

# ASSESSMENT REPORT TITLE PAGE AND SUMMARY

TITLE OF REPORT: Geological remote sensing investigation of the Tillicum Mineral Claims, Slocan Mining Division, B.C.

## **TOTAL COST: \$ 12,680**

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Cours a SIGNATURE(S):

NOTICE OF WORK PERMIT NUMBER(S)/DATE(S): STATEMENT OF WORK EVENT NUMBER(S)/DATE(S): 5535598

YEAR OF WORK: 2014

PROPERTY NAME: Tillicum

CLAIM NAME(S) (on which work was done): 320414, Tillicum 1 (555065), Tillicum 2 (5550660, Tillicum 3 (555068), Tillicum 4 (555069), Tillicum 5 (555071), Tillicum 6 (555074), Tillicum 7 (555078), Tillicum 8 ( 555079), Tillicum 9 (555087), Tillicum 10 (555089) and Tillicum 11 (555728)

COMMODITIES SOUGHT: Au, Ag

MINERAL INVENTORY MINFILE NUMBER(S), IF KNOWN: 082FNW234, 082FNW220 MINING DIVISION: Slocan NTS / BCGS: BCGS: 082F092, 082K002 LATITUDE: 49 59 22.55 42 " (at centre of work) W 36.99 LONGITUDE: 117 UTM Zone: 11 EASTING: 449085 NORTHING: 5537715

OWNER(S): AMT Tillicum Holdings, Inc.

MAILING ADDRESS: 607 E 200 S Fairfield Idaho, 83327, U.S.A

OPERATOR(S) [who paid for the work]: AMT Tillicum Holdings, Inc. 607 E 200 S Fairfield Idaho, 83327, U.S.A

REPORT KEYWORDS (lithology, age, stratigraphy, structure, alteration, mineralization, size and attitude. **Do not use abbreviations or codes**) Siliceous Calc-silicate Skarn, Basaltic Tuff, Meta Basalt, Tuffaceous Sediment/Sedimentary Rock, Argillite, Feldspar Porphyritic Diorite Sill, Feldspar Porphyritic Diorite, Quartzite, Siltstone, Quartz Biotite Gneiss Jurassic gold-bearing skarn

REFERENCES TO PREVIOUS ASSESSMENT WORK AND ASSESSMENT REPORT NUMBERS: 25004, 26847, 26681, 27144, 30488, 31182

TYPE OF WORK IN THIS REPORT	YPE OF WORK IN     EXTENT OF WORK       'HIS REPORT     (in metric units)		PROJECT COSTS APPORTIONED (incl. support)
GEOLOGICAL (scale, area)			
Ground, mapping			
Photo interpretation	1:10,000 36 km <sup>2</sup>	Tillicum 1 to 11	\$352.22/km²
GEOPHYSICAL (line-kilometres)			
Ground			
Magnetic			
Electromagnetic			
Induced Polarization			
Radiometric			
Seismic			
Other			
Airborne			
GEOCHEMICAL (number of sample	es analysed for)		
Soil			
Silt			
Rock			
Other			
DRILLING (total metres, number of	holes, size, storage location)		
Core			
Non-core			
RELATED TECHNICAL			
Sampling / Assaying			
Petrographic			
Mineralographic			
Metallurgic			
PROSPECTING (scale/area)			
PREPATORY / PHYSICAL			
Line/grid (km)			
Topo/Photogrammetric (sca	le, area)		
Legal Surveys (scale, area)			
Road, local access (km)/trai	l		
Trench (number/metres)			
Underground development	(metres)		
Other			
		TOTAL COST	\$ 12,680

BC Geological Survey Assessment Report 35269

# GEOLOGICAL REMOTE SENSING INVESTIGATION OF THE TILLICUM MINERAL CLAIMS

Tenure Numbers 320414, 555065, 555066, 555068, 555069, 555071, 555074, 555078, 555079, 555087, 555089 and 555728

located in the Slocan Mining Division, B.C.

117°42'36.99" W, 49°59'22.55" N, NTS 82F/13 and 82K/04

owned by:

AMT Tillicum Holdings, Inc. 607 E 200 S Fairfield Idaho, 83327, U.S.A.

operated by: AMT Tillicum Holdings, Inc. 607 E 200 S Fairfield Idaho, 83327, U.S.A

by:

K.V. Campbell, Ph.D., P.Geo.

