

GSC's Geo-mapping for Energy and Minerals program; Success Stories Across the North

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Summary

The Geological Survey of Canada's Geo-mapping for Energy and Minerals (GEM) collaborative program focussed on providing modern, public geoscience across Canada's north. The 12-year (2008-2020) \$200 million dollar program contributes towards Northern communities making responsible land-use decisions and supports evidence-based exploration for energy and mineral resources.

During the GEM program, researchers revealed a number of surprising new discoveries, which will advance our knowledge of one of Canada's most remote regions. Discoveries include, Earth's oldest fossil fungus in shales from the Amundsen Basin of the Northwest Territories. Dating of sedimentary layers that contain these fossils indicates that they are between 1,000 and 900 million years old, more than double the age of previous oldest known fossil fungus.

Researchers made another rare discovery in Nunavut, impact spherules within a 5 cm thick mudstone bed, which are traces of ancient space dust. These spherules are an indication of a large meteorite impact somewhere on Earth about 2.1 billion years ago. Analysis of the spherules reveal geochemical features unlike other solar system objects, suggesting the asteroid was a fragment from deep inside an exoplanet, which orbited a different star.

GSC scientists working on Victoria Island, Northwest Territories discovered a previously unknown, 28 km diameter, meteorite impact crater in 450 million year old rocks, which sparked a series of studies by scientists from around the world.

Surficial geology mapping in the Great Slave region of the Northwest Territories (NWT), included glacial sediment mapping in thaw-sensitive terrain, which provided useful information to determine the route for the (estimated) \$411 million dollar Tlicho All-Season Road. Thawing permafrost results in approximately \$51 million dollars per year in damage to public infrastructure in the NWT. New and timely surficial geology maps produced by the GEM program are useful resources for assessing climate change adaptations to development and infrastructure.

GEM scientists studying bocannes (fire-baked rock) in the Smoking Hills Formation near Franklin Bay, Northwest Territories noted a series of reddish-brown ponds and streams and investigated them. Previous research on the ponds suggested acid rain from the smoke of burning bocannes was acidifying nearby ponds to pH levels of 2. However, new research conducted by GEM scientists determined hyperacidification of the ponds is a natural product of the bedrock itself, not bocannes, and is an example of



natural acid-rock drainage. Tests on some ponds revealed pH levels down to -1.4, which is outrageously low. Tests of Smoking Hills pond water reveal toxic concentrations of metals, some (cadmium) up to 700,000% higher than Canada's Safe Drinking Water Guidelines.