

Micromorphological characteristics and environmental significance of the Holocene aeolian loess-paleosol section in the Zoige Basin

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摘要: A typical Holocene aeolian loess-paleosol section was identified in the Zoige Basin on the northeastern (NE) Tibetan Plateau. A systematic study was conducted on the micromorphological units (coarse grains, voids, and pedofeatures) of this section, combined with physicochemical indicators (grain-size, loss-on-ignition, Rb/Sr ratio, and magnetic susceptibility), to explore the environmental significance of micromorphology. The results revealed the following findings. (1) In the Zoige Basin of the alpine-cold region, the micromorphological characteristics were as follows: the coarse grain size mainly ranged from 100 to 200 μm , with quartz and plagioclase as the main mineral types. The main void types were stacked voids with rough walls. The inorganic matter in the pedofeatures consisted mainly of small amounts of secondary calcite. The organic matters included humus, plant residues, and charcoal fragments, among which the humus and charcoal fragments concentrated in the paleosol. (2) The micromorphological analysis results indicated that from aeolian loess to paleosol, the coarse grain parameters decreased significantly, and the unstable minerals exhibited the weathering imprints. The porosity, void type, and pedofeature content increased. Compared to the paleosol, the modern soil coarse grain parameters decreased significantly. The boundary of the unstable minerals was evident, and the porosity decreased and became more uniform. The pedofeature content was low. These characteristics presented a variation in the intensity of weathering and pedogenesis in the section from weak to strong and weak, suggesting a climatic evolution in the Zoige Basin from dry-cold to warm-wet and back to dry-cold since the Holocene. (3) Compared to the Zoige Basin in the alpine-cold region, the aeolian loess of the Loess Plateau in the humid monsoon region demonstrated certain weathering imprints on the unstable minerals. Secondary clay minerals were predominant in the paleosol, and the illuvial clay was well developed. Various types of voids such as vughs and channels were present. In contrast, the paleosol in the Zoige Basin was dominated by primary minerals, and the voids were mainly vesicles. These characteristics indicated that weathering and pedogenesis in the Loess Plateau were stronger than those in the Zoige Basin, reflecting that micromorphology exhibits different responses to varying climatic conditions. These results could provide the micromorphological evidence for reconstructing the Holocene paleoclimate evolution in the NE Tibetan Plateau.

关键词: Micromorphology; Paleoclimate; Environmental Significance; Aeolian loess-paleosol; Northeastern Tibetan Plateau