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Appalachian-style multi-terrane Wilson cycle model for the assembly of South China

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Lin et al. (2018) propose a model of Proterozoic-Mesozoic evolution of the South China block (SCB) involving West and East Cathaysia separated by the Northwest Fujian fault. They assume a northeastward translation of East Cathaysia after an Early Paleozoic orogeny due to the collision of West Cathaysia with a “proposed terrane”. This model ignores most of the available, robust field data.

Early Paleozoic Sedimentation

Several works document the sedimentological transition from Yangtze to Cathaysia (e.g., Wang et al., 2010; Shu et al., 2014, 2015). Overlying the several-kilometer-thick silicoclastic series of the Neoproterozoic Nanhua rift, the Cambrian-Ordovician deposits show, from northwest to southeast, a progressive facies evolution within a single southeastward deepening basin developed throughout Cathaysia. Though deposited in a sea, the Early Paleozoic formations were not floored by oceanic crust but by a thinned continental crust, as shown also by the bimodal alkaline magmatism.

The Early Paleozoic Orogeny (EPO)

The EPO received a great deal of attention in the past decade (e.g., Faure et al., 2009; Charvet et al., 2010; Li et al., 2010; Wang et al., 2013; Shu et al., 2014, 2015; Xu et al., 2016). Northwest-verging folds occur to the north of the Jiangshan-Shaoxing fault. South of it, structural studies document the unicity of Cathaysia with a progressive decrease of deformation and metamorphism from northwest to southeast. The synmetamorphic north-south stretching lineation and related kinematics, and fold vergence observed in the pre-Devonian rocks, show everywhere a consistent top-to-the-southeast sense of shear. As usual in orogens, the lower plate is the most buried one, with ductile shearing, and metamorphism. The pre-Devonian features of the SCB can easily be explained by this scheme. Thus the geodynamic sketch proposed in Lin et al.'s figure 6D for the 460–420 Ma period is totally at odds with field data. The Chen Cai metagabbro is not an ophiolitic relic, but a Neoproterozoic intraplate rock metamorphosed at ca 450 Ma. This mafic restite, enclosed in Paleozoic migmatites, is not a block-in-matrix sequence of an accretionary complex. An intracontinental tectonics is widely acknowledged for the EPO (cf. the above references). A collisional model requiring arc magmatism, ophiolitic mélange, and high-pressure metamorphism is not supported by any data. In the present knowledge, the closure of an intracontinental rift is the model that considers all the geological features of the SCB.

The Northwest Fujian Fault (NWFF)

The NWFF is postulated as a major boundary between West and East Cathaysia. Its location, kinematics, amount of displacement, and timing are not provided by Lin et al. The NWFF, if postdating the Triassic orogeny, is likely Mesozoic. Northeast-southwest–striking faults are widespread in southeast China, but wrenching has been widely overestimated. For instance, the sinistral offset was only a few kilometers in the Changle-Nan’ao belt (Wei et al. 2015). The similarity of Paleozoic series exposed on both sides of the NWFF invalidates a large displacement. Thus, an offset of hundreds of kilometers is unlikely.

The Middle Triassic Orogeny

Triassic tectonics is well documented in the SCB (e.g., Faure et al., 2016, and references therein). Again, Lin et al. ignore the recent literature. In Cathaysia, the Triassic event is represented by scattered plutons and north- or northwest-verging folds. The authors argue that “an Indosinian aged orogen was situated to the south”. This assumption, already proposed (Faure et al., 2016), is likely, but nothing supports the

existence of Late Paleozoic ophiolites in southeast China. The Late Paleozoic rifting (Lin et al.'s figure 6E) does not comply with data. The entire Cathaysia was a single continent.

Terrane PT

In their model, Lin et al. invoke a “proposed terrane” (PT) that would be the southern upper plate of their collisional scenario, and “moved away after the orogeny” before amalgamation of East and West Cathaysia. The PT is a speculation required by the model but not documented. Such reasoning does not satisfy the scientific method in which a model must explain facts, and not the opposite. The PT assumption appears as an ad hoc explanation to set up a model based on missing facts.

In conclusion, the geology of South China is still incompletely understood, but any new model should fully take into account the existing background knowledge. It is therefore unfortunate that Lin et al. did not make use of all of the available data from this interesting area since, by not doing so, their proposed model does not improve the understanding of its complicated tectonic history.

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