cascadero

May 22, 2018

Amended and refiled notification:

The Technical Report on the Sarita Este Gold Project, Salta Province, Northwestern Argentina authored by Lithos Geological Ltd. (Andrew L. Wilkins, B.Sc., P.Geo) and originally filed on May 3,2018 has been amended and refiled (as attached).

Technical Report on the Sarita Este Gold Project

Salta Province, Northwestern Argentina

Latitude 24° 34.5’ S, Longitude 67° 47’ W

Prepared for:

Cascadero Copper Corporation

by:

Lithos Geological Ltd.

Andrew L. Wilkins, B.Sc., P.Geo

March 31st, 2018

Statement of Qualifications

I, Andrew L. Wilkins, P.Geo, B.Sc, do hereby certify that I am the "Qualified Person and author" for the report titled "Technical Report on the Sarita Este Gold Project, Salta Province, Northwestern Argentina, March 31, 2018". I further certify the following:

1. I am a principal of Lithos Geological Inc. with a business address of 8328 Ski Jump Rise, Whistler, British Columbia, Canada.
2. I am a graduate of the University of British Columbia, Vancouver, B.C. and hold an Bachelor of Science Degree majoring in Geology that I obtained in 1981.
3. I take responsibility for all sections of the Technical Report titled "Technical Report on the Sarita Este Gold Project, Salta Province, Northwestern Argentina" with effective date March 31st, 2018.
4. I have practiced my profession as an exploration geologist for more than 37 years having worked and managed exploration projects in many geological environments including porphyry copper gold and epithermal gold deposits.
5. I have worked as an exploration geologist in British Columbia, the Yukon, Quebec and Nunavik in Canada, as well as Alaska, California, Nevada and Arizona in the USA, Northern Mexico and Northwestern Argentina.
6. I am registered as a Professional Geoscientist with the Association of Professional Engineers and Geoscientists of British Columbia (# 121825).
7. I have read the definition of "Qualified Person" set out in National Instrument 43-101 ("NI 43-101") and hereby certify that by reason of my education, affiliation with professional associations and past and recent relevant work experience, I fulfill the requirements to be a "Qualified Person" as defined in the National Instrument 43-101.
8. I supervised and worked on the Sarita Este Property from October 2nd to November 20th, 2017.
9. I have read National Instrument 43-101 and Form 43-101F1, and the Technical Report has been prepared in compliance with that Instrument and Form.
10. I am independent of Cascadero Copper Corporation.
11. I am not aware of any material fact or material change with respect to the subject matter of the Technical Report that is not reflected in the Technical Report, the omission to disclose which makes the Technical Report misleading and to the best of my knowledge, information and belief, the Technical Report contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated this 31st day of March, 2018

Andrew L. Wilkins, B.Sc., P. Geo.

Consent of Qualified Person

Pursuant to Section 8.3 of National Instrument 43-101

March 31, 2018

TO:

Cascadero Copper Corporation

British Columbia Securities Commission

Alberta Securities Commission

Ontario Securities Commission

Toronto Stock Exchange

Dear Sirs/Mesdames:

Re: Cascadero Copper Corporation. (the “Company”)

Public Filing of Technical Report

I, Andrew L Wilkins, MSc, P.Geo., consent to the public filing of the technical report titled “Technical Report on the Sarita Este Gold Project, Salta Province, Northwestern Argentina” dated March 31, 2018 (the “Technical Report”).

I consent to the publication of extracts from, or a summary of, the Technical Report.

I confirm that I have read the filing and that it fairly and accurately represents the information in the Technical Report that supports the disclosure.

Yours truly,

PROFESSIONAL A. L. W. WILKINS PROVINCE OF BRITISH COLUMBIA GEOSCIENTIST

Andrew L. Wilkins, B.Sc., P. Geo.
Dated this 31st day of March, 2018

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1 Summary

The Sarita Este Property is a gold-silver prospect located on the east side of the Sierra de Taca Taca range, in the western Puna of Salta province, Argentina. It is located approximately 240 kilometres due west of the city of Salta and 37 kilometres west of the village of Tolar Grande. Access to the property is by paved roads from the city of Salta to the town of San Antonio de Cobres, followed by all-weather gravel roads through Tolar Grande to the property. There is minimal infrastructure available in the vicinity of the Property. The Sarita Este Property consists of one concession, 830 hectares in size. The Property is controlled by Cascadero Copper Corporation ("Cascadero").

The Property lies within a known mining region with several proven copper and gold deposits nearby. The Taca Taca Bajo copper-gold-molybdenum porphyry deposit is located 3.5 kilometres to the northeast and has a published indicated resource of 2.165 billion tonnes grading 0.44% copper, 0.013% molybdenum, 0.08 grams per tonne gold (Sim et al., 2013). The Taca Taca Bajo mineralization is documented as Oligocene in age.

There has been a significant amount of historical prospecting on the Sarita Este Property, commencing with its discovery by Mansfield Minerals in 1996. Three small trenches were dug but not sampled in 2012. Historically, no systematic sampling had occurred on the Property; however, grab samples from prospecting have yielded results of up to 162.6 grams per tonne gold. Limited historic mapping outlined encouraging sericitic and phyllic alteration that is coincident with the known mineralization.

Three styles of mineralization have been observed in surface exposures at the Sarita Este Property. The first style consists of oxidized gold bearing quartz-limonite after pyrite micro veins that also contain anomalous values in lead, zinc and copper. The veins occur within recessive grey quartz-sericite-clay altered crystal lapilli tuff. Copper ± silver ± zinc replacement or skarn type mineralization associated with chlorite, epidote and diopside alteration within calcareous conglomerate rocks makes up the second style of mineralization. The third style of mineralization comprises siliceous brecciated veins that form prominent ribs and contain varying amounts of hematite with sporadic gold and silver mineralization. All three styles of mineralization are believed to be related to hydrothermal systems created by Andean magmatic events that occurred during the Oligocene epoch.

The 2017 program consisted of grid soil sampling over the Sarita Este Gold Zone. The program also included geological mapping of alteration, structure and rock sampling to confirm historic grab sample results. The three historic trenches that were not previously sampled were chip sampled and mapped.

The soil sampling program outlined a gold-in-soil anomaly that is coincident with mineralized historic rock samples and recessive grey quartz-sericite-clay (phyllic) altered crystal lapilli tuff. The anomaly is also consistent with the structural trends mapped on the Property. The anomaly is approximately 1,050 metres by 850 metres in size on surface.

At this time, an exploration program consisting of 2,000 metres of trenching and sampling is recommended. Contingent on results of the trenching program, a follow-up 1,500 metres of drilling is recommended to further test the gold anomaly.

2 Introduction and Terms of Reference

Cascadero Copper Corporation is involved in the exploration of several mining concessions in northwestern Argentina, including the Sarita Este Property. Mr. Andrew Wilkins, B.Sc., P.Geo and Ms. Lucia Maria Theny, M.Sc., G.I.T, of Lithos Geological Inc. were commissioned by Cascadero Copper Corporation of Vancouver, B.C. to manage the soil geochemistry program and to examine and evaluate the geology and mineralization of the Sarita Este Gold Zone located primarily on the Sarita Este concession. The authors were asked to recommend detailed work programs for the next phases of exploration in order to properly test the economic potential of the showings. In addition, the company requested that the authors complete a Technical Report summarizing the findings of the work to date. This report describes the results of the current and historic programs in accordance with the guidelines specified in National Instrument 43-101. It is based on the historical information available and the examination and evaluation of the Sarita Este Gold Zone by the authors. The authors were on the Property from October 2nd to November 30th, 2017 and were assisted in the field by Ms. Annie Borch, a recent B.Sc. graduate in Earth Sciences and Mr. Ron Bilquist, a long time prospector with over 20 years' experience working in Northwestern Argentina and the discoverer of many of the mineralized showings found on the Sarita Este and surrounding concessions. Sources of information include a review of the following documents:

- Cascadero Copper Corporation Company reports and other proprietary Company data, including results of historic sampling, prospecting and mapping.
- Available historic reports from other companies working in the area.
- "Taca Taca Property, porphyry Copper-Gold-Molybdenum Project, Argentina, NI 43-101 Technical Report" for the neighboring Taca Taca Bajo deposit (Sim et al., 2013).
- Review of geological maps and reports completed by various Argentinian governmental agencies.
- Published scientific papers on the geology and mineral deposits of the region and on mineral deposit types.

3 Reliance on Other Experts

The author is relying upon information supplied by the issuer regarding the legal status of the property.

4 Property Description and Location

4.1 Location

The Sarita Este Property is located in Salta Province in the high altitude Puna region of northwestern Argentina (Figure 4.1). The Property is on the east side of the Sierra Taca Taca range and the eastern boundary adjoins the Taca Taca Bajo Property. Elevations range between 3,450 and 3,900 metres above sea level. The centre of the Property is approximately situated at 24° 35' south latitude and 67° 46' west longitude. It is approximately 240 kilometres due west of the City of Salta, 55 kilometres east of the Argentine-Chilean border and 37 kilometres west of the village of Tolar Grande.

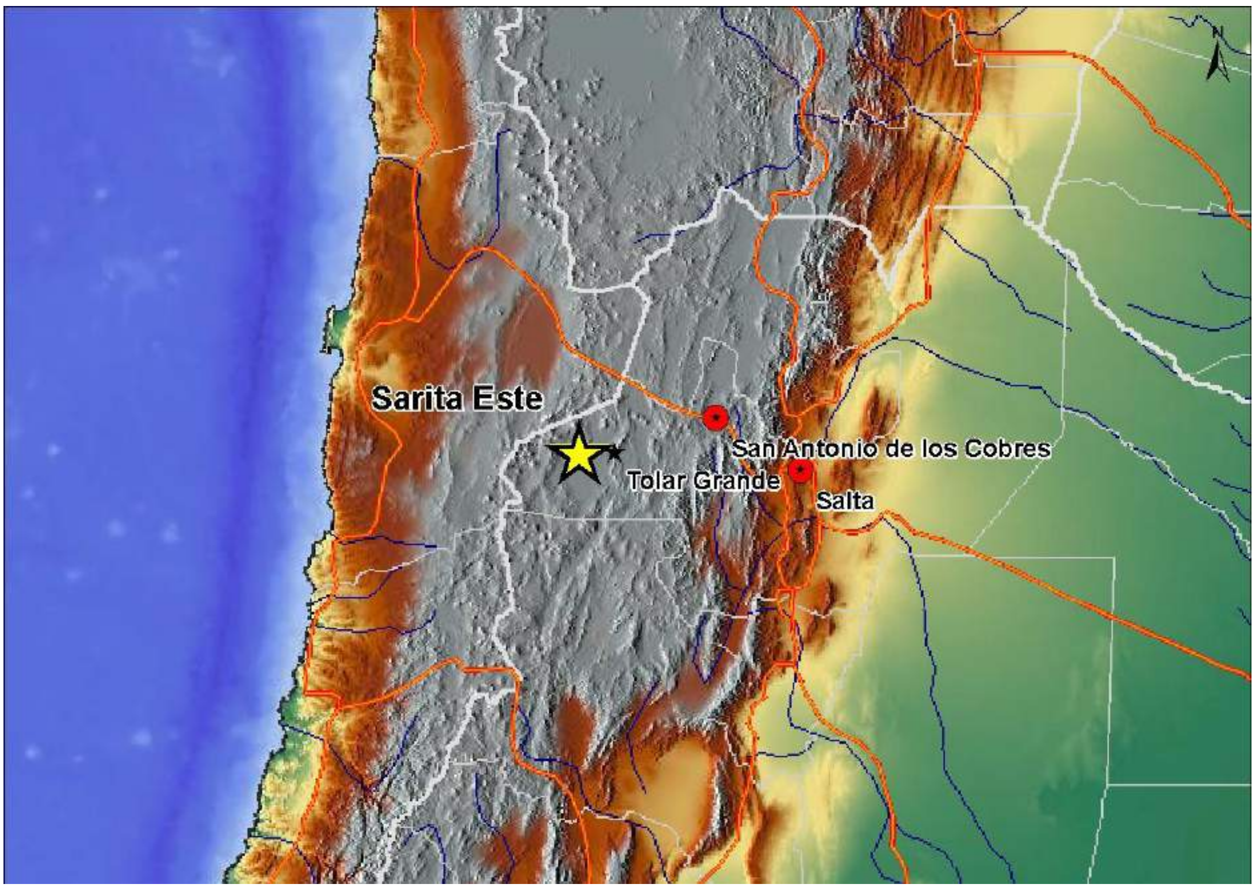


Figure 4.1 - Project Location Map (Yellow star denotes the location of the Property, small black star represents the village of Tolar Grande, thick grey line represents country boundaries, thin grey lines represent province boundaries, red dots represent towns and cities.)

4.2 Concessions

The Sarita Este Gold Zone straddles the Sarita Este and the Desierto I concessions. The majority of the gold zone is located on the Sarita Este concession.

The Sarita Este concession (Figure 4.2) is 100% owned by Cascadero Minerals SA (CMSA). CMSA is 70% owned by Cascadero Minerals Corporation; a private Canadian Company and reporting issuer and 30% by Regberg Ltd., a private company. There is a !%

NSR on the Sarita Este concession to Northwestern Enterprises Ltd. The Desierto I concession is registered to three (3) parties, Golden Minerals, La Pacha Minerals and Cascadero. The concessions have not been subject to a legal survey. The concessions (Table 4.1) are on Argentine federal land within the municipality of Tolar Grande. The author did not request verification of Title to the Concessions. The surface rights are not allocated or granted to any party. A 1.8% tax is payable to the municipality of Tolar Grande on the gross value of any contract work, such as a drill program. The registered companies are responsible for reporting, collecting and paying the tax to the municipality. Argentine Mining Investment Law empowers the provinces to collect a royalty from mineral production. The provinces set the rate and it can be up to 3% of production value.

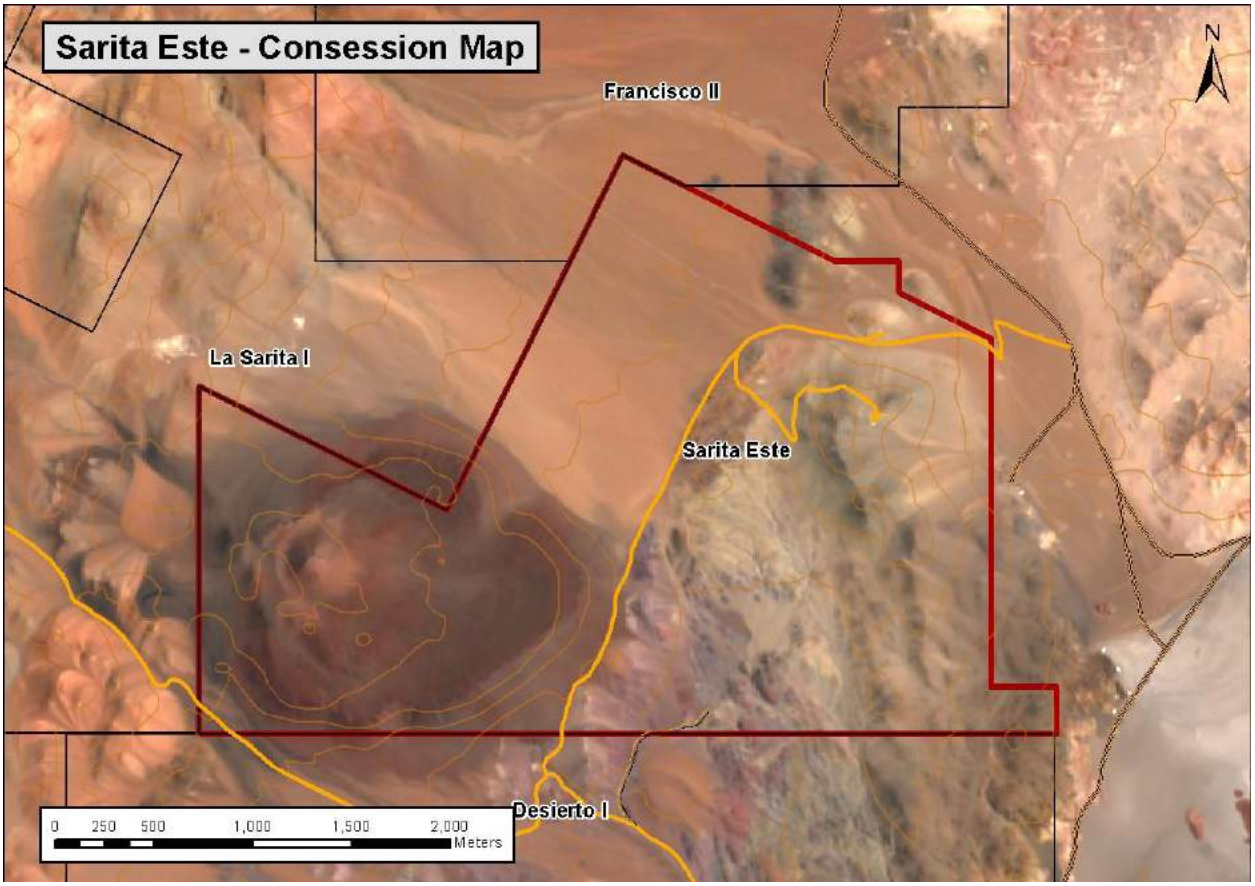


Figure 4.2 - Sarita Este Concession Map (concession boundary for Sarita Este in red, concession boundaries in black, 4 x 4 roads in orange, main road in yellow and black)

Table 4.1 – Sarita Este Concession Table

Concession	Concession Number	Number of Units	Area (hectares)	Ownership
Sarita Este	18060	9	830	CMSA 100%
Desierto I	18021		1500	SGSA 33% / Pacha 33% / Golden 33%

4.3 Environmental Liabilities

The Environmental Protection Mining Code (EPM) of Argentina is federal legislation monitored and enforced by the provinces. Prior to any mining related activity, the concession owner must prepare and submit to the applicable province an Environmental Impact Assessment (EIA) report. The province has a sixty-day period to either accept or reject the EIA. The EIA and the related Declaration of Environmental Impact (DEI) provide for sanctions for non-compliance to the EPM. The regulations include provisions and guidelines for reclamation if a concession is abandoned.

5 Accessibility, Local Resources, Infrastructure, Climate and Physiography

5.1 Accessibility and Resources

Access to the Property from the city of Salta is mostly by paved roads for approximately 100 kilometres followed by all-weather gravel roads for 300 kilometres via National Highway 51 and Provincial Highway 27. Numerous 4 x 4 trails cross the property. Travel time ranges from 8 to 10 hours from the city of Salta. There is no permanent camp at the Property. Accommodation and services for exploration workers are located at the village of Tolar Grande. Tolar Grande has a population of approximately 175. Travel to the Property includes crossing a portion of the Salar de Arizaro. The Salta - Antofagasta railway is located 9 kilometres to the north and the Argentine to Chile high tension power line is 110 kilometers to the east of the property. The power line is currently not electrified. The area is sparsely populated and there is sufficient land for mining operations. Surface water is scarce but subsurface water can be obtained from the surrounding aquifers.

5.2 Climate and Physiography

The Property is located in the Puna de Atacama eco-region. This eco-region is considered one of the driest regions on the planet with average annual rainfalls of less than 200 mm, rainfall occurs dominantly in the summer months. The mean annual maximum and minimum temperatures are +16 and -4 degrees Celsius, however extremes can range from -20 to +30 degrees Celsius. Windy periods are frequent and most prevalent in the afternoons. The area has more than 300 days of sunshine per year.

The Puna is host to large-scale salt lakes known as salars and high-volcanic complexes that are over 6,000 metres in elevation.

The vegetation is composed of mostly shrubs with the dominant species being the steppe shrub. In addition, there are tolas (species of low shrub), tolilla, añagua, suriyanta and queñoa as well as halophytes in saline depressions.

The fauna is represented mainly by camelids such as llama, vicuña and guanacos. In addition, there are Andean puma, a dwarf guinea pig, the common mouse, chinchilla, the cordilleran ostrich (suri or ñandu petiso), partridge, redfish, tero serrano, parinas (flamingos), lizards, snakes and donkeys.

6 History

The first recorded exploration in the area was related to the Taca Taca Bajo copper-gold-molybdenum porphyry deposit located 3.5 kilometres to the northeast of the Sarita Este Gold Zone. Taca Taca Bajo is currently being explored and considered for development by First Quantum Minerals Ltd. Copper mineralization was first discovered on the Taca Taca Bajo property in the mid-1960s. Between 1970 and 2008 the Taca Taca Bajo showing was explored by several companies including Falconbridge Argentina S.A., Gatro Argentina Minera S.A. (GAMSA), Corriente Resources, BHP Minerals, and Río Tinto Inc. Lumina Copper tested the extent of the porphyry mineralization between 2010 and 2012. The Taca Taca Bajo copper-gold-molybdenum porphyry deposit has a published indicated resource of 2.165 billion tonnes grading 0.44% copper, 0.013% molybdenum, and 0.08 grams per tonne gold (Sim et al., 2013).

The Taca Taca Alto copper-gold-molybdenum porphyry is located 5 kilometres to the northwest of the Sarita Este Property. It was discovered around the same time as the Taca Taca Bajo Property. The Taca Taca Alto Property was explored by the Direccion General De Fabricaciones Militares (DGFM) now known as Servicio Geológico Minero Argentino (SEGEMAR - Argentine Government Geological Services) and private companies including Gencor, RTZ and BHP.

Mansfield Minerals was quite active in the area in the 1990's and are believed to be the first company to recognize the gold mineralization in the Sarita Este Gold Zone. Cascadero acquired the property in 2005. Cascadero conducted mostly prospecting and sampling and some geologic mapping on the Sarita Este and surrounding concessions in 2017, 2012, 2007, 2006 and 2005. No mineral resources or reserves have been established and no mineralized production has occurred on the Property.

7 Geologic Setting and Mineralization

7.1 Regional Geology

The Andes, within the vicinity of the Sarita Este Property is characterized by high altitude basin and range topography consisting of an alternating landscape of parallel mountain ranges and valleys (Figures 7.1 and 7.2). Physiographic features from west to east are as follows:

- the Chilean Coastal Range
- the Central Valley
- the Cordillera Occidental along the Chilean Argentinian border
- the high plateau of the Argentinian Puna
- the Cordillera Oriental
- Sierras Subandinas.

These features are the result of two major orogenic cycles, the Paleozoic Hercynic cycle (Vicente, 1975) and the Meso-Cenozoic Andean cycle (Coira et al., 1982). The Hercynic cycle is characterized by alternating sedimentary and/or volcanic events with short deformation phases in between and frequently associated with syn-kinematic plutonism (Coira et al., 1982). The continental magmatic arc was initially termed the Western Puna Eruptive Belt (Palma et al., 1986) and has more recently been assigned as the Famatinian magmatic arc (Niemeyer et al., 2018). The Sarita Este Property lies within the Western Puna Eruptive Belt (Coira et al., 2009), also known as the Early Ordovician - Silurian Famatinian orogenic belt (Rapela et al., 2016). A northwest orientation of the arc between 21° and 26° latitudes in the northern Chile-Argentina Andes was first recognized by Palma et al. (1986) and has been related with a north east dipping subduction zone (Coira et al., 1982). Ordovician plutonic outcrops consisting of coarse grained granite are located along the western border of Salar de Arizaro, where they are known as the Taca Taca Granite (Poma et al., 2004). Several radiometric dates have been determined for the Taca Taca batholith including a Rb/Sr isochron at 469 ± 4 Ma age (Llambıas and Caminos, 1986), U/Pb zircon dating indicating a 476 ± 7 Ma age (Makepeace et al., 2002) and a more recent zircon date indicating a 441 Ma age (Sim et al., 2013).

The younger second orogenic cycle known as the Andean cycle is thought to be more directly controlled by subduction of the Pacific oceanic crust beneath the South American continent. The Andean cycle developed over two periods; a Jurassic to Early Cretaceous period characterized by the development of a well-defined magmatic-arc-back-arc basin pair and a Late Cretaceous to Recent period during which only an eastward migrating magmatic arc was present (Coira et al., 1982).

Late Permian granite and aplite are documented cross cutting the Taca Taca batholith, which is subsequently overlain by Late Permian sediments and volcaniclastics (Sim et al., 2013). Narrow, north-south striking, steeply dipping rhyolitic dykes of Permo-Triassic age outcrop throughout the region.

Oligocene rhyodacitic intrusions and related volcaniclastics and flow domes of the Santa Inés Formation cross cut and overlay the older rocks and are responsible for the porphyry copper mineralization and alteration at the Taca Taca Bajo porphyry deposit as well as the other mineralized occurrences in the area (Sim et al., 2013).

Late Tertiary red-bed sedimentary rocks are widely distributed in the region but are most abundant east of Salar de Arizaro (Carrera et al., 2006). These rocks possibly constitute the basal section of the sedimentary sequence that fills the Salar basin. Zappettini and Blasco (2001) suggest that the encompassing Arizaro basin is mainly filled by non-marine clastic Vizcachera Formation sediments.

Lavas from recent (Pliocene to Pleistocene) volcanoes are exposed to the west and north of the Taca Taca deposit (Almandoz, 2008; Sim et al., 2013). Large evaporite deposits of alternating salts and sand were deposited in regional intermontane basins to form the present-day salars (Poma et al., 2004).

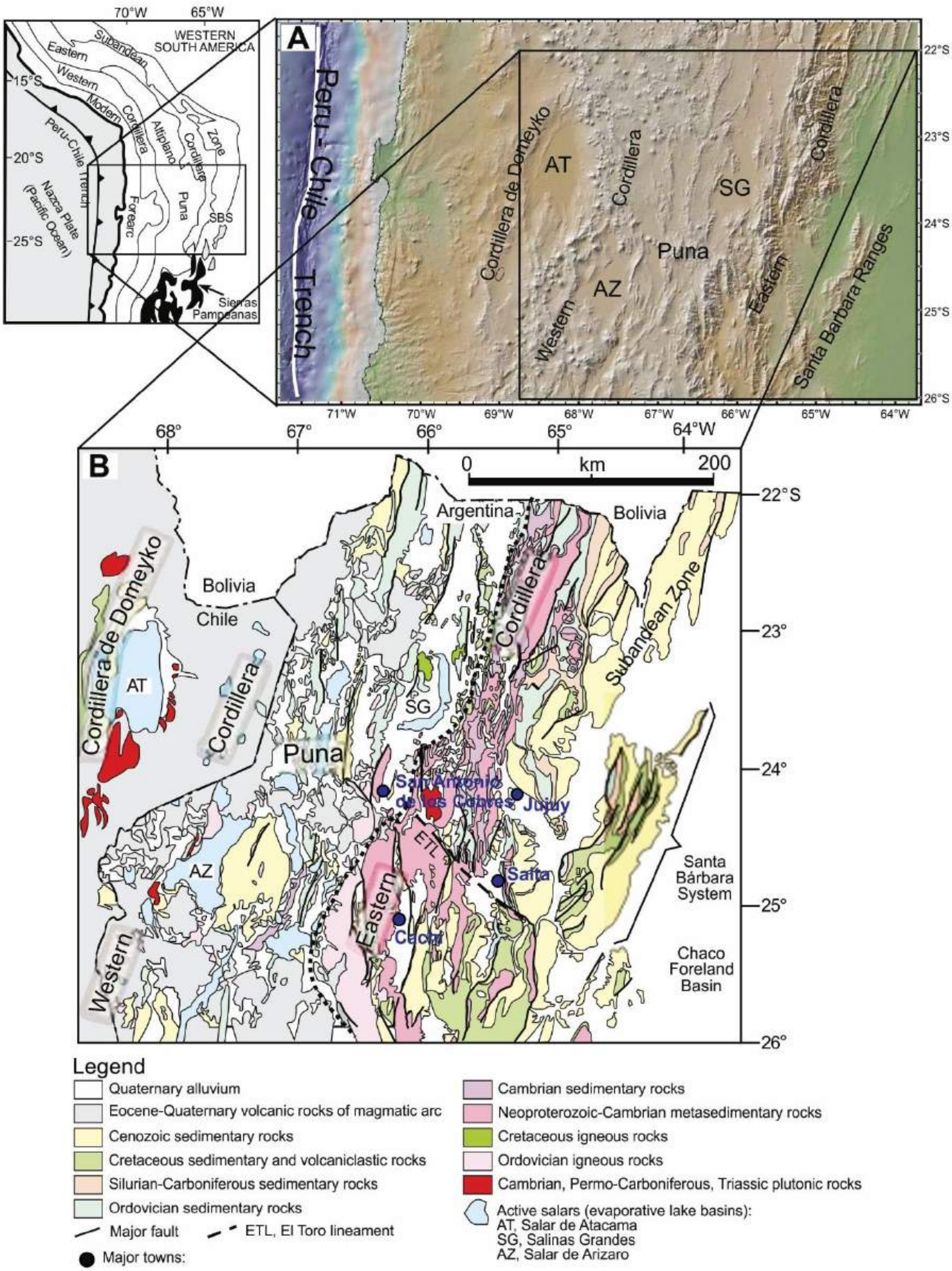


Figure 7.1 - Regional Geology, Puna, Northwest Argentina (from DeCelles et al., 2015; Reutter et al., 1994)

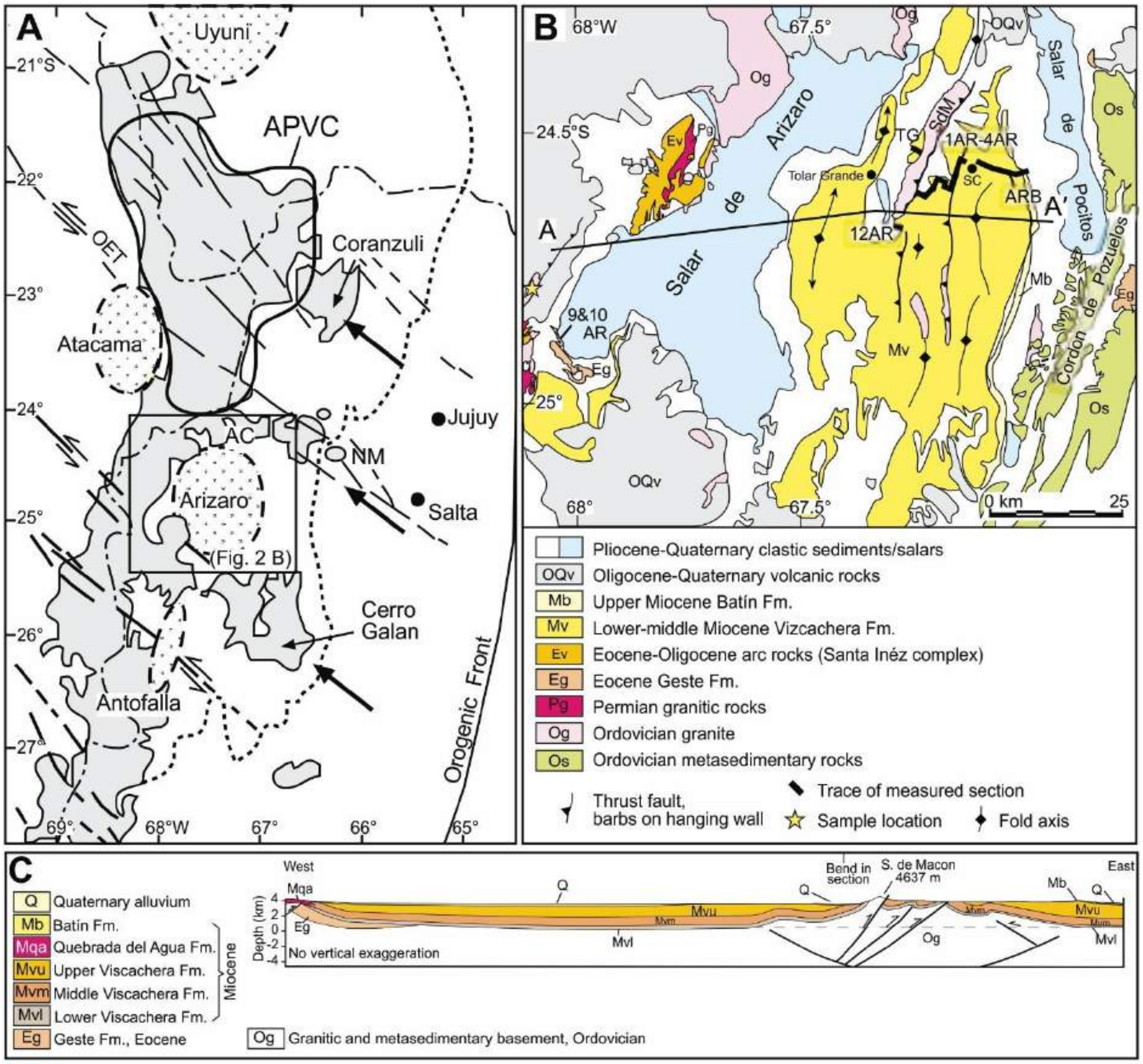


Figure 7.2 - Regional Geology, Salar de Arizaro (from DeCelles et al., 2015)

The Sierra de Taca Taca is interpreted to be an uplifted block of Paleozoic intrusive rocks (Poma et al., 2004). Oligocene volcanics that are exposed to the west of the property dip to the west. This suggests that the Sierra de Taca Taca was uplifted with an eastern convergence along a major, high angle reverse fault located near the western border of the Salar de Arizaro; regional evidence suggests uplift occurred during the Oligocene (Almandoz, 2008; Sim et al., 2013). A 2-kilometre-wide graben is mapped in the west and parallels the salar margin. This graben is thought to postdate the reverse faulting (Richards et. al., 2007). The Sarita Este and Desierto I concessions lie between these two major structures.

7.2 Property Geology

7.2.1 Lithology

The basement lithologies in the map area consist of granodiorite and granite of Ordovician age referred to as the Taca Taca granite (Coira et al., 1982; Niemeyer et al., 2018; Poma et al., 2004; Sim et. al., 2013). The Taca Taca granite has been intruded by Late Permian granite and aplite rocks and overlain by Late Permian sediments and volcaniclastics (DeCelles et al., 2015). These have been cross cut and overlain by Eocene-Oligocene arc rocks of the Santa Inez complex, including rhyodacitic hypabyssal intrusions, dykes, flow domes, crystal lapilli tuff and crystal tuff (DeCelles et al., 2015). The west central portion of the property is covered by a recent dacitic dome. This large feature occupies an interpreted 2 km wide graben structure (Richards et. al., 2007).

7.2.2 Structure

Sim et al. (2013) suggested that the structural fabric observed in the Ordovician granite host rock of the Taca Taca Bajo deposit is characterized by the presence of discrete but widespread NNE-SSW and NW-SE trending, steeply dipping proto-mylonite to mylonite zones. The emplacement of Oligocene rhyodacitic dykes, quartz veining related to the porphyry system, fractures, and small scale faults were controlled by these pre-existing zones of structural weakness.

The Sierra de Taca Taca region also contains an abundance of strong NW-SE and NNW-SSE lineaments. It is believed that only small scale extensional normal faulting has occurred along these structures since the timing of mineralization at the Taca Taca Bajo porphyry deposit (~ 29 Ma) (Sim et al., 2013). The lineaments may represent conjugate faults related to the large-scale graben mapped to the west of Sarita Este or to a major high angle reverse fault thought to be at the western edge of the Salar de Arizaro (Almandoz, 2008; Richards et al., 2007; Sim et. al., 2013). Almandoz observed westward tilting of Oligocene volcanic rocks to the west of the Taca Taca Bajo deposit and interpreted that the range was uplifted with eastern vergence along a major high angle reverse fault located near the western border of the Salar de Arizaro during Oligocene time (Almandoz, 2008).

7.2.3 Mineralization

Three styles of mineralization are recognized on the Property and are described as follows:

1. Oxidized gold bearing quartz-limonite after pyrite micro veins that also yield anomalous values in lead, zinc and copper. These veins occur within sinuous zones of mostly quartz-sericite and lesser clay altered crystal lapilli tuff. The Sarita Este soil geochemistry grid is positioned over these zones.
2. Copper ± silver ± zinc bearing replacement or skarn type mineralization in association with chlorite, epidote and diopside alteration within calcareous conglomerate rocks occur north of the Sarita Este grid.
3. Siliceous brecciated veins or “ribs” with varying amounts of hematite and sporadic gold and silver mineralization have been mapped and sampled. These veins range from 0.1 to 30 metres wide, are continuous and extend southward onto the Desierto I concession.

Mineralization at the Taca Taca Bajo porphyry deposit to the northeast is Oligocene in age (Sim et al., 2013). Although no geochronology has been performed on the Sarita Este mineralization, it is believed to be of similar age.

8 Deposit Type

The deposit model that best fits the style of lithology, alteration and mineralization seen on the Sarita Este concession is an intermediate sulphidation epithermal deposit model, peripheral to an Andean porphyry copper-gold-molybdenum system (Figure 8.1).

Supporting evidence for this model includes proximity to the Taca Taca Bajo and Taca Taca Alto porphyry deposit and showing respectively, presence of extensive and zoned propylitic, phyllic, argillic and silicic alteration regimes, a network of mineralized micro veins, as well as associated precious metal mineralization with notable concentrations of copper, lead, zinc and arsenic.

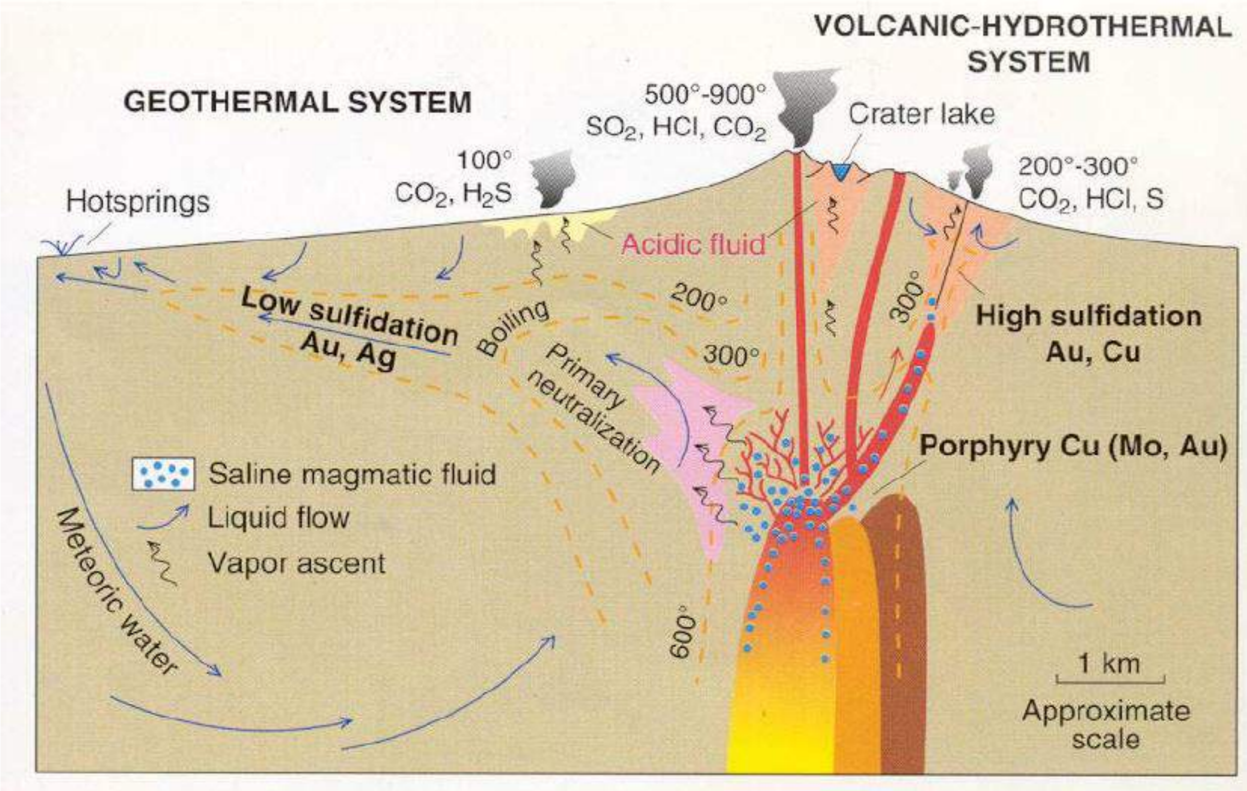


Figure 8.1 - Epithermal Models above Porphyry Systems (from Hedenquist and Lowenstern (1994).

9 Exploration

9.1 Previous Exploration

Mansfield Minerals was quite active in the area in the 1990's and are believed to be the first company to recognize the gold mineralization in the Sarita Este Gold Zone. Cascadero acquired the property in 2005. Cascadero conducted mostly prospecting and sampling and some geologic mapping on the Sarita Este and surrounding concessions in 2017, 2012, 2007, 2006 and 2005. In 2012, three trenches totaling 46 metres were excavated with a back-hoe. The trenches were about 1 metre wide and anywhere from 10 to 80 centimetres deep, however no sampling or mapping of the trenches was ever conducted.

9.2 2017 Work Program

During October and November of 2017, Cascadero conducted a roughly 150 person-day program of geological mapping, soil and rock geochemical surveys and concurrent prospecting on the Sarita Este Gold Zone. The main objective of the program was to generate potential trench and drill targets and to define areas that warrant further exploration.

9.2.1 Geologic Mapping

Detailed mapping of lithology, alteration and structure over the soil grid area was conducted. The three historic trenches in the Sarita Este Zone were mapped in detail. Selected samples were sent to Vancouver Petrographics Ltd. for detailed thin section descriptions. The petrographic report is located in Appendix 1. Mapping was conducted at a scale of 1:2,000 using a compass, GPS and base map. UTM WGS84 Zone 19S was used by the field crews. GPS waypoints, and fields notes were compiled nightly and outcrops were drawn into an ArcGIS database. The geology and alteration map is plotted on Figure 9.1.

9.2.2 Rock Geochemistry

A total of 152 rock samples were collected including 46 chip samples from the three historic trenches that were dug in 2012. Trench chip samples were continuous one metre long samples.. Rock samples were analyzed using a four acid digestion and multispectral induced coupling plasma (ICP-MS) for 42 elements and fire assay atomic absorption for gold by the Alex Stewart Lab in in Mendoza, ArgentinaRock samples for all the campaigns since 2006 are plotted in Figures 9.4 to 9.10.

9.2.3 Soil Geochemistry

A soil grid was established over the Sarita Este gold zone. A total of 17.1 kilometres of grid soil sampling was laid out. Sample stations were loaded into a GPS instrument. Samplers would navigate to the loaded sample station, dig through any pediment, and sieve C horizon material into a bucket using a #12 Keene plastic classifier sieve and collect about two kilograms of material. The soil grid extended 1700 metres NW/SE. Each grid line was 950 metres long. Grid lines were oriented at 070° azimuth. A total of 647 samples were collected at depths ranging from 5 to 100 cm in depth. Samples were collected at a 25-metre sampling interval along grid lines located 100 metres apart. Soil samples were analyzed by using a four acid digestion and multispectral induced coupling plasma (ICP-MS) for 42 elements and fire assay atomic absorption for gold by the Alex Stewart Lab in in Mendoza, Argentina. Contoured results for gold, silver, copper, lead, zinc, molybdenum and arsenic (Au, Ag, Cu, Pb, Zn, Mo and As) are shown in Figures 9.12 to 9.17.

9.3 Results

9.3.1 Geologic Mapping

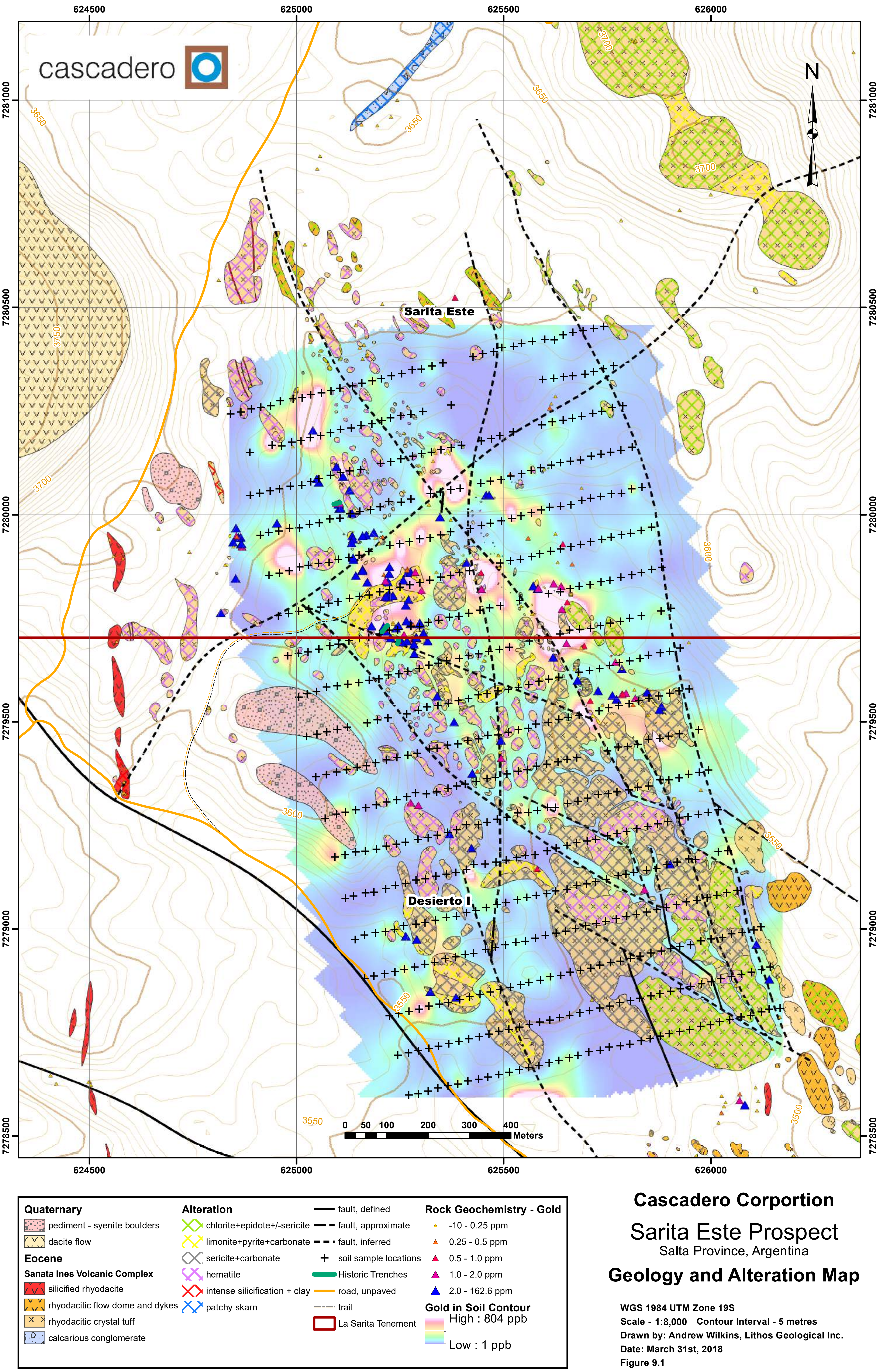
The Sarita Este showing is dominantly underlain by variably altered volcaniclastic rocks consisting primarily of rhyodacitic crystal tuff and crystal lapilli tuff (Figure 9.1). Petrographic analysis of 11 samples confirms a rhyodacite composition and that the samples submitted are likely consanguineous (McWilliam, 2018). Possible genetically related rhyodacitic domes occur to the east of the Sarita Este Zone and are scattered through the Desierto concessions. These interpreted domes are more resistive to weathering and commonly form topographic highs. Also noteworthy are prominent sub-parallel siliceous ribs that generally follow the dominant structural trend of 165°/90°, the most prominent of which has been named the Stegosaurus Vein. The Stegosaurus Vein is traceable for 4.2 kilometres to the south onto the Desierto I concession.

Alteration was mapped in detail in the vicinity of the soil grid survey on the Sarita Este and Desierto I concessions. Samples sent for petrographic analysis were reported to consist of five alteration assemblages. The assemblages included the following:

1. Weak propylitic (sericite-chlorite-epidote with magnetite preserved),
2. Weak/moderate propylitic (albite-sericite-chlorite-epidote-calcite-rutile)
3. Weak/moderate phyllic (increase in sericite)
4. Phyllic/silicic with gradation towards argillic (addition of clay-quartz-local possible jarosite-trace alunite)
5. Intense silicic (pervasive replacement and/or veinlets, stockworks or breccia matrix)

The detailed alteration mapping demonstrates that there is a direct relationship between quartz + sericite + clay alteration, micro quartz veining and gold mineralization. The quartz + sericite ± clay alteration delineates discrete zones that are evident in the field and further highlights their cross-cutting nature and preferred structural orientation. The alteration is recessive in nature making outcrop sampling problematic.

Structural analyses of mapped veins at the Sarita Este Gold Zone show three preferred orientations (Figure 9.2). The dominant trend occurs at an orientation on 165°/90°. The secondary orientation occurs at 105°/85° SW and a third minor orientation occurs at 040°/90°.



Cascadero Corportion

Sarita Este Prospect

Salta Province, Argentina

Geology and Alteration Map

WGS 1984 UTM Zone 19S

Scale - 1:8,000 Contour Interval - 5 metres

Drawn by: Andrew Wilkins, Lithos Geological Inc.

Date: March 31st, 2018

Figure 9.1

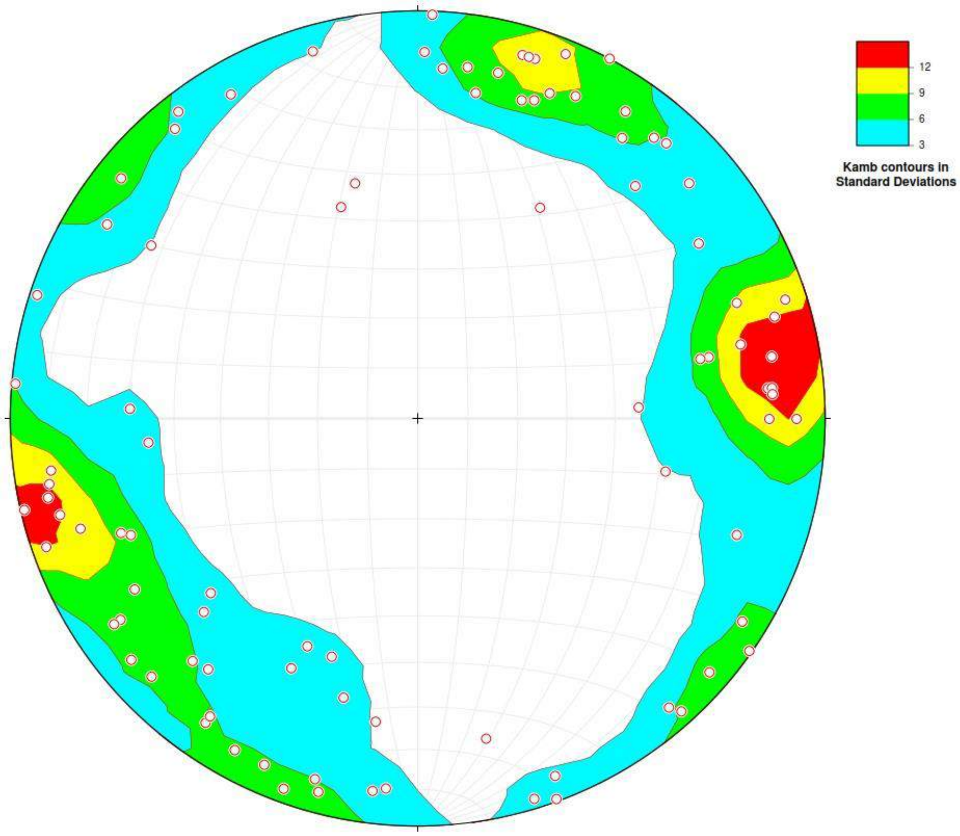


Figure 9.2 - Equal Area Projection Summarizing Structural Data of Vein Orientations (red circles represent projection of poles to planes measured; n = 96).

9.3.2 Rock Geochemistry

Since 2005, a total of 324 prospecting samples have been collected and analyzed in the Sarita Este area. Of these, 120 samples graded over 1 gram per tonne gold and averaged 15.3 grams per tonne gold. A total of 44 samples graded over 10 grams per tonne gold and averaged 35.0 grams per tonne gold. The highest assayed sample graded 162.6 grams per tonne. Digging and prospecting in 2017 extended the Sarita Este Gold Zone another 250 metres to the west of previously known mineralization.

Other than the channel chip samples from the three small trenches, most of the samples taken to date are prospecting grab samples, therefore, determining continuity of mineralization over measured widths is not possible and one cannot conclude the grade or potential deposit size from the current sampling. In the trenches, the best assay returned 1,553 ppb gold (1.553 grams per tonne gold) over 3 metres. Assay correlations show a strong association between gold, molybdenum and lead and a moderate association between gold, copper, arsenic and bismuth. Figure 9.3 is a photo of Trench SE 2012-02 and Figure 9.4 shows the results of the correlation analysis. Figures 9.5 to 9.11 are maps of rock geochemistry for gold, silver, copper, lead, zinc, molybdenum and arsenic respectively.

Figure 9.3 - Photograph of Trench SE 2012-02, note recessive nature of grey, sericitic alteration. Orange flagging represents metre marks.

