TILL GEOCHEMISTRY OF THE COLLEYMOUNT MAP AREA (093L/01), WEST-CENTRAL BRITISH COLUMBIA

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ABSTRACT

A regional-scale till geochemical survey was conducted in the Colleymount map area (093L/01). Major, minor, and trace element geochemical determinations on 84 basal till samples, and gold-grain counts on an additional 18 basal till samples, demonstrate a strong positive correlation between elevated commodity metal and pathfinder element concentrations and the locations of known mineralization. An analysis of Cu, Mo, Pb, Zn, Ag, and Hg determinations by aqua regia ICP-MS, and Au, As, and Sb determinations by INAA, highlights the Allin occurrence and Tsichgass Lake areas as being of geochemical interest.

Detailed geochemical studies conducted within the region at the Copper Star occurrence (porphyry Cu-Mo-Au), Huckleberry mine (producing porphyry Cu-Mo mine) and Equity Silver mine (past producing Ag-Cu-Au mine), and west-indicating ice-flow features (252°-288°) measured near Goosly Lake and the Equity Silver mine site, suggest that westward dispersal of till likely occurs in the study area. As part of any follow up on till geochemical data presented here, detailed outcrop-scale investigations of ice-flow indicators should be conducted. The complexity of the region's ice-flow history, and variability in till thickness, suggests that there could be local variation in net transport direction and distance.

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INTRODUCTION

This report presents results from a till geochemical survey conducted within the Colleymount map area (093L/01). Located approximately 40 km southeast of Houston, British Columbia (Figure 1), within the QUEST-West Project area and the mountain pine beetle impacted zone, this area has potential to host porphyry Cu±Mo and polymetallic vein-style (including Au) mineralization. This map area, and areas immediately adjacent, have a rich mineral exploration history and at present host a producing porphyry Cu-Mo mine (Huckleberry mine) and numerous developed Cu and Mo prospects (e.g., Berg, Lucky Ship, Whiting Creek; MacIntyre, 1985). This area also hosts epithermal vein and perhaps volcanogenic massive sulphide style mineralization, indicated by past producers such as Equity Silver, Silver Queen, and Emerald Glacier mines (MacIntyre, 1985; MacIntyre et al., 2004; Alldrick et al., 2007). Much of this map area is covered with glacial drift and continuous bedrock outcrop is limited to the higher peaks and their steep flanks. Till geochemical surveys are ideally suited to assessing the metallic mineral potential of areas where bedrock outcrop is obscured or scarce.

The main objective of this survey is to assess the mineral potential of an area where bedrock outcrop is limited. The goal of this study is to provide the mineral exploration community with high-quality, regional-scale, geochemical data that can be used to help guide exploration efforts. Integrating interpretations of these data with other geochemical and geophysical data (e.g., Geoscience BC QUEST-West Project), and historic data from the British Columbia Geological Survey (BCGS) and the Geological Survey of Canada, will provide a powerful tool for companies exploring in this drift-covered area.

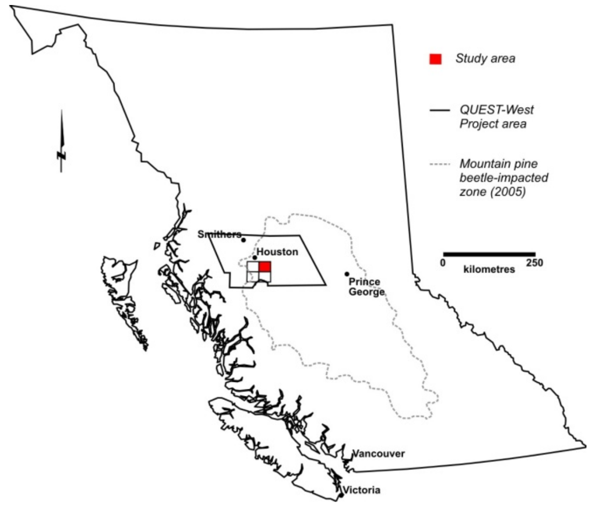


Figure 1. Location of study area in west-central British Columbia.

STUDY AREA

The study area is located in west-central BC, approximately 40 km southeast of Houston, BC (Figure 1). The area is accessible by Forest Service, mine, and mineral exploration roads. Quaternary sediments were studied in detail within 093L/01 while a regional-scale glacial history and ice-flow study was conducted within NTS 093L/01, 02 and 08 that builds on previous work conducted by Ferbey and Levson (2001a), Ferbey (2010a), and Ferbey and Levson (2010). To cover areas within NTS 093L/01 that lack appropriate sample material, additional infill till samples were collected within the most eastern portions of NTS 093L/02 (Figure 2).

The study area is situated in the Nechako Plateau, a subdivision of the Interior Plateau (Holland, 1976). The Nechako Plateau is an area of low relief with flat or gently rolling topography and near-continuous forest cover (Figure 3). Elevations within the study area range from 715 to 1624 m asl. Although glacial sediments are ubiquitous, bedrock outcrop can be found along lake shorelines, on the flanks of steep terrain, on local small-scale erosional remnants that stand above

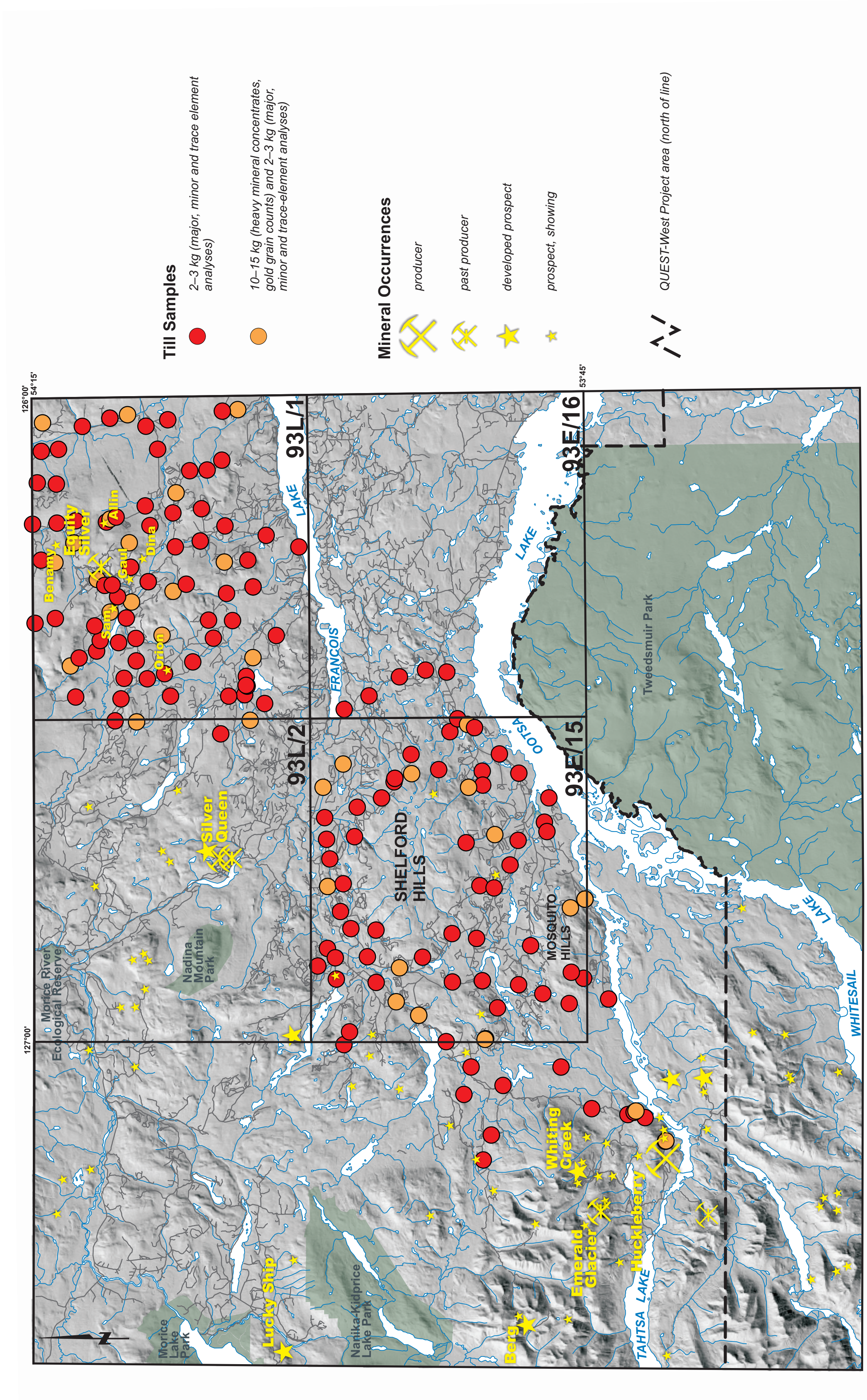


Figure 2. Study area including locations of mineral occurrences. Also shown are locations of till samples collected within NTS 093E/15 (Ferbey, 2010b) and 093L/01.

Figure 3. Subdued topography of the study area.

Quaternary sediments, and within some stream cuts. Small lakes and low discharge streams are common within the study area. The largest lake within the study area is Francois Lake which is fed at its west end by Nadina River and drains at its east end into Stellako River.

BEDROCK GEOLOGY

The bedrock geology of the study area was first described and mapped by Hanson et al. (1942). More detailed regional mapping has since been completed by Tipper (1976), Church and Barakso (1990), and Alldrick (2007a) while property-scale mapping at the past producing Equity Silver mine (located in the north-central part of the study area) has been completed by Alldrick (2007b). The following is a summary of the main geological subdivisions found in the study area from this more recent work.

The study area lies within the Stikine terrane, just east of the Coast Crystalline Belt (Monger et al., 1991). The oldest rocks include calc-alkaline volcanic rocks belonging to the Telkwa Formation of the Early Jurassic Hazelton Group (Figure 4). Unconformably overlying these rocks are coarse clastic marine sedimentary and volcanic rocks belonging to the Lower Cretaceous Skeena Group. The Lower Cretaceous volcanic succession, part of the Goosly sequence (Cyr et al., 1984), is significant from a mineral exploration perspective as a pyroclastic unit within it (a distal dacitic dust tuff) hosts Ag-Cu-Au mineralization at the past-producing Equity Silver mine (Alldrick, 2007a, b). These rocks are in turn unconformably overlain by volcanic rocks of the Upper Cretaceous Kasalka Group and Eocene Ootsa Lake and Endako groups. Andesite and basalt flows belonging to the Buck Creek Formation, and trachyte to basalt flows of the Goosly Lake Formation (both of the Endako Group), are the most areally extensive bedrock units exposed at surface in the study area (Figure 4).

Small to medium-sized stocks of Late Cretaceous to Early Tertiary age intrude these Jurassic and Cretaceous volcanic and sedimentary units (Figure 4). In the neighbouring region there is an association between the location of intrusive lithologies (in particular porphyritic intrusions like those of the Late Cretaceous Bulkley suite) and the locations of Cu, Mo, Ag, Pb, Zn, and/or Au mineralization (Carter, 1981; MacIntyre, 1985).

Significant contributions towards understanding the metallogenesis of the region's porphyry Cu-Mo deposits has been made from Carter (1981) and MacIntyre (1985). More recently MacIntyre (2001), MacIntyre et al. (2004), Alldrick (2007a, b) and Alldrick et al. (2007) have investigated the mineral potential of the Skeena Group.

Mineral Occurrences

There are seven documented metallic mineral occurrences within the study area (Figure 4). These showings and prospects are considered to be transitional, intrusion-related stockworks and veins (cf. Panteleyev, 1995). The exception is Orion showing (MINFILE 093L 330; Ag, Zn), which has not yet been assigned a mineral deposit type. Prospecting and mapping, geochemical, geophysical, and diamond drill programs have been conducted on Sam (MINFILE 093L 260; Ag, Zn;), Dina (MINFILE 093L 313; Cu, Ag), and Benamy (MINFILE 093L 331; Ag) showings and on Gaul (MINFILE 093L 256; Ag, Cu, Zn) and Allin (MINFILE 093L 293; Cu, Ag, Zn, Pb, Mo) prospects. Numerous assessment reports have been filed for this work and the reader is directed to these for a more detailed summary of results and recommendations (e.g., Scott, 1980; Lefebure, 1985; Betmanis, 1988; Donkersloot, 1988; Buchanan, 1998).

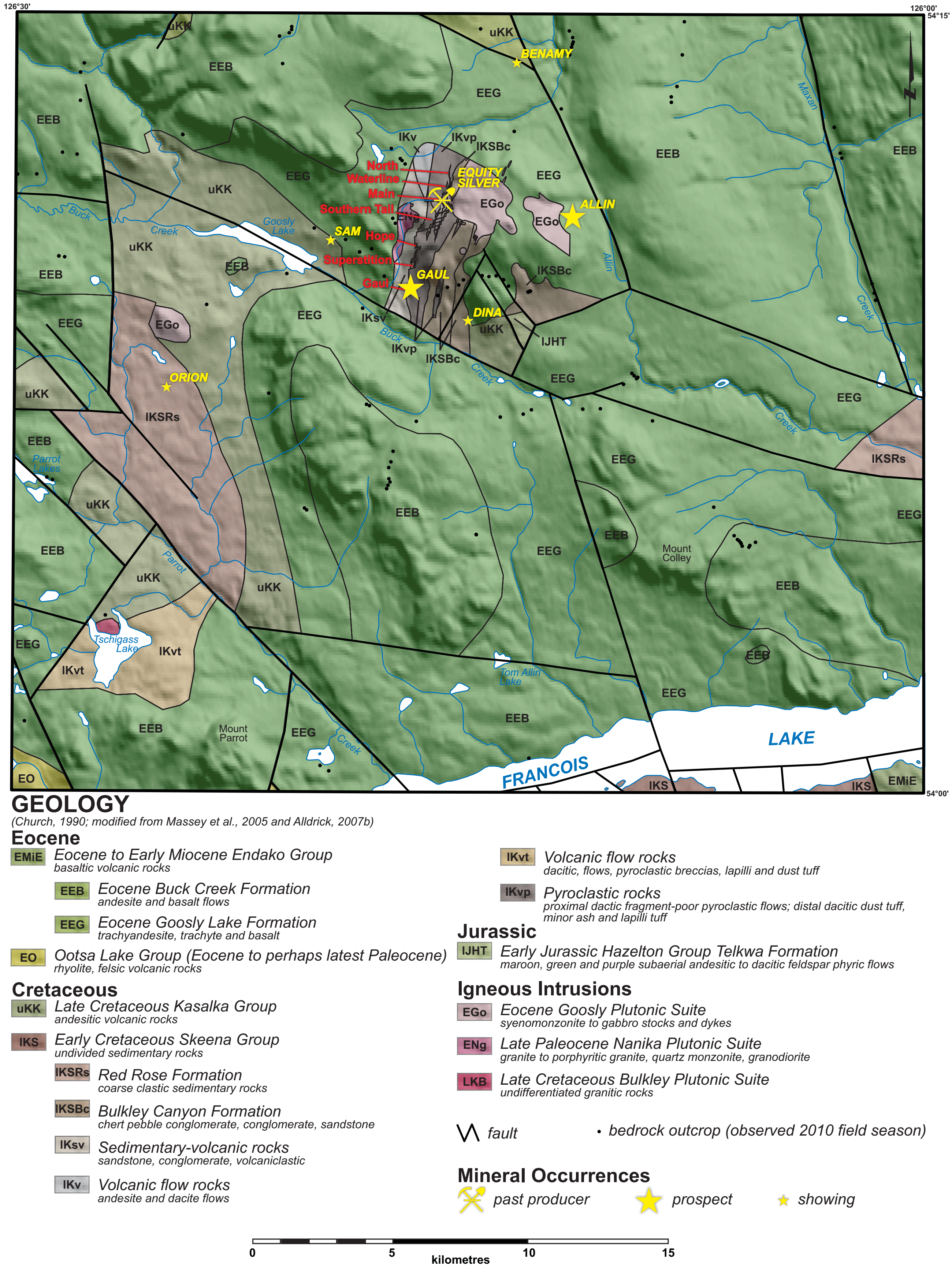


Figure 4. Bedrock geology of the Colleymount map area (093L/01). Mineralized zones at the past producing Equity Silver mine are labelled in red.

