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# Assessment Report on Geological Mapping and VLF Survey Chrome Property, Thunder Bay South District, Ontario

Patented Claims TB10827, TB10828, TB10835, TB10836 and TB8428
Obonga Lake Area (G-0100), Thunder Bay Mining Division
Latitude 49° 58′ 23″ N, Longitude 89° 29′ 39″ W;
UTM WGS84 Zone 16U 321165 mE, 5538605 mN;
NTS 52H 14 - Gull Bay

For: Pavey Ark Minerals Inc. Client number 41165

Prepared By: Richard Sutcliffe, P.Geo. (Client number 225603) 100 Broad Leaf Crescent, Ancaster, ON, L9G 3R8

October 19, 2017

#### **Executive Summary**

This assessment report documents grid cutting, geological mapping and VLF surveying of the Chrome Property, Thunder Bay South District, Thunder Bay Mining Division, Ontario. The exploration targets chromite, nickel, platinum group (PGM) and gold mineralization associated with the past producing Chrome Lake Mine and Puddy serpentinite.

The Chrome Property is located 179 km north of the city Thunder Bay, 49 km southwest of the town of Armstrong Station, and 1,043 km northwest of Toronto, Ontario. Highway 527, a paved highway that extends north from Thunder Bay to Armstrong, is located 25 km east of the Property. The property is accessed from the Obonga Lake and Scalp Creek roads and then a 2.2 km long hiking/snowmobile trail that extends SW to the Property from the west end of the Scalp Creek road.

Field work for this report was carried out October 11 to 15, 2017 on patented claims TB10827, TB10828, TB10835, TB10836 and TB8428. Reporting was completed on October 19, 2017. The total length of the cut grid is 2.75 km. Total expenditures were \$13,393.

The Chrome Property is underlain by the Chrome-Puddy serpentinite intrusion. Historically, exploration in the eastern portion of the serpentinite on which this work was performed has targeted chromite. Following the discovery of chromite at Chrome Lake in 1928, Consolidated Chromium Corporation completed trenching, drilling and shaft sinking at the Chrome Lake mine where 7,672 tons of chromite were mined between 1934 and 1938. The ultramafic rocks have been completely altered to serpentine, talc, chlorite, carbonate, magnetite, and amphibole. Medium-grained, biotite tonalite bounds the serpentinite to the north. South of Puddy Lake, the serpentinite intrusion is bound by mylonite and mixed metasedimentary and granitic rocks.

The 2017 VLF survey of the grid identified a VLF conductor on Lines 13+00W and 15+00W that is parallel to the strike of the serpentinite intrusion and north of the magnetic high defined by the Dighem airborne survey. This may be on strike with the stronger conductor defined in 2016.

Geological mapping has defined the approximate northern boundary of the serpentinite with foliated tonalite. Structures within the tonalite and sepentinite indicate that the serpentinite-tonalite contact is south dipping. The VLF conductor parallels the interpreted serpentinite-tonalite contact and warrants drill testing for potential Cu-Ni sulphides.

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#### 1.0 Introduction

This assessment report documents grid cutting, geological mapping, and VLF surveying on the Chrome Property, Thunder Bay Mining Division, Ontario. Field work for this report was carried out October 11 to 15, 2017 on patented claims TB10827, TB10828, TB10835, TB10836 and TB8428. Total expenditures were \$13,393. The exploration targets chromite, nickel, and platinum group (PGM) mineralization associated with the past producing Chrome Lake Mine and Puddy serpentinite.

#### 2.0 Location and Access

The Chrome Property is located in the Thunder Bay Mining District of northwestern Ontario. The property is 179 km north of the city Thunder Bay, 49 km southwest of the town of Armstrong Station, and 1,043 km northwest of Toronto, Ontario. Highway 527, a paved highway that extends north from Thunder Bay to Armstrong, is located 25 km east of the Property.

Logging roads east of the Property come to within 2.2 km of Chrome Lake. The logging road access route is from the "Obonga Lake Road" which is a signed gravel road west of highway 527 and located 30 km south of Armstrong Station. From the Obonga Lake Road, the property is accessed from the unmaintained Scalp Creek Road and then a hiking/snowmobile trail. The trail is approximately 2.2 km long and extends SW to the Property from the west end of the Scalp Creek road.

