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Tectonopalaeogeography and palaeotectonics

Palinspastic reconstruction and geological evolution of Permian residual marine basins bordering China and Mongolia

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Abstract One main feature of the tectono-paleogeographic evolution of the southern branch of the Paleo-Asian Ocean was that there developed residual marine basins in former backarc/forearc regions after the disappearance of oceanic crust. The paper illustrates the viewpoint taking the evolution of Dalandzadgad and Solonker oceanic basins as examples. The Dalandzadgad ocean subducted southwards during the Silurian−Devonian, created an intra-oceanic arc and a backarc basin in southern Mongolia. In addition, a continent marginal arc formed along the national boundary between China and Mongolia, the south of which was a backarc basin. The oceanic basin closed and arc−arc (continent) collision occurred during the early Early Permian, followed by two residual marine basins developing in the former backarc regions, named the South Gobi Basin in southern Mongolia and the Guaizihu Basin in western Inner Mongolia. The Solonker ocean subducted southwards and finally disappeared during the early Middle Permian. Afterwards, two residual marine basins occurred in northern China, the Zhesi Basin being situated in the former backarc region and the Wujiatun Basin in the former forearc region. The late Middle Permian was the most optimum period for the developing residual marine basins, when they covered a vast area. The basin evolution differentiated during the early Late Permian, with a general trend of uplift in the east and of subsidence in the west. The Upper Permian in the South Gobi Basin was characterized by coal-bearing strata hosting economically valuable coal fields. A transgression invaded westwards and the Chandmani−Bayanleg Basin was created in southwest Mongolia during the middle−late stage of the Late Permian. Correspondingly, the coal formation entered a flourishing time, with thick coal beds and sedimentary interbeds. All of these basins, namely, both the marine and non-marine residual basins, reversed and closed by the end of Permian.

Key words residual marine basin, tectono-palaeogeographic evolution, Dalandzadgad ocean, Solonker ocean, Central Asian Orogenic Belt, Permian, China−Mongolia border area

1 Introduction

In Mongolia, the Upper Carboniferous, Upper Permian, Lower−Middle Jurassic and Lower Cretaceous are coal-bearing systems (Erdenetsogt *et al*., 2009; Wu, 2013a). The Upper Permian coalfields, with giant reserves, excellent quality and convenient mining conditions, are mainly situated in the South Gobi (Ömnögovi) Province. The Nariin Sukhait Coal Mine is at a distance of 50 km from Ceke Port of Inner Mongolia, which exploits the coal fields and exports to China. The Tavan Dolgoi coalfield, 180 km away

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from the Ganqimaodao Port, is still undeveloped, with reserves of several billion tons. These coalfields attract the attention of many investors, especially, Chinese investors.

The eastern elongation of the Upper Permian coalfields is cut off by a magmatic arc, which means that the so-called South Gobi Basin must be a tectonic basin, instead of a primary one. Originally, the South Gobi Basin stretched northwestwards into the Bayanhongor Province, but some of the Upper Permian coal-seams there were mistaken as Jurassic in age for a long time. In addition, the relation between the coal-bearing marine basins and the Paleo-Asian Ocean is unknown up to now, so that the tectonic setting, characteristics and contributing factors of these basins are controversial.

This paper focuses on the following aspects: (1) Based on the reconstruction of the evolution of the southern branch of the Paleo-Asian Ocean, it is revealed that the coal-bearing basins are residual marine ones after subduction of the oceanic crust. (2) To combine a comparative study with simultaneous basins in northern China, a distribution map of the primary residual marine basins bordering China and Mongolia is drawn. (3) The basins' development can be divided into two main stages, and the coalfields with enormous economic values are created at a later stage. This study will also lay a foundation to explore the regularities of coalbed occurrences (Wu, 2013b).

