GEOLOGY, GEOCHEMISTRY AND AGE OF
INTRUSION-RELATED MINERALISATION
IN EASTERN MEXICO

Submitted by

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to the
UNIVERSITY OF EXETER

as a dissertation for the degree of DOCTOR OF PHILOSOPHY by Research

in
EARTH RESOURCES,

September, 2009

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I certify that all material in this dissertation which is not my own work has been identified and that no material has previously been submitted and approved for the award of a degree by this or any other University.

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ACKNOWLEDGMENTS

This thesis is dedicated to my father and lifelong business partner, J. Duane Poliquin. He introduced me to the field of geology and mineral exploration at the age of four when I began to work as his field assistant in Nevada. His friendship, good humour, empirical mind and enjoyment of the outdoors opened my eyes to the possibility of a world of adventure for which I will always be grateful. His support for the ideas that this project is based upon allowed it to get off the ground when funding was very difficult. Almaden Minerals and BHP Billiton financed the exploration programs that made this field work and research possible. I am grateful to all those who believed in the ideas enough to make this happen.

Many geologists and field staff contributed to the exploration programs of Almaden Minerals over the years in eastern Mexico. All of their efforts have enabled the exploration efforts that made this research project possible. Deserving particular mention are geologists Angus Campbell, Peter Daubeney, Anna Fonseca, Tom Ullrich, and Bill Wengzynowski and field technicians Marc Beaupre, Bill Donald-Hill, Ricardo Hernandez and Barry Sullivan who accompanied me into the Mexican unknown. Mel Caine's good humour and flying skills kept me upbeat and alive during many hours of dangerous flying in Mexico. Sadly the Hughes 500 we flew in, N61735, will not be a part of future adventures. I wish she could have kept her last pilot as safe as she did us, may he rest in peace.

This dissertation was encouraged from afar by my advisor at the Camborne School of Mines, Dr. Robin Shail. I am grateful for all his support, especially that during the final painful stages of completion. I am also very thankful for the very helpful comments of Dr. Jens Anderson, Senior Lecturer in igneous petrology at the Camborne School of Mines.

This research project could not have been possible without the isotopic analytical work of the Pacific Centre for Isotopic and Geochemical Research (PCIGR) at the University of British Columbia. Professor Jim Mortensen, who heads the PCIGR, encouraged and supported this project from its inception. His thoughtful comments, reviews and support made this thesis much better; the isotopic work of the PCIGR made it possible. I also wish
to thank the staff of the PCIGR at the time of this project, Janet Gabites and Tom Ullrich.

I am very grateful to T. James Reynolds of FLUID INC., Denver, Colorado who greatly helped me with my fluid inclusion observations. I thought I knew something about fluid inclusions until I met Jim. He opened my eyes to the possibilities and usefulness of fluid inclusion petrography. His time, instruction, observations, reviews and patience are most gratefully acknowledged.

My family has been my biggest support throughout my life. Anything I achieve is shared with them: my father, mother, sister and wife, Erin. They all got me through tough times and helped me make trips to Mexico when I sometimes didn't want to go. My wife has put up with long absences and supported me through the process of writing this dissertation despite a move and our first pregnancy. Her kindness, love and support make everything difficult worthwhile as she always helps me to see the great joys of life. As a relevant case in point after our first date I went to Mexico for a long stretch only to contract a severe case of histoplasmosis in an old mine working. Her *joie de vivre* helped me regain my health over several months of illness and we have never looked back.
ABSTRACT

Examination of igneous intrusions and related mineral deposits in eastern Mexico (including the determination of 26 new zircon U-Pb ages, 6 new mineral Ar-Ar ages and 26 new sulphide and feldspar Pb isotope and 61 new whole-rock geochemical data) revealed a spectrum of Eocene to Pleistocene mineral deposits and important aspects of the metallogenic history of Mexico. The synthesis of these data with recent tectonic reconstructions suggest the character of igneous rocks and mineral deposits was controlled by two periods of ocean ridge subduction and contemporaneous slab steepening and flattening.

Mineralisation occurred in four epochs: (1) Eocene ~ 43 to 38 Ma Cu (Au) skarn and porphyry deposits in northeastern Mexico; (2) Miocene, ~18 to 9 Ma Cu (Au) porphyry, skarn and high-sulphidation epithermal deposits in the Trans Mexican Volcanic Belt (TMVB) and Oaxaca; (3) Pliocene ~ 4.5 Ma low-sulphidation epithermal deposits in the TMVB; and (4) Pliocene to Pleistocene ~ 2.5-2.0 Ma Cu (Au) skarn and porphyry deposits in Chiapas. The intrusions of the Eocene and Miocene epochs are high-K, have adakite-like geochemistry including Sr/Y up to ~108 and ~85 respectively and La/Yb ratios up to ~38 and ~27 respectively, and were followed by alkaline magmatism. All episodes of mineralisation are interpreted to have occurred above areas of slab steepening following periods of flat slab subduction.

Shallow emplacement of Miocene ~ 9.0-8.0 Ma diorite stocks in the TMVB caused flashing of hydrothermal fluids, banded quartz vein formation and Au deposition which overprint potassic alteration and Cu-Au mineralisation. Barren quartz-alunite zones formed contemporaneously with potassic alteration at higher elevations. Later fluids deposited Au in some quartz-alunite zones.

There is little difference in Pb isotope compositions of feldspar and sulphides or variation over time, their compositions ranging from 18.3208 to 19.1637 for $^{206}\text{Pb}/^{204}\text{Pb}$, 15.4541 to 15.6675 for $^{207}\text{Pb}/^{204}\text{Pb}$ and 38.3096 to 39.2193 for $^{208}\text{Pb}/^{204}\text{Pb}$. This may reflect similar tectonic environments and magma sources for Pb.