Armstrong Station

Chrome Puddy

Lac des lles

Current Lake 

Current Bay

**Figure 1. Chrome Property Location** 

Source: Google Earth 2016

#### 3.0 Claim Holdings and Property Disposition

100 km

The work for this assessment was completed on five contiguous patented claims (TB10827, TB10828, TB10835, TB10836 and TB8428). Claims are 100% owned by Pavey Ark Minerals Inc., a private company. The complete list of patented and staked claims that forms the Chrome – Puddy Property is provided in Table 1 and 2.

Image

Image

Table 1. List of Patented Claims owned by Pavey Ark

Patent Number	Recorded Claim Number	Area (acres)	Area (hectares)
TB 8420	TB 14414 & TB14413	88.55	35.84
TB 8421	TB 14415	50.91	20.60
TB 8422	TB 14412	33.90	13.72
TB 8423	TB 10835	66.41	26.88
TB 8424	TB 10836	69.24	28.02
TB 8425	TB 10826	44.63	18.06
TB 8426	TB 10827	41.87	16.94
TB 8427	TB 10828	31.88	12.90
TB 8428	TB 10883	17.83	7.22
TB 8814	TB 8814	74.67	30.22
TB 9294	TB 19207	40.56	16.41
		Total 560.45	226.81

 Table 2 List of Staked Claims comprising the Chrome Puddy Property

		<u> </u>							
Township/Area	Claim	Recording	Claim Due		Percent	Work	Total	Total	Claim
	Number	Date	Date	us	Option	Required	Applied	Reserve	Bank
OBONGA LAKE AREA	<u>4244587</u>	2012-Oct-22	2018-Oct-22	Α	100 %	\$800	\$3,200	\$1,674	\$0
OBONGA LAKE AREA	4254345	2012-Nov-27	2018-Nov-27	Α	100 %	\$2,400	\$9,600	\$0	\$0
OBONGA LAKE AREA	4254346	2012-Nov-27	2017-Nov-27	Α	100 %	\$3,200	\$9,600	\$124	\$0
PUDDY LAKE AREA	4254343	2012-Nov-27	2017-Nov-27	Α	100 %	\$4,000	\$12,000	\$0	\$0
PUDDY LAKE AREA	4265978	2013-Mar-21	2018-Mar-21	Α	100 %	\$400	\$1,200	\$0	\$0
PUDDY LAKE AREA	4265979	2013-Mar-21	2018-Mar-21	Α	100 %	\$400	\$1,200	\$0	\$0
PUDDY LAKE AREA	<u>4265980</u>	2013-Mar-21	2018-Mar-21	Α	100 %	\$400	\$1,200	\$0	\$0
PUDDY LAKE AREA	4265987	2012-Oct-22	2017-Oct-22	Α	100 %	\$6,000	\$18,000	\$494	\$0
PUDDY LAKE AREA	<u>4265988</u>	2012-Oct-22	2018-Oct-22	Α	100 %	\$2,800	\$11,200	\$0	\$0

#### 4.0 Previous Work

Historically, exploration and development in the eastern portion of the Chrome-Puddy serpentinite has targeted chromite, while the western portions of the intrusion have been explored for nickel and precious metals. Historic exploration activity on the property, as documented by Puumala et al. (2012) is summarized below.

Chromite was first discovered in the vicinity of Chrome Lake in 1928 by W.K. Keefe and R.A. MacDonald who staked the occurrence and transferred ownership to Golden Centre Mines Inc. of New York. In 1930 Consolidated Chromium Corporation, a subsidiary of Golden Centre Mines, began development work, including stripping, trenching, drilling and shaft sinking. The shaft was sunk to a depth of 350 feet, with levels at 100 and 225 feet. Operations ceased in late fall of 1930 and did not resume until 1933, when new owner Chromium Alloy Co. sent 70 tons of ore to Niagara Falls, New York, for beneficiation tests. Chromium Mining and Smelting Corp. Ltd. was formed and took control of the property in 1934 and re-commenced operations in 1936. Underground work was discontinued in 1937 because of poor ore recovery, and all activities on the site ceased in 1938. The Chrome property has been inactive since 1938.

