Ancient Pacific Margin Part I: BCGS Contributions and Collaborative Activities with GSC and Yukon Geology Program

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INTRODUCTION

The Ancient Pacific Margin NATMAP project (Thompson *et al*., 2000) is a collaboration between the British Columbia Geological Survey Branch, the Geological Survey of Canada and the Yukon Geoscience Office. It aims to advance understanding of the Cordillera-long belt of complexly deformed pericratonic rocks that made up the Pacific margin of North America in Paleozoic to early Mesozoic time (Figure 1). This is the first operational year of the joint project.

Beginning in 1994, discoveries of volcanic-associated massive sulphide deposits in the Yukon-Tanana Terrane near Finlayson Lake, Yukon created significant exploration interest in the pericratonic terranes. These deposits, Kudz Ze Kayah, Wolverine, and Fyre Lake, along with Wolf in the nearby Cassiar Terrane, form a mineral camp of previously unsuspected importance (Hunt, 1997, 1998). Provincial and territorial surveys responded to these developments by commencing mapping in the Finlayson Lake belt (Murphy and Timmerman 1997; Figure 1), and by examining possible extensions of favorable stratigraphy along strike in the Yukon (Glenlyon area; Colpron, 1999; Figure 1) and south of the B.C. border (Nelson 1997; Nelson *et al.,* 1998; Mihalynuk *et al.,* 1998; Figure 1). During this time, the Geological Survey of Canada was revising the geology of the Vernon map sheet, which lies within the pericratonic belt of southern B.C., near the Eagle Bay Assemblage with its volcanogenic massive sulphide deposits - Rea Gold, Homestake, and Samatosum (Thompson and Daughtry, 1998).

These physically disparate projects share a conceptual basis: the analysis of the complex and poorly understood assemblages that once represented the active margin of North America. These assemblages include remnants of arcs and marginal basins with the potential to host syngenetic massive sulphide deposits. The Ancient Pacific Margin Project, designed in 1998 and approved in 1999, brings together ongoing work in the pericratonic belt by all three organizations, as well as adding major new initiatives. Geological Survey of Canada contributions to the Ancient Pacific Margin Project are divided geographically into three components, Southern, Central and Northern, along with a belt-long metallogenetic study (Thompson *et al.,* 2000; Figure 1).

BRANCH CONTRIBUTIONS TO THE ANCIENT PACIFIC MARGIN PROJECT

The Central Component included four BCGS contributions in 1999 (Figure 1): geological mapping of the Big Salmon Complex in northern Jennings River map area (Mihalynuk *et al.,* this volume), glacial mapping of the same area (Dixon-Warren and Hickin, this volume), geochemical studies (Cook and Pass, this volume), and geological mapping in the southeastern Dorsey Terrane in south-central Jennings River map area (Nelson, this volume).

Other BCGS contributions to the study of the pericratonic belts and their mineral potential include both regional mapping and detailed deposit studies (Figure 1). Trygve Höy collaborated in 1999 with Suzanne Paradis of the Geological Survey of Canada and others, in continuing analysis of the metallogeny of the Kootenay terrane in southern British Columbia. He coauthored a joint paper on the setting of the Rea-Homestake volcanogenic massive sulphide deposits in the Eagle Bay assemblage (Bailey *et al.,* 2000). His current work focusses on the potential for Broken Hill-type and related massive sulphide deposits in the southern Kootenay Terrane (Höy, 1987).

Fil Ferri investigated extensive rhyolites within the Earn Group in the westernmost Cassiar Terrane of north-central British Columbia (Figure 1; Ferri, this volume). The presence of felsic volcanics interbedded with Mississippian clastic rocks is geologically analogous to the setting of volcanogenic mineralization on Atna Resources' Wolf property in the Pelly Mountains, Yukon (Holbeck and Wilson 1998), except that the volcanic suite there is alkalic.

