THE CANADIAN ANALOGUE RESEARCH NETWORK (CARN): OPPORTUNITIES FOR TERRESTRIAL ANALOGUE STUDIES IN CANADA AND ABROAD. V. Hipkin[1], G. R. Osinski[1], A. Berinstain[1], R. Léveillé[1], [1]Canadian Space Agency, 6767 Route de l'Aeroport, St-Hubert, QC J3Y 8Y9, Canada (victoria.hipkin@space.gc.ca)

Introduction: The world of planetary exploration is rapidly evolving. More than ever before, the international scientific community is attempting to answer fundamental questions on the origins of life and of the Solar System, by exploring other planets. It is clear that humans will return to the Moon in the next 10–15 years and will one day explore Mars, using the Moon as a stepping-stone to demonstrate technologies and to pursue scientific investigations.

Currently, data is being returned from Mars missions at a very great rate, providing a wonderful resource for scientists. Recent imagery from Mars Global Surveyor, Mars Odyssey, Mars Express, and Mars Reconnaissance Orbiter, have shown fascinating surface features, including evidence for recent of periglacial and glacial, impact, volcanic, gully activity [1-3]. Surface composition data suggests varied geochemical settings, some of which involve water [4, 5], and some of which may be found to be *habitable*. However, it is widely recognized that interpretation must begin by using the Earth as a reference (e.g., [6]).

In this paper, we will present an overview of the Canadian Analogue Research Network (CARN), including a description of the various analogue sites in CARN, potential new sites (based on a review by [7]), and a discussion regarding how CARN is applicable to the global exploration strategy.

Terrestrial analogue activities: Terrestrial analogues are places on Earth that approximate the geological, environmental and putative biological conditions on Mars and other planetary bodies, either at the present-day or sometime in the past. Three key themes dominate terrestrial analogue activities [7]: (1) comparative planetary geology, including process studies and the characterization of analogue materials; (2) astrobiology; and (3) exploration science, which includes instrument testing and development, astronaut training, and exploration-related activities. Analogue sites are also important focal points for education and public outreach activities.

The Canadian Analogue Research Network (CARN): In response to input from the Canadian scientific community, the Canadian Space Agency (CSA) has established the Canadian Analogue Research Network (CARN) as part of a multi-disciplinary approach to use Mars analogue sites (and those of other planetary bodies) in Canada to further our scientific understanding of the Solar System, to develop and test specific exploration technologies, and to understand how to explore and live in a safe manner on other planets. The establishment of the CARN addresses one of the major recommendations made by Farr [6] as part of a U.S. National Research Council decadal community report, which was that there is currently little or no coordination between the many individual analogue projects in individual countries and around the world.

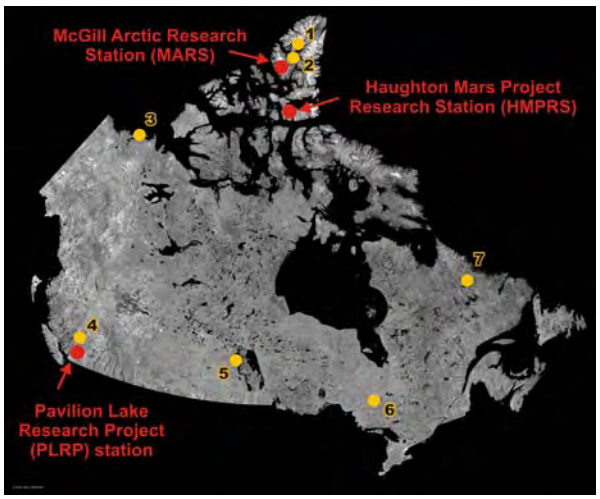

Figure 1. Current activities of the Canadian Analogue Research Network (CARN) superimposed on a Radarsat mosaic of Canada. The red dots represent the 3 sites chosen (via competitive process) to have logistical and infrastructure support. Research at these sites was supported through RFP CARN 05-01. The yellow dots represent other sites where analogue studies have been supported through RFP CARN 05-02. 1 = Borup Fiord, Ellesmere Island, Nunavut. 2 = Eureka Sound lowlands, Ellesmere Island, Nunavut. 3 = Tuktoyaktuk Peninsula, Northwest Territories. 4 = Various evaporite basins, British Columbia. 5 = East German Creek, Manitoba. 6 = Kidd Creek Mine, Ontario. 7 = Mistastin impact structure, Labrador and Newfoundland.