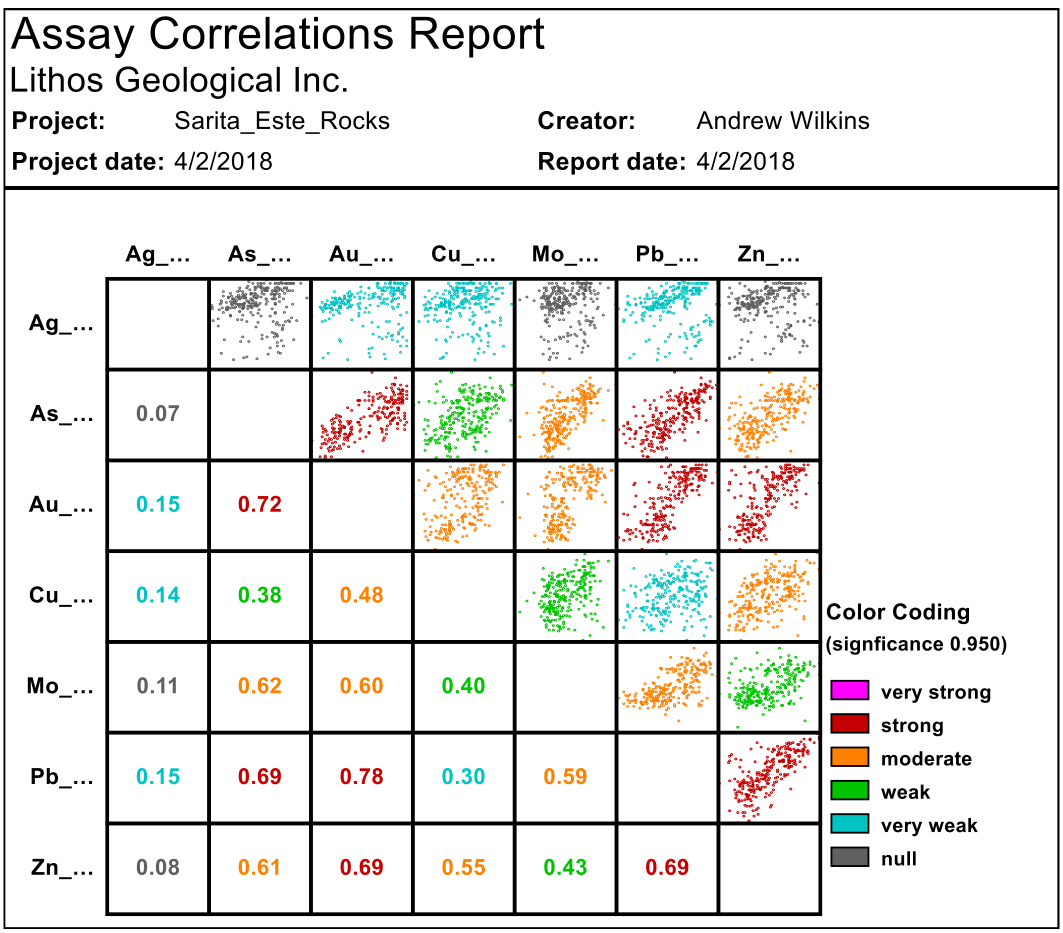


Figure 9.4 - Correlations Report for Rock Samples

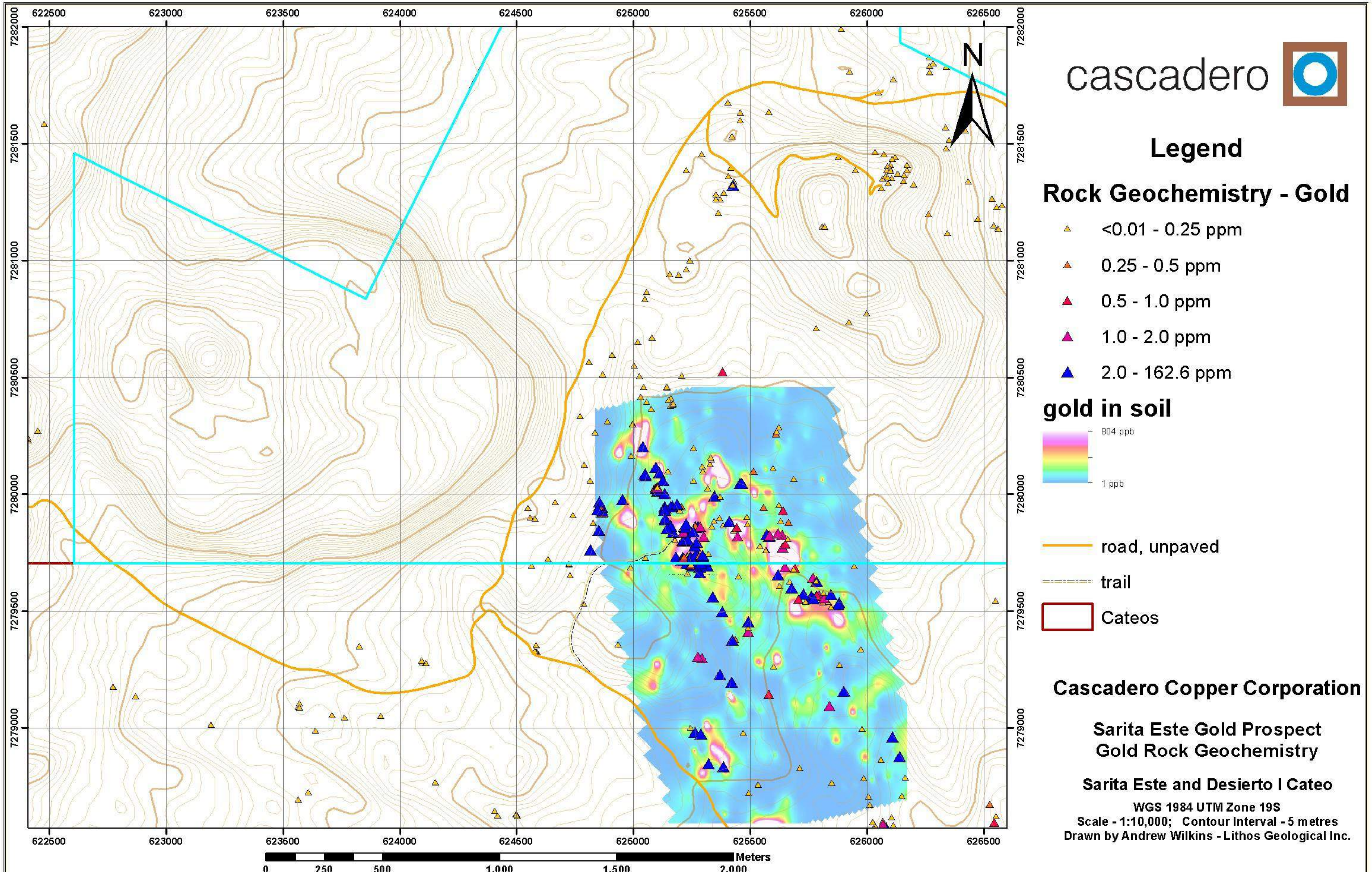
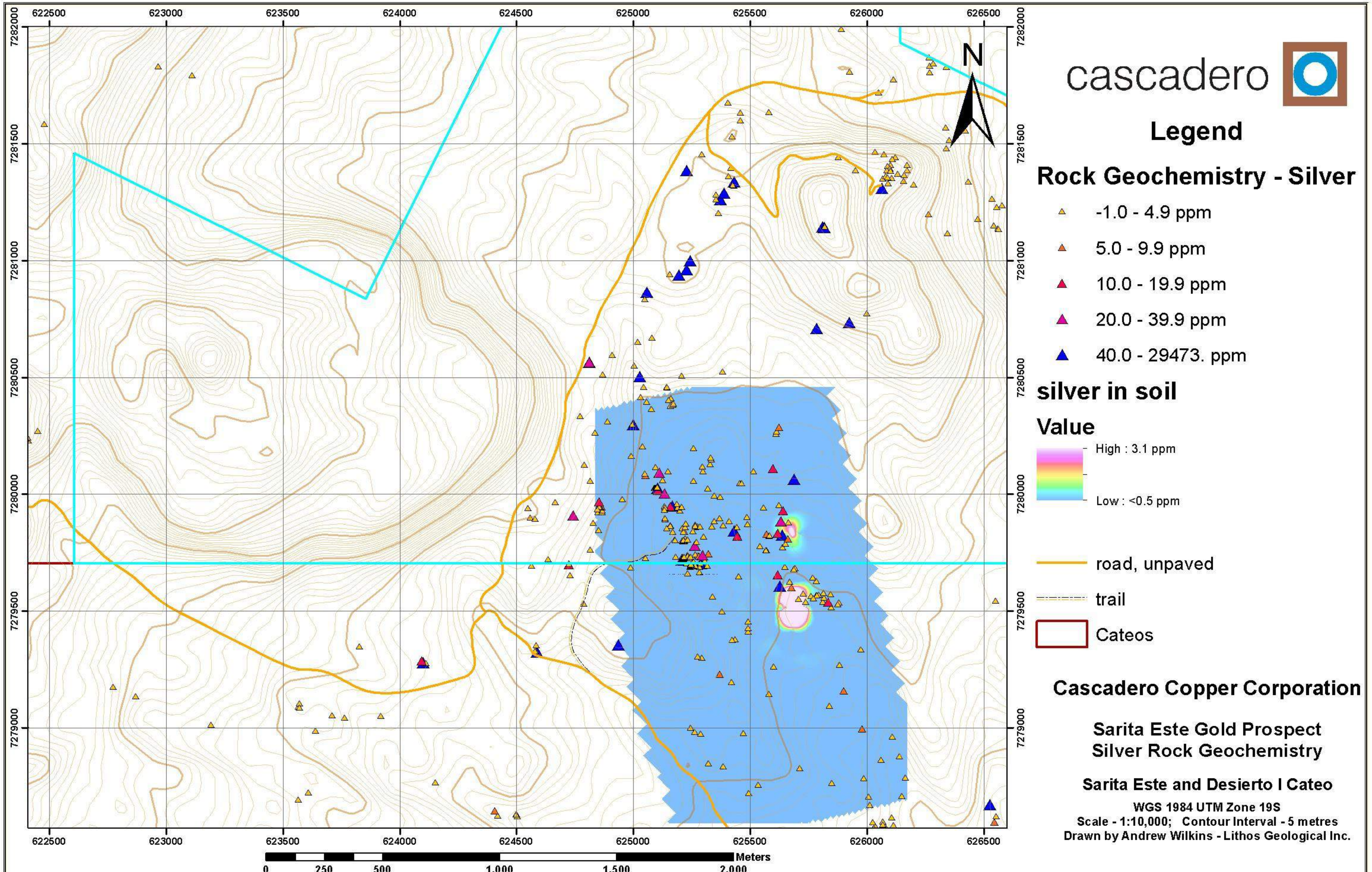

cascadero
N
Legend
Rock Geochemistry - Gold
<0.01 - 0.25 ppm
0.25 - 0.5 ppm
0.5 - 1.0 ppm
1.0 - 2.0 ppm
2.0 - 162.6 ppm
gold in soil
804 ppb
1 ppb
road, unpaved
trail
Cateos
Cascadero Copper Corporation
Sarita Este Gold Prospect
Gold Rock Geochemistry
Sarita Este and Desierto I Cateo
WGS 1984 UTM Zone 19S
Scale - 1:10,000; Contour Interval - 5 metres
Drawn by Andrew Wilkins - Lithos Geological Inc.
622500
623000
623500
624000
624500
625000
625500
626000
626500
7282000
7281500
7281000
7280500
7280000
7279500
7279000
0
250
500
1,000
1,500
2,000
Meters

Figure 9.5



622500
623000
623500
624000
624500
625000
625500
626000
626500
7282000
7281500
7281000
7280500
7280000
7279500
7279000
N
cascadero
Legend
Rock Geochemistry - Silver
-1.0 - 4.9 ppm
5.0 - 9.9 ppm
10.0 - 19.9 ppm
20.0 - 39.9 ppm
40.0 - 29473. ppm
silver in soil
Value
High : 3.1 ppm
Low : <0.5 ppm
road, unpaved
trail
Cateos
Cascadero Copper Corporation
Sarita Este Gold Prospect
Silver Rock Geochemistry
Sarita Este and Desierto I Cateo
WGS 1984 UTM Zone 19S
Scale - 1:10,000; Contour Interval - 5 metres
Drawn by Andrew Wilkins - Lithos Geological Inc.
Meters
0
250
500
1,000
1,500
2,000

Figure 9.6

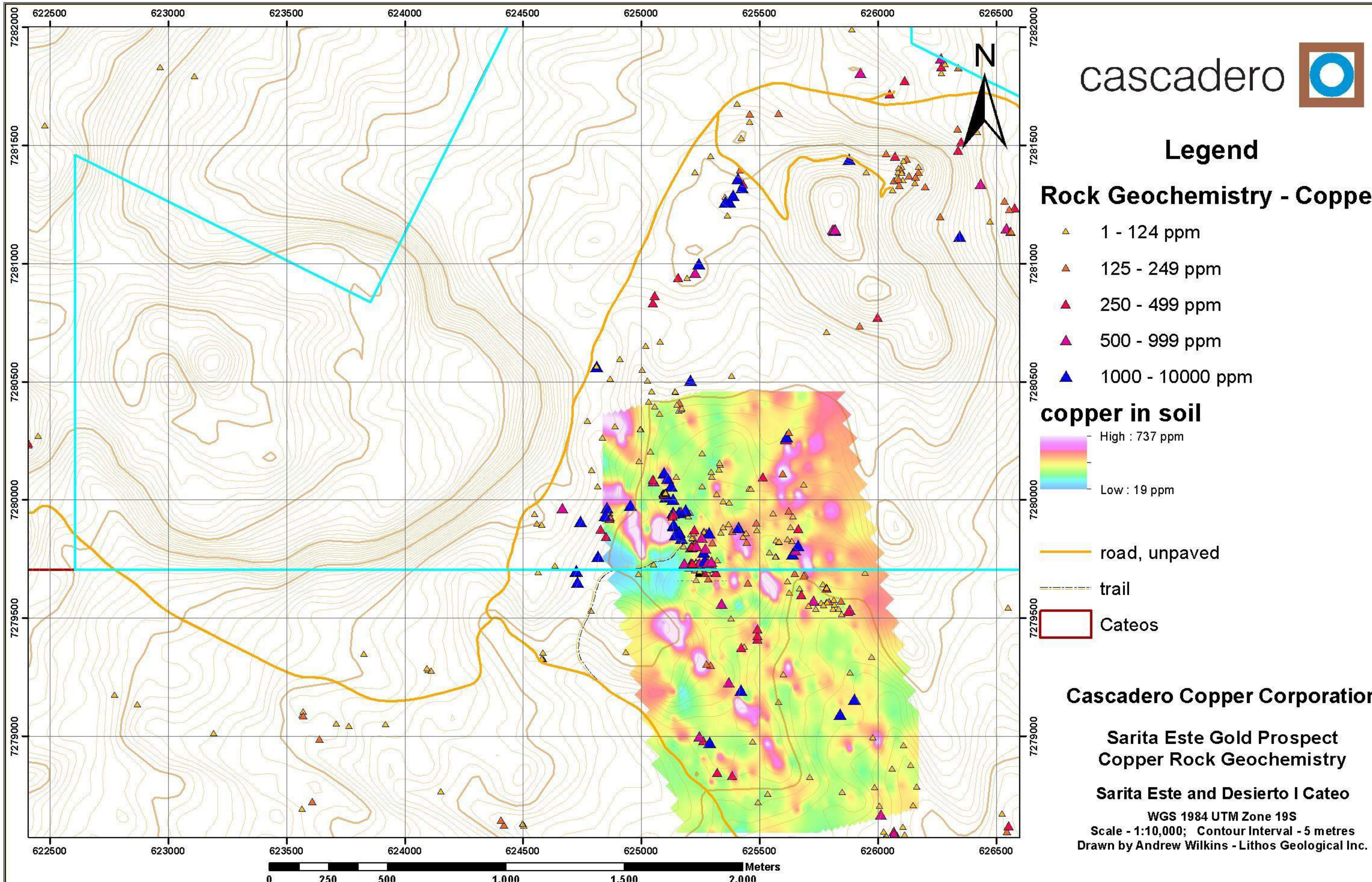
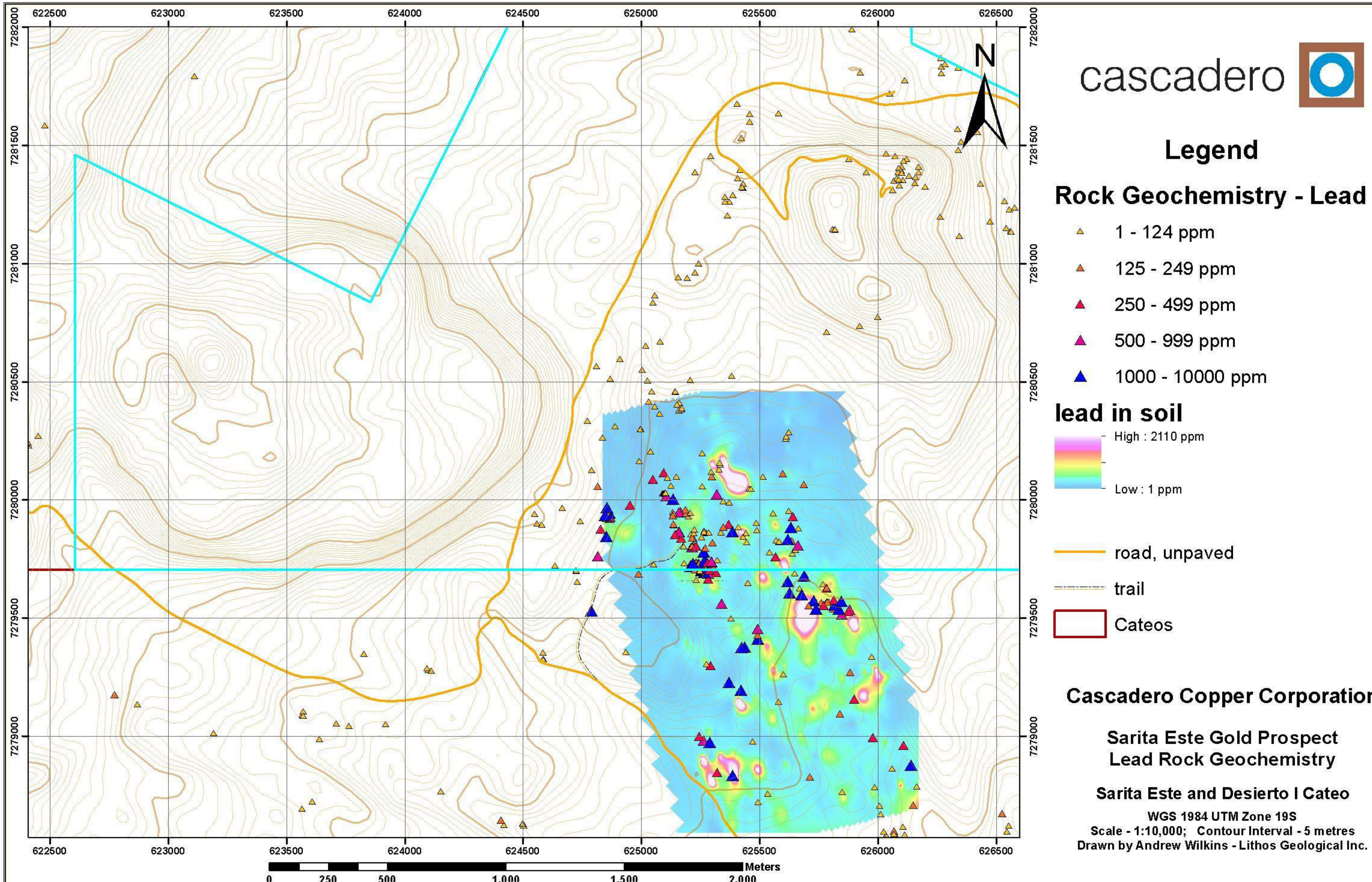

cascadero
Legend
Rock Geochemistry - Copper
1 - 124 ppm
125 - 249 ppm
250 - 499 ppm
500 - 999 ppm
1000 - 10000 ppm
copper in soil
High : 737 ppm
Low : 19 ppm
road, unpaved
trail
Cateos
Cascadero Copper Corporation
Sarita Este Gold Prospect
Copper Rock Geochemistry
Sarita Este and Desierto I Cateo
WGS 1984 UTM Zone 19S
Scale - 1:10,000; Contour Interval - 5 metres
Drawn by Andrew Wilkins - Lithos Geological Inc.
Meters
0
250
500
1,000
1,500
2,000
622500
623000
623500
624000
624500
625000
625500
626000
626500
7282000
7281500
7281000
7280500
7280000
7279500
7279000
N

Figure 9.7



cascadero
N
Legend
Rock Geochemistry - Lead
1 - 124 ppm
125 - 249 ppm
250 - 499 ppm
500 - 999 ppm
1000 - 10000 ppm
lead in soil
High : 2110 ppm
Low : 1 ppm
road, unpaved
trail
Cateos
Cascadero Copper Corporation
Sarita Este Gold Prospect
Lead Rock Geochemistry
Sarita Este and Desierto I Cateo
WGS 1984 UTM Zone 19S
Scale - 1:10,000; Contour Interval - 5 metres
Drawn by Andrew Wilkins - Lithos Geological Inc.
622500 623000 623500 624000 624500 625000 625500 626000 626500
7282000 7281500 7281000 7280500 7280000 7279500 7279000
Meters
0 250 500 1,000 1,500 2,000

Figure 9.8

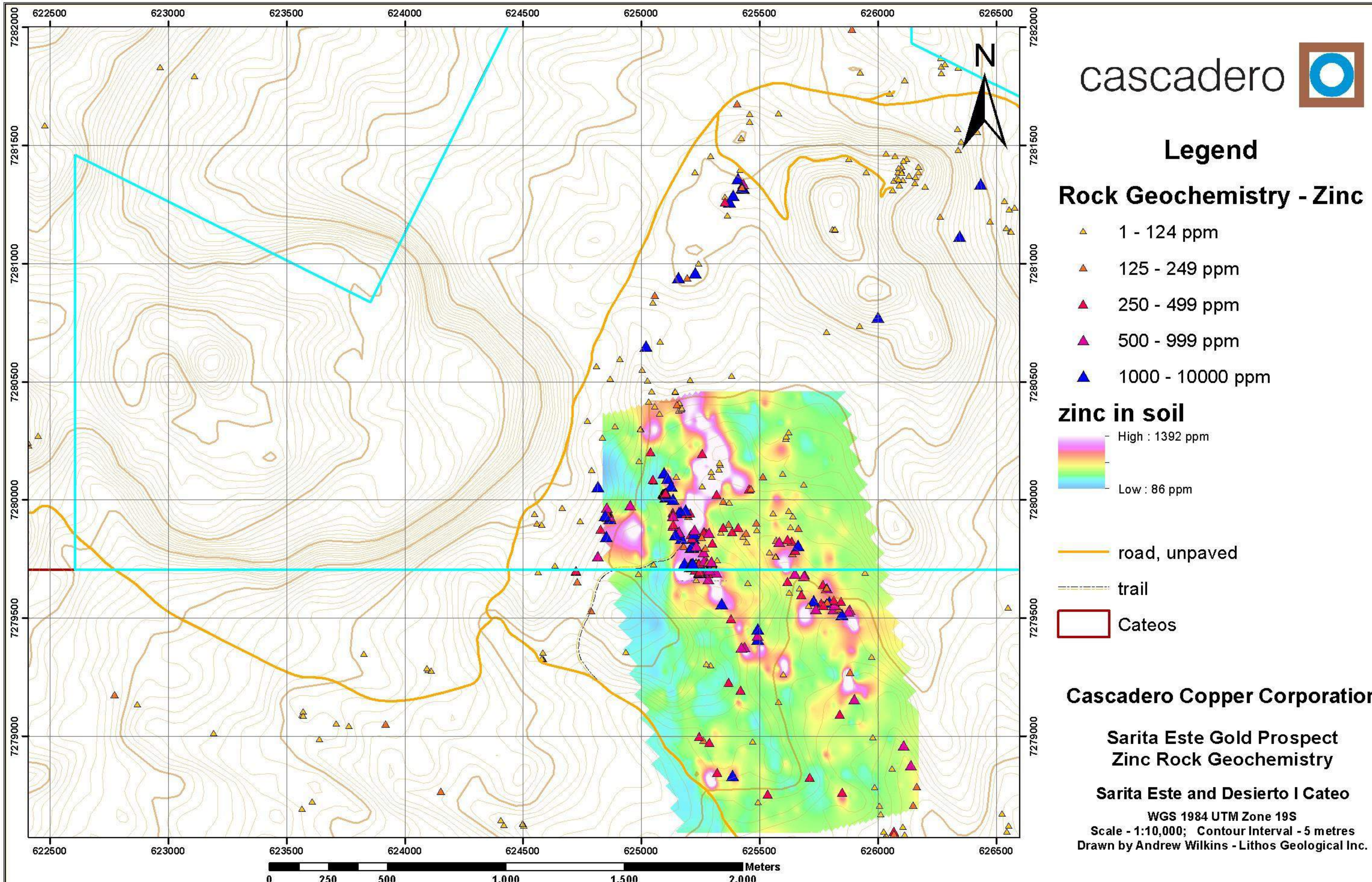
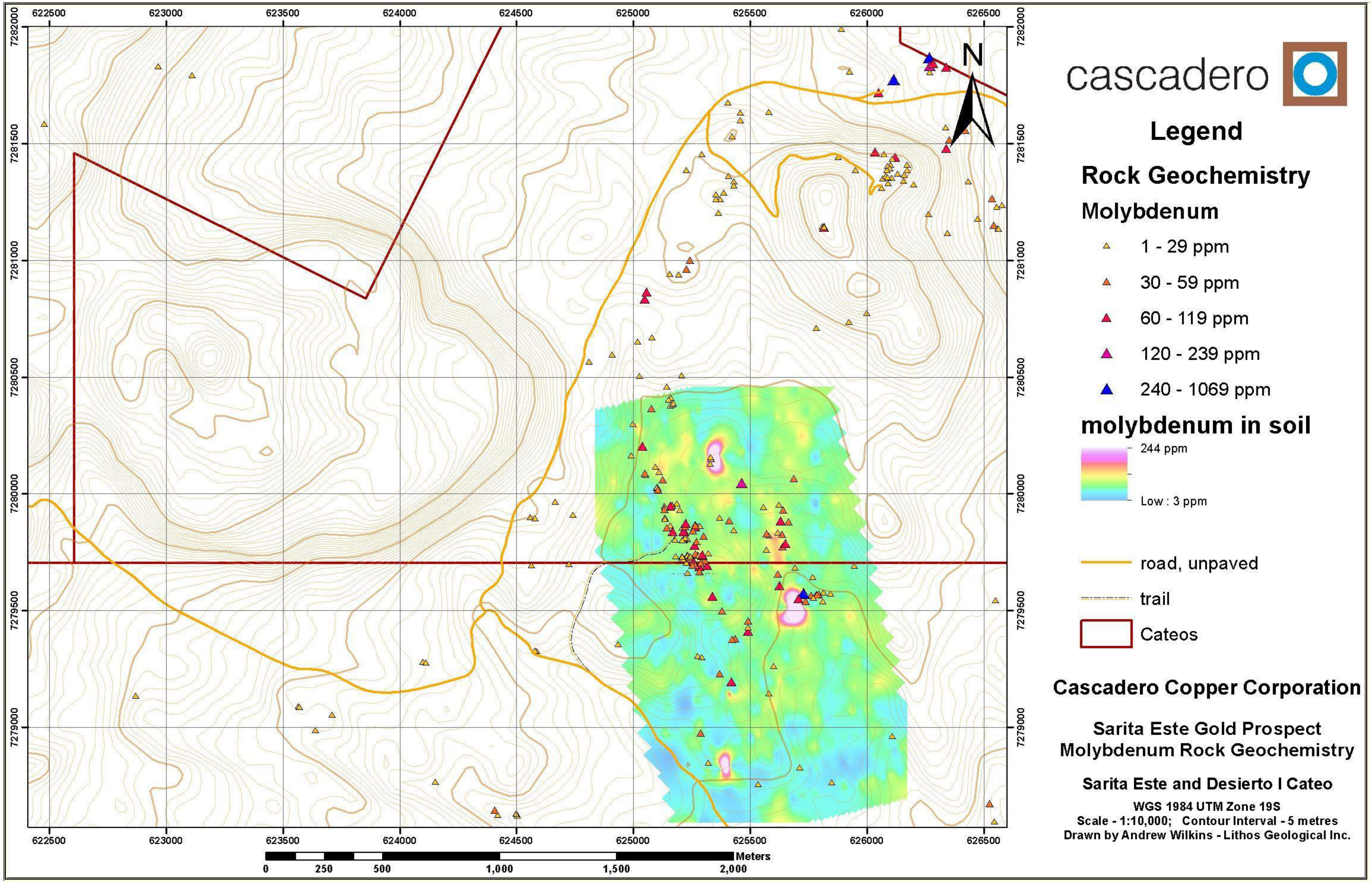

cascadero
N
Legend
Rock Geochemistry - Zinc
1 - 124 ppm
125 - 249 ppm
250 - 499 ppm
500 - 999 ppm
1000 - 10000 ppm
zinc in soil
High : 1392 ppm
Low : 86 ppm
road, unpaved
trail
Cateos
Cascadero Copper Corporation
Sarita Este Gold Prospect
Zinc Rock Geochemistry
Sarita Este and Desierto I Cateo
WGS 1984 UTM Zone 19S
Scale - 1:10,000; Contour Interval - 5 metres
Drawn by Andrew Wilkins - Lithos Geological Inc.
Meters
0 250 500 1,000 1,500 2,000
622500 623000 623500 624000 624500 625000 625500 626000 626500
7282000 7281500 7281000 7280500 7280000 7279500 7279000

Figure 9.9



cascadero
Legend
Rock Geochemistry
Molybdenum
1 - 29 ppm
30 - 59 ppm
60 - 119 ppm
120 - 239 ppm
240 - 1069 ppm
molybdenum in soil
244 ppm
Low : 3 ppm
road, unpaved
trail
Cateos
Cascadero Copper Corporation
Sarita Este Gold Prospect
Molybdenum Rock Geochemistry
Sarita Este and Desierto I Cateo
WGS 1984 UTM Zone 19S
Scale - 1:10,000; Contour Interval - 5 metres
Drawn by Andrew Wilkins - Lithos Geological Inc.
N
622500
623000
623500
624000
624500
625000
625500
626000
626500
7282000
7281500
7281000
7280500
7280000
7279500
7279000
0
250
500
1,000
1,500
2,000
Meters

Figure 9.10

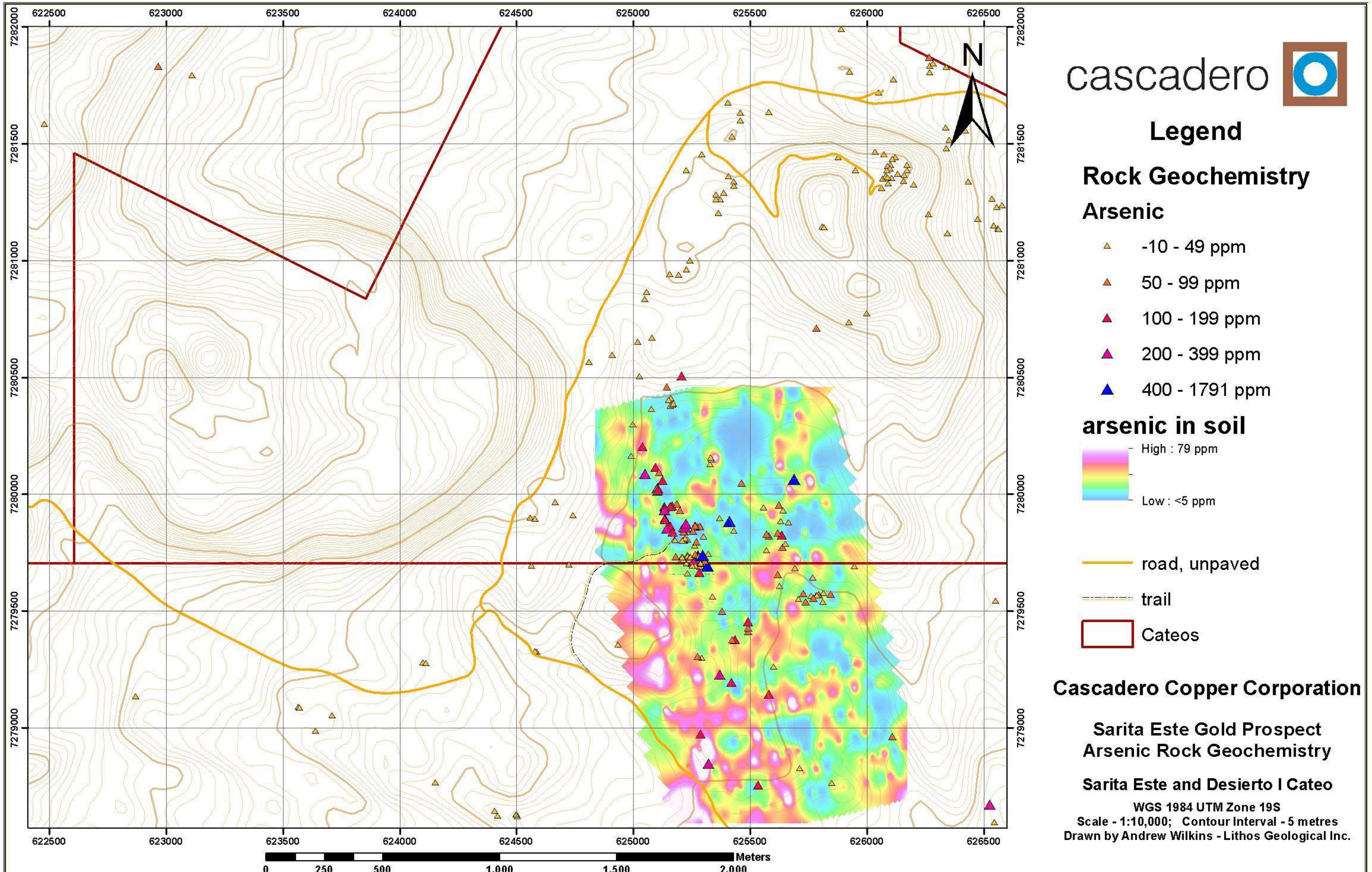

cascadero
Legend
Rock Geochemistry
Arsenic
-10 - 49 ppm
50 - 99 ppm
100 - 199 ppm
200 - 399 ppm
400 - 1791 ppm
arsenic in soil
High : 79 ppm
Low : <5 ppm
road, unpaved
trail
Cateos
Cascadero Copper Corporation
Sarita Este Gold Prospect
Arsenic Rock Geochemistry
Sarita Este and Desierto I Cateo
WGS 1984 UTM Zone 19S
Scale - 1:10,000; Contour Interval - 5 metres
Drawn by Andrew Wilkins - Lithos Geological Inc.
N
Meters
0
250
500
1,000
1,500
2,000
622500
623000
623500
624000
624500
625000
625500
626000
626500
7282000
7281500
7281000
7280500
7280000
7279500
7279000

Figure 9.11

9.3.3 Soil Geochemistry

Soil geochemistry results have outlined a main gold in soil anomaly that measures 850 metres by 1050 metres in size. Smaller anomalies are also present within the survey area. Throughout the grid, values range from <2 ppb to 804 ppb gold. The median value is 35.5 ppb gold and the mean value is 25.5 ppb gold over the entire grid. Correlation analysis of the soil data shows a moderate association between gold and zinc and a weak association between gold, copper, molybdenum and lead. Figure 9.12 shows the results of the correlation analysis. Figures 9.13 to 9.19 are maps of soil geochemistry for gold, silver, copper, lead, zinc, molybdenum and arsenic respectively.

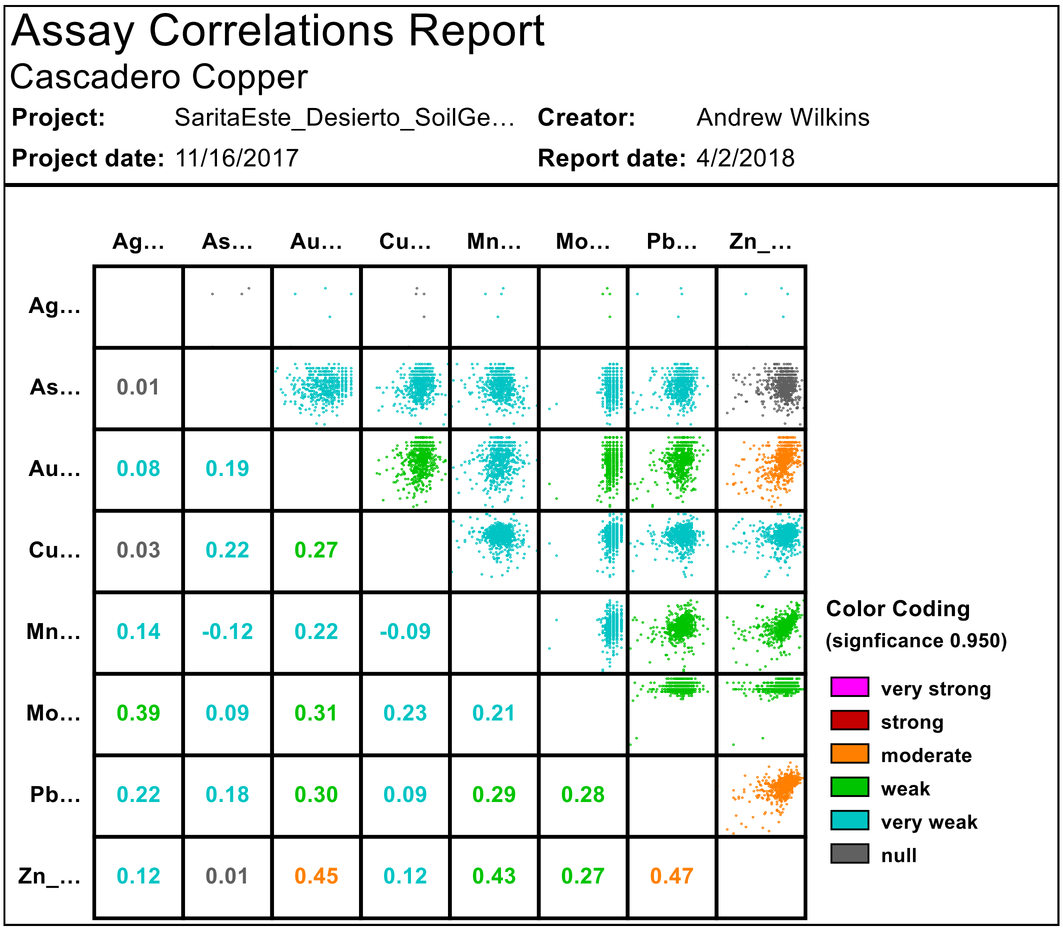
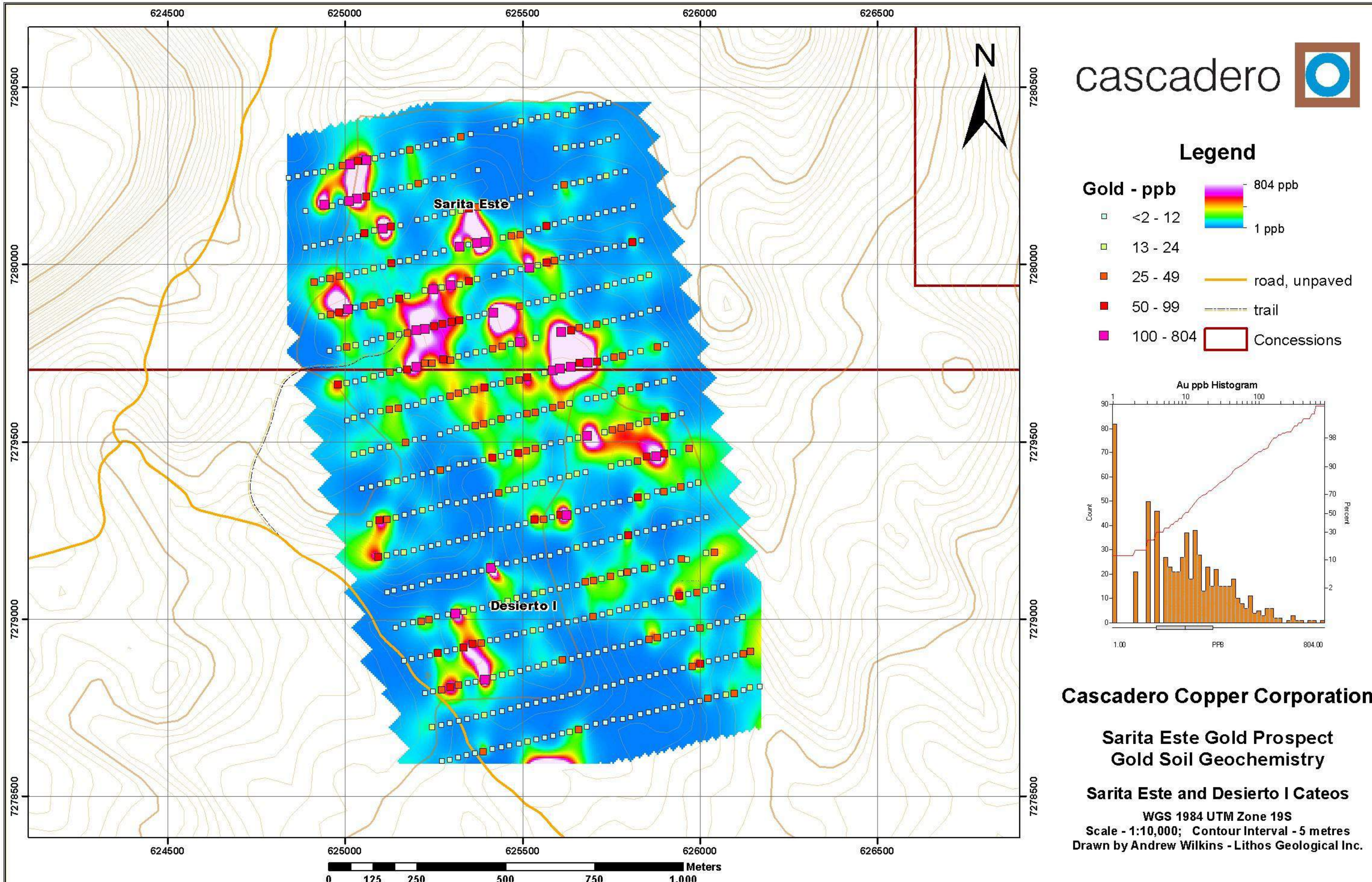
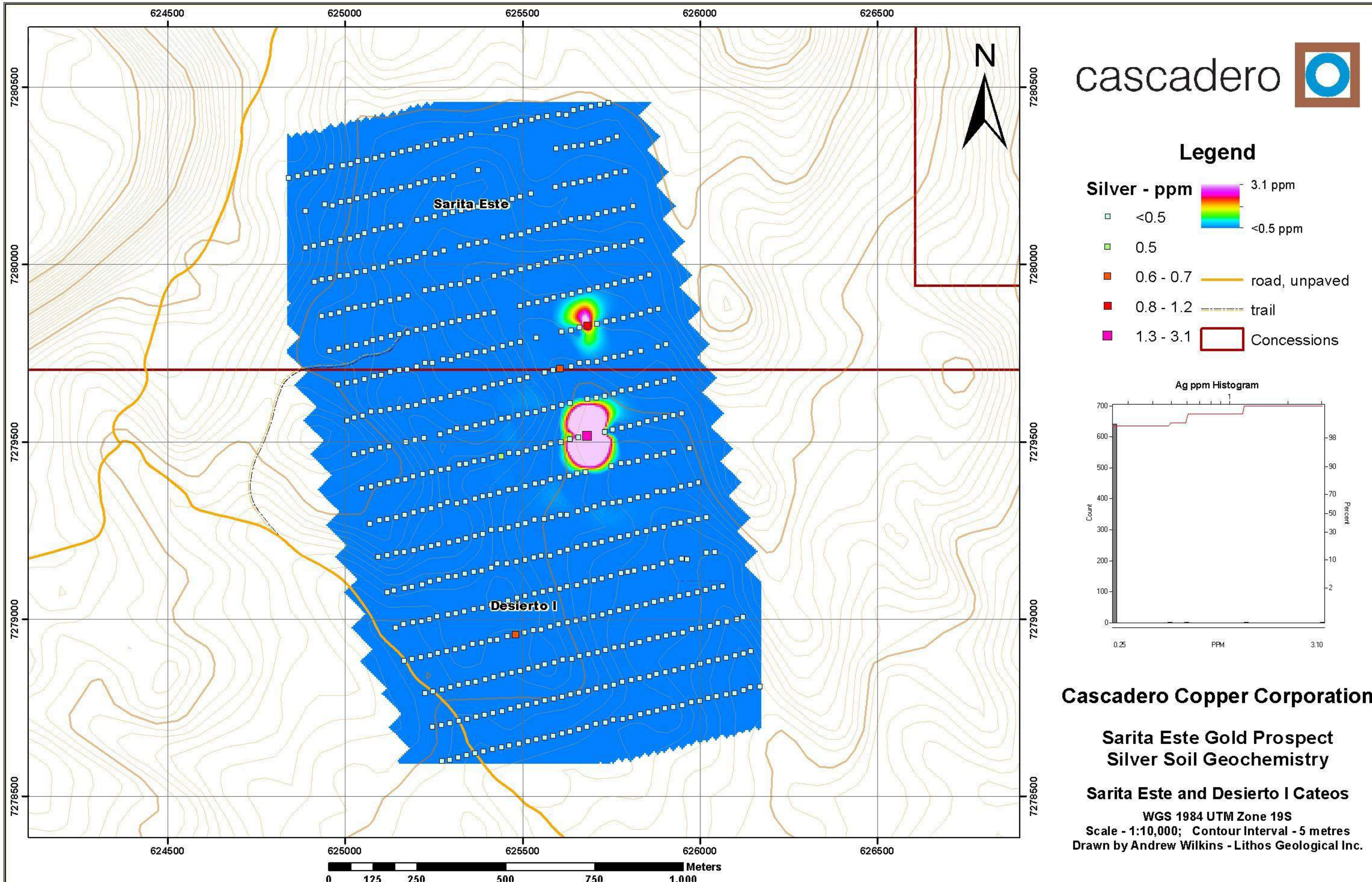


Figure 9.12 - Correlation Report for Soil Samples



624500
625000
625500
626000
626500
7280500
7280000
7279500
7279000
7278500
N
cascadero
Legend
Gold - ppb
804 ppb
1 ppb
<2 - 12
13 - 24
25 - 49
50 - 99
100 - 804
road, unpaved
trail
Concessions
Au ppb Histogram
Count
Percent
PPB
1.00
804.00
Sarita Este
Desierto I
Meters
0
125
250
500
750
1,000
Cascadero Copper Corporation
Sarita Este Gold Prospect
Gold Soil Geochemistry
Sarita Este and Desierto I Cateos
WGS 1984 UTM Zone 19S
Scale - 1:10,000; Contour Interval - 5 metres
Drawn by Andrew Wilkins - Lithos Geological Inc.

Figure 9.13



624500
625000
625500
626000
626500
7280500
7280000
7279500
7279000
7278500
N
Sarita Este
Desierto I
cascadero
Legend
Silver - ppm
3.1 ppm
<0.5 ppm
<0.5
0.5
0.6 - 0.7
0.8 - 1.2
1.3 - 3.1
road, unpaved
trail
Concessions
Ag ppm Histogram
Count
Percent
PPM
0.25
3.10
Cascadero Copper Corporation
Sarita Este Gold Prospect
Silver Soil Geochemistry
Sarita Este and Desierto I Cateos
WGS 1984 UTM Zone 19S
Scale - 1:10,000; Contour Interval - 5 metres
Drawn by Andrew Wilkins - Lithos Geological Inc.
Meters
0
125
250
500
750
1,000

Figure 9.14

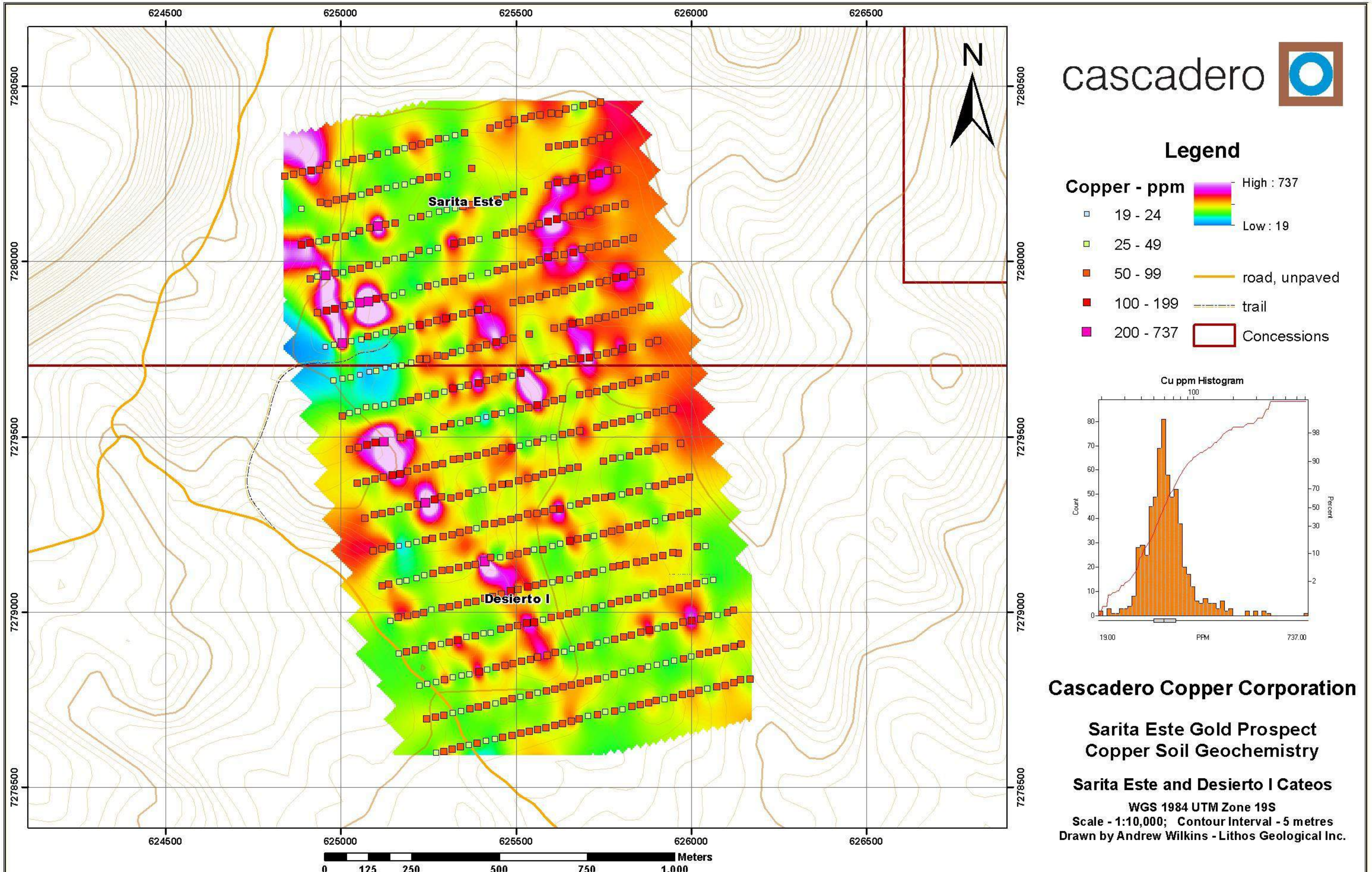
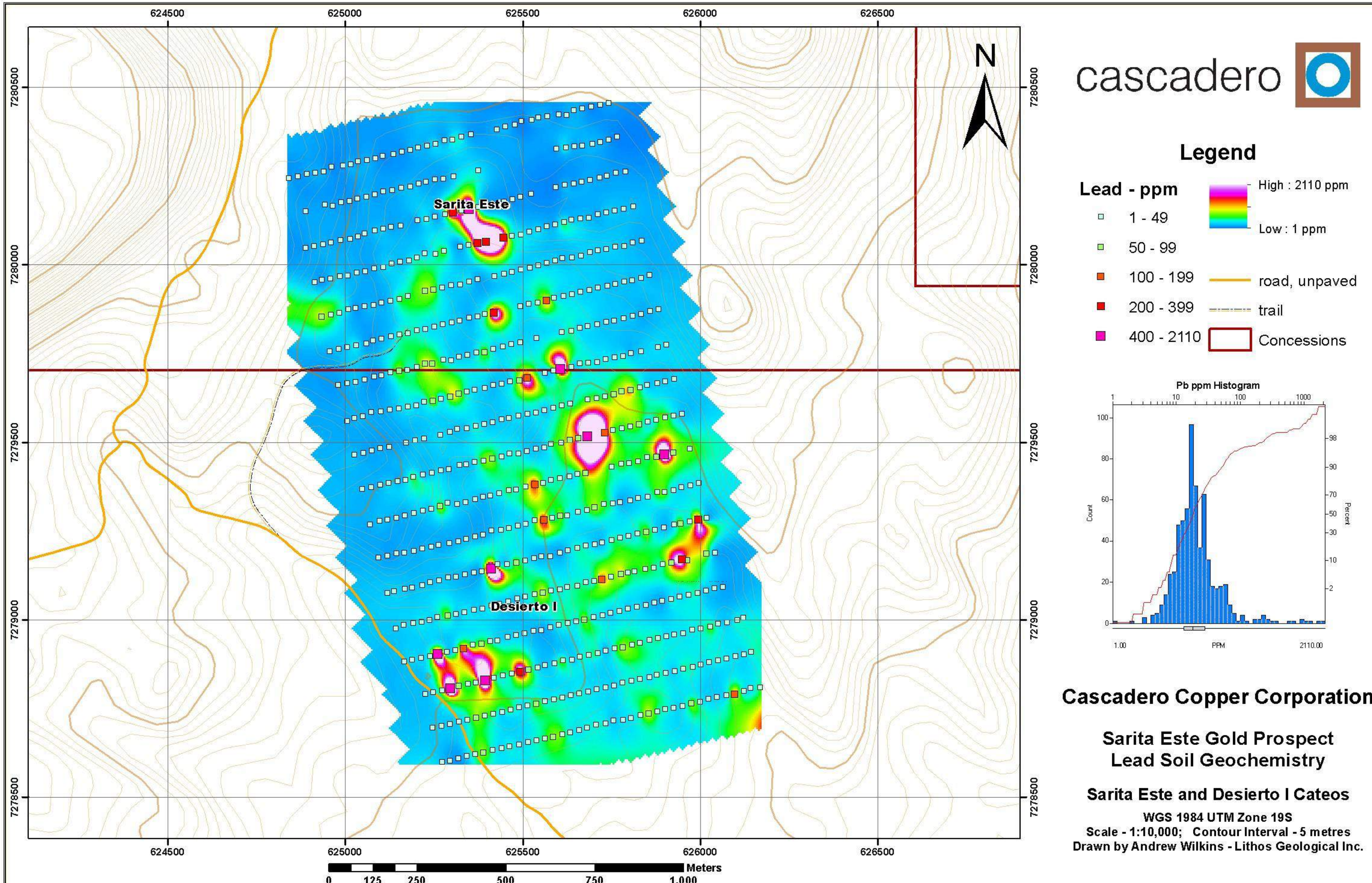
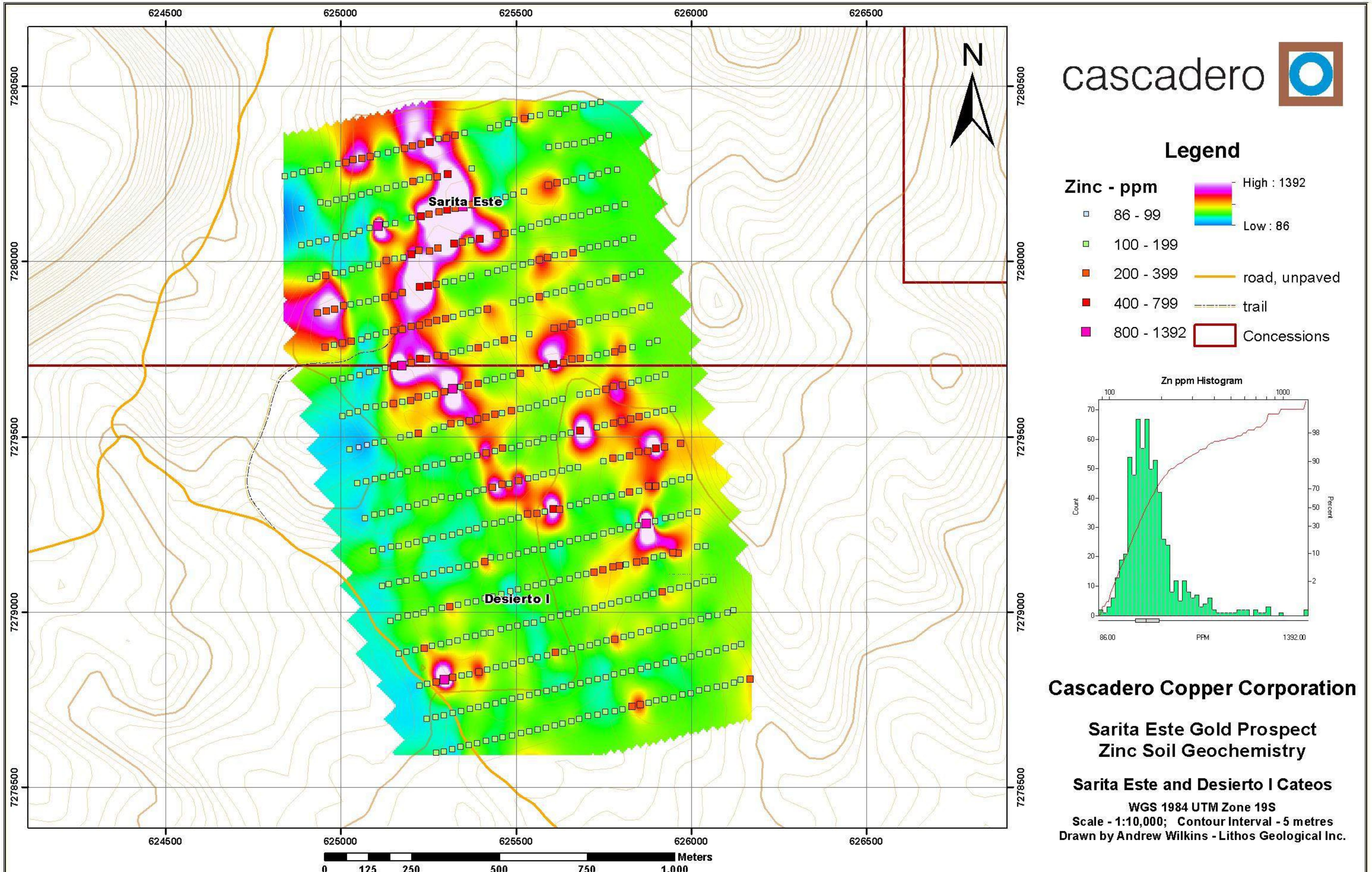

cascadero
Legend
Copper - ppm
19 - 24
25 - 49
50 - 99
100 - 199
200 - 737
High : 737
Low : 19
road, unpaved
trail
Concessions
Cu ppm Histogram
Sarita Este
Desierto I
Cascadero Copper Corporation
Sarita Este Gold Prospect
Copper Soil Geochemistry
Sarita Este and Desierto I Cateos
WGS 1984 UTM Zone 19S
Scale - 1:10,000; Contour Interval - 5 metres
Drawn by Andrew Wilkins - Lithos Geological Inc.
Meters
0 125 250 500 750 1,000

Figure 9.15



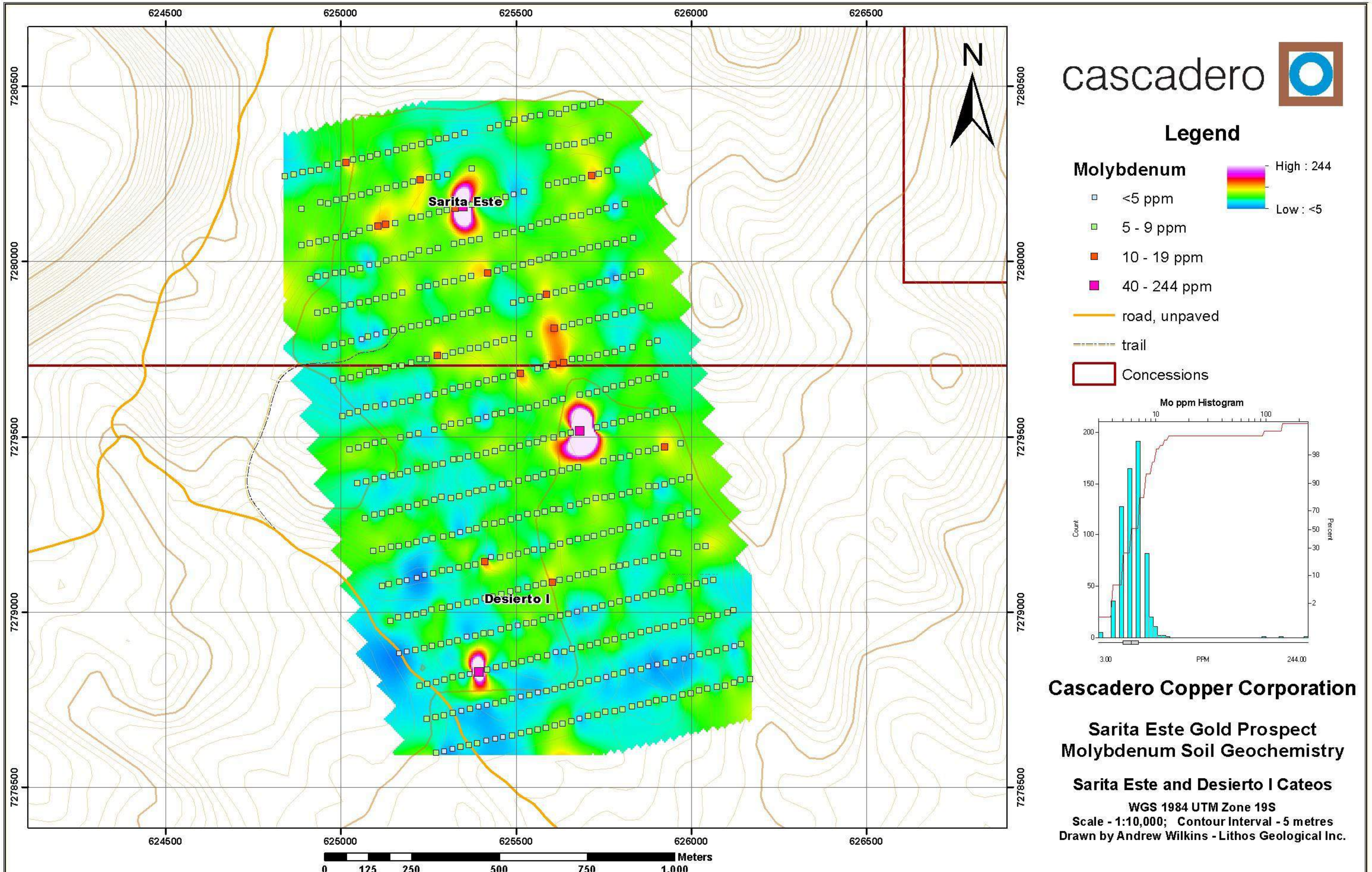
624500
625000
625500
626000
626500
7280500
7280000
7279500
7279000
7278500
N
cascadero
Sarita Este
Desierto I
Legend
Lead - ppm
1 - 49
50 - 99
100 - 199
200 - 399
400 - 2110
High : 2110 ppm
Low : 1 ppm
road, unpaved
trail
Concessions
Pb ppm Histogram
Count
Percent
PPM
1.00
2110.00
Cascadero Copper Corporation
Sarita Este Gold Prospect
Lead Soil Geochemistry
Sarita Este and Desierto I Cateos
WGS 1984 UTM Zone 19S
Scale - 1:10,000; Contour Interval - 5 metres
Drawn by Andrew Wilkins - Lithos Geological Inc.
Meters
0 125 250 500 750 1,000

Figure 9.16



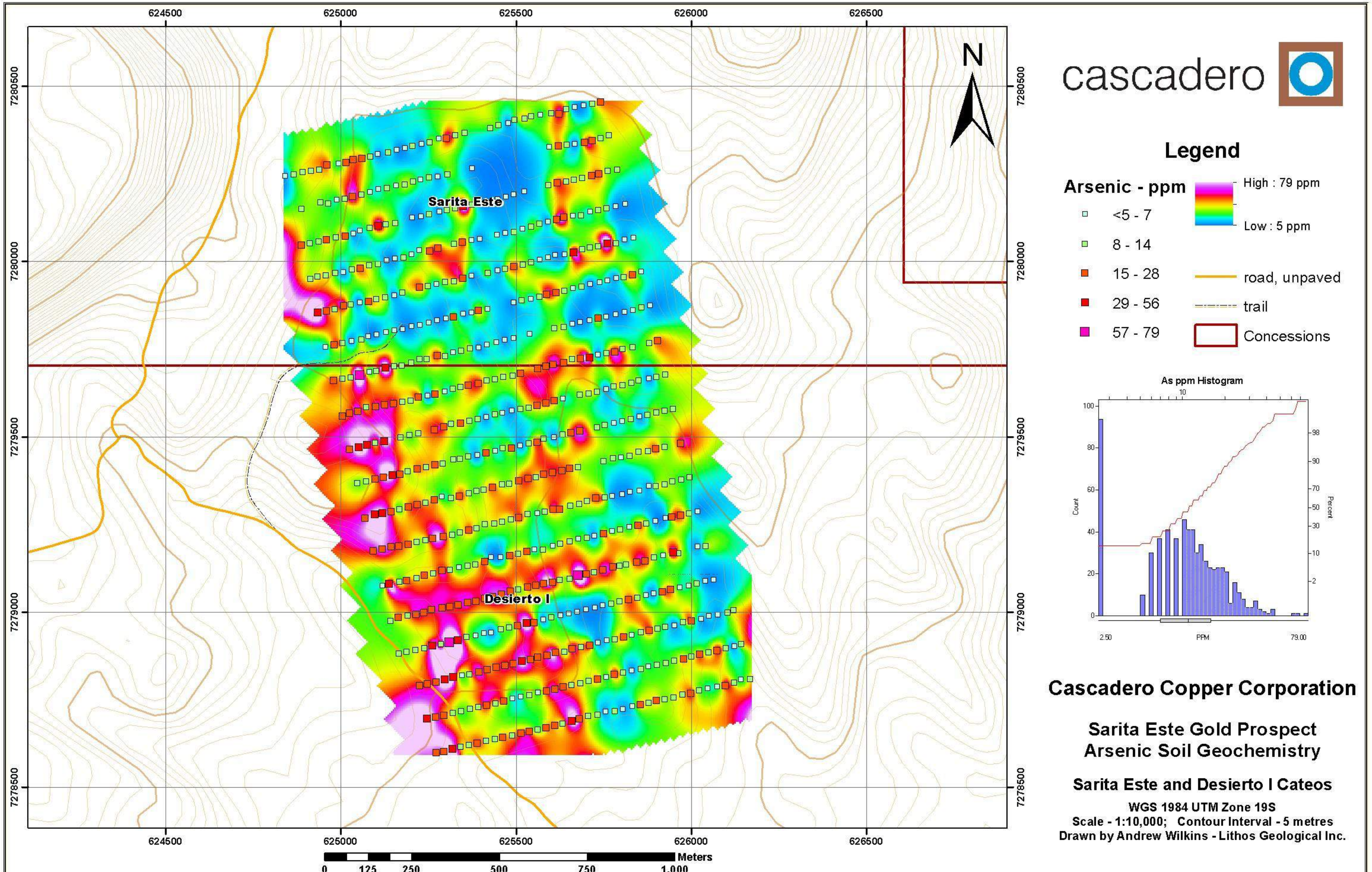
624500
625000
625500
626000
626500
7280500
7280000
7279500
7279000
7278500
Sarita Este
Desierto I
N
cascadero
Legend
Zinc - ppm
86 - 99
100 - 199
200 - 399
400 - 799
800 - 1392
High : 1392
Low : 86
road, unpaved
trail
Concessions
Zn ppm Histogram
Count
Percent
PPM
86.00
1392.00
Cascadero Copper Corporation
Sarita Este Gold Prospect
Zinc Soil Geochemistry
Sarita Este and Desierto I Cateos
WGS 1984 UTM Zone 19S
Scale - 1:10,000; Contour Interval - 5 metres
Drawn by Andrew Wilkins - Lithos Geological Inc.
Meters
0 125 250 500 750 1,000

Figure 9.17



624500
625000
625500
626000
626500
7280500
7280000
7279500
7279000
7278500
Sarita Este
Desierto I
N
cascadero
Legend
Molybdenum
<5 ppm
5 - 9 ppm
10 - 19 ppm
40 - 244 ppm
road, unpaved
trail
Concessions
High : 244
Low : <5
Mo ppm Histogram
Count
Percent
PPM
3.00
244.00
Cascadero Copper Corporation
Sarita Este Gold Prospect
Molybdenum Soil Geochemistry
Sarita Este and Desierto I Cateos
WGS 1984 UTM Zone 19S
Scale - 1:10,000; Contour Interval - 5 metres
Drawn by Andrew Wilkins - Lithos Geological Inc.
0
125
250
500
750
1,000
Meters

Figure 9.18



624500
625000
625500
626000
626500
7280500
7280000
7279500
7279000
7278500
Sarita Este
Desierto I
N
cascadero
Legend
Arsenic - ppm
<5 - 7
8 - 14
15 - 28
29 - 56
57 - 79
High : 79 ppm
Low : 5 ppm
road, unpaved
trail
Concessions
As ppm Histogram
Count
Percent
PPM
2.50
79.00
Cascadero Copper Corporation
Sarita Este Gold Prospect
Arsenic Soil Geochemistry
Sarita Este and Desierto I Cateos
WGS 1984 UTM Zone 19S
Scale - 1:10,000; Contour Interval - 5 metres
Drawn by Andrew Wilkins - Lithos Geological Inc.
0
125
250
500
750
1,000
Meters

Figure 9.19

10 Drilling

No drilling has occurred on the Sarita Este concession.