**ERSi Earth Resource Surveys Inc.** 6599 Millar Road Horsefly, B.C. V0L 1L0

> December 22, 2014 Event No. 5535598

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# 1 INTRODUCTION

This remote sensing study was undertaken for AMT Tillicum Holdings, Inc. ("AMT-T") of Fairfield, Idaho at the request of Mr. Philip Cash, CEO of AMT, and presents the 2014 assessment work on the mineral claims.

The Tillicum property is a developed prospect with gold and silver production from underground workings. It is an advanced exploration project with defined mineral reserves<sup>1</sup> and several significant mineral targets. Considerable exploration work has occurred on the property since its discovery in 1960. AMT Resources Ltd. ("AMT-R") acquired the property in 1997. Since that time the company has been restructured into AMT Tillicum Holdings, Inc.

The study, undertaken in the late fall of 2014, utilized digital elevation models (DEM's), RapidEye, ASTER and Landsat satellite imagery. The objectives of the study were to prepare image maps suitable for future field work and, if possible, provide information on the geological structure and occurrence of areas enriched in iron oxides or hydroxyl minerals.

# 1.1 Location and Access

The Tillicum mineral claims are situated about 64km north-northwest of Nelson in southeastern British Columbia within N.T.S. map sheets 82F/13 and 82K/04. The claims are centered near Tillicum Mountain at approximately 117°42'36.99" W, 49°59'22.55" N about 12.5km east of Burton, (Figure 1) and lie at an elevation between 920 and 2,200m asl between Caribou and Snow Creeks.

Access to the property is by way of logging and mining roads extending from Burton on Highway 6 up the south side of Caribou Creek to a former exploration camp site near the headwaters of Londonderry Creek (Figure 2). Four-wheel drive vehicles are required to negotiate the steep access road to the principal Tillicum workings near the summit of Tillicum Mountain. Total road distance from Burton is approximately 17 km.

# 1.2 Claim Status

Figure 2 is a claim plan of the eleven mineral claims and one mining lease making up the Tillicum property. Details, as of December 22, 2014, are summarized in Table 1.

Tenure No.	Claim Name	Owner (100%)	Issue Date	Good To Date	Area (Ha)
320414		AMT TILLICUM HOLDINGS, INC.	Jan. 23, 1996	Jan. 23, 2015	40.30
555065	TILLICUM 1	AMT TILLICUM HOLDINGS, INC.	March 23, 2007	June 30, 2015	166.21
555066	TILLICUM 2	AMT TILLICUM HOLDINGS, INC.	March 23, 2007	June 30, 2015	498.77
555068	TILLICUM 3	AMT TILLICUM HOLDINGS, INC.	March 23, 2007	June 30, 2015	498.47
555069	TILLICUM 4	AMT TILLICUM HOLDINGS, INC.	March 23, 2007	June 30, 2015	457.15

Table 1. Description of Tillicum mineral claims.

<sup>1</sup> these reserves may or may not be National Instrument 43-101 compliant.



UTM 11 NAD83



555071	TILLICUM 5	AMT TILLICUM HOLDINGS, INC.	March 23, 2007	June 30, 2015	498.34
555074	TILLICUM 6	AMT TILLICUM HOLDINGS, INC.	March 23, 2007	June 30, 2015	415.42
555078	TILLICUM 7	AMT TILLICUM HOLDINGS, INC.	March 23, 2007	June 30, 2015	269.95
555079	TILLICUM 8	AMT TILLICUM HOLDINGS, INC.	March 23, 2007	June 30, 2015	20.77
555087	TILLICUM 9	AMT TILLICUM HOLDINGS, INC.	March 23, 2007	June 30, 2015	207.66
555089	TILLICUM 10	AMT TILLICUM HOLDINGS, INC.	March 23, 2007	June 30, 2015	20.77
555728	TILLICUM 11	AMT TILLICUM HOLDINGS, INC.	March 23, 2007	June 30, 2015	498.37

The total area of the Tillicum mineral claims is 3,551.90 hectares. This does not include the 40.30 ha covered by the single mineral lease 320414.