The Ecstall volcanogenic massive sulphide belt, located in the Coast Mountains near Prince Rupert, is hosted by Devonian volcanic arc strata similar to pericratonic volcanosedimentary sequences of the Yukon-Tanana Terrane such as the Finlayson Lake belt and the Delta VMS district in the Alaska Range. This belt is the subject of a new, multi-year mapping and mineral deposit study led by Dani Alldrick (Figure 1; Alldrick and Gallagher, this volume).

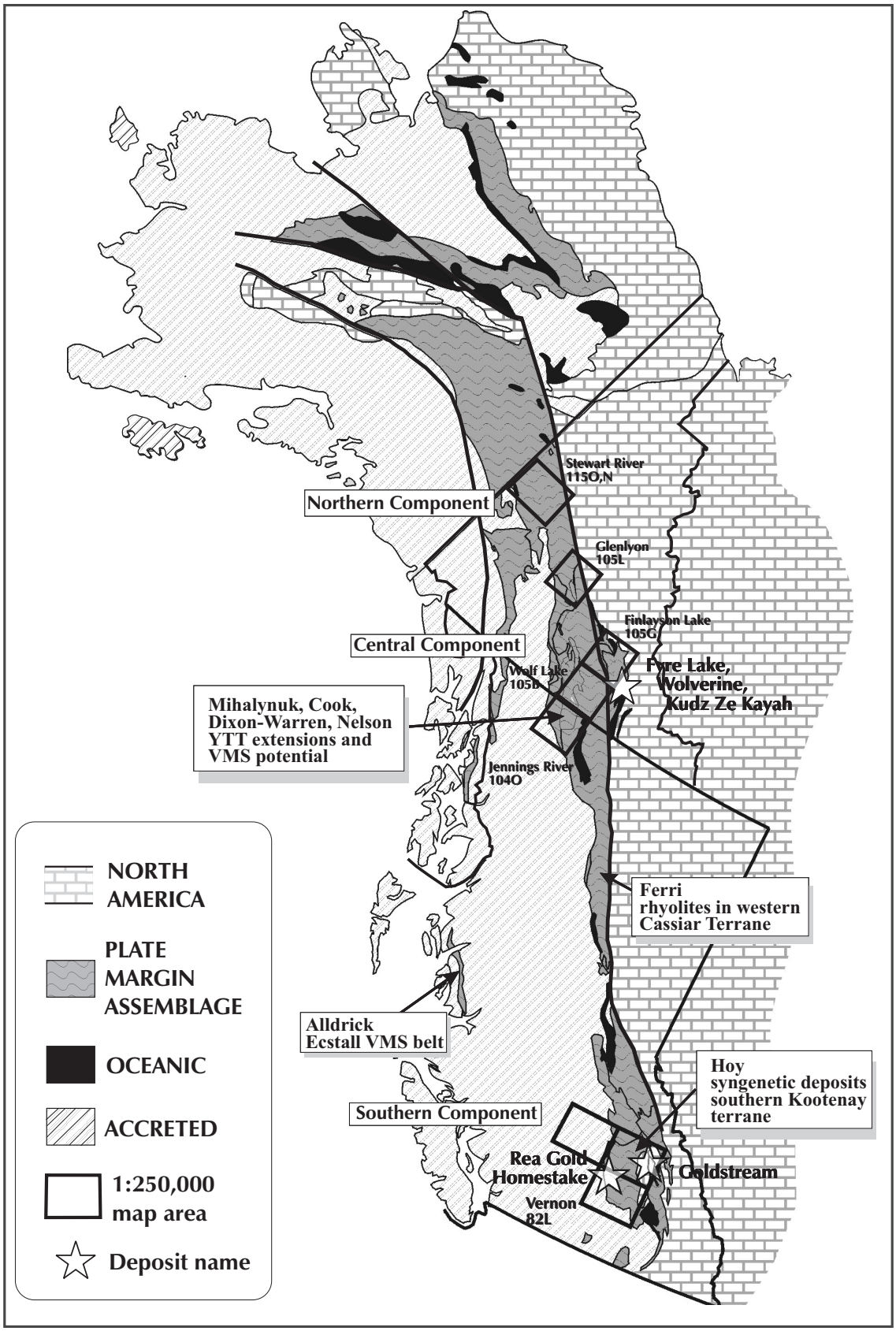

Figure 1. Location map of Ancient Pacific Margin project area.

