	0.6	-0.1	-0.1	4.7	-0.01	-0.1	0.7	0.7
71820	Orig	8.69	1.76	4.9	0.76	4.6	0.68	2	0.06	0.5	27.3	8.5	229	1.3	0.1	-0.1	-0.1	-0.1	-0.5	-0.01	-0.1	-0.5	-0.5
71840	Orig	6.89	1.46	4.34	0.69	4.4	0.65	1.15	0.05	0.4	23.4	7	61	1.1	-0.1	-0.1	-0.1	-0.1	-0.5	-0.01	-0.1	0.6	0.6
71909	Orig	5.18	1.08	3.02	0.46	2.92	0.42	0.09	-0.02	0.2	22.4	3.2	70	0.5	-0.1	-0.1	-0.1	-0.1	0.8	-0.01	-0.1	-0.5	-0.5
71910	Dup	5.24	1.08	3.2	0.49	3.08	0.44	0.11	-0.02	0.2	26.6	3	68	0.7	-0.1	-0.1	-0.1	-0.1	3	-0.01	-0.1	-0.5	-0.5
71919	Orig	7.28	1.43	3.93	0.57	3.73	0.53	0.19	-0.02	0.7	79.7	1.9	80	-0.5	0.4	-0.1	-0.1	-0.1	4.2	-0.01	-0.1	-0.5	-0.5
71920	Dup	7.12	1.37	3.85	0.57	3.59	0.51	0.15	-0.02	0.5	169.7	2	72	-0.5	0.4	-0.1	-0.1	-0.1	2.8	-0.01	-0.1	-0.5	-0.5
73082	Orig	9.78	1.98	5.87	0.89	5.47	0.82	0.11	-0.02	0.5	70.9	3.3	86	-0.5	-0.1	-0.1	-0.1	-0.1	1.4	-0.01	-0.1	-0.5	-0.5

Table A3 – Continued

Sample Number	Sample Type	BatchNumbe r	SiO2 wt%	Al2O3 wt%	Fe2O 3 w%	MgO w%	CaO w%	Na2O w%	K2O w%	TiO2 w%	P2O5 w%	MnO w%	Cr2O3 w%	Ni ppm	Sc wt%	LOI ppm	Ba ppm	Be ppm	Co ppm	Cs ppm
73082D	Dup.	SAN08000261	47.12	12.4	15.5	4.38	7.55	3.39	1.39	2.76	0.36	0.22	0.013	-20	46	4.6	363	1	41.5	0.2
73083	Orig	A723968	60.02	14.77	8.14	0.37	2.58	5.42	5.43	0.67	0.124	0.19	0.009	-20	7	2.2	284	2	1.4	0.8
73083D	Dup.	SAN08000261	60.24	14.71	7.98	0.38	2.62	5.32	5.32	0.66	0.12	0.19	0.009	-20	7	2.3	276	2	1.8	0.8
73084	Orig	A723968	55.83	13.94	9.72	3.1	3.82	1.87	3.95	1.61	0.367	0.19	0.016	-20	26	5.4	803	1	20.6	1.6
73084D	Dup.	SAN08000261	55.48	13.85	9.45	3.11	3.84	1.85	3.92	1.6	0.38	0.19	0.017	-20	27	6	862	2	21.1	1.6
73085	Orig	A723968	63.28	13.59	7.44	2.54	5.34	1.88	2.5	0.75	0.116	0.08	0.057	49	23	2.2	481	1	25.7	1
73085D	Dup.	SAN08000261	63.07	13.7	7.39	2.59	5.39	1.88	2.54	0.76	0.11	0.08	0.059	35	24	2.2	550	1	26.5	1.3
73086	Orig	A723968	45.54	13.96	15.4	4.74	10.1	2.56	0.76	2.82	0.299	0.21	0.023	25	50	3.3	237	-1	45	0.1
73086D	Dup.	SAN08000261	45.9	14.07	14.49	4.81	10	2.6	0.75	2.78	0.27	0.21	0.024	22	50	3.8	258	1	43.6	0.2
73087	Orig	A723968	55.65	15.45	10.42	1.48	3.23	6.43	2.77	0.94	0.258	0.2	0.006	-20	13	3	542	2	3.3	-0.1
73087D	Dup.	SAN08000261	55.72	15.32	10.11	1.48	3.34	6.39	2.8	0.94	0.25	0.2	0.006	-20	13	3.2	574	3	3.2	-0.1
73088	Orig	A723968	48.71	14.58	12.62	3.27	6.29	4.79	2.42	2.75	0.903	0.23	0.005	21	17	3.3	596	2	21.9	0.5
73088D	Dup.	SAN08000261	48.78	14.46	12.21	3.22	6.27	4.73	2.44	2.75	0.92	0.23	0.007	-20	18	3.7	614	2	21.5	0.6
73113	Orig	A723968	61.99	13.95	7.73	0.22	2.58	4.57	5.51	0.5	0.065	0.19	0.01	-20	4	2.6	515	2	-0.2	0.1
73113D	Dup.	SAN08000261	61.45	14.41	7.53	0.23	2.48	4.66	5.42	0.49	0.06	0.19	0.009	-20	3	2.9	562	2	0.5	-0.1
73132	Orig	SAN0800145	49.56	16.52	12.11	3.67	9.69	3.17	0.92	1.91	0.28	0.16	0.029	32	39	1.7	274	1	35.4	0.1
73133	Dup	SAN0800145	49.66	16.19	12.46	3.74	9.71	3.18	0.92	1.96	0.27	0.17	0.027	-20	40	1.4	279	-1	37.4	0.2
73152	Orig	SAN0800145	43.81	14.55	12.66	4.78	7.42	4.27	1.36	2.51	0.67	0.25	0.01	-20	26	7.5	398	-1	29.9	5.1
73153	Dup	SAN0800145	46.95	17.04	10.8	3.82	8.1	2.93	0.9	1.58	0.23	0.13	0.029	-20	35	7.2	272	-1	32.5	1.2
73192	Orig	SAN0800156	45.7	17.62	10.2	4.07	10.4	3.11	0.66	1.52	0.18	0.18	0.019	-20	34	6.1	223	-1	29.5	0.5
73193	Dup	SAN0800156	45.63	17.93	9.91	3.98	10.3	3.08	0.66	1.45	0.18	0.16	0.02	20	33	6.5	193	-1	28.7	0.5
73212	Orig	SAN0800164	52.5	14.32	7.35	3.84	5.35	0.48	2.44	1.1	0.29	0.13	0.021	43	25	12	440	1	26.9	1.3
73213	Dup	SAN0800164	50.25	14.52	7.99	4.22	6.08	0.81	2.21	1.19	0.24	0.14	0.016	41	26	12.1	442	1	28.4	0.8
73252	Orig	SAN0800187	59.69	10.33	3.04	1.22	11.6	0.31	4.3	0.32	0.09	0.03	0.034	-20	5	8.9	910	1	1.9	1.1
73253	Dup	SAN0800187	62.89	10.6	2.94	1.03	8.65	0.3	4.49	0.33	0.07	0.02	0.021	-20	5	8.5	904	2	2.3	0.8
73272	Orig	SAN0800187	71.23	12.35	4.3	0.27	1.01	0.47	6.01	0.41	0.13	0.02	0.021	-20	5	3.5	1271	1	2.1	1.6
73273	Dup	SAN0800187	71.48	12.19	4.69	0.29	1.1	0.47	5.37	0.42	0.11	0.02	0.047	-20	5	3.6	1295	3	2.3	1.7
73312	Orig	SAN0800224	73.8	11.85	3.81	0.13	0.46	1.58	6.54	0.23	0.04	0.05	0.093	-20	8	1.2	1074	2	2.7	1.7
73313	Dup	SAN0800224	74.25	11.8	3.7	0.12	0.39	1.62	6.55	0.23	0.05	0.04	0.093	-20	8	0.9	1055	2	2.4	1.5
73332	Orig	SAN0800224	70.29	12.61	4.91	0.19	1.39	2.42	5.86	0.4	0.13	0.06	0.041	-20	9	1.4	1115	2	3.4	1.5
73333	Dup	SAN0800224	70.25	12.49	5.04	0.19	1.55	2.41	5.67	0.41	0.12	0.06	0.048	-20	9	1.5	1089	2	3.7	1.5

Table A3 – Continued

Sample Number	Sample Type	Ga ppm	Hf ppm	Nb ppm	Rb ppm	Sn ppm	Sr ppm	Ta ppm	Th ppm	U ppm	V ppm	W ppm	Zr ppm	Y ppm	La ppm	Ce ppm	Pr ppm	Nd ppm	Sm ppm	Eu ppm	Gd ppm	Tb ppm
73082D	Dup.	21	6.9	35.6	30.1	2	219.2	2.1	4.3	0.9	458	0.5	254	55.9	23.4	49.9	7.1	31.9	7.99	2.5	9.06	1.4
73083	Orig	18.3	8.2	78.2	115	2	63.1	4.5	7.5	1.7	16	1.2	340	49.7	40.4	81.3	10.39	38.5	8.08	1.7	8.37	1.45
73083D	Dup.	20	9.4	80.5	117	3	68.6	4.8	7.5	1.8	32	1.3	349.5	49.2	39.3	77.6	9.89	38.4	8.21	1.8	8.37	1.26
73084	Orig	19	10.7	43	141	2	135.7	2.5	13.3	1.9	158	0.6	390.5	63.5	40	87.7	11.62	44.4	9.28	2.3	10.28	1.78
73084D	Dup.	20.4	10.8	43.5	147	3	148.9	2.7	12.4	2	170	0.8	407.3	63.3	39.7	85	10.95	42.8	9.61	2.3	10.41	1.54
73085	Orig	16	5.9	14.2	104	2	151	0.9	11.8	1.5	146	0.8	192.3	41.6	36.2	82.7	10.22	38.8	7.44	1.2	7.44	1.19
73085D	Dup.	18.1	6.4	14.8	110	2	160.4	1.2	13.4	1.6	159	0.8	205.5	41.8	37.8	84.5	10.27	38.7	8.1	1.4	8.11	1.1
73086	Orig	19.9	4.1	23.8	18.2	1	263.3	1.3	2.7	0.5	631	-0.5	152.7	42.1	16.3	36.5	5.22	23.5	5.79	1.9	6.72	1.16
73086D	Dup.	20.5	4.5	24.5	19	1	279.4	1.4	2.6	0.5	649	-0.5	155.8	41.5	16.4	35.4	5.09	23.4	5.76	2	6.67	1.02
73087	Orig	25.2	12.8	103	51.4	3	124.2	5.5	7.3	1.9	-8	-0.5	484	76.3	43.5	91.8	12.61	49.3	11.1	3.6	12.15	2.21
73087D	Dup.	27	13.3	102	53.2	4	132.8	5.8	7.7	2	13	0.7	503.8	79.3	44.2	90.4	12.29	50.6	11.7	3.8	12.74	1.96
73088	Orig	19.1	5.7	63.4	44.2	1	337.4	3.4	4.2	1.2	132	0.8	243.2	49.4	35.7	74.4	10.34	41.9	9.16	3.2	9.35	1.57
73088D	Dup.	19.1	6.4	62.6	44.7	2	345.5	3.6	4.5	1.2	139	0.7	248.2	49	36.8	73.3	9.63	40	9.06	3.2	9.5	1.34
73113	Orig	25.8	11.9	103	134	3	77.2	5.5	10	2	-8	0.6	463	71.8	50.7	98.4	12.61	48.8	11.3	3	11.97	2.17
73113D	Dup.	27.7	12.8	105	144	4	76	5.9	8.9	2.1	-8	0.7	490	75.5	48.9	98.8	12.55	51.3	11.2	2.8	11.78	1.84
73132	Orig	21.4	5.1	25	23.4	1	312	1.4	2.6	0.6	353	2.6	176.8	41	16.4	35.7	4.88	20.6	5.3	1.9	6.56	1.18
73133	Dup	21	5.7	25.6	23.4	1	308.2	1.4	3.2	0.6	373	-0.5	177.2	41.6	16.5	37	4.96	22.6	5.56	1.9	6.65	1.21
73152	Orig	18.2	3.9	39.2	25.9	2	273.9	2.4	2.6	0.8	257	0.5	164.8	37.4	25.7	51.1	6.73	28.9	6.74	2.4	7.01	1.23
73153	Dup	18.2	3.2	18.4	26.4	1	558	1	1.8	0.4	312	-0.5	134.1	31.6	12.9	27.2	3.72	16.6	4.36	1.5	5.07	0.92
73192	Orig	18.6	3.1	16	11.3	1	313.7	0.9	1.9	0.4	274	-0.5	114.6	29.6	11.3	24.8	3.49	15.6	3.85	1.4	4.75	0.86
73193	Dup	17.8	3.4	15.3	11.7	-1	324.9	1	1.7	0.3	264	0.5	109.8	26.5	10.8	22.8	3.29	15.4	3.61	1.3	4.33	0.79
73212	Orig	16.1	5.2	20.4	97.7	3	73.3	1.2	6	0.7	169	0.8	195.2	35.1	18.6	41	5.48	22.7	4.76	1.4	5.72	1.01
73213	Dup	15.7	4.7	21	74.3	2	82.2	1.3	4.2	0.7	174	0.9	167	33.6	17	36.3	4.96	19.8	4.77	1.4	5.24	0.95
73252	Orig	14.9	8.6	19.1	139	3	99.8	1.2	12.5	1.6	-8	2.3	302.6	41.3	43.2	86.8	10.99	41.8	8.4	1.4	7.87	1.22
73253	Dup	15.5	8.7	19	153	4	86.1	1.1	13.2	1.6	-8	2.5	308	37.4	44.5	93.6	11.18	44.1	8.37	1.3	7.83	1.17
73272	Orig	17.5	11.3	23.6	200	3	79.9	1.3	13	1.9	-8	1.8	390.2	38.4	42.4	85.7	10.4	39.3	7.53	1.4	6.94	1.11
73273	Dup	17.6	11.6	22.5	178	4	76.1	1.5	12	1.8	18	1.5	381.9	35.4	39.7	82.1	10.02	36.9	7.33	1.3	7.26	1.05
73312	Orig	17.1	8	19.2	217	7	77.9	1.4	26.6	4	-8	0.9	262.1	69.1	79.9	160	19.3	70.5	12.7	1.6	11.94	1.94
73313	Dup	16.4	8.3	18.4	209	7	73.9	1.4	26.8	3.9	-8	0.7	260.5	63.2	79.3	158	18.44	66.5	11.9	1.6	10.88	1.81
73332	Orig	17.8	10.3	22.2	176	3	109.2	1.3	18.6	2.8	-8	0.8	374	45.7	60.3	114	15.04	55.3	10.5	1.7	9.51	1.57
73333	Dup	17.8	10	23.8	174	4	107.6	1.4	18.1	2.7	-8	0.8	373.4	44.9	61.3	115	14.88	55	10.8	1.8	9.85	1.6

Table A3 – Continued

Sample Number	Sample Type	Dy ppm	Ho ppm	Er ppm	Tm ppm	Yb ppm	Lu ppm	TOT/C wt%	TOT/S wt%	Mo ppm	Cu ppm	Pb ppm	Zn ppm	As ppm	Cd ppm	Sb ppm	Bi ppm	Ag ppm	Au ppb	Hg ppm	Tl ppm	Se ppm	
73082D	Dup.	9.97	2.03	5.75	0.88	5.76	0.85	0.11	-0.02	0.6	69.9	2.9	86	-0.5	0.1	-0.1	-0.1	-0.1	-0.1	-0.5	-0.01	-0.1	-0.5
73083	Orig	9.09	1.78	5.21	0.83	5.2	0.78	0.12	-0.02	2.8	7.8	6.6	60	-0.5	-0.1	-0.1	-0.1	-0.1	-0.1	1.7	-0.01	-0.1	-0.5
73083D	Dup.	8.74	1.81	5.25	0.8	5.37	0.83	0.12	-0.02	2.7	8	6.4	59	0.6	-0.1	-0.1	-0.1	-0.1	-0.5	0.01	-0.1	-0.5	
73084	Orig	11.05	2.21	6.57	0.98	6.18	0.94	0.19	0.5	1.1	75.7	3.2	80	-0.5	0.2	-0.1	-0.1	-0.1	0.9	-0.01	0.3	0.5	
73084D	Dup.	10.56	2.24	6.27	1.02	6.45	0.95	0.19	0.42	1	73.3	3	80	0.7	0.1	-0.1	-0.1	-0.1	0.6	-0.01	0.2	-0.5	
73085	Orig	7.08	1.36	4.05	0.67	3.98	0.6	0.17	0.04	1.9	138	6.3	52	4.5	0.1	-0.1	0.1	-0.1	1.8	-0.01	0.2	1.1	
73085D	Dup.	7.17	1.53	4.28	0.65	4.29	0.63	0.17	0.03	1.7	134.8	6.3	52	4.6	-0.1	-0.1	-0.1	-0.1	-0.5	-0.01	0.2	0.7	
73086	Orig	7.34	1.54	4.41	0.66	4.18	0.61	0.1	0.02	0.7	98.1	1.2	74	-0.5	-0.1	-0.1	-0.1	-0.1	0.7	-0.01	-0.1	-0.5	
73086D	Dup.	7.54	1.47	4.36	0.64	4.15	0.63	0.09	-0.02	0.7	94.5	0.9	75	-0.5	-0.1	-0.1	-0.1	-0.1	-0.5	-0.01	-0.1	-0.5	
73087	Orig	13.99	2.91	8.36	1.34	8.33	1.28	0.23	-0.02	3.3	5.1	6.1	120	-0.5	0.2	-0.1	-0.1	-0.1	3	-0.01	-0.1	-0.5	
73087D	Dup.	14.24	2.84	8.23	1.31	8.58	1.32	0.22	-0.02	3.1	5.3	5.6	120	1.2	0.2	-0.1	-0.1	-0.1	0.6	0.01	-0.1	-0.5	
73088	Orig	9.48	1.83	5.04	0.79	4.6	0.69	0.16	0.07	1.3	4.9	3.4	98	-0.5	0.1	-0.1	-0.1	-0.1	1.1	-0.01	-0.1	-0.5	
73088D	Dup.	9.22	1.77	4.92	0.74	4.69	0.69	0.17	0.06	1.1	4.8	2.8	103	-0.5	-0.1	-0.1	-0.1	-0.1	-0.5	-0.01	-0.1	-0.5	
73113	Orig	13.15	2.71	7.78	1.27	7.89	1.31	0.24	-0.02	2.8	4.3	8	95	-0.5	0.2	-0.1	-0.1	-0.1	5.5	-0.01	-0.1	-0.5	
73113D	Dup.	13.08	2.74	8.09	1.27	8.18	1.3	0.23	-0.02	2.4	3.5	7.1	85	-0.5	0.2	-0.1	-0.1	-0.1	-0.5	-0.01	-0.1	-0.5	
73132	Orig	6.96	1.51	4.32	0.66	4.22	0.59	0.03	0.06	0.5	103.2	0.4	64	-0.5	-0.1	-0.1	-0.1	-0.1	-0.5	-0.01	-0.1	-0.5	
73133	Dup	6.94	1.48	4.46	0.68	4.26	0.61	0.03	0.06	0.3	95.9	0.5	62	-0.5	-0.1	-0.1	-0.1	-0.1	-0.5	-0.01	-0.1	-0.5	
73152	Orig	6.33	1.3	3.78	0.56	3.37	0.5	0.37	-0.02	0.6	29.5	0.9	71	-0.5	-0.1	-0.1	-0.1	-0.1	-0.5	-0.01	-0.1	-0.5	
73153	Dup	5.48	1.09	3.27	0.52	3.15	0.47	0.61	0.16	0.3	117.8	1.3	58	-0.5	-0.1	-0.1	-0.1	-0.1	-0.5	-0.01	-0.1	0.6	
73192	Orig	5.05	1.03	3.19	0.51	3.21	0.47	0.68	0.12	0.5	114.5	1.9	67	0.6	0.2	-0.1	0.1	-0.1	1.1	-0.01	-0.1	-0.5	
73193	Dup	4.54	1.07	2.93	0.45	2.73	0.41	0.6	0.13	0.4	108	1.7	65	0.7	0.2	-0.1	-0.1	-0.1	2.2	-0.01	-0.1	-0.5	
73212	Orig	5.9	1.27	3.8	0.59	3.8	0.58	0.85	0.55	1.7	67.2	16.8	65	11.2	0.2	-0.1	0.6	-0.1	8.6	-0.01	-0.1	1.4	
73213	Dup	5.65	1.2	3.61	0.56	3.31	0.51	0.99	0.61	1.7	66.8	7.3	63	12	0.2	-0.1	0.4	-0.1	-0.5	-0.01	-0.1	1.2	
73252	Orig	7.1	1.38	3.83	0.56	3.34	0.51	1.14	0.05	0.8	3.5	15.2	21	8.3	0.2	0.1	0.6	-0.1	4.5	-0.01	2.8	-0.5	
73253	Dup	6.51	1.24	3.67	0.55	3.18	0.51	1.2	0.06	0.7	3.5	6.5	19	5.8	0.2	-0.1	0.6	-0.1	1.6	-0.01	1.4	-0.5	
73272	Orig	6.23	1.29	3.68	0.59	3.51	0.56	0.06	0.18	0.7	1.7	9	21	7.2	0.4	0.1	0.3	-0.1	1.6	-0.01	0.3	-0.5	
73273	Dup	6.05	1.26	3.4	0.54	3.3	0.48	0.06	0.13	0.6	2	8.6	23	6.5	0.5	-0.1	0.3	-0.1	2.6	-0.01	0.4	0.5	
73312	Orig	11.75	2.35	7.08	1.03	6.51	1	-0.02	0.03	0.4	5.3	15	61	3.3	0.4	-0.1	0.1	-0.1	1.4	-0.01	-0.1	-0.5	
73313	Dup	10.46	2.17	6.59	0.98	6.15	0.91	-0.02	0.02	0.3	4.3	13.7	57	3.3	0.4	-0.1	-0.1	-0.1	-0.5	-0.01	-0.1	-0.5	
73332	Orig	9.05	1.81	5.37	0.81	4.98	0.75	0.18	0.06	0.1	3.7	13.9	68	2.4	0.2	-0.1	-0.1	-0.1	-0.5	-0.01	-0.1	-0.5	
73333	Dup	8.7	1.79	5.38	0.78	4.79	0.76	0.23	0.07	0.6	4.3	14.5	65	2.7	0.2	0.1	-0.1	-0.1	-0.5	-0.01	-0.1	-0.5	

Table A3 – Continued

Sample Number	Sample Type	BatchNumbe r	SiO2 wt%	Al2O3 wt%	Fe2O 3 wt%	MgO w%	CaO w%	Na2O w%	K2O w%	TiO2 w%	P2O5 w%	MnO w%	Cr2O3 w%	Ni ppm	Sc ppm	LOI wt%	Ba ppm	Be ppm	Co ppm	Cs ppm
73372	Orig	SAN0800254	71.13	13.08	4.21	0.3	0.88	2.56	6	0.42	0.11	0.05	0.02	-20	10	1	1124	1	3.3	2.7
73373	Dup	SAN0800254	71.56	12.63	4.25	0.31	0.97	2.5	5.77	0.41	0.14	0.05	0.026	-20	9	1.1	1065	2	3.5	2.5
73392	Orig	SAN0800254	58.43	16.69	6.62	1.21	2.03	5.16	6.35	0.64	0.14	0.14	-0.002	-20	6	2.3	1277	2	1.6	0.2
73393-rep	Dup	SAN0800254	58.49	16.65	6.83	1.22	2.01	5.1	6.31	0.69	0.15	0.14	-0.002	-20	6	2.1	1254	2	2	-0.1
73393-rep	Dup	SAN0800254	58.49	16.65	6.83	1.22	2.01	5.1	6.31	0.69	0.15	0.14	-0.002	-20	6	2.1	1254	2	2	-0.1
73432	Orig	SAN0800254	70.37	13.23	3.61	0.23	1.36	4.41	4.22	0.33	0.04	0.08	0.008	-20	8	1.9	759	3	1.4	0.7
73433	Dup	SAN0800254	70.78	13.3	3.6	0.23	1.45	4.48	4.28	0.33	0.05	0.08	0.008	-20	8	1.2	771	3	1.4	0.5
73462	Orig	SAN0800254	64.13	12.49	6.56	0.94	3.92	0.48	1.82	0.58	0.18	0.17	0.009	-20	12	8.6	484	2	6.7	1.4
73463	Dup	SAN0800254	64.73	12.56	5.8	0.86	4.04	0.45	1.71	0.58	0.18	0.15	0.01	-20	11	8.7	595	1	6.5	1.5
73482	Orig	SAN0800254	69.33	12.99	5.3	0.41	1.77	2.3	5.45	0.58	0.18	0.07	0.019	-20	12	1.4	985	2	5.8	2.7
73483	Dup	SAN0800254	69.11	12.99	5.15	0.39	1.77	2.32	5.63	0.58	0.17	0.07	0.027	-20	11	1.5	1014	2	5.6	2.7

Sample Number	Sample Type	Ga ppm	Hf ppm	Nb ppm	Rb ppm	Sn ppm	Sr ppm	Ta ppm	Th ppm	U ppm	V ppm	W ppm	Zr ppm	Y ppm	La ppm	Ce ppm	Pr ppm	Nd ppm	Sm ppm	Eu ppm	Gd ppm	Tb ppm
73372	Orig	16.5	10	22.8	194	3	124.6	1.2	19	2.6	11	-0.5	359.9	48	57.4	116	14.59	57.3	9.89	1.7	9.77	1.49
73373	Dup	16.4	10.3	23	189	3	125.7	1.3	18.7	2.6	12	-0.5	371.7	47.3	55.3	114	14.07	55.9	9.67	1.8	9.57	1.47
73392	Orig	21.2	10.2	104	133	3	79	5.7	7.5	2.1	9	1.1	418.6	58	48.8	96.7	11.18	46.4	9.24	2.6	9.5	1.66
73393-rep	Dup	21	9.9	103	131	3	80.6	5.8	7	2.1	17	1	404.8	56	46.4	93.8	10.82	43.5	8.5	2.5	9.18	1.64
73393-rep	Dup	21	9.9	103	131	3	80.6	5.8	7	2.1	17	1	404.8	56	46.4	93.8	10.82	43.5	8.5	2.5	9.18	1.64
73432	Orig	14.1	19	70.6	117	4	67.4	4.3	15.1	2.8	-8	-0.5	664.4	86.3	60.5	120	14.96	54.6	11.7	1.9	12.34	2.27
73433	Dup	13.4	18	71.6	113	4	66.7	4.1	14.3	2.9	-8	0.7	627.4	85.4	58.9	116	14.7	56.9	11.6	1.9	12.35	2.28
73462	Orig	19.6	10	24.9	153	3	28.6	1.6	16.7	2.4	25	-0.5	368	50	52.8	111	13.82	52.6	10.3	1.9	9.44	1.62
73463	Dup	19.8	10.2	23	151	3	33.3	1.4	17	2.4	22	-0.5	365.3	49.7	53.1	111	13.88	51.5	10.5	1.9	9.17	1.61
73482	Orig	18.9	9.9	23	214	3	115.4	1.3	17.7	2.8	32	1.2	366.1	54.5	57	119	14.59	57.6	10.3	1.9	9.64	1.59
73483	Dup	18.6	10.3	25.2	211	3	122.7	1.4	18.2	2.9	33	1.2	386.9	56.4	58.7	120	15.13	58.9	10.4	1.9	9.89	1.65

Table A3 –Continued

Sample Number	Sample Type	Dy ppm	Ho ppm	Er ppm	Tm ppm	Yb ppm	Lu ppm	TOT/C wt%	TOT/S wt%	Mo ppm	Cu ppm	Pb ppm	Zn ppm	As ppm	Cd ppm	Sb ppm	Bi ppm	Ag ppm	Au ppb	Hg ppm	Tl ppm	Se ppm
73372	Orig	9.07	1.88	5.26	0.83	5.02	0.78	0.03	0.08	0.1	3.1	10.3	68	2.1	0.2	0.1	-0.1	-0.1	-0.5	-0.01	-0.1	-0.5
73373	Dup	8.76	1.83	5.14	0.82	4.97	0.76	0.03	0.08	0.2	4.5	8.7	66	2.1	0.2	0.1	-0.1	-0.1	-0.5	-0.01	-0.1	-0.5
73392	Orig	9.6	2.06	6.26	1.02	6.27	0.96	0.18	-0.02	1.4	3.5	5.2	100	-0.5	0.2	-0.1	-0.1	-0.1	-0.5	-0.01	-0.1	-0.5
73393-rep	Dup	9.74	2	5.88	0.97	6.15	0.92	0.15	-0.02	1.6	5.8	5.2	103	-0.5	0.2	-0.1	-0.1	-0.1	-0.5	-0.01	-0.1	-0.5
73393-rep	Dup	9.74	2	5.88	0.97	6.15	0.92	0.15	-0.02	1.6	5.8	5.2	103	-0.5	0.2	-0.1	-0.1	-0.1	-0.5	-0.01	-0.1	-0.5
73432	Orig	14.2	3.11	9.82	1.64	10.4	1.63	0.19	0.23	1	12	6	86	7.8	-0.1	0.2	-0.1	-0.1	1.2	-0.01	-0.1	0.7
73433	Dup	14.16	3.13	9.59	1.64	10.4	1.58	0.2	0.25	1	12.3	5.9	84	8.8	-0.1	0.2	-0.1	-0.1	-0.5	-0.01	-0.1	0.8
73462	Orig	9.26	1.82	5.14	0.8	4.88	0.73	0.68	0.12	0.1	7.8	21.5	61	1.3	-0.1	-0.1	-0.1	-0.1	3.5	0.04	0.2	-0.5
73463	Dup	9.42	1.76	5.25	0.78	5.05	0.71	0.7	0.16	0.2	8.9	22	60	1.4	0.1	-0.1	-0.1	-0.1	4.5	0.04	0.1	-0.5
73482	Orig	9.24	1.8	5.37	0.81	4.99	0.75	0.06	0.03	0.4	9	6.5	66	2.5	-0.1	0.2	-0.1	-0.1	-0.5	-0.01	-0.1	-0.5
73483	Dup	9.55	1.89	5.48	0.86	5.11	0.77	0.07	0.03	0.9	9.1	7.2	65	2.2	-0.1	0.3	-0.1	-0.1	-0.5	-0.01	-0.1	-0.5



ACME INTERNAL QC INSERTION AND EVALUATION

QUALITY CONTROL MATERIALS

Samples submitted are analyzed with the strictest quality control. Blanks (analytical and method), duplicates and standard reference materials which are inserted in the sequences of client samples provide a measure of background noise, accuracy and precision. QA/QC protocol incorporates a granite or quartz sample-prep blank(s) carried through all stages of preparation and analysis as the first sample(s) in the job, a pulp replicate (REP) to monitor analytical precision, a -10 mesh reject duplicate (DUP) to monitor sub-sampling variation (drill core only), a reagent blank (BLK) to measure background and an aliquot of Certified Reference Material (CRM) or Inhouse Reference Material to monitor accuracy. In the absence of suitable CRMs Inhouse Reference Materials are prepared and certified against internationally certified reference materials such as CANMET and USGS standards where possible and will be externally verified at a minimum of 3 other commercial laboratories. Typically an analytical batch will be comprised of 34-36 client samples.

DATA REVIEW AND APPROVAL

Prior to release of results data is reviewed by the instrument operator on a rack by rack basis, a senior technician reviews all racks for an analysis in a job and a certified assayer reviews all analysis for a job together.

During rack validation, in addition to instrument calibration, linearity and drift, the operator reviews the following guidelines to evaluate the internal quality control samples to approve a rack data and to determine if some or all of the samples in a rack must be reweighed. Exceptions to the following many apply if supported by additional investigation.

Review the analytical blank (BLK).

Concentrations exceeding 5% of the lowest sample concentration or 5 times the detection limit for that element, (whichever is higher) the blank reporting > DL must be confirmed by re-analysis of the same solution.

Review pulp rerun samples (REP).

Elements whose concentration exceeds 5 times the detection limit and do not repeat values within 10% will be flagged and investigated. Solutions will be rerun and if confirmed and the operator may retrieve the pulp material for the sample to inspect the material for homogeneity and fineness.

Review of reject rerun samples (DUP).

The process for evaluating reject reruns is the same as for pulp reruns except 30% is the acceptable tolerance.

Review of standard reference materials inserted by Acme.

Elements reporting concentrations outside the tolerance limits are flagged and the problems must be reviewed. Any one element reporting outside the tolerance limits will not necessarily result in the failure of a standard. Factors such as, sample concentration, element, holdback from client samples and others will be evaluated to determine if a standard passes or fails. Tolerance limits are determined by method precision, element concentration and homogeneity of the reference material and may not be as listed on the suppliers certificate of analysis.

Figure A1 - ACME QA/QC Statement. Taken from <http://acmelab.com/services/quality-control/>

Review of preparation blanks.

If reported concentrations are higher than expected values, contamination may have occurred. Preparation blanks (i.e. G-1, Flour) are used to monitor contamination only. Concentration of preparation blanks greater than 50 times the sample concentration should be rechecked by first re-analysis of a group of samples followed by re-weighing, if the contamination is confirmed.

Review the sample concentrations for any anomalies.

Samples with concentrations significantly above or below the average concentration for the set will be highlighted by the LIMS system. If majority of the samples report similar concentrations and one or more samples report much higher or lower concentrations. Low concentrations are flagged as potential missed runs, insufficient sample, or over correction due to blanking or inference and must be reviewed. Samples with high concentrations are flagged as over limit. If requested by the client over limit samples will be re-run by another method.

If all of the above have been reviewed and considered acceptable data is approved and validated by the operator.

Table A4 – Whole rock sample location and identified lithogeochemical unit

HoleID	Sample Number	From (m)	To (m)	Lithogeochemical unit
LASDDH1	71924	-164.25	-165.25	San Miguel Granodiorite granophyres
LASDDH1	71923	-153.85	-154.85	Treinta y Tres B gabbros-basalts
LASDDH1	71925	-237.5	-238.5	Treinta y Tres B gabbros-basalts
LASDDH1	71926	-341.25	-342.25	Treinta y Tres B gabbros-basalts
LASDDH1	71927	-344.25	-345.25	Treinta y Tres B gabbros-basalts
LASDDH1	71928	-406.6	-407.5	India Muerta Rhyolites altered
LASDDH1	71931	-539.45	-540.45	Treinta y Tres A basalts
LASDDH1	71932	-624.35	-625.35	Treinta y Tres A basalts
LASDDH1	71934	-728.5	-729.5	Treinta y Tres A basalts
LASDDH1	71935	-784.45	-785.45	Treinta y Tres A basalts
LASDDH1	71929	-447.85	-448.85	Treinta y Tres A basalts
LASDDH1	71933	-707.85	-708.85	Treinta y Tres A basalts
LASDDH1	71936	-907.8	-908.8	Treinta y Tres A basalts
LASDDH1	71930-rep	-485.75	-486.15	Treinta y Tres A basalts altered
LASDDH2	73088	-649	-650	Lascano trachybasalts
LASDDH2	73083	-149.1	-150.1	Lascano trachydacites
LASDDH2	73113	-549.5	-550.5	Lascano trachydacites
LASDDH2	73087	-599	-600	Lascano trachyandesites altered
LASDDH2	129796R	-371.6	-372.6	Lascano trachydacites altered
LASDDH2	129797R	-372.5	-373.5	Lascano trachydacites altered
LASDDH2	71945	-267	-268	Santa Lucía gabbros-basalts
LASDDH2	71946	-268	-269	Santa Lucía gabbros-basalts
LASDDH2	71947	-269	-270	Santa Lucía gabbros-basalts
LASDDH2	71948	-270	-271	Santa Lucía gabbros-basalts
LASDDH2	71949	-271	-271.8	Santa Lucía gabbros-basalts
LASDDH2	73086	-498.3	-499.3	Santa Lucía gabbros-basalts
LASDDH2	121939R	-268.95	-269.95	Santa Lucía gabbros-basalts
LASDDH2	121940R	-269.95	-270.95	Santa Lucía gabbros-basalts
LASDDH2	121970R	-297.95	-298.95	Santa Lucía gabbros-basalts
LASDDH2	121999R	-325	-326	Santa Lucía gabbros-basalts
LASDDH2	71971	-353.75	-354.75	Santa Lucía gabbros-basalts
LASDDH2	71974	-299.4	-300.5	Santa Lucía gabbros-basalts
LASDDH2	129793R	-368.8	-369.8	Santa Lucía gabbros-basalts
LASDDH2	73082	-99	-100	Santa Lucía gabbros-basalts altered
LASDDH3	73046	-50.1	-51.1	San Miguel Granodiorite granophyres
LASDDH3	73047	-101.4	-102.4	San Miguel Granodiorite granophyres
LASDDH3	73048	-150	-151	San Miguel Granodiorite granophyres
LASDDH3	73049	-199.75	-200.75	San Miguel Granodiorite granophyres
LASDDH3	71901	-190	-191	San Miguel Granodiorite granophyres altered
LASDDH3	73050	-251.1	-252.1	San Miguel Granodiorite granophyres altered
LASDDH3	73094	-558.95	-559.95	Treinta y Tres B gabbros-basalts
LASDDH3	71902	-286.7	-287.7	Treinta y Tres B gabbros-basalts
LASDDH3	73090	-362.9	-363.9	Treinta y Tres B gabbros-basalts altered
LASDDH3	73091	-396.5	-397.5	Treinta y Tres B gabbros-basalts altered
LASDDH3	73093	-496.8	-497.8	Treinta y Tres B gabbros-basalts altered
LASDDH3	73092	-450.2	-451.2	Treinta y Tres B gabbros-basalts altered
LASDDH3	73096	-663	-664	Treinta y Tres B gabbros-basalts altered

Table A4 – Continued

HoleID	Sample Number	From (m)	To (m)	Lithogeochemical unit
LASDDH3	73089	-310	-311	India Muerta Rhyolites altered
LASDDH3	73097	-699.8	-700.8	Treinta y Tres A basalts altered
LASDDH3	73098	-750.9	-751.9	Treinta y Tres A basalts altered
LASDDH3	73099	-787.5	-788.5	Treinta y Tres A basalts altered
LASDDH3	73100	-829.8	-830.8	Treinta y Tres A basalts altered
LASDDH4	73051	-201.1	-202	Arrayán olivine basalts
LASDDH4	73052	-429	-430	Arrayán olivine basalts
LASDDH4	73053	-519.95	-520.85	Arrayán olivine basalts
LASDDH4	73101	-205.5	-206.5	Arrayán olivine basalts
LASDDH4	73102	-420.5	-421.5	Arrayán olivine basalts
LASDDH4	73103	-458.6	-459.6	Arrayán olivine basalts
LASDDH4	73104	-499	-500	Arrayán olivine basalts
LASDDH4	73110	-726.8	-727.8	India Muerta Rhyolites altered
LASDDH4	73111	-769.7	-770.7	India Muerta Rhyolites altered
LASDDH4	73112	-814.5	-815.5	India Muerta Rhyolites altered
LASDDH4	71908	-654.7	-655.7	Lavalleja rhyolites
LASDDH4	73107	-637.3	-638.3	Lavalleja rhyolites
LASDDH4	73106*	-597.3	-598.3	Lavalleja rhyolites altered
LASDDH4	73105	-549	-550	Lavalleja rhyolites altered
LASDDH4	73054	-398.2	-402.4	Quebracho conglomerates clasts
LASDDH4	73055	-404.45	-406.45	Quebracho conglomerates clasts
LASDDH4	73056	-218.4	-233	Quebracho conglomerates clasts
LASDDH5	73061	-150	-151	San Miguel Granodiorite granophyres
LASDDH5	73062	-160	-161	San Miguel Granodiorite granophyres
LASDDH5	73063	-200	-200.95	San Miguel Granodiorite granophyres
LASDDH5	73064	-250	-251.1	San Miguel Granodiorite granophyres
LASDDH5	73065	-300	-300.9	San Miguel Granodiorite granophyres
LASDDH5	73066	-340.5	-341.25	San Miguel Granodiorite granophyres
LASDDH5	73070	-549.85	-550.8	San Miguel Granodiorite granophyres
LASDDH5	73072	-602.2	-603.2	San Miguel Granodiorite granophyres
LASDDH5	73079	-900	-900.8	San Miguel Granodiorite granophyres
LASDDH5	73080	-950	-951	San Miguel Granodiorite granophyres
LASDDH5	71911	-142.3	-143.3	Treinta y Tres B gabbros-basalts
LASDDH5	73060	-120	-121	Treinta y Tres B gabbros-basalts
LASDDH5	73067	-400.3	-401.2	Treinta y Tres B gabbros-basalts
LASDDH5	73068	-450.3	-451.25	Treinta y Tres B gabbros-basalts
LASDDH5	73071	-570.25	-571	Treinta y Tres B gabbros-basalts
LASDDH5	73073	-650	-651	Treinta y Tres B gabbros-basalts
LASDDH5	73074	-700	-701	Treinta y Tres B gabbros-basalts
LASDDH5	73075	-750	-751	Treinta y Tres B gabbros-basalts
LASDDH5	73076	-799.9	-800.9	Treinta y Tres B gabbros-basalts
LASDDH5	73077	-849.7	-850.7	Treinta y Tres B gabbros-basalts
LASDDH5	73078	-880	-881	Treinta y Tres B gabbros-basalts
LASDDH5	71912	-332.45	-333.5	Treinta y Tres B gabbros-basalts
LASDDH5	73069	-500	-501	Treinta y Tres B gabbros-basalts
LASDDH5	73081	-1000	-1001	Treinta y Tres B gabbros-basalts
LASDDH6	73140	-225.25	-225.95	Lascano trachybasalts
LASDDH6	73144	-228.43	-229.43	Lascano trachybasalts

Table A4 – Continued

HoleID	Sample Number	From (m)	To (m)	Lithogeochemical unit
LASDDH6	73148	-232.43	-233.43	Lascano trachybasalts
LASDDH6	73150	-234.43	-235.43	Lascano trachybasalts
LASDDH6	73161	-244.7	-245.7	Lascano trachybasalts
LASDDH6	73175	-256.78	-257.23	Lascano trachybasalts
LASDDH6	73208	-285.86	-286.86	Lascano trachybasalts
LASDDH6	73376	-436	-436.55	Lascano trachybasalts
LASDDH6	73377	-437.35	-438.35	Lascano trachybasalts
LASDDH6	73387	-450	-451	Lascano trachybasalts
LASDDH6	73441	-646.05	-647.05	Lascano trachybasalts
LASDDH6	71917	-106.65	-107.35	Lascano trachybasalts
LASDDH6	73145	-229.43	-230.43	Lascano trachybasalts
LASDDH6	73146	-230.43	-231.43	Lascano trachybasalts
LASDDH6	73147	-231.43	-232.43	Lascano trachybasalts
LASDDH6	73151	-236	-237	Lascano trachybasalts
LASDDH6	73151	-236	-237	Lascano trachybasalts
LASDDH6	73152	-236.67	-237.7	Lascano trachybasalts
LASDDH6	73155	-238.57	-239.65	Lascano trachybasalts
LASDDH6	73156	-239.65	-240.76	Lascano trachybasalts
LASDDH6	73157	-240.76	-241.76	Lascano trachybasalts
LASDDH6	73158	-241.76	-242.78	Lascano trachybasalts
LASDDH6	73159	-242.78	-243.78	Lascano trachybasalts
LASDDH6	73160	-243.78	-244.7	Lascano trachybasalts
LASDDH6	73162	-245.7	-246.7	Lascano trachybasalts
LASDDH6	73164	-246.7	-247.7	Lascano trachybasalts
LASDDH6	73165	-247.7	-248.8	Lascano trachybasalts
LASDDH6	73166	-248.8	-249.8	Lascano trachybasalts
LASDDH6	73167	-249.8	-250.8	Lascano trachybasalts
LASDDH6	73168	-250.8	-251.94	Lascano trachybasalts
LASDDH6	73169	-251.94	-252.94	Lascano trachybasalts
LASDDH6	73170	-252.94	-253.88	Lascano trachybasalts
LASDDH6	73171	-253.88	-254.88	Lascano trachybasalts
LASDDH6	73172	-254.88	-255.88	Lascano trachybasalts
LASDDH6	73174	-255.88	-256.78	Lascano trachybasalts
LASDDH6	73357	-419.35	-420.35	Lascano trachybasalts
LASDDH6	73394	-597.55	-598.55	Lascano trachybasalts
LASDDH6	71915	-78.5	-79.5	Lascano trachybasalts
LASDDH6	71919	-166	-167	Lascano trachybasalts
LASDDH6	73137	-222.23	-223.23	Lascano trachybasalts
LASDDH6	73154	-237.7	-238.57	Lascano trachybasalts
LASDDH6	73274	-344.36	-345.35	Lascano trachybasalts
LASDDH6	73392	-594.95	-595	Lascano trachydacites
LASDDH6	73442	-677.35	-678.25	Lascano trachydacites
LASDDH6	73388	-463.15	-464.15	Lascano trachydacites
LASDDH6	73304	-371.1	-372.1	Lascano trachyandesites altered
LASDDH6	73390	-546.85	-547.85	Lascano trachyandesites altered
LASDDH6	73315	-381.35	-382.35	Lascano trachydacites altered
LASDDH6	73316	-382.35	-383.15	Lascano trachydacites altered
LASDDH6	73358	-420.35	-421	San Miguel Granodiorite granophyres

Table A4 – Continued

HoleID	Sample Number	From (m)	To (m)	Lithogeochemical unit
LASDDH6	73396	-602.8	-603.8	San Miguel Granodiorite granophyres
LASDDH6	73397	-603.8	-604.8	San Miguel Granodiorite granophyres
LASDDH6	73398	-604.8	-605.8	San Miguel Granodiorite granophyres
LASDDH6	73399	-605.8	-606.8	San Miguel Granodiorite granophyres
LASDDH6	73400	-606.8	-607.8	San Miguel Granodiorite granophyres
LASDDH6	73401	-607.8	-608.8	San Miguel Granodiorite granophyres
LASDDH6	73402	-608.8	-609.8	San Miguel Granodiorite granophyres
LASDDH6	73404	-609.8	-610.8	San Miguel Granodiorite granophyres
LASDDH6	73405	-610.8	-611.8	San Miguel Granodiorite granophyres
LASDDH6	73406	-611.8	-612.8	San Miguel Granodiorite granophyres
LASDDH6	73407	-612.8	-613.8	San Miguel Granodiorite granophyres
LASDDH6	73408	-613.8	-614.8	San Miguel Granodiorite granophyres
LASDDH6	73409	-614.8	-615.8	San Miguel Granodiorite granophyres
LASDDH6	73410	-615.8	-616.8	San Miguel Granodiorite granophyres
LASDDH6	73411	-617.25	-617.8	San Miguel Granodiorite granophyres
LASDDH6	73424	-627.8	-628.8	San Miguel Granodiorite granophyres
LASDDH6	71922	-601.8	-602.8	San Miguel Granodiorite granophyres altered
LASDDH6	73395	-600.8	-601.8	San Miguel Granodiorite granophyres altered
LASDDH6	73422	-627.7	-627.8	San Miguel Granodiorite granophyres altered
LASDDH6	73114	-202.03	-203.03	Santa Lucía gabbros-basalts
LASDDH6	73115	-203.03	-204.03	Santa Lucía gabbros-basalts
LASDDH6	73116	-204.03	-205.03	Santa Lucía gabbros-basalts
LASDDH6	73117	-205.03	-206.03	Santa Lucía gabbros-basalts
LASDDH6	73118	-206.03	-207.03	Santa Lucía gabbros-basalts
LASDDH6	73119	-207.03	-208.03	Santa Lucía gabbros-basalts
LASDDH6	73120	-208.03	-209.03	Santa Lucía gabbros-basalts
LASDDH6	73121	-209.03	-209.61	Santa Lucía gabbros-basalts
LASDDH6	73122	-209.61	-210.61	Santa Lucía gabbros-basalts
LASDDH6	73124	-210.61	-211.61	Santa Lucía gabbros-basalts
LASDDH6	73125	-211.61	-212.61	Santa Lucía gabbros-basalts
LASDDH6	73126	-212.61	-213.23	Santa Lucía gabbros-basalts
LASDDH6	73127	-213.23	-214.23	Santa Lucía gabbros-basalts
LASDDH6	73128	-214.23	-215.23	Santa Lucía gabbros-basalts
LASDDH6	73129	-215.35	-216.35	Santa Lucía gabbros-basalts
LASDDH6	73130	-216.23	-217.23	Santa Lucía gabbros-basalts
LASDDH6	73131	-217.23	-218.23	Santa Lucía gabbros-basalts
LASDDH6	73132	-218.23	-219.23	Santa Lucía gabbros-basalts
LASDDH6	73134	-219.23	-220.23	Santa Lucía gabbros-basalts
LASDDH6	73138	-223.23	-224.23	Santa Lucía gabbros-basalts
LASDDH6	73139	-224.25	-225.25	Santa Lucía gabbros-basalts
LASDDH6	73141	-226.4	-227.4	Santa Lucía gabbros-basalts
LASDDH6	73142	-227.23	-228.4	Santa Lucía gabbros-basalts
LASDDH6	73149	-233.7	-234.7	Santa Lucía gabbros-basalts
LASDDH6	73176	-257.4	-258.4	Santa Lucía gabbros-basalts
LASDDH6	73177	-258.23	-259.26	Santa Lucía gabbros-basalts
LASDDH6	73178	-259.26	-260.26	Santa Lucía gabbros-basalts
LASDDH6	73179	-260.26	-261.26	Santa Lucía gabbros-basalts

Table A4 – Continued

HoleID	Sample Number	From (m)	To (m)	Lithogeochemical unit
LASDDH6	73181	-262.26	-263.25	Santa Lucía gabbros-basalts
LASDDH6	73182	-263.25	-264.25	Santa Lucía gabbros-basalts
LASDDH6	73184	-264.25	-265.2	Santa Lucía gabbros-basalts
LASDDH6	73186	-266.25	-267.25	Santa Lucía gabbros-basalts
LASDDH6	73187	-267.25	-268.2	Santa Lucía gabbros-basalts
LASDDH6	73188	-268.2	-269.2	Santa Lucía gabbros-basalts
LASDDH6	73189	-269.2	-270.2	Santa Lucía gabbros-basalts
LASDDH6	73191	-271.2	-272.3	Santa Lucía gabbros-basalts
LASDDH6	73192	-272.3	-273.23	Santa Lucía gabbros-basalts
LASDDH6	73194	-273.23	-274.28	Santa Lucía gabbros-basalts
LASDDH6	73195	-274.28	-275.35	Santa Lucía gabbros-basalts
LASDDH6	73196	-275.35	-276.35	Santa Lucía gabbros-basalts
LASDDH6	73197	-276.35	-277.35	Santa Lucía gabbros-basalts
LASDDH6	73198	-277.35	-278.2	Santa Lucía gabbros-basalts
LASDDH6	73199	-278.2	-279.2	Santa Lucía gabbros-basalts
LASDDH6	73200	-279.2	-280.3	Santa Lucía gabbros-basalts
LASDDH6	73201	-280.3	-281.25	Santa Lucía gabbros-basalts
LASDDH6	73202	-281.25	-282.25	Santa Lucía gabbros-basalts
LASDDH6	73204	-282.25	-283.25	Santa Lucía gabbros-basalts
LASDDH6	73205	-283.25	-284.3	Santa Lucía gabbros-basalts
LASDDH6	73206	-284.3	-284.86	Santa Lucía gabbros-basalts
LASDDH6	71918	-141.25	-142.25	Santa Lucía gabbros-basalts
LASDDH6	71921	-176.15	-177.15	Santa Lucía gabbros-basalts
LASDDH6	73190	-270.2	-271.2	Santa Lucía gabbros-basalts
LASDDH6	73207	-284.86	-285.86	Santa Lucía gabbros-basalts
LASDDH6	73136	-221.23	-222.23	Santa Lucía gabbros-basalts altered
LASDDH6	73180	-261.26	-262.26	Santa Lucía gabbros-basalts altered
LASDDH6	73185	-265.2	-266.25	Santa Lucía gabbros-basalts altered
LASDDH6	71916	-88	-89	Santa Lucía gabbros-basalts altered
LASDDH6	73135	-220.23	-221.23	Santa Lucía gabbros-basalts altered
LASDDH6	73210	-287.86	-288.86	Santa Lucía gabbros-basalts altered
LASDDH6	73211	-288.86	-289.86	Santa Lucía gabbros-basalts altered
LASDDH6	73214	-290.86	-291.86	Santa Lucía gabbros-basalts altered
LASDDH6	73391	-549.7	-550.7	Santa Lucía gabbros-basalts altered
LASDDH6	73209	-286.86	-287.86	Treinta y Tres B gabbros-basalts altered
LASDDH6	73212	-289.86	-290.86	Treinta y Tres B gabbros-basalts altered
LASDDH6	73412	-617.8	-618.8	India Muerta Rhyolites
LASDDH6	73414	-618.8	-619.8	India Muerta Rhyolites
LASDDH6	73415	-619.8	-620.8	India Muerta Rhyolites
LASDDH6	73416	-621.15	-621.8	India Muerta Rhyolites
LASDDH6	73417	-621.8	-622.8	India Muerta Rhyolites
LASDDH6	73419	-624.25	-624.8	India Muerta Rhyolites
LASDDH6	73420	-624.8	-625.8	India Muerta Rhyolites
LASDDH6	73426	-629.8	-630.8	India Muerta Rhyolites
LASDDH6	73427	-630.8	-631.8	India Muerta Rhyolites
LASDDH6	73428	-631.8	-632.8	India Muerta Rhyolites
LASDDH6	73429	-632.8	-633.8	India Muerta Rhyolites
LASDDH6	73430	-633.8	-634.8	India Muerta Rhyolites
LASDDH6	73431	-634.8	-635.8	India Muerta Rhyolites

Table A4 – Continued

HoleID	Sample Number	From (m)	To (m)	Lithogeochemical unit
LASDDH6	73432	-635.8	-636.8	India Muerta Rhyolites
LASDDH6	73434	-636.8	-637.8	India Muerta Rhyolites
LASDDH6	73435	-637.8	-638.8	India Muerta Rhyolites
LASDDH6	73436	-638.8	-639.8	India Muerta Rhyolites
LASDDH6	73437	-639.8	-640.8	India Muerta Rhyolites
LASDDH6	73438	-640.8	-641.8	India Muerta Rhyolites
LASDDH6	73425	-628.8	-629.8	India Muerta Rhyolites
LASDDH6	73439	-641.8	-642.5	India Muerta Rhyolites
LASDDH6	73440	-642.8	-643.8	India Muerta Rhyolites
LASDDH6	73418	-622.8	-623.8	India Muerta Rhyolites
LASDDH6	73259	-331.36	-332.36	India Muerta Rhyolites altered
LASDDH6	73262	-334.36	-335.36	India Muerta Rhyolites altered
LASDDH6	73275	-345.35	-346.35	India Muerta Rhyolites altered
LASDDH6	73276	-346.35	-347.35	India Muerta Rhyolites altered
LASDDH6	73314	-380.35	-381.15	India Muerta Rhyolites altered
LASDDH6	73307	-374.35	-375.35	Lavalleja rhyolites
LASDDH6	73308	-375.35	-376.35	Lavalleja rhyolites
LASDDH6	73309	-376.35	-377.35	Lavalleja rhyolites
LASDDH6	73310	-377.35	-378.35	Lavalleja rhyolites
LASDDH6	73311	-378.35	-379.35	Lavalleja rhyolites
LASDDH6	73317	-383.35	-384.35	Lavalleja rhyolites
LASDDH6	73318	-384.35	-385.35	Lavalleja rhyolites
LASDDH6	73325	-390.35	-391.35	Lavalleja rhyolites
LASDDH6	73326	-391.35	-392.35	Lavalleja rhyolites
LASDDH6	73328	-393.35	-394.35	Lavalleja rhyolites
LASDDH6	73329	-394.35	-395.35	Lavalleja rhyolites
LASDDH6	73330	-395.35	-396.35	Lavalleja rhyolites
LASDDH6	73331	-396.35	-397.35	Lavalleja rhyolites
LASDDH6	73332	-397.35	-398.35	Lavalleja rhyolites
LASDDH6	73334	-398.35	-399.35	Lavalleja rhyolites
LASDDH6	73335	-399.35	-400.35	Lavalleja rhyolites
LASDDH6	73336	-400.35	-401.35	Lavalleja rhyolites
LASDDH6	73337	-401.35	-402.35	Lavalleja rhyolites
LASDDH6	73338	-402.35	-403.35	Lavalleja rhyolites
LASDDH6	73339	-403.35	-404.35	Lavalleja rhyolites
LASDDH6	73340	-404.35	-405.35	Lavalleja rhyolites
LASDDH6	73341	-405.35	-406.35	Lavalleja rhyolites
LASDDH6	73342	-406.35	-407.35	Lavalleja rhyolites
LASDDH6	73345	-408.35	-408.95	Lavalleja rhyolites
LASDDH6	73346	-409.35	-410.35	Lavalleja rhyolites
LASDDH6	73347	-410.35	-411.35	Lavalleja rhyolites
LASDDH6	73348	-411.35	-412.35	Lavalleja rhyolites
LASDDH6	73349	-412.35	-413.35	Lavalleja rhyolites
LASDDH6	73350	-413.35	-414.35	Lavalleja rhyolites
LASDDH6	73351	-414.35	-415.35	Lavalleja rhyolites
LASDDH6	73352	-415.35	-416.35	Lavalleja rhyolites
LASDDH6	73354	-416.35	-417.35	Lavalleja rhyolites
LASDDH6	73355	-417.35	-418.35	Lavalleja rhyolites

Table A4 – Continued

HoleID	Sample Number	From (m)	To (m)	Lithogeochemical unit
LASDDH6	73359	-421.35	-422.35	Lavalleja rhyolites
LASDDH6	73360	-422.35	-423.35	Lavalleja rhyolites
LASDDH6	73361	-423.35	-424.35	Lavalleja rhyolites
LASDDH6	73362	-424.35	-425.35	Lavalleja rhyolites
LASDDH6	73364	-425.35	-426.35	Lavalleja rhyolites
LASDDH6	73365	-426.35	-427.35	Lavalleja rhyolites
LASDDH6	73366	-427.35	-428.35	Lavalleja rhyolites
LASDDH6	73367	-428.35	-429.35	Lavalleja rhyolites
LASDDH6	73368	-429.35	-430.35	Lavalleja rhyolites
LASDDH6	73369	-430.35	-431.35	Lavalleja rhyolites
LASDDH6	73370	-431.35	-432.35	Lavalleja rhyolites
LASDDH6	73371	-432.35	-433.35	Lavalleja rhyolites
LASDDH6	73372	-433.35	-434.35	Lavalleja rhyolites
LASDDH6	73374	-434.35	-435.35	Lavalleja rhyolites
LASDDH6	73379	-439.35	-440.35	Lavalleja rhyolites
LASDDH6	73380	-440.35	-441.35	Lavalleja rhyolites
LASDDH6	73381	-441.35	-442.35	Lavalleja rhyolites
LASDDH6	73382	-442.35	-443.35	Lavalleja rhyolites
LASDDH6	73384	-443.35	-444.35	Lavalleja rhyolites
LASDDH6	73385	-444.35	-445.35	Lavalleja rhyolites
LASDDH6	73386	-445.35	-446.55	Lavalleja rhyolites
LASDDH6	73217	-293.36	-294.36	Lavalleja rhyolites altered
LASDDH6	73218	-294.36	-295.36	Lavalleja rhyolites altered
LASDDH6	73219	-295.36	-296.36	Lavalleja rhyolites altered
LASDDH6	73220	-296.36	-297.36	Lavalleja rhyolites altered
LASDDH6	73221	-297.36	-298.36	Lavalleja rhyolites altered
LASDDH6	73222	-297.45	-298.45	Lavalleja rhyolites altered
LASDDH6	73224	-299.36	-300.36	Lavalleja rhyolites altered
LASDDH6	73225	-300.36	-301.36	Lavalleja rhyolites altered
LASDDH6	73226	-301.36	-302.36	Lavalleja rhyolites altered
LASDDH6	73227	-302.36	-303.36	Lavalleja rhyolites altered
LASDDH6	73228	-303.36	-304.36	Lavalleja rhyolites altered
LASDDH6	73229	-304.36	-305.36	Lavalleja rhyolites altered
LASDDH6	73230	-305.36	-306.36	Lavalleja rhyolites altered
LASDDH6	73231	-306.36	-307.36	Lavalleja rhyolites altered
LASDDH6	73232	-307.36	-308.36	Lavalleja rhyolites altered
LASDDH6	73234	-308.36	-309.36	Lavalleja rhyolites altered
LASDDH6	73235	-309.36	-310.36	Lavalleja rhyolites altered
LASDDH6	73236	-310.36	-311.36	Lavalleja rhyolites altered
LASDDH6	73237	-311.36	-312.36	Lavalleja rhyolites altered
LASDDH6	73238	-312.36	-313.36	Lavalleja rhyolites altered
LASDDH6	73239	-313.36	-314.36	Lavalleja rhyolites altered
LASDDH6	73240	-314.36	-315.36	Lavalleja rhyolites altered
LASDDH6	73241	-315.36	-316.36	Lavalleja rhyolites altered
LASDDH6	73242	-316.36	-317.36	Lavalleja rhyolites altered
LASDDH6	73244	-317.36	-318.36	Lavalleja rhyolites altered
LASDDH6	73245	-318.36	-319.36	Lavalleja rhyolites altered
LASDDH6	73246	-319.36	-320.36	Lavalleja rhyolites altered
LASDDH6	73247	-320.36	-321.36	Lavalleja rhyolites altered

Table A4 – Continued

HoleID	Sample Number	From (m)	To (m)	Lithogeochemical unit
LASDDH6	73248	-321.36	-322.36	Lavalleja rhyolites altered
LASDDH6	73249	-322.36	-323.36	Lavalleja rhyolites altered
LASDDH6	73250	-323.36	-324.36	Lavalleja rhyolites altered
LASDDH6	73251	-324.36	-325.36	Lavalleja rhyolites altered
LASDDH6	73254	-326.36	-327.36	Lavalleja rhyolites altered
LASDDH6	73255	-327.36	-328.36	Lavalleja rhyolites altered
LASDDH6	73256	-328.36	-329.36	Lavalleja rhyolites altered
LASDDH6	73260	-332.36	-333.36	Lavalleja rhyolites altered
LASDDH6	73261	-333.36	-334.36	Lavalleja rhyolites altered
LASDDH6	73264	-335.36	-336.36	Lavalleja rhyolites altered
LASDDH6	73265	-336.36	-337.36	Lavalleja rhyolites altered
LASDDH6	73266	-337.36	-338.36	Lavalleja rhyolites altered
LASDDH6	73267	-338.36	-339.36	Lavalleja rhyolites altered
LASDDH6	73268	-339.36	-340.36	Lavalleja rhyolites altered
LASDDH6	73269	-340.36	-341.36	Lavalleja rhyolites altered
LASDDH6	73270	-341.36	-342.36	Lavalleja rhyolites altered
LASDDH6	73271	-342.36	-343.36	Lavalleja rhyolites altered
LASDDH6	73272	-343.36	-344.35	Lavalleja rhyolites altered
LASDDH6	73277	-347.35	-348.35	Lavalleja rhyolites altered
LASDDH6	73278	-348.35	-349.35	Lavalleja rhyolites altered
LASDDH6	73279	-349.35	-350.35	Lavalleja rhyolites altered
LASDDH6	73280	-350.35	-351.35	Lavalleja rhyolites altered
LASDDH6	73281	-351.35	-352.35	Lavalleja rhyolites altered
LASDDH6	73282	-352.35	-353.35	Lavalleja rhyolites altered
LASDDH6	73284	-353.35	-354.35	Lavalleja rhyolites altered
LASDDH6	73285	-354.35	-355.35	Lavalleja rhyolites altered
LASDDH6	73286	-355.35	-356.35	Lavalleja rhyolites altered
LASDDH6	73287	-356.35	-357.35	Lavalleja rhyolites altered
LASDDH6	73288	-357.35	-358.35	Lavalleja rhyolites altered
LASDDH6	73289	-358.35	-359.35	Lavalleja rhyolites altered
LASDDH6	73290	-359.35	-360.35	Lavalleja rhyolites altered
LASDDH6	73291	-360.35	-361.35	Lavalleja rhyolites altered
LASDDH6	73292	-361.35	-362.35	Lavalleja rhyolites altered
LASDDH6	73294	-362.35	-363.35	Lavalleja rhyolites altered
LASDDH6	73295	-363.35	-364.35	Lavalleja rhyolites altered
LASDDH6	73296	-364.35	-365.35	Lavalleja rhyolites altered
LASDDH6	73297	-365.35	-366.35	Lavalleja rhyolites altered
LASDDH6	73298	-366.35	-367.35	Lavalleja rhyolites altered
LASDDH6	73299	-367.35	-368.35	Lavalleja rhyolites altered
LASDDH6	73300	-368.35	-369.35	Lavalleja rhyolites altered
LASDDH6	73312	-379.35	-380.35	Lavalleja rhyolites altered
LASDDH6	73319	-385.35	-386.35	Lavalleja rhyolites altered
LASDDH6	73320	-386.35	-387.35	Lavalleja rhyolites altered
LASDDH6	73321	-387.35	-388.35	Lavalleja rhyolites altered
LASDDH6	73322	-388.35	-389.35	Lavalleja rhyolites altered
LASDDH6	73324	-389.35	-390.35	Lavalleja rhyolites altered
LASDDH6	73327	-392.35	-393.35	Lavalleja rhyolites altered
LASDDH7	71424	-460.95	-461.95	Lascano trachybasalts

Table A4 – Continued

HoleID	Sample Number	From (m)	To (m)	Lithogeochemical unit
LASDDH7	71425	-461.95	-462.75	Lascano trachybasalts
LASDDH7	71434	-469.95	-470.95	Lascano trachybasalts
LASDDH7	71435	-470.95	-471.55	Lascano trachybasalts
LASDDH7	71438	-473.6	-474.6	Lascano trachybasalts
LASDDH7	71439	-474.6	-475.6	Lascano trachybasalts
LASDDH7	71440	-475.6	-476.6	Lascano trachybasalts
LASDDH7	71441	-476.6	-477.6	Lascano trachybasalts
LASDDH7	71442	-477.6	-478.6	Lascano trachybasalts
LASDDH7	71444	-478.6	-479.45	Lascano trachybasalts
LASDDH7	71939	-207.8	-208.8	Lascano trachybasalts
LASDDH7	71940	-219.8	-220.8	Lascano trachybasalts
LASDDH7	71437	-472.55	-473.6	Lascano trachydacites altered
LASDDH7	71399	-438	-438.75	Santa Lucía gabbros-basalts
LASDDH7	71479	-532.1	-533.05	Santa Lucía gabbros-basalts
LASDDH7	71480	-545.4	-546.4	Santa Lucía gabbros-basalts
LASDDH7	71938	-188.8	-189.8	Santa Lucía gabbros-basalts
LASDDH7	71941	-293.15	-294.15	Santa Lucía gabbros-basalts
LASDDH7	71969	-157.8	-158.8	Santa Lucía gabbros-basalts
LASDDH7	71379	-388.55	-389.55	Santa Lucía gabbros-basalts altered
LASDDH7	71381	-390.35	-391.9	Treinta y Tres B gabbros-basalts
LASDDH7	71396	-403.95	-404.95	Treinta y Tres B gabbros-basalts
LASDDH7	71407	-445.15	-446.15	Treinta y Tres B gabbros-basalts altered
LASDDH7	71382	-391.95	-392.95	India Muerta Rhyolites
LASDDH7	71384	-392.95	-393.95	India Muerta Rhyolites
LASDDH7	71385	-393.95	-394.95	India Muerta Rhyolites
LASDDH7	71386	-394.95	-395.95	India Muerta Rhyolites
LASDDH7	71387	-395.95	-396.95	India Muerta Rhyolites
LASDDH7	71388	-396.95	-397.95	India Muerta Rhyolites
LASDDH7	71389	-397.95	-398.95	India Muerta Rhyolites
LASDDH7	71390	-398.95	-399.95	India Muerta Rhyolites
LASDDH7	71391	-399.95	-400.95	India Muerta Rhyolites
LASDDH7	71392	-400.95	-401.95	India Muerta Rhyolites
LASDDH7	71394	-401.95	-402.95	India Muerta Rhyolites
LASDDH7	71369	-379.9	-380.9	Treinta y Tres A basalts
LASDDH7	71370	-380.9	-381.9	Treinta y Tres A basalts
LASDDH7	71371	-381.9	-382.9	Treinta y Tres A basalts
LASDDH7	71372	-382.9	-383.9	Treinta y Tres A basalts
LASDDH7	71374	-383.9	-384.9	Treinta y Tres A basalts
LASDDH7	71375	-384.9	-385.9	Treinta y Tres A basalts
LASDDH7	71376	-385.9	-386.9	Treinta y Tres A basalts
LASDDH7	71377	-386.9	-387.9	Treinta y Tres A basalts
LASDDH7	71378	-387.35	-388.35	Treinta y Tres A basalts
LASDDH7	71397	-404.95	-405.95	Treinta y Tres A basalts
LASDDH7	71398	-405.95	-406.95	Treinta y Tres A basalts
LASDDH7	71380	-389.55	-390.55	Treinta y Tres A basalts
LASDDH7	71368	-378.9	-379.9	Treinta y Tres A basalts altered
LASDDH7	71400	-439.8	-440.8	Treinta y Tres A basalts altered
LASDDH7	71401	-440.15	-441.15	Treinta y Tres A basalts altered

Table A4 – Continued

HoleID	Sample Number	From (m)	To (m)	Lithogeochemical unit
LASDDH7	71402	-441.15	-442.15	Treinta y Tres A basalts altered
LASDDH7	71404	-442.15	-443.15	Treinta y Tres A basalts altered
LASDDH7	71405	-443.15	-444.15	Treinta y Tres A basalts altered
LASDDH7	71406	-444.15	-445.15	Treinta y Tres A basalts altered
LASDDH7	71360	-371.3	-372.3	Lavalleja rhyolites
LASDDH7	71361	-372.3	-373.3	Lavalleja rhyolites
LASDDH7	71362	-373.3	-374.8	Lavalleja rhyolites
LASDDH7	71364	-374.8	-375.9	Lavalleja rhyolites
LASDDH7	73451	-318.7	-319.7	Lavalleja rhyolites
LASDDH7	73452	-319.7	-320.7	Lavalleja rhyolites
LASDDH7	73455	-321.7	-322.7	Lavalleja rhyolites
LASDDH7	73457	-323.7	-324.7	Lavalleja rhyolites
LASDDH7	73458	-324.7	-325.7	Lavalleja rhyolites
LASDDH7	73466	-331.25	-332.25	Lavalleja rhyolites
LASDDH7	73467	-332.25	-333.25	Lavalleja rhyolites
LASDDH7	73468	-333.25	-334.25	Lavalleja rhyolites
LASDDH7	73474	-338.25	-339	Lavalleja rhyolites
LASDDH7	73475	-339.25	-340.25	Lavalleja rhyolites
LASDDH7	73476	-340.25	-341.3	Lavalleja rhyolites
LASDDH7	73478	-342.3	-343.3	Lavalleja rhyolites
LASDDH7	73479	-343.3	-344.3	Lavalleja rhyolites
LASDDH7	73480	-344.3	-345.3	Lavalleja rhyolites
LASDDH7	73481	-345.3	-346.3	Lavalleja rhyolites
LASDDH7	73482	-346.3	-347.3	Lavalleja rhyolites
LASDDH7	73484	-347.3	-348.3	Lavalleja rhyolites
LASDDH7	73485	-348.3	-349.3	Lavalleja rhyolites
LASDDH7	73486	-349.3	-350.3	Lavalleja rhyolites
LASDDH7	73487	-350.3	-351.3	Lavalleja rhyolites
LASDDH7	73488	-351.3	-352.3	Lavalleja rhyolites
LASDDH7	73489	-352.3	-353.3	Lavalleja rhyolites
LASDDH7	73490	-353.3	-354.3	Lavalleja rhyolites
LASDDH7	73491	-354.3	-355.3	Lavalleja rhyolites
LASDDH7	73492	-355.3	-356.3	Lavalleja rhyolites
LASDDH7	73494	-356.3	-357.3	Lavalleja rhyolites
LASDDH7	73495	-357.3	-358.3	Lavalleja rhyolites
LASDDH7	73496	-358.3	-359.3	Lavalleja rhyolites
LASDDH7	73497	-359.3	-360.3	Lavalleja rhyolites
LASDDH7	73498	-360.3	-361.3	Lavalleja rhyolites
LASDDH7	73499	-361.3	-362.3	Lavalleja rhyolites
LASDDH7	73500	-362.3	-363.3	Lavalleja rhyolites
LASDDH7	71351	-363.3	-364.3	Lavalleja rhyolites altered
LASDDH7	71352	-364.3	-365.3	Lavalleja rhyolites altered
LASDDH7	71354	-365.3	-366.3	Lavalleja rhyolites altered
LASDDH7	71355	-366.3	-367.3	Lavalleja rhyolites altered
LASDDH7	71356	-367.3	-368.3	Lavalleja rhyolites altered
LASDDH7	71357	-368.3	-369.3	Lavalleja rhyolites altered
LASDDH7	71358	-369.3	-370.3	Lavalleja rhyolites altered
LASDDH7	71359	-370.3	-371.3	Lavalleja rhyolites altered

Table A4 – Continued

HoleID	Sample Number	From (m)	To (m)	Lithogeochemical unit
LASDDH7	71366	-376.9	-377.9	Lavalleja rhyolites altered
LASDDH7	71367	-377.9	-378.9	Lavalleja rhyolites altered
LASDDH7	73445	-312.7	-313.7	Lavalleja rhyolites altered
LASDDH7	73446	-313.7	-314.7	Lavalleja rhyolites altered
LASDDH7	73448	-315.7	-316.7	Lavalleja rhyolites altered
LASDDH7	73449	-316.7	-317.7	Lavalleja rhyolites altered
LASDDH7	73450	-317.9	-318.7	Lavalleja rhyolites altered
LASDDH7	73454	-320.7	-321.7	Lavalleja rhyolites altered
LASDDH7	73456	-322.7	-323.7	Lavalleja rhyolites altered
LASDDH7	73459	-325.8	-326.45	Lavalleja rhyolites altered
LASDDH7	73460	-326.45	-327.45	Lavalleja rhyolites altered
LASDDH7	73461	-327.45	-328.45	Lavalleja rhyolites altered
LASDDH7	73462	-328.45	-329.45	Lavalleja rhyolites altered
LASDDH7	73464	-329.45	-330.45	Lavalleja rhyolites altered
LASDDH7	73465	-330.45	-331.25	Lavalleja rhyolites altered
LASDDH7	73469	-334.25	-335.25	Lavalleja rhyolites altered
LASDDH7	73470	-335.25	-336.1	Lavalleja rhyolites altered
LASDDH7	73471	-336.25	-337.25	Lavalleja rhyolites altered
LASDDH7	73472	-337.25	-338.25	Lavalleja rhyolites altered
LASDDH7	73477	-341.3	-342.3	Lavalleja rhyolites altered
LASDDH7	71414	-451.75	-452.75	Lavalleja rhyolites breccia
LASDDH7	71415	-452.75	-453.75	Lavalleja rhyolites breccia
LASDDH7	71416	-453.75	-454.75	Lavalleja rhyolites breccia
LASDDH7	71417	-454.75	-455.75	Lavalleja rhyolites breccia
LASDDH7	71418	-455.75	-456.75	Lavalleja rhyolites breccia
LASDDH7	71419	-456.75	-457.75	Lavalleja rhyolites breccia
LASDDH7	71420	-457.75	-458.75	Lavalleja rhyolites breccia
LASDDH7	71421	-458.75	-459.75	Lavalleja rhyolites breccia
LASDDH7	71422	-459.75	-460.95	Lavalleja rhyolites breccia
LASDDH7	71426	-462.75	-463.75	Lavalleja rhyolites breccia
LASDDH7	71427	-463.75	-464.75	Lavalleja rhyolites breccia
LASDDH7	71428	-464.75	-465.75	Lavalleja rhyolites breccia
LASDDH7	71429	-465.75	-466.75	Lavalleja rhyolites breccia
LASDDH7	71430	-466.75	-467.75	Lavalleja rhyolites breccia
LASDDH7	71431	-467.75	-468.95	Lavalleja rhyolites breccia
LASDDH7	71445	-479.45	-480.45	Lavalleja rhyolites breccia
LASDDH7	71446	-480.45	-481.45	Lavalleja rhyolites breccia
LASDDH7	71447	-481.45	-482.45	Lavalleja rhyolites breccia
LASDDH7	71448	-482.45	-483.45	Lavalleja rhyolites breccia
LASDDH7	71449	-483.45	-484.45	Lavalleja rhyolites breccia
LASDDH7	71461	-494.45	-495.45	Lavalleja rhyolites breccia
LASDDH7	71467	-517.85	-518.85	Lavalleja rhyolites breccia
LASDDH7	71468	-518.85	-519.85	Lavalleja rhyolites breccia
LASDDH7	71469	-519.85	-520.85	Lavalleja rhyolites breccia
LASDDH7	71470	-520.85	-521.85	Lavalleja rhyolites breccia
LASDDH7	71471	-521.85	-522.85	Lavalleja rhyolites breccia
LASDDH7	71472	-522.85	-523.85	Lavalleja rhyolites breccia
LASDDH7	71474	-523.85	-524.85	Lavalleja rhyolites breccia

Table A4 – Continued

HoleID	Sample Number	From (m)	To (m)	Lithogeochemical unit
LASDDH7	71475	-524.85	-525.85	Lavalleja rhyolites breccia
LASDDH7	71476	-525.85	-526.85	Lavalleja rhyolites breccia
LASDDH7	71477	-526.85	-527.85	Lavalleja rhyolites breccia
LASDDH7	71478	-527.85	-528.45	Lavalleja rhyolites breccia
LASDDH7	71458	-491.6	-492.45	Lavalleja rhyolites breccia
LASDDH7	71459	-492.45	-493.45	Lavalleja rhyolites breccia
LASDDH7	71460	-493.45	-494.45	Lavalleja rhyolites breccia
LASDDH7	71412	-450.75	-451.75	Lavalleja rhyolites breccia
LASDDH7	71450	-484.3	-485.3	Lavalleja rhyolites breccia
LASDDH7	71451	-485.45	-486.45	Lavalleja rhyolites breccia
LASDDH7	71452	-487.25	-489.25	Lavalleja rhyolites breccia
LASDDH7	71454	-487.45	-488.45	Lavalleja rhyolites breccia
LASDDH7	71455	-488.45	-489.45	Lavalleja rhyolites breccia
LASDDH7	71456	-489.45	-490.45	Lavalleja rhyolites breccia
LASDDH7	71457	-490.8	-491.45	Lavalleja rhyolites breccia
LASDDH7	71462	-495.45	-496.45	Lavalleja rhyolites breccia
LASDDH7	71464	-496.45	-497.45	Lavalleja rhyolites breccia
LASDDH7	71465	-497.45	-498.45	Lavalleja rhyolites breccia
LASDDH7	71466	-498.45	-499.7	Lavalleja rhyolites breccia
LASDDH8	71531	-195.5	-196.5	Lascano trachybasalts
LASDDH8	71532	-196.5	-197.5	Lascano trachybasalts
LASDDH8	71533	-197.5	-198.8	Lascano trachybasalts
LASDDH8	71555	-332.95	-333.9	Lascano trachybasalts
LASDDH8	71564	-480.95	-482.05	Lascano trachybasalts
LASDDH8	71574	-546.8	-547.65	Lascano trachybasalts
LASDDH8	71598	-697.4	-698.4	Lascano trachybasalts
LASDDH8	71943	-136.85	-137.55	Lascano trachybasalts
LASDDH8	71529	-194.5	-195.5	Lascano trachybasalts
LASDDH8	71563	-479.95	-480.95	Lascano trachybasalts
LASDDH8	71528	-193.5	-194.5	Lascano trachybasalts
LASDDH8	71535	-214.05	-215	Lascano trachybasalts
LASDDH8	71572	-515.25	-516.1	Lascano trachybasalts
LASDDH8	71589	-589.55	-590.55	Lascano trachybasalts
LASDDH8	71599	-728.55	-729.55	Lascano trachybasalts
LASDDH8	71601	-729.55	-730.55	Lascano trachybasalts
LASDDH8	71591	-603.6	-604.6	Lascano trachyandesites
LASDDH8	71611	-738.55	-739.55	Lascano trachyandesites
LASDDH8	71612	-739.55	-740.55	Lascano trachyandesites
LASDDH8	71613	-740.55	-741.55	Lascano trachyandesites
LASDDH8	71614	-741.55	-742.55	Lascano trachyandesites
LASDDH8	71615	-742.55	-743.55	Lascano trachyandesites
LASDDH8	71616	-743.55	-744.55	Lascano trachyandesites
LASDDH8	71617	-744.55	-745.55	Lascano trachyandesites
LASDDH8	71618	-745.55	-746.55	Lascano trachyandesites
LASDDH8	71619	-746.55	-747.55	Lascano trachyandesites
LASDDH8	71621	-747.55	-748.55	Lascano trachyandesites
LASDDH8	71622	-748.55	-749.55	Lascano trachyandesites
LASDDH8	71623	-749.55	-750.55	Lascano trachyandesites