11 Sample Preparation, Analyses and Security

During the 2017 exploration program, all geological and geochemical field stations and sample locations were recorded using a hand-held Garmin Global Positioning System (GPS instrument). Rock, soil and chip samples that were collected were placed in individual plastic bags and sealed with zap straps. Numbered sample tags were placed in the bags before sealing. Samples were driven back to the town of Tolar Grande at the end of each day, placed in rice bags and sealed. Samples were then delivered about every week by truck to the Cascadero office in Salta. The samples were then transferred to a courier truck to be delivered to the Alex Stewart Lab in Mendoza, Argentina. Rock and soil samples were analyzed using a four acid digestion and multispectral induced coupling plasma (ICP-MS) for 42 elements and fire assay atomic absorption for gold by the Alex Stewart Lab in in Mendoza, Argentina. The Alex Stewart Lab is an accredited lab for the preparation and physical-chemical analysis of mineral samples (ISO 9001-2015 and ISO 14001-2015 designation). The lab is independent of Cascadero Copper Corporation.

The author of this report is satisfied that the Sarita Este geochemical samples were obtained, transported and analysed appropriately, with sufficient attention to security, handling and reporting for the purposes intended.

12 Data Verification

Most of both the historic sampling and the 2017 sampling have been prospecting grab samples of mineralized veins and alteration. The author has resampled some of the historic samples and the current results are consistent with reported historic sampling. Table 12.1 shows results of repeated sampling.

Table 12.1 - Sample Repeats

Sample	Sample #	Au (ppb)	Ag (ppm)	Cu (ppm)	Pb (ppm)	Zn (ppm)	As (ppm)	Mo (ppm)
Historic	BR5491	30900	3.03	1119.50	631.07	654.20	150.80	16.94
Resample	1532165	12460	1.00	1278.00	550.00	582.00	144.00	18.00
Historic	LR1307	23800	1.31	121.50	65.24	171.00	82.10	196.86
Resample	1532058	9820	1.70	51.00	54.00	251.00	23.00	85.00
Historic	RT2728	4747	3.46	90.12	67.26	160.90	50.40	17.56
Resample	1532094	1820	3.70	121.00	117.00	533.00	76.00	61.00
Historic	AF 9708	4	11.00	2836.19	1.30	289.50	25.50	0.45
Resample	1532161	<10	<0.5	2598.00	<2	280.00	33.00	2.00
Historic	74280	<10	<0.5	22.16	2.95	7.71	10.40	2.10
Resample	B00-228828	<10	10.00	31.00	9.00	4.00	8.00	4.00

The Sarita Este Property is still an early stage exploration project and no further data verification is necessary at this point. Sampling to date has demonstrated that there is gold in the Sarita Este system, however no conclusions can be made at this time as to the potential size and grade. Going forward, drilling and trenching is warranted and recommended; QA/QC protocols, including blanks, standards and duplicates would be appropriate in future drill and trenching programs.

13 Mineral Processing and Metallurgical Testing

No mineral processing or metallurgical testing has been conducted on the property.

14 Mineral Resource Estimates

No mineral resource estimates have been calculated on the property.

15 Adjacent Properties

The Property lies within a known mining region. Two copper-gold-molybdenum porphyry deposits occur nearby as well as numerous copper, gold, silver and uranium showings.

The Taca Taca Bajo copper-gold-molybdenum porphyry deposit is located 3.5 kilometres to the northeast of the Sarita Este Gold Zone. Taca Taca Bajo is currently being explored and considered for development by First Quantum Minerals Ltd. Copper mineralization was first discovered on the Taca Taca Bajo property in the mid-1960s. Between 1970 and 2008 the Taca Taca Bajo showing was explored by several companies including Falconbridge Argentina S.A., Gatro Argentina Minera S.A. (GAMSA), Corriente Resources, BHP Minerals, and Río Tinto Inc. Lumina Copper tested the extent of the porphyry mineralization between 2010 and 2012. The Taca Taca Bajo copper-gold-molybdenum porphyry deposit has a published indicated resource of 2.165 billion tonnes grading 0.44% copper, 0.013% molybdenum, and 0.08 grams per tonne gold (Sim et al., 2013). Mineralization is documented as Oligocene in age.

The Taca Taca Alto copper-gold-molybdenum porphyry is located 5 kilometres to the northwest of the Sarita Este Property. It was discovered around the same time as the Taca Taca Bajo Property. The Taca Taca Alto Property was explored by the Direccion General De Fabricaciones Militares (DGFM) now known as Servicio Geológico Minero Argentino (SEGEMAR - Argentine Government Geological Services) and private companies including Gencor, RTZ and BHP.

16 Other Relevant Data and Information

In recent years, assay labs have developed ultra-trace multispectral induced coupling plasma (ultra-trace ICP-MS) techniques with lower detection limits for pathfinder elements. For the 2017 program, it was decided to use a local lab, the Alex Stewart Lab in in Mendoza, Argentina, as opposed to shipping prepped samples to Vancouver, BC, Canada. It was thought that the Alex Stewart Lab had similar ultra-trace ICP-MS capabilities, but unfortunately this was not the case. This will not impact the recommendations for the Sarita Este Gold Zone as the mineralization is on surface, however in the future, a 4 acid digestion followed by ultra-trace ICP-MS is recommended as the lower detection limits of pathfinder elements may help in vectoring to potential hidden mineralization.

17 Interpretations and Conclusions

In the Sarita Este Zone, the gold in soil geochemistry anomaly coincides with the historic gold bearing rock samples and the recessive, weathered, limonite after pyrite-sericite-clay altered volcaniclastics with quartz veinlets. At surface, alteration appears to be patchy and structurally controlled. The soil anomalies follow the same map patterns as the mapped veins with azimuths of 165°, 105° and 040°, suggesting mineralization is structurally controlled and within conjugate structures.

The data suggests that the exploration target within the Sarita Este Zone is an intermediate sulphidation epithermal showing, specifically the areal extent of grey sericite-clay-limonite (phyllic) alteration, the vuggy habit of micro quartz veins and the abundance of stockwork fracturing and veining. The gold mineralization is believed to be related to a distal porphyry system, such as the Taca Taca Bajo porphyry system to the northeast or an additional porphyry system at depth.

The Sarita Este showing has near-term exploration potential for the discovery of a significant epithermal gold deposit close to surface. There is also the potential of finding a blind porphyry deposit at depth in the area.

The Stegosaurus Vein is a prominent feature traceable for 4.2 kilometres that trends southward onto the Desierto I concession. The vein is 1 to 20 metres wide. There is some sporadic mineralization in the vein and some of the parallel veins are mineralized. The veins could possibly represent the silicified zone above the boiling point in a low sulphidation gold silver deposit.

18 Recommendations

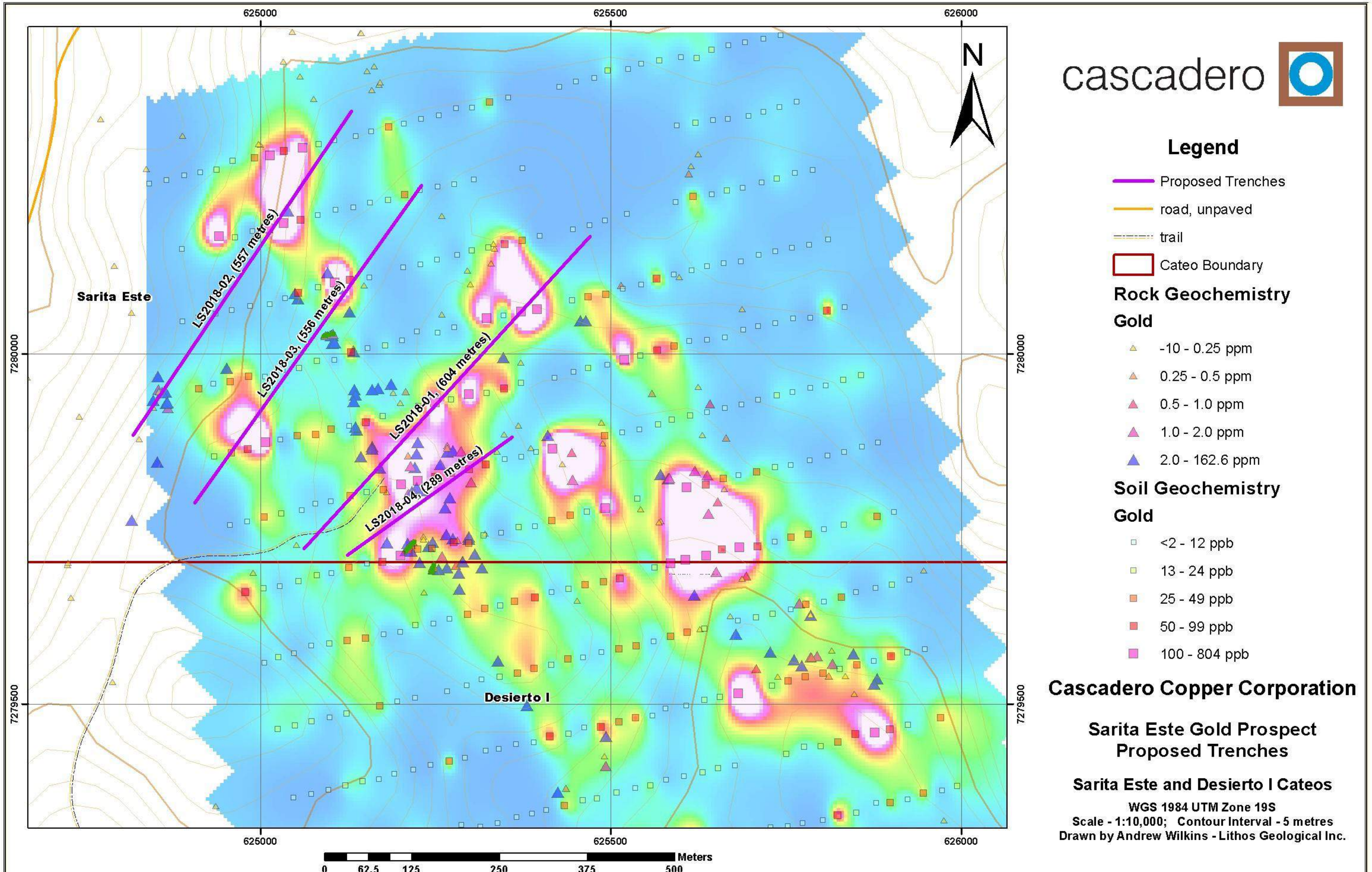
Follow up on the Sarita Este Zone is recommended in two phases (budget outlined in Table 12.1):

Phase one consists of 2,000 metres of trenching with concurrent mapping, sampling and spectrometer analysis of alteration minerals. Trenches should be oriented in a direction that will crosscut both the 165° and 106° vein and anomaly orientations (Figure 18.1).

Phase two is contingent on the results from phase one and would include 1,500 metres of diamond drilling, targeting the anomalies generated by the trenching program.

Table 18.1 - Proposed Budget

2018 - Phase 1 - 2,000 metre trenching program						
	Project Geologist	90	days	$ 850.00	per day	$ 76,500.00
	Geologist	90	days	$ 600.00	per day	$ 54,000.00
	4 Man sampling crew from Argentina	360	days	$ 300.00	per day	$ 108,000.00
	Excavator or Backhoe (100 metres per day)	600	hours	$ 100.00	per day	$ 60,000.00
	Tolar Grande - Room and Board (Excavator, Sampling and Geological crew)	720	mandays	$ 50.00	per manday	$ 36,000.00
	Assays	1000	samples	$ 40.00	per sample	$ 40,000.00
	Truck Rental x 2	180	days	$ 200.00	per day	$ 36,000.00
	Travel					$ 20,000.00
	Field Supplies, Equipment & Rentals					$ 15,000.00
	Final Report & Consulting					$ 25,000.00
Subtotal						**$ 470,500.00**
Contingency @ 20%						$ 94,100.00
Total Trenching and Sampling						**$ 564,600.00**
2018 Phase 2 - 1,500 metre drilling program						
	Drilling (all in)	1500	metres	$ 200.00	per metre	$ 300,000.00
	Project Geologist	50	days	$ 850.00	per day	$ 42,500.00
	Geologist	50	days	$ 600.00	per day	$ 30,000.00
	2 Man geotech and core cutting crew from Argentina	100	days	$ 300.00	per day	$ 30,000.00
	Tolar Grande - Room and Board (Geotech and Geological crew)	200	mandays	$ 50.00	per manday	$ 10,000.00
	Assays	750	samples	$ 40.00	per sample	$ 30,000.00
	Truck Rental	100	days	$ 200.00	per day	$ 20,000.00
	Travel					$ 15,000.00
	Field Supplies, Equipment & Rentals					$ 15,000.00
	Consulting and Final Report	100	hours	$ 85.00	per hour	$ 8,500.00
Subtotal						**$ 501,000.00**
Contingency @ 20%						$ 100,200.00
Total Drilling						**$ 601,200.00**
Total 2018 Exploration Program						**$ 1,165,800.00**



625000
625500
626000
7280000
7279500
N
cascadero
Legend
Proposed Trenches
road, unpaved
trail
Cateo Boundary
Rock Geochemistry
Gold
-10 - 0.25 ppm
0.25 - 0.5 ppm
0.5 - 1.0 ppm
1.0 - 2.0 ppm
2.0 - 162.6 ppm
Soil Geochemistry
Gold
<2 - 12 ppb
13 - 24 ppb
25 - 49 ppb
50 - 99 ppb
100 - 804 ppb
Cascadero Copper Corporation
Sarita Este Gold Prospect
Proposed Trenches
Sarita Este and Desierto I Cateos
WGS 1984 UTM Zone 19S
Scale - 1:10,000; Contour Interval - 5 metres
Drawn by Andrew Wilkins - Lithos Geological Inc.
Sarita Este
Desierto I
LS2018-02, (557 metres)
LS2018-03, (556 metres)
LS2018-01, (604 metres)
LS2018-04, (289 metres)
0
62.5
125
250
375
500
Meters

Figure 18.1

19 References

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Appendix 1 - Petrographic Report

PETROGRAPHIC REPORT ON 12 SAMPLES FROM CASCADERO COPPER COMPANY SARITA ESTE PROPERTY, ARGENTINA

Report for: Cascadero Copper Corporation. Invoice 180001

Jan. 11, 2018.

SUMMARY:

Of the 12 samples submitted, 11 appear to be closely related, felsic volcanic/tuffaceous rocks of about rhyodacite composition (in some cases obscured by significant silicic alteration), and one sample is a granite, suggesting consanguinity. Samples may be roughly classified as follows:

Felsic volcanic (3 samples, 22-8828, AW 33, AW B187): rhyodacitic flow and hypabyssal intrusive? composed of phenocrysts of plagioclase (oligoclase altered to albite?), quartz (slightly resorbed, locally overgrown) and relict mafic (biotite ±hornblende?), microphenocrysts of ilmeno-magnetite, in groundmass of seriate plagioclase, quartz and relict mafics, significant interstitial K-spar.

Tuffaceous felsic volcanic (8 samples, 1532175, AW 25, AW 1, 228940, AW B99, AW B28, AW B26, Trench): rhyodacitic crystal-lapilli tuff composed of phenocrysts/crystal shards of plagioclase (oligoclase altered to albite, commonly hematite-stained), quartz (slightly resorbed, locally overgrown) and relict mafic (biotite ±hornblende?), microphenocrysts of ilmeno-magnetite, in groundmass of seriate plagioclase, quartz and relict mafics, significant interstitial K-spar; vaguely to locally well-defined lithic clasts mostly <1 cm in size vary slightly in grain size or composition (typically more Kspar-rich; locally rhyodacite clasts in dacite host?).

Granite (1 sample, 81558): hypidiomorphic-granular textured biotite granite composed of sub-equal amounts of Kspar, plagioclase and quartz with minor interstitial relict biotite sites, cut by significant vein network/breccia matrix of secondary quartz with minor copper-trace electrum? mineralization.

Alteration ranges from weak propylitic (sericite-chlorite-epidote with magnetite preserved, e.g. AW 33) to weak/moderate propylitic (albite-sericite-chlorite-epidote-calcite-rutile, e.g. AW 25) grading to weak/moderate phyllic (with increase in sericite, e.g. AW B99, 28, 26), but the most important alteration appears to be phyllic/silicic with gradation towards argillic (with addition of clay?-quartz-local possible jarosite?-trace alunite?), e.g. 228940, AW 1 and Trench samples, or intense silicic (major quartz addition in form of pervasive replacement and/or veinlets, stockworks or breccia matrix, e.g. 22-8828, AW B187, veined portion of 81558). It is only with this last alteration that any remnant (largely oxidized) sulfides occur, namely cubic casts after pyrite in Trench sample, or malachite-limonite (hematite/goethite) likely after chalcopyrite in 81558, the granite sample (which may contain a trace of possible electrum, although this highly tentative identification requires SEM confirmation).

Capsule descriptions are as follows:

22-8828: intensely silicified felsic (originally quartz-feldspar ±mafic phyric), brecciated volcanic (matrix of secondary quartz-hematite) further cut by network of vuggy, limonite-stained sericite-trace Fe calcite fractures lacking visible evidence of gold.

1532175: weakly to locally moderately phyllic (sericite ±rutile) altered quartz-feldspar-biotite phyric felsic volcanic (rhyodacite?); alteration appears related to local irregular fractures with limonite (mainly goethite).

AW 25: weakly to locally moderately propylitic (hematite-stained albite, sericite-chlorite-epidote-carbonate ±hematite, rutile) altered quartz-feldspar-biotite-hornblende (?) phyric felsic volcanic (rhyodacite?). It may have been fragmental or volcaniclastic.

AW 33: weakly propylitic (sericite-chlorite-epidote ± rutile, hematite) altered quartz-feldspar-biotite-hornblende (?) phyric felsic rock (rhyodacite?), possibly hypabyssal in origin.

AWB 187: intensely silicified, accessory hematite-rutile altered quartz-probable feldspar/mafic phyric volcanic/tuffaceous rock likely consanguineous with AW 25 and 33; it shows evidence such as small drusy vugs and semi-perlitic cracking suggestive of significant volume loss during alteration.

81558: medium-grained biotite granite intrusive altered to hematite-stained albite-quartz-Kspar?-sericite-hematite-rutile in association with vein/breccia matrix of secondary quartz-malachite-limonite (after chalcopyrite?)-trace possible electrum (?).

AW 1: fragmental felsic volcanic composed of clay?-sericite-quartz altered, possibly originally rhyodacite clasts in (dacite?) host composed of closely packed relict (sericite, hematite-stained, albite altered), quartz and relict biotite (altered to sericite-rutile) and Fe-Ti oxide (now rutile) phenocrysts in groundmass altered to sericite.

228940: plagioclase-quartz-biotite phyric felsic volcanic (tuffaceous rhyodacite?) strongly phyllic/argillic altered to clay?/sericite-quartz-hematite-albite? ±Kspar-rutile in association with veins of clay?/sericite-jarosite?-hematite.

AW B99: weakly to locally moderately propylitic/phyllic (albite-sericite-chlorite-carbonate ±epidote-rutile) altered quartz-feldspar-biotite-amphibole phyric felsic volcanic (rhyodacite?), related to local irregular carbonate (dolomite?)-rare quartz veinlets.

AW B28: weakly propylitic/phyllic (albite-sericite-carbonate-chlorite ± rutile, hematite) altered quartz-feldspar-biotite (?) phyric, fragmental felsic volcanic (rhyodacite crystal-lapilli tuff?).

AW B26: weakly propylitic/phyllic (albite-sericite-carbonate-chlorite ± rutile, hematite) altered quartz-feldspar-biotite (?) phyric, fragmental felsic volcanic (rhyodacite crystal-lapilli tuff?).

Trench: weakly propylitic/phyllic grading to argillic (albite-clay?-sericite-carbonate-chlorite ± rutile, alunite?) altered quartz-feldspar-biotite (?) phyric, fragmental felsic volcanic (rhyodacite crystal-lapilli tuff?).

Detailed petrographic description and photomicrograph are appended (on CD/by email attachment). If you have any questions regarding the petrography, please do not hesitate to contact me.

22-8828: INTENSELY SILICIFIED FELSIC (ORIGINALLY QUARTZ-FELDSPAR ±MAFIC PHYRIC), BRECCIATED VOLCANIC (MATRIX OF SECONDARY QUARTZ-HEMATITE) FURTHER CUT BY NETWORK OF VUGGY, LIMONITE-STAINED SERICITE-TRACE FE CALCITE FRACTURES LACKING VISIBLE EVIDENCE OF GOLD

Hand sample shows brecciated felsic (quartz-feldspar phyric) volcanic rock composed of ~50% pale buff-coloured subangular to angular clasts up to 2.5 cm in diameter set in aphanitic, reddish-purple (hematitic) matrix, locally cut by a network of thin, pale orange-brown (limonitic), slightly vuggy fractures. The matrix thus appears to be largely of secondary, hydrothermal origin rather than merely a primary volcanic feature. The rock is not magnetic, shows minor reaction to cold dilute HCl (in the fracture network only), and no stain for K-feldspar (but extensive white etch for plagioclase) in the etched offcut. Modal mineralogy in polished thin section is approximately:

Quartz (secondary, after feldspar phenocrysts, breccia matrix)	50%
Quartz (primary, phenocrysts)	13%
Plagioclase (groundmass of clasts only, albitic?)	30%
Sericite (white mica, limonite stained, in fracture network)	3%
Hematite (mainly matrix; local clast replacement)	2%
Voids/vugs (fracture network)	1%
Carbonate (Fe-calcite?), fracture network only	<1%
Rutile (after relict Ti-oxide microphenocryst sites)	<1%

This section reveals an intensely silicified rock, in which the clasts consist of quartz-relict feldspar phyric felsic volcanic (feldspars completely replaced by secondary quartz, local possible mafics by quartz and hematite), set in a mainly secondary, likely hydrothermal, matrix of secondary quartz-hematite, in turn cut by a vuggy fracture network of sericite-Fe calcite-limonite.

Clasts consist of about 15% quartz phenocrysts or shards (broken, sub- to rarely euhedral, up to 1.6 mm in maximum dimension with local resorption features, locally veined by or with common secondary quartz overgrowths up to 0.2 mm thick), perhaps 20-25% relict feldspar (?) sites (sub- to euhedral outlines mainly <1 mm, now totally replaced by fine-grained secondary quartz as interlocking anhedra in the 10 µm to 0.12 mm range), <10% relict mafic (?) sites (sub- to locally euhedral outlines mainly <1 mm long, now totally replaced by secondary quartz as above plus hematite as subhedra mainly <15 µm) and <1% relict Fe-Ti oxide microphenocryst sites (replaced by accessory rutile/leucoxene as minute sub/euhedra in the 5-15 µm size range) in a groundmass of minutely crystalline plagioclase (randomly oriented, interlocking anhedra mainly <10 µm, possibly mixed with secondary quartz of similar size). Negative relief of plagioclase-rich areas compared to primary and secondary quartz suggests it may be albitic in composition (likely secondary also). Locally, thin (<0.3 mm) veinlets of hematite-secondary quartz cut the clasts (offshoots of the matrix0.

The largely secondary, hydrothermal matrix consists mainly of very fine-grained quartz (interlocking, subhedral crystals mainly <50 µm, but difficult to separate from larger crystals that probably mostly represent comminuted quartz phenocrysts; finer-grained quartz may also in part be from comminuted clasts), plus significant accessory hematite (euhedral plates rarely over 0.1 mm, but locally in aggregates with subhedral outlines up to 0.5 mm across). This original secondary quartz/hematite breccia matrix has been re-opened locally by the vuggy fracture network of orange-brown limonite-stained sericite or white mica (sub/euhedral flakes either mostly <25 µm or up to 0.15 mm in diameter), with local minor carbonate (subhedra <0.1 mm, probably Fe-calcite to judge by the limonite and the rapid reaction to HCl in hand specimen). Voids due to plucking during section preparation) and/or vugs associated with this network are angular, up to 4 mm across. Very rare traces of pyrite (shards <25 µm) are associated with the network, but no gold particles were located.

In summary, this is intensely silicified felsic (originally quartz-feldspar ±mafic phyric), brecciated volcanic (matrix of secondary quartz-hematite) further cut by network of vuggy, limonite-stained sericite-trace Fe calcite fractures lacking visible evidence of gold.

1532175: WEAKLY TO LOCALLY MODERATELY PHYLLIC (SERICITE ±RUTILE) ALTERED QUARTZ-FELDSPAR-BIOTITE PHYRIC FELSIC VOLCANIC (RHYODACITE?); ALTERATION APPEARS RELATED TO LOCAL IRREGULAR FRACTURES WITH LIMONITE (MAINLY GOETHITE)

Hand specimen shows pale orange-brown (limonite stained) fine-grained felsic-looking (quartz-feldspar phyric) volcanic or possibly volcaniclastic rock, cut by local black (Mn-oxide stained?) short discontinuous fractures. The rock is not magnetic, and shows no reaction to cold dilute HCl, but there is extensive stain for K-feldspar in the etched offcut (mainly groundmass; white etch reveals plagioclase phenocrysts). Modal mineralogy in polished thin section is approximately:

Plagioclase (phenocrysts, partly sericitized oligoclase-albite?)	30%
K-feldspar (groundmass only, primary?)	30%
Quartz (phenocrysts, possible groundmass?)	20%
Sericite, white mica (after plagioclase, biotite?)	15%
Limonite (goethite, after Fe-Ti oxides, possible pyrite?)	3-5%
Relict biotite	<1%
Rutile/leucoxene	<1%

This sample consists of about 35-40% relict (sericitized) plagioclase, 15% quartz and 5-10% relict (sericite-limonite ±rutile altered) biotite phenocrysts with somewhat seriate (progressively size-graded) texture set in an aphanitic groundmass of K-feldspar, local variations in which may suggest clasts and thus a tuffaceous or volcaniclastic origin (such clasts have elongated outlines to 3 mm long, parallel to weakly defined alignment of feldspar crystals, suggesting they could be fiamme?).

Relict plagioclase phenocrysts have mainly euhedral tabular to lath-shaped outlines up to almost 2 mm long (but grading to smaller crystals <0.25 mm in the groundmass), locally somewhat aligned to impart weak trachytic texture. They are typically 15-30% replaced by sericite as randomly oriented sub/euhedral flakes mostly <25 µm in size, but locally in patches or aggregates with irregular outlines <0.5 mm, mainly at relict crystal cores and/or highlighting former zoning in the crystals. Composition of the plagioclase appears to be about oligoclase to albite (core to rim) based on extinction Y^010 up to 13º; some smaller crystals may be albitized, to judge by the sericitization.

Quartz phenocrysts display rounded subhedral to rarely euhedral outlines mostly <1.5 mm (rarely to 2 mm where broken, glomeratic in nature) with local minor resorption features and very narrow (<20 µm) overgrowth rims. The crystals are essentially unstrained.

Relict biotite occurs as randomly oriented, mostly euhedral flakes or booklets <0.5 mm in diameter that have been interleaved by or pseudomorphed by white mica as similar-sized, euhedral flakes mixed with variable amounts of orange-brown, amorphous limonite (goethite?) and traces of rutile/leucoxene (minute subhedra <15 µm). Minor smaller <0.2 mm) mafic relics with rounded outlines locally display relict cleavage suggestive of former possible amphibole (?).

The groundmass consists of closely packed, small, seriate-textured crystals of all the above (plagioclase partly altered to sericite, quartz, biotite altered to white mica) plus microphenocrysts of Ti oxides (euhedral outlines <0.2 mm, now converted to rutile/leucoxene as above), set in aphanitic Kspar (individual microlites barely visible at <15 µm; probably includes some quartz of similar or finer grain size).

The irregular fracture networks are centered on sub-planar, open fractures mainly <0.1 mm thick, but spread out variably to almost 1 cm across, marked by central concentrations of opaque that appears to be mostly limonite (dark red-brown colour at thin edges suggests goethite?) although Mn-oxides could be present, surrounded by a paler-coloured stain of transported limonite associated with increased sericite alteration pervasively replacing the rock. It is not clear whether the opaque limonite is after former Fe-Ti oxides or possibly locally Fe-sulfides such as pyrite (?).

In summary, this is weakly to locally moderately phyllic (sericite ±rutile) altered quartz-feldspar-biotite phyric felsic volcanic (rhyodacite?); alteration appears related to local irregular fractures with limonite (mainly goethite).

AW 25: WEAKLY TO LOCALLY MODERATELY PROPYLITIC (HEMATITE-STAINED ALBITE, SERICITE-CHLORITE-EPIDOTE-CARBONATE ±HEMATITE, RUTILE) ALTERED QUARTZ-FELDSPAR-BIOTITE-HORNBLENDE (?) PHYRIC FELSIC VOLCANIC (RHYODACITE?), POSSIBLY FRAGMENTAL OR VOLCANICLASTIC

Hand specimen shows what appears to be salmon-pink/grey felsic volcanic (quartz, hematite stained feldspar, small dark green/black relict mafic crystals set in a variable-textured groundmass suggestive of fragmental origin?), altered to pale greenish epidote (?) and local calcite, cut by local black (Mn-oxide?) fractures. The rock is not magnetic, shows scattered minor reaction to cold dilute HCl, and pervasive yellow stain for K-feldspar in the groundmass of the etched offcut (pink feldspar phenocrysts etch white for plagioclase). Modal mineralogy in polished thin section is approximately:

Plagioclase (phenocrysts, weakly saussuritized hematite-stained albite?)	40%
K-feldspar (groundmass only, primary?)	20%
Quartz (phenocrysts, possible groundmass?)	20%
Sericite, white mica (after plagioclase, biotite?)	10%
Chlorite (after mafics, with white mica, epidote)	3-5%
Epidote (after mafics)	2-3%
Hematite (after Fe-Ti oxides?)	1-2%
Carbonate (mainly calcite, after mafics)	1-2%
Rutile/leucoxene	<1%

This sample consists of about 35-40% (saussuritized, hematized) plagioclase, 15% quartz and 10% relict (chlorite-epidote-sericite ±carbonate-rutile altered) mafic phenocrysts and seriate-textured crystals set in an aphanitic groundmass of K-feldspar, local variations in phenocryst content may suggest clasts and thus a tuffaceous or volcaniclastic origin (such clasts may have poorly defined outlines to 3 cm?).

Relict plagioclase phenocrysts have mainly euhedral tabular outlines up to almost 3 mm (but grading to smaller crystals <0.25 mm in the groundmass), mostly randomly oriented. They are typically 5-15% replaced by sericite (randomly oriented sub/euhedral flakes mostly <25 µm in size, but locally in patches or aggregates with irregular outlines <1 mm, mainly at relict crystal cores and/or highlighting former zoning in the crystals) locally with lesser epidote (subhedra <0.1 mm) and carbonate (anhedra <0.1 mm, likely calcite). Composition of the plagioclase appears to be about albite based on extinction Y^010 up to 15º; likely secondary, to judge by the saussuritization and hematite staining (minute particles <3 µm) typical of albitization.

Quartz phenocrysts display rounded subhedral, broken to rarely euhedral outlines mostly <2 mm (rarely to 3 mm where glomeratic), with local minor resorption features and very narrow (<20 µm) overgrowth rims. The crystals are essentially unstrained.

Relict mafics (biotite, hornblende?) occur as randomly oriented, mostly euhedral crystals up to 1.5 mm long. The former (biotite?) are replaced by chlorite (subhedral flakes <0.2 mm with distinct green pleochroism, length-slow anomalous blue/grey birefringence suggestive of Fe:Fe+Mg, or F:M, ratio about 0.6?) and white mica as similar-sized, euhedral flakes mixed with minor epidote (subhedra <0.15 mm) and traces of rutile/leucoxene (minute subhedra <15 µm). The latter (amphibole?) occurs in slender lath-like pseudomorphs up to .2 mm long replaced by variable combinations of chlorite, epidote (sub/euhedra to ~1 mm with yellow pleochroism indicative of high Fe content) and carbonate (ragged subhedra to 0.25 mm, possibly dolomite or calcite?).

The groundmass consists of closely packed, small, seriate-textured crystals of all the above (plagioclase partly altered to sericite; quartz; biotite altered as above) plus microphenocrysts of Fe-Ti oxides (euhedral outlines <0.2 mm, replaced by hematite as sub/euhedral plates to 0.1 mm, lesser rutile/leucoxene as above), set in aphanitic Kspar (individual microlites barely visible at <15 µm; probably includes some quartz of similar or finer grain size).

In summary, this is weakly to locally moderately propylitic (hematite-stained albite, sericite-chlorite-epidote-carbonate ±hematite, rutile) altered quartz-feldspar-biotite-hornblende (?) phyric felsic volcanic (rhyodacite?). It may have been fragmental or volcaniclastic.

AW 33: WEAKLY PROPYLITIC (SERICITE-CHLORITE-EPIDOTE ± RUTILE, HEMATITE) ALTERED QUARTZ-FELDSPAR-BIOTITE-HORNBLENDE (?) PHYRIC FELSIC, PROBABLY HYPABYSSAL ROCK (RHYODACITE?)

Hand specimen shows pale pinkish-grey felsic volcanic (quartz, plagioclase, small dark green/black relict mafic phenocrysts set in fine-grained groundmass) suggestive of volcanic (or hypabyssal?) origin, relatively fresh (unaltered), cut by rare thin orange-brown (limonitic) fractures. The rock is distinctly magnetic, shows no reaction to cold dilute HCl, and pervasive yellow stain for K-feldspar in the groundmass of the etched offcut; feldspar phenocrysts etch white for plagioclase. Modal mineralogy in polished thin section is approximately:

Plagioclase (phenocrysts, weakly saussuritized oligoclase-andesine?)	40%
K-feldspar (groundmass only, primary?)	25%
Quartz (phenocrysts, groundmass)	20%
Sericite, white mica (after plagioclase)	5%
Chlorite (after biotite, with epidote)	5%
Epidote (after biotite, rarely plagioclase)	2-3%
Magnetite (slightly altered to hematite)	2-3%
Rutile/leucoxene	<1%

This sample consists of about 30-35% saussuritized plagioclase, 15% quartz ,10% relict (chlorite-epidote ±rutile altered) biotite and 2% magnetite phenocrysts, plus smaller seriate-textured crystals set in fine-grained groundmass of Kspar-quartz-trace sericite-opaques.

Relict plagioclase phenocrysts have mainly euhedral tabular outlines up to almost 3 mm (but grading in seriate fashion to smaller crystals <0.25 mm in the groundmass), mostly randomly oriented. They are typically 5-25% replaced by sericite (randomly oriented sub/euhedral flakes mostly <25 µm in size, but locally in patches or along fractures, or locally minor epidote (subhedra <0.15 mm). The plagioclase crystals show vague, weakly oscillatory zoning, with relict primary composition about oligoclase-andesine based on extinction Y^010 typically <10º but locally up to 20º.

Quartz phenocrysts display rounded subhedral, broken to rarely euhedral outlines mostly <2 mm (rarely to 3 mm where glomeratic), with well-developed, major resorption features but only local narrow (<100 µm) overgrowth rims. The crystals are essentially unstrained.

Relict mafic (mainly biotite?) phenocrysts occur as randomly oriented, mostly euhedral crystals up to 1.5 mm long (some biotite may be secondary after hornblende, partly further altered to the typical chlorite-epidote). Relict biotite forming subhedral flakes to 0.6 mm with greenish-brown pleochroism is visible in some relicts, variably replaced by chlorite (subhedral flakes <0.2 mm with distinct green pleochroism, length-slow anomalous blue/grey birefringence suggestive of F:M ~0.6?) and epidote (subhedra <0.5 mm with strong yellow pleochroism indicative of high Fe content) plus accessory rutile/leucoxene (aggregates to 0.3 mm of subhedra <35 µm). The possible hornblende relics form more tabular subhedra up to .2 mm long replaced by variable combinations of secondary biotite, chlorite, epidote (sub/euhedra to 0.75 mm also with yellow pleochroism indicative of high Fe content) and accessory Fe-Ti oxides (magnetite as subhedra to 0.25 mm, similar to that described below).

The groundmass consists of closely packed, small, seriate-textured crystals of all the above (plagioclase partly altered to sericite; quartz; biotite altered as above) plus microphenocrysts of magnetite (euhedral outlines <0.6 mm, locally slightly replaced by hematite as minute sub/euhedra <25 µm), set in a matrix of fine-grained quartz as sub/anhedra rarely to 0.1 mm, interstitial Kspar (mostly <65 µm) and traces of sericite and rutile (both mostly <20 µm). No fractures or veinlets were seen in the section.

In summary, this is weakly propylitic (sericite-chlorite-epidote ± rutile, hematite) altered quartz-feldspar-biotite-hornblende (?) phyric felsic rock (rhyodacite?), possibly hypabyssal in origin.

AWB 187: INTENSELY SILICIFIED, ACCESSORY HEMATITE-RUTILE ALTERED QUARTZ-PROBABLE FELDSPAR/MAFIC PHYRIC VOLCANIC OR TUFFACEOUS ROCK LIKELY CONSANGUINEOUS WITH AW 25 AND 33; IT SHOWS EVIDENCE SUCH AS SMALL DRUSY VUGS AND SEMI-PERLITIC CRACKING SUGGESTIVE OF SIGNIFICANT VOLUME LOSS DURING ALTERATION

Hand specimen shows pale grey/slightly pinkish, fine-grained, siliceous felsic volcanic (quartz, small dark relict mafic phenocrysts set in fine-grained silicified-looking groundmass with local small relict lithic clasts?), suggestive of tuffaceous volcanic origin, with common small drusy vugs (?) and cut by rare thin orange-brown (limonitic) fractures. The rock is not magnetic, shows no reaction to cold dilute HCl, and no stain for K-feldspar in the etched offcut; feldspar phenocrysts etch white for plagioclase. Modal mineralogy in polished thin section is approximately:

Quartz (secondary, replacing feldspars, mafics)	60%
Plagioclase (relict, fine-grained, groundmass only)	20%
Quartz (primary phenocrysts)	15%
Hematite (secondary, after mafic sites with rutile/leucoxene)	1-2%
Rutile/leucoxene	1-2%
Voids/vugs (drusy, some due to plucking?)	1-2%
Sericite	trace

This is a relict, intensely silicified volcanic/hypabyssal rock similar to the previous four samples, in which only quartz phenocrysts have survived relatively unchanged; both former feldspar and former mafic sites are largely replaced by quartz, or quartz-hematite-rutile-trace sericite in the latter case. Veinlets and fractures are not well developed; the silicification is mainly pervasive, making recognition of possible former lithic clasts difficult.

Quartz phenocrysts display rounded subhedral, broken to rarely euhedral outlines mostly <2.5 mm, with well-developed, major resorption features and local discontinuous (up to 0.2 mm thick) overgrowth rims. The crystals are essentially unstrained but locally may be recrystallized to multiple sub-domains (<1 mm) or cut by micro-veinlets <50 µm thick of secondary quartz similar to that in the adjacent highly silicified groundmass.

Presumed relict feldspar (plagioclase?) sites have irregular anheddral to rarely subhedral outlines mostly <2.5 mm long, now completely replaced by fine-grained secondary quartz as tightly interlocking, randomly oriented sub/anhedral crystals mainly in the <20 µm to 0.15 mm size range. The larger crystals are commonly associated with or line the margins of vugs or voids up to 1.5 mm across. The vugs may be related to volume changes due to leaching/removal of alkalis during the intense silicification.

Presumed relict mafic sites of similar size and shape are distinguished from feldspar sites mainly by the presence of fine-grained opaques (hematite as sub- to locally euhedral crystals <30 µm, partly in elongated, micro-veinlet like aggregates up to 0.1 mm thick, and variable rutile or leucoxene as aggregates to 1.5 mm long of minute crystallites commonly <5 µm in size. Small aggregates of hematite and rutile with sub- to euhedral outlines mostly <0.3 mm, in the adjacent groundmass, are reminiscent of Fe-Ti oxide microphenocrysts in less altered rocks of this suite.

The groundmass is typically so fine-grained and featureless that it resists microscopic identification. Gradation between secondary quartz in the <50µm to 0.1 mm size range replacing the former phenocryst sites to randomly oriented sub/anhedra in the <5 to 25 µm range is common, making distinction between quartz and plagioclase presumed in the groundmass from the white etch in the offcut difficult. A closely spaced (commonly <0.2 mm) system of curving, semi-perlitic fractures emphasizes the highly silicified nature of the sample.

In summary, this is intensely silicified, accessory hematite-rutile altered quartz-probable feldspar/mafic phyric volcanic/tuffaceous rock likely consanguineous with AW 25 and 33; it shows evidence such as small drusy vugs and semi-perlitic cracking suggestive of significant volume loss during the alteration.

81558: MEDIUM-GRAINED BIOTITE GRANITE INTRUSIVE ALTERED TO HEMATITE-STAINED ALBITE-QUARTZ-KSPAR?-SERICITE-HEMATITE-RUTILE IN ASSOCIATION WITH VEIN/BRECCIA MATRIX OF SECONDARY QUARTZ-MALACHITE-LIMONITE (AFTER CHALCOPYRITE?)-TRACE POSSIBLE ELECTRUM (?)

Hand specimen shows salmon-pink/brick red altered felsic igneous rock (quartz, hematite stained plagioclase, K-feldspar, probable relict mafics?), possibly plutonic, cut by intense grey quartz-minor malachite stained vein or breccia zone up to ~3 cm thick. The rock is not magnetic, and shows no reaction to cold dilute HCl, but pervasive yellow stain for K-feldspar in the groundmass of the etched offcut (pink feldspar phenocrysts etch white for plagioclase). Modal mineralogy in polished thin section is approximately:

K-feldspar (groundmass/matrix, primary and secondary?)	30%
Plagioclase (phenocrysts, locally sericitized hematite-stained albite?)	20%
Quartz (primary crystals, partly recrystallized)	20%
(secondary, vein/breccia matrix)	20%
Sericite, white mica (after plagioclase, biotite?)	3-5%
Limonite (after chalcopyrite; vein/breccia matrix only)	2%
Malachite (after chalcopyrite; vein/breccia matrix only)	2%
Hematite (wallrock, after magnetite, traces of which remain)	1%
Rutile (mixed with hematite)	1%

This sample is distinctly hypidiomorphic-granular (plutonic) in character, composed of quartz, plagioclase and relict altered mafic sites (white mica-opaque oxides) plus abundant interstitial Kspar. It is cut by a well-developed vein network/breccia matrix of secondary quartz mineralized with limonite-malachite (likely after chalcopyrite?).

In the altered wallrock, plagioclase occurs as randomly oriented, tabular sub/euhedral crystals mostly <3 mm (locally glomeratic, up to 0.5 cm long in etched offcut). They are typically strongly "dusted' by minute (1-2 µm) particles of hematite and clay (?), imparting the salmon-pink colour in hand specimen, and are likely secondary albite in composition (based on relief negative compared to adjacent quartz and extinction on 010 up to 17°, implying An_{0-5}. Minor variable sericite (randomly oriented to aligned subhedral flakes mainly <70 µm) locally affects the plagioclase. Quartz occurs in irregular-shaped aggregates up to 5 mm across composed of interlocking sub/anhedra to ~3 mm, with minor strain indicated by weak undulose extinction, sub-grain development, and suturing of grain boundaries. Locally this quartz shows overgrowths replacing adjacent plagioclase, or grades into elongated, vein-like aggregates of secondary (partly recrystallized, sheared?) quartz that has been granulated to sub-domains <0.25 mm with stronger strain indicators. K-feldspar forms interlocking subhedra mainly <1.2 mm, but commonly aggregating to 3 mm; although it could be mostly primary, part could be of secondary origin, given the proximity to the well-developed vein system. Mafic relics are sparse, probable relict biotite sites with sub/euhedral shapes <1.5 mm (aggregates to ~3 mm) composed of interleaved white mica to ~1 mm and rutile/leucoxene (euhedra to 45 µm/<5 µm respectively) or limonite (mainly hematite, euhedral plates to 0.2 mm). Hematite also occurs as ragged subhedral aggregates to 0.5 mm with traces of remnant magnetite <50 µm at the cores.

In the vein/breccia, clasts of wallrock as described above but typically more altered to sericite occur in matrix of secondary quartz (interlocking, randomly oriented, bladed subhedra mostly <0.5 mm, with moderate strain indicators) and minor oxide copper minerals (malachite and limonite, likely after chalcopyrite?). Malachite occurs in small aggregates to ~2 mm across composed of central dark/bright green pleochroic <0.5 mm subhedra surrounded by pale green, matted microcrystalline (<25 µm) material or locally minor sericite (also matted flakes, <15 µm), associated with limonite as aggregates to ~1 mm of microcrystalline hematite surrounded by goethite, rarely with attached grains of possible electrum (?) <30 µm in size (require SEM confirmation).

In summary, this is medium-grained biotite granite intrusive altered to hematite-stained albite-quartz-Kspar?-sericite-hematite-rutile in association with vein/breccia matrix of secondary quartz-malachite-limonite (after chalcopyrite?)-trace possible electrum (?).

AW 1: FRAGMENTAL FELSIC VOLCANIC COMPOSED OF CLAY?-SERICITE-QUARTZ ALTERED, POSSIBLY ORIGINALLY RHYODACITE CLASTS IN (DACITE?) HOST COMPOSED OF CLOSELY PACKED RELICT (SERICITE, HEMATITE-STAINED, ALBITE ALTERED), QUARTZ AND RELICT BIOTITE (ALTERED TO SERICITE-RUTILE) AND FE-TI OXIDE (NOW RUTILE) PHENOCRYSTS IN GROUNDMASS ALTERED TO SERICITE

Hand specimen shows bright salmon-pink, fine-grained quartz phyric volcanic rock with scattered small (<1 cm) sub-rounded white patches that could be clasts, indicating a fragmental rock? (this is supported by the fact that they stain faint yellow for Kspar in the etched offcut, and are more readily scratched by steel than the host rock). The rock is not magnetic, and shows no reaction to cold dilute HCl, but there is extensive white etch for plagioclase in the etched offcut. Modal mineralogy in polished thin section is approximately:

Plagioclase (relict sericitized, hematite-stained albite?)	45%
Quartz (primary phenocrysts, groundmass; minor secondary?)	20%
Sericite (after plagioclase, groundmass)	20%
Clay (?), mainly in clast groundmass (after feldspars?)	10%
K-feldspar (relict, clay altered?)	3%
Rutile/leucoxene (after Fe-Ti oxides)	1-2%

This sample consists of about 10-15% aphanitic clasts (quartz phyric, possibly original Kspar groundmass altered to clay?/sericite) in host rock containing about 30-35% relict plagioclase (sericitized, hematite-stained albite?), 15% quartz , and 10% small relict (sericite-rutile altered) biotite phenocrysts plus 1-2% rutile altered Fe-Ti oxide crystals in sericitized groundmass.

In the clasts, which have irregular, somewhat ellipsoid outlines <1 cm (1.5 cm in hand specimen), plagioclase crystals are either absent or have been so thoroughly sericitized to disappear into the clay? altered matrix, mafic and Fe-Ti oxide crystals are not seen, and quartz phenocrysts may be slightly smaller (<0.6 mm) and less abundant than in the host, suggesting they represent a different but closely related rock. Also, there are discontinuous microveinlets of secondary quartz (<50 µm thick) which connect to small voids or vugs mainly <0.5 mm across.

In the host rock, plagioclase occurs as randomly oriented, tabular sub/euhedral crystals mostly <2 mm. They are 5-25% replaced by sericite (randomly oriented to aligned subhedral flakes mainly <50 µm) and "dusted' by minute (1-2 µm) particles of hematite and clay (?), imparting the salmon-pink colour in hand specimen. Composition is likely secondary albite, based on relief negative compared to adjacent quartz and extinction on 010 up to 15º, implying An_5. Quartz phenocrysts are unstrained, sub- to locally euhedral to 1.6 mm, with local resorbed textures and narrow overgrowths <75 µm. Mafic relics are sparse, probable relict biotite sites with sub/euhedral shapes <0.5 mm pseudomorphed by interleaved white mica to ~0.3 mm and rutile/leucoxene (euhedra to 15 µm/<5 µm respectively). The groundmass consists of smaller, seriate-textured crystals of all of the above, locally closely packed together, in a matrix heavily altered to sericite (randomly oriented subhedral flakes <20 µm, likely after feldspars) plus scattered Fe-Ti oxide relics (euhedral outlines mostly <0.25 mm, replaced by rutile as euhedra to 45 µm/leucoxene <5 µm). Minor quartz occurs as scattered anhedra <50 µm in the groundmass, locally along short discontinuous vein-like aggregates suggestive of secondary character.

In summary, this appears to represent fragmental felsic volcanic composed of clay?-sericite-quartz altered, possibly originally rhyodacite clasts in (dacite?) host composed of closely packed relict (sericite, hematite-stained, albite altered), quartz and relict biotite (altered to sericite-rutile) and Fe-Ti oxide (now rutile) phenocrysts in groundmass altered to sericite.

228940: PLAGIOCLASE-QUARTZ-BIOTITE PHYRIC FELSIC VOLCANIC (TUFFACEOUS RHYODACITE?) STRONGLY PHYLLIC/ARGILLIC ALTERED TO CLAY?/SERICITE-QUARTZ-HEMATITE-ALBITE? ±KSPAR-RUTILE IN ASSOCIATION WITH VEINS OF CLAY?/SERICITE-JAROSITE?-HEMATITE

Hand specimen shows strongly weathered and oxidized, reddish-coloured, fine-grained felsic volcanic rock (?) cut by prominent stockwork of pale yellowish-coloured veinlets and later open fracture system. The rock is not magnetic, shows no reaction to cold dilute HCl, and only faint yellow stain for K-feldspar in the etched offcut (but extensive white etch for plagioclase). The vein material is partly softer than steel (in the paler-coloured cores) and partly harder than steel (along darker-coloured selvages). Modal mineralogy in polished thin section is approximately:

Plagioclase (phenocrysts altered to sericite-albite ±Kspar?)	35%
Quartz (phenocrysts, groundmass; partly secondary?)	20%
Clay?/sericite (after groundmass, plagioclase, biotite?)	20%
(vein cores)	10%
Unidentified (vein selvages, could be jarosite?)	5%
K-feldspar (relict primary groundmass, minor secondary?)	5%
Limonite (mainly hematite?)	4-5%
Rutile/leucoxene (in relict biotite, Fe-Ti microphenocrysts)	<1%

Host rock is composed of closely packed, randomly oriented, 35-40% plagioclase (partly altered to sericite-albite ±Kspar?), 10-15% quartz and 5-10% relict mafic (biotite?) phenocrysts in groundmass strongly altered to sericite-hematite-local quartz. Veins consist of cores of soft clay?/sericite with selvages of harder, pale yellowish possible jarosite?

In the host rock, plagioclase occurs as randomly oriented, tabular sub/euhedral crystals mostly <2 mm. They are 5-25% replaced by sericite (randomly oriented to aligned subhedral flakes mainly <20 µm) or locally at cores by what may be Kspar (?) in irregular patches <0.35 mm across, and "dusted' along microfractures by minute (1-2 µm) particles of hematite and clay (?), imparting the pinkish colour in hand specimen. Composition is likely secondary albite, based on relief negative compared to adjacent quartz (but slightly above Kspar at cores) and extinction on 010 up to 14º, implying An_5. Quartz phenocrysts are unstrained, sub- to euhedral up to 2.4 mm, with local resorbed textures and rare narrow overgrowths <45 µm. Mafic relics are common, probable relict biotite sites with sub/euhedral shapes <1.25 mm pseudomorphed by interleaved white mica to ~0.3 mm and rutile/leucoxene (euhedra to 15 µm/<5 µm respectively). The groundmass is heavily altered to sericite (randomly oriented subhedral flakes <20 µm, likely after feldspars) and hematite (amorphous to microcrystalline) but locally appears to contain quartz (anhedra <25 µm) plus scattered Fe-Ti oxide relics (euhedral outlines mostly <0.1 mm, replaced by rutile as euhedra to 25 µm/leucoxene <5 µm). At one end of the section, significant quartz occurs as sub/anhedra <50 µm in the groundmass, locally optically continuous in aggregates to 1.3 mm strongly suggestive of secondary origin.

In the veins, which are mainly planar and up to 6 mm thick, cores are composed mainly of pale brownish coloured, very fine-grained clay?/sericite as minute flakes mainly <10 µm but commonly strongly aligned oblique to vein walls, imparting an aggregate cross-foliated texture which is highlighted by sub-parallel microveinlets <20 µm thick of the mineral forming the vein selvages. This mineral, making up the outer 40% of the veins, is unidentified although the pale yellow colour, strong positive relief and moderate birefringence of the closely packed sub/euhedral crystals in the 5-15 µm size range are suggestive of jarosite (?). In places, a concentration of hematite along vein envelopes, in places with fine-grained secondary quartz (as above) suggests a relation between hematite alteration of host rock and the veining. Late fractures are thin (<0.5 mm) and sub-planar.

In summary, this appears to be plagioclase-quartz-biotite phyric felsic volcanic (tuffaceous rhyodacite?) strongly phyllic/argillic altered to clay?/sericite-quartz-hematite-albite? ±Kspar-rutile in association with veins of clay?/sericite-jarosite?-hematite.

AW B99: WEAKLY/LOCALLY MODERATELY PROPYLITIC/PHYLLIC (ALBITE-SERICITE-CHLORITE-CARBONATE ±EPIDOTE-RUTILE) ALTERED QUARTZ-FELDSPAR-BIOTITE-AMPHIBOLE PHYRIC FELSIC VOLCANIC (RHYODACITE?), RELATED TO LOCAL IRREGULAR CARBONATE (DOLOMITE?)-RARE QUARTZ VEINLETS

Hand specimen shows pink-brown (hematitic) fine-grained felsic-looking (quartz, hematite-stained feldspar phyric) volcanic or possibly volcaniclastic rock. The rock is not magnetic, and shows no reaction to cold dilute HCl, but there is extensive stain for K-feldspar in the etched offcut (mainly in the groundmass; white etch reveals plagioclase phenocrysts). Modal mineralogy in polished thin section is approximately:

Plagioclase (phenocrysts, partly sericite-hematite altered albite?)	30%
K-feldspar (groundmass, minor shards, primary?)	30%
Quartz (phenocrysts, possible groundmass?)	20%
Sericite, white mica (after plagioclase, biotite?)	10%
Chlorite (with white mica, carbonate, epidote, after biotite?)	5%
Carbonate (rare veinlets/mainly after amphibole; dolomite?)	1-2%
Epidote (after biotite?)	1-2%
Rutile/leucoxene	1-2%
Hematite (amorphous, staining feldspars)	<1%
Apatite (microphenocrysts)	<1%

This sample consists of about 30-35% relict (sericite-hematite-albite altered) plagioclase/minor Kspar, 15% quartz and 5-10% relict (chlorite-sericite-carbonate ±epidote, rutile altered) mafic phenocrysts or shards with seriate texture set in an aphanitic groundmass of K-feldspar, local variations in which may suggest clasts (very poorly defined) and thus a likely tuffaceous or volcaniclastic origin.

