Temporal and spatial heterogeneity of the Ailaoshan–Song Ma–Song Chay ophiolitic mélange, and its significance on the evolution of Paleo-Tethys

Wei Lin[1,2]*, Fei Liu[1,2,3], Yin Wang[1,2], Lingtong Meng[1,2], Michel Faure[4], Yang Chu[1,2], Vuong Van Nguyen[5], Qinying Wu[1,2], Wei We[1,2], Hoai Luong Thi Thu[5], Tich Van Vu[5]

[1] *State Key Laboratory of Lithospheric Evolution, Institute of Geology and Geophysics, Innovation Academy of Earth Science, Chinese Academy of Sciences, Beijing 100029, China*
[2] *College of Earth and Planetary Sciences, University of Chinese Academy of Sciences, Beijing 100049, China*
[3] *Wuhan Center of China Geological Survey (Central South China Innovation Center for Geosciences), Wuhan 430205, China*
[4] *Institut des Sciences de la Terre d'Orléans, UMR CNRS 7327, Université d'Orléans, 45067 Orléans Cedex 2, France*
[5] *University of Science, Vietnam National University, Hanoi, Viet Nam*
* *linwei@mail.iggcas.ac.cn*

The ophiolite is the direct evidence to restore the oceanic evolution, and it is used to identify the convergence boundary of the plates. Compared with ophiolite, ophiolitic mélange, especially its matrix, contains more information about the evolution of ocean. The evolution of eastern Paleo-Tethys, between the South China and Indochina blocks, recorded the whole process of rifting from Gondwana and their northward migration and convergence. To understand the tectonic implications from matrix of ophiolitic mélange, the Mesozoic Paleo-Tethys Ailaoshan–Song Ma–Song Chay suture zone located in the North Vietnam–Southeast Yunnan region acts as an ideal study area. Based on the structural geology, we reviewed previous zircon U-Pb dating and Lu-Hf isotopic analyses on the detrital zircon from the Ailaoshan–Song Ma–Song