Although a mineral occurrence has not been documented in the Tsichgass Lake area, assessment reports have been submitted for work conducted immediately north and northeast of the lake (e.g., Tavela, 1971, 1981; Moll, 2007, 2010). It is interesting to note that mineralized float with an ore-grade Cu value has been found on Parrot Creek, 3 km north of Tsichgass Lake (0.45% Cu; Tavela, 1971), while float with high-grade Cu, Ag, and Au values has been found at surface 730 m south-southeast of Allin prospect (up to 10% Cu, 505 g/t Ag, and 5 g/t Au; Wall, 1993). To date, exploration efforts have not identified sources for this mineralized float.

Equity Silver (MINEFILE 093L 001; Ag, Cu, Au), located in the north-central part of the study area, is a past-producing Ag-Cu-Au mine. While in operation from 1980 to 1994 it was BC's largest silver mine and produced 33.8 million tonnes of ore grading 64.9 g/t Ag, 0.4% Cu, and 0.46 g/t Au (MINFILE, 2010). Since its discovery, there has been some debate over the style of mineralization at Equity Silver and the relationship, if any, between the orebodies and a Paleocene quartz monzonite stock to the west and an Eocene gabbro-monzonite stock to the east. The five genetic models that have been proposed for mineralization at Equity Silver, summarized from Alldrick et al. (2007), are:

- Early Cretaceous syngenetic exhalative mineralization with later remobilization resulting from emplacement of the eastern Eocene stock (Ney et al., 1972; MacIntyre 2006);
- Early Cretaceous epithermal mineralization with later remobilization resulting from emplacement of the eastern Eocene stock (Wojdak and Sinclair, 1984);
- Early Cretaceous porphyry-epithermal (transitional) mineralization with later remobilization resulting from emplacement of the eastern Eocene stock (Panteleyev, 1995);
- epigenetic mineralization related to emplacement of the western Paleocene stock (Cyr et al., 1984); and
- epigenetic mineralization related to emplacement of the eastern Eocene stock (Church and Barakso, 1990).

A U-Pb zircon radiometric age of 113.5 +4.5/-7.2 Ma confirms that the volcanic host-rock at Equity Silver is Early Cretaceous (D.G. MacIntyre, pers comm., 2011). Galena Pb isotope studies by Godwin et al. (1988) and Alldrick (1993) indicate that Pb was introduced into the ore zones during the Early Cretaceous, and may have been contemporaneous with the deposition of the dacitic dust tuffs and flows that hosts these mineralized zones (Alldrick et al., 2007). Of the five genetic models proposed the first three fit this geochronological control best. Understanding the timing and style of mineralization at Equity Silver, and the bedrock lithologies that host this mineralization, is important for the success of future exploration programs in the region.

In detail, the Goosly sequence is an Early Cretaceous inlier that hosts mineralization at Equity Silver. This sequence is composed of four conformable units which include a lower clastic division (basal conglomerate and minor argillite), a middle pyroclastic (intercalated subaerial tuffs, breccias, and epiclastics) and sedimentary-volcanic division (interbedded volcanic conglomerate, sandstone and tuff) and an upper volcanic flow division (bedded andesitic to dacitic flows). This sequence is intruded on its western margin by a Paleocene quartz-monzonite stock and on its eastern margin by an Eocene gabbro-monzonite stock. Andesitic and quartz latitic dykes cross cut the Goosly sequence and the eastern gabbro-monzonite stock (Ney et al., 1972; Cyr et al., 1984; Alldrick, 2007b; Figure 4).

The Main and Southern Tail zones were the primary focus of mining activity at Equity Silver mine and the Equity Silver occurrence sits squarely within the Main zone (Figure 4). Exploration continued after commissioning of the mine and other mineralized zones were identified adjacent to these zones. For example, thin, discontinuous and offset tabular zones of Ag-Cu-Au mineralization extend for approximately 2 km south-southwest of the Main and Southern Tail zones and include the Hope, Superstition, and Gaul zones (Alldrick et al., 2007; Figure 4). Extending north for almost 2 km from the Main zone are the Waterline and North zones (Figure 4). As suggested by more recent work conducted by Finlay Minerals Ltd. on their Silver Hope property, which includes the Gaul, Superstition, and Hope zones, there is potential for more mineralization to be discovered in the Equity Silver mine area (Brown, 2009).

QUATERNARY GEOLOGY

Previous Quaternary geology work conducted within the study area is limited to soils and terrain mapping. Researchers with the BC Ministry of Environment were the first to map the area, producing a 1:50 000-scale soil and landform map (BC Ministry of Environment, Lands, and Parks, 1976). Singh (1998) has completed the most recent mapping within the study area, a terrain classification map completed at 1:20 000-scale.

Quaternary geological studies have been conducted in adjacent areas. To the north and northwest, Clague (1984), Tipper (1994), Levson (2001a), and Levson (2002) discuss the Quaternary geology and geomorphic features of portions of NTS 093L, M and 103I, P. To the northeast, Plouffe (1996a, b) mapped the surficial deposits and described the Quaternary stratigraphy of the west half of NTS 093K. Mate (2000) conducted a similar study to the southeast in NTS 093F/12 while Ferbey and Levson (2001a, b, 2003), and Ferbey (2004) conducted a detailed study of the Quaternary geology and till geochemistry of the Huckleberry mine region. Included in this work was surficial geology mapping and detailed sedimentological descriptions for Quaternary sediments in the vicinity of Huckleberry mine and an investigation into the region's ice-flow history. Most recently Ferbey (2010a, b) presents data and interpretations on the Quaternary geology and till geochemistry of the Nadina River map area (NTS 093E/15), located immediately to the southwest of the study area.

Surficial Geology

The dominant surficial material found in the study area is an overconsolidated, light brown coloured diamicton with a clayey-silt to silt-rich matrix, similar to that described by Ferbey (2010a, b) for areas to the southwest. It is typically massive and matrix supported, and often exhibits vertical jointing and subhorizontal fissility giving it a blocky appearance (Figure 5). Matrix proportion varies from 65 to 75% and modal clast size is small pebble but can include boulder-sized material. Clast shape is typically subangular to subrounded. This diamicton generally conforms to underlying bedrock topography. Unlike areas to the south and southeast, however, streamlined terrain (drumlinized or fluted) is relatively

Figure 5. Clayey silt to silt rich, overconsolidated diamicton, interpreted as a basal till. Well developed vertical jointing and subhorizontal fissility give this basal till a blocky appearance. Pick for scale (65 cm).

uncommon in 093L/01 (cf. Ferbey, 2010a, b). Nevertheless, this overconsolidated, silt and clay-rich diamicton is thought to be a subglacially derived diamicton (Dreimanis, 1989) and is interpreted as a basal till; the ideal sample medium for a till geochemistry survey (Levson, 2001b).

Other glacial sediments occur within the study area. Glaciofluvial sands and gravels can be found along the south end of Parrott Lakes and extend southeast through Parrot Creek (locally known as Trout Creek) in a late-glacial to de-glacial drainage system. Other similar, but smaller-scale, systems occur in south flowing creeks that drain into Francois Lake. Sandy, cobble-sized gravels occur in outwash plains and fan-deltas where these creeks approach Francois Lake. Another de-glacial drainage system occurs within the Allin and Buck creek valleys east of Goosly Lake. Glaciofluvial hummocks in this system are up to 425 m long, 225 m across, and 20 m high, and are composed of sandy pebble to cobble-sized gravels.

Glaciolacustrine and lacustrine sediments appear to be rare within the study area, even along the shore of Francois Lake. This, and the almost exclusive occurrence of sands and gravels immediately adjacent to the larger physiographic features (such as the Francois and Goosly lake valleys), suggest that during deglaciation they were conduits for meltwater drainage rather than basins for meltwater ponding.

Ice-Flow History

During the 2010 field season ice-flow data were observed and recorded at 33 field stations (Figure 6). These data supplement 153 field stations and 207 moderately well to well-preserved streamlined landforms presented by Ferbey and Levson (2001a, b) and Ferbey (2004, 2010a, b) that summarize the ice flow history of the region. The majority of ice-flow indicators recorded during the 2010 field season were outcrop-scale features such as striations, grooves and rat tails (Benn and Evans, 1998). These features are typically found on the lower flanks of hillslopes where relatively unweathered bedrock has been exposed in road cuts. In many cases these features are remarkably well developed and preserved. Outcrop-scale, westward-oriented, ice-flow features were observed and recorded within the study area at high elevation (southeast of Equity Silver occurrence at 1400 m, Figure 7a) and low elevation (near southeast shore of Goosly Lake at 944 m; Figure 7b) sites.

Orientations of these ice-flow indicators show there are two dominant ice-flow directions in the study area, 062°-104° and 252°-288° (Figure 6). These values are in agreement with those presented by Stumpf et al. (2000), Ferbey and Levson (2001a, b) and Ferbey (2004, 2010a, b) and confirm that an ice-flow reversal occurred within the study area during the Late Wisconsinan. During the onset of glaciation, ice flowed radially from accumulation centres such as the Coast Mountains towards central-BC and the coast. At sometime during the glacial maximum this ice-divide migrated from the Coast Mountains east into central BC. Ice then flowed radially from central BC resulting in a reversal of ice-flow over the study area. Glaciers that were first flowing east then flowed west across some parts of the western Nechako Plateau, over the Coast Mountains and towards the Pacific Ocean. Stumpf et al. (2000) have suggested that this ice-divide was located somewhere east of the study area. Eastward ice-flow resumed within the study area after the ice divide migrated back over the axis of the Coast Mountains (in response to climate warming and a decline in ice volume) and continued until the close of the Late Wisconsinan glaciation.

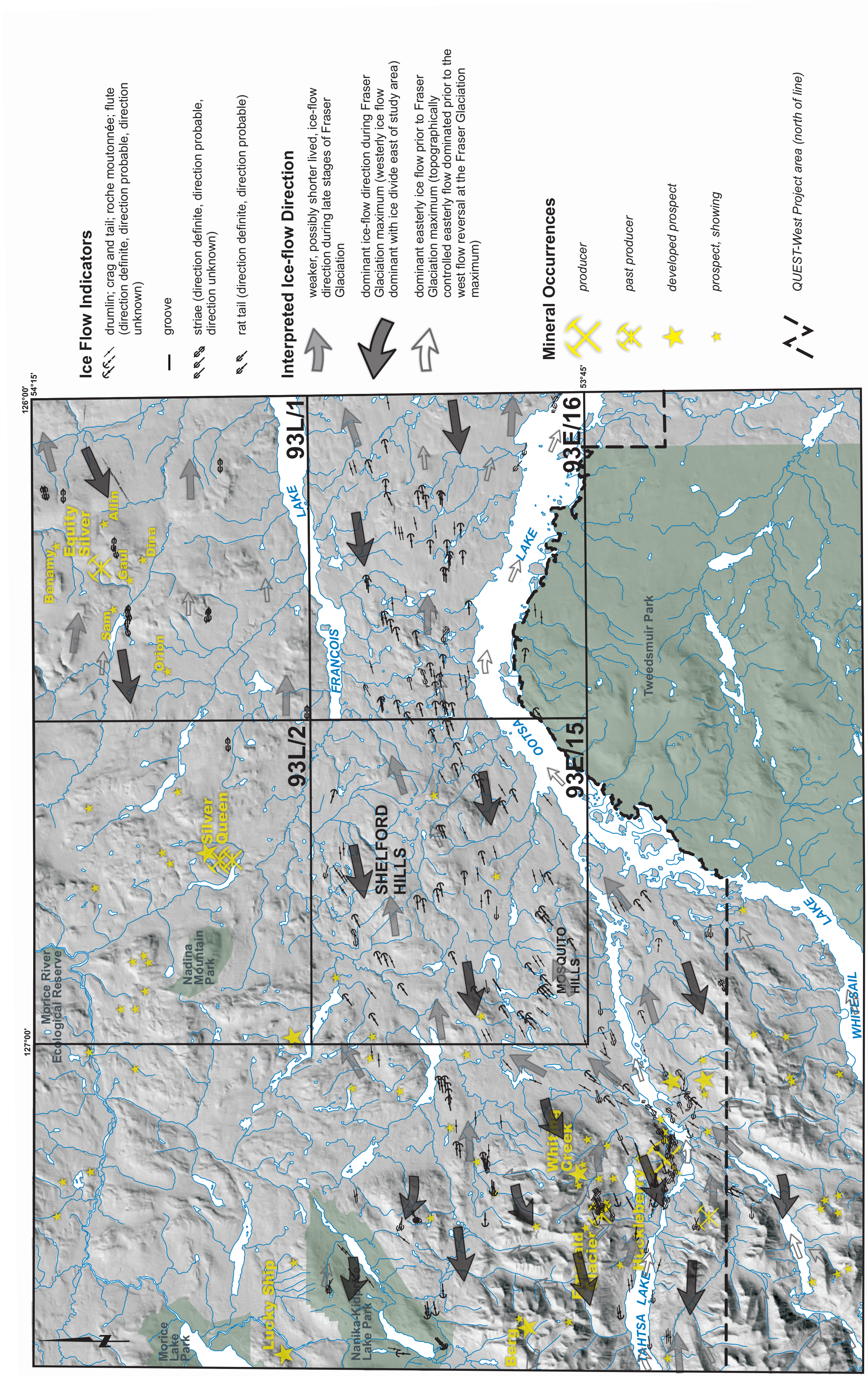


Figure 6. Ice-flow history of the study area and surrounding region (after Ferbey and Levson, 2001b).

Figure 7a. Photograph of well preserved rat tails on an outcrop of Goosly Lake trachyandesite. The outcrop is located 3 km southeast of Equity Silver minesite, on a southeastern aspect slope, at 1400 m asl. Orientations of these rat tails indicate ice flow towards 272°. Pen for scale (14 cm).

Figure 7b. Photograph of moderately preserved rat tail on an outcrop of Late Cretaceous Kasalka Group andesite. The outcrop is near the southeast shore of Goosly Lake at 944 m asl. Orientations of this rat tail indicates ice flow towards 252°. Pen for scale (14 cm).

TILL GEOCHEMISTRY SURVEY

Till geochemical surveys can detect mineralization and be used to identify new areas of geochemical interest where drift dominates and bedrock outcrop is scarce (e.g., Levson et al., 1994; Cook et al., 1995; Sibbick and Kerr, 1995; Plouffe, 1997; Levson, 2002). Basal till, the sample medium used in these surveys, is ideal for these assessments as it is a first derivative of bedrock (Shilts, 1993), has a predictable transport history, is deposited down-ice of its bedrock source, and produces a geochemical signature that is areally more extensive than its bedrock source (Levson, 2001b).

