Structural, metamorphic and geochronological works in the Hengshan-Wutaishan-Fuping massifs and correlation with the Lüliang massif: Implication for the tectonic evolution of the Trans-North China Belt

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The Paleoproterozoic Trans-North China Belt is a nearly north-south trending zone, of 1000 km long and 300 km wide, which resulted from collision between two Archean Eastern and Western Blocks, marking the amalgamation of the North China Craton. Field surveys in the best-exposed crustal segment of the Trans-North China Belt, namely Luliangshan, Hengshan, Wutaishan and Fuping massifs, allow us to recognize several tectono-metamorphic units that can be correlated throughout each massif. Structural work helps us to define the bulk geometry and kinematics of the belt.

In the Hengshan-Wutaishan massifs we highlight two main lithological units, called the "Orthogneiss and Volcanites Unit (OVU)" and the "Low Grade Mafic Unit (LGMU)". The OVU consists of a centimeter to meter-scale alternation of acidic and mafic volcanics intruded by calc-alkaline diorite and granodiorite, together with minor metasediments. The LGMU consists of pillows basalts, gabbro, ultramafics, volcanics and metasediments. Rocks from the OVU and the LGMU derive mainly from a magmatic arc and an oceanic environment respectively. Radiometric ages indicate that they formed around 2.5 Ga. The OVU experienced a syntectonic amphibolite facies metamorphism whereas the LGMU suffered a greenschist facies metamorphism coeval with nappe stacking. A mylonitic shear zone separates the two units. Both the OVU and the LGMU exhibit a conspicuous NW-SE trending

mineral and stretching lineation associated with a top-to-the-SE shearing. Therefore, the LGMU is interpreted as a synmetamorphic nappe overthrust to the SE upon the OVU. The later is in turn thrust to the SE upon the Fuping massif along a kilometre-scale flat lying ductile shear zone known as the Longquanguan Thrust. The deformation related to the Longquanguan Thrust reworked and cross cut an earlier dome-and-basin structure developed in the Fuping massif at ca. 2100 Ma. This contact represents a huge intracontinental flat lying ductile shear zone that affects both the OVU and the Fuping massif. Therefore, the Fuping massif and the OVU belong to the same micro-continental block named the Fuping Block. Precise U-Th-Pb chemical EPMA dating on monazite from Ky-bearing metapelites from the OVU allow us to constrain the timing of syn-metamorphic nappe stacking at 1880-1890 Ma. The Hengshan massif is similar to the OVU observed in the Wutaishan massif. Furthermore, a wide migmatitic domain, mainly developed in the Northern part of Hengshan massif, accounts for crustal melting during the exhumation of deep rocks of the belt. Zircons from magmatic leucosome yield LA-ICP-MS U-Pb age of 1850 ± 5 Ma. This shows that exhumation occurred ~30 Ma after burial. The stack of ductile and metamorphic nappes is unconformably overlain by a series of clastic and carbonate sedimentary rocks, named the Hutuo Supergroup, that result from erosion of the TNCB. Theses sediments are weakly to unmetamorphosed but ductilely deformed. Kinematics and fold vergence indicate a top-to-the SE shearing that argues for a second ductile deformation that occurred after the exhumation of the OVU.

Similar lithological and structural elements as those observed in the Hengshan-Wutaishan domain, namely the OVU, the LGMU, migmatites and late orogenic sediments, have been recognized more to the east in the Lüliangshan (cf Faure et al., this meeting). The LGMU form a klippe overthrusts upon the OVU through a mylonitic shear zone showing the same top-to-the south-east kinematics. In Lüliangshan also, a widespread migmatite overprint the nappe structure. The OVU and LGMU nappes are rooted along a fault marking the eastern margin of the Western Block that crops out in the Lüliangshan. This fault corresponds to the Trans-North China Suture, between the Western Block and the Fuping Block.

Consequently, we propose the following model for the tectonic evolution of the TNCB. In Neoarchean (~2.5 Ga), a magmatic arc developed upon the Fuping Block coevally with an oceanic domain, called the Lüliang Ocean, more to the NW. The north-westward subduction of the Lüliang Ocean below the Western Block is followed by the collision of the Western Block with the Fuping Block at ca. 1880-1890 Ma. The late orogenic exhumation

accommodated by crustal melting occurred at 1850 Ma. The second ductile event occurred immediately after the deposition of the late orogenic sediments of the Hutuo Supergroup. Post tectonic granites mark the end of the orogeny at ~1800 Ma

The north-westward subduction responsible for nappe stacking at 1880-1890 Ma lies between the Western Block and the Fuping Block and thus could not account for the formation of the magmatic arc located more to the east and formed ~700 Ma before. Consequently, the Neoarchean magmatic arc dated at 2.5 Ga might results from an older subduction zone located to the east of the Fuping Block, i.e. east of the Fuping complex. Furthermore, this geodynamic scenario leads us to question the age of the Hutuo Supergroup that is presently dated around 2100 Ma.