学 位 論 文 審 査 の 要 旨

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学 位 論 文 題 名

Development and application of biomass burning tracers in ice core for reconstruction of boreal forest fire history in North America
（森林火災トレーサーの評価とアイスコアを用いた過去の北アメリカ北方林の森林火災の変遷の復元）

Biomass burning is considered as a major disturbance factor for boreal forest and emits large amount of numerous greenhouse gases and aerosols into the atmosphere. Recent observations show that changes in climate can influence the fire regime in boreal regions. However, the observational based records are not sufficient to investigate the link between climate and fire. It is necessary to generate long-term reliable record of boreal fire activity to improve predictions of future climate changes. Regional forest fire activity in a past could be reconstructed by analyses of biomass burning tracers (levoglucosan and dehydroabietic acids) in paleoclimate archives such as ice core. Levoglucosan and dehydroabietic acid are a specific tracer of biomass burning. Although, these two aerosols have a potential as BB tracer, paleoclimatic utility of these tracers in ice core has not been evaluated.

In this study, continuous record of biomass burning tracers in the SE-Dome ice core was generated to evaluate the paleoclimatic utility of the biomass burning tracers in Greenland ice core (SE-Dome ice core). Comparison of the tracer records with area burned events in a possible source region of biomass burning aerosol suggests that the ice core tracer records document most of the pronounced biomass burning events in eastern Canada over the past 60 years. This result confirms that analyses of the biomass burning tracers in Greenland ice cores are promising approach to reconstruct the frequency of significant biomass burning events in regional scale. Next, the two tracers were applied to ice cores collected from northwestern Greenland (Sigma D) and southern Alaska (Aurora peak) to reconstruct the boreal forest fire history in North America over the past few hundred years. The both ice core records indicate that significant boreal forest fire events happened frequently in Alaska and Canada over the past 300 years with increases in boreal fires during Little Ice Age and the recent decades. Comparison of regional temperature and ice core biomass burning tracer records indicates that regional temperature is the major driver intensifying the fire in Canada and Alaska on decadal timescales, as prominent peaks of biomass burning tracers well correspond to the regional climate warming periods. In addition, changes in the decadal scale climate oscillations such as North Atlantic Oscillation (NAO), likely exert an

influence on fire dynamics in eastern Canada, by increasing aridity. On the other hand, strong link between decadal scale climate oscillations and boreal fire is not recognized in the western boreal region over the past 300 years. The coupling of boreal fire and regional temperature for the last 300 years, suggest that occurrence frequency of boreal forest fire will increase in a future due to the ongoing global warming.

In addition to the excellent academic knowledge in the research, her academic records throughout the Ph. D course are excellent. Based on these evidences, the committee reached to a conclusion that Parvin Fahmida deserves to become a Doctor of Environmental Science.