CARDS EVALUATION REPORT, PENELOPE PROPERTY

NTS map sheet 32F/08
Lebel-sur-Quévillon
Québec, Canada

Prepared for:

Ministère des Ressources Naturelles et de la Faune du Québec
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(November 2015 update)

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1. SUMMARY

On behalf of DIAGNOS Inc., a CARDS technical evaluation was carried out over the Lebel project area. The purpose of this study was to identify favourable exploration targets based on the analysis of all available geophysical and sample data using artificial intelligence and data mining techniques.

Over 3,685 km2 were subject to evaluation. The Lebel project area was evaluated trough three different models: gold, copper and copper-zinc models for which targets were generated. The priority targets which were selected based on their high similarity to known gold, copper or zinc mineralization, led to the staking of the Penelope property on July 27th, 2011.

The Penelope property consists of 27 map designated claims, totalling 1,512 hectares (15.12 km^2). The property is located on the southeastern shores of Lac Pusticamica, 52 km northeast of Lebel-sur-Quevillon and 14 km southeast of Miquelon, within NTS map sheet 32F/08.

The property is located in the Chibougamau-Matagami Archean greenstone belt of the Abitibi sub-province. This belt stretches over 400 km, from the Kapuskasing structure to the Grenville front and forms the northern half of the Northern Volcanic Zone (NVZ) as defined by Chown et al., (1992). On a local scale, the property straddles the contact between a fractionated pluton with felsic to ultramafic affinities and the surrounding Obatogamau basalts. The property was also affected by northeast trending faults parallel to the Pusticarnica shear zones and by two (2) west trending dextral faults.

The CARDS algorithm has allowed the Penelope Property to be highlighted based on the similarity to known gold mineralization inside the area covered by the Abitibi MEGATEM II Xstrata survey H, I &J.

Diagnos personnel also conducted a $2^{1/2}$ day reconnaissance field trip in July 2012 in order to validate the circular gold target generated by CARDS. Unfortunately, the bedrock associated to the target zone is buried under considerable amounts of overburden. Therefore, only few outcrops were encountered and no significant mineralization was discovered. Furthermore, the strong circular magnetic anomaly highlighted by CARDS was found to be caused by strong magnetite enrichment (Gauthier, 1986) within the entire granophyric intrusion (Barrette, 1991).

However, prospection of the southeastern shores of lac Pusticamica revealed outcrops containing larger amounts of sulfides, centimeter scale bands of iron formations, a stronger deformation and wider variety of alteration which merit further attention.

2. INTRODUCTION

The purpose of this report is to present and assess the Penelope property for gold mineralization, in relation with the recent and historical exploration work and the targets generated by CARDS (DIAGNOS Inc.).

This report presents the geology and potential for gold mineralization within the Penelope property. It summarizes the exploration work carried out on the property and sets out recommendations for additional work.

Diagnos personnel carried out a short reconnaissance field trip on the Penelope claims in July 2012. Field work was carried out and supervised by geologists Jean François Leclerc-Cloutier, P. Geo and Grigor Heba, P. Geo.

All of the information presented in this report is derived from historical public data, including assessment reports as well as geological, geochemical, and geophysical compilations, available online on the MRN's (Ministère des Ressources Naturelles du Québec website (SIGEOM).

In this report, figures are projected in NAD 83 UTM zone 18.

3. RELIANCE ON OTHER EXPERTS

In the course of this study, DIAGNOS used data from the MRN's public databases. The authors have not taken any action to verify or assess reported grades and metal concentrations, other than assessing the rationale used in the various reports. If not commented, the author considers the documentary sources as reliable, technically valid and usable with some restriction related to the present frame of work and the experience of the author.

Target zones on the Penelope property were generated using CARDS. Generation of these targets using "data mining techniques" was carried out by the "CARDS team" at DIAGNOS consisting of Riadh Kobbi, M.Sc., Data Modelling Manager, Jihed Chelbi, M.Sc., Business Intelligence Specialist, co-authors of sections 8 and 9 of this report, with the collaboration and under the supervision of Houssem Ben Tahar, B.Eng. Statistics, M.Sc., Vice-President, Development and Business Intelligence at DIAGNOS. The authors have relied on the opinion and work of the "CARDS team" at DIAGNOS responsible for target zone generation using CARDS. The methodology, validity, and any representations made upon such targets are and remains the sole responsibility of the "CARDS team".

4. PROPERTIES, LOCATION AND ACCESSIBILITY

The Penelope claims are located in the Jamesie region of Quebec, 52 km northeast of Lebel-sur-Quevillon (Figure 1) and 27 km southeast of Desmaraisville. The property straddles the Benoist and Ruette townships and covers parts of the NTS map sheet 32F/08.

The property is accessible by an all-weather forestry road (chemin du Moulin and Route 1000) from Lebel-sur-Quevillon or by using the Bachelor-Barry road which begins behind the Bachelor mine in Desmaraisville. Both communities are reachable using the provincial highway 113.

The Penelope claim block consists of 27 map designated claims, totalling 1,516 hectares (15.16 km^2). The claim block extends for 5.6 km north and 4.8 km east in the larger parts of its irregular shaped block. The property center point is located at latitude 49°16' 59" N and longitude -76° 22' 58" W (399,429 mE, 5,459,868 mN, NAD83 UTM zone 18). The complete list of claims is presented in Table 1.

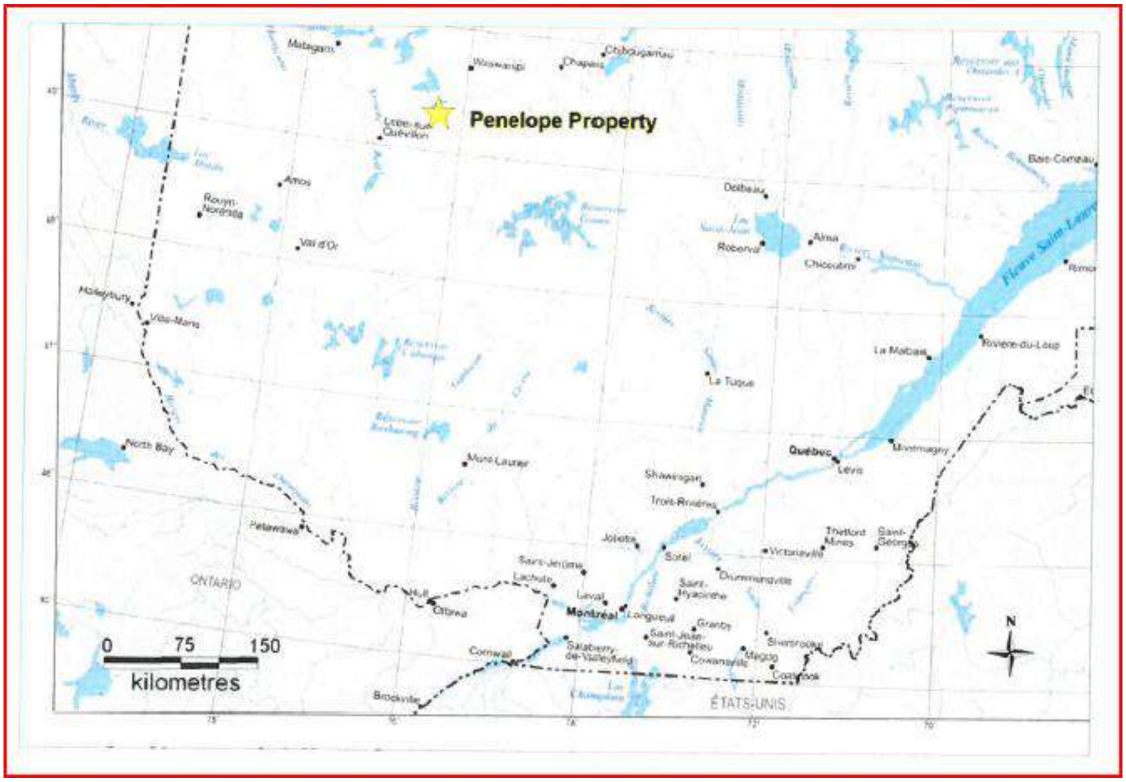

Figure 1: Penelope Property Location Map

The climate is characterized by cold winter and mild summers. Temperatures can range from 5°C to 35°C during the summer months and can reach -35°C, rarely rising above 0°C during the winter months with an average snow cover of 83 cm and 115 mm of rain in summer.

The topography of the project area is generally flat with very few hills and a large dry swamp which occupies a large area in the southern part of the property. Except for a few protruding hill tops, most of the region is covered by glacial deposits, with a thickness ranging from under one meter to a few meters thick.

