Geophysical Research Abstracts
Vol. 21, EGU2019-7910, 2019
EGU General Assembly 2019

Terrestrial temperature response to middle Miocene northern hemisphere climate change: Case studies from Central European and continental North American paleosols

Katharina Methner (1), C. Page Chamberlain (2), David Bajnai (3), Marion Campani (1), Jens Fiebig (3), Oliver Kempf (4), Emilija Krsnik (1), Niklas Löffler (1,3), Andreas Mulch (1,3)

(1) Senckenberg Biodiversity and Climate Research Centre, Frankfurt am Main, Germany (katharina.methner@senckenberg.de), (2) Department of Geological Sciences, Stanford University, Stanford, USA, (3) Institut für Geowissenschaften, Goethe-Universität, Frankfurt am Main, Germany, (4) Bundesamt für Landestopografie swisstopo, Geologische Landesaufnahme, Wabern, Switzerland

Please fill in your abstract text. Reconstructing temperature and rainfall patterns, as well as their seasonality, in the geologic past is crucial for paleo-environmental and paleo-ecological studies of ecosystem and biome evolution. The integration of combined carbonate stable isotope ($\delta^{18}O_{carbonate}$) and clumped isotope temperature (T(Δ_{47})) data, in conjunction with sedimentological and paleontological information, is a powerful tool for assessing such paleoenvironmental and paleoclimate conditions. Here we investigate the terrestrial climatic and environmental response to major global change during the middle Miocene Climate Optimum (MCO) and the subsequent middle Miocene Climate Transition (MMCT) in two very different environmental/tectonic settings, namely the Northern Alpine foreland basin (NABF) (Switzerland) and Northern Rockies (USA: Montana/Idaho).

The NAFB paleosol T(Δ_{47}) record shows temperatures between ca. 22˚C and 35˚C during the MCO, with a minimum temperatures at 16.4 Ma, resulting in a double-peak temperature pattern during the MCO that is also observed in coeval marine temperature records. The onset of the MMCT, deduced by a marked decline in soil temperatures, is coeval with cooling reported in high-latitudinal marine records and suggests a strong climate coupling between the North Atlantic and Central Europe in the middle Miocene. In contrast, MCO soil carbonates from intermontane basins in the continental western U.S. show generally cooler temperatures, ranging between ca. 16˚C and 25˚C. In particular, the western U.S. records show rather constant temperatures throughout the MCO and the absence of the temperature patterns observed in the NAFB and marine records. Calculated soil water $\delta^{18}O$ values (using $\delta^{18}O_{carbonate}$ and T(Δ_{47}) pairs), which are $\sim$5‰ lower than in the NAFB record, are consistent with the topographically and hydrologically distinct settings of inland high-elevation intermontane basins (western U.S.) and low-elevation foreland basin (NAFB) with closer proximity to the moisture source(s). Collectively, these data point to the important role of N Atlantic climate and ocean circulation dynamics for temperature and rainfall patterns in Eurasia during the MCO and MMCT.