Relict feldspar phenocrysts have mainly euhedral tabular to lath-shaped outlines <2 mm (but grading to smaller, commonly broken/shard-like crystals <0.25 mm in the groundmass), with random orientations. They are typically <5-10% replaced by sericite as randomly oriented sub/euhedral flakes mostly <25 μm in size, rare carbonate as subhedra <0.1 mm, and appear to be mostly albitized plagioclase, but locally some may be Kspar (?). Composition of plagioclase appears to be albite based on commonly vague twinning, relief negative compared to quartz, and extinction Y^010 up to 15º (largely secondary?) plus hematite staining as minute particles <1-2 μm.

Quartz phenocrysts display rounded subhedral to euhedral outlines mostly <1.5 mm (up to 2.5 mm, somewhat broken) with local minor resorption features and narrow (<20 μm) overgrowth rims, or rare replacements. The crystals are locally strained where broken or veined by secondary quartz.

Relict biotite forms randomly oriented, sub/euhedral flakes/booklets <0.5mm pseudomorphed by intimately interleaved chlorite (subhedral flakes <0.15 mm with pale green pleochroism, length-slow birefringence, F:M 0.5?) and white mica (similar-sized, euhedral flakes) mixed with variable amounts of epidote (aggregates <0.1 mm of brownish subhedra <15 μm) and accessory carbonate (as for epidote) and rutile/leucoxene (euhedra <45 μm). Less common, longer (up to 2 mm) mafic relics lath-like outlines pseudomorphed by carbonate (subhedra <0.25 mm, dolomite?) with minor chlorite, sericite and rutile are suggestive of former possible amphibole (hornblende?).

The groundmass consists of closely packed, small, seriate crystals or shards of all the above (feldspar, quartz, chlorite, white mica) plus microphenocrysts of Ti oxides (euhedral outlines <0.15 mm, now converted to rutile/leucoxene as above) and rare apatite (euhedra <0.1 mm), set in fine-grained Kspar (sub/anhedra <0.15 mm?) and lesser quartz(sub/anhedra <50 μm), sericite, chlorite and rutile (variations in contents of the micas suggests former lapilli?).

Rare short discontinuous veinlets <0.5 mm thick are mainly of carbonate as either rare clear or more commonly brownish subhedra to 0.35 mm (possibly dolomite?), rare quartz (<0.2 mm).

In summary, this is weakly to locally moderately propylitic/phyllic (albite-sericite-chlorite-carbonate ±epidote-rutile) altered quartz-feldspar-biotite-amphibole phyric felsic volcanic (rhyodacite?); alteration appears related to local irregular carbonate (dolomite?)-rare quartz veinlets.

AW B28: WEAKLY PROPYLITIC/PHYLLIC (ALBITE-SERICITE-CARBONATE-CHLORITE ± RUTILE, HEMATITE) ALTERED QUARTZ-FELDSPAR-BIOTITE? PHYRIC, FRAGMENTAL FELSIC VOLCANIC (RHYODACITE CRYSTAL-LAPILLI TUFF?)

Hand specimen shows pinkish-brown fine-grained felsic-looking (quartz, feldspar phyric) volcanic or possibly volcaniclastic rock. The rock is weakly magnetic, and shows weak pervasive reaction to cold dilute HCl, plus pervasive pale yellow stain for K-feldspar in the etched offcut (mainly in the groundmass; white etch reveals plagioclase phenocrysts). Modal mineralogy in polished thin section is approximately:

Plagioclase (phenocrysts, groundmass, sericite-carbonate altered albite?)	40%
K-feldspar (groundmass only, primary?)	20%
Quartz (phenocrysts, groundmass?)	20%
Sericite, white mica (after plagioclase, biotite?)	10%
Carbonate (after plagioclase, groundmass; mainly calcite)	5%
Chlorite (after biotite, with white mica)	2-3%
Magnetite (largely altered to hematite)	2-3%
Rutile/leucoxene (after ilmenite, traces of which remain)	<1%
Apatite (with relict mafic sites)	<1%

This sample consists of about 30-35% saussuritized plagioclase, 15% quartz, 10% relict (sericite-chlorite ±rutile altered) biotite and 2% magnetite phenocrysts, plus smaller seriate-textured crystals set in fine-grained groundmass of plagioclase-Kspar-sericite-carbonate-quartz-opaques. Local well-defined clasts with rounded outlines to ~1 cm are distinctly finer-grained than the host, with sparser, smaller phenocrysts or shards, and indicate a crystal-lapilli tuff origin.

Relict plagioclase phenocrysts have mainly euhedral tabular outlines up to ~2 mm (grading in seriate fashion to smaller crystals <0.25 mm in the groundmass), mostly randomly oriented. They are typically 5-25% replaced by sericite (randomly oriented sub/euhedral flakes mostly <25 µm) and carbonate (subhedra <0.25 mm, likely calcite). The plagioclase crystals show vague twinning with extinction Y^010 up to 16º, suggestive of albite composition (likely secondary in view of the sericite-carbonate alteration).

Quartz phenocrysts display rounded subhedral, broken to rarely euhedral outlines mostly <2 mm, with minor resorption features and very narrow (<20 µm) overgrowth rims (more commonly replaced by sericite at rims). The crystals are essentially unstrained.

Relict mafic (mainly biotite?) phenocrysts occur as randomly oriented, mostly euhedral crystals up to 1.2 mm long, variably replaced by white mica (muscovite) as subhedral flakes <0.5 mm, lesser chlorite (subhedral flakes <0.1 mm with almost no colour/pleochroism, length-fast anomalous grey birefringence suggestive of F:M ~0.4?) and minor carbonate (subhedra <0.15 m, likely calcite?) plus accessory rutile/leucoxene (aggregates to 0.2 mm of euhedra <65 µm) and traces of apatite as euhedral stubby prisms to 0.1 mm long, associated with accessory Fe-Ti oxides (microphenocrysts as described below). Hornblende relics appear to be absent.

The groundmass consists of closely packed, small, seriate-textured crystals of all the above (plagioclase partly altered to sericite; quartz; biotite altered as above) plus microphenocrysts of relict magnetite (euhedral outlines <0.5 mm, mostly replaced by hematite as minute sub/euhedra <25 µm, rarely with tabular relict ilmenite <0.2 mm replaced by rutile as described above), set in aphanitic-looking matrix apparently now composed of relict plagioclase (irregular crystals that may have been 0.15 mm prior to alteration to sericite as randomly oriented flakes <10 µm and carbonate as ragged, interlocking sub/anhedra <0.1 mm), with interstitial Kspar (mostly <65 µm) and relatively rare quartz (mostly <50 µm). No fractures or veinlets were seen in the section.

In summary, this is weakly propylitic/phyllic (albite-sericite-carbonate-chlorite ± rutile, hematite) altered quartz-feldspar-biotite (?) phyric, fragmental felsic volcanic (rhyodacite crystal-lapilli tuff?).

AW B26: WEAKLY PROPYLITIC/PHYLLIC (ALBITE-SERICITE-CARBONATE-CHLORITE ± RUTILE, HEMATITE) ALTERED QUARTZ-FELDSPAR-BIOTITE (?) PHYRIC, FRAGMENTAL FELSIC VOLCANIC (RHYODACITE CRYSTAL-LAPILLI TUFF?)

Hand specimen shows dark greenish-brown fine-grained felsic-looking (quartz, feldspar phyric) volcanic or possibly volcaniclastic rock. The rock is distinctly magnetic, and shows weak pervasive reaction to cold dilute HCl, plus pervasive pale yellow stain for K-feldspar in the etched offcut (mainly in the groundmass, concentrated in poorly defined clasts (?); white etch reveals plagioclase phenocrysts, groundmass). Modal mineralogy in polished thin section is approximately:

Plagioclase (phenocrysts, groundmass, sericite-carbonate altered albite?)	40%
K-feldspar (groundmass mainly certain clasts, primary?)	25%
Quartz (phenocrysts, groundmass?)	20%
Sericite, white mica (after plagioclase, biotite?)	10%
Carbonate (after plagioclase, groundmass; mainly calcite)	5%
Chlorite (after biotite, with white mica)	2-3%
Magnetite (largely altered to hematite)	2-3%
Rutile/leucoxene (after ilmenite, traces of which remain)	<1%
Apatite (with relict mafic sites)	<1%

This sample consists of about 30-35% saussuritized plagioclase, 15% quartz, 10% relict (sericite-chlorite ±rutile altered) mafic and 2% magnetite phenocrysts, plus smaller seriate-textured crystals set in fine-grained groundmass of plagioclase-Kspar-sericite-carbonate-quartz-opaques. Poorly-defined clasts with irregular ragged outlines to ~2 cm are richer in Kspar matrix, and indicate a crystal-lapilli tuff origin.

Relict plagioclase phenocrysts have mainly euhedral tabular outlines <2 mm (but grading in seriate fashion to smaller crystals <0.25 mm in the groundmass), mostly randomly oriented. They are typically 5-25% replaced by sericite (randomly oriented sub/euhedral flakes mostly <25 μm) and carbonate (subhedra <0.2 mm, likely calcite). The plagioclase crystals show vague twinning with extinction Y^010 up to 16º, suggestive of albite composition (likely secondary in view of the sericite-carbonate alteration). It is not possible to compare refractive indices with those of quartz.

Quartz phenocrysts display rounded subhedral to euhedral outlines mostly <2 mm, with local major resorption features and mostly very narrow (<20 μm) overgrowth rims (more commonly replaced by sericite at rims, or along microfractures). The crystals are essentially unstrained.

Relict mafic (mainly biotite, possible hornblende?) phenocrysts occur as randomly oriented, mostly euhedral crystals up to 1.2 mm long, variably replaced by white mica (muscovite) forming subhedral flakes <0.5 mm, lesser chlorite (subhedral flakes <0.1 mm with yellow-green colour/ weak pleochroism, length-slow moderate birefringence suggestive of F:M ~0.6?) and rare carbonate (subhedra <0.15 mm, likely calcite?) plus accessory rutile (aggregates to 0.2 mm of euhedra <65 μm) and traces of apatite as euhedral stubby prisms to 0.1 mm long, associated with accessory Fe-Ti oxides (microphenocrysts as described below). Hornblende relics may show more tabular outlines and be more altered to carbonate.

The groundmass consists of closely packed, small, seriate crystals <0.25 mm of all the above (plagioclase partly altered to sericite; quartz; biotite altered as above) plus microphenocrysts of relict magnetite (euhedral outlines <0.35 mm, mostly replaced by hematite as minute sub/euhedra <25 μm, rarely with tabular relict ilmenite <0.2 mm replaced by rutile as described above), set in aphanitic matrix apparently composed of Kspar (feathery microlites <15 μm) or in places relict plagioclase (both altered to sericite as randomly oriented flakes <10 μm and carbonate as ragged, interlocking sub/anhedra <0.1 mm), with relatively minor quartz (mostly <30 μm). Crude alignment of carbonate along fractures suggests cryptic <0.2 mm veinlets.

In summary, this is weakly propylitic/phyllic (albite-sericite-carbonate-chlorite ± rutile, hematite) altered quartz-feldspar-biotite (?) phyric, fragmental felsic volcanic (rhyodacite crystal-lapilli tuff?).

Trench: WEAKLY PROPYLITIC/PHYLLIC GRADING TO ARGILLIC (ALBITE-CLAY?-SERICITE-CARBONATE-CHLORITE ± RUTILE, ALUNITE?) ALTERED QUARTZ-FELDSPAR-BIOTITE (?) PHYRIC, FRAGMENTAL FELSIC VOLCANIC (RHYODACITE CRYSTAL-LAPILLI TUFF?)

Hand specimen shows pale greenish-buff coloured, fine-grained felsic crystal-lapilli tuff (clearly defined small fragments up to ~1 cm tend to be slightly darker, more sericite altered and contain more cubic limonite casts after pyrite; quartz phenocrysts may be up to 4 mm across), cut by thin pale orange-brown fracture coatings that react strongly to cold dilute HCl. The rock is not magnetic, shows only trace reaction to cold dilute HCl in the body of the rock, and variable yellow stain for K-feldspar/white etch for plagioclase in the etched offcut, depending on position in clasts versus matrix. Modal mineralogy in polished thin section is approximately:

Plagioclase (phenocrysts, groundmass, sericite-carbonate altered albite?)	45%
Quartz (phenocrysts, groundmass?)	20%
K-feldspar (groundmass mainly certain clasts, primary?)	15%
Clay?/sericite, white mica (after plagioclase, biotite?)	15%
Limonite (hematite, goethite; after pyrite?)	2%
Carbonate (after plagioclase, fracture fills; mainly calcite)	1%
Chlorite (with white mica, after biotite?)	<1%
Alunite (?), patches in matrix	<1%
Rutile/leucoxene (after mafic sites)	<1%

This sample consists of about 30-35% saussuritized plagioclase, 15% quartz, 10% relict (sericite-chlorite ±rutile altered) mafic phenocrysts and 2% limonite casts after pyrite, plus smaller seriate-textured crystals set in fine-grained groundmass of plagioclase-Kspar-quartz altered to clay?/sericite ±alunite (?). Poorly-defined clasts with irregular ragged outlines <1 cm are finer-grained and/or richer in clay? or sericite altered, variably Kspar-rich matrix, indicative of a crystal-lapilli tuff origin.

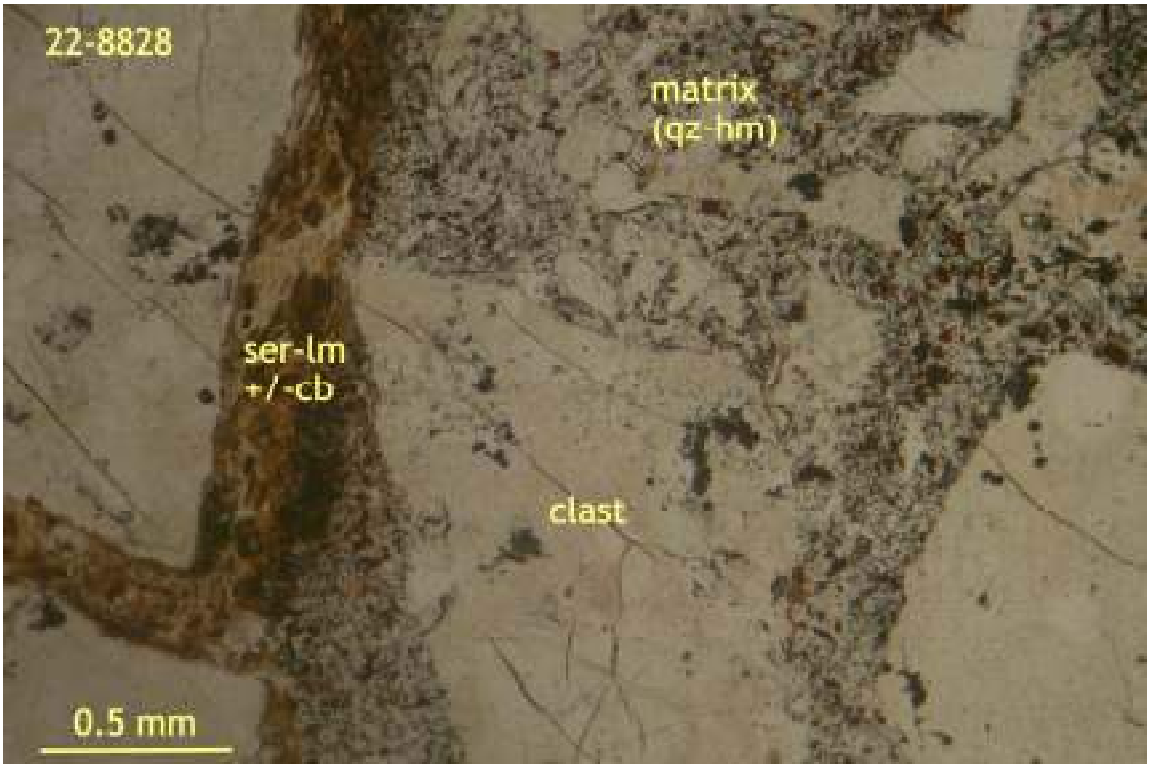
Relict plagioclase phenocrysts have mainly euhedral tabular outlines <2 mm (partly glomeratic, but grading in seriate fashion to smaller crystals <0.25 mm in the groundmass), mostly with random orientations. They are typically 5-25% replaced by sericite (randomly oriented sub/euhedral flakes mostly <30 µm) and carbonate (subhedra <0.25 mm, likely calcite). The plagioclase crystals show vague twinning with extinction Y^010 up to 16º, suggestive of albite composition (likely secondary in view of the sericite-carbonate alteration). It is not possible to compare refractive indices with those of quartz.

Quartz phenocrysts display rounded sub/euhedral outlines mostly <2 but up to 3 mm, with local resorption features and mostly very narrow (<20 µm) overgrowth rims (or in places replaced by minor sericite and quartz at the rim). The crystals are essentially unstrained.

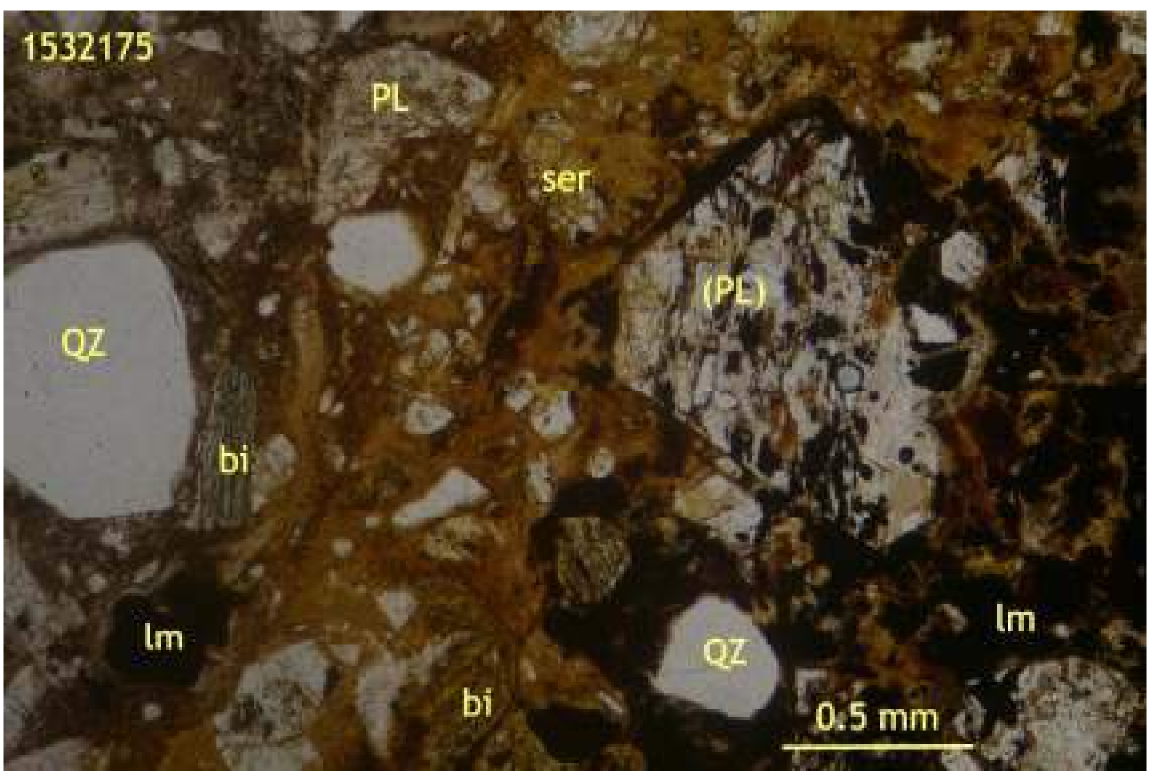
Relict mafic (mainly biotite?) phenocrysts occur as randomly oriented, mostly euhedral crystals up to 1 mm long, variably replaced by white mica (muscovite) forming subhedral flakes <0.5 mm and rare chlorite (subhedral flakes <0.1 mm with almost no colour/pleochroism, length-fast anomalous grey birefringence suggestive of F:M ~0.4?) plus accessory rutile (aggregates to 0.2 mm of euhedra <95 µm), variably associated with cubic limonite casts up to 2.5 mm across after pyrite.

The groundmass varies from clast to matrix, generally composed of closely packed, small, seriate crystals <0.25 mm of all the above (plagioclase partly altered to sericite; quartz; biotite altered as above) plus microphenocrysts of Fe-Ti oxides (euhedral outlines <0.15 mm, pseudomorphed by hematite as minute sub/euhedra <25 µm and rutile as described above), set in variable matrix apparently composed mainly brownish clay? (spherulitic/radiating textured) or paler-coloured sericite (subhedral flakes to 0.1 mm) rarely mixed with alunite (certain clasts only, matted randomly oriented sub/euhedra <20 µm distinguished by length-fast character), probably replacing both Kspar (feathery microlites <15 µm) or in places relict plagioclase, with variable quartz (subhedra mostly <25 µm).

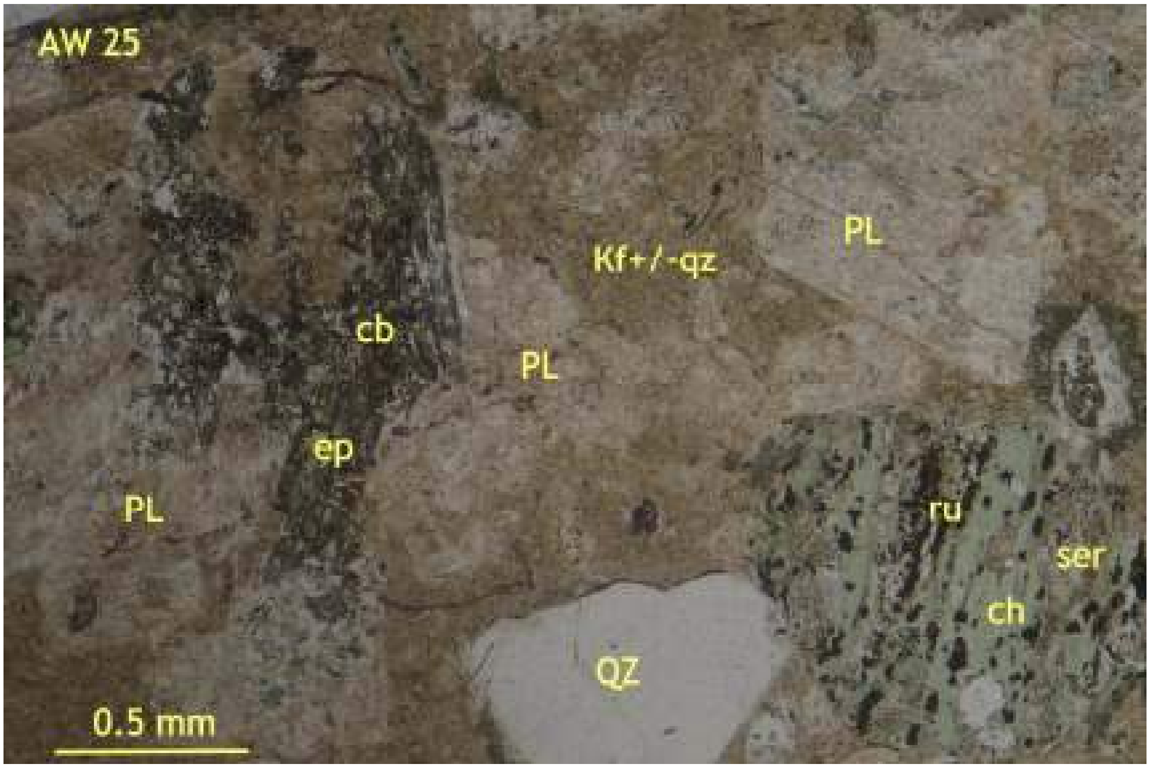
In summary, this is weakly propylitic/phyllic grading to argillic (albite-clay?-sericite-carbonate-chlorite ± rutile, alunite?) altered quartz-feldspar-biotite (?) phyric, fragmental felsic volcanic (rhyodacite crystal-lapilli tuff?).



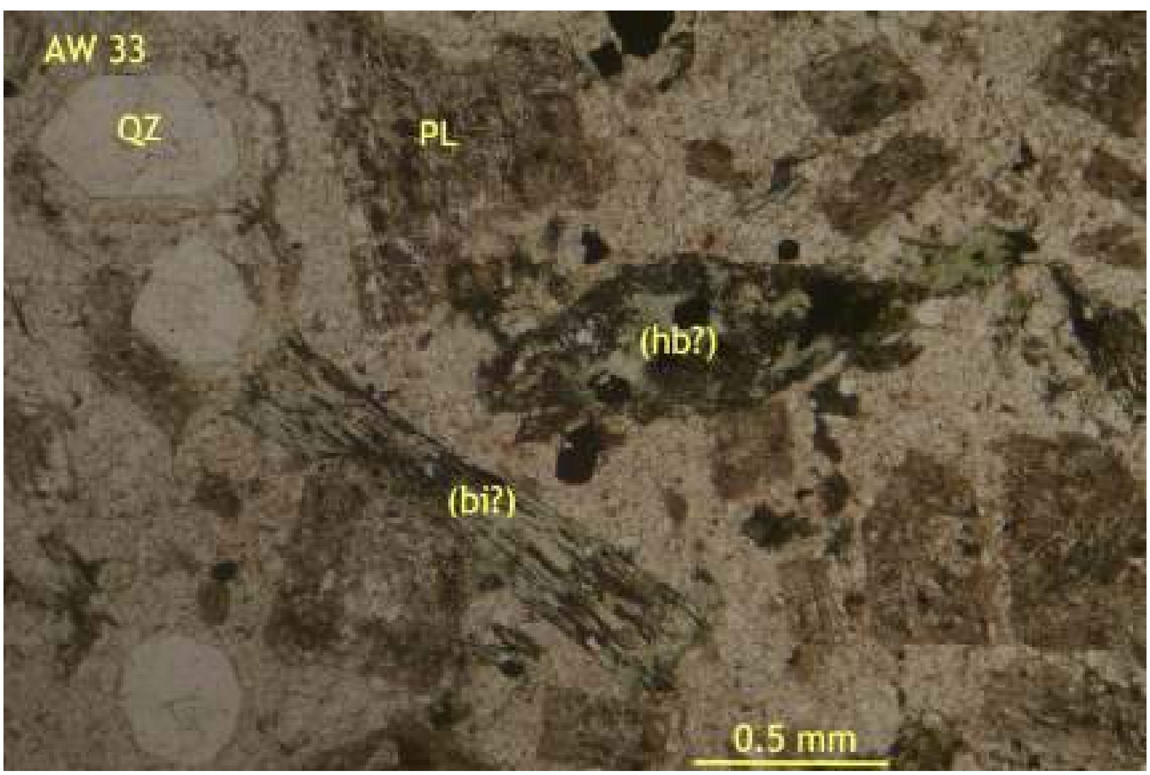
22-8828: brecciated, intensely silicified rock composed of angular clasts of quartz phyric felsic volcanic set in a matrix of fine-grained secondary quartz-hematite, later partly re-opened by fracture network of brownish (limonite-stained) sericite, local Fe-calcite. Transmitted plane light, field of view ~3 mm wide.



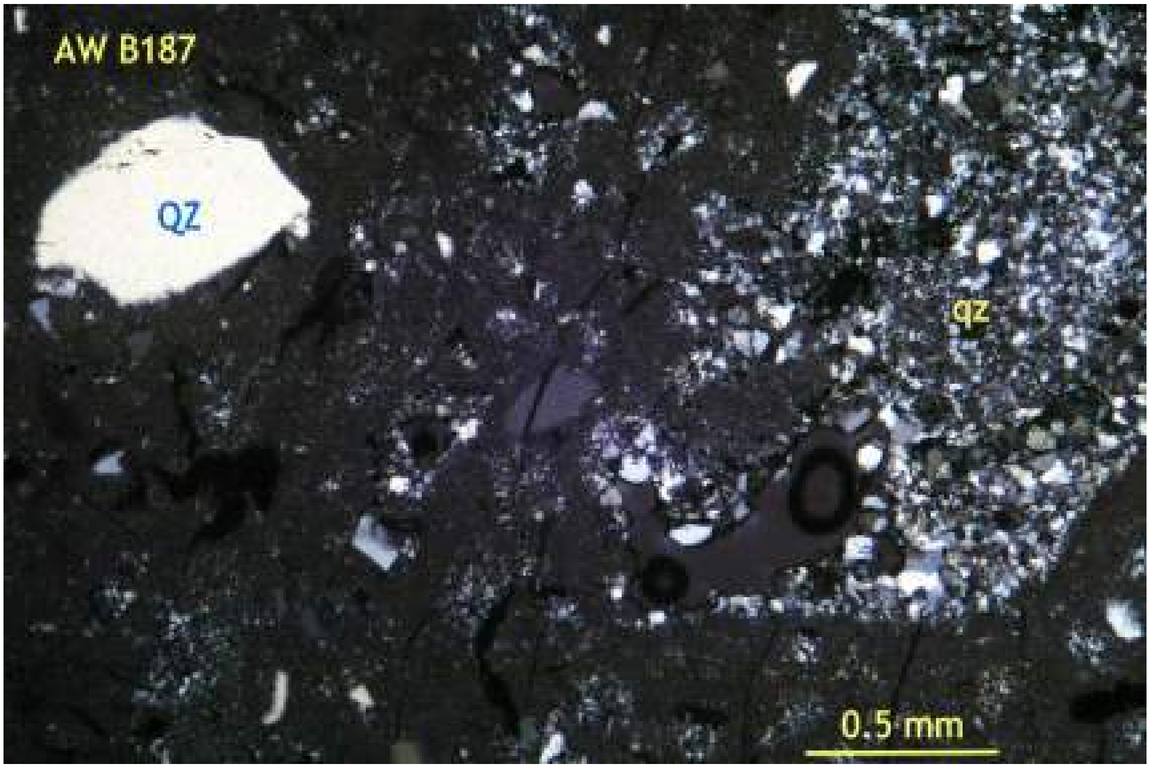
1532175: phenocrysts of relict plagioclase (PL), quartz (QZ) and smaller biotite (bi) partly altered to sericite, white mica particularly near heavy concentrations of opaque to orange-brown limonite irregularly distributed around fracture network located out of view to right of photo. Transmitted plane light, field of view ~3 mm wide.



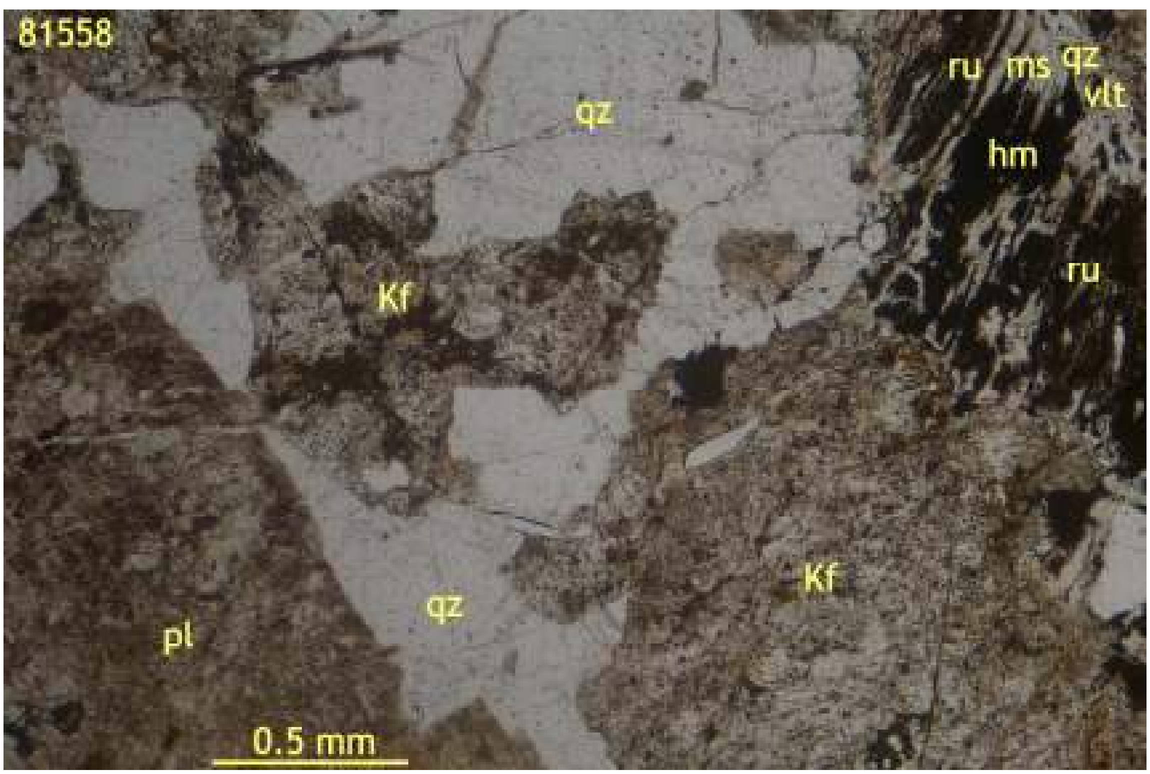
AW 25: possibly fragmental rhyodacite composed of phenocrysts of relict plagioclase (PL), quartz (QZ) and biotite (?) altered to chlorite-white mica ±rutile (ch-ser-ru), or hornblende (?) altered to epidote-carbonate (ep-cb), in groundmass of aphanitic Kspar (±quartz?). Transmitted plane light, field of view ~3 mm wide.



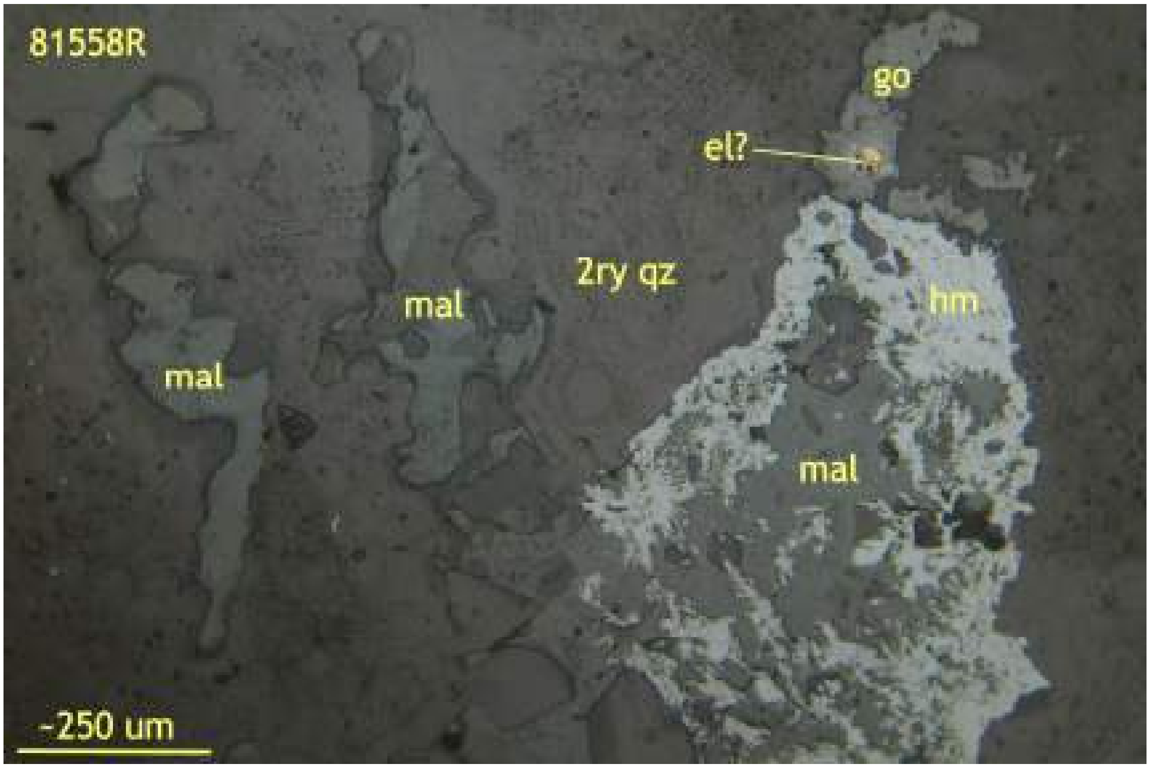
AW 33: possibly hypabyssal rhyodacite composed of phenocrysts of saussuritized plagioclase (PL), quartz (QZ) and biotite (bi?) altered to chlorite-epidote ±rutile, or hornblende (hb?) altered to chlorite-epidote-magnetite-rutile, in groundmass of Kspar-quartz with microphenocrysts of magnetite. Transmitted plane light, field of view ~3 mm wide.



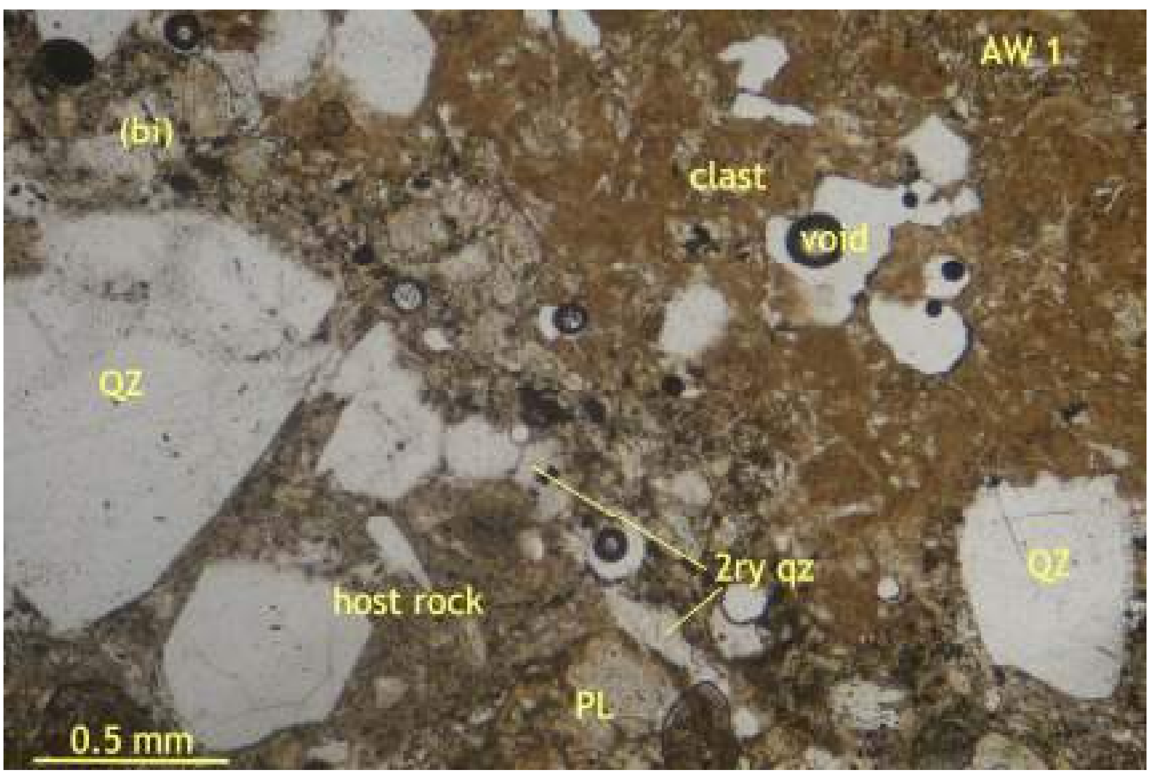
AWB 187: intensely silicified rock composed of remnant quartz (QZ) phenocrysts, possible relict feldspar phenocryst sites now completely replaced by interlocking secondary quartz (qz) in a groundmass of secondary quartz and possible microcrystalline relict plagioclase (?), local opaque (hematite/rutile). Transmitted light, crossed polars, ~3 mm wide.



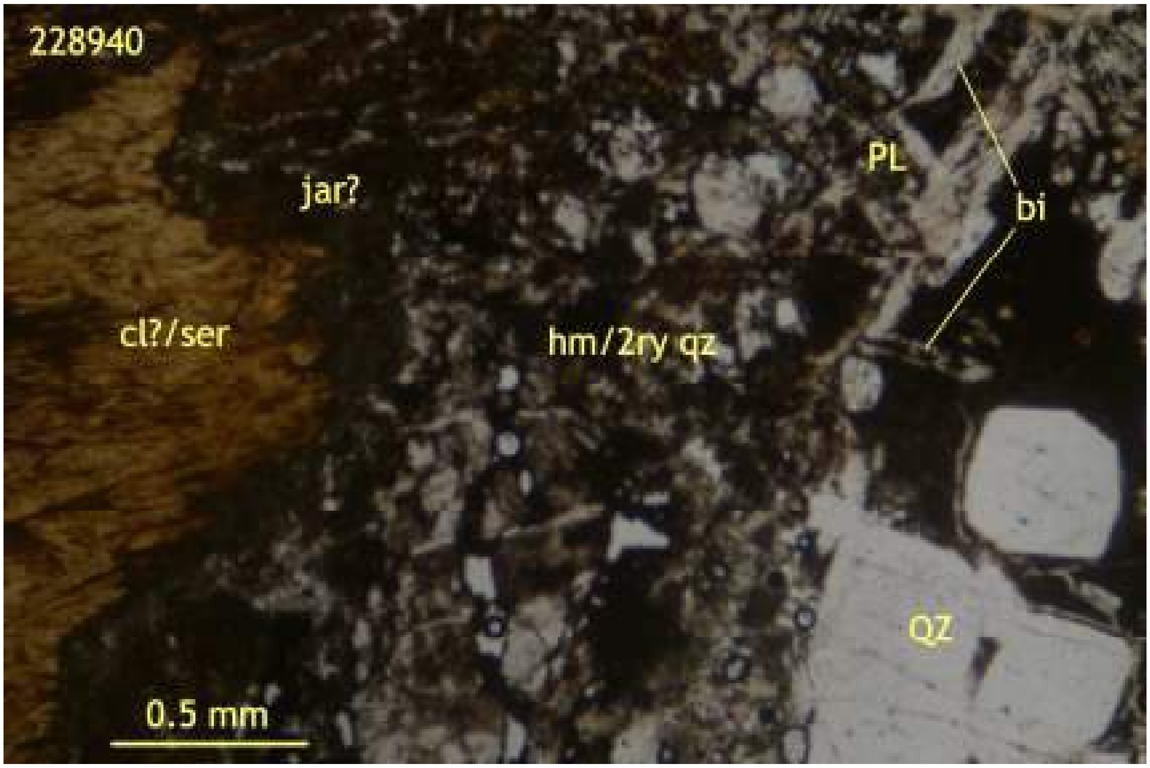
81558: relict granitic rock composed of clear quartz (qz), partly sericitized plagioclase (pl), cloudy Kspar (Kf) and relict biotite (interleaved white mica, ms, and rutile, ru, or hematite, hm, the latter partly after magnetite), cut by thin veinlet of secondary quartz (upper right corner). Transmitted plane light, field of view ~3 mm wide.



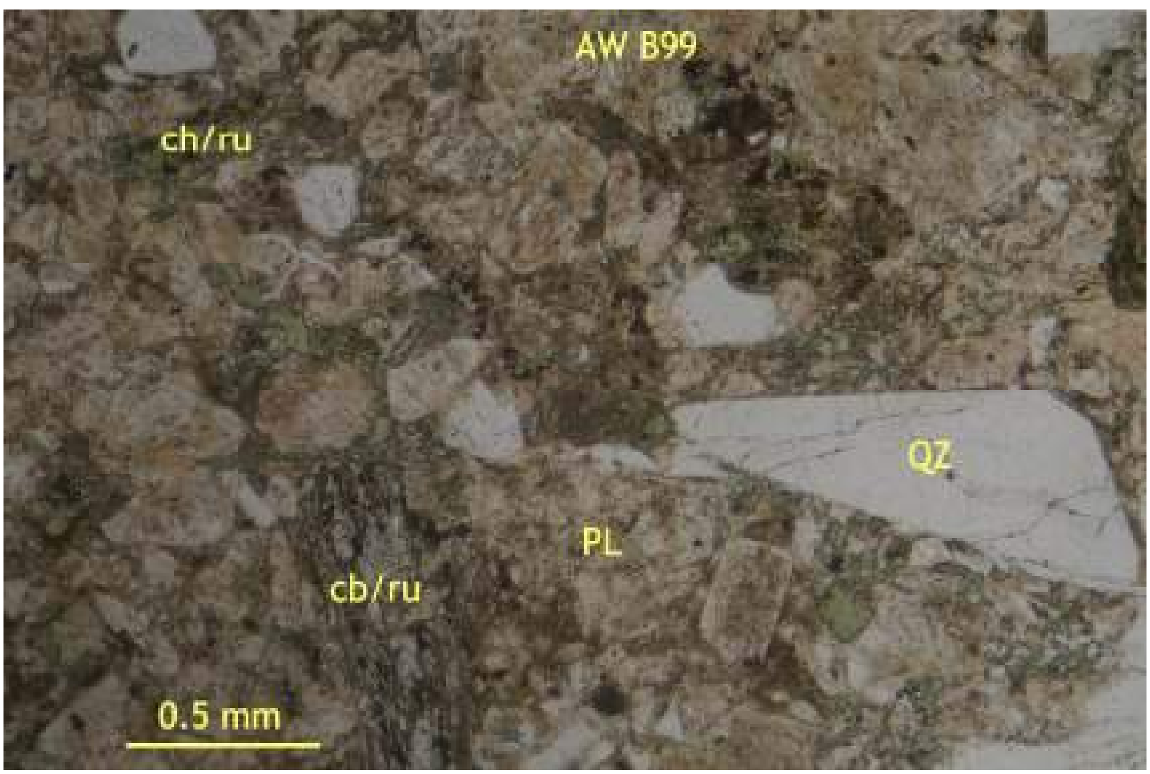
81558R: detailed view of malachite (mal, both coarse-grained and surrounding finer-grained) associated with limonite (hematite, hm and goethite, go) with trace possible electrum (el?) in matrix of secondary quartz forming vein/breccia matrix cutting altered granite. Reflected light, uncrossed polars, field of view ~1.5 mm wide.



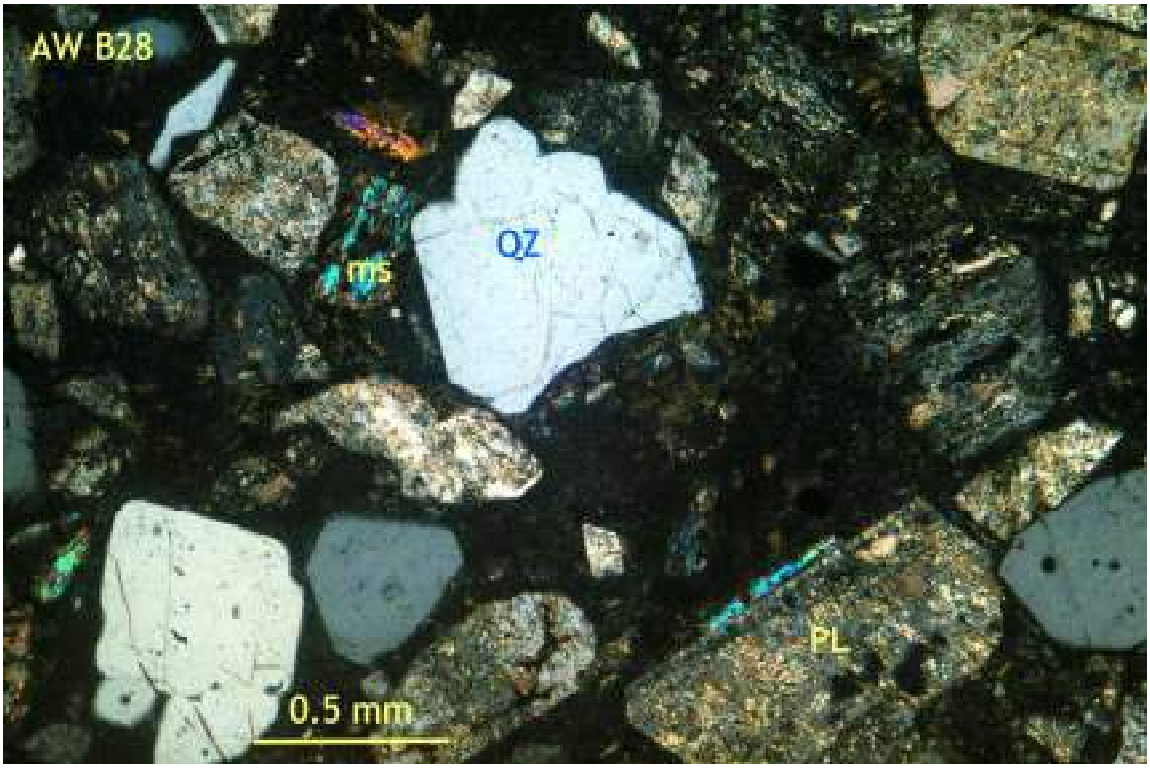
AW 1: boundary between clast (on right; smaller quartz phenocrysts, voids/vugs, feldspars completely altered to pale brownish clay ?) and host (on left; larger quartz phenocrysts, closely packed relict plagioclase, minor relict biotite, opaque relict Fe-Ti oxide sites, in sericite-local minor quartz altered matrix). Transmitted plane light, field of view ~3 mm wide.



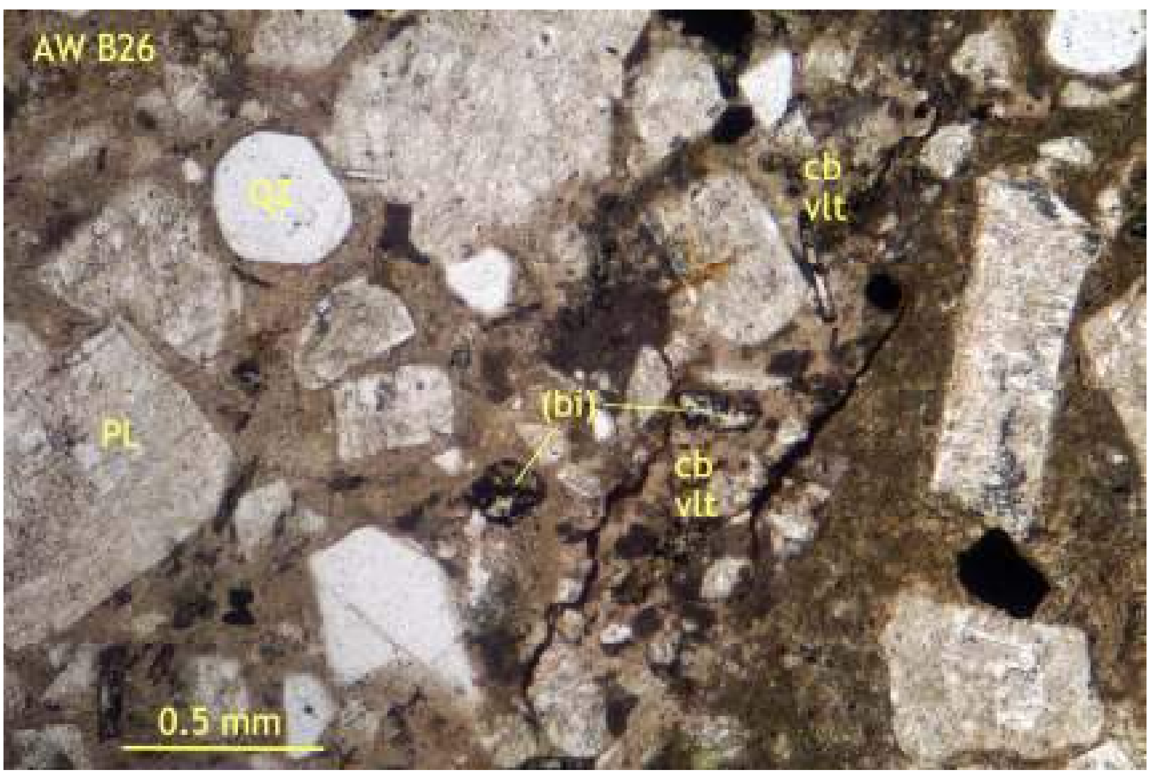
228940: quartz-plagioclase-minor relict biotite phyric felsic volcanic (groundmass strongly altered to hematite-sericite) separated by zone of hematite-secondary quartz from vein of clay?/sericite (cl?/ser) with selvage of possible jarosite (jar?). Transmitted plane light, field of view ~3 mm wide.



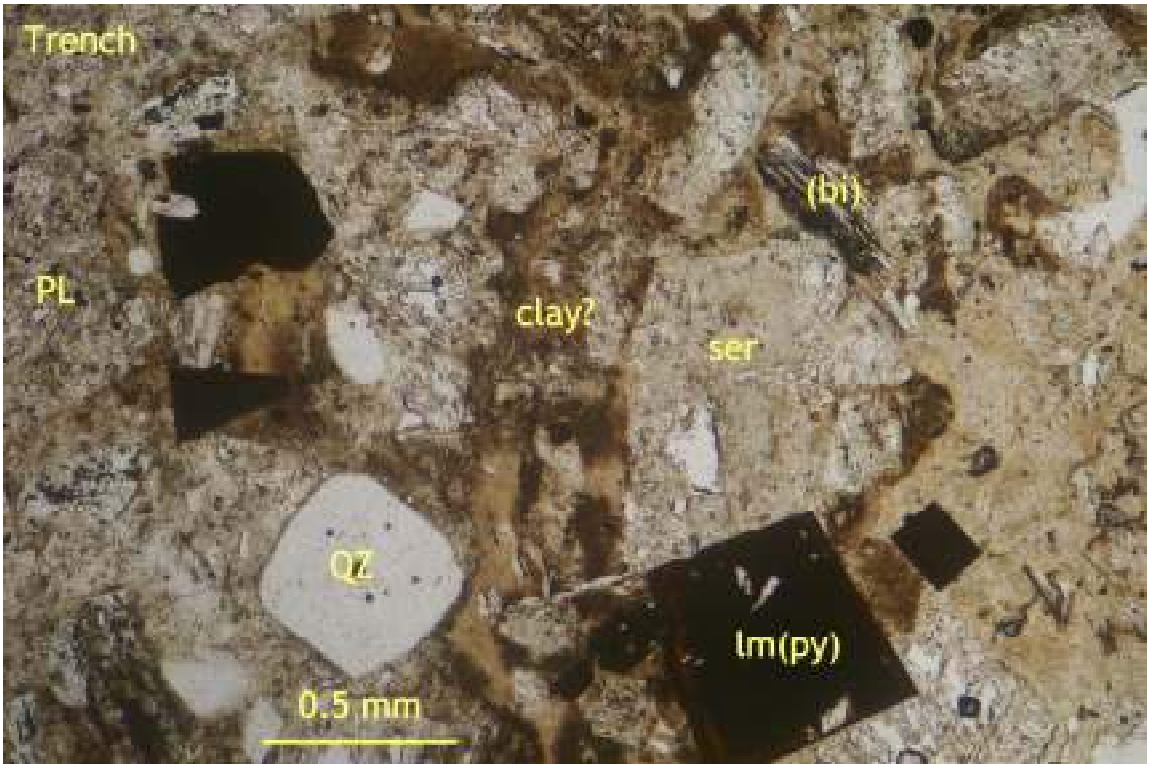
AW B99: rhyodacite tuff (?) composed of closely packed, randomly oriented, broken shard-like crystals of feldspar (mainly plagioclase), quartz, chlorite (ch) and rutile (ru, opaque) after biotite (?) or carbonate (cb)-rutile after hornblende (?), in groundmass of Kspar-minor quartz partly altered to sericite, chlorite. Transmitted plane light, field of view ~3 mm.



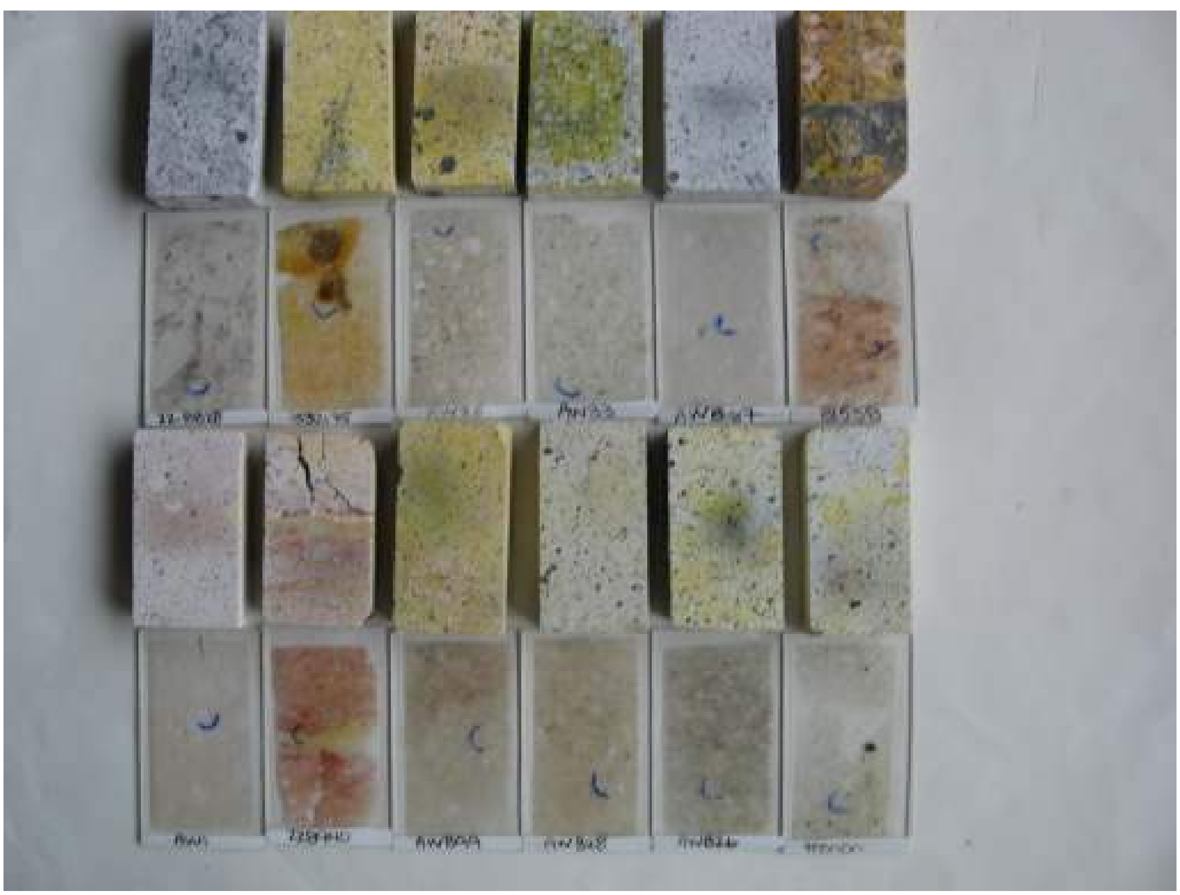
AW B28: rhyodacitic crystal-lapilli tuff composed of phenocryst/shards of plagioclase (PL, altered to sericite-carbonate), quartz (QZ) and probable biotite (altered to white mica, ms, and accessory rutile) in aphanitic groundmass of sericite-carbonate altered plagioclase, lesser Kspar and rare quartz. Transmitted light, crossed polars, field of view ~3 mm wide.



AW B26: view across boundary between finer-grained, more Kspar-rich clast (left) and host rock, both phyric in quartz, plagioclase, minor relict biotite and magnetite (opaque); boundary is marked by short discontinuous carbonate (cb) veinlets. Transmitted plane light, field of view ~3 mm wide.



Trench: rhyodacite crystal-lapilli tuff (usual phenocrysts of plagioclase partly altered to sericite-carbonate, quartz, biotite altered to white mica-rutile; note variation in groundmass from brownish, spherulitic-textured clay? to clearer sericite, ser) and cubic limonite casts after former pyrite. Transmitted plane light, field of view ~3 mm wide.



Overview of thin sections (blue semi-circle marks photomicrograph location) and offcuts.