Table 1: Penelope property claim list (November 2015 update)

Title No	NTS Sheet	Area (ha)	Registration Date	Expiry Date	Title holder (s)
2303940	32F08	56	2011-07-27	2017-07-26	DIAGNOS INC. (21100) 100%
2303941	32F08	56	2011-07-27	2017-07-26	DIAGNOS INC. (21100) 100%
2303945	32F08	56	2011-07-27	2017-07-26	DIAGNOS INC. (21100) 100%
2303946	32F08	56	2011-07-27	2017-07-26	DIAGNOS INC. (21100) 100%
2303947	32F08	56	2011-07-27	2017-07-26	DIAGNOS INC. (21100) 100%
2303948	32F08	56	2011-07-27	2017-07-26	DIAGNOS INC. (21100) 100%
2303949	32F08	56	2011-07-27	2017-07-26	DIAGNOS INC. (21100) 100%
2303950	32F08	56	2011-07-27	2017-07-26	DIAGNOS INC. (21100) 100%
2303951	32F08	56	2011-07-27	2017-07-26	DIAGNOS INC. (21100) 100%
2303952	32F08	56	2011-07-27	2017-07-26	DIAGNOS INC. (21100) 100%
2303953	32F08	56	2011-07-27	2017-07-26	DIAGNOS INC. (21100) 100%
2303954	32F08	56	2011-07-27	2017-07-26	DIAGNOS INC. (21100) 100%
2303955	32F08	56	2011-07-27	2017-07-26	DIAGNOS INC. (21100) 100%
2303956	32F08	56	2011-07-27	2017-07-26	DIAGNOS INC. (21100) 100%
2303957	32F08	56	2011-07-27	2017-07-26	DIAGNOS INC. (21100) 100%
2303958	32F08	56	2011-07-27	2017-07-26	DIAGNOS INC. (21100) 100%
2303959	32F08	56	2011-07-27	2017-07-26	DIAGNOS INC. (21100) 100%
2303960	32F08	56	2011-07-27	2017-07-26	DIAGNOS INC. (21100) 100%
2303961	32F08	56	2011-07-27	2017-07-26	DIAGNOS INC. (21100) 100%
2303962	32F08	56	2011-07-27	2017-07-26	DIAGNOS INC. (21100) 100%
2303963	32F08	56	2011-07-27	2017-07-26	DIAGNOS INC. (21100) 100%
2303964	32F08	56	2011-07-27	2017-07-26	DIAGNOS INC. (21100) 100%
2434375	32F08	56	2015-10-23	2017-10-22	DIAGNOS INC. (21100) 100%
2434376	32F08	56	2015-10-23	2017-10-22	DIAGNOS INC. (21100) 100%
2434377	32F08	56	2015-10-23	2017-10-22	DIAGNOS INC. (21100) 100%
2434378	32F08	56	2015-10-23	2017-10-22	DIAGNOS INC. (21100) 100%
2434379	32F08	56	2015-10-23	2017-10-22	DIAGNOS INC. (21100) 100%

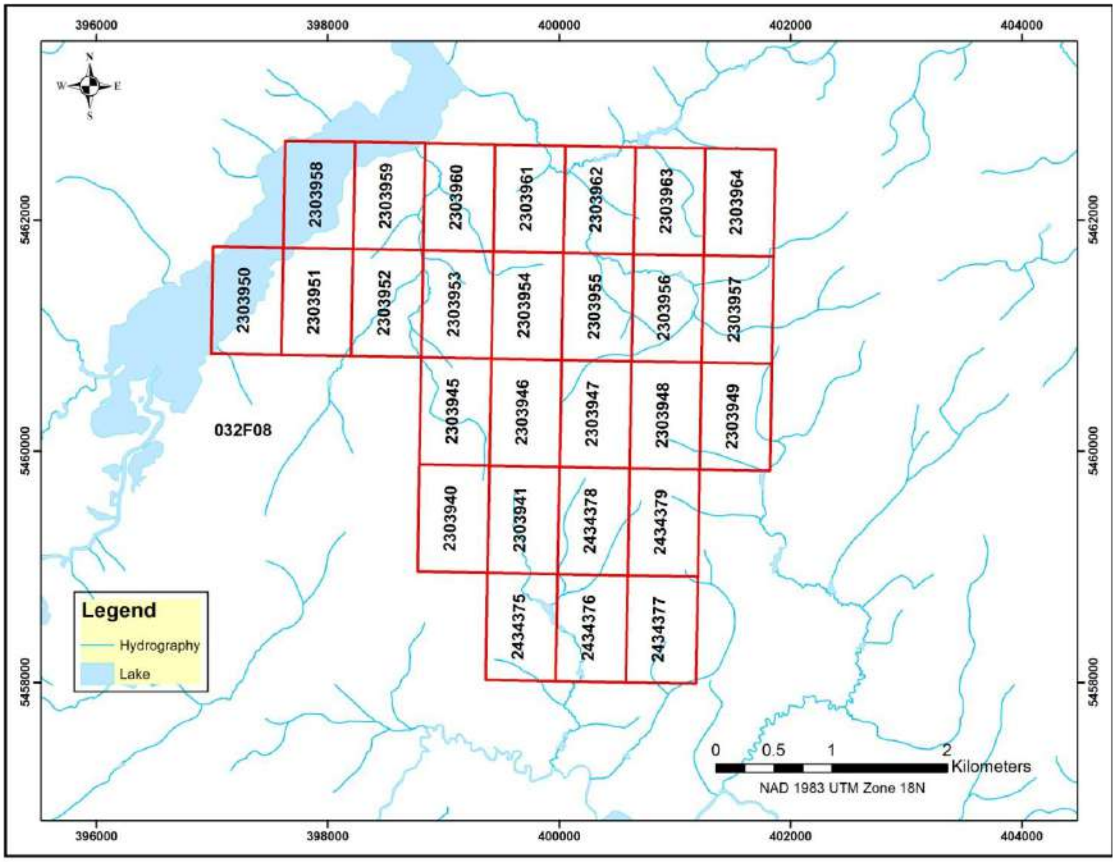

Figure 2: Penelope property claims (November 2015 update)

5. GEOLOGICAL CONTEXT

5.1. Regional geology

Penelope property is located in the southern band (Caopatina Segment) of the Chibougamau-Matagami Archean greenstone belt. The Chibougamau-Matagami belt forms the northern half of the Northern Volcanic Zone (NVZ) of the Abitibi sub-province as defined by Chown et al., (1992). The belt stretches for over 400 km, from the Kapuskasing structure to the Grenville front.

The Caopatina Segment is a volcano-sedimentary rock assemblage composed of two principal formations: the Obatogamau formation, a vast plain of tholeiitic basalts with a few mafic to felsic volcanic centers, and the Caopatina formation, an overlying sedimentary sequence. These formations are part of the lower volcanic cycle of the Roy Group.

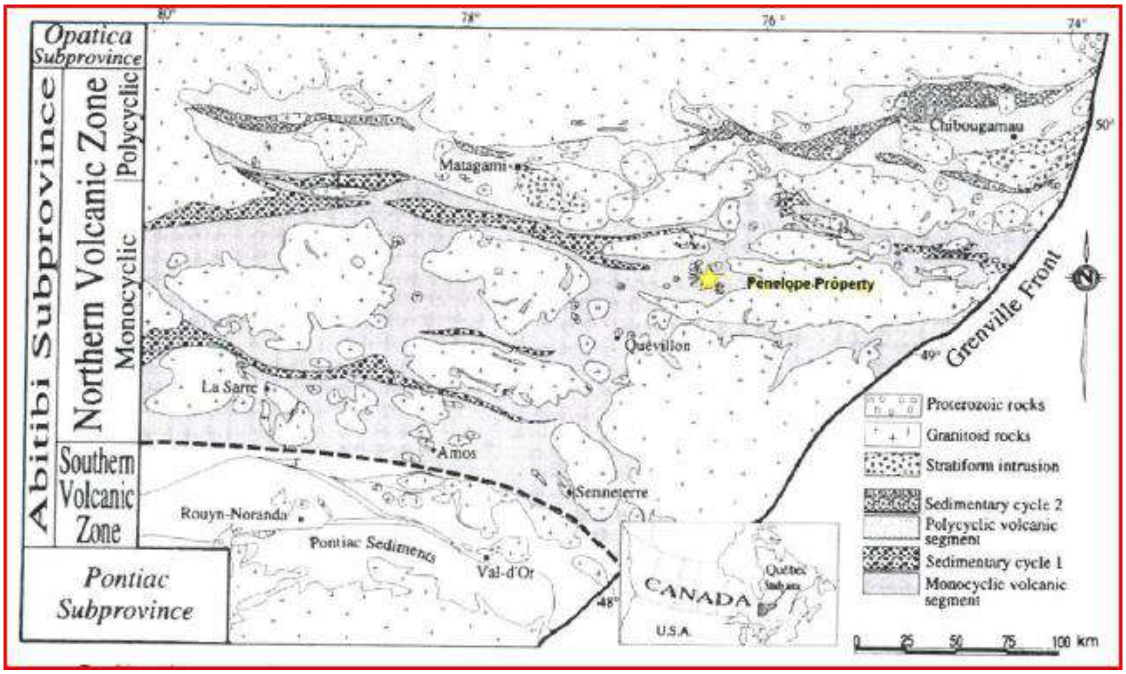

Figure 3: Northern Volcanic Zone of the Abitibi sub-province (modified after Chown et al., 1992.).

