Geophysical Research Abstracts
Vol. 14, EGU2012-5942, 2012
EGU General Assembly 2012

Holocene millennial cyclicity registered in petromagnetic parameters of a Siberian loess section imply a difference between continental and oceanic climate

V.A. Kravchinsky (1,2), C.G. Langereis (2), S.D. Walker (1), K.G. Dlusskiy (3,4), D. White (3,5)

(1) Department of Physics, University of Alberta, Edmonton, Canada T6G 2E1 (vadim@ualberta.ca), (2) Department of Earth Sciences, Utrecht University, Budapestlaan 17, 3584 CD Utrecht, the Netherlands, (3) Department of Anthropology, University of Alberta, Edmonton, Alberta, Canada T6G 2H4, (4) Solstice Canada Corp., Edmonton, Alberta, Canada T5M 0H1, (5) Archaeology, University of Southampton, Southampton SO17 1BJ, UK

The Holocene climate periodicity of ∼2500, ∼1500, and ∼1000 years has only been observed in or near marine settings and is strongly controlled by glacial input into the North Atlantic. We conducted a high-resolution study of a unique Holocene loess / buried soil sequence in Southern Siberia far from marine environment influences to determine the difference between the North Atlantic marine and in-land climate variations.

Relative wind strength was determined by sedimentary and magnetic grain size analyses. Petromagnetic parameters were measured to provide a proxy for the relative extent of pedogenesis and loess accumulation. An age model for the sections was built using the radiocarbon dating method. The windy events are associated with the absence of soil formation and relatively low values of frequency dependence of magnetic susceptibility (FD), which appeared to be a valuable quantitative marker of pedogenic activity. These events correspond to cold intervals registered in reduced solar insolation and the number of sun spots. Events, where the strength of the wind was lower, are characterized by resolute soil formation and correspond to high FD values. Our results demonstrate periodic change of 1000 and 500 years in relatively warm and cold intervals during the Holocene of Siberia. We presume that such climatic changes are driven both by local conditions and the higher amount of solar insolation reaching the Earth surface and amplified by other still controversial mechanisms (e.g., sun spot count). The discovered cycles in Siberia differ from the 1500 year cyclicity associated with the North Atlantic circulation which appears not to be caused by solar variation changes. Three time periods — 7500–9200 yrs BP, 3600–5200 yrs BP, and the present day–500 yrs BP — correspond to both the highest sun spot number and the most developed soil horizons in the studied sections. We suggest that the first of the three time intervals relates to the warmer period registered in the Greenland temperature and Siberian pollen records, the second time period correlates to the middle-late Holocene warmer and wetter period registered in the Lake Baikal oxygen isotope record and the most recent time period matches the post Little Ice Age warming.