## 1.3 Physiography and Vegetation

The Tillicum property lies on the western margin of the Selkirk Mountains of the northern Columbia Mountains within the Valhalla mountain range characterized by long, uniformly steep, heavily timbered slopes rising through 1,000m to over 1,500m to angular peaks and sharp narrow interconnecting ridges.

The area is contained within the Southern Interior Mountains Ecoprovince, in the Northern Columbia Mountain Ecoregion<sup>2</sup>, specifically in the Central Columbia Mountains Ecosection. Precipitation is high, from the valley bottoms to the upper slopes by the Pacific air moving over these mountains from either the west across the interior of the province or from the south from across the Columbia Basin in Washington. Such moisture brings high humidity and rain in the summer or deep snow in the winter. Under large systems Arctic air can overwhelm the entire area for short periods in the winter. The valleys and lower slopes are dominated by moist Interior Cedar-Hemlock forests; the middle mountain slopes have a moist Engelmann Spruce – Subalpine Fir forest. Alpine vegetation is moist, but barren rock occurs on the highest areas.

#### 1.4 Previous Work

# 1.4.1. 1960 to 1995

The following information has been summarized from Dykes (2003), the BC Ministry of Energy and Mines Minfile and assessment reports.

The town of Burton was founded in 1895 as a result of placer gold mining activity in the area. During the period 1896 to 1930 several small-scale, hard rock mine workings were active and are found throughout the area. In 1980 local prospectors Arnie and Elaine Gustafson discovered gold in what is now known as the Heino-Money Zone, on the north slope of Tillicum Mountain. Esperanza Explorations Ltd. optioned the property in the fall and 1981 and initiated an exploration program that sparked a district wide staking rush.

<sup>&</sup>lt;sup>2</sup> http://www.env.gov.bc.ca/ecology/ecoregions/

Early exploration was initially focused on the discovery zone, which later became the Heino-Money Mine. Work consisted of geophysical and geochemical surveys, mapping, trenching, surface drilling, underground drifting and raising, underground drilling and bulk sampling. Exploration work outside of the discovery zone led to the finding of several other significant mineralized zones. These include the East Ridge and Grizzly zones (Figure 3).

In 1993 Bethlehem Resources Corporation and Goldnev Resources Inc. optioned the property and obtained a permit for an underground mining operation. Mining commenced in mid-August of that year and was completed in late October. A total of 29,009m of surface and 3,865m of underground drilling for a total of 376 holes have been completed. In addition, underground development consisting of 1,374m in the Heino-Money zone and 410m in the East Ridge zone was completed.

Mineral Zone	Years	Drilling (surface)		Drilling (underground)		Underground Development
		Holes	Meters	Holes	Meters	
Heino-Money	1981-87	100	7060	9	177	955m 4 levels
	1988			92	3079	442m
	1993			8	284	121m
East Ridge	1981-84	26	1586			60m; 2118 cross cut
	1988	75	13149	14	610	350m; 2062 drift
	1989	10	1446			
Silver Queen	1984	12	???			
Grizzly	1984	4	615			
Arnie Flats	1984	5	292			

Table 2 . Summary of drilling and underground development.

Table 3 . Summary of production from Heino-Money zone, 1981 to 1993.

Year	Mined Tonnes	Milled Tonnes	Au grams recovered	Au ounces recovered	Ag grams recovered	Ag ounces recovered
1993	5,503	5,503	102,455	3,294	164,071	5,275
1991			9,207	296		
1985	227	168	48,351	1,554	51,570	1,658
1981	58	58	4,239	146	3,267	105
Total:	5,788	5,729	164,552	5,290	218,908	7,038

In 1994 Columbia Gold Mines Ltd. (formerly Esperanza Explorations Ltd.) commissioned Ross Glanville & Associates to carry out a valuation of the Tillicum Mountain project. This report (Glanville, 1994) confirms reserves<sup>3</sup> for the East Ridge deposit, in all categories, as totaling 1,172,000 tons (1,063,219 tonnes) grading 0.26 oz/ton (8.914 gm/tonne) gold with a cut-off grade of 0.15 oz/ton (5.143 gm/tonne).