Mafic layered intrusions intrude the mafic volcanic phase of cycle 1 (Roy Group), suggesting that these are the magmatic equivalents of mid-ocean-ridge basalt (MORB) type (Pellet and Barnes 1991). Post tectonic plutons occur along late tectonic structure that transects the structural trend. They may be locally deformed by these structures (Lauziere, 1989). The post tectonic plutons include both a granodiorite suite and a less voluminous syenite-carbonatite suite.

5.2. Regional Structure and Metamorphism

Rocks from the Chibougamau-Matagami greenstone belt were deformed and metamorphosed by two orogenic events. The earlier Kenoranorogen (2800-2600 Ma), was a three phase regional deformation that resulted in large E-W domes & basins structures and associated E-W, SE and

NE regional fault systems. The Grenville orogen (1300-1000 Ma), on the other hand is responsible for the NNE regional fault system.

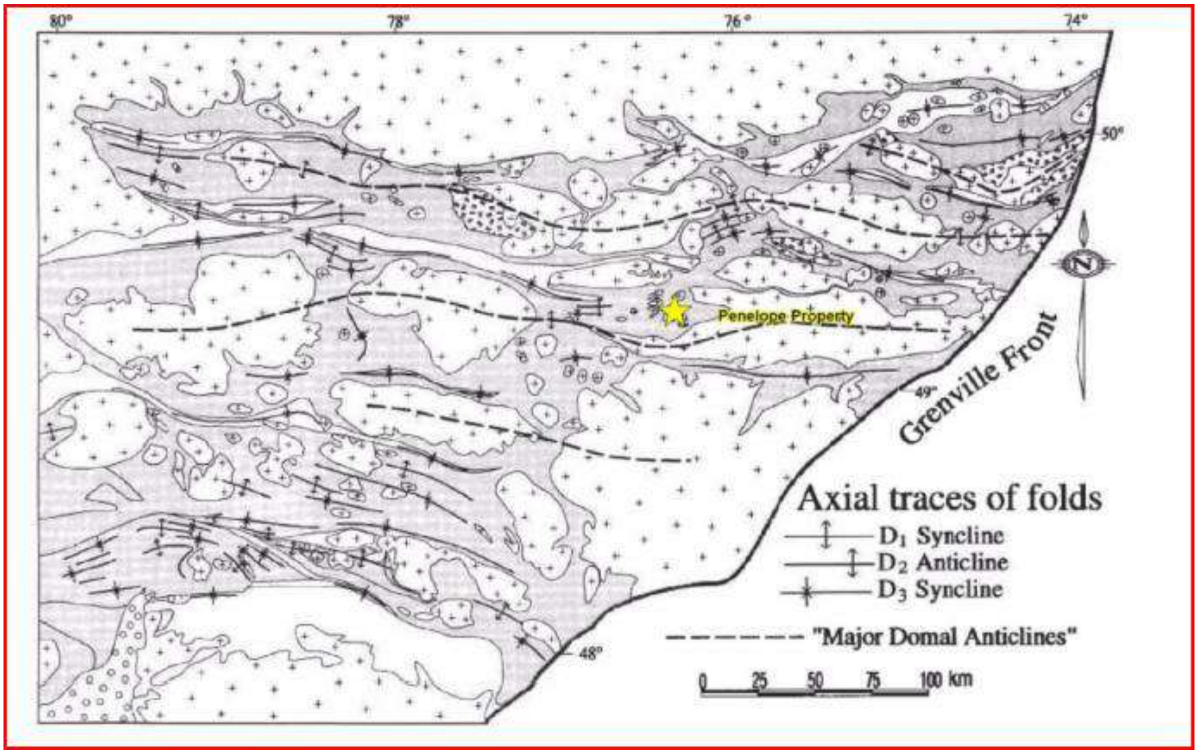

Figure 4: Fold patterns in the Northern Volcanic Zone. Map modified after Chown et al., 1992.

The tectonic grain of the region is defined by the second phase of the Kenoran orogeny, which is considered to be the most important tectonic event. This deformation phase, with a stress (al) oriented N-S, has engaged isoclinals folds responsible for the predominantly E-W orientation of the stratification and associated schistosity. Corridors have preferentially absorbed the N-S stress to form E-W shear zones. The NE faults and the associated secondary faults are the result of the third phase of the orogeny. These faults cross cut older structures (stratification, schistosity, fold axis and E-W faults) and are the illustration of the strike slip engaged towards the end of the orogeny.

The metamorphic grade of the belt is of greenschist facies, locally reaching the amphibolite facies near the Grenville front and along deformational corridors and intrusion margins.

5.3. Local Geology

The Penelope property is underlain by a tonalite/granite intrusion surrounded by a 500900m wide melanogabbro/pyroxenite ring (Figure 5). In the neighboring property, anorthosite was also reported to be included in the intrusive suite. The annular mafic/ultramafic sill and the felsic centre are characterized by a stronger magnetite enrichment which can be associated to the distinct circular airborne magnetic anomaly (Figure 8). This medium grained intrusive assemblage contains 10-20% bluish quartz, 5% amphibolites and 1-3% disseminated magnetite. The magnetite was also found associated with pyrrhotite in fine-quartz veinlets. The strong relation between the zoned intrusion and the surrounding ultramafic sill combined with the textural observations suggest the presence of a granophyric package where advanced crystal fractioning and magmatic differentiation occurred at a shallow depth (Barrette, 1991; Barrette, 1993; Gauthier, 1986).

The 5km wide mass of intrusive rock was emplaced into a larger sequence of plagioclase porphyry basalt better known as the Obatogamau basalts. A narrow dacitic lens interbedded into the Obatogamau basalts was also mapped in the southern part of the property (Gauthier, 1986). However, no outcrop validating an extension of this felsic volcanic unit through the Penelope claims was encountered inside the property limits.

The Penelope property is crosscut by a NE-trending structural feature known as the Pusticamica South fault (Barrette, 1991 & Gauthier, 1986). Although this fault is hidden by the linear shaped southeast arm of the Pusticamica Lake, the structural elements associated to this feature can be observed along the lake's shores as well as over the adjacent hills. This senestral lineament is parallel to the to the better known Pusticamica Lake shear zone which was identified approximately 2 km to the North. This fault zone is associated to significant amounts of proximal angular blocks scattered along the lake's shores. These basaltic rocks are well foliated and impregnated by a wider range of alteration products such as silicification, carbonization, albitization and chloritization.

These deformed rocks also display considerable amounts of disseminated pyrite as well as centimeter scale bands of iron formations.

Several outcrops encountered south of the property limits along the Pusticamica lake shear zone were described by Barrette in 1991 and 1993. Although none of these outcrops are located inside the property limits, the geology of these outcrops should be quiet similar to what would be encountered in the Penelope Property. The outcrops were classified as basalts metamorphosed or deformed into amphibolites, mylonites, chlorite schists, carbonate schists and gneiss. Several metric bands of rusted tuffs were also identified in the metabasalts. The mylonites which are accompanied by quartz veins are characterized by a NE orientation and are dipping abruptly to the SE. The Pusticamica South fault dips to the NW and is considered to be younger than the mylonitized rocks (Barrette, 1991).

The property was also crosscut by a NE-SW diabase associated to the Abitibi Proterozoic mafic dyke swarm.