Table A4 – Continued

HoleID	Sample Number	From (m)	To (m)	Lithogeochemical unit
LASDDH8	71624	-750.55	-751.55	Lascano trachyandesites
LASDDH8	71625	-751.55	-752.55	Lascano trachyandesites
LASDDH8	71626	-752.55	-753.75	Lascano trachyandesites
LASDDH8	71508	-175.2	-176.2	Lascano trachydacites
LASDDH8	71509	-176.2	-177.2	Lascano trachydacites
LASDDH8	71511	-177.2	-178.2	Lascano trachydacites
LASDDH8	71512	-178.2	-179.2	Lascano trachydacites
LASDDH8	71513	-179.2	-180.2	Lascano trachydacites
LASDDH8	71514	-180.2	-181.2	Lascano trachydacites
LASDDH8	71515	-181.2	-182.2	Lascano trachydacites
LASDDH8	71516	-182.2	-183.2	Lascano trachydacites
LASDDH8	71518	-184.2	-185.2	Lascano trachydacites
LASDDH8	71519	-185.2	-186.2	Lascano trachydacites
LASDDH8	71521	-186.2	-187.2	Lascano trachydacites
LASDDH8	71576	-548.65	-549.65	Lascano trachydacites
LASDDH8	71577	-549.65	-550.65	Lascano trachydacites
LASDDH8	71578	-550.65	-551.65	Lascano trachydacites
LASDDH8	71581	-552.65	-553.65	Lascano trachydacites
LASDDH8	71525	-190.2	-191.5	Lascano trachyandesites altered
LASDDH8	71557	-351.1	-352.1	Lascano trachyandesites altered
LASDDH8	71573	-545.65	-546.65	Lascano trachyandesites altered
LASDDH8	71575	-548.05	-548.65	Lascano trachyandesites altered
LASDDH8	71608	-736.7	-737.55	Lascano trachyandesites altered
LASDDH8	71507	-174.25	-175.2	Lascano trachydacites altered
LASDDH8	71522	-187.75	-188.75	Lascano trachydacites altered
LASDDH8	71526	-191.5	-192.5	Lascano trachydacites altered
LASDDH8	71579	-551.65	-552.65	Lascano trachydacites altered
LASDDH8	71582	-553.65	-554.75	Lascano trachydacites altered
LASDDH8	71597	-693.9	-694.75	Lascano trachydacites altered
LASDDH8	71556	-335.7	-336.65	San Miguel Granodiorite granophyres
LASDDH8	71558	-373.95	-374.85	San Miguel Granodiorite granophyres
LASDDH8	71559	-426.3	-427.25	San Miguel Granodiorite granophyres
LASDDH8	71561	-448.75	-449.55	San Miguel Granodiorite granophyres
LASDDH8	71562	-478.95	-479.9	San Miguel Granodiorite granophyres
LASDDH8	71566	-483.05	-484.05	San Miguel Granodiorite granophyres
LASDDH8	71567	-484.05	-485.05	San Miguel Granodiorite granophyres
LASDDH8	71568	-485.05	-486.05	San Miguel Granodiorite granophyres
LASDDH8	71569	-486.05	-487.05	San Miguel Granodiorite granophyres
LASDDH8	71571	-511.55	-512.55	San Miguel Granodiorite granophyres
LASDDH8	71583	-554.8	-555.8	San Miguel Granodiorite granophyres
LASDDH8	71584	-565.4	-566.4	San Miguel Granodiorite granophyres
LASDDH8	71585	-566.4	-567.4	San Miguel Granodiorite granophyres
LASDDH8	71586	-567.4	-568.4	San Miguel Granodiorite granophyres
LASDDH8	71587	-568.4	-569.4	San Miguel Granodiorite granophyres
LASDDH8	71588	-569.4	-569.9	San Miguel Granodiorite granophyres
LASDDH8	71592	-606.8	-607.7	San Miguel Granodiorite granophyres
LASDDH8	71593	-627.45	-628.45	San Miguel Granodiorite granophyres
LASDDH8	71595	-657.3	-658.3	San Miguel Granodiorite granophyres

Table A4 – Continued

HoleID	Sample Number	From (m)	To (m)	Lithogeochemical unit
LASDDH8	71596	-679.6	-680.6	San Miguel Granodiorite granophyres
LASDDH8	71602	-730.6	-731.55	San Miguel Granodiorite granophyres
LASDDH8	71603	-731.55	-732.55	San Miguel Granodiorite granophyres
LASDDH8	71604	-732.55	-733.55	San Miguel Granodiorite granophyres
LASDDH8	71605	-733.55	-734.55	San Miguel Granodiorite granophyres
LASDDH8	71606	-734.55	-735.55	San Miguel Granodiorite granophyres
LASDDH8	71607	-735.55	-736.65	San Miguel Granodiorite granophyres
LASDDH8	71634	-759.25	-760.25	San Miguel Granodiorite granophyres
LASDDH8	71635	-760.25	-761.25	San Miguel Granodiorite granophyres
LASDDH8	71636	-761.25	-762.25	San Miguel Granodiorite granophyres
LASDDH8	71637	-762.25	-763.25	San Miguel Granodiorite granophyres
LASDDH8	71638	-763.25	-764.25	San Miguel Granodiorite granophyres
LASDDH8	71639	-764.25	-765.25	San Miguel Granodiorite granophyres
LASDDH8	71641	-765.25	-766.25	San Miguel Granodiorite granophyres
LASDDH8	71642	-766.25	-767.25	San Miguel Granodiorite granophyres
LASDDH8	71643	-767.25	-768.25	San Miguel Granodiorite granophyres
LASDDH8	71644	-768.25	-769.25	San Miguel Granodiorite granophyres
LASDDH8	71645	-769.25	-770.25	San Miguel Granodiorite granophyres
LASDDH8	71646	-770.25	-771.25	San Miguel Granodiorite granophyres
LASDDH8	71649	-773.25	-774.25	San Miguel Granodiorite granophyres
LASDDH8	71654	-777	-778	San Miguel Granodiorite granophyres
LASDDH8	71656	-779	-780	San Miguel Granodiorite granophyres
LASDDH8	71657	-780	-781	San Miguel Granodiorite granophyres
LASDDH8	71658	-781	-782	San Miguel Granodiorite granophyres
LASDDH8	71661	-783	-784	San Miguel Granodiorite granophyres
LASDDH8	71662	-784	-785	San Miguel Granodiorite granophyres
LASDDH8	71663	-785	-786	San Miguel Granodiorite granophyres
LASDDH8	71664	-786	-787	San Miguel Granodiorite granophyres
LASDDH8	71665	-787	-788	San Miguel Granodiorite granophyres
LASDDH8	71666	-788	-789	San Miguel Granodiorite granophyres
LASDDH8	71667	-789	-790	San Miguel Granodiorite granophyres
LASDDH8	71668	-790	-791	San Miguel Granodiorite granophyres
LASDDH8	71669	-791	-792	San Miguel Granodiorite granophyres
LASDDH8	71671	-792	-793	San Miguel Granodiorite granophyres
LASDDH8	71672	-793	-794	San Miguel Granodiorite granophyres
LASDDH8	71673	-794	-795	San Miguel Granodiorite granophyres
LASDDH8	71674	-795	-796	San Miguel Granodiorite granophyres
LASDDH8	71675	-796	-797	San Miguel Granodiorite granophyres
LASDDH8	71676	-797	-798	San Miguel Granodiorite granophyres
LASDDH8	71677	-798	-799	San Miguel Granodiorite granophyres
LASDDH8	71678	-799	-800	San Miguel Granodiorite granophyres
LASDDH8	71679	-800	-801	San Miguel Granodiorite granophyres
LASDDH8	71681	-801	-802	San Miguel Granodiorite granophyres
LASDDH8	71682	-802	-803	San Miguel Granodiorite granophyres
LASDDH8	71683	-803	-804	San Miguel Granodiorite granophyres
LASDDH8	71629	-755.25	-756.25	San Miguel Granodiorite granophyres altered
LASDDH8	71631	-756.25	-757.25	San Miguel Granodiorite granophyres altered
LASDDH8	71632	-757.25	-758.25	San Miguel Granodiorite granophyres altered

Table A4 – Continued

HoleID	Sample Number	From (m)	To (m)	Lithogeochemical unit
LASDDH8	71633	-758.25	-759.25	San Miguel Granodiorite granophyres altered
LASDDH8	71647	-771.25	-772.25	San Miguel Granodiorite granophyres altered
LASDDH8	71648	-772.25	-773.25	San Miguel Granodiorite granophyres altered
LASDDH8	71651	-774.25	-775	San Miguel Granodiorite granophyres altered
LASDDH8	71652	-775	-776	San Miguel Granodiorite granophyres altered
LASDDH8	71653	-776	-777	San Miguel Granodiorite granophyres altered
LASDDH8	71655	-778	-779	San Miguel Granodiorite granophyres altered
LASDDH8	71659	-782	-783	San Miguel Granodiorite granophyres altered
LASDDH8	71684	-804	-805.2	San Miguel Granodiorite granophyres altered
LASDDH8	71942	-135.95	-136.85	Santa Lucía gabbros-basalts
LASDDH8	71527	-192.5	-193.5	Santa Lucía gabbros-basalts altered
LASDDH8	71973	-335.7	-338	enolith Treinta y Tres B basalt in San Miguel Granophyri
LASDDH8	71486	-155.45	-156.45	India Muerta Rhyolites
LASDDH8	71487	-156.45	-157.45	India Muerta Rhyolites altered
LASDDH8	71501	-168.45	-169.45	India Muerta Rhyolites altered
LASDDH8	71499	-167.45	-168.45	India Muerta Rhyolites altered
LASDDH8	71502	-169.45	-170.45	India Muerta Rhyolites altered
LASDDH8	71944	-141.25	-142.25	Treinta y Tres A basalts altered
LASDDH8	71485	-154.45	-155.45	Lavalleja rhyolites
LASDDH8	71503	-170.45	-171.45	Lavalleja rhyolites
LASDDH8	71504	-171.45	-172.45	Lavalleja rhyolites
LASDDH8	71548	-284.55	-285.55	Lavalleja rhyolites
LASDDH8	71551	-286.55	-287.55	Lavalleja rhyolites
LASDDH8	71552	-287.55	-288.55	Lavalleja rhyolites
LASDDH8	71553	-288.55	-289.55	Lavalleja rhyolites
LASDDH8	71554	-289.55	-290.95	Lavalleja rhyolites
LASDDH8	71505	-172.45	-173.45	Lavalleja rhyolites
LASDDH8	71482	-151.75	-152.45	Lavalleja rhyolites altered
LASDDH8	71483	-152.45	-153.45	Lavalleja rhyolites altered
LASDDH8	71484	-153.45	-154.45	Lavalleja rhyolites altered
LASDDH8	71488	-157.45	-158.45	Lavalleja rhyolites altered
LASDDH8	71489	-158.45	-159.45	Lavalleja rhyolites altered
LASDDH8	71491	-159.45	-160.45	Lavalleja rhyolites altered
LASDDH8	71492	-160.45	-161.45	Lavalleja rhyolites altered
LASDDH8	71493	-161.5	-162.45	Lavalleja rhyolites altered
LASDDH8	71494	-162.45	-163.45	Lavalleja rhyolites altered
LASDDH8	71495	-163.45	-164.45	Lavalleja rhyolites altered
LASDDH8	71496	-164.45	-165.45	Lavalleja rhyolites altered
LASDDH8	71497	-165.45	-166.45	Lavalleja rhyolites altered
LASDDH8	71498	-166.95	-167.45	Lavalleja rhyolites altered
LASDDH8	71506	-173.45	-174.2	Lavalleja rhyolites altered
LASDDH8	71536	-224.9	-225.9	Lavalleja rhyolites altered
LASDDH8	71543	-279.55	-280.55	Lavalleja rhyolites altered
LASDDH8	71544	-280.55	-281.55	Lavalleja rhyolites altered
LASDDH8	71545	-281.55	-282.55	Lavalleja rhyolites altered
LASDDH8	71546	-282.55	-283.55	Lavalleja rhyolites altered
LASDDH8	71547	-283.55	-284.55	Lavalleja rhyolites altered
LASDDH8	71549	-285.55	-286.55	Lavalleja rhyolites altered

Table A4 – Continued

HoleID	Sample Number	From (m)	To (m)	Lithogeochemical unit
LASDDH9	79497	-447.4	-448.4	Lascano trachybasalts
LASDDH9	79542	-487.35	-488.35	Lascano trachybasalts
LASDDH9	79658	-715.15	-716.15	Lascano trachybasalts
LASDDH9	79660	-752.05	-753.05	Lascano trachybasalts
LASDDH9	79699	-823.7	-824.7	Lascano trachybasalts
LASDDH9	79783	-898.1	-899.1	Lascano trachybasalts
LASDDH9	79805	-917.25	-918.25	Lascano trachybasalts
LASDDH9	71733	-210.4	-211.4	San Miguel Granodiorite granophyres
LASDDH9	71853	-343.45	-343.9	San Miguel Granodiorite granophyres
LASDDH9	79457	-392.35	-393.35	San Miguel Granodiorite granophyres
LASDDH9	79473	-425.4	-426.4	San Miguel Granodiorite granophyres
LASDDH9	79486	-437.4	-438.4	San Miguel Granodiorite granophyres
LASDDH9	79529	-476.4	-477.4	San Miguel Granodiorite granophyres
LASDDH9	79572	-514.55	-515.55	San Miguel Granodiorite granophyres
LASDDH9	79606	-545	-546	San Miguel Granodiorite granophyres
LASDDH9	79634	-568.9	-569.9	San Miguel Granodiorite granophyres
LASDDH9	79649	-582.05	-583.05	San Miguel Granodiorite granophyres
LASDDH9	79653	-620.55	-621.55	San Miguel Granodiorite granophyres
LASDDH9	79654	-654.55	-655.55	San Miguel Granodiorite granophyres
LASDDH9	79655	-672.55	-673.55	San Miguel Granodiorite granophyres
LASDDH9	79657	-695.55	-696.55	San Miguel Granodiorite granophyres
LASDDH9	79659	-730.05	-731.05	San Miguel Granodiorite granophyres
LASDDH9	79677	-803.85	-804.85	San Miguel Granodiorite granophyres
LASDDH9	79695	-819.45	-820.45	San Miguel Granodiorite granophyres
LASDDH9	79722	-843.7	-844.7	San Miguel Granodiorite granophyres
LASDDH9	79736	-856.7	-857.7	San Miguel Granodiorite granophyres
LASDDH9	79762	-879.6	-880.6	San Miguel Granodiorite granophyres
LASDDH9	79810	-922.45	-923.45	San Miguel Granodiorite granophyres
LASDDH9	79835	-943.35	-944.35	San Miguel Granodiorite granophyres
LASDDH9	79859	-965.7	-966.15	San Miguel Granodiorite granophyres
LASDDH9	71684B	-166.4	-167.4	San Miguel Granodiorite granophyres
LASDDH9	71708	-188.4	-189.4	San Miguel Granodiorite granophyres altered
LASDDH9	71745	-221.4	-222.4	San Miguel Granodiorite granophyres altered
LASDDH9	71783	-255.4	-256.4	San Miguel Granodiorite granophyres altered
LASDDH9	71802	-272.4	-273.4	San Miguel Granodiorite granophyres altered
LASDDH9	71816	-285.5	-286.45	San Miguel Granodiorite granophyres altered
LASDDH9	71840	-332.35	-333.35	San Miguel Granodiorite granophyres altered
LASDDH9	79652	-595.9	-596.9	Santa Lucía gabbros-basalts
LASDDH9	79820	-931.1	-932.1	Santa Lucía gabbros-basalts
LASDDH9	71820	-310.5	-311.85	Santa Lucía gabbros-basalts altered
LMD1	71906	-321.15	-322.15	Treinta y Tres A basalts
LMD1	71907	-433.7	-434.7	Treinta y Tres A basalts
LMD1	71904*	-93.85	-94.05	Treinta y Tres A basalts altered
LMD1	71905	-196.4	-197.4	Treinta y Tres A basalts altered
LMD1	71903	-51.2	-52.2	Lavalleja rhyolites

Table A5– Whole rock analysis from drillhole samples

Sample Number	BatchNumber	Acme	SiO2 wt%	Al2O3 wt%	Fe2O3 w%	MgO w%	CaO w%	Na2O w%	K2O w%	TiO2 w%	P2O5 w%	MnO w%	Cr2O 3 w%	Ni ppm	Sc ppm	LOI wt%	Ba ppm	Be ppm
71924	SAN08002928		67.65	13.09	6.94	0.98	2.66	3.24	4.27	0.79	0.22	0.11	0.06	-20	14	1.4	807	2
71923	SAN08002928		49.19	16.81	9.89	9.24	11.14	2.13	0.45	0.82	0.08	0.18	0.06	158	35	4.3	112	-1
71925	SAN08002928		48.88	16.31	10.81	8.77	11.64	2.16	0.30	0.83	0.06	0.19	0.07	119	39	2.8	85	-1
71926	SAN08002928		51.65	15.65	10.91	7.18	9.83	2.70	0.91	0.88	0.07	0.17	0.05	96	37	1.7	212	1
71927	SAN08002928		48.24	16.61	10.29	10.11	11.05	2.39	0.32	0.71	0.06	0.16	0.06	203	33	2	92	-1
71928	SAN08002928		74.12	12.00	3.98	0.09	1.40	2.39	5.62	0.22	0.03	0.06	0.09	-20	6	0	1366	2
71931	SAN08002928		50.68	17.14	10.33	6.13	10.88	2.37	1.11	1.07	0.11	0.15	0.03	75	36	5	190	-1
71932	SAN08002928		51.29	16.01	11.92	4.93	10.50	2.42	1.14	1.41	0.16	0.18	0.03	43	39	1.8	263	-1
71934	SAN08002928		49.25	17.06	11.21	6.52	10.79	2.55	0.74	1.46	0.19	0.20	0.03	122	34	4.1	258	-1
71935	SAN08002928		50.14	16.19	12.07	5.57	10.44	2.52	0.94	1.72	0.20	0.18	0.02	56	36	1.7	260	1
71929	SAN08002928		52.56	16.23	11.26	4.58	9.63	2.69	1.37	1.33	0.15	0.17	0.02	56	36	1.6	316	-1
71933	SAN08002928		49.80	17.38	10.73	5.61	10.75	2.92	1.03	1.42	0.19	0.16	0.02	55	34	3.1	259	1
71936	SAN08002928		49.74	16.02	12.36	6.10	10.34	2.88	0.56	1.62	0.19	0.17	0.02	68	37	4.6	188	2
71930-rep	SAN08002928		55.74	15.53	10.25	3.94	8.11	2.70	2.03	1.34	0.18	0.16	0.02	47	32	3.4	425	-1
73088	A723968		50.44	15.10	13.07	3.39	6.51	4.96	2.51	2.85	0.94	0.24	0.01	21	17	3.3	596	2
73083	A723968		61.42	15.11	8.33	0.38	2.64	5.55	5.56	0.69	0.13	0.19	0.01	-20	7	2.2	284	2
73113	A723968		63.70	14.33	7.94	0.23	2.65	4.70	5.66	0.51	0.07	0.20	0.01	-20	4	2.6	515	2
73087	A723968		57.47	15.96	10.76	1.53	3.34	6.64	2.86	0.97	0.27	0.21	0.01	-20	13	3	542	2
129796R	SAN08002610		60.19	16.45	8.23	1.47	2.49	3.70	6.69	0.56	0.06	0.16	0.00	-20	3	4	932	2
129797R	SAN08002610		60.27	16.33	8.22	1.38	2.24	3.72	7.07	0.55	0.05	0.17	0.00	-20	3	3.8	974	2
71945	ACMESAN08003029		47.77	14.49	16.55	4.08	9.28	2.99	1.17	3.06	0.36	0.23	0.02	-20	44	2.1	343	1
71946	ACMESAN08003029		47.93	14.41	16.53	4.11	9.31	2.97	1.13	3.02	0.35	0.21	0.03	-20	46	1.9	347	1
71947	ACMESAN08003029		48.90	13.72	16.50	4.45	9.14	2.78	1.03	2.88	0.35	0.22	0.03	-20	44	2.8	316	2
71948	ACMESAN08003029		48.94	14.45	16.05	3.94	8.94	2.95	1.14	2.98	0.36	0.21	0.03	-20	42	2.4	357	-1
71949	ACMESAN08003029		49.49	14.87	15.31	3.88	8.99	2.96	1.10	2.80	0.35	0.21	0.04	-20	41	2.4	333	-1
73086	A723968		47.22	14.47	15.97	4.91	10.51	2.65	0.79	2.92	0.31	0.22	0.02	25	50	3.3	237	-1
121939R	SAN08002610		49.98	13.50	15.48	4.43	9.46	2.76	1.02	2.78	0.34	0.23	0.02	-20	43	3.9	515	1
121940R	SAN08002610		48.97	14.76	15.15	4.04	9.37	3.04	1.12	2.94	0.39	0.21	0.01	-20	43	2.7	322	-1
121970R	SAN08002610		47.16	15.53	14.20	6.86	10.86	2.45	0.65	1.87	0.19	0.21	0.02	66	47	5.7	161	-1
121999R	SAN08002610		48.73	15.17	13.91	6.86	9.42	2.74	0.76	1.90	0.24	0.24	0.02	50	43	5.3	199	-1
71971	SAN09001926		49.09	19.97	10.01	4.13	11.08	3.23	0.71	1.42	0.18	0.17	0.01	29	34	3.6	185	1
71974	SAN09001926		49.56	17.58	12.10	3.98	10.35	3.33	0.92	1.75	0.24	0.20	0.01	39	39	2.7	235	1

Table A5– Continued

Sample Number	Co ppm	Cs ppm	Ga ppm	Hf ppm	Nb ppm	Rb ppm	Sn ppm	Sr ppm	Ta ppm	Th ppm	U ppm	V ppm	W ppm	Zr ppm	Y ppm	La ppm	Ce ppm	Pr ppm	Nd ppm	Sm ppm	Eu ppm
71924	8.7	2.8	18.7	10	29.1	154.9	4	125	1.9	15.1	2.2	33	1.5	388	63.2	48.6	103	12.82	46.6	10.44	2.1
71923	46.9	1.1	14.1	1.3	5.4	15.1	-1	223	0.3	1.3	0.2	226	-0.5	48.1	16.6	6.7	15	2	8.5	2.19	0.8
71925	51.2	0.6	15.1	1	4.1	8	-1	197	0.2	0.7	0.1	266	-0.5	36.6	16.9	4.3	9.9	1.41	6.6	1.88	0.8
71926	43.7	0.8	16.3	2.6	8	27.1	-1	187	0.5	2.6	0.4	247	-0.5	106	24.4	10.8	24	3.11	13.3	3.26	1
71927	53.5	1	13.9	1	4.3	7.6	-1	198	0.3	0.7	0.1	216	-0.5	39.7	15.2	4.4	9.7	1.38	6	1.74	0.7
71928	2.3	1.7	18.6	11	33.5	206.9	4	112	1.9	24	2.7	-8	0.6	379	65.8	80.1	171	21.21	80.8	15.39	2.2
71931	42.6	0.4	16.7	2.5	4.3	29.4	-1	221	0.3	2	0.3	244	-0.5	94.4	19.9	9.8	22	2.91	12.7	3.08	1
71932	42.7	0.2	17.5	3.3	6.4	34.8	1	188	0.4	3.2	0.5	282	-0.5	144	26.8	14.4	33	4.31	18.2	4.21	1.3
71934	50.1	0.1	18.7	3.6	6.1	15.4	-1	229	0.3	1.6	0.3	267	-0.5	139	24.5	12.6	28	3.93	17.9	4.27	1.4
71935	44.7	0.2	19.4	3.9	7	21.6	1	237	0.4	2.3	0.4	300	-0.5	157	27.3	13.6	31	4.27	19.3	4.5	1.6
71929	42.4	0.4	19.5	3.7	7.9	38.4	-1	199	0.4	4.3	0.6	254	0.6	151	28	18.3	40	5.08	20.5	4.82	1.4
71933	40	0.3	19.8	3.3	6	25.6	-1	234	0.3	1.8	0.3	272	-0.5	137	24.4	12.4	29	3.87	16.8	4.16	1.4
71936	45.8	0.3	17.2	3.2	6.7	13.5	2	252	0.4	2.1	0.3	287	-0.5	118	23.3	11.6	27	3.58	16.2	3.98	1.4
71930-rep	34.1	1.1	18.1	4.9	10	69.5	1	203	0.5	7.1	0.8	228	-0.5	193	30.4	25.4	55	6.92	26.9	5.69	1.5
73088	21.9	0.5	19.1	5.7	63.4	44.2	1	337	3.4	4.2	1.2	132	0.8	243	49.4	35.7	74	10.34	41.9	9.16	3.2
73083	1.4	0.8	18.3	8.2	78.2	114.9	2	63.1	4.5	7.5	1.7	16	1.2	340	49.7	40.4	81	10.39	38.5	8.08	1.7
73113	-0.2	0.1	25.8	12	103	134.2	3	77.2	5.5	10	2	-8	0.6	463	71.8	50.7	98	12.61	48.8	11.28	3
73087	3.3	-0.1	25.2	13	102.5	51.4	3	124	5.5	7.3	1.9	-8	-0.5	484	76.3	43.5	92	12.61	49.3	11.06	3.6
129796R	1	0.2	24.8	14	113.3	138.6	4	56.6	6.4	9.8	2.5	-8	0.5	533	89.8	50.4	106	13.71	55.4	12.7	3.1
129797R	0.4	0.1	22.7	14	114.6	139.4	4	55.4	6.3	10.9	2.3	-8	0.6	529	75.6	50.5	107	13.93	54.6	12.11	2.9
71945	40.6	0.3	22.4	6.5	34.3	30.8	2	275	1.9	3.9	0.7	467	-0.5	225	50.8	21.7	47	6.47	28.5	7.25	2.4
71946	40.9	0.2	21.9	6.3	33.6	30	2	269	2	4	0.7	474	0.7	226	53.8	21.6	48	6.53	29.2	7.28	2.4
71947	41.4	0.2	21.1	6	31.7	26.3	2	254	1.8	3.7	0.7	436	-0.5	217	50.3	20.8	46	6.23	28.3	6.97	2.2
71948	39.5	0.2	22.6	6	34.6	30.3	2	275	1.9	3.7	0.7	474	0.5	227	53.1	22	48	6.52	28.8	7.45	2.4
71949	37.1	0.2	21.8	5.5	31.4	27.6	2	265	1.9	3.5	0.7	428	-0.5	206	48.1	20.3	44	6.04	26.9	6.87	2.2
73086	45	0.1	19.9	4.1	23.8	18.2	1	263	1.3	2.7	0.5	631	-0.5	153	42.1	16.3	37	5.22	23.5	5.79	1.9
121939R	39.7	0.2	20.7	5.9	30.3	25.4	2	246	1.9	3.6	0.7	417	-0.5	211	47.7	19.7	43	5.92	26.2	6.62	2.1
121940R	36.7	0.2	21.5	5.6	31.7	28.2	1	259	1.9	4	0.7	438	-0.5	218	51	21.1	44	6.42	28.3	6.87	2.3
121970R	42.5	-0.1	17.9	3.1	15.2	14.5	1	230	0.9	1.9	0.4	386	-0.5	116	28.8	10.4	23	3.24	14	3.86	1.3
121999R	45.5	-0.1	18.6	4	19.9	17.2	2	227	1.3	2	0.5	340	-0.5	144	35	13.1	29	4.06	18.4	4.65	1.6
71971	32.3	0.5	21.2	3.5	15.7	19.8	1	337	0.9	1.9	0.4	274	0.5	111	27.9	10.9	25	3.2	14	3.78	1.4
71974	35.1	0.1	19.7	4.3	20.5	20.4	2	303	1.2	2.2	0.5	322	0.5	147	36.4	14.2	32	4.22	18.2	4.8	1.6

Table A5– Continued

Sample Number	Gd ppm	Tb ppm	Dy ppm	Ho ppm	Er ppm	Tm ppm	Yb ppm	Lu ppm	TOT/C wt%	TOT/S wt%	Mo ppm	Cu ppm	Pb ppm	Zn ppm	As ppm	Cd ppm	Sb ppm	Bi ppm	Ag ppm	Au ppb
71924	10.4	1.86	11.02	2.25	6.59	1.04	6.46	0.94	0.06	-0.02	0.7	13.8	2.9	57	1.4	-0.1	0.1	-0.1	-0.1	4.8
71923	2.52	0.47	2.92	0.6	1.82	0.29	1.78	0.27	0.05	-0.02	0.2	81.6	1.4	32	2.9	-0.1	-0.1	-0.1	-0.1	2.4
71925	2.48	0.48	3.06	0.63	1.96	0.3	1.86	0.27	0.03	0.06	0.1	73.8	0.9	31	1	-0.1	-0.1	-0.1	-0.1	3.6
71926	3.78	0.71	4.47	0.93	2.78	0.42	2.72	0.38	0.03	0.09	0.3	105	1.3	26	-0.5	-0.1	-0.1	-0.1	-0.1	1.9
71927	2.25	0.43	2.72	0.58	1.73	0.27	1.65	0.24	0.03	0.18	0.2	87.2	1	18	-0.5	-0.1	-0.1	-0.1	-0.1	1.6
71928	13.4	2.18	12.57	2.4	7.03	1.06	6.6	0.95	0.03	-0.02	0.2	6.9	3.6	24	1.6	-0.1	-0.1	-0.1	-0.1	-0.5
71931	3.5	0.63	3.81	0.75	2.2	0.33	2.08	0.31	0.03	-0.02	0.1	84.2	2.2	42	-0.5	-0.1	-0.1	-0.1	-0.1	4.8
71932	4.85	0.84	4.97	1.02	3.02	0.45	2.92	0.43	-0.02	-0.02	-0.1	119	1.8	38	-0.5	-0.1	-0.1	-0.1	-0.1	3.8
71934	4.67	0.81	4.71	0.97	2.74	0.41	2.64	0.39	0.04	0.04	0.2	150	1.8	54	-0.5	-0.1	-0.1	-0.1	-0.1	2.3
71935	5.04	0.91	5.22	1.07	3.14	0.47	2.99	0.44	0.02	-0.02	0.2	80.2	1.3	39	-0.5	-0.1	-0.1	-0.1	-0.1	1.4
71929	5.1	0.88	5.18	1.07	3.16	0.47	3.05	0.45	0.03	-0.02	0.2	97.5	2.1	47	-0.5	-0.1	-0.1	-0.1	-0.1	2.9
71933	4.49	0.8	4.74	0.98	2.82	0.4	2.65	0.38	0.03	-0.02	0.2	65	1.8	55	-0.5	-0.1	-0.1	-0.1	-0.1	1.2
71936	4.51	0.8	4.57	0.95	2.75	0.42	2.63	0.39	0.04	0.07	0.5	101	1.9	62	-0.5	-0.1	-0.1	-0.1	-0.1	5.9
71930-rep	5.76	0.98	5.53	1.13	3.27	0.49	3.17	0.46	-0.02	-0.02	0.3	74.5	3.9	51	0.8	-0.1	-0.1	-0.1	-0.1	3
73088	9.35	1.57	9.48	1.83	5.04	0.79	4.6	0.69	0.16	0.07	1.3	4.9	3.4	98	-0.5	0.1	-0.1	-0.1	-0.1	1.1
73083	8.37	1.45	9.09	1.78	5.21	0.83	5.2	0.78	0.12	-0.02	2.8	7.8	6.6	60	-0.5	-0.1	-0.1	-0.1	-0.1	1.7
73113	12	2.17	13.15	2.71	7.78	1.27	7.89	1.31	0.24	-0.02	2.8	4.3	8	95	-0.5	0.2	-0.1	-0.1	-0.1	5.5
73087	12.2	2.21	13.99	2.91	8.36	1.34	8.33	1.28	0.23	-0.02	3.3	5.1	6.1	120	-0.5	0.2	-0.1	-0.1	-0.1	3
129796R	13.7	2.08	14.95	3.08	8.83	1.4	9.15	1.42	0.41	-0.02	1.8	4.8	7.4	122	0.9	0.2	-0.1	-0.1	-0.1	-0.5
129797R	12.5	1.95	13.98	2.86	8.55	1.38	9	1.37	0.26	0.17	1.8	5.1	7.3	124	0.7	0.3	-0.1	-0.1	-0.1	-0.5
71945	8.34	1.5	8.85	1.88	5.47	0.84	5.07	0.78	0.1	0.03	1	182	1.8	91	-0.5	-0.1	-0.1	-0.1	-0.1	1.1
71946	8.61	1.52	9.03	1.93	5.37	0.85	5.11	0.78	0.05	0.02	0.9	180	1.5	91	-0.5	-0.1	-0.1	-0.1	-0.1	-0.5
71947	8.26	1.43	8.32	1.82	5.16	0.81	5	0.73	0.14	0.22	1.2	177	1.8	90	-0.5	-0.1	-0.1	-0.1	-0.1	2.3
71948	8.77	1.52	8.86	1.92	5.49	0.85	5.21	0.78	0.08	0.11	1	183	1.9	89	-0.5	-0.1	-0.1	-0.1	-0.1	-0.5
71949	8.01	1.42	8.26	1.74	5.11	0.79	4.76	0.71	0.12	0.26	1.3	169	2	90	-0.5	-0.1	-0.1	-0.1	-0.1	2
73086	6.72	1.16	7.34	1.54	4.41	0.66	4.18	0.61	0.1	0.02	0.7	98.1	1.2	74	-0.5	-0.1	-0.1	-0.1	-0.1	0.7
121939R	7.53	1.17	8.42	1.74	5.07	0.75	4.89	0.71	0.22	0.24	0.9	151	1.6	81	0.7	-0.1	-0.1	-0.1	-0.1	-0.5
121940R	7.97	1.24	8.72	1.83	5.2	0.79	4.99	0.74	0.05	0.1	1.1	169	1.4	82	-0.5	-0.1	-0.1	-0.1	-0.1	-0.5
121970R	4.41	0.72	5.05	1.05	3	0.45	2.81	0.42	0.26	0.15	1.6	813	1	65	0.7	-0.1	-0.1	-0.1	0.3	1.8
121999R	5.35	0.84	5.97	1.28	3.66	0.54	3.47	0.52	0.15	0.18	0.2	98.1	1.3	65	0.9	0.1	-0.1	-0.1	-0.1	0.8
71971	4.49	0.82	4.83	1.04	2.89	0.43	2.85	0.42	0.11	0.02	0.4	95.2	0.7	49	0.7	0.1	0.1	0.1	0.1	0.5
71974	5.96	1.04	6.41	1.37	3.83	0.56	3.54	0.55	0.15	0.04	0.5	256	1.2	46	1	0.1	0.1	0.1	0.1	0.5

Table A5– Continued

Sample Number	Hg ppm	Tl ppm	Se ppm
71924	-0.01	-0.1	0.5
71923	0.01	-0.1	-0.5
71925	-0.01	-0.1	-0.5
71926	-0.01	-0.1	-0.5
71927	-0.01	-0.1	-0.5
71928	-0.01	-0.1	-0.5
71931	-0.01	-0.1	-0.5
71932	-0.01	-0.1	-0.5
71934	-0.01	-0.1	-0.5
71935	-0.01	-0.1	-0.5
71929	-0.01	-0.1	-0.5
71933	-0.01	-0.1	-0.5
71936	-0.01	-0.1	-0.5
71930-rep	-0.01	-0.1	-0.5
73088	-0.01	-0.1	-0.5
73083	-0.01	-0.1	-0.5
73113	-0.01	-0.1	-0.5
73087	-0.01	-0.1	-0.5
129796R	-0.01	-0.1	-0.5
129797R	-0.01	-0.1	-0.5
71945	-0.01	-0.1	-0.5
71946	-0.01	-0.1	-0.5
71947	-0.01	-0.1	0.7
71948	-0.01	-0.1	1.2
71949	-0.01	-0.1	1.8
73086	-0.01	-0.1	-0.5
121939R	-0.01	-0.1	-0.5
121940R	-0.01	-0.1	1.2
121970R	-0.01	-0.1	-0.5
121999R	-0.01	-0.1	-0.5
71971	0.01	0.1	0.5
71974	0.01	0.1	0.5

Table A5– Continued

Sample Number	BatchNumber	Acme	SiO ₂ wt%	Al ₂ O ₃ wt%	Fe ₂ O ₃ wt%	MgO wt%	CaO wt%	Na ₂ O wt%	K ₂ O wt%	TiO ₂ wt%	P ₂ O ₅ wt%	MnO wt%	Cr ₂ O ₃ wt%	Ni ppm	Sc ppm	LOI wt%	Ba ppm	Be ppm
129793R	SAN08002610		56.80	14.03	9.21	5.20	10.83	1.87	0.33	1.40	0.16	0.16	0.02	24	23	11.1	86	-1
73082	A723968		49.01	13.03	16.90	4.47	7.94	3.60	1.46	2.94	0.40	0.23	0.01	22	45	4.4	331	-1
73046	A723968		68.73	13.92	5.30	0.52	2.29	3.00	5.15	0.81	0.17	0.10	0.01	-20	10	2.2	751	2
73047	A723968		67.92	14.03	5.94	0.55	2.17	3.00	5.25	0.82	0.14	0.14	0.03	-20	9	1.8	710	2
73048	A723968		67.85	14.03	5.35	0.99	2.20	3.27	5.17	0.83	0.16	0.11	0.04	-20	10	1	738	2
73049	A723968		67.49	13.84	5.75	1.17	2.45	3.26	4.90	0.83	0.17	0.09	0.04	-20	11	0.8	756	2
71901	SAN08002928		67.28	13.69	5.55	0.60	6.18	2.26	3.29	0.82	0.17	0.13	0.03	-20	10	8	444	2
73050	A723968		64.17	13.27	8.92	1.58	3.66	3.27	3.62	1.10	0.29	0.12	0.01	-20	19	1.6	726	2
73094	A723968		47.43	17.18	12.09	7.68	9.57	3.87	0.40	1.44	0.18	0.15	0.01	66	32	6.9	142	-1
71902	SAN08002928		48.76	15.47	11.19	8.70	12.37	2.07	0.26	0.85	0.05	0.19	0.09	109	46	3.1	72	-1
73090	A723968		53.71	15.33	12.41	4.79	7.37	2.67	1.54	1.59	0.38	0.18	0.03	65	30	4.1	514	-1
73091	A723968		47.76	16.59	13.34	6.86	9.46	3.02	1.00	1.53	0.24	0.19	0.02	99	35	5.9	241	-1
73093	A723968		47.60	14.72	11.34	11.45	10.34	2.58	0.64	0.95	0.13	0.17	0.10	288	39	7.8	162	-1
73092	A723968		49.81	15.64	13.03	6.52	8.25	3.30	1.50	1.47	0.26	0.19	0.01	88	33	6.8	356	-1
73096	A723968		59.93	12.93	11.51	2.87	5.95	3.31	1.81	1.36	0.15	0.17	0.02	-20	34	3.5	217	1
73089	A723968		73.55	12.40	4.04	0.09	1.62	2.78	5.08	0.28	0.05	0.06	0.04	-20	7	0.7	1420	2
73097	A723968		61.87	13.55	9.58	2.10	4.81	2.90	3.25	1.50	0.29	0.13	0.01	-20	27	1.6	790	-1
73098	A723968		53.42	15.75	11.84	3.38	10.16	1.52	1.93	1.60	0.23	0.16	0.00	42	33	14.4	338	-1
73099	A723968		55.86	14.45	11.92	4.99	5.96	2.80	2.20	1.43	0.19	0.18	0.03	39	37	5.1	434	2
73100	A723968		51.92	16.48	11.53	2.73	11.24	2.37	1.88	1.49	0.17	0.18	0.01	47	40	10.7	331	-1
73051	A722698		50.83	15.44	9.46	8.65	8.28	2.75	2.00	1.88	0.52	0.15	0.05	153	20	8.2	495.6	2
73052	A722698		48.48	15.54	10.97	7.91	11.13	2.74	1.31	1.40	0.33	0.13	0.06	150	26	8	376.3	2
73053	A722698		48.91	15.83	10.40	8.68	9.10	2.77	1.74	1.66	0.64	0.24	0.05	126	22	7.4	582.3	3
73101	A723968		49.68	15.76	10.06	8.19	8.84	2.98	1.89	1.82	0.59	0.13	0.06	161	24	5.7	598	2
73102	A723968		49.49	14.83	11.48	6.78	12.35	2.74	0.69	1.23	0.23	0.16	0.04	87	32	8.1	249	-1
73103	A723968		47.78	15.20	11.27	9.67	9.84	2.89	1.00	1.50	0.62	0.16	0.07	188	26	5.8	583	1
73104	A723968		49.76	15.02	10.93	8.96	9.47	2.73	1.27	1.36	0.29	0.14	0.07	194	26	8.7	388	-1
73110	A723968		74.26	11.72	3.92	0.18	1.94	0.75	6.85	0.24	0.04	0.06	0.05	-20	8	3.4	1263	2
73111	A723968		76.45	10.84	3.57	0.06	1.59	1.70	5.41	0.24	0.04	0.06	0.04	-20	7	2.3	1193	2
73112	A723968		75.68	11.34	3.61	0.05	1.04	2.05	5.82	0.23	0.05	0.06	0.05	-20	7	1.7	1306	1
71908	SAN08002928		69.89	13.08	5.64	0.34	2.72	2.23	5.15	0.65	0.19	0.07	0.03	-20	12	3.2	944	3
73107	A723968		70.28	12.66	5.98	1.16	1.49	2.14	5.27	0.67	0.20	0.10	0.03	-20	13	2.7	922	2

Table A5– Continued

Sample Number	Co	Cs	Ga	Hf	Nb	Rb	Sn	Sr	Ta	Th	U	V	W	Zr	Y	La	Ce	Pr	Nd	Sm	Eu
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
129793R	24.3	0.2	13.6	3.1	15.2	7.6	-1	126	0.9	2	0.3	191	-0.5	112	25.3	10.9	24	3.47	15	3.81	1.3
73082	41.5	0.1	19.4	6.6	33.5	28.5	1	203	2.1	4.4	0.8	442	1.1	235	55.4	22.7	51	7.19	30	7.49	2.3
73046	9.1	3.7	16.8	14	38.1	202.5	4	105	2.4	21	1.7	45	1.5	503	46.3	45.8	91	11.96	42.1	7.82	1.3
73047	9.2	3.9	16.9	13	39.3	209.5	4	85.9	2.6	22.3	3.5	43	2	474	58.1	50.4	110	13.22	49.5	8.94	1.3
73048	8.7	3	16.7	12	37.8	189.5	4	91	2.5	19.3	3.1	41	1.4	442	48.8	44.5	91	11.92	41	7.74	1.3
73049	10	3.2	17.6	12	35.7	187.6	3	103	2.3	19.4	3	48	1.9	436	55.8	47.4	101	12.82	44.9	9.17	1.5
71901	7.1	5.7	16.7	12	34.3	127.1	4	43.1	2.1	18.3	3.3	56	2.2	423	52.5	41.4	93	10.35	39.6	7.83	1.2
73050	14	2.4	20.5	11	28.6	127.1	3	139	1.9	13	1.8	86	1.2	380	66.4	43.6	95	12.71	46.3	10.03	2.2
73094	50	1.7	16.8	2.4	12.4	12.6	-1	374	0.9	0.7	0.2	205	0.7	93.7	22.1	8.1	19	2.57	11.8	3.11	1.2
71902	53	0.4	14.9	0.9	3.4	6	-1	180	0.2	0.5	-0.1	298	-0.5	39.3	15.8	3	7.1	1.04	5.1	1.6	0.7
73090	38.1	1	18.8	5.5	18.8	50.3	-1	250	1.2	6.4	0.7	219	-0.5	214	38.9	28.8	62	8.54	33.7	6.96	1.7
73091	48.9	0.4	16.7	3.1	12.1	19.1	-1	229	0.8	2.1	0.2	248	-0.5	116	26.5	12.5	27	3.69	16.7	3.66	1.2
73093	52.6	13.8	12.5	1.6	5.7	15.4	-1	213	0.5	0.6	-0.1	231	-0.5	61.8	19.5	6.5	15	2.03	9.2	2.36	0.9
73092	44.6	0.3	15.1	3.6	11.4	39	-1	295	0.7	2.5	0.3	226	-0.5	125	26	14.4	31	4.26	18.5	4.15	1.3
73096	34.5	1.9	18.5	4	11.1	57.9	2	102	0.8	6.2	1.3	250	1	131	28.9	19.4	43	5.34	20.6	5.02	1.3
73089	1.4	2.9	17.9	13	26	187.1	3	123	1.9	15.6	2.1	-8	0.7	483	54.6	63.5	125	17.37	66.2	11.99	2.2
73097	22.4	0.7	17.2	6.9	14.1	104.5	2	225	0.9	10.6	1.1	238	0.7	249	38.3	43.7	91	11.32	43.5	8.44	2
73098	32.7	0.8	16.3	4.7	9.2	60.9	-1	103	0.6	6.7	0.6	214	0.8	164	33.3	25.3	53	6.54	26.3	5.74	1.5
73099	36.8	1.1	17.9	4.7	8.8	72.3	1	165	0.5	6	0.6	235	0.8	157	31.2	23.6	49	6.22	24.3	5.26	1.5
73100	34.6	1.9	17.4	3.5	7.4	55	-1	160	0.6	4.4	0.5	242	1.2	137	30	17.4	36	4.8	19.3	4.77	1.4
73051	38.7	2.2	16.6	4.1	56.6	36.5	1	646	2.7	4.3	1.3	168	0.9	177	19.7	28	52	6.3	24.6	4.47	1.5
73052	50.2	1	16.6	2.9	41.8	26.9	1	523	2	3.2	0.9	199	0.9	116	18.8	20.3	37	4.58	19	3.59	1.2
73053	44.4	1.9	20.6	4.1	89.6	35.4	1	883	4.2	5.9	1.7	180	1.1	207	20.9	40	70	8.14	32.3	5.55	1.7
73101	37.4	3.3	16.6	4.3	55.7	31.1	-1	588	4.1	4.7	1.3	168	0.8	172	18.5	31	55	6.5	24.9	5.05	1.6
73102	42.4	2.6	15.9	2.2	17.9	27.3	-1	432	1	1.5	0.5	205	0.7	77	16.3	12.5	25	3.21	13	3.26	1.2
73103	45.9	9.4	16.3	3.5	75.6	16.3	-1	709	4	4.8	1.4	186	0.7	161	16.2	36.1	62	6.92	25.3	4.61	1.6
73104	42.3	1.5	17.7	2.8	50.4	31.1	-1	380	3.1	2.8	1.1	174	1.5	116	16.4	19.8	37	4.53	17.9	3.95	1.3
73110	1.5	2.2	18.9	11	32.2	199.7	4	55.2	2.6	23.7	1.9	16	1.5	382	70	85.3	165	21.2	80.3	15.11	2.2
73111	2.1	2.3	15	11	31.2	179	4	66.7	1.9	21.2	2	-8	1.1	385	63.2	75.6	159	19.04	69.8	14.22	2.2
73112	2	2.4	16.5	11	31.8	201.7	4	101	1.8	24.9	2	-8	1.3	382	64.5	77.7	170	20.06	74	14.58	2.4
71908	5.9	3.1	17.4	11	23.1	180.1	3	89.5	1.4	17.5	2.7	33	1.6	382	52	56.2	116	14.47	56.8	10.28	2
73107	6.8	2.9	16.2	10	22.5	169	3	87.8	2.6	17.2	2.7	29	1.6	358	48.5	55.8	112	13.79	50.3	10.05	1.9

Table A5– Continued

Sample Number	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	TOT/C	TOT/S	Mo	Cu	Pb	Zn	As	Cd	Sb	Bi	Ag	Au
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	wt%	wt%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppb
129793R	4.17	0.65	4.54	0.95	2.66	0.41	2.58	0.38	0.91	1.61	0.1	77.3	1.3	48	5.8	-0.1	-0.1	0.3	-0.1	-0.5
73082	9.01	1.57	9.78	1.98	5.87	0.89	5.47	0.82	0.11	-0.02	0.5	70.9	3.3	86	-0.5	-0.1	-0.1	-0.1	-0.1	1.4
73046	7.92	1.35	7.93	1.64	5.02	0.76	4.88	0.71	0.1	-0.02	0.8	15	2.5	40	2.4	-0.1	-0.1	-0.1	-0.1	1
73047	9.06	1.53	9.2	1.97	5.76	0.87	5.53	0.83	0.12	-0.02	1	37.9	2.3	62	4.5	-0.1	0.1	-0.1	-0.1	18.4
73048	7.96	1.35	8.21	1.67	5.2	0.83	5.02	0.75	0.05	-0.02	1	17	2.8	46	3.5	-0.1	0.1	-0.1	-0.1	1.1
73049	9.19	1.59	9.35	1.97	5.97	0.9	5.61	0.86	0.03	-0.02	1.1	18.2	2.1	37	-0.5	-0.1	-0.1	-0.1	-0.1	1.7
71901	8.24	1.41	8.65	1.77	5.11	0.8	4.93	0.75	0.58	-0.02	0.5	44.2	10	33	6.5	-0.1	-0.1	-0.1	-0.1	2.1
73050	10.5	1.8	11.39	2.34	7.01	1.12	6.62	1.05	0.07	-0.02	0.7	26.9	2.4	52	1.5	-0.1	0.1	-0.1	-0.1	1.1
73094	3.58	0.65	4.31	0.79	2.34	0.37	2.1	0.34	0.11	0.02	0.3	41.8	2.5	65	5.4	-0.1	-0.1	-0.1	-0.1	0.7
71902	2.11	0.41	2.59	0.56	1.59	0.26	1.6	0.25	0.08	-0.02	0.1	117	0.6	37	0.7	-0.1	-0.1	0.2	-0.1	5.9
73090	7.04	1.2	7.24	1.53	4.36	0.67	4.11	0.59	0.05	-0.02	0.3	43.9	2.9	75	-0.5	0.1	-0.1	-0.1	-0.1	1.3
73091	4.46	0.84	4.93	1	3.24	0.47	2.86	0.45	0.07	0.02	0.3	61.5	2.4	67	1.4	-0.1	-0.1	-0.1	-0.1	-0.5
73093	2.82	0.51	3.39	0.73	1.99	0.32	2.04	0.32	0.22	0.05	0.1	70.3	2	50	-0.5	-0.1	-0.1	-0.1	-0.1	2.9
73092	4.52	0.86	5.05	1.05	3.13	0.49	2.92	0.45	0.11	-0.02	0.1	57.1	3.2	71	-0.5	-0.1	-0.1	-0.1	-0.1	-0.5
73096	5.01	0.88	5.11	1.05	2.98	0.47	2.78	0.45	0.09	-0.02	0.7	31.4	13	78	1.4	-0.1	0.1	-0.1	-0.1	0.8
73089	10.3	1.7	9.74	1.93	5.47	0.88	5.68	0.85	0.08	-0.02	0.6	3.2	3	29	1.1	-0.1	-0.1	-0.1	-0.1	3.4
73097	7.96	1.24	7.18	1.38	3.96	0.61	3.57	0.53	0.03	-0.02	0.4	18.7	5.4	69	0.7	-0.1	-0.1	-0.1	-0.1	0.8
73098	5.97	1.01	5.68	1.2	3.37	0.52	3.25	0.51	1.53	0.03	0.2	104	4.3	74	-0.5	-0.1	-0.1	-0.1	-0.1	2.3
73099	5.41	0.96	5.51	1.09	3.2	0.49	3.13	0.5	0.25	-0.02	0.3	120	3.5	69	0.7	-0.1	-0.1	-0.1	-0.1	2
73100	4.83	0.88	5.17	1.07	2.91	0.47	2.9	0.43	1.4	0.05	0.4	136	4.1	66	1.1	0.1	-0.1	-0.1	-0.1	3.1
73051	4.09	0.69	3.54	0.62	1.65	0.23	1.48	0.22	0.14	0.02	1	47.6	2.4	61	2.2	0.1	-0.1	-0.1	-0.1	1.2
73052	3.46	0.59	3.13	0.58	1.55	0.21	1.46	0.21	0.45	-0.01	0.5	68.8	1.7	53	1.3	-0.1	-0.1	-0.1	-0.1	-0.5
73053	4.69	0.76	3.48	0.65	1.76	0.23	1.57	0.24	0.17	-0.01	1.2	53.6	1.6	55	3.8	0.1	0.1	-0.1	-0.1	1.2
73101	4.33	0.69	3.4	0.66	1.8	0.26	1.57	0.25	0.12	-0.02	1.3	48.1	2.6	56	-0.5	-0.1	-0.1	-0.1	-0.1	1.1
73102	3.32	0.55	3.24	0.58	1.64	0.24	1.5	0.24	0.53	-0.02	0.4	121	2.8	53	0.9	-0.1	-0.1	-0.1	-0.1	1.8
73103	4.09	0.6	3.32	0.6	1.52	0.23	1.44	0.21	0.09	-0.02	2	55.9	2.7	49	-0.5	-0.1	-0.1	-0.1	-0.1	1.4
73104	3.73	0.58	3.21	0.64	1.62	0.24	1.43	0.22	0.41	-0.02	0.8	34.5	5.8	62	2.8	-0.1	-0.1	-0.1	-0.1	2.9
73110	12.8	2.2	12.71	2.62	7.02	1.19	6.85	1.07	0.34	-0.02	0.8	4.1	21	57	2.2	-0.1	0.1	-0.1	-0.1	4
73111	12.4	2.09	11.71	2.28	6.23	1.1	6.05	0.92	0.25	-0.02	0.7	6.1	12	77	2.6	-0.1	0.1	-0.1	-0.1	3.6
73112	13	2.07	12.55	2.3	6.53	1.12	6.38	0.97	0.12	-0.02	0.9	6	7.5	66	2.7	-0.1	0.2	-0.1	-0.1	3.6
71908	9.46	1.59	8.82	1.78	5.34	0.81	5.01	0.75	0.26	-0.02	0.5	6.9	6.9	68	3.3	-0.1	0.2	-0.1	-0.1	2.5
73107	9.29	1.56	8.94	1.79	4.91	0.8	4.82	0.77	0.05	-0.02	0.7	7.9	7.6	69	3	-0.1	0.2	-0.1	-0.1	0.8

Table A5– Continued

Sample Number	Hg ppm	Tl ppm	Se ppm
129793R	-0.01	-0.1	-0.5
73082	-0.01	-0.1	-0.5
73046	-0.01	-0.1	-0.5
73047	-0.01	-0.1	-0.5
73048	-0.01	-0.1	-0.5
73049	-0.01	-0.1	-0.5
71901	-0.01	-0.1	-0.5
73050	-0.01	-0.1	-0.5
73094	-0.01	-0.1	-0.5
71902	-0.01	-0.1	-0.5
73090	-0.01	-0.1	-0.5
73091	-0.01	-0.1	-0.5
73093	-0.01	-0.1	-0.5
73092	-0.01	-0.1	-0.5
73096	-0.01	-0.1	-0.5
73089	-0.01	-0.1	-0.5
73097	-0.01	-0.1	-0.5
73098	-0.01	-0.1	-0.5
73099	-0.01	-0.1	-0.5
73100	-0.01	-0.1	-0.5
73051	0.01	-0.1	-0.5
73052	-0.01	-0.1	-0.5
73053	0.01	-0.1	-0.5
73101	-0.01	-0.1	-0.5
73102	0.01	-0.1	-0.5
73103	-0.01	-0.1	-0.5
73104	-0.01	-0.1	-0.5
73110	-0.01	-0.1	-0.5
73111	-0.01	-0.1	-0.5
73112	-0.01	-0.1	-0.5
71908	-0.01	-0.1	0.6
73107	-0.01	-0.1	-0.5

Table A5– Continued

Sample Number	BatchNumber	Acme	SiO2 wt%	Al2O3 wt%	Fe2O3 w%	MgO w%	CaO w%	Na2O w%	K2O w%	TiO2 w%	P2O5 w%	MnO w%	Cr2O 3 w%	Ni ppm	Sc ppm	LOI wt%	Ba ppm	Be ppm
73106*	A723968		67.01	15.16	6.92	0.82	4.89	2.71	1.53	0.69	0.22	0.05	0.00	-20	12	12.8	862	-1
73105	A723968		65.62	15.25	7.61	1.67	4.72	2.53	1.45	0.81	0.24	0.08	0.01	-20	14	12.8	988	2
73054	A722698		53.74	15.11	11.75	5.04	8.40	3.46	0.70	1.40	0.19	0.17	0.03	84	31	6.1	311.8	1
73055	A722698		54.44	14.19	12.78	4.99	7.30	2.78	1.16	1.89	0.22	0.23	0.01	37	35	5.8	378.9	1
73056	A722698		57.96	13.24	10.95	5.44	6.60	3.34	0.77	1.35	0.15	0.19	0.01	29	33	7.6	459.4	2
73061	723647		67.02	13.39	6.79	1.44	2.56	2.94	4.67	0.81	0.22	0.10	0.07	-20	15	1.7	764	2
73062	723647		67.99	13.41	6.09	1.05	2.48	3.19	4.65	0.78	0.22	0.09	0.03	-20	14	1.2	729	1
73063	723647		67.63	12.78	6.04	1.04	3.51	2.88	5.05	0.76	0.18	0.09	0.03	-20	13	3	704	2
73064	723647		68.12	13.21	6.08	0.99	2.90	3.07	4.52	0.80	0.19	0.10	0.02	-20	13	1.5	694	2
73065	723647		68.06	13.29	6.15	1.19	2.59	2.98	4.62	0.80	0.22	0.09	0.02	-20	14	1.2	810	2
73066	723647		64.60	13.63	7.76	1.91	3.50	3.06	4.24	0.93	0.23	0.10	0.03	21	20	1.2	704	2
73070	723647		66.93	13.62	6.48	1.53	3.00	3.02	4.29	0.82	0.20	0.08	0.02	-20	15	1.1	780	2
73072	723647		67.61	13.51	6.31	1.14	2.90	3.00	4.38	0.82	0.22	0.10	0.02	-20	14	1.2	767	2
73079	723647		67.39	13.44	6.29	1.07	3.11	3.08	4.45	0.83	0.19	0.10	0.05	20	14	0.5	698	1
73080	723647		67.28	13.52	6.26	1.02	3.01	3.15	4.63	0.83	0.19	0.09	0.02	28	14	0.8	752	2
71911	SAN08002928		49.93	16.52	9.77	8.83	10.57	2.95	0.37	0.78	0.05	0.16	0.06	131	35	5.5	86	-1
73060	723647		50.57	17.02	9.86	7.62	10.62	2.51	0.70	0.83	0.06	0.14	0.07	162	36	3.7	167	1
73067	723647		53.14	15.73	10.27	6.44	9.24	2.55	1.32	0.98	0.14	0.15	0.04	93	35	2.7	268	-1
73068	723647		49.64	16.78	9.69	8.89	10.90	2.66	0.41	0.77	0.08	0.15	0.04	148	37	1.9	123	-1
73071	723647		52.02	15.52	11.36	6.54	9.28	2.66	1.03	1.26	0.14	0.16	0.03	91	36	1.3	270	-1
73073	723647		50.72	16.68	10.18	7.80	9.93	2.48	0.95	0.95	0.11	0.17	0.04	119	36	3.3	184	-1
73074	723647		54.42	15.31	9.64	6.39	8.85	2.71	1.52	0.81	0.13	0.15	0.05	85	34	1.4	286	1
73075	723647		50.03	16.18	9.95	9.02	10.67	2.70	0.42	0.72	0.09	0.17	0.05	161	36	3	105	-1
73076	723647		50.56	16.93	9.93	8.02	10.56	2.24	0.66	0.81	0.09	0.15	0.04	132	34	1.6	162	-1
73077	723647		50.04	16.00	10.53	8.29	10.78	2.38	0.77	0.89	0.11	0.16	0.04	145	40	1.4	172	-1
73078	723647		52.32	14.78	10.57	6.94	10.59	2.64	0.90	0.92	0.11	0.17	0.05	75	46	1.1	184	-1
71912	SAN08002928		50.14	16.98	8.39	9.65	10.76	2.79	0.39	0.59	0.05	0.14	0.12	161	32	6.1	86	-1
73069	723647		51.72	15.83	10.22	7.38	9.41	3.15	1.12	0.86	0.13	0.15	0.03	101	33	1.9	252	-1
73081	723647		50.59	16.17	10.24	8.33	9.85	3.17	0.54	0.82	0.08	0.16	0.04	160	36	2	150	-1
73140	SAN08001455		51.67	16.56	11.98	4.17	8.23	3.42	1.25	2.09	0.41	0.21	0.01	-20	28	9.8	354	-1
73144	SAN08001455		49.96	16.54	12.27	4.12	8.48	3.80	1.20	2.67	0.64	0.31	0.01	-20	28	5.5	492	1
73148	SAN08001455		48.51	15.05	14.94	5.15	8.22	3.45	1.38	2.59	0.53	0.18	0.01	-20	38	4.8	425	1

Table A5– Continued

Sample Number	Co ppm	Cs ppm	Ga ppm	Hf ppm	Nb ppm	Rb ppm	Sn ppm	Sr ppm	Ta ppm	Th ppm	U ppm	V ppm	W ppm	Zr ppm	Y ppm	La ppm	Ce ppm	Pr ppm	Nd ppm	Sm ppm	Eu ppm
73106*	5.7	2.2	24.8	9.5	23.5	55.3	3	1113	1.6	19.9	4.7	20	0.8	348	45.8	54.1	102	13.02	48.2	9.32	1.9
73105	7.8	2.3	18.6	9.9	24	64.3	3	1166	1.5	16.5	2.3	37	-0.5	364	52.7	63.9	129	15.37	55	10.35	2.2
73054	36.8	0.9	18.8	3.3	18.8	21.8	1	366	0.9	2.6	1	233	1	114	30.6	20.1	34	4.79	20.7	4.21	1.3
73055	40	0.9	20.9	5.7	15.7	35.7	2	275	0.9	8.2	1.8	298	0.6	199	44.7	31.9	61	8.25	34.3	7.05	1.7
73056	39	1.1	21.2	4.9	10.3	27.8	1	354	0.5	6.4	1.4	257	0.4	170	37.7	26	53	7.21	29.8	6.18	1.4
73061	10.7	2.7	19.2	11	29.6	165.9	4	108	1.9	15.4	2.4	63	1.7	374	58.6	44.9	98	11.66	48.4	9.53	1.7
73062	9	2.8	16.8	9.6	28.1	149.9	3	109	1.7	17.6	2.2	38	1.4	357	58.3	46.3	95	11.68	46.4	9.18	1.8
73063	8.5	3.9	14.4	10	28.3	168.9	3	89	1.7	15.9	2.2	48	1.9	354	58.7	45.3	93	11.25	44.9	9.07	1.7
73064	8.2	2.8	14.9	11	29.3	148.1	4	103	2	15.3	2	45	1.6	356	60.3	46.6	96	11.74	46.1	9.34	1.6
73065	9.4	3.3	19	12	32.6	172.5	4	108	2	17.1	2.6	53	1.5	406	59.5	46.7	100	12.01	47.9	9.56	1.7
73066	13.4	2.9	16.9	9.6	25.1	135.6	3	120	1.7	13.2	2	89	1.4	320	57.7	41.1	86	10.71	40.4	8.59	1.7
73070	12.1	3	20.8	11	31.6	162.4	4	115	1.9	16.1	2.5	60	1.4	385	58.3	46	99	11.74	46.9	9.36	1.7
73072	9.1	2.2	18.2	12	31.7	156.1	4	105	1.9	16.1	2.5	51	1.2	398	58	45.2	98	11.94	46.8	9.27	1.7
73079	9.7	2	17.7	11	31	151.9	4	105	2	16.4	2.4	45	1.4	380	59.7	48.2	98	12.25	45.6	9.47	1.7
73080	9.1	2	16.1	11	30.6	161.6	3	101	2	15.7	2.5	43	1.5	367	58.7	46.7	96	11.84	45.5	9.35	1.6
71911	46	2.3	14	1.3	4.4	11.4	-1	179	0.2	1.5	0.3	240	-0.5	46.5	16.4	5.5	12	1.62	6.8	1.83	0.7
73060	42.5	0.8	14.5	2.3	8.3	18.4	1	212	0.4	3.2	0.4	222	0.6	71	21.6	10.2	23	2.9	12.1	2.74	0.9
73067	38.7	0.8	16.7	3.9	11.3	39.3	2	191	0.7	3.5	0.7	218	0.5	133	29.8	15.1	32	4.25	18.4	4.21	1.2
73068	44.2	8.5	15.3	1.6	5.9	10.3	-1	195	0.3	1.7	0.2	220	-0.5	49.1	17.5	6.5	15	1.98	8.4	2.06	0.7
73071	43.2	2.4	18.1	4.5	11.8	34.5	2	180	0.7	4.2	0.6	330	-0.5	157	29.4	14.9	32	4.04	17.3	3.98	1.2
73073	44.6	0.8	16.5	2.5	8.6	34.6	1	183	0.5	3.8	0.6	240	0.7	85.8	20.9	11.5	24	3.07	12.3	2.92	0.9
73074	36.1	0.8	16.8	4.3	11.7	50.6	1	169	0.7	5.5	0.8	191	-0.5	135	30.2	16.9	36	4.57	19.2	4.39	1.2
73075	47.2	1	14.1	1.7	5.2	14.6	-1	180	0.3	1.4	0.2	233	-0.5	57.4	16.5	5.7	12	1.6	7	1.86	0.7
73076	42.6	0.4	14.7	1.8	5.4	18.4	-1	192	0.3	2.2	0.4	208	-0.5	59	16.2	8.8	19	2.47	10.7	2.33	0.8
73077	44.5	0.3	15.6	2.4	6.9	23.9	1	181	0.5	2.1	0.4	249	-0.5	78.1	23.6	9.5	21	2.84	11.3	2.84	0.9
73078	40.1	0.5	14.7	2.4	8.1	24.2	1	173	0.4	2.4	0.4	254	-0.5	78.6	25.6	10.4	23	2.94	12.2	3.34	1
71912	44.2	14.4	12.8	1.3	4.4	14.2	-1	173	0.3	1.1	0.2	171	0.5	46.1	13.7	5.2	11	1.44	6.3	1.56	0.6
73069	44.5	4.3	15.9	3.3	10.9	34.6	1	176	0.6	3.4	0.5	193	-0.5	108	26.4	14	31	3.9	16.2	3.74	1.1
73081	46.5	2.8	13.1	2	6.7	17.6	-1	188	0.4	1.3	0.3	225	-0.5	63	21.1	8.6	18	2.44	10.3	2.63	0.9
73140	31	1.6	19.9	4	28.8	26.6	2	454	1.6	2.6	0.6	271	2.4	152	31.5	17.1	36	4.89	22	5.19	1.9
73144	34.1	2.7	20.4	5.1	42.2	25.3	1	453	2.5	2.9	0.8	276	14.6	192	38.2	25.8	53	6.99	29.8	7.06	2.5
73148	39.2	0.5	22.4	5	38.2	28.7	2	313	2.3	3.6	0.7	388	30.8	217	41.2	22.7	48	6.54	28.9	6.82	2.4

Table A5– Continued

Sample Number	Gd ppm	Tb ppm	Dy ppm	Ho ppm	Er ppm	Tm ppm	Yb ppm	Lu ppm	TOT/C wt%	TOT/S wt%	Mo ppm	Cu ppm	Pb ppm	Zn ppm	As ppm	Cd ppm	Sb ppm	Bi ppm	Ag ppm	Au ppb
73106*	8.41	1.39	8.24	1.63	4.61	0.75	4.67	0.7	0.21	-0.02	0.2	15.4	25	41	4.7	0.1	0.3	-0.1	-0.1	0.7
73105	9.79	1.65	9.51	1.86	5.13	0.83	5.2	0.78	0.11	-0.02	0.4	15.2	24	64	3.6	-0.1	-0.1	-0.1	-0.1	2.1
73054	4.56	0.83	4.27	0.89	2.45	0.35	2.36	0.34	0.04	0.02	0.3	63.3	3.1	48	0.7	0.1	0.2	-0.1	-0.1	1.8
73055	6.94	1.26	6.58	1.34	3.78	0.55	3.6	0.55	0.03	-0.01	0.1	35.6	7.7	41	0.7	0.1	-0.1	0.1	-0.1	6.5
73056	5.86	1.03	5.54	1.16	3.17	0.5	3.07	0.44	0.07	-0.01	0.2	47.2	7.1	55	1	0.1	-0.1	-0.1	-0.1	0.9
73061	9.44	1.68	9.98	2.01	5.88	0.92	5.85	0.87	0.07	0.02	1.7	31.9	10	63	8	-0.1	0.2	-0.1	-0.1	1.2
73062	8.96	1.66	9.7	2.01	6.09	0.97	5.82	0.88	0.04	0.1	1.4	30.5	9	52	40.2	-0.1	0.3	-0.1	-0.1	2
73063	8.83	1.6	9.18	2	6.18	0.95	5.7	0.89	0.33	0.07	0.9	28.6	10	60	12.2	0.2	0.9	0.1	-0.1	-0.5
73064	9.17	1.66	9.22	2.03	6.07	0.96	5.82	0.88	0.06	0.11	1.4	29.5	7.7	53	8.4	-0.1	0.6	-0.1	-0.1	1.6
73065	9.78	1.7	10.14	2.07	6.04	0.92	6.12	0.91	0.03	0.06	1.3	30.9	6.1	60	5.7	-0.1	0.6	0.1	-0.1	-0.5
73066	8.72	1.53	9.23	1.98	6.09	0.87	5.57	0.85	0.04	0.02	1.5	60.8	5.8	80	4	-0.1	0.5	-0.1	-0.1	0.7
73070	9.58	1.63	9.72	2.05	5.95	0.94	6	0.91	0.02	0.02	1.4	31.5	5.3	57	2.3	0.1	0.4	-0.1	-0.1	1.5
73072	9.59	1.66	9.74	2.04	5.95	0.96	6.1	0.9	0.03	-0.02	1.3	30.1	5.1	52	4	-0.1	0.5	-0.1	-0.1	-0.5
73079	9.18	1.67	9.79	2.12	6.41	0.97	5.95	0.9	0.02	-0.02	1.6	34	7.9	59	2.7	-0.1	0.4	-0.1	-0.1	1.1
73080	9.3	1.65	9.59	2.01	6.23	0.9	5.96	0.9	0.02	-0.02	1.6	30.3	7.7	54	2.3	-0.1	0.2	-0.1	-0.1	-0.5
71911	2.24	0.44	2.71	0.61	1.8	0.27	1.7	0.25	0.16	0.04	0.2	101	1.3	30	32.5	-0.1	-0.1	-0.1	-0.1	2.7
73060	3.17	0.57	3.4	0.73	2.18	0.36	2.16	0.33	0.12	0.09	1.5	127	3.3	47	14.4	-0.1	-0.1	-0.1	-0.1	3
73067	4.33	0.79	4.77	1.08	3.27	0.48	2.95	0.47	0.05	0.02	0.3	124	2.8	46	5.1	-0.1	0.4	-0.1	-0.1	1.2
73068	2.63	0.47	2.82	0.59	1.88	0.28	1.77	0.26	0.03	0.02	0.3	108	1.7	18	2.9	-0.1	1	-0.1	-0.1	1.5
73071	4.46	0.82	4.99	1.05	3.18	0.49	3.04	0.44	0.03	0.05	0.5	111	2	38	2.2	-0.1	0.6	0.1	-0.1	2
73073	3.33	0.59	3.68	0.77	2.18	0.34	2.15	0.33	0.05	0.02	0.4	112	2.1	35	3.9	-0.1	0.3	0.1	-0.1	1.8
73074	4.95	0.85	5.42	1.11	3.15	0.5	3.17	0.48	0.07	0.08	0.5	109	1.7	31	2.3	-0.1	0.2	-0.1	-0.1	1.8
73075	2.39	0.44	2.85	0.61	1.71	0.29	1.83	0.28	0.05	0.2	0.6	127	0.9	27	4.2	-0.1	0.6	-0.1	-0.1	1.9
73076	2.64	0.48	2.79	0.62	1.72	0.29	1.79	0.27	0.03	0.02	0.2	108	1.7	22	1.1	-0.1	0.1	-0.1	-0.1	0.9
73077	3.4	0.63	3.78	0.85	2.52	0.37	2.37	0.34	0.03	0.02	0.2	133	1.4	29	1	-0.1	0.1	-0.1	-0.1	2.4
73078	3.6	0.65	4.14	0.95	2.7	0.42	2.51	0.39	0.03	0.08	0.4	135	1.3	26	1.8	-0.1	0.4	-0.1	-0.1	2.6
71912	1.87	0.36	2.17	0.47	1.43	0.22	1.42	0.21	0.1	0.02	1.3	62.5	3.9	28	4.8	-0.1	0.3	0.1	-0.1	4.5
73069	4.11	0.75	4.49	0.95	2.78	0.42	2.68	0.41	0.03	0.24	0.2	98	2.5	25	3.4	-0.1	1.1	-0.1	-0.1	1.2
73081	3.01	0.58	3.67	0.77	2.38	0.34	2.21	0.34	0.03	0.02	0.3	105	1.9	28	0.8	-0.1	-0.1	-0.1	-0.1	2.1
73140	6.02	1.04	5.98	1.25	3.63	0.56	3.39	0.48	0.68	0.04	0.5	78.1	1.9	71	0.6	0.3	-0.1	-0.1	-0.1	0.6
73144	8.08	1.34	7.29	1.53	4.34	0.64	3.83	0.57	0.19	0.04	0.9	46.9	2.6	57	1.7	0.2	-0.1	-0.1	-0.1	1
73148	8.07	1.38	7.81	1.63	4.82	0.75	4.6	0.66	0.15	-0.02	0.6	81.3	1.3	96	-0.5	0.2	-0.1	-0.1	-0.1	-0.5

Table A5– Continued

Sample Number	Hg ppm	Tl ppm	Se ppm
73106*	0.16	-0.1	-0.5
73105	-0.01	-0.1	-0.5
73054	0.01	-0.1	-0.5
73055	0.02	-0.1	-0.5
73056	-0.01	-0.1	0.5
73061	-0.01	-0.1	0.9
73062	-0.01	-0.1	0.7
73063	0.02	-0.1	2.9
73064	-0.01	-0.1	1.1
73065	-0.01	-0.1	0.9
73066	-0.01	-0.1	0.7
73070	-0.01	-0.1	0.7
73072	-0.01	-0.1	0.6
73079	-0.01	-0.1	0.6
73080	-0.01	-0.1	-0.5
71911	-0.01	-0.1	-0.5
73060	-0.01	-0.1	0.6
73067	-0.01	-0.1	1
73068	-0.01	-0.1	0.7
73071	-0.01	-0.1	-0.5
73073	-0.01	-0.1	0.5
73074	-0.01	-0.1	-0.5
73075	-0.01	-0.1	-0.5
73076	-0.01	-0.1	-0.5
73077	-0.01	-0.1	-0.5
73078	-0.01	-0.1	-0.5
71912	-0.01	-0.1	-0.5
73069	-0.01	-0.1	-0.5
73081	-0.01	-0.1	-0.5
73140	-0.01	-0.1	-0.5
73144	-0.01	-0.1	-0.5
73148	-0.01	-0.1	-0.5

Table A5– Continued

Sample Number	BatchNumber	Acme	SiO ₂ wt%	Al ₂ O ₃ wt%	Fe ₂ O ₃ w%	MgO w%	CaO w%	Na ₂ O w%	K ₂ O w%	TiO ₂ w%	P ₂ O ₅ w%	MnO w%	Cr ₂ O ₃ 3 w%	Ni ppm	Sc ppm	LOI wt%	Ba ppm	Be ppm
73150	SAN08001455		50.90	15.15	12.98	4.06	8.75	3.70	1.13	2.55	0.55	0.22	0.01	-20	32	9.2	312	2
73161	SAN08001455		46.69	17.15	13.98	4.60	9.12	3.46	1.29	2.83	0.63	0.23	0.01	-20	31	6.8	406	-1
73175	SAN08001564		46.34	16.16	14.35	4.66	9.47	3.80	1.20	2.93	0.76	0.32	0.01	-20	25	5.4	340	2
73208	SAN08001649		48.38	18.74	11.68	5.11	8.88	3.27	1.57	1.73	0.36	0.27	0.01	34	31	7.6	409	2
73376	SAN08002548		45.87	16.80	13.46	5.66	9.64	3.29	1.68	2.73	0.62	0.25	0.01	36	25	6.5	586	1
73377	SAN08002548		45.29	16.95	13.74	5.48	10.02	3.22	1.69	2.73	0.62	0.26	0.01	46	25	5.8	604	1
73387	SAN08002548		48.26	16.20	13.34	4.86	10.49	2.96	1.15	2.27	0.29	0.17	0.01	36	42	5	273	1
73441	SAN08002548		48.60	19.85	10.29	4.74	9.23	4.64	0.66	1.51	0.27	0.19	0.01	42	27	4.9	254	1
71917	SAN08002928		48.16	15.94	12.97	4.97	8.24	4.25	1.52	2.85	0.76	0.32	0.01	-20	24	4	450	1
73145	SAN08001455		49.06	15.27	12.81	4.51	9.15	4.08	1.33	2.80	0.72	0.26	0.01	-20	25	5.6	419	1
73146	SAN08001455		49.42	15.51	12.55	4.31	8.82	4.33	1.30	2.79	0.71	0.26	0.01	-20	25	5	433	1
73147	SAN08001455		48.86	15.36	13.67	5.14	7.76	4.05	1.38	2.80	0.75	0.22	0.00	-20	24	6.1	471	1
73151	SAN08001455		48.09	16.47	13.11	4.81	8.66	3.99	1.37	2.62	0.63	0.24	0.01	-20	28	6.5	394	-1
73151	SAN08001455		48.09	16.47	13.11	4.81	8.66	3.99	1.37	2.62	0.63	0.24	0.01	-20	28	6.5	394	-1
73152	SAN08001455		47.47	15.77	13.72	5.18	8.04	4.63	1.47	2.72	0.73	0.27	0.01	-20	26	7.5	398	-1
73155	SAN08001455		47.83	16.07	13.48	5.05	8.19	4.09	1.42	2.86	0.74	0.27	0.00	-20	26	7	445	1
73156	SAN08001455		47.52	16.33	13.31	4.90	8.26	4.65	1.30	2.76	0.69	0.29	0.00	-20	27	6.5	400	-1
73157	SAN08001455		47.12	16.34	13.56	5.09	7.94	4.77	1.31	2.79	0.77	0.30	0.01	-20	27	5.8	402	-1
73158	SAN08001455		46.75	15.89	13.82	5.02	8.50	4.74	1.33	2.91	0.77	0.27	0.00	-20	26	7	394	-1
73159	SAN08001455		47.06	16.12	14.05	4.90	8.36	3.96	1.57	2.97	0.75	0.26	0.00	-20	28	6.6	406	1
73160	SAN08001455		47.08	16.12	13.23	4.38	10.45	3.67	1.31	2.82	0.71	0.22	0.01	-20	27	8	386	1
73162	SAN08001455		47.81	17.21	12.99	4.62	8.38	4.06	1.32	2.70	0.66	0.24	0.01	-20	27	8.6	384	-1
73164	SAN08001455		47.59	16.34	13.24	4.53	9.08	3.97	1.36	2.88	0.75	0.23	0.03	87	26	4.9	427	1
73165	SAN08001455		47.75	16.28	13.17	4.79	9.22	3.96	1.23	2.69	0.66	0.23	0.00	26	28	-3.2	427	-1
73166	SAN08001455		47.99	16.25	12.98	4.73	9.12	4.04	1.23	2.75	0.68	0.23	0.01	-20	24	8.6	418	-1
73167	SAN08001455		48.11	16.14	12.87	4.57	9.06	4.27	1.27	2.80	0.67	0.23	0.01	-20	26	5.9	415	-1
73168	SAN08001455		47.88	15.98	13.16	4.87	9.28	3.94	1.22	2.81	0.67	0.20	0.00	-20	26	6.7	409	1
73169	SAN08001455		48.11	16.05	13.11	4.63	8.80	4.20	1.26	2.91	0.70	0.23	0.01	-20	28	1.6	441	1
73170	SAN08001455		47.71	15.89	13.27	4.76	9.12	4.10	1.42	2.80	0.71	0.22	0.00	-20	26	6	413	-1
73171	SAN08001455		47.60	15.72	13.13	4.48	9.43	4.43	1.46	2.82	0.68	0.25	0.00	-20	26	8.5	421	-1
73172	SAN08001564		46.77	15.98	13.89	4.74	9.18	4.00	1.56	2.90	0.72	0.26	0.00	-20	26	6.9	454	1
73174	SAN08001564		46.81	16.38	13.96	4.74	9.01	3.91	1.43	2.83	0.70	0.24	0.00	-20	25	7.8	383	1

