The Vermiculated Red Soil in southern China and the strength extreme of East Asian monsoon

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Introduction

The Palaeosol, widely distributed in the areas south of the Yangtze River and characterized by red and white veins, is called Vermiculated Red Soil (VRS). It formed in mid-Pleistocene based on chronological studies[1-3], corresponding to the marine isotope stages 11-15 in times.

However, there are still some disputes about soil-forming processes and environmental significances of the VRS, which are very important to understand the palaeoenvironment of southern China in mid-Pleistocene. Moreover, many sections of the VRS are important Paleolithic sites[2,3], so the Pleistocene. Moreover, many sections of the VRS are studied. These two sections both have reliable palaeoenvironment and archaeology[2,3].

Based on soil micromorphology, clay mineralogy and chemistry, the following problems are discussed:(1) Morphological, chemical and mineralogical characteristics of the VRS and their implications for soil-geological processes; (2) Climate and environment when the VRS formed, and their potential relations with regional and global environment.

Results and discussion

Soil Micromorphology is of special importance in reconstructing the original properties of the palaeosols. Micromorphological thin sections were studied using an optical microscope. The chemical analyses of the Clay fractions(<2 μm) of the red and white veins were conducted on a XRF-1500 spectrum instrument. The oriented specimens of these clay fractions were treated with X-ray diffraction analyses on a DMAX 2400 X-ray diffraction instrument.

Based on their relative situations to each other, the homogeneous red soil matrices containing coatings of type a and planes were formed firstly, the white veins were formed around the planes subsequently and the coatings of type b, c, d, and e were formed in turn lastly. According to this, the development of the VRS can be divided into the following three stages.

Stage 1 Formation of homogeneous red soil matrices

The homogeneous red soil in tropical Red Earth in Chinese soil genetic classification, the second is the white veins forming period characterized by large rainfall all the year and great iron loss, and the last is the period with the alternating temperate-subtropical soil-forming processes. The formation of the white veins is the key for the vermicated characteristics. The white veins represented the extreme strength of East Asian summer monsoon circulation. The vast areas south of the Yangtze River were under the control of summer monsoon circulations all the year in mid-Pleistocene, and there was no visible dry season. Some studies that showed unusually strong African and Indian Ocean monsoon in mid-Pleistocene[12] shows that the extreme strength of the East Asian monsoon is of global significance.

Conclusion

The VRS had mainly undergone three development periods. The first is the formation period of red soil matrices which have the characteristics of Red Earth in Chinese soil genetic classification, the second is the white veins forming period characterized by large rainfall all the year and great iron loss, and the last is the period with the alternating temperate-subtropical soil-forming processes. The formation of the white veins is the key for the vermicated characteristics. The white veins represented the extreme strength of East Asian summer monsoon circulation. The vast areas south of the Yangtze River were under the control of summer monsoon circulations all the year in mid-Pleistocene, and there was no visible dry season. Some studies that showed unusually strong African and Indian Ocean monsoon in mid-Pleistocene[12] shows that the extreme strength of the East Asian monsoon is of global significance.

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