

Reconstruction of spatio-temporal vegetation changes in Mongolia and southern Siberia based on palynological assemblages for the past 40 kyrs

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It is matter of Siberia permafrost melting to change global environment with recently global warming (Crichton *et al*, 2016, *Nature Geosci*). There are some studies to estimate dynamics of permafrost with global warming based climate model. However, it remains unknown how response of vegetation for dynamics of permafrost, it needs knowledge for past records. So, in this study, we focus on northern Mongolia in located boundary between edge of permafrost and desert. On this area, it is possible to record dynamics of permafrost with climate change. However, it is no continuous pollen records after last glacial and is a few pollen record to reconstruct past vegetation changes, because this area is semi-dry area near boundary of desert (Chevalier *et al.*, 2020; *ESR*). In this study, we reconstruct continuous pollen assemblages change based lake sediment in Sangiin Dalai lake in northern Mongolia, try to find out spatio-temporal vegetation changes for the past 40 kyrs with climate change by compare pollen records in southern Siberia and southern Mongolia.

In this study, We took surface sediment core in August 2016 (16SD01~04; ca. 82 cm length, respectively), and five boring cores in March 2019 (19SD01~05; totally ca. 20 m length) from Sangiin Dalai lake (N49° 15' 42" ; E98°55' 23" ; elevation 1885 m; water depth 25 m). In order to reconstruct paleoenvironmental and paleovegetation change, we conducted palynological analysis and high-resolution elemental composition analysis using μ XRF core scanner (Cox, Itrax).

Result of palynological analysis, it revealed that herb vegetation is expanded during all period because of more not-arboreal pollen (ex. *Artemisia*) than arboreal pollen (ex. *Pinus*) through all horizon. However, that ratio was changing a lot per period. Only steppe vegetation mainly comprised of *Artemisia* was expanded during Last glacial (41~12 ka). On the other hand, forest-steppe vegetation was expanded during Holocene (after 12 ka). In addition, it is revealed that dominant vegetation is changing with insolation change as follows. Cold deciduous forest vegetation mainly comprised *Betula* as pioneer arboreal species was expanded during Preboreal warm period (12~9.8 ka). Humid conifer forest vegetation mainly comprised *Pinus* and *Picea* was expanded during early to mid Holocene (9.8~4.0 ka). Steppe vegetation mainly comprised *Artemisia* and Poaceae was expanded during late Holocene. Especially, *Pinus* pollen changes corresponds to summer insolation change at 50 degrees north latitude. It is suggested vegetation changes respond to increase and decrease of soil moisture because of melting and freezing of permafrost with insolation changes during Holocene. Moreover, abrupt vegetation changes (1000 years scale) correspond to precipitation changes with meandering of westerlies. In addition this study, result of palynological analysis for Sangiin Dalai lake in north Mongolia compare result of Kotokel lake in southern Siberia (Shichi *et al.*, 2009; *QI*) and Orog lake in southern Mongolia (Yu *et al.*, 2019; *Paleo-3*). Result of compared, cold deciduous forest vegetatin is gradually increase during Preboreal warm period, humid conifer forest vegetation is rapidly increase at 60 ka in southern Siberia. On the other hand, Steppe vegetation is expanding during last glacial, dry desert vegetation is expanding during Holocene in southern Mongolia. It is revealed respond of vegetation change correspond to latitude change.

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