

中国四川盆地白垩系陸成堆積物の後背地化学風化度と古気候の解析 Evaluation of hinterland weathering and paleoclimate of the Cretaceous strata in the Sichuan basin, central China

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Reconstruction of paleoclimate during the Cretaceous Period is important for the understanding of the Earth system operating during the greenhouse conditions. However, information of paleoclimate from continental inland-basins is scarce compared to continental margin marine-basins. This situation is also true in the Asian continent; Cretaceous ecosystem and paleoclimate data are accumulating in the Pacific side, while those of the Asian continental side is lacking. Paleoclimate conditions in Asian inland basins are considered to be equally important in order to elucidate the land-ocean climate system operated during the Cretaceous. In this regard, the present study investigates the geochemistry and clay mineralogy of the Cretaceous mudstones distributed in the Sichuan basin, central China, for the aim of paleoclimate evaluation. The depositional age of studied strata ranges from Berriasian to Maastrichtian. Sediments are mostly fluvial to lacustrine origin, however recently, a broad distribution of aeolian dune sandstones was identified from the Cenomanian to Turonian interval (Li et al., 2016). Before discussing hinterland weathering and paleoclimate, the effect of diagenesis was evaluated, which can alter the geochemical signatures of paleoclimate. The illite crystallinity index indicates that diagenetic effect was moderately high for the analyzed mudstones, and the degree of diagenesis has a high correlation with CaCO₃ abundance. Accordingly, CaO wt% abundances are mostly of post-depositional carbonate origin, and thus, CaO derived from carbonates was subtracted from the following discussion of hinterland weathering evaluation. Geochemical weathering indices (e.g., W value) demonstrate a significant increase in hinterland paleoweathering from Berriasian (W=70) to Cenomanian-Turonian (W=95), and then slightly decrease towards the Maastrichtian (W=80). This fluctuation pattern of the weathering indices is concordant with the Cretaceous paleotemperature estimates (e.g., O'Brien et al., 2017). Therefore, the present result suggests that the hinterland paleoweathering rate in the Sichuan basin was governed by the global temperature changes. The weathering index reached the maximum value of 95 in Cenomanian-Turonian stages. Furthermore, sediments of Cenomanian-Turonian horizons contained abundant kaolinite mineral, which is a product of hydrolysis decomposition of rock-forming minerals. Both lines of evidence suggest that the Sichuan basin was under the tropical and pluvial climate during the Cenomanian-Turonian. However, as mentioned before, the previous study identified aeolian sand dunes from the Cenomanian-Turonian strata. Note that Li et al. (2016) elucidated an arid climate from amalgamated sandstone facies, while the present pluvial climate interpretation is derived from the analysis of intervening piled mudstone facies. When these geological evidences are integrated together, it is reasonable to suggest the development of an alternating pluvial and arid paleoclimate during the Cenomanian-Turonian. The nature and trigger of this extremely oscillating pluvial/arid climate cannot be deduced solely from the present study. However, the timing of this renewed climate system matches with the Cretaceous greenhouse optimum (Cenomanian-Turonian). The development of monsoon-like pluvial/arid paleoclimate in the Sichuan basin is possibly related to the mid-Cretaceous re-configuration in the global climate system.

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