Geophysical Research Abstracts
Vol. 14, EGU2012-8116, 2012
EGU General Assembly 2012

Miocene climate seasonality in southern India – first direct evidence for a weak Indian monsoon during the Middle Miocene Climate Optimum

W.E. Piller (1), M. Reuter (1), A.K. Kern (2), and M. Harzhauser (2)

(1) University of Graz, Institute of Earth Sciences, 8010 Graz, Austria (werner.piller@uni-graz.at), (2) Natural History Museum Vienna, Geological-Paleontological Department, 1010 Vienna, Austria

The Asian monsoon is an integral component of the global climate system. This large-scale atmospheric circulation comprises the East Asian summer and winter monsoon and the Indian monsoon subsystems, all characterized by seasonal reversing winds and precipitation changes associated with asymmetric heating of land and sea. The Neogene monsoon history is mainly reconstructed from chemical and physical weathering rates recorded in widely continuous marine sequences of the Indus Fan, Bengal Fan and South China Sea, which, depending on the source, physiography and sediment, indicate drier or wetter climates. These indirect climate proxies display an unusually dry period during the Middle Miocene Climate Optimum (MMCO, 16.5–15 Ma).

As part of the FWF-projects P18189, P21414 and P23492, we present an Early/Middle Miocene coastal palynoflora record from the siliciclastic Ambalapuzha Formation at the coastal cliff of Varkala (Kerala Basin, SW India). Pollen assemblages and facies document a coastal wetland with mangrove vegetation. The Coexistence Approach was applied for palaeoclimatic reconstructions. This method uses climatic tolerances of all nearest living relatives known for a fossil flora by assuming that the tolerances of a fossil taxon are not significantly different from its modern counterpart. The maximum overlap of the environmental tolerances of all nearest living relatives (coexistence interval) is then regarded as being indicative of the most likely palaeoenvironment. By enquiring the Palaeoflora Database (http://www.palaeoflora.de/), the palaeoclimatic parameters of the pollen flora were calculated.

The reconstructed climatic parameters for the MMCO show a seasonal precipitation pattern with a dry and a wet period and moderate rainfalls during the warmest period, which is comparable to the present day annual precipitation cycle in coastal Kerala, and affirms the presence of a monsoon-like atmospheric circulation over South India during the MMCO. However, the precipitation amounts during the wet (average 75%) and the warmest period (average 68%) were significantly reduced compared to today, while the rainfalls during the dry seasons are in the same order. This implies a weak Indian monsoon during the MMCO and a low thermal land – sea gradient between the Eurasian landmass and the Indian Ocean.

Although a $\sim$3°C warmer global climate during the MMCO and a weaker monsoon accounts for a higher near-surface air temperature during summer, the calculated mean annual temperature (MAT; 24.4°C) is 2.7°C lower than at present. The estimated warmest month temperature is, however, in the same range as today. Therefore, the low coldest month temperature (CMT; 20.6–22.8°C) in the Miocene has to account for the high MAT difference. This parameter represents the lower temperature threshold of the Varkala flora, and displays only the minimum temperature during the coldest month, which is significantly lower than the average CMT. Accordingly, the Miocene CMT approximates the present 24-h minimum temperature during the coldest month in Kerala (22.4°C). The reconstructed seasonal temperature cycle supports climate models, which suggest a higher temperature increase in mid-latitudes than in low-latitudes as well as warmer equatorial sea surface temperatures during the MMCO.