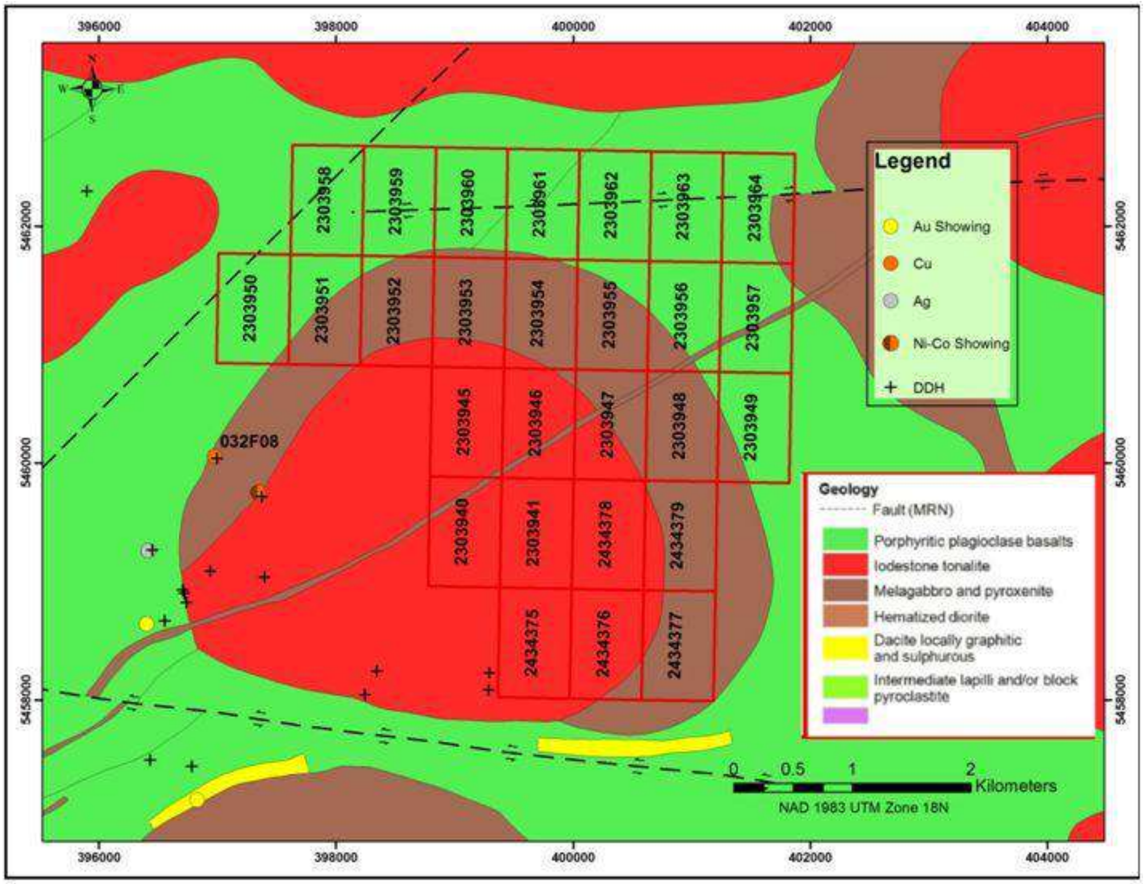

Figure 5: Geology of the Penelope Property (November 2015 update)

6. MINERALIZATION AND DEPOSITS

The northern part of the Abitibi greenstone belt is characterized by Cu-Zn massive sulphides, Cu-Zn vein deposits and lode gold deposits where volcanic strata are the usual host for massive sulphide deposition. Gold occurs in veins within shear zones and iron formations, or as disseminated mineralization associated with felsic intrusions (Card and Poulsen, 1998). The region is host to rich mineral deposits such as the Bachelor Lake gold mine which is located 28 km northeast of the property and the Gonzague-Langlois Mine, 22.5 km south-west of property. The bands of mafic volcanic rocks and meta-sediments that characterize the Chibougamau-

Matagami volcano-sedimentary belt are defined as favourable areas for gold and base metal deposits.

The Penelope property area has three known gold and base metal deposits within a 30 km radius:

- **Bachelor Lake Mine,** total measured+ indicated resources of 643 826 tons grading at 7.96 g/t Au (Darling & Lafontaine, 2011), 28 km northeast of the property)

- **Coniagas Mine** (closed) 651 777 t 10.80% Zn, 1.10% Pb and 163.62 g /t Ag, 27 km northeast of the property.

- **Gonzague Langlois Mine,** total measured+ indicated resources of 6 659 000 tons grading at 10.07% Zn, 0.65% Cu, 47.44 g/t Ag and 0.07 g/t Au (Jensen, 2010), 22.5 km South-West of the property.

Although no mineralized showing was encountered inside the property limits, the surrounding areas host several gold and base metal occurrences within a 10 km radius (Figure 6):

Ruisseau Montain Est (Au & Cu); discovered in 1959; 3.8 km SW of the property center point. 3810 ppb Au from a trench sample, 2-8% disseminated pyrite & chalcopyrite in quartz veins. This showing consists of 3 mineralized veins in the contact zone between a narrow felsic volcanic bands and the pyroxenite gabbro. During previous geological mapping programs, this contact zone was drawn out to the southern part of Penelope property; however, no outcrop validating an extension of this felsic volcanic unit through the Penelope claims was encountered within the property limits. The occurrence zone is associated to an 800m long VLF conductor. The mineralized veins are orientated between 70 and 90 degrees azimuth and dipping sub vertically. The vein #1 is 10 to 30 cm wide, 40m long and contains disseminated pyrite. The vein #2 is 15 to 30 cm wide and is hosted into strongly altered (mostly carbonization and silicification) felsic volcanic rock. The vein #3 is 10 to 30 cm wide and contains 2% disseminated pyrite or 30% pyrite as semi massive lenses (Provost, 1984).

- **Marie** (Au, Ag, Zn, ±Cu); discovered in 1992, 3.3 km WSW of the property center point. DDH assayed intervals of up to 15,800 ppm Zn (40 cm), 1,850 ppb Au, 13.37 ppm Ag and 4200 ppm Cu. This showing presents 0-3% chalcopyrite as well as 1-20% disseminated pyrite. Mineralization which is associated with chlorite, biotite, fuchsite and magnetite occurs as clusters or as veinlet along a 50m wide felsic dyke. This dyke showing an east-west orientation is often brecciated and tourmalinized. The highest Au and Cu assays are associated with small silicified zones displaying intense pyritisation which have been intersected by chalcopyrite-pyrite-magnetite enriched quartz veins (Barrette, 1993).

- **Paradis** (Zn, Ag, Mo, Zn); discovered in 1991, 3.1 km WSW of the property center point. 25,500 ppm Zn, 290.4 ppm Ag, 2,100 ppm Mo, 2,060 ppb Au from grab samples. This showing is composed of mineralized microgranite lens or dykes crosscutting a chlorite schist. The orientation of the granite lens is parallel to the Pusticamica fault zone. Mineralization consists of disseminated pyrite in the granite or in quartz veins and veinlets. Mineralization in quartz veins is mostly associated to fluorine, tourmaline, pyrite, molybdenum, silver tellurides and traces of gold. Visible gold was also identified in an ambered quartz vein (Barrette, 1993).
- **Marcel** (Cu, NI, Au); discovered in 1993, 2.1 km west of the property center point. 15,200 ppm Cu and 4,600 ppm Ni from grab samples. Mineralization consists of 5-30% semi massive sulfides composed of disseminated chalcopyrite, pyrite and nickelliferous pyrrhotite. Mineralization is hosted in a pyroxenite and a gabbro-anorthosite which was encountered lying at the base of a quartz enriched leucogabbroic anorthosite sill and a tonalite sill. The gabbroic anorthosite is crosscut by a 3m wide quartz-tourmaline-pyrite vein with carbonitized and pyritized selvages
- **Marcel N-0** (Cu, ±Au) discovered in 1993, 2.5 km west of the property center point. 46,800 ppm Cu and 267 ppb Au from grab samples. Mineralization consists of chalcopyrite, pyrite and pyrrhotite hosted in a gabbroic-anorthosite sill. Similar types of sills were encountered at the Marcel occurrence.
- **Benoist** (Au, Ag, ±Cu); discovered in 1989, 6.4 km north of the property center point. Cartier Resources is currently conducting a resource definition program. Grades of up to 3.50 g/t Au sur 7 m, 13.89 ppm Ag sur 17.5 m were reported in a recent drill campaign. The occurrence is crosscut by several northeast trending brittle ductile shear zone associated to the Pusticamica shear zone. Mineralization is encountered in mm to cm thick veins and the calculated grades are proportional to the density of veins and the amount of sulfides present in the veins.

Note: Resource estimates and assay results from the above occurrences and from the Coniagas mine are derived from the SIGEOM 2013 public database and is not necessarily NI 43-101 compliant.

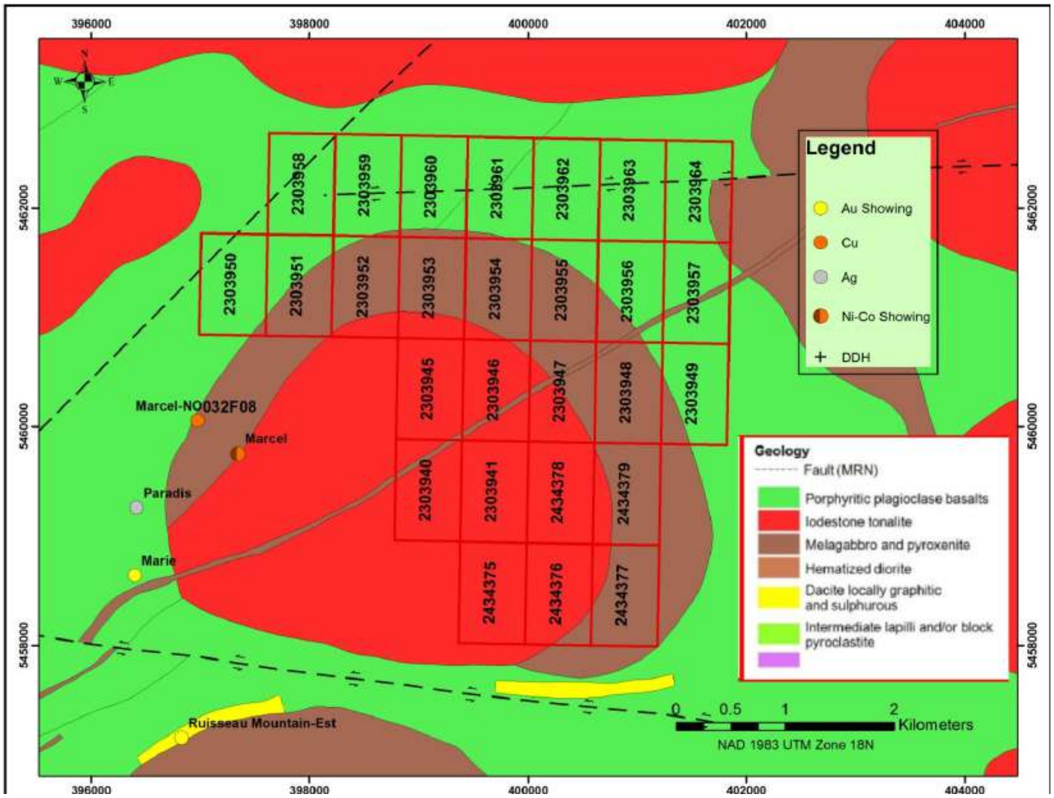

Figure 6: Occurrences in the Penelope property surroundings (November 2015 update)

7. History

Attention was first brought to the region in 1934 by G.S., Mackenzie who introduced the first geological map of the Pusticamica Lake region. Although most outcrops exposed inside the property limits were first described during this early reconnaissance field survey, no significant mineral occurrences was discovered. 25 years later, in 1959, three rich gold bearing quartz veins were discovered in the Ruette Township by Osisko Lake Mines Ltd, approximately 1 km south of the property limits.

