The Early Neogene decelerated denudation of the Red River-Ailao Shan shear zone, SE Asia: new sedimentary and paleomagnetic constraints on the Middle Miocene deposits

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The current tectonic framework in Southeast Asia is considerably recognized as a direct resultant of the continental collision between Indian and Eurasian since ~50 Ma (Rowley, 1996; Dupont-Nivet *et al.*, 2010). The collision led to the comprehensive orogeny along the Himalayan, crustal thickening in internal of the Tibetan plateau (TP) and lateral extrusion of lithospheric material along a series of major strike-slip fault belts surrounding the TP (Molnar and Tapponnier, 1975; Tapponnier *et al.*, 1986, 1990; Wang *et al.*, 1997, 1998; Burchfiel and Wang, 2003). In recent couple of decade, as a significant tectonic boundary of the Indochina block, lots of tectonic, thermo-chronological and paleomagnetic studies have been conducted on the Red River-Ailao Shan shear zone (RRAS) for the purpose of constructing the tectonic evolution pattern of the southeast TP during the Cenozoic (Schärer *et al.*, 1990, 1994; Harrison *et al.*, 1992, 1996; Leloup *et al.*, 1995, 2001; Schoenbohm et al., 2006a, 2006b; Sato et al., 2007; Searle et al., 2010).

The RRAS linearly founded by four metamorphic complexes in northwest-southeast direction, including Xuelong Shan, Diancang Shan, Ailao Shan in China and Day Nui Con Voi in Vietnam, extends over 1500 km from the southeast TP to the South China Sea (Fig. 1). The current Red River fault (RRF) is composed of two branches: 1) inactive Range-front fault, bounding the Ailao Shan metamorphic belt on the northeast, is characterized by normal faulting in Late Oligocene to Early Miocene, and 2) active Mid-valley fault, extending along the current Red River valley, is dominated by right-lateral strike slip after the Late Pliocene. Numerous researches pointed out that the RRAS undergone 1) left shearing and sny-kinematic metamorphism, and denudation accommodated by the Range-front fault in the Late Oligocene-Early Miocene, and 2) right-lateral strike slip activity along the Mid-valley fault after the Late Pliocene (Harrison *et al.*, 1992, 1996). But, we still do not clearly know what has happened on the RRAS in interval between these two tectonic events. We here show our newest sedimentary and paleomagnetic evidence from a set of the Late Oligocene-Early Miocene deposits distributed along the Red River valley in the northeast of the Ailao Shan metamorphic belt, and exert reliable constraints on the tectonic evolution of the RRAS during the Early Neogene.

The sampling section is located about 34 km northwest of Yuanjiang County, SE China. This section spans a thickness of more than 700 m and is mainly composed of yellow or brown silty mudstone or mudstone in the upper part, purple mudstone interbedded with angular debris or conglomerates layers in the central part and medium-coarse sandstone interbedded with in the lower part. The whole Cenozoic strata, dipping to SW about 30ºin general, uncomformably rested on the underlying Upper Triassic mudstone and sandstone in northeast and contacted with Ailao Shan metamorphic rocks along the Range-front fault in the southwest. The gradual lithic facies change of the sequence from bottom to top implies the sedimentary environment transited from fluvial to lacustrine or fan-delta facies, which further indicates the deceleration of local sedimentation.

We systematically collected 417 samples and conducted paleomagnetic analysis at the Paleomagnetism and Geochronology Laboratory in the Institute of Geology and Geophysics, Chinese Academy of Sciences. Finally, a linear extrapolation of the average sedimentation rate yielded an age of 8.5 and ~12 Ma for the top and base of the section, respectively. Consistent with the sedimentary analysis, paleomagnetic data also indicate that the normal faulting along the Range-front fault and the rapid denudation of the RRAS decelerated from ~12 Ma to 8.5 Ma at least. Therefore, we proposed that there might exist a tectonic "quiescence epoch" on the RRAS in the Middle Miocene.