<sup>&</sup>lt;sup>3</sup> this valuation may or may not be National Instrument 43-101 compliant



UTM 11 NAD 83 Contour interval = 20m

# 1.4.2. 1996 to present

AMT Resources Ltd. acquired the property in 1996. In that year the company undertook surface and underground geological evaluation and sampling, geophysical survey work, access road rehabilitation, VLF-EM surveys, extensive mapping and sampling and a new tonnage estimate which is summarized in Table 4.

Zone	Reserve	Tons	Grade	Au (oz)	Tonnes	Grade	Au (gm)
	Туре		(oz/ton)			gm/tonne	
East Ridge	drill indicated	523, 203	0.28	149,017	474,642	9.599	4,634,947
Grizzly	possible	277,854	0.40	111,142	252,065	13.71	3,456,903
Totals:		810, 057		260,159	726,707		8,091,850

Table 4. 1997 Tonnage and grade estimates (Addie, 1997)<sup>4</sup>

In 1997 the property was optioned to 1033275 Ontario Limited, a subsidiary of Mustang Minerals Corporation. In 2001 this company performed rock and soil sampling (Carter, 2001), a compilation of historical data and modeling of the mineralization (Carter and Hinzer, 2002).

In 2002 1033275 Ontario Limited undertook computerization of the existing data, geostatistics and 3D modeling (Dykes, 2003).

Subsequently, the property was returned to AMT Industries Canada Inc. ("AMT-I"), the successor to AMT Resources Ltd. This company then completed a soil sampling program (Walker, 2008).

In 2009 AMT-I completed a VLF-EM survey along the network of exploration roads on the claims (Walker, 2009).

Since that time there has been no recorded work on the Tillicum property and AMT-I has been restructured into AMT Tillicum Holdings, Inc. However, in 2013 and 2014 AMT-T completed significant physical improvements to the property including the installation of new 12 man sleepers with complete restrooms and washing and drying areas along with a refurbished kitchen with all new appliances for 50 man unit, a new septic system and 100 kilo watt generator and a ~10m x 22m' shop with concrete floor. In addition, 17 new culverts and ditches for were installed for erosion control plus a 40ft x 8 ft culvert on Londonderry Creek.

# 2 REGIONAL GEOLOGY

The regional geology is shown in Figure 4 after Massey et al, 2005. The Tillicum Mountain property is mapped as being underlain by the Early to Late Triassic Slocan Group (TrSlc), a sequence of

<sup>&</sup>lt;sup>4</sup> these calculations may or may not be National Instrument 43-101 compliant



UTM 11 NAD83 Contour interval = 200 m

#### **Stratigraphic Units**



Eocene Coryell Plutonic Suite



Paleocene to Eocene Sheppard, Tuzo Creek, Shingle Creek Intrusions



Cretaceous - granodioritic intrusive rocks



Cretaceous\ - quartz monzonitic intrusive rocks



Cretaceous Whatshan Batholith - granodioritic intrusive rocks



Middle Jurassic - leucogranitic rocks



Middle Jurassic Kuskanax Batholith - quartz monzonitic intrusive rocks

URE

Lower Jurassic Rossland Group - Elise Formation - mafic volcanics



Triassic Slocan Group - limestone, slate, siltstone, argillite



Carboniferous to Permian Kaslo Group - basaltic volcanic rocks



Carboniferous to Permian - paragneiss, orthogneiss, pegmatite



Upper Mississippian to Permian Milford Formation - limestone, slate, siltstone, argillite



Proterozoic to Lower Paleozoic Monashee Complex - paragneiss



Minfile_No_	Name	Commodities
082F NW234	TILLICUM	Au, Ag, Pb
082F NW220	SILVER QUEEN	Pb, Zn, Au
082K SW184	ORO	Au, Wo
082K SW171	EUREAKA	Ag, Pb, Zn
082K SW177	EUREAKA SOUTHEAST	Ag, Pb, Zn
082F NW255	CARIBOU	Au
082K SW050	POORMAN	Ag, Pb, Zn
082F NW272	GOLD CANYON	Au, Ag, Pb
082K SW133	INDEPENDENCE	Pb
082K SW131	GOLDEN EAGLE	Au



AMT Tillicum Holdings, Inc.

