PACIFIC

Passive seismic techniques for environmentally friendly and cost efficient mineral exploration

D3.1– Deployment complete

Grant agreement number	776622	**Due date of Deliverable**	28/02/2019
Start date of the project	01/06/2018	**Actual submission date**	28/01/2019
Duration	36 months		
Lead Beneficiary	DIAS	**Contributors**	SIBSTIL, SISP

Description
Report describing node deployment at the Marathon pilot site.

Dissemination Level		
PU	Public	X
CO	Confidential, only for members of the consortium (including the Commission Services)	

Table of content

1 Executive Summary

Permitting of the seismic survey and the acquisition of data are the first steps in WP3, the pilot test of the passive reflection seismic technique in the Marathon deposit. The processing and development stages of the Work Package rely directly on the successful acquisition of ambient seismic noise data from the Marathon test site.

Between September 17th and October 26th of 2018, at the Marathon test site, a 1025 sensor passive seismic survey was completed. The sensors equipment was rented from SAExploration. 1024 sensors were successfully deployed; however, only 1019 were recovered. The loss of sensors was due to animal activity or being buried by a rock slide.

The grid design was composed of two overlapping grids, a 416-sensor array and a 609-sensor profile line. The array had a grid spacing of 150m, while the profile line had a grid spacing of 50m. Both grids designs were configured along the main noise source of Lake Superior in the direction of 250deg to the west.

The sensors selected for the survey were ZL and C1, vertical direction sensors with a 10hz range. Once the sensors were retrieved, they were shipped back to SAExploration for download. The data was successfully downloaded and shipped to Sisprobe for analysis.

2 Introduction

Building on the traditional passive seismic method, the survey at the Marathon Project site will enable the development of a technique appropriate for greenfield exploration. Body waves from ambient seismic noise will be extracted and used to detect reflections at geological interfaces.

The resulting technique will provide a new tool for exploring the subsurface in a variety of geological terrains at both a regional and local scale. Passive seismic technology has a low impact design and will excel at projects with issues of accessibility or environmental sensitivity. The lower cost of completing a passive seismic survey relative to active seismic will increase the techniques accessibility to the mining and exploration industry.

The Marathon test site was chosen for several reasons: the geology, emplacement model and controls on mineralisation are all well known. Also, there is an extensive drill database, geochemical analysis and regional geophysics completed at the test site.

The Marathon test site is located 10km north of the town of Marathon, Ontario, Canada along the north shore of Lake Superior. The project site is part of the Coldwell Alkaline Complex.

The Coldwell Alkaline Complex is a 25km wide intrusion, the largest of its kind in North America and part of the Superior Mid Continental Rift (1108-1105Ma). The complex intruded into the Archean Hemlo-Schreiber greenstone belt. The Marathon PGM-Cu deposit is a disseminated Cu-PGE deposit hosted in a gabbroic to ultramafic intrusion that was emplaced along the outer margin of the Coldwell Complex.

The Marathon site is an ideal test location for passive reflection seismic methodological development as ore bodies and footwall have a high velocity and density contrast, leading to high seismic reflectivity at geological boundaries.

The deployment and successful acquisition were the first step in developing the passive reflection seismic technique. It was vital to complete this deliverable on time and budget to maintain a successful work flow plan.

This document is produced as collaboration between PACIFIC partners SIBSTIL, DIAS and SISP.

3 Deployment of sensors

The initial task 3.1 in the proposal was to acquire all necessary permits and approvals for the deployment of the survey equipment. Stillwater Canada Inc.'s existing exploration permit already had passive seismic as an approved activity. No additional permitting was required, which allowed the survey to commence earlier than planned.

The deployment, task 3.1 as per the Description of Action, was originally scheduled between months 3 and 11 from the start of the project, June 1st, 2018. The actual survey was completed between September 17th and October 26th, months 4 and 5. Because both tasks – permitting and data acquisition – were completed earlier, this allowed the overall project to stay on budget and on the projected timeline.

The grid layout was designed taking into account the dominant noise direction, 250deg to the west. The noise direction was determined from an early noise test performed in 2017, and the main source is Lake Superior. The grid is composed of two overlapping grids, as shown in Figure 1. The first grid is an array comprising 416 sensors spaced 150m apart in all directions. The extent of the array was sufficient enough to cover the Marathon Deposit and the model down dip extension to the west. The second grid was a profile line with a width of 200m, a length 6040m, and a sensor spacing of 50m. The profile line consisted of 609 sensors. 4 sensors in the profile line could not be placed at the designed grid location or within a distance tolerance of 25m because of lakes; therefore they were relocated.

