University of Victoria | Graduate Studies

Notice of the Final Oral Examination
for the Degree of Doctor of Philosophy

of

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MSc (Tongji University, 1998)
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"Reconstructing Holocene East Asian Monsoon Climate and Oceanographic History of the Northern South China Sea: High-Resolution Records of Pollen, Spores, and Dinoflagellate Cysts"

School of Earth and Ocean Sciences

Friday, December 14, 2018
10:00 A.M.
Bob Wright Centre
Room A319

Supervisory Committee:
Dr. Vera Pospelova, School of Earth and Ocean Sciences, University of Victoria (Supervisor)
Dr. Eileen Van der Flier-Keller, School of Earth and Ocean Sciences, UVic (Member)
Dr. Richard Hebda, School of Earth and Ocean Sciences, UVic (Member)
Dr. Sophia Johannessen, Department of Geography, UVic (Outside Member)

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Dr. Florin Pendea, Geography & The Environment Sustainability Sciences, Lakehead University

Chair of Oral Examination:
Dr. Juan Ausio, Department of Biochemistry and Microbiology, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

This study contributes to developing terrestrial and marine palynological indicators of winter or summer monsoon signals as well as oceanographic environments of the South China Sea (SCS). The high-resolution reconstructions on Holocene East Asian Monsoon (EAM) climate and oceanographic condition of the northern SCS provide insights of regional climate events in the western low-latitude Pacific Ocean and their impacts on local oceanography and ecology.

Research on sediment trap samples from the southwest Taiwan waters of the SCS in winter monsoon (March-April) and summer monsoon (July-August) seasons identifies *Pinus* and *Ulmus* pollen as good indicators of the winter monsoon whereas fern spores as the indicators of the summer monsoon with intensified fluvial effects. The increased fluxes of almost all dinoflagellate cyst (DC) taxa during summer were correlated with the decreased sea-surface salinity (SSS) from the strengthened river inputs with rich nutrients.

DC distributions across the SCS show that specific DC taxa can be used as indicators of changes in sea-surface temperature, sea-surface salinity, water depth and Chl-*α* concentrations associated with EAM and oceanographic conditions in the SCS. In particular, *Brigantedinium* spp., *Impagidinium* spp. and cysts of *Protoperidinium* together with *Echinidinium* spp. can be linked to past monsoon strength, Kuroshio Current influences and primary productivity.

High-resolution palynological records from a sediment core in the northern SCS reflect several EAM climatic and oceanographic events since 12.5 cal kyr BP. A short-term *Impagidinium* decrease implied the Taiwan Strait opening at ~11.7–11.0 cal kyr BP, with the reduced Kuroshio Current influence when the East China Sea waters entered through the Taiwan Strait. The general trend of palynological records was related to three Holocene relative sea-level stages with boundaries at ~10.4 and ~6.8-6.0 cal kyr BP. The highest herb pollen abundances were observed before ~10.4 cal kyr BP with the shortest distance from the grassland sources on the exposed shelf at the low sea-level stand. High *Brigantedinium* and cysts of *Protoperidinium* abundances indicate a near-shore environment. During ~10.4- ~6.8-6.0 cal kyr BP at the rising sea-level stage, fern spore abundances had increased whereas DC abundances had decreased. Steadily low total DC concentrations and the highest fern

spore abundances were observed after ~6.8-6.0 cal kyr BP when the present oceanographic setting was formed. Increased abundances of *Pinus* pollen reflected three strengthened winter monsoon intervals at ~5.5, 4.0 and 2.5 cal kyr BP under the present oceanographic conditions. The highest *Dapsilidinium pastielsii* abundances reflected the warmest interval at ~6.8-5.5 cal kyr BP of the northern SCS.

In this study, the research on sediment traps for the first time provides the notable differences among specific individual taxa through directly comparing the palynological records between winter and summer monsoons. However, limited by the selected sites and time intervals, continuous influences from EAM on individual DC taxon and their assemblages in details are unknown, and more sensitive potential indicators cannot be tested. A study of annual or multi-annual time series at more sites in the SCS would be the priority of the further research.