Between 1964 and 1967, Commerce Nickel Mines carried out the first significant exploration program targeting nickel in the western portion of the Puddy serpentinite, including trenching, geological mapping, geochemical and geophysical surveys and diamond drilling (24 diamond-drill holes, totalling 5,590 feet). Between 1967 and 1968, Newmont Mining Corp. of Canada completed trenching, electromagnetic surveying and diamond drilling (10 holes, totalling 3106 feet). By the mid- to late-1980s, the area began to receive attention for its PGE potential. Between 1985 and 1993, K. Kuhner carried out prospecting, outcrop stripping, surface sampling and ground geophysical surveys on claims located on the south side of Puddy Lake. The property was transferred to Obongo Precious Metals Ltd. in 1993, and Obongo completed approximately 20 diamond-drill holes between 1993 and 1996. Imperial Platinum Corp. carried out geological mapping, sampling and ground geophysical surveys in 1987 and 1988 over an adjacent property encompassing areas west, north and southeast of Puddy Lake.

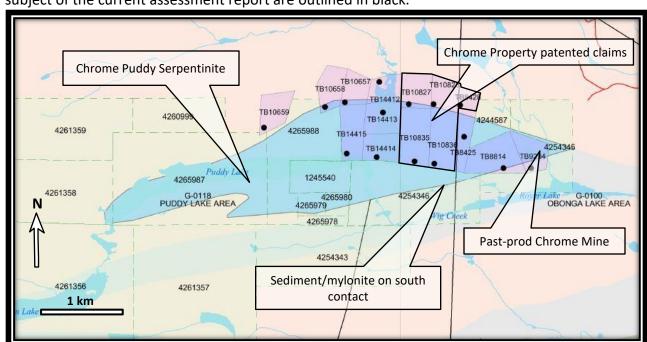
The OGS completed airborne magnetic and electromagnetic surveys with the Dighem EM system in 2000 with 200m line spacing and a nominal 58m terrain clearance (OGS 2000). The most recent exploration activity includes ground magnetic and electromagnetic surveys conducted by Vale Inco Ltd. in 2007 over a property covering the western half of the Puddy Lake serpentinite that identified a number of east west trending conductors, particularly north of Puddy Lake. D. Plumridge has carried out prospecting and sampling of a claim near the southeast end of Puddy Lake since 2004. Pavey Ark Minerals Inc reported results of mapping, portable XRF analysis and prospecting in 2014 and 2015. Pavey Ark conducted geological mapping and VLF-EM surveying on a 3.7 km grid west of the Chrome Mine shaft in 2016.

#### 5.0 Geology

The Chrome-Puddy Property is located in the Obonga metavolcanic and metasedimentary greenstone belt of the Archean Superior Province. The Obonga greenstone belt is a relatively small (approximately 10 x 40 km) greenstone belt, situated between the Sturgeon-Savant belt on the west and the Onaman-Tashota belt to the east, and has been considered to be part of the Wabigoon Subprovince (Percival and Stott 2000).

The Chrome Puddy Property is underlain by the Chrome-Puddy serpentinite intrusion that is exposed for 7 km along strike and is approximately 1 km in width (Figure 2). Whittaker (1986) reports that rocks of the intrusion include dunite, peridotite, and minor pyroxenite, all of which are serpentinized. Medium-grained, biotite tonalite bounds the Serpentinite to the north. South of Puddy Lake, the serpentinite intrusion is bound by mylonite and mixed metasedimentary and granitic rocks. North-striking and east-striking diabase dikes of probable middle Proterozoic age cut the Serpentinite.