Tillicum Project Slocan Mining Division, B.C.

### **Explanation for Figure 4**

DWG: 565-4b Nov. 2014

metasedimentary and metavolcanic rocks. Intrusive into these rocks is the Early to Late Cretaceous granodioritic Whatshan Batholith.

Addie (1997) described the property as being underlain by a sequence of Pennsylvanian (308 my) to Triassic (232 my) Milford Group volcano-sedimentary wackes overlain by Lower Jurassic (200 my) Rossland Group basaltic-andesitic flows and tuffaceous siltstones. Dykes (2003) summarizes the regional geology in much the same way.

Devlin and Roberts (1989) description included porphyritic stocks and sills of uncertain age, intruding the sedimentary and volcanic rock units, that have subalkalic, talc-alkaline affinities and quartz monzonite to quartz monzodiorite composition. Gold and/or silver occurs in shear related talc-silicate quartz skarns developed in meta-volcanic and meta-sedimentary rocks of both the Milford and Rossland Groups, adjacent to or in close proximity to these stocks and sills.

Dykes (2003) recognized three episodes of intrusion. The first consists of swarms of dioritic sills of uncertain age, the second is the large-scale Cretaceous monzonitic stocks and the third are swarms of Lamprophyre dykes that cut all rocks. Gold and silver mineralization occurs in shear related calcsilicate quartz skarns, developed in metavolcanic and metasedimentary rocks of both the Milford and Rossland Groups, adjacent to or in close proximity to these stocks and sills.

The metamorphic grade throughout the region is generally sillimanite facies, however the grade is lower around Tillicum Mountain with biotite, muscovite, chlorite and amphibole the main metamorphic minerals (Dykes, 2003).

All of the above units have been subjected to at least two stages of folding and metamorphism of lower green schist facies, and are intruded by the Goat Canyon and Halifax Creek stocks of probable Cretaceous (125 my) age. Lamprophyre dyke swarms of probable Eocene age (50 my) intrude all rock units in the Tillicum area. (Addie, 1997).

# 3 PROPERTY GEOLOGY

Despite all the exploration efforts expended on the Tillicum claims no geologic mapping of sufficient quality is available to AMT-T. Earlier assessment reports include sketch compilations but these lack coordinates and/or enough topographic detail with which to geocode them. Addie's 1997 maps, for example, display a single latitude/longitude coordinate registration point ~150m southeast of the road network. When this point is translated to UTM NAD83 coordinates it plots ~400m northwest of the road network. Carter and Hinzer (2002) present a geological map but it lacks coordinates. It does include a road network and this has been used to roughly geocode the configuration of rock units, shown in Figure 5.

Carter and Hinzer's description (2002) of the property geology follows, set in terms of the area being underlain by the Milford and Rossland Groups.



UTM 11 NAD 83 Contour interval = 20m





dw	'G: 565-5	Scale 1:20,000	Nov. 2014	Figure: 5
		Earth	Resource Surveys In ERSi	ıc.

"The oldest rocks exposed on the Tillicum property consist of a predominantly metasedimentary sequence which underlies the central and southeastern property area. These rocks are comprised of deformed and metamorphosed siltstones, calcareous siltstones, quartzites, greywackes and impure carbonate and marble units. Thought to be part of the late Paleozoic Milford Group, these metasediments are partly overlain in the central part of the property by massive metamorphosed basalt and andesite flows and fragmental rocks, which in turn are overlain by volcaniclastic rocks consisting of epiclastics, tuffaceous siltstones, lapilli tuffs and siltstones. These two volcanic units are thought to represent the lower and upper Elise Formation which forms the basal part of the early Jurassic Rossland Group. The metasedimentary and overlying metavolcanic sequences are intruded by feldspar porphyry dykes and sills which predate the Halifax Creek Goatcanyon Creek granitic stocks. These intrusions, which may be of early Jurassic age and possibly comagmatic with the metavolcanic rocks, are of quartz diorite quartz monzodiorite composition. Individual sills and dykes are up to 60m in thickness. In the vicinity of Tillicum Mountain, they occur in two north-northeast-trending belts, which are 900m wide and extend along a strike a distance of 2km.