Table A5– Continued

Sample Number	Co	Cs	Ga	Hf	Nb	Rb	Sr	Ta	Th	U	V	W	Zr	Y	La	Ce	Pr	Nd	Sm	Eu	
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	
73150	32.1	1.4	17.8	4.2	32.2	21.4	2	430	2	2.4	0.6	324	-0.5	160	37.5	21.1	44	5.72	25.1	6.05	2
73161	35.5	0.9	19.1	4.7	36.8	25.1	1	355	2.4	3.2	0.8	274	1.2	176	39	25.3	50	6.63	28.6	6.68	2.3
73175	31.9	2	22.6	4.7	42.7	17	2	430	2	2.6	0.8	246	0.7	176	39.3	26.1	58	7.41	34.1	7.04	2.6
73208	37.3	4	19.9	4.1	39.2	36.7	1	309	2.3	2.6	0.7	246	-0.5	164	35.1	23.2	47	6.12	25.4	5.71	2.1
73376	39.1	1.7	23.3	5	60.3	35	2	655	3.4	4	1.1	301	0.6	187	31	35.6	71	8.32	34.8	6.64	2.3
73377	40.6	0.8	24.7	4.7	61.7	35.2	2	672	3.6	4	1.1	310	1	185	31.7	35.6	71	8.45	34.3	6.56	2.2
73387	37.5	0.5	20.3	4.5	27.7	29.3	2	261	1.6	2.5	0.6	370	0.5	154	35.3	17.5	35	4.61	21.1	5.3	1.8
73441	32.6	7.7	16.6	3.1	21.1	24.2	2	327	1.1	1.9	0.4	213	-0.5	121	27.3	11.1	25	3.39	16.6	4.24	1.5
71917	31.8	1.8	19.9	4.8	46.5	28.1	1	381	2.5	3	0.8	246	-0.5	195	41.2	28.1	58	7.76	32	7.48	2.7
73145	30.9	3.2	20.2	5.1	45.7	28.3	2	418	2.7	2.8	0.9	330	-0.5	193	38.3	27.8	57	7.53	32.6	7.32	2.7
73146	30.8	3.7	20.4	4.9	45.1	25.6	1	456	2.6	3	0.7	276	0.6	190	36.4	27.4	55	7.31	33.7	7.19	2.6
73147	30.8	3.4	20.8	4.5	48.1	26.8	1	420	2.7	3	0.9	246	-0.5	203	37.5	28.1	57	7.58	33.6	7.48	2.8
73151	31.9	1.8	19.6	3.9	35.7	27	1	367	2.1	2.5	0.6	290	1.8	164	36.7	23.8	49	6.35	27.3	6.49	2.3
73151	31.9	1.8	19.6	3.9	35.7	27	1	367	2.1	2.5	0.6	290	1.8	164	36.7	23.8	49	6.35	27.3	6.49	2.3
73152	29.9	5.1	18.2	3.9	39.2	25.9	2	274	2.4	2.6	0.8	257	0.5	165	37.4	25.7	51	6.73	28.9	6.74	2.4
73155	31.6	3.1	20.4	4.2	42.3	29.7	2	360	2.6	2.9	0.9	282	1	179	40.5	28.9	59	7.6	32.8	7.5	2.5
73156	30.8	4.3	18.2	4.6	37.7	26	2	313	2.3	2.5	0.7	240	-0.5	174	38	26.3	53	6.76	30.4	6.71	2.4
73157	31.1	6.6	18.7	4.4	39.8	26.2	1	275	2.3	3.2	0.9	241	0.7	173	40.4	28	55	7.18	30.2	7.18	2.5
73158	31.6	6.3	19.2	4.3	42.5	25.2	2	271	2.5	2.4	0.7	241	1.1	180	40.3	28.5	57	7.37	32.4	7.23	2.5
73159	32.2	2.9	18.8	4.2	41.9	27.1	2	370	2.5	3.2	0.8	252	1.1	183	38	27.9	54	6.96	29.3	6.94	2.5
73160	30.7	1.2	19.7	4.1	38.5	23.4	2	384	2.1	2.6	0.7	243	1.6	173	36.9	26.5	54	6.93	29	6.61	2.3
73162	32	2.4	17.6	4.6	39.1	24.2	2	374	2.3	3	0.7	241	-0.5	182	38.3	25.6	52	6.72	28.8	6.83	2.4
73164	33.5	2.6	19.2	4.5	44.2	26.1	2	403	2.7	3	0.8	245	0.7	188	42.2	29.4	59	7.65	32.2	7.56	2.6
73165	34.9	3.8	20.5	4.8	41.9	22.1	2	420	1.6	3.3	0.9	282	-0.5	193	37.8	30.4	52	6.88	30.5	7.13	2.4
73166	33.8	4.7	18.2	4.4	40	23.1	1	406	2.1	2.6	0.8	245	1	169	38.9	26.4	54	6.93	30.5	7.09	2.5
73167	33.1	4.9	19	4.2	40.1	21.8	1	406	2.3	2.4	0.7	244	5.5	163	36.5	25.9	52	6.85	28.7	6.6	2.4
73168	32	5	18.2	7.8	61.2	22.3	1	391	4.5	2.7	0.8	250	0.5	333	42.7	29.1	61	7.72	32.8	7.52	2.6
73169	32.9	4.8	19.9	4.9	42.4	23.5	2	408	2.2	2.8	0.7	248	4.4	175	40	26.8	55	7.21	31.5	7.24	2.5
73170	31.1	3.6	18.7	4	42.9	25.2	1	368	2.4	3	0.7	218	-0.5	174	38	26.4	53	7.12	30.5	6.81	2.4
73171	30.4	3.6	18	4.4	39.8	25.7	1	318	2.1	3.2	0.7	226	-0.5	169	37.8	24.3	51	6.72	29.6	6.52	2.4
73172	28.9	2.8	21.1	4.2	42.9	29.1	1	354	2.7	3.1	0.8	246	-0.5	181	38.5	27.2	53	7.25	30.3	7.05	2.5
73174	29.9	2.4	19.6	4.5	40	22.5	1	412	2.4	2.6	0.7	231	-0.5	170	35.4	26.5	50	6.87	29	6.59	2.4

Table A5– Continued

Sample Number	Gd ppm	Tb ppm	Dy ppm	Ho ppm	Er ppm	Tm ppm	Yb ppm	Lu ppm	TOT/C wt%	TOT/S wt%	Mo ppm	Cu ppm	Pb ppm	Zn ppm	As ppm	Cd ppm	Sb ppm	Bi ppm	Ag ppm	Au ppb
73150	6.7	1.16	6.2	1.31	3.82	0.62	3.57	0.52	0.91	0.06	0.6	58.3	2	84	0.9	0.2	-0.1	-0.1	-0.1	-0.5
73161	7.01	1.27	6.76	1.38	3.87	0.6	3.64	0.55	0.78	0.07	8.3	53.2	2.1	89	1.3	0.2	-0.1	-0.1	-0.1	-0.5
73175	8.58	1.28	7.11	1.5	4.21	0.56	3.67	0.53	0.3	0.03	1.9	28.4	2.6	67	1.5	0.1	-0.1	-0.1	-0.1	4.5
73208	6.32	1.09	6.14	1.27	3.77	0.58	3.29	0.52	0.59	0.23	4.5	89.9	2.1	73	2.6	-0.1	-0.1	-0.1	-0.1	0.8
73376	6.27	1.05	5.85	1.11	3.08	0.47	2.76	0.4	0.42	0.1	1.3	44	2.3	74	1	0.1	-0.1	-0.1	-0.1	1
73377	6.39	1.04	5.75	1.15	2.94	0.45	2.73	0.43	0.54	0.13	1.3	43.8	2.2	79	1.3	0.1	-0.1	-0.1	-0.1	-0.5
73387	5.95	1.08	6.38	1.27	3.54	0.57	3.35	0.53	0.26	0.06	0.5	116	1.8	69	0.7	-0.1	-0.1	-0.1	-0.1	0.5
73441	4.91	0.88	5.16	1.08	3.14	0.47	3.05	0.42	0.4	0.17	1.2	77.6	5.4	55	15.1	0.1	-0.1	-0.1	-0.1	0.6
71917	8.08	1.32	7.47	1.5	4.25	0.62	3.73	0.56	0.06	-0.02	0.9	26	1.5	50	-0.5	-0.1	-0.1	-0.1	-0.1	1.3
73145	8.24	1.32	7.63	1.47	4.32	0.65	3.8	0.56	0.28	-0.02	0.7	24.9	1.4	57	-0.5	-0.1	-0.1	-0.1	-0.1	-0.5
73146	8.04	1.28	7.4	1.48	4.33	0.62	3.84	0.55	0.22	0.03	0.8	25.2	1.5	54	0.7	-0.1	-0.1	-0.1	-0.1	-0.5
73147	8.35	1.35	7.36	1.52	4.51	0.64	3.94	0.57	0.21	-0.02	0.8	23.4	1	75	-0.5	-0.1	-0.1	-0.1	-0.1	-0.5
73151	6.7	1.19	6.34	1.31	3.69	0.59	3.35	0.51	0.45	0.02	0.8	42.9	1.2	78	-0.5	0.1	-0.1	-0.1	-0.1	-0.5
73151	6.7	1.19	6.34	1.31	3.69	0.59	3.35	0.51	0.45	0.02	0.8	42.9	1.2	78	-0.5	0.1	-0.1	-0.1	-0.1	-0.5
73152	7.01	1.23	6.33	1.3	3.78	0.56	3.37	0.5	0.37	-0.02	0.6	29.5	0.9	71	-0.5	-0.1	-0.1	-0.1	-0.1	-0.5
73155	7.74	1.31	7.09	1.41	3.97	0.62	3.71	0.53	0.42	0.02	0.7	29.4	1.1	71	-0.5	0.1	-0.1	-0.1	-0.1	-0.5
73156	7.24	1.24	6.57	1.34	3.82	0.6	3.43	0.5	0.32	-0.02	0.7	35.5	1.4	66	-0.5	0.2	-0.1	-0.1	-0.1	-0.5
73157	7.36	1.29	7.21	1.4	3.96	0.58	3.55	0.53	0.24	-0.02	0.7	28.7	1.2	65	-0.5	0.1	-0.1	-0.1	-0.1	-0.5
73158	7.63	1.29	6.86	1.41	4.07	0.63	3.64	0.54	0.48	0.03	6.2	25.8	1.3	66	-0.5	-0.1	-0.1	-0.1	-0.1	-0.5
73159	7.35	1.26	6.71	1.34	3.78	0.59	3.48	0.52	0.43	0.03	21.5	36.4	1.6	70	1.2	0.1	-0.1	-0.1	-0.1	1
73160	7.14	1.24	6.66	1.3	3.74	0.6	3.56	0.53	0.96	0.07	11.5	44.1	1.3	84	1.4	0.1	-0.1	-0.1	-0.1	-0.5
73162	7.17	1.21	6.86	1.35	3.82	0.6	3.47	0.51	0.36	0.04	1.5	45.9	1.6	75	1	0.1	-0.1	-0.1	-0.1	-0.5
73164	8.02	1.37	7.18	1.44	3.89	0.65	3.69	0.56	0.31	0.03	2.1	30.3	1.3	71	0.5	-0.1	-0.1	-0.1	-0.1	1.2
73165	7.38	1.23	6.56	1.38	3.81	0.59	3.45	0.5	0.18	0.04	1.5	25.7	1.5	55	0.8	-0.1	-0.1	-0.1	-0.1	-0.5
73166	7.27	1.24	6.64	1.32	3.75	0.57	3.41	0.52	0.17	0.06	1.9	25.6	1.4	58	1.1	-0.1	-0.1	-0.1	-0.1	-0.5
73167	7.01	1.18	6.5	1.3	3.68	0.56	3.38	0.49	0.13	0.05	1.4	24.1	1.3	54	0.7	-0.1	-0.1	-0.1	-0.1	-0.5
73168	8.35	1.4	7.69	1.52	4.45	0.68	4.14	0.63	0.19	0.05	1.5	26.2	1.6	54	0.7	-0.1	-0.1	-0.1	-0.1	-0.5
73169	7.66	1.28	6.77	1.43	4.1	0.62	3.6	0.53	0.11	0.04	1.4	25.9	1.5	51	0.6	-0.1	-0.1	-0.1	-0.1	-0.5
73170	7.28	1.26	6.86	1.41	3.85	0.61	3.72	0.54	0.32	0.05	1.4	27.8	1.2	59	-0.5	-0.1	-0.1	-0.1	-0.1	-0.5
73171	7.25	1.22	6.73	1.39	3.88	0.6	3.63	0.52	0.68	0.11	0.8	28.2	0.8	62	0.8	-0.1	-0.1	-0.1	-0.1	0.5
73172	7.74	1.28	7.25	1.42	4.03	0.61	3.35	0.54	0.65	0.03	0.7	24.2	1.3	81	0.8	0.1	-0.1	-0.1	-0.1	-0.5
73174	7.1	1.16	6.77	1.34	3.68	0.57	3.26	0.53	0.53	0.02	1	27.1	1.4	82	0.7	-0.1	-0.1	-0.1	-0.1	6.6

Table A5– Continued

Sample Number	Hg ppm	Tl ppm	Se ppm
73150	-0.01	-0.1	-0.5
73161	-0.01	-0.1	-0.5
73175	-0.01	-0.1	-0.5
73208	-0.01	-0.1	-0.5
73376	-0.01	-0.1	-0.5
73377	-0.01	-0.1	-0.5
73387	-0.01	-0.1	0.7
73441	-0.01	-0.1	-0.5
71917	0.03	-0.1	-0.5
73145	-0.01	-0.1	-0.5
73146	-0.01	-0.1	-0.5
73147	-0.01	-0.1	-0.5
73151	-0.01	-0.1	-0.5
73151	-0.01	-0.1	-0.5
73152	-0.01	-0.1	-0.5
73155	-0.01	-0.1	-0.5
73156	-0.01	-0.1	-0.5
73157	-0.01	-0.1	-0.5
73158	-0.01	-0.1	-0.5
73159	-0.01	0.1	0.5
73160	-0.01	-0.1	-0.5
73162	-0.01	-0.1	-0.5
73164	-0.01	-0.1	-0.5
73165	-0.01	-0.1	-0.5
73166	-0.01	-0.1	0.5
73167	-0.01	-0.1	-0.5
73168	-0.01	-0.1	-0.5
73169	-0.01	-0.1	-0.5
73170	-0.01	-0.1	-0.5
73171	-0.01	-0.1	-0.5
73172	-0.01	-0.1	-0.5
73174	-0.01	-0.1	-0.5

Table A5– Continued

Sample Number	BatchNumber	Acme	SiO2 wt%	Al2O3 wt%	Fe2O3 wt%	MgO wt%	CaO wt%	Na2O wt%	K2O wt%	TiO2 wt%	P2O5 wt%	MnO wt%	Cr2O 3 wt%	Ni ppm	Sc ppm	LOI wt%	Ba ppm	Be ppm
73357	SAN08002243		49.92	16.87	11.32	5.01	9.22	3.72	1.57	1.71	0.41	0.23	0.03	49	31	3.7	551	2
73394	SAN08002548		50.38	16.63	11.42	4.68	9.29	3.81	1.50	1.66	0.39	0.22	0.01	49	31	3.9	546	1
71915	SAN08002928		48.85	15.26	13.36	2.66	9.71	3.94	2.50	2.66	0.78	0.27	0.01	-20	21	7.6	580	2
71919	SAN08002928		47.87	15.86	13.25	4.23	8.05	5.25	1.66	2.83	0.75	0.25	0.01	-20	23	6.4	506	1
73137	SAN08001455		49.40	15.20	13.00	4.81	7.48	5.06	1.33	2.73	0.70	0.28	0.01	26	24	6.3	382	-1
73154	SAN08001455		47.92	15.67	13.34	4.95	7.83	5.12	1.33	2.81	0.75	0.28	0.00	-20	26	7.2	389	-1
73274	SAN08001870		51.20	17.18	13.06	1.66	5.98	4.33	3.53	1.98	0.82	0.25	0.00	-20	17	4.9	1137	2
73392	SAN08002548		59.98	17.13	6.80	1.24	2.08	5.30	6.52	0.66	0.14	0.14	0.00	-20	6	2.3	1277	2
73442	SAN08002548		60.15	15.99	8.24	0.51	2.56	5.16	6.28	0.74	0.14	0.22	0.00	-20	9	2	635	2
73388	SAN08002548		61.25	14.83	8.71	1.03	2.74	4.52	5.93	0.66	0.11	0.19	0.00	-20	7	2	790	2
73304	SAN08002243		57.27	15.89	9.08	1.08	5.67	2.52	7.35	0.81	0.14	0.15	0.03	-20	9	6.6	913	2
73390	SAN08002548		58.69	15.84	10.17	0.90	4.01	5.22	3.74	0.90	0.25	0.28	0.00	-20	14	4.1	905	3
73315	SAN08002243		57.73	16.67	9.31	0.43	3.12	4.03	7.62	0.72	0.13	0.25	0.01	-20	6	3.4	590	3
73316	SAN08002243		60.72	15.23	8.60	0.35	3.53	3.09	7.52	0.59	0.09	0.22	0.04	-20	6	3.6	686	2
73358	SAN08002243		64.36	13.85	6.79	1.87	4.44	2.96	4.53	0.85	0.21	0.10	0.04	-20	17	4.1	930	2
73396	SAN08002548		67.13	15.02	4.97	0.97	1.78	2.69	6.22	0.92	0.20	0.07	0.02	-20	12	1.6	840	2
73397	SAN08002548		69.08	14.03	4.92	0.85	1.51	2.57	5.99	0.81	0.18	0.05	0.03	-20	10	1.7	791	2
73398	SAN08002548		65.30	14.54	6.57	1.16	2.67	2.64	5.60	1.15	0.26	0.09	0.01	-20	15	1.5	737	2
73399	SAN08002548		68.08	14.54	4.78	1.06	2.15	2.70	5.57	0.85	0.19	0.07	0.02	-20	12	1.7	693	2
73400	SAN08002548		68.00	14.44	4.76	1.19	2.54	2.83	5.11	0.85	0.19	0.06	0.02	-20	11	1.5	696	2
73401	SAN08002548		64.95	13.82	7.44	1.50	3.07	2.75	4.87	1.18	0.28	0.13	0.02	-20	15	1.8	665	2
73402	SAN08002548		67.20	14.32	5.33	1.19	2.44	2.66	5.60	0.95	0.20	0.08	0.02	-20	12	1.7	795	1
73404	SAN08002548		65.54	14.15	6.67	1.34	2.88	2.75	5.13	1.11	0.28	0.12	0.04	-20	15	1.7	657	2
73405	SAN08002548		68.17	14.09	4.78	1.15	2.52	2.59	5.56	0.84	0.18	0.09	0.03	-20	11	1.6	706	2
73406	SAN08002548		67.88	14.26	4.94	1.08	2.64	2.78	5.26	0.85	0.19	0.08	0.04	-20	11	1.6	683	2
73407	SAN08002548		67.58	14.46	5.10	1.08	2.62	2.75	5.24	0.88	0.20	0.07	0.03	-20	11	1.7	724	2
73408	SAN08002548		67.69	14.31	5.06	1.09	2.82	2.75	5.16	0.84	0.18	0.06	0.04	-20	11	1.8	711	2
73409	SAN08002548		67.61	14.43	4.91	1.13	2.65	2.88	5.24	0.85	0.19	0.07	0.03	-20	11	1.5	721	2
73410	SAN08002548		65.28	14.57	6.42	1.16	3.27	3.33	4.54	1.01	0.29	0.10	0.03	-20	15	1.6	755	1
73411	SAN08002548		65.86	14.55	6.07	1.14	3.12	3.25	4.69	0.96	0.24	0.09	0.02	-20	14	1.5	740	2
73424	SAN08002548		67.13	14.44	5.44	1.06	1.60	3.15	5.89	0.95	0.24	0.10	0.01	-20	12	2.2	968	1
71922	SAN08002928		62.97	15.51	6.66	2.23	3.66	2.41	5.32	0.94	0.18	0.08	0.03	24	16	2.8	747	2

Table A5– Continued

Sample Number	Co	Cs	Ga	Hf	Nb	Rb	Sn	Sr	Ta	Th	U	V	W	Zr	Y	La	Ce	Pr	Nd	Sm	Eu
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
73357	34.3	7	20.8	4.3	44.7	29.2	-1	413	2.7	2.6	0.8	211	0.5	187	35.5	26.3	51	6.72	27.9	6.3	2.3
73394	32.5	6.1	19.5	4.7	45.8	28.6	2	401	2.5	2.7	0.8	204	-0.5	178	37	24.8	52	6.58	28	6.19	2.3
71915	27.1	0.6	21.1	5.4	60.4	42.7	2	389	3.3	4	1.2	183	0.8	232	47.7	33.1	66	8.68	37.4	8.26	3
71919	29.5	3.5	20.1	4.8	45.8	41.2	2	273	2.7	3	0.8	242	0.7	188	40.3	28.1	57	7.4	30.7	7.18	2.6
73137	29.8	6.1	18.5	4.7	42.3	24.8	1	261	2.5	2.8	0.7	231	1.6	176	37.2	25.9	54	6.98	32.4	6.7	2.5
73154	30.6	6.4	18.3	4.4	40.2	25.2	2	253	2.4	2.4	0.8	250	0.5	166	38	27.6	55	7	30.5	6.71	2.4
73274	12.3	-0.1	24.9	9	90.2	79.9	3	281	5.2	5.5	1.6	24	1.3	332	67.9	44.1	94	11.89	49.1	11.67	3.9
73392	1.6	0.2	21.2	10	104.2	133.2	3	79	5.7	7.5	2.1	9	1.1	419	58	48.8	97	11.18	46.4	9.24	2.6
73442	1.3	0.3	24.2	7.7	71.3	144.7	3	140	4.3	6.7	1.6	-8	0.6	309	41.3	34.4	70	8.65	34	7.55	2.3
73388	1	0.1	20.3	10	85.9	124.5	2	59.2	5.1	7.4	1.8	-8	0.6	378	59	38.8	84	10.58	43.6	9.59	2.2
73304	5	0.7	23	9.5	75.9	167.3	4	53.4	4.3	8.6	2.4	38	1.2	344	61.2	45.4	96	11.8	45.5	10.21	2
73390	2.6	0.2	27	14	99.1	80.5	4	211	6.2	7.1	2	-8	-0.5	494	78.1	45.1	96	11.92	51.3	11.63	3.8
73315	0.6	0.2	27.5	11	97.6	155.1	4	49.7	5.2	7.8	1.8	-8	0.8	409	64.6	47	95	12	48.3	10.46	2.3
73316	1.4	2.7	25	9.7	76.7	192.4	4	64.6	4.3	12	2.5	-8	0.7	373	65.7	53.9	106	13.03	49.9	10.46	2
73358	14.4	4.5	17.4	7.5	30.4	136.8	6	255	1.7	13.5	1.9	83	1.2	330	46	49.4	98	12.59	47.5	9.44	2
73396	9.3	1.6	17.2	14	41.4	220.4	4	96.4	2.8	23	3.6	57	1.2	533	50	50.8	105	12.16	46.1	8.57	1.3
73397	8.2	1.9	16.2	14	41	241.6	4	82.9	3	31.5	4.4	47	1.6	500	54.4	53.2	113	13.06	47.7	8.88	1.1
73398	12.2	1.9	18.4	13	43.7	199.7	4	115	2.9	22	3.1	57	1.5	533	55.3	50.6	108	12.46	47.4	9.31	1.6
73399	9	2.2	17.8	13	40	217.4	4	92.1	2.6	25.8	3.4	51	1.3	513	49.6	51.3	107	12.57	45.2	8.52	1.2
73400	8.9	2.4	18.7	14	39.6	204.3	5	95.5	2.9	24.3	3.3	51	1.8	504	47.4	48.5	101	11.8	43.3	8.29	1.2
73401	11.7	2.2	20.3	13	45	175.5	5	104	3	19.2	3	51	1.7	504	58.6	47.3	100	12.07	46.2	9.24	1.7
73402	9.7	2.3	17.9	15	43.7	218.8	5	96.9	2.8	22.1	2.9	56	1.2	588	49.2	47.8	101	11.75	45	8.25	1.3
73404	11.4	2.3	18.7	14	43.9	194	5	103	3	22.4	3.3	58	1.3	515	54.2	48.9	102	11.9	47.3	9.25	1.6
73405	8.9	2.8	18	14	39.7	223.8	5	88.4	2.8	24	3.4	49	1.2	512	46.8	47	96	11.38	42.4	7.93	1.1
73406	8.9	2.8	16.7	13	39.6	208.8	5	84.3	2.8	24.7	3.8	49	1.5	500	44.3	46.7	99	11.56	41.9	8.21	1.2
73407	9	2.8	18.8	15	41.8	210.6	4	90.4	3	25	3.3	54	1.3	546	45.9	47.9	100	11.6	42.6	8.48	1.2
73408	8.7	3.1	17.9	14	39.7	205.1	4	93.3	2.7	24.4	3.3	51	1.2	542	44	46.7	99	11.4	43.6	8.15	1.2
73409	9.2	3.4	17.2	14	39.4	201.4	5	92.9	2.5	23.2	3.3	50	0.9	513	42.8	44.3	95	11.16	41.1	7.94	1.2
73410	9.2	3.7	20.2	15	49.4	177.2	5	127	3.4	22	3.4	46	1.2	560	57.4	48.4	102	12.19	47.9	10.23	1.9
73411	9.4	3.3	19.4	15	45.5	183.5	4	122	2.8	22.4	3.2	48	1.3	556	52.2	48.3	103	12.09	46.3	9.74	1.7
73424	9.2	1.4	14.5	13	41.3	188.3	4	91	2.5	20.3	3.3	52	0.9	511	49.7	47.9	101	12.11	48.2	8.57	1.6
71922	17.2	1.4	17.1	12	32.5	190.9	3	129	2.1	17.2	2.6	99	1.5	473	42.2	40.1	82	9.86	37	7.15	1.2

Table A5– Continued

Sample Number	Gd ppm	Tb ppm	Dy ppm	Ho ppm	Er ppm	Tm ppm	Yb ppm	Lu ppm	TOT/C wt%	TOT/S wt%	Mo ppm	Cu ppm	Pb ppm	Zn ppm	As ppm	Cd ppm	Sb ppm	Bi ppm	Ag ppm	Au ppb
73357	6.53	1.15	6.39	1.28	3.75	0.58	3.34	0.54	0.09	0.03	1.6	78.3	2	66	3.7	-0.1	-0.1	-0.1	-0.1	2.2
73394	6.65	1.14	6.44	1.28	3.66	0.59	3.46	0.51	0.07	-0.02	1.7	78.9	2.4	64	0.9	-0.1	-0.1	-0.1	-0.1	-0.5
71915	8.89	1.47	8.43	1.68	4.77	0.7	4.35	0.64	0.88	-0.02	0.9	58.9	2.5	94	1.6	-0.1	-0.1	-0.1	-0.1	5.2
71919	7.57	1.26	7.28	1.43	3.93	0.57	3.73	0.53	0.19	-0.02	0.7	79.7	1.9	80	-0.5	0.4	-0.1	-0.1	-0.1	4.2
73137	7.88	1.23	6.78	1.4	4.03	0.6	3.59	0.52	0.26	-0.02	0.8	26.2	0.8	65	-0.5	-0.1	-0.1	-0.1	-0.1	0.7
73154	7.34	1.23	6.77	1.4	3.83	0.6	3.49	0.51	0.37	-0.02	0.6	26.6	0.7	67	-0.5	-0.1	-0.1	-0.1	-0.1	-0.5
73274	12.5	2.03	12.14	2.36	6.62	1.02	6.33	0.92	0.58	0.05	2.2	12.4	4.2	121	0.8	0.2	-0.1	-0.1	-0.1	0.8
73392	9.5	1.66	9.6	2.06	6.26	1.02	6.27	0.96	0.18	-0.02	1.4	3.5	5.2	100	-0.5	0.2	-0.1	-0.1	-0.1	-0.5
73442	7.85	1.41	8.06	1.58	4.77	0.76	4.76	0.77	0.13	-0.02	3.2	5.6	5.7	79	0.9	0.2	-0.1	-0.1	-0.1	-0.5
73388	9.77	1.8	10.51	2.18	6.39	1.01	6.68	1.07	0.16	-0.02	2.2	5.5	6	86	-0.5	0.1	-0.1	-0.1	-0.1	0.7
73304	10.7	1.87	11.04	2.21	6.53	1.03	6.77	1.05	0.96	0.07	1.2	14.4	7.8	115	4.3	0.3	-0.1	-0.1	-0.1	0.6
73390	12.5	2.24	13.74	2.84	8.24	1.34	8.51	1.31	0.27	-0.02	2.9	4.6	5.3	113	-0.5	0.2	-0.1	-0.1	-0.1	-0.5
73315	10.7	1.94	11.13	2.36	7.15	1.09	6.93	1.18	0.57	0.03	2.1	5.9	6	125	1.2	0.2	-0.1	-0.1	-0.1	2
73316	10.4	1.86	11.28	2.39	7.32	1.1	7.18	1.16	0.67	0.03	1.7	5.2	8.9	100	3.1	0.2	-0.1	-0.1	-0.1	1.4
73358	8.64	1.49	8.33	1.75	4.92	0.76	4.5	0.71	0.48	0.11	0.5	31.9	4.8	72	1.8	-0.1	0.1	-0.1	-0.1	3.8
73396	8.12	1.4	8.27	1.63	5.04	0.8	5.06	0.72	0.04	0.38	1.9	25.7	4.8	45	5	-0.1	-0.1	-0.1	-0.1	-0.5
73397	8.59	1.45	8.92	1.77	5.51	0.85	5.4	0.77	0.02	0.54	2.3	28.8	5.5	40	16.2	-0.1	0.1	-0.1	-0.1	-0.5
73398	9.13	1.58	9.45	1.87	5.59	0.91	5.72	0.82	0.04	0.15	1.5	28	3.6	59	5.5	-0.1	0.1	-0.1	-0.1	0.7
73399	8.01	1.38	8.12	1.59	4.95	0.79	5.06	0.73	0.06	0.12	1.2	23.7	4.5	50	7.3	-0.1	0.1	-0.1	-0.1	-0.5
73400	7.86	1.35	7.84	1.56	4.54	0.76	4.88	0.71	0.05	0.13	1.7	32.8	4.3	42	12.3	-0.1	-0.1	-0.1	-0.1	-0.5
73401	9.56	1.65	9.54	1.96	6.23	0.99	5.91	0.87	0.1	0.19	1.7	27.5	4.9	62	7.3	-0.1	-0.1	-0.1	-0.1	1.8
73402	7.91	1.38	7.97	1.7	4.89	0.78	4.97	0.72	0.02	0.04	1.7	26.8	3.5	51	9	-0.1	-0.1	-0.1	-0.1	-0.5
73404	9.24	1.61	9.24	1.83	5.58	0.91	5.67	0.82	0.09	0.09	1.3	24.2	5.1	62	5.9	-0.1	-0.1	-0.1	-0.1	-0.5
73405	7.52	1.32	7.67	1.52	4.52	0.78	4.61	0.69	0.14	0.12	1.7	21.7	4.5	56	8.6	-0.1	-0.1	-0.1	-0.1	-0.5
73406	7.98	1.33	7.94	1.57	4.8	0.77	4.92	0.7	0.14	0.15	1.5	23.6	3.6	54	8.5	-0.1	0.1	-0.1	-0.1	-0.5
73407	7.87	1.37	7.77	1.6	4.72	0.78	4.88	0.72	0.08	0.1	1.3	25.4	2.8	43	7.1	-0.1	-0.1	-0.1	-0.1	-0.5
73408	7.91	1.32	7.98	1.59	4.91	0.79	4.85	0.71	0.14	0.09	1.7	23.1	3.2	42	5.9	-0.1	-0.1	-0.1	-0.1	-0.5
73409	7.91	1.35	7.78	1.54	4.74	0.74	4.73	0.69	0.12	0.04	1.2	22.6	3.6	46	3.9	-0.1	-0.1	-0.1	-0.1	-0.5
73410	10.2	1.76	10.59	2.08	6.5	1.03	6.42	0.96	0.14	0.08	1.4	20.8	3.9	62	5.1	0.1	-0.1	-0.1	-0.1	-0.5
73411	9.66	1.67	9.72	1.95	6.08	0.95	6.13	0.9	0.15	0.08	1.4	21.2	4.1	60	4.7	-0.1	-0.1	-0.1	-0.1	-0.5
73424	8.28	1.43	8.65	1.75	5.05	0.82	5.25	0.76	0.08	0.26	0.7	24.4	20	70	5.7	-0.1	0.1	-0.1	-0.1	2.3
71922	6.92	1.18	7.02	1.42	4.28	0.67	4.2	0.63	0.02	0.53	18.3	36.6	3.3	53	7.1	-0.1	-0.1	-0.1	-0.1	5.1

Table A5– Continued

Sample Number	Hg ppm	Tl ppm	Se ppm
73357	-0.01	-0.1	0.6
73394	-0.01	-0.1	-0.5
71915	0.01	-0.1	-0.5
71919	-0.01	-0.1	-0.5
73137	-0.01	-0.1	-0.5
73154	-0.01	-0.1	0.6
73274	-0.01	-0.1	-0.5
73392	-0.01	-0.1	-0.5
73442	-0.01	-0.1	-0.5
73388	-0.01	-0.1	0.6
73304	-0.01	-0.1	-0.5
73390	-0.01	-0.1	0.6
73315	-0.01	-0.1	0.5
73316	-0.01	-0.1	-0.5
73358	-0.01	-0.1	0.6
73396	-0.01	-0.1	-0.5
73397	-0.01	-0.1	-0.5
73398	-0.01	-0.1	-0.5
73399	-0.01	-0.1	-0.5
73400	-0.01	-0.1	0.5
73401	-0.01	-0.1	-0.5
73402	-0.01	-0.1	-0.5
73404	-0.01	-0.1	-0.5
73405	-0.01	0.1	-0.5
73406	-0.01	-0.1	-0.5
73407	-0.01	-0.1	-0.5
73408	-0.01	-0.1	-0.5
73409	-0.01	-0.1	-0.5
73410	-0.01	-0.1	-0.5
73411	-0.01	-0.1	-0.5
73424	-0.01	-0.1	-0.5
71922	-0.01	0.2	-0.5

Table A5– Continued

Sample Number	BatchNumber	Acme	SiO2 wt%	Al2O3 wt%	Fe2O3 w%	MgO w%	CaO w%	Na2O w%	K2O w%	TiO2 w%	P2O5 w%	MnO w%	Cr2O 3 w%	Ni ppm	Sc ppm	LOI wt%	Ba ppm	Be ppm
73395	SAN08002548		66.62	14.73	5.77	1.04	1.81	2.47	6.31	0.95	0.23	0.06	0.01	-20	13	2.3	936	2
73422	SAN08002548		64.16	14.99	7.08	1.50	2.58	4.12	3.89	1.18	0.35	0.14	0.01	-20	17	3.7	661	2
73114	SAN08001455		50.40	18.83	10.97	3.80	9.74	3.31	0.91	1.66	0.21	0.11	0.06	41	30	3	222	-1
73115	SAN08001455		48.56	17.77	13.09	4.84	9.09	3.37	0.79	2.09	0.25	0.13	0.02	41	32	4.3	223	-1
73116	SAN08001455		48.75	17.63	12.82	5.27	9.29	3.18	0.75	1.87	0.26	0.14	0.04	73	32	6.3	185	-1
73117	SAN08001455		51.08	17.68	11.81	4.39	8.90	3.20	0.71	1.76	0.25	0.16	0.05	44	28	4.4	208	-1
73118	SAN08001455		50.18	18.36	11.80	3.96	9.26	3.32	0.84	1.85	0.24	0.14	0.04	25	30	3.8	230	-1
73119	SAN08001455		49.61	17.74	12.08	3.98	9.75	3.29	0.96	2.09	0.32	0.15	0.04	26	29	5.3	287	1
73120	SAN08001455		50.22	17.06	12.60	4.61	9.11	3.09	0.86	2.01	0.27	0.15	0.03	27	33	5.5	237	-1
73121	SAN08001455		50.89	15.66	13.04	5.26	8.70	2.96	0.91	2.10	0.31	0.15	0.02	-20	35	4.9	242	-1
73122	SAN08001455		47.32	12.14	19.32	7.03	7.79	2.55	0.96	2.31	0.33	0.20	0.04	98	41	4.9	253	2
73124	SAN08001455		49.33	12.29	16.41	6.30	9.40	2.55	0.91	2.27	0.31	0.19	0.06	47	52	3.6	246	1
73125	SAN08001455		48.36	11.15	17.75	6.53	9.83	2.40	0.88	2.55	0.28	0.22	0.05	52	61	5.2	240	1
73126	SAN08001455		46.56	12.42	19.13	6.62	8.94	2.45	0.70	2.62	0.31	0.20	0.05	70	47	4.1	210	1
73127	SAN08001455		47.45	14.68	15.97	7.18	8.99	2.58	0.59	2.11	0.26	0.18	0.03	85	37	6.1	171	-1
73128	SAN08001455		49.92	18.63	11.38	3.40	10.42	3.19	0.82	1.79	0.28	0.12	0.04	62	34	2.1	242	-1
73129	SAN08001455		48.37	15.52	14.59	5.90	9.70	2.74	0.65	2.09	0.24	0.17	0.04	104	40	4.3	187	1
73130	SAN08001455		46.06	11.57	19.42	9.72	8.38	2.02	0.39	1.94	0.27	0.21	0.03	118	40	7.3	136	1
73131	SAN08001455		50.35	16.87	12.53	3.82	9.78	3.21	0.95	1.96	0.31	0.16	0.06	22	38	2.2	257	-1
73132	SAN08001455		50.56	16.85	12.35	3.74	9.89	3.23	0.94	1.95	0.29	0.16	0.03	32	39	1.7	274	1
73134	SAN08001455		50.19	15.55	13.90	4.67	8.79	3.27	0.97	2.16	0.30	0.17	0.03	23	44	3.5	256	-1
73138	SAN08001455		51.18	17.89	12.25	4.29	8.37	2.96	0.83	1.80	0.24	0.16	0.04	30	34	9.7	299	-1
73139	SAN08001455		53.25	15.40	10.97	3.08	10.81	3.10	1.14	1.78	0.25	0.19	0.02	27	33	10.8	385	1
73141	SAN08001455		50.47	16.73	12.34	3.66	10.97	2.56	0.96	1.86	0.25	0.17	0.02	33	32	13.2	263	-1
73142	SAN08001455		50.75	16.08	12.60	4.23	9.23	3.32	1.15	2.06	0.39	0.20	0.01	-20	32	9.2	329	1
73149	SAN08001455		49.96	17.62	13.51	4.02	8.33	3.09	0.92	2.10	0.29	0.15	0.01	-20	41	8.2	241	1
73176	SAN08001564		49.61	16.84	13.74	4.51	9.48	2.32	0.93	2.08	0.30	0.19	0.01	23	34	14	191	-1
73177	SAN08001564		49.83	16.65	12.30	4.34	11.62	2.11	0.90	1.83	0.24	0.17	0.01	-20	33	13.9	165	-1
73178	SAN08001564		50.32	17.72	12.53	4.68	8.21	2.83	1.24	2.01	0.27	0.17	0.01	21	36	11.2	205	1
73179	SAN08001564		51.83	14.91	10.39	3.60	13.76	2.61	0.94	1.60	0.19	0.16	0.01	-20	30	11.7	224	1
73181	SAN08001564		49.63	16.86	11.60	4.32	11.60	2.75	1.05	1.78	0.23	0.17	0.01	-20	33	13.5	211	1
73182	SAN08001564		50.53	16.99	11.83	4.39	10.25	2.98	0.81	1.74	0.24	0.21	0.02	-20	34	8.7	176	-1

Table A5– Continued

Sample Number	Co ppm	Cs ppm	Ga ppm	Hf ppm	Nb ppm	Rb ppm	Sr ppm	Ta ppm	Th ppm	U ppm	V ppm	W ppm	Zr ppm	Y ppm	La ppm	Ce ppm	Pr ppm	Nd ppm	Sm ppm	Eu ppm	
73395	9.5	2.5	17	15	45	240.4	4	118	3.4	28.6	3.9	53	2	537	60.2	55.5	118	13.78	52	9.64	1.5
73422	9.9	0.9	18.5	14	48.6	120.2	5	102	2.8	17.8	2.7	50	0.9	516	66.3	51.7	109	13.42	53.2	10.55	2.2
73114	32.7	0.2	19.6	3.8	17.8	19.3	-1	337	1.1	2.6	0.4	328	2.3	126	28.4	12.9	27	3.49	15.4	3.9	1.5
73115	39.8	0.1	20.2	3.9	21.7	17.6	1	312	1.1	2.3	0.5	346	-0.5	142	32	13.8	29	3.91	18.1	4.65	1.6
73116	39.6	0.2	18.5	3.6	19.6	17.1	-1	260	1.1	2.6	0.4	278	-0.5	133	29.3	13.7	27	3.63	16.1	4.24	1.6
73117	35.2	0.2	19.4	4.3	20.7	16.8	1	292	1.1	2.2	0.4	260	33.1	134	30.8	13.9	29	3.89	17.5	4.45	1.6
73118	33.2	0.1	19.4	4	22.5	21.7	-1	286	1.4	2.5	0.5	277	-0.5	146	33.5	14.7	31	4.17	18.3	4.8	1.7
73119	32.1	0.3	21.3	4.6	27.1	21.5	1	282	1.5	2.6	0.6	302	1.8	162	35.2	17.7	35	4.78	21	5.41	1.9
73120	34.8	0.2	20.2	4.8	25.7	21	1	285	1.6	2.6	0.6	333	-0.5	164	36.6	16.2	35	4.53	20.1	5.13	1.8
73121	36.4	0.2	20.4	4.8	25.7	22.9	1	281	1.4	2.9	0.4	360	-0.5	167	38.5	16.8	36	4.85	22.6	5.5	1.9
73122	74.5	0.3	18.7	5.4	27.9	25.9	1	191	1.6	3.7	0.7	342	-0.5	200	43.1	18.8	39	5.31	23.8	5.94	1.9
73124	53.4	0.1	17.8	4.6	27.5	22.3	1	195	1.5	3.3	0.6	391	5.2	188	43.7	19	39	5.2	23.7	6.07	2
73125	59.8	0.1	18.2	5.4	26.3	23.2	1	189	1.7	3.4	0.6	549	0.9	191	44.7	17.5	37	5.11	23.4	5.92	1.9
73126	71.9	0.2	18.8	4.3	26.7	19.8	1	226	1.7	2.7	0.5	408	10.1	166	41.3	16.5	36	4.8	21.6	5.67	1.9
73127	58.2	0.2	18	4	21	12.7	-1	224	1.2	2.6	0.5	334	-0.5	160	33.4	13.9	30	4.05	17.2	4.57	1.6
73128	32.7	0.1	20.4	4.4	22.8	19.5	2	320	1.4	2.3	0.5	329	61.4	154	35.4	15.3	32	4.33	18.5	4.83	1.7
73129	51.9	-0.1	18.9	3.7	20.5	15.5	-1	250	1.2	2.1	0.4	356	-0.5	138	34.2	13	29	3.9	17.5	4.53	1.6
73130	82	0.2	15.6	3.3	20.2	10.4	-1	184	1	2	0.4	326	4.3	129	32.3	11.8	26	3.68	17.5	4.34	1.5
73131	34.3	0.2	20.1	4.7	25.3	23	1	289	1.5	2.5	0.6	349	1.5	174	40	16.5	36	4.84	22.2	5.63	1.8
73132	35.4	0.1	21.4	5.1	25	23.4	1	312	1.4	2.6	0.6	353	2.6	177	41	16.4	36	4.88	20.6	5.3	1.9
73134	38.5	0.1	20.5	4.7	24.6	21.4	1	280	1.3	2.8	0.5	377	-0.5	174	42.4	17.2	37	5.04	23	5.59	1.9
73138	31.8	0.8	18.5	3.6	18.7	21.3	1	646	1.1	1.9	0.4	274	1.3	133	28.8	12.5	27	3.6	15.5	4.02	1.5
73139	30.8	0.6	16.5	3.6	19.3	24.2	1	917	1.2	2.3	0.4	291	-0.5	138	31.7	13	28	3.81	17.7	4.43	1.5
73141	29.2	1.2	13.5	4.3	19.1	16.8	1	264	1	2.3	0.5	267	2.9	138	28.6	10	25	3.54	17.3	3.79	1.5
73142	32.4	1.1	19.8	3.9	26.4	18.9	1	566	1.5	2.5	0.4	267	-0.5	156	32	15.2	34	4.69	20.9	5.23	1.9
73149	36.2	1.7	19.1	4.8	23.3	19	-1	292	1.3	2.5	0.5	390	63.1	169	32.2	13.6	31	4.27	18.5	5.08	1.7
73176	33.2	0.9	17.4	3.7	22.1	22.2	1	208	1.3	3.3	0.5	285	-0.5	138	32.4	15.1	29	4.17	16.8	4.84	1.6
73177	29.6	0.7	16.6	2.9	17.5	19.1	-1	149	1	2	0.4	267	-0.5	122	29.7	12.8	25	3.8	16.6	4.32	1.5
73178	29.9	1.1	18.8	3.3	20	28.3	1	181	1.2	2.6	0.4	296	-0.5	144	32.8	14.7	28	4.21	17.9	4.95	1.5
73179	26.3	0.6	16.8	2.9	15.6	19.6	-1	184	1	1.8	0.4	236	-0.5	113	27.4	11.9	22	3.35	15.5	3.76	1.3
73181	27.5	0.3	18	2.7	16.8	20.4	-1	173	0.9	2.6	0.5	255	-0.5	122	29.8	12.1	24	3.51	15.9	4.25	1.5
73182	28	0.3	17.1	3.6	16.8	14.1	-1	200	1	2.5	0.3	273	-0.5	125	29.8	12.3	24	3.75	15.9	4.38	1.4

Table A5– Continued

Sample Number	Gd ppm	Tb ppm	Dy ppm	Ho ppm	Er ppm	Tm ppm	Yb ppm	Lu ppm	TOT/C wt%	TOT/S wt%	Mo ppm	Cu ppm	Pb ppm	Zn ppm	As ppm	Cd ppm	Sb ppm	Bi ppm	Ag ppm	Au ppb
73395	9.65	1.68	9.91	2.05	6.03	0.96	5.99	0.88	0.03	0.93	9.8	27.2	3.6	56	10.8	-0.1	0.2	-0.1	-0.1	-0.5
73422	10.8	1.88	11.4	2.28	6.65	1.08	6.96	0.99	0.16	0.45	1.3	25.1	17	80	7.6	-0.1	0.2	-0.1	-0.1	-0.5
73114	4.77	0.84	4.8	1.02	2.89	0.46	2.8	0.45	0.19	0.03	0.6	71.6	0.8	56	-0.5	-0.1	-0.1	-0.1	-0.1	-0.5
73115	5.25	0.96	5.37	1.15	3.21	0.51	3.17	0.5	0.04	0.02	0.4	111	0.8	70	-0.5	-0.1	-0.1	-0.1	-0.1	-0.5
73116	4.88	0.88	4.93	1.08	2.97	0.48	2.98	0.47	0.06	-0.02	0.3	159	0.9	65	-0.5	-0.1	-0.1	-0.1	-0.1	-0.5
73117	5.21	0.94	5.16	1.15	3.24	0.48	3.09	0.48	0.09	0.03	0.7	163	1.1	63	-0.5	0.1	-0.1	-0.1	-0.1	-0.5
73118	5.69	1	5.67	1.22	3.51	0.56	3.45	0.54	0.11	0.02	0.5	114	1	63	-0.5	-0.1	-0.1	-0.1	-0.1	-0.5
73119	6.16	1.1	6.26	1.31	3.81	0.59	3.53	0.56	0.32	0.14	0.6	86.2	1.3	68	-0.5	0.1	-0.1	-0.1	-0.1	-0.5
73120	6.11	1.09	6.38	1.27	3.73	0.61	3.73	0.57	0.18	0.04	0.4	86.5	0.9	70	-0.5	-0.1	-0.1	-0.1	-0.1	-0.5
73121	6.72	1.19	6.69	1.39	4.12	0.64	3.84	0.63	0.13	0.03	0.4	81	0.9	73	-0.5	-0.1	-0.1	-0.1	-0.1	-0.5
73122	7.06	1.28	7.37	1.57	4.52	0.72	4.3	0.69	0.05	0.03	0.5	138	1.4	97	-0.5	-0.1	-0.1	-0.1	-0.1	1.1
73124	7.22	1.3	7.47	1.57	4.65	0.72	4.43	0.67	0.1	0.03	0.5	316	1.1	75	-0.5	-0.1	-0.1	-0.1	-0.1	1.2
73125	7.1	1.31	7.38	1.62	4.73	0.73	4.52	0.69	0.04	0.03	0.5	254	1.1	72	-0.5	-0.1	-0.1	-0.1	-0.1	0.6
73126	6.75	1.21	7.26	1.54	4.45	0.65	4.14	0.63	0.04	0.06	0.6	111	0.9	93	-0.5	0.1	-0.1	-0.1	-0.1	0.8
73127	5.68	1	5.74	1.22	3.44	0.55	3.53	0.52	0.09	0.05	0.4	294	1.1	81	-0.5	-0.1	-0.1	-0.1	-0.1	0.7
73128	5.8	1.05	6.11	1.33	3.79	0.58	3.63	0.55	0.07	0.14	0.4	89.5	0.6	57	-0.5	-0.1	-0.1	-0.1	-0.1	-0.5
73129	5.61	1.01	5.56	1.23	3.63	0.54	3.39	0.52	0.1	0.62	1	75.2	0.7	72	-0.5	-0.1	-0.1	-0.1	-0.1	-0.5
73130	5.15	0.94	5.42	1.2	3.35	0.55	3.26	0.48	0.09	0.43	0.9	131	1	93	0.7	-0.1	-0.1	-0.1	0.1	-0.5
73131	6.44	1.18	6.67	1.43	4.28	0.65	4.12	0.61	0.08	0.19	0.5	147	0.6	65	-0.5	-0.1	-0.1	-0.1	-0.1	0.5
73132	6.56	1.18	6.96	1.51	4.32	0.66	4.22	0.59	0.03	0.06	0.5	103	0.4	64	-0.5	-0.1	-0.1	-0.1	-0.1	-0.5
73134	6.85	1.22	7.22	1.55	4.49	0.68	4.47	0.63	0.1	0.11	0.5	107	0.7	67	-0.5	-0.1	-0.1	-0.1	-0.1	0.6
73138	4.89	0.88	5.15	1.13	3.26	0.52	3.01	0.45	0.66	0.11	0.3	123	1.4	63	-0.5	-0.1	-0.1	-0.1	-0.1	-0.5
73139	5.23	0.96	5.74	1.21	3.53	0.55	3.37	0.47	1.37	0.1	0.3	121	1.8	63	-0.5	0.1	-0.1	-0.1	-0.1	-0.5
73141	4.52	0.85	5.14	1.03	3.03	0.47	3.04	0.42	1.3	0.14	0.3	90.7	2.8	63	1.7	0.3	-0.1	-0.1	-0.1	-0.5
73142	6.13	1.05	5.94	1.23	3.68	0.57	3.31	0.51	0.76	0.08	0.4	79.5	5	74	1.6	0.4	-0.1	-0.1	-0.1	1
73149	6.03	1.09	6.28	1.37	4.05	0.62	3.77	0.55	0.49	0.07	0.3	111	1.6	82	0.8	0.2	-0.1	-0.1	-0.1	-0.5
73176	5.56	0.96	5.9	1.19	3.37	0.51	3.04	0.51	1.46	1.11	8.6	55	2.5	78	0.6	0.2	-0.1	0.1	-0.1	3
73177	4.98	0.88	4.98	1.09	3.22	0.51	2.83	0.49	1.98	1.29	12.3	197	2.4	90	-0.5	0.2	-0.1	0.1	-0.1	2.2
73178	5.69	1.01	6.08	1.23	3.68	0.54	3.21	0.55	1.33	0.55	1.4	168	2.5	86	-0.5	0.2	-0.1	0.1	-0.1	-0.5
73179	4.52	0.78	4.88	1.03	2.84	0.43	2.63	0.44	2.28	0.6	5.4	103	1.7	60	-0.5	0.1	-0.1	0.1	-0.1	3.2
73181	4.95	0.87	5.37	1.08	2.97	0.47	2.88	0.48	1.7	0.32	1.7	154	1.8	74	-0.5	0.2	-0.1	-0.1	-0.1	2.5
73182	4.94	0.92	5.29	1.14	3.2	0.52	3	0.47	1.24	0.16	0.3	123	1.7	70	-0.5	0.2	-0.1	-0.1	-0.1	2.4

Table A5– Continued

Sample Number	Hg ppm	Tl ppm	Se ppm
73395	-0.01	0.2	-0.5
73422	-0.01	-0.1	0.6
73114	-0.01	-0.1	-0.5
73115	-0.01	-0.1	-0.5
73116	-0.01	-0.1	-0.5
73117	-0.01	-0.1	-0.5
73118	-0.01	-0.1	-0.5
73119	-0.01	-0.1	0.6
73120	-0.01	-0.1	0.9
73121	-0.01	-0.1	1.1
73122	-0.01	-0.1	0.6
73124	-0.01	-0.1	-0.5
73125	-0.01	-0.1	-0.5
73126	-0.01	-0.1	-0.5
73127	-0.01	-0.1	1
73128	-0.01	-0.1	-0.5
73129	-0.01	-0.1	-0.5
73130	-0.01	-0.1	-0.5
73131	-0.01	-0.1	-0.5
73132	-0.01	-0.1	-0.5
73134	-0.01	-0.1	-0.5
73138	-0.01	-0.1	-0.5
73139	-0.01	-0.1	-0.5
73141	-0.01	0.1	-0.5
73142	-0.01	-0.1	-0.5
73149	-0.01	-0.1	-0.5
73176	-0.01	-0.1	-0.5
73177	-0.01	0.1	-0.5
73178	-0.01	-0.1	-0.5
73179	-0.01	-0.1	-0.5
73181	-0.01	-0.1	-0.5
73182	-0.01	-0.1	-0.5

Table A5– Continued

Sample Number	BatchNumber	Acme	SiO2 wt%	Al2O3 wt%	Fe2O3 w%	MgO w%	CaO w%	Na2O w%	K2O w%	TiO2 w%	P2O5 w%	MnO w%	Cr2O 3 w%	Ni ppm	Sc ppm	LOI wt%	Ba ppm	Be ppm
73184	SAN08001564		48.96	18.68	11.97	4.26	10.14	3.01	0.76	1.84	0.24	0.15	0.01	25	36	4.7	179	-1
73186	SAN08001564		47.79	18.80	12.94	4.54	8.95	3.73	0.76	2.05	0.26	0.19	0.01	-20	38	9.9	193	1
73187	SAN08001564		52.38	15.99	10.27	3.75	11.76	3.16	0.74	1.57	0.21	0.14	0.01	-20	30	10	258	2
73188	SAN08001564		49.86	18.77	10.55	3.94	11.01	3.45	0.47	1.60	0.20	0.15	0.01	-20	34	7.7	182	1
73189	SAN08001564		49.63	19.45	10.42	3.80	10.45	3.87	0.61	1.44	0.17	0.15	0.01	26	30	7.3	210	1
73191	SAN08001564		49.79	18.68	10.84	4.06	10.53	3.40	0.76	1.58	0.19	0.17	0.01	27	33	5.9	261	1
73192	SAN08001564		48.80	18.81	10.89	4.35	11.09	3.32	0.70	1.62	0.19	0.19	0.02	-20	34	6.1	223	-1
73194	SAN08001564		49.49	19.95	11.10	4.21	9.76	2.90	0.60	1.58	0.21	0.18	0.02	21	33	7.4	162	-1
73195	SAN08001564		49.82	18.53	11.23	3.79	11.40	2.44	0.80	1.62	0.22	0.13	0.02	23	33	10.9	153	-1
73196	SAN08001564		48.77	19.54	11.03	4.34	10.90	2.80	0.69	1.58	0.20	0.13	0.03	34	31	12.7	179	1
73197	SAN08001564		48.98	19.83	10.58	4.33	11.52	2.80	0.15	1.45	0.19	0.15	0.02	21	30	8.3	92	-1
73198	SAN08001564		48.65	19.25	10.98	3.97	11.10	2.83	1.28	1.58	0.21	0.15	0.02	-20	31	12.1	289	2
73199	SAN08001564		50.66	16.74	11.26	4.26	11.78	2.93	0.27	1.71	0.21	0.16	0.01	-20	34	10.2	120	1
73200	SAN08001564		50.19	20.20	9.64	4.02	11.18	2.49	0.61	1.34	0.17	0.14	0.01	25	27	9.8	145	-1
73201	SAN08001564		49.45	17.49	12.22	4.10	10.35	3.26	0.92	1.81	0.23	0.16	0.01	22	36	10.3	195	2
73202	SAN08001564		51.27	17.64	10.29	4.04	12.14	2.35	0.42	1.49	0.19	0.16	0.01	24	31	10	187	1
73204	SAN08001564		49.03	17.76	12.38	4.42	10.36	2.65	1.30	1.71	0.23	0.16	0.01	-20	35	12.2	180	2
73205	SAN08001564		50.19	17.71	11.38	4.43	11.04	2.46	0.80	1.62	0.20	0.17	0.01	24	34	10.8	192	1
73206	SAN08001564		49.36	18.36	10.94	4.08	11.71	2.65	0.91	1.57	0.20	0.22	0.01	28	34	7.7	225	-1
71918	SAN08002928		49.53	13.57	14.79	4.94	9.54	3.87	1.06	2.15	0.29	0.25	0.02	39	51	5.2	303	-1
71921	SAN08002928		50.73	12.75	14.48	5.35	9.64	3.08	1.18	2.16	0.33	0.27	0.03	25	52	3.5	286	1
73190	SAN08001564		50.66	17.98	10.56	3.84	10.06	4.42	0.60	1.51	0.20	0.16	0.01	24	31	8.8	262	2
73207	SAN08001649		48.41	19.96	11.61	4.76	9.98	2.28	0.84	1.70	0.23	0.21	0.01	25	36	8.6	241	-1
73136	SAN08001455		54.68	14.93	13.40	4.32	5.57	3.07	1.36	2.14	0.28	0.22	0.02	23	42	8	373	-1
73180	SAN08001564		48.63	19.70	13.53	5.05	6.64	2.84	1.15	2.00	0.27	0.19	0.01	23	38	10.2	205	1
73185	SAN08001564		49.25	18.94	13.65	4.64	6.64	3.07	1.13	2.20	0.28	0.19	0.01	21	42	8.8	244	2
71916	SAN08002928		50.50	12.61	17.00	4.60	5.83	4.07	1.61	3.12	0.44	0.21	0.01	21	46	7.1	354	2
73135	SAN08001455		56.37	15.37	11.58	3.18	6.39	3.57	1.23	1.83	0.27	0.18	0.03	-20	37	6.1	305	-1
73210	SAN08001649		54.45	15.54	9.83	6.20	8.62	1.50	2.13	1.32	0.23	0.18	0.01	42	25	11.3	331	-1
73211	SAN08001649		60.11	13.71	8.83	5.08	6.52	1.60	2.37	1.34	0.25	0.18	0.02	32	20	9	496	1
73214	SAN08001649		56.21	16.78	10.33	5.51	6.24	0.34	2.68	1.42	0.29	0.17	0.02	55	25	12.1	814	-1
73391	SAN08002548		50.19	14.31	15.42	3.65	8.45	2.95	1.72	2.70	0.36	0.24	0.01	-20	47	2	421	2

Table A5– Continued

Sample Number	Co	Cs	Ga	Hf	Nb	Rb	Sn	Sr	Ta	Th	U	V	W	Zr	Y	La	Ce	Pr	Nd	Sm	Eu
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
73184	30.7	0.2	20	2.9	18	12.7	1	283	1.1	2.8	0.4	284	-0.5	132	30.3	14	27	4.07	17.9	4.54	1.6
73186	33	0.4	20.5	3.8	20.5	13.2	1	251	1.1	2.2	0.4	307	-0.5	151	34.9	15.3	29	4.41	19.3	5.15	1.7
73187	25.8	0.4	17.5	3.4	15.8	12.7	1	245	0.9	2.1	0.3	246	-0.5	118	27.6	11.5	26	3.51	15.3	3.72	1.3
73188	28.3	0.1	18.2	3.5	16.4	6.9	-1	320	1	1.6	0.3	269	-0.5	116	29.8	11.4	25	3.41	14.8	3.69	1.4
73189	27.3	0.3	18.8	2.5	15	10.9	1	315	1	1.6	0.3	247	1.3	107	26.4	10.5	23	3.13	14.6	3.44	1.2
73191	29.2	0.1	20.6	3.3	16	12.2	1	393	0.9	1.6	0.4	268	0.9	117	29.3	11.5	24	3.42	16.6	3.76	1.4
73192	29.5	0.5	18.6	3.1	16	11.3	1	314	0.9	1.9	0.4	274	-0.5	115	29.6	11.3	25	3.49	15.6	3.85	1.4
73194	27.6	0.4	18.8	2.9	16.6	11.2	1	263	0.9	1.4	0.4	265	4.7	112	29.5	11.7	25	3.37	15.1	3.83	1.4
73195	28.5	0.8	17	2.9	16.1	18.4	3	209	0.9	2.1	0.4	262	7.8	117	27.7	11.4	23	3.31	14.9	3.69	1.3
73196	29.8	0.6	18.5	3.8	15.6	16.6	2	245	0.9	1.7	0.3	249	4.3	113	26.5	11.3	23	3.2	13.7	3.61	1.3
73197	30	0.2	20.8	3	15.4	2.9	-1	264	0.9	2.1	0.3	254	-0.5	109	26.4	11.6	24	3.25	14.3	3.51	1.3
73198	28.3	0.9	17.9	3.2	15	30.8	-1	260	1	1.4	0.3	255	0.7	110	27.1	11	24	3.29	14.2	3.54	1.3
73199	28.3	0.3	17.7	3.1	16	6.2	1	244	0.8	2	0.4	275	0.9	119	29.1	11.5	25	3.43	15.7	4.09	1.4
73200	24.5	1	17	2.7	13.3	16.4	-1	231	0.9	1.5	0.3	217	-0.5	94.9	23.6	9.8	21	2.77	13.2	3	1.2
73201	29.3	0.9	17.5	3.8	17.9	22.5	1	266	0.9	2	0.4	284	-0.5	127	30.4	11.7	26	3.61	17.8	4.14	1.4
73202	25.4	0.6	18	3	15.1	13	-1	281	0.9	1.6	0.3	244	3.7	109	26	10.8	23	3.14	13.9	3.64	1.3
73204	32.5	0.8	16.8	2.9	17	32.5	1	215	1	1.9	0.4	272	0.7	120	28	11.1	24	3.45	17.2	3.91	1.3
73205	30.3	0.7	17.8	3.5	17	19.8	1	234	1	1.5	0.3	267	-0.5	117	27.8	11.3	25	3.47	16.3	3.95	1.4
73206	28.4	0.2	18.4	3	16.5	17	-1	273	0.8	1.5	0.4	258	-0.5	115	26.8	11.4	25	3.36	16.1	3.67	1.4
71918	45.5	0.2	17.3	5	23.7	22.4	1	507	1.5	2.8	0.4	333	1.5	171	41.8	16	35	4.82	20.5	5.64	1.9
71921	43	0.2	18.8	5.3	26.8	28.3	2	246	1.6	3.5	0.7	534	0.9	205	48.6	19.8	44	5.92	27.1	6.7	2.1
73190	28	0.7	17.5	2.8	15.2	10.9	1	675	0.8	1.6	0.4	259	1.4	109	27.9	11	22	3.22	14.6	3.62	1.3
73207	34.7	0.6	20	3.2	18.9	20.6	-1	272	1.1	1.8	0.4	311	-0.5	126	32.6	12.8	27	3.66	16	4.06	1.6
73136	31.6	1.2	17.4	4.2	24	29.1	2	689	1.5	2.6	0.6	599	-0.5	168	36.5	15.9	33	4.56	22.1	4.84	1.7
73180	34.5	0.8	19.4	3.2	19.9	27.5	-1	202	1.2	2.5	0.4	307	-0.5	140	32.9	14	27	4.16	17.3	4.92	1.6
73185	35.1	0.5	21.5	4.2	22	21.8	1	193	1.4	3.2	0.4	332	-0.5	163	36	16.7	31	4.67	20.9	5.35	1.8
71916	39.4	0.5	19.9	7.4	37.1	44.5	2	451	2.1	5	0.9	430	0.5	274	62.1	26.6	57	7.7	33.5	8.42	2.5
73135	31.6	0.9	17.8	4.6	22.3	28.1	1	369	1.3	2.6	0.5	347	2.3	160	36.8	14.5	32	4.27	20.2	4.8	1.7
73210	31	0.6	17.7	4.7	18.8	53.9	1	117	1.1	3.3	0.6	183	-0.5	160	31.5	17.8	37	4.95	20.6	4.51	1.4
73211	22.6	0.7	14.5	4.7	20.9	60.8	1	113	1.5	3.7	0.7	171	-0.5	166	32.9	20	42	5.67	23.1	5.05	1.5
73214	36.3	1.1	17.4	4.9	21	73.9	2	96.5	1.2	3.5	0.7	183	1.1	170	33.2	18.8	41	5.56	22.6	5.2	1.4
73391	37.8	0.4	24.2	8.4	38.4	46.1	2	241	2.2	4.6	1	391	-0.5	283	60.2	27	59	7.72	35.2	8.28	2.5

Table A5– Continued

Sample Number	Gd ppm	Tb ppm	Dy ppm	Ho ppm	Er ppm	Tm ppm	Yb ppm	Lu ppm	TOT/C wt%	TOT/S wt%	Mo ppm	Cu ppm	Pb ppm	Zn ppm	As ppm	Cd ppm	Sb ppm	Bi ppm	Ag ppm	Au ppb
73184	5.56	0.94	5.91	1.15	3.52	0.53	3.29	0.49	0.41	0.06	0.5	121	1.7	78	-0.5	-0.1	-0.1	-0.1	-0.1	1.1
73186	6.06	1.08	6.34	1.38	3.76	0.6	3.67	0.6	0.98	0.12	0.3	129	1.9	84	0.6	0.2	-0.1	0.2	-0.1	2.1
73187	4.41	0.87	5.19	1.06	3.12	0.48	2.99	0.44	1.61	0.33	0.3	102	1.8	69	2.5	0.5	-0.1	0.7	-0.1	1.9
73188	4.8	0.88	5.2	1.1	3.2	0.48	2.97	0.44	0.56	0.03	0.4	109	2.3	69	1	0.4	-0.1	0.6	-0.1	3.7
73189	4.3	0.79	4.83	0.99	2.8	0.45	2.86	0.4	0.94	0.28	0.4	99.7	2.1	64	1.9	0.7	-0.1	0.3	-0.1	4
73191	4.78	0.83	5.07	1.04	3.1	0.47	3.02	0.44	0.65	0.09	1	104	2.1	62	1.2	0.2	-0.1	0.1	-0.1	2.7
73192	4.75	0.86	5.05	1.03	3.19	0.51	3.21	0.47	0.68	0.12	0.5	115	1.9	67	0.6	0.2	-0.1	0.1	-0.1	1.1
73194	4.62	0.86	5.12	1.05	3.11	0.45	2.99	0.44	0.71	0.08	0.3	109	1.8	71	0.9	0.2	-0.1	0.1	-0.1	2.7
73195	4.56	0.84	5.02	1.05	3.08	0.46	2.87	0.43	1.45	0.22	0.7	105	2.1	69	1.1	0.1	-0.1	-0.1	-0.1	2.3
73196	4.41	0.84	4.85	1.02	2.85	0.45	2.84	0.4	0.99	-0.02	0.6	104	2	69	-0.5	-0.1	-0.1	-0.1	-0.1	1.9
73197	4.59	0.82	4.69	0.92	2.83	0.41	2.65	0.41	0.98	0.04	0.2	99	2.5	65	-0.5	-0.1	-0.1	0.1	-0.1	-0.5
73198	4.2	0.79	4.85	0.94	3.21	0.43	2.81	0.4	1.68	0.16	0.3	103	2.1	65	1.7	0.2	-0.1	0.8	-0.1	0.7
73199	4.88	0.86	5.36	1.11	3.15	0.48	3.24	0.44	1.62	0.08	2.5	106	4.1	69	0.9	0.4	-0.1	1.4	-0.1	-0.5
73200	3.81	0.68	4.22	0.86	2.56	0.4	2.44	0.35	0.97	0.02	0.6	95.3	2.7	60	0.8	0.1	-0.1	0.2	-0.1	1
73201	5.21	0.92	5.77	1.17	3.39	0.51	3.24	0.47	1.57	0.48	0.7	114	2.5	71	1.4	0.3	-0.1	0.7	-0.1	1.4
73202	4.73	0.78	4.81	0.99	2.83	0.42	2.73	0.4	1.48	0.07	0.7	109	1.9	63	1	0.2	-0.1	0.4	-0.1	1.4
73204	4.9	0.88	5.1	1	3.24	0.49	3.11	0.41	1.66	0.49	1	113	2.7	69	1.6	0.4	-0.1	0.3	-0.1	4.8
73205	4.65	0.86	5.06	1.05	3.19	0.48	2.86	0.42	1.5	0.15	0.4	111	2	73	1.2	0.1	-0.1	0.2	-0.1	0.9
73206	4.7	0.83	5.2	1.05	3.23	0.47	2.94	0.44	1.11	0.06	0.4	113	2.2	66	0.8	-0.1	-0.1	-0.1	-0.1	1.4
71918	6.65	1.22	7.33	1.5	4.31	0.65	4.11	0.62	0.39	0.02	0.2	88.6	1.6	67	2.3	0.4	-0.1	0.8	-0.1	2.9
71921	7.8	1.41	8.33	1.73	5.01	0.78	4.72	0.69	0.15	-0.02	0.3	112	4	80	2.4	0.2	-0.1	0.2	-0.1	3.7
73190	4.35	0.79	4.77	1	3.07	0.46	2.83	0.4	1.06	0.13	0.3	103	2.3	67	1.3	0.3	-0.1	0.2	-0.1	1.9
73207	5.03	0.95	5.59	1.17	3.39	0.51	3.05	0.46	0.68	0.19	0.8	118	1.8	69	0.5	0.1	-0.1	-0.1	-0.1	-0.5
73136	5.82	1.05	6.75	1.32	4.1	0.58	3.72	0.59	0.51	0.34	0.5	175	2.8	79	-0.5	0.2	-0.1	0.1	-0.1	-0.5
73180	5.52	0.99	6.18	1.22	3.72	0.56	3.27	0.54	0.73	0.27	8.8	140	2.3	89	-0.5	-0.1	-0.1	-0.1	-0.1	3.3
73185	6.45	1.13	6.98	1.4	4.23	0.65	3.88	0.59	0.72	0.15	0.3	166	2.1	90	-0.5	0.2	-0.1	0.1	-0.1	1.1
71916	9.68	1.74	10.86	2.25	6.4	0.94	5.99	0.89	0.2	-0.02	0.3	91.2	4.3	78	-0.5	-0.1	-0.1	-0.1	-0.1	1.8
73135	5.92	1.07	6.1	1.36	4.08	0.64	3.89	0.57	0.38	0.4	1.1	677	1.3	70	-0.5	0.2	-0.1	-0.1	-0.1	1.5
73210	5.1	0.91	5.27	1.12	3.23	0.48	2.92	0.44	1.1	0.17	0.9	60.5	3.1	64	8.8	0.2	-0.1	0.2	-0.1	-0.5
73211	5.48	1	5.53	1.18	3.37	0.51	2.95	0.46	0.78	0.17	0.5	45	2.5	56	7.1	0.2	-0.1	0.2	-0.1	1
73214	5.48	1	5.55	1.18	3.49	0.55	3.18	0.5	0.92	0.38	14.1	56.7	3.6	83	17.8	0.1	-0.1	0.2	-0.1	-0.5
73391	9.71	1.76	10.7	2.26	6.35	0.97	5.95	0.92	0.07	0.02	1.1	156	2	79	-0.5	-0.1	-0.1	-0.1	-0.1	-0.5

Table A5– Continued

Sample Number	Hg ppm	Tl ppm	Se ppm
73184	0.01	-0.1	-0.5
73186	-0.01	-0.1	-0.5
73187	-0.01	-0.1	-0.5
73188	-0.01	-0.1	-0.5
73189	-0.01	-0.1	-0.5
73191	-0.01	-0.1	-0.5
73192	-0.01	-0.1	-0.5
73194	-0.01	-0.1	-0.5
73195	-0.01	-0.1	-0.5
73196	-0.01	-0.1	-0.5
73197	-0.01	-0.1	-0.5
73198	-0.01	-0.1	-0.5
73199	-0.01	-0.1	-0.5
73200	-0.01	-0.1	0.6
73201	-0.01	-0.1	-0.5
73202	-0.01	-0.1	-0.5
73204	-0.01	-0.1	-0.5
73205	-0.01	-0.1	-0.5
73206	-0.01	-0.1	-0.5
71918	0.02	-0.1	-0.5
71921	0.01	-0.1	-0.5
73190	-0.01	-0.1	-0.5
73207	-0.01	-0.1	0.5
73136	-0.01	-0.1	1.6
73180	-0.01	-0.1	-0.5
73185	-0.01	-0.1	-0.5
71916	0.02	-0.1	-0.5
73135	-0.01	-0.1	7.9
73210	-0.01	-0.1	1.3
73211	-0.01	-0.1	1.8
73214	-0.01	0.2	1
73391	-0.01	-0.1	-0.5

Table A5– Continued

Sample Number	BatchNumber	Acme	SiO2 wt%	Al2O3 wt%	Fe2O3 w%	MgO w%	CaO w%	Na2O w%	K2O w%	TiO2 w%	P2O5 w%	MnO w%	Cr2O 3 w%	Ni ppm	Sc ppm	LOI wt%	Ba ppm	Be ppm
73209	SAN08001649		58.54	14.90	8.52	5.27	6.03	1.77	3.42	1.13	0.24	0.15	0.02	36	22	7.8	512	1
73212	SAN08001649		59.78	16.31	8.37	4.37	6.09	0.55	2.78	1.25	0.33	0.15	0.02	43	25	12	440	1
73412	SAN08002548		67.32	14.82	5.31	0.47	2.05	4.56	4.62	0.57	0.14	0.10	0.04	-20	11	0.9	973	3
73414	SAN08002548		69.06	14.56	4.27	0.26	1.51	4.60	5.13	0.41	0.06	0.09	0.03	-20	9	1.3	953	3
73415	SAN08002548		69.77	14.56	3.95	0.23	1.27	4.48	5.23	0.37	0.04	0.08	0.03	-20	8	1.3	1029	3
73416	SAN08002548		69.71	14.54	3.92	0.20	1.30	4.50	5.34	0.36	0.04	0.08	0.02	-20	8	1.2	1061	3
73417	SAN08002548		70.40	14.50	3.90	0.22	0.95	4.44	5.09	0.36	0.05	0.08	0.02	-20	8	1.5	984	3
73419	SAN08002548		70.62	14.14	3.65	0.23	1.67	4.85	4.35	0.35	0.05	0.08	0.01	-20	8	1.8	743	3
73420	SAN08002548		69.98	14.45	3.90	0.22	1.16	4.83	4.96	0.36	0.05	0.08	0.01	-20	8	1.2	849	3
73426	SAN08002548		69.99	14.27	3.77	0.34	1.67	4.54	4.94	0.37	0.03	0.08	0.01	-20	9	2.6	882	3
73427	SAN08002548		70.35	14.32	3.95	0.25	0.89	4.50	5.25	0.36	0.04	0.08	0.01	-20	8	1.5	937	3
73428	SAN08002548		70.99	13.90	3.45	0.24	1.69	4.61	4.68	0.33	0.03	0.08	0.01	-20	8	2.7	796	2
73429	SAN08002548		70.76	13.97	3.81	0.25	1.36	4.64	4.70	0.37	0.05	0.08	0.01	-20	8	1.7	794	3
73430	SAN08002548		70.02	14.40	3.82	0.24	1.33	4.76	4.93	0.37	0.05	0.08	0.01	-20	8	1.8	839	3
73431	SAN08002548		69.81	14.15	4.27	0.35	1.50	4.60	4.71	0.43	0.09	0.09	0.01	-20	9	1.7	785	3
73432	SAN08002548		71.89	13.52	3.69	0.23	1.39	4.51	4.31	0.34	0.04	0.08	0.01	-20	8	1.9	759	3
73434	SAN08002548		71.58	13.89	3.49	0.24	1.61	4.44	4.30	0.33	0.04	0.08	0.01	-20	8	1.9	751	2
73435	SAN08002548		70.91	13.95	3.73	0.25	1.50	4.26	4.93	0.35	0.03	0.08	0.01	-20	8	1.8	856	2
73436	SAN08002548		70.19	14.28	3.72	0.22	1.29	4.53	5.28	0.35	0.05	0.08	0.01	-20	8	1.9	962	2
73437	SAN08002548		69.96	14.46	3.72	0.23	1.27	4.52	5.35	0.35	0.04	0.09	0.01	-20	8	2	918	2
73438	SAN08002548		69.51	14.37	4.00	0.29	1.35	4.33	5.61	0.39	0.05	0.08	0.02	-20	9	1.8	947	2
73425	SAN08002548		63.16	14.55	8.49	1.31	2.86	5.32	2.64	1.14	0.38	0.14	0.00	-20	20	2.7	578	3
73439	SAN08002548		61.25	14.46	8.56	1.33	4.23	4.81	3.64	1.20	0.38	0.14	0.01	-20	20	3.4	742	2
73440	SAN08002548		61.71	13.70	9.05	1.56	4.77	5.08	2.21	1.33	0.45	0.14	0.01	-20	21	4.1	452	2
73418	SAN08002548		70.90	14.03	3.86	0.26	1.63	5.16	3.66	0.36	0.04	0.08	0.01	-20	8	1.6	701	3
73259	SAN08001870		76.71	12.92	6.05	0.21	0.59	0.15	2.74	0.44	0.14	0.01	0.04	-20	10	4.9	234	3
73262	SAN08001870		78.74	13.00	4.03	0.17	0.55	0.13	2.84	0.42	0.11	-0.01	0.03	-20	14	4.7	203	2
73275	SAN08001870		78.77	11.36	5.90	0.26	0.84	0.16	2.18	0.36	0.11	0.03	0.03	-20	10	4.3	242	4
73276	SAN08001870		80.08	10.45	4.20	0.14	0.60	0.27	3.91	0.25	0.05	0.01	0.04	-20	8	4.4	554	3
73314	SAN08002243		72.27	12.70	4.86	0.16	1.02	2.07	6.38	0.32	0.06	0.07	0.09	-20	7	1.6	958	2
73307	SAN08002243		74.89	11.79	3.58	0.10	0.32	2.33	6.62	0.23	0.04	0.04	0.06	-20	11	0.6	1027	2
73308	SAN08002243		74.74	11.94	3.68	0.07	0.39	2.18	6.59	0.22	0.05	0.03	0.10	-20	10	1.9	1017	3

Table A5– Continued

Sample Number	Co	Cs	Ga	Hf	Nb	Rb	Sn	Sr	Ta	Th	U	V	W	Zr	Y	La	Ce	Pr	Nd	Sm	Eu
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
73209	29.3	0.5	17.3	5.6	21.8	82.2	2	132	1.4	7.1	1.1	159	-0.5	203	35.2	24.3	51	6.87	27.5	5.81	1.6
73212	26.9	1.3	16.1	5.2	20.4	97.7	3	73.3	1.2	6	0.7	169	0.8	195	35.1	18.6	41	5.48	22.7	4.76	1.4
73412	3.8	1.2	22.5	19	77.4	128.8	5	109	4.4	14.8	2.8	12	0.9	713	104	65.4	137	16.75	70.1	13.64	2.5
73414	2.4	0.7	21.2	20	78.8	141	6	81.9	4.3	15.3	2.9	16	0.9	724	103	64.3	134	16.73	68.9	13.25	2.2
73415	1.7	0.9	20.6	20	76.4	146.3	6	79.7	4.5	16.1	3.1	11	0.8	734	100	67	139	16.47	68	13.23	2.1
73416	1.6	0.8	20.3	21	76.9	149.9	7	79.7	4.6	17.9	3.2	9	0.8	741	107	66.4	137	16.86	67.8	13.44	2.2
73417	1.7	1.1	17.8	20	77.5	142.8	7	75.8	4.2	15.8	3	9	0.7	733	101	63.4	133	16.32	66.6	12.76	2.1
73419	1.5	0.4	15.6	20	73.7	119.7	4	70.7	4.3	16.5	2.8	10	-0.5	693	104	64.4	132	16.03	67.3	13.12	2.2
73420	1.6	0.6	13.8	19	77.4	137.9	5	80.1	4.5	16.3	3	8	-0.5	706	98.2	65.7	137	16.35	68.6	12.86	2.1
73426	1.6	0.6	13.5	19	73.6	133	4	96	4.5	14.9	3.1	9	0.6	664	89.2	62.2	127	15.64	59	11.97	2
73427	1.4	0.7	12.6	20	76.8	146.4	5	91.1	4.4	15.1	3.1	-8	-0.5	707	95.8	64.3	129	16.1	60.6	12.43	2.1
73428	1.3	0.5	15	18	71.3	126.8	4	73.8	4.3	14.6	2.8	-8	-0.5	652	90.4	60.1	121	15.22	57.3	12.17	1.9
73429	1.7	0.5	14.4	19	74.4	127.9	5	70.4	4.1	15.3	2.8	9	5.3	689	96.5	61.5	126	15.46	58.7	12.3	2
73430	1.6	0.6	13.6	19	75.8	132	4	72.5	4.4	14.8	3	-8	-0.5	683	90.7	64.2	127	15.53	57.6	12.16	1.9
73431	2.8	0.6	14.8	18	72.3	128.1	4	69.8	4.4	14.5	2.8	14	-0.5	659	93.1	61.2	125	15.72	59.2	12.54	2.1
73432	1.4	0.7	14.1	19	70.6	117	4	67.4	4.3	15.1	2.8	-8	-0.5	664	86.3	60.5	120	14.96	54.6	11.71	1.9
73434	1.4	0.5	14.5	18	72.9	119	5	75.4	4	14.7	3.1	-8	-0.5	676	93.7	60.7	124	15.34	59.5	12.31	2
73435	1.6	0.6	12.6	19	74	129.6	4	87.1	4.7	14.7	2.9	-8	2.9	683	92.7	62	125	15.48	58	12.25	2
73436	1.5	0.7	13.8	20	78.9	142.2	5	98.5	5	15.3	3	-8	0.6	711	116	64.2	131	16.35	64.9	14.26	2.5
73437	1.2	0.7	14	21	78	139.8	4	103	4.6	15.7	3.5	-8	-0.5	708	95.5	63.2	126	15.59	61.9	13.07	2.1
73438	2	0.6	14	20	76.8	152.1	4	114	4.4	17.8	3.2	-8	0.5	705	87.7	62.4	126	15.42	58.7	12.66	2.1
73425	8.4	0.3	17.4	15	64.1	74.7	5	106	3.5	11.5	2.1	38	1.1	582	89.7	57.1	120	15.44	63.3	13.36	3.2
73439	8.5	0.5	18.7	15	62.4	93.6	4	111	3.5	9.9	2.1	31	0.8	566	82.9	53	109	14.21	55.9	13.1	3.2
73440	10.4	0.4	17.9	14	57.8	56.7	4	121	3.3	9.4	1.6	41	0.5	522	80.9	49.3	103	13.27	53.9	12.32	3.2
73418	1.7	0.4	17	19	71.5	101.5	4	73.8	4.2	15.2	2.7	15	-0.5	699	98.1	65	130	15.75	63.9	12.72	2.1
73259	5.2	1.5	17.3	5.5	24.8	96.5	3	55.1	1.5	13.9	2.1	-8	2.2	201	49.7	48.8	104	12.89	48.5	9.37	1.6
73262	4.4	1.8	17.1	4	25.5	97.2	3	36.3	3.6	18.6	2.6	20	2.3	166	58	57.9	129	16.68	60.1	12.06	2.1
73275	3.9	2.2	17.4	5.2	20.2	97.8	4	36.6	1.4	18.5	2.4	17	1.2	164	36.2	46.6	95	11	37.1	7.04	1.2
73276	2.9	1.8	13.1	3.5	16.3	144.5	3	40.1	1.2	14.4	1.7	13	1	115	27.9	41.4	83	9.84	36.4	6.46	1
73314	2.3	2.4	19.5	8.7	32.1	202.5	6	88.2	2.1	21.5	3.5	-8	0.8	292	65.6	74.7	145	17.42	61.6	11.69	1.6
73307	2.3	1.3	17	8.5	18.8	213.4	5	90.8	1.3	26.2	3.7	14	0.9	251	77.3	83.5	164	20.22	78.6	13.64	1.7
73308	2.7	1.5	17.4	7.9	19.4	207.3	6	91.2	1.4	24.9	4	11	1.5	242	68.5	83.2	154	18.64	71.3	12.74	1.5