Approximately 75 km southwest of the study area, Ferbey and Levson (2001a, 2007) conducted a detailed till geochemical survey of the Huckleberry mine region. These studies demonstrate a clear relationship between till samples elevated in Cu, Mo, Au, Ag, and Zn and Cu-Mo ore zones at Huckleberry mine and smaller-scale polymetallic vein occurrences on the mine property. Lateral and vertical variability in trace element concentrations in till at Huckleberry mine provide further evidence for the ice-flow reversal mentioned above, that occurred during the Late Wisconsinan glacial maximum (Ferbey and Levson, 2007). Results from till geochemical transect conducted by Ferbey and Levson (2010) through the Copper Star Cu±Mo±Au occurrence (approximately 70 km west of the study area) also provide geochemical evidence for an ice-flow reversal. Due to a complex transport history, interpreting trace element geochemical data from tills and soils is difficult in this region.

Ney et al. (1972) recognized this ice-flow reversal during the early stages of exploration on the Sam Goosly deposit (eventually to become Equity Silver mine) when exploratory trenching and drilling of Ag anomalies in soils was initially unsuccessful. The eventual recognition of westward transport of glacial sediments (resulting from an examination of trench walls and glacially polished and resistant dykes) led to drilling up-ice or northeast of the Ag anomalies in soils. This resulted in the delineation of a mineralized zone.

Sample Media

During the 2010 field season, 2-3 kg till samples were collected at 84 sample sites for major, minor, and trace element geochemical analyses (Figure 2). An additional 18 till samples, each weighing 10-15 kg, were collected for heavy mineral separation and gold-grain counts (Figure 2). These larger samples were collected at sites where there was an adequate exposure of sample material. Till sample density for this survey is one sample per 10.5 km^2. Most samples were collected from unweathered till typically 1 m below surface.

Sample Preparation and Analysis

Till samples collected for major, minor, and trace element analyses were sieved, decanted and centrifuged, to produce a silt plus clay-sized (<0.063 mm) and clay-sized (<0.002 mm) fraction. This sample preparation was conducted at Acme Analytical Laboratories Ltd. (Vancouver, BC). Heavy mineral samples were sent to Overburden Drilling Management (Nepean, ON), where heavy mineral (0.25 to 2.0 mm) and gold grain (<2.0 mm) concentrates were produced using a combination of gravity tabling and heavy liquids.

On the 2-3 kg samples, minor and trace element analyses (37 elements) were conducted on splits of the silt plus clay and clay-sized fractions, respectively, by inductively coupled plasma mass spectrometry (ICP-MS), following an aqua regia digestion. Major element analyses were conducted on a split of the silt plus clay-sized fraction only using inductively coupled plasma emission spectrometry (ICP-ES), following a lithium metaborate/tetraborate fusion and dilute nitric acid digestion. This analytical work was conducted at Acme Analytical Laboratories Ltd. (Vancouver, BC).

An additional split of the silt plus clay-sized fraction (<0.063 mm) was analyzed for 35 elements by instrumental neutron activation analysis (INAA) at Becquerel Laboratories Inc. (Mississauga, ON). Instrumental neutron activation analyses for elements such as Au, Ba and Cr complement those produced by an aqua-regia digestion followed by ICP-MS as they are considered to be a near-total determination and hence more representative of rock-forming and economic mineral geochemistry. Additionally, INAA determinations were conducted on bulk heavy mineral concentrates produced from the 10-15 kg samples.

Elements analyzed for by aqua regia ICP-MS and INAA, and their detection limits, are summarized in Tables 1 and 2, respectively. Geochemical determinations on the silt plus clay-sized fraction (<0.063 mm) by aqua regia ICP-MS are presented in Appendix A, while determinations for the same size fraction by INAA are presented in Appendix B. Although not discussed here, major element determinations on the silt plus clay-sized fraction (<0.063 mm) are presented in Appendix C. Gold-grain data, including calculated visible gold concentrations (ppb) are presented in Appendix D. Determinations on the clay-sized fraction (<0.002 mm) will be the subject of a future report.

Quality Control

Quality control measures for analytical determinations include the use of field duplicates, analytical duplicates, and reference standards. For each block of 20 samples submitted for analysis, one field duplicate (taken at a randomly selected sample site), one analytical duplicate (a sample split after sample preparation but before analysis), and one reference standard were included in INAA and aqua regia ICP-MS analyses. Reference standards used were a combination of certified Canada Centre for Mineral and Energy Technology (CANMET) and in-house BCGS geochemical reference materials. Duplicate samples are used here to measure sampling and analytical variability, whereas reference standards are used to measure the accuracy and precision of the analytical methods.

For this study 12 field duplicate samples were collected (i.e., six duplicate pairs). In Appendices A and B, FDUP10 identifies the first sample collected at a field duplicate site while FDUP20 is the second sample collected at the same sample site. Six analytical pairs and five reference standards were also inserted into the sample sequence before analysis.

Copper, Mo, Pb, Zn, Ag, and Hg by aqua regia ICP-MS and Au, As, and Sb by INAA, the main elements of interest for this study, were selected for quality control analyses. Figures 8a and 8b present scatterplots of trace element concentrations measured in field duplicates by aqua regia ICP-MS and INAA, respectively. Figures 9a and 9b present scatterplots of trace element concentrations measure in analytical duplicates by aqua regia ICP-MS and INAA, respectively. Table 3 presents certified and reference values for CANMET and BCGS standards used in this study.

There are high correlation coefficients (R^2>0.9) for all field duplicate samples indicating good reproducibility and suggest a relatively high degree of sampling and analytical precision (Figures 8a and 8b). These results suggest that there is a relatively homogenous distribution of

Element	Detection Limit
Mo	0.01 ppm
Cu	0.01 ppm
Pb	0.01 ppm
Zn	0.1 ppm
Ag	2 ppb
Ni	0.1 ppm
Co	0.1 ppm
Mn	1 ppm
Fe	0.01 %
As	0.1 ppm
U	0.1 ppm
Au	0.2 ppb
Th	0.1 ppm
Sr	0.5 ppm
Cd	0.01 ppm
Sb	0.02 ppm
Bi	0.02 ppm
V	2 ppm
Ca	0.01 %
P	0.001 %
La	0.5 ppm
Cr	0.5 ppm
Mg	0.01 %
Ba	0.5 ppm
Ti	0.001 %
B	20 ppm
Al	0.01 %
Na	0.001 %
K	0.01 %
W	0.1 ppm
Sc	0.1 ppm
Tl	0.02 ppm
S	0.02 %
Hg	5 ppb
Se	0.1 ppm
Te	0.02 ppm
Ga	0.1 ppm

Table 1. Elements analyzed for by aqua regia ICP-MS, on the silt plus clay-sized fraction (<0.063 mm) of till samples, and associated detection limits.

Element	Detection Limit
Sb	0.1 ppm
As	0.5 ppm
Ba	50 ppm
Br	0.5 ppm
Cd	5 ppm
Ce	5 ppm
Cs	0.5 ppm
Cr	20 ppm
Co	5 ppm
Eu	1 ppm
Au	2 ppb
Hf	1 ppm
Ir	50 ppb
Fe	0.2%
La	2 ppm
Lu	0.2 ppm
Mo	1 ppm
Ni	10 ppm
Rb	5 ppm
Sm	0.1 ppm
Sc	0.2 ppm
Se	5 ppm
Ag	2 ppm
Na	0.05%
Ta	0.5 ppm
Te	10 ppm
Tb	0.5 ppm
Th	0.2 ppm
Sn	100 ppm
Ti	500 ppm
W	1 ppm
U	0.2 ppm
Yb	2 ppm
Zn	100 ppm
Zr	200 ppm

Table 2. Elements analyzed for by INAA, on the silt plus clay-sized fraction (<0.063 mm) of till samples, and associated detection limits.

a)

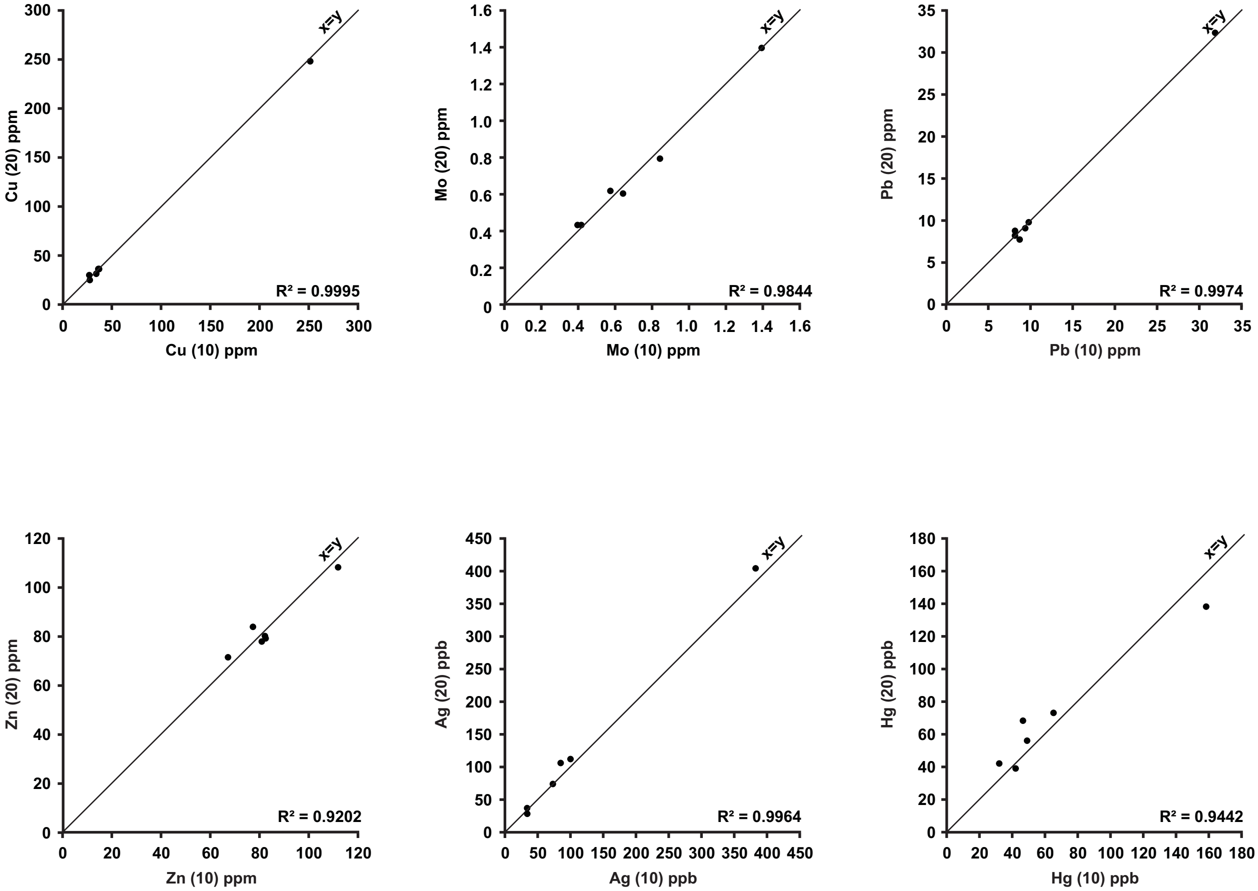
	Cu (ppm)	Mo (ppm)	Pb (ppm)	Zn (ppm)	Ag (ppb)	Hg (ppb)
Till- 4						
this study	248.78	15.73	37.86	59.2	194	53
	235.99	15.15	36.96	59.1	179	<5
certified value	*254*	*14*	*36*	*63*	*<200*	*39*
BCGS-1						
this study	186.41	0.88	220.95	349.3	1628	314
	182.79	0.83	236.66	328.2	1554	308
reference value	*179.13*	*0.8*	*221.21*	*348.4*	*1473*	*373*
BCGS-2						
this study	164.01	12.94	6.55	51.2	90	28
reference value	*171.04*	*13.41*	*7.56*	*50*	*74*	*25*

b)

	Au (ppb)	As (ppm)	Sb (ppm)
Till-4			
this study	<2	112.0	1.1
	<2	110.0	1.1
certified value	*5*	*111.0*	*1.0*
BCGS-1			
this study	33	68.1	17.1
	28	67.6	16.9
reference value	*34*	*67.9*	*15.5*
BCGS-2			
this study	32	8.3	0.8
reference value	*58*	*9.4*	*0.9*

Table 3. Summary statistics for standards used in this study. Determinations for a) Cu, Mo, Pb, Zn, Ag, and Hg are by aqua regia ICP-MS and b) Au, As, and Sb by INAA. Till-4 is certified by Canada Centre for Mineral and Energy Technology (CANMET). BCGS-1 and BCGS-2 are standards that have been developed in house by the British Columbia Geological Survey. The values presented for this study are single determinations on the silt plus clay-sized fraction (<0.063 mm).

a) Field duplicate determinatons by aqua regia ICP-MS



b) Field duplicate determinations by INAA

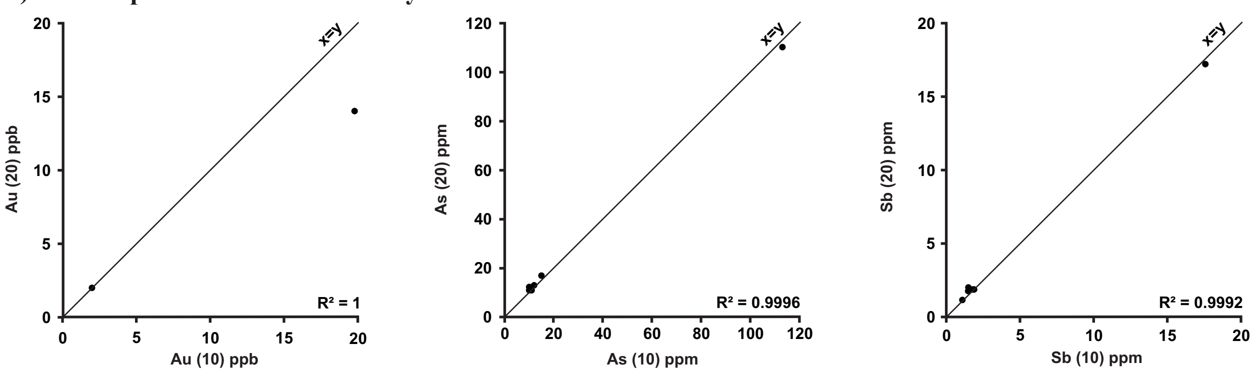
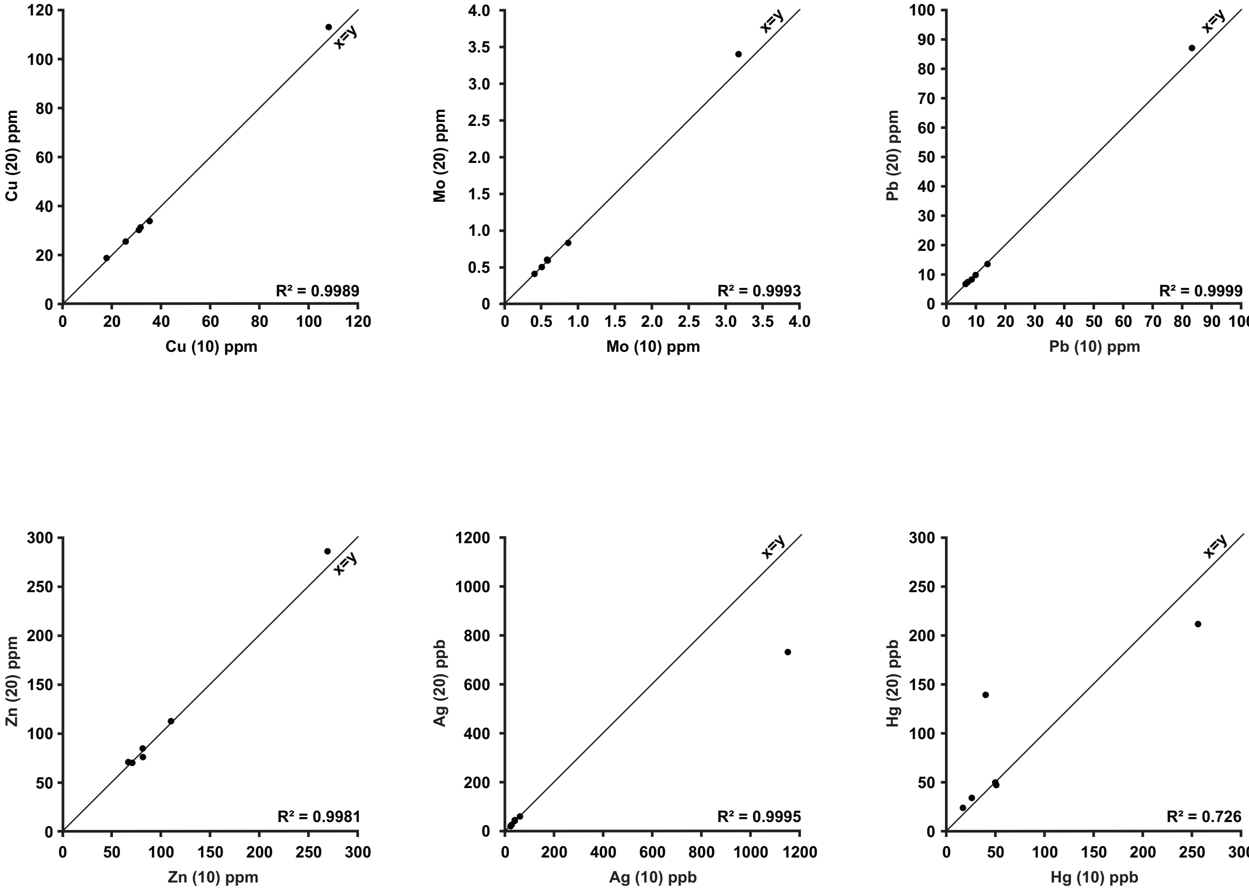


