Geophysical Research Abstracts
Vol. 17, EGU2015-507, 2015
EGU General Assembly 2015

Highly-seasonal monsoons controlled by Central Asian Eocene epicontinental sea

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Modern Asian climate is mainly controlled by seasonal reverse winds driven by continent-ocean thermal contrast. This yields monsoon pattern characterized by a strong seasonality in terms of precipitation and temperature and a duality between humidity along southern and eastern Asia and aridity in Central Asia. According to climate models, Asian Monsoons and aridification have been governed by Tibetan plateau uplift, global climate changes and the retreat of a vast epicontinental sea (the Proto-Paratethys sea) that used to cover Eurasia in Eocene times (55 to 34 Myr ago). Evidence for Asian aridification and monsoons a old as Eocene, are emerging from proxy and model data, however, the role of the Proto-Paratethys sea remains to be established by proxy data. By applying a novel infra-annual geochemical multi-proxy methodology on Eocene oyster shells of the Proto-Paratethys sea and comparing results to climate simulations, we show that the Central Asian region was generally arid with high seasonality from hot and arid summers to wetter winters. This high seasonality in Central Asia supports a monsoonal circulation was already established although the climate pattern was significantly different than today. During winter months, a strong influence of the Proto-Paratethys moisture is indicated by enhanced precipitations significantly higher than today. Precipitation probably dwindled because of the subsequent sea retreat as well as the uplift of the Tibetan and Pamir mountains shielding the westerlies. During Eocene summers, the local climate was hotter and more arid than today despite the presence of the Proto Paratethys. This may be explained by warmer Eocene global conditions with a strong anticyclonic Hadley cell descending at Central Asian latitudes (25 to 45 N). urthermore, the Tibetan plateau emerging at this time to the south must have already contributed a stronger Foehn effect during summer months bringing warm and dry air into Central Asia. Proto-Paratethys moisture driven into Asia by the westerlies during winters provides a potential mechanical link between Eocene global climate and Asian aridification through sea level fluctuations.