Table A5– Continued

Sample Number	Gd ppm	Tb ppm	Dy ppm	Ho ppm	Er ppm	Tm ppm	Yb ppm	Lu ppm	TOT/C wt%	TOT/S wt%	Mo ppm	Cu ppm	Pb ppm	Zn ppm	As ppm	Cd ppm	Sb ppm	Bi ppm	Ag ppm	Au ppb
73209	6.31	1.09	6	1.3	3.9	0.59	3.46	0.52	0.65	0.15	3.5	52.4	6.6	66	6.9	0.2	-0.1	0.2	-0.1	0.9
73212	5.72	1.01	5.9	1.27	3.8	0.59	3.8	0.58	0.85	0.55	1.7	67.2	17	65	11.2	0.2	-0.1	0.6	-0.1	8.6
73412	14.2	2.72	17.2	3.58	10.6	1.78	12.22	1.75	0.13	0.2	2.9	14.3	4.5	83	4	0.2	-0.1	-0.1	-0.1	-0.5
73414	14.1	2.68	17.01	3.53	10.7	1.83	12.26	1.8	0.2	0.07	3	12.1	7.3	92	1.9	0.1	-0.1	-0.1	-0.1	1.8
73415	13.7	2.57	16.54	3.65	10.4	1.78	12.31	1.77	0.16	0.08	2.6	11.8	7.2	84	2.3	0.2	0.1	-0.1	-0.1	-0.5
73416	14.1	2.7	17.83	3.71	10.7	1.85	12.66	1.8	0.18	0.07	2.5	11.1	9	81	1.9	0.2	-0.1	-0.1	-0.1	1
73417	13.4	2.63	16.69	3.5	10.8	1.81	12.15	1.74	0.08	0.12	2.5	12.2	11	88	3.1	0.1	0.1	-0.1	-0.1	-0.5
73419	14.2	2.66	17.15	3.54	10.3	1.75	12.05	1.72	0.25	0.33	1.3	13.9	6.7	91	7.1	0.1	0.2	-0.1	-0.1	-0.5
73420	13.3	2.54	16.23	3.56	10.3	1.83	12.03	1.76	0.14	0.27	2.5	13.1	10	92	5.8	0.2	0.2	-0.1	-0.1	1.4
73426	12.5	2.35	15.11	3.16	9.86	1.78	11.52	1.72	0.25	0.22	2.1	12.5	8.3	88	7.3	0.2	0.7	-0.1	-0.1	0.9
73427	13.2	2.58	16.23	3.44	10.5	1.83	12.08	1.78	0.13	0.24	1.9	13.1	7.7	93	6.7	0.1	0.1	-0.1	-0.1	-0.5
73428	12.6	2.38	15.07	3.25	9.91	1.67	10.97	1.65	0.28	0.31	1.4	11.6	6.4	85	8.5	-0.1	0.2	-0.1	-0.1	0.7
73429	13	2.5	15.68	3.33	10.3	1.74	10.99	1.65	0.19	0.27	1.7	12.3	6.8	87	7.7	-0.1	0.2	-0.1	-0.1	1.5
73430	12.2	2.36	15.45	3.26	10.1	1.73	11.59	1.72	0.2	0.26	1.9	13.1	6.5	90	7.2	0.1	0.2	-0.1	-0.1	-0.5
73431	13.3	2.48	15.65	3.29	10.5	1.76	10.97	1.67	0.21	0.23	1.5	14.1	6.3	94	5.6	0.1	0.1	-0.1	-0.1	0.8
73432	12.3	2.27	14.2	3.11	9.82	1.64	10.43	1.63	0.19	0.23	1	12	6	86	7.8	-0.1	0.2	-0.1	-0.1	1.2
73434	13	2.47	15.3	3.24	9.81	1.71	11.08	1.65	0.23	0.37	1	12	5.7	83	12.1	-0.1	0.2	-0.1	-0.1	-0.5
73435	13.2	2.5	16.05	3.4	10.4	1.76	11.51	1.68	0.22	0.31	1.4	12	6.8	79	11.2	0.2	0.2	-0.1	-0.1	-0.5
73436	15.9	3.12	18.62	4.06	11.9	1.94	12.24	1.84	0.2	0.16	1.4	12.3	7.1	85	7.5	-0.1	0.1	-0.1	-0.1	1.9
73437	13.9	2.63	16.59	3.5	11.1	1.86	11.82	1.78	0.21	0.1	1.4	12.2	6.5	87	5.9	0.1	0.1	-0.1	-0.1	0.7
73438	13.1	2.45	15.41	3.32	10.2	1.69	11.15	1.69	0.22	0.09	1.7	13.2	6.4	83	5.3	-0.1	-0.1	-0.1	-0.1	0.8
73425	14.1	2.63	16.12	3.25	9.57	1.6	10.01	1.49	0.28	0.36	1.4	20.7	7.2	113	7.4	0.2	0.1	-0.1	-0.1	2
73439	14.2	2.48	15.13	3.09	9.54	1.53	9.38	1.41	0.51	0.08	1.1	20	5.9	103	3.4	0.1	-0.1	-0.1	-0.1	0.9
73440	13.7	2.43	14.39	3.1	9.07	1.43	8.91	1.35	0.56	0.14	1	21.5	6	105	5.6	0.3	-0.1	-0.1	-0.1	0.9
73418	13.6	2.55	15.76	3.48	10.2	1.76	11.64	1.68	0.23	0.16	1	15.4	7.4	91	3.6	0.1	0.1	-0.1	-0.1	0.6
73259	9.13	1.49	8.31	1.65	4.63	0.74	4.38	0.67	0.02	0.12	0.7	6.3	10	40	8.9	0.7	-0.1	2.5	-0.1	1
73262	9.87	1.95	10.91	2.26	6.08	0.9	5.21	0.79	0.03	0.06	0.2	8.9	16	26	5.7	1.3	-0.1	2.1	-0.1	1.8
73275	6.38	1.02	6.39	1.26	3.69	0.56	3.72	0.53	0.09	0.14	4.7	3.1	10	38	15.9	1.4	0.2	1	-0.1	1.6
73276	5.81	0.88	5.21	1.02	2.84	0.47	2.72	0.41	0.06	1.73	5.4	4.9	12	33	62	2	0.6	0.6	-0.1	4.7
73314	10.5	1.84	11.17	2.3	6.77	1.02	6.54	1	0.15	0.02	0.5	4.3	11	71	3.1	0.4	-0.1	-0.1	-0.1	1.6
73307	13.6	2.19	13.34	2.62	7.59	1.17	7.02	1.06	-0.02	0.06	0.3	3.9	14	74	4.9	0.2	0.2	-0.1	-0.1	1.9
73308	11.8	1.92	11.58	2.36	7.13	1.09	6.68	0.99	0.02	0.04	0.5	5.7	15	89	4.7	0.3	0.1	-0.1	-0.1	-0.5

Table A5– Continued

Sample Number	Hg ppm	Tl ppm	Se ppm
73209	-0.01	-0.1	1.1
73212	-0.01	-0.1	1.4
73412	-0.01	-0.1	0.6
73414	-0.01	-0.1	1.1
73415	-0.01	-0.1	0.9
73416	-0.01	-0.1	0.7
73417	-0.01	-0.1	0.8
73419	-0.01	-0.1	1.2
73420	-0.01	-0.1	0.9
73426	-0.01	-0.1	0.7
73427	-0.01	-0.1	0.9
73428	-0.01	-0.1	0.9
73429	-0.01	-0.1	0.9
73430	-0.01	-0.1	0.6
73431	-0.01	-0.1	0.7
73432	-0.01	-0.1	0.7
73434	-0.01	-0.1	0.8
73435	-0.01	-0.1	0.6
73436	-0.01	-0.1	0.8
73437	-0.01	-0.1	0.6
73438	-0.01	-0.1	0.8
73425	-0.01	-0.1	0.7
73439	-0.01	-0.1	0.8
73440	-0.01	-0.1	0.7
73418	-0.01	-0.1	0.9
73259	-0.01	0.4	-0.5
73262	-0.01	0.3	-0.5
73275	-0.01	0.4	-0.5
73276	-0.01	0.6	-0.5
73314	-0.01	-0.1	-0.5
73307	-0.01	-0.1	-0.5
73308	-0.01	-0.1	0.5

Table A5– Continued

Sample Number	BatchNumber	Acme	SiO ₂ wt%	Al ₂ O ₃ wt%	Fe ₂ O ₃ w%	MgO w%	CaO w%	Na ₂ O w%	K ₂ O w%	TiO ₂ w%	P ₂ O ₅ w%	MnO w%	Cr ₂ O ₃ w%	Ni ppm	Sc ppm	LOI wt%	Ba ppm	Be ppm
73309	SAN08002243		74.54	11.46	3.88	0.14	0.89	2.31	6.35	0.23	0.03	0.05	0.11	-20	12	1.1	1031	3
73310	SAN08002243		74.95	11.59	4.07	0.11	0.28	2.05	6.50	0.24	0.05	0.04	0.11	-20	9	0.6	1103	3
73311	SAN08002243		75.49	11.81	3.62	0.11	0.29	1.77	6.55	0.23	0.05	0.03	0.05	-20	8	0.8	1111	3
73317	SAN08002243		74.09	12.02	3.87	0.12	0.81	2.10	6.56	0.23	0.04	0.06	0.10	-20	8	0.5	1021	2
73318	SAN08002243		74.63	12.04	3.70	0.08	0.61	1.83	6.70	0.23	0.04	0.04	0.09	-20	7	1	1021	2
73325	SAN08002243		76.45	11.65	2.67	0.11	0.69	1.91	6.15	0.22	0.04	0.05	0.06	-20	7	0.9	1106	2
73326	SAN08002243		74.92	12.02	3.47	0.08	0.99	1.71	6.43	0.23	0.04	0.04	0.06	-20	7	1.1	1036	2
73328	SAN08002243		71.77	12.94	4.08	0.19	1.83	1.95	6.73	0.31	0.08	0.09	0.03	-20	11	1.8	1104	2
73329	SAN08002243		71.31	12.77	5.32	0.30	1.26	2.33	6.01	0.41	0.14	0.08	0.07	-20	9	1.6	1040	3
73330	SAN08002243		72.44	12.82	4.65	0.41	1.96	1.86	5.18	0.41	0.12	0.10	0.04	-20	9	2.1	1096	3
73331	SAN08002243		72.32	12.54	5.11	0.25	0.94	2.21	5.98	0.41	0.11	0.07	0.04	-20	8	1.3	1115	3
73332	SAN08002243		71.50	12.83	4.99	0.19	1.41	2.46	5.96	0.41	0.13	0.06	0.04	-20	9	1.4	1115	2
73334	SAN08002243		73.08	12.52	4.61	0.21	1.35	2.30	5.23	0.42	0.13	0.06	0.07	-20	9	1.6	1146	1
73335	SAN08002243		72.18	12.58	4.58	0.20	1.06	2.65	6.10	0.41	0.11	0.07	0.05	-20	10	1	1183	3
73336	SAN08002243		72.56	12.75	4.66	0.23	1.33	2.42	5.43	0.42	0.09	0.07	0.04	-20	9	1.9	1237	2
73337	SAN08002243		72.57	12.68	4.40	0.25	1.02	2.05	6.41	0.39	0.12	0.06	0.05	-20	10	2.1	1162	2
73338	SAN08002243		72.72	12.59	4.61	0.24	1.00	2.14	6.08	0.42	0.11	0.07	0.03	-20	10	1.4	1224	2
73339	SAN08002243		72.65	12.72	4.62	0.27	1.12	1.95	6.01	0.41	0.14	0.07	0.04	-20	10	1.7	1164	3
73340	SAN08002243		72.78	12.43	4.57	0.22	1.06	2.62	5.67	0.41	0.12	0.07	0.05	-20	10	1.5	1246	3
73341	SAN08002243		72.24	12.64	4.69	0.30	0.83	2.52	6.11	0.41	0.13	0.08	0.05	-20	10	1.2	1238	2
73342	SAN08002243		71.65	13.39	4.70	0.33	0.58	1.79	6.92	0.42	0.11	0.08	0.02	-20	10	1.6	1288	2
73345	SAN08002243		74.12	11.81	3.63	0.23	0.90	2.71	6.05	0.31	0.08	0.06	0.09	-20	9	1.6	1122	2
73346	SAN08002243		74.10	11.79	3.46	0.14	1.15	2.61	6.29	0.26	0.04	0.05	0.12	-20	9	1.1	1137	2
73347	SAN08002243		74.92	12.14	3.35	0.16	0.96	2.34	5.66	0.29	0.05	0.05	0.07	-20	8	0.4	1210	1
73348	SAN08002243		72.01	13.10	4.62	0.11	1.62	2.43	5.45	0.41	0.12	0.05	0.08	-20	10	1.7	1197	2
73349	SAN08002243		72.92	12.35	4.77	0.13	1.13	2.57	5.46	0.42	0.13	0.05	0.07	-20	9	0.4	1264	2
73350	SAN08002243		71.15	12.64	5.04	0.24	2.03	2.78	5.37	0.46	0.16	0.06	0.08	-20	9	1.4	1172	2
73351	SAN08002243		71.75	12.51	4.47	0.26	1.55	3.11	5.73	0.43	0.11	0.05	0.04	-20	10	1.1	1161	1
73352	SAN08002243		71.08	12.46	4.71	0.31	2.25	2.72	5.79	0.43	0.14	0.05	0.07	-20	10	1.5	1149	2
73354	SAN08002243		70.75	12.42	4.39	0.26	3.49	2.27	5.76	0.41	0.13	0.05	0.05	-20	10	2.6	1117	2
73355	SAN08002243		71.73	12.71	5.48	0.36	1.21	2.35	5.34	0.52	0.14	0.08	0.08	-20	10	1.1	1165	2
73359	SAN08002243		73.05	12.42	4.22	0.30	1.31	2.46	5.63	0.42	0.11	0.05	0.03	-20	10	1.6	1151	1

Table A5– Continued

Sample Number	Co	Cs	Ga	Hf	Nb	Rb	Sn	Sr	Ta	Th	U	V	W	Zr	Y	La	Ce	Pr	Nd	Sm	Eu
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
73309	2.5	1.4	16.3	8.8	20.2	207.5	9	83.9	1.4	31	4.5	10	1.1	251	75.8	79.4	160	20.16	77	13.57	1.6
73310	3.3	1.6	17.3	8.8	20.6	218.9	6	84.8	1.5	26.7	4.1	-8	1.1	271	71.9	83.4	167	19.76	74.2	13.44	1.7
73311	1.9	1.5	18.2	8.2	19.4	223	6	86	1.4	25.9	3.9	-8	1.3	263	69.7	79.8	158	18.76	69.1	12.38	1.6
73317	2	1.6	16.1	8.2	18.2	194.6	5	79.5	1.3	23.9	3.9	-8	0.7	259	63.7	76.5	147	17.94	62.9	11.68	1.5
73318	2.3	1.8	16.7	8	18.8	208.1	5	81	1.4	21.2	3.4	-8	1	259	56.4	68.5	135	16.74	60.8	11.11	1.4
73325	1.8	1.6	15.8	7.6	19.5	213.5	13	87.3	1.5	20.2	3.3	13	0.7	257	63	78.4	158	18.81	64.3	12.5	1.5
73326	1.5	1.6	13.4	7.4	18.2	180.8	12	84.4	1.2	21.3	2.7	-8	0.5	245	48	66.9	130	15.81	57.2	11.03	1.3
73328	2.5	1.4	15.1	8.3	20.8	193.1	14	88.3	1.2	22.8	3.7	-8	0.9	280	71.7	86	175	22.73	83.8	16.17	2.1
73329	3.7	1.7	18.2	9.5	21.4	178.3	9	99	1.2	17.9	3.2	-8	0.9	353	51.5	68.5	132	16.3	59.5	11.41	1.9
73330	3.6	1.6	20.9	10	24.3	183.2	16	100	1.6	18.9	3.9	17	1	372	72.2	87	181	21.28	73.9	14.15	2.3
73331	3.3	1.4	16.8	9.8	22.1	185.3	7	99.1	1.2	18.8	3.4	-8	0.7	354	54.5	75.7	143	17.77	63.1	12.02	2
73332	3.4	1.5	17.8	10	22.2	175.5	3	109	1.3	18.6	2.8	-8	0.8	374	45.7	60.3	114	15.04	55.3	10.5	1.7
73334	3.8	1.4	17.5	9.8	23.1	184.8	-1	106	1.4	17.4	2.7	19	1.1	390	51.7	59.6	128	15.11	57.8	10.75	1.7
73335	3.6	1.5	16.1	10	22.9	205.3	1	119	1.5	20.4	2.7	8	0.6	379	53.6	62.3	129	15.95	60.6	10.92	1.8
73336	3.7	1.4	16.3	11	28.4	195.4	1	115	2.1	18.4	3	20	1.2	420	54.6	62.2	132	15.91	61.7	11.35	1.8
73337	3.4	1.8	17.5	10	22.9	215.9	5	109	1.3	19.7	3.1	9	0.7	363	54.6	63.8	129	15.78	61.3	10.84	1.7
73338	3.3	1.8	16.4	12	24.8	207.1	6	112	1.5	21.3	2.9	9	0.5	419	56.8	64.8	132	16.24	63	11.05	1.8
73339	3.7	1.9	16.4	11	24.2	207.7	6	111	1.5	18.9	3	10	0.7	403	54.6	62.2	128	15.69	60.5	10.65	1.8
73340	3.5	1.8	14.6	11	24	187.3	5	115	1.4	20.5	3	9	0.8	378	54.2	63	128	15.98	61.9	10.91	1.8
73341	3.9	1.4	14.9	11	24	189.3	5	109	1.4	19.8	3.5	13	1.2	412	71.2	90.4	182	21.64	79.9	13.55	2.2
73342	3.8	1.9	18.2	12	24	235	4	98.7	1.3	20.3	3.9	15	-0.5	402	66.9	81.6	165	20.24	75.5	13.67	2.2
73345	3.9	1.5	18.8	10	21.6	204.6	3	99.7	1.5	20.8	3.5	12	0.7	325	69	77.9	160	19.63	73.9	13.35	1.8
73346	3.3	2	18.3	8.7	21	209.4	1	96.5	1.6	21.5	3.9	11	0.7	292	65.5	76.2	158	19.03	74.1	12.83	1.6
73347	2.9	1.5	18.5	8.6	21.4	186.3	2	102	1.3	20.2	2.7	17	0.8	295	55.9	65.6	147	15.97	59.7	11.17	1.5
73348	4.4	2.7	18.4	12	23.8	186.2	2	138	1.4	22.5	2.7	10	-0.5	397	54.6	68.2	141	16.91	65	12.12	1.9
73349	4.1	2.1	17.1	11	22.7	180.7	4	130	1.3	21	2.8	37	0.7	396	51.7	60	125	15.52	62.5	10.71	1.8
73350	4.7	2.1	19.6	11	23.7	183.7	4	144	1.3	18.8	2.8	34	0.7	381	51.9	59.5	124	15.61	63.2	10.99	1.9
73351	3.8	1.6	19.9	10	22.6	189.3	3	138	1.4	18.1	2.8	14	-0.5	398	51.3	62.4	127	15.53	59.8	11.12	1.8
73352	4.3	1.8	18.9	10	23.5	193.6	1	142	1.3	18.9	2.8	14	0.6	381	51.1	60.8	122	15.18	56.7	10.73	1.8
73354	4.1	1.4	20.6	10	23.1	179.6	3	127	1.4	18.1	2.6	13	0.6	391	49.1	60.6	121	15.1	58.8	10.87	1.7
73355	4.9	2.5	17.1	10	26.3	187.1	4	130	1.4	17.7	2.7	25	0.9	401	51.8	58.3	124	14.66	56.9	10.46	1.7
73359	3.7	2.2	15.5	11	23.2	198.5	10	124	1.5	19.1	2.8	14	0.8	404	51.4	63.7	125	15.8	58.3	11.02	1.8

Table A5– Continued

Sample Number	Gd ppm	Tb ppm	Dy ppm	Ho ppm	Er ppm	Tm ppm	Yb ppm	Lu ppm	TOT/C wt%	TOT/S wt%	Mo ppm	Cu ppm	Pb ppm	Zn ppm	As ppm	Cd ppm	Sb ppm	Bi ppm	Ag ppm	Au ppb
73309	12.9	2.17	12.95	2.58	7.97	1.24	7.67	1.15	0.12	0.06	0.5	5.7	19	84	6.8	0.6	0.2	-0.1	-0.1	0.6
73310	12.5	2.01	11.82	2.43	7.21	1.17	7.29	1.06	-0.02	0.03	0.5	5.8	14	75	4.2	0.5	0.1	-0.1	-0.1	1.8
73311	11.4	1.91	11.55	2.39	6.9	1.05	6.46	1.01	-0.02	0.02	0.2	3.7	14	62	2.7	0.6	-0.1	-0.1	-0.1	-0.5
73317	10.8	1.85	10.43	2.16	6.39	0.98	6.07	0.91	0.1	0.04	0.3	4.2	14	52	6.6	0.3	0.2	-0.1	-0.1	1.7
73318	10.3	1.74	9.85	1.97	6.07	0.91	5.57	0.85	0.04	0.04	0.2	3.7	13	52	4.3	0.3	0.1	-0.1	-0.1	1.1
73325	10.7	1.91	11.36	2.25	6.82	1.07	6.28	0.93	0.05	0.02	0.3	4.8	23	67	3.5	0.2	0.1	-0.1	-0.1	-0.5
73326	9.9	1.6	9	1.89	5.46	0.83	5.09	0.75	0.06	0.04	0.2	4	26	53	4	0.1	0.1	-0.1	-0.1	-0.5
73328	14.4	2.42	13.53	2.75	7.87	1.19	7.28	1.08	0.23	0.08	0.1	6.1	22	123	5.4	0.3	0.1	-0.1	-0.1	-0.5
73329	10.2	1.69	9.57	2	5.8	0.9	5.38	0.86	0.15	0.04	0.3	5.5	13	98	3.3	0.3	0.1	-0.1	-0.1	-0.5
73330	12	2.18	12.53	2.48	7.32	1.17	7.2	1.08	0.18	0.07	0.2	7.2	18	129	4.4	0.2	0.1	-0.1	-0.1	-0.5
73331	11	1.85	10.2	2.17	6.44	0.96	6.07	0.92	0.1	0.04	0.2	4.2	20	96	3.1	0.3	0.1	-0.1	-0.1	-0.5
73332	9.51	1.57	9.05	1.81	5.37	0.81	4.98	0.75	0.18	0.06	0.1	3.7	14	68	2.4	0.2	-0.1	-0.1	-0.1	-0.5
73334	9.65	1.56	8.91	1.8	4.99	0.77	4.91	0.72	0.15	0.03	0.2	4.9	13	64	1.7	0.3	-0.1	-0.1	-0.1	0.5
73335	9.67	1.66	9.12	1.86	5.6	0.82	4.93	0.79	0.13	0.04	0.1	5.5	15	67	1.8	0.2	0.1	-0.1	-0.1	1.3
73336	10.4	1.68	9.94	1.86	5.48	0.84	5.05	0.73	0.13	0.07	0.2	5.1	13	66	1.6	0.2	0.1	-0.1	-0.1	-0.5
73337	9.83	1.67	9.46	1.93	5.83	0.85	5.2	0.8	0.1	0.05	0.2	4.8	11	64	2	-0.1	0.2	-0.1	-0.1	1.8
73338	10.3	1.71	9.38	1.96	5.94	0.89	5.29	0.8	0.09	0.14	0.2	5.8	18	76	2.6	0.1	0.2	-0.1	-0.1	-0.5
73339	9.82	1.64	9.03	1.9	5.56	0.82	4.79	0.75	0.08	0.06	0.2	5.5	18	67	1.9	-0.1	0.2	-0.1	-0.1	1.5
73340	9.86	1.67	9.52	1.88	5.63	0.86	5	0.78	0.1	0.05	0.2	6	18	65	2	0.2	0.1	-0.1	-0.1	0.7
73341	12.1	2.08	11.73	2.36	7.28	1.13	6.79	1.07	0.08	0.04	0.2	8	18	74	1.7	0.2	0.1	-0.1	-0.1	-0.5
73342	12.1	2.05	11.39	2.3	7.05	1.05	6.44	0.99	0.04	0.07	0.1	6	18	68	2	0.1	0.1	-0.1	-0.1	1.8
73345	11.7	2.06	11.53	2.36	6.92	1.11	6.39	0.99	0.12	0.13	0.4	6.3	15	76	3.4	-0.1	0.4	-0.1	-0.1	2.7
73346	11.2	1.92	10.91	2.26	6.39	1.01	6.12	0.94	0.18	0.05	0.5	7.2	9.6	67	2.1	-0.1	0.3	-0.1	-0.1	-0.5
73347	9.84	1.63	9.88	2	5.49	0.87	5.3	0.8	0.09	0.07	0.5	6.5	5.9	90	2.1	-0.1	0.2	-0.1	-0.1	1.5
73348	10.3	1.75	9.67	1.97	5.6	0.85	5.26	0.79	0.11	0.16	0.4	6.4	12	83	1.4	-0.1	0.2	-0.1	-0.1	1.6
73349	9.49	1.64	8.47	1.82	5.4	0.83	4.96	0.74	0.08	0.04	0.3	6	11	82	1.9	-0.1	0.1	-0.1	-0.1	0.7
73350	9.87	1.69	9.53	1.88	5.53	0.87	5.16	0.76	0.27	0.07	0.3	9	7.6	82	3.1	-0.1	0.1	-0.1	-0.1	2
73351	9.73	1.65	9.15	1.87	5.42	0.87	5.13	0.76	0.2	0.06	0.3	5.9	12	70	2.7	-0.1	0.2	-0.1	-0.1	1.5
73352	9.63	1.65	8.8	1.82	5.43	0.83	4.93	0.77	0.3	0.07	0.2	8.9	8.4	71	3.8	-0.1	0.1	-0.1	-0.1	1.2
73354	9.41	1.6	8.72	1.79	5.14	0.79	4.76	0.74	0.42	0.13	0.3	6.7	14	69	4	-0.1	0.2	-0.1	-0.1	3.3
73355	9.81	1.58	8.47	1.81	4.94	0.77	4.81	0.71	0.07	0.09	0.3	8.5	12	94	3.8	-0.1	0.2	-0.1	-0.1	5.3
73359	9.54	1.71	9.36	1.87	5.43	0.86	5.21	0.78	0.1	0.05	0.1	6.3	18	71	1.9	0.2	0.1	-0.1	-0.1	2.7

Table A5– Continued

Sample Number	Hg ppm	Tl ppm	Se ppm
73309	-0.01	-0.1	-0.5
73310	-0.01	-0.1	-0.5
73311	-0.01	-0.1	-0.5
73317	-0.01	-0.1	-0.5
73318	-0.01	-0.1	0.6
73325	-0.01	-0.1	-0.5
73326	-0.01	-0.1	0.6
73328	-0.01	-0.1	-0.5
73329	-0.01	-0.1	-0.5
73330	-0.01	-0.1	-0.5
73331	-0.01	-0.1	-0.5
73332	-0.01	-0.1	-0.5
73334	-0.01	-0.1	-0.5
73335	-0.01	-0.1	0.6
73336	-0.01	-0.1	1.3
73337	-0.01	-0.1	0.7
73338	-0.01	-0.1	0.8
73339	-0.01	-0.1	0.5
73340	-0.01	-0.1	0.7
73341	-0.01	-0.1	0.9
73342	-0.01	-0.1	0.7
73345	-0.01	-0.1	0.9
73346	-0.01	-0.1	1.3
73347	-0.01	-0.1	1
73348	-0.01	-0.1	-0.5
73349	-0.01	-0.1	-0.5
73350	-0.01	-0.1	-0.5
73351	-0.01	-0.1	0.7
73352	-0.01	-0.1	0.9
73354	-0.01	-0.1	-0.5
73355	-0.01	-0.1	0.8
73359	-0.01	-0.1	0.9

Table A5– Continued

Sample Number	BatchNumber	Acme	SiO2 wt%	Al2O3 wt%	Fe2O3 w%	MgO w%	CaO w%	Na2O w%	K2O w%	TiO2 w%	P2O5 w%	MnO w%	Cr2O 3 w%	Ni ppm	Sc ppm	LOI wt%	Ba ppm	Be ppm
73360	SAN08002548		73.43	12.61	4.19	0.31	0.92	2.32	5.66	0.41	0.11	0.04	0.02	-20	10	1.4	1210	2
73361	SAN08002548		73.52	12.67	3.91	0.33	1.12	2.26	5.63	0.39	0.12	0.04	0.02	-20	9	2	1117	2
73362	SAN08002548		73.55	12.56	4.21	0.39	1.67	2.27	4.73	0.41	0.13	0.05	0.02	-20	9	2.6	1025	2
73364	SAN08002548		73.30	12.52	4.27	0.33	1.01	2.53	5.44	0.42	0.12	0.04	0.01	-20	9	1.7	1077	2
73365	SAN08002548		73.35	12.60	4.30	0.27	1.05	2.49	5.34	0.40	0.14	0.04	0.03	34	9	1.4	1228	2
73366	SAN08002548		73.11	12.77	4.20	0.37	1.19	2.23	5.56	0.41	0.11	0.04	0.02	-20	9	1.9	1102	2
73367	SAN08002548		72.63	12.92	4.28	0.30	0.92	2.33	6.01	0.42	0.13	0.04	0.02	-20	9	1.7	1162	1
73368	SAN08002548		72.96	12.81	4.29	0.32	0.96	2.30	5.74	0.41	0.14	0.05	0.02	23	10	1.7	1211	2
73369	SAN08002548		73.51	12.68	4.35	0.38	1.81	1.91	4.72	0.40	0.14	0.06	0.02	-20	9	2.8	992	2
73370	SAN08002548		73.09	12.65	4.25	0.30	1.24	2.30	5.56	0.42	0.12	0.05	0.02	-20	9	2	1082	1
73371	SAN08002548		72.39	12.93	4.33	0.32	1.25	2.49	5.66	0.42	0.13	0.05	0.03	-20	10	1.9	1077	1
73372	SAN08002548		72.02	13.24	4.26	0.30	0.89	2.59	6.08	0.43	0.11	0.05	0.02	-20	10	1	1124	1
73374	SAN08002548		71.75	13.20	4.55	0.35	1.27	2.40	5.84	0.44	0.13	0.05	0.03	-20	10	1.3	1057	2
73379	SAN08002548		71.49	12.63	4.84	0.63	2.02	2.61	5.00	0.54	0.14	0.07	0.02	-20	11	2	1097	2
73380	SAN08002548		72.78	12.43	4.44	0.53	1.23	2.52	5.40	0.44	0.14	0.06	0.03	-20	11	1.7	1159	2
73381	SAN08002548		72.90	12.57	4.33	0.41	1.57	2.31	5.30	0.42	0.12	0.05	0.02	-20	10	2.3	1112	1
73382	SAN08002548		73.58	12.21	4.46	0.51	1.60	2.41	4.58	0.44	0.12	0.06	0.01	-20	10	2.5	959	2
73384	SAN08002548		73.60	12.47	4.46	0.42	1.52	2.23	4.73	0.41	0.11	0.04	0.02	-20	10	2.3	993	2
73385	SAN08002548		72.88	12.53	4.19	0.28	1.53	2.76	5.22	0.41	0.12	0.05	0.02	-20	10	2	1080	2
73386	SAN08002548		74.30	11.98	3.91	0.33	1.00	2.61	5.30	0.40	0.11	0.05	0.02	-20	10	2	994	2
73217	SAN08001649		78.25	14.31	2.44	0.49	0.89	0.18	2.80	0.50	0.12	-0.01	0.03	-20	10	5.9	584	2
73218	SAN08001649		77.01	14.49	3.65	0.52	0.87	0.17	2.65	0.50	0.12	0.01	0.02	-20	11	6.3	391	2
73219	SAN08001649		74.54	13.98	5.09	1.50	0.88	0.18	3.02	0.59	0.16	0.03	0.03	-20	12	6.6	1106	2
73220	SAN08001649		72.86	16.33	4.82	0.89	0.93	0.19	3.22	0.54	0.16	0.02	0.03	-20	14	7.5	329	2
73221	SAN08001649		73.84	13.80	4.35	1.22	0.65	0.41	5.09	0.45	0.13	0.03	0.03	-20	11	4.5	1174	2
73222	SAN08001649		73.48	12.37	4.44	0.56	1.01	0.59	6.95	0.39	0.12	0.05	0.04	-20	10	2.4	1473	2
73224	SAN08001649		71.43	12.54	4.93	0.46	3.30	0.52	6.18	0.41	0.14	0.05	0.05	-20	9	4	1170	2
73225	SAN08001649		72.23	12.92	4.76	1.08	0.75	0.67	6.92	0.42	0.13	0.06	0.04	-20	10	2.6	1621	2
73226	SAN08001649		74.36	14.25	4.01	0.54	0.93	0.38	4.85	0.49	0.15	0.03	0.01	-20	11	4.1	1083	2
73227	SAN08001649		73.49	13.04	5.23	0.46	0.55	0.62	5.96	0.45	0.13	0.03	0.03	-20	10	3	1157	2
73228	SAN08001649		72.51	13.69	5.54	0.61	0.95	0.49	5.57	0.45	0.14	0.03	0.01	-20	11	3	1156	3
73229	SAN08001649		73.48	12.80	4.23	1.03	1.34	0.61	5.91	0.41	0.12	0.04	0.03	-20	10	2.8	1305	2

Table A5– Continued

Sample Number	Co ppm	Cs ppm	Ga ppm	Hf ppm	Nb ppm	Rb ppm	Sn ppm	Sr ppm	Ta ppm	Th ppm	U ppm	V ppm	W ppm	Zr ppm	Y ppm	La ppm	Ce ppm	Pr ppm	Nd ppm	Sm ppm	Eu ppm
73360	3.5	2.2	16.4	10	23.2	206.6	9	123	1.4	19.5	2.8	13	0.7	370	55.2	61.8	128	15.91	60.7	10.31	1.8
73361	3.1	1.9	16.7	11	21.9	192.5	8	109	1.4	20.7	2.8	11	1	356	54.2	62.6	128	16.11	61.1	10.37	1.7
73362	3.5	1.8	18.6	10	22.5	159	8	105	1.4	20.8	2.8	12	0.8	393	56.2	65.6	134	16.55	64.1	10.72	1.9
73364	3.2	2	17.6	11	23.6	184.6	6	115	1.3	17.8	2.7	11	0.5	376	51.7	60.1	124	15.48	60.7	9.97	1.8
73365	3.9	1.8	16.3	10	23	207.8	4	118	1.4	23.6	2.8	31	0.5	359	59.5	68.9	133	16.78	65.3	11.79	2
73366	3.2	2	18.3	11	22.4	188.4	3	109	1.4	19.4	2.7	10	-0.5	381	49.1	58.6	121	14.99	58.5	9.72	1.7
73367	3.1	2.1	17.8	10	22.1	199.3	4	114	1.4	18	2.6	10	-0.5	379	51.3	58.8	120	15.08	58.2	9.84	1.7
73368	3.2	2.1	16	10	22	224.4	4	112	1.2	19.3	3.1	30	-0.5	355	56	66.6	126	15.62	60.4	10.87	1.8
73369	3.4	1.4	16.9	11	22.5	173.8	5	93.6	1.3	22.7	2.9	25	0.9	372	54.7	63.9	122	15.34	62.4	10.74	1.7
73370	3.1	2.1	16.2	11	22.9	182.7	3	115	1.3	19.3	2.8	10	0.5	387	48.2	56.8	116	14.57	58	9.96	1.8
73371	3.2	2.2	17.1	11	23.3	180.5	3	118	1.4	20.1	2.7	10	0.9	376	48.3	57.3	115	14.6	57.5	9.83	1.8
73372	3.3	2.7	16.5	10	22.8	194.2	3	125	1.2	19	2.6	11	-0.5	360	48	57.4	116	14.59	57.3	9.89	1.7
73374	3.5	2.8	17.2	10	24.4	188	4	131	1.5	18.7	2.7	12	2.3	367	49.9	56.4	116	14.52	57.4	10.06	1.8
73379	5.8	1.9	15.9	11	25.2	171.5	4	142	1.6	19.2	2.4	33	0.7	381	54.6	62	131	15.79	61.7	11.08	1.9
73380	3.6	2.1	16.4	11	24.2	184	6	107	1.6	20.4	3.3	19	1.1	394	55.6	64.3	139	16.69	62.9	11.82	1.8
73381	3.6	1.5	16.2	12	24.2	176.3	7	105	1.6	19.5	3.1	17	1.1	411	53.6	62	131	15.84	61.3	11.18	1.8
73382	3.5	1.3	18	11	24.1	144.3	9	106	1.4	19.4	3.4	18	1.1	389	51.8	61.9	134	15.91	62.8	10.96	1.8
73384	3.2	1.4	18.1	11	22.3	163.4	6	106	1.5	18.1	2.6	14	1	367	53.2	60.9	129	15.56	62.4	10.88	1.8
73385	2.9	1.4	14.9	10	22.5	169.5	4	101	1.5	17.9	2.3	12	1.3	379	52.6	60.7	128	15.45	59	10.96	1.8
73386	3	2	15.6	10	23.3	177.3	4	92.1	1.5	20.7	2.9	14	0.7	333	55.6	64.5	137	16.5	64.3	11.33	1.5
73217	3.5	1.2	13.6	13	27.5	99.9	5	46.8	1.8	21	2.3	30	1.8	437	55.5	68.6	137	17	63.8	11.43	1.9
73218	2.4	0.6	15.8	12	27.2	94.9	5	36.6	1.6	22.5	2.4	18	2.1	406	58.8	68.2	142	17.46	65.2	11.61	2
73219	10.2	0.7	15.2	11	23.7	100.1	5	53	1.4	18.1	2.4	41	3.7	369	55.4	57.7	119	14.8	56.9	10.48	1.9
73220	4.4	0.8	15.7	12	28.4	100.5	5	28.1	1.8	22.9	3.3	14	0.9	452	65.7	73.6	150	18.72	72	12.58	2.2
73221	3.6	1	15	12	26.1	166.3	4	52.3	1.6	21.7	3.3	11	1.4	400	58.3	67.7	141	16.98	65.8	11.46	1.9
73222	3.9	1.4	13.7	11	23.9	230.7	3	80.4	1.4	18.5	2.8	10	-0.5	373	51.6	60.4	125	15.41	58.4	10.57	1.7
73224	4.4	1.1	13.2	9.4	21.7	197.3	3	80	1.1	17.5	2.4	8	2.1	361	49.9	57.9	121	14.63	54.4	9.97	1.6
73225	5.6	1.3	15.2	10	22.6	231.4	3	92	1.3	19.3	2.7	9	-0.5	358	52.4	61	128	15.56	59.3	10.88	1.8
73226	3.5	0.9	14.8	12	25.8	149.2	7	47.7	1.5	21.4	3	11	0.7	407	56.8	69.6	141	17.14	65.8	12.05	2
73227	2.7	1	15.3	10	24.6	187.8	4	64.7	1.4	20.6	2.9	9	-0.5	382	55.3	64.4	135	16.33	61.8	11.21	1.8
73228	2.7	0.9	15.9	12	24.6	174.1	4	66.2	1.3	19.8	2.9	10	0.6	394	57.1	63.6	136	16.2	59.5	11.3	1.9
73229	2.8	0.8	13.6	11	23.3	186.6	5	83.2	1.2	20	2.9	9	0.6	351	50.9	61.5	127	15.45	56.2	10.55	1.7

Table A5– Continued

Sample Number	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	TOT/C	TOT/S	Mo	Cu	Pb	Zn	As	Cd	Sb	Bi	Ag	Au
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	wt%	wt%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppb
73360	9.94	1.61	9.49	2	5.61	0.85	5.45	0.82	0.04	-0.02	0.1	7.4	12	69	1.2	0.1	-0.1	-0.1	-0.1	-0.5
73361	9.91	1.53	9.24	1.85	5.47	0.85	5.14	0.8	0.04	0.03	0.2	5.1	15	66	2	0.1	-0.1	-0.1	-0.1	1.3
73362	10.5	1.63	9.64	2.04	5.74	0.89	5.42	0.8	0.05	0.12	0.2	4.3	21	73	3.1	0.2	0.1	-0.1	-0.1	0.8
73363	9.63	1.47	9.03	1.89	5.17	0.86	5.04	0.77	0.04	0.06	0.1	4.9	12	71	2.1	0.1	0.1	-0.1	-0.1	-0.5
73364	10.1	1.76	10.07	1.94	5.81	0.9	5.5	0.78	0.04	0.06	0.2	4.9	14	69	2.6	0.2	0.1	-0.1	-0.1	-0.5
73366	9.58	1.49	9.12	1.83	5.16	0.79	5.1	0.73	0.05	0.09	0.2	4.7	14	62	3	0.3	0.2	-0.1	-0.1	0.8
73367	9.68	1.51	8.69	1.85	5.16	0.81	5.05	0.77	0.05	0.07	0.1	2.6	14	63	2.7	0.2	0.1	-0.1	-0.1	1
73368	9.63	1.66	9.23	1.8	5.15	0.87	4.89	0.75	0.04	0.18	0.1	6.4	14	67	2.8	0.2	0.2	-0.1	-0.1	1.2
73369	9.22	1.62	8.99	1.79	5.19	0.82	4.67	0.74	0.06	0.11	0.2	6.9	23	69	5	0.3	0.2	-0.1	-0.1	1.4
73370	9.48	1.45	8.92	1.83	4.99	0.82	4.88	0.77	0.06	0.22	0.2	3	14	66	3.2	0.3	0.2	-0.1	-0.1	1.2
73371	9.75	1.47	9.17	1.89	5.11	0.82	4.96	0.76	0.08	0.15	0.2	4.9	12	68	3.5	0.3	0.1	-0.1	-0.1	1.2
73372	9.77	1.49	9.07	1.88	5.26	0.83	5.02	0.78	0.03	0.08	0.1	3.1	10	68	2.1	0.2	0.1	-0.1	-0.1	-0.5
73374	9.88	1.53	9.55	1.98	5.32	0.84	5.37	0.82	0.06	0.06	0.3	5.6	7.8	72	2.1	0.2	0.1	-0.1	-0.1	0.8
73379	9.86	1.69	10.02	2.03	5.4	0.86	5.22	0.79	0.13	-0.02	1	6.9	13	64	2.3	0.2	0.1	-0.1	-0.1	0.8
73380	10.4	1.78	9.97	2.05	5.73	0.89	5.3	0.83	0.08	-0.02	0.6	4.3	14	65	3.7	0.3	0.1	-0.1	-0.1	-0.5
73381	10.1	1.7	9.65	1.99	5.55	0.87	5.56	0.81	0.08	0.02	0.4	2.9	15	60	2.2	0.3	0.1	-0.1	-0.1	-0.5
73382	9.95	1.66	9.48	1.9	5.36	0.85	5.25	0.78	0.07	0.02	0.4	3.8	21	67	1.6	0.3	0.1	-0.1	-0.1	0.7
73384	9.88	1.62	9.27	1.87	5.21	0.79	5.18	0.73	0.05	0.06	0.4	1.9	15	67	1.3	0.3	0.2	-0.1	-0.1	-0.5
73385	10	1.62	9.56	1.94	5.36	0.86	5.37	0.76	0.14	-0.02	0.2	3	14	66	0.8	0.2	-0.1	-0.1	-0.1	0.8
73386	10.3	1.72	9.88	1.99	5.63	0.86	5.4	0.81	0.04	-0.02	0.2	12.6	13	59	1.7	0.2	0.1	-0.1	-0.1	-0.5
73217	10.2	1.73	9.36	1.98	5.81	0.9	5.24	0.82	0.04	0.65	2.3	23.5	29	23	13.7	0.3	-0.1	1	-0.1	0.6
73218	10.9	1.87	10.33	2.09	6.18	0.96	5.5	0.84	0.03	1.03	1.8	6.2	35	25	44.7	0.3	-0.1	0.7	-0.1	0.9
73219	10.1	1.75	9.61	1.97	5.68	0.82	4.74	0.74	-0.02	1.29	2.4	15.1	20	29	24.7	0.4	-0.1	0.8	-0.1	0.7
73220	12	1.99	11.38	2.34	6.72	1.04	6.25	0.98	-0.02	1.83	1	8.6	37	32	12.3	0.2	-0.1	0.6	-0.1	0.7
73221	10.6	1.78	9.78	2.03	5.79	0.91	5.54	0.84	0.03	0.94	0.9	6.3	20	52	7.7	0.3	-0.1	0.5	-0.1	-0.5
73222	9.45	1.61	8.89	1.81	5.28	0.8	4.82	0.74	0.13	0.23	0.4	11.9	11	77	9.1	0.1	-0.1	0.4	-0.1	0.7
73224	9.06	1.54	8.76	1.74	4.92	0.8	4.63	0.71	0.56	0.14	0.5	13.7	14	97	10.5	0.2	-0.1	0.7	-0.1	-0.5
73225	9.69	1.61	9.34	1.83	5.5	0.84	4.77	0.73	0.09	0.19	2.2	25.7	9.6	213	2.6	0.2	-0.1	0.8	0.1	-0.5
73226	10.6	1.78	9.85	1.99	5.78	0.91	5.31	0.84	0.08	0.35	5.7	8	24	39	7.2	0.4	-0.1	0.5	-0.1	-0.5
73227	10.5	1.75	9.82	1.98	5.69	0.87	5.2	0.81	0.04	0.26	3.8	6.3	16	55	7.9	0.3	-0.1	0.4	-0.1	-0.5
73228	10.5	1.77	10.06	1.99	5.83	0.91	5.2	0.81	0.11	0.27	3.5	5.9	16	64	9.2	0.4	-0.1	0.4	-0.1	-0.5
73229	9.5	1.59	9.11	1.79	5.27	0.8	4.73	0.77	0.2	0.13	2.3	6.3	11	39	6.8	0.4	-0.1	0.3	-0.1	-0.5

Table A5– Continued

Sample Number	Hg ppm	Tl ppm	Se ppm
73360	-0.01	-0.1	-0.5
73361	-0.01	-0.1	-0.5
73362	-0.01	-0.1	-0.5
73364	-0.01	-0.1	-0.5
73365	-0.01	-0.1	-0.5
73366	-0.01	-0.1	-0.5
73367	-0.01	0.1	-0.5
73368	-0.01	-0.1	-0.5
73369	-0.01	-0.1	-0.5
73370	-0.01	-0.1	-0.5
73371	-0.01	-0.1	-0.5
73372	-0.01	-0.1	-0.5
73374	-0.01	-0.1	-0.5
73379	-0.01	-0.1	0.5
73380	-0.01	-0.1	0.5
73381	-0.01	-0.1	0.7
73382	-0.01	-0.1	-0.5
73384	-0.01	-0.1	0.5
73385	-0.01	-0.1	-0.5
73386	-0.01	-0.1	-0.5
73217	-0.01	0.3	0.7
73218	-0.01	0.4	0.9
73219	-0.01	0.5	-0.5
73220	-0.01	0.4	1
73221	-0.01	0.3	1.1
73222	-0.01	0.1	0.6
73224	-0.01	0.1	0.9
73225	-0.01	0.1	0.8
73226	-0.01	0.2	0.9
73227	-0.01	0.2	1.1
73228	-0.01	0.2	0.7
73229	-0.01	0.1	0.6

Table A5– Continued

Sample Number	BatchNumber	Acme	SiO ₂ wt%	Al ₂ O ₃ wt%	Fe ₂ O ₃ wt%	MgO wt%	CaO wt%	Na ₂ O wt%	K ₂ O wt%	TiO ₂ wt%	P ₂ O ₅ wt%	MnO wt%	Cr ₂ O ₃ wt%	Ni ppm	Sc ppm	LOI wt%	Ba ppm	Be ppm
73230	SAN08001649		74.22	12.76	4.41	0.45	1.23	0.52	5.79	0.42	0.12	0.03	0.03	-20	10	3	1274	2
73231	SAN08001649		74.11	13.02	4.46	0.45	0.77	0.54	6.07	0.42	0.12	0.02	0.02	-20	10	3.3	1141	3
73232	SAN08001649		75.18	12.13	4.20	0.67	1.97	0.40	4.86	0.41	0.13	0.03	0.03	-20	9	4	1042	3
73234	SAN08001649		73.21	13.15	4.24	0.95	0.74	0.63	6.48	0.42	0.12	0.03	0.02	-20	10	2.9	1246	2
73235	SAN08001649		74.57	12.34	4.38	0.86	2.13	0.42	4.74	0.41	0.10	0.03	0.01	-20	10	4.2	1113	1
73236	SAN08001649		72.41	12.89	5.08	0.64	0.99	0.74	6.65	0.41	0.14	0.02	0.03	-20	10	2.8	1233	2
73237	SAN08001649		72.69	13.23	4.92	0.50	0.72	0.70	6.63	0.43	0.13	0.02	0.03	-20	10	2.3	1276	2
73238	SAN08001649		75.04	13.12	3.60	0.67	0.71	0.39	5.88	0.42	0.12	0.02	0.01	-20	9	2.9	1215	2
73239	SAN08001649		75.01	13.15	3.46	0.63	0.68	0.28	6.19	0.43	0.13	0.02	0.01	-20	8	3.3	1219	2
73240	SAN08001649		75.05	13.56	3.61	0.35	1.01	0.23	5.58	0.44	0.15	0.01	0.02	-20	7	3.7	1031	2
73241	SAN08001649		78.47	12.64	3.07	0.31	1.07	0.17	3.70	0.41	0.13	0.01	0.03	-20	7	4.1	597	2
73242	SAN08001649		76.53	13.00	3.28	0.35	0.61	0.21	5.43	0.42	0.12	0.01	0.03	-20	6	3.1	1040	2
73244	SAN08001649		76.83	12.99	2.78	0.52	1.06	0.22	5.02	0.42	0.12	0.01	0.03	-20	6	4.2	940	2
73245	SAN08001649		77.11	12.42	3.81	1.01	0.72	0.17	4.24	0.39	0.10	0.02	0.02	-20	7	4.5	760	2
73246	SAN08001649		74.96	12.67	3.91	0.78	0.68	0.26	6.17	0.42	0.12	0.02	0.02	-20	8	3.5	1253	2
73247	SAN08001649		73.87	12.88	4.44	0.42	0.52	0.33	6.96	0.41	0.12	0.02	0.03	-20	8	2.4	1338	2
73248	SAN08001649		75.48	13.54	4.32	0.39	0.69	0.22	4.74	0.44	0.15	0.01	0.04	-20	8	3.9	811	2
73249	SAN08001649		77.48	13.05	3.31	0.33	0.56	0.18	4.46	0.45	0.15	-0.01	0.04	-20	7	4.1	761	2
73250	SAN08001649		75.65	11.83	4.28	1.39	0.45	0.27	5.57	0.38	0.12	0.03	0.02	-20	6	2.9	1110	2
73251	SAN08001649		73.96	12.08	3.77	2.09	1.04	0.33	6.15	0.38	0.12	0.04	0.02	-20	6	3.5	1409	2
73254	SAN08001870		72.21	11.97	4.35	0.92	4.04	0.34	5.66	0.36	0.10	0.02	0.03	-20	5	4.5	1109	2
73255	SAN08001870		73.71	12.06	4.29	0.49	2.51	0.37	6.02	0.39	0.11	0.01	0.03	-20	5	4	1130	2
73256	SAN08001870		75.08	12.85	4.20	0.31	0.55	0.34	6.10	0.41	0.10	0.01	0.04	-20	6	3.6	1172	2
73260	SAN08001870		72.35	13.18	5.66	0.15	0.24	0.54	7.29	0.42	0.12	0.01	0.03	-20	7	2.4	1371	2
73261	SAN08001870		73.50	13.68	5.70	0.19	0.40	0.36	5.55	0.44	0.15	0.01	0.03	-20	8	3.4	968	2
73264	SAN08001870		75.37	12.27	4.84	0.13	0.37	0.43	6.08	0.39	0.10	-0.01	0.02	-20	9	2.2	1455	2
73265	SAN08001870		74.60	12.77	4.79	0.15	0.48	0.43	6.24	0.40	0.11	-0.01	0.03	-20	7	2.4	1344	1
73266	SAN08001870		77.27	12.28	4.16	0.16	0.67	0.26	4.66	0.39	0.12	-0.01	0.03	-20	9	3.2	1142	2
73267	SAN08001870		75.90	11.98	4.66	0.14	0.43	0.41	5.93	0.38	0.12	0.01	0.03	-20	9	2.6	1148	-1
73268	SAN08001870		75.90	12.52	4.62	0.16	0.53	0.35	5.39	0.38	0.12	0.01	0.02	-20	7	3.2	1037	2
73269	SAN08001870		72.54	13.26	6.37	0.21	0.36	0.45	6.19	0.42	0.13	0.01	0.05	-20	7	3	1378	1
73270	SAN08001870		76.42	12.38	4.22	0.19	0.48	0.37	5.42	0.37	0.10	0.01	0.03	-20	7	3.4	1140	2

Table A5– Continued

Sample Number	Co	Cs	Ga	Hf	Nb	Rb	Sn	Sr	Ta	Th	U	V	W	Zr	Y	La	Ce	Pr	Nd	Sm	Eu
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
73230	3	0.9	14.9	12	24.7	191.6	6	74.9	1.3	19.7	2.8	9	0.6	425	53.5	64.3	135	16.3	62.4	11.41	1.8
73231	2.7	1.1	16.8	10	24.1	210.8	4	74.6	1.3	21.4	2.9	9	0.7	381	52.7	63.6	134	16.1	57.9	11	1.9
73232	3	0.8	14.9	11	24.1	161.1	4	68.2	1.4	20.4	2.8	9	0.6	375	53.3	64.4	133	16.07	59.7	11.01	1.7
73234	2.8	1	17.3	9.9	24.5	208.2	4	87.4	1.4	20.4	2.8	10	0.6	382	53.1	66.4	134	16.42	60.2	11.17	1.9
73235	2.7	0.6	15.5	9.5	22.6	137.6	4	76.9	1.4	20	2.7	-8	0.9	358	47.5	59.9	114	15.14	53.8	10.36	1.8
73236	3	1.1	16.8	10	23	220.8	3	97.7	1.3	18.6	3	-8	0.7	386	49.2	61	123	15.55	55.7	10.63	1.7
73237	3.5	1	18.9	11	24.1	214.4	4	86.8	1.3	18.7	2.9	9	1.1	394	50.7	65	129	16.36	57.4	11.13	1.9
73238	2.6	0.9	19.5	11	24.4	185.6	9	86.1	1.3	19.6	2.6	9	2.2	408	44.3	63.1	122	15.78	57.1	10.35	1.6
73239	2.6	1	18.8	12	24.7	221.2	7	89.1	1.5	17.9	2.7	24	2.2	390	46.4	57.9	124	14.44	56.2	9.99	1.6
73240	2.3	0.9	19.7	12	24.6	177.9	7	71.3	1.4	17.1	2.5	23	1.9	419	46.2	57.4	120	14.08	56	9.81	1.6
73241	2.4	1.1	18.8	10	22.3	120.4	5	47.1	1.5	13.5	2.1	20	2.8	355	40.9	45.7	98	11.74	46.7	8.58	1.4
73242	2.3	0.9	18.1	12	24.8	163.2	4	70.7	1.3	16.7	2.2	17	8.7	419	45.6	53.5	114	13.47	53.5	9.74	1.6
73244	2.5	1	18.8	11	23.2	150.8	6	69.7	1.3	15.4	2.2	18	4.6	384	41.5	49.9	105	12.45	47.6	8.64	1.4
73245	3.4	1.1	19.8	9.8	21.5	146.3	3	62.7	1.3	13.5	2.1	20	2	350	40.3	41.9	88	10.34	40.6	7.26	1.3
73246	3.5	0.9	20.9	11	23.4	206.1	4	86.5	1.4	16	2.5	22	2.2	387	43.3	52.1	109	12.73	48.1	9.02	1.5
73247	3.4	1	19.6	11	24.2	229.6	3	91.2	1.3	18.7	2.8	18	4	358	48.2	62	128	15.03	58.1	10.69	1.7
73248	4.9	1.3	19.8	12	24.9	164	4	63.6	1.5	16	2.5	23	2.3	444	47.9	53.4	117	13.8	54	10.48	1.7
73249	4.2	1.3	17.9	12	25.1	150.2	4	49.9	1.5	16.1	2.3	23	3.2	420	39.4	50.2	104	12.26	47.2	8.39	1.4
73250	3.2	0.9	16.5	12	21.7	188.2	3	63.9	1.4	15.1	2.2	19	3.2	385	40.8	48.9	102	12.05	44.3	8.48	1.4
73251	2.8	0.9	16.4	11	21.7	197.5	4	84	1.4	14.7	2	15	1.6	358	38.2	49.7	103	12.07	48.3	8.56	1.4
73254	2.6	1	17	9.3	22.2	188.4	3	82.1	1.3	14.3	2	-8	2.5	349	41.6	52.6	105	12.47	46.1	8.55	1.4
73255	3.3	1	18.3	11	22.3	191.4	3	77.5	1.5	15.7	2.5	-8	2.6	390	44.9	53.1	112	13.24	49.3	9.05	1.5
73256	2.9	0.9	18.4	10	24.2	186.7	3	71.1	1.4	14.7	2.1	-8	1.5	396	37.6	48.6	101	11.96	42.6	8.06	1.4
73260	3	1	16.7	13	23.2	212.3	3	61.9	1.5	14.1	2	9	1.7	466	47.4	51.6	111	13.33	51.2	9.76	1.7
73261	4.4	1.1	18.3	10	25.5	157.6	3	49.4	1.5	19.9	2.6	9	2.3	371	56.5	58.6	131	16.07	62.6	11.69	1.8
73264	4.9	1.2	17.2	12	23	203.6	3	66.9	1.5	17.5	2.7	-8	2.8	397	51.7	59.7	127	15.44	56.9	10.96	1.8
73265	3.9	1.4	18.2	9.7	24.9	201.2	4	63.1	1.5	18.5	2.6	-8	2.6	350	58.6	60.6	131	16	59.3	11.3	1.8
73266	3.5	1.8	14.8	10	22.4	144	3	44	1.4	19.5	2.2	10	2.1	347	59.4	55.8	121	15.15	60.6	11.42	1.9
73267	3.1	1.1	15.1	9.7	22.1	181.9	3	56	1.3	18.3	2.3	11	1.9	351	51.5	54.6	114	14.07	55.2	10.2	1.7
73268	2.7	1.4	17.2	11	22.3	167.9	4	53.3	1.4	16.3	2.2	-8	2.4	357	35.9	48	97	11.52	43.3	7.92	1.4
73269	3.2	1.1	19.9	11	24.3	194.9	4	67.2	1.4	15.1	2.2	-8	1.9	416	39.8	52.1	107	13.24	52.4	9.22	1.6
73270	2.8	1.3	17.2	11	21.6	176.4	4	57.5	1.4	13.4	2	-8	1.6	379	37.9	46	90	10.96	40.5	7.65	1.4

Table A5– Continued

Sample Number	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	TOT/C	TOT/S	Mo	Cu	Pb	Zn	As	Cd	Sb	Bi	Ag	Au
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	wt%	wt%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppb
73230	10.5	1.67	9.58	1.89	5.41	0.85	5	0.78	0.17	0.2	3.2	7.1	17	45	7.5	0.3	-0.1	0.3	-0.1	-0.5
73231	10.2	1.71	9.65	1.89	5.49	0.84	4.82	0.79	0.05	0.16	5.6	5	13	40	7.7	0.2	-0.1	0.3	-0.1	-0.5
73232	10.2	1.7	9.51	1.86	5.41	0.85	5.08	0.78	0.29	0.1	6.1	5.7	19	33	7.1	0.2	-0.1	0.3	-0.1	-0.5
73233	10.6	1.68	9.64	1.96	5.58	0.88	5.05	0.81	0.09	0.12	3.1	5.8	10	40	6.2	0.2	-0.1	0.3	-0.1	2.3
73234	9.81	1.63	8.94	1.84	5.13	0.78	4.86	0.73	0.31	0.11	2.8	6.4	19	38	6.1	0.3	-0.1	0.3	-0.1	1.9
73235	9.78	1.61	9.2	1.89	5.38	0.85	4.92	0.77	0.1	0.09	0.4	6.2	6.2	43	5.9	-0.1	-0.1	0.3	-0.1	1.7
73236	10.3	1.69	9.75	1.89	5.4	0.84	5.02	0.77	0.08	0.06	0.9	6.3	5.7	42	5.3	0.1	-0.1	0.3	-0.1	1.1
73237	9.15	1.5	8.63	1.68	4.85	0.76	4.45	0.68	0.06	0.06	2.3	3.9	8.5	24	5.6	0.4	-0.1	0.6	-0.1	1.6
73238	9.45	1.47	8.51	1.71	4.89	0.74	4.42	0.68	0.05	0.08	0.6	2.9	6.6	29	5.4	0.2	-0.1	0.4	-0.1	42.6
73239	9.15	1.43	8.23	1.65	4.67	0.69	4.28	0.64	0.1	0.06	2.5	3.6	12	19	4.8	0.2	-0.1	0.4	-0.1	1.5
73240	7.96	1.26	7.21	1.39	3.94	0.62	3.8	0.56	0.09	0.05	1.3	3.9	16	10	2.3	0.2	-0.1	0.5	-0.1	0.9
73241	8.86	1.43	8	1.62	4.45	0.67	4.07	0.64	0.04	0.06	0.6	2.5	8.4	12	3	0.1	-0.1	0.4	-0.1	1
73242	8.05	1.28	7.31	1.4	3.96	0.61	3.81	0.57	0.05	0.05	0.6	3.7	9.9	11	1.9	0.2	-0.1	0.7	-0.1	-0.5
73243	6.94	1.16	6.3	1.32	3.77	0.58	3.8	0.56	0.04	0.06	0.4	4.4	5.7	29	3.8	0.1	-0.1	0.6	-0.1	-0.5
73244	8.46	1.36	7.79	1.54	4.24	0.66	4.05	0.63	0.05	0.07	0.3	4.9	4.6	90	3.2	-0.1	-0.1	0.4	-0.1	-0.5
73245	10	1.57	8.73	1.76	4.9	0.72	4.42	0.68	0.04	0.07	0.3	4.7	3.8	39	3.8	-0.1	-0.1	0.2	-0.1	0.9
73246	9.32	1.47	8.41	1.68	4.79	0.73	4.45	0.68	0.04	0.08	0.2	6.6	16	32	2.6	-0.1	-0.1	0.3	-0.1	-0.5
73247	8.05	1.21	7.07	1.44	3.88	0.58	3.69	0.54	-0.02	0.06	0.2	5.9	15	15	1.4	-0.1	-0.1	0.5	-0.1	0.8
73248	7.8	1.25	6.98	1.4	4.14	0.62	3.92	0.58	-0.02	0.06	-0.1	4.5	5	29	6.9	-0.1	-0.1	0.4	-0.1	0.6
73249	7.95	1.27	7.22	1.39	4	0.6	3.65	0.54	0.04	0.05	0.3	5.3	3.6	21	5.8	0.1	-0.1	0.5	-0.1	-0.5
73250	8.2	1.28	7.37	1.44	3.88	0.63	3.76	0.57	0.03	0.04	0.6	3.7	7.7	25	6.6	0.1	-0.1	0.7	-0.1	0.8
73251	9.22	1.38	8.15	1.58	4.34	0.69	4.01	0.61	0.03	0.1	0.7	4.3	6.8	25	5.5	0.1	-0.1	0.8	-0.1	-0.5
73252	7.6	1.21	6.73	1.32	3.92	0.56	3.48	0.53	0.04	0.05	1.1	3.7	6	25	7.8	0.1	-0.1	1.1	-0.1	-0.5
73253	9.28	1.48	8.47	1.66	4.67	0.75	4.62	0.68	-0.02	0.2	0.2	4.8	8.1	29	16.5	0.3	-0.1	0.8	-0.1	-0.5
73254	10.7	1.77	9.58	2.02	5.48	0.85	5.26	0.74	0.02	0.06	0.2	6.4	13	38	12.8	0.5	-0.1	1.2	-0.1	-0.5
73255	9.92	1.66	9.34	1.89	5.16	0.81	4.84	0.76	0.04	0.07	0.9	9.6	9.4	26	11.7	0.7	-0.1	0.9	-0.1	1.7
73256	10.6	1.8	10.4	1.97	5.59	0.84	5	0.75	0.05	0.04	1.3	7.5	8.1	22	5.6	0.5	-0.1	0.6	-0.1	1.8
73257	11.7	1.83	9.86	2.07	5.74	0.84	5.15	0.75	0.06	0.03	0.2	8.2	13	20	3.1	0.7	-0.1	0.7	-0.1	1.1
73258	9.73	1.57	8.38	1.83	4.78	0.75	4.61	0.68	0.03	0.03	0.2	6.1	8	22	7.4	0.4	-0.1	0.6	-0.1	1.4
73259	7.16	1.16	6.44	1.3	3.61	0.57	3.48	0.55	-0.02	0.05	0.5	4	11	29	7.1	0.6	-0.1	0.7	-0.1	2.5
73260	8.36	1.27	7.14	1.37	3.84	0.6	3.87	0.62	0.02	0.18	1	4.1	11	40	18.4	0.4	0.2	0.6	-0.1	1.6
73261	6.96	1.12	6.29	1.3	3.71	0.61	3.68	0.58	0.02	0.07	0.4	4.5	9.5	24	6.9	0.7	-0.1	0.4	-0.1	3.3

Table A5– Continued

Sample Number	Hg ppm	Tl ppm	Se ppm
73230	-0.01	0.2	0.5
73231	-0.01	0.2	0.8
73232	-0.01	0.2	0.9
73234	-0.01	0.2	0.8
73235	-0.01	0.2	-0.5
73236	-0.01	0.1	0.7
73237	-0.01	0.2	0.9
73238	-0.01	0.3	-0.5
73239	-0.01	0.3	0.7
73240	-0.01	0.3	0.5
73241	-0.01	0.3	0.6
73242	-0.01	0.2	-0.5
73244	-0.01	0.3	-0.5
73245	-0.01	0.2	-0.5
73246	-0.01	0.3	-0.5
73247	-0.01	0.3	0.6
73248	-0.01	0.3	-0.5
73249	-0.01	0.3	0.6
73250	-0.01	0.2	0.5
73251	-0.01	0.3	0.8
73254	-0.01	2	-0.5
73255	-0.01	1.2	-0.5
73256	-0.01	0.3	-0.5
73260	-0.01	0.2	-0.5
73261	-0.01	0.2	-0.5
73264	-0.01	0.2	-0.5
73265	-0.01	0.2	0.5
73266	-0.01	0.3	0.6
73267	-0.01	0.3	-0.5
73268	-0.01	0.3	-0.5
73269	-0.01	0.3	-0.5
73270	-0.01	0.3	-0.5

Table A5– Continued

Sample Number	BatchNumber	Acme	SiO ₂ wt%	Al ₂ O ₃ wt%	Fe ₂ O ₃ w%	MgO w%	CaO w%	Na ₂ O w%	K ₂ O w%	TiO ₂ w%	P ₂ O ₅ w%	MnO w%	Cr ₂ O ₃ w%	Ni ppm	Sc ppm	LOI wt%	Ba ppm	Be ppm
73271	SAN08001870		74.86	12.15	4.93	0.19	0.41	0.49	6.43	0.40	0.10	0.01	0.03	-20	7	3.8	1408	2
73272	SAN08001870		74.03	12.84	4.47	0.28	1.05	0.49	6.25	0.43	0.14	0.02	0.02	-20	5	3.5	1271	1
73277	SAN08001870		75.66	12.39	5.14	0.18	0.77	0.27	5.01	0.40	0.11	0.01	0.06	-20	9	4.7	973	1
73278	SAN08001870		74.66	12.50	4.50	0.20	0.41	0.49	6.75	0.34	0.10	0.02	0.03	-20	9	1.7	1345	1
73279	SAN08001870		76.24	11.77	3.45	0.16	0.34	0.59	7.05	0.27	0.07	0.02	0.04	-20	7	1.9	1253	1
73280	SAN08001870		75.79	12.43	3.88	0.21	0.56	0.41	6.19	0.43	0.07	0.02	0.03	-20	12	2.5	1252	3
73281	SAN08001870		76.76	11.56	3.45	0.16	0.28	0.51	6.89	0.26	0.06	0.02	0.06	-20	10	1.7	1488	1
73282	SAN08001870		73.88	13.01	4.56	0.23	0.62	0.43	6.72	0.41	0.09	0.02	0.02	-20	13	2.6	1393	3
73284	SAN08001870		73.79	13.09	4.76	0.21	0.66	0.37	6.51	0.44	0.12	0.02	0.02	-20	12	3.1	1180	2
73285	SAN08001870		74.10	13.24	4.97	0.23	0.71	0.30	5.82	0.43	0.12	0.03	0.04	-20	14	3.1	1124	2
73286	SAN08001870		75.05	12.99	4.19	0.19	0.48	0.34	6.26	0.37	0.09	0.02	0.02	-20	13	3	1175	2
73287	SAN08001870		74.46	12.80	4.58	0.23	0.55	0.38	6.43	0.40	0.12	0.03	0.02	-20	9	2.9	1154	2
73288	SAN08001870		73.82	12.71	4.80	0.23	0.54	0.44	6.89	0.40	0.12	0.03	0.02	-20	9	2.1	1251	2
73289	SAN08001870		72.94	13.08	5.02	0.20	0.65	0.45	7.05	0.42	0.12	0.03	0.03	-20	10	2.9	1361	2
73290	SAN08001870		75.93	12.55	3.58	0.19	0.75	0.37	6.22	0.29	0.08	0.02	0.02	-20	8	2.8	1120	2
73291	SAN08001870		76.86	12.22	3.18	0.14	0.65	0.36	6.27	0.22	0.04	0.02	0.03	-20	7	2.7	1148	2
73292	SAN08001870		77.15	11.80	3.25	0.14	0.53	0.39	6.42	0.24	0.02	0.02	0.03	-20	8	2.4	1077	2
73294	SAN08001870		76.14	12.14	3.14	0.19	0.47	0.47	7.10	0.25	0.04	0.03	0.02	-20	9	2.1	1237	2
73295	SAN08001870		75.82	11.98	3.12	0.29	0.63	0.51	7.30	0.24	0.03	0.04	0.04	-20	8	2	1206	2
73296	SAN08001870		76.34	12.08	2.83	0.27	0.65	0.48	7.01	0.24	0.05	0.03	0.03	-20	9	2.2	1149	3
73297	SAN08001870		76.22	12.10	3.00	0.30	0.56	0.54	6.93	0.23	0.04	0.03	0.04	-20	8	1.8	1152	2
73298	SAN08001870		75.62	12.05	3.04	0.25	0.49	0.75	7.46	0.23	0.04	0.03	0.03	-20	8	1.7	1174	2
73299	SAN08001870		75.76	11.95	3.14	0.31	0.57	0.52	7.40	0.24	0.05	0.03	0.03	-20	8	2.1	1173	2
73300	SAN08002243		75.02	11.56	3.65	0.44	0.69	1.12	7.11	0.23	0.05	0.04	0.08	-20	8	1.5	1047	2
73312	SAN08002243		74.86	12.02	3.86	0.13	0.47	1.60	6.63	0.23	0.04	0.05	0.09	-20	8	1.2	1074	2
73319	SAN08002243		74.66	11.92	3.76	0.12	0.61	1.76	6.74	0.23	0.06	0.05	0.09	-20	8	0.7	1033	2
73320	SAN08002243		74.29	12.20	3.74	0.17	1.19	1.27	6.74	0.22	0.04	0.05	0.06	-20	7	1.6	1076	2
73321	SAN08002243		73.96	12.15	3.83	0.17	0.73	1.76	6.99	0.23	0.05	0.06	0.07	-20	7	1	1114	2
73322	SAN08002243		74.29	12.10	3.80	0.15	0.74	1.68	6.82	0.23	0.05	0.06	0.08	-20	7	1	1042	2
73324	SAN08002243		74.16	12.55	3.70	0.22	0.51	1.28	7.23	0.22	0.04	0.07	0.03	-20	8	1	1038	3
73327	SAN08002243		74.37	12.17	3.61	0.09	0.92	1.67	6.79	0.23	0.04	0.04	0.06	-20	7	0.9	1042	2
71424	SAN08002547		43.05	16.55	15.05	5.11	12.99	2.61	0.87	3.10	0.38	0.28	0.01	33	44	8.4	270	2

Table A5– Continued

Sample Number	Co	Cs	Ga	Hf	Nb	Rb	Sr	Ta	Th	U	V	W	Zr	Y	La	Ce	Pr	Nd	Sm	Eu	
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	
73271	3	1.4	17.4	10	22.7	204.1	4	67.7	1.4	16.4	2.3	-8	2.1	361	47	53.9	111	13.52	51.8	9.44	1.7
73272	2.1	1.6	17.5	11	23.6	200	3	79.9	1.3	13	1.9	-8	1.8	390	38.4	42.4	86	10.4	39.3	7.53	1.4
73277	3.7	2	16.3	12	21.4	173.7	4	44.1	1.5	14.1	1.8	11	0.7	367	36.6	44.1	95	11.11	40.7	7.85	1.3
73278	3	1.6	17	13	21.1	228.2	4	70.3	1.7	17.8	2.2	-8	1.1	404	43.6	55.3	115	13.7	50.6	9.53	1.5
73279	2.2	1.2	16.4	10	19.1	219.8	4	65.8	1.4	15.1	2.4	-8	0.8	320	36.4	50.5	99	11.73	41.3	7.86	1.2
73280	3.7	1.6	16.4	17	25.9	207.9	4	53.9	1.4	17.6	3.4	16	1.2	530	40.8	55.1	111	12.66	45.6	8.58	1.4
73281	2.9	1.2	16.1	11	16.7	226.3	3	52.4	1.3	15.1	2.7	18	0.9	322	33	53.8	102	10.59	36.3	7.03	1.2
73282	3.4	1.3	18.1	14	22.1	218.9	4	60.9	1.4	17.8	2.7	20	1.3	436	40.4	49.5	97	11.03	39.5	7.05	1.1
73284	3.5	1.3	16.8	11	21.1	209.2	4	59	1.3	19.1	3.1	11	1.2	387	45.6	54.6	112	13.01	47.2	9.04	1.4
73285	4	1.5	17.6	12	23.2	203	5	58.2	1.4	16.9	2.2	10	53.1	408	48.5	46.1	96	11.52	42.1	8.21	1.3
73286	3.7	1.5	16.9	12	21.5	209.9	11	61.2	1.4	17.1	2.4	-8	1.1	419	39.6	50.8	103	11.86	42.3	7.74	1.2
73287	2.9	1.5	17.4	11	22.2	218.3	7	73.8	1.3	17.9	2.6	-8	1.6	383	45.4	54.3	119	13.93	50.1	9.61	1.4
73288	2.4	1.5	15.8	12	22.5	228.2	8	79.1	1.4	17	2.6	-8	1.4	351	43.6	55.3	119	14.22	50.3	9.68	1.4
73289	3.3	1.5	16.7	14	22.3	229	6	70.3	1.3	16.8	2.1	-8	1.8	473	43.2	52.7	110	12.9	45.8	9.22	1.4
73290	2.6	1.5	16	10	17	204.8	4	61.6	1.3	15.5	2.1	-8	1	318	35.6	50.7	102	11.95	43	8.24	1.2
73291	2.5	1.7	16.5	13	19	213.8	4	60.2	1.4	16.6	2.2	-8	1.1	417	31.5	52.9	105	12.06	42.3	7.83	1.2
73292	2.2	1.4	16.3	12	18.3	217.3	4	59.2	1.3	20.6	2.5	-8	1	343	50.7	53.6	113	13.71	50.9	9.53	1.4
73294	2.3	1.3	16.1	10	19.9	238.7	5	72.2	1.3	20.9	4.7	-8	1.6	290	55	61.3	135	16.04	59.8	10.66	1.5
73295	2.4	1.3	15.9	9.7	18.8	243.2	4	73.2	1.3	21.2	3.1	-8	0.7	278	48.8	57.1	121	14.95	54.3	10.19	1.2
73296	1.3	1.3	17.2	8	19	243.4	4	74	1.3	25.2	3.1	-8	1	242	48.8	58.2	127	15.62	55.3	10.76	1.3
73297	1.4	1.2	16.4	8.5	19.1	238.5	4	76.6	1.4	25.2	2.7	-8	1.6	260	54.8	56.4	124	15.42	53.7	10.64	1.3
73298	1.3	1.6	16	9.1	20.7	258.8	4	74.1	1.3	23.7	3.2	-8	1.2	285	47.8	56.5	125	15.03	55.1	10.12	1.2
73299	1.3	1.5	15.2	9.5	20	264.2	4	70.4	1.4	21.9	2.7	-8	0.9	290	45.6	52.8	119	14.58	54.3	9.95	1.2
73300	2.1	1.5	13.5	8.1	20	216.3	4	80.7	1.4	19.6	2.4	28	0.7	256	53.5	64.9	133	16.26	61.1	10.99	1.3
73312	2.7	1.7	17.1	8	19.2	216.9	7	77.9	1.4	26.6	4	-8	0.9	262	69.1	79.9	160	19.3	70.5	12.72	1.6
73319	2.2	1.7	16.4	7.7	18.6	208.5	5	79.7	1.3	23.1	3.5	-8	0.8	240	57.4	74.8	144	17.47	61.8	11.58	1.4
73320	3.3	1.8	16.2	7.1	18.6	208.8	8	76.2	1.2	22.7	3.7	-8	0.8	245	60.8	81.1	160	19.1	68.9	12.82	1.5
73321	1.9	1.6	16.1	7.4	19.1	214	7	85.8	1.3	23	3.6	-8	0.6	240	66.1	84.3	161	19.92	71.4	13.32	1.6
73322	1.9	1.6	16.7	7.7	20	210.6	8	83.2	1.2	20.5	3.5	-8	0.7	257	68.6	81.8	164	20.47	74.4	13.67	1.6
73324	1.4	1.8	17.6	7.7	18.3	216.7	12	77	1.2	24.3	4.9	-8	0.6	255	70.5	97.8	191	23.47	84.1	15.03	1.8
73327	2.1	1.7	14.7	6.9	19	205.5	13	84.6	1.3	22.1	3	-8	0.5	246	52.7	68.2	130	16.56	58.1	11.31	1.4
71424	48.5	-0.1	21.4	3.5	32.2	22.7	2	311	1.8	1.8	0.6	471	0.5	149	42.6	20.5	42	5.81	26	6.18	2.2