Figure 8. Field duplicate scatter plots for a) Cu, Mo, Pb, Zn, Ag, and Hg determinations by aqua regia ICP-MS (n=6) and b) Au, As, and Sb determinations by INAA (n=6).

a) Analytical duplicate determinatons by aqua regia ICP-MS



b) Analytical duplicate determinations by INAA

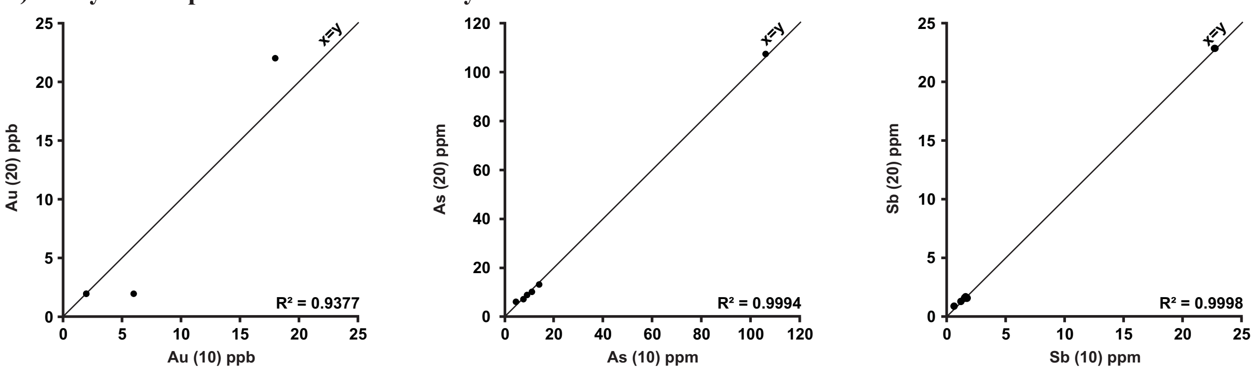


Figure 9. Analytical duplicate scatter plots for a) Cu, Mo, Pb, Zn, Ag, and Hg determinations by aqua regia ICP-MS (n=6) and b) Au, As, and Sb determinations by INAA (n=6).

elements in the silt plus clay-sized fraction (<0.063 mm) of tills in the study area. In the case of Au, an R^2 value of 1.0 is misleading as five of the six duplicate pairs returned Au values below detection (<2 ppb).

Correlation coefficients for analytical duplicate pairs are also high (R^2>0.95); Hg (R^2=0.726) being an exception (Figures 9a and 9b). A comparison of field and analytical duplicate correlation coefficients shows that R^2 values are very similar. In the case of Mo, Pb, Zn, Ag, and Sb analytical duplicate correlation coefficients are slightly higher which is to be expected as variability within a specific sample should be less that variability at a sample site.

The analyses presented here of field duplicate and analytical duplicate samples suggests that there is good reproducibility (high precision) for Cu, Mo, Pb, Zn, Ag, Hg, As, and Sb and that caution should be exercised if using Au data. Data presented in Table 3 show that there is also good reproducibility in certified and reference standards and that the analytical methods used demonstrate an acceptable degree of accuracy and precision.

TILL GEOCHEMICAL DATA

The following section presents aqua regia ICP-MS determinations for Cu, Mo, Pb, Zn, Ag, Hg, and INAA determinations for Au, As, and Sb on the silt plus clay-sized fraction (<0.063 mm) of till samples and calculated visible gold concentrations. This calculation is based on the total number of gold grains recovered in the <2.0 mm fraction of till samples and their size.

Summary statistics for Cu, Mo, Pb, Zn, Ag, Hg, Au, As, and Sb are presented in Tables 4 and 5. Percentile class breaks used in the proportional symbol plots (≤50, >50-70, >70-90, >90-95, >95-98, >98) are commonly used to categorize till geochemical data as they do not bias data classification (Plouffe and Ballantyne, 1993; Levson, 2001a; Levson, 2002; Levson and Mate, 2002; Lett et al., 2006; Plouffe et al., 2009; Ferbey, 2010b). For these summary statistics and proportional symbol plots, the second sample collected at a field duplicate sample site (i.e., FDUP20; see Appendices A and B) has been removed from the data set. Therefore the remainder of this report presents and discusses samples with unique locations (n=84).

Background concentrations are defined here as the median value for a given element and >95th percentile concentrations are considered elevated. The following discussion addresses background and elevated values for the elements of interest, and their spatial distribution and relationship with local bedrock lithologies.

Copper and Molybdenum

The spatial distribution for elevated Cu and Mo values is similar and so will be discussed together (Figures 10 and 11). The median Cu and Mo values for the study area are 31.32 ppm and 0.56 ppm, respectively. There is a strong positive correlation between elevated Cu and Mo values and locations of known mineralized zones at Equity Silver mine. The maximum Cu value (495.47 ppm) and second highest Mo value (10.61 ppm) occur 1.5 km west of the central portion of the Equity Silver mine's Southern Tail zone (sample 10TFE6105). The highest Mo value (16.32 ppm) and second highest Cu value (381.9 ppm) occur 1.2 km west of the southern end of the Southern Tail zone (sample 10TFE6106).

There is a northwest-trending group of regional samples that extends from the Goosly Lake area south to the Mount Colley area that have >70th percentile Cu and Mo values. Similar Cu values also occur in the northeastern part of the study area in tills exposed east of Maxan Creek. These samples were collected over areally

	Cu (ppm) ICP-MS	Mo (ppm) ICP-MS	Pb (ppm) ICP-MS	Zn (ppm) ICP-MS	Ag (ppb) ICP-MS	Hg (ppb) ICP-MS
detection limit	0.01	0.01	0.01	0.1	2	5
maximum	495.47	16.32	86.99	285.2	972	250
minimum	10.39	0.36	3.57	40.8	15	11
mean	45.48	0.98	12.12	83.9	110	64
median	31.32	0.56	8.80	78.0	55	46
n=	84	84	84	84	84	84

Table 4. Summary statistics for aqua regia ICP-MS determinations of Cu, Mo, Pb, Zn, Ag, and Hg on the silt plus clay-sized fraction (<0.063 mm) of till samples (n=84).

	Au (ppb) INAA	As (ppm) INAA	Sb (ppm) INAA
detection limit	2	0.5	0.1
maximum	31	113.0	24.4
minimum	<2	2.7	0.4
mean	-	15.9	3.2
median	<2	11.0	1.5
n=	84	84	84

Table 5. Summary statistics for INAA determinations of Au, As, and Sb on the silt plus clay-sized fraction (<0.063 mm) of till samples (n=84). Seventy-three of 84 samples collected for this study (87%) have values below the detection limit for Au by INAA.

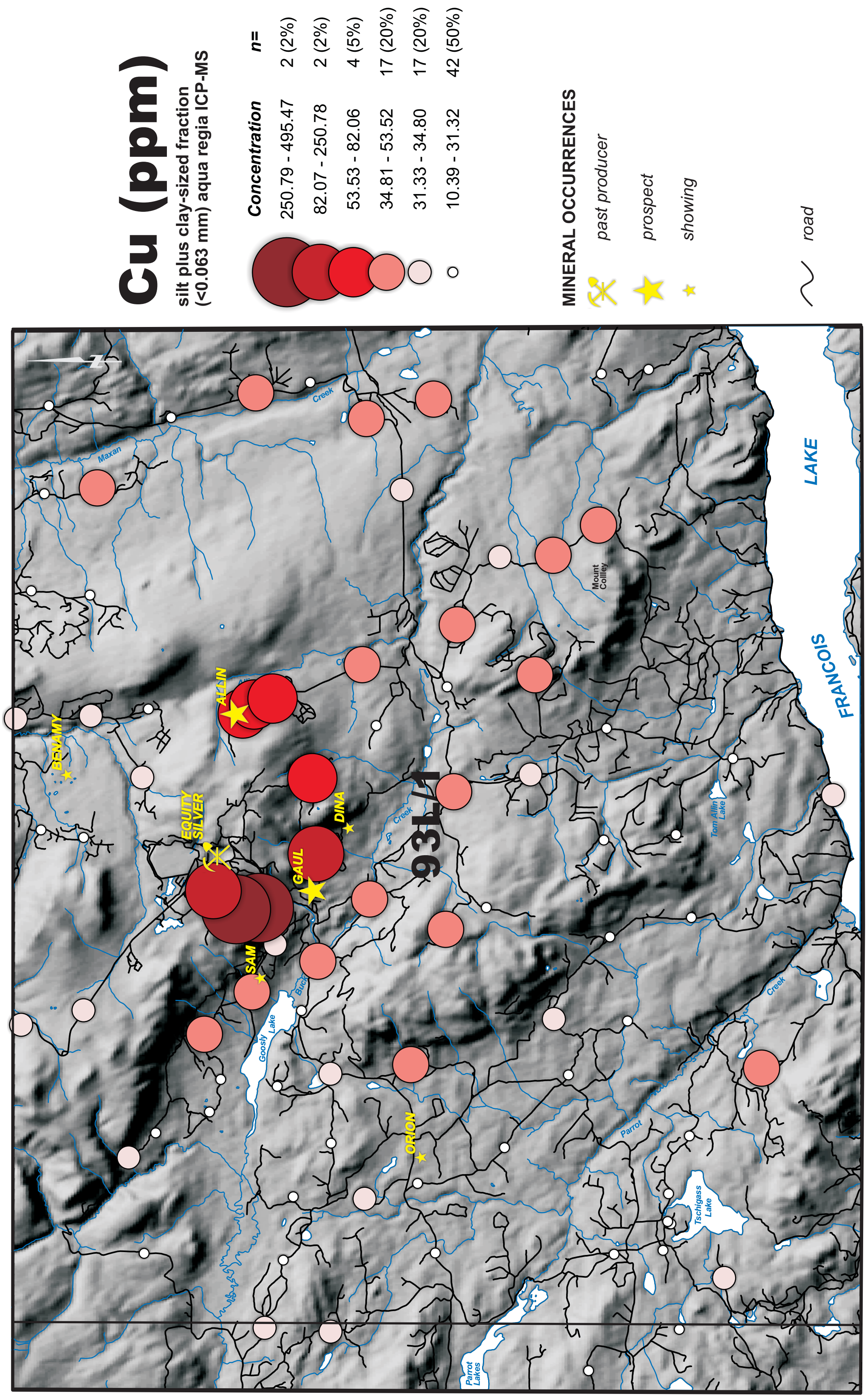


Figure 10. Proportional symbol plot for Cu values in the silt plus clay-sized fraction (<0.063 mm) of till samples collected in the study area.

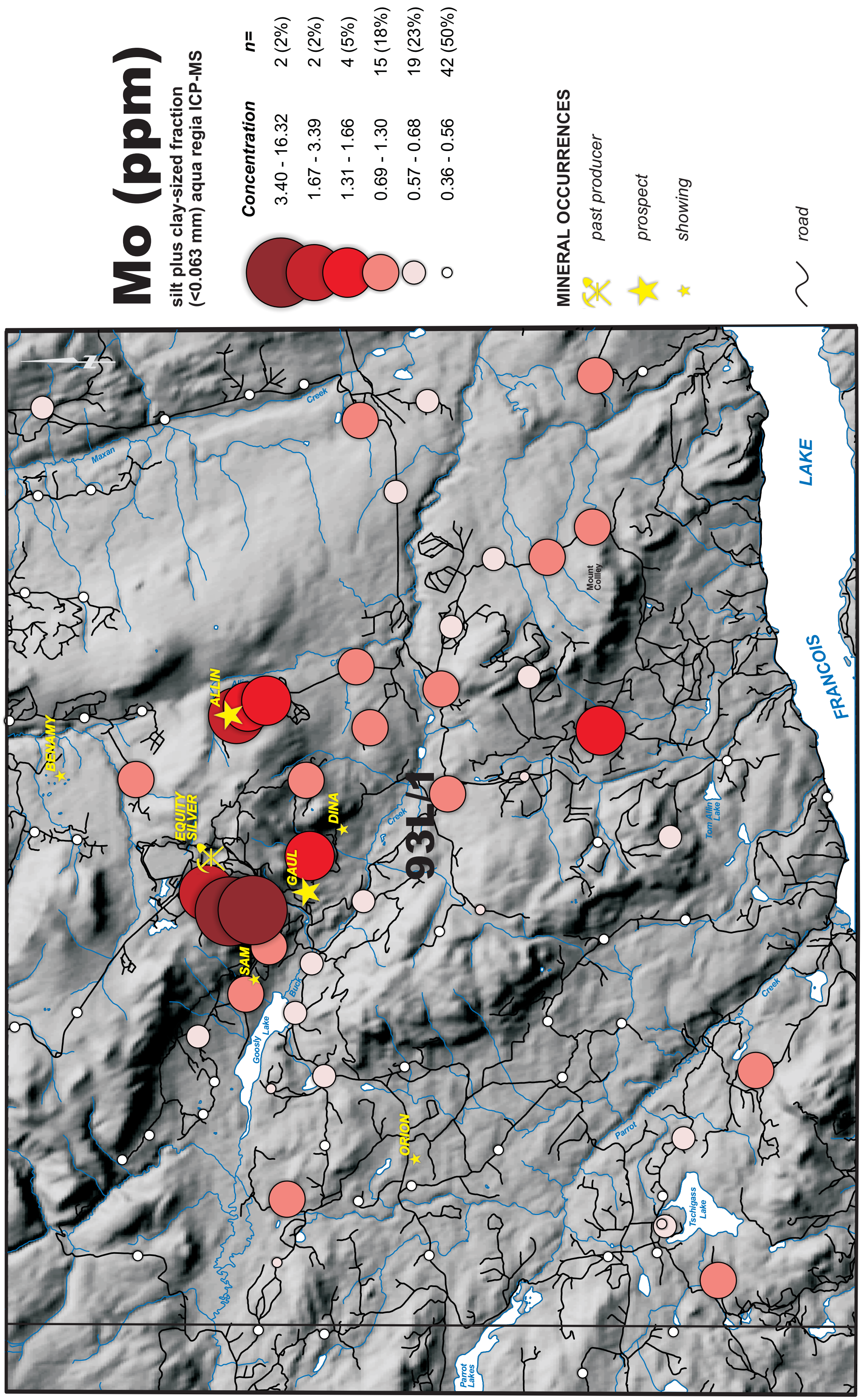


Figure 11. Proportional symbol plot for Mo values in the silt plus clay-sized fraction (<0.063 mm) of till samples collected in the study area.

extensive trachyandesite, andesite, and basalt flows belonging to the Eocene Buck Creek and Goosly Lake formations.