The Cretaceous Goatcanyon and Halifax Creek stocks (Figure 4) intrude all of the Jurassic (and older) layered and intrusive rocks. They consist mainly of medium-grained quartz monzonites and granodiorites. These intrusions postdate the regional metamorphism affecting the older rocks. Contact metamorphic effects are evident along their margins. The youngest rocks in the area are narrow (3m) lamprophyre dykes of probable Tertiary age which parallel the dominant north-northeast structural trend. These dykes occur in swarms which are particularly evident within the two principal mineralized zones, Heino-Money and East Ridge. The structure is locally complex with numerous moderately to steeply-dipping northerly trending normal and reverse faults. Some of the larger fault structures have major displacements, notably the arcuate, west-dipping "Aussie Fault" which divides the central property into two structural domains, and which was previously thought to separate the Heino-Money zone from the East Ridge Zone. The two northeast-trending belts of feldspar porphyry dykes and sills are intimately associated with all of the known precious metals zones on the northern and eastern slopes of Tillicum Mountain. Gold (and silver)-enriched skarns are developed within and marginal to, the feldspar porphyry intrusions. These skarn zones, which vary in thickness from 2m to 60m, are structurally controlled and strike north-northeast and dip steeply east and west, paralleling the trend of the intrusions. Native gold occurs as fine disseminations and as coarse flakes in quartz-rich segregations along the margins of quartz-actinolite-chlorite skarn zones. These also contain variable amounts of finely disseminated pyrrhotite, pyrite, sphalerite and galena and traces of chalcopyrite and tetrahedrite."

No adequate maps of the structural geology were available to AMT-T at the time of preparing this report.

#### 4 REGIONAL GEOPHYSICS

Aeromagnetic data gridded with a cell size of 200m was obtained from Natural Resources Canada.

Figure 6 shows the residual total field in the vicinity of the property and Figure 7 displays the first vertical derivative. Although the dataset is very coarse the mineralized zones in the center of the claims area



UTM 11 NAD83



UTM 11 NAD83



appear to be spatially related to a magnetic high anomaly there. Aeromagnetic linears include eastnortheast, northeast and north-northwest sets. The northeast set approximate the trend of the lamprophyre dykes mapped by Carter and Hinzer and evident on their map (Figure 5).

#### 5 **REMOTE SENSING INVESTIGATION**

#### 5.1 Data Sources

Digital elevation models for the area were generated from 1:20,000 TRIM<sup>5</sup> and 1:50,000 digital contour maps.

The satellite imagery utilized in this study included Landsat ETM<sup>6</sup>, ASTER<sup>7</sup> and RapidEye data. Table 5 summarizes the characteristics of these sensor systems. Acquisition dates and the processing level of the image data sets are provided in Table 6.

Landsat 7 ETM			ASTER			RapidEye		
Band	Bandwidth (µm )	Resolution (m)	Band	Bandwidth (µm )	Resolution (m)	Band	Bandwidth (µm )	Resolution (m)
1	0.45-0.52	30	1	0.52-0.60	15	1	0.440-0.510	6.5
2	0.53-0.61	30	2	0.63-0.69	15	2	0.520-0.590	6.5
3	0.32-0.69	30	3	0.76-0.86	15	3	0.530-0.685	6.5
4	0.78-0.90	30	4	1.60-1.70	30	4	0.690-0.730	6.5
5	1.55-1.75	30	5	2.145-2.185	30	5	0.760-0.850	6.5
6	10.4-12.5	60	6	2.185-2.225	30			
7	2.08-2.35	30	7	2.235-2.285	30			
8	0.52-0.90	15	8	2.295-2.365	30			
			9	2.36-2.43	30			
			10	8.125-8.475	90			
			11	8.475-8.825	90			
			12	8.925-10.25	90			
			13	10.25-10.95	90			
			14	10.95-11.65	90			

Table 5.	Optical	satellite sensor	comparison.