Table A5– Continued

Sample Number	Gd ppm	Tb ppm	Dy ppm	Ho ppm	Er ppm	Tm ppm	Yb ppm	Lu ppm	TOT/C wt%	TOT/S wt%	Mo ppm	Cu ppm	Pb ppm	Zn ppm	As ppm	Cd ppm	Sb ppm	Bi ppm	Ag ppm	Au ppb
73271	8.77	1.43	8.17	1.64	4.63	0.71	4.32	0.65	-0.02	1.31	0.4	3.5	10	25	19.2	0.6	0.3	0.3	-0.1	0.9
73272	6.94	1.11	6.23	1.29	3.68	0.59	3.51	0.56	0.06	0.18	0.7	1.7	9	21	7.2	0.4	0.1	0.3	-0.1	1.6
73277	7.85	1.15	6.88	1.35	3.47	0.54	3.62	0.49	0.05	1.61	1.8	6.8	16	47	51.8	1	0.4	0.6	-0.1	11
73278	9.04	1.39	8.59	1.6	4.45	0.67	4.12	0.59	0.03	0.11	0.3	3.9	7.7	43	14.2	0.9	-0.1	0.4	-0.1	4.4
73279	7.57	1.19	7.04	1.35	3.99	0.61	3.85	0.56	0.03	0.06	0.2	2.8	6.9	32	10.8	0.7	-0.1	0.2	-0.1	1.5
73280	8.04	1.26	7.53	1.5	4.19	0.66	4.04	0.57	0.05	0.1	0.3	3.7	8.5	45	6.8	1.3	-0.1	0.3	-0.1	1.1
73281	6.64	0.95	5.71	1.18	3.33	0.55	3.35	0.47	0.04	0.13	0.3	2.3	6.7	28	7.7	0.5	0.1	0.1	-0.1	1.3
73282	6.86	1.09	6.88	1.37	4.15	0.65	4.06	0.61	0.05	0.09	0.3	2.5	9.7	39	4.2	0.5	-0.1	0.2	-0.1	0.6
73284	8.59	1.33	8.06	1.56	4.62	0.77	4.86	0.73	0.07	0.07	0.5	2.8	9	47	4.6	0.5	-0.1	0.2	-0.1	1
73285	7.96	1.28	7.79	1.58	4.7	0.78	4.73	0.7	0.07	0.06	1	3.1	12	45	4.9	0.6	0.1	0.3	-0.1	-0.5
73286	7.09	1.08	6.8	1.33	3.95	0.66	4.15	0.6	0.03	0.05	0.3	2.5	11	54	4.6	0.7	0.1	0.2	-0.1	-0.5
73287	9.07	1.36	7.75	1.62	4.59	0.71	4.58	0.67	0.04	0.03	0.2	3.1	9.6	58	3.8	0.6	-0.1	0.1	-0.1	1.1
73288	9.4	1.4	7.85	1.56	4.36	0.68	4.19	0.62	0.05	0.03	0.2	3.1	9	63	2.8	0.4	-0.1	0.1	-0.1	-0.5
73289	8.55	1.31	7.74	1.55	4.46	0.68	4.32	0.62	0.09	0.05	0.2	3.6	11	61	12.9	0.2	0.2	-0.1	-0.1	0.8
73290	7.86	1.17	7.06	1.34	3.67	0.57	3.64	0.49	0.12	0.05	0.2	2.9	11	58	3.7	0.2	-0.1	-0.1	-0.1	-0.5
73291	7.04	1.09	6.37	1.28	3.62	0.52	3.31	0.47	0.1	0.03	0.2	3.3	9.7	51	2.2	0.2	-0.1	-0.1	-0.1	0.9
73292	9.09	1.4	8.48	1.88	5.78	0.95	6.42	0.98	0.07	0.03	0.3	2.8	11	54	3	0.1	-0.1	-0.1	-0.1	7.2
73294	10.5	1.57	9.86	2.06	6.01	0.99	6.48	0.99	0.06	0.07	0.3	2.3	8	72	2.7	0.1	-0.1	-0.1	-0.1	1.1
73295	9.56	1.5	9	1.87	5.41	0.88	5.74	0.83	0.09	0.03	0.3	1.9	6.5	56	3.2	0.1	-0.1	-0.1	-0.1	1.8
73296	10	1.57	9.65	1.93	5.37	0.86	5.31	0.79	0.09	0.07	0.6	2	7.6	38	5	0.1	-0.1	-0.1	-0.1	2.5
73297	10.5	1.64	10.39	2.16	6.32	0.98	6.04	0.89	0.06	0.02	0.4	1.7	9.7	43	4.3	-0.1	-0.1	-0.1	-0.1	3.3
73298	9.44	1.47	9.04	1.88	5.35	0.84	5.34	0.76	0.05	0.03	0.2	1.6	8	35	2.9	-0.1	-0.1	-0.1	-0.1	6.5
73299	9.03	1.46	8.97	1.8	5.16	0.83	5.04	0.69	0.05	0.08	0.3	2.4	9.2	31	5.6	-0.1	0.1	-0.1	-0.1	0.6
73300	10.2	1.66	10	2.02	5.54	0.85	5.4	0.77	0.02	0.06	0.4	2.8	19	37	4.7	-0.1	0.2	-0.1	-0.1	1
73312	11.9	1.94	11.75	2.35	7.08	1.03	6.51	1	-0.02	0.03	0.4	5.3	15	61	3.3	0.4	-0.1	0.1	-0.1	1.4
73319	10.5	1.77	10.11	2.1	6.32	0.96	5.81	0.91	0.05	0.06	0.3	4.7	13	53	3.1	0.3	0.1	-0.1	-0.1	-0.5
73320	11.3	1.92	11	2.27	6.76	1.02	6.53	1	0.09	0.38	0.2	6.7	21	78	5.5	0.4	0.2	-0.1	-0.1	0.5
73321	11.8	1.98	11.52	2.39	7.06	1.06	6.56	1.02	0.09	0.2	0.6	6.2	15	74	4.5	0.3	0.1	-0.1	-0.1	1.9
73322	12.6	2.07	11.82	2.42	7.33	1.14	7.23	1.06	0.1	0.09	0.5	5.9	17	64	5.1	0.3	0.2	-0.1	-0.1	0.8
73324	13.1	2.18	12.56	2.62	7.88	1.26	7.97	1.22	-0.02	0.03	-0.1	6	25	90	4.7	0.3	0.1	-0.1	-0.1	-0.5
73327	10.2	1.71	9.55	1.93	5.81	0.87	5.67	0.83	0.09	0.05	0.5	4.7	25	81	3.9	0.2	0.2	-0.1	-0.1	0.5
71424	7.16	1.22	7.17	1.37	3.92	0.59	3.31	0.5	1.26	0.23	0.8	87.4	1.9	89	0.6	0.1	-0.1	-0.1	-0.1	-0.5

Table A5– Continued

Sample Number	Hg ppm	Tl ppm	Se ppm
73271	-0.01	0.4	-0.5
73272	-0.01	0.3	-0.5
73277	-0.01	0.4	0.5
73278	-0.01	0.2	-0.5
73279	-0.01	0.2	-0.5
73280	-0.01	0.3	0.6
73281	-0.01	0.4	-0.5
73282	-0.01	0.3	0.6
73284	-0.01	0.2	0.6
73285	-0.01	0.2	-0.5
73286	-0.01	0.2	-0.5
73287	-0.01	0.1	0.7
73288	-0.01	0.1	0.6
73289	-0.01	0.2	0.8
73290	-0.01	0.2	-0.5
73291	-0.01	0.2	-0.5
73292	-0.01	0.1	0.6
73294	-0.01	0.2	1
73295	-0.01	0.1	0.5
73296	-0.01	0.1	1.1
73297	-0.01	0.2	-0.5
73298	-0.01	0.1	0.7
73299	-0.01	0.1	0.8
73300	-0.01	-0.1	-0.5
73312	-0.01	-0.1	-0.5
73319	-0.01	-0.1	-0.5
73320	-0.01	-0.1	-0.5
73321	-0.01	-0.1	-0.5
73322	-0.01	-0.1	-0.5
73324	-0.01	-0.1	0.7
73327	-0.01	-0.1	-0.5
71424	-0.01	-0.1	-0.5

Table A5– Continued

Sample Number	BatchNumber	Acme	SiO2 wt%	Al2O3 wt%	Fe2O3 w%	MgO w%	CaO w%	Na2O w%	K2O w%	TiO2 w%	P2O5 w%	MnO w%	Cr2O 3 w%	Ni ppm	Sc ppm	LOI wt%	Ba ppm	Be ppm
71425	SAN08002547		43.00	17.21	15.76	5.07	11.98	2.49	0.95	2.89	0.37	0.26	0.01	34	41	8.7	239	2
71434	SAN08002547		47.11	15.78	11.87	5.65	12.66	3.39	1.09	1.96	0.26	0.22	0.02	47	33	11.5	438	3
71435	SAN08002547		50.10	16.84	11.94	5.60	8.50	3.50	1.12	1.92	0.26	0.20	0.02	56	33	8.3	377	3
71438	SAN08002547		46.22	15.07	15.91	5.95	8.62	3.10	1.24	3.13	0.45	0.31	0.01	37	44	5.9	383	2
71439	SAN08002547		46.78	15.74	14.28	6.21	9.80	2.81	0.91	2.80	0.47	0.20	0.01	29	37	7.5	351	1
71440	SAN08002547		46.94	16.21	12.05	8.31	10.26	2.80	0.76	1.97	0.41	0.23	0.08	173	30	8.6	263	2
71441	SAN08002547		46.60	16.45	12.88	6.15	10.75	2.87	1.05	2.52	0.48	0.22	0.03	88	32	7.8	348	2
71442	SAN08002547		46.16	15.90	15.35	6.36	9.45	2.56	0.63	3.00	0.42	0.15	0.01	31	43	7.4	211	-1
71444	SAN08002547		44.08	16.25	16.33	5.60	10.45	2.67	0.85	3.09	0.46	0.22	0.01	37	42	7.9	248	2
71939	ACMESAN08003029		47.08	17.55	12.06	4.48	10.38	3.82	1.33	2.45	0.63	0.20	0.02	21	23	3.4	437	-1
71940	ACMESAN08003029		47.36	17.04	12.39	4.45	9.97	3.91	1.46	2.52	0.67	0.20	0.03	-20	23	1.5	481	-1
71437	SAN08002547		60.57	16.79	7.74	2.33	1.72	3.74	6.21	0.68	0.10	0.11	0.00	-20	7	3.7	1664	3
71399	SAN08002547		51.93	15.43	12.26	5.17	9.76	2.22	0.97	1.78	0.29	0.17	0.01	39	32	9.8	274	1
71479	SAN08002547		49.70	21.89	8.29	3.16	11.70	2.78	0.83	1.28	0.22	0.12	0.03	41	23	3.4	202	-1
71480	SAN08002547		49.60	21.68	8.12	3.58	11.75	2.73	0.85	1.31	0.23	0.13	0.02	40	24	3.2	187	-1
71938	ACMESAN08003029		48.39	22.11	8.76	4.62	10.53	3.57	0.40	1.23	0.21	0.16	0.02	58	20	7.7	190	-1
71941	ACMESAN08003029		46.30	21.65	6.77	4.86	15.86	3.02	0.51	0.79	0.11	0.10	0.04	41	23	9.1	118	-1
71969	SAN09001926		49.01	13.98	15.37	4.81	8.61	3.64	1.33	2.62	0.37	0.25	0.01	32	49	2.5	419	1
71379	SAN08002547		52.39	16.74	11.59	4.45	9.36	1.90	1.75	1.38	0.22	0.20	0.02	33	25	13.5	301	-1
71381	SAN08002547		52.37	16.69	11.01	4.83	10.99	1.00	1.35	1.35	0.19	0.20	0.02	46	31	15.7	171	2
71396	SAN08002547		52.71	15.73	10.37	6.81	9.56	1.60	1.54	1.29	0.17	0.21	0.02	41	31	12.8	74	1
71407	SAN08002547		50.49	16.14	12.38	4.17	11.60	1.54	1.65	1.57	0.24	0.19	0.03	57	36	12.3	207	1
71382	SAN08002547		68.45	15.46	4.11	1.20	2.29	3.04	4.90	0.41	0.05	0.07	0.01	-20	7	5	954	3
71384	SAN08002547		69.62	14.98	4.16	0.61	1.82	3.07	5.16	0.42	0.06	0.08	0.01	-20	8	3.6	1105	3
71385	SAN08002547		68.47	15.30	4.34	0.70	2.50	3.03	5.06	0.45	0.06	0.08	0.00	-20	8	4	1082	3
71386	SAN08002547		68.55	15.18	4.45	0.76	2.86	2.92	4.64	0.47	0.08	0.08	0.00	-20	8	4.7	1007	3
71387	SAN08002547		68.72	15.11	4.54	0.76	2.37	3.41	4.45	0.47	0.07	0.09	0.00	-20	8	3.8	945	3
71388	SAN08002547		66.64	15.34	4.49	0.88	3.89	3.52	4.53	0.50	0.08	0.11	0.01	-20	9	4.6	919	2
71389	SAN08002547		69.43	15.01	3.81	0.87	1.90	3.17	5.29	0.40	0.06	0.06	0.00	-20	7	2.8	943	3
71390	SAN08002547		67.97	15.00	4.57	1.03	2.67	3.41	4.71	0.48	0.08	0.08	0.01	-20	9	4.1	895	3
71391	SAN08002547		67.37	15.19	4.56	1.20	2.90	3.57	4.54	0.48	0.09	0.07	0.01	-20	8	4.8	890	3
71392	SAN08002547		66.51	14.69	4.28	1.01	5.07	3.31	4.50	0.46	0.08	0.09	0.01	-20	8	6.5	1158	3

Table A5– Continued

Sample Number	Co	Cs	Ga	Hf	Nb	Rb	Sr	Ta	Th	U	V	W	Zr	Y	La	Ce	Pr	Nd	Sm	Eu	
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	
71425	45.7	0.3	21.6	4.2	30.6	25.5	1	299	1.8	2.5	0.6	441	0.6	144	43.9	19.9	42	5.88	25.1	6.21	2
71434	38.3	7.3	18.4	3	25.7	31.9	1	606	1.4	2.2	0.5	321	1.1	118	29.8	16.7	33	4.41	19.5	4.41	1.6
71435	35.9	3.2	20.2	3.6	31.9	33.8	2	620	1.8	2.3	0.6	312	1.6	143	31.3	22.3	47	6.11	24.8	5.12	1.7
71438	45.4	0.3	25.1	4.6	39.8	32.7	1	233	2.1	2.7	0.8	467	1.5	165	37.6	25.2	47	5.93	26.7	5.78	2.1
71439	41.5	0.2	21	4.2	43.8	19	1	412	2.3	2.9	0.8	410	1.2	158	35.1	23.7	48	5.99	25.4	5.63	2
71440	49.3	3.7	17.9	4.4	36	12.3	1	397	1.9	2.5	0.7	236	0.7	182	33.4	20.1	42	5.57	24.5	5.55	1.9
71441	45.7	0.7	19.3	5	44.5	15	1	513	2.5	2.9	0.8	335	0.8	187	34	25.6	51	6.55	28.6	6.12	2.1
71442	48.5	-0.1	21	4.3	37.6	12.8	1	335	2.1	2.4	0.7	479	0.6	161	36	19.9	41	5.35	24	5.65	2
71444	46.7	0.2	22	4.8	40.5	23.6	2	289	2.2	2.8	0.9	470	1.4	176	49.4	24.3	51	6.47	28.4	6.61	2.1
71939	32.5	0.3	19.8	4.5	43.8	22.4	1	532	2.6	2.7	0.8	251	-0.5	155	33	25.4	52	6.68	30.3	6.25	2.3
71940	33.4	0.3	20.6	4.4	49.5	25.8	1	555	2.9	3.4	0.9	260	0.6	175	35.8	28.1	56	7.26	31.6	6.82	2.4
71437	5.6	0.2	19.1	16	148.7	165.6	5	91.8	7.8	11.9	3.2	39	0.6	674	93.6	54.7	114	13.91	59	12.09	2.9
71399	37.1	0.7	16.9	4.1	17.1	29.5	-1	127	1.1	2.3	0.4	235	0.5	139	33.4	14.3	31	4.3	20.5	4.56	1.6
71479	25.4	0.5	18.1	4	20.6	21.3	1	345	1.2	2.6	0.5	170	-0.5	156	28.8	14	29	3.88	17.6	4.44	1.3
71480	25.4	0.5	18	4.5	19.9	21.5	1	341	1.2	2.5	0.6	172	-0.5	151	30.4	14.4	31	4.08	17.5	4.36	1.4
71938	28.9	-0.1	16.3	3.3	17.1	4.9	1	413	0.9	1.9	0.4	111	0.7	126	26.3	12.7	27	3.58	15.2	3.71	1.3
71941	26.7	0.7	13.4	1.5	8.2	11.5	-1	354	0.5	0.8	0.2	154	0.9	51.3	14.2	5.3	11	1.54	7.3	1.94	0.8
71969	40	0.1	21.3	6.9	33.3	29.7	2	234	2	3.4	0.8	468	0.6	240	56.2	22.3	52	6.6	28.9	7.39	2.4
71379	28.1	0.7	17	5.8	30.8	44.1	2	413	1.9	3.7	0.7	164	-0.5	207	32.6	20.3	43	5.67	25.5	5.86	1.8
71381	37.1	0.8	18.3	4.2	11	50.4	3	201	0.6	3.3	0.5	239	0.6	156	29.9	18.8	39	5.02	19.8	4.67	1.2
71396	32.5	1.2	16.4	4.6	12.7	65.5	1	54.7	0.8	3.7	0.7	269	0.8	166	30.2	16.8	37	4.92	19.7	4.32	1.2
71407	39.7	1.6	16.5	4.1	11.1	54.3	-1	69.1	0.8	3.5	0.4	228	0.9	141	28.8	18.1	37	4.96	21.2	4.64	1.4
71382	3.5	0.4	20.3	18	79.9	114.6	6	74.2	4.5	15.4	3	16	1	688	95.2	61.2	125	14.81	57.8	12.22	1.9
71384	2.7	0.4	20.5	19	75.6	115	5	56.8	4.2	14	3.2	15	1	673	91.3	58.5	118	14.35	57.5	11.83	1.9
71385	3.4	0.4	20.8	19	77.2	114.4	6	58.1	4.4	15	3.3	19	1.1	704	94.5	59.4	122	14.5	57	11.98	1.9
71386	3.7	0.5	21.4	19	76.3	111.3	5	51.9	4.4	14	2.9	22	0.9	695	94.4	60.1	120	14.73	60.6	11.84	2
71387	3.7	0.2	20.7	18	75.9	106	5	48.2	4.5	14.4	3	22	0.8	680	91.1	57.8	116	14.37	55.7	11.62	1.9
71388	4.4	0.1	23.8	18	71.3	103.9	4	45.5	4.1	13.8	2.8	24	0.7	662	88.5	55.5	112	13.69	55	11.46	1.9
71389	2.3	0.2	20.8	18	78.9	128.8	6	62.2	4.6	15.1	3.2	8	1	677	97	61.2	124	15.02	56.9	12.08	1.9
71390	3.8	0.5	23.5	18	77.8	122.8	5	55.3	4.5	14	3.1	24	1.2	674	90.7	58.5	116	14.14	55	11.82	1.9
71391	4.2	0.4	22.4	18	75.2	124.2	5	59.4	4.2	13.4	2.9	24	1.1	656	88.6	57.4	117	14	55.2	11.64	2
71392	3.4	0.5	21	17	71.9	106.7	4	63.7	4	13	2.7	17	1	633	85.6	55.2	111	13.78	52.9	10.99	2

Table A5– Continued

Sample Number	Gd ppm	Tb ppm	Dy ppm	Ho ppm	Er ppm	Tm ppm	Yb ppm	Lu ppm	TOT/C wt%	TOT/S wt%	Mo ppm	Cu ppm	Pb ppm	Zn ppm	As ppm	Cd ppm	Sb ppm	Bi ppm	Ag ppm	Au ppb
71425	7.45	1.35	7.45	1.45	4.09	0.6	3.31	0.51	1	0.06	0.7	86	2.3	92	-0.5	0.1	-0.1	-0.1	-0.1	-0.5
71434	4.87	0.88	5.08	1.01	2.88	0.47	2.71	0.42	1.41	0.11	0.4	83.9	1.6	72	1	-0.1	-0.1	-0.1	-0.1	1
71435	5.42	0.92	5.25	1.1	3.08	0.49	2.86	0.44	0.5	0.19	0.7	80.7	3.4	81	2.5	-0.1	-0.1	-0.1	-0.1	-0.5
71438	6.43	1.15	6.4	1.32	3.68	0.58	3.64	0.52	0.2	-0.02	1.2	95.8	1.9	96	0.5	0.2	-0.1	-0.1	-0.1	-0.5
71439	6.3	1.06	6.09	1.21	3.41	0.53	3.19	0.47	0.45	0.11	1.2	80.9	1.8	89	0.8	0.1	-0.1	-0.1	-0.1	-0.5
71440	5.96	1	5.79	1.13	3.21	0.5	3.01	0.44	0.43	0.1	0.9	76.1	2	63	1.9	0.1	-0.1	-0.1	-0.1	1.5
71441	6.34	1.04	5.76	1.19	3.13	0.51	3.06	0.45	0.61	0.12	1.4	72.1	2.1	83	1.5	0.1	-0.1	-0.1	-0.1	-0.5
71442	6.53	1.11	6.36	1.29	3.61	0.58	3.51	0.5	0.32	0.35	0.8	97.9	1.6	89	-0.5	0.1	-0.1	-0.1	-0.1	-0.5
71444	8.09	1.41	8.27	1.65	4.51	0.69	4.15	0.6	0.82	0.07	1.1	98.6	2.3	101	-0.5	-0.1	-0.1	-0.1	-0.1	-0.5
71939	6.55	1.1	6.13	1.24	3.33	0.49	2.9	0.44	0.13	0.04	1.7	54.5	2.3	71	-0.5	0.1	-0.1	-0.1	-0.1	-0.5
71940	7.05	1.15	6.58	1.31	3.52	0.55	3.2	0.49	0.05	0.04	1.9	52.3	2.5	75	-0.5	0.1	-0.1	-0.1	-0.1	-0.5
71437	13.1	2.42	14.71	3.19	9.49	1.52	10.12	1.49	0.17	0.09	3.8	16.3	8.6	141	2.5	0.3	-0.1	-0.1	-0.1	1.3
71399	5.51	0.97	5.79	1.16	3.45	0.5	3.08	0.49	1.3	0.4	0.4	90.5	4.2	78	5	0.2	-0.1	0.5	-0.1	0.7
71479	4.6	0.86	4.88	1.08	3.16	0.49	3.03	0.45	0.04	-0.02	0.7	60.4	1.7	50	-0.5	-0.1	-0.1	-0.1	-0.1	3.1
71480	4.8	0.9	5.16	1.12	3.22	0.5	3.16	0.47	0.05	-0.02	0.7	55.2	1.6	55	-0.5	-0.1	-0.1	-0.1	-0.1	1.9
71938	4.28	0.77	4.62	0.98	2.71	0.44	2.61	0.4	0.49	0.12	0.4	62	2.3	63	-0.5	0.1	-0.1	-0.1	-0.1	-0.5
71941	2.33	0.42	2.51	0.52	1.48	0.22	1.34	0.21	0.46	1.9	0.4	58.6	0.9	35	-0.5	-0.1	-0.1	-0.1	-0.1	0.6
71969	9.1	1.62	9.76	2.05	5.82	0.86	5.74	0.87	0.04	0.02	1	82	1.8	85	0.5	0.1	0.1	0.1	0.1	1.1
71379	6.16	1.04	6.07	1.28	3.51	0.58	3.57	0.54	1.33	0.84	0.6	54.6	4.9	87	0.6	0.2	-0.1	-0.1	-0.1	-0.5
71381	4.88	0.84	4.98	1.02	3.13	0.48	2.94	0.47	1.65	0.97	0.3	71.9	7.4	71	-0.5	0.1	-0.1	0.5	-0.1	-0.5
71396	4.77	0.85	5.3	1.06	3.03	0.51	3.03	0.48	1.14	1.19	-0.1	82.6	5.9	59	-0.5	0.1	-0.1	-0.1	-0.1	0.9
71407	5.11	0.88	5.14	1.04	3.07	0.45	2.78	0.41	1.98	0.83	0.7	101	7	86	3.3	0.2	-0.1	0.4	-0.1	0.9
71382	12.5	2.39	15.16	3.19	10.3	1.64	10.69	1.69	0.4	0.06	3.9	12.9	20	78	1.2	0.3	0.2	0.5	-0.1	1.2
71384	11.9	2.33	14.41	3.24	10.1	1.57	10.47	1.63	0.28	0.03	1.3	12.2	14	83	1.2	0.3	-0.1	-0.1	-0.1	-0.5
71385	12.4	2.42	15.05	3.15	10.4	1.65	10.52	1.64	0.39	0.04	1.4	13.4	12	80	-0.5	0.2	-0.1	-0.1	-0.1	-0.5
71386	12.7	2.37	14.74	3.18	9.98	1.63	10.44	1.62	0.43	-0.02	1	13.9	12	83	-0.5	0.2	-0.1	-0.1	-0.1	0.5
71387	12	2.27	13.94	3.04	9.9	1.57	10.11	1.6	0.39	0.03	1.4	15.3	12	84	0.5	0.2	0.1	-0.1	-0.1	-0.5
71388	11.8	2.26	14.24	3.01	9.52	1.54	9.85	1.54	0.56	0.26	0.6	15.3	13	83	1.4	0.2	-0.1	-0.1	-0.1	-0.5
71389	12.7	2.4	15.35	3.23	10.2	1.67	10.65	1.62	0.26	0.12	2.9	11.8	15	91	3.3	0.2	-0.1	-0.1	-0.1	-0.5
71390	12.2	2.34	14.75	3.09	10	1.61	10.41	1.62	0.4	0.02	1.1	14.3	9.5	92	0.6	0.2	-0.1	-0.1	-0.1	-0.5
71391	12	2.26	14.25	3.07	9.61	1.57	9.93	1.59	0.4	0.05	1.2	14.1	9.8	85	-0.5	0.3	-0.1	-0.1	-0.1	0.6
71392	11.6	2.22	13.99	2.92	9.26	1.46	9.53	1.5	0.64	0.38	1	12.9	9.2	82	-0.5	0.2	-0.1	-0.1	-0.1	-0.5

Table A5– Continued

Sample Number	Hg ppm	Tl ppm	Se ppm
71425	-0.01	-0.1	-0.5
71434	-0.01	-0.1	-0.5
71435	0.01	-0.1	-0.5
71438	-0.01	-0.1	-0.5
71439	-0.01	-0.1	-0.5
71440	-0.01	-0.1	-0.5
71441	-0.01	-0.1	-0.5
71442	-0.01	-0.1	-0.5
71444	-0.01	-0.1	-0.5
71939	-0.01	-0.1	0.5
71940	-0.01	-0.1	-0.5
71437	-0.01	-0.1	-0.5
71399	-0.01	-0.1	-0.5
71479	-0.01	-0.1	-0.5
71480	-0.01	-0.1	-0.5
71938	-0.01	-0.1	-0.5
71941	0.01	-0.1	-0.5
71969	0.01	0.1	0.5
71379	0.02	0.1	-0.5
71381	0.03	0.2	-0.5
71396	-0.01	-0.1	1
71407	0.01	0.2	-0.5
71382	-0.01	-0.1	-0.5
71384	-0.01	-0.1	-0.5
71385	-0.01	-0.1	-0.5
71386	-0.01	-0.1	-0.5
71387	-0.01	-0.1	-0.5
71388	-0.01	-0.1	-0.5
71389	-0.01	-0.1	-0.5
71390	-0.01	-0.1	-0.5
71391	-0.01	-0.1	-0.5
71392	-0.01	-0.1	-0.5

Table A5– Continued

Sample Number	BatchNumber	Acme	SiO2 wt%	Al2O3 wt%	Fe2O3 w%	MgO w%	CaO w%	Na2O w%	K2O w%	TiO2 w%	P2O5 w%	MnO w%	Cr2O 3 w%	Ni ppm	Sc ppm	LOI wt%	Ba ppm	Be ppm
71394	SAN08002547		68.42	14.64	3.87	0.88	3.36	3.49	4.78	0.39	0.07	0.07	0.01	-20	7	5.2	904	3
71369	SAN08002547		53.03	15.80	11.21	5.72	9.52	2.18	0.79	1.37	0.18	0.19	0.02	40	31	11	333	-1
71370	SAN08002547		52.05	16.61	10.82	6.71	9.04	2.04	1.07	1.33	0.17	0.15	0.02	52	33	10.5	324	-1
71371	SAN08002547		51.57	15.63	11.73	6.51	9.79	1.92	1.23	1.28	0.17	0.15	0.02	41	31	12.6	471	-1
71372	SAN08002547		51.28	15.70	11.41	5.97	10.78	1.87	1.33	1.33	0.15	0.17	0.02	42	31	13	451	-1
71374	SAN08002547		51.62	15.80	11.97	6.62	9.22	2.10	0.88	1.44	0.18	0.16	0.02	52	33	10.7	270	-1
71375	SAN08002547		50.86	16.10	11.53	6.59	10.04	2.24	0.87	1.40	0.18	0.17	0.02	49	32	11.2	224	-1
71376	SAN08002547		53.82	15.58	11.81	6.45	7.55	2.14	0.97	1.35	0.18	0.14	0.02	39	31	9.7	280	-1
71377	SAN08002547		53.69	15.39	11.76	6.54	8.10	2.11	0.78	1.26	0.18	0.16	0.02	37	32	10.1	225	-1
71378	SAN08002547		51.25	15.76	12.64	5.04	10.46	1.67	1.45	1.33	0.17	0.22	0.02	51	32	13.3	192	-1
71397	SAN08002547		52.47	15.78	11.45	7.32	8.00	1.94	1.26	1.36	0.17	0.23	0.02	49	32	11.8	185	-1
71398	SAN08002547		52.02	15.42	12.22	6.81	8.48	2.22	0.96	1.45	0.18	0.23	0.02	44	34	11.4	215	1
71380	SAN08002547		51.17	16.60	12.94	6.14	8.57	1.25	1.13	1.77	0.24	0.17	0.02	45	38	13.9	497	-1
71368	SAN08002547		51.30	16.34	12.27	5.73	9.42	1.66	1.55	1.32	0.20	0.18	0.02	48	33	12.5	404	-1
71400	SAN08002547		56.19	15.75	11.71	3.31	7.73	0.94	2.57	1.47	0.20	0.11	0.01	49	32	10.8	127	1
71401	SAN08002547		56.56	15.23	11.18	3.43	8.31	1.37	2.23	1.34	0.19	0.13	0.02	41	31	10.3	188	1
71402	SAN08002547		56.92	14.95	11.07	3.00	8.77	1.16	2.35	1.43	0.20	0.15	0.01	36	30	10.5	251	1
71404	SAN08002547		53.83	15.28	11.35	3.51	10.49	1.64	2.02	1.51	0.20	0.16	0.01	30	32	10.6	380	1
71405	SAN08002547		52.93	16.36	13.27	4.25	7.80	1.22	2.07	1.70	0.23	0.16	0.01	43	35	10.3	404	-1
71406	SAN08002547		53.03	15.82	13.79	3.77	7.72	1.85	1.87	1.76	0.22	0.16	0.01	47	35	10	199	-1
71360	SAN08002547		70.67	13.37	5.17	0.74	1.60	1.66	5.93	0.58	0.18	0.07	0.03	-20	11	4.2	997	1
71361	SAN08002547		70.95	13.28	5.16	0.76	1.52	1.72	5.73	0.60	0.19	0.06	0.03	-20	11	4	949	2
71362	SAN08002547		69.96	13.59	5.50	0.88	1.48	1.78	5.93	0.61	0.20	0.06	0.02	-20	11	4.3	955	2
71364	SAN08002547		69.95	13.39	5.73	1.09	1.31	1.81	5.79	0.60	0.22	0.07	0.02	-20	11	3.7	959	1
73451	SAN08002547		71.36	13.34	5.24	0.35	2.02	1.84	4.99	0.60	0.19	0.05	0.02	-20	11	3.4	1134	2
73452	SAN08002547		73.25	12.35	4.98	0.29	1.94	1.93	4.41	0.56	0.21	0.05	0.03	-20	11	2.9	1016	1
73455	SAN08002547		72.80	12.28	5.00	0.26	2.03	1.83	4.96	0.56	0.18	0.07	0.02	-20	11	2.4	1304	2
73457	SAN08002547		72.63	12.03	4.84	0.24	1.66	1.73	6.03	0.55	0.18	0.08	0.03	-20	11	2	1021	1
73458	SAN08002547		70.71	13.02	5.52	0.31	1.52	1.94	6.07	0.61	0.21	0.08	0.02	-20	12	2.3	1097	1
73466	SAN08002547		71.60	12.70	4.62	0.22	1.65	2.22	6.20	0.53	0.16	0.07	0.03	-20	10	1.9	915	1
73467	SAN08002547		69.89	13.41	5.20	0.24	1.29	2.20	6.91	0.60	0.17	0.06	0.02	-20	11	1.4	975	2
73468	SAN08002547		71.51	12.77	4.88	0.25	1.30	2.01	6.48	0.54	0.16	0.06	0.02	-20	10	1.5	920	2

Table A5– Continued

Sample Number	Co ppm	Cs ppm	Ga ppm	Hf ppm	Nb ppm	Rb ppm	Sn ppm	Sr ppm	Ta ppm	Th ppm	U ppm	V ppm	W ppm	Zr ppm	Y ppm	La ppm	Ce ppm	Pr ppm	Nd ppm	Sm ppm	Eu ppm
71394	2.3	0.4	20.6	18	75.3	116	5	64.7	4.3	12.8	3.2	8	1.1	661	89.6	54.6	110	13.89	54	11.28	1.8
71369	37.6	0.4	17	3.3	6.9	20.3	1	792	0.4	3.3	0.5	222	1	125	25.4	15	32	4.41	19.4	4.15	1.2
71370	41.3	0.5	16.7	3.5	6.3	24.3	1	674	0.3	2.5	0.4	215	-0.5	118	24.5	13.7	30	4.03	18.2	4.02	1.2
71371	39.3	0.7	15.3	3	5.7	32.1	-1	1092	0.3	2.6	0.3	219	-0.5	104	21.7	12.2	27	3.69	16.5	3.85	1.1
71372	36.4	0.7	15.8	3	6.1	37.4	1	1010	0.3	2.2	0.3	228	0.6	106	22.8	12.4	27	3.62	15.9	3.77	1.2
71374	38.7	0.5	16.6	3.1	6.5	22.1	-1	630	0.4	2.6	0.4	256	-0.5	116	23.9	13.8	30	4.04	17.5	4.09	1.2
71375	40.6	0.4	16.3	3.4	6.4	20.8	-1	485	0.3	2.4	0.4	239	-0.5	121	23.3	12.9	28	3.85	17.2	3.92	1.2
71376	36.8	0.5	16.8	3.5	7.4	27	1	517	0.3	3.9	0.6	230	-0.5	142	26.4	16.2	35	4.69	20.4	4.55	1.3
71377	36.3	0.5	16.1	3.7	7.2	23.6	1	372	0.4	3.3	0.5	225	-0.5	140	25.1	16.1	34	4.6	20.1	4.31	1.3
71378	34.7	1.2	17.9	3.9	6.9	62	1	305	0.4	3.5	0.4	220	0.6	135	24.5	16.7	36	4.7	20.1	4.25	1.3
71397	36.1	0.8	16.5	3.2	6.7	50.4	-1	75.6	0.4	2.4	0.4	255	0.7	114	23.6	15.4	33	4.22	17.6	3.92	1.2
71398	36.4	0.5	15.4	3.7	7.3	31.6	1	229	0.4	3	0.4	220	1	133	26.5	16.6	36	4.71	19.1	4.13	1.2
71380	41.9	0.7	17	4.4	7.6	36.3	2	390	0.4	3.1	0.5	287	0.9	157	29.8	19.8	41	5.44	23.2	4.76	1.4
71368	35	0.8	15.5	3	6.5	46.9	1	801	0.4	2.7	0.4	209	-0.5	122	25.6	16.2	34	4.54	20.5	4.17	1.3
71400	37.4	1.8	17.8	4.8	8.2	97.4	-1	34.4	0.5	3.9	0.5	215	1.1	155	29	18.2	39	5.14	21.5	4.62	1.3
71401	35.3	1.5	17.2	4.6	8.9	75.4	1	48.9	0.6	4.7	0.7	209	0.8	159	30	20.5	45	5.8	23.3	4.96	1.4
71402	36.5	1.5	17.2	4.5	8.6	80.6	1	46.3	0.5	5.4	0.6	214	0.7	160	31.2	21.7	47	6.05	25.1	5.26	1.5
71404	38.5	1.4	17.4	4.3	7.6	67.5	1	73.6	0.4	4.5	0.6	235	0.8	146	29.4	19.1	40	5.3	22.3	4.73	1.4
71405	46.1	1.4	18.8	4.9	7.9	68.4	-1	50.3	0.5	3.8	0.5	248	0.8	162	31	17.7	39	5.13	21.5	4.75	1.5
71406	42.1	1.4	18.1	5.1	7.9	60.4	1	61.2	0.4	4.5	0.4	238	0.7	161	31.3	18.2	40	5.23	22	4.85	1.5
71360	5.1	3	17.3	9.9	21.5	189.8	3	71.7	1.5	19.5	2.8	23	2	322	51.5	55.6	116	14.45	58	10.43	1.8
71361	5.4	3.1	17.6	9.7	21.4	187.6	4	71.6	1.3	18.9	2.7	21	1.3	328	51.3	54.1	115	14.14	56.6	10.17	1.8
71362	6.3	2.9	17.3	9.8	22.2	190.3	3	71.9	1.5	19.7	2.7	21	1.1	343	53.4	55.5	114	14.22	55.4	10.4	1.8
71364	5.4	2.4	15.3	9	21.3	178.6	3	70.8	1.3	17.1	2.6	23	0.8	334	51.4	56.4	117	14.13	56	10.14	1.8
73451	5.7	1.3	17.9	11	23.1	138.8	3	152	1.5	17.6	2.7	29	1	384	53.1	58	119	14.57	55.4	10.47	2
73452	6.1	1.1	16.9	9.8	21.5	125.3	3	227	1.3	15.7	2.7	28	1.2	341	52.1	54.8	114	13.88	51.2	9.96	1.9
73455	5.3	0.8	16.4	8.7	22.5	132.3	3	204	1.4	15.9	2.6	26	1.2	319	53.2	54.7	117	14.23	55.1	10.33	1.9
73457	6.1	1.1	16	8.6	20.6	176	3	86.7	1.3	15.3	2.4	23	1.1	315	50.9	51.5	107	13.28	52	9.51	1.8
73458	6.3	1.2	18.2	10	23.6	172.6	3	81.7	1.4	16.6	2.6	25	1.1	364	52.6	56.5	116	14.41	56	10.51	2
73466	5.2	1.2	15.5	8.4	20	178.2	4	90.4	1.3	14.4	2.8	21	1.4	317	44.7	48.4	102	12.38	47.5	9.37	1.7
73467	5.4	1.5	16.7	9.6	22.3	199.2	3	96.3	1.4	16	2.8	24	1.3	348	47.1	52.7	109	13.44	51.8	10.15	1.8
73468	5.1	1.3	15.8	9.2	20.8	193.7	3	98.3	1.3	15.7	2.9	20	1.3	330	45.4	50.5	103	12.63	50.1	9.42	1.7

Table A5– Continued

Sample Number	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	TOT/C	TOT/S	Mo	Cu	Pb	Zn	As	Cd	Sb	Bi	Ag	Au
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	wt%	wt%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppb
71394	11.6	2.26	13.96	3.03	9.51	1.58	9.86	1.57	0.44	0.14	1	11.3	11	80	-0.5	0.2	-0.1	-0.1	-0.1	0.6
71369	4.53	0.78	4.36	0.97	2.88	0.42	2.61	0.41	0.82	0.24	0.1	74.4	3.9	65	2.1	-0.1	-0.1	-0.1	-0.1	-0.5
71370	4.41	0.74	4.27	0.94	2.74	0.42	2.65	0.39	0.56	0.36	0.1	101	5	77	2.3	0.2	-0.1	-0.1	-0.1	-0.5
71371	3.92	0.68	4	0.88	2.37	0.38	2.31	0.35	0.83	0.16	-0.1	109	4.3	75	1.8	0.1	-0.1	-0.1	-0.1	1.6
71372	4.26	0.7	4.09	0.93	2.57	0.39	2.45	0.38	1.03	0.06	0.1	112	3.8	62	0.7	0.1	-0.1	-0.1	-0.1	0.8
71374	4.64	0.75	4.48	0.97	2.8	0.4	2.53	0.38	0.7	0.09	-0.1	106	4.8	72	0.6	-0.1	-0.1	-0.1	-0.1	-0.5
71375	4.35	0.74	4.5	0.95	2.54	0.4	2.64	0.38	0.89	0.07	0.1	65.4	5.3	82	-0.5	-0.1	-0.1	-0.1	-0.1	0.9
71376	4.87	0.82	4.8	1.04	3.02	0.45	2.74	0.44	0.51	0.05	0.1	74.7	6	68	0.8	-0.1	-0.1	-0.1	-0.1	-0.5
71377	4.63	0.8	4.6	1.03	2.79	0.44	2.67	0.4	0.67	0.08	0.2	62.3	6	58	1	-0.1	-0.1	-0.1	-0.1	-0.5
71378	4.67	0.78	4.39	1.03	2.89	0.45	2.73	0.41	1.54	0.2	0.2	82	5.8	57	-0.5	-0.1	-0.1	-0.1	-0.1	-0.5
71397	3.95	0.7	4.08	0.83	2.48	0.37	2.33	0.35	1.11	0.41	0.1	70.4	5	63	-0.5	0.1	-0.1	-0.1	-0.1	-0.5
71398	4.52	0.8	4.68	0.92	2.74	0.42	2.53	0.38	1.01	0.04	0.1	61.9	4.7	66	-0.5	-0.1	-0.1	-0.1	-0.1	-0.5
71380	5.25	0.92	5.27	1.06	3.06	0.47	2.89	0.43	1.14	1.88	0.2	80.2	7.1	93	-0.5	0.2	-0.1	-0.1	-0.1	0.7
71368	4.42	0.75	4.33	0.97	2.79	0.4	2.52	0.37	0.84	0.34	0.6	64.5	4	60	1	-0.1	-0.1	-0.1	-0.1	-0.5
71400	4.79	0.85	4.77	1.01	2.99	0.47	2.83	0.45	1.26	2.72	0.6	75.4	8.1	66	10.3	0.2	-0.1	0.6	-0.1	1.6
71401	5.03	0.91	5.04	1.04	3.11	0.46	2.83	0.44	1.47	1.13	0.3	66.5	6.6	66	4	-0.1	-0.1	0.4	-0.1	1.1
71402	5.38	0.95	5.4	1.09	3.33	0.48	2.95	0.46	1.51	0.94	0.1	64	6.8	64	3.3	0.2	-0.1	0.4	-0.1	-0.5
71404	5.03	0.88	5.16	1.02	3.15	0.46	2.67	0.45	1.73	0.83	0.6	70.5	6.2	68	3.2	0.2	-0.1	0.3	-0.1	-0.5
71405	5.18	0.93	5.27	1.14	3.43	0.51	3.01	0.48	1.34	1.46	0.3	82.6	7.5	89	4.1	0.2	-0.1	0.3	-0.1	0.8
71406	5.27	0.94	5.56	1.12	3.43	0.49	3.04	0.49	1.16	0.46	0.3	78.5	5.7	82	2.3	0.2	-0.1	0.3	-0.1	0.8
71360	9.45	1.56	9.17	1.88	5.23	0.8	4.95	0.74	0.16	0.02	0.4	8.4	6	58	1.4	-0.1	-0.1	-0.1	-0.1	-0.5
71361	9.14	1.53	8.94	1.89	5.17	0.8	4.8	0.72	0.13	0.02	0.5	9	5.5	70	1.6	-0.1	-0.1	-0.1	-0.1	0.8
71362	9.42	1.56	9.34	1.89	5.04	0.8	5.09	0.75	0.14	0.03	0.3	9.2	7.5	92	1.4	0.1	-0.1	-0.1	-0.1	-0.5
71364	9.44	1.57	8.94	1.85	5.21	0.82	4.98	0.76	0.14	0.13	0.3	10.4	11	76	1.5	-0.1	-0.1	-0.1	-0.1	1.2
73451	9.3	1.63	9.79	1.87	5.23	0.8	5.14	0.75	0.1	0.1	0.3	9.3	15	55	0.5	0.2	-0.1	-0.1	-0.1	0.7
73452	9.06	1.57	9.2	1.83	5.08	0.78	4.88	0.73	0.05	0.12	0.4	9.3	12	56	1.2	0.2	-0.1	-0.1	-0.1	-0.5
73455	9.47	1.61	9.21	1.88	5.37	0.84	5.03	0.77	0.09	0.05	0.4	9.1	12	56	1	0.1	-0.1	-0.1	-0.1	3.1
73457	8.86	1.53	8.78	1.76	5.03	0.76	4.75	0.71	0.15	0.11	0.4	11.6	10	55	2.6	-0.1	-0.1	0.1	-0.1	0.8
73458	9.32	1.62	9.41	1.86	5.2	0.83	4.96	0.75	0.12	0.14	0.4	10.1	12	61	3.2	0.1	-0.1	-0.1	-0.1	0.8
73466	8.24	1.42	8.17	1.66	4.67	0.72	4.39	0.65	0.14	0.1	0.5	7.7	12	56	2	-0.1	0.1	-0.1	-0.1	1.5
73467	8.9	1.54	8.98	1.79	4.87	0.78	4.61	0.7	0.04	0.12	0.5	10.4	10	60	1.3	0.1	0.2	-0.1	-0.1	1
73468	8.47	1.42	8.26	1.61	4.66	0.75	4.6	0.68	0.05	0.15	0.4	8.9	11	53	1.7	-0.1	0.1	-0.1	-0.1	-0.5

Table A5– Continued

Sample Number	Hg ppm	Tl ppm	Se ppm
71394	-0.01	-0.1	-0.5
71369	-0.01	-0.1	-0.5
71370	-0.01	-0.1	-0.5
71371	-0.01	-0.1	-0.5
71372	-0.01	-0.1	-0.5
71374	-0.01	-0.1	-0.5
71375	-0.01	-0.1	-0.5
71376	-0.01	-0.1	-0.5
71377	-0.01	-0.1	-0.5
71378	-0.01	-0.1	-0.5
71397	-0.01	-0.1	0.8
71398	-0.01	-0.1	-0.5
71380	0.03	0.1	-0.5
71368	0.01	-0.1	-0.5
71400	-0.01	0.4	-0.5
71401	-0.01	0.2	-0.5
71402	-0.01	0.2	-0.5
71404	-0.01	0.2	-0.5
71405	-0.01	0.2	-0.5
71406	-0.01	0.2	-0.5
71360	0.02	-0.1	-0.5
71361	0.03	-0.1	-0.5
71362	0.04	-0.1	-0.5
71364	0.02	-0.1	-0.5
73451	-0.01	-0.1	-0.5
73452	0.01	-0.1	-0.5
73455	0.01	-0.1	-0.5
73457	-0.01	0.1	-0.5
73458	0.02	0.2	-0.5
73466	-0.01	0.1	-0.5
73467	-0.01	-0.1	-0.5
73468	-0.01	-0.1	-0.5

Table A5– Continued

Sample Number	BatchNumber	Acme	SiO ₂ wt%	Al ₂ O ₃ wt%	Fe ₂ O ₃ w%	MgO w%	CaO w%	Na ₂ O w%	K ₂ O w%	TiO ₂ w%	P ₂ O ₅ w%	MnO w%	Cr ₂ O ₃ w%	Ni ppm	Sc ppm	LOI wt%	Ba ppm	Be ppm
73474	SAN08002547		71.23	13.17	5.35	0.47	1.58	1.70	5.58	0.58	0.23	0.08	0.01	-20	11	3.8	892	1
73475	SAN08002547		72.57	12.67	4.24	0.41	1.64	1.55	6.18	0.48	0.16	0.07	0.03	-20	9	3.7	798	1
73476	SAN08002547		72.92	12.62	4.01	0.43	1.31	1.69	6.31	0.46	0.14	0.07	0.02	-20	9	2.9	785	2
73478	SAN08002547		69.89	13.29	5.52	0.41	1.76	2.20	6.01	0.61	0.20	0.07	0.02	-20	12	2.2	941	2
73479	SAN08002547		70.12	13.35	5.32	0.49	1.83	2.23	5.75	0.60	0.21	0.08	0.03	-20	11	2.4	956	1
73480	SAN08002547		69.30	13.49	5.73	0.42	1.81	2.30	6.04	0.63	0.19	0.07	0.02	-20	12	1.2	975	2
73481	SAN08002547		71.80	12.76	4.99	0.52	1.53	2.22	5.38	0.55	0.15	0.07	0.02	-20	11	1.9	967	2
73482	SAN08002547		70.46	13.20	5.39	0.42	1.84	2.34	5.54	0.59	0.18	0.07	0.02	-20	12	1.4	985	2
73484	SAN08002547		71.58	12.70	5.13	0.43	1.84	2.23	5.26	0.57	0.16	0.08	0.02	-20	11	1.7	988	2
73485	SAN08002547		71.75	12.76	4.91	0.46	1.57	2.18	5.58	0.53	0.17	0.07	0.03	-20	10	1.5	987	2
73486	SAN08002547		71.20	13.06	4.75	0.49	1.64	2.30	5.78	0.52	0.16	0.07	0.02	-20	10	1.5	992	1
73487	SAN08002547		70.84	12.92	5.38	0.51	1.85	2.35	5.28	0.59	0.17	0.08	0.04	-20	12	1.1	1009	2
73488	SAN08002547		70.46	13.07	5.27	0.49	1.85	2.34	5.66	0.58	0.17	0.08	0.03	-20	11	1.6	1010	2
73489	SAN08002547		70.14	13.08	5.51	0.45	1.86	2.16	5.93	0.58	0.18	0.07	0.04	-20	11	2.2	1023	2
73490	SAN08002547		72.26	12.73	4.93	0.78	1.45	1.68	5.35	0.57	0.17	0.06	0.02	-20	11	3.7	885	2
73491	SAN08002547		70.35	13.40	5.51	0.75	1.52	1.92	5.68	0.59	0.18	0.07	0.02	-20	12	3.6	948	2
73492	SAN08002547		70.68	13.27	5.25	0.62	1.41	1.97	5.97	0.58	0.18	0.06	0.02	-20	11	3	1006	2
73494	SAN08002547		70.94	13.08	5.39	0.67	1.62	1.81	5.66	0.57	0.18	0.06	0.02	-20	11	3.8	1439	2
73495	SAN08002547		71.33	12.89	5.22	0.67	1.69	1.75	5.62	0.56	0.17	0.06	0.03	-20	11	4	1040	2
73496	SAN08002547		70.44	13.62	5.12	0.70	1.51	1.86	5.92	0.59	0.17	0.06	0.02	-20	11	4.1	994	2
73497	SAN08002547		70.41	13.33	5.27	0.81	2.21	1.77	5.33	0.59	0.18	0.08	0.01	-20	11	5.1	936	2
73498	SAN08002547		70.51	13.51	5.18	0.75	2.16	1.84	5.18	0.59	0.18	0.08	0.02	-20	12	4.6	1026	2
73499	SAN08002547		70.56	13.29	5.16	0.72	2.33	1.81	5.25	0.59	0.17	0.09	0.02	-20	11	4.4	918	2
73500	SAN08002547		70.05	13.41	5.22	0.58	2.26	1.95	5.64	0.60	0.18	0.09	0.02	-20	11	3.6	988	2
71351	SAN08002547		70.89	13.45	4.69	0.79	1.58	1.49	6.29	0.57	0.17	0.06	0.02	-20	10	5.6	922	1
71352	SAN08002547		70.02	13.45	5.45	0.84	1.76	1.40	6.17	0.62	0.21	0.06	0.02	-20	11	6	1079	1
71354	SAN08002547		71.26	13.02	5.25	1.09	1.78	1.21	5.47	0.62	0.20	0.08	0.01	-20	11	6.5	1028	1
71355	SAN08002547		70.53	13.45	5.48	1.03	1.83	1.37	5.43	0.61	0.19	0.06	0.02	-20	11	6.7	820	2
71356	SAN08002547		71.30	12.94	5.45	0.93	1.81	1.26	5.41	0.59	0.20	0.07	0.02	-20	11	6.4	860	1
71357	SAN08002547		70.98	12.87	5.29	0.81	2.16	1.34	5.70	0.58	0.16	0.08	0.03	-20	11	5.6	943	1
71358	SAN08002547		71.28	12.96	5.10	0.93	1.79	1.36	5.68	0.60	0.19	0.08	0.01	-20	11	5.4	970	1
71359	SAN08002547		70.71	13.09	5.54	0.76	1.60	1.51	5.88	0.61	0.20	0.07	0.03	-20	11	4.6	942	2

Table A5– Continued

Sample Number	Co	Cs	Ga	Hf	Nb	Rb	Sn	Sr	Ta	Th	U	V	W	Zr	Y	La	Ce	Pr	Nd	Sm	Eu
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
73474	5.2	1.3	16.2	9.3	21.1	178	3	42.3	1.2	15.4	2.6	19	0.9	344	45.4	49.8	104	12.87	49.3	9.85	1.8
73475	4.3	1.6	14.5	7.6	18	185.2	3	41.3	1.1	14.4	2.9	15	1	281	39.4	43.9	91	11.05	42	8.43	1.5
73476	4.6	1.4	15.3	7.8	18	193.1	4	44.2	1.1	14.6	2.8	15	1	281	40.1	42.6	89	10.85	42.2	8.5	1.5
73478	5.7	2.3	18.2	10	23.4	192.4	3	88.6	1.4	16.8	2.8	21	1.8	377	48.2	54.1	112	13.65	51.6	10.27	2
73479	5.6	2.3	18.5	9.7	22.7	186.7	3	105	1.4	15.5	2.8	20	1.1	373	47.5	51.7	108	13.3	52.1	10.16	2
73480	5.9	2.6	18.4	9.7	23.6	197	3	127	1.5	17.3	2.8	23	1.7	376	50	55.5	115	14.18	54.3	10.81	2
73481	5.7	2.5	17.9	9.7	22.4	205.9	5	101	1.3	17.8	2.6	30	1.3	373	51.3	55.1	116	14.15	55.2	10.14	1.9
73482	5.8	2.7	18.9	9.9	23	213.5	3	115	1.3	17.7	2.8	32	1.2	366	54.5	57	119	14.59	57.6	10.26	1.9
73484	5.2	3	18.5	9.4	22.8	206.9	3	135	1.2	17.6	2.7	31	1.2	347	51.6	56.9	117	14.32	55.6	9.9	1.9
73485	5.6	2.9	18.3	9.4	21.8	215.4	3	144	1.3	18	2.8	28	1.1	359	51.6	55.2	113	14.09	54.3	9.88	1.8
73486	5.2	2.7	18.4	9	21.7	221.4	4	142	1.2	17.9	3.2	27	0.9	339	50.9	53.7	113	13.63	55.1	9.75	1.7
73487	6	2.7	18.8	10	23.7	198.5	3	131	1.3	19.7	2.8	31	1.6	369	54.5	57.5	117	14.59	57.4	10.45	1.9
73488	5.7	2.7	18.5	9.4	22.6	202.4	3	124	1.3	18.6	2.8	29	1.4	348	52.1	56.5	114	14.35	56.3	10.03	1.9
73489	5.9	2.8	18.6	9.3	22.3	202.6	3	125	1.3	17.8	2.7	27	1.2	355	52	55.5	114	14.27	56.3	9.84	1.8
73490	6.2	2.8	18.4	8.8	21.1	192.7	3	108	1.2	17.8	2.7	29	1	342	49.3	51.1	107	13.38	53.4	9.53	1.7
73491	5.4	2.8	18.7	9.6	22.2	205.3	3	102	1.2	17.5	2.6	26	1.3	349	51	57.2	115	14.37	56.7	10.06	1.9
73492	4.9	2.8	17.6	9.7	21.5	208.2	3	95.9	1.3	17.9	2.8	27	1.4	351	51.3	55.4	114	13.89	53.4	9.95	1.8
73494	5.2	2.8	18.1	9.7	21.7	204.1	15	101	1.3	17.7	2.7	27	1.4	360	51.6	56	114	14.15	55.5	9.88	1.9
73495	5.1	2.8	17.2	9	21.6	198.6	26	74.7	1.2	17.4	2.7	27	1.4	332	48.8	54.2	109	13.56	53.2	9.42	1.7
73496	4.6	2.9	17.9	10	22.5	210.9	4	72.8	1.3	18.9	2.8	28	1.8	348	54.5	56.4	115	14.26	54.7	10.02	1.9
73497	5.7	2.9	19.3	9.8	23	193.7	3	78.2	1.3	18.5	2.6	29	1.5	345	51.8	56.2	115	14.17	55	10.23	1.9
73498	5.9	2.8	18.3	11	21.6	184.4	3	87.6	1.3	18.1	2.7	24	1.6	359	50.9	54.9	112	14.11	55.3	9.48	1.9
73499	5.5	2.8	17.8	10	21	182.5	3	85.4	1.3	17.4	2.8	23	1.8	355	48.6	53.1	110	13.56	52.9	9.25	1.8
73500	5.8	3.2	18.6	9.9	21.4	199.4	3	85.5	1.4	17.7	2.7	27	1.5	345	50.6	55.9	115	14.33	56.1	9.47	1.8
71351	4.8	3.1	17.8	11	19.9	204.8	6	53.2	1.3	19.7	2.9	29	1	347	50.4	53.3	116	13.99	55.8	10.03	1.7
71352	5.5	2.3	18.1	11	21.6	190	6	53	1.6	19.5	2.6	27	1.6	371	51.8	55.5	116	14.46	55.9	10.54	1.9
71354	5.9	2.3	19.4	11	22.3	170	3	52.2	1.4	19.9	2.9	30	3.4	369	50.6	56.7	121	14.39	54.3	10.48	1.8
71355	4.9	3.2	17.2	12	21.4	171.6	3	58.7	1.5	19.2	2.9	24	1.6	383	50.2	53.4	114	13.92	54.2	10.26	1.9
71356	4.8	2.7	17.5	11	21.1	172	3	56.5	1.4	17.6	2.7	25	1.6	351	47.9	51	106	12.79	50.2	9.55	1.7
71357	4.9	3.1	17.7	11	21.5	182	3	59.3	1.3	17.9	2.6	26	1.5	368	49.1	54.7	112	13.81	54.1	9.86	1.8
71358	5.8	3.3	18.6	9.7	22	182	3	64.1	1.5	18.8	3	40	1.5	345	49.6	53.8	114	13.7	51.8	9.59	1.8
71359	5.1	2.8	17	10	20.9	184.4	3	66.6	1.4	18	2.7	26	1.5	345	49.7	53	108	13.63	54.1	9.92	1.8

Table A5– Continued

Sample Number	Gd ppm	Tb ppm	Dy ppm	Ho ppm	Er ppm	Tm ppm	Yb ppm	Lu ppm	TOT/C wt%	TOT/S wt%	Mo ppm	Cu ppm	Pb ppm	Zn ppm	As ppm	Cd ppm	Sb ppm	Bi ppm	Ag ppm	Au ppb
73474	8.73	1.47	8.6	1.68	4.81	0.77	4.69	0.72	0.21	0.11	0.2	8.3	17	60	1.4	0.1	-0.1	-0.1	-0.1	1.4
73475	7.58	1.31	7.78	1.47	4.3	0.65	4.03	0.6	0.25	0.02	0.2	7.7	15	43	1.3	-0.1	-0.1	0.1	-0.1	1.2
73476	7.42	1.32	7.7	1.5	4.22	0.65	4.06	0.6	0.19	0.03	0.2	7.6	15	42	2.5	-0.1	-0.1	-0.1	-0.1	-0.5
73478	9.38	1.62	9.39	1.84	5.12	0.84	5.08	0.76	0.13	0.03	0.6	10.3	8.8	76	1.6	0.1	0.1	-0.1	-0.1	-0.5
73479	9.19	1.59	8.96	1.83	5.11	0.81	4.81	0.71	0.09	0.05	0.4	11	7.7	75	2.5	-0.1	0.2	-0.1	-0.1	-0.5
73480	9.7	1.69	9.69	1.85	5.48	0.84	5.25	0.77	0.06	0.03	0.5	9.4	6.6	74	2	-0.1	0.2	-0.1	-0.1	-0.5
73481	9.33	1.56	8.84	1.73	5.01	0.78	4.59	0.73	0.05	-0.02	0.4	8.9	7.8	61	1.6	-0.1	0.2	0.2	-0.1	-0.5
73482	9.64	1.59	9.24	1.8	5.37	0.81	4.99	0.75	0.06	0.03	0.4	9	6.5	66	2.5	-0.1	0.2	-0.1	-0.1	-0.5
73484	9.45	1.57	9.05	1.83	5.24	0.79	4.87	0.73	0.08	-0.02	0.5	8.5	5.2	63	2.2	-0.1	0.2	-0.1	-0.1	0.7
73485	9.28	1.54	8.8	1.72	5.09	0.81	4.81	0.71	0.05	-0.02	0.5	8.1	6.4	66	1.9	-0.1	0.2	-0.1	-0.1	-0.5
73486	9.07	1.5	8.3	1.71	4.98	0.77	4.68	0.7	0.05	-0.02	0.5	7.9	6.5	64	2.4	-0.1	0.2	-0.1	-0.1	-0.5
73487	9.47	1.62	9.37	1.84	5.23	0.8	4.92	0.74	0.05	-0.02	0.5	9.7	5.2	76	3.3	-0.1	0.2	-0.1	-0.1	-0.5
73488	9.34	1.56	9.21	1.79	5.33	0.79	5.07	0.73	0.08	-0.02	0.4	7.9	6	78	4.2	-0.1	0.2	-0.1	-0.1	-0.5
73489	9.17	1.55	8.95	1.8	5	0.79	4.84	0.73	0.1	-0.02	0.4	8.6	5.6	67	4	-0.1	0.2	-0.1	-0.1	0.6
73490	8.93	1.45	8.23	1.65	4.77	0.75	4.63	0.67	0.04	-0.02	0.4	8.5	5.8	58	1.9	-0.1	-0.1	-0.1	-0.1	0.8
73491	9.11	1.57	8.78	1.71	4.99	0.77	4.77	0.72	0.05	-0.02	0.4	8.5	7.5	64	1.8	-0.1	0.1	-0.1	-0.1	-0.5
73492	9.21	1.54	8.83	1.74	4.92	0.79	4.89	0.71	0.04	-0.02	0.5	7.7	5.7	60	2.7	-0.1	0.1	-0.1	-0.1	-0.5
73494	9.15	1.55	8.85	1.76	5.29	0.79	4.95	0.73	0.08	-0.02	0.3	7.4	5.8	47	2.5	-0.1	-0.1	0.1	-0.1	1.3
73495	8.8	1.5	8.68	1.68	4.83	0.77	4.69	0.69	0.13	0.03	0.3	7.6	6.4	41	4.5	0.1	0.1	0.4	-0.1	0.6
73496	9.42	1.59	8.92	1.85	5.32	0.82	4.8	0.75	0.08	-0.02	0.3	8	6.6	47	2.1	-0.1	-0.1	-0.1	-0.1	-0.5
73497	9.58	1.58	9.06	1.82	5.34	0.82	5.03	0.75	0.19	-0.02	0.3	8	6.7	62	2.2	-0.1	-0.1	-0.1	-0.1	-0.5
73498	9.1	1.48	8.73	1.79	5.12	0.79	4.76	0.73	0.16	-0.02	0.4	9.2	6.2	67	2.9	0.1	-0.1	-0.1	-0.1	0.9
73499	8.89	1.42	8.5	1.74	5.06	0.75	4.67	0.72	0.2	-0.02	0.3	7.9	5.6	73	3.7	-0.1	0.1	-0.1	-0.1	-0.5
73500	9.23	1.44	8.75	1.81	5.1	0.8	4.9	0.74	0.21	-0.02	0.4	6.6	6	108	3.6	-0.1	0.1	0.2	-0.1	-0.5
71351	9.21	1.51	9.05	1.8	5.02	0.78	4.74	0.72	0.13	-0.02	0.3	8.6	8	89	2.2	-0.1	-0.1	0.6	-0.1	-0.5
71352	9.92	1.58	9.49	1.93	5.29	0.8	5.08	0.75	0.16	-0.02	0.2	7.7	9.2	70	2.6	0.1	-0.1	0.7	-0.1	0.9
71354	9.24	1.57	8.98	1.82	5.15	0.84	5.05	0.74	0.16	0.02	0.4	8.9	9.3	72	2.3	0.1	-0.1	0.2	-0.1	0.7
71355	9.47	1.57	9.3	1.89	5.04	0.76	4.93	0.73	0.14	-0.02	0.3	9.9	7.5	70	3	-0.1	0.1	-0.1	-0.1	0.6
71356	8.52	1.45	8.76	1.78	4.79	0.73	4.65	0.69	0.16	-0.02	0.2	8.6	7.3	57	3.1	-0.1	-0.1	-0.1	-0.1	-0.5
71357	8.95	1.49	8.58	1.8	5.01	0.78	4.71	0.72	0.27	-0.02	0.3	7.7	6.2	47	3.5	-0.1	0.1	-0.1	-0.1	-0.5
71358	9.06	1.51	9.1	1.83	5.01	0.75	4.83	0.73	0.2	0.02	0.3	8.7	6.9	51	1.6	-0.1	-0.1	-0.1	-0.1	0.6
71359	8.76	1.49	8.68	1.86	5.08	0.78	4.64	0.69	0.15	-0.02	0.5	8.9	5.8	63	1.8	-0.1	-0.1	-0.1	-0.1	-0.5

Table A5– Continued

Sample Number	Hg ppm	Tl ppm
73474	-0.01	-0.1
73475	-0.01	-0.1
73476	-0.01	-0.1
73478	0.01	-0.1
73479	0.02	-0.1
73480	0.01	-0.1
73481	-0.01	-0.1
73482	-0.01	-0.1
73484	-0.01	-0.1
73485	-0.01	-0.1
73486	-0.01	-0.1
73487	-0.01	-0.1
73488	-0.01	-0.1
73489	-0.01	-0.1
73490	0.01	-0.1
73491	0.01	-0.1
73492	0.01	-0.1
73494	0.01	-0.1
73495	0.02	-0.1
73496	0.04	-0.1
73497	0.02	-0.1
73498	0.01	-0.1
73499	-0.01	-0.1
73500	-0.01	-0.1
71351	0.01	-0.1
71352	-0.01	-0.1
71354	0.01	-0.1
71355	0.02	-0.1
71356	0.03	-0.1
71357	0.01	-0.1
71358	0.02	-0.1
71359	0.02	-0.1

Table A5– Continued

Sample Number	BatchNumber	Acme	SiO2 wt%	Al2O3 wt%	Fe2O3 w%	MgO w%	CaO w%	Na2O w%	K2O w%	TiO2 w%	P2O5 w%	MnO w%	Cr2O 3 w%	Ni ppm	Sc ppm	LOI wt%	Ba ppm	Be ppm
71366	SAN08002547		71.99	12.75	4.97	1.19	4.91	0.53	2.78	0.61	0.16	0.09	0.01	-20	11	8.5	514	2
71367	SAN08002547		66.20	13.29	7.25	2.01	5.70	0.75	3.60	0.81	0.21	0.15	0.03	45	15	9.2	547	2
73445	SAN08002547		62.34	20.29	8.75	0.75	3.08	0.42	3.17	0.97	0.16	0.07	0.01	23	18	11.3	309	3
73446	SAN08002547		70.19	15.02	6.13	0.89	3.36	0.54	2.92	0.66	0.21	0.06	0.02	-20	13	9.3	492	2
73448	SAN08002547		63.41	17.27	9.65	0.78	4.15	1.06	2.49	0.80	0.30	0.08	0.01	-20	14	10.9	800	2
73449	SAN08002547		64.59	17.03	8.64	0.79	3.99	1.47	2.35	0.82	0.27	0.06	0.00	-20	14	9.9	897	2
73450	SAN08002547		69.20	14.29	5.41	0.38	3.41	1.68	4.70	0.66	0.19	0.05	0.02	-20	12	5.5	1390	2
73454	SAN08002547		67.38	15.15	6.48	0.56	2.89	2.10	4.41	0.71	0.22	0.07	0.01	-20	13	5.5	1037	2
73456	SAN08002547		68.82	14.23	6.30	0.58	2.75	1.88	4.42	0.70	0.22	0.08	0.02	-20	13	4.9	1084	2
73459	SAN08002547		72.54	12.91	5.24	0.64	3.46	0.76	3.53	0.59	0.19	0.11	0.03	-20	11	6.7	689	2
73460	SAN08002547		70.13	15.32	6.05	0.88	3.40	0.61	2.56	0.72	0.21	0.11	0.01	-20	13	9.3	220	2
73461	SAN08002547		64.94	17.56	7.41	1.16	4.05	0.59	3.05	0.82	0.27	0.14	0.01	-20	15	11	230	2
73462	SAN08002547		70.26	13.68	7.19	1.03	4.29	0.53	1.99	0.64	0.20	0.19	0.01	-20	12	8.6	484	2
73464	SAN08002547		67.61	15.10	7.91	1.21	4.35	0.67	2.04	0.70	0.20	0.19	0.01	22	14	9.8	440	2
73465	SAN08002547		72.65	12.10	5.53	1.07	5.58	0.95	1.14	0.57	0.22	0.17	0.01	-20	10	9.5	1026	-1
73469	SAN08002547		68.80	13.96	6.35	0.62	3.05	1.71	4.50	0.68	0.21	0.10	0.01	-20	13	5	1583	2
73470	SAN08002547		65.51	17.72	6.96	0.76	1.64	0.81	5.47	0.79	0.24	0.10	0.01	-20	15	7.4	1195	2
73471	SAN08002547		57.92	23.44	10.97	1.21	1.94	0.32	2.73	1.01	0.30	0.16	0.01	-20	18	12.4	216	3
73472	SAN08002547		70.97	13.48	5.79	0.69	1.62	1.32	5.20	0.61	0.21	0.09	0.01	-20	12	4.9	934	2
73477	SAN08002547		73.29	11.92	4.45	0.33	1.28	1.50	6.50	0.50	0.15	0.06	0.02	-20	10	2.2	772	2
71414	SAN08002547		78.01	11.85	2.55	0.28	1.32	0.23	5.35	0.29	0.08	0.02	0.01	-20	7	3.1	572	2
71415	SAN08002547		76.02	11.98	2.26	0.09	1.52	0.27	7.54	0.24	0.05	0.01	0.02	-20	7	2.4	740	2
71416	SAN08002547		77.73	11.05	2.38	0.16	2.62	0.23	5.58	0.19	0.04	0.02	0.02	-20	7	3.6	525	2
71417	SAN08002547		76.88	11.87	2.57	0.16	2.10	0.28	5.86	0.20	0.04	0.02	0.03	-20	7	3.2	572	3
71418	SAN08002547		76.58	11.30	2.83	0.20	2.07	0.34	6.35	0.24	0.05	0.03	0.02	-20	8	2.9	948	2
71419	SAN08002547		75.41	12.72	4.46	0.62	1.05	0.18	5.07	0.40	0.04	0.04	0.02	-20	13	3.3	633	4
71420	SAN08002547		77.45	12.26	3.29	0.39	1.16	0.16	4.96	0.28	0.02	0.02	0.02	-20	11	3.4	393	3
71421	SAN08002547		70.11	12.00	4.87	1.01	6.39	0.41	4.45	0.60	0.08	0.05	0.02	-20	12	7.1	323	3
71422	SAN08002547		75.75	12.51	2.77	0.28	1.65	0.24	6.46	0.27	0.04	0.02	0.01	-20	9	3.3	418	2
71426	SAN08002547		78.94	10.71	2.58	0.27	2.37	0.19	4.62	0.24	0.03	0.03	0.03	-20	8	3.1	301	2
71427	SAN08002547		78.42	10.65	2.23	0.12	2.53	0.19	5.64	0.17	0.01	0.02	0.02	-20	7	3.8	343	3
71428	SAN08002547		76.20	11.41	3.27	0.40	1.89	0.25	6.07	0.37	0.08	0.03	0.02	-20	9	3	414	2

Table A5– Continued

Sample Number	Co	Cs	Ga	Hf	Nb	Rb	Sr	Ta	Th	U	V	W	Zr	Y	La	Ce	Pr	Nd	Sm	Eu	
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	
71366	4.9	2.3	14	8.3	22.6	95.5	3	39.8	1.4	16.4	2.3	59	1.1	310	44.9	51.2	104	13.09	49.5	9.41	1.7
71367	18.4	4.3	16.2	8.2	21.4	123.9	3	96.7	1.3	13.1	2.1	70	0.9	320	43.1	42.5	91	11.3	44.9	8.79	1.7
73445	8.5	2.2	26.7	14	31	153.1	5	43.6	1.8	24.8	4	55	0.8	513	80.1	76.2	157	19.92	79.2	14.63	2.6
73446	6.9	2.4	20.2	11	29.9	121.4	4	57.9	1.8	19.2	3.4	41	1.4	406	64.6	60.2	126	15.58	59.6	11.45	2.2
73448	6.7	1.2	23.7	13	29.3	82.8	4	72.6	1.6	21.5	3.2	42	0.9	472	70.9	63.6	139	17.03	64.8	12.78	2.3
73449	7.1	1.1	23.6	12	29	76	4	132	1.8	20	3.1	39	0.9	442	68.1	66.5	143	17.68	67.5	12.82	2.4
73450	5.3	1.1	19.3	12	25.8	130.5	4	144	1.5	18.2	2.9	32	0.9	400	58.4	64.8	133	16.29	61.5	11.8	2.2
73454	6.8	1.2	22.1	11	27	122.1	4	255	1.7	17.5	2.9	30	1.1	395	60	63.6	131	16.18	61.5	12.02	2.3
73456	6.5	1.1	21.6	12	25.9	134	4	212	1.6	17.8	2.7	30	0.9	407	58.4	61	130	15.6	61.1	11.32	2.2
73459	6.3	2.2	16.9	9.5	22.3	159.2	3	45.1	1.5	15.6	2.4	22	0.9	341	48.7	52.9	110	13.46	52.6	9.92	1.9
73460	7	2.1	19.2	11	25.2	168.9	3	28.4	1.5	18.3	2.8	25	0.7	419	55.1	60.9	126	15.42	59.2	11.37	2.1
73461	6.9	2.5	23.1	12	29.6	240.2	4	25.5	1.8	19.9	3.3	28	-0.5	454	66.3	70.6	147	17.98	69.4	13.55	2.3
73462	6.7	1.4	19.6	10	24.9	153.2	3	28.6	1.6	16.7	2.4	25	-0.5	368	50	52.8	111	13.82	52.6	10.32	1.9
73464	6.8	1.5	20.5	10	24.8	157.5	4	29.3	1.4	19.2	3.3	26	0.6	367	54.6	57.1	123	15.38	61.8	11.1	1.9
73465	4.9	0.6	14.8	8	20	75.5	3	58.1	1.1	13.5	2.4	18	-0.5	307	44.6	43	94	11.51	45.6	9.03	1.5
73469	6.1	0.8	20.1	11	24.5	116.4	3	227	1.5	18	2.7	23	1.1	406	53.2	59.3	121	14.96	58.2	11.18	2.2
73470	6.6	1.4	20.9	13	29.3	153.4	4	66.2	1.7	21.1	3.2	26	0.7	464	62.4	66.5	137	17.35	69	13.13	2.4
73471	9.3	2.2	25.8	14	33.7	135	8	25.2	2	24.8	4.1	36	0.6	523	74.4	77.4	161	19.93	77.6	15.11	3
73472	6.1	1.6	19.2	10	22.3	182.8	4	38.5	1.4	16.6	2.5	21	1.1	374	47.7	51.9	110	13.58	52.5	10.45	1.9
73477	4.9	2.2	15.6	8	20.6	205.8	3	52	1.3	14.6	2.6	17	1.5	322	42.1	46.4	97	11.93	46.3	9.03	1.6
71414	3.2	1.4	15.3	8.1	22.3	167.4	3	31.8	1.5	21.2	2.2	32	1.5	247	39	58.1	119	14.1	52	8.98	1
71415	1.4	0.7	14.3	8.2	21.3	197.8	4	36.8	1.3	22.3	2.5	-8	1.1	264	50.7	64	119	14.45	50.8	9.99	1.1
71416	1.7	1.1	15.7	7.3	21.9	209.8	4	42.6	1.5	26.7	3	29	2.1	228	62.7	78.5	154	18.61	66.9	11.81	1
71417	1.4	1.2	14.6	7.7	22	219.1	4	45.2	1.5	26.8	3.1	22	0.6	248	66.3	83.7	166	20.35	75	13.18	1.1
71418	1.9	1	15.3	8.3	21.3	230.2	4	55.5	1.4	24	3	21	1	262	61	69.7	143	17.12	64.9	11.57	1.4
71419	7.8	1.8	19.8	7.8	20.1	217.3	4	40.1	1.3	22.1	2.7	55	0.6	253	70.7	66.3	133	16.49	62.6	11.44	1.3
71420	5	1.7	16.1	8.3	21.1	212.5	4	35.8	1.5	25.9	3.6	36	0.8	245	97.2	83	175	20.95	79.9	14.58	1.1
71421	9.5	1.1	16.1	6.1	21.5	162.4	4	64.8	1.5	21.1	2.5	89	0.7	190	51	56.9	120	14.64	54.3	10.14	0.9
71422	2.4	1.5	17.2	7.6	24.3	254.9	5	49.7	1.7	29.2	3.9	27	0.8	237	75.8	85.3	177	21.11	79.4	14.67	0.9
71426	3	1.3	13	7.2	19.7	190.8	4	41.2	1.3	24.4	3.1	19	-0.5	201	54.9	71.8	149	18.48	68.4	12.4	0.8
71427	1.2	1.3	13.3	6.8	20.7	225.8	4	42	1.5	26.9	3.7	-8	0.5	204	58.8	73.6	149	18.41	69.2	12.54	0.8
71428	3.2	1.2	15.4	6.9	24.9	230.8	4	50.2	1.7	26.9	3.3	18	0.7	219	63.1	76.2	156	19.65	74.5	13	1

Table A5– Continued

Sample Number	Gd ppm	Tb ppm	Dy ppm	Ho ppm	Er ppm	Tm ppm	Yb ppm	Lu ppm	TOT/C wt%	TOT/S wt%	Mo ppm	Cu ppm	Pb ppm	Zn ppm	As ppm	Cd ppm	Sb ppm	Bi ppm	Ag ppm	Au ppb
71366	8.41	1.37	7.67	1.63	4.52	0.74	4.59	0.67	0.75	0.35	0.8	10.9	21	48	3.5	-0.1	-0.1	-0.1	-0.1	2.4
71367	8.22	1.35	7.62	1.62	4.55	0.73	4.48	0.64	0.87	0.5	0.6	24.8	9.6	73	1.9	-0.1	-0.1	-0.1	-0.1	0.6
73445	13.9	2.39	13.31	2.66	7.84	1.16	7.59	1.12	0.31	0.29	0.2	14.8	24	85	3.4	-0.1	-0.1	0.2	-0.1	2.3
73446	11.2	1.89	10.53	2.19	6.06	0.99	5.98	0.9	0.39	0.2	0.5	13.6	22	59	2.8	-0.1	-0.1	0.1	-0.1	2
73448	12.1	2.13	12.02	2.38	6.71	1.09	6.35	0.95	0.37	0.36	0.3	10.8	24	63	1.9	0.2	-0.1	0.1	-0.1	0.7
73449	11.7	2.03	11.94	2.3	6.62	1.01	6.29	0.91	0.25	0.15	0.2	9.9	24	72	2.4	0.2	-0.1	0.1	-0.1	1.7
73450	10.4	1.77	10.08	1.99	5.76	0.89	5.55	0.82	0.3	0.15	0.3	10.6	16	58	1.3	0.1	-0.1	-0.1	-0.1	1.2
73454	10.8	1.86	10.58	2.1	6.02	0.94	5.7	0.84	0.08	0.07	0.4	9.9	19	70	0.8	0.2	-0.1	0.1	-0.1	6.1
73456	10.1	1.75	10.22	1.99	5.72	0.89	5.38	0.83	0.13	0.06	0.4	10.2	17	72	0.8	-0.1	-0.1	-0.1	-0.1	1.4
73459	8.68	1.52	8.81	1.73	5.06	0.77	4.86	0.71	0.5	0.12	0.2	9.3	16	49	2	0.1	-0.1	0.2	-0.1	0.7
73460	10.2	1.73	9.84	1.97	5.64	0.9	5.51	0.82	0.45	0.18	0.1	9.1	25	56	2.5	0.2	-0.1	0.1	-0.1	0.5
73461	12.1	2.06	12.08	2.37	6.82	1.07	6.53	0.96	0.53	0.19	0.1	10.1	33	71	0.9	0.2	-0.1	0.1	-0.1	-0.5
73462	9.44	1.62	9.26	1.82	5.14	0.8	4.88	0.73	0.68	0.12	0.1	7.8	22	61	1.3	-0.1	-0.1	-0.1	-0.1	3.5
73464	9.98	1.7	9.68	1.91	5.48	0.86	5.58	0.8	0.66	0.05	0.2	9.2	25	57	-0.5	0.1	-0.1	0.1	-0.1	1.2
73465	8.12	1.4	7.91	1.56	4.56	0.69	4.18	0.62	0.83	0.07	0.2	6.8	19	51	2	0.1	-0.1	-0.1	-0.1	-0.5
73469	10.4	1.76	9.99	1.96	5.63	0.85	5.26	0.78	0.23	0.11	0.2	10	19	55	1.7	-0.1	-0.1	-0.1	-0.1	-0.5
73470	11.9	2.02	11.57	2.28	6.7	1.03	6.43	0.94	0.11	0.64	0.3	11.3	22	66	2.7	0.2	-0.1	0.1	-0.1	0.6
73471	13.7	2.37	13.72	2.69	7.68	1.21	7.33	1.09	0.05	0.59	0.4	15.7	34	79	4.7	-0.1	-0.1	0.6	-0.1	-0.5
73472	9.2	1.61	9.49	1.82	5.16	0.79	4.89	0.73	0.22	0.14	0.2	10.9	18	65	2.2	0.1	-0.1	0.2	-0.1	1.9
73477	8.13	1.4	8.06	1.55	4.7	0.71	4.24	0.63	0.15	0.05	0.4	8.5	12	54	2.4	-0.1	0.2	-0.1	-0.1	-0.5
71414	7.5	1.29	7.16	1.41	4.28	0.67	4.05	0.64	0.22	0.9	4.7	14.6	8.1	18	4	-0.1	-0.1	0.1	-0.1	0.7
71415	9.29	1.69	9.62	1.93	5.7	0.82	5.01	0.77	0.29	0.9	1.7	17.6	8.8	23	4.4	-0.1	-0.1	0.2	-0.1	1.9
71416	10.5	1.81	10.67	2.11	6.34	1.03	6.09	0.9	0.52	0.76	1.7	12.1	8.2	13	3.1	-0.1	-0.1	0.2	-0.1	0.7
71417	11.8	1.94	11.05	2.14	6.76	1.08	6.16	0.95	0.39	0.9	2.7	6.9	35	33	3.7	-0.1	-0.1	0.2	-0.1	0.9
71418	10.6	1.83	10.31	2.12	6.22	0.97	5.84	0.88	0.38	0.71	2.6	13.8	27	52	5.6	-0.1	-0.1	0.2	-0.1	2.3
71419	11	1.87	11.01	2.21	6.72	1.08	6.3	0.96	0.17	0.45	2	23.4	8.1	47	4.6	-0.1	-0.1	0.3	-0.1	2.4
71420	13.6	2.3	13.7	2.94	9.64	1.69	10.57	1.66	0.2	1	2.1	14.4	36	31	4.3	0.3	-0.1	0.2	-0.1	0.9
71421	9.47	1.6	9	1.7	4.87	0.8	4.54	0.68	1.16	0.7	0.9	19.6	34	37	3.5	0.1	-0.1	0.1	-0.1	0.5
71422	14	2.32	13.51	2.7	7.97	1.27	7.36	1.14	0.31	0.81	0.8	9.8	40	78	3.2	0.1	-0.1	0.2	-0.1	1.2
71426	11	1.83	10.26	1.99	5.77	0.93	5.51	0.83	0.45	0.74	0.4	8.5	42	46	3.6	-0.1	-0.1	0.1	-0.1	-0.5
71427	11	1.83	10.34	2.07	5.95	0.93	5.5	0.81	0.51	0.79	0.3	5.6	41	46	2.9	-0.1	-0.1	0.1	-0.1	0.8
71428	11.7	1.93	11.15	2.15	6.45	1.05	6	0.9	0.32	0.73	0.2	7.5	38	41	2.8	0.1	-0.1	0.1	-0.1	1.1