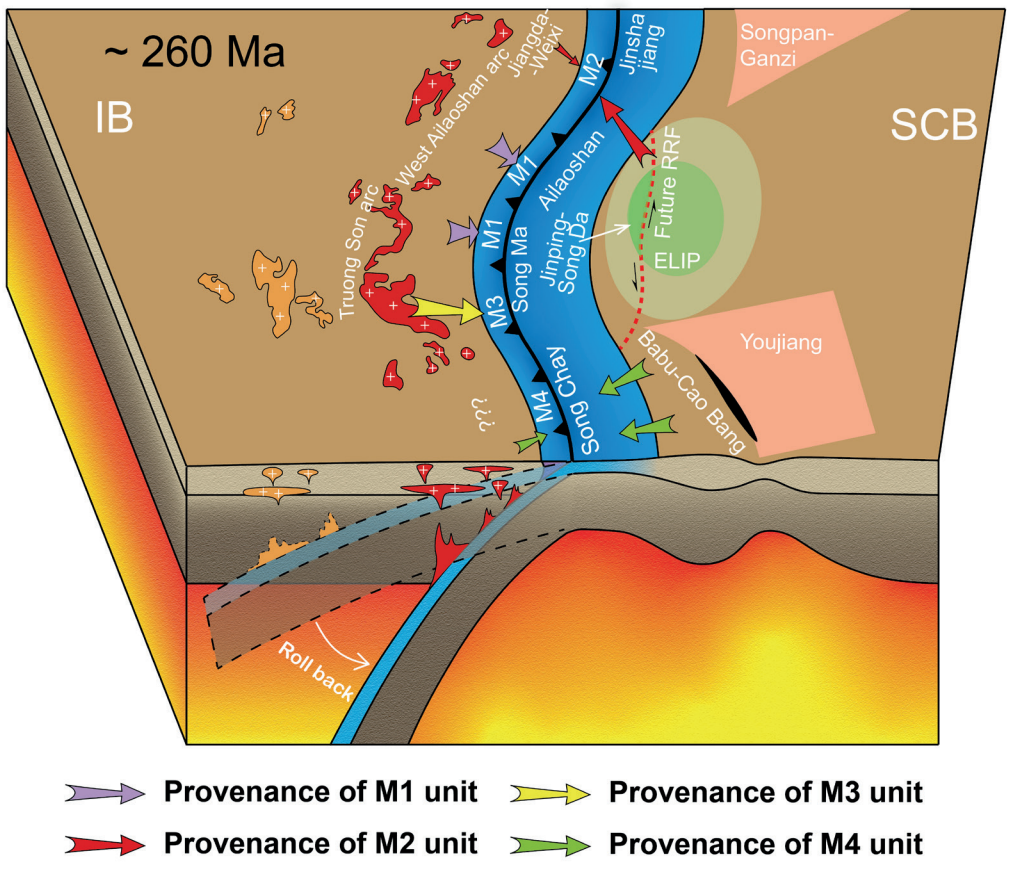

Fig. 1. Palaeogeographic reconstruction of SCB and IB at 260 Ma. Arrow indicated palaeo-currents

eISSN 2353-3641 | ISSN 1731-0830

Chay ophiolitic mélange. Accordingly, we subdivide the matrix of these ophiolitic mélange into four parts (M1, M2, M3, and M4; Fig. 1). M1 is mainly located in the middle segment of the Ailaoshan–Song Ma belt. It shows age peaks of 440 Ma and 960 Ma with $\varepsilon_{Hf}(t)$ values of −19.6 ~ +10.3. M2 is mainly located in the NW segment of the Ailaoshan–Song Ma belt, showing a dominant age peak of ~260 Ma. Particularly, it has $\varepsilon_{Hf}(t)$ values of −28.9 ~ +8.1. M3 is mainly located in the SE segment of the Ailaoshan–Song Ma belt, showing the peaks at ~250 Ma, 440 Ma, and 960 Ma with $\varepsilon_{Hf}(t)$ values of −21.9 ~ +10.1. M4 is mainly located in the Song Chay belt, showing the peaks at ~310 Ma, 470 Ma, 610 Ma, 770 Ma, and 965 Ma with $\varepsilon_{Hf}(t)$ values of −28.2 ~ +10.8. The geochronological data of the detrital zircon from the matrix of the Ailaoshan–Song Ma–Song Chay ophiolitic mélange zone, documents a temporal heterogeneity between the M1, M2, M3, and M4 units, which formed at 310–270 Ma, 265–250 Ma, 245–240 Ma, and 310–255 Ma, respectively. The different components and provenances of each unit reflect a strike-parallel heterogeneity (Fig. 1). The M1 unit was mainly sourced from the Paleozoic sedimentary rocks of the Indochina Block (IB). The main provenance for the M2 unit is Emeishan Large Igneous Province (ELIP). The magmatic arc developed in the IB provided the materials for the M3 unit, and the detrital materials of the M4 were mainly sourced from the South China Block (SCB) (Fig. 1). The Cenozoic strike-slip deformation led to an inverted geometry of the M1, M2, and M3 units, accounting for a strike-perpendicular heterogeneity straight to the strike of the orogenic belt. The temporal, strike-parallel, and strike-perpendicular heterogeneity help us to decipher the tempo-spatial evolution of the Paleo-Tethys. The M1, M2, M3, and M4 units contain information from different evolutionary stages, likely recording the comprehensive history of the ancient oceanic basin. Importantly, our results demonstrate that both the active continental margin of the IB and the passive continental margin of the SCB acted as provenance sources that supplied significant amount of detrital material in the ophiolitic mélange matrix, indicating that the Paleo-Tethys Ocean was a "narrow" or "limited" ocean rather than the archipelagic ocean proposed before.