



Short Communications (Research Advances)

Discovery of tuff in Wujiaping Formation of Upper Permian in the northern Sichuan Basin: Implications for the termination of Emeishan Large Igneous Province

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1. Objective

The Emeishan basalts is located in southwest China and northern Vietnam, covering an area of 2.5×10^5 km² (Zhong YT et al., 2014), which is the first widely recognized large igneous province (LIP) in China (Zhang ZS, 2009). The Emeishan LIP has attracted a numbers of scholars for the reason that the LIP may play a significant role in the evolution of environment and climate. Yang JH et al., (2018) pointed out that the weathering of the Emeishan basalts consumed carbon dioxide and caused a decrease in the climate of the early Wuchiapingian. However, the duration and termination of the Emeishan basalts eruption remain in doubt. This paper reports a new discovery of tuffaceous in the middle part of the Upper Permian Wujiaping Formation from the northern margin of the Sichuan Basin, applying of LA-ICP-MS to obtain zircon U-Pb ages of tuffaceous and to constrain the lasted eruption timing of Emeishan LIP.

2. Methods

The tuffaceous samples were collected from Wangchang, Guangyuan City (Fig. 1) in the north Sichuan Basin. The tuffaceous is grayish-white and appears as a thin layer sandwiched between thin to medium layers of limestone of the Wujiaping Formation. Rock crushing and zircon separation were performed at Langfang Yantuo Geological Service Co., Ltd, Langfang, Hebei. Cathodoluminescence (CL) and laser ablation inductively coupled plasma-mass spectrometry (LA-ICP-MS) zircon U-Pb dating were carried out at the Wuhan Sample Solution Analytical Technology

Co., Ltd, Wuhan, Hubei.

3. Results

CL images show that zircon in the Wujiaping Formation tuffaceous from the Wangchang section is dominated by semi-automorphic to automorphic columns, the grain size is mainly concentrated in 80–120 μm and aspect ratios between 3 : 1 and 1.5 : 1, and most of the zircon grains are intact zircon grains indicative of short transport distance or drift, in addition to which typical magmatic zircon features can be observed, with typical oscillatory ring zoning characteristics. Twenty-two zircons were selected for the LA-ICP-MS U-Pb dating (Supplementary Table S1), excluding ten analytical spots with concordance lower than 95% (Fig. 2), the remaining twelve spots yielding a weighted mean ²⁰⁶Pb/²³⁸U age of 258.06±1.01 Ma (1σ, MSWD=0.71, n=12), which obviously later than the termination time (259.1 ± 0.5 Ma) of the Emeishan flood basalts (Zhong YT et al., 2014). The result suggests that the eruption of the Emeishan volcanism lasted at least until the Middle Wuchiapingian. Therefore, when discussing the climate evolution in South China and even the Paleo-Tethys during the early to middle Wuchiapingian, the Emeishan volcanism cannot be ignored as an influence factor.

4. Conclusion

The tuff of the Wujiaping Formation from the northern Sichuan Basin yielding a weighted mean ²⁰⁶Pb/²³⁸U age of 258.06±1.01 Ma, significantly later than the main eruption period of Emeishan volcanism, indicating the termination of the Emeishan LIP was at least until the Middle Wuchiapingian. Therefore, the contribution of Emeishan LIP to global climate may have persisted up to the Middle Wuchiapingian.