Table A5– Continued

Sample Number	Hg ppm	Tl ppm	Se ppm
71366	0.03	-0.1	4.1
71367	0.02	0.1	1.2
73445	0.02	0.2	-0.5
73446	0.03	0.2	-0.5
73448	0.02	-0.1	-0.5
73449	0.01	-0.1	-0.5
73450	0.01	0.1	-0.5
73454	0.01	0.1	-0.5
73456	0.01	-0.1	-0.5
73459	0.03	0.1	-0.5
73460	0.05	0.2	-0.5
73461	0.05	0.2	-0.5
73462	0.04	0.2	-0.5
73464	0.03	-0.1	-0.5
73465	0.01	-0.1	-0.5
73469	0.02	-0.1	-0.5
73470	0.02	0.1	-0.5
73471	0.02	0.1	-0.5
73472	0.02	0.1	-0.5
73477	0.01	-0.1	-0.5
71414	-0.01	-0.1	-0.5
71415	-0.01	-0.1	-0.5
71416	-0.01	-0.1	-0.5
71417	-0.01	0.2	-0.5
71418	-0.01	0.1	-0.5
71419	-0.01	0.2	-0.5
71420	-0.01	0.1	-0.5
71421	-0.01	0.2	-0.5
71422	-0.01	0.1	-0.5
71426	-0.01	0.2	-0.5
71427	-0.01	0.1	-0.5
71428	-0.01	0.1	-0.5

Table A5– Continued

Sample Number	BatchNumber	Acme	SiO2 wt%	Al2O3 wt%	Fe2O3 w%	MgO w%	CaO w%	Na2O w%	K2O w%	TiO2 w%	P2O5 w%	MnO w%	Cr2O 3 w%	Ni ppm	Sc ppm	LOI wt%	Ba ppm	Be ppm
71429	SAN08002547		75.59	12.28	3.08	0.29	1.42	0.17	6.78	0.31	0.05	0.02	0.01	-20	8	2.7	400	2
71430	SAN08002547		75.33	12.38	3.29	0.29	1.67	0.16	6.44	0.32	0.07	0.02	0.02	-20	9	4.1	380	3
71431	SAN08002547		77.02	11.35	2.33	0.15	2.08	0.30	6.53	0.18	0.03	0.01	0.02	-20	8	2.8	438	2
71445	SAN08002547		75.26	11.85	4.07	0.76	1.25	0.64	5.65	0.40	0.06	0.04	0.01	-20	11	2.6	493	3
71446	SAN08002547		75.49	11.98	4.06	0.66	0.86	0.97	5.47	0.40	0.05	0.04	0.02	-20	11	2.5	473	2
71447	SAN08002547		73.85	12.61	4.88	0.63	1.37	1.12	4.92	0.51	0.06	0.04	0.02	-20	13	3.1	458	3
71448	SAN08002547		73.35	12.59	4.83	0.74	1.63	1.17	5.07	0.49	0.06	0.04	0.03	-20	14	2.9	489	3
71449	SAN08002547		75.01	12.08	4.01	0.55	1.38	1.10	5.31	0.43	0.07	0.04	0.02	-20	11	2.8	624	3
71461	SAN08002547		56.73	17.22	13.07	3.57	1.89	2.78	2.79	1.48	0.24	0.21	0.01	75	34	5.6	197	4
71467	SAN08002547		77.77	12.05	2.43	0.36	2.29	2.27	2.59	0.18	0.02	0.02	0.01	-20	6	7.6	514	2
71468	SAN08002547		77.85	11.89	2.54	0.30	1.53	1.75	3.91	0.19	-0.01	0.03	0.02	-20	7	5.1	603	2
71469	SAN08002547		78.05	11.82	2.63	0.27	1.41	1.28	4.28	0.19	0.03	0.02	0.02	-20	7	2.9	636	2
71470	SAN08002547		78.88	10.30	2.60	0.21	1.39	0.97	5.38	0.16	0.03	0.02	0.05	-20	6	2	424	2
71471	SAN08002547		77.81	10.97	2.33	0.14	0.36	0.79	7.35	0.16	0.01	0.02	0.04	-20	6	2.5	500	2
71472	SAN08002547		77.67	11.36	2.30	0.15	0.21	1.36	6.71	0.17	0.02	0.02	0.02	-20	7	1.5	534	2
71474	SAN08002547		77.41	11.33	2.47	0.13	0.19	1.59	6.59	0.17	0.04	0.02	0.05	-20	7	1.1	544	2
71475	SAN08002547		77.52	11.12	2.49	0.08	0.18	1.35	7.00	0.17	0.02	0.02	0.06	-20	7	1.1	457	2
71476	SAN08002547		77.74	11.25	2.34	0.24	0.75	1.29	6.13	0.17	0.02	0.03	0.02	20	6	1.5	484	2
71477	SAN08002547		78.27	11.16	2.45	0.20	0.33	1.83	5.50	0.17	0.02	0.03	0.05	-20	7	1.5	469	2
71478	SAN08002547		76.63	11.85	3.15	0.63	1.54	2.22	3.67	0.20	0.03	0.04	0.05	-20	7	2.8	509	2
71458	SAN08002547		68.58	14.00	6.99	0.82	1.32	1.85	5.30	0.77	0.21	0.16	0.02	-20	15	3.3	1342	2
71459	SAN08002547		68.09	14.23	6.89	0.77	1.44	1.93	5.47	0.77	0.22	0.19	0.01	-20	16	2.9	1343	2
71460	SAN08002547		68.69	13.98	6.71	0.91	1.48	1.96	5.13	0.73	0.19	0.20	0.03	-20	15	2.6	1335	3
71412	SAN08002547		72.47	13.19	5.94	0.70	0.97	0.80	5.09	0.65	0.14	0.04	0.02	-20	14	3.7	679	3
71450	SAN08002547		76.36	11.62	3.63	0.49	1.19	1.39	4.82	0.36	0.09	0.03	0.01	-20	9	2.4	772	2
71451	SAN08002547		73.27	11.55	6.71	0.51	1.60	1.30	4.25	0.62	0.14	0.03	0.02	-20	13	2.8	1057	3
71452	SAN08002547		70.91	12.85	8.09	0.80	1.24	0.69	4.60	0.58	0.17	0.04	0.03	-20	12	3.7	1280	3
71454	SAN08002547		71.18	13.55	5.88	0.75	1.32	1.28	5.37	0.51	0.10	0.04	0.03	-20	11	3.3	1204	-1
71455	SAN08002547		69.95	13.30	7.13	0.64	1.54	1.81	4.70	0.69	0.18	0.05	0.01	23	13	3.1	1163	1
71456	SAN08002547		66.69	14.95	8.30	1.11	1.26	1.62	4.95	0.83	0.21	0.06	0.02	-20	19	3.5	1038	3
71457	SAN08002547		67.03	14.41	8.67	1.27	1.20	1.62	4.57	0.89	0.22	0.10	0.01	22	19	3.5	999	3
71462	SAN08002547		67.95	14.11	8.63	1.50	1.33	1.31	3.97	0.88	0.21	0.09	0.02	-20	17	4.3	1006	2

Table A5– Continued

Sample Number	Co	Cs	Ga	Hf	Nb	Rb	Sr	Ta	Th	U	V	W	Zr	Y	La	Ce	Pr	Nd	Sm	Eu	
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	
71429	2.8	1.5	16.8	7.9	24.2	266.7	5	44.3	1.7	28	3	11	0.6	228	46.9	71.2	137	16.71	59	10.42	0.9
71430	2.2	1.2	17	7.6	25.1	257.3	5	40.4	1.7	27.5	3.4	10	0.7	229	66.7	83.8	178	21.39	79.4	14.02	1
71431	1.2	1.5	13.5	7	21.7	264.9	4	52.9	1.5	27.2	3	-8	-0.5	221	69.5	72.9	151	17.62	67.3	12.9	0.8
71445	7.9	2.1	16.7	8	20.2	246.2	4	66	1.5	24.5	3.4	42	0.7	259	53.6	68.7	152	17.51	66.8	12.24	1
71446	7.4	2	18	8.6	20.4	243.8	4	64.7	1.4	25.7	3	36	0.6	259	68.2	74.7	181	21.79	89.2	15.67	1.1
71447	8.2	3	21.7	9.2	29.1	221.9	5	68	1.6	28.5	3.4	28	0.8	298	105	82.7	187	22.08	86.2	17.95	1.5
71448	9.1	3	20.1	8.2	24.8	219.4	4	76.8	1.6	25.6	3	42	0.9	282	81.4	83	182	21.37	80.8	15.96	1.3
71449	6.4	2.8	18.9	8.4	28.6	219.2	5	72.3	1.4	27.8	3.6	42	0.9	288	122	102	225	24.43	93.6	17.49	1.2
71461	41.9	3.2	21.8	5.1	19.8	150.8	2	120	1.1	6.9	1.8	93	1.1	178	51.6	25.4	60	7.9	32.9	7.71	1.5
71467	0.6	1.7	14.5	6.6	18.8	116.7	4	248	1.4	23.1	2.8	-8	0.7	211	59	70.4	142	17.43	64.7	11.97	0.9
71468	0.9	1.2	16.4	7	20.3	154.5	4	192	1.6	24.7	3.1	-8	0.9	229	59.8	70.5	142	17.69	64.6	12.33	1
71469	0.8	1.2	18	7.4	22.2	163.5	5	138	1.6	25.7	2.4	-8	0.7	232	65.1	73	151	18.77	68.2	13.27	1
71470	1.1	0.9	11.3	6.8	17.7	205.6	10	50.3	1.3	20.8	3.1	-8	0.6	202	38.9	59.4	122	14.49	52.4	9.23	0.7
71471	0.8	0.7	12.1	7	19.1	267	13	51.6	1.4	23.9	2.8	-8	0.5	214	47	61.2	124	14.84	54.5	9.82	0.8
71472	0.8	0.8	14	7.6	19.8	251.8	10	51.5	1.6	25.7	3	-8	0.7	225	60.2	66.7	137	16.75	60.3	11.48	1
71474	1.1	1.2	15.8	8.5	21.5	250.7	10	51.3	1.5	27.6	3.4	-8	0.8	239	53.8	75	151	18.57	68.3	12.61	0.9
71475	1.1	1	14.5	7.3	21.2	264.6	7	43.5	1.5	26.4	3.4	-8	0.6	228	59.3	72	150	18.72	69.9	12.95	0.9
71476	0.7	0.7	16	7.1	20.5	235.8	7	46.4	1.5	26.1	2.8	-8	-0.5	229	62.8	69.7	144	17.72	65.5	12.8	1
71477	0.8	0.5	13.7	7.2	19.4	198.3	7	56.1	1.4	24.3	2.7	-8	-0.5	214	57.5	68.1	141	17.24	63.9	12.31	0.9
71478	2.6	0.8	15.2	7.5	19.6	134.8	6	87.4	1.5	23.9	2.8	9	-0.5	221	47.9	64.9	132	16.18	62.5	10.81	0.8
71458	20	1.7	19.6	14	28	185.6	3	92.4	1.9	20.5	1.8	69	0.6	532	97.1	72.8	155	19.89	79.2	15.89	2.6
71459	18.1	1.5	20.4	14	32.5	189.3	3	95.8	1.8	20.9	2.4	63	0.6	547	68.4	72.2	154	19.93	76.8	14.77	2.6
71460	16.5	1.7	20.3	13	31	179.8	4	111	1.7	20.7	2.2	65	0.7	534	60.9	74.7	160	20.31	79.4	14.72	2.4
71412	10.3	1.2	19	10	23.3	176.8	3	36.9	1.5	19	2.6	54	1.7	333	59.6	60.1	124	15.48	60.9	11.66	1.7
71450	4.2	2.2	16.5	9	23.2	196.8	4	81.9	1.5	25.1	2.4	52	0.7	318	53.3	85.3	199	25.91	96.8	16.44	1.5
71451	4.2	2.8	17.8	13	29.5	169.7	4	90.6	1.7	21.7	2.3	27	1.2	543	78.8	73.1	151	20.22	80.8	15.56	2.5
71452	5.4	4	20.9	13	28.2	184.9	4	64.8	1.8	24.8	2	39	-0.5	461	71.3	75.7	155	19.08	73.8	14	2.4
71454	6	2.4	19.8	12	27.6	198.2	4	74.2	1.6	28.9	2.3	60	2	379	69.1	86.4	188	23.5	92.8	14.69	2.2
71455	7	1.9	18.7	12	31.8	174	3	81.5	1.9	18.2	2	59	0.8	466	60.8	70.9	157	20.42	87.4	14.08	2.4
71456	16.1	2.1	21.2	12	30	183.6	4	78.7	1.7	19.1	2.4	59	0.9	454	74.4	61.4	134	17.66	74.4	15.64	2.6
71457	23.7	2.7	22.5	11	31.2	176	4	79.6	1.7	17.7	2.2	84	0.8	421	122	66.3	146	18.77	83.2	18.64	2.9
71462	13.5	1.9	19.9	12	28.6	146.2	3	67.4	1.7	17.6	1.3	68	0.7	480	58.3	61.8	134	16.93	65.2	12.5	2.3

Table A5– Continued

Sample Number	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	TOT/C	TOT/S	Mo	Cu	Pb	Zn	As	Cd	Sb	Bi	Ag	Au
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	wt%	wt%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppb
71429	9.28	1.56	8.15	1.68	4.73	0.82	4.43	0.75	0.25	0.95	0.5	6	55	16	4.1	-0.1	-0.1	0.2	-0.1	1.3
71430	12.4	2.08	11.88	2.34	6.57	0.99	5.97	0.87	0.31	1.02	1.4	7	54	51	3.5	0.1	-0.1	0.1	-0.1	0.6
71431	12.3	2.13	12.25	2.32	6.62	1	5.37	0.8	0.42	0.94	0.6	6.3	43	26	2.6	-0.1	-0.1	-0.1	-0.1	-0.5
71445	10.5	1.74	10.11	2	5.91	0.94	5.97	0.86	0.17	0.46	0.4	15.7	28	51	2.3	0.2	-0.1	0.1	-0.1	1.9
71446	12.9	2.12	12.7	2.54	7.49	1.17	7.17	0.99	0.12	0.31	0.4	13.1	28	52	1.5	0.2	-0.1	0.1	-0.1	0.6
71447	18.2	3.23	18.73	3.71	9.86	1.47	8.07	1.12	0.22	0.19	0.2	12	25	52	1.4	0.1	-0.1	0.1	-0.1	-0.5
71448	15.3	2.53	14.14	2.74	7.46	1.11	6.55	0.89	0.26	0.08	0.2	13.8	22	42	1.2	0.1	-0.1	0.1	-0.1	0.9
71449	18.9	2.99	18.21	3.73	10.3	1.55	9.17	1.25	0.24	0.33	0.1	9.7	22	35	1.7	-0.1	-0.1	0.2	-0.1	1.2
71461	7.82	1.5	8.33	1.83	5.1	0.81	4.85	0.71	0.15	-0.02	-0.1	36.8	7.4	139	-0.5	0.2	-0.1	0.2	-0.1	-0.5
71467	9.75	1.76	9.67	2.06	5.66	0.94	5.82	0.84	0.03	0.05	0.3	4.2	26	42	5.4	-0.1	0.1	0.1	-0.1	-0.5
71468	10.6	1.89	10.34	2.22	6.27	0.97	5.85	0.87	0.04	0.11	0.4	5.6	22	40	10.7	0.2	0.2	0.1	-0.1	0.8
71469	11.1	2.04	10.97	2.28	6.59	1.03	6.18	0.93	-0.02	0.14	6	5.4	23	40	18	0.3	0.4	0.2	-0.1	1.2
71470	7.17	1.26	7.46	1.46	4.31	0.73	4.66	0.68	0.19	0.63	40.9	6	28	48	12.5	0.1	0.6	-0.1	-0.1	-0.5
71471	7.88	1.49	8.11	1.76	5.06	0.86	5.51	0.81	0.03	0.84	8.9	3.2	33	51	7.2	-0.1	0.4	-0.1	-0.1	1.2
71472	9.69	1.79	10.18	2.16	6.25	1.03	6.19	0.9	0.02	0.77	7.9	2.6	36	56	5.9	0.2	0.3	-0.1	-0.1	-0.5
71474	10.4	1.82	10.17	2.14	5.96	1.01	6.07	0.9	-0.02	0.42	5.5	3.6	32	57	7.6	0.1	0.3	-0.1	-0.1	3.5
71475	10.7	1.96	10.68	2.24	6.46	1.01	6.3	0.92	-0.02	0.34	2.2	3.2	29	51	6.1	-0.1	0.2	-0.1	-0.1	2
71476	10.8	1.94	10.74	2.19	6.18	1	5.97	0.86	0.05	0.21	6	2.8	30	52	6.4	-0.1	0.2	-0.1	-0.1	1.6
71477	10.4	1.85	10.44	2.09	5.79	0.97	5.79	0.86	0.02	0.2	14.1	3.4	31	51	7.6	-0.1	0.5	-0.1	-0.1	2.2
71478	9.03	1.54	8.72	1.81	5.58	0.89	5.4	0.84	0.09	0.17	13.6	14.9	28	48	5.5	0.1	0.3	-0.1	-0.1	1.5
71458	16.1	2.85	16.32	3.43	9.45	1.38	7.66	1.15	0.16	0.15	0.1	16	15	64	0.9	-0.1	-0.1	0.1	-0.1	1.4
71459	12.5	2.12	11.59	2.33	6.8	1.07	6.53	0.97	0.16	0.14	0.1	17.5	15	68	1.5	-0.1	-0.1	0.1	-0.1	0.8
71460	12	2.05	11.07	2.26	6.33	0.98	6.2	0.92	0.12	-0.02	0.1	15.8	13	57	-0.5	0.2	-0.1	0.1	-0.1	0.5
71412	10.5	1.86	10.62	2.1	6.5	0.94	5.95	0.88	0.14	1.08	5.3	37.5	18	62	4.5	0.4	-0.1	0.4	-0.1	0.7
71450	13.1	1.96	10	1.84	4.89	0.74	4.6	0.63	0.19	0.25	0.2	10.7	24	41	1.8	-0.1	-0.1	0.2	-0.1	1.1
71451	14.1	2.33	13.14	2.72	7.94	1.26	7.84	1.15	0.22	0.71	0.5	11.2	22	63	4.2	0.1	-0.1	0.2	-0.1	0.7
71452	12.8	2.16	12.09	2.47	7.09	1.11	6.69	1.01	0.15	0.62	0.3	15.5	30	100	2.5	-0.1	-0.1	0.3	-0.1	-0.5
71454	12.5	2.11	12.89	2.39	6.86	1.02	6.88	0.98	0.13	0.09	0.1	10.6	30	67	0.7	0.1	-0.1	0.2	-0.1	1.1
71455	11.9	1.98	11.39	2.1	6.33	0.92	5.76	0.86	0.14	0.17	0.1	13.7	21	64	0.8	0.1	-0.1	0.2	-0.1	-0.5
71456	13.5	2.35	13.14	2.64	7.47	1.15	7.1	1.04	0.08	0.03	-0.1	20.9	14	149	-0.5	0.5	-0.1	0.1	-0.1	0.6
71457	20.9	3.68	21.05	4.34	12.2	1.95	11.56	1.73	0.1	0.11	0.1	17.3	13	68	0.7	0.2	-0.1	0.1	-0.1	0.7
71462	10.7	1.84	10.13	2.12	6.06	0.97	5.79	0.87	0.13	-0.02	0.1	17.4	17	95	0.6	0.1	-0.1	0.4	-0.1	1.3

Table A5– Continued

Sample Number	Hg ppm	Tl ppm	Se ppm
71429	-0.01	0.1	-0.5
71430	-0.01	0.1	-0.5
71431	-0.01	0.1	-0.5
71445	-0.01	0.1	-0.5
71446	-0.01	0.1	-0.5
71447	-0.01	-0.1	-0.5
71448	-0.01	-0.1	-0.5
71449	-0.01	-0.1	-0.5
71461	-0.01	-0.1	-0.5
71467	-0.01	-0.1	-0.5
71468	-0.01	-0.1	-0.5
71469	-0.01	-0.1	-0.5
71470	-0.01	0.5	-0.5
71471	-0.01	0.2	-0.5
71472	-0.01	0.1	-0.5
71474	-0.01	0.1	-0.5
71475	-0.01	-0.1	-0.5
71476	-0.01	0.1	-0.5
71477	-0.01	0.2	-0.5
71478	-0.01	0.2	-0.5
71458	-0.01	-0.1	-0.5
71459	-0.01	-0.1	-0.5
71460	-0.01	-0.1	-0.5
71412	-0.01	0.2	-0.5
71450	-0.01	-0.1	-0.5
71451	-0.01	-0.1	-0.5
71452	-0.01	0.1	-0.5
71454	-0.01	-0.1	-0.5
71455	-0.01	-0.1	-0.5
71456	-0.01	-0.1	-0.5
71457	-0.01	-0.1	-0.5
71462	-0.01	-0.1	-0.5

Table A5– Continued

Sample Number	BatchNumber	Acme	SiO2 wt%	Al2O3 wt%	Fe2O3 w%	MgO w%	CaO w%	Na2O w%	K2O w%	TiO2 w%	P2O5 w%	MnO w%	Cr2O 3 w%	Ni ppm	Sc ppm	LOI wt%	Ba ppm	Be ppm
71464	SAN08002547		65.46	14.60	9.97	1.61	1.26	0.91	4.99	0.86	0.21	0.12	0.01	-20	18	4.1	3156	2
71465	SAN08002547		67.71	12.99	9.91	1.00	1.28	0.81	5.33	0.65	0.19	0.11	0.01	-20	13	2.9	2105	2
71466	SAN08002547		67.42	13.02	9.93	0.70	1.23	1.42	5.32	0.64	0.19	0.10	0.03	-20	13	2	2415	1
71531	SAN08002590		46.34	17.44	13.45	7.11	8.23	3.10	1.43	2.20	0.47	0.22	0.02	73	29	9.7	364	1
71532	SAN08002590		46.52	16.48	14.96	6.42	8.47	2.80	1.06	2.62	0.42	0.24	0.01	47	35	9	431	1
71533	SAN08002590		46.17	16.95	13.43	5.58	9.97	3.14	1.34	2.53	0.50	0.35	0.03	75	33	8.2	303	1
71555	SAN08002590		45.70	15.50	15.62	5.60	9.71	3.14	1.02	3.02	0.41	0.27	0.01	30	41	6.8	336	2
71564	SAN08002590		44.73	16.13	14.38	5.81	11.72	3.43	0.80	2.40	0.34	0.24	0.02	51	40	9.4	189	3
71574	SAN08002590		46.04	15.74	10.93	7.19	13.75	2.68	1.13	1.73	0.41	0.31	0.09	204	25	10.3	287	-1
71598	SAN08002590		48.64	16.79	10.93	7.43	8.59	3.44	1.39	1.84	0.59	0.29	0.06	128	22	7.1	494	1
71943	ACMESAN08003029		48.39	19.29	12.13	6.81	8.77	0.89	1.55	1.68	0.32	0.17	0.01	41	23	17.4	363	-1
71529	SAN08002590		48.53	16.78	10.53	7.07	8.78	3.91	1.45	1.90	0.63	0.36	0.06	129	22	7.2	441	1
71563	SAN08002590		47.13	15.86	13.60	5.09	9.70	4.48	0.91	2.36	0.60	0.25	0.01	33	34	9.2	160	2
71528	SAN08002590		48.85	17.63	12.02	6.77	6.61	3.27	1.93	2.00	0.55	0.31	0.04	111	25	7.6	441	2
71535	SAN08002590		48.83	15.37	13.08	3.91	7.66	4.63	2.19	2.89	1.15	0.27	0.01	-20	21	1.7	642	2
71572	SAN08002590		51.66	15.96	11.99	3.10	6.82	3.82	3.13	2.35	0.98	0.18	0.00	-20	14	4.9	975	3
71589	SAN08002590		49.50	15.65	13.05	3.87	8.03	4.06	1.97	2.62	0.94	0.30	0.01	23	20	4.8	669	1
71599	SAN08002590		51.46	16.11	14.13	1.98	5.71	5.44	2.02	2.02	0.80	0.31	0.00	-20	20	3.9	510	2
71601	SAN08002590		51.36	15.93	12.51	1.22	8.39	5.76	1.95	1.93	0.74	0.20	0.00	-20	19	6.4	578	1
71591	SAN08002590		54.98	16.43	11.13	1.51	5.07	5.81	2.87	1.46	0.49	0.26	0.00	-20	11	3.9	539	3
71611	SAN08002590		55.26	17.01	10.91	1.29	4.49	5.70	3.37	1.28	0.41	0.26	0.01	-20	12	4	764	2
71612	SAN08002590		56.57	16.35	10.52	1.43	3.84	5.79	3.54	1.28	0.41	0.27	0.00	-20	12	2.3	890	2
71613	SAN08002590		56.50	16.22	10.62	1.48	4.15	5.60	3.41	1.34	0.43	0.25	0.00	-20	13	2.6	879	2
71614	SAN08002590		55.59	16.57	10.91	1.48	4.53	5.56	3.28	1.36	0.46	0.26	0.00	-20	13	3.1	761	3
71615	SAN08002590		55.14	16.64	11.00	1.47	4.92	5.28	3.38	1.43	0.49	0.26	0.00	-20	13	3	752	2
71616	SAN08002590		55.32	16.50	11.04	1.48	4.91	5.28	3.33	1.39	0.47	0.27	0.00	-20	14	2.8	683	3
71617	SAN08002590		55.57	16.35	11.09	1.51	4.65	5.64	3.02	1.40	0.47	0.30	0.00	-20	13	2.9	714	2
71618	SAN08002590		55.82	16.42	11.00	1.48	4.48	5.45	3.21	1.40	0.46	0.28	0.00	-20	13	2.6	759	3
71619	SAN08002590		56.05	16.17	11.04	1.48	4.48	5.40	3.23	1.39	0.47	0.27	0.01	-20	14	2.6	766	2
71621	SAN08002590		55.60	16.54	10.95	1.50	4.52	5.49	3.24	1.40	0.48	0.28	0.01	-20	13	3.2	781	2
71622	SAN08002590		55.26	16.76	11.03	1.59	4.14	5.93	3.16	1.40	0.47	0.26	0.00	-20	14	2.6	743	3
71623	SAN08002590		55.68	16.60	11.08	1.59	3.79	5.85	3.29	1.37	0.47	0.27	0.01	25	14	2.4	822	2

Table A5– Continued

Sample Number	Co	Cs	Ga	Hf	Nb	Rb	Sr	Ta	Th	U	V	W	Zr	Y	La	Ce	Pr	Nd	Sm	Eu	
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	
71464	14.2	1.8	22.9	14	26.9	173.8	3	110	1.6	15.3	1.5	64	0.6	559	78	58.5	127	15.99	64.8	13.19	3.5
71465	4.1	1.4	21.3	16	33.3	171.2	3	76.2	2	17.1	0.9	58	0.7	662	82.3	65.8	142	18.14	75.2	14.94	3.9
71466	5.2	1.2	20	15	27.6	153	3	102	1.8	17.4	0.9	50	-0.5	625	83.8	61	131	17.22	70.1	14.73	3.9
71531	40.3	1.3	18.2	4.6	39.8	29.9	1	267	2.2	2.6	0.7	263	0.5	177	33.8	24	49	6.06	26.1	5.6	1.9
71532	44.7	0.3	19	4.5	38.2	23.8	1	294	2	2.2	0.7	368	0.5	166	34.8	20.8	44	5.62	25.2	5.65	1.9
71533	41.8	0.9	17.8	5.2	44.2	29.4	2	312	2.3	3.6	0.9	334	0.8	200	40.5	27.3	58	7.33	31.2	6.54	2.2
71555	45.4	0.6	20.8	4	35.7	28.3	2	261	2.1	1.9	0.7	467	1.3	145	33.6	18.5	38	5.08	23.1	5.13	1.9
71564	43	0.8	22.7	4	27.4	27.2	1	173	1.7	2.1	0.5	334	1.2	156	36	16.2	34	4.78	21.2	5.41	1.9
71574	47.9	5.8	23.2	4.3	35.4	28.6	1	306	2.1	2.5	0.7	190	1.6	172	28.8	23.9	47	5.95	24.3	5.38	1.7
71598	39.3	27.2	18.6	5.1	49.1	30	2	376	2.8	4.5	0.9	173	-0.5	219	33.2	29	58	7.33	30.8	6.04	2
71943	32.3	0.5	11.4	3.9	26.5	29.3	1	599	1.4	1.8	0.6	137	-0.5	140	30.9	14.9	30	4.22	18.7	4.67	1.8
71529	38.3	7	16.6	5.7	55.7	28.1	1	327	2.8	4	1.2	177	0.8	243	36.3	32.1	64	7.88	34.3	6.67	2.1
71563	34.3	0.6	25.3	5.4	41.4	31.3	2	108	2.6	2.9	0.7	242	3.2	206	46.2	22.9	49	6.78	30.1	7.62	2.6
71528	39.2	5.2	17.6	6	50.7	50.7	2	262	2.7	4.9	1.1	201	0.7	249	36.1	28.9	58	7.37	31.8	6.43	1.9
71535	26.2	7.8	20.7	6	65.7	47.2	2	446	3.8	3.9	1	168	0.7	242	50.8	36.4	77	9.9	43.3	9.77	3.3
71572	16	10.9	27	7.8	80.2	94.2	2	586	4.7	5.2	1.4	54	1.1	310	57.3	42	86	11.17	47.1	10.52	3.4
71589	26	24.1	22	5.7	62.7	51.1	2	393	3.7	3.7	1.1	138	0.7	227	48.9	33.2	67	8.94	37.6	8.76	3.1
71599	13	0.4	26.2	9.7	83.6	56.6	2	176	4.9	5.5	1.6	12	1.5	370	76.8	43.1	91	12.07	50.7	11.64	4
71601	13.4	0.3	22.5	9.9	81.8	45.9	2	110	4.5	6.7	1.8	17	2.1	383	87.5	45.1	92	12.05	50.3	11.94	3.7
71591	7.4	0.5	23.6	10	95.1	81.5	3	150	5.5	5.2	1.7	14	1.2	372	62.2	48.9	93	11.48	46.4	9.77	3.6
71611	7.6	0.2	28.9	12	115.8	82.7	4	140	6.5	8	2	-8	1.6	488	76.6	49.9	98	12.63	52.3	11.9	3.6
71612	7.6	0.2	23.1	12	113.1	94.9	3	209	6.1	8.7	2.2	-8	1.3	476	76.3	50.6	99	12.83	51.9	11.56	3.7
71613	7.4	0.2	22.3	11	107.7	98.7	4	215	6.1	7	2	-8	1.4	453	71.4	48.2	94	12.19	51.4	11.27	3.5
71614	7.9	0.3	22.4	11	107.7	96.6	3	176	5.8	7.1	1.8	-8	1.4	454	71	48.2	95	12.29	50.8	11.32	3.6
71615	8.6	0.5	26.1	12	110.8	103.8	4	163	6.3	6.8	2.1	-8	1.4	473	73.4	50	98	12.82	54.2	11.68	3.8
71616	8.6	0.6	25.9	11	102.9	100.5	3	226	5.7	6.2	1.9	-8	1.7	436	70.9	46.5	90	11.72	48.2	11.24	3.6
71617	8.7	0.5	24.4	12	106.6	89.9	3	227	6	7.4	2.1	-8	1.9	454	73.3	47.2	92	12.06	50.6	11.48	3.6
71618	8.4	0.5	24.9	10	110.9	97.6	3	204	6	6.8	2.2	-8	1.6	472	71.5	48	93	12.05	51.6	11.53	3.7
71619	8.3	0.4	25.1	12	109	96.9	3	176	5.9	6.1	1.9	-8	1.7	463	68.6	47.3	92	11.88	49.3	11.19	3.6
71621	8	0.5	23.5	11	111.3	95.3	3	184	6.3	6.5	2.1	-8	1.5	474	67.6	47.4	91	11.94	50	11.37	3.7
71622	8.4	0.4	23.1	11	111.8	97.7	4	204	6.1	6.8	1.9	-8	1.6	441	78.4	49.8	102	12.43	53.9	11.98	3.7
71623	7.9	0.3	21.1	11	110.7	100.4	3	225	5.9	6.2	1.8	-8	1.2	440	72.3	48.4	98	12.2	53.7	11.53	3.6

Table A5– Continued

Sample Number	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	TOT/C	TOT/S	Mo	Cu	Pb	Zn	As	Cd	Sb	Bi	Ag	Au
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	wt%	wt%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppb
71464	12.9	2.28	12.6	2.59	7.14	1.12	6.52	1.01	0.13	0.14	0.1	19.1	15	130	0.8	0.3	-0.1	0.5	-0.1	1.1
71465	14.1	2.44	13.54	2.77	7.85	1.26	7.65	1.17	0.17	0.09	0.2	14.7	19	104	1.4	0.1	-0.1	-0.1	-0.1	2
71466	14	2.5	14.03	2.95	8.1	1.27	7.5	1.13	0.15	0.18	0.1	15.3	19	103	4.7	-0.1	-0.1	0.1	-0.1	-0.5
71531	5.93	1.05	5.97	1.22	3.41	0.54	3.14	0.48	0.6	0.19	0.8	69.3	2.2	84	1.3	0.1	-0.1	-0.1	-0.1	-0.5
71532	6.08	1.09	6.34	1.27	3.5	0.55	3.29	0.5	0.5	0.34	0.8	83.7	2.8	90	1.9	0.1	-0.1	-0.1	-0.1	-0.5
71533	6.79	1.22	7.1	1.41	3.95	0.59	3.57	0.54	0.78	0.64	1.1	81.6	4.4	95	2.9	0.4	-0.1	0.2	-0.1	0.6
71555	6.06	1.02	5.95	1.2	3.46	0.51	3.27	0.48	0.6	0.06	0.8	89.9	1.3	72	0.8	0.1	-0.1	-0.1	-0.1	0.9
71564	6.23	1.11	6.47	1.25	3.63	0.56	3.34	0.5	1.14	0.3	0.4	119	1.5	89	2.1	0.1	-0.1	-0.1	-0.1	-0.5
71574	5.51	0.9	5.06	1	2.89	0.43	2.38	0.39	1.15	0.08	0.6	78.2	2.4	46	0.6	0.1	-0.1	-0.1	-0.1	1.5
71598	6.15	1.02	5.95	1.18	3.53	0.52	2.98	0.46	0.14	0.03	0.9	63.3	2.9	43	0.7	0.1	-0.1	-0.1	-0.1	0.9
71943	5.3	0.92	5.61	1.17	3.2	0.52	3.08	0.48	1.23	2.26	0.2	60.6	2.6	71	-0.5	-0.1	-0.1	-0.1	-0.1	-0.5
71529	6.59	1.12	5.98	1.28	3.46	0.55	3.23	0.51	0.34	0.06	1.2	61.1	3.1	50	0.5	0.1	-0.1	-0.1	-0.1	0.9
71563	8.37	1.45	8.45	1.68	4.73	0.73	4.14	0.65	1.1	0.27	0.5	87.5	1.9	94	1.4	0.1	-0.1	-0.1	-0.1	1.7
71528	6.52	1.13	6.12	1.28	3.64	0.58	3.44	0.55	0.2	0.19	0.9	60.5	3.7	65	1.9	0.3	-0.1	0.2	-0.1	0.6
71535	9.95	1.68	9.63	1.89	5.15	0.76	4.62	0.69	0.05	0.06	2.3	24.8	1.9	91	1	0.1	-0.1	-0.1	-0.1	-0.5
71572	10.8	1.87	10.2	2.01	5.83	0.92	5.53	0.82	0.11	0.04	0.6	10.1	2.5	117	0.6	0.2	-0.1	-0.1	-0.1	1.5
71589	9.2	1.53	8.58	1.74	4.97	0.74	4.16	0.66	0.05	0.06	0.6	29.1	2.1	44	-0.5	0.1	-0.1	-0.1	-0.1	1.2
71599	13	2.27	12.82	2.68	7.7	1.19	6.82	1.05	0.27	0.04	2.2	19.5	4.2	143	-0.5	0.2	-0.1	-0.1	-0.1	-0.5
71601	13.3	2.38	14.01	2.9	8.45	1.25	7.62	1.12	1.01	2.03	2.3	21.5	6.5	143	32.4	0.3	0.3	-0.1	-0.1	1.6
71591	10.5	1.86	10.66	2.29	6.66	0.98	6.11	0.93	0.48	0.04	1.5	7.2	3.9	109	1	0.2	-0.1	-0.1	-0.1	0.7
71611	12.2	2.26	13.23	2.73	8.3	1.26	7.94	1.19	0.34	0.02	2.8	14.6	5.7	132	-0.5	0.2	-0.1	-0.1	-0.1	3.3
71612	12	2.24	13.26	2.61	8.47	1.28	7.59	1.15	0.1	-0.02	2.7	16.5	5.5	115	-0.5	0.2	-0.1	-0.1	-0.1	2.7
71613	11.7	2.18	12.73	2.64	7.8	1.2	7.36	1.13	0.02	-0.02	2.7	16	5.7	117	-0.5	0.2	-0.1	-0.1	-0.1	3.5
71614	11.5	2.22	12.55	2.61	8.03	1.22	7.4	1.12	0.05	-0.02	2.7	17.3	5.1	124	-0.5	0.2	-0.1	-0.1	-0.1	2.5
71615	12.3	2.32	13.5	2.7	8.3	1.26	7.78	1.15	0.02	-0.02	3	17.7	5.2	118	0.7	0.2	-0.1	-0.1	-0.1	1
71616	11.7	2.15	12.76	2.57	7.74	1.17	7.25	1.11	0.04	-0.02	2.7	17.7	4.9	101	1	0.2	-0.1	-0.1	-0.1	2
71617	12	2.19	12.49	2.58	7.59	1.2	7.48	1.11	0.08	-0.02	3.2	19.2	4.9	109	0.6	0.2	-0.1	-0.1	-0.1	2.1
71618	12.2	2.19	12.62	2.58	7.64	1.18	7.48	1.11	0.03	-0.02	3.3	18.4	5.2	106	-0.5	0.2	-0.1	-0.1	-0.1	2.2
71619	11.7	2.2	12.28	2.55	7.69	1.2	7.09	1.1	0.03	-0.02	2.8	18.3	4.8	109	0.8	0.2	-0.1	-0.1	-0.1	1.3
71621	12	2.21	12.77	2.59	7.84	1.21	7.7	1.13	0.04	-0.02	3.2	15.8	5.2	99	-0.5	0.2	-0.1	-0.1	-0.1	0.7
71622	12.7	2.24	14.1	2.69	8.01	1.24	7.74	1.2	0.04	-0.02	2.6	17.9	4.8	100	-0.5	0.2	-0.1	-0.1	-0.1	-0.5
71623	12.1	2.13	13.42	2.57	7.55	1.18	7.61	1.14	0.05	-0.02	2.9	16.8	5.1	108	-0.5	0.2	-0.1	-0.1	-0.1	0.8

Table A5– Continued

Sample Number	Hg ppm	Tl ppm	Se ppm
71464	-0.01	-0.1	0.5
71465	-0.01	-0.1	-0.5
71466	-0.01	-0.1	-0.5
71531	-0.01	-0.1	0.7
71532	-0.01	-0.1	0.8
71533	-0.01	0.1	-0.5
71555	-0.01	-0.1	-0.5
71564	-0.01	-0.1	-0.5
71574	-0.01	-0.1	-0.5
71598	-0.01	-0.1	-0.5
71943	-0.01	-0.1	0.6
71529	-0.01	-0.1	0.5
71563	-0.01	-0.1	-0.5
71528	-0.01	0.2	-0.5
71535	-0.01	0.1	-0.5
71572	-0.01	-0.1	0.9
71589	-0.01	-0.1	0.5
71599	-0.01	-0.1	0.7
71601	-0.01	0.3	0.9
71591	-0.01	-0.1	0.7
71611	-0.01	-0.1	-0.5
71612	-0.01	-0.1	-0.5
71613	-0.01	-0.1	0.5
71614	-0.01	-0.1	-0.5
71615	-0.01	-0.1	0.6
71616	-0.01	-0.1	-0.5
71617	-0.01	0.1	0.5
71618	-0.01	-0.1	-0.5
71619	-0.01	-0.1	0.5
71621	-0.01	-0.1	-0.5
71622	-0.01	-0.1	-0.5
71623	-0.01	-0.1	0.9

Table A5– Continued

Sample Number	BatchNumber	Acme	SiO2 wt%	Al2O3 wt%	Fe2O3 w%	MgO w%	CaO w%	Na2O w%	K2O w%	TiO2 w%	P2O5 w%	MnO w%	Cr2O 3 w%	Ni ppm	Sc ppm	LOI wt%	Ba ppm	Be ppm
71624	SAN08002590		54.78	16.65	11.42	1.65	4.29	5.68	3.43	1.38	0.47	0.26	0.01	-20	14	3.1	825	2
71625	SAN08002590		55.38	16.92	11.33	1.53	3.53	5.78	3.47	1.34	0.45	0.26	0.01	21	14	3	837	3
71626	SAN08002590		55.53	16.94	10.98	1.25	3.93	6.20	3.25	1.24	0.41	0.27	0.00	27	13	4	700	3
71508	SAN08002590		60.31	16.86	6.45	0.24	3.86	5.50	6.06	0.48	0.07	0.17	0.00	-20	3	3.6	516	3
71509	SAN08002590		61.17	16.85	7.08	0.19	2.12	5.83	6.06	0.47	0.07	0.15	0.00	-20	3	2.1	580	4
71511	SAN08002590		60.79	16.16	7.22	0.22	3.38	5.74	5.78	0.45	0.07	0.19	0.00	-20	3	3.3	562	4
71512	SAN08002590		60.99	16.10	7.28	0.26	3.28	5.56	5.78	0.45	0.11	0.20	0.00	-20	3	2.8	699	4
71513	SAN08002590		61.59	16.30	7.29	0.23	2.22	5.93	5.72	0.47	0.05	0.19	0.00	-20	3	2.1	616	3
71514	SAN08002590		63.07	15.47	7.35	0.33	2.53	5.28	5.27	0.47	0.06	0.17	0.01	-20	4	2.6	610	3
71515	SAN08002590		62.53	15.48	6.67	0.31	3.68	5.55	5.08	0.44	0.05	0.20	0.01	-20	3	3.6	443	3
71516	SAN08002590		62.78	16.30	6.97	0.44	2.03	5.15	5.61	0.47	0.07	0.17	0.00	-20	3	2.9	496	3
71518	SAN08002590		61.22	16.06	7.01	0.41	2.87	5.53	6.22	0.45	0.05	0.18	0.00	-20	3	2.8	554	3
71519	SAN08002590		61.27	16.43	7.35	0.48	2.38	5.92	5.47	0.47	0.05	0.17	0.01	-20	3	2.2	486	3
71521	SAN08002590		61.39	16.86	7.16	0.66	1.65	6.22	5.35	0.48	0.06	0.16	0.00	-20	3	1.3	420	3
71576	SAN08002590		62.57	16.05	7.08	0.49	2.03	5.44	5.68	0.44	0.05	0.17	0.00	-20	3	1.5	424	4
71577	SAN08002590		63.31	15.89	6.95	0.35	2.07	5.51	5.28	0.43	0.05	0.17	0.00	-20	2	2	462	4
71578	SAN08002590		63.25	15.60	7.18	0.39	2.11	5.65	5.15	0.43	0.05	0.18	0.01	-20	3	2.1	450	4
71581	SAN08002590		62.45	16.32	7.27	0.38	2.03	6.09	4.78	0.44	0.05	0.19	0.00	-20	3	2.1	370	5
71525	SAN08002590		59.35	16.00	9.04	2.93	3.68	3.29	4.31	1.05	0.16	0.20	0.01	20	13	6.2	526	3
71557	SAN08002590		54.04	17.43	11.85	1.09	4.83	6.26	2.60	1.22	0.40	0.28	0.00	-20	14	5	779	3
71573	SAN08002590		57.66	16.21	8.34	1.53	4.84	4.50	5.79	0.76	0.15	0.19	0.02	41	8	4.6	668	4
71575	SAN08002590		54.34	16.14	9.57	4.67	5.97	3.50	4.08	1.19	0.25	0.24	0.05	122	16	5.5	529	5
71608	SAN08002590		58.47	16.66	8.71	0.92	4.88	6.17	2.81	0.94	0.23	0.18	0.01	-20	9	4.5	555	2
71507	SAN08002590		60.28	18.06	8.21	0.36	2.42	4.25	5.73	0.52	0.07	0.11	0.00	-20	4	5	493	3
71522	SAN08002590		62.09	16.57	7.37	1.09	1.95	4.33	5.81	0.60	0.06	0.13	0.00	-20	5	3.3	490	4
71526	SAN08002590		60.45	17.03	7.57	1.94	2.16	4.40	5.61	0.62	0.07	0.15	0.00	-20	6	4	498	3
71579	SAN08002590		62.98	16.26	7.19	0.45	2.70	5.39	4.34	0.45	0.06	0.19	0.00	-20	3	3.8	377	4
71582	SAN08002590		62.45	16.36	7.06	0.37	2.13	6.94	4.04	0.44	0.05	0.17	0.00	-20	2	1.7	305	4
71597	SAN08002590		63.31	16.00	7.07	0.25	1.96	6.95	3.78	0.43	0.04	0.19	0.01	-20	2	1.5	278	3
71556	SAN08002590		67.49	14.17	5.10	1.24	2.82	2.63	5.44	0.87	0.19	0.06	0.01	-20	11	2.9	817	2
71558	SAN08002590		67.42	14.40	5.11	1.09	2.29	2.89	5.64	0.89	0.20	0.06	0.01	-20	11	2.4	828	3
71559	SAN08002590		68.19	14.31	4.93	1.11	2.18	2.64	5.54	0.84	0.18	0.06	0.02	-20	11	2.6	814	3

Table A5– Continued

Sample Number	Co ppm	Cs ppm	Ga ppm	Hf ppm	Nb ppm	Rb ppm	Sn ppm	Sr ppm	Ta ppm	Th ppm	U ppm	V ppm	W ppm	Zr ppm	Y ppm	La ppm	Ce ppm	Pr ppm	Nd ppm	Sm ppm	Eu ppm
71624	8.1	0.3	24.7	11	110.7	104.1	3	215	5.9	6.8	1.8	-8	1.2	441	72.3	48.3	99	12.08	53.9	11.39	3.5
71625	7.6	0.3	26	12	115.5	103	3	195	6	7	2	-8	1	462	75.5	48.6	101	12.47	55.4	11.97	3.6
71626	6.2	0.3	29.5	13	120.2	92.2	3	138	6.5	7.2	2.2	-8	1.2	487	75.4	50.1	102	12.54	55.5	11.91	3.6
71508	0.6	0.2	30.9	16	146.7	130.6	4	18.3	8.5	11	2.7	-8	1.6	651	86.7	61.6	118	14.39	58.3	12.73	2.5
71509	0.6	0.2	30.6	17	147.9	129.9	5	18.2	8.4	11.1	2.9	-8	1	660	84.4	63	120	14.63	59.7	12.84	2.5
71511	0.5	0.1	29.5	17	140	117.7	4	23.1	7.9	9.8	2.7	-8	0.6	632	81.2	60	115	14.03	57.7	12.55	2.3
71512	0.9	0.1	28.6	16	145.5	122.5	5	24.5	7.7	8.7	2.6	-8	-0.5	609	84.5	60.5	119	14.17	54.1	12.06	2.3
71513	0.5	-0.1	28.1	15	146.8	129.5	4	22.8	7.9	9.4	2.7	-8	0.8	598	79.3	57.8	115	13.67	55.2	11.45	2.3
71514	2.1	0.4	26.7	15	137.7	135.8	5	29.9	7.4	9.5	2.6	11	1.7	587	76.3	58.3	117	14.05	57.4	11.48	2
71515	0.6	0.2	26.2	15	138	110.5	4	21.8	7.5	9.3	2.7	-8	0.9	569	78.1	56.1	110	13.21	56	11.06	2.1
71516	0.8	0.4	26.2	15	137.2	158.1	4	20.9	7.3	10.1	2.6	-8	1.2	585	77.5	56.4	112	13.44	54.9	11.06	2
71518	0.8	0.2	25.4	16	147.9	196.8	4	21.5	7.8	9.7	2.7	-8	1.6	603	80.1	58.2	116	13.69	56.9	11.63	2
71519	0.7	-0.1	29.9	16	150	119.8	4	21.7	8.1	10	2.8	-8	0.9	617	85.2	60.5	120	14.33	59.9	11.9	2.3
71521	0.6	0.1	31	16	154.3	123	5	19.1	8.3	9.8	2.8	-8	1	622	81	61.8	121	14.51	59.9	11.91	2.2
71576	1.4	0.6	28.7	16	153	175.5	5	70.3	8.6	10.5	2.8	-8	0.9	653	85.9	61.9	121	14.71	56.3	12.53	2.2
71577	0.5	0.4	28.3	16	148	154.6	5	72.4	8.7	10.5	2.8	-8	1	636	83.4	61.5	117	14.36	56.1	12.74	2.2
71578	0.5	0.5	28.2	17	160.8	142.2	5	71.9	9.6	11.4	3.1	-8	0.8	699	99.1	65.5	128	15.58	61.5	13.54	2.4
71581	0.6	0.3	32.2	16	159	125	5	64.9	9.2	11.4	2.7	-8	1	695	91.2	64.4	124	15.06	59.7	13.32	2.3
71525	15.5	1.1	20.5	11	88.8	128.3	3	60.7	4.8	8.9	1.9	95	1.1	415	56.5	38.9	79	9.74	40.8	8.44	1.7
71557	5.4	0.3	32.2	12	112.9	67.5	4	98	6.5	7.2	2.3	13	1.9	476	87.8	49.4	106	13.73	59	13.11	4.6
71573	10.7	0.6	24.5	15	134.7	185.1	4	78.1	7.7	10	2.7	45	1.4	574	82.2	57.2	112	13.84	50.1	11.69	2.2
71575	27.7	2.3	26.9	11	96.4	131.8	3	236	5.4	7.3	1.9	109	1.4	426	56	46.4	90	10.9	42.9	9.31	2.1
71608	5.3	0.4	27.5	14	110.3	74.8	4	94.5	6.2	9.5	2.4	13	1.3	526	80.8	51.1	101	12.51	48.3	10.7	3
71507	0.9	0.3	32.9	17	151.3	133.7	5	25.8	8.7	12.1	2.9	-8	1.5	700	92.3	61.7	120	14.53	61.2	13.21	2.5
71522	3.4	1.1	24.6	15	129	196.5	4	28.8	7	12.2	3.1	17	1.3	598	81.6	55.6	115	13.82	56.1	11.52	2
71526	4.1	0.8	22.4	16	131.3	154.7	4	31.8	7.2	11.9	2.8	24	1.2	589	78.2	53.1	109	12.88	54.6	10.98	2
71579	0.7	0.4	30.6	16	146.4	105.8	5	61.9	8.3	10.1	2.7	-8	0.7	636	86.5	60.5	117	14.14	56.5	12.17	2.3
71582	0.8	0.3	31.7	17	160.5	107.3	5	59.8	9.2	11.1	2.8	-8	1.7	710	90.7	65.8	125	15.22	60.5	13.22	2.2
71597	0.4	0.2	29	17	157.7	106.2	5	72	8.7	11.3	2.9	-8	1.3	654	94.3	61.7	123	15.33	59.4	12.95	2.2
71556	9.3	2.7	16.5	13	36.7	217.7	4	99.9	2.5	22.4	3.2	63	1.6	472	41.3	44	94	10.97	40.8	7.73	1.2
71558	9.5	2.7	16.9	13	39.4	223.5	5	106	2.5	23.1	3.4	59	1.3	496	45.7	48.3	101	11.76	44.2	8.26	1.2
71559	8.6	2.5	16.6	13	40	230	9	101	2.4	25.5	3.5	55	1.6	531	48.4	50.7	105	12.33	46.2	8.47	1.2

Table A5– Continued

Sample Number	Gd ppm	Tb ppm	Dy ppm	Ho ppm	Er ppm	Tm ppm	Yb ppm	Lu ppm	TOT/C wt%	TOT/S wt%	Mo ppm	Cu ppm	Pb ppm	Zn ppm	As ppm	Cd ppm	Sb ppm	Bi ppm	Ag ppm	Au ppb
71624	12.2	2.12	12.97	2.56	7.35	1.19	7.4	1.14	0.22	-0.02	2.7	16.9	4.8	114	-0.5	0.1	-0.1	-0.1	-0.1	1
71625	12.4	2.18	13.4	2.61	7.72	1.22	7.57	1.18	0.16	-0.02	2.9	17.3	5.4	124	-0.5	0.2	-0.1	-0.1	-0.1	-0.5
71626	12.5	2.17	13.81	2.65	7.77	1.24	7.83	1.21	0.38	-0.02	3.5	15.2	5.6	131	-0.5	0.3	-0.1	-0.1	-0.1	-0.5
71508	13.5	2.4	15.03	3.08	9.66	1.47	9.1	1.41	0.68	-0.02	3.9	5.3	7.8	131	-0.5	0.3	-0.1	-0.1	-0.1	-0.5
71509	13.4	2.4	14.93	3.11	9.45	1.51	9.48	1.45	0.33	-0.02	3.5	5.7	7.4	117	-0.5	0.2	-0.1	-0.1	-0.1	-0.5
71511	12.8	2.31	14.16	3.07	9.18	1.45	8.93	1.38	0.58	-0.02	3.6	5.2	7.2	110	-0.5	0.2	-0.1	-0.1	-0.1	-0.5
71512	13	2.37	14.09	3.03	8.83	1.46	8.87	1.43	0.57	0.02	3.2	5.4	7.3	110	0.7	0.3	-0.1	-0.1	-0.1	-0.5
71513	11.8	2.27	13.33	2.87	8.51	1.4	8.44	1.36	0.34	-0.02	3.4	5.1	7.7	114	-0.5	0.2	-0.1	-0.1	-0.1	-0.5
71514	11.4	2.12	12.14	2.77	8.04	1.35	8.2	1.29	0.38	0.14	3.1	7.3	7.4	105	4.3	0.2	-0.1	0.2	-0.1	-0.5
71515	11.4	2.22	12.94	2.83	8.21	1.36	8.45	1.3	0.65	0.03	3	5	6.3	104	0.8	0.3	-0.1	-0.1	-0.1	-0.5
71516	11.3	2.21	13.13	2.78	7.95	1.33	8.21	1.29	0.28	-0.02	3.4	7	8.2	110	0.8	0.3	-0.1	-0.1	-0.1	-0.5
71518	12.1	2.32	13.29	2.99	8.66	1.45	8.78	1.39	0.39	-0.02	4.1	5.6	6.9	110	0.9	0.3	-0.1	-0.1	-0.1	-0.5
71519	12.2	2.4	13.8	3.04	8.84	1.48	9.08	1.42	0.36	-0.02	3.7	5.2	8.2	112	-0.5	0.2	-0.1	-0.1	-0.1	-0.5
71521	12	2.32	13.78	3.01	8.86	1.47	8.99	1.45	0.18	-0.02	3.9	5.8	7.8	111	-0.5	0.2	-0.1	-0.1	-0.1	-0.5
71576	13.3	2.52	15.13	3.17	9.65	1.55	9.37	1.46	0.21	0.03	1.6	6	9	121	0.9	0.2	-0.1	-0.1	-0.1	-0.5
71577	13.3	2.46	14.79	3.1	9.16	1.48	9.43	1.44	0.18	-0.02	1.3	5.1	9	123	0.8	0.3	-0.1	-0.1	-0.1	-0.5
71578	14.6	2.72	16.27	3.5	10.6	1.69	10.29	1.6	0.15	-0.02	1.7	5.7	8.7	123	1	0.3	-0.1	-0.1	-0.1	-0.5
71581	14.3	2.6	15.94	3.34	10.1	1.66	10.03	1.55	0.11	-0.02	1.9	5	8.3	115	0.6	0.2	-0.1	-0.1	-0.1	-0.5
71525	8.52	1.6	9.33	1.96	5.84	0.97	5.89	0.95	0.5	0.29	3.2	28.2	8.4	85	5	0.8	-0.1	0.9	-0.1	-0.5
71557	14.4	2.44	14.04	3.04	8.55	1.34	8.4	1.26	0.67	0.11	2.3	9.8	5.4	139	1.9	0.3	-0.1	-0.1	-0.1	3
71573	12.7	2.31	14.01	3	8.77	1.39	8.61	1.35	0.71	0.12	2.2	23.1	7.5	127	4	0.3	0.1	-0.1	-0.1	3.9
71575	9.44	1.7	9.98	2.04	6.04	0.98	6.08	0.93	0.27	0.06	1.2	50.6	5	92	1.2	0.2	-0.1	-0.1	-0.1	1.4
71608	11.3	2.12	12.51	2.63	8.2	1.26	7.88	1.2	0.57	-0.02	3.3	14.6	8.4	138	2.1	0.3	-0.1	0.1	-0.1	8.8
71507	14.1	2.58	15.3	3.28	10.3	1.6	9.86	1.52	0.32	0.33	4.3	6.5	9.1	155	5.2	0.2	-0.1	0.5	-0.1	0.9
71522	11.9	2.29	12.86	2.85	8.02	1.38	8.41	1.29	0.25	0.35	3.6	11.9	11	103	5.1	0.4	-0.1	0.1	-0.1	-0.5
71526	11.6	2.18	12.84	2.79	8.12	1.36	8.04	1.3	0.34	0.38	3.1	12.5	8.5	111	2.8	0.8	-0.1	0.4	-0.1	-0.5
71579	12.6	2.4	14.6	3.09	9.6	1.54	9.49	1.44	0.11	-0.02	1.7	5.9	8.8	127	1.4	0.3	0.1	-0.1	-0.1	-0.5
71582	13.6	2.58	15.77	3.3	10.2	1.68	10.1	1.56	0.17	0.02	3.2	6	8.9	126	0.7	0.3	-0.1	-0.1	-0.1	-0.5
71597	13.4	2.54	15.16	3.21	9.8	1.6	9.48	1.47	0.15	-0.02	3.6	6.5	9	117	0.9	0.3	-0.1	-0.1	-0.1	-0.5
71556	7.28	1.24	6.91	1.43	4.45	0.71	4.43	0.67	0.3	0.15	0.4	24.7	4.6	51	6.6	-0.1	-0.1	-0.1	-0.1	0.8
71558	7.65	1.34	8	1.62	4.78	0.74	4.74	0.71	0.16	0.09	0.2	17.2	9.2	44	2.4	0.2	-0.1	-0.1	-0.1	-0.5
71559	8.01	1.39	7.68	1.63	4.92	0.77	4.72	0.72	0.11	0.07	1	18.9	9	42	5.4	-0.1	-0.1	-0.1	-0.1	2.2

Table A5— Continued

Sample Number	Hg ppm	Tl ppm	Se ppm
71624	-0.01	-0.1	-0.5
71625	-0.01	-0.1	-0.5
71626	-0.01	-0.1	0.5
71508	-0.01	-0.1	-0.5
71509	-0.01	-0.1	-0.5
71511	-0.01	-0.1	-0.5
71512	-0.01	-0.1	-0.5
71513	-0.01	-0.1	-0.5
71514	-0.01	0.2	-0.5
71515	-0.01	-0.1	-0.5
71516	-0.01	0.1	-0.5
71518	-0.01	-0.1	-0.5
71519	-0.01	-0.1	-0.5
71521	-0.01	-0.1	-0.5
71576	-0.01	-0.1	0.8
71577	-0.01	-0.1	-0.5
71578	-0.01	-0.1	0.7
71581	-0.01	-0.1	0.6
71525	-0.01	0.6	-0.5
71557	-0.01	-0.1	0.5
71573	-0.01	-0.1	0.6
71575	-0.01	-0.1	0.7
71608	-0.01	-0.1	0.5
71507	-0.01	0.2	-0.5
71522	-0.01	0.4	-0.5
71526	-0.01	0.2	-0.5
71579	-0.01	-0.1	1
71582	-0.01	-0.1	-0.5
71597	-0.01	-0.1	0.6
71556	-0.01	-0.1	-0.5
71558	-0.01	-0.1	-0.5
71559	-0.01	-0.1	-0.5

Table A5– Continued

Sample Number	BatchNumber	Acme	SiO ₂ wt%	Al ₂ O ₃ wt%	Fe ₂ O ₃ w%	MgO w%	CaO w%	Na ₂ O w%	K ₂ O w%	TiO ₂ w%	P ₂ O ₅ w%	MnO w%	Cr ₂ O ₃ w%	Ni ppm	Sc ppm	LOI wt%	Ba ppm	Be ppm
71561	SAN08002590		67.34	14.46	5.23	0.97	2.57	2.96	5.31	0.88	0.18	0.07	0.02	-20	11	2.2	767	2
71562	SAN08002590		70.38	12.75	4.70	0.62	2.44	2.75	5.34	0.80	0.15	0.05	0.02	-20	10	3.7	810	2
71566	SAN08002590		69.09	13.97	4.90	1.11	1.89	3.05	4.94	0.81	0.17	0.06	0.02	-20	10	3.3	689	3
71567	SAN08002590		69.22	13.97	4.70	1.11	1.61	2.95	5.38	0.80	0.15	0.07	0.02	-20	10	2.6	778	2
71568	SAN08002590		67.66	14.58	5.08	1.03	2.56	2.75	5.20	0.88	0.19	0.06	0.01	-20	10	3.7	742	3
71569	SAN08002590		70.90	13.36	4.39	0.86	1.19	2.97	5.38	0.73	0.14	0.05	0.02	-20	9	2.5	711	1
71571	SAN08002590		66.13	14.93	5.13	1.06	2.65	3.52	5.41	0.90	0.19	0.07	0.01	-20	11	2.7	747	2
71583	SAN08002590		66.98	13.84	5.32	0.97	3.59	3.35	4.89	0.77	0.16	0.09	0.02	-20	9	4.3	685	4
71584	SAN08002590		67.63	14.37	4.99	1.07	2.51	2.74	5.62	0.82	0.17	0.07	0.00	-20	10	2.3	760	3
71585	SAN08002590		68.15	14.17	4.99	1.12	1.80	2.89	5.74	0.86	0.19	0.07	0.02	32	10	2.5	813	1
71586	SAN08002590		70.15	13.49	4.84	0.99	2.35	2.50	4.62	0.82	0.17	0.06	0.01	-20	10	3.1	614	2
71587	SAN08002590		68.71	14.17	4.93	1.03	1.94	2.80	5.33	0.86	0.17	0.06	0.01	-20	10	2.1	769	2
71588	SAN08002590		68.14	14.09	4.96	1.00	2.62	2.70	5.41	0.83	0.17	0.06	0.01	-20	10	2.4	763	1
71592	SAN08002590		67.01	14.80	5.14	0.95	2.32	3.33	5.30	0.88	0.18	0.07	0.01	-20	11	2.3	851	2
71593	SAN08002590		68.82	13.84	5.06	0.99	2.12	2.97	5.09	0.83	0.18	0.07	0.04	-20	10	2.9	712	1
71595	SAN08002590		67.60	14.07	5.05	1.07	2.29	3.18	5.63	0.84	0.20	0.06	0.02	-20	10	2.8	725	1
71596	SAN08002590		68.19	14.01	4.94	0.94	2.23	2.96	5.65	0.83	0.18	0.06	0.02	-20	10	2.8	800	1
71602	SAN08002590		66.66	13.24	5.24	0.80	5.30	3.31	4.34	0.81	0.19	0.07	0.03	-20	9	5	708	2
71603	SAN08002590		70.10	13.62	4.67	0.93	1.76	3.19	4.76	0.74	0.15	0.06	0.01	-20	9	2.9	719	2
71604	SAN08002590		69.24	13.59	4.68	0.93	2.35	3.02	5.21	0.76	0.14	0.06	0.02	-20	9	2.6	774	1
71605	SAN08002590		69.38	14.06	4.73	0.89	2.27	3.19	4.44	0.80	0.15	0.06	0.02	-20	10	3	698	1
71606	SAN08002590		69.36	13.77	4.89	0.88	1.85	3.19	5.00	0.79	0.15	0.07	0.04	-20	9	2.6	781	2
71607	SAN08002590		69.91	13.32	4.67	0.82	2.02	3.35	4.90	0.73	0.15	0.07	0.04	-20	9	2.5	770	2
71634	SAN08002590		68.11	14.33	4.77	0.87	1.64	3.32	5.86	0.82	0.17	0.05	0.06	-20	10	2.2	774	2
71635	SAN08002590		68.22	14.10	5.08	0.95	1.42	3.33	5.78	0.79	0.18	0.06	0.08	-20	10	2.2	746	2
71636	SAN08002590		68.51	13.96	4.99	0.95	1.75	3.26	5.51	0.80	0.17	0.05	0.05	-20	10	2.5	743	1
71637	SAN08002590		68.69	13.90	4.89	0.90	1.75	3.59	5.22	0.77	0.17	0.05	0.07	-20	10	2.4	742	2
71638	SAN08002590		69.74	13.57	4.45	0.89	1.59	3.68	5.09	0.74	0.16	0.05	0.04	-20	10	1.7	733	2
71639	SAN08002590		68.62	13.88	4.99	0.90	1.88	3.53	5.10	0.81	0.18	0.05	0.07	-20	10	2.9	678	1
71641	SAN08002590		69.15	13.72	4.63	0.87	1.91	3.48	5.18	0.77	0.16	0.06	0.06	-20	9	2.3	670	2
71642	SAN08002590		68.45	13.90	5.04	0.90	1.56	3.40	5.63	0.79	0.16	0.07	0.09	-20	10	2.2	715	1
71643	SAN08002590		68.21	14.08	4.78	0.95	1.76	3.33	5.84	0.76	0.16	0.06	0.05	-20	10	2.6	725	2

Table A5– Continued

Sample Number	Co ppm	Cs ppm	Ga ppm	Hf ppm	Nb ppm	Rb ppm	Sn ppm	Sr ppm	Ta ppm	Th ppm	U ppm	V ppm	W ppm	Zr ppm	Y ppm	La ppm	Ce ppm	Pr ppm	Nd ppm	Sm ppm	Eu ppm
71561	9	2.5	16.8	14	39.4	208.8	5	90.8	2.4	21.2	3.3	54	1.6	495	45.4	47.5	99	11.71	43.3	8.02	1.2
71562	8.7	2.6	10.4	12	36.2	215.1	5	98.4	2.2	20.2	2.9	49	1.6	469	40.9	41	86	10.07	39	7.05	1
71566	9.1	2	13	13	39.7	207.9	4	103	2.7	24.6	3.5	53	3.3	478	46	48.2	98	11.59	43.3	8.1	1.1
71567	7.7	2	14.1	14	39.6	217.4	4	95.8	2.3	23.4	3.5	48	1.7	516	45.1	46.8	96	11.35	40.8	7.91	1.1
71568	8.4	1.9	14.9	15	40.3	205.5	5	89.8	2.6	23.4	3.4	49	1.4	560	47.8	48.3	102	11.79	42.2	8.14	1.2
71569	7.7	1.9	13.8	15	38.9	222.5	4	74.8	2.7	26.5	3.8	42	1.3	504	43.5	48.9	100	11.65	41.3	7.72	1
71571	8.6	3.3	16.7	14	40.5	221.4	4	97.7	2.7	22.3	3.1	47	1.8	492	46.5	47.6	101	11.91	41.3	8.29	1.2
71583	7.6	2.6	20.7	13	50.4	198.6	4	109	3.1	19.5	2.9	41	1.4	516	44.8	44.5	91	10.85	42.9	8.15	1.2
71584	8.4	2.8	17.5	15	37.7	222.5	4	105	2.6	24.6	3.8	49	1.6	587	46.1	47.9	100	11.66	43.4	8.57	1.2
71585	8.7	2.8	14.7	14	39.2	210.9	5	110	2.6	20.6	3.1	50	1.3	498	47.1	47.1	98	11.7	43.2	7.91	1.2
71586	8.8	2.8	13.8	13	36.4	179.2	3	117	2.5	23.8	3.5	44	1	502	39.6	42.8	87	10.61	38.5	8.03	1.1
71587	9.3	3	16.7	13	39.7	207.4	4	108	2.5	22.2	3.3	62	1.6	483	47.6	46.4	97	11.48	40.9	8.02	1.2
71588	8.8	3.1	16.2	14	39	214.4	4	108	2.4	25	4.1	60	1.3	520	48.1	48.1	97	11.77	40	8.09	1.2
71592	9.5	2.9	15.6	15	41	211.8	4	123	2.6	22.7	3.4	56	1.2	508	48.7	51	104	12.43	45.7	8.41	1.3
71593	9.1	2.8	15.2	14	38.4	209.7	4	143	2.5	23	3.5	52	2	500	45.8	47.9	96	11.34	41.1	7.74	1.1
71595	8	2	15.6	14	39.9	212.7	4	107	2.6	23.9	3.3	51	1.5	490	47.6	48.3	99	11.88	45	8.2	1.1
71596	8.4	2.8	13.9	13	36.7	223.9	4	105	2.2	21.3	3.4	52	1.7	482	46.9	46.9	95	11.37	39.9	7.69	1.1
71602	8.2	2.6	13.7	13	39.1	168.4	4	87.5	2.4	20.8	3	38	1.2	430	41.1	44.7	90	10.5	39.5	7.35	1.2
71603	7.9	2.8	14.5	12	36.4	190.8	4	85.9	2.3	20.7	3.5	45	0.8	456	41.1	46.8	94	11.1	39.8	7.14	1
71604	7.7	3.6	14.4	13	37.6	215.4	4	96.5	2.4	23.6	3.4	48	1	497	42.7	45.3	94	10.96	40.8	7.55	1
71605	8.2	3.6	13.9	12	37.3	170.1	4	96.9	2.3	22.2	3.3	43	1	482	45.1	45.2	91	10.9	38.7	7.28	1
71606	7.9	3.2	14.9	14	38.1	197.2	4	93.2	2.5	22.5	3.6	44	0.9	513	43.6	45.4	92	10.89	40.8	7.29	1
71607	7.9	2.8	14.4	14	36.5	199	4	90.8	2.4	21.3	3.3	40	0.8	477	40.2	44.1	89	10.54	38.4	6.97	1
71634	8.1	3.5	15.7	15	40.9	234.6	4	90.9	2.8	23.4	3.4	43	1.1	521	44.5	47.3	101	11.28	44.2	8.17	1.1
71635	8.5	3.6	16.4	13	40.1	230.4	4	94.5	2.8	22	3.5	45	1.3	486	42.4	45.2	98	11.18	41.8	7.78	1
71636	8.3	6.4	15.5	13	41.3	218.4	4	109	2.6	22.9	3.4	46	1.1	515	43.3	47.6	100	11.33	43.7	8.01	1
71637	9.2	3.4	15.8	13	40	216.3	5	82.5	2.5	22.1	3.4	45	1.4	487	44.1	44.9	94	10.77	42.6	7.59	1
71638	7.7	2.7	13	12	37.1	204.4	4	83.1	2.7	22.3	3.3	41	0.7	480	43.9	44.1	92	10.53	39.9	7.37	1
71639	8.7	2.7	15.4	13	40.4	203.9	5	80.1	2.5	21.8	3.5	41	1.1	498	41.9	44.1	96	10.82	42.6	7.57	1
71641	8	3	14.2	13	38.6	208.2	4	80.1	2.5	22.2	3.3	37	1	471	40.4	42.5	93	10.67	40.5	7.54	1
71642	8.6	3.3	16.3	12	37.7	221.4	5	92.4	2.5	21	3.3	44	1.1	487	40.2	42.9	94	10.5	41	7.42	1
71643	7.3	3.6	14.8	13	37.2	226.2	5	89.7	2.7	21.5	3.4	41	1.2	495	41.1	44.6	93	10.52	39.7	7.47	1

Table A5– Continued

Sample Number	Gd ppm	Tb ppm	Dy ppm	Ho ppm	Er ppm	Tm ppm	Yb ppm	Lu ppm	TOT/C wt%	TOT/S wt%	Mo ppm	Cu ppm	Pb ppm	Zn ppm	As ppm	Cd ppm	Sb ppm	Bi ppm	Ag ppm	Au ppb
71561	7.8	1.32	7.88	1.55	4.67	0.73	4.5	0.7	0.16	0.04	0.8	21.8	8.2	57	2.7	0.1	-0.1	-0.1	-0.1	-0.5
71562	6.46	1.13	7.13	1.43	4.25	0.67	4.05	0.62	0.18	1.79	1.7	32.5	11	43	11.1	0.1	0.3	-0.1	-0.1	6.4
71566	7.69	1.32	7.44	1.57	4.67	0.76	4.6	0.69	0.06	1.03	1.3	29.5	13	49	4.8	0.2	-0.1	-0.1	0.1	6.6
71567	7.33	1.27	7.7	1.53	4.67	0.73	4.64	0.67	0.08	0.25	1	20.4	15	53	2.5	0.1	-0.1	-0.1	-0.1	2.4
71568	7.79	1.34	7.81	1.58	4.76	0.77	4.51	0.9	0.11	0.9	1	22.9	15	52	3.9	-0.1	-0.1	-0.1	-0.1	4.6
71569	7.3	1.27	7.4	1.52	4.64	0.72	4.36	0.68	0.08	0.38	0.8	28	16	45	4	-0.1	-0.1	-0.1	-0.1	5.3
71571	7.91	1.36	7.74	1.52	4.77	0.76	4.5	0.69	0.23	0.17	1.4	23.9	14	55	12.4	-0.1	0.3	-0.1	-0.1	3.6
71583	7.95	1.42	8.28	1.63	4.83	0.77	4.76	0.74	0.41	0.14	1.9	20.7	9.3	56	13.7	-0.1	0.2	-0.1	-0.1	-0.5
71584	8.11	1.41	8.13	1.64	4.93	0.82	4.63	0.73	0.17	0.08	1.1	22.3	9.4	47	3.3	-0.1	-0.1	-0.1	-0.1	1.1
71585	7.53	1.29	7.57	1.64	4.77	0.74	4.45	0.7	0.05	0.3	1	23.3	12	48	5.3	-0.1	0.1	-0.1	-0.1	2.1
71586	7.14	1.29	7.3	1.58	4.58	0.69	4.51	0.65	0.05	1.21	1.4	23.4	14	48	9.9	-0.1	0.1	-0.1	-0.1	3.4
71587	7.64	1.33	7.55	1.59	4.88	0.75	4.75	0.7	0.06	0.12	1.1	25.1	11	56	4	-0.1	-0.1	-0.1	-0.1	0.8
71588	7.69	1.34	7.58	1.64	4.83	0.76	4.68	0.7	0.19	0.06	1.4	24	10	49	2.2	-0.1	-0.1	-0.1	-0.1	-0.5
71592	8.18	1.4	8.29	1.73	4.91	0.8	4.73	0.72	0.18	0.11	1.3	24.8	12	47	14.9	-0.1	0.2	-0.1	-0.1	1.1
71593	7.38	1.29	7.35	1.55	4.74	0.73	4.43	0.65	0.18	0.04	1.3	25.9	12	53	3.1	-0.1	-0.1	-0.1	-0.1	-0.5
71595	7.68	1.31	7.47	1.59	4.91	0.72	4.67	0.7	0.24	0.05	1.5	19.7	16	52	2.2	-0.1	-0.1	-0.1	-0.1	-0.5
71596	7.24	1.27	7.63	1.55	4.52	0.73	4.48	0.66	0.21	0.52	1.1	26.2	13	51	6.9	-0.1	-0.1	-0.1	-0.1	0.7
71602	6.84	1.18	6.81	1.43	4.24	0.67	4.18	0.63	0.77	0.75	1.3	17.3	12	47	18.9	0.1	0.2	-0.1	-0.1	2.5
71603	6.8	1.22	6.82	1.43	4.25	0.65	4.2	0.6	0.1	0.35	1	19.1	15	57	4.9	-0.1	0.1	-0.1	-0.1	-0.5
71604	6.54	1.22	7.06	1.43	4.45	0.71	4.32	0.62	0.25	0.44	1.1	23.2	14	56	5.5	-0.1	0.1	-0.1	-0.1	-0.5
71605	6.72	1.25	7.41	1.48	4.56	0.69	4.27	0.64	0.11	0.46	1.1	21.4	16	51	9.7	-0.1	0.1	-0.1	-0.1	2.5
71606	6.78	1.22	7.04	1.42	4.42	0.71	4.35	0.63	0.14	0.38	1.1	25.9	13	50	10.5	-0.1	0.1	-0.1	-0.1	2.2
71607	6.42	1.19	6.52	1.31	4.17	0.66	4.19	0.6	0.21	0.09	1.2	25.6	13	49	7.8	-0.1	0.1	0.1	-0.1	1.1
71634	7.38	1.27	7.32	1.47	4.36	0.7	4.58	0.68	0.18	0.51	2.3	25.2	12	38	12.2	-0.1	0.8	-0.1	-0.1	2.2
71635	7.22	1.23	7.62	1.42	4.09	0.68	4.3	0.63	0.09	0.45	3.1	25.5	12	44	10.7	-0.1	0.4	-0.1	-0.1	1.5
71636	7.3	1.23	7.04	1.44	4.25	0.69	4.44	0.62	0.14	0.52	3.2	28	13	38	10.9	-0.1	0.5	-0.1	-0.1	1.5
71637	7.06	1.2	7.42	1.44	4.45	0.7	4.37	0.65	0.14	0.62	1.7	23.7	15	52	10.1	-0.1	0.4	-0.1	-0.1	3
71638	6.98	1.2	7.27	1.46	4.35	0.67	4.16	0.62	0.11	0.88	1.4	23.6	14	44	8.7	-0.1	0.4	-0.1	-0.1	1.9
71639	7.3	1.23	7.14	1.45	4.14	0.66	4.21	0.64	0.16	0.71	2.6	26.5	15	43	9.9	-0.1	0.3	-0.1	-0.1	2.6
71641	7.22	1.22	6.97	1.43	4.17	0.66	4.21	0.64	0.18	0.62	1.6	24.2	13	43	8.9	-0.1	0.3	-0.1	-0.1	1.1
71642	7.06	1.2	6.93	1.39	4.08	0.67	4.37	0.61	0.15	0.29	1.5	24.5	15	58	5.9	-0.1	0.2	-0.1	-0.1	1.4
71643	7.16	1.21	6.96	1.47	4.35	0.67	4.21	0.63	0.2	0.2	1.6	24.2	13	50	4	-0.1	0.1	-0.1	-0.1	1.3

Table A5– Continued

Sample Number	Hg ppm	Tl ppm	Se ppm
71561	-0.01	-0.1	-0.5
71562	-0.01	-0.1	-0.5
71566	-0.01	-0.1	-0.5
71567	-0.01	-0.1	-0.5
71568	-0.01	-0.1	-0.5
71569	-0.01	-0.1	-0.5
71571	-0.01	-0.1	0.7
71583	-0.01	-0.1	0.6
71584	-0.01	-0.1	0.6
71585	-0.01	-0.1	-0.5
71586	-0.01	-0.1	-0.5
71587	-0.01	-0.1	-0.5
71588	-0.01	-0.1	-0.5
71592	-0.01	-0.1	-0.5
71593	-0.01	-0.1	0.6
71595	-0.01	-0.1	0.5
71596	-0.01	-0.1	-0.5
71602	-0.01	0.2	0.6
71603	-0.01	-0.1	0.6
71604	-0.01	-0.1	-0.5
71605	-0.01	0.1	-0.5
71606	-0.01	-0.1	0.5
71607	-0.01	-0.1	-0.5
71634	-0.01	0.1	0.6
71635	-0.01	0.1	-0.5
71636	-0.01	0.1	0.7
71637	-0.01	-0.1	-0.5
71638	-0.01	-0.1	-0.5
71639	-0.01	-0.1	-0.5
71641	-0.01	-0.1	0.6
71642	-0.01	-0.1	-0.5
71643	-0.01	-0.1	-0.5