Technical Report on the Sarita Este Gold Project

Salta Province, Northwestern Argentina

Latitude 24° 34.5' S, Longitude 67° 47' W

Prepared for:

Cascadero Copper Corporation

by:

Lithos Geological Ltd.

Andrew L. Wilkins, B.Sc., P.Geo

March 31st, 2018

Statement of Qualifications

I, Andrew L. Wilkins, P.Geo, B.Sc, do hereby certify that I am the “Qualified Person and author” for the report titled “Technical Report on the Sarita Este Gold Project, Salta Province, Northwestern Argentina, March 31, 2018”. I further certify the following:

1. I am a principal of Lithos Geological Inc. with a business address of 8328 Ski Jump Rise, Whistler, British Columbia, Canada.
2. I am a graduate of the University of British Columbia, Vancouver, B.C. and hold an Bachelor of Science Degree majoring in Geology that I obtained in 1981.
3. I take responsibility for all sections of the Technical Report titled “Technical Report on the Sarita Este Gold Project, Salta Province, Northwestern Argentina” with effective date March 31st, 2018.
4. I have practiced my profession as an exploration geologist for more than 37 years having worked and managed exploration projects in many geological environments including porphyry copper gold and epithermal gold deposits.
5. I have worked as an exploration geologist in British Columbia, the Yukon, Quebec and Nunavik in Canada, as well as Alaska, California, Nevada and Arizona in the USA, Northern Mexico and Northwestern Argentina.
6. I am registered as a Professional Geoscientist with the Association of Professional Engineers and Geoscientists of British Columbia (# 121825).
7. I have read the definition of “Qualified Person” set out in National Instrument 43-101 (“NI 43-101”) and hereby certify that by reason of my education, affiliation with professional associations and past and recent relevant work experience, I fulfill the requirements to be a “Qualified Person” as defined in the National Instrument 43-101.
8. I supervised and worked on the Sarita Este Property from October 2nd to November 20th, 2017.
9. I have read National Instrument 43-101 and Form 43-101F1, and the Technical Report has been prepared in compliance with that Instrument and Form.
10. I am independent of Cascadero Copper Corporation.
11. I am not aware of any material fact or material change with respect to the subject matter of the Technical Report that is not reflected in the Technical Report, the omission to disclose which makes the Technical Report misleading and to the best of my knowledge, information and belief, the Technical Report contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated this 31st day of March, 2018

Andrew L. Wilkins, B.Sc., P. Geo.

Consent of Qualified Person

Pursuant to Section 8.3 of National Instrument 43-101

March 31, 2018

TO:

Cascadero Copper Corporation

British Columbia Securities Commission

Alberta Securities Commission

Ontario Securities Commission

Toronto Stock Exchange

Dear Sirs/Mesdames:

Re: Cascadero Copper Corporation. (the “Company”)

Public Filing of Technical Report

I, Andrew L Wilkins, MSc, P.Geo., consent to the public filing of the technical report titled “Technical Report on the Sarita Este Gold Project, Salta Province, Northwestern Argentina” dated March 31, 2018 (the “Technical Report”).

I consent to the publication of extracts from, or a summary of, the Technical Report.

I confirm that I have read the filing and that it fairly and accurately represents the information in the Technical Report that supports the disclosure.

Yours truly,

PROFESSIONAL
A. L. W. WILKINS
PROVINCE OF BRITISH COLUMBIA
GEOSCIENTIST

Andrew L. Wilkins, B.Sc., P. Geo.
Dated this 31st day of March, 2018

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1 Summary

The Sarita Este Property is a gold-silver prospect located on the east side of the Sierra de Taca Taca range, in the western Puna of Salta province, Argentina. It is located approximately 240 kilometres due west of the city of Salta and 37 kilometres west of the village of Tolar Grande. Access to the property is by paved roads from the city of Salta to the town of San Antonio de Cobres, followed by all-weather gravel roads through Tolar Grande to the property. There is minimal infrastructure available in the vicinity of the Property. The Sarita Este Property consists of one concession, 830 hectares in size. The Property is controlled by Cascadero Copper Corporation (“Cascadero”).

The Property lies within a known mining region with several proven copper and gold deposits nearby. The Taca Taca Bajo copper-gold-molybdenum porphyry deposit is located 3.5 kilometres to the northeast and has a published indicated resource of 2.165 billion tonnes grading 0.44% copper, 0.013% molybdenum, 0.08 grams per tonne gold (Sim et al., 2013). The Taca Taca Bajo mineralization is documented as Oligocene in age.

There has been a significant amount of historical prospecting on the Sarita Este Property, commencing with its discovery by Mansfield Minerals in 1996. Three small trenches were dug but not sampled in 2012. Historically, no systematic sampling had occurred on the Property; however, grab samples from prospecting have yielded results of up to 162.6 grams per tonne gold. Limited historic mapping outlined encouraging sericitic and phyllic alteration that is coincident with the known mineralization.

Three styles of mineralization have been observed in surface exposures at the Sarita Este Property. The first style consists of oxidized gold bearing quartz-limonite after pyrite micro veins that also contain anomalous values in lead, zinc and copper. The veins occur within recessive grey quartz-sericite-clay altered crystal lapilli tuff. Copper ± silver ± zinc replacement or skarn type mineralization associated with chlorite, epidote and diopside alteration within calcareous conglomerate rocks makes up the second style of mineralization. The third style of mineralization comprises siliceous brecciated veins that form prominent ribs and contain varying amounts of hematite with sporadic gold and silver mineralization. All three styles of mineralization are believed to be related to hydrothermal systems created by Andean magmatic events that occurred during the Oligocene epoch.

The 2017 program consisted of grid soil sampling over the Sarita Este Gold Zone. The program also included geological mapping of alteration, structure and rock sampling to confirm historic grab sample results. The three historic trenches that were not previously sampled were chip sampled and mapped.

The soil sampling program outlined a gold-in-soil anomaly that is coincident with mineralized historic rock samples and recessive grey quartz-sericite-clay (phyllic) altered crystal lapilli tuff. The anomaly is also consistent with the structural trends mapped on the Property. The anomaly is approximately 1,050 metres by 850 metres in size on surface.

At this time, an exploration program consisting of 2,000 metres of trenching and sampling is recommended. Contingent on results of the trenching program, a follow-up 1,500 metres of drilling is recommended to further test the gold anomaly.

2 Introduction and Terms of Reference

Cascadero Copper Corporation is involved in the exploration of several mining concessions in northwestern Argentina, including the Sarita Este Property. Mr. Andrew Wilkins, B.Sc., P.Geo and Ms. Lucia Maria Theny, M.Sc., G.I.T, of Lithos Geological Inc. were commissioned by Cascadero Copper Corporation of Vancouver, B.C. to manage the soil geochemistry program and to examine and evaluate the geology and mineralization of the Sarita Este Gold Zone located primarily on the Sarita Este concession. The authors were asked to recommend detailed work programs for the next phases of exploration in order to properly test the economic potential of the showings. In addition, the company requested that the authors complete a Technical Report summarizing the findings of the work to date. This report describes the results of the current and historic programs in accordance with the guidelines specified in National Instrument 43-101. It is based on the historical information available and the examination and evaluation of the Sarita Este Gold Zone by the authors. The authors were on the Property from October 2nd to November 30th, 2017 and were assisted in the field by Ms. Annie Borch, a recent B.Sc. graduate in Earth Sciences and Mr. Ron Bilquist, a long time prospector with over 20 years' experience working in Northwestern Argentina and the discoverer of many of the mineralized showings found on the Sarita Este and surrounding concessions. Sources of information include a review of the following documents:

- Cascadero Copper Corporation Company reports and other proprietary Company data, including results of historic sampling, prospecting and mapping.
- Available historic reports from other companies working in the area.
- "Taca Taca Property, porphyry Copper-Gold-Molybdenum Project, Argentina, NI 43-101 Technical Report" for the neighboring Taca Taca Bajo deposit (Sim et al., 2013).
- Review of geological maps and reports completed by various Argentinian governmental agencies.
- Published scientific papers on the geology and mineral deposits of the region and on mineral deposit types.

3 Reliance on Other Experts

The author is relying upon information supplied by the issuer regarding the legal status of the property.

4 Property Description and Location

4.1 Location

The Sarita Este Property is located in Salta Province in the high altitude Puna region of northwestern Argentina (Figure 4.1). The Property is on the east side of the Sierra Taca Taca range and the eastern boundary adjoins the Taca Taca Bajo Property. Elevations range between 3,450 and 3,900 metres above sea level. The centre of the Property is approximately situated at 24° 35' south latitude and 67° 46' west longitude. It is approximately 240 kilometres due west of the City of Salta, 55 kilometres east of the Argentine-Chilean border and 37 kilometres west of the village of Tolar Grande.

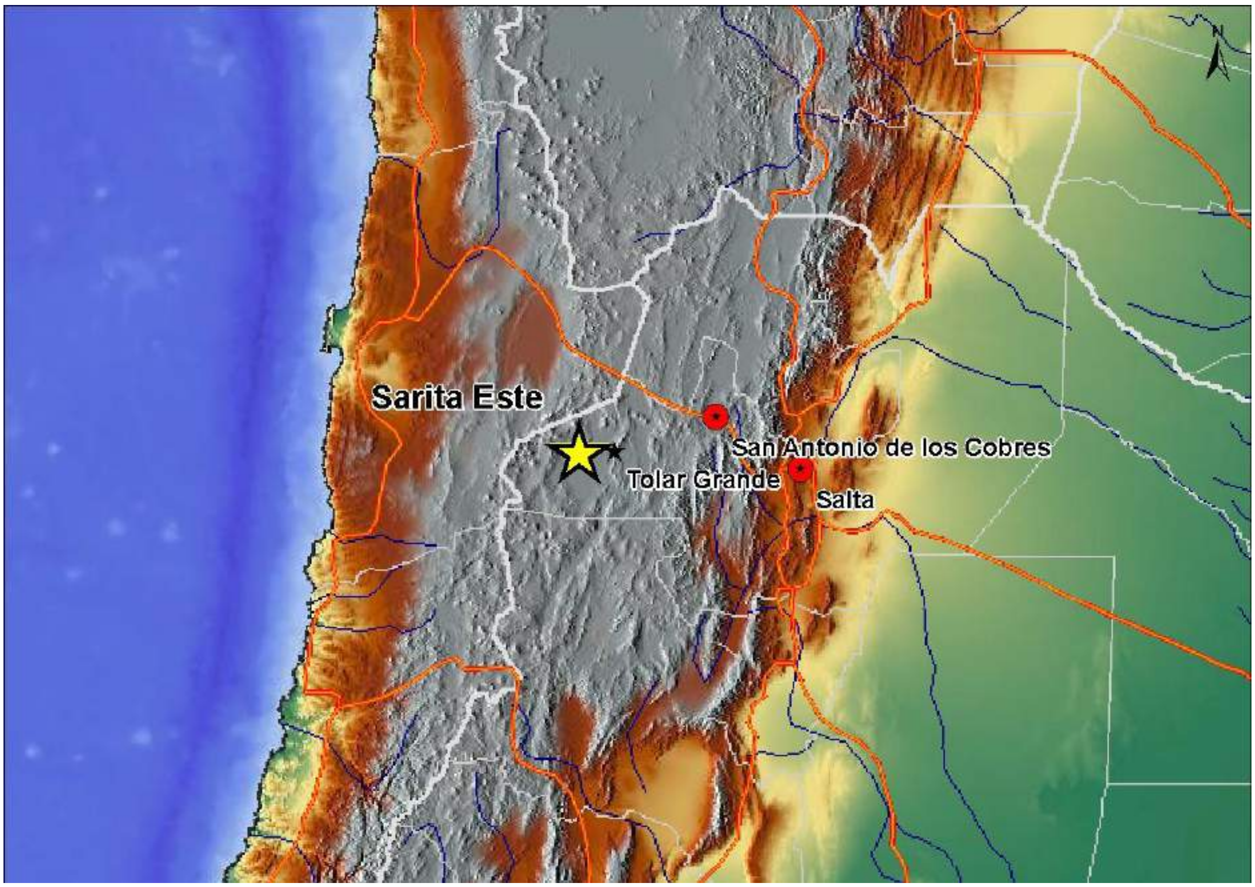


Figure 4.1 - Project Location Map (Yellow star denotes the location of the Property, small black star represents the village of Tolar Grande, thick grey line represents country boundaries, thin grey lines represent province boundaries, red dots represent towns and cities.)

4.2 Concessions

The Sarita Este Gold Zone straddles the Sarita Este and the Desierto I concessions. The majority of the gold zone is located on the Sarita Este concession.

The Sarita Este concession (Figure 4.2) is 100% owned by Cascadero Minerals SA (CMSA). CMSA is 70% owned by Cascadero Minerals Corporation; a private Canadian Company and reporting issuer and 30% by Regberg Ltd., a private company. There is a !%

NSR on the Sarita Este concession to Northwestern Enterprises Ltd. The Desierto I concession is registered to three (3) parties, Golden Minerals, La Pacha Minerals and Cascadero. The concessions have not been subject to a legal survey. The concessions (Table 4.1) are on Argentine federal land within the municipality of Tolar Grande. The author did not request verification of Title to the Concessions. The surface rights are not allocated or granted to any party. A 1.8% tax is payable to the municipality of Tolar Grande on the gross value of any contract work, such as a drill program. The registered companies are responsible for reporting, collecting and paying the tax to the municipality. Argentine Mining Investment Law empowers the provinces to collect a royalty from mineral production. The provinces set the rate and it can be up to 3% of production value.

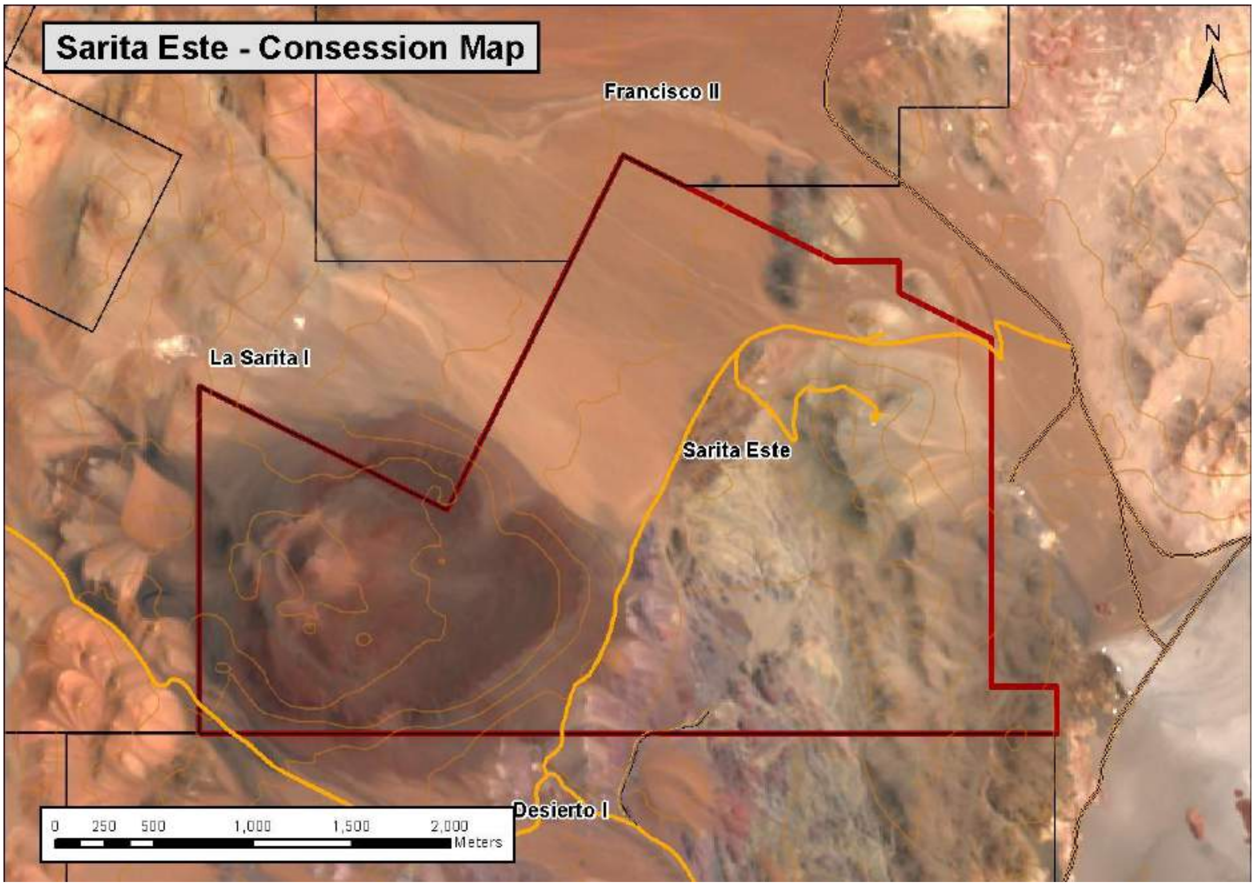


Figure 4.2 - Sarita Este Concession Map (concession boundary for Sarita Este in red, concession boundaries in black, 4 x 4 roads in orange, main road in yellow and black)

Table 4.1 – Sarita Este Concession Table

Concession	Concession Number	Number of Units	Area (hectares)	Ownership
Sarita Este	18060	9	830	CMSA 100%
Desierto I	18021		1500	SGSA 33% / Pacha 33% / Golden 33%

4.3 Environmental Liabilities

The Environmental Protection Mining Code (EPM) of Argentina is federal legislation monitored and enforced by the provinces. Prior to any mining related activity, the concession owner must prepare and submit to the applicable province an Environmental Impact Assessment (EIA) report. The province has a sixty-day period to either accept or reject the EIA. The EIA and the related Declaration of Environmental Impact (DEI) provide for sanctions for non-compliance to the EPM. The regulations include provisions and guidelines for reclamation if a concession is abandoned.

5 Accessibility, Local Resources, Infrastructure, Climate and Physiography

5.1 Accessibility and Resources

Access to the Property from the city of Salta is mostly by paved roads for approximately 100 kilometres followed by all-weather gravel roads for 300 kilometres via National Highway 51 and Provincial Highway 27. Numerous 4 x 4 trails cross the property. Travel time ranges from 8 to 10 hours from the city of Salta. There is no permanent camp at the Property. Accommodation and services for exploration workers are located at the village of Tolar Grande. Tolar Grande has a population of approximately 175. Travel to the Property includes crossing a portion of the Salar de Arizaro. The Salta - Antofagasta railway is located 9 kilometres to the north and the Argentine to Chile high tension power line is 110 kilometers to the east of the property. The power line is currently not electrified. The area is sparsely populated and there is sufficient land for mining operations. Surface water is scarce but subsurface water can be obtained from the surrounding aquifers.

5.2 Climate and Physiography

The Property is located in the Puna de Atacama eco-region. This eco-region is considered one of the driest regions on the planet with average annual rainfalls of less than 200 mm, rainfall occurs dominantly in the summer months. The mean annual maximum and minimum temperatures are +16 and -4 degrees Celsius, however extremes can range from -20 to +30 degrees Celsius. Windy periods are frequent and most prevalent in the afternoons. The area has more than 300 days of sunshine per year.

The Puna is host to large-scale salt lakes known as salars and high-volcanic complexes that are over 6,000 metres in elevation.

The vegetation is composed of mostly shrubs with the dominant species being the steppe shrub. In addition, there are tolas (species of low shrub), tolilla, añagua, suriyanta and queñoa as well as halophytes in saline depressions.

The fauna is represented mainly by camelids such as llama, vicuña and guanacos. In addition, there are Andean puma, a dwarf guinea pig, the common mouse, chinchilla, the cordilleran ostrich (suri or ñandu petiso), partridge, redfish, tero serrano, parinas (flamingos), lizards, snakes and donkeys.

6 History

The first recorded exploration in the area was related to the Taca Taca Bajo copper-gold-molybdenum porphyry deposit located 3.5 kilometres to the northeast of the Sarita Este Gold Zone. Taca Taca Bajo is currently being explored and considered for development by First Quantum Minerals Ltd. Copper mineralization was first discovered on the Taca Taca Bajo property in the mid-1960s. Between 1970 and 2008 the Taca Taca Bajo showing was explored by several companies including Falconbridge Argentina S.A., Gatro Argentina Minera S.A. (GAMSA), Corriente Resources, BHP Minerals, and Río Tinto Inc. Lumina Copper tested the extent of the porphyry mineralization between 2010 and 2012. The Taca Taca Bajo copper-gold-molybdenum porphyry deposit has a published indicated resource of 2.165 billion tonnes grading 0.44% copper, 0.013% molybdenum, and 0.08 grams per tonne gold (Sim et al., 2013).

The Taca Taca Alto copper-gold-molybdenum porphyry is located 5 kilometres to the northwest of the Sarita Este Property. It was discovered around the same time as the Taca Taca Bajo Property. The Taca Taca Alto Property was explored by the Direccion General De Fabricaciones Militares (DGFM) now known as Servicio Geológico Minero Argentino (SEGEMAR - Argentine Government Geological Services) and private companies including Gencor, RTZ and BHP.

Mansfield Minerals was quite active in the area in the 1990's and are believed to be the first company to recognize the gold mineralization in the Sarita Este Gold Zone. Cascadero acquired the property in 2005. Cascadero conducted mostly prospecting and sampling and some geologic mapping on the Sarita Este and surrounding concessions in 2017, 2012, 2007, 2006 and 2005. No mineral resources or reserves have been established and no mineralized production has occurred on the Property.

7 Geologic Setting and Mineralization

7.1 Regional Geology

The Andes, within the vicinity of the Sarita Este Property is characterized by high altitude basin and range topography consisting of an alternating landscape of parallel mountain ranges and valleys (Figures 7.1 and 7.2). Physiographic features from west to east are as follows:

- the Chilean Coastal Range
- the Central Valley
- the Cordillera Occidental along the Chilean Argentinian border
- the high plateau of the Argentinian Puna
- the Cordillera Oriental
- Sierras Subandinas.

These features are the result of two major orogenic cycles, the Paleozoic Hercynic cycle (Vicente, 1975) and the Meso-Cenozoic Andean cycle (Coira et al., 1982). The Hercynic cycle is characterized by alternating sedimentary and/or volcanic events with short deformation phases in between and frequently associated with syn-kinematic plutonism (Coira et al., 1982). The continental magmatic arc was initially termed the Western Puna Eruptive Belt (Palma et al., 1986) and has more recently been assigned as the Famatinian magmatic arc (Niemeyer et al., 2018). The Sarita Este Property lies within the Western Puna Eruptive Belt (Coira et al., 2009), also known as the Early Ordovician - Silurian Famatinian orogenic belt (Rapela et al., 2016). A northwest orientation of the arc between 21° and 26° latitudes in the northern Chile-Argentina Andes was first recognized by Palma et al. (1986) and has been related with a north east dipping subduction zone (Coira et al., 1982). Ordovician plutonic outcrops consisting of coarse grained granite are located along the western border of Salar de Arizaro, where they are known as the Taca Taca Granite (Poma et al., 2004). Several radiometric dates have been determined for the Taca Taca batholith including a Rb/Sr isochron at 469 ± 4 Ma age (Llambıas and Caminos, 1986), U/Pb zircon dating indicating a 476 ± 7 Ma age (Makepeace et al., 2002) and a more recent zircon date indicating a 441 Ma age (Sim et al., 2013).

The younger second orogenic cycle known as the Andean cycle is thought to be more directly controlled by subduction of the Pacific oceanic crust beneath the South American continent. The Andean cycle developed over two periods; a Jurassic to Early Cretaceous period characterized by the development of a well-defined magmatic-arc-back-arc basin pair and a Late Cretaceous to Recent period during which only an eastward migrating magmatic arc was present (Coira et al., 1982).

Late Permian granite and aplite are documented cross cutting the Taca Taca batholith, which is subsequently overlain by Late Permian sediments and volcaniclastics (Sim et al., 2013). Narrow, north-south striking, steeply dipping rhyolitic dykes of Permo-Triassic age outcrop throughout the region.

Oligocene rhyodacitic intrusions and related volcaniclastics and flow domes of the Santa Inés Formation cross cut and overlay the older rocks and are responsible for the porphyry copper mineralization and alteration at the Taca Taca Bajo porphyry deposit as well as the other mineralized occurrences in the area (Sim et al., 2013).

Late Tertiary red-bed sedimentary rocks are widely distributed in the region but are most abundant east of Salar de Arizaro (Carrera et al., 2006). These rocks possibly constitute the basal section of the sedimentary sequence that fills the Salar basin. Zappettini and Blasco (2001) suggest that the encompassing Arizaro basin is mainly filled by non-marine clastic Vizcachera Formation sediments.

Lavas from recent (Pliocene to Pleistocene) volcanoes are exposed to the west and north of the Taca Taca deposit (Almandoz, 2008; Sim et al., 2013). Large evaporite deposits of alternating salts and sand were deposited in regional intermontane basins to form the present-day salars (Poma et al., 2004).

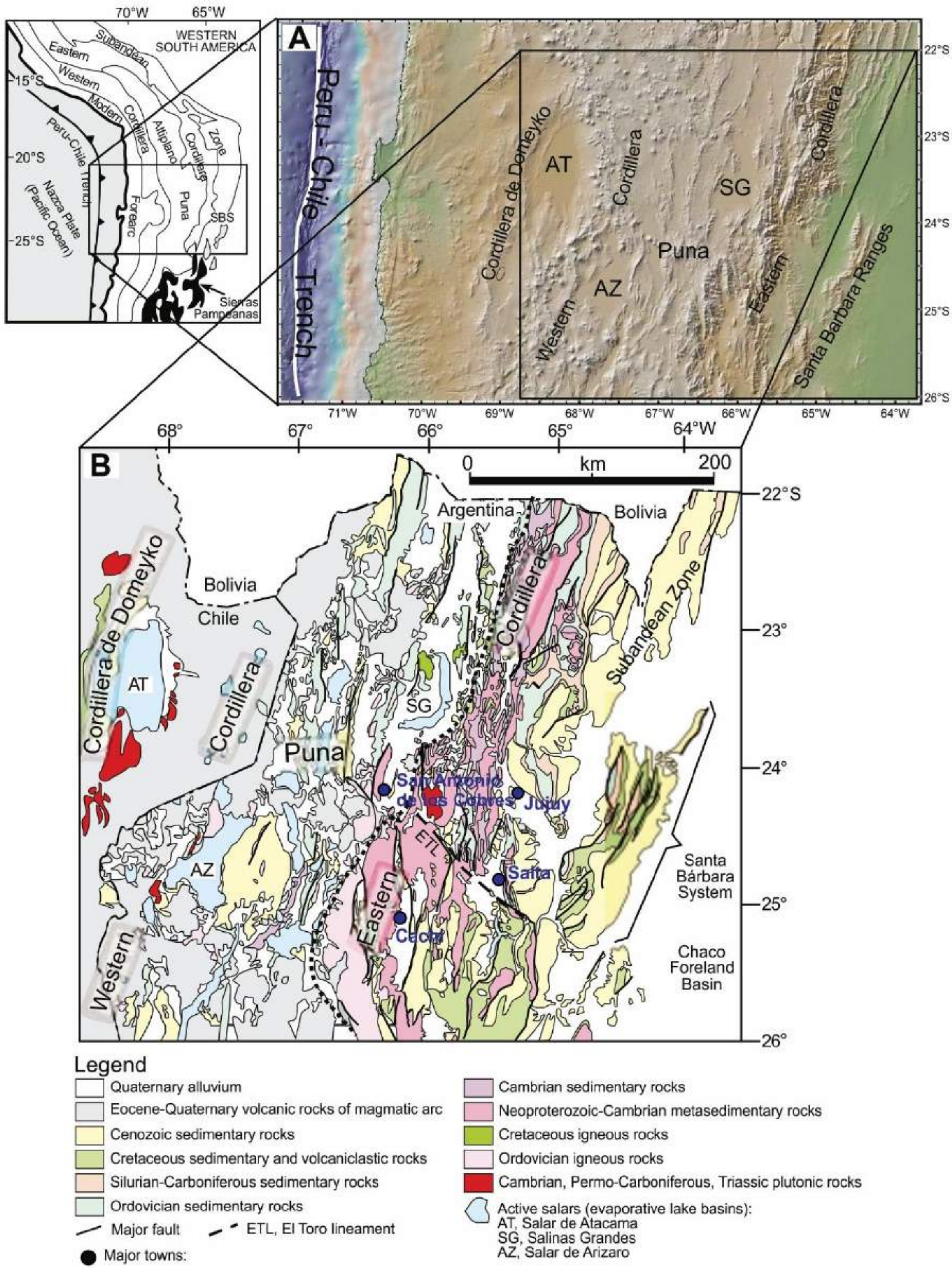


Figure 7.1 - Regional Geology, Puna, Northwest Argentina (from DeCelles et al., 2015; Reutter et al., 1994)

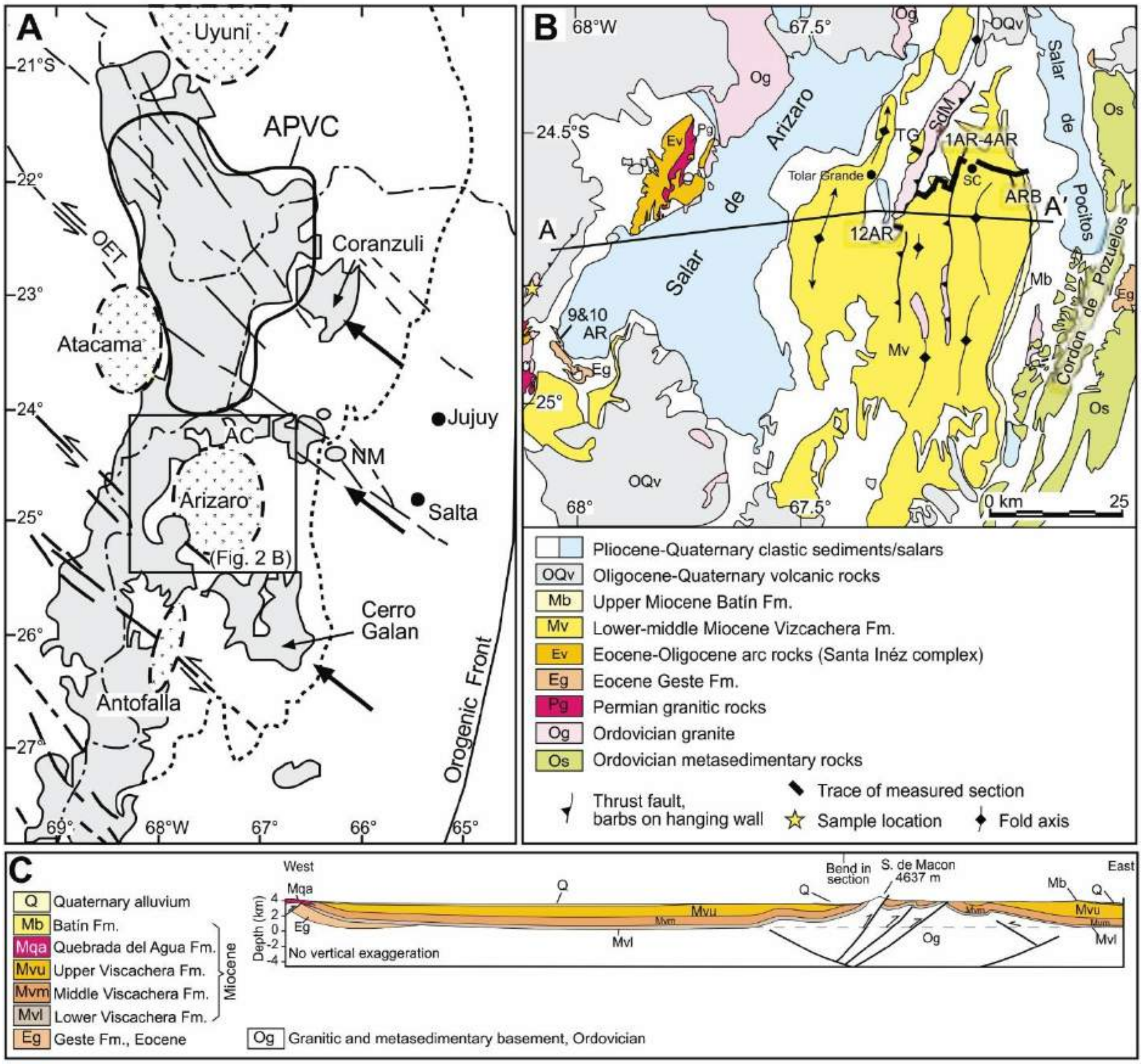


Figure 7.2 - Regional Geology, Salar de Arizaro (from DeCelles et al., 2015)

The Sierra de Taca Taca is interpreted to be an uplifted block of Paleozoic intrusive rocks (Poma et al., 2004). Oligocene volcanics that are exposed to the west of the property dip to the west. This suggests that the Sierra de Taca Taca was uplifted with an eastern convergence along a major, high angle reverse fault located near the western border of the Salar de Arizaro; regional evidence suggests uplift occurred during the Oligocene (Almandoz, 2008; Sim et al., 2013). A 2-kilometre-wide graben is mapped in the west and parallels the salar margin. This graben is thought to postdate the reverse faulting (Richards et. al., 2007). The Sarita Este and Desierto I concessions lie between these two major structures.

7.2 Property Geology

7.2.1 Lithology

The basement lithologies in the map area consist of granodiorite and granite of Ordovician age referred to as the Taca Taca granite (Coira et al., 1982; Niemeyer et al., 2018; Poma et al., 2004; Sim et. al., 2013). The Taca Taca granite has been intruded by Late Permian granite and aplite rocks and overlain by Late Permian sediments and volcaniclastics (DeCelles et al., 2015). These have been cross cut and overlain by Eocene-Oligocene arc rocks of the Santa Inez complex, including rhyodacitic hypabyssal intrusions, dykes, flow domes, crystal lapilli tuff and crystal tuff (DeCelles et al., 2015). The west central portion of the property is covered by a recent dacitic dome. This large feature occupies an interpreted 2 km wide graben structure (Richards et. al., 2007).

7.2.2 Structure

Sim et al. (2013) suggested that the structural fabric observed in the Ordovician granite host rock of the Taca Taca Bajo deposit is characterized by the presence of discrete but widespread NNE-SSW and NW-SE trending, steeply dipping proto-mylonite to mylonite zones. The emplacement of Oligocene rhyodacitic dykes, quartz veining related to the porphyry system, fractures, and small scale faults were controlled by these pre-existing zones of structural weakness.

The Sierra de Taca Taca region also contains an abundance of strong NW-SE and NNW-SSE lineaments. It is believed that only small scale extensional normal faulting has occurred along these structures since the timing of mineralization at the Taca Taca Bajo porphyry deposit (~ 29 Ma) (Sim et al., 2013). The lineaments may represent conjugate faults related to the large-scale graben mapped to the west of Sarita Este or to a major high angle reverse fault thought to be at the western edge of the Salar de Arizaro (Almandoz, 2008; Richards et al., 2007; Sim et. al., 2013). Almandoz observed westward tilting of Oligocene volcanic rocks to the west of the Taca Taca Bajo deposit and interpreted that the range was uplifted with eastern vergence along a major high angle reverse fault located near the western border of the Salar de Arizaro during Oligocene time (Almandoz, 2008).

7.2.3 Mineralization

Three styles of mineralization are recognized on the Property and are described as follows:

1. Oxidized gold bearing quartz-limonite after pyrite micro veins that also yield anomalous values in lead, zinc and copper. These veins occur within sinuous zones of mostly quartz-sericite and lesser clay altered crystal lapilli tuff. The Sarita Este soil geochemistry grid is positioned over these zones.
2. Copper ± silver ± zinc bearing replacement or skarn type mineralization in association with chlorite, epidote and diopside alteration within calcareous conglomerate rocks occur north of the Sarita Este grid.
3. Siliceous brecciated veins or “ribs” with varying amounts of hematite and sporadic gold and silver mineralization have been mapped and sampled. These veins range from 0.1 to 30 metres wide, are continuous and extend southward onto the Desierto I concession.

Mineralization at the Taca Taca Bajo porphyry deposit to the northeast is Oligocene in age (Sim et al., 2013). Although no geochronology has been performed on the Sarita Este mineralization, it is believed to be of similar age.

8 Deposit Type

The deposit model that best fits the style of lithology, alteration and mineralization seen on the Sarita Este concession is an intermediate sulphidation epithermal deposit model, peripheral to an Andean porphyry copper-gold-molybdenum system (Figure 8.1).

Supporting evidence for this model includes proximity to the Taca Taca Bajo and Taca Taca Alto porphyry deposit and showing respectively, presence of extensive and zoned propylitic, phyllic, argillic and silicic alteration regimes, a network of mineralized micro veins, as well as associated precious metal mineralization with notable concentrations of copper, lead, zinc and arsenic.

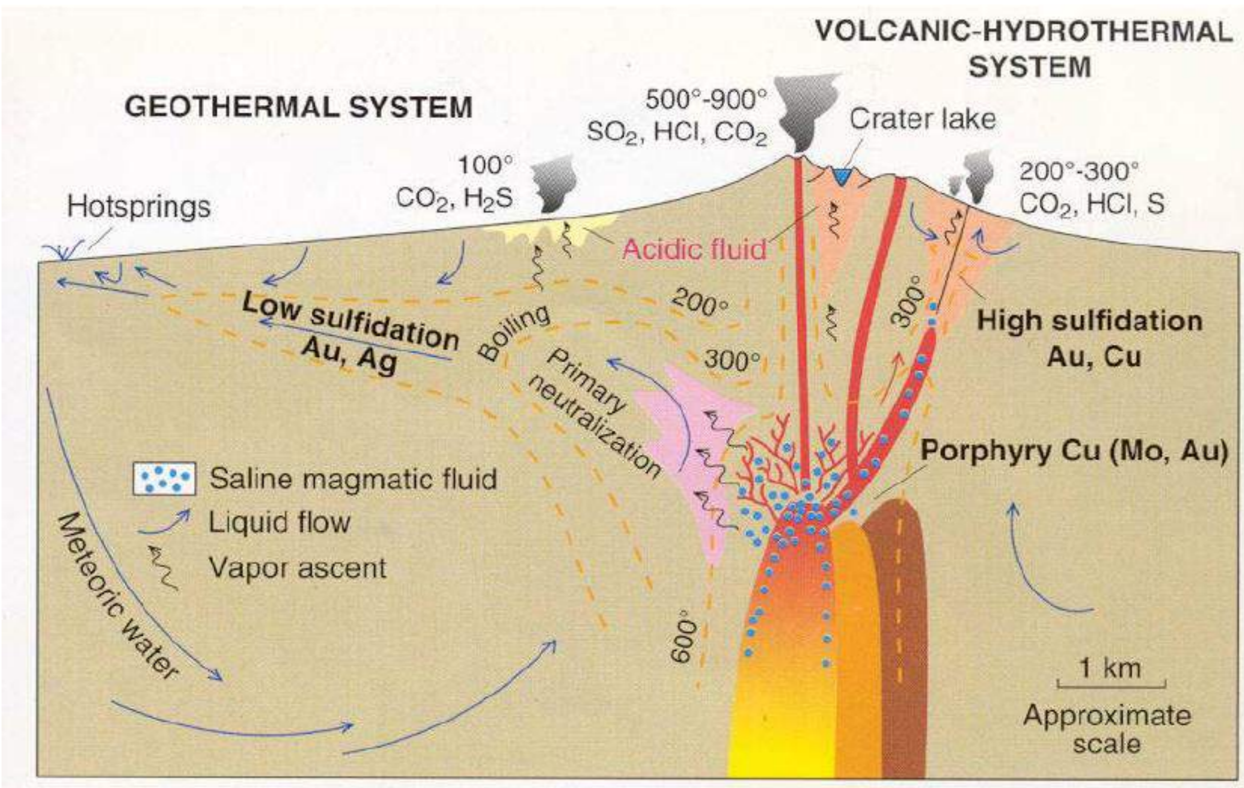


Figure 8.1 - Epithermal Models above Porphyry Systems (from Hedenquist and Lowenstern (1994).

9 Exploration

9.1 Previous Exploration

Mansfield Minerals was quite active in the area in the 1990's and are believed to be the first company to recognize the gold mineralization in the Sarita Este Gold Zone. Cascadero acquired the property in 2005. Cascadero conducted mostly prospecting and sampling and some geologic mapping on the Sarita Este and surrounding concessions in 2017, 2012, 2007, 2006 and 2005. In 2012, three trenches totaling 46 metres were excavated with a back-hoe. The trenches were about 1 metre wide and anywhere from 10 to 80 centimetres deep, however no sampling or mapping of the trenches was ever conducted.

9.2 2017 Work Program

During October and November of 2017, Cascadero conducted a roughly 150 person-day program of geological mapping, soil and rock geochemical surveys and concurrent prospecting on the Sarita Este Gold Zone. The main objective of the program was to generate potential trench and drill targets and to define areas that warrant further exploration.

9.2.1 Geologic Mapping

Detailed mapping of lithology, alteration and structure over the soil grid area was conducted. The three historic trenches in the Sarita Este Zone were mapped in detail. Selected samples were sent to Vancouver Petrographics Ltd. for detailed thin section descriptions. The petrographic report is located in Appendix 1. Mapping was conducted at a scale of 1:2,000 using a compass, GPS and base map. UTM WGS84 Zone 19S was used by the field crews. GPS waypoints, and fields notes were compiled nightly and outcrops were drawn into an ArcGIS database. The geology and alteration map is plotted on Figure 9.1.

9.2.2 Rock Geochemistry

A total of 152 rock samples were collected including 46 chip samples from the three historic trenches that were dug in 2012. Trench chip samples were continuous one metre long samples.. Rock samples were analyzed using a four acid digestion and multispectral induced coupling plasma (ICP-MS) for 42 elements and fire assay atomic absorption for gold by the Alex Stewart Lab in in Mendoza, ArgentinaRock samples for all the campaigns since 2006 are plotted in Figures 9.4 to 9.10.

9.2.3 Soil Geochemistry

A soil grid was established over the Sarita Este gold zone. A total of 17.1 kilometres of grid soil sampling was laid out. Sample stations were loaded into a GPS instrument. Samplers would navigate to the loaded sample station, dig through any pediment, and sieve C horizon material into a bucket using a #12 Keene plastic classifier sieve and collect about two kilograms of material. The soil grid extended 1700 metres NW/SE. Each grid line was 950 metres long. Grid lines were oriented at 070° azimuth. A total of 647 samples were collected at depths ranging from 5 to 100 cm in depth. Samples were collected at a 25-metre sampling interval along grid lines located 100 metres apart. Soil samples were analyzed by using a four acid digestion and multispectral induced coupling plasma (ICP-MS) for 42 elements and fire assay atomic absorption for gold by the Alex Stewart Lab in in Mendoza, Argentina. Contoured results for gold, silver, copper, lead, zinc, molybdenum and arsenic (Au, Ag, Cu, Pb, Zn, Mo and As) are shown in Figures 9.12 to 9.17.

9.3 Results

9.3.1 Geologic Mapping

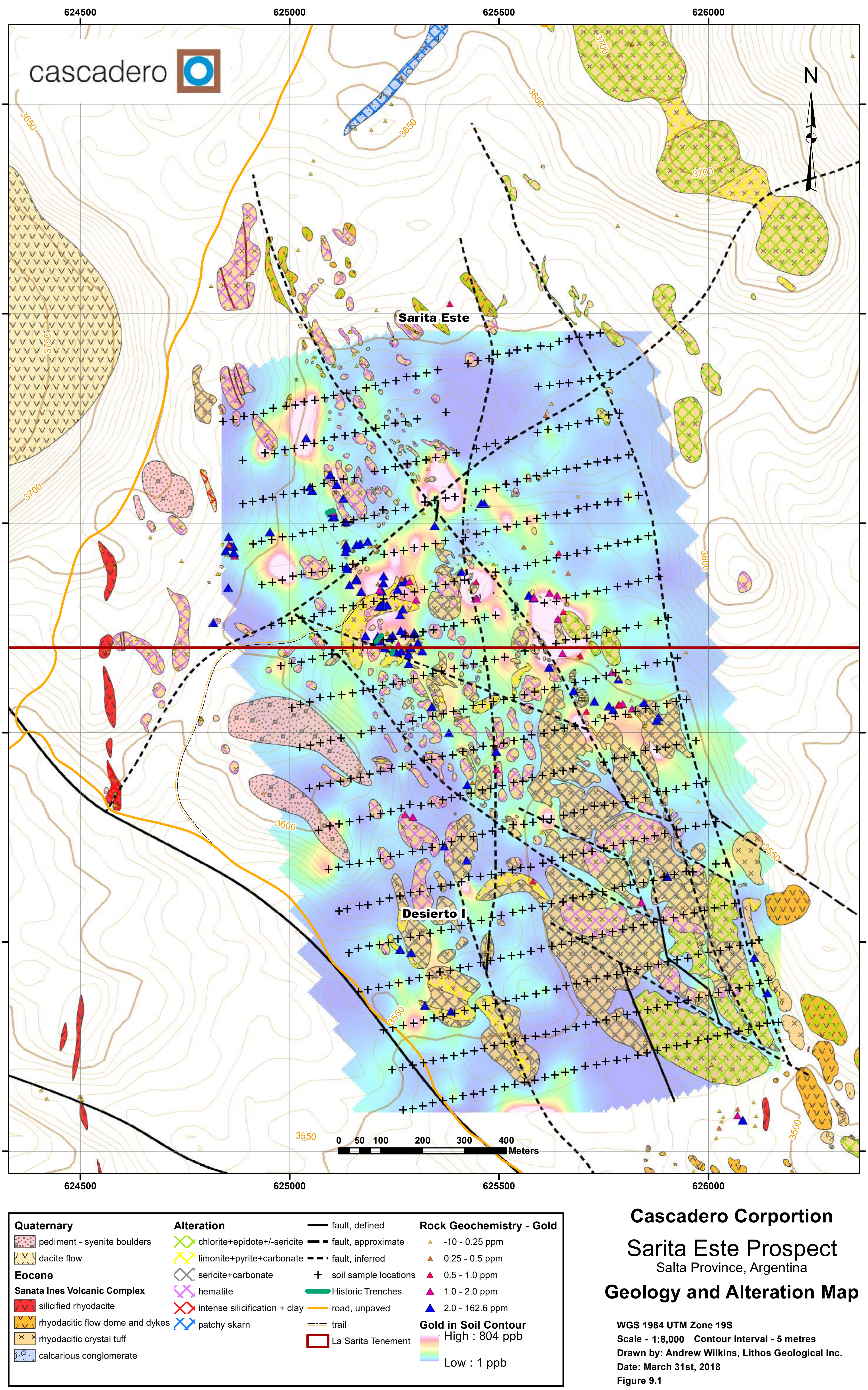
The Sarita Este showing is dominantly underlain by variably altered volcaniclastic rocks consisting primarily of rhyodacitic crystal tuff and crystal lapilli tuff (Figure 9.1). Petrographic analysis of 11 samples confirms a rhyodacite composition and that the samples submitted are likely consanguineous (McWilliam, 2018). Possible genetically related rhyodacitic domes occur to the east of the Sarita Este Zone and are scattered through the Desierto concessions. These interpreted domes are more resistive to weathering and commonly form topographic highs. Also noteworthy are prominent sub-parallel siliceous ribs that generally follow the dominant structural trend of 165°/90°, the most prominent of which has been named the Stegosaurus Vein. The Stegosaurus Vein is traceable for 4.2 kilometres to the south onto the Desierto I concession.

Alteration was mapped in detail in the vicinity of the soil grid survey on the Sarita Este and Desierto I concessions. Samples sent for petrographic analysis were reported to consist of five alteration assemblages. The assemblages included the following:

1. Weak propylitic (sericite-chlorite-epidote with magnetite preserved),
2. Weak/moderate propylitic (albite-sericite-chlorite-epidote-calcite-rutile)
3. Weak/moderate phyllic (increase in sericite)
4. Phyllic/silicic with gradation towards argillic (addition of clay-quartz-local possible jarosite-trace alunite)
5. Intense silicic (pervasive replacement and/or veinlets, stockworks or breccia matrix)

The detailed alteration mapping demonstrates that there is a direct relationship between quartz + sericite + clay alteration, micro quartz veining and gold mineralization. The quartz + sericite ± clay alteration delineates discrete zones that are evident in the field and further highlights their cross-cutting nature and preferred structural orientation. The alteration is recessive in nature making outcrop sampling problematic.

Structural analyses of mapped veins at the Sarita Este Gold Zone show three preferred orientations (Figure 9.2). The dominant trend occurs at an orientation on 165°/90°. The secondary orientation occurs at 105°/85° SW and a third minor orientation occurs at 040°/90°.



cascadero
N
Sarita Este
Desierto I
624500
625000
625500
626000
7281000
7280500
7280000
7279500
7279000
7278500
3500
3550
3600
3650
3700
3750
0 50 100 200 300 400 Meters
Quaternary
pediment - syenite boulders
dacite flow
Eocene
Sanata Ines Volcanic Complex
silicified rhyodacite
rhyodacitic flow dome and dykes
rhyodacitic crystal tuff
calcarious conglomerate
Alteration
chlorite+epidote+/-sericite
limonite+pyrite+carbonate
sericite+carbonate
hematite
intense silicification + clay
patchy skarn
fault, defined
fault, approximate
fault, inferred
soil sample locations
Historic Trenches
road, unpaved
trail
La Sarita Tenement
Rock Geochemistry - Gold
-10 - 0.25 ppm
0.25 - 0.5 ppm
0.5 - 1.0 ppm
1.0 - 2.0 ppm
2.0 - 162.6 ppm
Gold in Soil Contour
High : 804 ppb
Low : 1 ppb
Cascadero Corportion
Sarita Este Prospect
Salta Province, Argentina
Geology and Alteration Map
WGS 1984 UTM Zone 19S
Scale - 1:8,000 Contour Interval - 5 metres
Drawn by: Andrew Wilkins, Lithos Geological Inc.
Date: March 31st, 2018
Figure 9.1

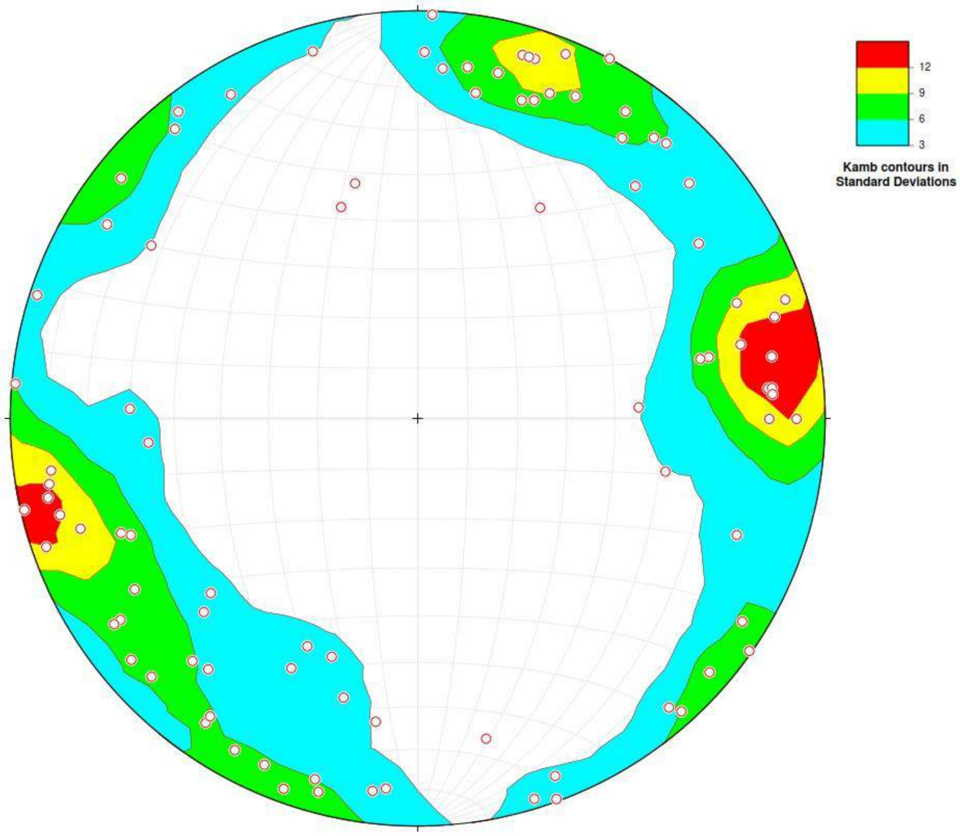


Figure 9.2 - Equal Area Projection Summarizing Structural Data of Vein Orientations (red circles represent projection of poles to planes measured; n = 96).

9.3.2 Rock Geochemistry

Since 2005, a total of 324 prospecting samples have been collected and analyzed in the Sarita Este area. Of these, 120 samples graded over 1 gram per tonne gold and averaged 15.3 grams per tonne gold. A total of 44 samples graded over 10 grams per tonne gold and averaged 35.0 grams per tonne gold. The highest assayed sample graded 162.6 grams per tonne. Digging and prospecting in 2017 extended the Sarita Este Gold Zone another 250 metres to the west of previously known mineralization.

Other than the channel chip samples from the three small trenches, most of the samples taken to date are prospecting grab samples, therefore, determining continuity of mineralization over measured widths is not possible and one cannot conclude the grade or potential deposit size from the current sampling. In the trenches, the best assay returned 1,553 ppb gold (1.553 grams per tonne gold) over 3 metres. Assay correlations show a strong association between gold, molybdenum and lead and a moderate association between gold, copper, arsenic and bismuth. Figure 9.3 is a photo of Trench SE 2012-02 and Figure 9.4 shows the results of the correlation analysis. Figures 9.5 to 9.11 are maps of rock geochemistry for gold, silver, copper, lead, zinc, molybdenum and arsenic respectively.

Figure 9.3 - Photograph of Trench SE 2012-02, note recessive nature of grey, sericitic alteration. Orange flagging represents metre marks.