The CSA has employed a 2-step process to supporting terrestrial analogue activities in Canada. The first step was to put in place infrastructure and logistical support services at several key analogue sites that were chosen based on their multi-year and multi-disciplinary potential. The second step involves funding scientists and engineers to carry out research at these, and other, analogue sites.

Main CARN sites. The first 3 CARN sites were selected in June 2005 through a "Request for Proposals [RFP] to Provide Logistical and Engineering Support Services for Analogue Research Studies in Canada". The selected sites are (Fig. 1):

- Haughton–Mars Project Research Station, Devon Island, Nunavut, 75°22' N, 89°41' W.
- McGill Arctic Research Station, Axel Heiberg Island, Nunavut, 79°26' N, 90°46' W.
- Pavilion Lake Research Project station, British Columbia, 50°51'N, 121°44' W.

In addition, the Exploration Systems Operations Centre (ExSOC) based at Simon Fraser University, British Columbia, was selected through this RFP to provide engineering, communications, and safety support, mission operations support, analysis, management, and planning services for analogue activities at these (and other) sites. ExSOC will be able to aid scientists in placing their analogue activities into a planetary exploration context, in addition to providing core logistics services [8].

Analogue activities. Following the selection of the three CARN sites and ExSOC, a Request for Proposals for Access and Support for Activities at Canadian Analogue Research Network (CARN) Sites (RFP CARN 05-01) was released in August 2005. This RFP was specifically to support science investigations and science instrument testing and validation at the three CARN sites. However, it was also recognized through discussions with the Canadian planetary science community that there are several proven and likely other potential analogue sites throughout Canada, both on land and under the ocean. Thus, a second RFP was released simultaneously to support research activities at other analogue sites in Canada: Request for Proposals for Analogue Research Studies in Canada (RFP CARN 05-02) (see Fig. 1). Details of both RFP's can be found on the CSA website:
http://www.space.gc.ca/asc/eng/scientific/ao/current.asp

A variety of activities at a variety of analogue sites were funded (Fig. 2). These two announcements will be released on an annual basis to support analogue research activities in Canada: proposals submitted to the RFP CARN 06 program are currently under review and will be awarded by March 31st 2007.

Future directions – An International Analogue Network (IAN): Currently, support through the CARN is only available to Canadian universities, not-for-profit institutions, industry and other government departments. It is a desire of the Canadian Space Agency to continue to expand the CARN to more sites throughout Canada and to use this program to leverage an International Analogue Network (IAN). Such a network would make available any site to any researcher in a participating country, for the benefit of the entire planetary science and exploration communities. Given the likely international nature of future Moon–Mars missions, international coordination of analogue activities would be a logical first step.

Interested organizations and agencies are invited to contact the CSA and/or contact the authors at this conference. Discussions on the topic of a future International Analogue Network will feature in the upcoming joint Canadian Space Agency–Italian Space Agency: The 2nd International Workshop on Exploring Mars and its Earth Analogues, June 19–23 2007 http://irsps.sci.unich.it/education/mars07/.

Figure 2. Field photographs of various analogue sites in Canada. (a) Native sulfur at the outlet of a spring on the wall of an incised supraglacial melt water channel, Borup Fiord, Ellesmere Island, Nunavut. Image courtesy of S. Grasby. (b) Colour Peak springs, Expedition Fiord, Axel Heiberg Island, Nunavut. (c) Close-up of the Gypsum Hill springs, Expedition Fiord, Axel Heiberg Island, Nunavut. (b) and (c) courtesy of D. Andersen. (d) Oblique aerial image of the impact melt breccia hills of the Haughton impact structure, Devon Island, Nunavut, showing well-developed gullies and small valley networks. (e) Sampling for groundwater geochemistry and gas at seeping borehole at Kidd Creek Mine, Timmins, Ontario. Image courtesy of B. Sherwood-Lollar. (f) Microbialites in Pavilion Lake, British Columbia. Image reproduced with permission of D. Reid. (g) Ibyuk Pingo, Tuktoyaktuk Peninsula, Northwest Territories. Image courtesy of R. Soare. (h) Archean stromatolite from the Steep Rock Group, Atikokan, Ontario. Image courtesy of H. Hoffman. (i) High-temperature fluid venting from sulphide chimney structures along the Juan de Fuca Ridge. Image credit: Keck-ROPOS. Figure from [7].

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