Table A5– Continued

Sample Number	BatchNumber	Acme	SiO2 wt%	Al2O3 wt%	Fe2O3 wt%	MgO wt%	CaO wt%	Na2O wt%	K2O wt%	TiO2 wt%	P2O5 wt%	MnO wt%	Cr2O 3 wt%	Ni ppm	Sc ppm	LOI wt%	Ba ppm	Be ppm
71644	SAN08002590		68.62	14.15	4.84	0.95	1.42	3.38	5.60	0.79	0.16	0.06	0.02	-20	10	2.6	732	2
71645	SAN08002590		68.47	14.32	4.68	0.91	1.58	3.34	5.63	0.79	0.17	0.06	0.03	-20	10	2.5	718	2
71646	SAN08002590		68.42	14.19	4.45	0.95	1.76	3.49	5.68	0.82	0.17	0.05	0.02	-20	10	2.5	778	1
71649	SAN08002590		70.65	12.77	4.23	0.62	3.17	3.28	4.34	0.74	0.13	0.04	0.04	-20	8	4.2	639	3
71654	SAN08002590		70.29	13.35	4.25	0.78	1.76	3.52	5.06	0.76	0.16	0.05	0.02	-20	9	2.5	644	1
71656	SAN08002590		69.07	13.49	4.53	0.84	2.03	3.52	5.50	0.76	0.17	0.05	0.05	-20	9	3.2	647	2
71657	SAN08002590		67.54	14.27	4.62	0.86	2.42	3.44	5.79	0.78	0.17	0.06	0.05	-20	10	3.2	678	1
71658	SAN08002590		67.64	13.94	4.63	0.75	2.83	3.79	5.42	0.77	0.15	0.05	0.03	-20	9	3.3	670	1
71661	SAN08002590		67.31	13.90	4.66	0.75	3.06	3.85	5.42	0.79	0.16	0.05	0.04	-20	9	3.5	641	2
71662	SAN08002590		67.29	14.11	4.88	0.89	2.42	3.25	6.08	0.80	0.16	0.06	0.05	-20	10	2.2	687	2
71663	SAN08002590		67.30	14.09	4.82	0.91	2.45	3.37	6.02	0.80	0.14	0.06	0.03	-20	10	2.7	668	2
71664	SAN08002590		66.95	14.46	4.82	0.89	2.21	3.59	6.02	0.81	0.15	0.06	0.03	-20	10	2.3	669	2
71665	SAN08002590		67.50	14.13	4.85	0.90	2.24	3.47	5.87	0.78	0.15	0.06	0.05	-20	10	2.9	670	2
71666	SAN08002590		67.00	14.08	4.91	0.86	2.66	3.45	5.98	0.78	0.16	0.06	0.05	-20	10	2.8	685	2
71667	SAN08002590		66.51	13.81	4.56	0.80	4.32	3.25	5.74	0.75	0.16	0.06	0.03	-20	9	4.4	712	2
71668	SAN08002590		66.35	13.97	4.59	0.84	4.19	3.28	5.76	0.77	0.14	0.07	0.04	-20	9	4.1	725	3
71669	SAN08002590		67.91	14.14	4.89	0.93	1.94	3.24	5.89	0.79	0.15	0.07	0.05	-20	9	2.2	775	2
71671	SAN08002590		68.07	14.14	4.80	0.91	1.95	3.15	5.94	0.77	0.16	0.06	0.04	-20	9	2.7	807	2
71672	SAN08002590		67.87	14.18	4.71	0.88	2.39	3.47	5.49	0.79	0.14	0.06	0.03	-20	9	3	750	-1
71673	SAN08002590		68.03	14.19	4.97	0.99	1.59	3.16	6.04	0.79	0.15	0.06	0.04	-20	9	2	732	2
71674	SAN08002590		67.97	14.01	4.88	0.93	2.08	3.08	5.99	0.78	0.15	0.07	0.04	-20	9	2.4	768	3
71675	SAN08002590		68.56	13.87	4.76	0.91	2.10	3.13	5.67	0.77	0.14	0.06	0.04	-20	9	2.9	768	2
71676	SAN08002590		67.67	14.39	4.86	0.94	1.82	3.34	5.95	0.79	0.14	0.06	0.03	-20	9	2.2	805	2
71677	SAN08002590		68.09	14.17	4.87	0.87	1.68	3.48	5.80	0.79	0.15	0.06	0.03	-20	10	2.8	659	1
71678	SAN08002590		68.50	13.93	4.78	0.91	1.60	3.63	5.64	0.78	0.14	0.06	0.04	-20	9	1.9	763	3
71679	SAN08002590		68.13	13.82	4.93	0.84	2.07	3.53	5.65	0.78	0.16	0.06	0.04	-20	9	3.1	764	2
71681	SAN08002590		67.85	14.03	5.00	0.80	1.85	3.60	5.82	0.79	0.14	0.06	0.07	-20	9	3	760	2
71682	SAN08002590		68.05	14.01	4.93	0.88	1.81	3.52	5.73	0.81	0.14	0.06	0.05	-20	9	2.6	756	2
71683	SAN08002590		69.23	13.50	4.60	0.79	1.94	3.67	5.32	0.73	0.13	0.05	0.04	-20	8	2.4	728	2
71629	SAN08002590		71.81	12.54	3.09	0.38	3.30	4.39	3.58	0.65	0.14	0.04	0.07	-20	9	2.4	548	2
71631	SAN08002590		67.79	14.43	4.40	0.82	2.55	3.84	5.05	0.81	0.16	0.06	0.07	-20	11	2.6	727	2
71632	SAN08002590		69.68	13.63	4.08	0.69	2.40	3.93	4.55	0.74	0.15	0.05	0.09	-20	9	2.7	680	2

Table A5– Continued

Sample Number	Co ppm	Cs ppm	Ga ppm	Hf ppm	Nb ppm	Rb ppm	Sn ppm	Sr ppm	Ta ppm	Th ppm	U ppm	V ppm	W ppm	Zr ppm	Y ppm	La ppm	Ce ppm	Pr ppm	Nd ppm	Sm ppm	Eu ppm
71644	7.5	3.3	15.6	13	39.9	226.1	5	96.3	2.6	23.1	3.4	44	1.6	507	41.8	45	96	10.87	43.3	7.47	1
71645	8.1	3.4	14.9	13	38.5	217	4	111	2.6	21.6	3.5	40	1.4	486	39.7	43.2	92	10.55	40.9	7.27	1
71646	7.9	3.1	15.3	13	39.5	229.9	4	93.3	2.6	21.6	3.5	47	1.2	504	41.1	44.5	95	10.91	42.4	7.55	1
71649	7.3	2.6	10.4	12	36.3	167.3	4	58.7	2.2	23.5	3.5	81	2.4	471	39.9	43.5	89	10.32	40.4	6.74	1
71654	7.7	2.3	15	13	36.8	197.4	5	62.9	2.4	23.1	3.3	39	1.2	496	35.7	44.7	94	10.17	40.3	7.26	0.9
71656	7.6	3.2	14.2	13	38	228.3	5	69.1	2.6	22.3	3.7	38	1.3	507	38.6	42.9	92	10.38	40.8	7.55	0.9
71657	8	3.3	14.6	13	37.2	233.7	4	71.8	2.7	21.8	3.4	42	1.2	505	36.7	42.1	90	10.35	43	7.78	1
71658	7.6	2.8	13.9	14	37.6	212.4	4	73.7	2.4	24.9	3.5	69	1.2	511	44.3	47	99	11.28	41.3	7.72	1
71661	7.3	3.2	14	14	37.1	204.9	4	75	2.5	22.9	3.5	57	1.1	514	43.3	45.9	95	10.84	39.6	7.64	0.9
71662	7.5	4.3	16.3	13	38.6	238.7	4	83.3	2.5	23.5	3.5	56	1.2	507	42.3	43.5	93	10.65	38.2	7.58	1
71663	7.1	4	15.6	13	36.6	232.7	4	82.6	2.5	23.4	3.5	53	1.1	469	41.7	44.1	91	10.48	37.4	7.17	0.9
71664	7.1	3.6	16	14	37.5	235.5	4	87.6	2.5	23.9	3.4	55	1.1	543	41.4	44.4	90	10.41	38.8	7.26	0.9
71665	7.6	3.7	15.7	12	37.4	239.8	4	78.6	2.4	22	3.4	53	1.3	496	40.9	44.8	91	10.28	37.7	7.11	1
71666	7.4	3.8	14.9	13	37.4	236.9	4	81	2.6	22.9	3.4	50	1.4	511	40.6	43.4	90	10.33	35.4	7.14	0.9
71667	7.8	4	15.4	13	38.1	238.2	4	88.2	2.5	23	3.6	50	1.3	500	44.1	46.2	96	10.92	39.1	7.65	1
71668	8	3.8	16.1	14	38.5	245.5	4	87.3	2.7	21.8	3.3	49	1.1	518	42.4	46.5	94	10.66	39.3	7.35	0.9
71669	8.9	4.4	18.3	16	41.9	253.1	5	91.1	2.8	27.7	4	50	1.5	574	48.7	50.2	105	12.14	45.3	8.29	1.1
71671	9	5	17.9	16	43	264.8	5	94.4	2.8	26.8	3.7	47	1.4	576	48.6	49.1	106	12.14	43.6	8.29	1.1
71672	8	4	17.8	16	42	249.7	5	89.9	2.8	26.8	3.7	49	1.4	566	46.7	48.6	102	11.98	43.3	8.24	1.1
71673	8.7	4.5	17.9	15	40.2	263.6	5	79.3	2.8	26.5	3.9	43	1.4	533	46.4	46.2	100	11.75	43.4	8.15	1.1
71674	8.6	4.6	18.3	16	42.3	265.7	5	83.1	3	25.8	3.7	45	1.6	578	46.2	49.5	105	11.95	42.3	8.04	1.1
71675	9.1	4.3	17.8	16	43.6	258.1	5	80	2.9	27	4	48	1.3	597	47.2	51.1	106	12.35	46.4	8.29	1.1
71676	9.2	4.4	19.2	14	44.1	269.4	5	84.6	3	26.3	3.3	55	1.3	586	47.8	50.5	107	12.36	44.7	8.6	1.2
71677	7.2	2.9	16.5	14	37.5	228.4	5	74.2	2.8	23.8	3.6	44	1.1	497	41.8	45.4	94	10.78	36.4	7.28	1
71678	8.5	3.8	18.6	14	43	252.8	5	78.6	2.8	25.6	3.5	48	1.1	568	45	49.1	103	11.6	42.5	8.03	1.1
71679	8.9	3.3	16.5	15	43.5	248.9	5	79.2	2.8	25.8	3	50	1.4	605	46.2	48.6	103	11.86	44.6	8.09	1.1
71681	8.7	3.4	16.6	13	41.8	254.8	5	73.9	2.7	25.5	3.1	47	1.8	566	44.7	46.6	100	11.31	42.6	7.7	1
71682	8.8	2.9	18.3	15	42.9	255.1	5	71.1	2.8	26	3.4	50	1.2	600	45.2	47.9	100	11.55	41.9	8	1
71683	9	2.1	17.3	13	39.8	236.4	5	67.7	2.6	25.2	3.1	48	1	570	41.8	46.6	97	10.94	41.2	7.67	1
71629	6.9	1.6	11.8	11	33.2	142	4	79.3	2.1	19.2	2.8	24	0.8	410	36.7	40.2	83	9.5	37.5	6.63	0.9
71631	8.4	2.5	15	13	40	192.4	4	82.3	2.5	21.7	3.2	39	0.9	495	42.8	45.7	97	10.9	42	7.64	1
71632	8	2.2	13.7	13	37	177.4	3	77.1	2.5	21.3	3.4	34	1	459	41.1	43.4	90	10.22	38.4	7.2	0.9

Table A5– Continued

Sample Number	Gd ppm	Tb ppm	Dy ppm	Ho ppm	Er ppm	Tm ppm	Yb ppm	Lu ppm	TOT/C wt%	TOT/S wt%	Mo ppm	Cu ppm	Pb ppm	Zn ppm	As ppm	Cd ppm	Sb ppm	Bi ppm	Ag ppm	Au ppb
71644	7.25	1.23	7.41	1.47	4.34	0.67	4.31	0.66	0.1	0.38	3.7	23.3	16	52	7.2	-0.1	0.2	-0.1	-0.1	-0.5
71645	7.22	1.2	7.26	1.42	4.2	0.68	4.39	0.64	0.09	0.57	4.1	22.4	16	41	9.6	-0.1	0.3	-0.1	-0.1	1.7
71646	7.3	1.27	7.13	1.46	4.45	0.7	4.68	0.66	0.15	0.5	2	29.1	15	42	7.3	-0.1	0.3	-0.1	-0.1	1.6
71649	6.63	1.14	6.74	1.3	4.08	0.61	4.34	0.64	0.31	1.17	3.3	25	19	27	20.9	-0.1	1.5	-0.1	-0.1	5.6
71654	6.76	1.16	6.97	1.36	4.03	0.67	4.24	0.61	0.15	0.32	2.6	21.4	18	44	12.7	-0.1	0.6	-0.1	-0.1	1.6
71656	7	1.21	7.21	1.46	4.42	0.67	4.38	0.64	0.24	1.26	1.6	25.8	16	50	20.8	-0.1	0.6	-0.1	-0.1	4.6
71657	7.05	1.23	7.66	1.43	4.26	0.68	4.47	0.61	0.3	1.03	1.4	21.6	15	42	20.1	-0.1	0.5	-0.1	-0.1	4.5
71658	7.52	1.23	7.22	1.5	4.48	0.7	4.48	0.66	0.38	1.22	1.9	23.4	16	49	21.7	-0.1	0.7	-0.1	-0.1	5.4
71661	7.36	1.2	7.33	1.47	4.25	0.68	4.24	0.64	0.42	0.97	3	25.4	15	43	24.5	-0.1	0.8	-0.1	-0.1	5.5
71662	6.85	1.15	7.36	1.48	4.48	0.69	4.19	0.65	0.29	0.38	1.6	25.1	11	46	11.2	-0.1	0.3	-0.1	-0.1	3.5
71663	6.81	1.14	6.94	1.4	4.25	0.64	4.31	0.63	0.31	0.28	1.7	23.8	11	49	8.4	-0.1	0.2	-0.1	-0.1	2.3
71664	6.87	1.13	6.93	1.4	4.15	0.66	4.23	0.65	0.3	0.46	1.8	24.1	12	51	11.1	-0.1	0.2	-0.1	-0.1	3
71665	6.64	1.12	6.73	1.46	4.27	0.68	4.1	0.64	0.29	0.53	2.2	22.6	13	48	11.5	-0.1	0.3	-0.1	-0.1	3
71666	6.93	1.14	7.08	1.42	4.2	0.68	4.05	0.63	0.37	0.72	2.4	22.5	12	48	12	-0.1	0.4	-0.1	-0.1	3.4
71667	7.27	1.19	7.4	1.51	4.27	0.67	4.44	0.65	0.71	0.67	1.4	22.3	12	50	13.2	-0.1	0.3	-0.1	-0.1	4
71668	7.15	1.17	7.09	1.48	4.3	0.67	4.13	0.65	0.69	0.38	1.3	22.1	12	47	9.8	-0.1	0.2	-0.1	-0.1	2.7
71669	8.12	1.37	8.13	1.66	5.16	0.76	4.98	0.74	0.26	0.16	1.7	26.3	11	55	5.3	-0.1	0.1	-0.1	-0.1	2.3
71671	8.42	1.37	8.35	1.69	4.96	0.79	5.09	0.76	0.25	0.16	1.6	22.7	13	56	4.9	-0.1	0.1	-0.1	-0.1	6.7
71672	8.15	1.38	7.84	1.6	4.79	0.76	5	0.73	0.32	0.36	1.5	22	14	50	11	-0.1	0.2	-0.1	-0.1	4.3
71673	8.03	1.34	7.78	1.69	4.87	0.76	4.94	0.75	0.12	0.48	1.4	24.4	13	51	7.6	-0.1	0.2	-0.1	-0.1	3.5
71674	8.09	1.33	7.59	1.63	4.83	0.76	4.81	0.74	0.25	0.15	1.3	21.3	13	47	5.3	-0.1	0.1	-0.1	-0.1	1.3
71675	8.1	1.36	8.36	1.67	4.9	0.77	4.96	0.76	0.24	0.25	1.4	23.5	13	47	5.6	-0.1	0.1	-0.1	-0.1	2.7
71676	8.23	1.39	7.98	1.66	4.78	0.8	5.12	0.73	0.21	0.22	1.3	22.8	14	58	4.9	-0.1	0.2	-0.1	-0.1	1.9
71677	6.71	1.17	7.44	1.4	4.03	0.64	4.12	0.65	0.17	0.88	1.9	24.8	16	53	7.4	-0.1	0.2	-0.1	-0.1	0.9
71678	7.67	1.3	7.65	1.59	4.68	0.75	4.73	0.71	0.16	1.16	1.6	23.4	14	54	8.3	-0.1	0.3	-0.1	-0.1	3.2
71679	8.08	1.35	7.97	1.65	4.89	0.77	4.8	0.72	0.22	1.37	1.5	24.9	15	55	12.7	-0.1	0.6	-0.1	-0.1	3.9
71681	7.71	1.28	7.23	1.54	4.53	0.7	4.77	0.69	0.19	1.13	1.2	22.7	15	50	9.8	-0.1	0.5	-0.1	-0.1	3.8
71682	7.63	1.29	7.6	1.61	4.69	0.74	4.81	0.7	0.2	0.96	1.8	25.9	16	51	10.7	-0.1	0.6	-0.1	-0.1	3.9
71683	7.23	1.25	7.12	1.5	4.57	0.69	4.39	0.67	0.23	1.1	1.1	20	17	52	11.7	-0.1	0.6	-0.1	-0.1	5.7
71629	6.28	1.08	6.69	1.3	3.81	0.6	3.93	0.58	0.44	0.08	1.4	16.7	18	23	8.4	0.6	0.3	-0.1	-0.1	1.9
71631	7.19	1.22	7.49	1.44	4.42	0.7	4.49	0.65	0.28	0.24	1	25.8	16	30	13.8	-0.1	0.7	-0.1	-0.1	1
71632	6.82	1.18	7.29	1.4	4.2	0.67	4.4	0.62	0.25	0.78	2.6	24.4	16	29	20.4	-0.1	1.5	-0.1	0.1	3.3

Table A5— Continued

Sample Number	Hg ppm	Tl ppm	Se ppm
71644	-0.01	-0.1	0.6
71645	-0.01	-0.1	-0.5
71646	-0.01	-0.1	0.8
71649	-0.01	0.2	1.3
71654	-0.01	0.1	1
71656	-0.01	0.1	0.7
71657	-0.01	-0.1	0.6
71658	-0.01	-0.1	1
71661	-0.01	-0.1	-0.5
71662	-0.01	-0.1	0.6
71663	-0.01	-0.1	-0.5
71664	-0.01	-0.1	-0.5
71665	-0.01	-0.1	0.6
71666	-0.01	-0.1	-0.5
71667	-0.01	-0.1	0.6
71668	-0.01	-0.1	0.5
71669	-0.01	-0.1	-0.5
71671	-0.01	-0.1	-0.5
71672	-0.01	-0.1	0.7
71673	-0.01	-0.1	0.6
71674	-0.01	-0.1	0.5
71675	-0.01	-0.1	0.6
71676	-0.01	-0.1	0.7
71677	-0.01	-0.1	0.5
71678	-0.01	-0.1	-0.5
71679	-0.01	-0.1	0.7
71681	-0.01	-0.1	0.6
71682	-0.01	-0.1	0.7
71683	-0.01	-0.1	-0.5
71629	-0.01	0.2	0.8
71631	-0.01	0.1	0.7
71632	-0.01	0.1	0.8

Table A5– Continued

Sample Number	BatchNumber	Acme	SiO ₂ wt%	Al ₂ O ₃ wt%	Fe ₂ O ₃ w%	MgO w%	CaO w%	Na ₂ O w%	K ₂ O w%	TiO ₂ w%	P ₂ O ₅ w%	MnO w%	Cr ₂ O ₃ w%	Ni ppm	Sc ppm	LOI wt%	Ba ppm	Be ppm
71633	SAN08002590		69.38	13.61	3.87	0.69	4.76	3.52	3.19	0.73	0.16	0.05	0.04	-20	9	4.7	487	1
71647	SAN08002590		67.47	13.79	5.11	0.77	2.87	3.80	5.02	0.88	0.22	0.05	0.02	-20	9	3.6	681	1
71648	SAN08002590		70.63	13.36	4.06	0.46	2.55	3.82	4.22	0.69	0.14	0.03	0.04	-20	7	4.2	605	2
71651	SAN08002590		70.37	13.10	4.15	0.69	2.99	3.59	4.11	0.77	0.16	0.04	0.03	-20	10	3.7	551	2
71652	SAN08002590		71.74	12.13	4.16	0.45	3.95	3.84	2.81	0.71	0.15	0.03	0.03	-20	7	4	363	2
71653	SAN08002590		70.41	13.90	3.37	0.63	5.69	3.03	2.07	0.69	0.15	0.03	0.03	-20	8	5.8	237	1
71655	SAN08002590		70.11	12.92	3.92	0.70	2.94	3.57	4.91	0.70	0.14	0.05	0.04	-20	9	2.9	651	1
71659	SAN08002590		69.37	12.20	3.93	0.34	5.42	4.06	3.83	0.65	0.12	0.04	0.04	-20	8	4.7	542	2
71684	SAN08002590		68.79	13.66	4.61	0.85	2.04	3.94	5.13	0.75	0.14	0.05	0.03	-20	9	2.3	726	3
71942	ACMESAN08003029		47.65	20.12	13.02	6.99	8.96	0.45	0.73	1.65	0.25	0.15	0.02	45	24	20	215	-1
71527	SAN08002590		46.57	19.68	14.27	5.76	6.28	2.42	2.16	2.24	0.39	0.23	0.01	51	31	8.9	301	2
71973	VAN10000428		51.87	18.42	13.29	5.87	2.75	4.09	1.66	1.56	0.25	0.20	0.04	67	42	5.6	243	2
71486	SAN08002590		79.63	14.93	3.20	0.01	0.89	0.04	0.03	1.17	0.08	0.01	0.01	-20	5	7.4	82	-1
71487	SAN08002590		83.73	13.05	1.75	-0.01	0.41	0.05	0.05	0.75	0.21	-0.01	0.02	-20	6	6.2	930	-1
71501	SAN08002590		81.17	12.57	4.86	0.01	0.27	0.05	0.05	0.83	0.16	-0.01	0.02	-20	4	7.6	505	-1
71499	SAN08002590		81.22	14.20	3.02	0.02	0.28	0.04	0.08	0.92	0.20	-0.01	0.02	-20	4	6.9	154	-1
71502	SAN08002590		78.07	15.66	4.71	0.01	0.31	0.09	0.08	0.87	0.20	-0.01	0.03	-20	5	8.3	261	-1
71944	ACMESAN08003029		53.07	17.79	11.92	5.13	8.11	0.48	1.84	1.32	0.18	0.13	0.02	34	28	17.8	346	-1
71485	SAN08002590		63.05	25.97	8.50	0.09	0.23	0.06	0.23	1.74	0.14	-0.01	0.01	-20	17	12.9	43	-1
71503	SAN08002590		76.94	16.82	4.46	0.01	0.46	0.04	0.04	0.96	0.24	-0.01	0.02	-20	6	8.6	414	-1
71504	SAN08002590		76.36	16.44	5.65	0.01	0.25	0.04	0.04	0.97	0.21	-0.01	0.03	-20	7	9.1	479	-1
71548	SAN08002590		68.10	14.36	5.56	0.81	2.42	1.96	5.68	0.84	0.19	0.07	0.01	-20	12	4.6	851	1
71551	SAN08002590		68.89	14.07	4.58	0.62	2.92	2.21	5.67	0.84	0.17	0.05	0.00	-20	11	4.1	795	2
71552	SAN08002590		68.01	14.17	4.95	0.49	3.13	2.30	5.82	0.87	0.20	0.06	0.01	-20	11	4.1	809	3
71553	SAN08002590		72.00	13.03	4.64	0.30	2.01	1.95	5.46	0.47	0.08	0.05	0.02	-20	10	3.3	1326	3
71554	SAN08002590		73.68	12.40	4.47	0.22	1.85	1.89	5.05	0.31	0.05	0.05	0.03	-20	9	3	1450	3
71505	SAN08002590		76.34	18.31	3.63	0.02	0.25	0.04	0.04	1.16	0.19	-0.01	0.02	-20	10	8.6	349	-1
71482	SAN08002590		62.28	11.22	5.34	1.33	12.31	0.87	5.76	0.59	0.17	0.10	0.04	-20	13	11	650	-1
71483	SAN08002590		66.02	11.95	8.66	2.56	5.91	0.24	3.61	0.78	0.14	0.10	0.02	-20	16	9.5	1157	1
71484	SAN08002590		68.17	16.91	8.63	1.39	1.59	0.23	1.77	1.06	0.23	0.02	0.02	-20	15	12.8	161	2
71488	SAN08002590		72.80	17.53	6.34	0.23	1.18	0.08	0.61	0.88	0.34	-0.01	0.03	-20	15	9	155	-1
71489	SAN08002590		71.78	16.07	6.48	0.57	0.71	0.15	2.97	0.99	0.25	0.02	0.02	-20	14	7.8	649	2

Table A5– Continued

Sample Number	Co	Cs	Ga	Hf	Nb	Rb	Sn	Sr	Ta	Th	U	V	W	Zr	Y	La	Ce	Pr	Nd	Sm	Eu
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
71633	7.2	2.7	17.3	12	37.1	123.7	4	79.7	2.4	21.1	3.3	34	0.9	461	41.1	42.6	87	10.18	40.1	7.28	0.9
71647	8.3	2.3	13.4	13	38.8	187.3	4	75.2	2.1	22.7	2.9	129	1.6	461	40.5	43.7	89	10.59	38.3	7.2	1.2
71648	7.2	2.4	10.2	13	32.5	157.3	4	60.7	2	19.9	2.8	104	2.1	455	39	40	84	9.78	36	6.49	0.9
71651	8.3	2.2	11.2	12	35.6	152.1	4	55.7	2.5	21.2	3	36	1.1	458	34.6	41.1	88	9.89	37.5	6.99	0.9
71652	7.5	1.2	11.1	12	34.5	104.4	4	47	2.5	21.4	3.2	67	1.5	421	40.7	44.5	90	10.62	39.8	6.94	0.9
71653	5.6	2.1	19.6	11	30.8	75.8	3	57.1	2.2	19.5	2.8	35	1.4	430	34.9	40.1	83	9.59	39.3	7.12	0.9
71655	6.8	2.1	14.2	13	36.2	201	4	68.3	2.4	21.3	3.4	33	1.1	470	37.7	44.8	93	10.56	40.4	7.62	1
71659	6.1	1.7	10.7	11	31	143.8	3	71.6	1.9	19.5	2.8	49	1.2	407	43.9	55.2	112	13.06	47.2	8.89	0.9
71684	8.1	1.6	16.1	14	41.2	225.4	5	67.8	2.7	26.5	3.3	53	1.1	576	42.8	45.6	96	11.21	42.1	7.67	1
71942	34	0.5	13.8	3.2	20.8	19	1	281	1.2	1.6	0.4	74	-0.5	124	28.2	11.7	25	3.38	15.8	3.95	1.4
71527	39.3	1.2	22.2	7	42.5	71.7	2	196	2.3	7.5	1.3	266	1	276	38.5	30.9	65	7.93	33	6.8	1.8
71973	36.8	6.1	25.4	6.2	23.5	62.5	5	125	1.4	7.6	1.6	198	1.5	210	53.9	37	83	9.35	37.9	8.22	1.7
71486	0.5	-0.1	28.5	13	50	1.1	8	51.2	3.2	21.4	1.5	76	3.2	474	29.6	40.8	77	8.22	31.3	5.49	0.7
71487	0.8	-0.1	15.6	8.9	32.2	2	3	106	2.1	19	1	41	2.4	318	22.6	57.4	96	9.62	33.2	4.9	0.7
71501	0.9	-0.1	14.3	8.3	31.6	2.1	5	33.1	2.2	11.6	0.8	42	1.9	321	19.3	26.9	55	6.32	24.8	4.84	0.7
71499	1.3	-0.1	15.8	9.5	36.1	2.9	5	39.7	2.6	14.4	0.7	42	2.8	360	24.1	31.6	65	7.99	33.1	6.65	1
71502	1.7	-0.1	17.2	12	40.3	2.5	5	25.7	2.7	12.8	0.6	39	1.8	433	13.2	26.1	50	5.48	20.7	3.92	0.6
71944	33.2	1	15.7	4.4	10.5	39.4	1	302	0.6	4.4	0.8	189	0.5	158	27.2	20.6	44	5.5	22.2	4.87	1.6
71485	6.2	0.1	25	21	63	9.5	9	68.2	3.4	33	4.5	75	2.6	737	68.3	82.5	168	20.07	78.4	14.46	2.2
71503	1.8	-0.1	18	16	45.5	1.8	5	28.8	2.8	20	0.7	33	1.8	598	9.2	29.3	49	3.34	11.8	2.98	0.5
71504	3.1	-0.1	17.5	14	39.8	1.5	6	74.4	2.6	24.8	1.4	37	1.8	532	11.4	70.8	149	16.46	55.9	9.22	1.1
71548	7.8	2.5	15.5	13	37.6	203.7	4	95.2	2.3	20	2.8	42	1.1	517	42.4	46.8	99	11.82	46.4	8.61	1.3
71551	7	2.6	18	13	38.2	233.5	6	93.4	2.5	23.8	3	60	1.2	470	48.8	50.5	105	12.23	47.3	8.44	1.3
71552	7.3	2.5	16.8	13	39.2	213	8	97.3	2.3	22.3	3	59	1	481	48.8	49.5	103	12.16	45.8	8.76	1.3
71553	3.4	2.3	17.5	14	33.6	205.5	5	106	2.1	22	2.8	27	1.1	512	60.6	68.9	147	18.1	72	12.99	2.2
71554	1.9	2.2	18.4	15	33.6	190.8	4	107	2	21.7	2.2	14	0.6	532	64.7	75	159	19.82	80.2	14.31	2.4
71505	2.3	-0.1	20.4	21	41.3	1.6	6	61.2	2.7	19.2	1.8	40	2.1	741	35.5	42.2	91	10.91	45.6	9.08	1.4
71482	8.9	0.4	15	7.4	15.4	149.4	2	171	0.9	10	1.5	99	0.9	300	34.1	36.3	78	9.66	36.8	6.76	1.5
71483	15.4	0.9	21.5	7.6	19.4	107.1	3	50.6	1.2	12.2	2.2	123	1.6	276	39.1	34.1	74	9.11	35.7	6.76	1.2
71484	11.8	2	17.6	13	35.7	79	4	55.5	2.3	21.8	4.1	100	2.6	483	50.6	46.2	97	11.35	42.1	7.95	1.4
71488	8.9	0.6	15.6	13	35.4	30.5	4	62.4	2.3	21.3	4.1	60	2.6	486	67.2	50.1	110	13.59	55.7	10.9	1.6
71489	11.1	1	16.9	15	41.1	85.1	4	50.1	2.7	25.2	5.8	41	2.7	538	52.8	51.7	109	12.89	52.4	9.46	1.4

Table A5– Continued

Sample Number	Gd ppm	Tb ppm	Dy ppm	Ho ppm	Er ppm	Tm ppm	Yb ppm	Lu ppm	TOT/C wt%	TOT/S wt%	Mo ppm	Cu ppm	Pb ppm	Zn ppm	As ppm	Cd ppm	Sb ppm	Bi ppm	Ag ppm	Au ppb
71633	6.67	1.14	7.29	1.42	4.19	0.69	4.4	0.66	0.48	0.45	1.6	17.5	16	26	8.6	-0.1	0.4	-0.1	-0.1	1.6
71647	6.65	1.09	6.82	1.35	3.91	0.62	3.93	0.6	0.38	1.19	2.9	25	15	40	20.9	-0.1	0.7	-0.1	0.1	3.7
71648	5.95	1.07	6.48	1.33	3.97	0.62	4.15	0.6	0.2	1.62	3.3	20.5	21	24	27	-0.1	1.5	-0.1	0.1	4.4
71651	6.58	1.13	6.76	1.34	3.93	0.66	4.07	0.61	0.28	1.51	3.8	25	21	28	23.5	-0.1	0.9	-0.1	-0.1	2.7
71652	6.7	1.18	7.02	1.32	3.97	0.62	4.05	0.59	0.42	1.64	3.4	21.6	21	26	28.5	-0.1	1.2	-0.1	-0.1	3.3
71653	6.66	1.12	6.33	1.31	3.81	0.6	3.74	0.57	0.34	0.58	1.7	16.2	13	25	13.5	-0.1	0.3	-0.1	-0.1	1.9
71655	7.32	1.22	7.17	1.38	4.09	0.65	4.28	0.6	0.31	0.58	2.2	19.5	18	48	18.7	-0.1	0.6	-0.1	0.1	3.4
71659	8.16	1.26	7.25	1.4	4.08	0.61	3.77	0.56	0.87	1.53	8.6	25	16	29	41	-0.1	1.9	-0.1	-0.1	6.2
71684	7.61	1.27	7.22	1.55	4.45	0.73	4.5	0.71	0.25	0.7	35.2	22.9	19	46	19.9	-0.1	0.7	-0.1	-0.1	4.3
71942	4.66	0.83	5.12	1.04	3.04	0.46	2.86	0.44	1.19	3.76	-0.1	69.2	2.2	66	1	0.1	-0.1	-0.1	-0.1	0.9
71527	6.8	1.2	6.65	1.39	3.96	0.6	3.68	0.58	0.46	1.04	1.6	65.1	11	92	5.3	1	-0.1	0.5	-0.1	-0.5
71973	8.87	1.64	9.94	2.06	5.83	0.95	5.71	0.87	0.11	0.18	0.4	196	8	126	6	0.1	0.2	0.1	0.2	1.4
71486	5.22	0.79	4.63	0.99	3.24	0.54	3.69	0.57	0.16	2.03	2	6	7.9	3	12.1	-0.1	-0.1	-0.1	-0.1	-0.5
71487	4.05	0.67	3.74	0.82	2.54	0.44	2.68	0.43	-0.02	1.1	1	3.9	7.8	2	3.3	-0.1	-0.1	-0.1	-0.1	0.5
71501	4.27	0.62	3.52	0.76	2.32	0.39	2.33	0.36	-0.02	3.28	6.5	3.9	14	7	5.3	-0.1	0.1	1.3	-0.1	1.4
71499	5.93	0.9	4.66	0.97	3.01	0.5	3.06	0.45	-0.02	2.04	3.7	5.4	15	11	4.1	-0.1	0.1	0.9	-0.1	1.3
71502	3.36	0.5	2.51	0.52	1.57	0.26	1.66	0.26	-0.02	2.92	6.8	5.2	16	11	5.2	-0.1	0.1	0.8	-0.1	1.8
71944	4.91	0.85	5	1.03	2.9	0.45	2.8	0.41	1.1	3.98	0.3	78.7	5.5	68	0.8	0.2	-0.1	0.1	-0.1	-0.5
71485	12.2	1.93	11.29	2.33	6.96	1.13	7.27	1.07	-0.02	5.02	0.9	20.1	35	6	10.6	0.2	0.1	2.9	-0.1	-0.5
71503	2.72	0.44	2.18	0.39	1.17	0.2	1.3	0.19	0.02	2.96	6.1	9	24	4	6.6	-0.1	0.1	3.3	-0.1	4.4
71504	5.55	0.7	2.96	0.49	1.52	0.28	1.83	0.28	-0.02	3.63	4	10.3	24	8	11.2	0.1	0.1	4.2	-0.1	2.7
71548	7.88	1.4	8.46	1.67	4.86	0.74	4.64	0.71	0.28	-0.02	0.3	22.3	9	32	7.6	-0.1	-0.1	0.2	-0.1	-0.5
71551	8.05	1.36	7.89	1.7	4.89	0.76	4.97	0.71	0.4	0.04	0.2	22.6	6.8	29	8.6	0.2	-0.1	0.1	-0.1	3.7
71552	8.45	1.39	8.07	1.65	4.92	0.78	4.79	0.71	0.46	0.1	0.3	19.8	8.4	26	5.9	0.1	-0.1	0.1	-0.1	-0.5
71553	11.6	1.9	10.7	2.12	6.17	0.98	6.12	0.87	0.22	0.03	0.2	7.5	4.8	29	5.8	-0.1	-0.1	0.3	-0.1	0.8
71554	13	2.08	11.87	2.37	6.6	1.05	6.62	0.96	0.18	0.03	0.2	2.3	4.4	26	4.9	-0.1	-0.1	0.4	-0.1	-0.5
71505	8.06	1.2	6.14	1.26	3.91	0.6	3.69	0.57	-0.02	2.19	3	10.8	18	7	15.5	-0.1	-0.1	8	-0.1	2.9
71482	5.99	1.04	5.78	1.15	3.42	0.51	2.98	0.48	1.81	0.33	3.3	14.8	6.1	55	1.4	-0.1	-0.1	0.1	-0.1	3.3
71483	6.38	1.08	6.31	1.29	3.93	0.59	3.51	0.53	0.25	0.67	2.8	30.2	9.9	51	5.2	0.8	-0.1	0.6	-0.1	0.6
71484	7.95	1.4	8.17	1.73	5.18	0.75	4.72	0.7	0.03	4.11	4.4	25.6	21	36	7.5	0.3	-0.1	0.5	-0.1	1
71488	11	1.86	10.8	2.11	6.07	0.94	5.28	0.79	-0.02	3.48	2.1	45.1	24	26	10.1	-0.1	0.1	0.8	-0.1	0.8
71489	8.79	1.53	8.68	1.79	5.36	0.77	4.76	0.74	-0.02	1.85	0.9	55.5	19	98	4.4	0.7	-0.1	6.3	-0.1	-0.5

Table A5– Continued

Sample Number	Hg ppm	Tl ppm	Se ppm
71633	-0.01	0.2	0.6
71647	-0.01	-0.1	0.8
71648	-0.01	0.1	0.9
71651	-0.01	0.1	0.8
71652	-0.01	0.2	0.9
71653	-0.01	-0.1	0.9
71655	-0.01	0.1	1
71659	-0.01	0.2	1.6
71684	-0.01	0.3	0.7
71942	0.01	-0.1	-0.5
71527	-0.01	0.4	-0.5
71973	0.01	0.1	0.5
71486	-0.01	0.2	1.3
71487	-0.01	-0.1	0.8
71501	-0.01	0.2	-0.5
71499	-0.01	0.3	-0.5
71502	-0.01	0.3	-0.5
71944	0.04	0.6	-0.5
71485	0.16	1.3	1.4
71503	-0.01	0.2	-0.5
71504	0.01	0.4	-0.5
71548	-0.01	0.1	-0.5
71551	-0.01	-0.1	-0.5
71552	-0.01	-0.1	-0.5
71553	-0.01	-0.1	-0.5
71554	-0.01	-0.1	0.7
71505	-0.01	0.3	-0.5
71482	0.02	1.5	-0.5
71483	0.08	3.3	3.5
71484	0.1	1.5	0.9
71488	0.01	1	0.9
71489	0.01	0.8	-0.5

Table A5– Continued

Sample Number	BatchNumber	Acme	SiO2 wt%	Al2O3 wt%	Fe2O3 w%	MgO w%	CaO w%	Na2O w%	K2O w%	TiO2 w%	P2O5 w%	MnO w%	Cr2O 3 w%	Ni ppm	Sc ppm	LOI wt%	Ba ppm	Be ppm
71491	SAN08002590		71.01	15.32	7.09	0.47	0.48	0.19	4.25	0.92	0.21	0.03	0.01	-20	13	6.6	869	2
71492	SAN08002590		71.03	14.82	5.82	0.46	1.20	0.25	5.24	0.83	0.32	0.03	0.01	-20	12	6.1	1153	2
71493	SAN08002590		68.49	14.21	4.65	0.58	1.64	0.54	8.75	0.86	0.24	0.04	0.01	-20	12	3.3	1051	2
71494	SAN08002590		66.00	14.32	5.45	0.75	2.35	0.82	9.14	0.89	0.21	0.06	0.01	-20	11	4	946	2
71495	SAN08002590		69.43	13.83	5.58	0.76	1.07	0.56	7.69	0.83	0.20	0.04	0.02	-20	10	4.7	852	2
71496	SAN08002590		66.56	14.45	5.85	0.80	1.20	1.03	8.97	0.90	0.19	0.05	0.02	-20	11	3	858	3
71497	SAN08002590		66.41	14.53	4.86	0.54	2.49	0.90	9.14	0.90	0.20	0.03	0.01	-20	11	3.7	1517	2
71498	SAN08002590		73.19	16.43	6.15	0.64	0.41	0.15	1.74	1.05	0.18	0.03	0.02	-20	13	7.5	226	3
71506	SAN08002590		78.29	16.40	3.10	0.12	0.72	0.12	0.22	0.83	0.19	-0.01	0.02	-20	7	8.5	73	2
71536	SAN08002590		67.64	14.45	5.60	1.76	1.17	1.09	7.18	0.84	0.17	0.07	0.01	-20	10	3.9	675	1
71543	SAN08002590		67.16	17.92	4.41	0.93	2.15	0.51	5.79	0.84	0.24	0.05	0.01	-20	13	7.2	714	2
71544	SAN08002590		70.22	13.71	4.56	0.65	2.54	0.70	6.60	0.77	0.18	0.07	0.01	-20	11	5.2	959	1
71545	SAN08002590		67.97	15.41	5.49	0.97	2.05	0.79	6.18	0.85	0.19	0.09	0.01	-20	12	6.6	921	1
71546	SAN08002590		68.84	14.14	5.18	0.73	2.65	1.45	6.00	0.78	0.16	0.07	0.01	20	11	4.9	895	1
71547	SAN08002590		69.64	14.02	4.94	0.77	2.41	1.47	5.78	0.74	0.16	0.06	0.01	-20	10	4.8	844	1
71549	SAN08002590		69.98	13.96	4.50	0.71	3.44	1.92	4.58	0.69	0.15	0.06	0.01	-20	10	5.5	742	2
79497	SAN08003031		45.48	15.57	16.02	6.98	8.53	3.33	0.75	2.72	0.32	0.28	0.02	30	44	7.1	183	-1
79542	SAN08003061		46.56	15.85	13.35	8.02	10.33	2.63	0.82	1.93	0.27	0.20	0.03	51	37	6.3	230	-1
79658	SAN08003062		44.60	15.06	15.95	5.10	9.74	3.61	1.36	3.55	0.67	0.34	0.01	-20	32	6.3	337	-1
79660	SAN08003062		45.03	14.70	16.47	5.80	9.30	2.99	1.16	3.60	0.67	0.30	0.00	-20	32	6	244	-1
79699	SAN08003062		45.99	14.23	15.92	5.37	9.11	3.37	1.61	3.44	0.67	0.28	0.01	-20	30	6.3	414	1
79783	SAN08003060		46.95	16.26	11.60	7.47	11.44	3.06	0.87	1.84	0.28	0.18	0.05	87	31	6.9	256	2
79805	SAN08003060		46.83	16.64	11.88	8.25	10.63	2.60	0.77	1.68	0.41	0.21	0.09	149	29	7.7	246	-1
71733	SAN08003031		67.10	14.44	5.23	0.53	3.40	2.79	5.34	0.89	0.18	0.06	0.04	-20	10	4.2	781	1
71853	SAN08003031		65.31	14.52	5.99	1.91	3.01	3.10	5.05	0.85	0.15	0.09	0.03	-20	15	7.1	596	2
79457	SAN08003031		66.91	13.43	4.08	0.64	5.59	2.93	5.44	0.75	0.15	0.06	0.02	-20	8	6.4	701	2
79473	SAN08003031		67.84	14.35	4.85	1.37	1.72	2.77	6.00	0.83	0.18	0.07	0.03	-20	10	3.2	784	1
79486	SAN08003031		67.58	14.39	5.60	1.04	1.68	2.75	5.80	0.88	0.18	0.06	0.04	-20	11	3	825	2
79529	SAN08003061		67.13	14.36	5.03	1.01	2.52	2.77	6.07	0.85	0.17	0.07	0.03	-20	10	3.1	730	1
79572	SAN08003061		68.04	14.07	4.73	1.05	2.21	3.00	5.92	0.75	0.12	0.06	0.04	-20	9	2.7	655	1
79606	SAN08003061		68.46	13.96	4.68	1.15	2.28	2.63	5.86	0.75	0.16	0.03	0.05	49	8	4.1	619	1
79634	SAN08003062		67.00	14.20	5.12	1.06	2.40	3.62	5.51	0.83	0.15	0.06	0.04	-20	10	2.6	666	1

Table A5– Continued

Sample Number	Co ppm	Cs ppm	Ga ppm	Hf ppm	Nb ppm	Rb ppm	Sn ppm	Sr ppm	Ta ppm	Th ppm	U ppm	V ppm	W ppm	Zr ppm	Y ppm	La ppm	Ce ppm	Pr ppm	Nd ppm	Sm ppm	Eu ppm
71491	9.1	1.1	16.8	14	39.5	122.4	4	43.9	2.4	23.5	4.8	35	3	525	46.8	50.6	103	12.11	49.8	8.67	1.3
71492	8.1	1.6	15.5	13	35.9	160.3	4	46.2	2.3	22.5	4.2	31	2.1	476	43	49.2	99	11.68	46.1	8.4	1.3
71493	11	1.8	15.6	13	37.1	271.1	4	24.4	2.4	21.5	3.6	32	1.9	487	45.4	45.9	95	11.31	43.7	7.95	1.1
71494	11.9	2.1	15.5	13	37.2	307.3	4	27.7	2.5	23.1	3.2	28	1.9	489	43	44.9	93	11.14	46.1	7.88	1.1
71495	15.6	2.6	15.1	12	35.2	264.3	4	32.1	2.2	21.2	3.1	30	1.8	479	40.3	44.6	90	10.54	41.2	7.13	1.1
71496	10.6	2.9	17	14	37.4	310.7	4	31.1	2.6	22.4	3	44	1.9	510	43	45.9	95	11.24	43.9	8.04	1.1
71497	10.3	2.4	15.8	13	38.2	293.7	4	32.8	2.6	21.6	3.5	41	2.4	521	45.6	45.5	94	11.17	44.6	8.02	1.1
71498	7.7	1.4	18.7	16	41.9	73.4	5	53.1	3	26.3	2.9	42	4	597	45.1	53.2	112	13	52.5	9.22	1.2
71506	1.5	0.6	20.7	12	27.7	11.5	4	55.5	1.7	14	1.3	40	1.6	469	22.5	37.3	82	7.52	28.7	5.29	0.9
71536	7.5	2.4	15.1	13	35.6	278.5	3	52.5	2.2	20.2	2.9	96	1.2	463	37	42.4	89	10.17	37.3	6.84	1
71543	8.5	2.8	21.2	15	39.4	225.7	6	60.3	2.5	27	4.2	49	1.4	553	60.5	69.8	149	17.65	68.5	12.77	2.1
71544	6.5	2.6	14.9	13	33.5	240.1	5	71.2	2.1	22.4	2.8	40	1.4	493	41.8	51.9	111	12.94	50.4	9.27	1.4
71545	8.5	1.9	15.3	13	37.6	206.8	4	80.7	2.3	23	3.4	47	1.3	520	37.3	52	110	12.68	49.8	8.79	1.3
71546	7.4	2.6	15.7	13	35.7	220.3	4	91.2	2.1	21.9	3.3	40	1.1	512	44.7	51.6	108	12.67	50.2	9.17	1.4
71547	6.3	2.6	14	12	31.5	195.5	4	79.9	2	21	2.5	32	1.5	452	37.6	47.3	99	11.55	44.4	8.23	1.2
71549	7.1	2.3	16.2	12	31.9	170.8	6	91	2	21.5	4	59	1.1	445	47.9	49.6	105	12.34	46.7	8.64	1.3
79497	45.2	0.8	20.4	3.6	25.9	20.1	1	197	1.6	1.8	0.5	420	1.1	145	34.7	15.5	32	4.36	20.4	5.07	1.8
79542	41.8	5.1	18.4	3.2	25.4	17.4	-1	310	1.7	1.9	0.4	283	0.7	111	23.1	14.7	29	3.89	17.7	3.91	1.4
79658	37.6	1.3	21.7	4.3	43.3	45.1	1	114	2.5	2.5	0.7	376	3.8	177	35.2	21.9	48	6.31	28.8	6.76	2.4
79660	39.4	0.5	22.9	4.6	45.2	33.9	1	280	2.8	3	0.8	375	2.2	178	30.9	23.9	51	6.88	30.9	6.61	2.3
79699	37.2	0.9	20.4	4.9	45.8	56	2	171	2.7	2.5	0.7	356	1.5	180	31.6	24.8	52	7	30.6	6.8	2.4
79783	38.5	7	16.5	3.2	25	18.6	2	439	1.2	2.1	0.5	248	0.6	136	24.8	16.7	34	4.73	20.6	4.37	1.4
79805	43	0.7	15.9	3.6	35.3	15.3	1	305	2	3.1	0.6	200	1	150	28.3	20.4	41	5.38	22.3	4.55	1.5
71733	9.8	3.4	18.8	13	40.4	217.6	4	85.3	2.6	22.5	3	60	1.4	522	44.7	48.3	100	11.78	43.1	8.09	1.2
71853	13.6	2.7	16.5	11	32.3	200.4	4	84	2.2	22.1	3.4	81	1.4	434	41.3	41.6	86	10.06	36.7	7.1	1
79457	6.3	2.3	16.4	12	34.9	205.4	3	75.1	2.3	20.7	3.3	39	1.2	489	37.8	41	84	9.86	35.8	6.86	1
79473	8.4	2.7	16.1	14	38.8	233.8	4	85.1	2.6	22.4	3.3	47	1.1	551	45.9	45.6	94	11.04	40.1	7.65	1.1
79486	8.5	2.4	15.6	13	39.5	224.6	6	85.2	2.6	22.3	3.1	51	1.8	543	44.7	47	97	11.35	41	7.98	1.1
79529	8.5	3.1	15.3	13	38.9	224	4	104	2.5	20.1	3	45	1.1	494	41.6	42.4	90	10.71	38.8	7.15	1
79572	6.6	2	15.1	12	35.1	220.7	3	60.7	2.3	20.1	3.2	38	1.2	456	37.9	40.3	85	10.1	37	6.88	0.9
79606	7.3	2.6	14.2	12	36.3	222.5	3	79.5	2.6	21.9	3.3	43	1.6	449	38.2	41.2	86	10.22	38	6.85	0.9
79634	8.4	1.8	15	13	36.1	201.3	4	75.7	2.4	20.3	3	47	1.3	456	43.1	42.5	88	10.57	38	7.2	1

Table A5– Continued

Sample Number	Gd ppm	Tb ppm	Dy ppm	Ho ppm	Er ppm	Tm ppm	Yb ppm	Lu ppm	TOT/C wt%	TOT/S wt%	Mo ppm	Cu ppm	Pb ppm	Zn ppm	As ppm	Cd ppm	Sb ppm	Bi ppm	Ag ppm	Au ppb
71491	7.98	1.35	7.84	1.6	4.86	0.75	4.65	0.7	-0.02	2.13	0.2	34.4	16	52	2.7	0.5	-0.1	3.4	-0.1	-0.5
71492	7.74	1.28	7.33	1.51	4.37	0.71	4.21	0.64	0.05	2.64	0.3	24.2	14	36	2.6	0.7	-0.1	0.5	-0.1	1.2
71493	7.44	1.27	7.4	1.54	4.68	0.71	4.43	0.67	0.14	0.79	0.2	25.7	11	42	2	1.1	-0.1	-0.1	-0.1	0.6
71494	7.3	1.23	7.1	1.51	4.46	0.69	4.27	0.65	0.27	0.19	0.3	24.9	9.1	44	2.3	1.3	-0.1	-0.1	-0.1	-0.5
71495	6.62	1.15	6.96	1.41	4.35	0.66	4.16	0.61	0.09	2.03	0.3	26.8	12	51	4.2	1.5	-0.1	-0.1	-0.1	-0.5
71496	7.23	1.25	7.28	1.51	4.67	0.72	4.32	0.65	0.03	0.07	0.4	26.2	6.4	55	2.2	0.5	-0.1	0.7	-0.1	-0.5
71497	7.37	1.28	7.57	1.55	4.82	0.73	4.42	0.67	0.1	0.43	0.5	26.1	11	53	2.8	0.6	0.1	-0.1	-0.1	0.9
71498	7.78	1.31	7.74	1.57	4.77	0.76	4.73	0.73	-0.02	1.45	1.2	24.8	20	39	3.4	0.2	-0.1	0.3	-0.1	0.6
71506	4.18	0.69	3.79	0.8	2.59	0.43	2.6	0.41	-0.02	1.3	1.7	6.8	24	6	11.6	-0.1	-0.1	3.7	-0.1	1.7
71536	6.02	1.11	6.58	1.37	4.05	0.66	4.1	0.6	0.09	0.04	0.2	22.6	6.1	41	2.9	3.8	-0.1	-0.1	-0.1	-0.5
71543	11.5	2	11.86	2.35	6.78	1.06	6.36	0.98	0.27	0.18	0.3	20.1	34	30	12	0.3	-0.1	0.7	-0.1	3.7
71544	8.16	1.44	8.31	1.65	4.7	0.77	4.76	0.74	0.49	0.06	0.1	19.3	11	30	6.1	0.2	-0.1	0.2	-0.1	0.6
71545	7.44	1.32	7.75	1.51	4.55	0.74	4.62	0.71	0.36	0.12	0.1	21	14	41	7.9	0.2	-0.1	0.2	-0.1	1.5
71546	8.13	1.46	8.57	1.74	5.14	0.81	5.08	0.77	0.4	0.04	0.1	17.1	9.6	27	7.6	-0.1	-0.1	0.2	-0.1	-0.5
71547	7.09	1.3	7.53	1.48	4.33	0.68	4.28	0.65	0.33	0.09	0.2	13.2	9	29	8	0.2	-0.1	0.2	-0.1	-0.5
71549	7.99	1.38	8.22	1.68	4.7	0.78	4.81	0.71	0.43	0.08	0.1	15.1	14	39	7.8	0.5	-0.1	0.1	-0.1	1.4
79497	5.9	1	5.75	1.24	3.43	0.52	3.19	0.47	0.5	0.09	0.6	11.1	1.6	71	-0.5	0.1	-0.1	-0.1	-0.1	1
79542	4.34	0.62	4.31	0.87	2.61	0.37	2.22	0.34	0.19	-0.02	0.6	118	1.5	59	1.5	-0.1	-0.1	-0.1	-0.1	-0.5
79658	7.12	1.03	6.61	1.29	4.07	0.56	3.41	0.51	0.52	-0.02	5.5	35.5	2.4	57	2.8	0.1	-0.1	-0.1	-0.1	-0.5
79660	7.17	1.02	7.02	1.41	3.71	0.58	3.58	0.5	0.28	0.03	10.1	37.7	2.2	83	2.8	-0.1	-0.1	-0.1	-0.1	2.9
79699	7.05	1.01	7.28	1.42	3.88	0.57	3.5	0.5	0.49	0.04	1.8	35.6	2.1	74	-0.5	0.1	-0.1	-0.1	-0.1	-0.5
79783	4.71	0.65	4.57	0.87	2.57	0.35	2.3	0.34	0.36	0.15	0.5	90.9	1.9	57	3.6	-0.1	-0.1	-0.1	-0.1	-0.5
79805	5.09	0.71	4.86	1	3.07	0.42	2.63	0.41	0.3	0.09	1.3	82.3	2.1	58	2.3	0.1	-0.1	-0.1	-0.1	0.9
71733	7.37	1.28	7.14	1.52	4.44	0.71	4.46	0.64	0.93	1.02	0.4	25.6	4	27	4.6	-0.1	-0.1	-0.1	-0.1	-0.5
71853	6.44	1.15	6.6	1.44	4.23	0.7	4.38	0.65	1.36	1.11	0.4	68.1	9.5	66	12.5	0.1	0.1	-0.1	-0.1	-0.5
79457	6.35	1.12	6.47	1.39	4.11	0.65	4.13	0.61	1.17	0.09	0.3	24.4	6.5	29	2.8	-0.1	0.1	-0.1	-0.1	-0.5
79473	7.06	1.26	7.27	1.57	4.69	0.73	4.48	0.66	0.21	0.4	0.3	25.9	10	43	6.1	-0.1	0.1	-0.1	-0.1	5.4
79486	7.2	1.27	7.37	1.52	4.53	0.74	4.57	0.68	0.27	0.38	1.1	14.1	12	48	12.4	0.2	-0.1	-0.1	-0.1	-0.5
79529	6.95	1.01	7.02	1.42	4.49	0.68	4.28	0.65	0.21	0.14	0.2	35.8	9.8	38	1.8	-0.1	-0.1	-0.1	-0.1	3.8
79572	6.26	0.91	6.34	1.26	4.11	0.59	3.79	0.59	0.28	0.08	0.8	24.1	14	50	3.6	-0.1	0.2	0.1	-0.1	-0.5
79606	6.41	0.93	6.48	1.27	4.05	0.64	3.95	0.59	0.13	1.49	1.5	23	10	11	18	-0.1	0.4	-0.1	-0.1	-0.5
79634	6.69	1	6.84	1.41	4.38	0.67	4.38	0.65	0.25	0.77	0.6	24.1	16	42	9.7	-0.1	0.2	-0.1	-0.1	-0.5

Table A5– Continued

Sample Number	Hg ppm	Tl ppm	Se ppm
71491	-0.01	0.7	-0.5
71492	0.01	0.8	-0.5
71493	0.01	0.8	-0.5
71494	0.01	0.8	-0.5
71495	0.02	1.5	-0.5
71496	-0.01	0.9	-0.5
71497	-0.01	1.5	0.5
71498	-0.01	0.7	-0.5
71506	-0.01	0.2	-0.5
71536	-0.01	0.1	-0.5
71543	-0.01	0.2	-0.5
71544	-0.01	0.1	-0.5
71545	-0.01	-0.1	-0.5
71546	-0.01	-0.1	-0.5
71547	-0.01	-0.1	-0.5
71549	-0.01	-0.1	-0.5
79497	-0.01	-0.1	-0.5
79542	-0.01	-0.1	-0.5
79658	-0.01	-0.1	-0.5
79660	-0.01	-0.1	-0.5
79699	-0.01	-0.1	-0.5
79783	-0.01	-0.1	-0.5
79805	-0.01	-0.1	-0.5
71733	-0.01	-0.1	-0.5
71853	-0.01	-0.1	-0.5
79457	-0.01	-0.1	-0.5
79473	-0.01	-0.1	-0.5
79486	-0.01	-0.1	-0.5
79529	-0.01	-0.1	-0.5
79572	-0.01	-0.1	-0.5
79606	-0.01	0.2	-0.5
79634	-0.01	-0.1	-0.5

Table A5– Continued

Sample Number	BatchNumber	Acme	SiO2 wt%	Al2O3 wt%	Fe2O3 w%	MgO w%	CaO w%	Na2O w%	K2O w%	TiO2 w%	P2O5 w%	MnO w%	Cr2O3 w%	Ni ppm	Sc ppm	LOI wt%	Ba ppm	Be ppm
79649	SAN08003062		68.25	13.89	5.04	1.15	1.77	2.88	5.91	0.85	0.16	0.06	0.03	22	11	2.4	738	2
79653	SAN08003062		67.66	14.18	4.88	0.98	2.09	3.52	5.59	0.82	0.17	0.07	0.04	-20	10	2.2	713	2
79654	SAN08003062		67.25	14.45	4.99	1.06	2.12	3.40	5.59	0.86	0.17	0.07	0.03	-20	10	2.1	742	1
79655	SAN08003062		69.11	14.09	4.10	0.91	1.66	2.85	6.37	0.70	0.12	0.05	0.04	-20	9	1.8	744	1
79657	SAN08003062		67.58	14.38	4.68	1.00	2.15	3.29	5.87	0.79	0.15	0.07	0.04	-20	10	2.4	712	1
79659	SAN08003062		67.83	13.99	4.61	0.82	2.48	3.43	5.77	0.80	0.16	0.06	0.05	-20	10	2.3	671	1
79677	SAN08003062		67.71	14.43	5.05	1.08	1.81	3.01	5.83	0.80	0.15	0.08	0.04	-20	10	2	723	1
79695	SAN08003062		67.98	14.51	5.05	0.94	1.30	3.04	6.15	0.79	0.14	0.05	0.04	-20	10	2.3	833	1
79722	SAN08003062		68.73	14.49	4.89	0.45	1.00	3.00	6.39	0.77	0.16	0.03	0.09	-20	9	1.9	785	1
79736	SAN08003062		68.38	14.37	5.04	0.77	1.15	3.21	6.04	0.78	0.14	0.06	0.05	-20	10	1.6	760	2
79762	SAN08003060		69.15	13.85	4.52	1.05	1.56	3.07	5.81	0.77	0.11	0.06	0.04	-20	9	1.9	737	1
79810	SAN08003060		67.81	14.21	4.78	0.89	2.83	2.91	5.48	0.80	0.14	0.07	0.07	-20	9	2.9	648	1
79835	SAN08003060		70.30	13.59	4.24	0.90	1.49	3.44	5.08	0.73	0.13	0.06	0.04	-20	8	1.8	621	-1
79859	SAN08003060		69.12	14.08	4.40	0.79	1.75	3.15	5.77	0.72	0.11	0.06	0.05	21	8	2	608	2
71684B	SAN08003031		67.02	14.04	4.98	1.89	3.36	2.12	5.48	0.83	0.19	0.09	0.01	-20	10	5.8	792	2
71708	SAN08003031		65.91	15.71	6.26	1.17	3.01	1.40	4.95	1.21	0.28	0.10	0.02	-20	14	9	685	2
71745	SAN08003031		66.68	15.19	5.82	1.15	2.46	1.99	5.49	0.96	0.20	0.02	0.03	-20	10	8.4	756	1
71783	SAN08003031		68.04	15.59	4.60	1.03	2.36	1.62	5.47	0.98	0.22	0.09	0.01	-20	11	7.1	701	2
71802	SAN08003031		67.05	15.02	5.38	1.08	2.54	2.04	5.71	0.92	0.19	0.06	0.01	-20	10	5.9	779	2
71816	SAN08003031		67.51	14.16	4.93	1.27	4.40	1.86	4.78	0.82	0.18	0.08	0.02	-20	9	8.4	638	2
71840	SAN08003031		67.20	13.95	4.77	0.98	3.48	2.39	6.18	0.79	0.15	0.07	0.03	-20	9	6.2	771	-1
79652	SAN08003062		47.56	17.27	12.94	5.29	11.30	2.65	0.61	1.87	0.22	0.20	0.07	53	40	3.7	167	-1
79820	SAN08003060		51.72	15.64	10.67	6.23	8.50	3.28	1.95	1.47	0.26	0.22	0.05	82	28	5.9	330	-1
71820	SAN08003031		52.23	16.62	14.02	1.92	5.31	3.75	2.30	2.97	0.64	0.24	0.01	-20	24	10.6	1074	3
71906	SAN08002928		50.01	17.75	9.97	6.12	11.83	2.53	0.50	1.00	0.10	0.16	0.03	71	36	4.2	156	-1
71907	SAN08002928		50.26	17.54	10.94	4.78	10.51	2.71	1.22	1.63	0.22	0.18	0.02	48	33	4.5	305	1
71904*	SAN08002928		56.40	13.68	11.99	3.57	7.64	2.70	2.24	1.43	0.13	0.18	0.02	-20	35	2.2	321	2
71905	SAN08002928		55.68	15.70	10.08	3.65	8.65	2.64	1.97	1.28	0.16	0.15	0.03	28	31	2	420	2
71903	SAN08002928		73.25	12.01	5.10	0.37	1.34	2.21	4.98	0.51	0.08	0.09	0.06	-20	14	1.5	870	3

Table A5– Continued

Sample Number	Co	Cs	Ga	Hf	Nb	Rb	Sr	Ta	Th	U	V	W	Zr	Y	La	Ce	Pr	Nd	Sm	Eu
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
79649	9.9	1.2	13.3	12	36.5	211.9	3	81.1	2.6	18.6	2.9	46	1.2	425	41.2	40.8	87	10.49	39.4	7.11
79653	9	2.2	15.5	13	39.1	217	4	87.4	2.7	21.6	3.1	48	1.5	498	44.7	42.8	91	10.91	41.9	7.53
79654	8.5	3.1	17.5	12	40.1	212.8	5	96.6	2.7	21.6	3.3	50	1.5	480	44.8	45.1	94	11.25	40.9	7.61
79655	7.2	3.1	14.9	14	42.1	246	6	75.2	3	23	3.6	38	1.4	511	40.6	43.4	91	10.74	39.8	7.29
79657	8.5	4.5	15.4	14	38.7	219.3	4	87.1	2.6	21.4	3.4	45	2.4	519	38.9	41.4	88	10.33	38.6	7.19
79659	8.6	3.2	16.1	14	40.2	217.8	4	81.8	2.7	24.7	3.9	47	1.3	523	38.8	41.6	87	10.29	38.9	7.28
79677	8.4	2.9	17.4	14	38.7	215.5	5	82.9	2.5	24.5	3.4	57	2	498	34.7	45.2	95	11.09	42.3	7.57
79695	8.4	2.8	16.8	15	39.5	221.3	5	78.5	2.4	25	3.5	53	1.8	535	34.9	45.9	95	11.52	44.4	7.41
79722	8.7	4	16.5	14	39.1	236.2	4	83.8	2.5	24.4	3.5	50	1.8	527	35.4	45.1	96	11.26	43	7.38
79736	8.5	3.4	16.7	14	41.5	226.8	4	89.7	2.8	23.4	3.4	54	1.3	536	35.8	44.9	94	11.23	42.6	7.68
79762	7.2	2.8	14.5	12	37.3	212.7	4	79.1	2.5	20.4	3.4	42	1.1	467	38.1	39.7	83	10.06	37	6.76
79810	7.4	2.3	15.2	13	37.2	200.7	5	91.8	2.5	20.4	3	45	0.9	481	38.3	40.1	84	10.32	38.6	7.14
79835	7.5	2.3	14.3	12	36.2	189.9	5	69.6	2.6	19.5	2.9	36	1.2	462	36.4	39.3	81	9.91	36.7	6.39
79859	7	2.1	15	13	38.1	220.7	4	85.1	2.6	22.8	3.5	40	1.7	488	39.9	43.2	89	10.9	40.7	7.03
71684B	8.9	3.2	16.7	13	36.6	213.7	3	80.3	2.3	21.7	3.1	53	1.4	500	48.6	45.6	95	11.14	40.6	7.52
71708	12.8	2.8	16.9	14	42.9	196.2	4	92.2	2.8	22	3.3	98	1.5	534	51.1	48.1	100	11.86	44	8.49
71745	9.5	3.5	17.1	14	41	203	6	80.7	2.6	22.8	3.2	53	1.7	527	45.7	48.2	101	11.67	43.7	8.2
71783	8.1	5.2	17.7	14	44.2	221.6	4	69.3	2.7	25.4	3	57	1.5	534	48.3	51.4	107	12.52	46.9	8.52
71802	9.7	3.2	17.1	15	43.8	227.8	6	75.9	2.7	22.8	3.2	52	1.5	595	46.8	48.4	100	11.7	42.9	8.06
71816	14.5	2.4	16.3	14	40.3	183.4	5	72.6	2.7	23.7	10.7	46	1.8	538	52.8	47	97	11.33	41.2	7.99
71840	7.7	2.8	15.7	14	42.9	240	4	81.7	2.9	22.9	2.8	40	1.2	565	41.9	44.8	91	10.62	38.7	7.23
79652	39	0.5	18.5	3.3	17.6	12.7	-1	262	1	1.5	0.3	316	-0.5	122	31.5	11.1	24	3.43	15	4.13
79820	30.5	11.3	18.1	5.9	29.8	50.8	2	255	1.9	4	0.8	182	0.7	219	35.2	23.1	48	6.55	27.9	5.93
71820	19.5	5.4	33.2	8	54.9	65.1	3	365	3.2	4.9	0.9	277	1.3	345	47.6	38.4	80	10.33	43.3	9.39
71906	42.9	0.3	17.4	2.6	4	13.6	-1	201	0.2	1.8	0.3	264	-0.5	84.4	20.4	9.3	21	2.82	12	2.87
71907	39.5	0.6	20.9	4	7.3	34.2	1	263	0.4	2	0.4	272	-0.5	148	29.4	15.7	35	4.82	20.1	4.87
71904*	40.5	1.5	19.3	5	11.7	74.8	2	169	0.8	7.1	1.4	298	1	149	32.7	21.6	46	5.93	24.8	5.4
71905	33.7	0.4	19.1	5.8	9	59.7	-1	204	0.5	5.8	0.8	205	-0.5	179	30.5	24.7	53	6.74	28.3	5.66
71903	5.2	2.8	16.7	9.1	20.7	180.4	3	131	1.4	17.5	3.1	42	1.7	297	45.5	48.4	102	12.7	48.9	9.3

Table A5— Continued

Sample Number	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	TOT/C	TOT/S	Mo	Cu	Pb	Zn	As	Cd	Sb	Bi	Ag	Au
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	wt%	wt%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppb
79649	6.81	0.99	6.53	1.39	4.34	0.62	4.07	0.61	0.16	0.58	29.8	26.7	16	44	17.3	-0.1	0.3	-0.1	-0.1	-0.5
79653	6.99	1.09	7.26	1.48	4.93	0.73	4.67	0.68	0.21	0.04	0.5	27.2	14	51	6.5	-0.1	0.2	-0.1	-0.1	-0.5
79654	7.48	1.09	7.33	1.46	4.66	0.68	4.48	0.66	0.19	0.08	2.1	24.6	13	48	4.1	-0.1	0.1	-0.1	-0.1	-0.5
79655	6.65	1.01	6.8	1.37	4.5	0.65	4.24	0.63	0.16	0.11	2.2	23.5	13	41	3.9	-0.1	0.1	-0.1	-0.1	-0.5
79657	6.61	1	6.51	1.34	4.43	0.68	4.31	0.64	0.25	0.22	2.9	23.6	11	46	6.1	0.1	0.2	-0.1	-0.1	-0.5
79659	6.92	1.03	6.72	1.36	4.58	0.68	4.31	0.67	0.31	0.27	1.8	28.9	15	56	8.1	-0.1	0.2	-0.1	-0.1	0.6
79677	6.57	0.98	7.23	1.5	4.06	0.66	4.44	0.62	0.09	0.42	1.1	43.3	14	57	4.1	-0.1	0.1	-0.1	-0.1	-0.5
79695	6.92	1.01	6.85	1.51	4.29	0.69	4.67	0.63	0.06	0.83	1.6	22.2	14	23	7.6	-0.1	0.3	-0.1	-0.1	-0.5
79722	7.16	0.99	7.26	1.51	4.45	0.66	4.38	0.62	0.06	0.99	2.1	25.8	12	14	7.1	-0.1	0.2	-0.1	-0.1	-0.5
79736	7.05	1.01	7.49	1.52	4.46	0.71	4.42	0.65	0.03	0.43	1.7	26.9	11	34	7.2	-0.1	0.2	-0.1	-0.1	-0.5
79762	6.29	0.93	6.55	1.34	4.07	0.6	4.07	0.62	0.14	0.47	1.6	28.4	10	38	8.4	-0.1	0.2	-0.1	-0.1	-0.5
79810	6.76	0.94	6.69	1.39	4.13	0.61	4.04	0.61	0.21	0.13	2.4	25.9	19	66	5	-0.1	0.1	-0.1	-0.1	-0.5
79835	6.24	0.91	6.32	1.3	4.12	0.61	4.14	0.59	0.06	0.41	1.4	24.1	15	45	11.6	-0.1	0.3	-0.1	-0.1	-0.5
79859	6.33	0.95	6.38	1.37	4.29	0.64	4.18	0.63	0.1	0.28	1.8	37.3	19	57	5.3	0.1	0.1	-0.1	-0.1	-0.5
71684B	7.33	1.3	7.51	1.62	4.77	0.77	4.68	0.69	0.31	0.73	0.8	24	5.2	52	9.4	0.1	-0.1	-0.1	-0.1	-0.5
71708	8.04	1.42	8.25	1.75	5.15	0.8	4.94	0.72	0.88	0.6	0.3	30.4	7.3	64	2.5	0.1	-0.1	-0.1	-0.1	-0.5
71745	7.38	1.29	7.52	1.57	4.59	0.73	4.63	0.67	0.21	3.14	2.1	23.4	7.1	26	24.6	-0.1	0.3	-0.1	-0.1	-0.5
71783	7.8	1.35	7.59	1.65	4.78	0.76	4.71	0.7	0.86	0.67	0.4	26.5	7.8	32	4.4	-0.1	-0.1	-0.1	-0.1	-0.5
71802	7.44	1.3	7.44	1.6	4.64	0.74	4.62	0.69	1	0.57	0.3	25.6	7.9	31	4.3	-0.1	-0.1	-0.1	-0.1	-0.5
71816	7.64	1.39	8.18	1.78	5.19	0.83	5.13	0.73	1.29	1.03	0.5	26.1	13	239	15.1	0.4	-0.1	-0.1	-0.1	-0.5
71840	6.71	1.18	6.89	1.46	4.34	0.69	4.4	0.65	1.15	0.05	0.4	23.4	7	61	1.1	-0.1	-0.1	-0.1	-0.1	-0.5
79652	4.97	0.76	5.14	1.1	3.38	0.51	3.07	0.47	0.03	-0.02	0.8	117	1.3	66	0.7	-0.1	-0.1	-0.1	-0.1	-0.5
79820	6.5	0.92	6.44	1.33	4.02	0.58	3.66	0.53	0.25	0.08	1.3	71.2	4.3	81	1.6	0.1	-0.1	-0.1	-0.1	-0.5
71820	9.47	1.53	8.69	1.76	4.9	0.76	4.6	0.68	2	0.06	0.5	27.3	8.5	229	1.3	0.1	-0.1	-0.1	-0.1	-0.5
71906	3.35	0.6	3.59	0.73	2.13	0.33	2.03	0.3	0.03	-0.02	-0.1	83.6	1.7	27	-0.5	-0.1	-0.1	-0.1	-0.1	4.9
71907	5.06	0.89	5.29	1.07	3.13	0.46	2.87	0.42	0.04	-0.02	0.1	61.3	1.6	58	-0.5	-0.1	-0.1	-0.1	-0.1	0.6
71904*	5.56	0.96	5.51	1.19	3.43	0.5	3.11	0.48	0.17	-0.02	0.2	103	2.4	60	1.2	-0.1	-0.1	-0.1	-0.1	6.8
71905	5.56	0.92	5.08	1.07	3.13	0.49	2.99	0.44	0.04	-0.02	-0.1	45.8	2.6	57	-0.5	-0.1	-0.1	-0.1	-0.1	2.8
71903	8.45	1.4	8.06	1.65	4.56	0.72	4.62	0.68	0.02	-0.02	0.3	14.9	4.3	50	2.1	-0.1	-0.1	-0.1	-0.1	1.9

Table A5– Continued

Sample Number	Hg ppm	Tl ppm	Se ppm
79649	-0.01	0.2	-0.5
79653	-0.01	-0.1	-0.5
79654	-0.01	-0.1	-0.5
79655	-0.01	-0.1	-0.5
79657	-0.01	-0.1	-0.5
79659	-0.01	-0.1	-0.5
79677	-0.01	-0.1	-0.5
79695	-0.01	-0.1	-0.5
79722	-0.01	-0.1	-0.5
79736	-0.01	-0.1	-0.5
79762	-0.01	-0.1	-0.5
79810	-0.01	-0.1	-0.5
79835	-0.01	-0.1	-0.5
79859	-0.01	-0.1	-0.5
71684B	-0.01	0.1	-0.5
71708	-0.01	-0.1	-0.5
71745	-0.01	0.6	-0.5
71783	-0.01	-0.1	0.5
71802	-0.01	-0.1	-0.5
71816	-0.01	-0.1	-0.5
71840	-0.01	-0.1	0.6
79652	-0.01	-0.1	-0.5
79820	-0.01	-0.1	-0.5
71820	-0.01	-0.1	-0.5
71906	-0.01	-0.1	-0.5
71907	-0.01	-0.1	-0.5
71904*	-0.01	-0.1	-0.5
71905	-0.01	-0.1	-0.5
71903	-0.01	-0.1	-0.5

Table A6– Whole rock analysis from surface samples

Sample Number	Lithogeochemical unit	Location	Easting	Northing	BatchNumber Acme	SiO ₂ wt%	Al ₂ O ₃ wt%	Fe ₂ O ₃ wt%	MgO wt%
71952	Lascano trachydacite	Mariscal	603221	6234292	SAN08003089	63.36	16.53	6.10	0.43
71954	Lascano trachydacite altered	Mariscal	611108	6243230	SAN08003089	69.83	12.13	7.16	0.04
71978	Fl-Mn-Qtz veins	Fluorite mine	617933	6222863	SAN09001926	16.04	1.45	0.60	0.21
71964	San Miguel Granodiorite Granophyres	San Miguel	706379	6271847	SAN08003089	75.23	11.72	3.95	0.20
71965	San Miguel Granodiorite Granophyres	San Miguel	704130	6271423	SAN08003089	74.05	12.04	4.91	0.47
71957	Treinta y Tres B basalt	Lascano-W	642967	6268561	SAN08003089	50.26	15.91	13.16	5.67
71968	Treinta y Tres B gabbros	San Miguel	700457	6266754	SAN08003089	48.23	16.72	9.36	10.72
71982	Treinta y Tres B basalts	Lascano W	643044	6268667	SAN09001926	48.33	15.65	14.51	5.90
71980	Treinta y Tres B basalts altered	Lascano W	640507	6265136	SAN09001926	57.36	14.08	12.59	3.91
71967	Treinta y Tres B gabbros altered	San Miguel	693617	6265641	SAN08003089	55.18	13.83	13.91	3.14
71955	Aiguá rhyolites	Aigua	610081	6229155	SAN08003089	77.50	11.44	3.22	0.09
71950	Aiguá rhyolites	Mariscal	599613	6234764	SAN08003089	65.62	16.10	6.33	0.19
71977	Aiguá rhyolites	Salamanca	609779	6229151	SAN09001926	76.28	11.98	3.01	0.22
71975	Aiguá rhyolites altered	Arequita	549289	6206293	SAN09001926	77.78	11.28	2.53	0.05
71976	Treinta y Tres A basalts altered	Salamanca	610137	6229173	SAN09001926	69.75	13.46	7.82	1.39
71956	Low Nb/Zr Rhyolites	Lascano-W	647075	6275277	SAN08003089	71.45	12.88	6.16	0.48
71959	Low Nb/Zr Rhyolites	Lascano-W	634468	6273972	SAN08003089	71.34	12.66	6.91	0.21
71960	Low Nb/Zr Rhyolites	Lascano-W	652522	6266807	SAN08003089	71.52	12.79	5.76	0.30
71981	Low Nb/Zr Rhyolites	Lascano W	640677	6264969	SAN09001926	72.61	12.88	4.60	0.29
71983	Low Nb/Zr Rhyolites	Lascano W	636334	6281937	SAN09001926	70.17	13.32	6.60	0.29
71984	Low Nb/Zr Rhyolites	Lascano W	635726	6281431	SAN09001926	70.47	13.02	6.53	0.25
71985	Low Nb/Zr Rhyolites	Lascano W	646295	6270402	SAN09001926	69.99	13.61	5.52	0.63
71988	Low Nb/Zr Rhyolites	Lascano E	672665	6266304	SAN09001926	73.65	12.36	5.39	0.25
71989	Low Nb/Zr Rhyolites	Lascano E	673601	6268353	SAN09001926	73.20	12.74	4.70	0.15
71990	Low Nb/Zr Rhyolites	Lascano E	673802	6268733	SAN09001926	67.21	13.46	9.78	0.55
71991	Low Nb/Zr Rhyolites	Lascano E	666402	6259459	SAN09001926	77.17	11.19	2.59	0.08
71992	Low Nb/Zr Rhyolites	Lascano E	653476	6266482	SAN09001926	71.57	12.43	5.69	0.20
71993	Low Nb/Zr Rhyolites	Lascano E	647699	6269479	SAN09001926	70.93	12.79	5.56	0.38
71951	Lavalleja rhyolites altered	Mariscal	600717	6234507	SAN08003089	75.49	13.30	1.34	0.04
71961	Lavalleja rhyolites altered	Lascano-W	648401	6265267	SAN08003089	69.71	13.35	6.20	0.82
71966	Lavalleja rhyolites altered	San Miguel	699818	6267519	SAN08003089	73.17	11.95	5.27	0.44

