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A New Geological Map of the Arctic: Geological Survey of Canada Open File 5816

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Abstract

As part of International Polar Year activities and related objectives of the Commission for the Geological Map of the World (CGMW), nations of the circumpolar Arctic have cooperated to produce a new bedrock geology map and related digital data sets at 1:5,000,000 scale (Figure 1). The polar stereographic map includes onshore and offshore geological coverage to 60 degrees North. A preliminary print version is approximately 1.4 m in diameter and is accompanied by three correlation chart sheets and separate legend (GSC Open File 5816).

New compilation work includes Sweden, onshore and offshore Russia, the United States in Alaska, and two of the northern territories of Canada (Nunavut and Northwest Territories). Existing published material derives from digital maps of northern Europe (1:4M), the Fennoscandian shield (1:2M), Greenland (1:2.5M), Yukon (1:1M), and parts of Arctic Canada (1:5M). Captured analog sources cover the northwest Atlantic and North America offshore (1:5M).

Vector data include geological contacts, faults, active and extinct spreading ridges. Point features include: impact structures; volcanoes, cinder cones and related features; diapirs and; kimberlitic rocks. Standardized map unit attributes have been applied to over 32,500 geology polygons. This has been facilitated by the ICS 2008 time scale, drawing on the absolute scale for the Precambrian and the relative scale for Ediacaran and younger rocks. The map and database feature 137 divisions of geologic time based on maximum and minimum age ranges of compilation map units; 107 in the Phanerozoic and 30 in the Precambrian. Lithology is expressed by 27 compositional assemblages: extrusive (6), intrusive (8), sedimentary based on depositional setting (8) and others (5). Metamorphic grade data have also been collected.

Map units in the Precambrian are grouped and coded by “domain”. These include cratons and massifs (10), pericratonic terranes and ophiolitic belts (4), magmatic arcs and magmatic suites (9), orogens and fold-thrust belts (21) and post-orogenic basins (8). These divisions facilitate and highlight the correlation of diverse but once contiguous medium and high grade terranes located within widely separated continental nuclei.

In the Phanerozoic there is considerable disagreement as to an appropriate definition of terranes and domains. The problem, especially acute in the Phanerozoic orogens, is side-stepped on the new map by using 58 major physiographic features of the Arctic, only loosely linked to geology, as a spatial guide to unit correlation. These include divisions of: the Arctic North Atlantic (5); European Platform and Urals (6); West Siberian Basin and Siberian Platform (7); Verkhoyansk-Kolyma region (4); interior western Alaska (6); Brooks Range, Chukotka and the Arctic Shelf (5); Okhotsk, Bering Sea and Pacific Alaska (6); eastern Alaska, Yukon and the Mackenzie region (5); Canada-Greenland shield and cover (5); the Innuitian region and North Greenland (6) and; the Arctic Ocean (3)

While a short term objective has been the production of a new hardcopy geology map of the circumpolar Arctic, the true value of this major synthesis effort is the new underlying database. This archive of digital spatial data for the circumarctic represents a treasury for the production of formal digital products and also informal user-defined map products accessed via the worldwide web. Collectively, these data can serve as a model for expanded digital map coverage, both into the subsurface and to other parts of the globe.

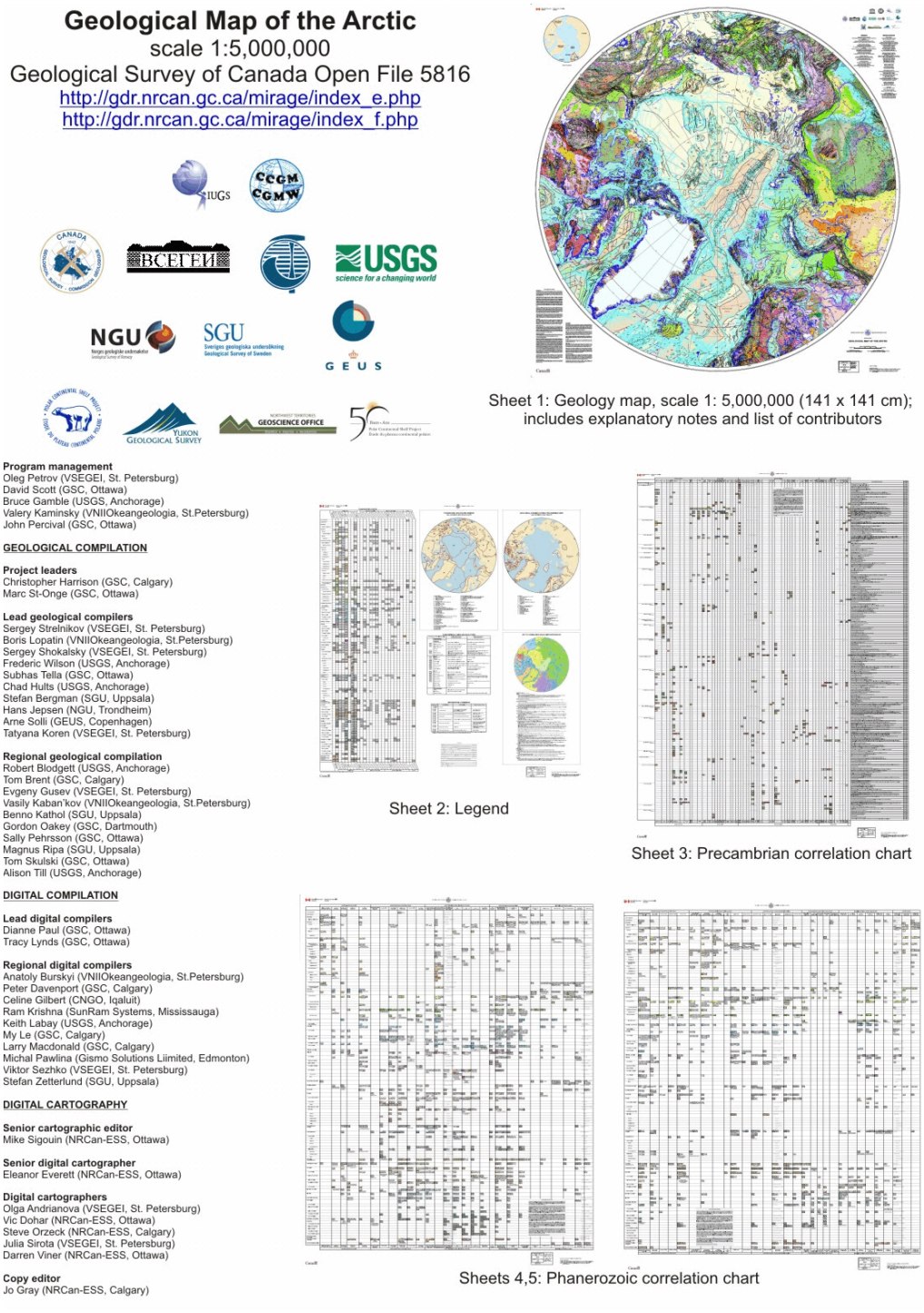

Figure 1: Thumbnail illustration of the Geological Map of the Arctic, GSC Open File 5816 (five sheets), with list of sponsors and contributors.