BRANCH CONTRIBUTIONS TO THE WOLF-JENNINGS PROJECT (CENTRAL COMPONENT)

The largest BCGS contribution to the Ancient Pacific Margin project was to the Central Component in far northern British Columbia, with four interrelated field studies in 1999 (Figure 1). The impetus for this degree of attention comes from interesting discoveries made during recent BCGS mapping of the Big Salmon Complex in northwestern Jennings River map area. In 1997, Mihalynuk and coworkers traced out a metamorphosed silica-(manganese-iron) exhalative unit over 40 kilometres of strike length (Mihalynuk *et al.,* 1998). This unit, the crinkled chert, is regionally anomalous in barium and locally in base metals. In addition, a large pluton, the Hazel orthogness, was dated as Devono-Mississippian by U-Pb methods (362.3+7.9/-6.8 Ma, Mihalynuk *et al.,* this volume), and felsic tuffs were dated as late Mississippian **(**325.1±3.0 Ma , Mihalynuk *et al.,* this volume). These positive indicators of a Devono-Mississippian volcanogenic environment reinforced the perceived potential of the area based on extrapolation of known metallotects (Nelson, 1997).

In 1999, geological mapping of the Big Salmon Complex was completed (Mihalynuk *et al.,* this volume); this work resulted in significant increase of the known strike extent of the crinkled chert, and the discovery of several new showings and areas of quartz-sericite schist. A complementary surficial project produced a map of the Big Salmon Complex in British Columbia (Dixon-Warren and Hickin, this volume). The surficial geology map can be used to identify unconsolidated units suitable for geochemical sampling, and as a guide for tracing geochemical anomalies to their bedrock sources. Multimedia geochemical studies focussed on the crinkled chert, RGS anomalies, and known sulphide occurrences, with some regional stream data (Cook and Pass, this volume; Dixon-Warren and Hickin, 2000a, this volume; Dixon-Warren and Hickin, 2000b). The geochemical case studies aim to highlight the potential for VMS mineralization in Yukon-Tanana correlative rocks of the Big Salmon Complex by characterizing the surficial geochemical responses of known VMS prospects and their felsic and mafic volcanic host rocks.

Extensions and possible correlatives of the Big Salmon Complex were the subject of a continuing regional bedrock mapping project in southern/central Jennings River area (Nelson, this volume; Figure 1). Late Mississippian felsic tuffs coeval with those in the Big Salmon Complex, and rocks similar to Big Salmon greenstones near the southern border of the Jennings River area, suggest that the potential Mississippian VMS environment extends well into British Columbia.

The 1999 BCGS program was integrated with a new GSC 1:250 000 mapping project in the Wolf Lake/Jennings River map area, which traced Big Salmon Complex stratigraphy along Hazel Ridge north of the Yukon border (Roots *et al.,* 2000; Figure 1). Continued mapping projects by Don Murphy and Maurice Colpron of the Yukon Geology Program in the Finlayson Lake and Glenlyon map areas in Yukon also form part of the Central Component (Figure 1). In the Finlayson project, Murphy and collaborators have covered the area of the Kudz Ze Kayah and Wolverine VMS properties, providing a preliminary stratigraphic template that is useful for workers in parts of the terrane where volcanogenic potential is less well known (Murphy and Piercey 1999, 2000). Colpron has mapped two areas in the Teslin Zone, the continuation of Yukon-Tanana Terrane southwest of the Tintina Fault (Colpron, 1999, Colpron and Reinecke, 2000).

Collaboration between participants in the Central Component of the Natmap project is already leading to a better understanding of the regional relationships. We are starting to see how stratigraphic sections from different parts of the pericratonic belt from Finlayson Lake to southern Jennings River map area may correlate (Nelson *et al.,* this volume). The geologic history of this region, albeit complex, is decipherable through systematic geological mapping supported by geochronological studies. This is good news for explorationists interested in pursuing the metallogenetic possibilities of the ancient continental margin.

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