Lead and Zinc

The spatial distribution for elevated Pb and Zn values is similar and so will also be discussed together (Figures 12 and 13). The median Pb and Zn values for the study area are 8.80 ppm and 78.0 ppm, respectively. As with Cu and Mo, there is a strong positive correlation between elevated Pb and Zn values and locations of known mineralization. The maximum Pb and Zn values (86.99 pm and 258.2 ppm, respectively) occur in sample 10TFE6103 located 1.3 km west of Equity Silver's Main zone. The second highest Pb and Zn values (50.94 ppm and 150.6 ppm, respectively) for the study area occur in sample 10TFE6084 located 150 m south of Allin occurrence.

As with Cu and Mo, there is a northwest-trending group of regional samples that extends from the Goosly Lake area south to the Mount Colley area that have >70th percentile Pb and Zn values. These samples were collected over areally extensive trachyandesite, andesite, and basalt flows belonging to the Eocene Buck Creek and Goosly Lake formations. Separated from this group of samples by a series of samples with dominantly background Pb and Zn values, is a cluster of samples in the Tsichgass Lake area with 90th percentile values of Pb and Zn. These samples were collected near the only mapped Late Cretaceous Bulkley Suite granodiorite which has intruded into volcanic flows, pyroclastic breccias, and tuffs of intermediate to felsic compositon.

Silver

The median Ag value for the study area is 55 ppb. The maximum Ag value (972 ppb) occurs 1.2 km west of the southern end of Equity Silver's Southern Tail zone (sample 10TFE6106; Figure 14) while the second highest Ag value (949 ppb) occurs 150 m south of Allin occurrence (sample 10TFE6084). All ≥95th percentile Ag concentrations occur in the vicinity of Equity Silver, Gaul, Dina, and Allin occurrences.

In contrast to >70th percentile values for Cu, Mo, Pb, and Zn, the distribution of >70th percentile Ag values are not as spatially constrained. Similar to Mo, Pb, Zn, Hg, As, and Sb, however, 90th percentile Ag values occur in two samples in the Tsichgass Lake area. These samples were collected near the only mapped Late Cretaceous Bulkley Suite granodiorite which has intruded into volcanic flows, pyroclastic breccias, and tuffs of intermediate to felsic compositon.

Mercury

The median Hg value for the study area is 46 ppb. The spatial distribution of above-background Hg values is the most varied of the elements presented here (Figure 15). The highest Hg value (250 ppb, sample 10TFE6042) occurs 2 km northeast of Dina occurrence while the second highest Hg value (232 ppb, sample 10TFE6105) occurs 1.5 km west of the central portion of the Equity Silver mine's Southern Tail zone.

Approximately 3.5 km south-southeast of Dina showing, on the south side of Buck Creek valley, 225 ppb Hg occurs (sample 10TFE6026) while 222 ppb Hg occurs on the north side of Allin Creek valley near the eastern border of the study area (sample 10TFE6089). These 98th percentile Hg concentration samples were collected over areally extensive trachyandesite, andesite, and basalt flows belonging to the Eocene Buck Creek and Goosly Lake formations, in areas with no known mineralization.

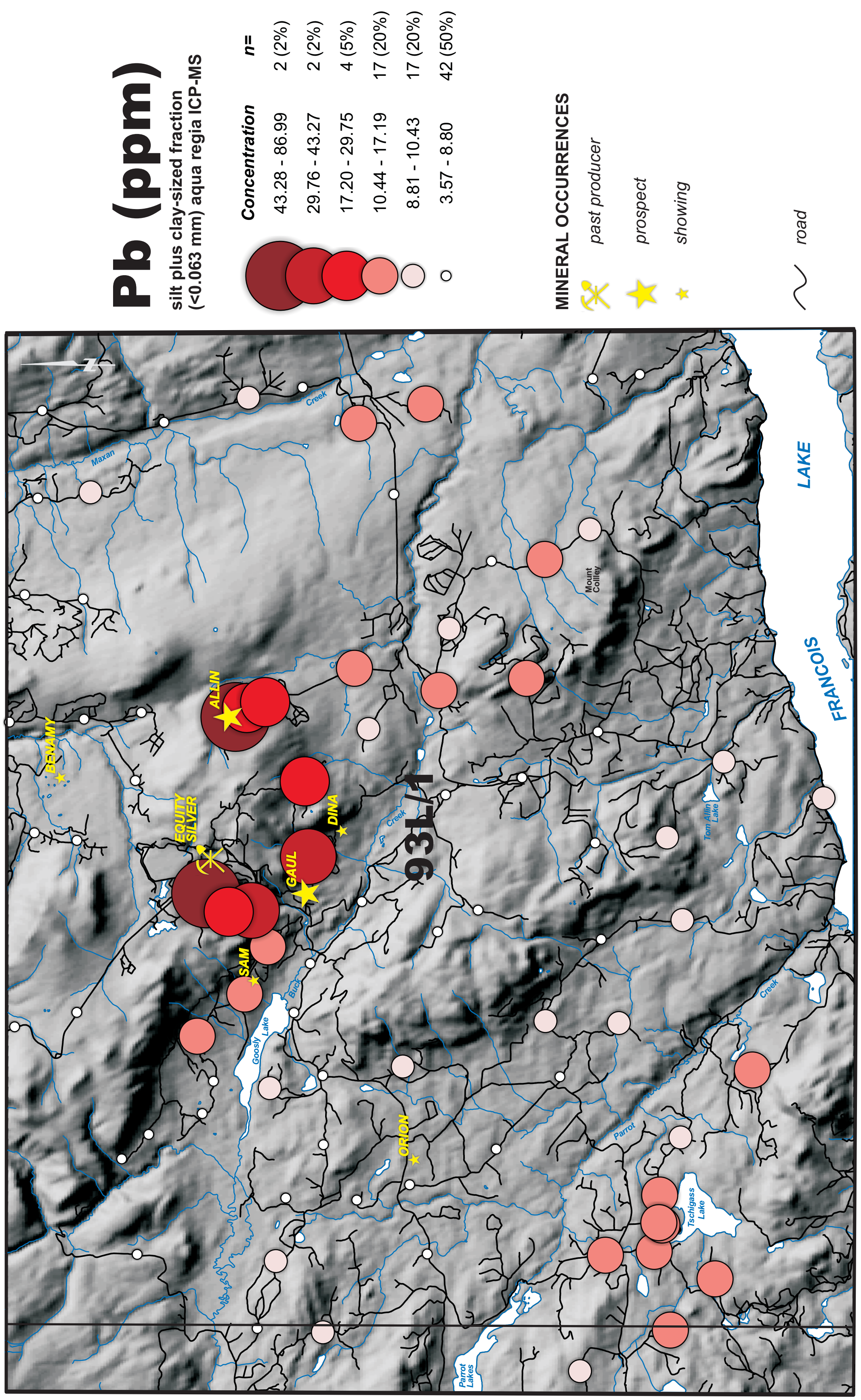


Figure 12. Proportional symbol plot for Pb values in the silt plus clay-sized fraction (<0.063 mm) of till samples collected in the study area.

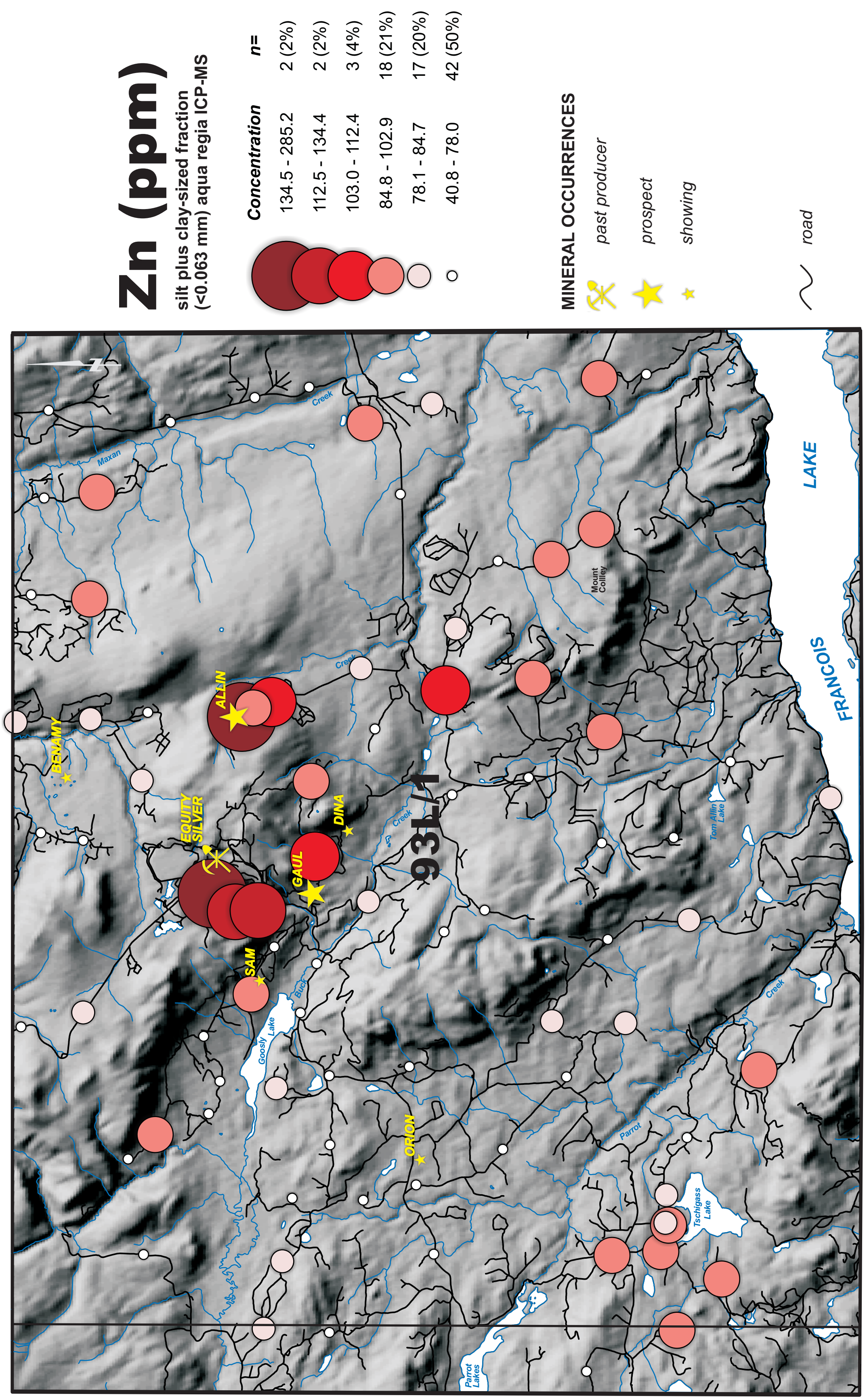


Figure 13. Proportional symbol plot for Zn values in the silt plus clay-sized fraction (<0.063 mm) of till samples collected in the study area.

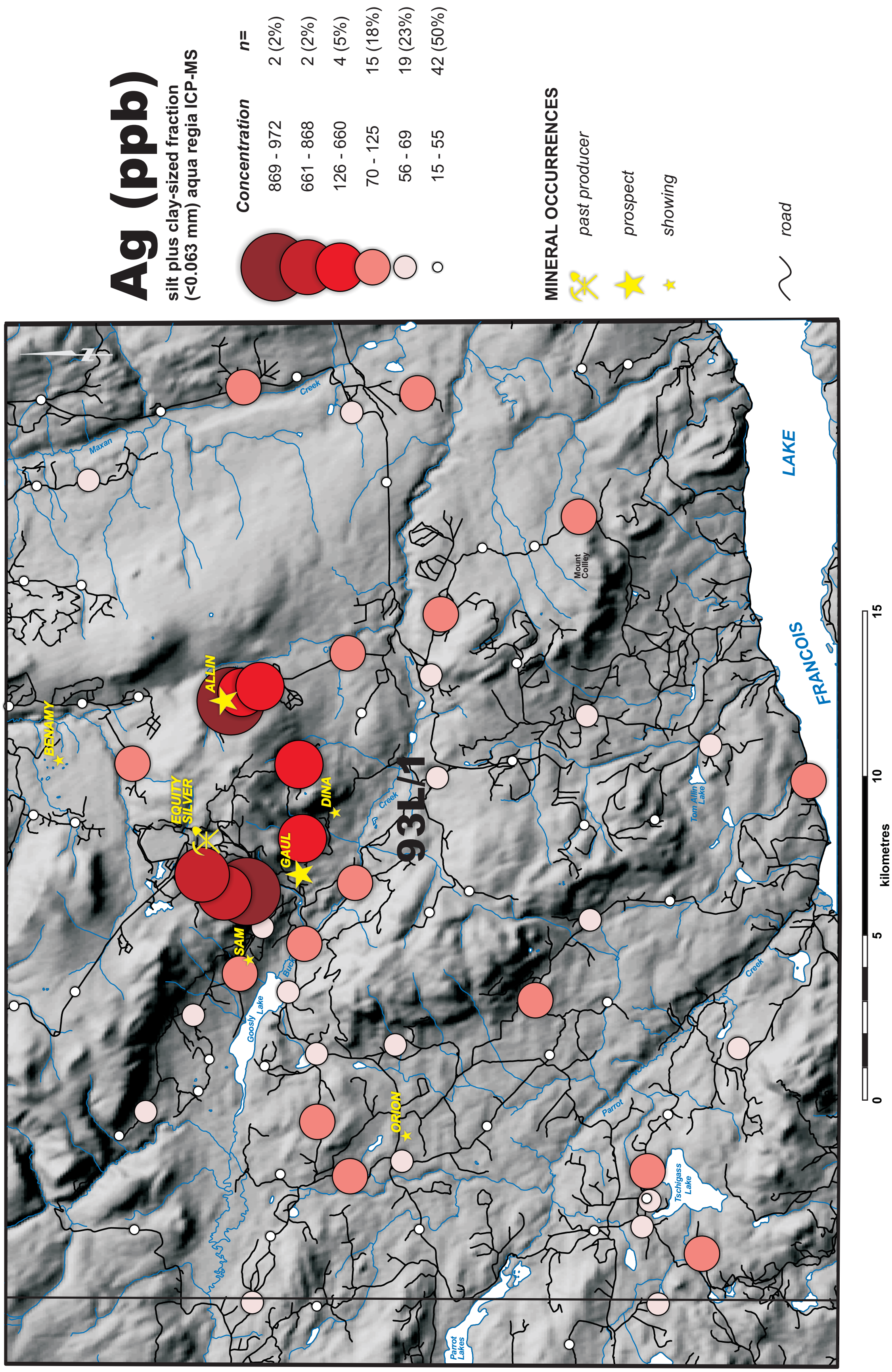


Figure 14. Proportional symbol plot for Ag values in the silt plus clay-sized fraction (<0.063 mm) of till samples collected in the study area.