The ultramafic rocks have been completely altered to serpentine, talc, chlorite, carbonate, magnetite, and amphibole. The alteration, metamorphism and deformation of the serpentinite has made the interpretation of protoliths in the intrusion difficult (Graham 1930; Hurst 1931; Simpson and Chamberlain 1967; Whittaker 1986). Although no ultramafic rocks with primary mineralogy remain, the original rock types in some areas can be inferred with some confidence by comparison with the results of studies on known types of serpentine pseudomorphs.



**Figure 2. Chrome Puddy Property geology.** Chrome Property patented claims that are the subject of the current assessment report are outlined in black.

Base map source: MNDM Claimaps 2015

#### 6.0 Grid

For the present program a 2.75 km grid was cut by A-Star Prospecting of Thunder Bay and was cut between October 11 to 14, 2017. The 2017 grid is an extension of the grid cut in 2016. BL1+00W is located at 321348mE 5538340mN with the grid origin being coincident with the Chrome Mine shaft. The baseline for the present survey extended from 7+50W to 15+00mW at azimuth 120° relative to UTM grid. Lines are cut orthogonal to the baseline at 030°, spaced at 200 m, from 9+00mW to 15+00mW and are picketed at 25 m intervals. Grid coordinates are provided in Appendix 1.

#### 7.0 Grid Geology

Geological mapping on the grid (Map 2) was conducted by R.H. Sutcliffe on October 12 and 15, 2017. Mapping was done on the 200m grid lines and incorporated some bush traverses. Outcrop exposure is generally limited in the area of the serpentinite, however there is a large outcrop area of sepentinite exposed on and south of the baseline between BL12+00W and BL15+00W. The south eastern part of the grid is characterized by very large boulders and blocks making it very difficult to conclusively identify bedrock. North of the baseline, large angular tonalite boulders and heaved blocks in excess of 10 m diameter are common. Outcrops and station locations were located by a handheld Garmin Etrex GPS receiver and plotted on a digital map base map previously downloaded from the MNDM CLAIMaps III application.

#### 8.1 Serpentinite

Outcrops of serpentinized ultramafic rocks are well exposed along the base line between 12+00W and 14+50W. In this area the ultramafic rocks are creamy grey to buff weathering and have dark, grey-green serpentinized fresh surfaces. Locally, excellent examples of "elephant hide" weathering are present. Although primary ultramafic lithologies are difficult to determine due to the high degree of serpentinite alteration, local relict olivine cumulate textures can be identified on weathered surfaces indicating that some of the ultramafic rocks are altered dunites.

#### 10.2 Biotite Tonalite

Strongly foliated, medium grained biotite tonalite (Unit 3a) occurs north of the Chrome-Puddy serpentinite on lines 9+00W, 11+00W, and 13+00W.

#### 8.3 Structure

Shallow (approximately 40°) south-dipping foliations are observed in the biotite tonalite and locally in the ultramafic rocks. These orientations are consistent with those measured on the grid in 2016.

Underground workings at the #1 shaft of the Chrome Lake Mine also document that both the northern and southern contacts of the serpentinite dip south at approximately 45° (Hurst, 1931).

Approximately 100 m south of the Chome Lake mine waste dump, the serpentinite-tonalite contact appears to be truncated by an east-west trending mylonite zone that dips at approximately 45° south.

#### 8.0 VLF Survey

The Chrome grid was surveyed on October 13 and 14, 2017 with a Geonics EM16 (serial number 3353) using NAA Cutler, Maine as the transmitter. Data was collected by R.H. Sutcliffe. In-Phase and Quadrature measurements were collected at picketed 25m station intervals in a north facing direction. All four grid lines and the base line were surveyed.

In-Phase and Quadrature measurements were recorded manually and entered into a spreadsheet for processing. The data were plotted and evaluated by Dr. Colin Bowdidge. Map 3 plots data postings and Map 4 plots the data profiles.

The 2017 VLF survey of the grid identified a VLF conductor on Lines 13+00W and 15+00W that is parallel to the strike of the serpentinite intrusion and north of the magnetic high defined by the Dighem airborne survey. This may be on strike with the stronger conductor defined in

2016. The position of the VLF conductor relative to the total magnetic field (OGS, 2000) is shown on Map 5.

#### 10.0 Conclusions and Recommendations

Geological mapping has defined the approximate northern boundary of the serpentinite with foliated tonalite, however, the precise location of the contact is obscured by overburden and large boulders. Foliations within the tonalite and serpentinite suggest that the contact is south dipping.

