2.9, 2.36, and 1.96 Ga zircons in orthogneisis south of the Red River shear zone in Viet Nam: Evidence from SHRIMP U-Pb dating and tectonothermal implications

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Abstract: Orthogneissic rocks coexisting with migmatites and containing small amphibolite lenses are exposed in the center of the metamorphic belt which runs parallel to the Day Nui Con Voi-Red River shear zone in northern Viet Nam. The orthogneiss complex has given some radiogenic dates of Early Proterozoic and Late Archean, which are the oldest ages ever registered for the Southeast Asian continent. Zircon grains separated from three samples of the orthogneiss complex have been dated to establish the protolith age and the timing of high-grade tectonothermal events in the complex. Sixty-five SHRIMP U-Th-Pb analyses of these zircons define three age groups of 2.84-2.91, 2.36, and 1.96 Ga. The age groups correspond to three periods of zircon generation. The oldest ?2.9 Ga cores indicate a minimum age for the protolith of the orthogneiss complex. Two younger generations (including ?2.36 Ga outer-cores and ?1.96 Ga rims) probably grew during later high-grade tectono-metamorphic events, which were previously suggested by K-Ar and $^{40}Ar/^{39}Ar$ cooling ages of ?2.0 Ga for synkinematic hornblendes. An early thermal history of the orthogneiss complex has been constrained, including a primary magma-crystallization stage starting at ?2.9 Ga, followed by two Early Proterozoic (?2.36 and ?1.96 Ga) high-grade tectonothermal events. The ca. 2.9 Ga protolith age of the orthogneiss complex documented in this study provides new convincing evidence for the presence of Archean rocks in Indochina, and clearly indicates that the crustal evolution of northern Viet Nam started as early as Late Archean time.

Author Keywords: Archean; Indochina; Red River shear zone; SHRIMP U-Pb dating; Viet Nam; Zircon geochronology

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