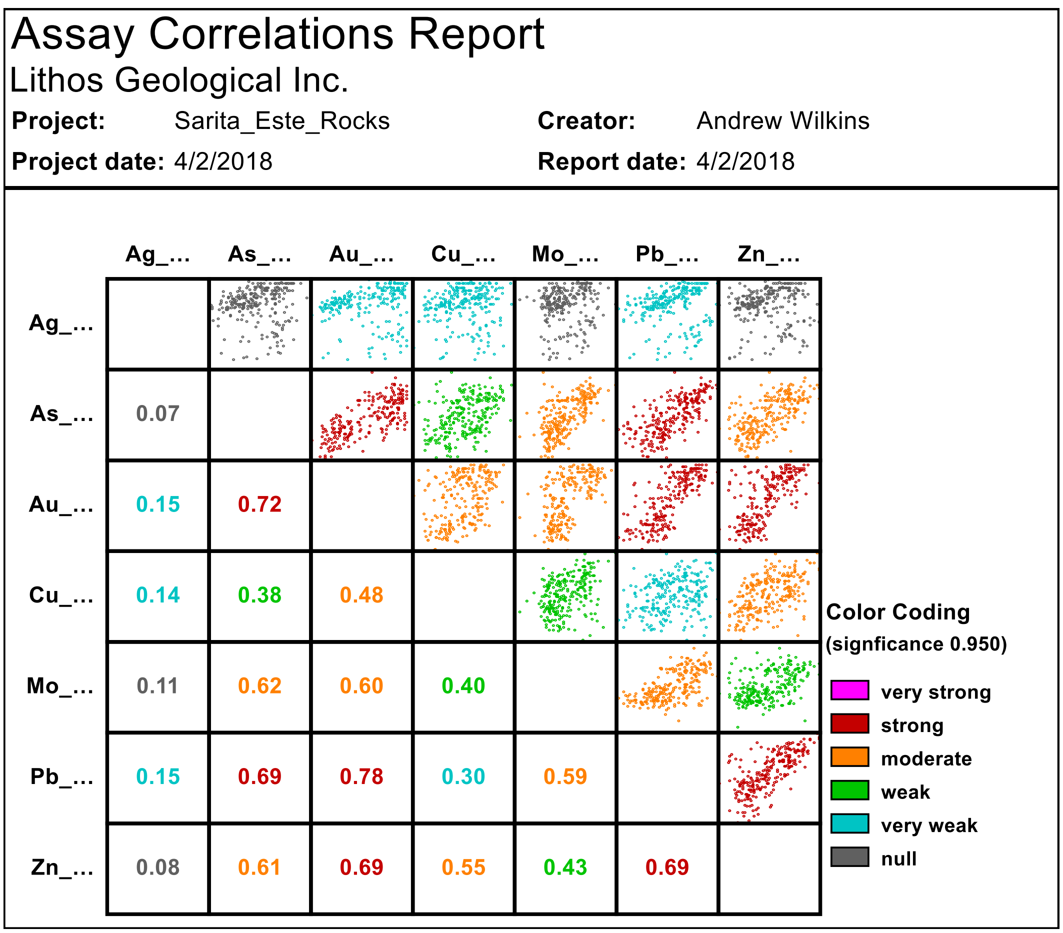


Figure 9.4 - Correlations Report for Rock Samples

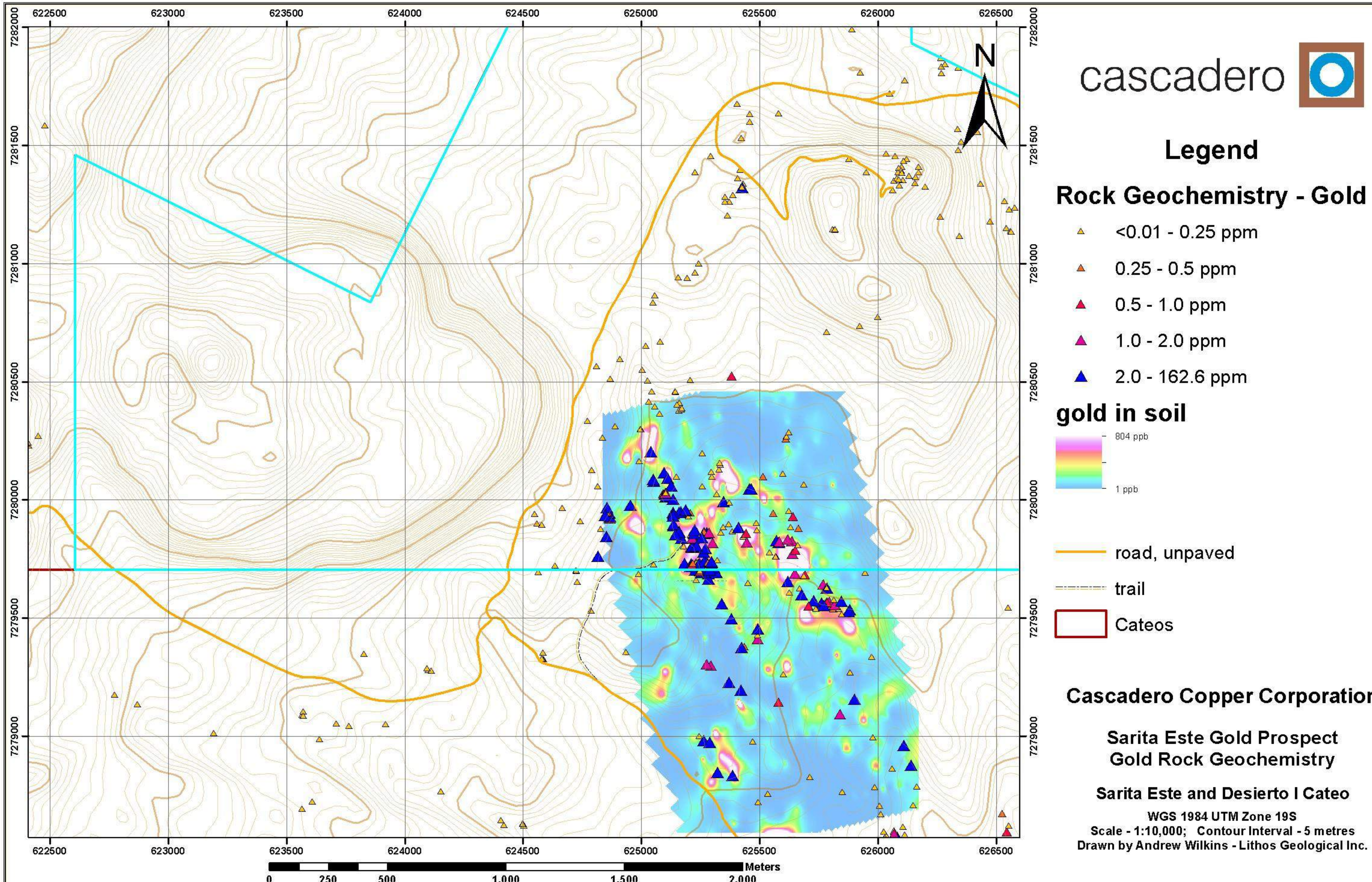
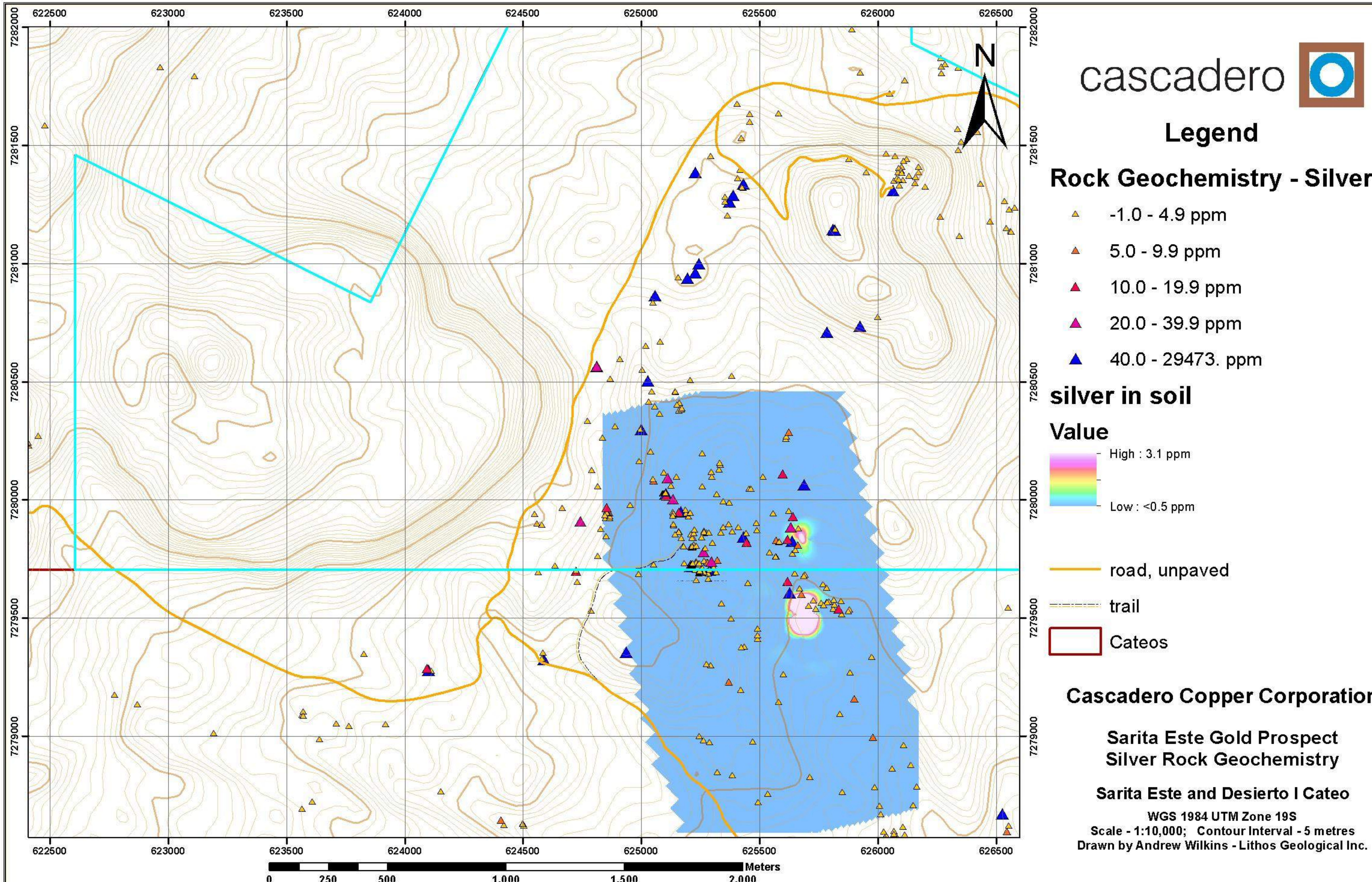

cascadero
Legend
Rock Geochemistry - Gold
<0.01 - 0.25 ppm
0.25 - 0.5 ppm
0.5 - 1.0 ppm
1.0 - 2.0 ppm
2.0 - 162.6 ppm
gold in soil
804 ppb
1 ppb
road, unpaved
trail
Cateos
Cascadero Copper Corporation
Sarita Este Gold Prospect
Gold Rock Geochemistry
Sarita Este and Desierto I Cateo
WGS 1984 UTM Zone 19S
Scale - 1:10,000; Contour Interval - 5 metres
Drawn by Andrew Wilkins - Lithos Geological Inc.
Meters
0 250 500 1,000 1,500 2,000
622500 623000 623500 624000 624500 625000 625500 626000 626500
7282000 7281500 7281000 7280500 7280000 7279500 7279000
N

Figure 9.5


cascadero
Legend
Rock Geochemistry - Silver
-1.0 - 4.9 ppm
5.0 - 9.9 ppm
10.0 - 19.9 ppm
20.0 - 39.9 ppm
40.0 - 29473. ppm
silver in soil
Value
High : 3.1 ppm
Low : <0.5 ppm
road, unpaved
trail
Cateos
Cascadero Copper Corporation
Sarita Este Gold Prospect
Silver Rock Geochemistry
Sarita Este and Desierto I Cateo
WGS 1984 UTM Zone 19S
Scale - 1:10,000; Contour Interval - 5 metres
Drawn by Andrew Wilkins - Lithos Geological Inc.
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1,500
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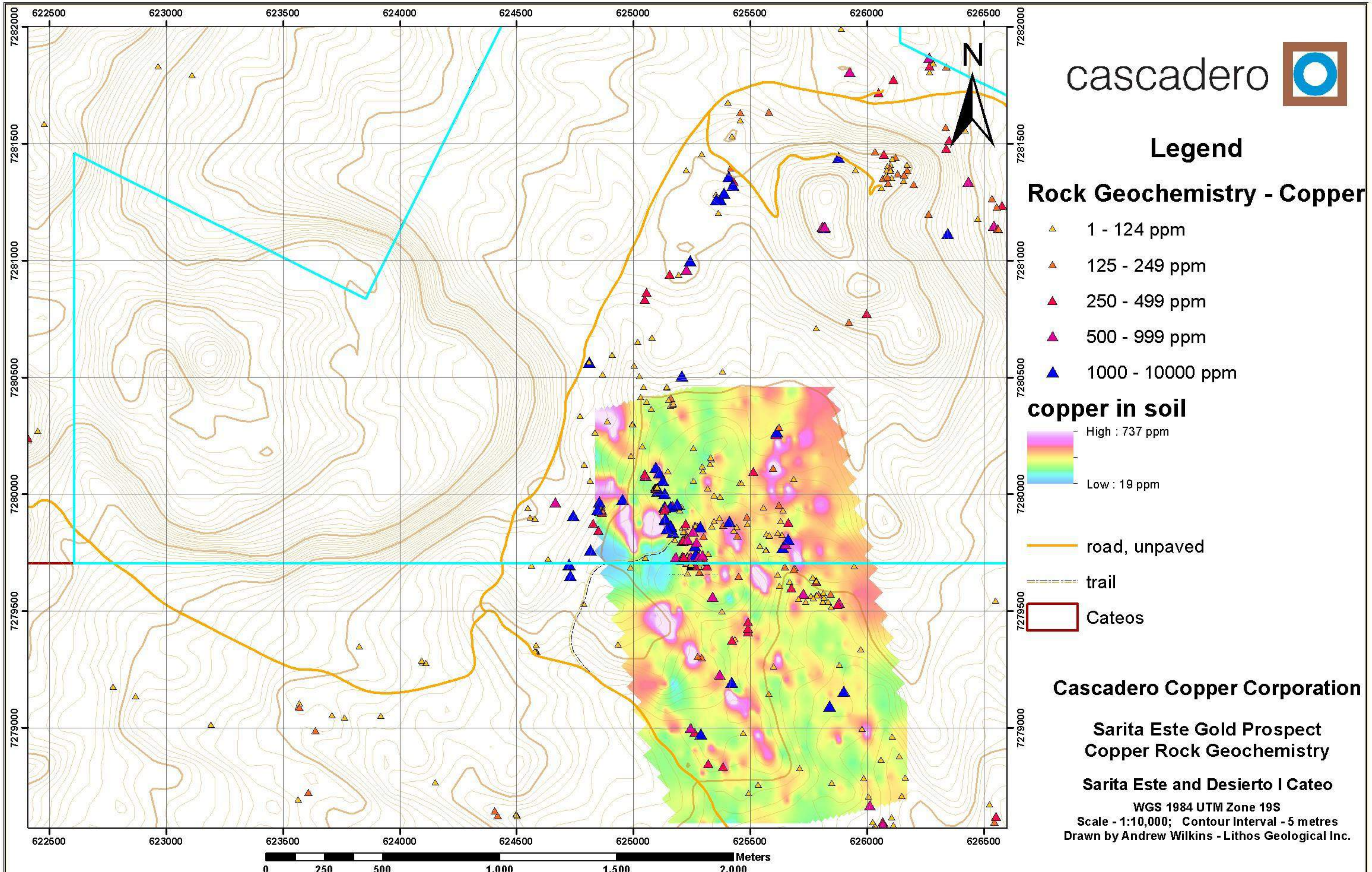
Figure 9.6



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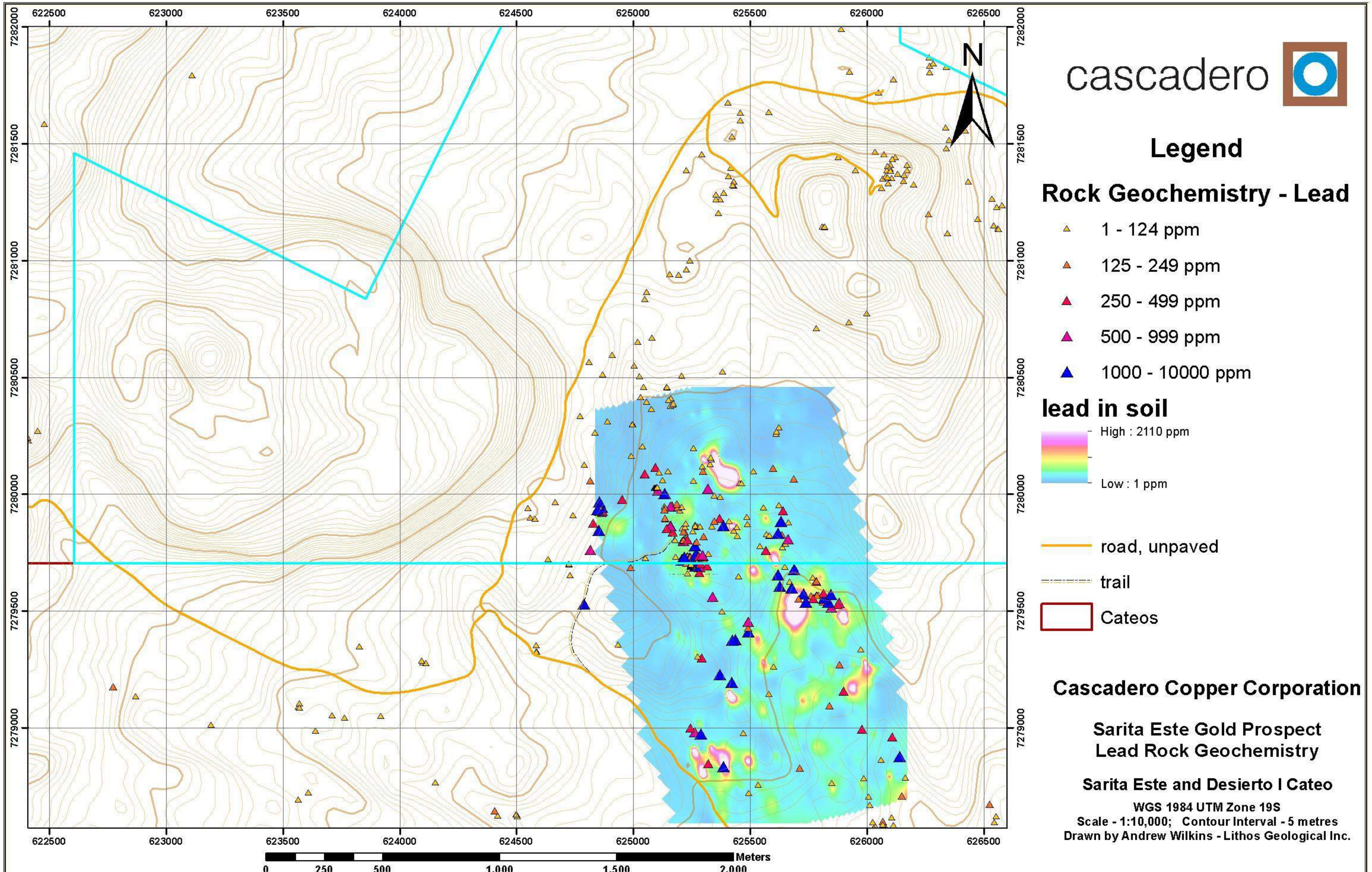
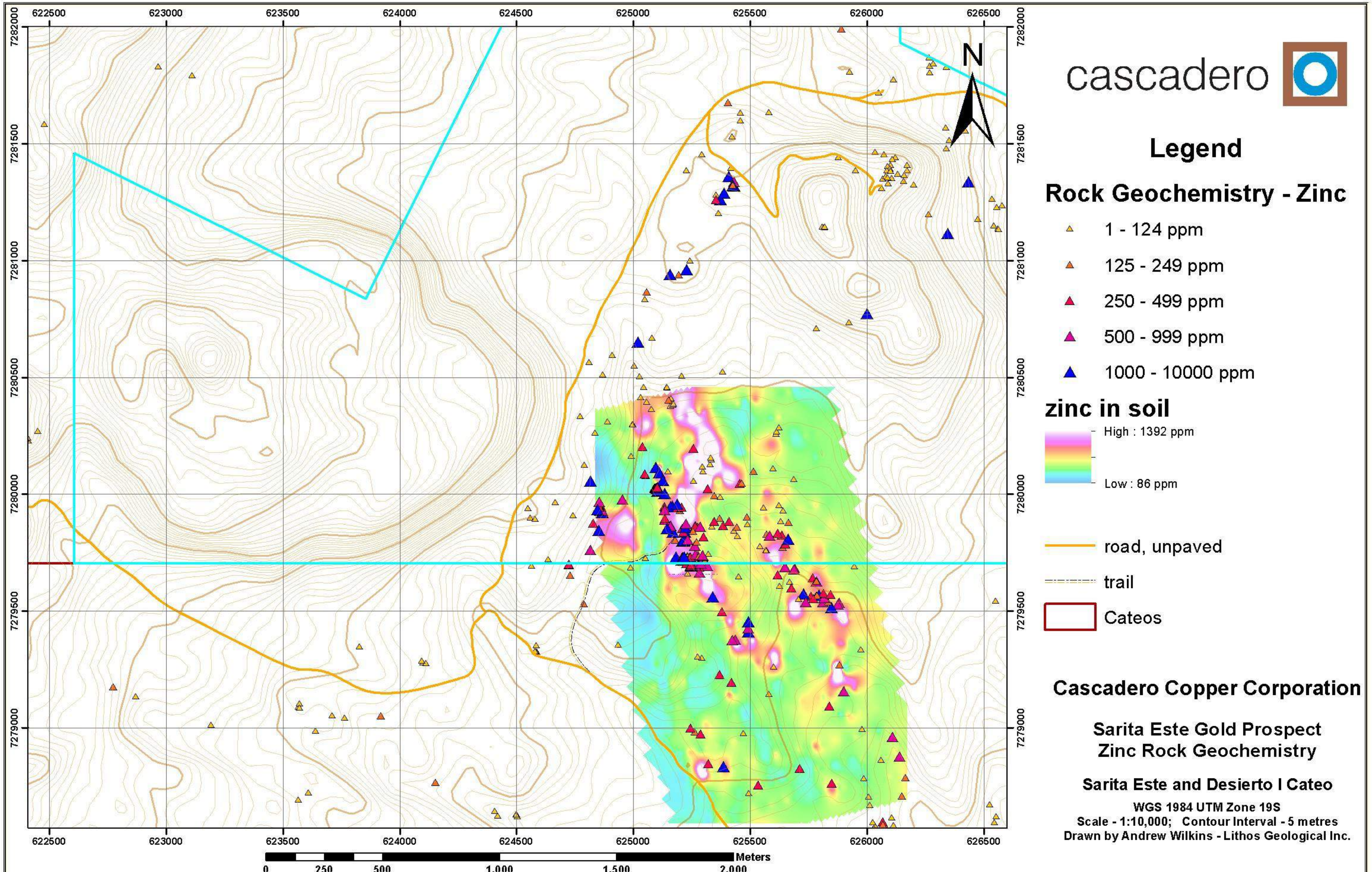
cascadero
Legend
Rock Geochemistry - Copper
1 - 124 ppm
125 - 249 ppm
250 - 499 ppm
500 - 999 ppm
1000 - 10000 ppm
copper in soil
High : 737 ppm
Low : 19 ppm
road, unpaved
trail
Cateos
Cascadero Copper Corporation
Sarita Este Gold Prospect
Copper Rock Geochemistry
Sarita Este and Desierto I Cateo
WGS 1984 UTM Zone 19S
Scale - 1:10,000; Contour Interval - 5 metres
Drawn by Andrew Wilkins - Lithos Geological Inc.
Meters
0
250
500
1,000
1,500
2,000

Figure 9.7



cascadero
Legend
Rock Geochemistry - Lead
1 - 124 ppm
125 - 249 ppm
250 - 499 ppm
500 - 999 ppm
1000 - 10000 ppm
lead in soil
High : 2110 ppm
Low : 1 ppm
road, unpaved
trail
Cateos
Cascadero Copper Corporation
Sarita Este Gold Prospect
Lead Rock Geochemistry
Sarita Este and Desierto I Cateo
WGS 1984 UTM Zone 19S
Scale - 1:10,000; Contour Interval - 5 metres
Drawn by Andrew Wilkins - Lithos Geological Inc.
Meters
0
250
500
1,000
1,500
2,000
N

Figure 9.8



cascadero
N
Legend
Rock Geochemistry - Zinc
1 - 124 ppm
125 - 249 ppm
250 - 499 ppm
500 - 999 ppm
1000 - 10000 ppm
zinc in soil
High : 1392 ppm
Low : 86 ppm
road, unpaved
trail
Cateos
Cascadero Copper Corporation
Sarita Este Gold Prospect
Zinc Rock Geochemistry
Sarita Este and Desierto I Cateo
WGS 1984 UTM Zone 19S
Scale - 1:10,000; Contour Interval - 5 metres
Drawn by Andrew Wilkins - Lithos Geological Inc.
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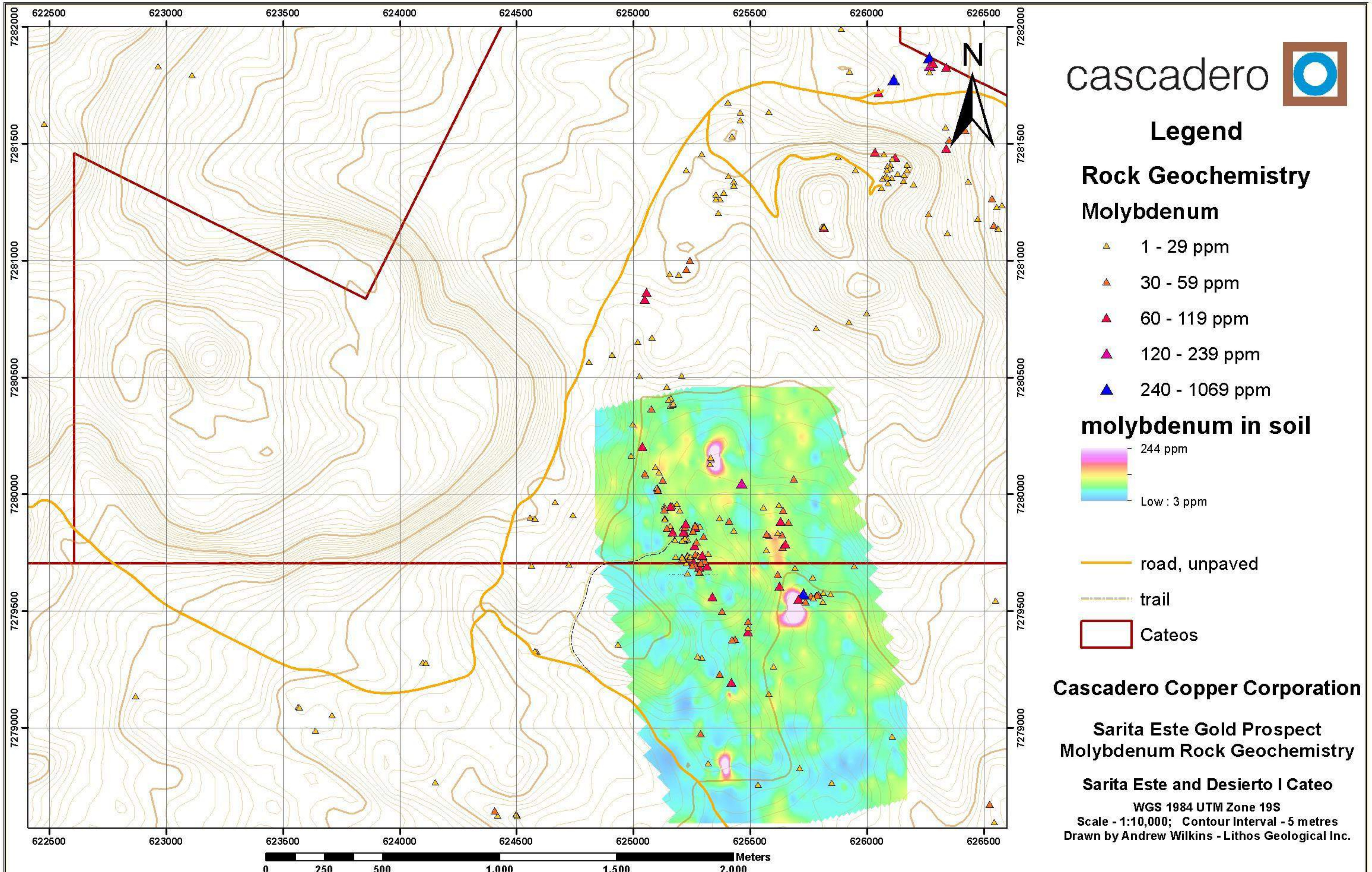
1,500
2,000

Figure 9.9



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7281000
7280500
7280000
7279500
7279000
N
cascadero
Legend
Rock Geochemistry
Molybdenum
1 - 29 ppm
30 - 59 ppm
60 - 119 ppm
120 - 239 ppm
240 - 1069 ppm
molybdenum in soil
244 ppm
Low : 3 ppm
road, unpaved
trail
Cateos
Cascadero Copper Corporation
Sarita Este Gold Prospect
Molybdenum Rock Geochemistry
Sarita Este and Desierto I Cateo
WGS 1984 UTM Zone 19S
Scale - 1:10,000; Contour Interval - 5 metres
Drawn by Andrew Wilkins - Lithos Geological Inc.
0
250
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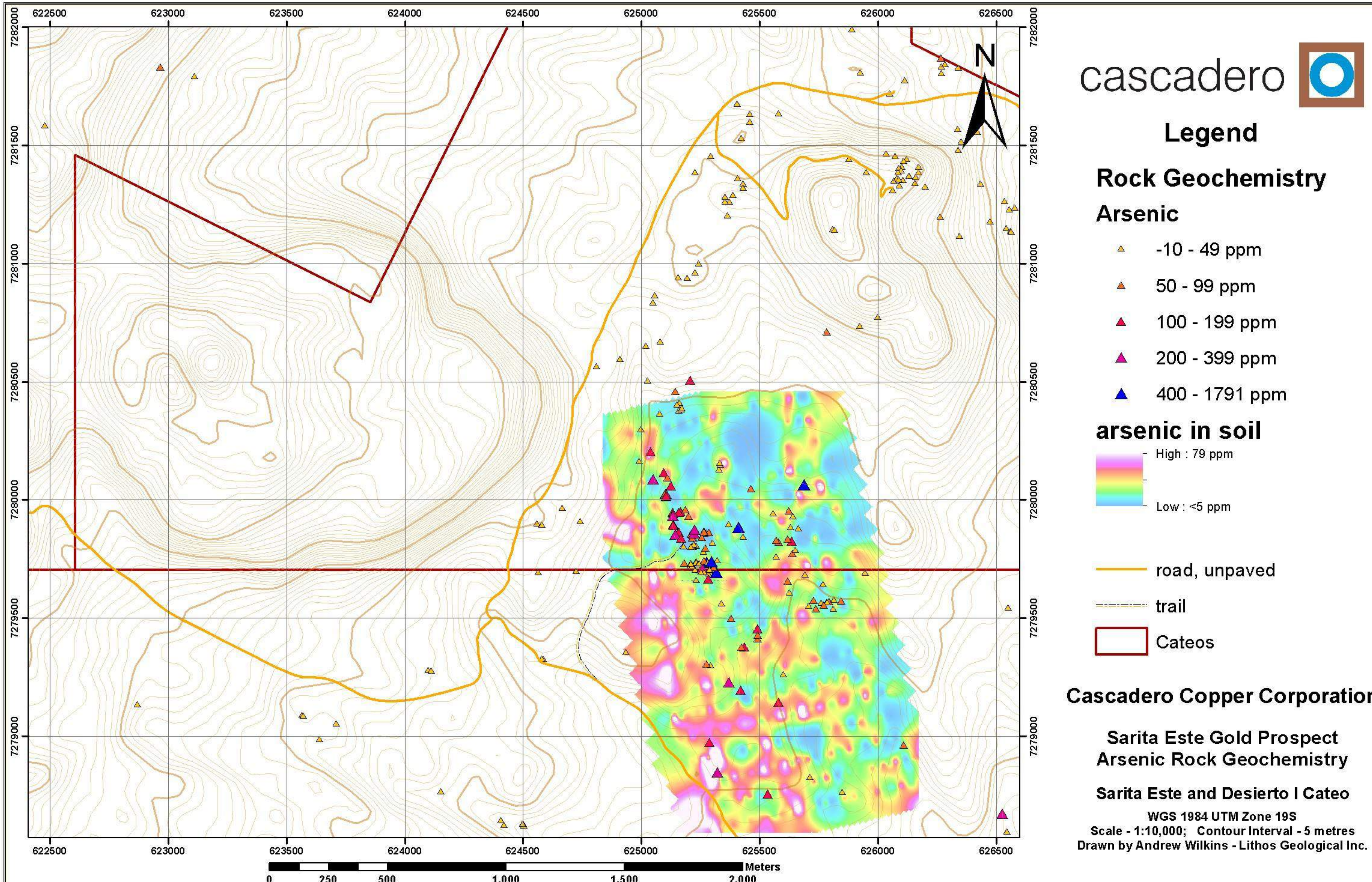
1,000
1,500
2,000
Meters

Figure 9.10



cascadero
Legend
Rock Geochemistry
Arsenic
-10 - 49 ppm
50 - 99 ppm
100 - 199 ppm
200 - 399 ppm
400 - 1791 ppm
arsenic in soil
High : 79 ppm
Low : <5 ppm
road, unpaved
trail
Cateos
Cascadero Copper Corporation
Sarita Este Gold Prospect
Arsenic Rock Geochemistry
Sarita Este and Desierto I Cateo
WGS 1984 UTM Zone 19S
Scale - 1:10,000; Contour Interval - 5 metres
Drawn by Andrew Wilkins - Lithos Geological Inc.
N
622500
623000
623500
624000
624500
625000
625500
626000
626500
7282000
7281500
7281000
7280500
7280000
7279500
7279000
Meters
0
250
500
1,000
1,500
2,000

Figure 9.11

9.3.3 Soil Geochemistry

Soil geochemistry results have outlined a main gold in soil anomaly that measures 850 metres by 1050 metres in size. Smaller anomalies are also present within the survey area. Throughout the grid, values range from <2 ppb to 804 ppb gold. The median value is 35.5 ppb gold and the mean value is 25.5 ppb gold over the entire grid. Correlation analysis of the soil data shows a moderate association between gold and zinc and a weak association between gold, copper, molybdenum and lead. Figure 9.12 shows the results of the correlation analysis. Figures 9.13 to 9.19 are maps of soil geochemistry for gold, silver, copper, lead, zinc, molybdenum and arsenic respectively.

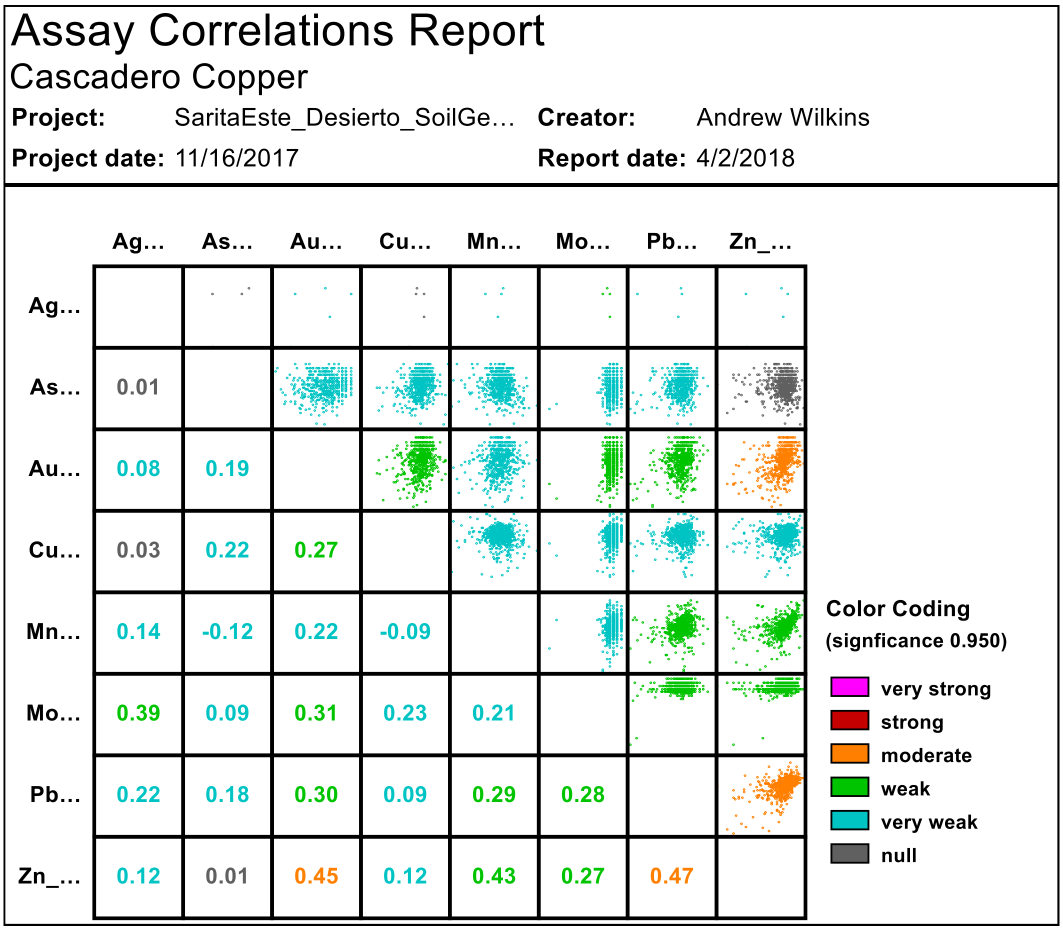
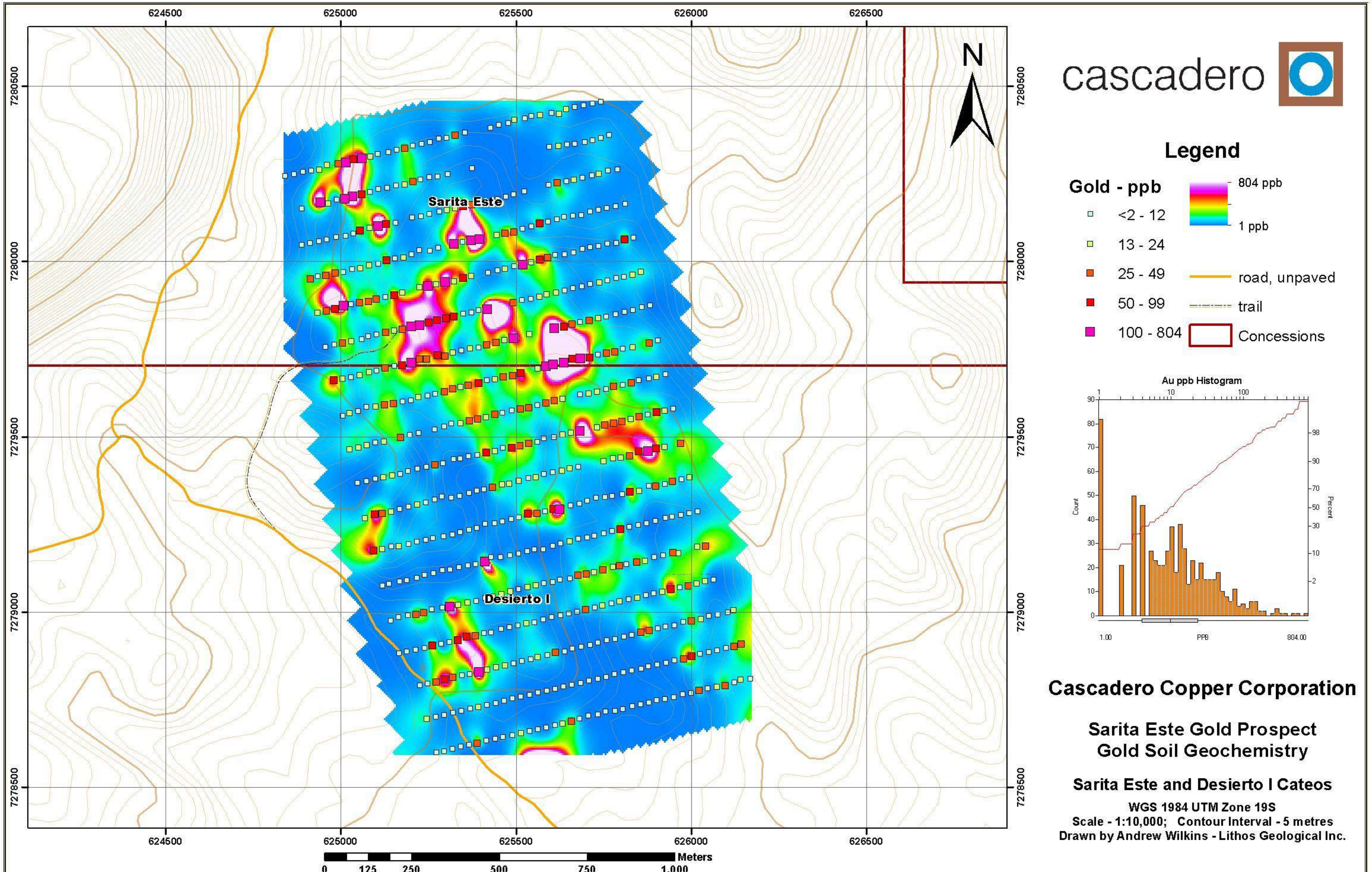


Figure 9.12 - Correlation Report for Soil Samples



cascadero
Legend
Gold - ppb
<2 - 12
13 - 24
25 - 49
50 - 99
100 - 804
804 ppb
1 ppb
road, unpaved
trail
Concessions
Au ppb Histogram
Sarita Este
Desierto I
N
Meters
0
125
250
500
750
1,000
624500
625000
625500
626000
626500
7280500
7280000
7279500
7279000
7278500
Cascadero Copper Corporation
Sarita Este Gold Prospect
Gold Soil Geochemistry
Sarita Este and Desierto I Cateos
WGS 1984 UTM Zone 19S
Scale - 1:10,000; Contour Interval - 5 metres
Drawn by Andrew Wilkins - Lithos Geological Inc.

Figure 9.13

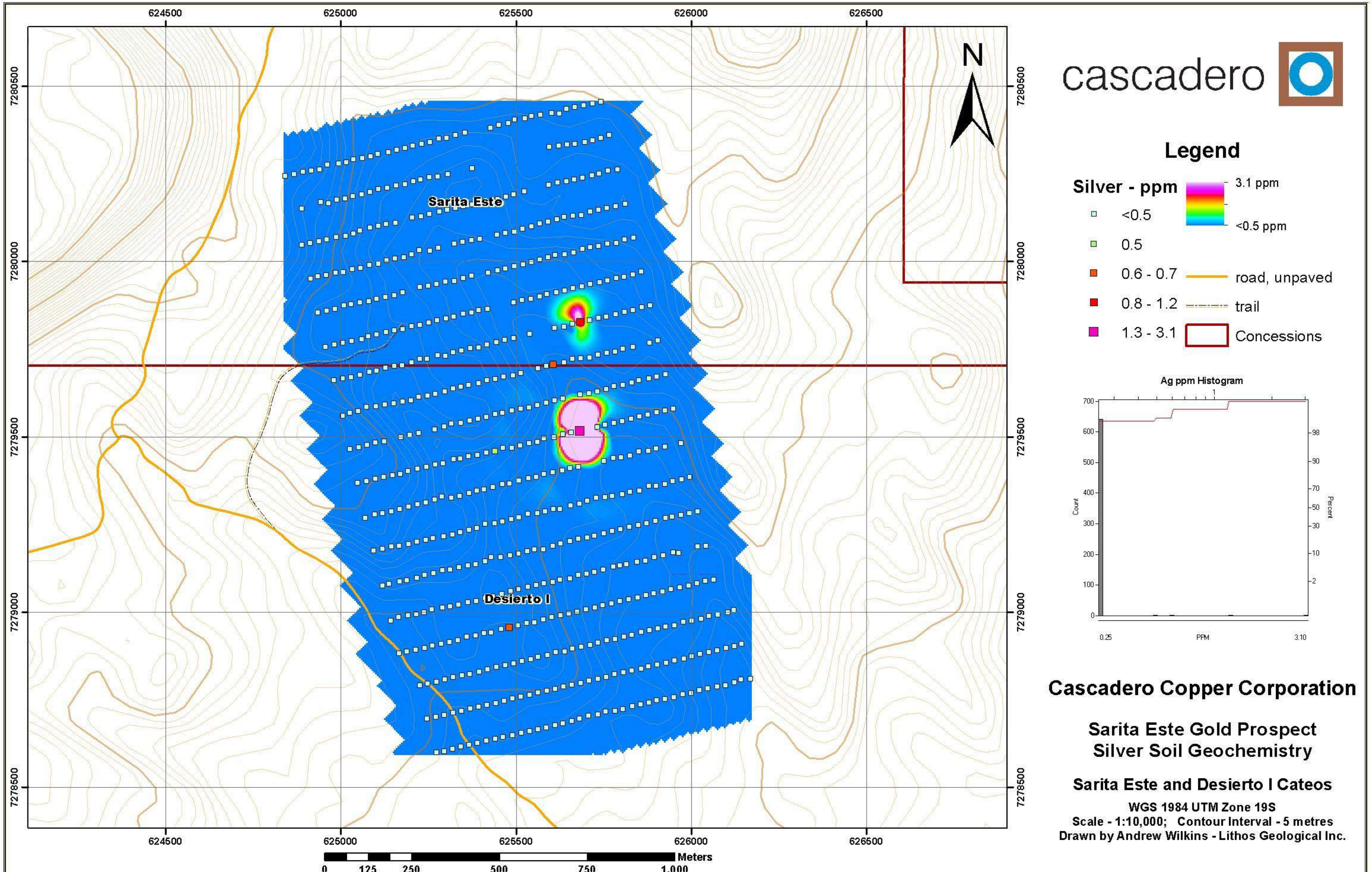
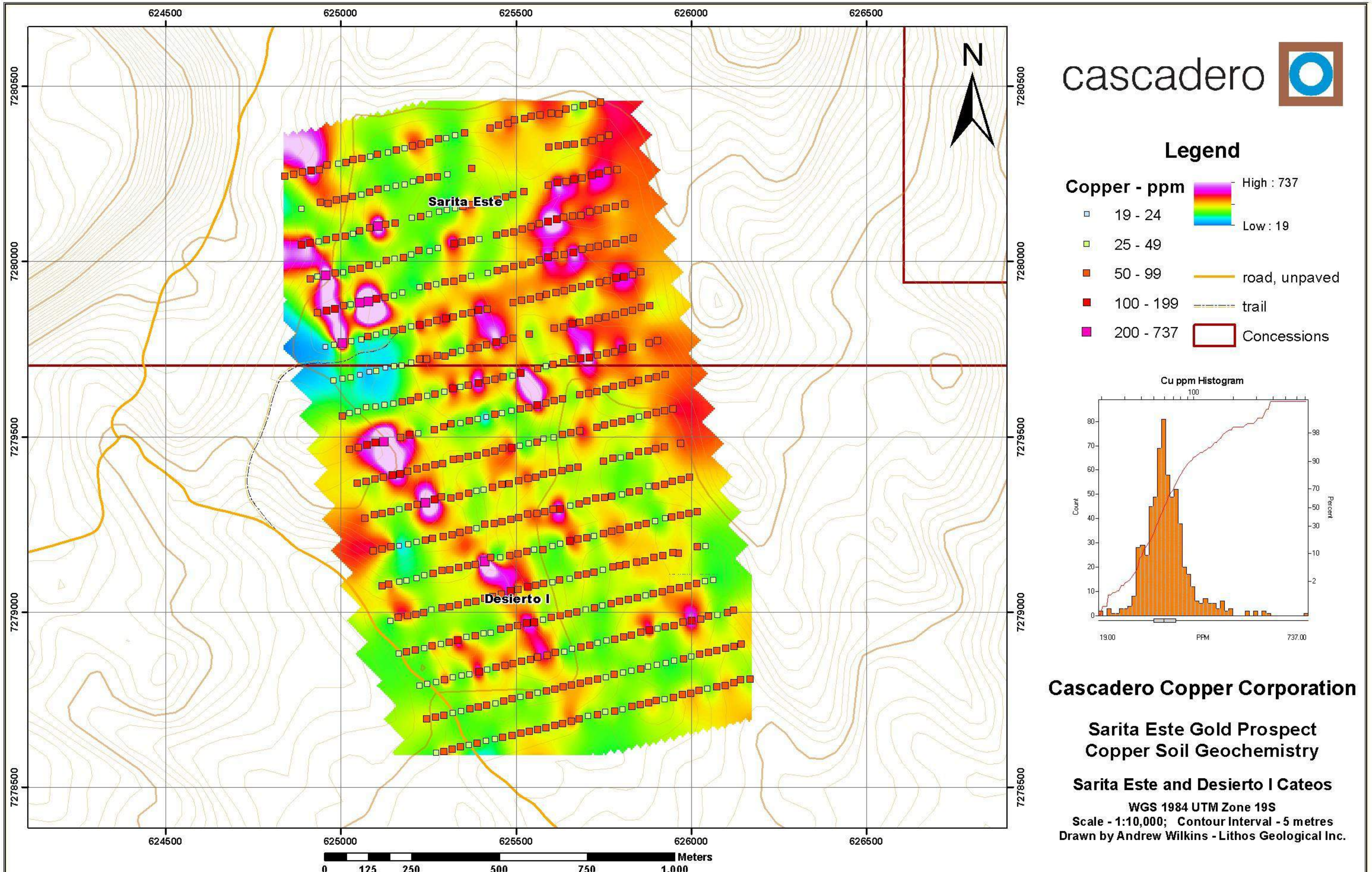
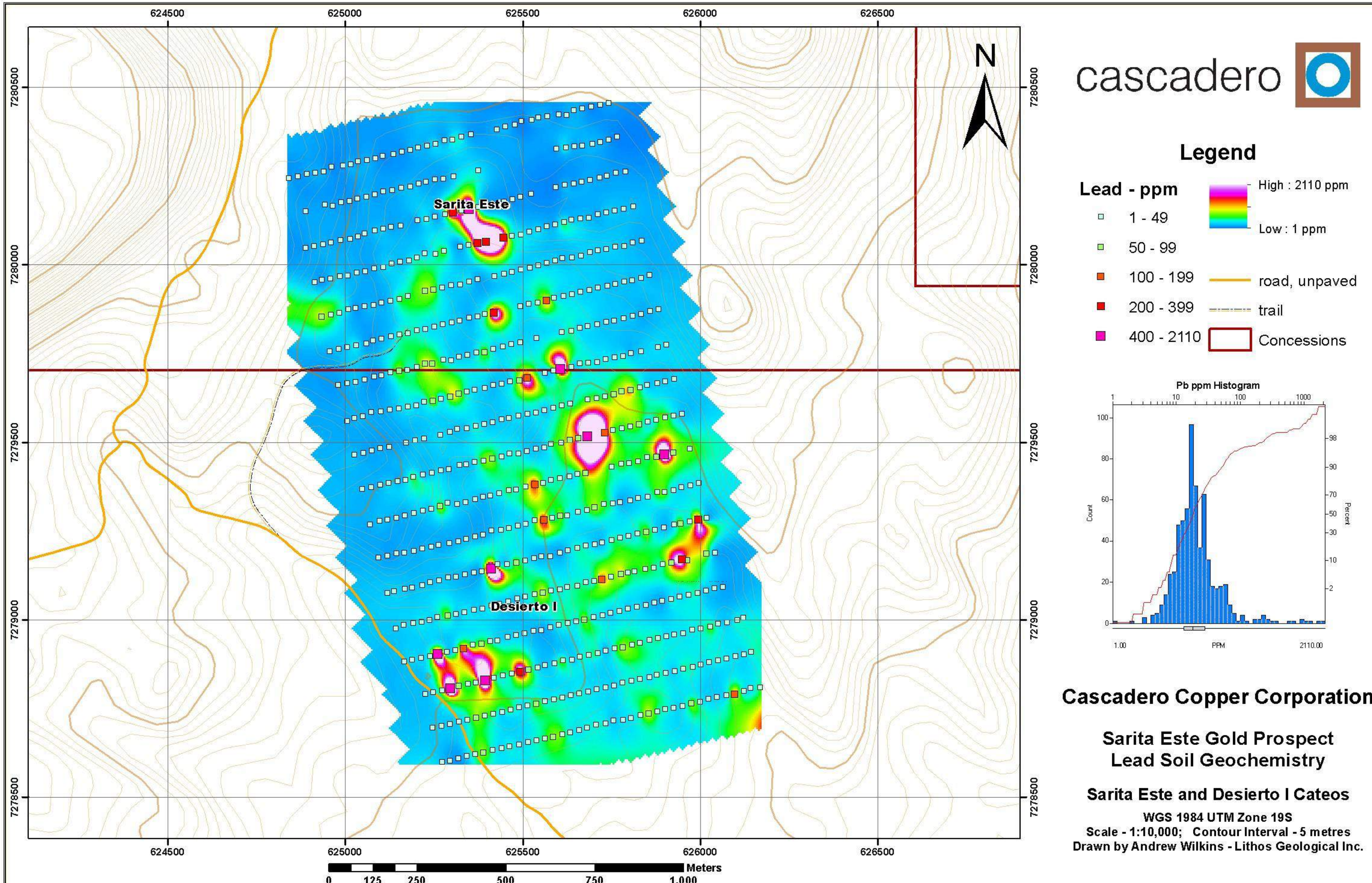

624500
625000
625500
626000
626500
7280500
7280000
7279500
7279000
7278500
N
Sarita Este
Desierto I
0 125 250 500 750 1,000 Meters
cascadero
Legend
Silver - ppm
<0.5
0.5
0.6 - 0.7
0.8 - 1.2
1.3 - 3.1
3.1 ppm
<0.5 ppm
road, unpaved
trail
Concessions
Ag ppm Histogram
Count
Percent
PPM
0.25
3.10
Cascadero Copper Corporation
Sarita Este Gold Prospect
Silver Soil Geochemistry
Sarita Este and Desierto I Cateos
WGS 1984 UTM Zone 19S
Scale - 1:10,000; Contour Interval - 5 metres
Drawn by Andrew Wilkins - Lithos Geological Inc.

Figure 9.14



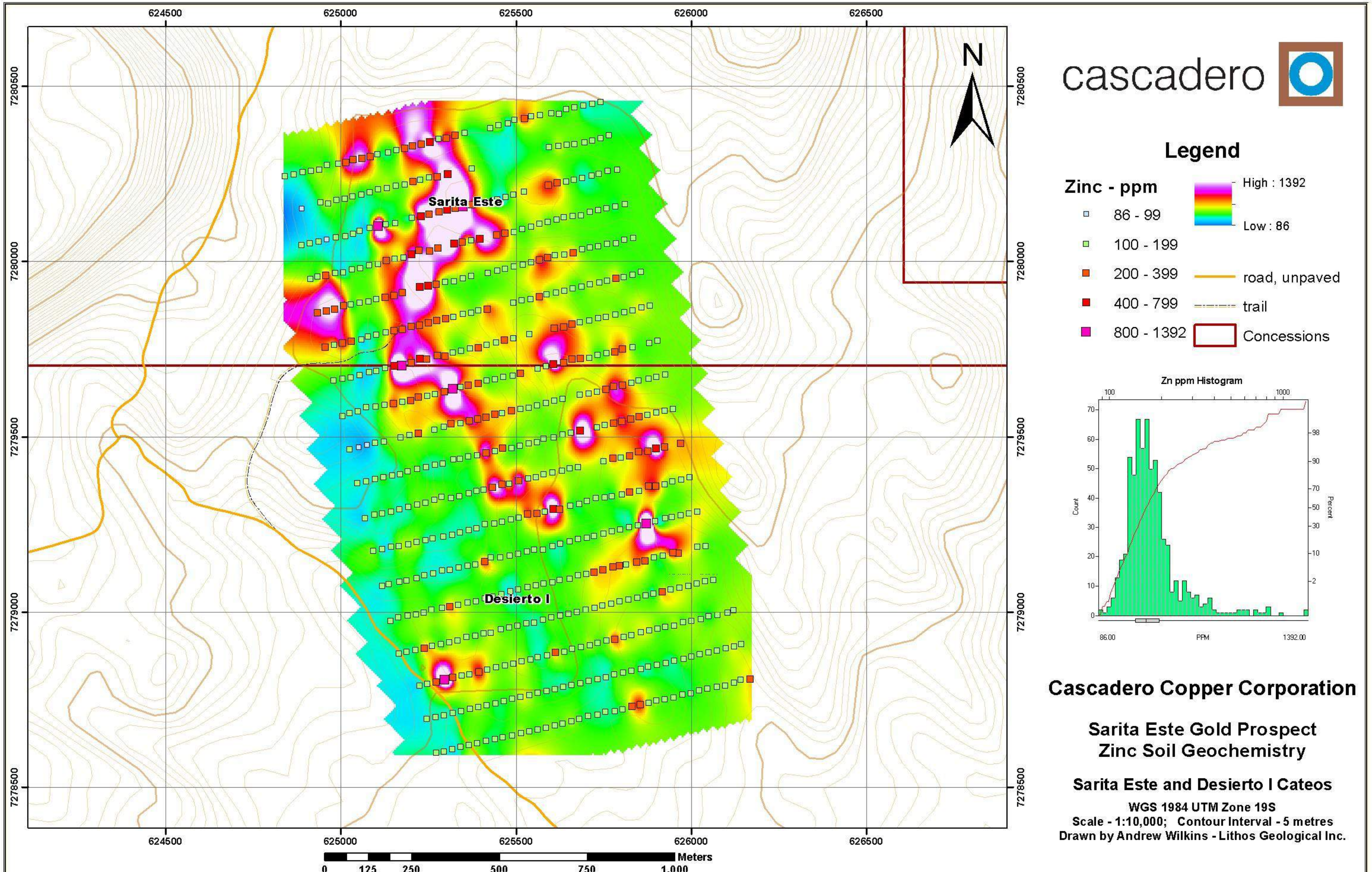
624500
625000
625500
626000
626500
7280500
7280000
7279500
7279000
7278500
Sarita Este
Desierto I
N
cascadero
Legend
Copper - ppm
19 - 24
25 - 49
50 - 99
100 - 199
200 - 737
High : 737
Low : 19
road, unpaved
trail
Concessions
Cu ppm Histogram
Count
Percent
PPM
19.00
737.00
Cascadero Copper Corporation
Sarita Este Gold Prospect
Copper Soil Geochemistry
Sarita Este and Desierto I Cateos
WGS 1984 UTM Zone 19S
Scale - 1:10,000; Contour Interval - 5 metres
Drawn by Andrew Wilkins - Lithos Geological Inc.
0
125
250
500
750
1,000
Meters

Figure 9.15



cascadero
N
Legend
Lead - ppm
1 - 49
50 - 99
100 - 199
200 - 399
400 - 2110
High : 2110 ppm
Low : 1 ppm
road, unpaved
trail
Concessions
Pb ppm Histogram
Count
Percent
PPM
1.00
2110.00
Sarita Este
Desierto I
624500
625000
625500
626000
626500
7280500
7280000
7279500
7279000
7278500
0
125
250
500
750
1,000
Meters
Cascadero Copper Corporation
Sarita Este Gold Prospect
Lead Soil Geochemistry
Sarita Este and Desierto I Cateos
WGS 1984 UTM Zone 19S
Scale - 1:10,000; Contour Interval - 5 metres
Drawn by Andrew Wilkins - Lithos Geological Inc.

Figure 9.16



cascadero
Legend
Zinc - ppm
86 - 99
100 - 199
200 - 399
400 - 799
800 - 1392
High : 1392
Low : 86
road, unpaved
trail
Concessions
Zn ppm Histogram
Sarita Este
Desierto I
Cascadero Copper Corporation
Sarita Este Gold Prospect
Zinc Soil Geochemistry
Sarita Este and Desierto I Cateos
WGS 1984 UTM Zone 19S
Scale - 1:10,000; Contour Interval - 5 metres
Drawn by Andrew Wilkins - Lithos Geological Inc.
Meters
0 125 250 500 750 1,000
624500 625000 625500 626000 626500
7280500 7280000 7279500 7279000 7278500

Figure 9.17

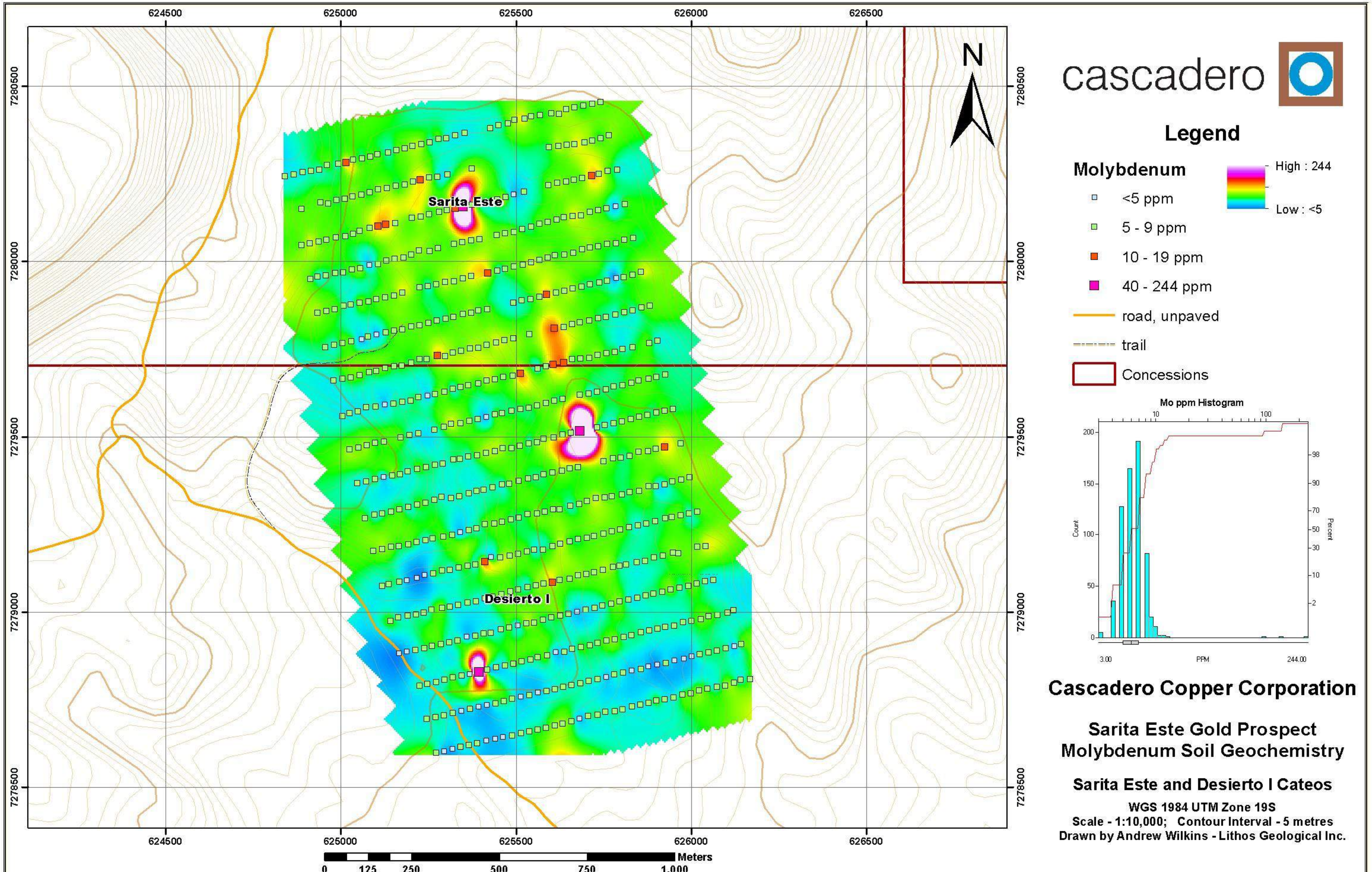
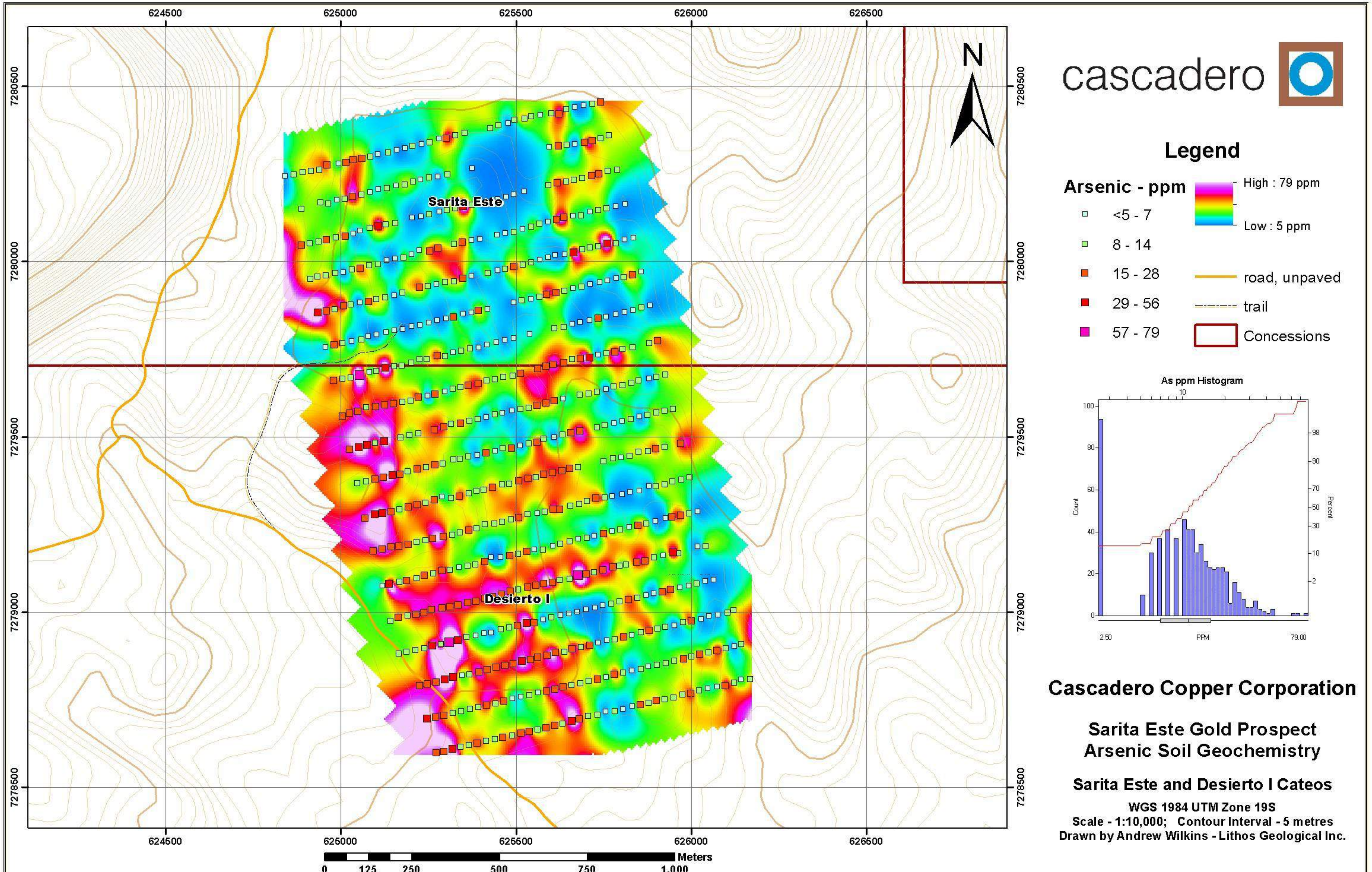

cascadero
Legend
Molybdenum
<5 ppm
5 - 9 ppm
10 - 19 ppm
40 - 244 ppm
road, unpaved
trail
Concessions
High : 244
Low : <5
Mo ppm Histogram
Count
Percent
PPM
3.00
244.00
Sarita Este
Desierto I
N
624500
625000
625500
626000
626500
7280500
7280000
7279500
7279000
7278500
Meters
0
125
250
500
750
1,000
Cascadero Copper Corporation
Sarita Este Gold Prospect
Molybdenum Soil Geochemistry
Sarita Este and Desierto I Cateos
WGS 1984 UTM Zone 19S
Scale - 1:10,000; Contour Interval - 5 metres
Drawn by Andrew Wilkins - Lithos Geological Inc.

