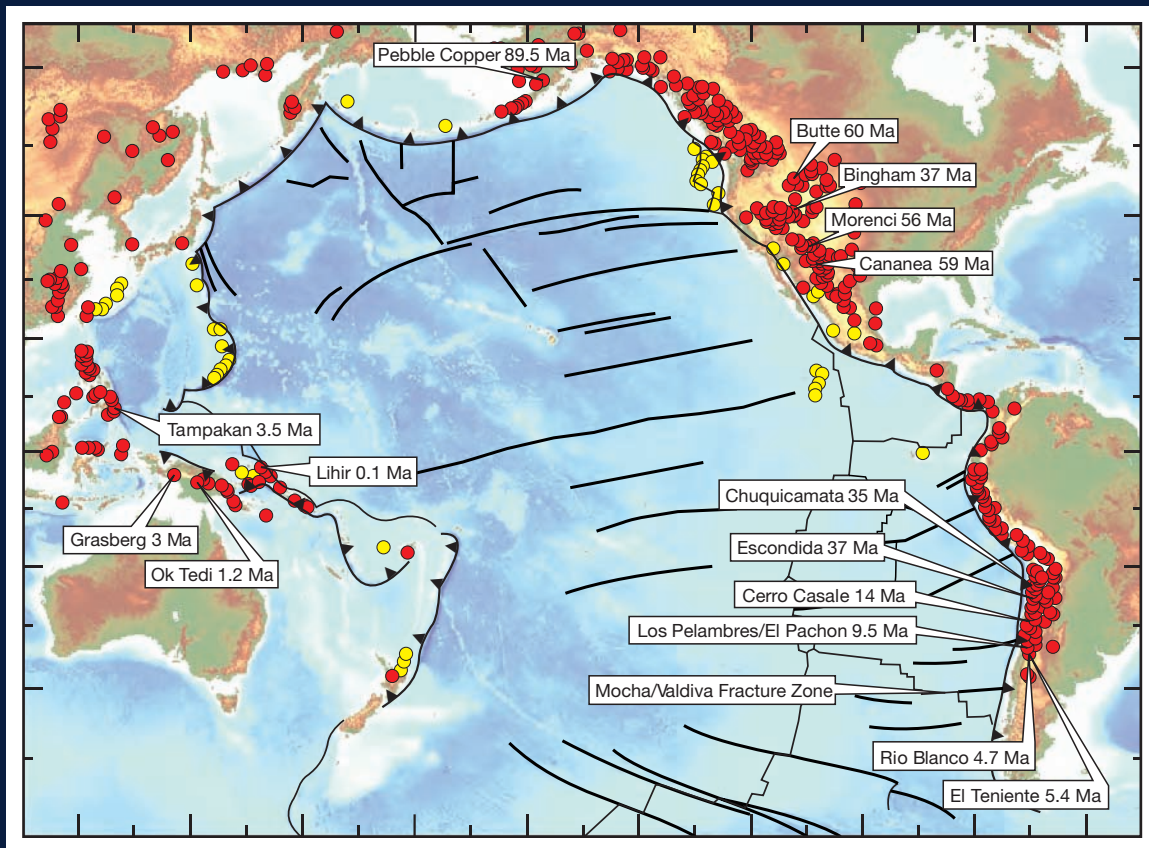




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Tectonics, Metallogeny, and Discovery: The North American Cordillera and Similar Accretionary Settings



Maurice Colpron, Thomas Bissig, Brian G. Rusk,
and John F.H. Thompson, Editors

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On the cover: Map of the Pacific Rim highlighting the location of known porphyry (Cu-Au-Mo) deposits (red points) and documented occurrences of sea-floor massive sulfides (yellow points). The name and age of some of the largest deposits are shown. From the paper by S. W. Richards and R. J. Holm.

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Contents

Preface	<i>M. Colpron, T. Bissig, B.G. Rusk, and J.F.H. Thompson</i>	v
Conference Sponsors		vii
1 <u>Metallogenic and Regulatory Inequalities Around the Northern Pacific Rim: Implications for Discovery</u>	<i>Richard H. Sillitoe</i>	1
2 <u>Large Igneous Provinces (LIPs) and Metallogeny</u>	<i>Richard E. Ernst and Simon M. Jowitt</i>	17
3 <u>The Cordillera of British Columbia, Yukon, and Alaska: Tectonics and Metallogeny</u>	<i>JoAnne L. Nelson, Maurice Colpron, and Steve Israel</i>	53
4 <u>Magmatic and Metallogenic Framework of West-Central Yukon and Eastern Alaska</u>	<i>Murray M. Allan, James K. Mortensen, Craig J.R. Hart, Leif A. Bailey, Matías G. Sánchez, Witold Ciolkiewicz, Greg G. McKenzie, and Robert A. Creaser</i>	111
5 <u>Tectonic Evolution and Cretaceous Gold Metallogenesis of Southwestern Alaska</u>	<i>Garth E. Graham, Richard J. Goldfarb, Marti Miller, Kati Gibler, and Mike Roberts</i>	169
6 <u>Tectonic and Metallogenetic History of Mexico</u>	<i>Antoni Camprubí</i>	201
7 <u>Carbonatites in Western North America— Occurrences and Metallogeny</u>	<i>Leo J. Millonig and Lee A. Groat</i>	245
8 <u>Tectonic Preconditioning and the Formation of Giant Porphyry Deposits</u>	<i>S. W. Richards and R. J. Holm</i>	265
9 <u>Lithospheric Fertilization and Mineralization by Arc Magmas: Genetic Links and Secular Differences Between Porphyry Copper ± Molybdenum ± Gold and Magmatic-Hydrothermal Iron Oxide Copper-Gold Deposits</u>	<i>Jeremy P. Richards and A. Hamid Mumin</i>	277
10 <u>Tectonomagmatic Controls on Porphyry Mineralization: Geochemical Evidence from the Black Mountain Porphyry System, Philippines</u>	<i>Pete Hollings, Gabriel Sweet, Mike Baker, David R. Cooke, and Richard Friedman</i>	301
11 <u>Volcanotectonic Setting of World-Class Alkalic Porphyry and Epithermal Au ± Cu Deposits of the Southwest Pacific</u>	<i>Anthony C. Harris, David R. Cooke, Jacqueline L. Blackwell, Nathan Fox, and Evan A. Orovan</i>	337