7.1. Previous Work

From 1959 to 1968, extensive surface work was carried out by Osisko Lake Mines Ltd on the Ruette property. This campaign included trenching, geological mapping and geophysical surveys.

All the information gathered lead to the discovery the Ruisseau Montain-Est occurrence which is composed of three rich gold bearing quartz veins. Vein #1 presented gold values between 188, 54 g/t and 3,1 g/t and 0,06 g/t to 20,6 g/t with intervals ranging from 30 to 60 cm. Specific rock samples collected from vein #2 contain an average of gold between 14, 74 g/t and 47, 99 g/t. Finally, gold mineralization of 0, 17 g/t to 0, 34 g/t was assayed in the vein #3.

In 1970, Departement of Natural Resources conducted surface work which included geological mapping and sediments sampling.

In 1983, Serem Ltee conducted, on Ruette property, two geophysical surveys, VLF-EM and MAG (GM 40840). Results of these surveys revealed four anomalous conductivity zones. The four conductors were found to be parallel to the rich gold bearing quartz veins discovered in the past works.

In 1985, MNRF carried out a geological mapping campaign in the Miquelon region (DP-8610). Most geological data available in the SIGEOM originated from this project.

In 1987, an EM-VLF geophysical survey (GM 43822) was conducted by SEREM QUEBEC INC on Duplessis property situated approximately 3 km east from Penelope property. The results highlighted high conductivity zones oriented NE-SW.

In 1992, the MER visited few outcrops on the Ruette property of RPM Inc. The geochemistry of the collected rock samples did not show evidences of economic

potential. However, the company suggested pursuing exploration in this particular sector.

In 1993 and 1995, Valimex Inc. carried out a prospection campaign including geological mapping, Beep-Mat, sampling, VLF and MAG on their property situated in the north-west of Ruette township. A mineralization interface associated to copper, zinc and gold anomalous was revealed.

In 1998, a total of 10.9 km of ground geophysical survey such as Induced / Resistivity polarisation was carried out by VAL D'OR SAGAX INC on Ruette property. Six anomalous zones were identified following this survey. One in particular is associated to an EM-TBF conductor which could be associated to a massive mineralization including pyrrhotine.

* It is important to note that all these previous campaign were conducted outside the Penelope claims. J.-P., Barrette and J. Gauthier are the two authors who truly worked on the Penelope Property area.

Table 2: Previous work in the surroundings claims

Report	Year	Company	Report title	Geology	Geophysics	Sampling	Result Highlights
GM 9549	1959	Osisko Lake Mines		Geological mapping			3 rich gold bearing
GM 9550	1959	Osisko Lake Mines			Airborn EM		
GM 12386	1962	Osisko Lake Mines	Magnetometer Survey	Geological mapping	Airborn MAG		
GM 14110	1964	Osisko Lake Mines			EM		
GM 18746	1966	Osisko Lake Mines		Trenching			
GM 40840	1983	SEREM	Project Grevet-		VFL-EM &		2,29 g/t/Au/,2 and
DP-8610	1985	MNRF		Geological		Rocks	
GM 43822	1987	SEREM QUEBEC	Survey EM-VLF		Ground EM-		High conductivity zones oriented NE-SW
GM 52060	1992	MER	Evaluation	Geological		Rocks	
GM 53534	1993	Valimex inc.	Report of the prospection works	Geological mapping	Beep-Mat	sampling	
GM 53534	1995	Valimex inc.	Report of the prospection works		VLF & MAG		
GM 57181	1998	VAL D'OR SAGAX	Leve de polarisation provoquee/resistivite		Induced / Resistivity		

7.2. Previous Drilling

No drill campaign was conducted on the Penelope property. The drill hole information and result highlights from the nearest properties are presented in Table 3.

Table 3: List of drill holes and result highlights in the surrounding properties

Hole ID	Year	Compagny	Township	Reference	Results Highlights
526	1964	CLAIMS LOWN	Ruette	GM 16617	
294	1982	SEREM LTEE	Ruette	GM 40307	
295	1982	SEREM LTEE	Ruette	GM 40307	
296	1982	SEREM LTEE	Ruette	GM 40307	
74	1990	SEREM QUEBEC INC	Duplessis	GM 50230	
989	1992	RESSOURCES MINIERES	Ruette	GM 52505	2,55%Zn/,2
988	1992	RESSOURCES MINIERES	Ruette	GM 52505	0,55g/tAu/,4
987	1992	RESSOURCES MINIERES	Ruette	GM 52505	0,27g/tAu/1,5
990	1992	RESSOURCES MINIERES	Ruette	GM 52505	
986	1992	RESSOURCES MINIERES	Ruette	GM 52505	0,18%Zn/3 ,07%Cu/2,7
984	1992	RESSOURCES MINIERES	Ruette	GM 52505	
985	1992	RESSOURCES MINIERES	Ruette	GM 52505	
1181	1993	RESSOURCES MINIERES	Ruette	GM 52930	
1182	1993	RESSOURCES MINIERES	Ruette	GM 52930	
1255	2001	HUDSON BAY EXPL AND DEV	Duplessis	GM 59464	3g/tAg/1,7

8. CARDS MODELLING AND PREDICTION SYSTEM

CARDS is a state of the art computer system that uses the latest artificial intelligence and pattern recognition algorithms to analyze large digital exploration data sets and produce exploration targets. CARDS Uses many layers of gridded data (variables) to learn the “signature” of known mineralized sites (positive cells) in a given area. The area is then scored and cells with a high similarity to the sought “signature” are identified.

The primary layers of gridded data can be:

- Geophysical surveys: MAG, EM, IP, gravity, radiometry

- Geochemical surveys: soil, stream sediment, lake bottom, till
- Digital elevation models
- Satellite imagery
- Geological maps: rock type, alteration
- Proximity to interpreted lineaments, mapped faults and shear zones
- Proximity to lithological contacts or specific intrusive suites
- Proximity to a geochemical anomaly

But these data layers may contain only part of the information because single point readings taken alone have little meaning. The neighborhood around each individual cell also contains important information and patterns. For example, there is no good reason for mineralization to occur at a single elevation; but when all the cells of the topography grid are combined, patterns such as: linear ridges, drainage patterns, circular patterns, etc. can appear and in some cases be an indicator of structure or lithology. The same logic applies to geophysical grids; it might be that certain slopes near a high values have statistical significance. Such patterns can be represented by 1) calculating the derivatives of the primary grids and 2) calculating "neighbourhood" variables, which allow the characteristics of all cells within a specified distance (neighborhood) to be weighed into the evaluation of each individual cell.

These many extra calculated layers are imputed in CARDS along with the primary layers creating an important training database. Each cell in this database is identified as positive or unknown, based on drill hole and rock sample assays, and linked to its own set of characteristics (primary, derivative and neighbouring variables). Several algorithms are then used to identify the unknown cells that have a set of characteristics most similar to the signature of the positive cells.

The quality and usefulness of results derived from CARDS modelling is dependent on a variety of factors including the coverage, quantity, variety and quality of geoscientific and historical exploration data processed. In addition, where interpreted data is used, it is also dependent on the adequacy of the interpretation.

Targets generated by CARDS should be evaluated in conjunction with all readily available geological data in the evaluation of the economic potential of a property as well as in the outlining of exploration targets.

8.1. Modelling

In order to study the accuracy of predictions and to validate modelling results, several methods are used and compared on the modelling area.

8.1.1. AGEO (Aggregation of GEO-referenced models)

The AGEO algorithm, developed at DIAGNOS, is the main prediction algorithm used during the modelling phase. Based on ensemble learning methods[1] and semi-supervised learning methods[2], AGEO uses multiple classifiers, called decision trees[3], to discriminate between labeled (positive) and unlabeled (unknown) cells. The results of each classifier are then aggregated to produce the final model results.

The advantage of using a decision tree based algorithm is that this type of prediction model permits the identification of the most important or discriminant variables. The importance of a variable may be due to its (possibly complex) interaction with other variables, but in the main, variables that appear frequently and in the top levels of AGEO's decision trees are more important.