This program has defined a VLF conductor that may be a western continuation of the VLF conductor identified north west of the Chrome mine shaft in 2016. The conductor parallels the interpreted serpentinite-tonalite contact, and is located on the north flank of a magnetic high on the published airborne maps. The conductor warrants drill testing for potential Cu-Ni sulphides.

#### **Acknowledgements**

Field support by Greg Smith and Joey Achneepineskum of A-Star Prospecing was greatly appreciated. Dr. Colin Bowdidge provided guidance on the VLF instrument and an interpretation of the results.

#### 11.0 References

Graham, A.R., 1930, Obonga Lake Chromite Area, District of Thunder Bay, in the Thirty-Ninth Annual Report of the Ontario Department of Mines, Vol. XXXIX, Part II, pp. 51-60.

Hurst, M.E., 1931, Chromite Deposits of the Obonga Lake Area, District of Thunder Bay, in the Fortieth Annual Report of the Ontario Department of Mines, Vol. XL, Part IV, pp. 111-119.

Ontario Geological Survey, 2000, Airborne magnetic and electromagnetic surveys, Garden-Obonga area, Ontario Geological Survey, Map 82-097, Scale 1:20,000.

Percival, J.A., and Stott, G.M. 2000, toward a revised stratigraphy and structural framework for the Obonga Lake greenstone belt, Ontario, Geological Survey of Canada, Current Research 2000-C22, 8 p.

Puumala, M., et al. 2013, Report of Activities 2012, Resident Geologists Program, Thunder Bay South District, Ontario Geological Survey P6285.

Simpson, P.R., and Chamberlain, J.A., 1967: Nickel Distribution in Serpentinites from Puddy Lake, Ontario; Geo. Assoc. Canada Proceedings, Vol. 18, p.67-91.

Whittaker, P.J., 1986, Chromite Deposits in Ontario, Ontario Geological Survey, Study 55, 97p.

#### 12.0 Statement of Qualifications

I, Richard H. Sutcliffe, of 100 Broadleaf Crescent, Ancaster, Ontario, do hereby certify that:

I am a graduate of University of Toronto (B.Sc. Geology, 1977, M.Sc Geology 1980), and a graduate of University of Western Ontario (Ph.D. Geology, 1986) and I have been practising my profession as a geologist since.

I am a member with the Association of Professional Geoscientists of Ontario (#852). I have direct knowledge of the exploration work performed for this assessment and I am indirectly the owner of the claims on which the work was performed.

Signed

"R.H. Sutcliffe"

Richard H. Sutcliffe, Ph.D., P.Geo. October 19, 2017 Ancaster, Ontario

#### **Appendix 1. Grid coordinates**

Instrument - Geonics EM16, serial number 3353
Data collected by Richard H. Sutcliffe
Transmitter - NAA Cutler
Facing direction - North, In-Phase read as % slope

Chrome Cr-PGM Property
Baseline Coordinates
BL9W 320648mE 5538741mN
BL11W 320477mE 5538848mN
BL13W 320299mE 5538939mN
BL15W 320129mE 5539035mN

Line End Point Coordinates
L9W 3+00N 320790mE 5538984mN
L9W 2+00S 320550mE 5538584mN
L11W 3+00N 320626mE 5539074mN
L11W 2+00S 320385mE 5538662mN
L13W 3+00N 320447mE 5539197mN
L13W 2+00S 320201mE 5538773mN
L15W 3+00N 320267mE 5539299mN
L15W 2+00S 320030mE 5538870mN