12	<u>An Overview of the Structure, Stratigraphy, and Zn-Pb-Ag Deposits of the Red Dog District, Northwestern Alaska</u>	<i>Scott K. Blevings, Jamie L. Kraft, James U. Stemler, and Tom E. Krolak</i>	361
13	<u>A Comparison of Carlin-type Deposits in Nevada and Yukon</u>	<i>Greg B. Arehart, Michael Ressel, Rob Carne, and John Muntean</i>	389
14	<u>Goldrush: Lessons Learned from the Latest Giant Gold Deposit Discovered in Nevada</u>	<i>Kevin D. Creel and Mark A. Bradley</i>	403

Preface

This Society of Economic Geologists Special Publication was initiated as a companion volume for the SEG-SEGCF conference, *Whistler 2013: Geoscience for Discovery*, September 24–27, 2013. The purpose of the volume parallels the themes of the conference—namely, to examine and illustrate the connections between both fundamental and applied geoscience focused on tectonics, the resulting improved understanding of metallogeny, and the discovery of new mineral deposits. The focus of the conference and the volume is the northern Pacific Rim and, particularly, the Cordillera of North America. Several papers are included, however, that go well beyond the Cordillera and northern Pacific Rim in terms of geography, but these papers provide context for large-scale tectonic processes and information on the metallogeny and deposits that is directly applicable to the focus of the conference and volume.

Post the widespread acceptance of plate tectonics in the 1960s and 1970s, there followed a period when great strides were made in understanding the tectonic collage that makes up the North American Cordillera. The development of the terrane concept (Coney et al., 1980; Jones et al., 1983), supported by paleontology, paleomagnetism, geochronology, and petrology allowed terranes to be defined, and the chronology of assembly and accretion to be documented (Monger et al., 1972, 1982). It became apparent that this concept had direct application to mineral exploration—specific terranes and parts of terranes were clearly prospective for certain types of deposits. The terrane concept became a widely accepted part of mineral exploration targeting and talks on new tectonic or terrane models drew large audiences from the ranks of the explorers. As knowledge increased through the 1980s and 1990s and into the 2000s, the tectonic debates became more nuanced and while still very important, of less immediate interest to the exploration audience. At the same time, the exploration industry changed with new young people entering the business, new approaches and constraints on exploration, new technologies, and the gradual loss of geoscientists who developed their trade during the heyday of tectonics and terranes and the related success in exploration.

Given this background, the organizers of Whistler 2013 and the editors of this volume set out to reinvigorate the excitement generated by the debates around terrane models, the tectonic constraints on critical deposits within the terranes and on the adjacent continental margin, and some of the recent discoveries that in some cases pose questions for tectonic models. The volume includes papers that discuss large-scale tectonic processes and their influence on ore formation, particularly for the major or giant deposits in arcs and on continental margins. Arc processes are discussed in terms of the petrology of the magmatic rocks and their influence on deposits, particularly the unusual suite of alkaline porphyry deposits that are important in British Columbia. Current terrane models,

their geodynamic interpretations, and their controls on metallogeny are reviewed for Mexico, western Canada, and Alaska, highlighting the orogenic complexity that still poses challenges to science and exploration. Finally, some of the deposits and new discoveries in the region are described, including the emerging gold districts in the Yukon, some of which may show similarities to gold deposits in Nevada, a province that is itself still producing new discoveries. Variation in metallogeny is evident at all scales—amongst districts and terranes, and even within large segments of the Circum-Pacific. Realistic explanations for this heterogeneity are emerging but are not proven. Tectonic and metallogenic models help us understand the distribution of many deposit types but are not necessarily sufficient to help us develop exploration targets. Conversely, in some cases the deposits constrain the tectonic and terrane models, particularly when they have unusual characteristics such as the case of the alkaline porphyry deposits.

Mining is critical to the economies of many of the jurisdictions described in this volume, particularly in western North America but also some parts of the western Pacific margin. Discovering new economic deposits is therefore vital for these jurisdictions. As exploration becomes more challenging both technically and non-technically, it is important that explorers take advantage of new thinking in structure and tectonics, new terrane models, improved geochronological and petrological constraints on metallogeny, and the implications of emerging districts and new discoveries. We hope that this volume and the Whistler 2013 conference provide new insights to those interested in fundamental processes, guidance to today's mineral explorers and, more importantly, added impetus for solving some of the major questions that remain.

We thank all of the authors for working hard to meet our tight deadlines while still producing quality papers, and the expert reviewers who also devoted time to help us ensure that quality. The volume would not have been possible without the dedicated efforts of Alice Bouley and her production team at SEG headquarters in Littleton, Colorado.

M. COLPRON, T. BISSIG, B.G. RUSK, AND J.F.H. THOMPSON

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