Mesozoic doming extensional tectonics of Wugongshan, South China*

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Abstract Wugongshan in Jiangxi Province, China was a Mesozoic granitic dome-type extensional tectonics that is composed of metamorphic core complexes, ductile and brittle shear-deformed zones distributed around Mesozoic granites. Within it, the foliation defines an E-W elliptical shape and bears S-N stretching lineations. The axial part is located in Hongjiang-Wanlongshan area and occupied by oriented granites with coaxial symmetric shear fabrics. The southern and northern flanks, including rocks in the Anfu Basin to the south and the Pingxiang Basin to the north, display top-to-south and top-to-north motions, respectively. The ductile and brittle structures indicate a geometric and kinematic consistency. The extensional tectonics is developed on a Caledonian metamorphic basement and is unconformably covered by Late Cretaceous red beds. Isotopic ages on muscovite, biotite and whole rock by $^{40}$Ar-$^{39}$Ar, K-Ar and Rb-Sr suggest that the Wugongshan extensional doming began from the Triassic and ended in the Late Cretaceous. A geodynamic model is discussed.

Keywords: extensional tectonics, granitic dome, kinematic analysis, Mesozoic, Wugongshan.

From the late 1970s, important discoveries of the Cordilleran metamorphic core complexes¹ and the low-angle normal faults in the Basin and Range province² have promoted the studies on ductile extension tectonics within orogenic belts on a global scale; some typical extension tectonics related to crustal thinning event during orogeny or post-orogeny were reported in Northern America³, Europe⁴, Sino-Mongolian boundary area⁵ and Yunnengshan (Beijing)⁶. In South China, Wugongshan geology has attracted many researchers since the 1960s due to its distinctive rock types and structural styles. Some authors⁷ called it migmatite field; Tang and Wang proposed a compression-extension composite model⁸. Since 1991, we have been researching the Wugongshan tectonics by means of tectonic geometry, petrology, kinematics and geochronology, and found that Wugongshan is a typical granitic dome-type extension tectonics within the South China belt.

1 Stratigraphic sequence and geometric feature

1.1 Stratigraphic sequence relative to the extension tectonics

Upper Cretaceous: red coarse clastic rocks, covering unconformably the Triassic and Upper Paleozoic rocks.

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Jurassic-Upper Triassic: red mudstone, sandstone and conglomerate rocks.

Lower Triassic-Permian-Carboniferous: sandstone, shale and carbonatite, which are mainly rocks of the Anfu and the Pingxiang basins and were ductily sheared near the granitic dome.

Upper Devonian: quartz sandstone and quartzite, unconformably overlying the metamorphosed Lower Paleozoic rocks. To the northern side of Wugongshan, sandstones were commonly mylonitized.

Ordovician and Cambrian: phyllite volcanic turbidite and graywacke.

Sinian: schistose siliceous rocks bearing iron beds, graywacke and tuff.

Upper Proterozoic (Shenshan Group): schistose volcanic clastic rock with intercalations of basalt, spilite and ultramafic blocks.

1.2 Geometric feature

Wugongshan is located in the middle segment\(^{[9]}\) of the South China Early Paleozoic fold belt and occupies an elliptical shape regime with an E-W-trending long axis of 100 km, from Pingxiang to Xinyu in E-W direction and from Yichun to Anfu in N-S direction (fig. 1). Its axial part is located in the Hongjiang-Wanlongshan zone and is occupied by oriented Mesozoic granites with margins of gneiss granite. Mylonitized phyllites, schists, orthogneisses and small migmatitic dikes are asymmetrically distributed to both sides. The Pingxiang and the Anfu Late Paleozoic-Mesozoic basins occur in the northern and the southern parts, respectively (figure 1).

1.3 Spatial evolution of metamorphism and deformation

Within Wugongshan, metamorphism and deformation gradually rose from the margin to the centre (fig. 2), and several metamorphosed zones can be defined by typical minerals of sericite, biotite, garnet and sillimanite. The disthene and sillimanite were also found in the western and the southeastern extremes. The feldspar mineral lineation and softening deformation crystal mush structures\(^{[10]}\) are common in the porphyritic granite in the axial zone; the flatten and elongated quartz, newly formed muscovite and garnet grains develop parallel to the stretching lineation in the Devonian quartzite that occur along the margins of metamorphic core complexes. The recrystallized calcite, newly formed muscovite grains and stretching lineations were found in the Permian-Carboniferous limestone and marlomite rocks in the Wugongshan piedmont. The rocks within Anfu and Pingxiang basins are characterised by brittle deformation. The fine leucogranite dikes intruded into metamorphic rocks and Mesozoic granitoids and were intrusive bodies during the late doming.

2 Kinematic analysis

2.1 Component feature

The Wugongshan extension tectonics has three-layer configuration that is composed of brittle deformed layer, lower greenschist facies flow layer, amphibolite facies ductile shear layer and oriented Mesozoic granite (fig. 3). Large detachment fault developed mainly along a sliding plan between brittle and ductile layers, and is a listric normal fault series. The northern branch is the northern Xinyu-southern Yichun fault, the southern branch being the southern Shanzhuang-northern Yantian fault (fig. 1). The upper detachment side is composed of brittle S-N-trending normal faults and fractured Late Paleozoic-Mesozoic limestone and sandstone. In the Pingxiang basin, submeridian slickensides and steps on N-slipping fault planes indicate a top-to-the north