## Appendix 2. Expenditures

Item	Units	Unit Cost	HST	Total
Line Cutting – October 11 to 14, 2017				
A-Star Prospecting - Line cutting, plus	3 km	\$875/km	749.13	6,511.63
mob/demob/camp costs, trail				
Geologist – R. Sutcliffe				
Field work – October 12 to 15, 2017	4 days	\$650/day	338.00	2,938.00
Reporting – 1 day, October 19, 2017	1 days	\$650/day	84.50	734.50
Geophysics – Colin Bowdidge				
Data plotting and interp	1 day			\$750.00
Travel				
Personal Vehicle – 1 trip Ancaster/T	3,402 km	\$0.50/km		1,701.00
Bay/Armstrong/Ancaster				
Food and Accommodation				
Groceries	5 days	\$35/day		175.00
Hotel, Wawa, Oct 11 and 15, 2017	2 nights		44.33	385.33
Office Supplies & Field consumables				
Copies - Staples			1.52	13.22
Sat Phone – In Reach			2.59	22.54
Teranetexpress – Land records			13.70	161.45
TOTAL EXPENDITURES				13,392.67

Assignment of Expenditure to Claims					
Claim	Percentage	Expenditure	Applied	Banked	Order to be Cut
					back
TB10827	30%	\$4,018	\$0	\$0	
TB10828	20%	2,679	\$0	\$0	
TB10835	10%	1,339	\$0	\$0	
TB10836	30%	4,018	\$0	\$0	
TB8428	10%	1,339	\$0	\$0	
4265987	0%	0	\$6,193	\$0	3
4254346	0%	0	3,200	\$0	2
4254343	0%	0	4,000	\$0	1
Total		\$13,393	\$13,393		