Figure 9.18



cascadero
Legend
Arsenic - ppm
<5 - 7
8 - 14
15 - 28
29 - 56
57 - 79
High : 79 ppm
Low : 5 ppm
road, unpaved
trail
Concessions
As ppm Histogram
Count
Percent
PPM
Sarita Este
Desierto I
Cascadero Copper Corporation
Sarita Este Gold Prospect
Arsenic Soil Geochemistry
Sarita Este and Desierto I Cateos
WGS 1984 UTM Zone 19S
Scale - 1:10,000; Contour Interval - 5 metres
Drawn by Andrew Wilkins - Lithos Geological Inc.
Meters
0 125 250 500 750 1,000
624500 625000 625500 626000 626500
7278500 7279000 7279500 7280000 7280500

Figure 9.19

10 Drilling

No drilling has occurred on the Sarita Este concession.

11 Sample Preparation, Analyses and Security

During the 2017 exploration program, all geological and geochemical field stations and sample locations were recorded using a hand-held Garmin Global Positioning System (GPS instrument). Rock, soil and chip samples that were collected were placed in individual plastic bags and sealed with zap straps. Numbered sample tags were placed in the bags before sealing. Samples were driven back to the town of Tolar Grande at the end of each day, placed in rice bags and sealed. Samples were then delivered about every week by truck to the Cascadero office in Salta. The samples were then transferred to a courier truck to be delivered to the Alex Stewart Lab in Mendoza, Argentina. Rock and soil samples were analyzed using a four acid digestion and multispectral induced coupling plasma (ICP-MS) for 42 elements and fire assay atomic absorption for gold by the Alex Stewart Lab in in Mendoza, Argentina. The Alex Stewart Lab is an accredited lab for the preparation and physical-chemical analysis of mineral samples (ISO 9001-2015 and ISO 14001-2015 designation). The lab is independent of Cascadero Copper Corporation.

The author of this report is satisfied that the Sarita Este geochemical samples were obtained, transported and analysed appropriately, with sufficient attention to security, handling and reporting for the purposes intended.

12 Data Verification

Most of both the historic sampling and the 2017 sampling have been prospecting grab samples of mineralized veins and alteration. The author has resampled some of the historic samples and the current results are consistent with reported historic sampling. Table 12.1 shows results of repeated sampling.

Table 12.1 - Sample Repeats

Sample	Sample #	Au (ppb)	Ag (ppm)	Cu (ppm)	Pb (ppm)	Zn (ppm)	As (ppm)	Mo (ppm)
Historic	BR5491	30900	3.03	1119.50	631.07	654.20	150.80	16.94
Resample	1532165	12460	1.00	1278.00	550.00	582.00	144.00	18.00
Historic	LR1307	23800	1.31	121.50	65.24	171.00	82.10	196.86
Resample	1532058	9820	1.70	51.00	54.00	251.00	23.00	85.00
Historic	RT2728	4747	3.46	90.12	67.26	160.90	50.40	17.56
Resample	1532094	1820	3.70	121.00	117.00	533.00	76.00	61.00
Historic	AF 9708	4	11.00	2836.19	1.30	289.50	25.50	0.45
Resample	1532161	<10	<0.5	2598.00	<2	280.00	33.00	2.00
Historic	74280	<10	<0.5	22.16	2.95	7.71	10.40	2.10
Resample	B00-228828	<10	10.00	31.00	9.00	4.00	8.00	4.00

The Sarita Este Property is still an early stage exploration project and no further data verification is necessary at this point. Sampling to date has demonstrated that there is gold in the Sarita Este system, however no conclusions can be made at this time as to the potential size and grade. Going forward, drilling and trenching is warranted and recommended; QA/QC protocols, including blanks, standards and duplicates would be appropriate in future drill and trenching programs.

13 Mineral Processing and Metallurgical Testing

No mineral processing or metallurgical testing has been conducted on the property.

14 Mineral Resource Estimates

No mineral resource estimates have been calculated on the property.

15 Adjacent Properties

The Property lies within a known mining region. Two copper-gold-molybdenum porphyry deposits occur nearby as well as numerous copper, gold, silver and uranium showings.

The Taca Taca Bajo copper-gold-molybdenum porphyry deposit is located 3.5 kilometres to the northeast of the Sarita Este Gold Zone. Taca Taca Bajo is currently being explored and considered for development by First Quantum Minerals Ltd. Copper mineralization was first discovered on the Taca Taca Bajo property in the mid-1960s. Between 1970 and 2008 the Taca Taca Bajo showing was explored by several companies including Falconbridge Argentina S.A., Gatro Argentina Minera S.A. (GAMSA), Corriente Resources, BHP Minerals, and Río Tinto Inc. Lumina Copper tested the extent of the porphyry mineralization between 2010 and 2012. The Taca Taca Bajo copper-gold-molybdenum porphyry deposit has a published indicated resource of 2.165 billion tonnes grading 0.44% copper, 0.013% molybdenum, and 0.08 grams per tonne gold (Sim et al., 2013). Mineralization is documented as Oligocene in age.

The Taca Taca Alto copper-gold-molybdenum porphyry is located 5 kilometres to the northwest of the Sarita Este Property. It was discovered around the same time as the Taca Taca Bajo Property. The Taca Taca Alto Property was explored by the Direccion General De Fabricaciones Militares (DGFM) now known as Servicio Geológico Minero Argentino (SEGEMAR - Argentine Government Geological Services) and private companies including Gencor, RTZ and BHP.

16 Other Relevant Data and Information

In recent years, assay labs have developed ultra-trace multispectral induced coupling plasma (ultra-trace ICP-MS) techniques with lower detection limits for pathfinder elements. For the 2017 program, it was decided to use a local lab, the Alex Stewart Lab in in Mendoza, Argentina, as opposed to shipping prepped samples to Vancouver, BC, Canada. It was thought that the Alex Stewart Lab had similar ultra-trace ICP-MS capabilities, but unfortunately this was not the case. This will not impact the recommendations for the Sarita Este Gold Zone as the mineralization is on surface, however in the future, a 4 acid digestion followed by ultra-trace ICP-MS is recommended as the lower detection limits of pathfinder elements may help in vectoring to potential hidden mineralization.

17 Interpretations and Conclusions

In the Sarita Este Zone, the gold in soil geochemistry anomaly coincides with the historic gold bearing rock samples and the recessive, weathered, limonite after pyrite-sericite-clay altered volcaniclastics with quartz veinlets. At surface, alteration appears to be patchy and structurally controlled. The soil anomalies follow the same map patterns as the mapped veins with azimuths of 165°, 105° and 040°, suggesting mineralization is structurally controlled and within conjugate structures.

The data suggests that the exploration target within the Sarita Este Zone is an intermediate sulphidation epithermal showing, specifically the areal extent of grey sericite-clay-limonite (phyllic) alteration, the vuggy habit of micro quartz veins and the abundance of stockwork fracturing and veining. The gold mineralization is believed to be related to a distal porphyry system, such as the Taca Taca Bajo porphyry system to the northeast or an additional porphyry system at depth.

The Sarita Este showing has near-term exploration potential for the discovery of a significant epithermal gold deposit close to surface. There is also the potential of finding a blind porphyry deposit at depth in the area.

The Stegosaurus Vein is a prominent feature traceable for 4.2 kilometres that trends southward onto the Desierto I concession. The vein is 1 to 20 metres wide. There is some sporadic mineralization in the vein and some of the parallel veins are mineralized. The veins could possibly represent the silicified zone above the boiling point in a low sulphidation gold silver deposit.

18 Recommendations

Follow up on the Sarita Este Zone is recommended in two phases (budget outlined in Table 12.1):

Phase one consists of 2,000 metres of trenching with concurrent mapping, sampling and spectrometer analysis of alteration minerals. Trenches should be oriented in a direction that will crosscut both the 165° and 106° vein and anomaly orientations (Figure 18.1).

Phase two is contingent on the results from phase one and would include 1,500 metres of diamond drilling, targeting the anomalies generated by the trenching program.

Table 18.1 - Proposed Budget

2018 - Phase 1 - 2,000 metre trenching program						
	Project Geologist	90	days	$ 850.00	per day	$ 76,500.00
	Geologist	90	days	$ 600.00	per day	$ 54,000.00
	4 Man sampling crew from Argentina	360	days	$ 300.00	per day	$ 108,000.00
	Excavator or Backhoe (100 metres per day)	600	hours	$ 100.00	per day	$ 60,000.00
	Tolar Grande - Room and Board (Excavator, Sampling and Geological crew)	720	mandays	$ 50.00	per manday	$ 36,000.00
	Assays	1000	samples	$ 40.00	per sample	$ 40,000.00
	Truck Rental x 2	180	days	$ 200.00	per day	$ 36,000.00
	Travel					$ 20,000.00
	Field Supplies, Equipment & Rentals					$ 15,000.00
	Final Report & Consulting					$ 25,000.00
Subtotal						**$ 470,500.00**
Contingency @ 20%						$ 94,100.00
Total Trenching and Sampling						**$ 564,600.00**
2018 Phase 2 - 1,500 metre drilling program						
	Drilling (all in)	1500	metres	$ 200.00	per metre	$ 300,000.00
	Project Geologist	50	days	$ 850.00	per day	$ 42,500.00
	Geologist	50	days	$ 600.00	per day	$ 30,000.00
	2 Man geotech and core cutting crew from Argentina	100	days	$ 300.00	per day	$ 30,000.00
	Tolar Grande - Room and Board (Geotech and Geological crew)	200	mandays	$ 50.00	per manday	$ 10,000.00
	Assays	750	samples	$ 40.00	per sample	$ 30,000.00
	Truck Rental	100	days	$ 200.00	per day	$ 20,000.00
	Travel					$ 15,000.00
	Field Supplies, Equipment & Rentals					$ 15,000.00
	Consulting and Final Report	100	hours	$ 85.00	per hour	$ 8,500.00
Subtotal						**$ 501,000.00**
Contingency @ 20%						$ 100,200.00
Total Drilling						**$ 601,200.00**
Total 2018 Exploration Program						**$ 1,165,800.00**

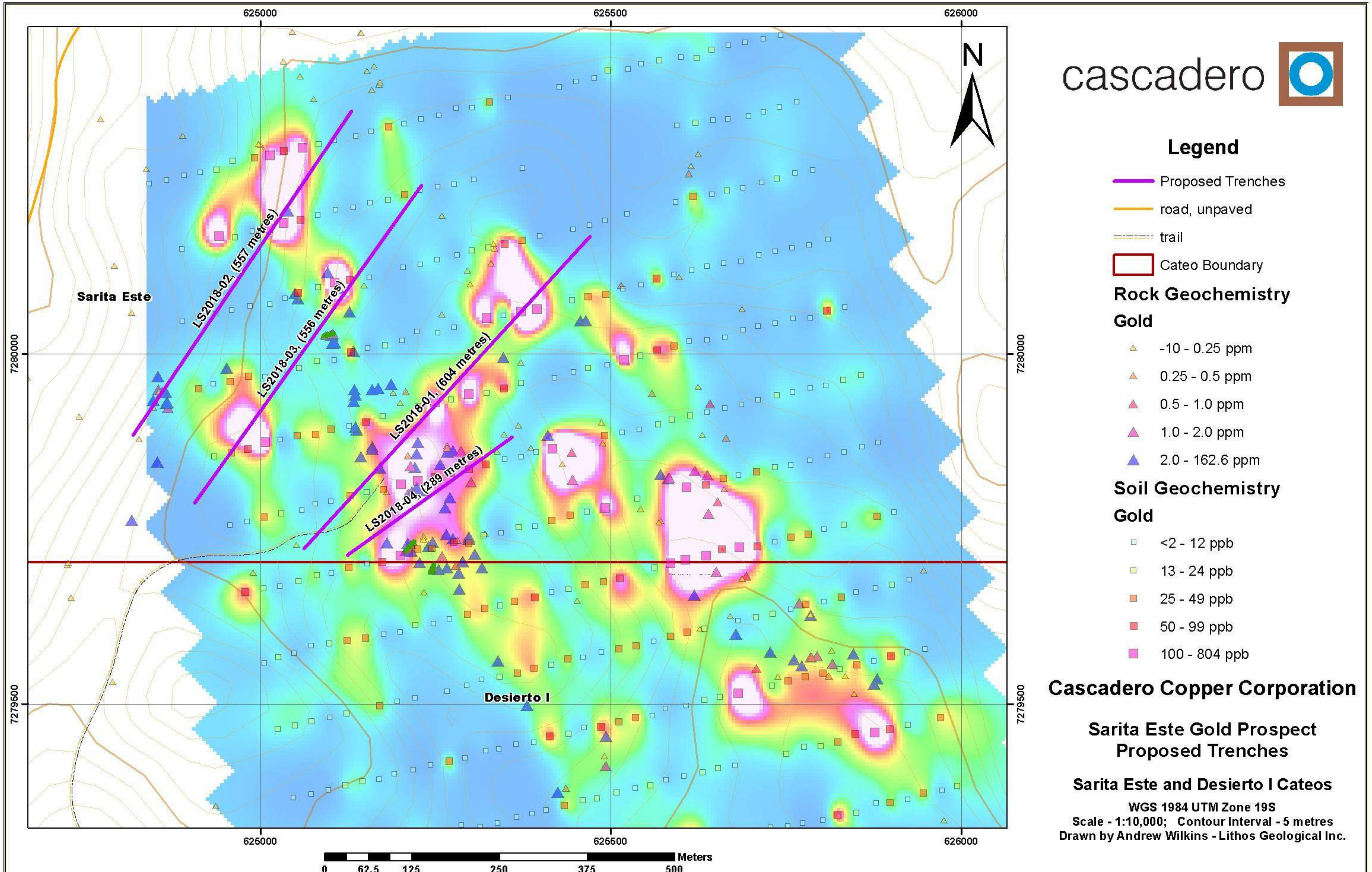

cascadero
Legend
Proposed Trenches
road, unpaved
trail
Cateo Boundary
Rock Geochemistry
Gold
-10 - 0.25 ppm
0.25 - 0.5 ppm
0.5 - 1.0 ppm
1.0 - 2.0 ppm
2.0 - 162.6 ppm
Soil Geochemistry
Gold
<2 - 12 ppb
13 - 24 ppb
25 - 49 ppb
50 - 99 ppb
100 - 804 ppb
Cascadero Copper Corporation
Sarita Este Gold Prospect
Proposed Trenches
Sarita Este and Desierto I Cateos
WGS 1984 UTM Zone 19S
Scale - 1:10,000; Contour Interval - 5 metres
Drawn by Andrew Wilkins - Lithos Geological Inc.
N
Sarita Este
Desierto I
LS2018-01, (604 metres)
LS2018-02, (557 metres)
LS2018-03, (556 metres)
LS2018-04, (289 metres)
625000
625500
626000
7280000
7279500
Meters
0
62.5
125
250
375
500

Figure 18.1

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Appendix 1 - Petrographic Report

PETROGRAPHIC REPORT ON 12 SAMPLES FROM CASCADERO COPPER COMPANY
SARITA ESTE PROPERTY, ARGENTINA

Report for: Cascadero Copper Corporation. Invoice 180001

Jan. 11, 2018.

SUMMARY:

Of the 12 samples submitted, 11 appear to be closely related, felsic volcanic/tuffaceous rocks of about rhyodacite composition (in some cases obscured by significant silicic alteration), and one sample is a granite, suggesting consanguinity. Samples may be roughly classified as follows:

Felsic volcanic (3 samples, 22-8828, AW 33, AW B187): rhyodacitic flow and hypabyssal intrusive? composed of phenocrysts of plagioclase (oligoclase altered to albite?), quartz (slightly resorbed, locally overgrown) and relict mafic (biotite ±hornblende?), microphenocrysts of ilmeno-magnetite, in groundmass of seriate plagioclase, quartz and relict mafics, significant interstitial K-spar.

Tuffaceous felsic volcanic (8 samples, 1532175, AW 25, AW 1, 228940, AW B99, AW B28, AW B26, Trench): rhyodacitic crystal-lapilli tuff composed of phenocrysts/crystal shards of plagioclase (oligoclase altered to albite, commonly hematite-stained), quartz (slightly resorbed, locally overgrown) and relict mafic (biotite ±hornblende?), microphenocrysts of ilmeno-magnetite, in groundmass of seriate plagioclase, quartz and relict mafics, significant interstitial K-spar; vaguely to locally well-defined lithic clasts mostly <1 cm in size vary slightly in grain size or composition (typically more Kspar-rich; locally rhyodacite clasts in dacite host?).

Granite (1 sample, 81558): hypidiomorphic-granular textured biotite granite composed of sub-equal amounts of Kspar, plagioclase and quartz with minor interstitial relict biotite sites, cut by significant vein network/breccia matrix of secondary quartz with minor copper-trace electrum? mineralization.

Alteration ranges from weak propylitic (sericite-chlorite-epidote with magnetite preserved, e.g. AW 33) to weak/moderate propylitic (albite-sericite-chlorite-epidote-calcite-rutile, e.g. AW 25) grading to weak/moderate phyllic (with increase in sericite, e.g. AW B99, 28, 26), but the most important alteration appears to be phyllic/silicic with gradation towards argillic (with addition of clay?-quartz-local possible jarosite?-trace alunite?), e.g. 228940, AW 1 and Trench samples, or intense silicic (major quartz addition in form of pervasive replacement and/or veinlets, stockworks or breccia matrix, e.g. 22-8828, AW B187, veined portion of 81558). It is only with this last alteration that any remnant (largely oxidized) sulfides occur, namely cubic casts after pyrite in Trench sample, or malachite-limonite (hematite/goethite) likely after chalcopyrite in 81558, the granite sample (which may contain a trace of possible electrum, although this highly tentative identification requires SEM confirmation).

Capsule descriptions are as follows:

22-8828: intensely silicified felsic (originally quartz-feldspar ±mafic phyric), brecciated volcanic (matrix of secondary quartz-hematite) further cut by network of vuggy, limonite-stained sericite-trace Fe calcite fractures lacking visible evidence of gold.

1532175: weakly to locally moderately phyllic (sericite ±rutile) altered quartz-feldspar-biotite phyric felsic volcanic (rhyodacite?); alteration appears related to local irregular fractures with limonite (mainly goethite).

AW 25: weakly to locally moderately propylitic (hematite-stained albite, sericite-chlorite-epidote-carbonate ±hematite, rutile) altered quartz-feldspar-biotite-hornblende (?) phyric felsic volcanic (rhyodacite?). It may have been fragmental or volcaniclastic.

AW 33: weakly propylitic (sericite-chlorite-epidote ± rutile, hematite) altered quartz-feldspar-biotite-hornblende (?) phyric felsic rock (rhyodacite?), possibly hypabyssal in origin.

AWB 187: intensely silicified, accessory hematite-rutile altered quartz-probable feldspar/mafic phyric volcanic/tuffaceous rock likely consanguineous with AW 25 and 33; it shows evidence such as small drusy vugs and semi-perlitic cracking suggestive of significant volume loss during alteration.

81558: medium-grained biotite granite intrusive altered to hematite-stained albite-quartz-Kspar?-sericite-hematite-rutile in association with vein/breccia matrix of secondary quartz-malachite-limonite (after chalcopyrite?)-trace possible electrum (?).

AW 1: fragmental felsic volcanic composed of clay?-sericite-quartz altered, possibly originally rhyodacite clasts in (dacite?) host composed of closely packed relict (sericite, hematite-stained, albite altered), quartz and relict biotite (altered to sericite-rutile) and Fe-Ti oxide (now rutile) phenocrysts in groundmass altered to sericite.

228940: plagioclase-quartz-biotite phyric felsic volcanic (tuffaceous rhyodacite?) strongly phyllic/argillic altered to clay?/sericite-quartz-hematite-albite? ±Kspar-rutile in association with veins of clay?/sericite-jarosite?-hematite.

AW B99: weakly to locally moderately propylitic/phyllic (albite-sericite-chlorite-carbonate ±epidote-rutile) altered quartz-feldspar-biotite-amphibole phyric felsic volcanic (rhyodacite?), related to local irregular carbonate (dolomite?)-rare quartz veinlets.

AW B28: weakly propylitic/phyllic (albite-sericite-carbonate-chlorite ± rutile, hematite) altered quartz-feldspar-biotite (?) phyric, fragmental felsic volcanic (rhyodacite crystal-lapilli tuff?).

AW B26: weakly propylitic/phyllic (albite-sericite-carbonate-chlorite ± rutile, hematite) altered quartz-feldspar-biotite (?) phyric, fragmental felsic volcanic (rhyodacite crystal-lapilli tuff?).

Trench: weakly propylitic/phyllic grading to argillic (albite-clay?-sericite-carbonate-chlorite ± rutile, alunite?) altered quartz-feldspar-biotite (?) phyric, fragmental felsic volcanic (rhyodacite crystal-lapilli tuff?).

Detailed petrographic description and photomicrograph are appended (on CD/by email attachment). If you have any questions regarding the petrography, please do not hesitate to contact me.

22-8828: INTENSELY SILICIFIED FELSIC (ORIGINALLY QUARTZ-FELDSPAR ±MAFIC PHYRIC), BRECCIATED VOLCANIC (MATRIX OF SECONDARY QUARTZ-HEMATITE) FURTHER CUT BY NETWORK OF VUGGY, LIMONITE-STAINED SERICITE-TRACE FE CALCITE FRACTURES LACKING VISIBLE EVIDENCE OF GOLD

Hand sample shows brecciated felsic (quartz-feldspar phyric) volcanic rock composed of ~50% pale buff-coloured subangular to angular clasts up to 2.5 cm in diameter set in aphanitic, reddish-purple (hematitic) matrix, locally cut by a network of thin, pale orange-brown (limonitic), slightly vuggy fractures. The matrix thus appears to be largely of secondary, hydrothermal origin rather than merely a primary volcanic feature. The rock is not magnetic, shows minor reaction to cold dilute HCl (in the fracture network only), and no stain for K-feldspar (but extensive white etch for plagioclase) in the etched offcut. Modal mineralogy in polished thin section is approximately:

Quartz (secondary, after feldspar phenocrysts, breccia matrix)	50%
Quartz (primary, phenocrysts)	13%
Plagioclase (groundmass of clasts only, albitic?)	30%
Sericite (white mica, limonite stained, in fracture network)	3%
Hematite (mainly matrix; local clast replacement)	2%
Voids/vugs (fracture network)	1%
Carbonate (Fe-calcite?), fracture network only	<1%
Rutile (after relict Ti-oxide microphenocryst sites)	<1%

This section reveals an intensely silicified rock, in which the clasts consist of quartz-relict feldspar phyric felsic volcanic (feldspars completely replaced by secondary quartz, local possible mafics by quartz and hematite), set in a mainly secondary, likely hydrothermal, matrix of secondary quartz-hematite, in turn cut by a vuggy fracture network of sericite-Fe calcite-limonite.

Clasts consist of about 15% quartz phenocrysts or shards (broken, sub- to rarely euhedral, up to 1.6 mm in maximum dimension with local resorption features, locally veined by or with common secondary quartz overgrowths up to 0.2 mm thick), perhaps 20-25% relict feldspar (?) sites (sub- to euhedral outlines mainly <1 mm, now totally replaced by fine-grained secondary quartz as interlocking anhedra in the 10 µm to 0.12 mm range), <10% relict mafic (?) sites (sub- to locally euhedral outlines mainly <1 mm long, now totally replaced by secondary quartz as above plus hematite as subhedra mainly <15 µm) and <1% relict Fe-Ti oxide microphenocryst sites (replaced by accessory rutile/leucoxene as minute sub/euhedra in the 5-15 µm size range) in a groundmass of minutely crystalline plagioclase (randomly oriented, interlocking anhedra mainly <10 µm, possibly mixed with secondary quartz of similar size). Negative relief of plagioclase-rich areas compared to primary and secondary quartz suggests it may be albitic in composition (likely secondary also). Locally, thin (<0.3 mm) veinlets of hematite-secondary quartz cut the clasts (offshoots of the matrix0.

The largely secondary, hydrothermal matrix consists mainly of very fine-grained quartz (interlocking, subhedral crystals mainly <50 µm, but difficult to separate from larger crystals that probably mostly represent comminuted quartz phenocrysts; finer-grained quartz may also in part be from comminuted clasts), plus significant accessory hematite (euhedral plates rarely over 0.1 mm, but locally in aggregates with subhedral outlines up to 0.5 mm across). This original secondary quartz/hematite breccia matrix has been re-opened locally by the vuggy fracture network of orange-brown limonite-stained sericite or white mica (sub/euhedral flakes either mostly <25 µm or up to 0.15 mm in diameter), with local minor carbonate (subhedra <0.1 mm, probably Fe-calcite to judge by the limonite and the rapid reaction to HCl in hand specimen). Voids due to plucking during section preparation) and/or vugs associated with this network are angular, up to 4 mm across. Very rare traces of pyrite (shards <25 µm) are associated with the network, but no gold particles were located.

In summary, this is intensely silicified felsic (originally quartz-feldspar ±mafic phyric), brecciated volcanic (matrix of secondary quartz-hematite) further cut by network of vuggy, limonite-stained sericite-trace Fe calcite fractures lacking visible evidence of gold.

1532175: WEAKLY TO LOCALLY MODERATELY PHYLLIC (SERICITE ±RUTILE) ALTERED QUARTZ-FELDSPAR-BIOTITE PHYRIC FELSIC VOLCANIC (RHYODACITE?); ALTERATION APPEARS RELATED TO LOCAL IRREGULAR FRACTURES WITH LIMONITE (MAINLY GOETHITE)

Hand specimen shows pale orange-brown (limonite stained) fine-grained felsic-looking (quartz-feldspar phyric) volcanic or possibly volcaniclastic rock, cut by local black (Mn-oxide stained?) short discontinuous fractures. The rock is not magnetic, and shows no reaction to cold dilute HCl, but there is extensive stain for K-feldspar in the etched offcut (mainly groundmass; white etch reveals plagioclase phenocrysts). Modal mineralogy in polished thin section is approximately:

Plagioclase (phenocrysts, partly sericitized oligoclase-albite?)	30%
K-feldspar (groundmass only, primary?)	30%
Quartz (phenocrysts, possible groundmass?)	20%
Sericite, white mica (after plagioclase, biotite?)	15%
Limonite (goethite, after Fe-Ti oxides, possible pyrite?)	3-5%
Relict biotite	<1%
Rutile/leucoxene	<1%

This sample consists of about 35-40% relict (sericitized) plagioclase, 15% quartz and 5-10% relict (sericite-limonite ±rutile altered) biotite phenocrysts with somewhat seriate (progressively size-graded) texture set in an aphanitic groundmass of K-feldspar, local variations in which may suggest clasts and thus a tuffaceous or volcaniclastic origin (such clasts have elongated outlines to 3 mm long, parallel to weakly defined alignment of feldspar crystals, suggesting they could be fiamme?).

Relict plagioclase phenocrysts have mainly euhedral tabular to lath-shaped outlines up to almost 2 mm long (but grading to smaller crystals <0.25 mm in the groundmass), locally somewhat aligned to impart weak trachytic texture. They are typically 15-30% replaced by sericite as randomly oriented sub/euhedral flakes mostly <25 µm in size, but locally in patches or aggregates with irregular outlines <0.5 mm, mainly at relict crystal cores and/or highlighting former zoning in the crystals. Composition of the plagioclase appears to be about oligoclase to albite (core to rim) based on extinction Y^010 up to 13º; some smaller crystals may be albitized, to judge by the sericitization.

Quartz phenocrysts display rounded subhedral to rarely euhedral outlines mostly <1.5 mm (rarely to 2 mm where broken, glomeratic in nature) with local minor resorption features and very narrow (<20 µm) overgrowth rims. The crystals are essentially unstrained.

Relict biotite occurs as randomly oriented, mostly euhedral flakes or booklets <0.5 mm in diameter that have been interleaved by or pseudomorphed by white mica as similar-sized, euhedral flakes mixed with variable amounts of orange-brown, amorphous limonite (goethite?) and traces of rutile/leucoxene (minute subhedra <15 µm). Minor smaller <0.2 mm) mafic relics with rounded outlines locally display relict cleavage suggestive of former possible amphibole (?).

The groundmass consists of closely packed, small, seriate-textured crystals of all the above (plagioclase partly altered to sericite, quartz, biotite altered to white mica) plus microphenocrysts of Ti oxides (euhedral outlines <0.2 mm, now converted to rutile/leucoxene as above), set in aphanitic Kspar (individual microlites barely visible at <15 µm; probably includes some quartz of similar or finer grain size).

The irregular fracture networks are centered on sub-planar, open fractures mainly <0.1 mm thick, but spread out variably to almost 1 cm across, marked by central concentrations of opaque that appears to be mostly limonite (dark red-brown colour at thin edges suggests goethite?) although Mn-oxides could be present, surrounded by a paler-coloured stain of transported limonite associated with increased sericite alteration pervasively replacing the rock. It is not clear whether the opaque limonite is after former Fe-Ti oxides or possibly locally Fe-sulfides such as pyrite (?).

In summary, this is weakly to locally moderately phyllic (sericite ±rutile) altered quartz-feldspar-biotite phyric felsic volcanic (rhyodacite?); alteration appears related to local irregular fractures with limonite (mainly goethite).

AW 25: WEAKLY TO LOCALLY MODERATELY PROPYLITIC (HEMATITE-STAINED ALBITE, SERICITE-CHLORITE-EPIDOTE-CARBONATE ±HEMATITE, RUTILE) ALTERED QUARTZ-FELDSPAR-BIOTITE-HORNBLENDE (?) PHYRIC FELSIC VOLCANIC (RHYODACITE?), POSSIBLY FRAGMENTAL OR VOLCANICLASTIC

Hand specimen shows what appears to be salmon-pink/grey felsic volcanic (quartz, hematite stained feldspar, small dark green/black relict mafic crystals set in a variable-textured groundmass suggestive of fragmental origin?), altered to pale greenish epidote (?) and local calcite, cut by local black (Mn-oxide?) fractures. The rock is not magnetic, shows scattered minor reaction to cold dilute HCl, and pervasive yellow stain for K-feldspar in the groundmass of the etched offcut (pink feldspar phenocrysts etch white for plagioclase). Modal mineralogy in polished thin section is approximately:

Plagioclase (phenocrysts, weakly saussuritized hematite-stained albite?)	40%
K-feldspar (groundmass only, primary?)	20%
Quartz (phenocrysts, possible groundmass?)	20%
Sericite, white mica (after plagioclase, biotite?)	10%
Chlorite (after mafics, with white mica, epidote)	3-5%
Epidote (after mafics)	2-3%
Hematite (after Fe-Ti oxides?)	1-2%
Carbonate (mainly calcite, after mafics)	1-2%
Rutile/leucoxene	<1%

This sample consists of about 35-40% (saussuritized, hematized) plagioclase, 15% quartz and 10% relict (chlorite-epidote-sericite ±carbonate-rutile altered) mafic phenocrysts and seriate-textured crystals set in an aphanitic groundmass of K-feldspar, local variations in phenocryst content may suggest clasts and thus a tuffaceous or volcaniclastic origin (such clasts may have poorly defined outlines to 3 cm?).

Relict plagioclase phenocrysts have mainly euhedral tabular outlines up to almost 3 mm (but grading to smaller crystals <0.25 mm in the groundmass), mostly randomly oriented. They are typically 5-15% replaced by sericite (randomly oriented sub/euhedral flakes mostly <25 µm in size, but locally in patches or aggregates with irregular outlines <1 mm, mainly at relict crystal cores and/or highlighting former zoning in the crystals) locally with lesser epidote (subhedra <0.1 mm) and carbonate (anhedra <0.1 mm, likely calcite). Composition of the plagioclase appears to be about albite based on extinction Y^010 up to 15º; likely secondary, to judge by the saussuritization and hematite staining (minute particles <3 µm) typical of albitization.

Quartz phenocrysts display rounded subhedral, broken to rarely euhedral outlines mostly <2 mm (rarely to 3 mm where glomeratic), with local minor resorption features and very narrow (<20 µm) overgrowth rims. The crystals are essentially unstrained.

Relict mafics (biotite, hornblende?) occur as randomly oriented, mostly euhedral crystals up to 1.5 mm long. The former (biotite?) are replaced by chlorite (subhedral flakes <0.2 mm with distinct green pleochroism, length-slow anomalous blue/grey birefringence suggestive of Fe:Fe+Mg, or F:M, ratio about 0.6?) and white mica as similar-sized, euhedral flakes mixed with minor epidote (subhedra <0.15 mm) and traces of rutile/leucoxene (minute subhedra <15 µm). The latter (amphibole?) occurs in slender lath-like pseudomorphs up to .2 mm long replaced by variable combinations of chlorite, epidote (sub/euhedra to ~1 mm with yellow pleochroism indicative of high Fe content) and carbonate (ragged subhedra to 0.25 mm, possibly dolomite or calcite?).

The groundmass consists of closely packed, small, seriate-textured crystals of all the above (plagioclase partly altered to sericite; quartz; biotite altered as above) plus microphenocrysts of Fe-Ti oxides (euhedral outlines <0.2 mm, replaced by hematite as sub/euhedral plates to 0.1 mm, lesser rutile/leucoxene as above), set in aphanitic Kspar (individual microlites barely visible at <15 µm; probably includes some quartz of similar or finer grain size).

In summary, this is weakly to locally moderately propylitic (hematite-stained albite, sericite-chlorite-epidote-carbonate ±hematite, rutile) altered quartz-feldspar-biotite-hornblende (?) phyric felsic volcanic (rhyodacite?). It may have been fragmental or volcaniclastic.

AW 33: WEAKLY PROPYLITIC (SERICITE-CHLORITE-EPIDOTE ± RUTILE, HEMATITE) ALTERED QUARTZ-FELDSPAR-BIOTITE-HORNBLENDE (?) PHYRIC FELSIC, PROBABLY HYPABYSSAL ROCK (RHYODACITE?)

Hand specimen shows pale pinkish-grey felsic volcanic (quartz, plagioclase, small dark green/black relict mafic phenocrysts set in fine-grained groundmass) suggestive of volcanic (or hypabyssal?) origin, relatively fresh (unaltered), cut by rare thin orange-brown (limonitic) fractures. The rock is distinctly magnetic, shows no reaction to cold dilute HCl, and pervasive yellow stain for K-feldspar in the groundmass of the etched offcut; feldspar phenocrysts etch white for plagioclase. Modal mineralogy in polished thin section is approximately:

Plagioclase (phenocrysts, weakly saussuritized oligoclase-andesine?)	40%
K-feldspar (groundmass only, primary?)	25%
Quartz (phenocrysts, groundmass)	20%
Sericite, white mica (after plagioclase)	5%
Chlorite (after biotite, with epidote)	5%
Epidote (after biotite, rarely plagioclase)	2-3%
Magnetite (slightly altered to hematite)	2-3%
Rutile/leucoxene	<1%

This sample consists of about 30-35% saussuritized plagioclase, 15% quartz ,10% relict (chlorite-epidote ±rutile altered) biotite and 2% magnetite phenocrysts, plus smaller seriate-textured crystals set in fine-grained groundmass of Kspar-quartz-trace sericite-opaques.

Relict plagioclase phenocrysts have mainly euhedral tabular outlines up to almost 3 mm (but grading in seriate fashion to smaller crystals <0.25 mm in the groundmass), mostly randomly oriented. They are typically 5-25% replaced by sericite (randomly oriented sub/euhedral flakes mostly <25 µm in size, but locally in patches or along fractures, or locally minor epidote (subhedra <0.15 mm). The plagioclase crystals show vague, weakly oscillatory zoning, with relict primary composition about oligoclase-andesine based on extinction Y^010 typically <10º but locally up to 20º.

Quartz phenocrysts display rounded subhedral, broken to rarely euhedral outlines mostly <2 mm (rarely to 3 mm where glomeratic), with well-developed, major resorption features but only local narrow (<100 µm) overgrowth rims. The crystals are essentially unstrained.

Relict mafic (mainly biotite?) phenocrysts occur as randomly oriented, mostly euhedral crystals up to 1.5 mm long (some biotite may be secondary after hornblende, partly further altered to the typical chlorite-epidote). Relict biotite forming subhedral flakes to 0.6 mm with greenish-brown pleochroism is visible in some relicts, variably replaced by chlorite (subhedral flakes <0.2 mm with distinct green pleochroism, length-slow anomalous blue/grey birefringence suggestive of F:M ~0.6?) and epidote (subhedra <0.5 mm with strong yellow pleochroism indicative of high Fe content) plus accessory rutile/leucoxene (aggregates to 0.3 mm of subhedra <35 µm). The possible hornblende relics form more tabular subhedra up to .2 mm long replaced by variable combinations of secondary biotite, chlorite, epidote (sub/euhedra to 0.75 mm also with yellow pleochroism indicative of high Fe content) and accessory Fe-Ti oxides (magnetite as subhedra to 0.25 mm, similar to that described below).

The groundmass consists of closely packed, small, seriate-textured crystals of all the above (plagioclase partly altered to sericite; quartz; biotite altered as above) plus microphenocrysts of magnetite (euhedral outlines <0.6 mm, locally slightly replaced by hematite as minute sub/euhedra <25 µm), set in a matrix of fine-grained quartz as sub/anhedra rarely to 0.1 mm, interstitial Kspar (mostly <65 µm) and traces of sericite and rutile (both mostly <20 µm). No fractures or veinlets were seen in the section.

In summary, this is weakly propylitic (sericite-chlorite-epidote ± rutile, hematite) altered quartz-feldspar-biotite-hornblende (?) phyric felsic rock (rhyodacite?), possibly hypabyssal in origin.

AWB 187: INTENSELY SILICIFIED, ACCESSORY HEMATITE-RUTILE ALTERED QUARTZ-PROBABLE FELDSPAR/MAFIC PHYRIC VOLCANIC OR TUFFACEOUS ROCK LIKELY CONSANGUINEOUS WITH AW 25 AND 33; IT SHOWS EVIDENCE SUCH AS SMALL DRUSY VUGS AND SEMI-PERLITIC CRACKING SUGGESTIVE OF SIGNIFICANT VOLUME LOSS DURING ALTERATION

Hand specimen shows pale grey/slightly pinkish, fine-grained, siliceous felsic volcanic (quartz, small dark relict mafic phenocrysts set in fine-grained silicified-looking groundmass with local small relict lithic clasts?), suggestive of tuffaceous volcanic origin, with common small drusy vugs (?) and cut by rare thin orange-brown (limonitic) fractures. The rock is not magnetic, shows no reaction to cold dilute HCl, and no stain for K-feldspar in the etched offcut; feldspar phenocrysts etch white for plagioclase. Modal mineralogy in polished thin section is approximately:

Quartz (secondary, replacing feldspars, mafics)	60%
Plagioclase (relict, fine-grained, groundmass only)	20%
Quartz (primary phenocrysts)	15%
Hematite (secondary, after mafic sites with rutile/leucoxene)	1-2%
Rutile/leucoxene	1-2%
Voids/vugs (drusy, some due to plucking?)	1-2%
Sericite	trace

This is a relict, intensely silicified volcanic/hypabyssal rock similar to the previous four samples, in which only quartz phenocrysts have survived relatively unchanged; both former feldspar and former mafic sites are largely replaced by quartz, or quartz-hematite-rutile-trace sericite in the latter case. Veinlets and fractures are not well developed; the silicification is mainly pervasive, making recognition of possible former lithic clasts difficult.

Quartz phenocrysts display rounded subhedral, broken to rarely euhedral outlines mostly <2.5 mm, with well-developed, major resorption features and local discontinuous (up to 0.2 mm thick) overgrowth rims. The crystals are essentially unstrained but locally may be recrystallized to multiple sub-domains (<1 mm) or cut by micro-veinlets <50 µm thick of secondary quartz similar to that in the adjacent highly silicified groundmass.

Presumed relict feldspar (plagioclase?) sites have irregular anheddral to rarely subhedral outlines mostly <2.5 mm long, now completely replaced by fine-grained secondary quartz as tightly interlocking, randomly oriented sub/anhedral crystals mainly in the <20 µm to 0.15 mm size range. The larger crystals are commonly associated with or line the margins of vugs or voids up to 1.5 mm across. The vugs may be related to volume changes due to leaching/removal of alkalis during the intense silicification.

Presumed relict mafic sites of similar size and shape are distinguished from feldspar sites mainly by the presence of fine-grained opaques (hematite as sub- to locally euhedral crystals <30 µm, partly in elongated, micro-veinlet like aggregates up to 0.1 mm thick, and variable rutile or leucoxene as aggregates to 1.5 mm long of minute crystallites commonly <5 µm in size. Small aggregates of hematite and rutile with sub- to euhedral outlines mostly <0.3 mm, in the adjacent groundmass, are reminiscent of Fe-Ti oxide microphenocrysts in less altered rocks of this suite.

The groundmass is typically so fine-grained and featureless that it resists microscopic identification. Gradation between secondary quartz in the <50µm to 0.1 mm size range replacing the former phenocryst sites to randomly oriented sub/anhedra in the <5 to 25 µm range is common, making distinction between quartz and plagioclase presumed in the groundmass from the white etch in the offcut difficult. A closely spaced (commonly <0.2 mm) system of curving, semi-perlitic fractures emphasizes the highly silicified nature of the sample.

In summary, this is intensely silicified, accessory hematite-rutile altered quartz-probable feldspar/mafic phyric volcanic/tuffaceous rock likely consanguineous with AW 25 and 33; it shows evidence such as small drusy vugs and semi-perlitic cracking suggestive of significant volume loss during the alteration.

81558: MEDIUM-GRAINED BIOTITE GRANITE INTRUSIVE ALTERED TO HEMATITE-STAINED ALBITE-QUARTZ-KSPAR?-SERICITE-HEMATITE-RUTILE IN ASSOCIATION WITH VEIN/BRECCIA MATRIX OF SECONDARY QUARTZ-MALACHITE-LIMONITE (AFTER CHALCOPYRITE?)-TRACE POSSIBLE ELECTRUM (?)

Hand specimen shows salmon-pink/brick red altered felsic igneous rock (quartz, hematite stained plagioclase, K-feldspar, probable relict mafics?), possibly plutonic, cut by intense grey quartz-minor malachite stained vein or breccia zone up to ~3 cm thick. The rock is not magnetic, and shows no reaction to cold dilute HCl, but pervasive yellow stain for K-feldspar in the groundmass of the etched offcut (pink feldspar phenocrysts etch white for plagioclase). Modal mineralogy in polished thin section is approximately:

K-feldspar (groundmass/matrix, primary and secondary?)	30%
Plagioclase (phenocrysts, locally sericitized hematite-stained albite?)	20%
Quartz (primary crystals, partly recrystallized)	20%
(secondary, vein/breccia matrix)	20%
Sericite, white mica (after plagioclase, biotite?)	3-5%
Limonite (after chalcopyrite; vein/breccia matrix only)	2%
Malachite (after chalcopyrite; vein/breccia matrix only)	2%
Hematite (wallrock, after magnetite, traces of which remain)	1%
Rutile (mixed with hematite)	1%

This sample is distinctly hypidiomorphic-granular (plutonic) in character, composed of quartz, plagioclase and relict altered mafic sites (white mica-opaque oxides) plus abundant interstitial Kspar. It is cut by a well-developed vein network/breccia matrix of secondary quartz mineralized with limonite-malachite (likely after chalcopyrite?).

In the altered wallrock, plagioclase occurs as randomly oriented, tabular sub/euhedral crystals mostly <3 mm (locally glomeratic, up to 0.5 cm long in etched offcut). They are typically strongly "dusted' by minute (1-2 µm) particles of hematite and clay (?), imparting the salmon-pink colour in hand specimen, and are likely secondary albite in composition (based on relief negative compared to adjacent quartz and extinction on 010 up to 17º, implying $An_{0\text{-}5}$. Minor variable sericite (randomly oriented to aligned subhedral flakes mainly <70 µm) locally affects the plagioclase. Quartz occurs in irregular-shaped aggregates up to 5 mm across composed of interlocking sub/anhedra to ~3 mm, with minor strain indicated by weak undulose extinction, sub-grain development, and suturing of grain boundaries. Locally this quartz shows overgrowths replacing adjacent plagioclase, or grades into elongated, vein-like aggregates of secondary (partly recrystallized, sheared?) quartz that has been granulated to sub-domains <0.25 mm with stronger strain indicators. K-feldspar forms interlocking subhedra mainly <1.2 mm, but commonly aggregating to 3 mm; although it could be mostly primary, part could be of secondary origin, given the proximity to the well-developed vein system. Mafic relics are sparse, probable relict biotite sites with sub/euhedral shapes <1.5 mm (aggregates to ~3 mm) composed of interleaved white mica to ~1 mm and rutile/leucoxene (euhedra to 45 µm/<5 µm respectively) or limonite (mainly hematite, euhedral plates to 0.2 mm). Hematite also occurs as ragged subhedral aggregates to 0.5 mm with traces of remnant magnetite <50 µm at the cores.

In the vein/breccia, clasts of wallrock as described above but typically more altered to sericite occur in matrix of secondary quartz (interlocking, randomly oriented, bladed subhedra mostly <0.5 mm, with moderate strain indicators) and minor oxide copper minerals (malachite and limonite, likely after chalcopyrite?). Malachite occurs in small aggregates to ~2 mm across composed of central dark/bright green pleochroic <0.5 mm subhedra surrounded by pale green, matted microcrystalline (<25 µm) material or locally minor sericite (also matted flakes, <15 µm), associated with limonite as aggregates to ~1 mm of microcrystalline hematite surrounded by goethite, rarely with attached grains of possible electrum (?) <30 µm in size (require SEM confirmation).

In summary, this is medium-grained biotite granite intrusive altered to hematite-stained albite-quartz-Kspar?-sericite-hematite-rutile in association with vein/breccia matrix of secondary quartz-malachite-limonite (after chalcopyrite?)-trace possible electrum (?).

AW 1: FRAGMENTAL FELSIC VOLCANIC COMPOSED OF CLAY?-SERICITE-QUARTZ ALTERED, POSSIBLY ORIGINALLY RHYODACITE CLASTS IN (DACITE?) HOST COMPOSED OF CLOSELY PACKED RELICT (SERICITE, HEMATITE-STAINED, ALBITE ALTERED), QUARTZ AND RELICT BIOTITE (ALTERED TO SERICITE-RUTILE) AND FE-TI OXIDE (NOW RUTILE) PHENOCRYSTS IN GROUNDMASS ALTERED TO SERICITE

Hand specimen shows bright salmon-pink, fine-grained quartz phyric volcanic rock with scattered small (<1 cm) sub-rounded white patches that could be clasts, indicating a fragmental rock? (this is supported by the fact that they stain faint yellow for Kspar in the etched offcut, and are more readily scratched by steel than the host rock). The rock is not magnetic, and shows no reaction to cold dilute HCl, but there is extensive white etch for plagioclase in the etched offcut. Modal mineralogy in polished thin section is approximately:

Plagioclase (relict sericitized, hematite-stained albite?)	45%
Quartz (primary phenocrysts, groundmass; minor secondary?)	20%
Sericite (after plagioclase, groundmass)	20%
Clay (?), mainly in clast groundmass (after feldspars?)	10%
K-feldspar (relict, clay altered?)	3%
Rutile/leucoxene (after Fe-Ti oxides)	1-2%

This sample consists of about 10-15% aphanitic clasts (quartz phyric, possibly original Kspar groundmass altered to clay?/sericite) in host rock containing about 30-35% relict plagioclase (sericitized, hematite-stained albite?), 15% quartz , and 10% small relict (sericite-rutile altered) biotite phenocrysts plus 1-2% rutile altered Fe-Ti oxide crystals in sericitized groundmass.

In the clasts, which have irregular, somewhat ellipsoid outlines <1 cm (1.5 cm in hand specimen), plagioclase crystals are either absent or have been so thoroughly sericitized to disappear into the clay? altered matrix, mafic and Fe-Ti oxide crystals are not seen, and quartz phenocrysts may be slightly smaller (<0.6 mm) and less abundant than in the host, suggesting they represent a different but closely related rock. Also, there are discontinuous microveinlets of secondary quartz (<50 µm thick) which connect to small voids or vugs mainly <0.5 mm across.

In the host rock, plagioclase occurs as randomly oriented, tabular sub/euhedral crystals mostly <2 mm. They are 5-25% replaced by sericite (randomly oriented to aligned subhedral flakes mainly <50 µm) and “dusted’ by minute (1-2 µm) particles of hematite and clay (?), imparting the salmon-pink colour in hand specimen. Composition is likely secondary albite, based on relief negative compared to adjacent quartz and extinction on 010 up to 15º, implying An_5. Quartz phenocrysts are unstrained, sub- to locally euhedral to 1.6 mm, with local resorbed textures and narrow overgrowths <75 µm. Mafic relics are sparse, probable relict biotite sites with sub/euhedral shapes <0.5 mm pseudomorphed by interleaved white mica to ~0.3 mm and rutile/leucoxene (euhedra to 15 µm/<5 µm respectively). The groundmass consists of smaller, seriate-textured crystals of all of the above, locally closely packed together, in a matrix heavily altered to sericite (randomly oriented subhedral flakes <20 µm, likely after feldspars) plus scattered Fe-Ti oxide relics (euhedral outlines mostly <0.25 mm, replaced by rutile as euhedra to 45 µm/leucoxene <5 µm). Minor quartz occurs as scattered anhedra <50 µm in the groundmass, locally along short discontinuous vein-like aggregates suggestive of secondary character.

In summary, this appears to represent fragmental felsic volcanic composed of clay?-sericite-quartz altered, possibly originally rhyodacite clasts in (dacite?) host composed of closely packed relict (sericite, hematite-stained, albite altered), quartz and relict biotite (altered to sericite-rutile) and Fe-Ti oxide (now rutile) phenocrysts in groundmass altered to sericite.

228940: PLAGIOCLASE-QUARTZ-BIOTITE PHYRIC FELSIC VOLCANIC (TUFFACEOUS RHYODACITE?) STRONGLY PHYLLIC/ARGILLIC ALTERED TO CLAY?/SERICITE-QUARTZ-HEMATITE-ALBITE? ±KSPAR-RUTILE IN ASSOCIATION WITH VEINS OF CLAY?/SERICITE-JAROSITE?-HEMATITE

Hand specimen shows strongly weathered and oxidized, reddish-coloured, fine-grained felsic volcanic rock (?) cut by prominent stockwork of pale yellowish-coloured veinlets and later open fracture system. The rock is not magnetic, shows no reaction to cold dilute HCl, and only faint yellow stain for K-feldspar in the etched offcut (but extensive white etch for plagioclase). The vein material is partly softer than steel (in the paler-coloured cores) and partly harder than steel (along darker-coloured selvages). Modal mineralogy in polished thin section is approximately:

Plagioclase (phenocrysts altered to sericite-albite ±Kspar?)	35%
Quartz (phenocrysts, groundmass; partly secondary?)	20%
Clay?/sericite (after groundmass, plagioclase, biotite?)	20%
(vein cores)	10%
Unidentified (vein selvages, could be jarosite?)	5%
K-feldspar (relict primary groundmass, minor secondary?)	5%
Limonite (mainly hematite?)	4-5%
Rutile/leucoxene (in relict biotite, Fe-Ti microphenocrysts)	<1%

Host rock is composed of closely packed, randomly oriented, 35-40% plagioclase (partly altered to sericite-albite ±Kspar?), 10-15% quartz and 5-10% relict mafic (biotite?) phenocrysts in groundmass strongly altered to sericite-hematite-local quartz. Veins consist of cores of soft clay?/sericite with selvages of harder, pale yellowish possible jarosite?

In the host rock, plagioclase occurs as randomly oriented, tabular sub/euhedral crystals mostly <2 mm. They are 5-25% replaced by sericite (randomly oriented to aligned subhedral flakes mainly <20 μm) or locally at cores by what may be Kspar (?) in irregular patches <0.35 mm across, and "dusted' along microfractures by minute (1-2 μm) particles of hematite and clay (?), imparting the pinkish colour in hand specimen. Composition is likely secondary albite, based on relief negative compared to adjacent quartz (but slightly above Kspar at cores) and extinction on 010 up to 14°, implying An_5. Quartz phenocrysts are unstrained, sub- to euhedral up to 2.4 mm, with local resorbed textures and rare narrow overgrowths <45 μm. Mafic relics are common, probable relict biotite sites with sub/euhedral shapes <1.25 mm pseudomorphed by interleaved white mica to ~0.3 mm and rutile/leucoxene (euhedra to 15 μm/<5 μm respectively). The groundmass is heavily altered to sericite (randomly oriented subhedral flakes <20 μm, likely after feldspars) and hematite (amorphous to microcrystalline) but locally appears to contain quartz (anhedra <25 μm) plus scattered Fe-Ti oxide relics (euhedral outlines mostly <0.1 mm, replaced by rutile as euhedra to 25 μm/leucoxene <5 μm). At one end of the section, significant quartz occurs as sub/anhedra <50 μm in the groundmass, locally optically continuous in aggregates to 1.3 mm strongly suggestive of secondary origin.

In the veins, which are mainly planar and up to 6 mm thick, cores are composed mainly of pale brownish coloured, very fine-grained clay?/sericite as minute flakes mainly <10 μm but commonly strongly aligned oblique to vein walls, imparting an aggregate cross-foliated texture which is highlighted by sub-parallel microveinlets <20 μm thick of the mineral forming the vein selvages. This mineral, making up the outer 40% of the veins, is unidentified although the pale yellow colour, strong positive relief and moderate birefringence of the closely packed sub/euhedral crystals in the 5-15 μm size range are suggestive of jarosite (?). In places, a concentration of hematite along vein envelopes, in places with fine-grained secondary quartz (as above) suggests a relation between hematite alteration of host rock and the veining. Late fractures are thin (<0.5 mm) and sub-planar.

In summary, this appears to be plagioclase-quartz-biotite phyric felsic volcanic (tuffaceous rhyodacite?) strongly phyllic/argillic altered to clay?/sericite-quartz-hematite-albite? ±Kspar-rutile in association with veins of clay?/sericite-jarosite?-hematite.

AW B99: WEAKLY/LOCALLY MODERATELY PROPYLITIC/PHYLLIC (ALBITE-SERICITE-CHLORITE-CARBONATE ±EPIDOTE-RUTILE) ALTERED QUARTZ-FELDSPAR-BIOTITE-AMPHIBOLE PHYRIC FELSIC VOLCANIC (RHYODACITE?), RELATED TO LOCAL IRREGULAR CARBONATE (DOLOMITE?)-RARE QUARTZ VEINLETS

Hand specimen shows pink-brown (hematitic) fine-grained felsic-looking (quartz, hematite-stained feldspar phyric) volcanic or possibly volcaniclastic rock. The rock is not magnetic, and shows no reaction to cold dilute HCl, but there is extensive stain for K-feldspar in the etched offcut (mainly in the groundmass; white etch reveals plagioclase phenocrysts). Modal mineralogy in polished thin section is approximately:

Plagioclase (phenocrysts, partly sericite-hematite altered albite?)	30%
K-feldspar (groundmass, minor shards, primary?)	30%
Quartz (phenocrysts, possible groundmass?)	20%
Sericite, white mica (after plagioclase, biotite?)	10%
Chlorite (with white mica, carbonate, epidote, after biotite?)	5%
Carbonate (rare veinlets/mainly after amphibole; dolomite?)	1-2%
Epidote (after biotite?)	1-2%
Rutile/leucoxene	1-2%
Hematite (amorphous, staining feldspars)	<1%
Apatite (microphenocrysts)	<1%

This sample consists of about 30-35% relict (sericite-hematite-albite altered) plagioclase/minor Kspar, 15% quartz and 5-10% relict (chlorite-sericite-carbonate ±epidote, rutile altered) mafic phenocrysts or shards with seriate texture set in an aphanitic groundmass of K-feldspar, local variations in which may suggest clasts (very poorly defined) and thus a likely tuffaceous or volcaniclastic origin.