Table 6.	Sensor acquisition	dates,	processing	level.
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Sensor	Acquisition Date(s)	Processing Level	Note
Landsat 7 ETM	September 9, 1999	Level 1G	radiometric and geometrically corrected
ASTER	August 27, 2006	Level 1B	radiometric and geometrically calibrated
RapidEye	August 24, 2010; September 6, 2012; September 1, 2013	Level 3A	radiometric corrected, orthorectified

<sup>5</sup> TRIM: Terrain Resource Information Management <sup>6</sup> ETM: Enhanced Thematic Mapper

<sup>&</sup>lt;sup>7</sup> ASTER: Advanced Spaceborne Thermal Emission and Reflection Radiometer

## 5.2 Data Processing and Enhancement

Preprocessing and analytical software used in this study included ENVI, PCI Geomatica, ERMapper, MapInfo and Discover.

## 5.2.1. Landsat

Preprocessing of the Landsat ETM scene included a dark object subtraction to remove haze followed by orthorectification. The orthorectification procedure employed a DEM generated from 1:50,000 scale contours gridded to 10m and 1:50,000 scale vectors of drainage and the road network.

Enhancements applied to the Landsat bands color contrast stretching and a sharpening filter.

# 5.2.2. ASTER

The ASTER SWIR (shortwave infrared) sensor is affected by a crosstalk signal scattering problem resulting in Band 4 incident radiation affecting the other SWIR bands. Application of the crosstalk correction algorithm developed by the ASTER Japanese science team recalibrates the reflectance of the SWIR bands in the Level 1B product. Following this correction the data is atmospherically corrected using a dark object subtraction technique. In the case where there is little haze to start with, as in the ASTER dataset used in this study, this method is quite sufficient.

Following these preprocessing steps the ASTER data was orthorectified using a DEM generated from 1:20,000 scale contours and vectors of the drainage and road network. Subsequent enhancements included contrast stretching and sharpening filters.

#### 5.2.3. RapidEye

The Level 3A RapidEye product used in this study is already orthorectified. It was delivered as four tiles of three different dates. First is mosaicked with a color balancing applied to two of the tiles making up the mosaic. The data was then reprojected to UTM11 NAD83. Verification of the orthorectified data was accomplished using the 1:20,000 scale TRIM vector data of the drainage and road network. Basic enhancements of the RapidEye imagery included atmospheric correction, contrast stretching and edge sharpening.

# 6 RESULTS OF SATELLITE IMAGERY ANALYSIS

#### 6.1 Landsat

Analysis of the Landsat imagery focused on the potential of alteration mapping to located areas of enriched iron oxides and hydroxyl (clay) minerals using the 'Crosta technique' (Loughlin, 1991), a principal component analysis or PCA. This technique uses selected principal components of the spectral bands in such a way that surficial materials with elevated iron oxides, for example, are enhanced as bright pixels. In the case of iron oxide mapping the principal components of ETM bands 1,3, 4 and 5 are

first determined. The component with a strong positive eigenvector loading in band 3 and strong negative loading in bands 1 and 4 then maps those pixels with the most potential of being enriched in iron oxides. A similar technique is used to map pixels with anomalous hydroxyl content. In this case ETM bands 1,4,5 and 7 are used and the principal component with a strong positive eigenvector loading in band 5, a strong negative eigenvector loading in band 7 and negative or low positive loadings in bands 1 and 4 is used to map pixels with enriched hydroxyl minerals. These procedures are performed on unstretched data that has only been subjected to nearest neighbour resampling. The result of the PCA, an grayscale image, is then used to identify all pixels above an arbitrary threshold value which are then deemed to be anomalous. For this study the top 1% of the pixels were mapped.

The result of the Landsat PCA for iron oxide alteration mapping is in Figures 8. The analysis is identifying some anomalous areas near the known mineralized zones. The hydroxyl mapping exercise did not identify any areas of interest within or proximal to the claims and is not presented.

# 6.2 ASTER

A similar procedure was applied to the ASTER imagery. No significant areas of iron oxide or hydroxyl alteration enrichment were identified. Figure 9 is a false color composite of ASTER bands 6,2,1 (RGB) with the configuration of known mineralized zones. No insights on the lithology or structure were gleaned from this imagery.

# 6.3 RapidEye

Figure 10 is a natural color composite of RapidEye bands 3,2,1 (RGB). Overlain on this are the results of the iron oxide mapping exercise. In this instance the iron oxide index was calculated from (Band 3 - Band 1) + Band 3. The top one percentile is considered anomalous. The results more or less mirror the result of the Landsat PCA iron oxide analysis, although the 5m cell size of the RapidEye imagery provides greater detail.

