Forum Reply

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A positive test for the Greater Tarim Block at the heart of Rodinia: Mega-dextral suturing of supercontinent assembly

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We thank Song and Li (2018) for their Comment on our paper (Wen et al., 2018) concerning the geological evidence in support of our model of Rodinia amalgamation and formation, which places the Greater Tarim Block (GTB) at the heart of the supercontinent. In this Reply, we respond to each aspect of the criticisms of Song and Li and conclude that our hypothesis remains viable at present understanding.

Restoration of the major units of the GTB along the Altyn Fault. Criticism on this aspect of our paper is not warranted. We agree that the major blocks, i.e., the Tarim craton and neighboring Quanji Massif-Alxa block, were offset by the sinistral Altyn fault with total displacement of ~400 km. Our reconstructions (Wen et al., 2018, our figure 3; and also Wen et al., 2017), have actually addressed and restored this offset. We defined the "GTB" as an assemblage of tectonic units in central Asia that have been reworked through Phanerozoic tectonic cycles but still have largely retained their neighboring associations. Song and Li may have misunderstood our figure 1A, showing different tectonic units of the assemblage in present-day coordinates for ease of geographic reference.

Evidence for the Rodinia-forming Tarimian suture. There is a growing body of evidence supporting the occurrence of Rodinia-forming (1.1–0.9 Ga) sutures within the GTB assemblage. First, after restoration of the Altyn fault, a belt of Middle Proterozoic shallow-marine strata can be traced continuously from the Qilian Mountains through the Altun Shan (e.g., Gehrels et al., 2003a). Second, a series of granitic plutons intruding the oceanic assemblages yielded emplacement ages of ca. 920 Ma, and one granitoid intruding eclogite-bearing ultramafic rocks in the region gave a zircon U-Pb age of 928 ± 10 Ma (Gehrels et al., 2003b). The occurrence of coeval granitoids intrusive into the oceanic assemblages and into the ultramafic rocks related to ultrahigh-pressure) metamorphism suggests ocean closure by ca. 930–920 Ma. As shown in our figure 1A (Wen et al., 2018), most of these data define the proposed suture zone. To explain sporadic data plotting outside the suture zone, simplified as depicted, we emphasize that our proposed highly transcurrent collisional geometry is naturally expected to generate strike-slip duplication of early collisional structures in an anastomosing array. Space limitations in our paper prevented us from elaborating on overlapping regions of Proterozoic orogenesis and Paleozoic tectonic reworking. We suggest that tectonic elements of GTB were juxtaposed in Meso-Neoproterozoic time, and subsequent Paleozoic tectonism involved narrow oceanic tracts (perhaps similar in scale to those of the Alpine orogeny overprinting earlier Hercynian sutures in Europe) and minor rearrangement of Asian blocks in ways yet to be fully understood (e.g., Zuza and Yin, 2017).

Multiple reported ages of crystalline bedrock in the TC1 borehole (Guo et al., 2005; Li et al., 2005), which we duly acknowledged in the text of our paper, motivated us to query the suture's westward continuation in central Tarim Basin (Wen et al., 2018, our figure 1A). Granodiorites and diorites from that well show geochemical signatures of calc-alkaline I-type granites related to subduction (Li et al., 2005; Guo et al., 2005), while the wide range of ages (from ca. 1200 to 750 Ma) could be interpreted in two ways: (1) they could represent different tectonic environments (see below) because Guo et al. (2005) identified three different kinds of diorites; or (2) the younger Ar/Ar data might only provide minimum age estimates. We hope that our hypothesis will inspire more work, particularly with improved geochronology from the deeply entombed basement rocks of west-central Tarim Basin.

Where exposed near the margins of Tarim Basin, multiple phases of ≥900 Ma and ca. 820–800 Ma magmatism are shown to be generated in arc/syncollisional and extensional settings, respectively (Wu et al., 2017). The granulite-facies metamorphism between 820 and 790 Ma near Boston Lake (He et al., 2012) may be similarly related to regional metamorphism of a deep-seated protolith assemblage. We noted in our paper that the Aksu blueschists may represent a relic subduction-collision system from the time of Rodinia assembly, or a gulf of the circum-Rodinian ocean if the South China Block is positioned along the northwestern side of Australia (see also Wen et al., 2017). An additional complicating factor is that the Aksu high-pressure metamorphism may be as young as ca. 700 Ma (Zhu et al., 2011), in which case it could have occurred as the GTB broke out of Rodinia (refer to Wen et al., 2017, their figure 10).

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