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Structural Relationships along a Neoarchean Arc-Continent Collision Zone, North China Craton

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The Archean North China Craton is composed of the Western Block, Eastern Block and the intervening Central Orogenic Belt. A 4-10 km wide and 85 km long tectonic mélange belt informally called the Zanhuang tectonic mélange is documented in the Zanhuang Massif of the Central Orogenic Belt, separating the Eastern Block from an Archean arc terrane in the Central Orogenic Belt. The mélange belt contains a structurally complex tectonic mixture of metapelites, metapsammites, marbles and quartzites mixed with exotic tectonic blocks of volcanic, mafic and ultramafic rocks, metabasalts that locally include relict pillow structures, and TTG gneisses. The Zanhuang tectonic mélange marks the suture of an arc-continent collisional zone between the Western Zanhuang Massif in the Central Orogenic Belt and Eastern Block of the North China Craton, and is one of the best-preserved Archean tectonic mélanges in the world. Here we show, using zircon U-Pb dating of various types of blocks from the Zanhuang mélange, that the formation and associated deformation of the Zanhuang mélange occurred in the Neoarchean (circa 2.5 Ga). High-precision (1:20-1:200) litho-structural mapping of three key outcrops reveals details of the internal fabrics and kinematics of the mélange and regional structural relationships along the arc-continent collisional zone. A synthesis of studies on the tectonic evolution of the North China Craton coupled

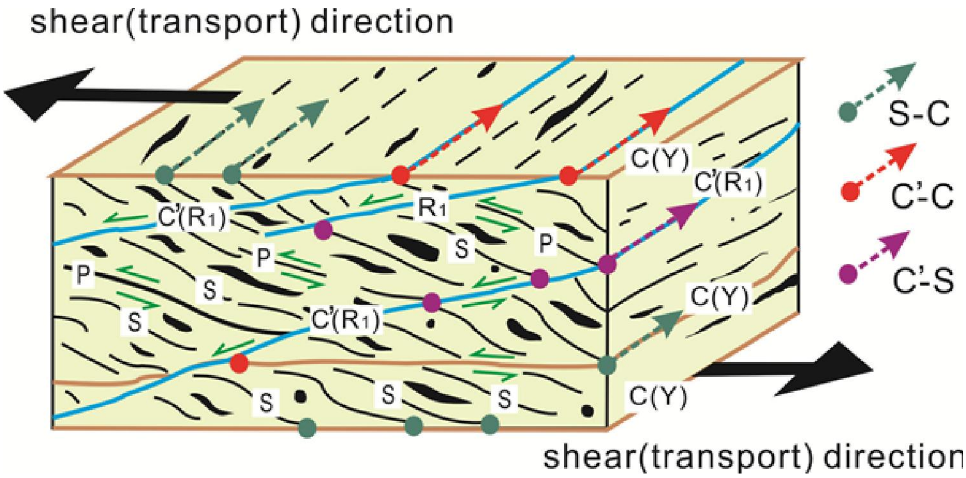

Fig. 1 Three-dimensional kinematic framework of C, S and C' fabrics in mélange (Modified from Kusky and Bradley, 1999). C represents the main shearing plane; S represents preferred shape orientation of clasts or secondary foliation; C' represents extensional shearing plane. Black arrows: direction of shearing or transportation; Blue line: boundary of C'surface; Brown line: boundary of Csurface; Black line: boundary of S surface; Purple dot: intersection line between S and C'; Red dot: intersection line between C and C'; Green dot: intersection line between S and C.

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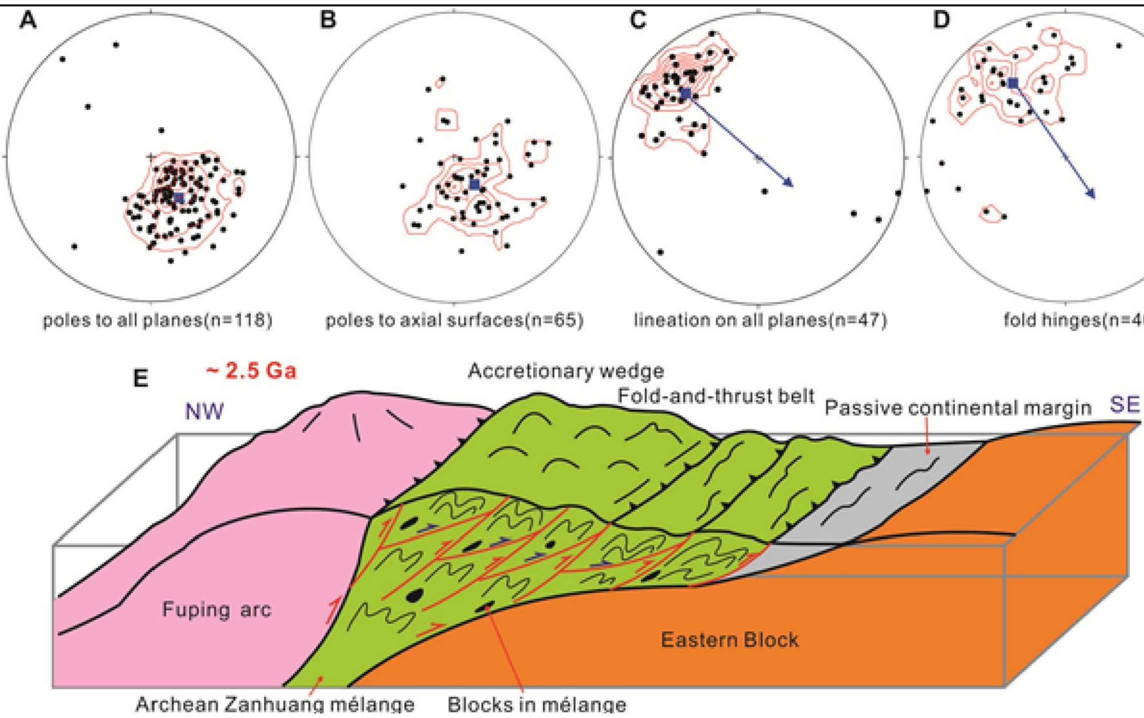

Fig. 2 A: Poles to all measured planes with 1% area contour. B: Poles to all measured axial surfaces with 1% area contour. C: All measured lineation on different planes. D: Projections of fold hinges with 1% area contour. The mean values of different fabrics are shown as the solid blue square. The blue solid lines represent the transport directions of hanging wall with the arrows pointing to the southeast. The data here is combined with the some data from our previous study (Wang et al., 2013). E: Model for tectonic evolution of an arc-continent collision in the North China craton in the late Neoarchean. Note that the Fuping arc collided with the Eastern Block, leading to the formation of the Zanhuang mélange with typical fold-and-thrust structures similar to the style of accretionary wedge. The blue and red arrows represent two generations of thrusts.

with our new fabric and kinematic analysis of the Zanhuang mélange further constrains the initial amalgamation timing and geometry of an arc-continent collision between the Fuping arc terrane in the Central Orogenic Belt and the Eastern Block with a northwest-dipping subduction polarity. The asymmetric structures and mixture of different blocks and matrices with folding and thrusting events in the Zanhuang mélange record kinematic information that is consistent with a tectonic setting of an accretionary wedge that was thrust over the passive margin of the Eastern Block by 2.5 Ga. Litho-structural mapping shows that the classic mélange and fold-and-thrust structures along the Neoarchean arc-continent collisional zone are broadly similar to Phanerozoic collisional belts.