Table A6– Continued

Sample Number	CaO w%	Na2O w%	K2O w%	TiO2 w%	P2O5 w%	MnO w%	Cr2O3 w%	Ni ppm	Sc ppm	LOI wt%	Ba ppm	Be ppm	Co ppm	Cs ppm	Ga ppm	Hf ppm	Nb ppm	Rb ppm	Sn ppm	Sr ppm
71952	0.82	5.79	6.10	0.61	0.10	0.14	0.02	-20	7	1.7	274	3	2.5	0.9	26.3	10.8	85.9	122.4	3	27.9
71954	0.22	4.00	5.80	0.59	0.03	0.17	0.01	-20	-1	1.8	50	5	0.9	0.8	36.4	21.8	191.1	191.1	7	7.2
71978	79.30	0.09	0.17	0.04	0.03	2.08	0.00	20	1	6.1	4434	4	4.5	4.3	7.8	0.4	0.8	7.5	1	342
71964	0.57	2.68	4.99	0.44	0.06	0.08	0.08	-20	7	1.6	1001	2	2.3	6.9	14.5	11	24.8	183.3	4	71.1
71965	0.76	2.83	4.23	0.56	0.05	0.08	0.02	-20	10	1.8	703	3	2.8	8.5	16.6	10.5	25.4	165.2	6	95.6
71957	9.36	2.33	1.23	1.63	0.26	0.17	0.01	77	37	1.7	451	-1	46.4	0.1	19	4.8	15.4	26.9	-1	273.7
71968	12.07	1.91	0.19	0.51	0.05	0.14	0.08	225	36	1.5	134	-1	47.6	1.6	13	1.1	2.2	4.8	-1	121.4
71982	9.59	2.38	1.22	1.90	0.32	0.20	0.01	79	37	3	385	1	51.5	0.1	21.1	4.8	16.3	30.5	1	292.2
71980	5.57	2.30	2.18	1.59	0.20	0.21	0.00	41	33	8.9	1357	1	35.2	1.1	16.8	5.6	26.4	84.9	1	2570
71967	5.59	3.31	2.38	2.05	0.35	0.22	0.03	30	40	1.8	755	2	33.2	3.9	18.5	5.2	13.4	83.8	2	188.6
71955	0.28	1.60	5.56	0.20	0.02	0.05	0.04	-20	3	1.7	312	4	1.1	0.9	18.8	12.5	51.9	181	9	29.1
71950	0.40	5.13	5.44	0.57	0.04	0.14	0.01	-20	6	2.2	747	5	4.1	1.1	28.1	16.5	116.6	118	5	52.2
71977	0.21	2.79	5.11	0.27	0.09	0.05	0.00	20	1	2.3	126	2	1.2	4.8	26	18.4	94	212.4	6	24.2
71975	0.36	2.51	5.27	0.17	0.03	0.02	0.00	20	1	1.5	252	5	0.6	1	22.4	12.3	35.4	155.5	4	29.1
71976	2.48	0.72	3.44	0.64	0.14	0.15	0.00	20	11	11.9	1512	6	4.3	3.6	21.9	25.1	46.6	138.6	5	1691
71956	0.86	2.00	5.37	0.59	0.09	0.07	0.04	-20	13	2.6	1201	3	5.3	2.5	19.2	12.7	27.5	177.7	3	119.2
71959	0.32	2.58	5.15	0.64	0.10	0.06	0.03	40	16	1.7	1247	2	2.8	3.4	19.9	9.8	28.1	195.9	6	112.4
71960	1.49	2.00	5.16	0.64	0.17	0.08	0.08	-20	12	1.7	1480	2	7.1	3.1	17.3	10.6	22.1	181.7	3	118.7
71981	0.27	1.84	6.97	0.42	0.07	0.05	0.00	20	9	2.4	2049	1	2.8	2.7	15.2	11.7	23.7	228.6	3	89.1
71983	1.06	2.83	4.81	0.64	0.09	0.18	0.00	20	15	2.8	1208	3	9.2	4.7	20.4	10.1	29.9	179.4	4	123
71984	1.32	2.73	4.73	0.63	0.12	0.21	0.00	20	14	2.7	900	3	4.3	3.1	19.9	9.9	29	169.1	4	134.3
71985	2.48	2.97	3.85	0.67	0.19	0.08	0.00	20	12	3.9	1279	2	6	3.7	18.3	10.7	23.4	184.3	3	197.7
71988	0.35	1.59	5.51	0.68	0.14	0.07	0.00	20	15	3	1172	2	4	4.1	15.3	8.7	20.2	192.2	5	49.2
71989	0.21	1.09	7.29	0.43	0.04	0.14	0.00	86	11	2.5	1895	1	10.4	2	15.7	10.9	24.9	207	4	73.9
71990	0.65	1.45	6.00	0.59	0.15	0.16	0.00	20	12	4.7	2477	2	3.6	2.5	23.8	15.7	35.4	178	3	168.5
71991	0.39	1.74	6.55	0.21	0.02	0.04	0.01	20	8	0.9	1091	3	1.8	2.9	15.1	8.2	18.9	211.5	4	64.7
71992	0.70	1.81	6.75	0.63	0.15	0.06	0.01	20	12	1.9	1043	2	5.7	2.1	15	9.7	22.3	211.8	4	74.1
71993	1.01	1.50	6.95	0.64	0.15	0.07	0.01	20	12	2.6	1054	3	5.3	6.2	16.1	9.7	25.8	178.7	3	115.6
71951	0.11	3.82	5.67	0.17	0.02	-0.01	0.06	-20	3	0.6	152	2	1.7	0.6	15.8	5.8	16.1	134.3	2	56.2
71961	2.81	3.70	2.38	0.70	0.21	0.10	0.02	-20	14	4.3	993	2	6.8	3.6	18.7	10.7	24.9	204.9	3	208.3
71966	1.47	2.63	4.16	0.63	0.13	0.14	0.03	-20	15	1.7	661	2	3.7	6.3	15.2	9	18.5	150.8	4	105.7

Table A6– Continued

Sample Number	Ta ppm	Th ppm	U ppm	V ppm	W ppm	Zr ppm	Y ppm	La ppm	Ce ppm	Pr ppm	Nd ppm	Sm ppm	Eu ppm	Gd ppm	Tb ppm	Dy ppm	Ho ppm	Er ppm	Tm ppm	Yb ppm	Lu ppm
71952	4.6	9.5	0.6	9	0.7	455	51.6	68.8	138.9	16.2	59.3	10.4	1.22	9.16	1.59	8.8	1.79	5.39	0.84	5.39	0.82
71954	10.3	21.9	3.4	-8	1.3	900	105	96.9	185.8	26.1	99.8	18.3	1.28	16.4	3.02	18.6	3.82	12	1.89	12.57	1.87
71978	0.1	0.3	3.3	39	99.8	14.2	27.2	35.9	43.1	8.37	30.9	4.68	0.69	4.03	0.61	3.75	0.68	2.01	0.27	1.65	0.22
71964	1.7	15.9	3	28	2.3	375	66.9	37	87.2	9.85	38.7	8.83	1.8	9.43	1.76	10.7	2.26	6.92	1.03	6.47	0.94
71965	1.6	14.3	2.3	22	3	343	51.7	38.7	80	10.6	43.4	9.07	2.05	8.9	1.59	9.27	1.87	5.59	0.87	5.57	0.83
71957	1.1	3.9	0.4	274	-0.5	173	36.6	21.4	44.6	6.22	26.3	5.65	1.57	5.92	1.06	6.24	1.25	3.86	0.58	3.78	0.55
71968	0.1	0.5	0.1	166	-0.5	37.7	14.8	3.5	7.5	1.1	5.2	1.56	0.59	2.03	0.42	2.56	0.56	1.78	0.25	1.61	0.24
71982	1	3.7	0.4	329	0.5	178	40.7	20.6	46.4	5.91	25.7	5.62	1.69	6.34	1.11	6.66	1.47	4.24	0.6	4.01	0.62
71980	0.6	8.1	0.9	268	0.5	197	45.3	35.7	62.2	10	38.9	8.73	2.13	8.79	1.43	7.84	1.69	4.7	0.65	4.23	0.62
71967	0.9	6.4	1.1	283	0.9	177	48.3	24.4	52.2	7.25	33	7.55	2.05	8.21	1.47	8.55	1.74	5.28	0.77	4.79	0.7
71955	2.8	26.5	2.9	30	2	388	71.3	115	280.6	28.7	109.1	17.6	1.27	14.4	2.29	12.3	2.39	7.34	1.1	7.17	1.05
71950	6.2	13.7	3.3	10	1.2	702	58.5	69.7	146.4	16.7	66.4	11.2	1.93	10	1.8	10.8	2.28	7.17	1.16	7.55	1.19
71977	5.7	21.9	3.6	46	0.6	644	89.4	229	287	54.7	189.4	27.4	0.51	16.5	2.76	15.6	3.18	9.19	1.38	8.87	1.31
71975	2	15.8	2.2	10	0.5	394	54.5	51.3	163.6	12.2	41.8	8.38	0.63	7.92	1.51	9.1	1.88	5.28	0.78	5.15	0.7
71976	2.2	11.8	1.9	8	0.7	1089	103	287	326.9	48.5	171.3	28.2	4.56	22	3.52	18.6	3.68	9.93	1.43	9.04	1.35
71956	1.6	18	2.1	23	1.2	457	51.1	55.8	116.4	14.6	58	10.6	1.99	9.41	1.56	9	1.78	5.34	0.8	5.28	0.77
71959	2	16	3.1	-8	2	339	46.6	50.6	91.7	12.7	50.3	9.59	2.05	8.61	1.46	8.52	1.63	5.05	0.77	4.86	0.78
71960	1.4	18.6	2.5	32	1.6	356	65.1	67.9	132.2	17.5	70.2	12.7	2.4	11.5	1.91	10.7	2.15	6.34	0.92	5.85	0.84
71981	1.3	20.1	2.3	31	1.2	400	52.3	65.8	140.3	15.8	60.7	10.9	1.87	9.42	1.58	9.09	1.91	5.26	0.78	5.11	0.74
71983	2.1	16.9	1.7	28	1.6	355	63.9	75.4	139.1	18.4	69	13.6	2.85	12.5	1.99	11.6	2.33	6.59	1	6.48	0.91
71984	2.1	15.9	2.5	47	7.7	343	49.3	48.6	114.5	12.6	48.4	9.7	2.28	9.24	1.6	9.06	1.94	5.47	0.79	5.35	0.76
71985	1.5	18.3	2.8	30	2.5	377	53.2	61.4	131.4	15	57.2	11.1	2.05	9.83	1.65	9.24	1.96	5.36	0.82	5.27	0.78
71988	1.4	15.1	2.6	44	4	318	78.5	69.3	133.5	16.7	67.8	13	2.76	12.9	2.25	12.7	2.58	7.62	1.1	7.02	1.07
71989	1.5	19.2	1.7	56	1.7	409	47.3	60.3	128	13.5	52	9.14	1.54	7.87	1.39	7.9	1.64	4.93	0.77	4.96	0.75
71990	1.8	20	1.4	26	1.6	582	112	139	216	39.6	157.7	28.9	6.48	24.9	4	21	3.88	11	1.61	10.1	1.48
71991	1.4	20.7	2.2	44	1.7	243	54.4	69.9	136.9	15.8	60.4	11	1.39	9.69	1.66	9.17	1.84	5.35	0.79	5	0.73
71992	1.4	15.4	2.2	46	1.5	346	55.3	62.1	123.9	15	58.7	11	1.98	9.73	1.68	8.87	1.8	5.42	0.78	4.79	0.72
71993	1.3	18.4	2.3	43	3.4	352	60.1	73.1	126.5	17.1	67.9	12.3	2.36	11.2	1.84	9.85	2.04	5.79	0.87	5.25	0.79
71951	1.1	14.7	2.1	11	0.6	185	25.8	29.8	51.7	7.78	29.4	5.97	0.64	4.95	0.84	4.55	0.88	2.65	0.41	2.61	0.4
71961	1.6	16.4	2.4	25	1.4	373	60.2	56.9	111.3	14.9	60.4	11.1	2.05	10.4	1.82	10.4	2.05	6.35	0.94	5.9	0.87
71966	1.3	13.8	2.5	11	1.2	306	61.7	40.7	83.5	11.2	47.5	10.3	2.2	10	1.85	10.9	2.17	6.61	1.01	6.36	0.93

Table A6– Continued

Sample Number	TOT/C wt%	TOT/S wt%	Mo ppm	Cu ppm	Pb ppm	Zn ppm	As ppm	Cd ppm	Sb ppm	Bi ppm	Ag ppm	Au ppb	Hg ppm	Tl ppm	Se ppm
71952	0.1	-0.02	1.1	8.3	10	79	-0.5	0.2	-0.1	-0.1	-0.1	1.3	-0.01	0.1	-0.5
71954	0.07	-0.02	3.7	5.1	18.1	51	-0.5	0.2	-0.1	-0.1	-0.1	-0.5	-0.01	-0.1	1.4
71978	0.02	0.04	1.1	7.4	12.7	6	2	0.1	0.2	0.2	0.1	0.5	0.01	2.2	1.2
71964	0.2	0.09	0.6	4.6	4.7	24	3.2	-0.1	0.2	-0.1	-0.1	0.9	-0.01	-0.1	1.3
71965	-0.02	-0.02	0.9	5.2	19.9	49	-0.5	-0.1	0.3	-0.1	-0.1	-0.5	-0.01	-0.1	1.3
71957	-0.02	-0.02	0.3	58.5	2.2	48	-0.5	-0.1	-0.1	-0.1	-0.1	-0.5	-0.01	-0.1	-0.5
71968	0.03	-0.02	0.1	90.5	1.3	20	1.9	-0.1	-0.1	-0.1	-0.1	4.7	-0.01	-0.1	-0.5
71982	0.02	0.02	0.2	56.5	1.4	54	0.8	0.1	0.1	0.1	0.1	0.5	0.01	0.1	0.5
71980	0.02	0.02	0.3	108.3	9.3	64	1.1	0.1	0.1	0.1	0.1	0.5	0.01	0.1	0.9
71967	-0.02	-0.02	0.2	40.8	5.6	40	5.7	-0.1	-0.1	0.5	-0.1	1	-0.01	0.1	1.2
71955	0.06	-0.02	1.9	9.5	15.1	82	6.6	-0.1	-0.1	-0.1	-0.1	-0.5	-0.01	-0.1	1.3
71950	0.09	-0.02	1.6	7.8	20.6	75	1	-0.1	-0.1	-0.1	-0.1	-0.5	-0.01	-0.1	0.7
71977	0.15	0.02	0.8	5.2	23.6	80	3.3	0.1	0.1	0.1	0.1	0.5	0.01	0.1	0.6
71975	0.03	0.02	2	6.4	7.1	61	0.7	0.1	0.1	0.1	0.1	0.5	0.01	0.1	0.5
71976	0.08	0.02	0.8	5.7	33	98	0.9	0.1	0.1	0.1	0.1	0.5	0.01	0.3	0.6
71956	-0.02	-0.02	0.8	7.5	4.4	109	2	-0.1	-0.1	-0.1	-0.1	-0.5	-0.01	-0.1	1.3
71959	0.08	-0.02	0.4	7.5	9.4	79	1.7	-0.1	-0.1	-0.1	-0.1	0.7	-0.01	0.1	0.8
71960	0.09	-0.02	0.8	10.7	5.1	71	4.7	0.1	0.2	-0.1	-0.1	-0.5	-0.01	0.1	1.4
71981	0.1	0.02	0.6	7.6	5.6	49	4.9	0.1	0.2	0.1	0.1	0.5	0.01	0.1	0.6
71983	0.02	0.02	1	8.7	7	82	5	0.1	0.1	0.1	0.1	0.5	0.01	0.1	0.8
71984	0.02	0.02	1.3	8	5.5	80	4.3	0.1	0.1	0.1	0.1	0.5	0.01	0.1	0.7
71985	0.02	0.02	0.4	6.3	2.6	25	0.5	0.1	0.1	0.1	0.1	0.5	0.01	0.1	0.5
71988	0.05	0.02	0.7	6.9	9.1	56	1.4	0.1	0.3	0.1	0.1	0.5	0.01	0.1	0.6
71989	0.1	0.02	0.5	8	8.4	34	5.6	0.1	0.3	0.1	0.1	0.5	0.01	0.1	0.8
71990	0.02	0.02	2.1	9.6	6.1	115	1.8	0.3	0.1	0.1	0.1	0.5	0.01	0.2	1.3
71991	0.02	0.02	0.8	4.5	2.9	34	4.4	0.1	0.3	0.1	0.1	0.5	0.01	0.1	0.5
71992	0.02	0.02	0.8	8.6	4.8	38	3.4	0.1	0.2	0.1	0.1	0.5	0.01	0.1	0.5
71993	0.02	0.02	0.6	8.1	7.6	62	2.5	0.1	0.2	0.1	0.1	0.5	0.01	0.1	1
71951	0.04	-0.02	0.3	3	8.5	7	-0.5	-0.1	-0.1	-0.1	-0.1	0.9	-0.01	-0.1	0.7
71961	-0.02	-0.02	0.4	7.1	3.2	37	-0.5	-0.1	-0.1	-0.1	-0.1	-0.5	-0.01	-0.1	-0.5
71966	0.03	-0.02	0.2	2.9	3.7	34	3.9	-0.1	0.1	0.1	-0.1	2.5	-0.01	-0.1	1.2

Table A6– Continued

Sample Number	Lithogeochemical unit	Location	Easting	Northing	BatchNumber Acme	SiO ₂ wt%	Al ₂ O ₃ wt%	Fe ₂ O ₃ wt%	MgO wt%
71979	Precambrian gneiss	Fluorite mine	617933	6222863	SAN09001926	70.96	14.48	3.64	0.82
71995	Qtz veins in Valle Chico syenites	Mariscala	611116	6243231	SAN10000673A	90.25	3.07	2.71	0.35
71986	Santa Teresa Precambrian Granodiorite	Lascano E	695338	6247336	SAN09001926	75.11	13.53	2.15	0.28
71953	Valle Chico syenite	Mariscala	604924	6235033	SAN08003089	66.30	14.79	6.70	0.81
71994	Valle Chico syenite with qtz veins	Mariscala	611116	6243231	SAN10000673A	63.88	14.23	8.33	1.08

Sample Number	CaO wt%	Na ₂ O wt%	K ₂ O wt%	TiO ₂ wt%	P ₂ O ₅ wt%	MnO wt%	Cr ₂ O ₃ wt%	Ni ppm	Sc ppm	LOI wt%	Ba ppm	Be ppm	Co ppm	Cs ppm	Ga ppm	Hf ppm	Nb ppm	Rb ppm	Sr ppm
71979	2.08	3.16	4.12	0.51	0.17	0.06	0.00	20	7	2.1	1596	5	9.3	19.4	17	6.9	10.4	177.6	7 380.8
71995	1.24	0.63	1.32	0.26	0.10	0.06	0.00	20	3	1.2	260	1	3.8	0.7	6	2.1	14.3	39	1 76.9
71986	0.46	3.15	4.90	0.25	0.13	0.05	0.00	20	4	1.1	248	9	1.9	32.7	22.3	4.7	35.8	444.9	23 57.2
71953	1.07	3.48	5.40	1.00	0.30	0.12	0.03	-20	13	1.7	1341	3	8.1	1.4	22	11.2	55.5	163.4	3 222.7
71994	2.13	3.55	4.81	1.36	0.46	0.15	0.00	20	14	2.2	1272	3	10.6	2	21.4	11.2	76.8	133.1	4 294.6

Sample Number	Ta ppm	Th ppm	U ppm	V ppm	W ppm	Zr ppm	Y ppm	La ppm	Ce ppm	Pr ppm	Nd ppm	Sm ppm	Eu ppm	Gd ppm	Tb ppm	Dy ppm	Ho ppm	Er ppm	Tm ppm	Yb ppm	Lu ppm
71979	0.4	6.1	1.3	46	1.8	270	17.8	36.4	98.1	8.39	31.5	5.24	1.52	4.13	0.64	3.58	0.73	2.05	0.28	1.81	0.27
71995	0.8	1.6	0.4	24	0.5	83.5	9.8	12.7	28	2.81	10.6	1.89	0.37	1.71	0.28	1.61	0.33	1.01	0.18	1.13	0.17
71986	6.5	28.3	6.9	12	7.8	161	36.1	39.3	88.2	9.79	35.5	7.02	0.58	5.41	0.99	5.77	1.21	3.61	0.61	4.48	0.68
71953	3.5	12.2	2.5	33	1	446	55	57.6	122.6	14.1	54.2	10	2.17	9.23	1.56	9.09	1.81	5.45	0.86	5.27	0.81
71994	4.2	7.8	1.4	71	0.8	409	38.9	58.2	115.4	12.8	47.7	8.31	2.19	7.25	1.21	6.73	1.34	4.17	0.65	4.05	0.62

Table A6– Continued

Sample Number	TOT/C wt%	TOT/S wt%	Mo ppm	Cu ppm	Pb ppm	Zn ppm	As ppm	Cd ppm	Sb ppm	Bi ppm	Ag ppm	Au ppb	Hg ppm	Tl ppm	Se ppm
71979	0.02	0.02	0.2	5	7.1	45	0.6	0.1	0.1	0.6	0.1	0.5	0.01	0.5	0.5
71995	0.12	0.02	4.1	7.1	3.6	21	5.7	0.1	0.2	0.1	0.1	29.1	0.01	0.2	0.5
71986	0.06	0.02	0.7	2	6.2	28	0.5	0.1	0.1	0.1	0.1	0.5	0.01	0.5	0.5
71953	0.1	-0.02	1.8	9.7	14.1	73	-0.5	-0.1	-0.1	-0.1	-0.1	0.7	-0.01	-0.1	1
71994	0.21	0.02	3.1	12.8	5.2	58	2.6	0.1	0.1	0.1	0.1	1.2	0.01	0.4	0.5

Appendix 3 – $^{40}\text{Ar}/^{39}\text{Ar}$ data

Table A7 – Sample 71907

Incremental Heating	36Ar(a)	37Ar(ca)	38Ar(cl)	39Ar(k)	40Ar(r)	Age $\pm 2\sigma$ (Ma)	40Ar(r) 39Ar(k) (%)	K/Ca $\pm 2\sigma$
10C2727	0.000163	0.010993	0.000002	0.001720	0.065247	118.15 ± 4.01	57.54	0.067 ± 0.005
10C2728	0.000133	0.019606	0.000005	0.003165	0.184988	178.94 ± 2.94	82.51	0.069 ± 0.005
10C2729	0.000122	0.095812	0.000000	0.062227	0.333125	164.43 ± 1.70	90.22	0.028 ± 0.002
10C2731	0.000033	0.117409	0.000000	0.004799	0.219516	141.51 ± 1.55	95.77	0.018 ± 0.001
10C2732	0.000050	0.163880	0.000000	0.006188	0.253237	127.12 ± 1.27	94.44	0.016 ± 0.001
10C2733	0.000037	0.104394	0.000000	0.003866	0.157862	126.84 ± 1.44	93.51	0.016 ± 0.001
10C2735	0.000049	0.095414	0.000000	0.003533	0.144455	127.00 ± 1.92	90.90	0.016 ± 0.001
10C2736	0.000046	0.065741	0.000000	0.002401	0.098000	126.80 ± 2.27	87.72	0.016 ± 0.001
10C2737	0.000043	0.047896	0.000000	0.001716	0.069957	126.64 ± 4.27	84.52	0.015 ± 0.001
10C2739	0.000056	0.057432	0.000002	0.002114	0.086042	126.43 ± 3.34	83.99	0.016 ± 0.001
10C2740	0.000063	0.030331	0.000000	0.001105	0.045348	127.41 ± 5.10	71.00	0.016 ± 0.001
10C2742	0.000055	0.013773	0.000000	0.000509	0.020823	127.05 ± 13.97	56.27	0.016 ± 0.001
Σ	0.000850	0.822683	0.000009	0.037343	1.678601			

Information on Analysis	Results	40(r)/39(k) $\pm 2\sigma$	Age $\pm 2\sigma$ (Ma)	MSWD	39Ar(k) (%)	K/Ca $\pm 2\sigma$
71907 plagioclase E. Oregon jh	Weighted Plateau	40.8675 ± 0.2515 $\pm 0.62\%$	126.94 ± 0.89 $\pm 0.70\%$ External Error ± 2.20 Analytical Error ± 0.75	0.04 2.36 1.0000	57.39 8 Statistical T Ratio Error Magnification	0.016 ± 0.000
Project = Dilles Irradiation = OSU2B10 J = 0.0017838 ± 0.0000034 FCT-3 = 28.030 ± 0.003 Ma	Total Fusion Age	44.9511 ± 0.2283 $\pm 0.51\%$	139.15 ± 0.85 $\pm 0.61\%$ External Error ± 2.37 Analytical Error ± 0.68		12 0.020 ± 0.000	

Table A8 – Sample 80002

Incremental Heating	36Ar(a)	37Ar(ca)	38Ar(cl)	39Ar(k)	40Ar(r)	Age $\pm 2\sigma$ (Ma)	40Ar(r) 39Ar(k) (%)	K/Ca $\pm 2\sigma$
10C2773	0.000273	0.022839	0.000026	0.001958	0.030775	49.66 $\pm$ 3.20	27.64	0.037 $\pm$ 0.003
10C2774	0.000093	0.083776	0.000000	0.002600	0.090622	108.33 $\pm$ 2.37	76.72	0.013 $\pm$ 0.001
10C2775	0.000054	0.177059	0.000000	0.004566	0.183155	124.11 $\pm$ 1.73	91.97	0.011 $\pm$ 0.001
10C2777	0.000040	0.170621	0.000000	0.005016	0.208051	128.19 $\pm$ 1.63	94.67	0.013 $\pm$ 0.001
10C2778	0.000023	0.067775	0.000000	0.002794	0.115523	127.82 $\pm$ 2.42	94.54	0.018 $\pm$ 0.001
10C2779	0.000027	0.076064	0.000000	0.003241	0.134814	128.57 $\pm$ 2.13	94.32	0.018 $\pm$ 0.001
10C2780	0.000032	0.116367	0.000000	0.004407	0.180802	126.86 $\pm$ 1.57	95.02	0.016 $\pm$ 0.001
10C2782	0.000023	0.130999	0.000000	0.004652	0.193343	128.46 $\pm$ 2.02	96.59	0.015 $\pm$ 0.001
10C2783	0.000030	0.168824	0.000000	0.005668	0.233516	127.36 $\pm$ 1.83	96.40	0.014 $\pm$ 0.001
10C2784	0.000024	0.147691	0.000000	0.004533	0.178507	121.93 $\pm$ 1.87	96.13	0.013 $\pm$ 0.001
10C2786	0.000025	0.120739	0.000000	0.003444	0.137364	123.45 $\pm$ 2.36	94.81	0.012 $\pm$ 0.001
10C2787	0.000024	0.110357	0.000000	0.003171	0.129142	125.95 $\pm$ 2.21	94.86	0.012 $\pm$ 0.001
Σ	0.000667	1.393111	0.000026	0.046050	1.815615			

Information on Analysis	Results	40(r)/39(k) $\pm 2\sigma$	Age $\pm 2\sigma$ (Ma)	MSWD	39Ar(k) (% , n)	K/Ca $\pm 2\sigma$
80002 plag Dilles 2B2-10 plagioclase E. Oregon jh	Weighted Plateau	41.3372 $\pm$ 0.2559 $\pm$ 0.62%	127.78 $\pm$ 0.90 $\pm$ 0.70% External Error $\pm$ 2.22 Analytical Error $\pm$ 0.76	0.57	55.98 6 Statistical T Ratio Error Magnification	0.015 $\pm$ 0.002
Project = Dilles Irradiation = OSU2B10 J = 0.0017756 $\pm$ 0.0000034 FCT-3 = 28.030 $\pm$ 0.003 Ma	Total Fusion Age	39.4270 $\pm$ 0.1945 $\pm$ 0.49%	122.07 $\pm$ 0.73 $\pm$ 0.60% External Error $\pm$ 2.07 Analytical Error $\pm$ 0.58		12	0.014 $\pm$ 0.000

Table A9 – Sample 80006

Incremental Heating											K/Ca $\pm 2\sigma$	
	36Ar(a)	37Ar(ca)	38Ar(cl)	39Ar(k)	40Ar(r)	Age $\pm 2\sigma$ (Ma)	40Ar(r) (%)	39Ar(k) (%)	40Ar(r) (%)	39Ar(k) (%)	K/Ca $\pm 2\sigma$	
10C2788	0.022627	0.002052	0.000300	0.010989	0.321158	90.06 $\pm$ 9.47	4.58	0.23	4.58	0.23	2.303 $\pm$ 0.604	
10C2789	0.011157	0.002599	0.000151	0.042877	1.657384	118.18 $\pm$ 1.47	33.45	0.89	33.45	0.89	7.094 $\pm$ 1.474	
10C2791	0.006499	0.004733	0.000119	0.070476	2.885425	124.94 $\pm$ 0.74	60.04	1.46	60.04	1.46	6.403 $\pm$ 0.761	
10C2792	0.004628	0.012476	0.000181	0.166845	6.974640	127.48 $\pm$ 0.55	83.60	3.45	83.60	3.45	5.751 $\pm$ 0.491	
10C2793	0.001947	0.011286	0.000154	0.173512	7.284965	128.02 $\pm$ 0.31	92.68	3.59	92.68	3.59	6.611 $\pm$ 0.621	
10C2794	0.001817	0.014158	0.000205	0.245588	10.392978	129.00 $\pm$ 0.70	95.09	5.08	95.09	5.08	7.459 $\pm$ 0.656	
10C2798	0.003675	0.022186	0.000506	0.611169	25.895518	129.15 $\pm$ 0.29	95.97	12.64	95.97	12.64	11.845 $\pm$ 0.872	
10C2799	0.001968	0.013286	0.000369	0.383405	16.242664	129.13 $\pm$ 0.98	96.54	7.93	96.54	7.93	12.409 $\pm$ 0.928	
10C2801	0.001429	0.010927	0.000299	0.314906	13.366378	129.37 $\pm$ 1.30	96.94	6.51	96.94	6.51	12.393 $\pm$ 1.162	
10C2803	0.002007	0.012674	0.000237	0.366995	15.537000	129.05 $\pm$ 0.41	96.32	7.59	96.32	7.59	12.451 $\pm$ 1.060	
10C2804	0.001754	0.011202	0.000296	0.359592	15.201059	128.86 $\pm$ 0.67	96.70	7.44	96.70	7.44	13.804 $\pm$ 1.125	
10C2805	0.001806	0.009131	0.000223	0.292079	12.369147	129.08 $\pm$ 0.78	95.86	6.04	95.86	6.04	13.755 $\pm$ 1.237	
10C2807	0.001162	0.006940	0.000190	0.258526	10.925797	128.83 $\pm$ 0.84	96.95	5.35	96.95	5.35	16.018 $\pm$ 1.420	
10C2808	0.001478	0.007962	0.000128	0.287139	12.138095	128.86 $\pm$ 0.47	96.52	5.94	96.52	5.94	15.507 $\pm$ 1.334	
10C2809	0.001538	0.007565	0.000224	0.256559	10.876215	129.21 $\pm$ 0.68	95.99	5.31	95.99	5.31	14.583 $\pm$ 1.139	
10C2811	0.001201	0.006033	0.000168	0.217472	9.221320	129.24 $\pm$ 0.60	96.29	4.50	96.29	4.50	15.499 $\pm$ 1.322	
10C2812	0.001110	0.005958	0.000193	0.207695	8.817279	129.39 $\pm$ 0.71	96.41	4.30	96.41	4.30	14.990 $\pm$ 1.277	
10C2813	0.000883	0.005155	0.000131	0.173544	7.288657	128.06 $\pm$ 0.28	96.54	3.59	96.54	3.59	14.476 $\pm$ 1.237	
10C2815	0.000752	0.004126	0.000108	0.164903	6.910154	127.78 $\pm$ 0.82	96.88	3.41	96.88	3.41	17.186 $\pm$ 1.649	
10C2816	0.000721	0.003674	0.000102	0.140513	5.917386	128.39 $\pm$ 0.53	96.52	2.91	96.52	2.91	16.447 $\pm$ 1.996	
10C2817	0.000536	0.003478	0.000110	0.090284	3.684588	124.56 $\pm$ 0.63	95.88	1.87	95.88	1.87	11.161 $\pm$ 1.182	
Information on Analysis	Σ 0.076695 0.477599 0.004935 4.895669 203.997688											
	Results											
80006 plagioclase E. Oregon jh	40(r)/39(k) $\pm 2\sigma$											
	Weighted Plateau											
Project = Dilles Irradiation = OSU2B10 J = 0.0017515 $\pm$ 0.0000035 FCT-3 = 28.030 $\pm$ 0.003 Ma	42.3492 $\pm$ 0.0550 $\pm$ 0.13%											
	129.09 $\pm$ 0.52 $\pm$ 0.41% External Error $\pm$ 2.12 Analytical Error $\pm$ 0.16											
Total Fusion Age	MSWD											
	39Ar(k) (%,n)											
Total Fusion Age	K/Ca $\pm 2\sigma$											
	78.62 12 Statistical T Ratio Error Magnification											
Total Fusion Age	21											
	11.707 $\pm$ 0.251											

Table A10 – Sample 79992

Incremental Heating	36Ar(a)	37Ar(ca)	38Ar(d)	39Ar(k)	40Ar(r)	Age $\pm 2\sigma$ (Ma)	40Ar(r) 39Ar(k) (%)	K/Ca $\pm 2\sigma$
10C2819	0.004906	0.018729	0.000041	0.002760	0.075308	84.82 $\pm$ 9.18	4.94	0.063 $\pm$ 0.005
10C2820	0.004227	0.025247	0.000042	0.011199	0.427598	117.59 $\pm$ 1.48	25.50	0.191 $\pm$ 0.014
10C2821	0.001434	0.030629	0.000028	0.008567	0.342280	122.88 $\pm$ 1.62	44.68	0.120 $\pm$ 0.009
10C2823	0.000762	0.055262	0.000013	0.012677	0.532755	129.03 $\pm$ 1.26	70.30	0.099 $\pm$ 0.007
10C2824	0.000305	0.049711	0.000019	0.012151	0.510811	129.06 $\pm$ 1.47	85.02	0.105 $\pm$ 0.008
10C2825	0.000368	0.059162	0.000017	0.012580	0.530098	129.36 $\pm$ 0.89	82.97	0.091 $\pm$ 0.007
10C2826	0.000398	0.062067	0.000018	0.012952	0.543378	128.81 $\pm$ 0.60	82.22	0.090 $\pm$ 0.007
10C2828	0.000444	0.061983	0.000004	0.012977	0.544862	128.91 $\pm$ 0.76	80.60	0.090 $\pm$ 0.007
10C2829	0.000567	0.078237	0.000017	0.015945	0.669938	128.99 $\pm$ 0.72	79.99	0.088 $\pm$ 0.006
10C2830	0.000481	0.067991	0.000018	0.014070	0.591120	128.98 $\pm$ 1.01	80.62	0.089 $\pm$ 0.007
10C2831	0.000313	0.043508	0.000004	0.009029	0.378811	128.81 $\pm$ 0.88	80.38	0.089 $\pm$ 0.006
10C2833	0.000198	0.030237	0.000003	0.006068	0.260127	131.52 $\pm$ 0.92	81.64	0.086 $\pm$ 0.006
Σ	0.014401	0.582763	0.000224	0.130975	5.407086			

Information on Analysis	Results	40(r)/39(k) $\pm 2\sigma$	Age $\pm 2\sigma$ (Ma)	MSWD	39Ar(k) (%)	K/Ca $\pm 2\sigma$
79992 plagioclase E: Oregon jh	Weighted Plateau	42.0036 $\pm$ 0.1013 $\pm$ 0.24%	128.96 $\pm$ 0.56 $\pm$ 0.43%	0.18	78.17 8	0.092 $\pm$ 0.004
			External Error $\pm$ 2.12 Analytical Error $\pm$ 0.30	2.36 1.0000	Statistical T Ratio Error Magnification	
Project = Dilles Irradiation = OSU2B10 J = 0.0017641 $\pm$ 0.0000034 FCT-3 = 28.030 $\pm$ 0.003 Ma	Total Fusion Age	41.2833 $\pm$ 0.1249 $\pm$ 0.30%	126.82 $\pm$ 0.59 $\pm$ 0.47%		12	0.097 $\pm$ 0.002
			External Error $\pm$ 2.10 Analytical Error $\pm$ 0.37			

Appendix 4 – Photographs of the Merín basin rocks

Figure A2 – Rocks of the Merín basin 1. A) Aiguá rhyolite flows on top of Grutas de Salamanca hills, close to Aiguá town (609779 mE, 6229151mN). B) Rheomorphically deformed quartz-plagioclase ignimbrites with elongated fiammes and occasional shards from outcrops between Lascano-East and Lascano-West (643132 mE, 6268699 mN). C) Lithic clast in Lavalleja ignimbrite from outcrops in the periphery of Lascano-East (670709 mE, 6266150 mN). D) Banded plagioclase rich Lavalleja rhyolitic ignimbrite from Lascano-East. Note arrow pointing a lithoclast (653476 mE, 6266482 mN). E) Volcanic breccias of Lavalleja rhyolites from Lascano-West (647075 mE, 6275277 mN). F) Lavalleja rheo-ignimbrite outcrops between Lascano-East and Lascano-West (643132 mE, 6268699 mN). G) Banded plagioclase-rich Lavalleja rheo-ignimbrite (LASDDH4, 655 m). H) Quartz and plagioclase porphyritic India Muerta rhyolite dike (LASDDH4, 788 m). F) Quartz and plagioclase porphyritic India Muerta rhyolite dike (LASDDH3, 250 m).

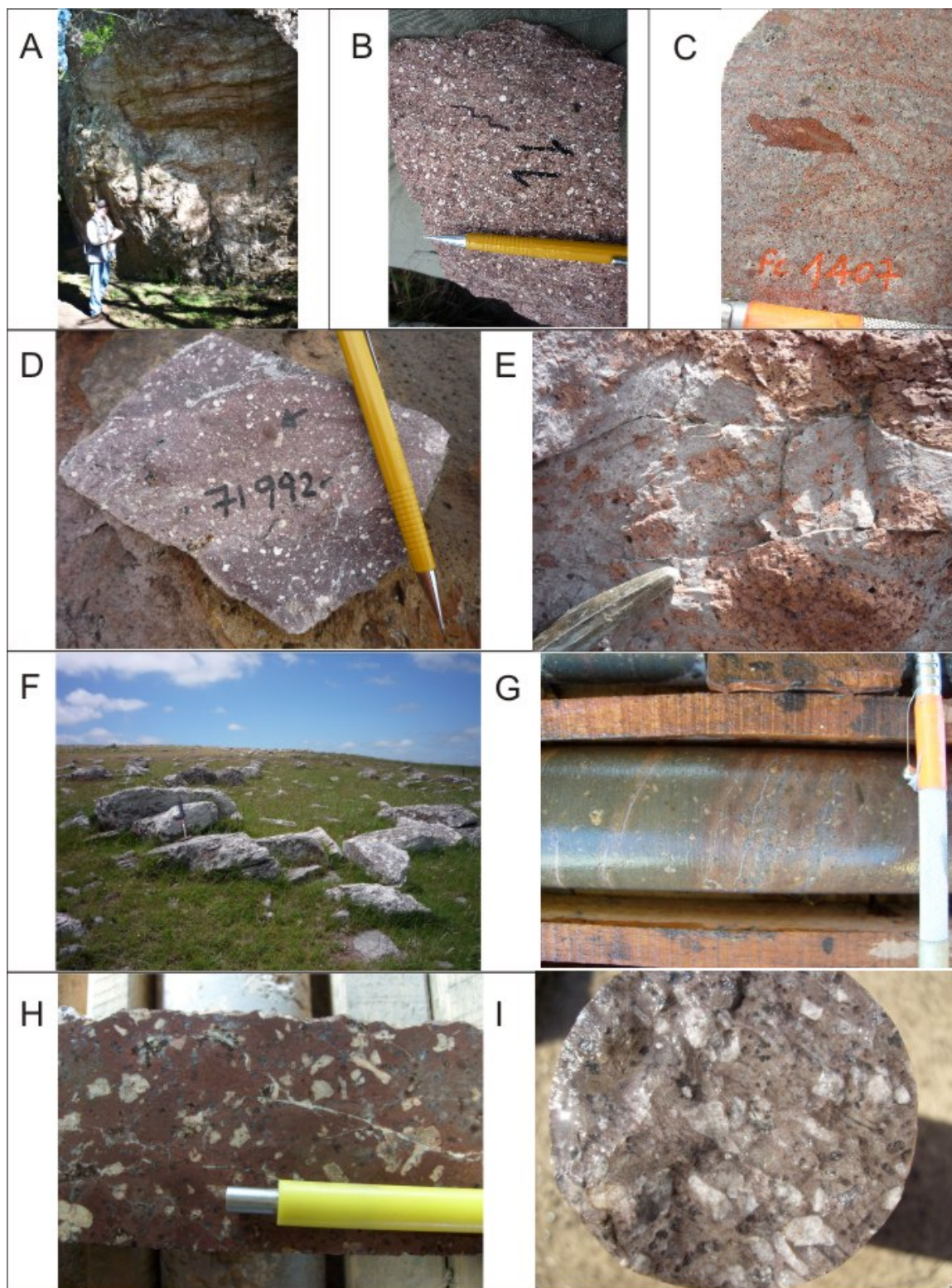


Figure A2 – Rocks of the Merín basin 1.

FigureA3 – Rocks of the Merín basin 2. A) Lavalleya rhyolitic rheo-ignimbrite with quartz and plagioclase phenocrysts in spherulitic vitreous matrix (LASDDH7, 319 m). B) Quartz and plagioclase porphyritic rhyolite with fine-grained matrix (LASDDH7, 456.3 m). C) Lavalleya rhyolitic vitrophyre at Lascano-East (648401 mE, 6265267 mN). D) Lascano trachyte showing pilotaxitic alignment of feldspar microliths (dike LASDDH8, 682.7 m). E) Lascano trachyte dike (light green) cutting Santa Lucía basalts (dark green) at 45° (LASDDH6, 465 m). F) Lascano gabbro dike (black) cutting Lavalleya ignimbritic rhyolites (pale grey), upper contact is at 45° to the core axis and lower is at 30° (LASDDH6, 435 m). G) Subvertical contact of Lascano trachyte dike intruding Santa Lucía basalts (LASDHH2, 350 m). H) Coarse-grained Valle Chico syenite (604924 mE, 6235033 mN). I) Lascano subvertical trachyte dike (left, green) cutting through Valle Chico syenite (coarser grained, right) (611116 mE, 6243231 mN).

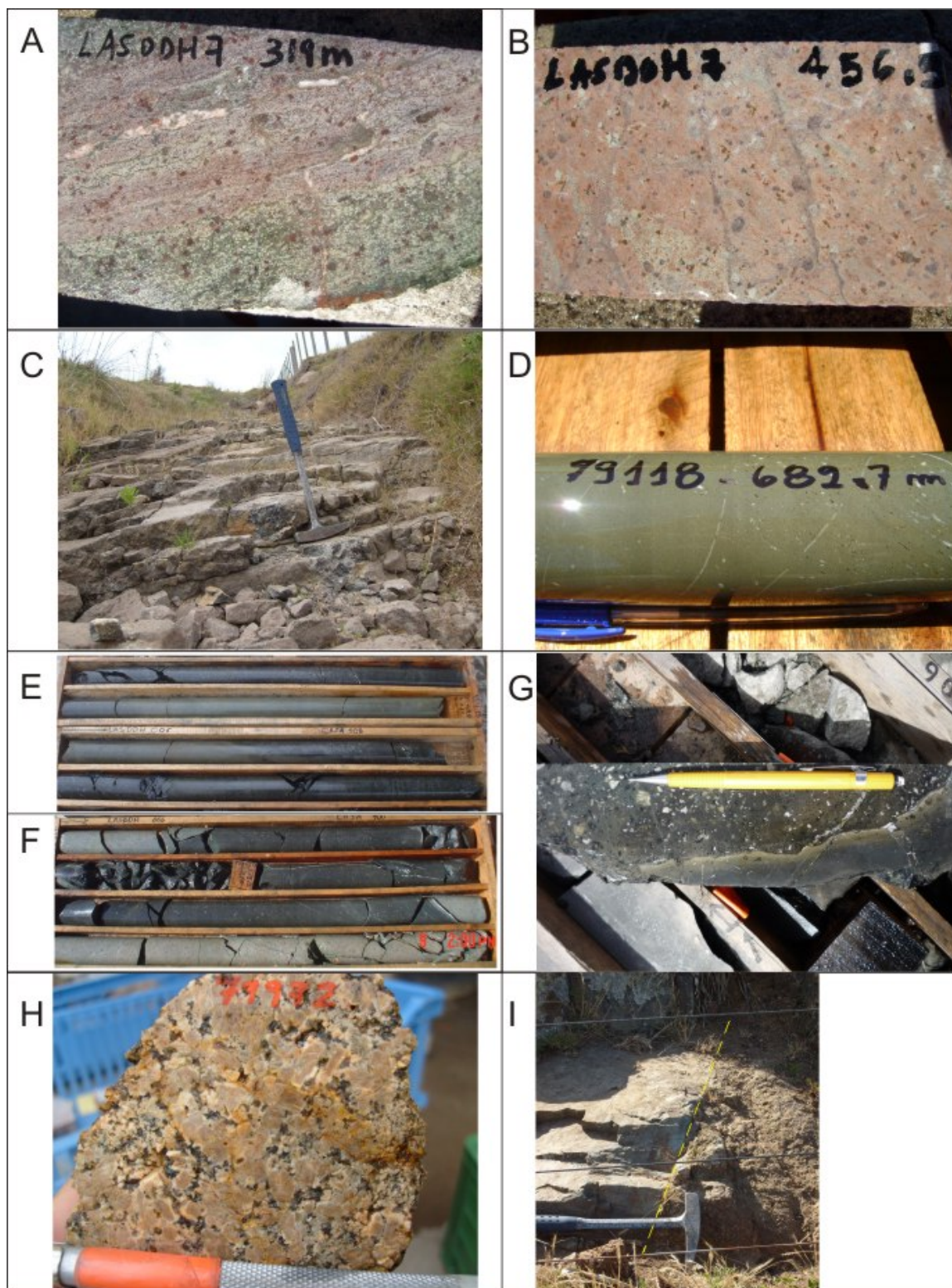


Figure A3 – Rocks of the Merín basin 2.

Figure A4 – Rocks of the Merín basin 3. A) Panoramic view of Lascano-West outcrops looking southwest from Uruguay Highway Route 14 towards the complex. Note apparent dip of Lavalleja rhyolites towards north/northwest. B) several 3- to 6-meter-wide subvertical Lascano trachyte dikes cutting the Valle Chico syenite and striking 140° (611116 mE, 6243231 mN). C) Best exposures of San Miguel granodiorite granophyres in quarry near the town of 19 de Abril near the edge of San Luis geophysical anomaly and inferred intrusive complex (704130 mE, 6271423 mN). D) Narrow dikes of San Miguel granodiorite granophyres cutting Treinta y Tres B gabbros (LASDDH7, 130.7 m) E) Lascano gabbro xenoliths in San Miguel granodiorite granophyre (LASDHH7, 909 m) F) Characteristic porphyritic plagioclase texture of San Miguel granodiorite granophyres (LASDDH5, 200 m). G) Massive San Miguel granodiorite granophyre showing “Liesegang” texture of hematite produced by ground water carrying iron after weathering of Fe-rich minerals, including pyrite (704130 mE, 6271423 mN).

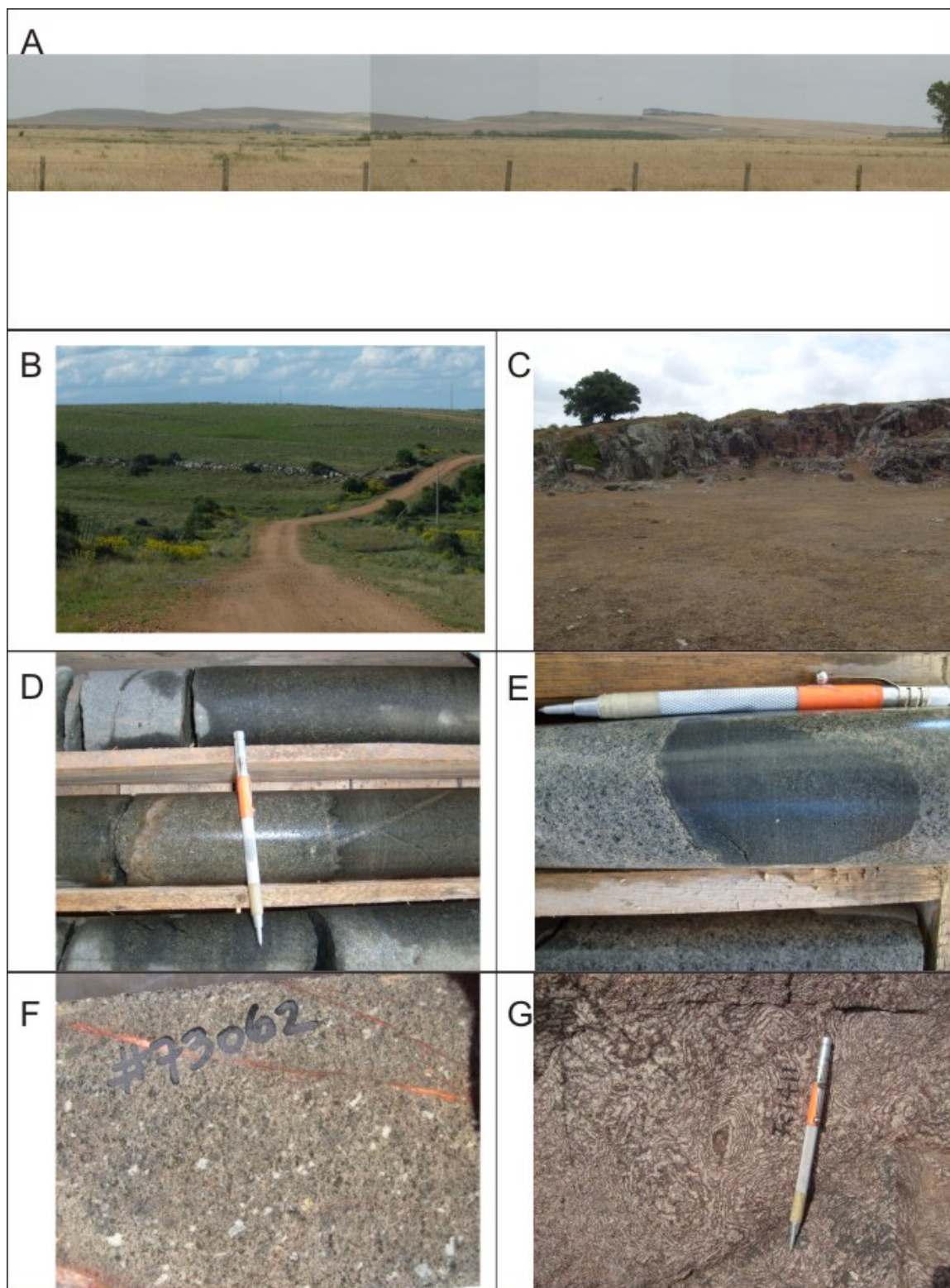


Figure A4 – Rocks of the Merín basin 3.

Figure A5 – Rocks of the Merín basin 4. A) Typical outcrop of Treinta y Tres B basalts in a road cut immediately south of Lascano-West intrusive complex. View is SW with basalt dipping 2 to 3° to the north (643044 mE, 6268667 mN). B) Equigranular Treinta y Tres B gabbro dikes/sills (LASDDH1, 321 m). C) Hyaloclastically fractured Treinta y Tres A basalt (LASDDH4, 537 m). D) Treinta y Tres B basalt with sparse pyroxene phenocrysts and typical zeolite-filled vesicles (LASDDH3, 405 m). E) Plagioclase glomeroporphyritic Treinta y Tres A basalt (LMD1, 433.7 m). F) Vesicular nearly aphyric Treinta y Tres A basalts with sparse small plagioclase phenocrysts. Upper is weathered (hematite-rich) and lower is fresher (LMD1, 80 m / 320 m). G) Coarse-grained plagioclase porphyritic Treinta y Tres A basalt (LASDDH1, 715.6 m). H) Weathered breccia top of a Treinta y Tres A basalt flow (LMD1, 63 m).

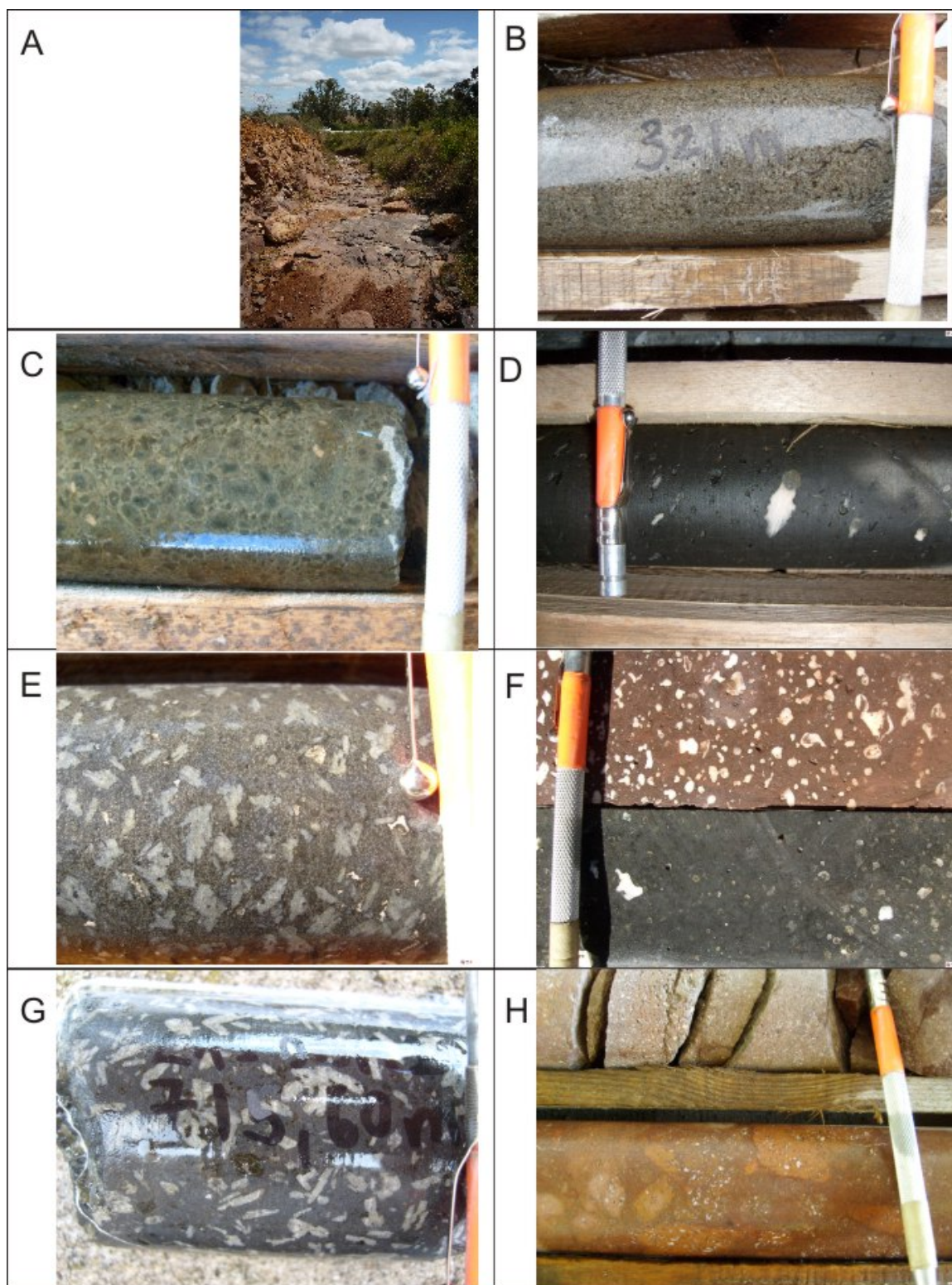


Figure A5 – Rocks of the Merín basin 4.

Figure A6 – Rocks of the Merín basin 5. A) Santa Lucía coarse-grained gabbro from the central zone of a dike. Note coarse magnetite (LASDDH2, 198.3 m). B) Same Santa Lucía gabbro dike showing finer grain size closer to the contact. C) Typical Santa Lucía basalt showing coarse-grained plagioclase phenocrysts (LASDDH2, 368.6 m). D) Plagioclase porphyritic Lascano gabbro (LASDDH7, 220 m) E) Quebracho Formation conglomerates showing erosional contact on top of Arrayán olivine basalts (LASDDH4, 419 m). F) Arrayán olivine basalts showing typical olivine phenocrysts altered to iddingsite (LASDDH4, 205 m). G) Quebracho Formation conglomerates showing several fining upwards cycles from coarse conglomerates to sandstones (LASDDH4, 300 m). H) Typical polymictic Cañada Solís conglomerates (LASDDH4, 380 m).

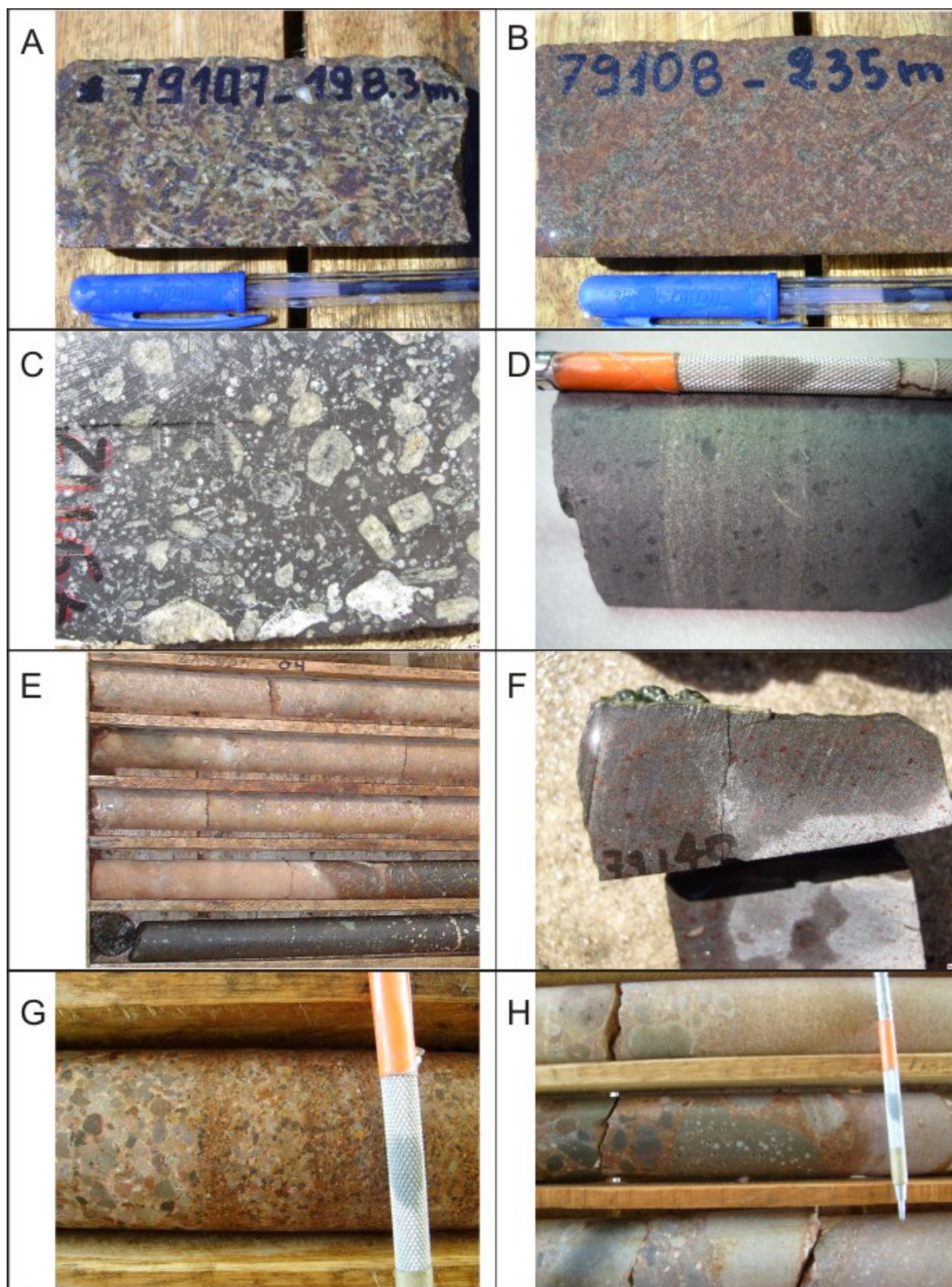


Figure A6 – Rocks of the Merín basin 5.

Figure A7 – Rocks of the Merín basin 6. A,B) Slab of a Lascano trachyte dike (green, left) in contact with Santa Lucía basalt (dark, right). Staining with sodium cobaltinitrite stains K-feldspar in yellow and evidence more intense alteration near the contact that diffuses towards the inner part of the dike (LASDDH2, 126.5 m) C) Lavalleja rhyolite slab. The lower piece is stained with sodium cobaltinitrite and evidence patchy hydrothermal K-feldspar. Quartz-fluorite veins present brownish to green alteration halos and are cutting and displacing quartz-chalcedony veins (LASDDH8, 165.9m). D) Lavelleja rhyolite showing alteration of the fine grain matrix to K-feldspar and clays and unaltered quartz phenocrysts (LASDDH6, 347.5 m). E) Lavalleja rhyolite showing green-clays over a small fault plane with pyrite disseminations (LASDDH8, 160.45 m). F) Lavalleja rhyolite showing K-feldspar only partially replacing some plagioclase phenocrysts (LASDDH6, 346 m). G) Fluorite veins in Lavalleja rhyolite (LASDDH8, 165 m).



Figure A7 – Rocks of the Merín basin 6.

Figure A8 – Rocks of the Merín basin 7. A) Dark phyllosilicates and pyrite veins cutting through a Santa Lucía gabbro sill (LASDDH2, 215.15m). B) Quartz-chalcopyrite vein cutting through contact zone between Santa Lucía gabbro sill and Santa Lucía basalt (LASDDH2, 299.7 m). C) Pyrite and quartz-pyrite veins cutting through Santa Lucía basalts (LASDDH2, 340 m). D) Quartz-phyllosilicates-carbonate vein cutting through Santa Lucía gabbro (LASDDH2, 269.8 m). E,F) Santa Lucía basalt slab stained with sodium cobaltinitrite. Voids are dark colored or show dark edges. Plagioclase phenocrysts rims are overgrown by K-feldspar (yellow) (LASDDH2, 307 m).

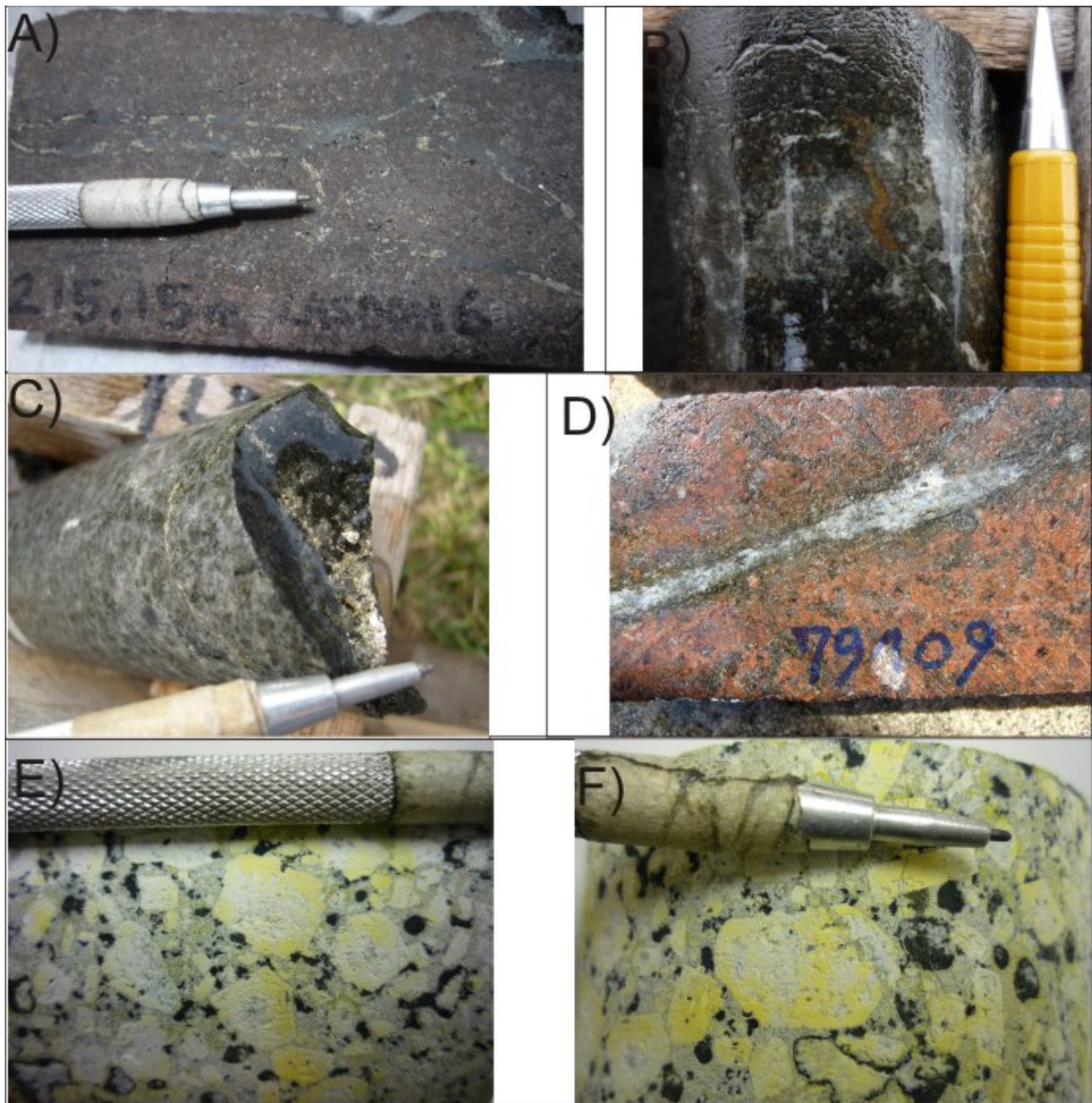


Figure A8 – Rocks of the Merín basin 7.

Appendix 5 – Short wave infrared spectroscopy data

Table A10 – Identified minerals with SWIR

Sample Number	ASD Sample	Mineral ID	Sample Number	ASD Sample	Mineral ID
71411	LAS.465.sco	Muscovite	73228	LAS.837.sco	Illite
71414	LAS.467.sco	Muscovite	73231	LAS.841.sco	Illite
71416	LAS.469.sco	Muscovite	73232	LAS.842.sco	Illite
71418	LAS.471.sco	Muscovite	73235	LAS.844.sco	Illite
71419	LAS.472.sco	Muscovite	73237	LAS.846.sco	Illite
71426	LAS.478.sco	Muscovite	73238	LAS.847.sco	Illite
71428	LAS.481.sco	Muscovite	73241	LAS.850.sco	Illite
71429	LAS.482.sco	Muscovite	73242	LAS.851.sco	Illite
71430	LAS.483.sco	Muscovite	73248	LAS.856.sco	Illite
71431	LAS.484.sco	Muscovite	73249	LAS.857.sco	Illite
71470	LAS.517.sco	Muscovite	73254	LAS.862.sco	Illite
71401	LAS.455.sco	Muscovite	73256	LAS.864.sco	Illite
71412	LAS.466.sco	Muscovite	73261	LAS.869.sco	Illite
71451	LAS.501.sco	Muscovite	73265	LAS.872.sco	Illite
71651	LAS.686.sco	Illite	73266	LAS.873.sco	Illite
71404	LAS.457.sco	Illite	73267	LAS.874.sco	Illite
71405	LAS.458.sco	Illite	73268	LAS.875.sco	Illite
71636	LAS.673.sco	Illite	73269	LAS.876.sco	Illite
71638	LAS.675.sco	Illite	73270	LAS.877.sco	Illite
71407	LAS.461.sco	Illite	73271	LAS.878.sco	Illite
71386	LAS.442.sco	Illite	73277	LAS.884.sco	Illite
71415	LAS.468.sco	Illite	73278	LAS.885.sco	Illite
71417	LAS.470.sco	Illite	73280	LAS.887.sco	Illite
71420	LAS.473.sco	Illite	73284	LAS.890.sco	Illite
71422	LAS.475.sco	Illite	73286	LAS.892.sco	Illite
71427	LAS.479.sco	Illite	73320	LAS.925.sco	Illite
71472	LAS.519.sco	Illite	73327	LAS.931.sco	Illite
73259	LAS.867.sco	Illite	73459	LAS.372.sco	Illite
73262	LAS.870.sco	Illite	73075	LAS.342.sco	Kaolinite
73275	LAS.882.sco	Illite	71487	LAS.537.sco	Kaolinite
73276	LAS.883.sco	Illite	71501	LAS.549.sco	Kaolinite
71400	LAS.454.sco	Illite	71388	LAS.444.sco	Kaolinite
71402	LAS.456.sco	Illite	71486	LAS.536.sco	Kaolinite
71406	LAS.459.sco	Illite	71502	LAS.550.sco	Kaolinite
73330	LAS.934.sco	Illite	73111	LAS.321.sco	Kaolinite
73331	LAS.935.sco	Illite	73112	LAS.322.sco	Kaolinite
73336	LAS.939.sco	Illite	71485	LAS.535.sco	Kaolinite
73337	LAS.941.sco	Illite	71503	LAS.551.sco	Kaolinite
73347	LAS.950.sco	Illite	71504	LAS.552.sco	Kaolinite
73366	LAS.968.sco	Illite	73385	LAS.985.sco	Kaolinite
73368	LAS.970.sco	Illite	71505	LAS.553.sco	Kaolinite
73369	LAS.971.sco	Illite	71488	LAS.538.sco	Kaolinite
73474	LAS.385.sco	Illite	71489	LAS.539.sco	Kaolinite
71450	LAS.499.sco	Illite	71491	LAS.541.sco	Kaolinite
71454	LAS.502.sco	Illite	71492	LAS.542.sco	Kaolinite
73217	LAS.827.sco	Illite	71493	LAS.543.sco	Kaolinite
73218	LAS.828.sco	Illite	71494	LAS.544.sco	Kaolinite

Table A10 – Continued

Sample Number	ASD Sample	Mineral ID	Sample Number	ASD Sample	Mineral ID
73220	LAS.830.sco	Illite	71497	LAS.547.sco	Kaolinite
73221	LAS.831.sco	Illite	71498	LAS.548.sco	Kaolinite
73224	LAS.833.sco	Illite	71506	LAS.554.sco	Kaolinite
73226	LAS.835.sco	Illite	73225	LAS.834.sco	Kaolinite
73470	LAS.382.sco	Kaolinite	71942	LAS.528.sco	Montmorillonite
71434	LAS.485.sco	Montmorillonite	73207	LAS.817.sco	Montmorillonite
71435	LAS.486.sco	Montmorillonite	73210	LAS.821.sco	Montmorillonite
71438	LAS.489.sco	Montmorillonite	73211	LAS.822.sco	Montmorillonite
71943	LAS.529.sco	Montmorillonite	73214	LAS.824.sco	Montmorillonite
73140	LAS.754.sco	Montmorillonite	71925	LAS.270.sco	Montmorillonite
73148	LAS.762.sco	Montmorillonite	73068	LAS.334.sco	Montmorillonite
73150	LAS.764.sco	Montmorillonite	73071	LAS.337.sco	Montmorillonite
73208	LAS.818.sco	Montmorillonite	71912	LAS.349.sco	Montmorillonite
73053	LAS.311.sco	Montmorillonite	73069	LAS.335.sco	Montmorillonite
73101	LAS.303.sco	Montmorillonite	73212	LAS.823.sco	Montmorillonite
73304	LAS.909.sco	Montmorillonite	71365	LAS.423.sco	Montmorillonite
73441	LAS.1034.scc	Montmorillonite	71382	LAS.438.sco	Montmorillonite
71940	LAS.355.sco	Montmorillonite	71384	LAS.439.sco	Montmorillonite
73157	LAS.770.sco	Montmorillonite	71387	LAS.443.sco	Montmorillonite
73158	LAS.771.sco	Montmorillonite	71409	LAS.463.sco	Montmorillonite
73162	LAS.775.sco	Montmorillonite	71445	LAS.495.sco	Montmorillonite
73164	LAS.776.sco	Montmorillonite	71446	LAS.496.sco	Montmorillonite
71915	LAS.723.sco	Montmorillonite	71447	LAS.497.sco	Montmorillonite
71919	LAS.727.sco	Montmorillonite	71461	LAS.509.sco	Montmorillonite
73108	LAS.316.sco	Montmorillonite	71467	LAS.514.sco	Montmorillonite
71507	LAS.555.sco	Montmorillonite	73447	LAS.361.sco	Montmorillonite
71526	LAS.572.sco	Montmorillonite	71370	LAS.428.sco	Montmorillonite
71667	LAS.702.sco	Montmorillonite	71371	LAS.429.sco	Montmorillonite
73061	LAS.327.sco	Montmorillonite	71378	LAS.434.sco	Montmorillonite
71517	LAS.565.sco	Montmorillonite	71398	LAS.452.sco	Montmorillonite
71629	LAS.667.sco	Montmorillonite	71368	LAS.426.sco	Montmorillonite
71632	LAS.669.sco	Montmorillonite	71380	LAS.436.sco	Montmorillonite
73118	LAS.733.sco	Montmorillonite	71944	LAS.530.sco	Montmorillonite
73120	LAS.735.sco	Montmorillonite	71360	LAS.418.sco	Montmorillonite
73131	LAS.746.sco	Montmorillonite	71361	LAS.419.sco	Montmorillonite
73138	LAS.752.sco	Montmorillonite	71362	LAS.421.sco	Montmorillonite
73139	LAS.753.sco	Montmorillonite	71458	LAS.506.sco	Montmorillonite
73141	LAS.755.sco	Montmorillonite	71459	LAS.507.sco	Montmorillonite
73142	LAS.756.sco	Montmorillonite	71548	LAS.593.sco	Montmorillonite
73177	LAS.789.sco	Montmorillonite	71551	LAS.595.sco	Montmorillonite
73178	LAS.790.sco	Montmorillonite	71552	LAS.596.sco	Montmorillonite
73179	LAS.791.sco	Montmorillonite	71553	LAS.597.sco	Montmorillonite
73180	LAS.792.sco	Montmorillonite	71554	LAS.598.sco	Montmorillonite
73182	LAS.794.sco	Montmorillonite	71908	LAS.315.sco	Montmorillonite
73184	LAS.795.sco	Montmorillonite	73107	LAS.314.sco	Montmorillonite
73186	LAS.797.sco	Montmorillonite	73452	LAS.366.sco	Montmorillonite

Table A10 – Continued

Sample Number	ASD Sample	Mineral ID	Sample Number	ASD Sample	Mineral ID
73187	LAS.798.sco	Montmorillonite	73292	LAS.898.sco	Montmorillonite
73194	LAS.805.sco	Montmorillonite	73294	LAS.899.sco	Montmorillonite
73195	LAS.806.sco	Montmorillonite	73295	LAS.901.sco	Montmorillonite
73196	LAS.807.sco	Montmorillonite	73296	LAS.902.sco	Montmorillonite
73198	LAS.809.sco	Montmorillonite	73297	LAS.903.sco	Montmorillonite
73199	LAS.810.sco	Montmorillonite	73298	LAS.904.sco	Montmorillonite
73202	LAS.813.sco	Montmorillonite	73299	LAS.905.sco	Montmorillonite
73205	LAS.815.sco	Montmorillonite	73321	LAS.926.sco	Montmorillonite
71916	LAS.724.sco	Montmorillonite	73445	LAS.358.sco	Montmorillonite
73497	LAS.406.sco	Montmorillonite	73446	LAS.359.sco	Montmorillonite
73498	LAS.407.sco	Montmorillonite	73448	LAS.362.sco	Montmorillonite
73499	LAS.408.sco	Montmorillonite	73449	LAS.363.sco	Montmorillonite
73500	LAS.409.sco	Montmorillonite	73454	LAS.367.sco	Montmorillonite
71903	LAS.717.sco	Montmorillonite	73456	LAS.369.sco	Montmorillonite
71351	LAS.410.sco	Montmorillonite	73458	LAS.371.sco	Montmorillonite
71352	LAS.411.sco	Montmorillonite	73476	LAS.387.sco	Montmorillonite
71354	LAS.412.sco	Montmorillonite	73478	LAS.389.sco	Montmorillonite
71355	LAS.413.sco	Montmorillonite	73485	LAS.394.sco	Montmorillonite
71356	LAS.414.sco	Montmorillonite	73490	LAS.399.sco	Montmorillonite
71357	LAS.415.sco	Montmorillonite	73491	LAS.401.sco	Montmorillonite
71358	LAS.416.sco	Montmorillonite	73492	LAS.402.sco	Montmorillonite
71359	LAS.417.sco	Montmorillonite	73495	LAS.404.sco	Montmorillonite
71366	LAS.424.sco	Montmorillonite	73496	LAS.405.sco	Montmorillonite
71367	LAS.425.sco	Montmorillonite	73461	LAS.374.sco	Montmorillonite
71455	LAS.503.sco	Montmorillonite	73464	LAS.375.sco	Montmorillonite
71457	LAS.505.sco	Montmorillonite	73465	LAS.376.sco	Montmorillonite
71462	LAS.510.sco	Montmorillonite	73471	LAS.383.sco	Montmorillonite
71483	LAS.533.sco	Montmorillonite	73472	LAS.384.sco	Montmorillonite
71484	LAS.534.sco	Montmorillonite	73054	LAS.305.sco	Montmorillonite
71495	LAS.545.sco	Montmorillonite	73055	LAS.306.sco	Montmorillonite
71496	LAS.546.sco	Montmorillonite	73422	LAS.1017.sco	Montmorillonite
71536	LAS.582.sco	Montmorillonite			
71543	LAS.588.sco	Montmorillonite			
71544	LAS.589.sco	Montmorillonite			
71545	LAS.590.sco	Montmorillonite			
71546	LAS.591.sco	Montmorillonite			
71547	LAS.592.sco	Montmorillonite			
71549	LAS.594.sco	Montmorillonite			
73219	LAS.829.sco	Montmorillonite			
73239	LAS.848.sco	Montmorillonite			
73240	LAS.849.sco	Montmorillonite			
73244	LAS.852.sco	Montmorillonite			
73246	LAS.854.sco	Montmorillonite			
73251	LAS.859.sco	Montmorillonite			
73285	LAS.891.sco	Montmorillonite			
73291	LAS.897.sco	Montmorillonite			

Appendix 6 – X-ray diffraction data

Table A11 – Identified minerals with XRD

XRD #	ASD number	Geochemical Sample Number	Rock type	Hydrous mineral identified with SWIR	Minerals identified with XRD
1	LAS-529	71943	Marmarajá series gabbro dike	Montmorillonite	Montmorillonite, quartz
2	LAS-1017	73422	San Miguel granodiorite granophyre	Montmorillonite	Montmorillonite, quartz
3	LAS-469	71416	Lavalleja rhyolite breccia	Phengitic muscovite	Muscovite/illite?, quartz, orthoclase
4	LAS-469	71416b	Lavalleja rhyolite breccia (scraped powder)	Phengitic muscovite	Muscovite/illite?, quartz, orthoclase
5	LAS-850	73241	Lavalleja rhyolite ignimbrite	Illite	Muscovite/illite?, kaolinite, quartz
7	LAS-478	71426	Lavalleja rhyolite breccia	Phengitic muscovite	Muscovite/illite?, quartz
8	LAS-549	71501	Lavalleja rhyolite ignimbrite	Kaolinite	Kaolinite, quartz
9	LAS-387	73476	Lavalleja rhyolite ignimbrite	Montmorillonite	Montmorillonite, quartz

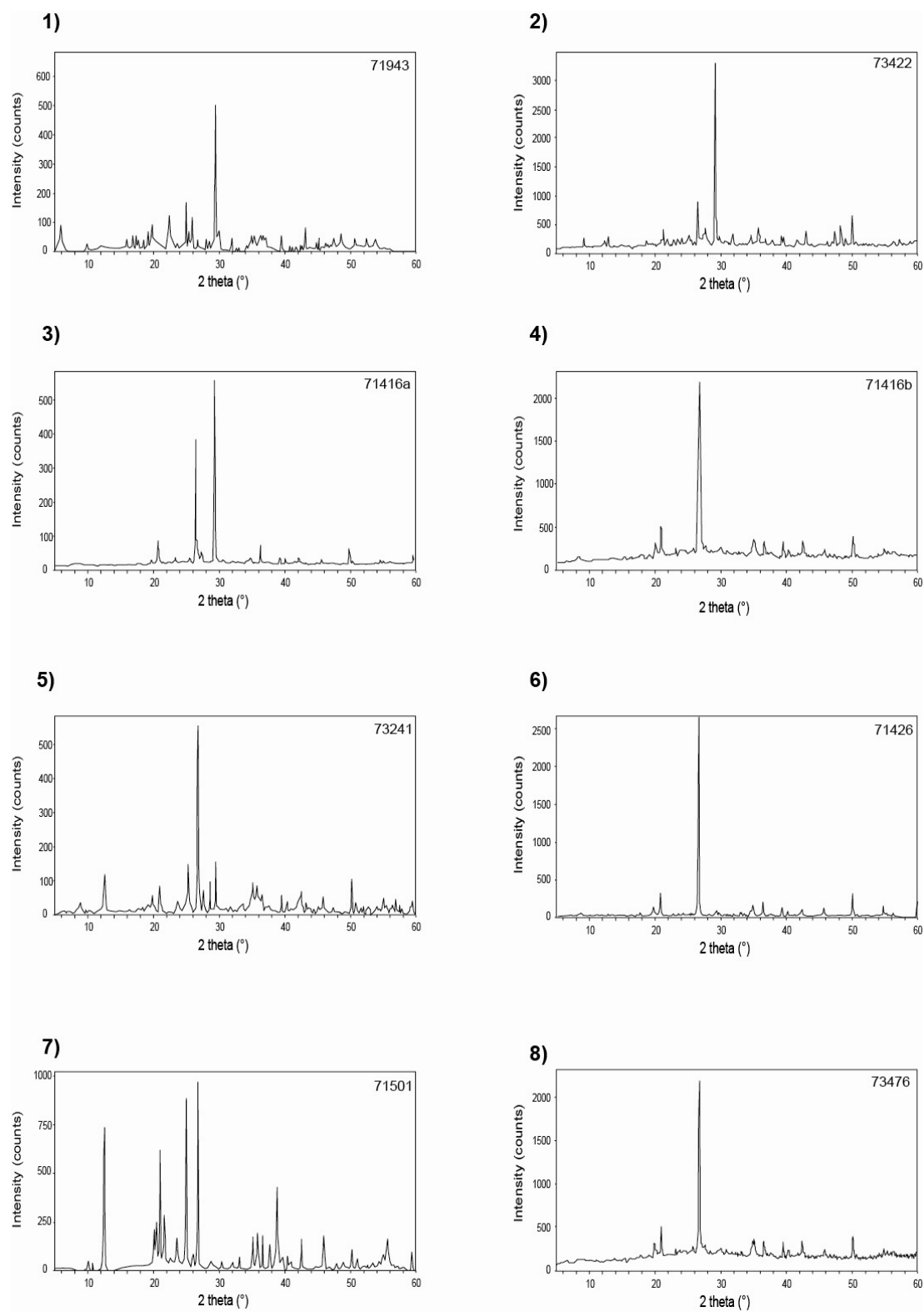


Figure A9 – XRD spectra of analyzed samples