Relict feldspar phenocrysts have mainly euhedral tabular to lath-shaped outlines <2 mm (but grading to smaller, commonly broken/shard-like crystals <0.25 mm in the groundmass), with random orientations. They are typically <5-10% replaced by sericite as randomly oriented sub/euhedral flakes mostly <25 µm in size, rare carbonate as subhedra <0.1 mm, and appear to be mostly albitized plagioclase, but locally some may be Kspar (?). Composition of plagioclase appears to be albite based on commonly vague twinning, relief negative compared to quartz, and extinction Y^010 up to 15º (largely secondary?) plus hematite staining as minute particles <1-2 µm.

Quartz phenocrysts display rounded subhedral to euhedral outlines mostly <1.5 mm (up to 2.5 mm, somewhat broken) with local minor resorption features and narrow (<20 µm) overgrowth rims, or rare replacements. The crystals are locally strained where broken or veined by secondary quartz.

Relict biotite forms randomly oriented, sub/euhedral flakes/booklets <0.5mm pseudomorphed by intimately interleaved chlorite (subhedral flakes <0.15 mm with pale green pleochroism, length-slow birefringence, F:M 0.5?) and white mica (similar-sized, euhedral flakes) mixed with variable amounts of epidote (aggregates <0.1 mm of brownish subhedra <15 µm) and accessory carbonate (as for epidote) and rutile/leucoxene (euhedra <45 µm). Less common, longer (up to 2 mm) mafic relics lath-like outlines pseudomorphed by carbonate (subhedra <0.25 mm, dolomite?) with minor chlorite, sericite and rutile are suggestive of former possible amphibole (hornblende?).

The groundmass consists of closely packed, small, seriate crystals or shards of all the above (feldspar, quartz, chlorite, white mica) plus microphenocrysts of Ti oxides (euhedral outlines <0.15 mm, now converted to rutile/leucoxene as above) and rare apatite (euhedra <0.1 mm), set in fine-grained Kspar (sub/anhedra <0.15 mm?) and lesser quartz(sub/anhedra <50 µm), sericite, chlorite and rutile (variations in contents of the micas suggests former lapilli?).

Rare short discontinuous veinlets <0.5 mm thick are mainly of carbonate as either rare clear or more commonly brownish subhedra to 0.35 mm (possibly dolomite?), rare quartz (<0.2 mm).

In summary, this is weakly to locally moderately propylitic/phyllic (albite-sericite-chlorite-carbonate ±epidote-rutile) altered quartz-feldspar-biotite-amphibole phyric felsic volcanic (rhyodacite?); alteration appears related to local irregular carbonate (dolomite?)-rare quartz veinlets.

AW B28: WEAKLY PROPYLITIC/PHYLLIC (ALBITE-SERICITE-CARBONATE-CHLORITE ± RUTILE, HEMATITE) ALTERED QUARTZ-FELDSPAR-BIOTITE? PHYRIC, FRAGMENTAL FELSIC VOLCANIC (RHYODACITE CRYSTAL-LAPILLI TUFF?)

Hand specimen shows pinkish-brown fine-grained felsic-looking (quartz, feldspar phyric) volcanic or possibly volcaniclastic rock. The rock is weakly magnetic, and shows weak pervasive reaction to cold dilute HCl, plus pervasive pale yellow stain for K-feldspar in the etched offcut (mainly in the groundmass; white etch reveals plagioclase phenocrysts). Modal mineralogy in polished thin section is approximately:

Plagioclase (phenocrysts, groundmass, sericite-carbonate altered albite?)	40%
K-feldspar (groundmass only, primary?)	20%
Quartz (phenocrysts, groundmass?)	20%
Sericite, white mica (after plagioclase, biotite?)	10%
Carbonate (after plagioclase, groundmass; mainly calcite)	5%
Chlorite (after biotite, with white mica)	2-3%
Magnetite (largely altered to hematite)	2-3%
Rutile/leucoxene (after ilmenite, traces of which remain)	<1%
Apatite (with relict mafic sites)	<1%

This sample consists of about 30-35% saussuritized plagioclase, 15% quartz, 10% relict (sericite-chlorite ±rutile altered) biotite and 2% magnetite phenocrysts, plus smaller seriate-textured crystals set in fine-grained groundmass of plagioclase-Kspar-sericite-carbonate-quartz-opaques. Local well-defined clasts with rounded outlines to ~1 cm are distinctly finer-grained than the host, with sparser, smaller phenocrysts or shards, and indicate a crystal-lapilli tuff origin.

Relict plagioclase phenocrysts have mainly euhedral tabular outlines up to ~2 mm (grading in seriate fashion to smaller crystals <0.25 mm in the groundmass), mostly randomly oriented. They are typically 5-25% replaced by sericite (randomly oriented sub/euhedral flakes mostly <25 µm) and carbonate (subhedra <0.25 mm, likely calcite). The plagioclase crystals show vague twinning with extinction Y^010 up to 16º, suggestive of albite composition (likely secondary in view of the sericite-carbonate alteration).

Quartz phenocrysts display rounded subhedral, broken to rarely euhedral outlines mostly <2 mm, with minor resorption features and very narrow (<20 µm) overgrowth rims (more commonly replaced by sericite at rims). The crystals are essentially unstrained.

Relict mafic (mainly biotite?) phenocrysts occur as randomly oriented, mostly euhedral crystals up to 1.2 mm long, variably replaced by white mica (muscovite) as subhedral flakes <0.5 mm, lesser chlorite (subhedral flakes <0.1 mm with almost no colour/pleochroism, length-fast anomalous grey birefringence suggestive of F:M ~0.4?) and minor carbonate (subhedra <0.15 m, likely calcite?) plus accessory rutile/leucoxene (aggregates to 0.2 mm of euhedra <65 µm) and traces of apatite as euhedral stubby prisms to 0.1 mm long, associated with accessory Fe-Ti oxides (microphenocrysts as described below). Hornblende relics appear to be absent.

The groundmass consists of closely packed, small, seriate-textured crystals of all the above (plagioclase partly altered to sericite; quartz; biotite altered as above) plus microphenocrysts of relict magnetite (euhedral outlines <0.5 mm, mostly replaced by hematite as minute sub/euhedra <25 µm, rarely with tabular relict ilmenite <0.2 mm replaced by rutile as described above), set in aphanitic-looking matrix apparently now composed of relict plagioclase (irregular crystals that may have been 0.15 mm prior to alteration to sericite as randomly oriented flakes <10 µm and carbonate as ragged, interlocking sub/anhedra <0.1 mm), with interstitial Kspar (mostly <65 µm) and relatively rare quartz (mostly <50 µm). No fractures or veinlets were seen in the section.

In summary, this is weakly propylitic/phyllic (albite-sericite-carbonate-chlorite ± rutile, hematite) altered quartz-feldspar-biotite (?) phyric, fragmental felsic volcanic (rhyodacite crystal-lapilli tuff?).

AW B26: WEAKLY PROPYLITIC/PHYLLIC (ALBITE-SERICITE-CARBONATE-CHLORITE ± RUTILE, HEMATITE) ALTERED QUARTZ-FELDSPAR-BIOTITE (?) PHYRIC, FRAGMENTAL FELSIC VOLCANIC (RHYODACITE CRYSTAL-LAPILLI TUFF?)

Hand specimen shows dark greenish-brown fine-grained felsic-looking (quartz, feldspar phyric) volcanic or possibly volcaniclastic rock. The rock is distinctly magnetic, and shows weak pervasive reaction to cold dilute HCl, plus pervasive pale yellow stain for K-feldspar in the etched offcut (mainly in the groundmass, concentrated in poorly defined clasts (?); white etch reveals plagioclase phenocrysts, groundmass). Modal mineralogy in polished thin section is approximately:

Plagioclase (phenocrysts, groundmass, sericite-carbonate altered albite?)	40%
K-feldspar (groundmass mainly certain clasts, primary?)	25%
Quartz (phenocrysts, groundmass?)	20%
Sericite, white mica (after plagioclase, biotite?)	10%
Carbonate (after plagioclase, groundmass; mainly calcite)	5%
Chlorite (after biotite, with white mica)	2-3%
Magnetite (largely altered to hematite)	2-3%
Rutile/leucoxene (after ilmenite, traces of which remain)	<1%
Apatite (with relict mafic sites)	<1%

This sample consists of about 30-35% saussuritized plagioclase, 15% quartz, 10% relict (sericite-chlorite ±rutile altered) mafic and 2% magnetite phenocrysts, plus smaller seriate-textured crystals set in fine-grained groundmass of plagioclase-Kspar-sericite-carbonate-quartz-opaques. Poorly-defined clasts with irregular ragged outlines to ~2 cm are richer in Kspar matrix, and indicate a crystal-lapilli tuff origin.

Relict plagioclase phenocrysts have mainly euhedral tabular outlines <2 mm (but grading in seriate fashion to smaller crystals <0.25 mm in the groundmass), mostly randomly oriented. They are typically 5-25% replaced by sericite (randomly oriented sub/euhedral flakes mostly <25 µm) and carbonate (subhedra <0.2 mm, likely calcite). The plagioclase crystals show vague twinning with extinction Y^010 up to 16º, suggestive of albite composition (likely secondary in view of the sericite-carbonate alteration). It is not possible to compare refractive indices with those of quartz.

Quartz phenocrysts display rounded subhedral to euhedral outlines mostly <2 mm, with local major resorption features and mostly very narrow (<20 µm) overgrowth rims (more commonly replaced by sericite at rims, or along microfractures). The crystals are essentially unstrained.

Relict mafic (mainly biotite, possible hornblende?) phenocrysts occur as randomly oriented, mostly euhedral crystals up to 1.2 mm long, variably replaced by white mica (muscovite) forming subhedral flakes <0.5 mm, lesser chlorite (subhedral flakes <0.1 mm with yellow-green colour/ weak pleochroism, length-slow moderate birefringence suggestive of F:M ~0.6?) and rare carbonate (subhedra <0.15 mm, likely calcite?) plus accessory rutile (aggregates to 0.2 mm of euhedra <65 µm) and traces of apatite as euhedral stubby prisms to 0.1 mm long, associated with accessory Fe-Ti oxides (microphenocrysts as described below). Hornblende relics may show more tabular outlines and be more altered to carbonate.

The groundmass consists of closely packed, small, seriate crystals <0.25 mm of all the above (plagioclase partly altered to sericite; quartz; biotite altered as above) plus microphenocrysts of relict magnetite (euhedral outlines <0.35 mm, mostly replaced by hematite as minute sub/euhedra <25 µm, rarely with tabular relict ilmenite <0.2 mm replaced by rutile as described above), set in aphanitic matrix apparently composed of Kspar (feathery microlites <15 µm) or in places relict plagioclase (both altered to sericite as randomly oriented flakes <10 µm and carbonate as ragged, interlocking sub/anhedra <0.1 mm), with relatively minor quartz (mostly <30 µm). Crude alignment of carbonate along fractures suggests cryptic <0.2 mm veinlets.

In summary, this is weakly propylitic/phyllic (albite-sericite-carbonate-chlorite ± rutile, hematite) altered quartz-feldspar-biotite (?) phyric, fragmental felsic volcanic (rhyodacite crystal-lapilli tuff?).

Trench: WEAKLY PROPYLITIC/PHYLLIC GRADING TO ARGILLIC (ALBITE-CLAY?-SERICITE-CARBONATE-CHLORITE ± RUTILE, ALUNITE?) ALTERED QUARTZ-FELDSPAR-BIOTITE (?) PHYRIC, FRAGMENTAL FELSIC VOLCANIC (RHYODACITE CRYSTAL-LAPILLI TUFF?)

Hand specimen shows pale greenish-buff coloured, fine-grained felsic crystal-lapilli tuff (clearly defined small fragments up to ~1 cm tend to be slightly darker, more sericite altered and contain more cubic limonite casts after pyrite; quartz phenocrysts may be up to 4 mm across), cut by thin pale orange-brown fracture coatings that react strongly to cold dilute HCl. The rock is not magnetic, shows only trace reaction to cold dilute HCl in the body of the rock, and variable yellow stain for K-feldspar/white etch for plagioclase in the etched offcut, depending on position in clasts versus matrix. Modal mineralogy in polished thin section is approximately:

Plagioclase (phenocrysts, groundmass, sericite-carbonate altered albite?)	45%
Quartz (phenocrysts, groundmass?)	20%
K-feldspar (groundmass mainly certain clasts, primary?)	15%
Clay?/sericite, white mica (after plagioclase, biotite?)	15%
Limonite (hematite, goethite; after pyrite?)	2%
Carbonate (after plagioclase, fracture fills; mainly calcite)	1%
Chlorite (with white mica, after biotite?)	<1%
Alunite (?), patches in matrix	<1%
Rutile/leucoxene (after mafic sites)	<1%

This sample consists of about 30-35% saussuritized plagioclase, 15% quartz, 10% relict (sericite-chlorite ±rutile altered) mafic phenocrysts and 2% limonite casts after pyrite, plus smaller seriate-textured crystals set in fine-grained groundmass of plagioclase-Kspar-quartz altered to clay?/sericite ±alunite (?). Poorly-defined clasts with irregular ragged outlines <1 cm are finer-grained and/or richer in clay? or sericite altered, variably Kspar-rich matrix, indicative of a crystal-lapilli tuff origin.

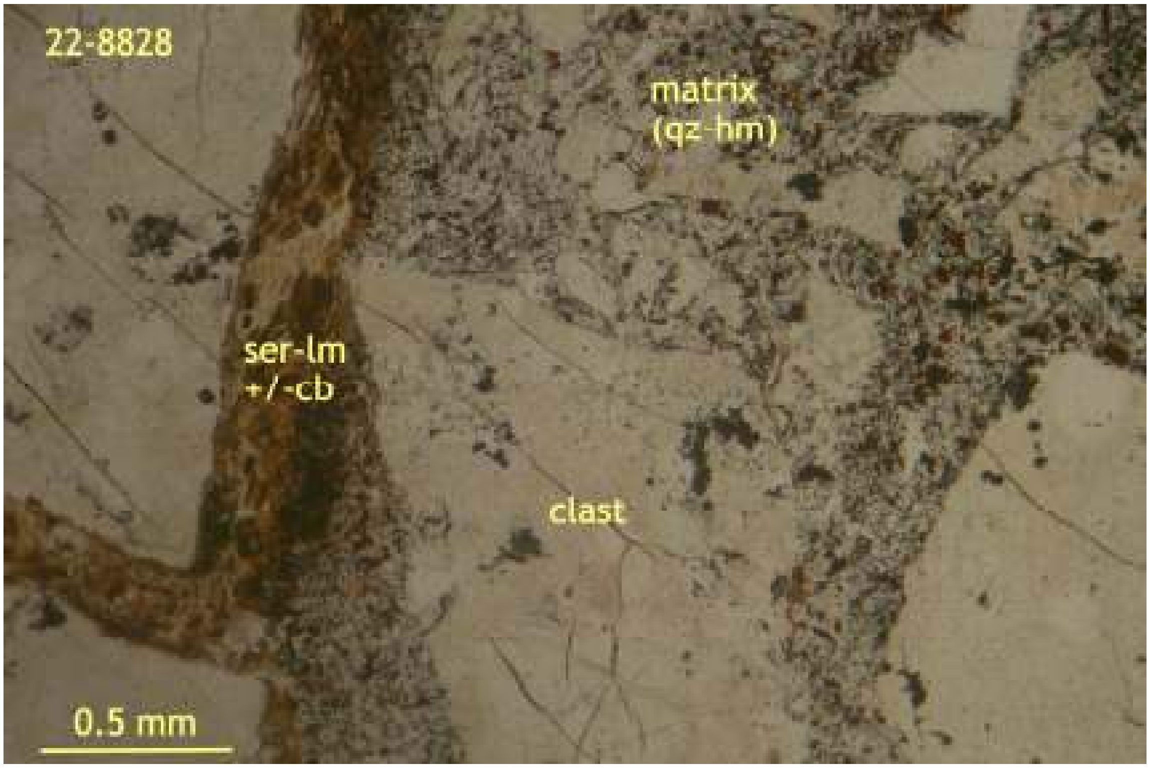
Relict plagioclase phenocrysts have mainly euhedral tabular outlines <2 mm (partly glomeratic, but grading in seriate fashion to smaller crystals <0.25 mm in the groundmass), mostly with random orientations. They are typically 5-25% replaced by sericite (randomly oriented sub/euhedral flakes mostly <30 µm) and carbonate (subhedra <0.25 mm, likely calcite). The plagioclase crystals show vague twinning with extinction Y^010 up to 16º, suggestive of albite composition (likely secondary in view of the sericite-carbonate alteration). It is not possible to compare refractive indices with those of quartz.

Quartz phenocrysts display rounded sub/euhedral outlines mostly <2 but up to 3 mm, with local resorption features and mostly very narrow (<20 µm) overgrowth rims (or in places replaced by minor sericite and quartz at the rim). The crystals are essentially unstrained.

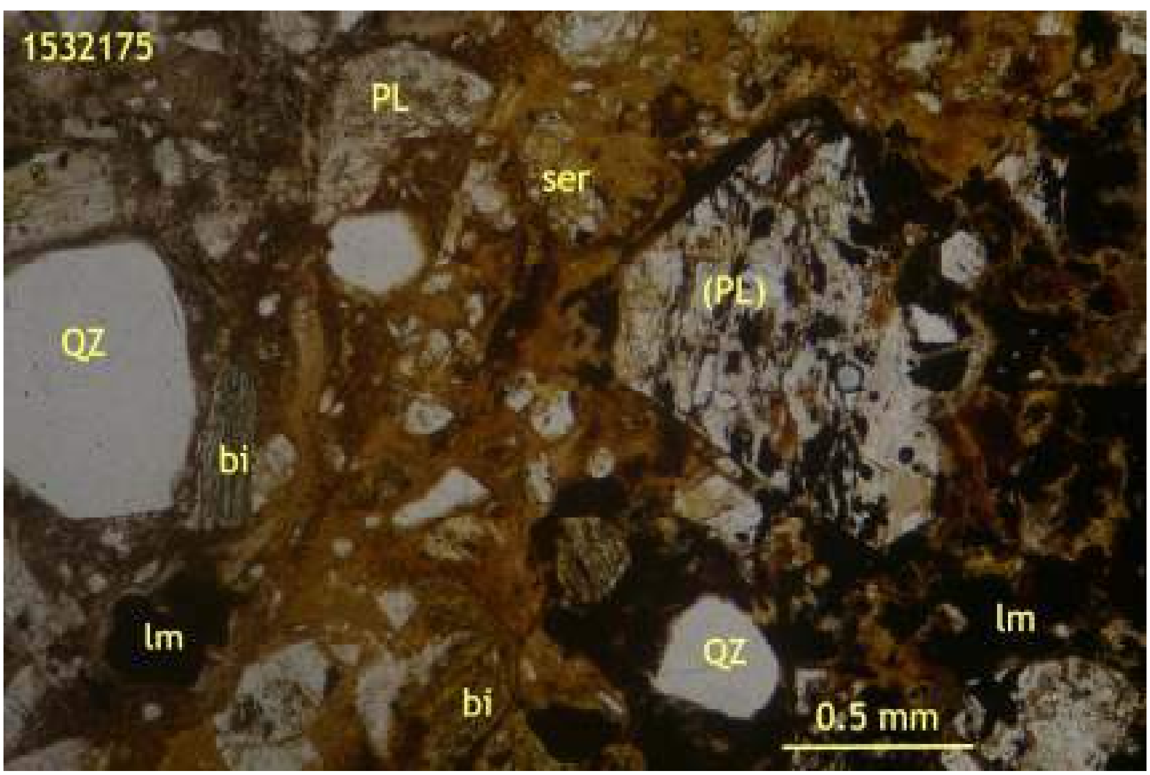
Relict mafic (mainly biotite?) phenocrysts occur as randomly oriented, mostly euhedral crystals up to 1 mm long, variably replaced by white mica (muscovite) forming subhedral flakes <0.5 mm and rare chlorite (subhedral flakes <0.1 mm with almost no colour/pleochroism, length-fast anomalous grey birefringence suggestive of F:M ~0.4?) plus accessory rutile (aggregates to 0.2 mm of euhedra <95 µm), variably associated with cubic limonite casts up to 2.5 mm across after pyrite.

The groundmass varies from clast to matrix, generally composed of closely packed, small, seriate crystals <0.25 mm of all the above (plagioclase partly altered to sericite; quartz; biotite altered as above) plus microphenocrysts of Fe-Ti oxides (euhedral outlines <0.15 mm, pseudomorphed by hematite as minute sub/euhedra <25 µm and rutile as described above), set in variable matrix apparently composed mainly brownish clay? (spherulitic/radiating textured) or paler-coloured sericite (subhedral flakes to 0.1 mm) rarely mixed with alunite (certain clasts only, matted randomly oriented sub/euhedra <20 µm distinguished by length-fast character), probably replacing both Kspar (feathery microlites <15 µm) or in places relict plagioclase, with variable quartz (subhedra mostly <25 µm).

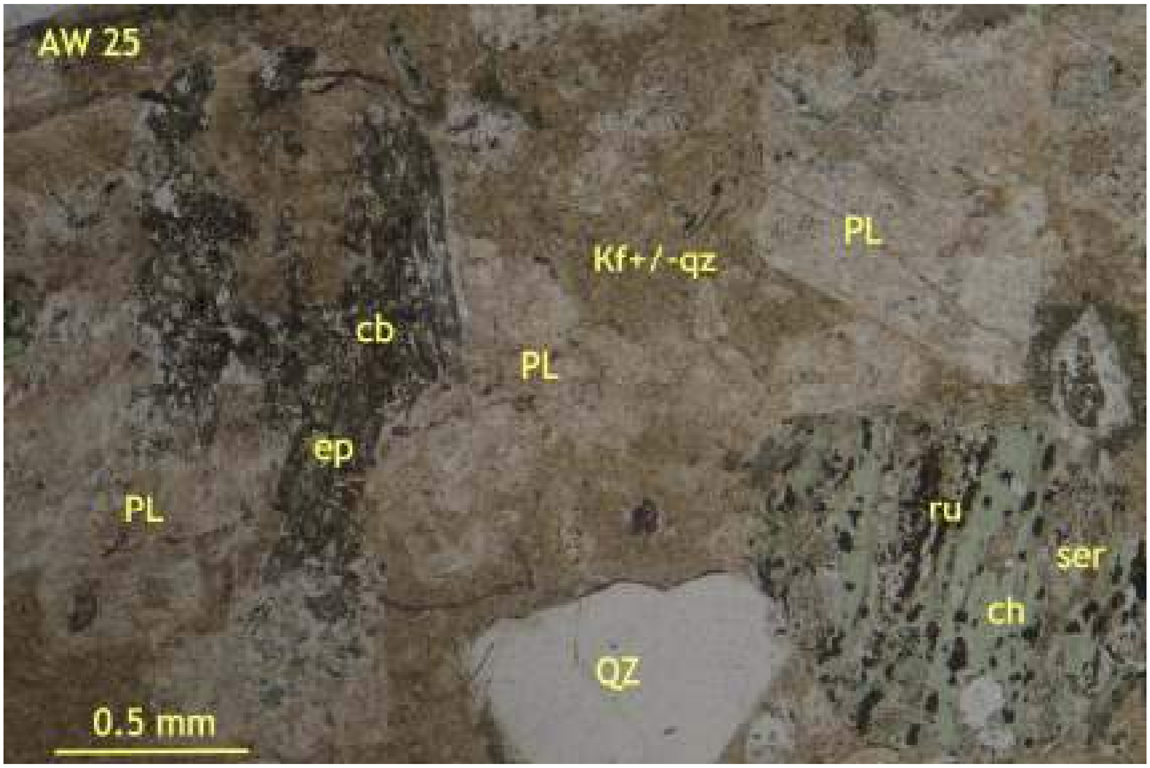
In summary, this is weakly propylitic/phyllic grading to argillic (albite-clay?-sericite-carbonate-chlorite ± rutile, alunite?) altered quartz-feldspar-biotite (?) phyric, fragmental felsic volcanic (rhyodacite crystal-lapilli tuff?).



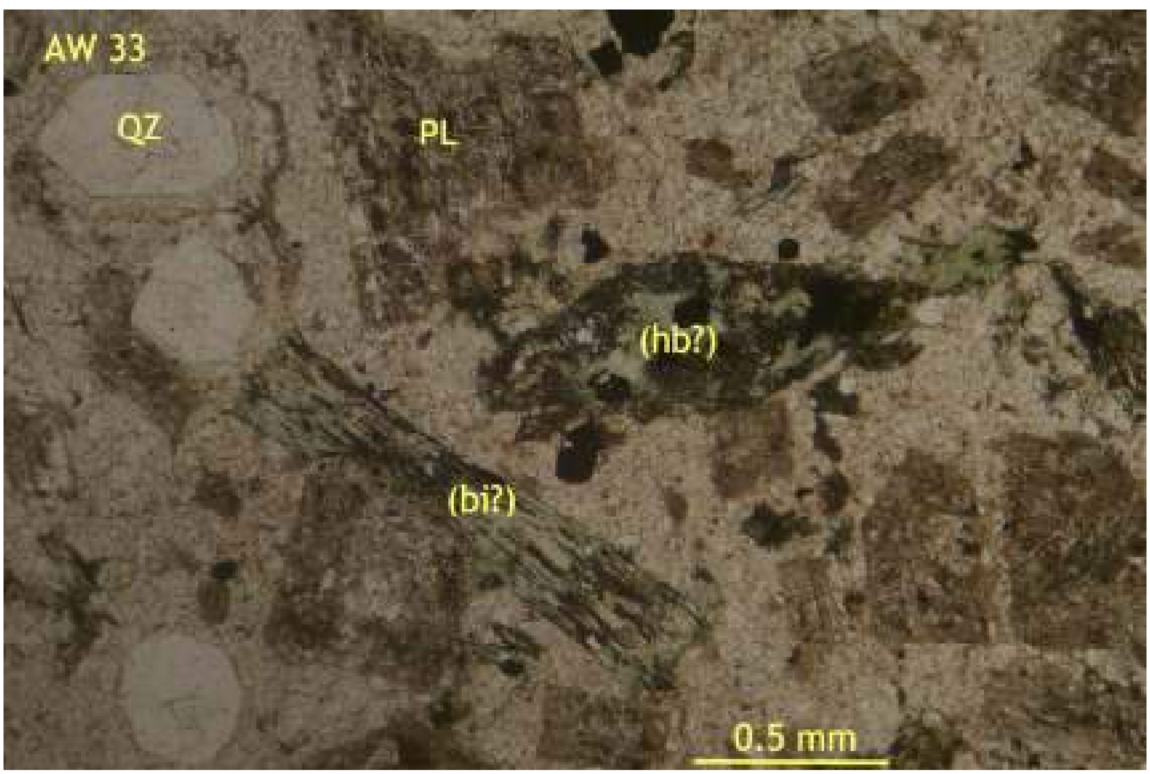
22-8828: brecciated, intensely silicified rock composed of angular clasts of quartz phyric felsic volcanic set in a matrix of fine-grained secondary quartz-hematite, later partly re-opened by fracture network of brownish (limonite-stained) sericite, local Fe-calcite. Transmitted plane light, field of view ~3 mm wide.



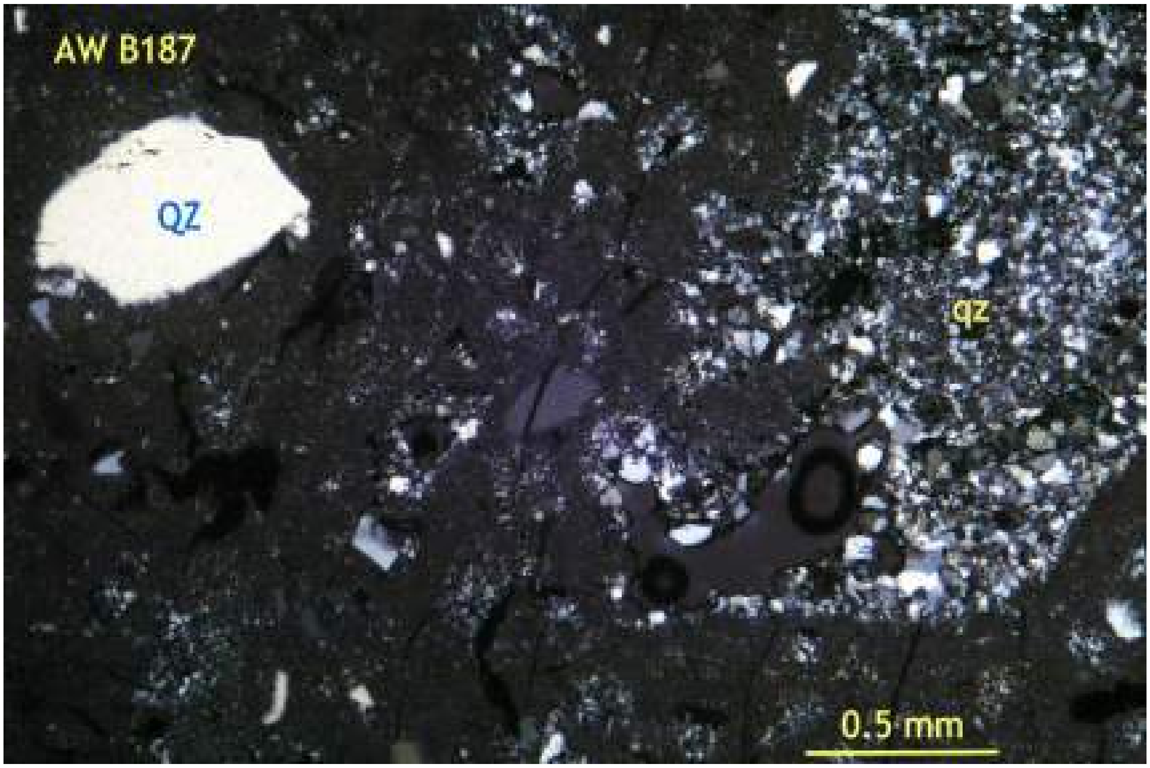
1532175: phenocrysts of relict plagioclase (PL), quartz (QZ) and smaller biotite (bi) partly altered to sericite, white mica particularly near heavy concentrations of opaque to orange-brown limonite irregularly distributed around fracture network located out of view to right of photo. Transmitted plane light, field of view ~3 mm wide.



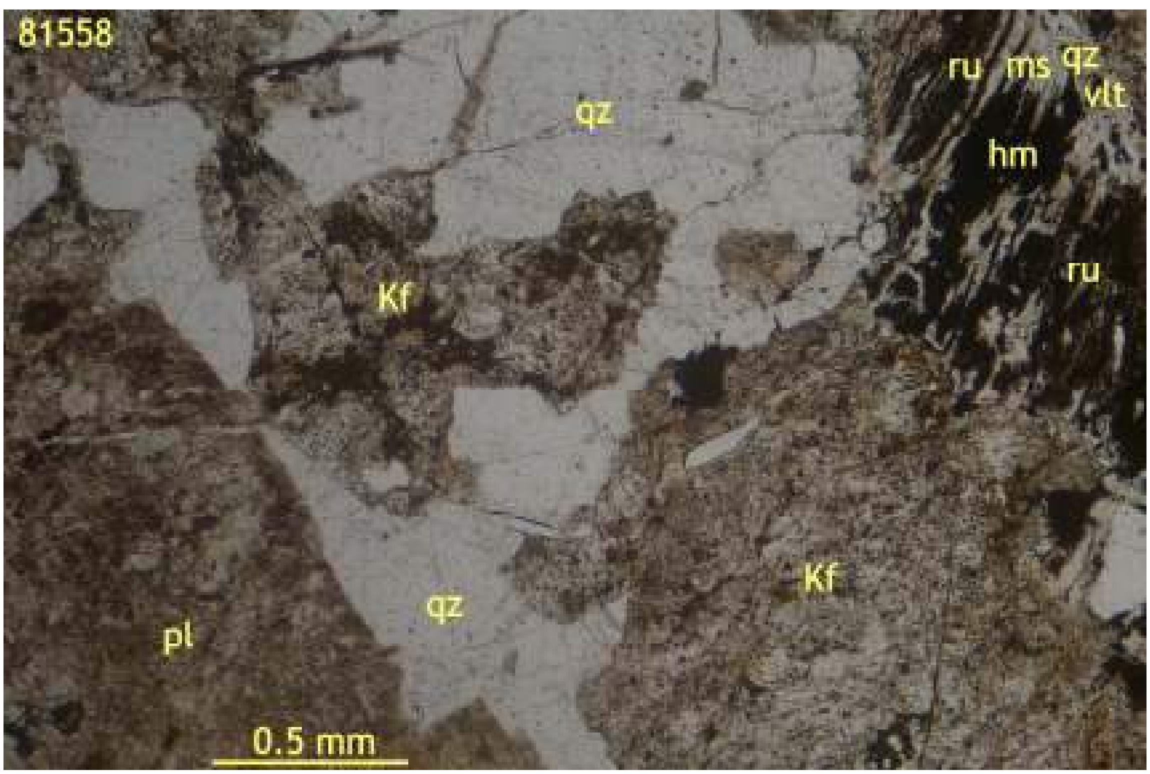
AW 25: possibly fragmental rhyodacite composed of phenocrysts of relict plagioclase (PL), quartz (QZ) and biotite (?) altered to chlorite-white mica ±rutile (ch-ser-ru), or hornblende (?) altered to epidote-carbonate (ep-cb), in groundmass of aphanitic Kspar (±quartz?). Transmitted plane light, field of view ~3 mm wide.



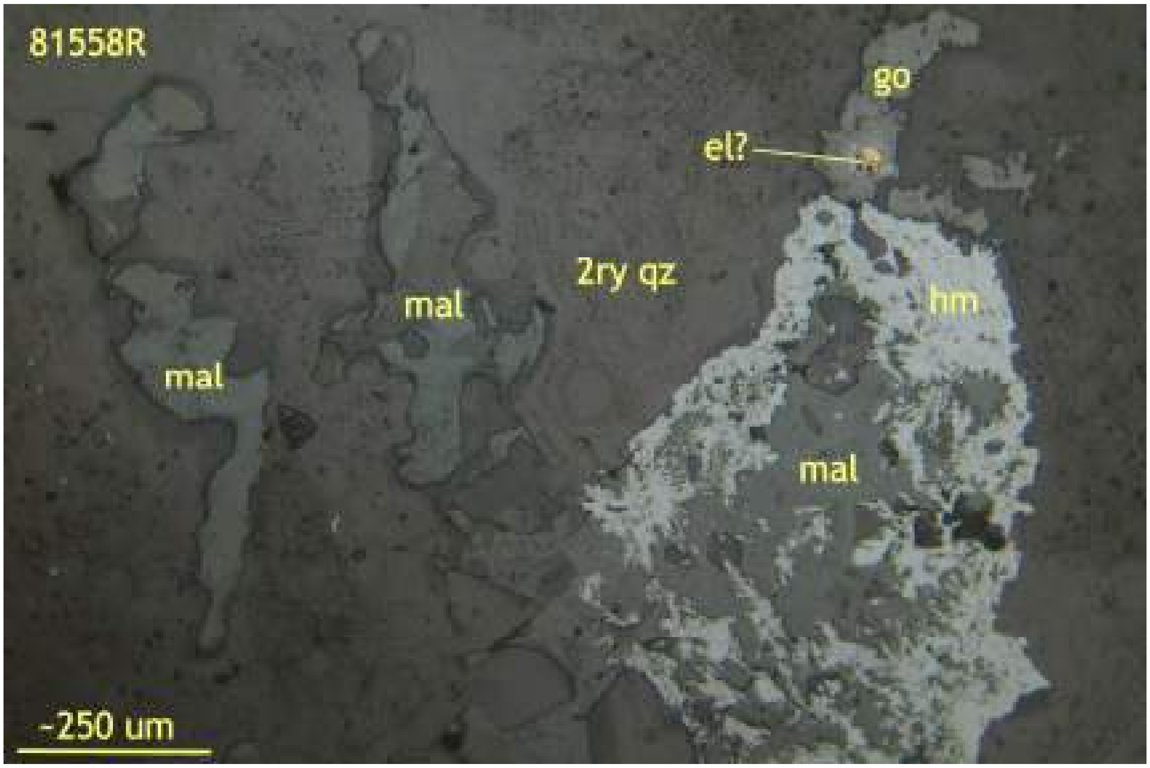
AW 33: possibly hypabyssal rhyodacite composed of phenocrysts of saussuritized plagioclase (PL), quartz (QZ) and biotite (bi?) altered to chlorite-epidote ±rutile, or hornblende (hb?) altered to chlorite-epidote-magnetite-rutile, in groundmass of Kspar-quartz with microphenocrysts of magnetite. Transmitted plane light, field of view ~3 mm wide.



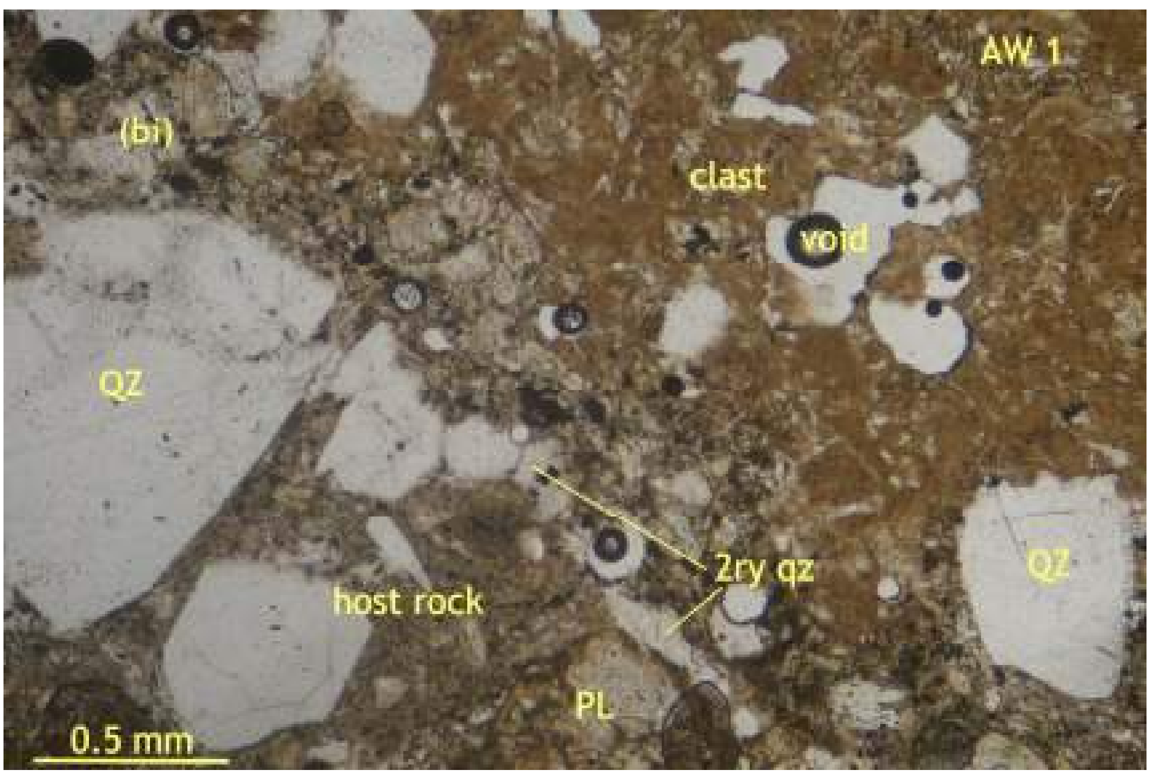
AWB 187: intensely silicified rock composed of remnant quartz (QZ) phenocrysts, possible relict feldspar phenocryst sites now completely replaced by interlocking secondary quartz (qz) in a groundmass of secondary quartz and possible microcrystalline relict plagioclase (?), local opaque (hematite/rutile). Transmitted light, crossed polars, ~3 mm wide.



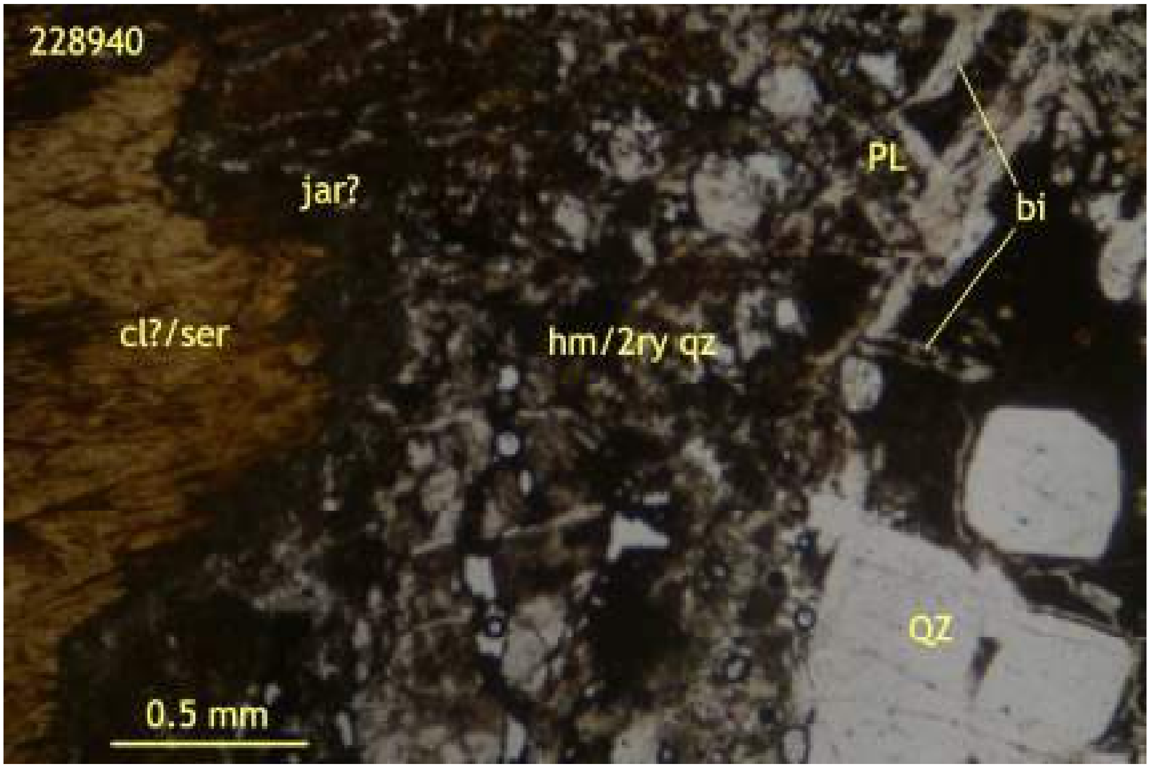
81558: relict granitic rock composed of clear quartz (qz), partly sericitized plagioclase (pl), cloudy Kspar (Kf) and relict biotite (interleaved white mica, ms, and rutile, ru, or hematite, hm, the latter partly after magnetite), cut by thin veinlet of secondary quartz (upper right corner). Transmitted plane light, field of view ~3 mm wide.



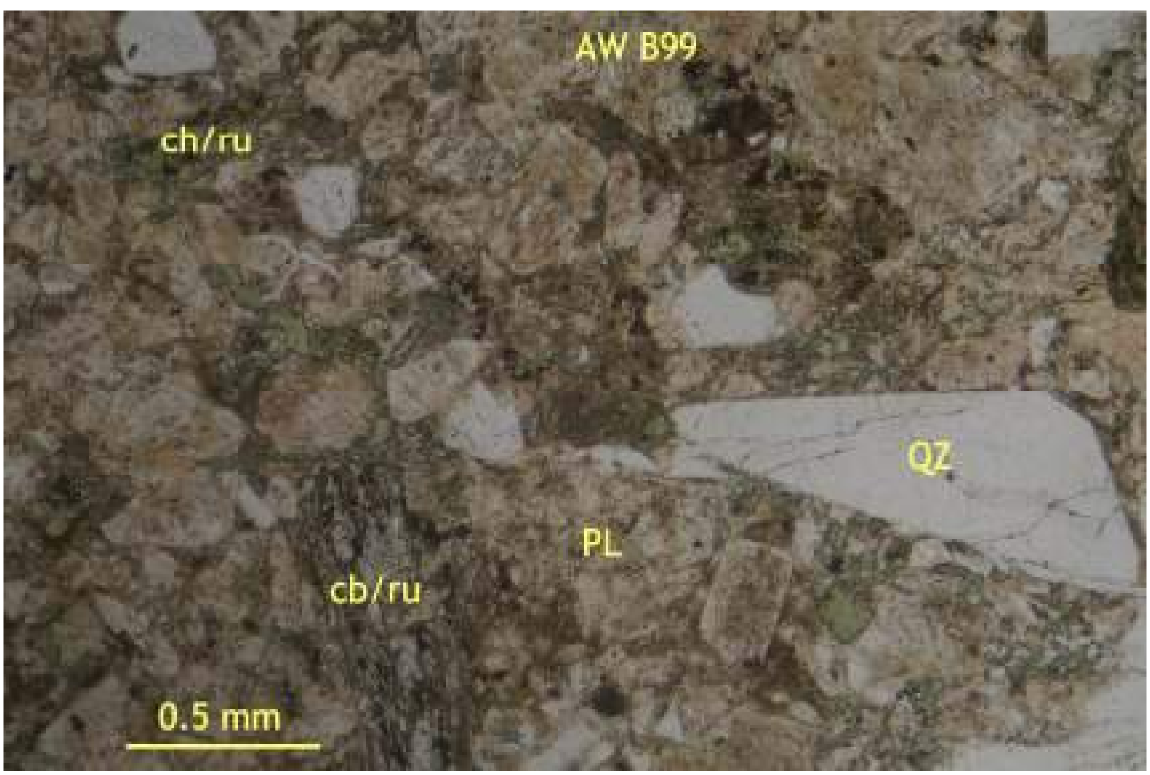
81558R: detailed view of malachite (mal, both coarse-grained and surrounding finer-grained) associated with limonite (hematite, hm and goethite, go) with trace possible electrum (el?) in matrix of secondary quartz forming vein/breccia matrix cutting altered granite. Reflected light, uncrossed polars, field of view ~1.5 mm wide.



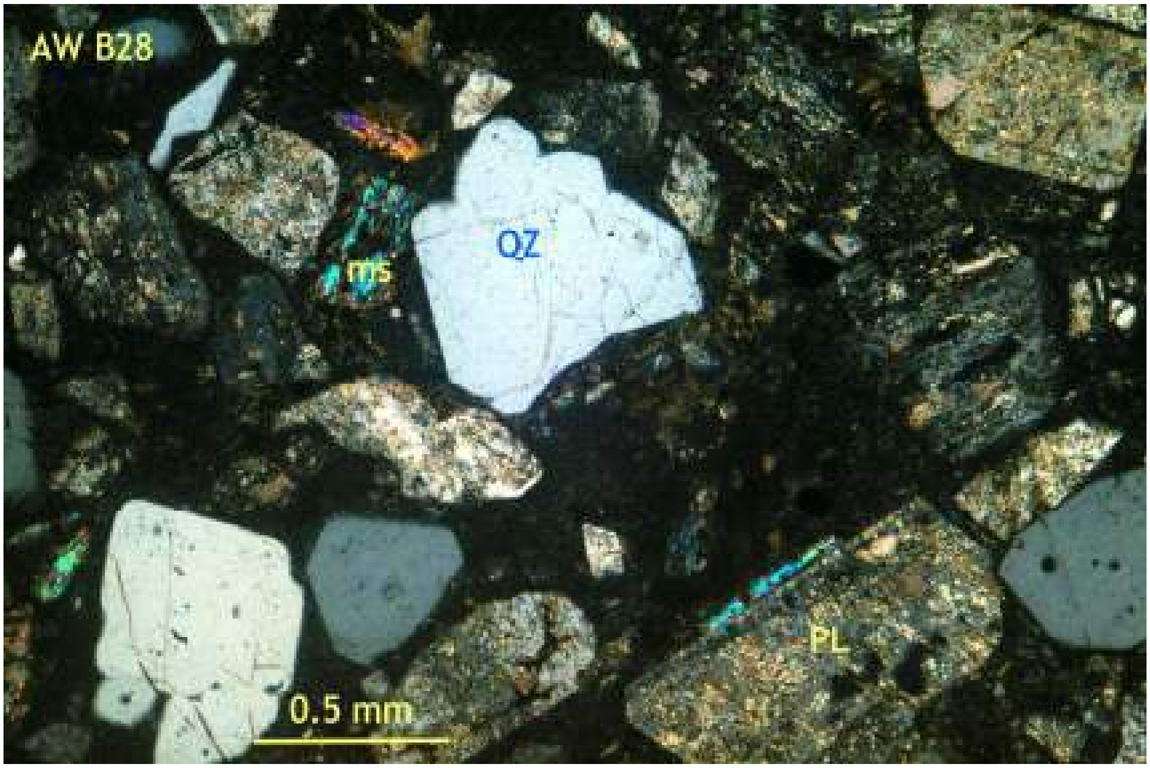
AW 1: boundary between clast (on right; smaller quartz phenocrysts, voids/vugs, feldspars completely altered to pale brownish clay ?) and host (on left; larger quartz phenocrysts, closely packed relict plagioclase, minor relict biotite, opaque relict Fe-Ti oxide sites, in sericite-local minor quartz altered matrix). Transmitted plane light, field of view ~3 mm wide.



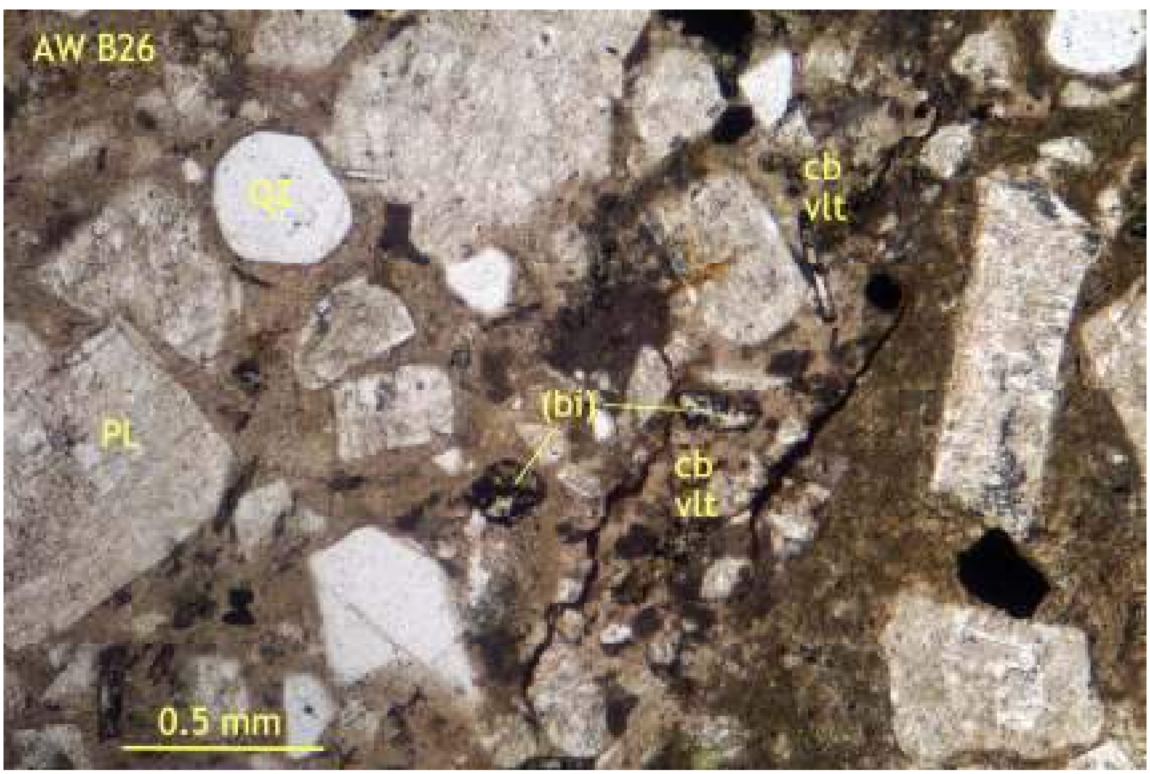
228940: quartz-plagioclase-minor relict biotite phyric felsic volcanic (groundmass strongly altered to hematite-sericite) separated by zone of hematite-secondary quartz from vein of clay?/sericite (cl?/ser) with selvage of possible jarosite (jar?). Transmitted plane light, field of view ~3 mm wide.



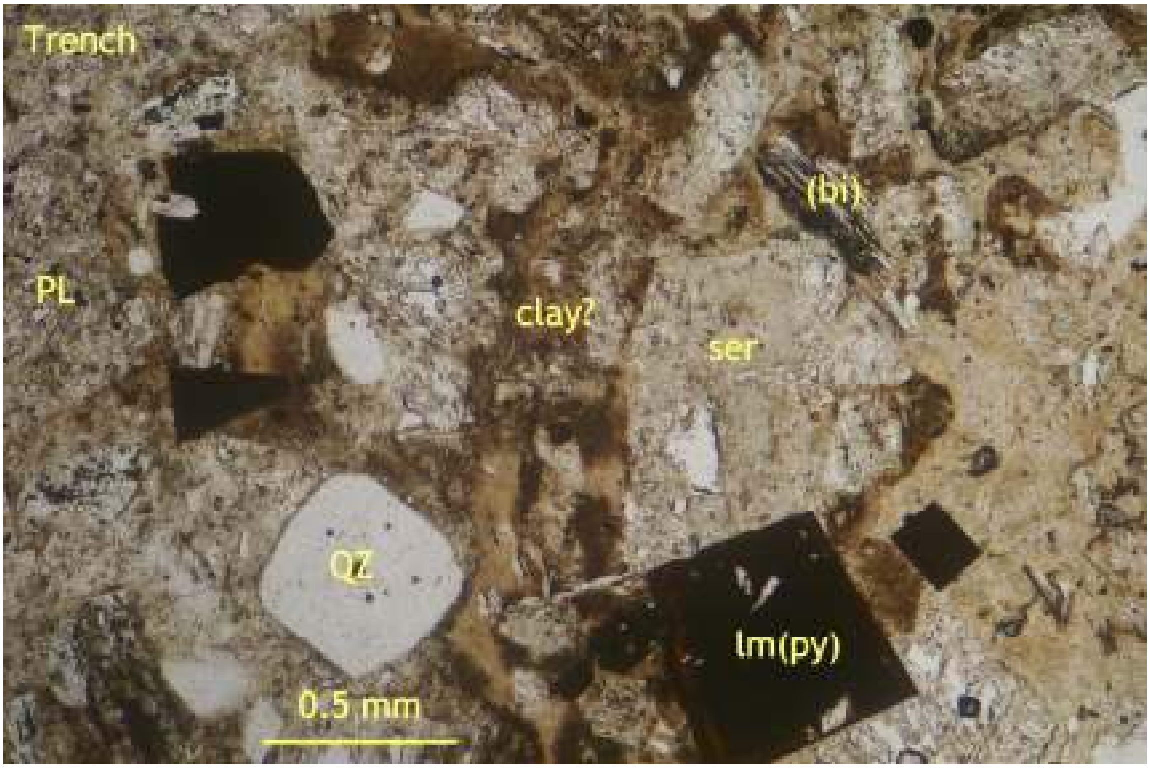
AW B99: rhyodacite tuff (?) composed of closely packed, randomly oriented, broken shard-like crystals of feldspar (mainly plagioclase), quartz, chlorite (ch) and rutile (ru, opaque) after biotite (?) or carbonate (cb)-rutile after hornblende (?), in groundmass of Kspar-minor quartz partly altered to sericite, chlorite. Transmitted plane light, field of view ~3 mm.



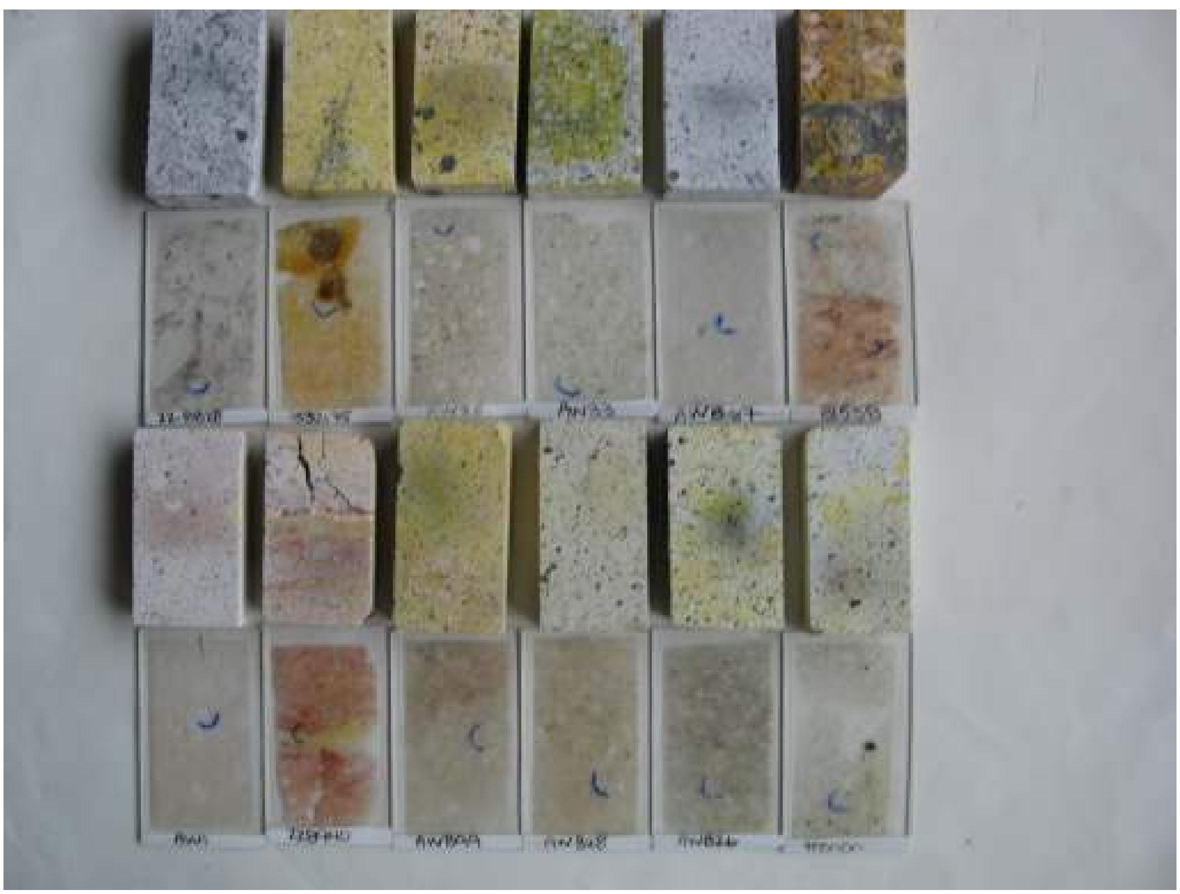
AW B28: rhyodacitic crystal-lapilli tuff composed of phenocryst/shards of plagioclase (PL, altered to sericite-carbonate), quartz (QZ) and probable biotite (altered to white mica, ms, and accessory rutile) in aphanitic groundmass of sericite-carbonate altered plagioclase, lesser Kspar and rare quartz. Transmitted light, crossed polars, field of view ~3 mm wide.



AW B26: view across boundary between finer-grained, more Kspar-rich clast (left) and host rock, both phyric in quartz, plagioclase, minor relict biotite and magnetite (opaque); boundary is marked by short discontinuous carbonate (cb) veinlets. Transmitted plane light, field of view ~3 mm wide.



Trench: rhyodacite crystal-lapilli tuff (usual phenocrysts of plagioclase partly altered to sericite-carbonate, quartz, biotite altered to white mica-rutile; note variation in groundmass from brownish, spherulitic-textured clay? to clearer sericite, ser) and cubic limonite casts after former pyrite. Transmitted plane light, field of view ~3 mm wide.



Overview of thin sections (blue semi-circle marks photomicrograph location) and offcuts.