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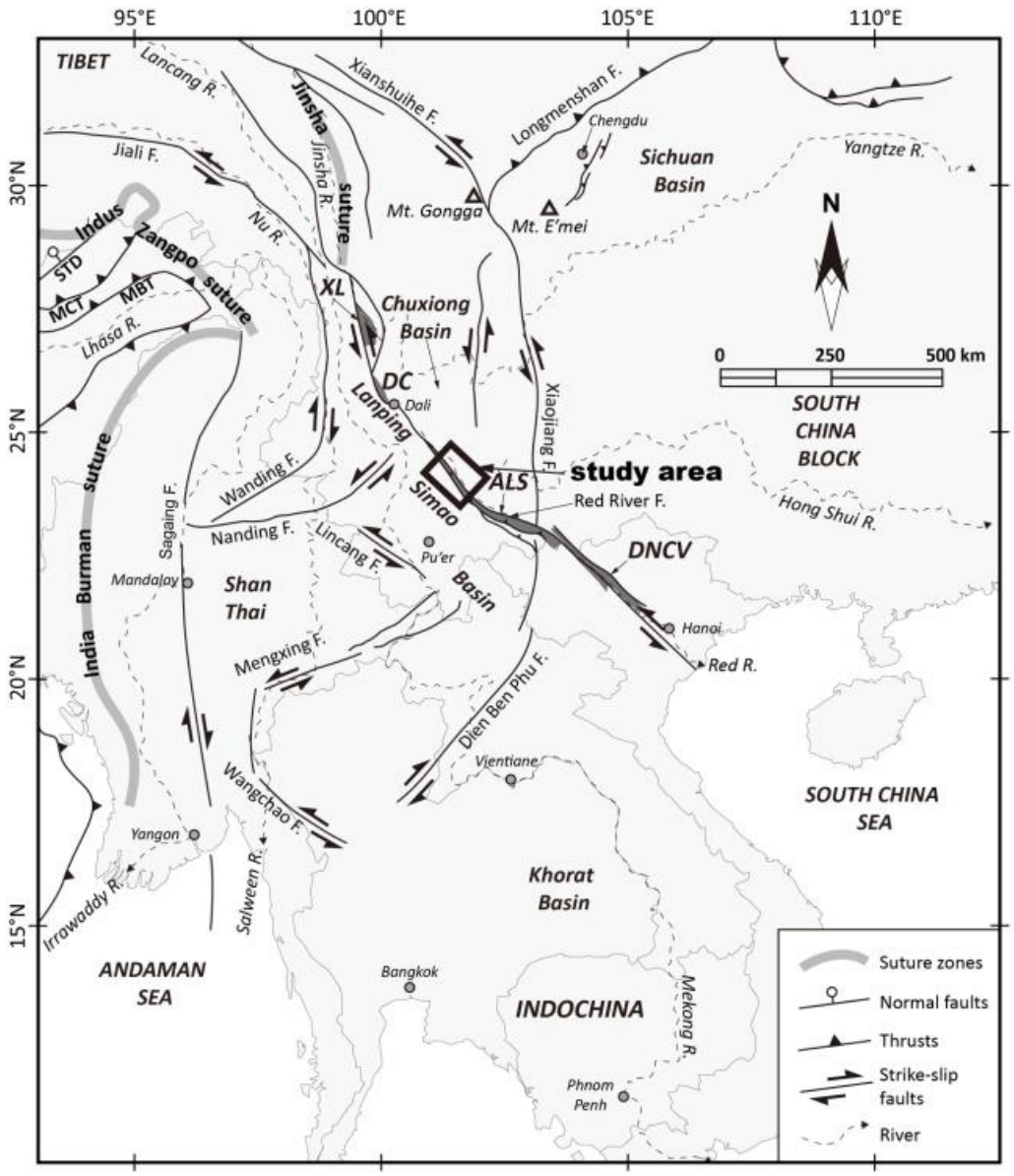

Figure 1. General tectonic sketch map of SE Asia. Major sutures and faults have shown in this figure. The black bold box shows the location of the paleomagnetic section in this study. STD, South Tibetan Detachment; MCT, Main Central Thrust; MBT, Main Boundary Thrust; XL, Xuelong Shan; DC, Diancang Shan; ALS, Ailao Shan; DNCV, Day Nui Con Voi.

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