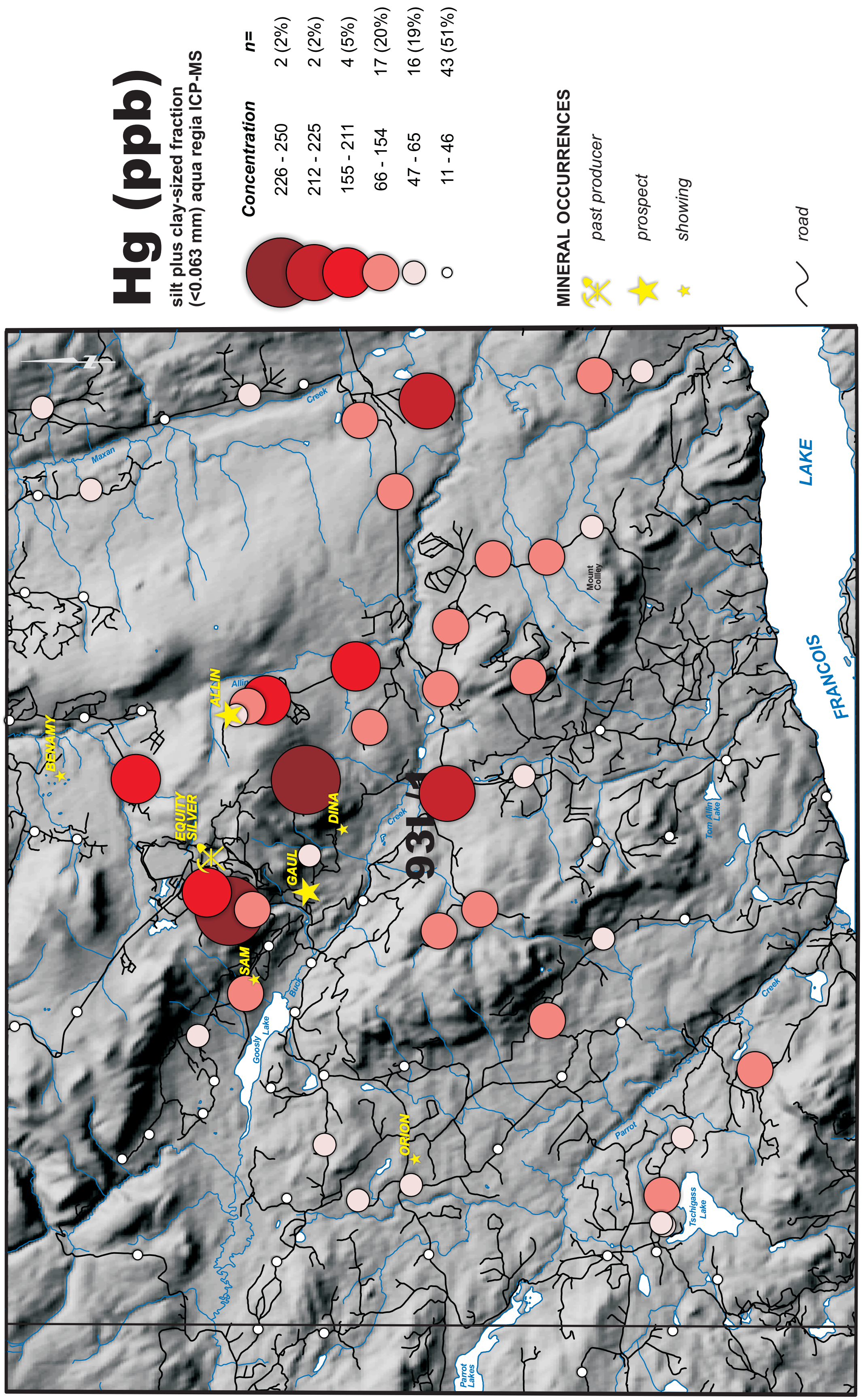


Figure 15. Proportional symbol plot for Hg values in the silt plus clay-sized fraction (<0.063 mm) of till samples collected in the study area.

Gold

GOLD BY INAA

Seventy-three of 84 samples collected for this study (87%) have values below detection for Au by INAA (2 ppb; Figure 16). The background value for Au for this study is therefore considered to be <2ppb. The highest Au by INAA value (31 ppb, sample 10TFE6106) occurs 1.2 km west of Southern Tail zone while the second highest Au value (29 ppb, sample 10TFE6105) occurs just to the north of here. The three samples with 95 percentile Au values (27, 22 and 20 ppb in samples 10TFE6084, 10TFE6103, and 10TFE6044, respectively) also occur in the Equity Silver mine and Allin occurrence area. Of the 12 samples that have Au values above background only three occur in areas where there is no known mineralization. One sample is located on the western flank of Mount Colley (sample 10TFE6082) and another is located southeast of Tom Allin Lake (sample 10TFE6083). Both samples contain 6 ppb Au. The third sample is located 1.3 km north of the northwest shore of Goosly Lake (sample 10TFE6048) and contains 4 ppb Au.

CALCULATED VISIBLE GOLD COCENTRATION FROM GOLD GRAIN COUNTS

Calculated visible gold concentrations are based on the total number of gold grains recovered in the <2.0 mm fraction of till samples and their size. The median calculated visible gold concentration is 19 ppb. The maximum value (120 ppb, sample 10TFE6104) occurs 1.2 km west of Equity Silver's Main zone (Figure 17) while the second highest value (111 ppb, sample 10TFE6043) occurs 2 km northeast of Dina occurrence. A <90th percentile value occurs in sample 10TFE6085 (87 ppb calculated Au), located 150 m south-southeast of Allin occurrence, and the remaining <90th percentile values occur in areas where there is no known mineralization. When looked at in detail, however, above background values for Cu, Mo, Ag, Hg, As, and Sb can be coincident with above background calculated visible gold concentrations.

Arsenic

The median As value for the study area is 11.0 ppm. The highest As value (113.0 ppm, sample 10TFE6044) occurs 1 km east of Gaul prospect while the second highest value (107.0 ppm, sample 10TFE6103) occurs 1.2 km west of Equity Silver mine's Main zone (Figure 18). Seven of eight samples with ≥95th percentile As concentrations occur in the vicinity of Equity Silver, Gaul, Dina, and Allin occurrences.

The spatial distribution of ≥90th percentile As values is similar to that of Cu and Mo in that the majority occur in an area that extends from the Goosly Lake area south to the Mount Colley area. Samples with 90th percentile As values also occur in the Tsichgass Lake area, and in sample 10TFE6115 located southeast of there.

Antimony

The median Sb value for the study area is 1.5 ppm. The maximum Sb value (24.4 ppm) occurs 1.2 km west of the southern end of the Southern Tail zone (sample 10TFE6106; Figure 19). All ≥95th percentile Sb values occur in the vicinity of Equity Silver, Gaul, Dina, and Allin occurrences. The spatial distribution of samples with ≥90th percentile Sb values is similar to that of ≥90th percentile Pb, Zn, and As, especially in the Tsichgass Lake area and in sample 10TFE6115, located southeast of there.

Element Associations

Coincident commodity metal and pathfinder element values occur in the study area. There are examples throughout it of

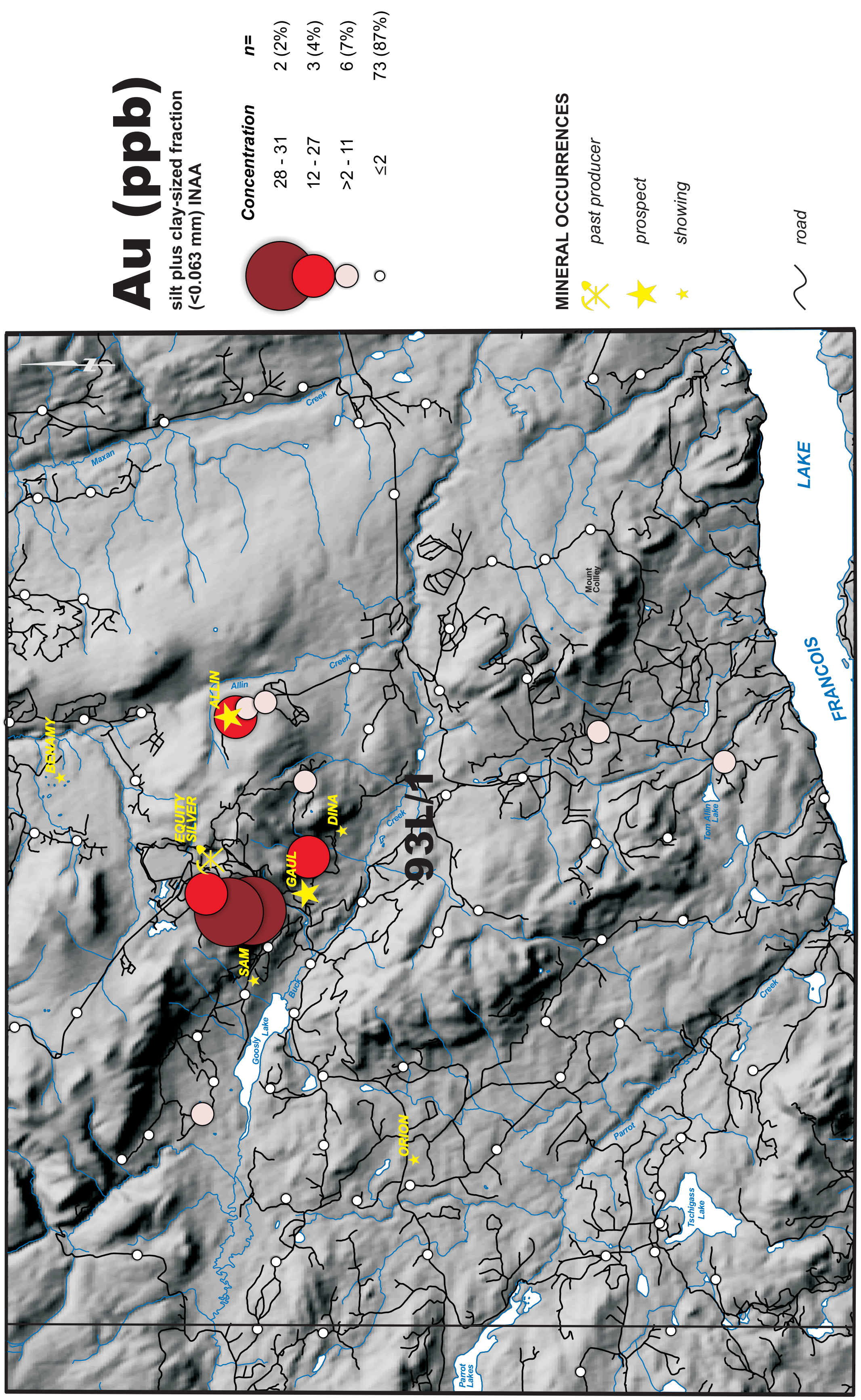


Figure 16. Proportional symbol plot for Au values in the silt plus clay-sized fraction (<0.063 mm) of till samples collected in the study area.

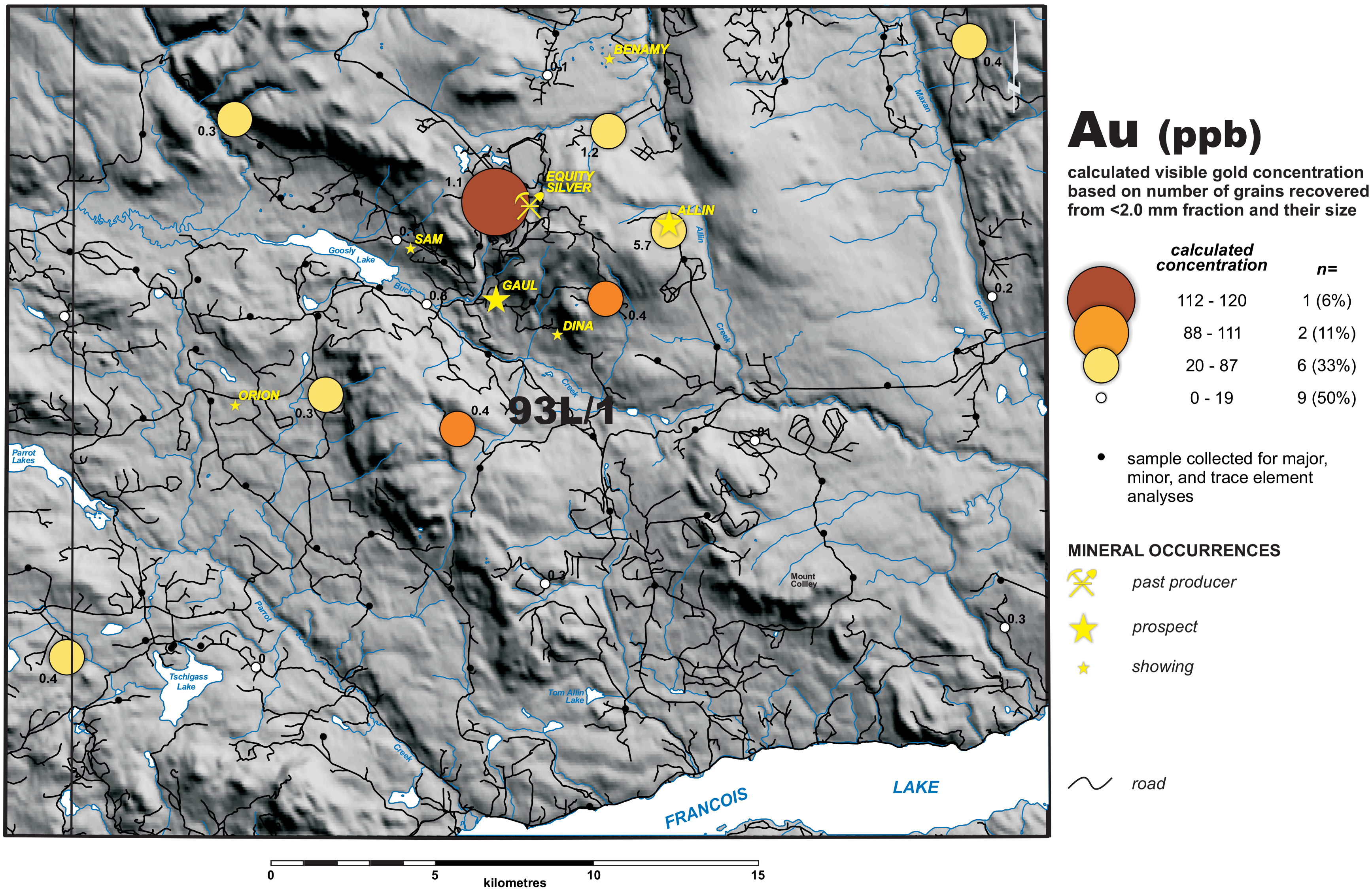


Figure 17. Proportional symbol plot for calculated visible gold concentrations. Labels are Au grain counts (grains/kg) on the <2.0 mm fraction of till samples, normalized to weight of sediment processed (i.e., table feed).

