JEFFREY MINE, ASBESTOS, QUEBEC, CANADA: ANALOGUE SITE FOR A MARS METHANE MISSION. E. A. Cloutis[1], H. Vrionis[2], A. Qadi[3], L. Whyte[2], C. Samson[4], A. Tremblay[5], B. Wing[6], K. Strong[7], A. Ellery[3], R. Kruzelecky[8], J.F. Bell III[9], A. Boivin[4], J. Stromberg[1], P. Mann[1], and G. Berard[1], [1]Department of Geography, University of Winnipeg, 515 Portage Ave., Winnipeg, MB, Canada R3B 2E9, e.cloutis@uwinnipeg.ca, [2]Dept. of Natural Resource Sciences, McGill University, Ste. Anne de Bellevue, QC, Canada, Helen.vrionis@mcgill.ca; [3]Dept. of Mechanical and Aerospace Engineering, Carleton University, Ottawa, ON, Canada, alaqadi@mae.carleton.ca; [4]Dept. of Earth Sciences, Carleton University, Ottawa, ON, Canada, csamson@earthsci.carleton.ca; [5]Sciences de la Terre et de l'Atmosphére, Université du Quebec á Montréal, Montreal, QC, Canada, tremblay.a@uqam.ca; [6]Dept. of Earth and Planetary Sciences, McGill University, Montreal, QC, Canada, boswell.wing@mcgill.ca; [7]Dept. of Physics, University of Toronto, Toronto, ON, Canada, strong@atmos.physics.utoronto.ca; [8]MPBC Inc., Pointe Claire, QC, Canada, roman.kruzelecky@mpbc.ca; [9]School of Earth and Space Exploration, Arizona State University, Tempe, AZ, USA, jim.bell@asu.edu.

Introduction: As part of a CSA-funded program to investigate planetary analogues sites and their use for testing of technologies destined for future planetary missions, we have been investigating the Jeffrey Mine in Quebec. The Jeffrey Mine is an active open pit serpentinite deposit that we are investigating as a suitable analogue for future Mars landers/rovers that may target similar terrains on Mars. Field campaigns which include rover trials and testing of an array of investigative technologies (tunable spectrometers, imaging spectrometers, Raman) are planned for the summer of 2011 and 2012.

The Jeffrey Mine hosts an extensive body of serpentinite which contains a wide variety of minerals, many of which are also found on Mars. Of most significance, it hosts abundant serpentinite, magnesium carbonates, and iron oxides/hydroxides, all of which have been detected on Mars [1, 2]. One of the areas on Mars that hosts these deposits is the Nili Fossae region: one of four candidate MSL sites.

Mission Description: The Jeffrey Mine site, because of its mineralogical similarities to serpentinite- and Mg-carbonate-bearing terrains in Nili Fossae (and other regions on Mars) can be used to assess the performance of various MSL instruments in mapping geological diversity at such sites, as well as for methane detection and characterization. Future applications could include assessing the performance of geophysical tools in mapping subsurface structures at such sites as well as possible relationships between surface mineralogy, the presence of subsurface fractures (as pathways for subsurface methane release), and any mineral alteration that may be induced by methane release.

Planned activities at the analogue site include mapping areal patterns of any methane release and determining relationships to fractures, C isotope analysis of any evolved methane, and microbiological assessment of surface and subsurface environments.

Scientific hypotheses that can be tested at the site include determining whether methane is actively produced in non-hydrothermal serpentinites, the types of microbial communities that exist at such sites, and the nature of any evolved methane.

Science Merit Related to Mission Objectives: The investigations planned at the analogue site include testing the performance of stable isotope analysers similar to that being used by MSL, as well as assessing the XRD/XRF and spectroscopic signatures of minerals at the site (Fig. 1). The Jeffrey Mine site includes both freshly exposed as well as previously exposed serpentinites, as well as surrounding country rocks (non-serpentinitic) that have been excavated to enable open pit mining of the ore body. It also contains an extensive network of NE-SW trending fractures likely associated with emplacement of the serpentinite body (Fig. 2). The site includes a wide range of terrain types suitable for testing rover performance, ranging from intact bedrock to surface fines, and a wide range of slopes. Available imagery for the site includes archival SPOT and Landsat imagery as well as a series of historic and recent aerial photographs.

Most Important Question Answered by Site: This analogue site can help us address the quality and quantity of information that MSL (and future missions) could derive concerning the geology, (structure), microbiology, and presence and nature of methane that may be present at non-hydrothermal serpentinite- and Mg carbonate-bearing sites.

Logistic and Environmental Constraints: The Jeffrey Mine is located immediately adjacent to the town of Asbestos, Quebec, Canada (population ~7000), and approximately 2 hours by road from Montreal. The site itself has a series of access roads that cross the mine site (~4 x 3 km in areal extent). Site managers have been extremely generous in providing access to the site for initial reconnaissance and for future activities at the site. Weather in the area averages -15C in January to +18C in July, with average precipitation of 90 cm/year. The mine site is free of vegetation.

Standard Information Required for Analogue Sites: See below.

Table 1: Jeffrey Mine site, Asbestos, Quebec, Canada.

Site Name	Jeffrey Mine
Center Coordinates (lat., long.)	45°46' 20" N 71° 57' 00" W
Elevation	~220 m
Areal Extent	~4 km by ~3 km
Prime Science Questions	What is the mineralogical diversity of a serpentinite-bearing terrain? Do non-hydrothermal serpentinite-bearing terrains produce methane?Of what composition? What microbial communities are hosted in such terrains? What is the relationship between surface geology, structure (e.g., fractures) and methane production?
Distance of Science Targets from nearest road or airstrip	~1 km for all targets
Environmental characteristics	Max temp: ~18 C; Min temp: ~-15 C Precipitation: ~90 cm/year Vegetation coverage: None

Previous studies at analogue site	Refs 3-5
Primary Landing Site Target	Nili Fossae serpentinite-bearing terrains

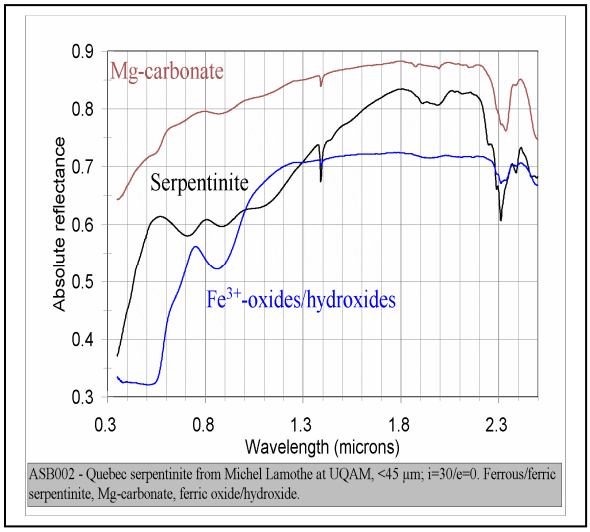

Figure 1. Reflectance spectra of phases present in Asbestos-region serpentinites (measured at University of Winnipeg laboratory).

Figure 2: Satellite view of Jeffrey Mine site. Asbestos townsite can be seen E and SE of mine. Regional tectonic fabric (NE-SW) can be seen in N part of mine. Tentative locations of rover traverse starting points for 2011 and 2012 field campaigns are shown.

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