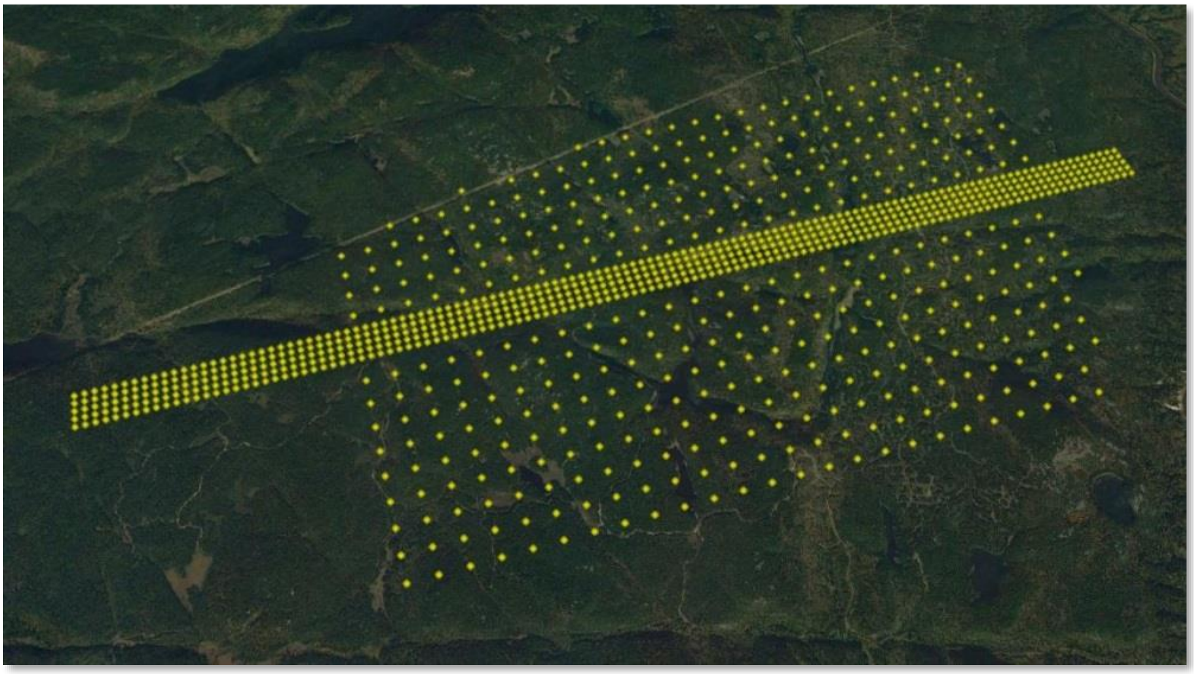

Figure 1: Grid design for the Marathon test site.

The southern and eastern portion of the grid design was accessible by ground, with personnel using ATV and traversing to access each site. Each crew member was limited by weight to carrying 10 sensors at a time. Due to the lack of trails in the north and central part of the grid, helicopter support was used to transport crews and sensors to site.

SAExploration was contracted to supply 1025 Zland C1, vertical direction sensors for the project. Upon delivery, 1024 were operational. The parameters for the sensor set up are in Table 1.

Table 1: ZLand Gen2 Parameters

Parameter:	**Description:**
Co-ordinate system	UTM WGS84 Zone 16N
Acquisition Schedule	Continuous
Acquisition Parameters:	
Sample Rate	4ms
Pre-Amp Gain	36dB
Anti-Alias Filter	Linear
Low Cut Filter	None
Sensor Used	Internal 10hz DTCC SOLO

The deployment of the sensors commenced on September 17th and was completed on schedule by September 21st. This allowed for a recording time of 30 days. The sensors were retrieved from October 22nd to October 26th.

Of the 1024 sensors deployed, 6 were not recovered, either because they were disturbed by animal movement or buried under a rockslide. Insurance had been purchased to cover the loss or damage of the rental equipment so no unplanned expenses were incurred. The sensors were shipped back to SAExploration for data download and quality check. The data were successfully downloaded and shipped to Sisprobe by external hard drive, by late November.

4 Conclusion

Permitting was completed prior to the planned commencement of the survey because Stillwater Canada Inc.’s existing exploration permit already had passive seismic as an approved activity.

The passive seismic test survey at the Marathon site was completed with no reportable accidents, incidents or near misses. Also there were no reportable environmental issues, or community concerns. The deployment, data recording and retrieval were executed and completed on time and on budget allowing for the overall Work Package to stay on schedule.

Of the 1025 sensors shipped to the project site, 6 were not recovered due to unforeseen reasons, including animal activity and rockslides. Insurance was purchased to cover the loss of damage of the rental equipment so no unplanned expenses were incurred.

With the successful completion of the data acquisition at the Marathon Project site and download of data, the processing of the data for development of the passive reflective seismic can commence.

5 Bibliography

ZLand Lithium-ion 1C Battery Pack, Safety Data Sheet (SDS), Fairfield nodal.