Ontario Ministry of Northern Development and Mines Mining Lands Claim Map

# **Administrative Districts**

Township

PUDDY LAKE AREA

Mining Division

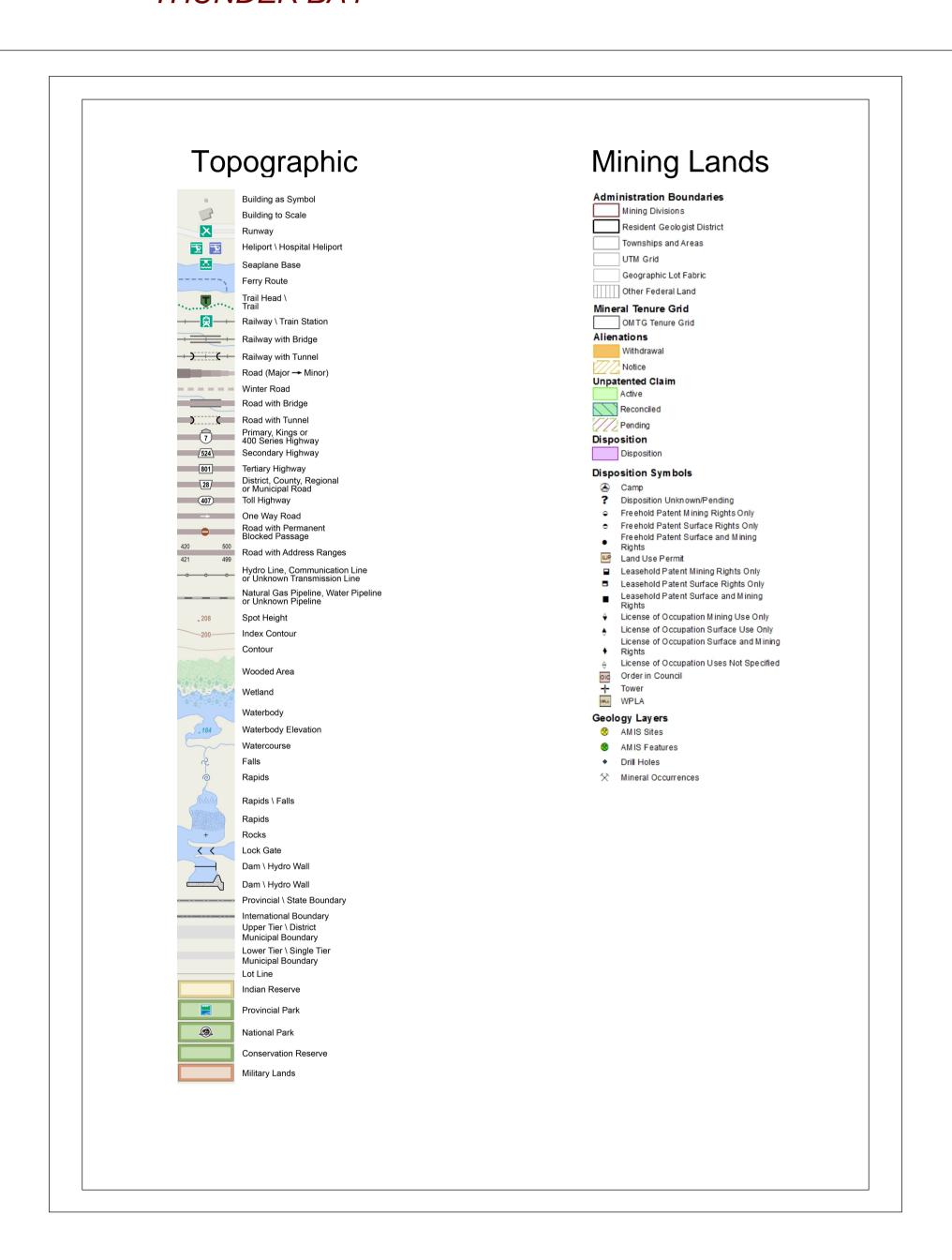
Thunder Bay

Land Registry

THUNDER BAY

MNRF District Office

THUNDER BAY

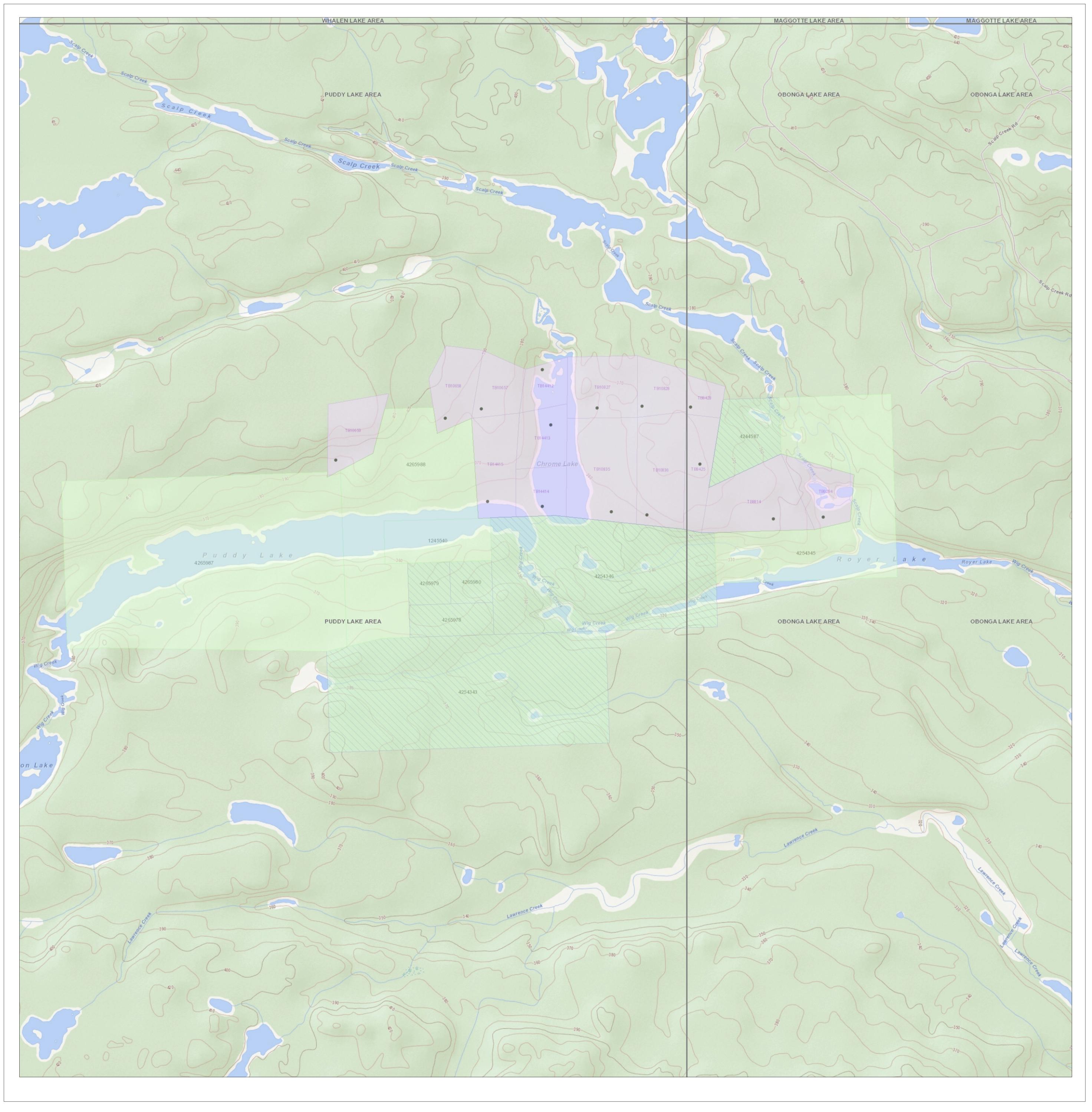


Scale: 1:10,000

2.00 km

Map Datum: NAD 83 Projection: Web Mercator

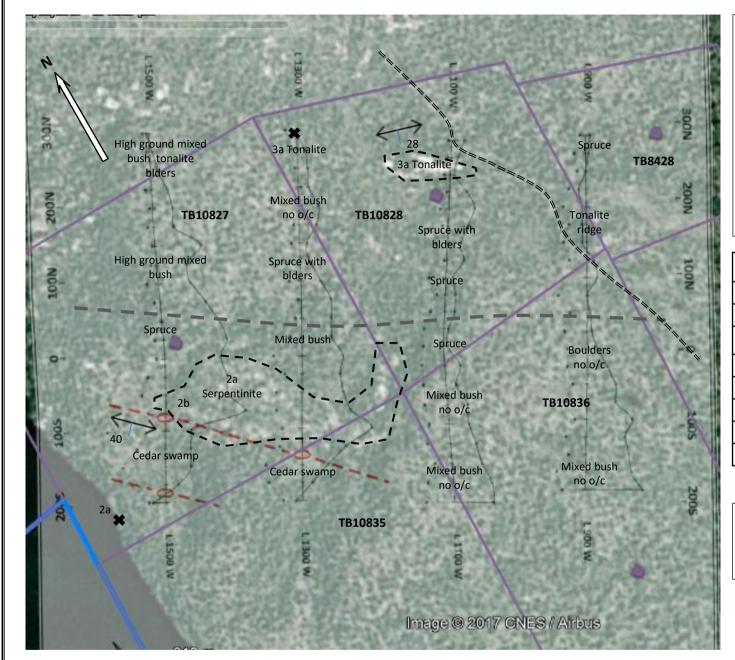




Those wishing to stake mining claims should consult with the Provincial Mining Recorders' Office of the Ministry of Northern Development and Mines for additional information on the status of the lands shown hereon. This map is not intended for navigational, survey, or land title determination purposes as the information shown on this map is compiled from various sources.

Completeness and accuracy are not guaranteed.

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### Map 2. Chrome Property Geology

Patented Claims TB10827, TB10828, TB10835, TB10836 and TB8428

G-0100, Obonga Lake area, Thunder Bay Mining Division NTS 52H 14 - Gull Bay

Datum NAD83, UTM Zone 16U Magnetic declination 3° 53' W

For: Pavey Ark Minerals Inc., Client number 41165 Prepared By: R. H. Sutcliffe, P.Geo.

October 19, 2017

Legend				
3a Biotite tonalite	Cr – chromite			
2a Serpentinite	Geological Contact — — —			
2b Serpentinite with chromite	Claim Line			
	Trail =====			
Foliation —	no o/c – no outcrop			
1	Outcrop *			
VLF Conductor	Grid Line			

