Magnetostratigraphy of the Upper Cretaceous deposits, southern Mongolia: Implication for desert development in the Asian interior

Hitoshi Hasegawa[1]; Yusuke Suganuma[2]; Ryuji Tada[1]; Niiden Ichinnorov[3]; Koji Seike[1]; Demchig Badamgarav[3]; Yondon Khand[3]

[1] DEPS, Univ. Tokyo; [2] Tokyo Univ.; [3] Paleontological Center, MAS

Non-marine Upper Cretaceous deposits, which are widely distributed in the Gobi Basin of southern Mongolia, record the following remarkable paleoclimatic changes during the Late Cretaceous. (1) Through the Cenomanian to the Santonian (the Bayanshiree Fm), humid climate characterized by meandering fluvial environments were dominant. (2) The fluvial environments were then gradually transformed into sand dune desert environments (extending at least 160,000km2) under the arid climate during the Campanian time, which are represented by the predominance of large-scale cross-stratified eolian sandstones and mature calcretes in the Djadokhta and the Baruungoyot formations. (3) At the early Maastrichtian time (the Nemegt Fm), the sand dune desert environment was once replaced by a fluvio-lacustrine environment indicating increase in humidity. Finally, the Gobi region turned back to the sand dune desert environments under the arid climate during the middle Maastrichtian (Dzunmod Fm). Such desertification and climatic aridification during the Campanian-Maastrichtian is also recorded in northern China. Hence, this aridification is thought to have occurred broadly in the mid-latitude of the Asian interior at that time. However, detailed geochronological study on this Mongolian Upper Cretaceous deposits have been limited.

A paleomagnetic study has been conducted on the Upper Cretaceous deposits (Bayanshiree, Djadokhta, Baruungoyot, and Nemegt formations) in the Gobi basin of southern Mongolia, in order to provide onset and duration of desert development in this region. Paleomagnetic samples were collected from 144 horizons along an approximately 300 m thick composite sections (the Bayanshiree Fm of the Khongil Tsav locality, Djadokhta Fm of the Bayan Zag and Tugrikiin Shiree localities, Baruungoyot and Nemegt formations of the Nemegt locality, in ascending order). Rock magnetic experiments and stepwise thermal demagnetizations revealed that the main carrier of the magnetization of the sediments is magnetite and the samples have stable magnetization. Characteristic remanent magnetization (ChRM) directions, calculated by the principal component analysis, revealed normal or reversed polarities of magnetization. In total, five normal and four reversed polarity zones are recognized from the studied section. Based on paleontological age constraints, this magnetostratigraphic column of the Mongolian Upper Cretaceous correlates best with Chron C34n-C31n of the geomagnetic polarity time scale from the geological time scale (GTS2004). This correlation revealed that sedimentation of the eolian deposits (Djadokhta, Baruungoyot, and Dzunmod formations) began approximately at 80 Ma and continued until at least 72 Ma with a mean sedimentation rate of approximately 4.2 cm/ky.