Proceedings of the IGCP-440 and LEGENDS International Symposium and Field Workshop on "The Role of Sri Lanka in Rodinia and Gondwana Assembly and Break-up", March-April 2003, Centenary Publication, Geological Survey & Mines Bureau, Sri Lanka, (K.V.W. Kehelpannala, Ed.) pp. 53-55

Assembly, Accretion and Break-up of the Palaeo-Mesoproterozoic Supercontinent Columbia and its Records in the North China Craton

Guochun Zhao[1], Min Sun[1], Simon A. Wilde[2] and Sanzhong Li[3]

1 - Department of Earth Sciences, The University of Hong Kong, Pokfulam Road, Hong Kong,

2 - Department of Applied Geology, Curtin University of Technology, Bentley 6012, Western Australia, Australia

3 - College of Marine Geosciences, Ocean University of China, 266003, Qingdao, China

Geological and paleomagnetic data support the hypothesis that a Paleo-Mesoproterozoic supercontinent, referred to as Columbia, existed before the formation of Rodinia (Rogers and Santosh, 2002; Condie, 2002; Zhao et al., 2002; Wilde et al., 2002; Meert, 2002; Sears and Price, 2002; Santosh et al., 2003). This pre-Rodinia supercontinent contained almost all of Earth's continental blocks that were amalgamated along global-scale 2.1-1.8 Ga collisional orogens, including the 2.1-2.0 Ga Transamazonian Orogen in South America and Eburnean Orogen in West Africa; the 2.0–1.9 Ga Capricorn Belt in Western Australia; the 1.9-1.8 Ga Trans-Hudson and Nagssugtoqidain Orogens or their equivalents in Laurentia, Kola–Karelia Orogen in Baltica (East Europe) and Akitkan Orogen in Siberia; and the ~1.8 Ga Central Indian Tectonic Zone in India (Zhao et al., 2002). Following its final assembly at ~1.8 Ga, the supercontinent Columbia underwent a long-lived, subduction-related accretion, forming the 1.8-1.7 Ga Yavapai, Central Plains, Makkovikian, Ketilidian Belts, 1.7-1.6 Ga Mazatzal and Labradorian Belts, 1.5-1.3 Ga St. Francois and Spavinaw Granite-Rhyolite Belts and 1.3-1.2 Ga Elzevirian Belt along the southwestern-northeastern margin of Laurentia; the 1.8-1.7 Transscandinavian Igneous Belt, 1.7-1.6 Ga Kongsberggian-Gothian Belt, 1.6-1.5 Ga Southwest Sweden Granitoid Belt and 1.3-1.2 Ga early Sveconorwegian Belt along the southern margin of Baltica; the 1.80-1.45 Ga Rio Negro-Juruena Belt and 1.45-1.30 Ga Rondonian-San Ignacio Belt along the western margin of South America; and the 1.8-1.5 Ga Arunta, Musgrave, Mt. Isa, Georgetown, Coen and Broken Hill inliers along the southern and eastern margins of the North Australia Craton (Rogers and Santosh, 2002; Zhao et al., 2002). Fragmentation of the supercontinent began about 1.6 Ga ago and continued until its final breakup at about 1.2 Ga, associated with widespread continental-scale rifting, represented by the Belt-Purcell Supergroup in North America, the Telemark Supergroup in Baltica, the Riphean

Aulacogens in Siberia, the Kalahari Copper Belt in Southern Africa, and the Kibaran Belt in eastern and central Africa. Also associated with the

fragmentation and break-up of the supercontinent Columbia were widespread anorogenic magmatism and emplacement of mafic dyke swarms.

Like most other cratonic blocks, the North China Craton records the history of the assembly, accretion and breakup of Columbia (Zhai et al., 2000). New data indicate that the evolution of the North China Craton involved the discrete Eastern and Western Blocks that developed independently during the Archean and collided along the Trans-North China Orogen (Fig. 1) during a global Paleoproterozoic orogenic event (Zhao, 2001; Zhao et al., 1999, 2000; 2001; 2002; Wilde et al., 2002; Guan et al., 2002; Guo et al., 2002). Following the final amalgamation at ~1.85 Ga, the North China Craton underwent a long-lived (1.8-1.4 Ga), subduction-related, outgrowth along its southern margin, forming the Xiong'er volcanic belt (Fig. 1). The most robust evidence in the North China Craton for the Mesoproterozoic fragmentation of Columbia comes from the 1.6-1.2 Ga Zhaertai-Bayan Obo rift zone along the northern margin of the craton (Fig. 1). The development of this rift zone may have been associated with the separation of the North China Craton from India, whose western margin is considered to have connected to the northern margin of the North China Craton until the start of the Mesoproterozoic when the dispersion of Columbia commenced (Zhao et al., 2003).

