Cretaceous-Cenozoic exhumation of Dabashan from apatite fission track thermochronology and its implication for growth of the northeastern Tibetan plateau margin

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As a part of Qinling collisional orogenic belt, Dabashan located at the northeast margin of Sichuan craton basin and closely adjacent to the eastern Tibetan plateau margin, is an ideal region for better understanding the tectonic evolution of Qinling orogeny roundly and stepwise migration of the northeastern Tibetan plateau margin. Apatite fission track dating and time-temperature thermal history modeling were carried to analyze on 10 samples in the Dabashan. The new data yield ages ranging from 73±8 to 33±4 and mean track lengths between 11.4±1.6 to 12.7±1.6. Thermal history models based on the AFT data taken together with published K-Ar data (Zheng et al., 2006) indicate that the cooling and exhumation process of Dabashan can be divided into three stages since Cretaceous. The three stages are identified as (1) a phase of rapid uplifting cooling at 120-110 Ma, (2) following by a period of relative thermal stability during which rocks remained at temperatures with in AFT partial annealing zone (~60-110°C), (3) ending with a new stage of accelerated uplifting during ~10Ma to resent. The first rapid uplifting cooling phase has been suggested to reflect the large-scale transtensional deformation of Qinling orogeny belt, which is attributed to the Cretaceous eastward tectonic escape and Pacific backarc extension (Hu et al., 2006). Following the transition phase the subsequent slow cooling phase pattern implies a net reduction in horizontal compressional stress corresponding to increased extension rates along the continental margin due to the decrease in plate convergene. The last accerelated uplifting event is response to eastward growth of Tibetan plateau uplift and lateral growth, which continues today. Numerous studies of Tibetan Plateau suggest that the onset of deformation in eastern and northern margin of Tibetan Plateau occurred in the latest Miocene (Tapponnier et al., 2001; Kirby et al., 2002; Zheng et al., 2006; Enkelmann et al., 2006).

References

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Pedogenic origin dolomite developed within calcium concretion of Tertiary red clay at Loess Plateau, China

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Previous research has shown that the land-origin dolomite was almost deposited at the high salinity environments. Only a few researches reported the un-salina origin dolomite was existed in the paleosol of Hawaii for a particular geologic reason and not any data regarding the authigenic dolomite in Chinese Loess has been recorded.

The carbonate concretions are widely existed in Tertiary red clay layers developed at the Xifeng area of Loess Plateau, central China. With application of the XRD and the highresolution SEM and TEM, lots of dolomite in rhombohedron in company with palygorskite has been detected, distributing along the dissolved interspaces within the calcium concretion. The morphological characters of those minerals indicate they are authigenic origin and come into being during the pedogenic period of the red clay. The former appearance needs enough Mg²⁺in environment. In this case, Mg²⁺is thought from the condensation of the outcome of the thorough weathering of the carbonate and silicate after the action of the heavy precipitation during the pedogenic period. The latter is widely considered only formed under the extremely dry climate. Electron Microprobe analysis farther testifies that the dolomite is with low Mg concentration and the lower ratio of Mg/Ca. Moreover, the cations such as Mg²⁺, Sr²⁺, Na⁺ etc. in dolomites at the different carbonate concretions are in a wide range, indicating the dolomites don't come into being in the unitary soil solution, but at the dividable micro-environments with different salinity.

It can be concluded that, when the red clay come into being, the climatic condition was characterized as the alternation of heavy precipitation-high temperature and dryhigh temperature. The result has also provided an example to explain the cause of formation of dolomite in terrigenous fresh-water environment.

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