As the modelling progresses, data mining experts of the "CARDS team" constantly evaluate the performance of the AGEO models in collaboration with the geoscientific team. This evaluation is based both on the importance of variables in the decision trees and on the comparison with other statistic models. By coupling the modelling and model evaluation phases, certain aspects of the model can be controlled. For example, if a data

[1] Ensemble learning methods generate many classifiers and aggregate their results. In fact, ensemble methods use multiple models to obtain a better predictive performance than could be obtained from any of the constituent models.

[2] Semi-supervised learning is a class of machine learning techniques that makes use of both labeled and unlabeled data for training, typically a small amount of labeled data with a large amount of unlabeled data. Semi-supervised learning falls between unsupervised learning (without any labeled training data) and supervised learning (with completely labeled training data).

[3] The decision tree represents the classification process as a series of nested choices or questions which enable the identification of the predictable attributes. At each step (node) in the process, a single binary or multinomial question is posed, and the answer determines the next set of choices to be made. The path between the root (first node) and the leaf (terminal node) of the decision tree is an assignment rule of the type "if condition, then conclusion", and the hierarchical rules of the tree constitute the prediction model.

layer considered weak by the geoscientific team appears to be too discriminant, it can be removed from the final model.

8.1.2. C-Cluster (Class Clustering)

The C-Cluster algorithm, developed at DIAGNOS, is used to compare and validate predictions generated by the AGEO algorithm. It is a predictive approach based on re-sampling techniques and clustering[4].

C-Cluster classifies all cells (positive and unknown) in clusters of similarity and scores the unknown cells of each cluster according to the proportion of positive cells in the cluster. The higher is this proportion in a particular cluster, the higher scored are the unknown cells of the cluster. Multiple runs of the clustering algorithm assign multiple scores to each unknown cell, and the average of these scores gives the final value of similarity.

The C-Cluster algorithm lacks transparency when compared with the AGEO method. In C-Cluster, all variables are weighted equally and therefore, the identification of particular variables influencing the model results is impossible.

8.2. Methodology

The modelling process can be summarized as follows:

1- Prepare the database

- Compile all available gridded data layers covering the modelling area (geophysical, geochemical, topographic, etc).
- Calculate derivatives (dx, dy, dz, 2dz, analytical signal, tilt, etc.) of selected primary layers and create 7 derivative grids for each of these layers.

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[4] When there is no specified class, clustering is used to group items that seem to fall naturally together.

- Use a moving window to capture the neighbouring patterns around each point and create the 22 neighborhood grids for each primary layer and each derivative layer.
- Identify the positive points according to an established threshold and associate them to their closest cell.

2- Run the AGEO algorithm

- Run a base learning algorithm (base model) to narrow the modelling area and keep only the zones that are most similar to the areas that have been subject to mineral exploration (drilling and rock sampling).
- Run a prediction learning algorithm to discriminate between labeled positive cells and unlabeled unknown cells for training. This algorithm uses multiple models based on decision trees.
- Generate a signature that discriminates between the positive and unknown cells using all the existing data layers (variables).
- Aggregate the different rules of all the trees and assign to each cell a probability score between 0 (unlike-positive) and 1 (like-positive) computed as the average of the different scores this cell received. This probability score represents the level of similarity of each point to the existing positive sites based on all variables used in the modelling.

3- Run the C-Cluster algorithm

- Using all positive cells and an equal amount of randomly selected unknown cells, create many separate clusters for which all variables are similar. Assign a score to the unknown cells of each cluster corresponding to the proportion of positive cells in the cluster. Repeat these operations until all unknown cells have been assigned a score.
- Repeat the clustering algorithm described above at least 5 times
- Assign a final probability score to each unknown cell corresponding to the average of scores this cell received. This probability score represents the level of similarity of each point to the existing positive sites based on all variables used in the modelling.

4- Visually compare the images of targets generated by the AGEO and C-Cluster models and decide the relevance and priorities of these targets in conjunction with the geological setting.

9. VARIABLES

A total of 18 primary variables were retained to develop each model. These variables were derived from public domain information obtained from the "Ministère des Ressources Naturelles et de la Faune" (MRNF) and the Shuttle Radar Topography Mission (SRTM).

The Primary variables can be summarized in four categories:

- Geophysical data: residual magnetic field, conductance;
- Topographic data: SRTM digital elevation model;
- Derivative data: dx, dy, dz, analytical signal, tilt.
- Neighbouring data: sum, median, standard deviation, etc.

The geophysical data utilized for the Lebel project is of public domain and consists of an airborne EM survey flown during 2002-2003 at an altitude of 120 m with 200 m line spacing. This corresponds to the Abitibi MEGATEM II Xstrata survey H, I & J, available through the MRN (Figure 7). The SRTM 90m resolution topographic model was used on the project. The complete list of variables utilized in the modeling process is presented in the table 4.

The MEGATEM Survey was able to detect and delineate a large circular magnetic anomaly inside the property (Figure 8). A large linear conductor was also identified at the top left corner of the property. However, the emplacement of this conductor seems to correlate with Pusticamica Lake contour.

