University of Victoria | Graduate Studies

Notice of the Final Oral Examination
for the Degree of Master of Science

of

**ZHU TIAN**

MSc (China University of Geosciences (Beijing), 2013)
BSc (China University of Geosciences (Beijing), 2006)

# "Tracing On-Axis Diffuse Fluids by Chalcophile Elements Distribution in Upper Oceanic Crust at Pito Deep, East Pacific Rise"

School of Earth and Ocean Sciences

Tuesday, October 11, 2016
9:00 A.M.
Bob Wright Centre
Room A319

Supervisory Committee:
Dr. Laurence Coogan, School of Earth and Ocean Sciences, University of Victoria (Supervisor)
Dr. Dante Canil, School of Earth and Ocean Sciences, UVic (Member)
Dr. Kathy Gillis, School of Earth and Ocean Sciences, UVic (Member)
Dr. Frank van Veggel, Department of Chemistry, UVic (Outside Member)

External Examiner:
Dr. Dominique Weis, Department of Earth, Ocean & Atmospheric Sciences, University of British Columbia

Chair of Oral Examination:
Dr. Abdul Roudsari, School of Health Information Science, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

## Abstract

The mid-ocean ridge hydrothermal systems play an important role in the cycling of energy and mass between the solid earth and oceans. The on-axis low-temperature diffuse fluids carry ~90% of the on-axis heat fluxes, whereas the diffuse fluids generation is poorly constrained. This study traced the abundances of the chalcophile elements which formed metal-sulphides in the rock record to test the plausible models for diffuse fluids generation, fluid mixing between seawater and high-temperature hydrothermal fluids, and conductive cooling of high-temperature hydrothermal fluids.

This thesis determined the concentrations of the elements of interest in geological reference materials by an analytical method of standard addition, which were applied to calibrate the samples from Pito Deep to trace the abundance of these elements within the upper oceanic crust. The results show that the Zn, Cu, As, Ag, Cd, Tl, and Pb are generally depleted in sheeted dikes and enriched in the lava unit and/or the transition zone, which is consistent with previous studies on fast-spreading EPR crust at Hole 504B, Hess Deep and Hole 1256D. The enrichment of these elements in the lava unit and/or the transition zone suggests that cooling high-temperature hydrothermal fluids to form diffuse fluids occurred in this area of the oceanic crust.
Molybdenum and Sb are added into all units of the crust by recharged seawater. The concentrations of chalcophile elements in diffuse fluids were calculated by a mass balance. The results of this study favored the diffuse fluids generation model of fluid mixing of seawater and high-temperature hydrothermal fluids. Results also show that the observed precipitation of Mo and Sb requires extra input source besides the recharged seawater and oceanic crust, possibly seawater particulates.