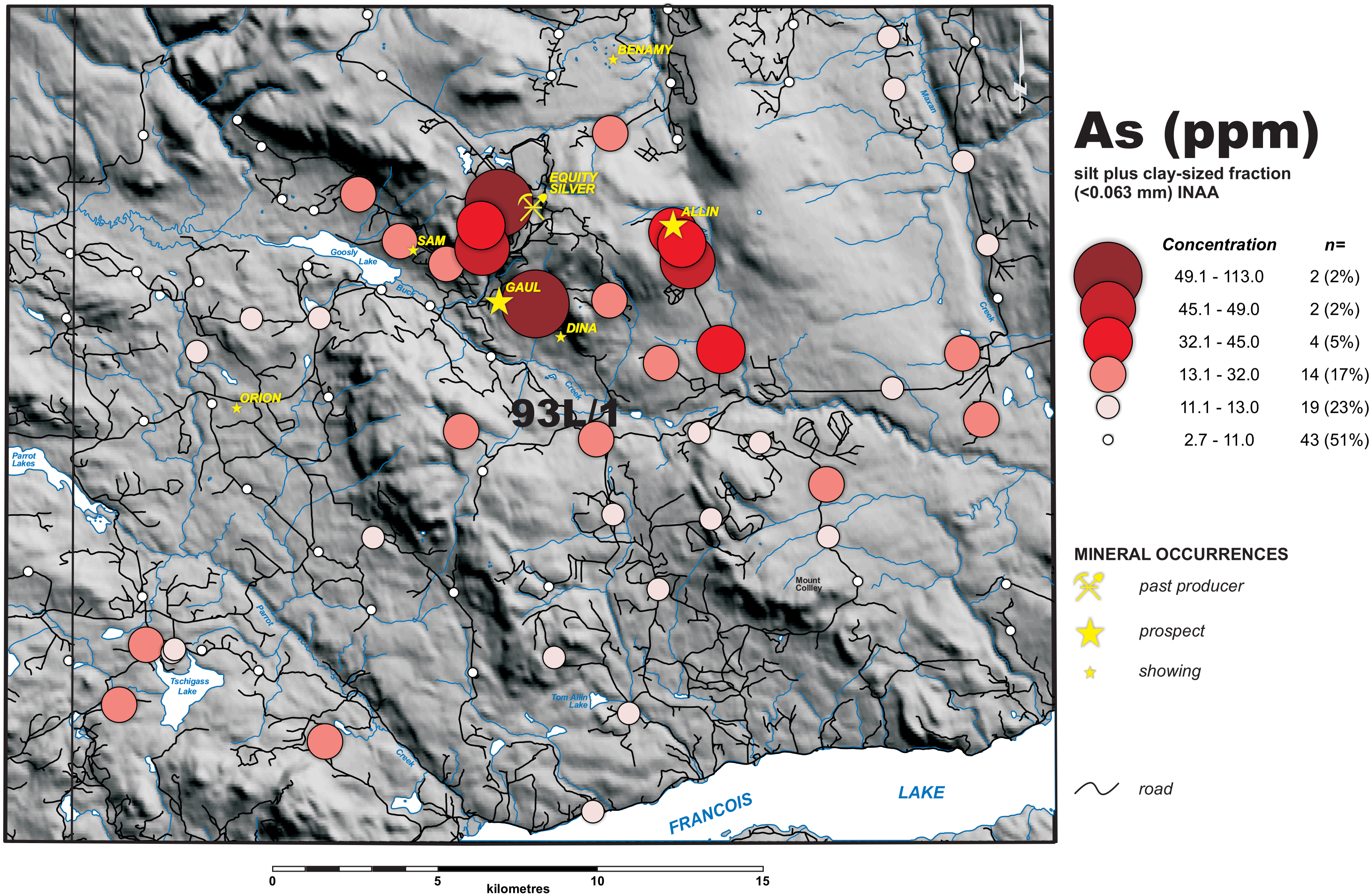


Figure 18. Proportional symbol plot for As values in the silt plus clay-sized fraction (<0.063 mm) of till samples collected in the study area.

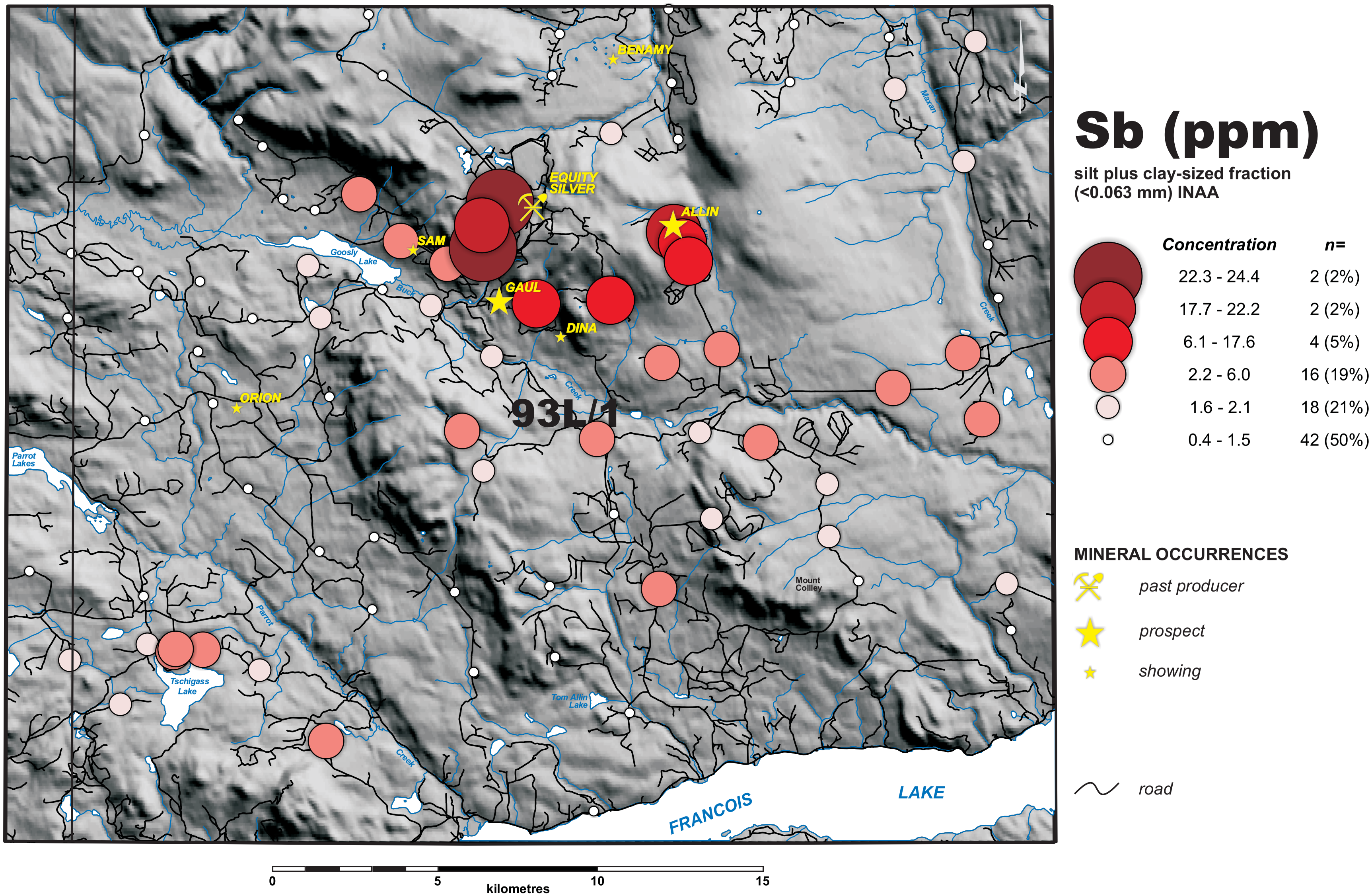


Figure 19. Proportional symbol plot for Sb values in the silt plus clay-sized fraction (<0.063 mm) of till samples collected in the study area.

coincident, and above background, element values occurring in a single sample. Good examples of coincident, and elevated, element values occurring in neighbouring samples can be found in the vicinity of Equity Silver mine, Allin occurrence, and Tsichgass Lake areas. These multi-element, multi-site associations are summarized here.

EQUITY SILVER MINE AREA

Elevated element values in tills are associated with detrital dispersal from Equity Silver's Main zone (Figure 20). Approximately 1.3 km west of it, in sample 10TFE6103, the maximum Pb (86.99 ppm) and Zn (258.2 ppm) values occur. Coincident with these Pb and Zn values are >98th percentile concentrations of As (107.0 ppm) and Sb (22.8 ppm) and 95th percentile Au (22 ppb).

Elevated element values in tills are also associated with detrital dispersal from Equity Silver's Southern Tail zone. Approximately 1.5 km west of it, in sample 10TFE6105, the maximum Cu value (495.47 ppm) and second highest Mo value (10.61 ppm) occur (Figure 20). Coincident with these values are the second highest values for Au by INAA (29 ppb) and Hg (232 ppb). Just south of here, in sample 10TFE6106, the maximum Mo (16.32 ppm), Ag (972 ppb), Au by INAA (31 ppb), and Sb (24.4) values occur which are coincident with the second highest Cu value (381.9 ppm).

ALLIN OCCURRENCE AREA

Elevated element values are present in tills in the Allin occurrence area. The second highest Pb (50.94 ppm), Zn (150.6 ppm) and Ag (949 ppb) values for the study area occur 150 m south of Allin occurrence in sample 10TFE6084 (Figure 20). Coincident with these values are 98th percentile Mo (1.74 ppm) and Sb (22.2 ppm) and 95th percentile Au (27 ppb) values. South of 10TFE6084, in samples 10TFE6086 and 10TFE6087, 95th percentile values of Cu, Mo, Pb, Zn, Ag, Hg, As, and Sb occur. Hydrothermally altered and weakly mineralized bedrock has been identified in the Allin occurrence area but a zone of mineralization has not yet been defined (Buchanan, 1998). These multi-element, multi-site associations cannot be explained by what is currently known about local bedrock lithologies occurring here.

TSICHGASS LAKE AREA

Multi-element associations occur in till samples of the Tsichgass Lake area (Figure 20). In each of the samples 10TFE6011, 10TFE6015, 10TFE6016, 10TFE6065, 10TFE6066, and 10TFE6067, 90th percentile values of at least two, and up to four, of the elements Mo, Pb, Zn, Ag, Hg, As, and Sb occur. Sample 10TFE6016 stands out from the group with the highest Mo (0.84 ppm), Pb (16.87 ppm), Zn (102.9 ppm), and As (15.0 ppm) values. Absolute element values occurring here are subdued compared to those occurring in the Equity Silver mine and Allin occurrence areas. They are included here, however, because of the large area they occur over.

TRANSPORT DIRECTION OF TILLS

Detailed till geochemical case studies conducted in the neighbouring region suggest that the detrital dispersal of mineralization from bedrock sources has been effected by the previously discussed Late Wisconsinan ice-flow reversal. For example, 70 km west of the survey area at the Copper Star porphyry Cu-Mo-Au occurrence and 75 km southwest of the survey area at the producing Huckleberry porphyry Cu-Mo Mine, net westward dispersal of Cu, Mo, Au, Ag, and Zn in till has been documented (Ferbey and Levson, 2007; Ferbey and Levson, 2010). The short transport distance at Copper Star occurrence (10's m from the bedrock source to the head of the dispersal train) is attributed not only

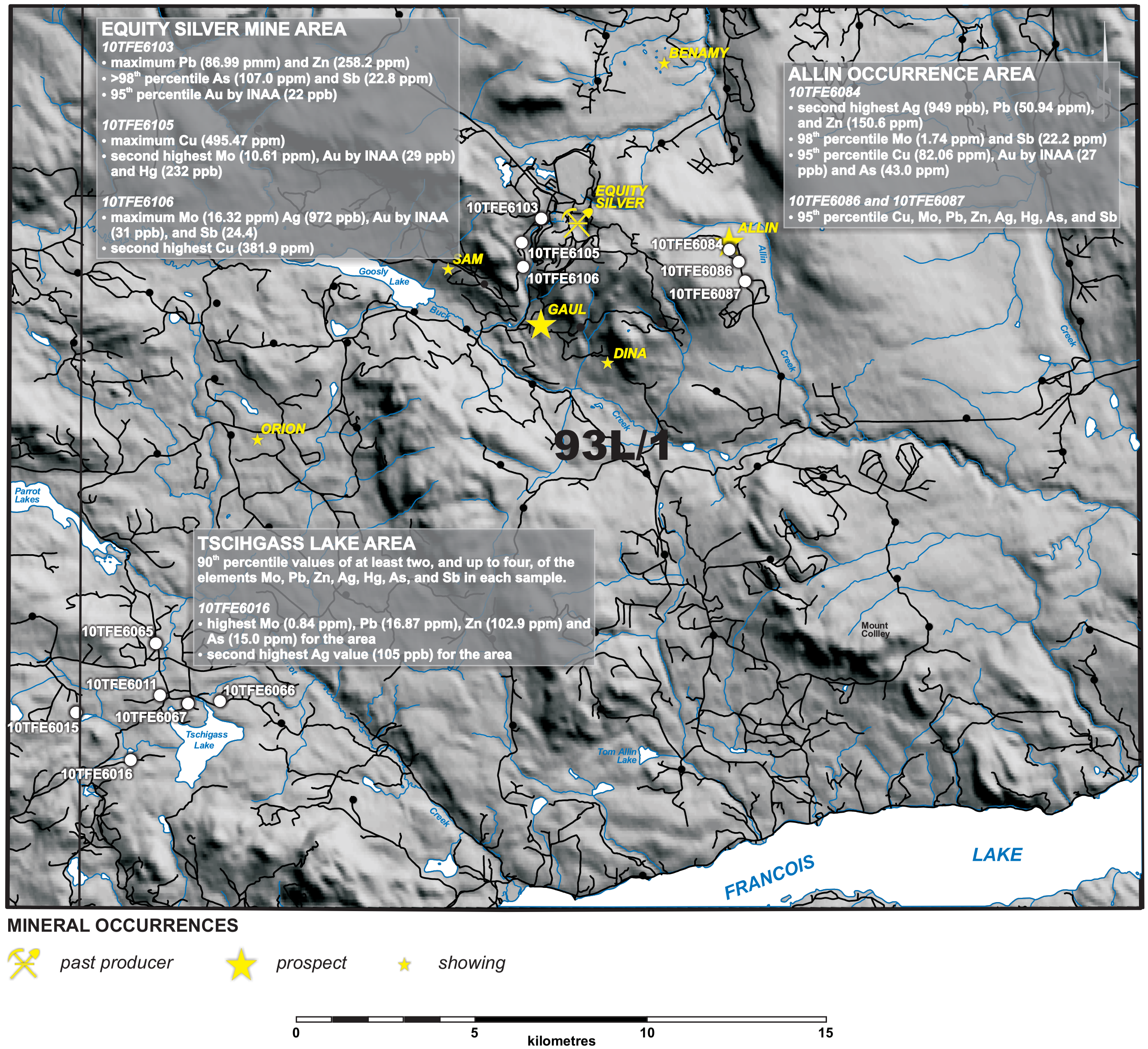


Figure 20. Element associations in tills of the study area.

the to the region's complex ice-flow history (two distinct and near-opposing ice-flow directions) but also to the thin till units there. At Huckleberry Mine, where till sequences >15 m thick occur, elevated element values can be detected 500 to 1250 m west-southwest of bedrock sources.