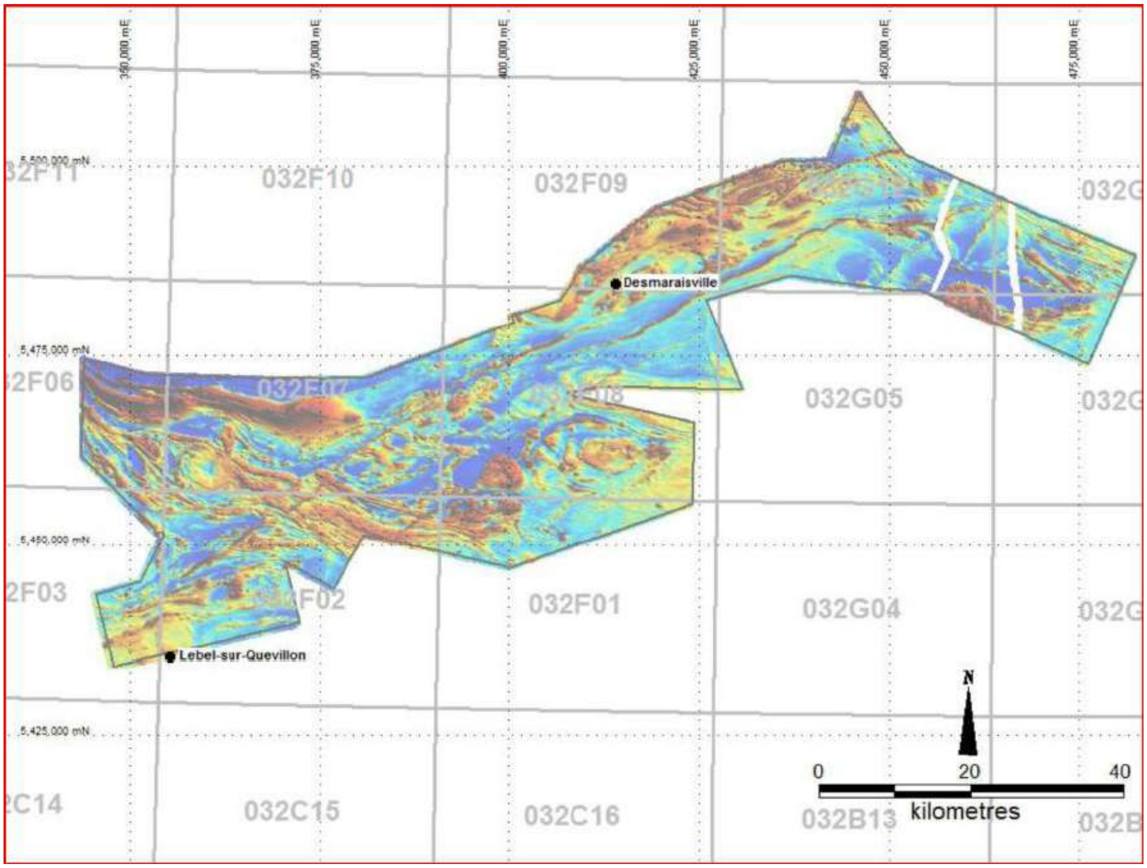

Figure 7: Lebel project modeling area on magnetic residual field

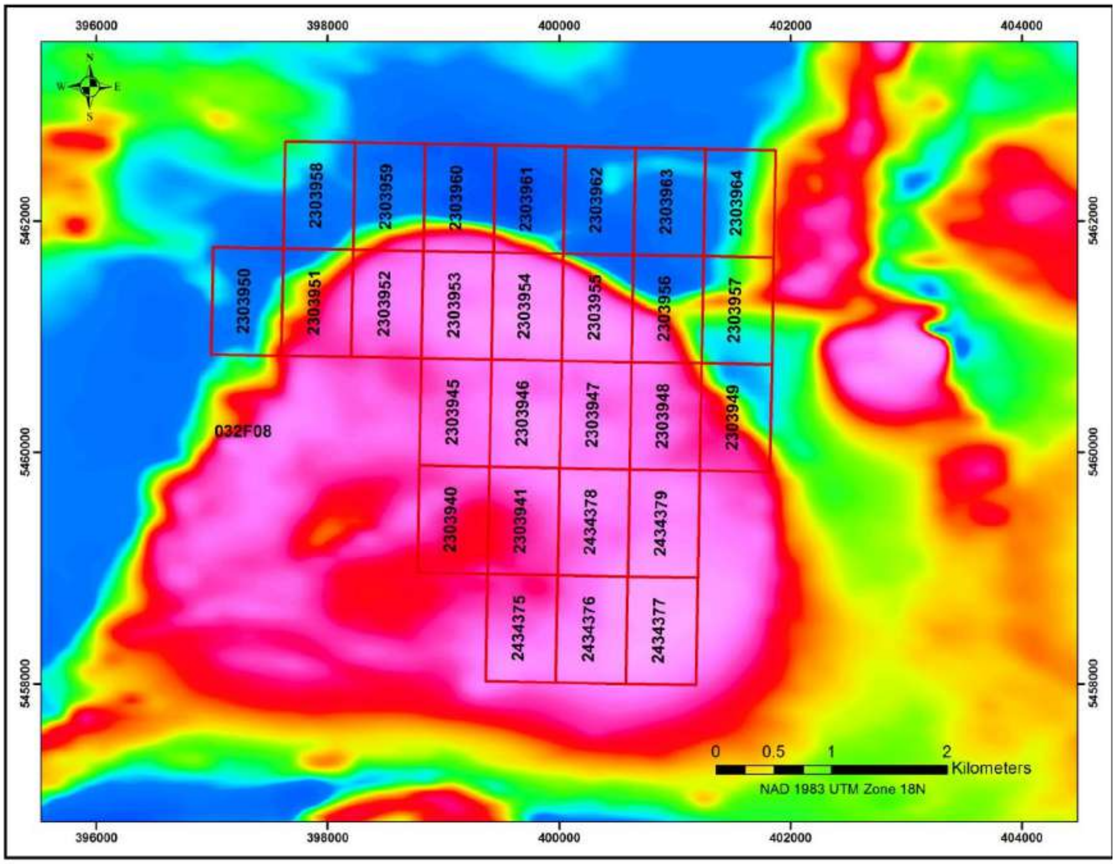

Figure 8: residual magnetic field of Penelope Property (November 2015 update)

Table 4: Variables data set

Variables		Description
1	mag	Magnetic residual field
2	m_dx	Derivative of *mag in* x
3	m_dy	Derivative of *mag in* y
4	m_1vd	Vertical derivative (dz) of *mag*
5	m_2vd	Second vertical derivative of *mag*
6	m_asig	Analytical signal of *mag*
7	m_tdr	Tilt derivative of *mag*
8	tdr_hd	Horizontal derivative of *m_tdr*
9	m_Slc_	Mag slice 5-20 (bandwidth)
10	m_Slc_	Mag slice 50-100 (bandwidth)
11	m_Slc_	Mag slice 200-300 (bandwidth)
12	srtm	SRTM digital elevation model
13	t_dx	Derivative of srtm in x
14	t_dy	Derivative of srtm in y
15	t_dz	Vertical derivative (dz) of SRTM
16	t_2vd	Second vertical derivative of SRTM
17	t_asig	Analytical signal of SRTM
18	app_cn	Apparent conductivity

The neighbouring variables have been calculated for most of the measured and/or calculated variables. The characteristics of all points within a specified distance are weighed into the evaluation of that point. In this manner, points lacking data can still be highlighted if the combination of their limited characteristics and their proximity to points with other significant characteristics is similar to that of known positive points. Therefore, 22 additional calculated variables are introduced into the models for each variable (Table 5).

Table 5: Calculated neighboring variables

Variables		Description
1	_hood_sum	Sum in the neighborhood
2	_hood_abssum	Sum of absolute values in the neighborhood
3	_hood_min	Minimum in the neighborhood
4	_hood_max	Maximum in the neighborhood
5	_hood_avg	Average in the neighborhood
6	_hood_stddev	Standard deviation in the neighborhood
7	_hood_reldev	Relative deviation in the neighborhood
8	_hood_kurtosis	kurtosis (measure of the "peakedness") in the neighborhood
9	_MedianGradient	Median gradient in the neighborhood
10	_DistGravCenter	Distance from gravity center in the neighborhood
11	_hood_hslope	Horizontal slope in the neighborhood
12	_hood_hslope_min	Minimum of horizontal slopes in the neighborhood
13	_hood_hslope_max	Maximum of horizontal slopes in the neighborhood
14	_hood_hslope_sum	Sum of horizontal slope in the neighborhood
15	_hood_hslope_avg	Average of horizontal slopes in the neighborhood
16	_hood_hslope_stdd	Standard deviation of horizontal slopes in the neighborhood
17	_hood_vslope	Vertical slope in the neighborhood
18	_hood_vslope_min	Minimum of vertical slopes in the neighborhood
19	_hood_vslope_max	Maximum of vertical slopes in the neighborhood
20	_hood_vslope_sum	Sum of vertical slopes in the neighborhood
21	_hood_vslope_avg	Average of vertical slopes in the neighborhood
22	_hood_vslope_stddev	Standard deviation of vertical slopes in the neighborhood

Therefore, a total of 396 variables (18 x 22) was introduced into the database. Data was gridded to a 50m cell size (model resolution) which corresponds to 1,140,967 data points.

10. TRAINING DATA

A total of 4,950 drill holes and 6,438 rock samples were selected as learning data (training points) for the Lebel regional models. Selected drill holes and rock samples are public domain information obtained from the MRN databases.

Drill holes and rock samples within the modeling area with reported gold, copper and zinc assays above a designated threshold were identified as positive points within the training databases.

The following table (Table 6) presents the training points used for each of the models, spatial distribution of those points are illustrated in Figure 9.

Table 6: Training points

	Gold Model	**Copper Model**	**Copper-Zinc Model**
DDH AU > 500 ppb	1,210	-	-
DDH CU > 1,000 ppm & ZN = 0 ppm	-	176	-
DDH CU > 1,000 ppm & ZN > 1,000	-	-	514
Rock Sample AU > 100 ppb	323	-	-
Rock Sample CU > 1,000 ppm	-	52	69
Rock Sample ZN > 100 ppm	-	-	0
TOTAL	**1,533**	**228**	**583**

Models were generated using compiled exploration data derived from the public domain. The validity and integrity of such data has not been thoroughly verified.

All of the public data used for this project is available on the MRN website at the following address: http://www.mrnf.gouv.qc.ca.

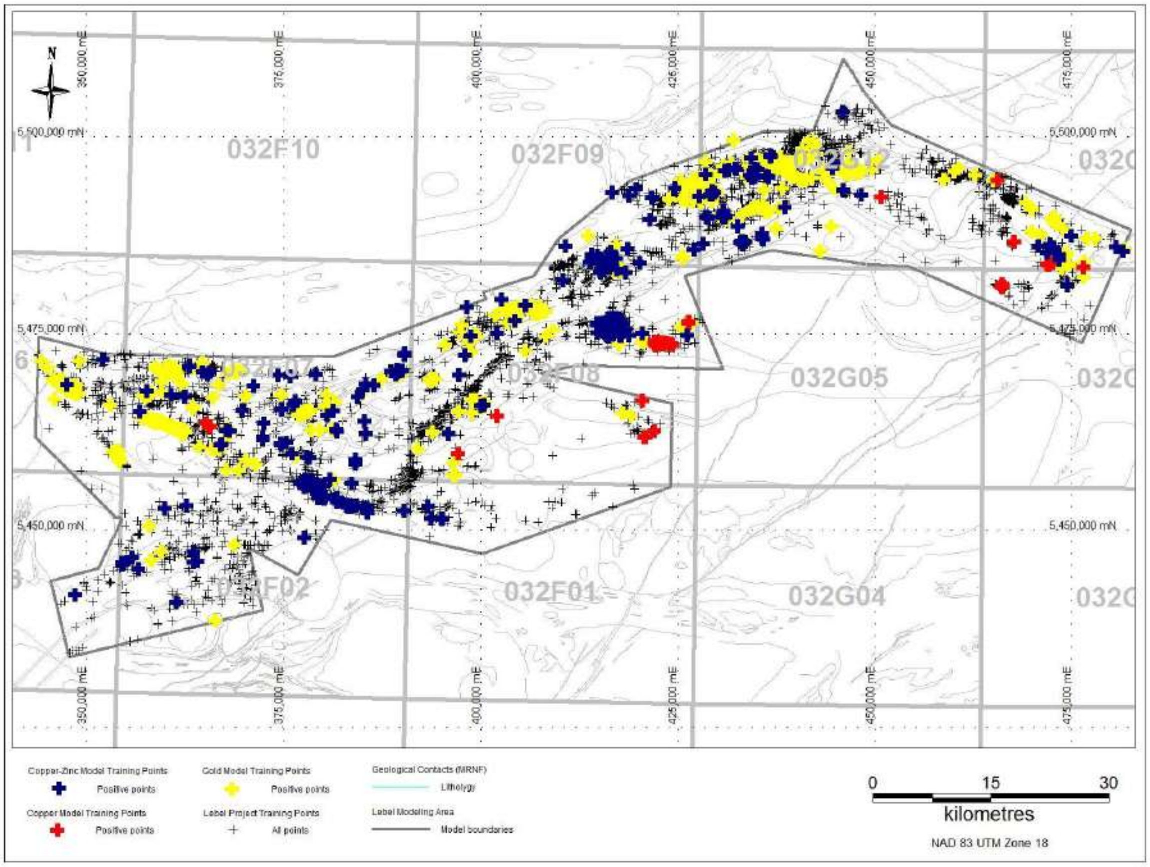

Figure 9: Lebel project training points

11. RESULT INTERPERATION

The prediction results generated on the Lebel modelling area from the gold, copper and copper-zinc models are presented as target zones. The identified target illustrates the similarity percentage to the known mineralization signature. In this case, three (3) large gold targets were generated on the Penelope property. Results are presented on the following map (Figure 10) at 80% similarity.

