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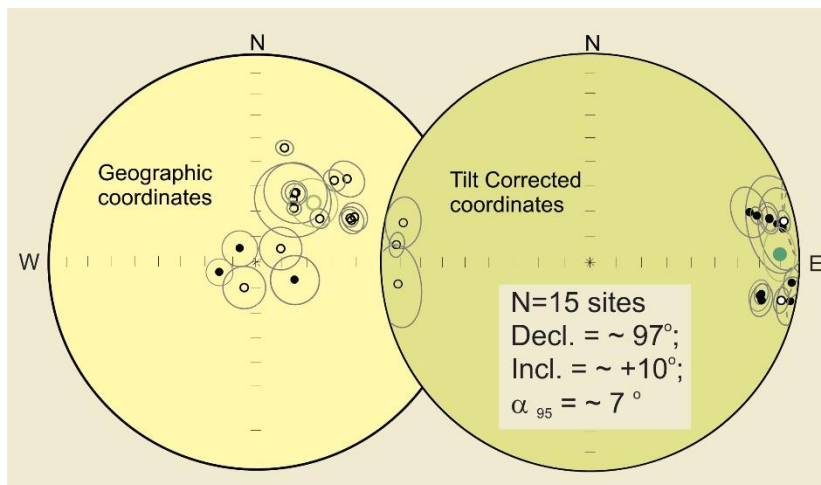
New Paleomagnetic data from Upper Permian and Lower Triassic Volcanic Sequences from Northwest Vietnam and Their Bearing on the Accretion History of Southeast Asia

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New paleomagnetic data from Upper Permian to Lower Triassic volcanic rocks sampled in northwest Vietnam provide more quantitative constraints on the paleogeographic setting of crustal elements that comprise the Song Da Terrane, east of the Song Ma suture, between the South China block (SCB) and north Indochina. These include results from 12 sites (125 samples) from basalts of the Vien Nam Formation, exposed at Hoa Binh Dam; eight sites (74 samples) from basalts of the Cam Thuy Formation near Thuan Chau; and 19 sites (198 samples) from andesites and basalts of the Lower Triassic Vien Nam Formation near Quynh Nhai. Our collection is limited by the quality of exposures (mainly road cuts) and quantity of independent flows. Most sites yield interpretable magnetizations in progressive demagnetization, and the response implies that characteristic remanent magnetization (ChRM) components are carried by low-titanium magnetite or hematite, or a combination of both; these are isolated from secondary components. Rock magnetic data and petrography support the retention of an early-acquired



thermoremanent magnetization in most sites. The Vien Nam Formation mafic volcanic rocks yield a grand mean, in geographic coordinates, of $D=33.8^\circ$, $I=-28.4^\circ$ ($\alpha_{95} = 9.5^\circ$, $k=30.3$, $N=9$ accepted sites), and a pole position at $\text{Lat}=41.1\text{N}$, $\text{Long}=239.8\text{E}$ and

a paleolatitude at $\sim 15^\circ\text{S}$ during the Late Permian to Early Triassic. Permian basalts of the Cam

Thuy Formation provide a grand mean, corrected for structural tilt, of $D=216.1^\circ$, $I=+10.5^\circ$, $\alpha_{95}=8.9^\circ$, $k=107.8$, and $N=4$, with a pole position at $\text{Lat}=45.6\text{N}$, $\text{Long}=226.8\text{E}$. Volcanic rocks at the Quynh Nhai locality likely yield the most robust paleofield determination, as the in situ data do not resemble any post-Triassic field directions, the data are of dual polarity and pass a reversal test. The tilt corrected grand mean (normal polarity) is $D\sim 97^\circ$, $I\sim +10^\circ$, $\alpha_{95}\sim 7^\circ$, $k\sim 30$, $N=15$, and this in turn yields an inferred paleomagnetic pole at $\text{Lat}=35.7\text{N}$, $\text{Long}=217.4\text{E}$, and a paleolatitude of $\sim 5^\circ\text{N}$ for the late Permian. Compared with the Late Permian-Early Triassic SCB

Figure 1. Equal area projection of preliminary paleomagnetic data from Lower Triassic basalt flows, Viennam Fm., Quynh Nhai District, northwest Vietnam

apparent polar wander path, the data show that volcanic crustal elements of northwest Vietnam, east of the Song Ma suture zone, have been close to, but not unequivocally a coherent part of the SCB, since the Late Permian. Development of the parallel NW-SE striking Song Ma and Song Chay orogenic belts did not involve the closure of wide ($> 500\text{ km}$) ocean basins.

