

Tectono-metamorphic evolution during Asian continental growth

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In E- and SE-Asia, there are at least six micro-continental blocks of North China, South China, Indochina, Shanthai, Sibumasu and West Burma from NE to SW. Geological Research program to realize the tectono-metamorphic processes in continental collision zones of E- and SE-Asia has been done for the last decade. During the processes, the following new evidences were identified especially in Vietnam and related areas; 1) findings of UHT (~1000 C) pelitic granulites, UHP (~40 kbar) Dia-bearing eclogitic rocks and HP/MT gneisses from the Kontum Massif, 2) LT eclogite and HP granulite from the Song Ma suture zone, and 3) UHT/extremely-HP aluminous metamorphic rocks from the Red River zone. Estimated P-T conditions and reaction textures from these rocks delineate a characteristic clockwise P-T-t path for each other, which generally represent a collision zone metamorphism (Osanai et al., 2004; Nakano et al., 2008, 2009, 2013).

A simultaneous collision metamorphism throughout Vietnam should have taken place during the continental collision between Indochina and South China blocks, which led to the formation of the Trans Vietnam Orogenic Belt (TVOB: Osanai et al., 2008). Northern extension of the TVOB reaches up to Cangshan Mountains in Yunnan Province, near Dali, through the Ailaoshan terrane in China and tapers off caused by the final Indian sub-continent collision and large crustal deformation during Eocene time. Permo-Triassic metamorphic and granitic rocks in SW Borneo are considered as the southern extension of the TVOB, which would be separated by the South China Sea opening during Cenozoic. Pre-collisional low-grade metamorphic and plutonic rocks of Devonian age (400~Ma) also distribute in the TVOB as large blocks surrounded by shear zones.

The metamorphic rocks from the Nujiang-Kachin area in Yunnan Province and Myanmar, and the Inthanon-Hua Hin area in Thailand indicate low-pressure metamorphic field gradients with low-pressure clockwise P-T evolution processes, which show a different evolution process to the TVOB (Yonemura et al., 2013). They situate in the continental collision boundary between the Shanthai and Sibumasu blocks. Newly determined LA-ICP-MS dating indicates a middle Triassic (220-200 Ma) collision metamorphism for the Nujiang-Kachin and Inthanon-Hua Hin areas. The LTHP (blueschist) and amphibolite-facies metamorphic rocks from the collision zone between Indochina and Shanthai blocks, which are Cangshan-Simao area in Yunnan Province and Rayong area in Thailand, also show a Permo-Triassic metamorphic age and a clockwise P-T evolution.

The metamorphic rocks from the Mongolian Altai Mountains in the Central Asian Orogenic Belt (CAOB: Sengor et al., 1993) show Devonian to Early Permian (ca. 350 Ma and ca. 260 Ma) collision metamorphic event. On the other hand the rocks from the Lake Zone in west-central Mongolia indicate Cambrian (ca. 500 Ma) metamorphism. Therefore the multiple collision zone metamorphism and related orogen to form the Asian Continent would have taken place from N (southern margin of Siberian Craton) to S and SW, and the collided blocks in SE-Asia were finally deformed and converged in the Sanjiang region by the Indian sub-continent collision at Eocene.

Keywords: Asian continent, micro-continent collision, collision metamorphism, extreme metamorphism, zircon U-Pb age