Results from an historical soil geochemical survey conducted west of Equity Silver occurrence (then called Sam Goosly deposit) also suggest net west-southwest transport of basal till in the study area (Ney et al., 1972). It was the eventual recognition of westward transport of glacial sediments (resulting from an examination of trench walls and glacially polished and resistant dykes), and drilling up-ice or northeast of a Ag anomaly in soil that led to the delineation of a mineralized zone. Till samples 10TFE6103, 10TFE6105, and 10TFE6106 were collected within the western periphery of the Ag in soil anomaly and elevated commodity metal and pathfinder element values in these till samples are similarly attributed to westward detrital dispersal of mineralization from mineralized zones at Equity Silver mine.

Based on the results of these geochemical surveys and the location of the study area relative to them, the proposed location of a Late Wisconsinan glacial maximum ice divide east of the study area (Stumpf et al., 2000), and the occurrence of west-southwest to west-northwest-indicating ice-flow features at high and low elevation settings within the study area, the dominant (or net) dispersal direction in tills of the study area is likely between west-southwest to west-northwest. As bedrock outcrop is limited within the study area, and there is some uncertainty around transport distance (due to the two distinct and near-opposing ice-flow directions), it would be prudent to begin any follow-up on results presented here at bedrock outcrop closest to till samples of interest. This could be considered a starting point from which follow-up work would continue in the up-ice direction, or generally towards the east and northeast. As part of any follow up on till geochemical data presented here, detailed outcrop scale investigations of ice-flow indicators should be conducted. The complexity of the region's ice-flow history, and variability in till thickness, suggests that there could be local variation in net transport direction and distance.

AREAS OF GEOCHEMICAL INTEREST

Two areas of geochemical interest have been identified using results presented in this study, the Allin occurrence and Tsichgass Lake areas. In identifying these areas, consideration was also given to mapped bedrock geology, locations of known mineral occurrences, exploration work conducted to date (as filed in assessment reports) and conductivity responses observed in helicopter-borne time-domain electromagnetic (EM) data acquired over Geoscience BC's QUEST-West Project area (Kowalczyk, 2009; Walker, 2009).

Figure 21 presents the locations of these two areas of geochemical interest. Also included are off-time profiles from EM data acquired over the study area (Kowalczyk, 2009). Although a legend is included, the reader is directed to the original report and map for a more detailed presentation of these data and survey parameters (Walker, 2009). For the purpose of the discussion that follows, higher amplitude EM responses can correspond to more conductive bedrock lithologies while lower amplitude EM responses can correspond to less conductive (more resistive) bedrock lithologies (Walker, 2009).

Allin Occurrence Area

The Allin occurrence area has been highlighted based on Cu, Mo, Pb, Zn, Ag,

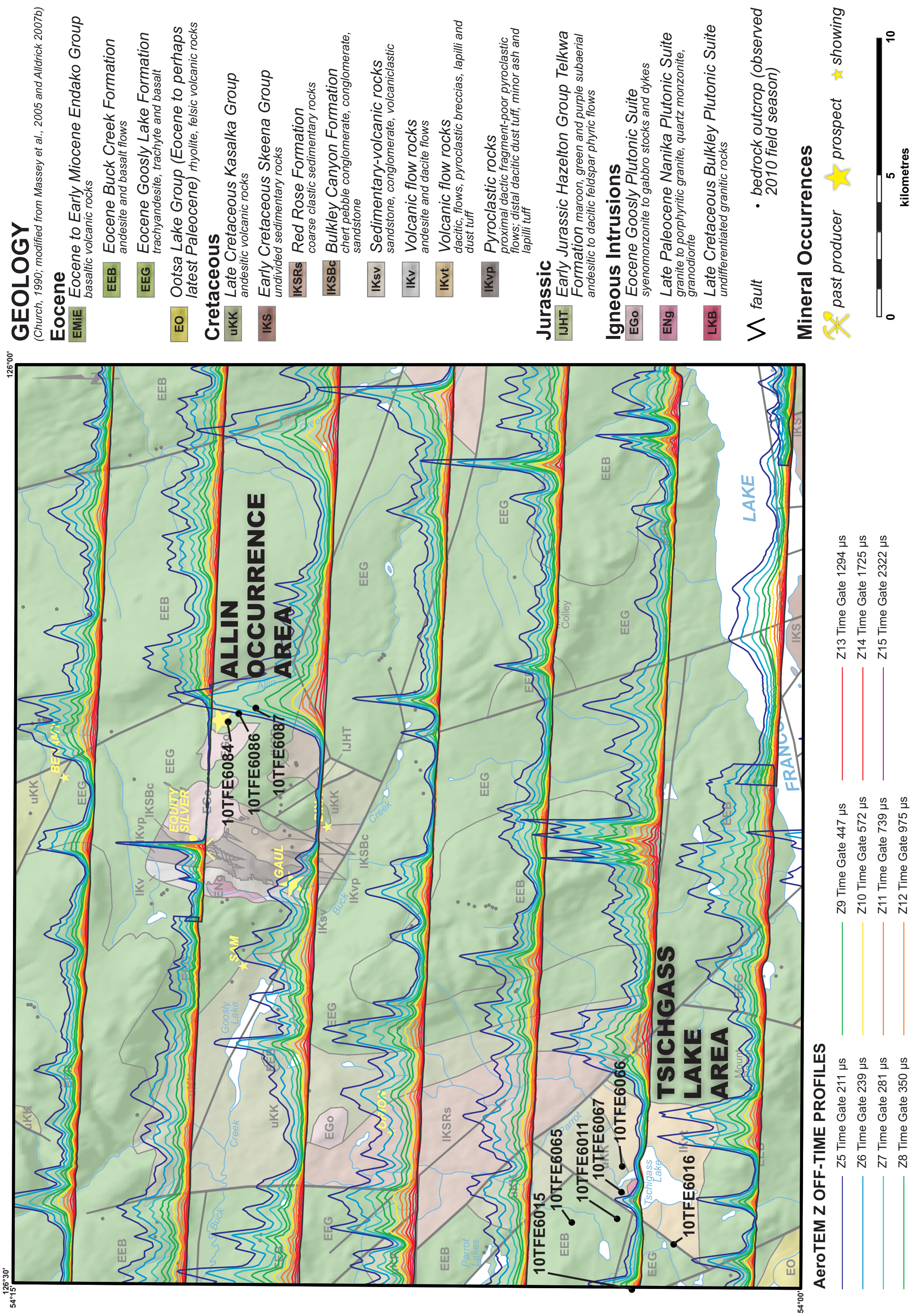


Figure 21. Areas of geochemical interest. Samples used to identify these areas are labelled. Also included here are helicopter-borne time domain EM data acquired for Geoscience BC's QUEST-West Project area. In these data, a higher amplitude EM response can correspond to more conductive bedrock lithologies while a lower amplitude EM response can correspond to less conductive (more resistive) bedrock lithologies.

Hg, Au by INAA, As, and Sb values in till (Figure 20). In sample 10TFE6084 the second highest Ag (949 ppb), Pb (50.94 ppm), and Zn (150.6 ppm) values occur for the study area. Coincident with these values are 98th percentile Mo (1.74 ppm) and Sb (22.2 ppm) values and 95th percentile Cu (82.06 ppm), Au by INAA (27 ppb) and As (43.0) ppm values. In samples 10TFE6086 and 10TFE6087, collected within 1 km south of Allin occurrence, 95th percentile values of Cu, Mo, Pb, Zn, Ag, Hg, As, and Sb also occur. For till samples collected as part of this study, these commodity metal and pathfinder element values are only exceeded by those occurring west of mineralization at Equity Silver mine.

In 1969, exploration work began south of Allin occurrence with the staking of the Dev claims by Summit Oils Ltd., and implementation of geological, geochemical, and geophysical exploration programs (Anselmo, 1970). Initial exploration objectives were to investigate aeromagnetic patterns suggestive of fault traces. One of these traces cut through property to the west, held by Kennco Explorations (Western) Limited, which at the time was known to host mineralization, and that was to eventually become Equity Silver mine. Over the subsequent 40 years additional prospecting, geological mapping, ground geophysical, soil geochemical, and diamond drill programs have been conducted in the vicinity of Allin occurrence (Anselmo and White, 1970; Garagan, 1988, Wall, 1993; Buchanan, 1998).

Hydrothermally altered and weakly mineralized tuffs and andesite to dacite flows, and unaltered diorite and andesite to dacite dykes, which are lithologically similar to the ore-hosting Goosly sequence at Equity Silver mine, have been identified locally in outcrop and in drill core. Results from these programs, however, have not been able to adequately explain elevated and coincident Ag and Cu values in soil, induced polarization anomalies, nor the occurrence of high-grade float at surface (up to 10% Cu, 505 g/t Ag, and 5 g/t Au; Wall, 1993) in the vicinity of Allin occurrence. Existing geological, geochemical, and geophysical data for the Allin occurrence area also do not explain the occurrence of elevated Cu, Mo, Pb, Zn, Ag, Hg, Au by INAA, As, and Sb values in till.

With the exception of an extensive soil geochemical survey presented by Van Damme (1996), exploration work as been conducted near to Allin occurrence. Diamond drilling has been conducted due east and southeast of Allin occurrence, immediately adjacent to the east side of Allin Creek channel (Buchanan, 1998). As seen in Figure 21, there is a low amplitude EM response over the gabbro-monzonite stock that intrudes Equity Silver's Goosly sequence. Ore-grade mineralization within this sequence can occur proximal to this intrusive contact. This same low amplitude response extends east to Allin occurrence and south towards Dina occurrence, suggesting this gabbro-monzonite stock could be areally more extensive than is currently mapped.

Till geochemical data presented here corroborate results from earlier soil geochemistry surveys by demonstrating that elevated Ag and Cu values do occur here. They go one step further and demonstrate that elevated Mo, Pb, Zn, As, and Sb values in till are coincident with elevated Ag and Cu values. They also put this multi-element, multi-site geochemical target in to the context of glacial dispersal. These elevated element concentrations occur in basal till which has a unique erosion, transport, and depositional history. It is this glacigenic history that provides a new exploration strategy for future work in the Allin occurrence area.

Any follow-up to data presented here should first begin with a thorough review of work previously conducted in the Allin occurrence area, and include a review of the newly acquired, regional-scale helicopter-borne EM data for the QUEST-West Project area (Kowalczyk, 2009; Walker, 2009).

Tsichgass Lake Area

The Tsichgass Lake area has been highlighted based on Mo, Pb, Zn, Ag, Hg, As, and Sb values (Figure 20). Samples 10TFE6011, 10TFE6015, 10TFE6016, 10TFE6065, 10TFE6066, 10TFE6067 have 90th percentile values of at least two, and up to four, of the elements Mo, Pb, Zn, Ag, Hg, As, and Sb. Within this group, sample 10TFE6016 stands out with the highest Mo (0.84 ppm), Pb (16.87 ppm), Zn (102.9 ppm) and As (15.0 ppm) values and the second highest Ag value (105 ppb). Lead, Zn, Ag, Hg, As, and Sb values in the Tsichgass Lake area are higher than those near Orion and Benamy occurrences.

Work in the Tsichgass Lake area began in 1970 with the staking of the Sean claims. These claims were located based on the discovery of hydrothermally altered and pyritic felsic volcanics in outcrop on Popular Creek and the discovery of a chalcopyrite and molybdenite-bearing quartz-monzonite boulder 3 km north of Tsichgass Lake, on Parrot Creek (0.45% Cu; Tavela, 1971). Approximately 2 km north of the northwest finger of Tsichgass Lake, slightly elevated Zn and Cu values in soil were identified (Gutrath, 1972). Subsequent bedrock geology mapping in the area has identified silicified breccias, volcaniclastics and argillites, basalt, andesite, and dacite flows and an adesite dyke (Tavela, 1981; Moll, 2007). A diamond drill hole located 400 m northeast of the northeastern finger of Tsichgass Lake, has identified a sequence of clay-altered felsic volcaniclastics (including flow-banded and brecciated zones and tuffs) that are cut by an andesitic dyke (Moll, 2010). To the west, immediately adjacent to this diamond drill hole, is a fine-grained and pyritic Late Cretaceous Bulkley suite granodiorite. Lithologies present in the Tsichgass Lake area are compositionally and texturally similar to some divisions of the Goosly sequence. Exploration work conducted to date in the Tsichgass Lake area cannot explain these 90th percentile commodity metal and pathfinder element values in tills.

As seen in Figure 21, there is a low amplitude EM response over the fine-grained and pyritic Late Cretaceous Bulkley suite granodiorite that occurs north of Tsichgass Lake. A narrow, slightly higher amplitude, EM response truncates a western extension of this lower amplitude EM response. East of the mapped granodiorite, this low amplitude EM response continues for 3 km suggesting this granodiorite stock could be areally more extensive. Bedrock exposed in the Tsichgass Lake area could be another Late Cretaceous inlier to younger Eocene volcanic flows, as the Goosly sequence is at Equity Silver mine. In recent work completed by Alldrick (2007a), bedrock in the immediate Tsichgass Lake area has been assigned to the Equity Mine dacite unit.

Relative to till samples in the Allin occurrence area, and those collected in the vicinity of the past producing Equity Silver mine, the tills of Tsichgass Lake area present a much more subdued geochemical exploration target. Till geochemical data presented here show that coincident above background values of Pb, Zn, Ag, Hg, As, and Sb exist here. These elevated element concentrations occur in basal till which has a unique erosion, transport, and depositional history. It is this glacigenic history that provides a new exploration strategy for future work in the Tsichgass Lake area.

SUMMARY

During the 2010 field season 84 basal till samples were collected for major, minor, and trace element geochemical analyses, while an additional 18 till samples were collected for separation and analysis of heavy mineral concentrates and gold-grain counts. There is a strong positive correlation between elevated commodity metal and pathfinder element concentrations and the locations of known mineralization at the past producing Equity Silver mine. Here, and 4 km to the west in the vicinity of Allin occurrence, maximum and ≥98th percentile concentrations for Cu, Mo, Pb, Zn, Ag, Au by INAA, and Sb occur. Elevated till geochemical data presented here successfully highlighted these areas of known mineralization, demonstrating the utility of this exploration technique in this area.

An analysis of Cu, Mo, Pb, Zn, Ag, and Hg determinations by aqua regia ICP-MS, and Au, As, and Sb determinations by INAA, has highlighted two areas as being of geochemical interest. These areas are:

- Allin occurrence area (identified using Cu, Mo, Pb, Zn, Ag, Hg, Au by INAA, As, and Sb values in three till samples located south of Allin occurrence); and
- Tsichgass Lake area (identified using Pb, Zn, Ag, Hg, As, and Sb values in six till samples located north and west of Tsichgass Lake).

These two areas are not new to the mineral exploration community as over the past 40 years they have been the focus of a variety of exploration programs. Results published to date on these programs, however, do not explain the commodity metal and pathfinder element concentrations found there. These concentrations occur in basal till which has a unique erosion, transport, and depositional history. It is this glacigenic history of this sediment that provides a new exploration strategy for future work in these areas.

Detailed geochemical studies conducted within the region at the Copper Star occurrence (porphyry Cu-Mo-Au), Huckleberry mine (producing porphyry Cu-Mo mine) and Equity Silver mine (past producing Ag-Cu-Au mine), and west-indicating ice-flow features measured in the study area (252°-288°), suggest that westward dispersal of till likely occurs here. The complexity of the region's ice-flow history, and variability in till thickness, suggests that there could be local variation in net transport direction and distance.

Mineral exploration in the Colleymount map area has benefitted from new bedrock exposures created along recently constructed forestry roads and the acquisition of new geophysical and geochemical data. As suggested by Alldrick et al. (2007), a systematic, multidisciplinary reconnaissance and property-scale exploration program will be required for future discoveries to be made in this drift covered area.

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