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Insight of the reactivated Dien Bien Phu fault, northwest Vietnam: Implication of the kinematics in north Indochina

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As one of the most conspicuous fault systems in the Indochina, the NNE-trending Dien Bien Phu fault zone extends over a distance of 150 km from Yunnan, China through the NW Vietnam into Laos and may dextrally displaces the Paleozoic-Triassic granitoids and Song Ma suture, performing a great geological discontinuity. Detailed active fault mapping, compiled from stereographic aerial photos, topographic maps, ASTER satellite imageries, and field reconnaissance, along the Dien Bien Phu fault reveals information about the fault geometry, the magnitude and distribution of displacement along the fault, and the relationship between river offset and activity of fault. The modern Dien Bien Phu fault is complex, including step-overs and branches, and is dominated by left-lateral strike-slip displacement. Numerous multiple offsets along the fault can be detected and reconstructed, and the largest sinistral displacement on the Dien Bien Phu fault is probably ca. 12.5 km. Since sinistral motion is likely to have initiated around 5 Ma, the most reasonable Pliocene to present-day average slip rate on the Dien Bien Phu fault is at an order of 2.5 mm/yr. There are several basins developed along the fault and the strongest evidence for an extensional component of displacement is along the southern part of the fault where the basin developed by a half graben with growing strata. Based on the combined Global Positioning System velocity fields observed from northwest Vietnam and south China, about 2 to 3 mm/yr left-lateral slip is measured across the Dien Bien Phu fault, implying the order of $\sim$10 mm/yr left-lateral slip of the Xianshuihe-Xiaojang fault is transferred southward to Dien Bien Phu fault but with an abrupt decrease in magnitude. Further the western block of Dien Bien Phu fault represents more significant E-W extensional behavior as non-rigid block with internal deformation. Results of this study suggest the modern Dien Bien Phu fault performs as a reactivated fault, yet different slip sense, and acts as an eastern boundary of the crustal deformation in north Indochina. However, the present-day kinematics in north Indochina may be dominated by E-W extension and be accommodated by internal distributed deformation different from the crustal fragment defined by Xianshuihe-Xiaojang fault with a clockwise rotating around the eastern Himalayan syntaxis.