Figure 11 is a 1:10,000 scale image base map of the Tillicum property and Figure 12 is the accompanying topographic base map.

Perspective views of the property are shown in Figures 13, 14 and 15.

# 7 CONCLUSIONS

Analysis of the satellite imagery did not identify any significant alteration associated with the known areas of mineralization other than some surficial materials with elevated iron oxide content. These are all in relatively open areas, most where there is some degree of surface disturbance related to exploration activities, and are most likely due to oxidation of the exposed soils.

The imagery did not provide any information as to the structural geology of the property. The regional aeromagnetics, however, did indicate east-northeast, northeast and north-northwest trending magnetic linears.



UTM 11 NAD83 Contour interval = 20m



UTM 11 NAD83



UTM 11 NAD83



#### AMT Tillicum Holdings, Inc.

Tillicum Project

Slocan Mining Division, B.C.

# Perspective View to North

(showing location of mineralized zones)

DWG: 565-13 Nov. 2014

Figure: 13

Scale ~ 1:35,000





DWG: 565-15 Nov. 2014

Figure: 15

## 8 **RECOMMENDATIONS**

- A high resolution airborne magnetics and radiometrics survey is recommended with a line spacing of 50m.
- If none of the historical drilling, sampling information is available then the recommendation is
  made that a drill program, compliant with National Instrument 43-101, be developed to reassess
  the mineralized zones and resource estimates. It may be possible to compile some of the
  historical information from sample locations and analyses from assessment and other reports.
  This work will be necessary before a mining plan can be developed.
- The recommendation is made to rehabilitate the underground workings if possible. This will
  permit underground mapping and sampling to assist with the development of a resource
  calculation.
- Given the number of mineralized zones on the property, the relative lack of surface rock exposures and the lack of information regarding the structural geology it is quite possible there are additional zones of mineralization yet to be found. Therefore a program of detailed mapping of both lithologies and structure is recommended.
- The level of detail regarding geochemical sample locations and analytical results in the historical assessment reports renders much of this work of little value. Because of this a new program of geochemical soil sampling is recommended.

Respectfully submitted,

ERSi Earth Resource Surveys Inc.

long anos

K. Vincent Campbell, Ph.D., P.Geo. December 20th, 2014

# 9 STATEMENT OF COSTS

Item	Unit Cost/Rate	Subtotals
TRIM data; 082F092, 082K002	\$ 200	\$ 400
RapidEye imagery; 500km²	\$1.28/km²	\$ 640
K.V. Campbell; Ph.D., P.Geo.; image processing, report preparation; October 2 to December 22, 2014; 74.6 hours @ \$75/hr	\$150/hr	\$ 11,190
Report production; 3 copies	\$150	\$ 450
	Total:	\$ 12,680

# 10 REFERENCES

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# 11 CERTIFICATE

I, KENNETH VINCENT CAMPBELL, resident of Horsefly, Province of British Columbia, hereby certify as follows:

1. I am a geologist employed by ERSi Earth Resource Surveys Inc., 6599 Millar Road, Horsefly, British Columbia.

2. I graduated with a degree of Bachelor of Science, Honours Geology, from the University of British Columbia in 1966, a degree of Master of Science, Geology, from the University of Washington in 1969, and a degree of Doctor of Philosophy, Geology, from the University of Washington in 1971.

3. I have practiced my profession for 48 years. I have been a member of the Association of Professional Engineers and Geoscientists of British Columbia since August 11th, 1992.

4. This report, dated December 20th, 2014 is based on my examination and analysis of Landsat, ASTER and RapidEye satellite imagery over the Tillicum property, Slocan Mining Division, B.C.

Dated at Horsefly, Province of British Columbia

This 20<sup>th</sup> day of December, 2014

Cours 200

K. Vincent Campbell, Ph.D., P.Geo. Geologist

# PLASTIC POCKET FOR FIGURE 11.

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FOLLOWED BY PLASTIC POCKET FOR FIGURE 12 (NO PAGE NUMBER)





