Investigation of decadal–centennial-scale climatic variations during the early Eocene, using the lacustrine record of the Green River Formation in Utah, US

*Hiroki Momose[1], Hitoshi Hasegawa[1], Hirofumi Asahi[1], Ryusei Kuma[2], Jessica Whiteside[3]

1. Faculty of Science and Technology, Kochi University, 2. Nagoya University, 3. Southampton University

Climatic oscillations on decadal- to centennial- time scales are widely recognized in the Holocene and last glacial paleoclimatic records. Given the marked correlation with cosmogenic radionuclide production rates, changes in solar activity are proposed to cause the observed climatic oscillations (e.g., ~11-year Schwabe cycle, ~88–120-year Gleissberg cycle, and ~210-year de Vries cycle; e.g., Steinhilber *et al.*, 2012; Adolphi *et al.*, 2014; Soon *et al.*, 2014). There is an evidence of the ~11-year Schwabe cycle from a Permian fossil tree-ring record (Ludwig *et al.*, 2017), supporting the possible continuity of the solar dynamo periodicity through geological time. However, the existence of decadal–centennial climatic variations and their relationship with solar cycles have not been evaluated prior to the late Pleistocene, except for some lacustrine records of late Miocene (Kern *et al.*, 2012), middle Eocene (Lenz et al., 2010), and late Early Cretaceous (Hasegawa et al., submitted), essentially due to the lack of appropriate datasets based on reliable proxy and archives .
We investigates decadal- to centennial-scale climate variability during the early Eocene (ca. 49 Ma) from a lacustrine sedimentary core of the Green River Formation in Utah, USA. Fluorescent microscopic inspection and EPMA analyses reveal that they are composed of micrometer-scale lamination, consisting of couplets of algal organic matter and clay minerals. Given the average thickness of micro-laminae and calculated sedimentation rate obtained from radiometric age of intercalated tuffs, micrometer-scale laminations are most likely varves, reflecting seasonal cyclicity. Based on seasonally-resolving analyses of the varve record by using a fluorescent microscope, we reconstructed changes in algal organic matter flux for 365 years. which probably reflecting changes in lake surface productivity controlled by strength of summer insolation.The preliminary results of algal organic matter proxy show periodicities resembles to Schwabe and Gleissberg cycle. With additional data for longer duration, we will discuss the possibility of solar influence of decadal–centennial-scale climatic variations in the early Eocene.

Keywords: Solar climate linkage, Lacustrine varve, Eocene