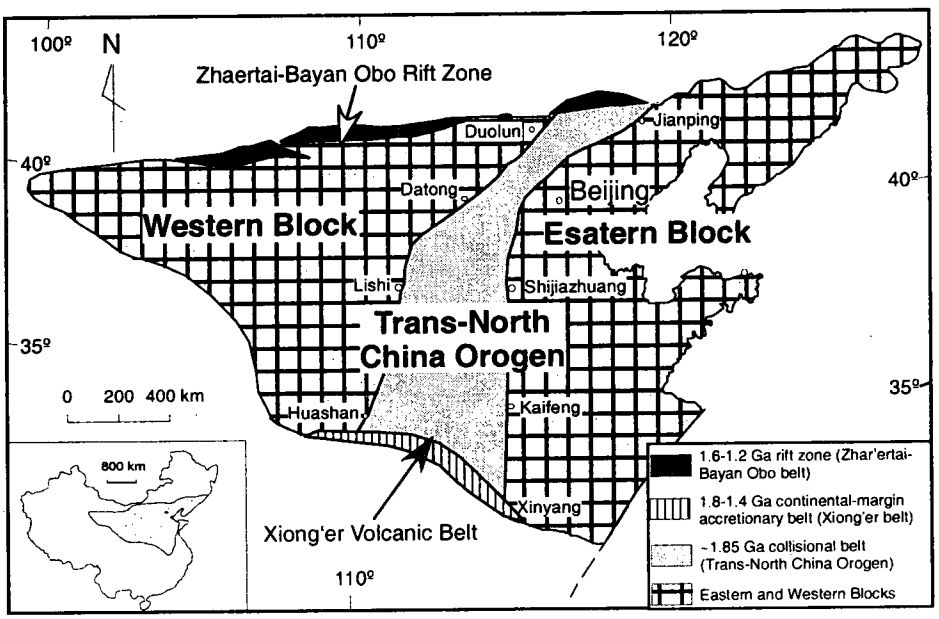

Figure 1. Sketch map showing the distribution of the 1.85 Ga Trans-North China Orogen, 1.8-1.4 Ga Xiong'er continental-margin arc accretionary belt, and 1.6-1.2 Ga Zhaertai-Bayan Obo rift zone in the North China Craton.

Acknowledgements

We benefited from thoughtful discussions with J.J.W. Rogers. Hong Kong RGC Grants (HKU7115/00P & HKU7090/01P) and a NSFC Grant (40002015) financially supported this work.

References

Condie, K.C. (2002) Breakup of a Paleoproterozoic supercontinent. Gondwana Res., v. 5, pp. 41–43.

Guan, H., Sun, M., Wilde, S.A., Zhou, X.H. and Zhai M.G. (2002) SHRIMP U-Pb zircon geochronology of the Fuping Complex: implications for formation and assembly of the North China craton. Precambrian Res., v. 113, pp. 1-18.

Guo, J.H., O'Brien, P.J. and Zhai, M.G. (2002) High-pressure granulites in the Sangan area, North China Craton: metamorphic evolution, P-T paths and geotectonic significance. J. Metamorph. Geol., v. 20, pp. 741–756.

Meert, J.G. (2002) Paleomagnetic evidence for a Paleo-Mesoproterozoic supercontinent Columbia, Gondwana Res., v. 5, pp. 207–216.

Rogers, J. J. W. and Santosh, M. (2002) Configuration of Columbia, a Mesoproterozoic Supercontinent, Gondwana Res., v. 5, pp. 5–22.

Santosh, M., Yokoyama, K., Biju-Sekhar, S., and Rogers, J.J.W. (2003) Multiple tectonothermal events in the granulite block of Southern India revealed from EPMA dating: implications on the history of supercontinent. Gondwana Res. 6, 27–61.

Sears, J.W. and Price, R.A. (2002) The hypothetical Mesoproterozoic supercontinent Columbia: implications of the Siberian-West Laurentian connection. Gondwana Res., v. 5, pp. 35–40.

Wilde, S. A., Zhao, G. C. and Sun, M. (2002) Development of the North China Craton during the late Archean and its final amalgamation at 1.8 Ga: some speculations on its position within a global Paleoproterozoic supercontinent. Gondwana Res., v. 5, pp. 85–94.

Zhai, M.G., Bian, A.G. and Zhao, T.P. (2000) The amalgamation of the supercontinent of North China Craton at the end of Neo-Archaean and its breakup during late Palaeoproterozoic and Mesoproterozoic. Sci. China (Series D), v. 43, pp. 219–232.

Zhao, G.C. (2001) Palaeoproterozoic assembly of the North China Craton. Geol. Mag., v. 138, pp. 87–91.

Zhao, G.C., Wilde, S.A., Cawood, P.A. and Lu, L.Z. (1999) Tectonothermal history of the basement rocks in the western zone of the North China Craton and its tectonic implications. Tectonophysics, v. 310, pp. 37–53.

Zhao, G.C., Cawood, P.A., Wilde, S.A. and Lu, L.Z. (2000) Metamorphism of basement rocks in the Central Zone of the North China Craton: implications for Paleoproterozoic tectonic evolution. Precambrian Res., v. 103, pp. 55–88.

Zhao, G.C., Wilde, S.A., Cawood, P.A. and Sun M. (2001) Archean blocks and their boundaries in the North China Craton: lithological, geochemical, structural and P-T path constraints and tectonic evolution. Precambrian Res., v. 107, pp. 45–73.

Zhao, G.C., Cawood, P.A., Wilde, S.A. and Sun, M. (2002) Review of global 2.1-1.8 Ga orogens: implications for a pre-Rodinia supercontinent, Earth Sci. Rev., v. 59, pp. 125–162.

Zhao, G.C., Sun, M. and Wilde, S.A. (2003) Correlations between the Eastern Block of the North China Craton and the South Indian Block of the Indian Shield: An Archean to Paleoproterozoic link. Precambrian Res., in press.