Reconnaissance field work was conducted in summer 2012 in order to validate the targets generated over the Penelope property. Two teams of geologists carried out several traverses over the targeted zones. The bedrock associated to the target zones are buried under a thick layer of overburden. Consequently, only few outcrops were encountered and no significant mineralization was discovered. The very limited exposed rocks were mostly composed of massive undeformed and unaltered intrusive rocks such as tonalites and pyroxenites. Futhermore, the strong circular magnetic anomaly enhanced by CARDS was found to be caused by higher concentration of magnetite within the pluton. It was also suggested that the ring pattern displayed by the intrusive suite and the granophyric texture were caused by crystal fractioning and magma differentiation (Gauthier, 1986; Barrette, 1991).

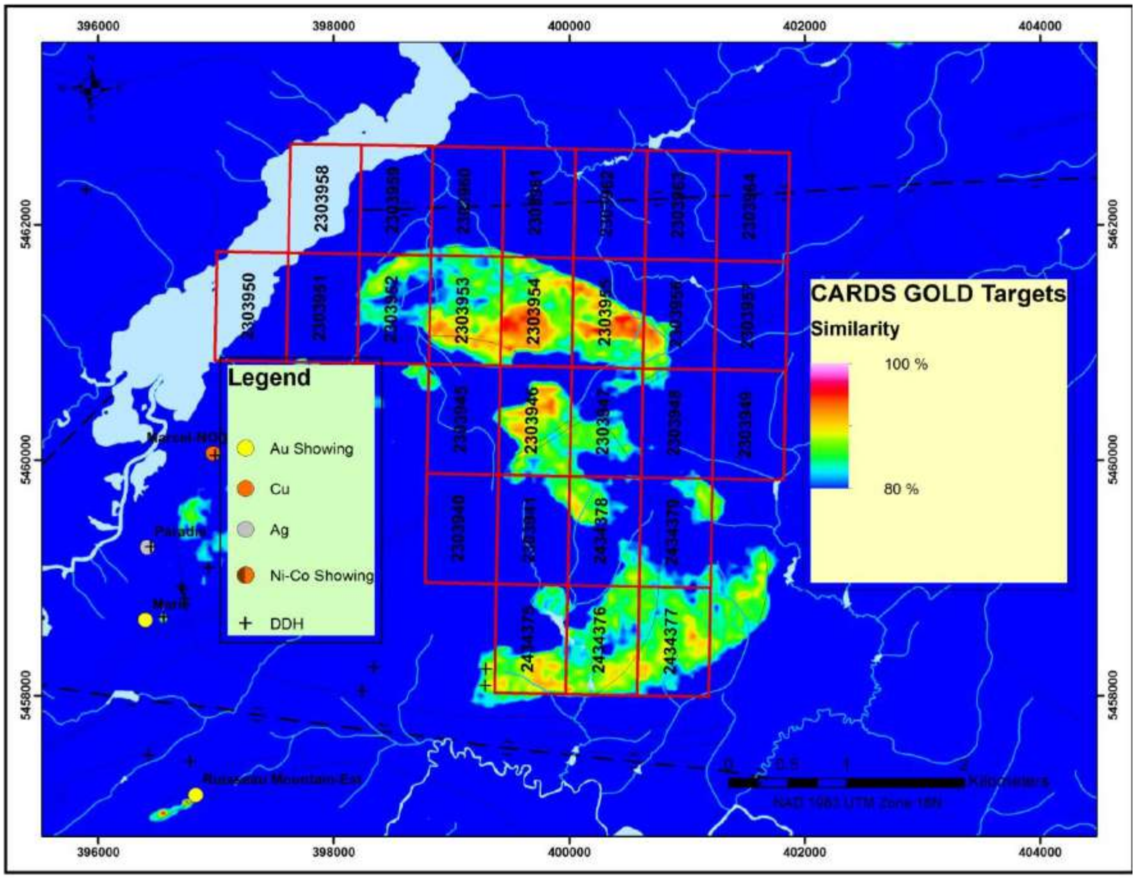

Figure 10: CARDS Au Targets (November 2015 update)

12. CONCLUSION

The Penelope property and this part of the Abitibi greenstone belt remains a renowned and prime area for mineral exploration. CARDS models have been able to outline a large area with potential for gold mineralization. Penelope property had very limited training data to learn from, however, prediction models responded well and allowed for high similarity areas to be identified.

Although most traverses carried out in this $2^{1/2}$ days program over the targeted zone were inconclusive due to a lack of exposed outcrops, prospection of the southeastern shores of the Pusticamica Lake and the adjacent hills revealed outcrops containing larger amounts of sulfides, centimetre scale bands of iron formations, a stronger deformation and a wider variety of alteration products. It is the author's opinion that this mineralized zone could be linked to the Pusticamica Est fault and therefore be related to the Marie, Marcel and Paradis occurrences.

13. RECOMENDATIONS

In order to maximize the chances of extending known mineralized zones and locating new zones, DIAGNOS recommends that further explorative work include:

- Pursue prospection work and sampling of the entire property.
- Conduct a detailed sampling and mapping campaign of the Pusticamica Lake shores and the adjacent hills. A 25-50m grid at 65 degrees should be established for detailed sampling and mapping. The area is covered by the claims # 2303958, 2303959, 2303950, 2303950 and 2303952. It also includes all the mafic volcanic rock affected by the Pusticamica Est fault as well as the contact zone around the pluton
- Locate areas along the Pusticamica Lake and adjacent hills where bedrock is shallow enough for trenching or stripping.
- High resolution geophysical surveys (EM, IP) should be conducted throughout the established grid if the sample assays return positive results

- Drill targets may be established only if potential zones are delineated and proper geophysical techniques have been applied to the property.

Respectfully submitted,

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www.theweathernetwork.corn

15. CERTIFICATES OF QUALIFICATION

Report Title: **CARDS EVALUATION REPORT, PENELOPE PROPERTY**
NTS map sheet 32F08
Quebec, Canada

I, the undersigned, Jean-François Leclerc-Cloutier, residing in Montréal, Québec, Canada do hereby certify that:

1. I am graduated with a B.Sc. in Geology from UQAM (University of Québec in Montreal) in 2000 and a M.Sc. in Earth Sciences from UQAM (University of Québec in Montreal) in 2004. I have participated in exploration programs for gold and base metals in Québec, Ontario and South America

2. I am a senior Geologist with the firm of DIAGNOS Inc. with an office at the Suite 340, 7005 Taschereau Boulevard, Brossard, Québec, Canada

3. I am the author of this report and I have visited the Penelope property.

4. I am a member of l"Ordre des géologues du Québec, (OGQ#1063) as a Professional Geologist

5. The current report is based on compilation of historical data from the public domain (MRN).

____

Jean-François Leclerc-Cloutier, M.Sc., P.Geo.

Signed in Brossard, Québec,

Date: ____

Report Title: CARDS Evaluation report, Penelope Property, Quebec, Canada

I, Grigor Heba, residing in Brossard, Quebec, Canada do hereby certify that:

1- I am a senior Geologist with the firm of DIAGNOS Inc. with an office at Suite 340, 7005, Taschereau Boulevard, Brossard, Quebec, Canada.

2- I hold a B.Sc. in Geology (1990) from the Polytechnic University of Tirana (Albania), a DEA in Sedimentary Geology, Geochemistry and Geophysics (1997) from the Universite des Sciences et Technologies de Lille (France) and a Ph.D. in Mineral Resources (2008) from the Universite du Quebec a Montreal (UQAM), (Quebec, Canada).

3- I am a member in good standing of l'Ordre des Geologues du Quebec (#1464).

4- The CARDS targets generated by this study-are purely the result of mathematical algorithms used on exploration and historical data and should only be considered as such.

5- The current report is based on compilation of historical data in the public domain carried out by DIAGNOS Inc., using Exploration Best Practices Guidelines.

6- I am the co-author of this report and I have visited the Penelope Property

____

Grigor Heba, Ph.D., P.Geo.

Signed in Brossard, Québec,

Date: ____