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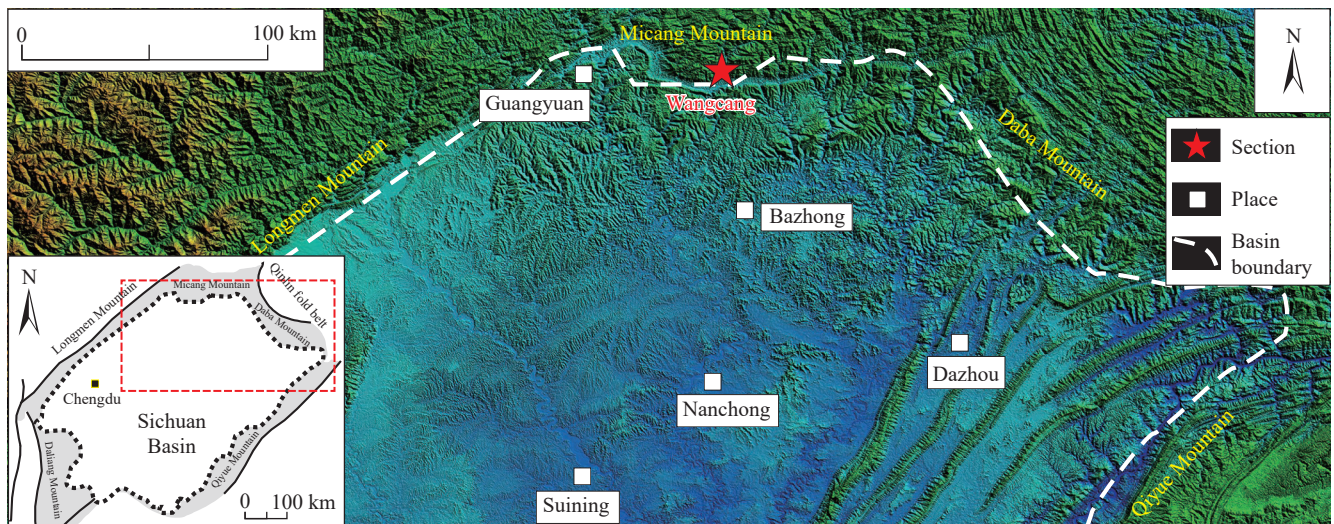


Fig. 1. Section location map in the northern Sichuan Basin.

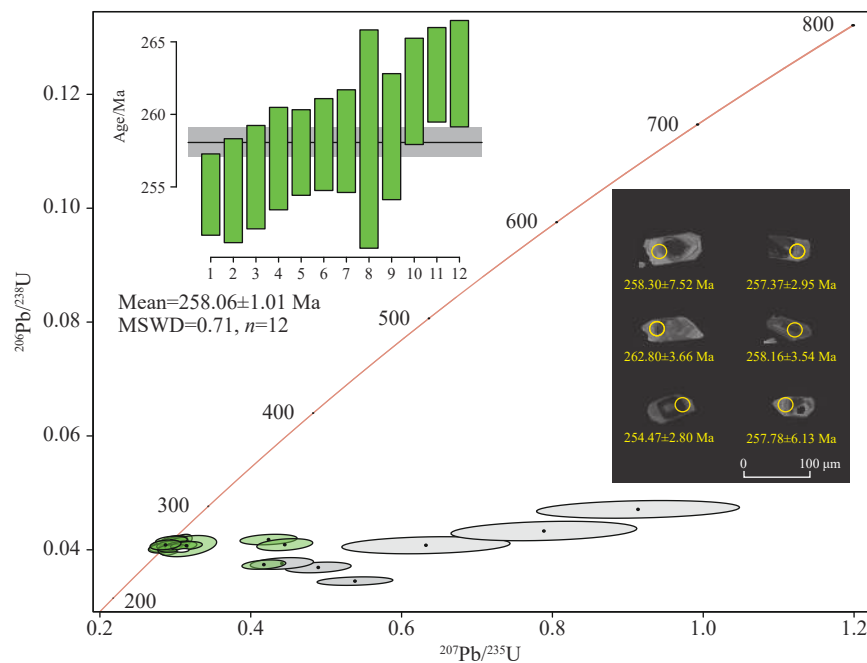


Fig. 2. Zircon U-Pb Concordia diagram and representative zircons from the tuffaceous of Wangcang section.

CRedit authorship contribution statement

Yu Yu carried out the experiment and wrote the manuscript. Xiao-liang Deng collected the samples and supervised the findings of this work. All authors discussed the results and contributed to the final manuscript.

Declaration of competing interest

The authors declare no conflicts of interest.

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Supplementary dataset

Supplementary data (Supplementary Table S1) to this article can be found online at doi: [10.31035/cg2023142](https://doi.org/10.31035/cg2023142).

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