The end-Permian mass extinction was the most severe event in Earth history, and killed 90% of species (Erwin, 2006). It led to profound changes in terrestrial and marine ecosystems, and shaped the subsequent biological evolution (Benton and Twitchett, 2003; Payne et al., 2006; Knoll et al., 2007). Although different recovery pathway have been observed among animal groups after the extinction (Chen et al., 2002), it was widely accepted that full recovery and radiation of the ecosystem occurred until the Anisian, Middle Triassic (Hallam, 1991; Payne et al., 2004; Tong et al., 2007). Early Triassic strata are characterized by low diversity, reduced size of organisms, reduced abundance of skeletal animals, reduced levels of bioturbation, and carbon-cycle instability (Woods et al., 1999; Wignall and Twitchett, 2002; Payne et al., 2004, 2006). Early Anisian was crucial to the subsequent recovery, which occurred after the end of the volcanic activity and CO2 release (Payne and Kump, 2007). This change in the environment is focused on the Early-Middle Triassic boundary. The marine ecosystems transformed from the turbulent situation in the Early Triassic to stable volatility in the Middle Triassic (Payne and Kump, 2007; Chen and Benton, 2012). The volcanic ash layer deposited in this period, commonly known as “green-bean rock”, is bean-shaped in appearance, with a colour of gray-green in fresh and pale in weathered surface. Similar layers of “green-bean rock” have been documented across South China, including the Sichuan Basin and adjacent Hubei, Guizhou, Yunnan and other provinces (Hu et al., 1996). The layer is stable and easy to identify and is widely treated as the mark of the Olenekian-Anisian boundary on the basis of macrofossils (Guizhou Bureau of Geology and Mineral Resources, 1987; Guan et al., 1990).

The Member I of the Guanling Formation just above the “green-bean rock” in Luoping area yields the index Anisian bivalve fossils *Myophoria* (*Costatoria*) *goldfussi mansuyi* Hsü. Conodont fossils *Neospathodus triangularis* (Bander), the index fossil of Olenekian, were collected from the underlying Jialingjiang Formation. The age of the “green-bean rock” is about Olenekian-Anisian boundary according to zircon U-Pb isotopic date of 246.6±1.4Ma (Xie et al., 2013). Chemical analysis of the volcanic ash sample from the bottom of the Guanling Formation in Zhangkoudong section, Luoping area, with a content of 81% to 86% for SiO2, Al2O3 and Fe2O3, show proximity to acid rock and reflect the compositional characteristics from the acidic volcanic material sources. A obvious feature is the higher content of K2O(2.6% ~ 5.0%).

Through the comprehensive survey to the “green-bean rock” at the Early-Middle Triassic boundary in Luoping and surrounding area, combined with previous studies, we suggest that it is tremendous palaeogeographic changes across the Early-Middle Triassic boundary in the Luoping area. The marine ecosystems after end-Permian mass extinction transformed from the turbulent in the Early Triassic to stable volatility in the Middle Triassic, so that the ecological environment of the earth system to reconstruction and rehabilitation. According to the distribution of the volcanic ash layer in the large area during this period, the volcanic eruption must have a large scale and degree, indicating a regional and even global catastrophic event, and consequently caused the changes in the earth’s atmosphere and hydrosphere, and led to climate and environmental emergencies to biological death.
or extinction. However, the subsequent reconstruction of the ecosystem is more important, as shown by the full record of the evolution of the major ecosystem process in the marine strata. The Middle Triassic Luoping biota, characteristic of marine reptiles as top predators, showing typical structure of Cenozoic marine ecosystem (Tong and Yin, 2009), represents the best example of full rebuilding of ecosystem (Solé et al., 2002; Hu et al., 2011).

**Key words**: Early-Middle Triassic; volcanic-ash; green-bean rock; Luoping; biological recovery

**References**