2 Regional tectonic framework

Tectonically, the China−Mongolia border area is attached to the Central Asian Orogenic Belt (CAOB; Figure 1), which grew out of the closure of Paleo-Asian Ocean

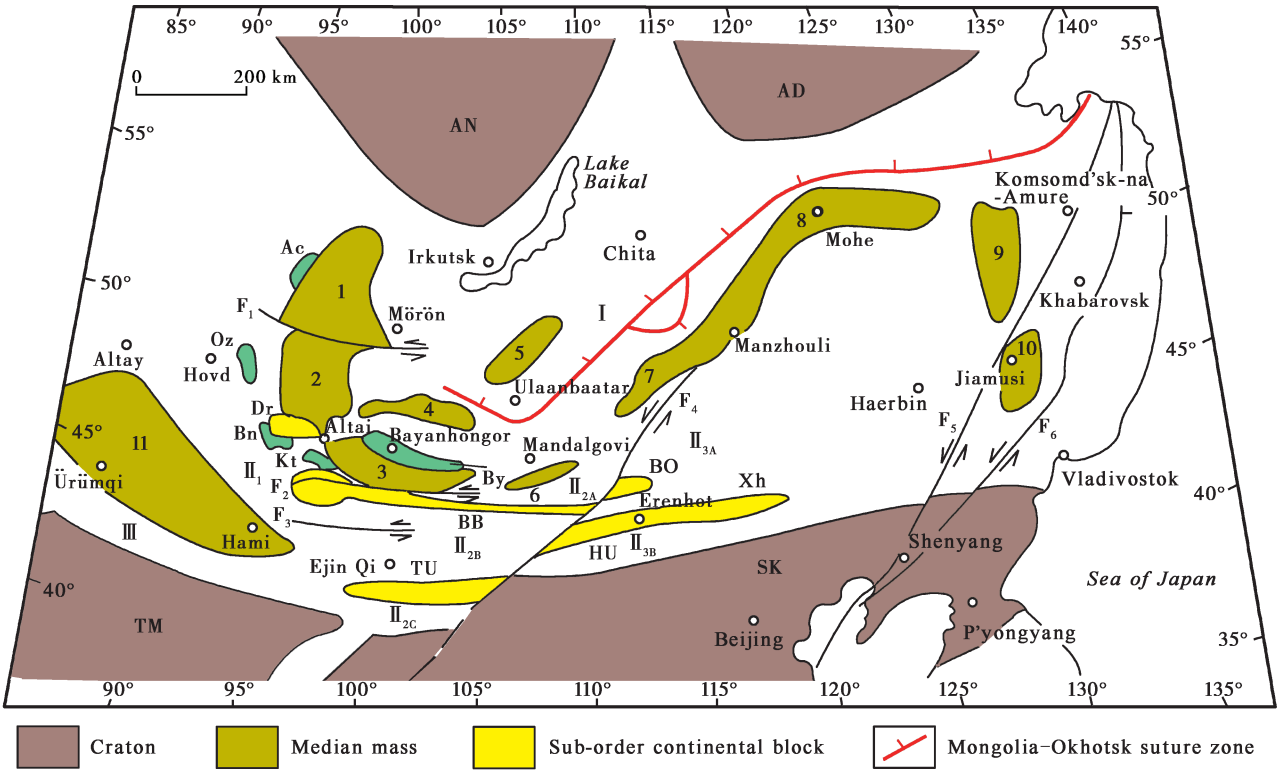

Figure 1 Tectonic scheme of the CAOB (based on the present geographic position). Names of cratons: AN−Angara; AD−Aldan; TM−Tarim; SK−Sino-Korean (North China + Jiaoliao). Names of intermediate masses: 1−Southern Tuva; 2−Dzabkhan; 3−Baydrag; 4−Tarvagatay; 5−Hara; 6−Middle Gobi; 7−Ereen Davaa; 8−Ergun; 9−Bureya; 10−Jiamusi; 11−Junggar−Turpan−Hami. Names of sub-order continental blocks: Dr−Dariv; BB−Baga Bogd; BO−Barga Ovoo; HU−Hutag Uul; Xh−Xilinhot; TU−Tsagaan Uul. Names of sinistral shear zones: F_1−Hangay; F_2−Gobi Altai; F_3−Gobi−Tienshan; F_4−Zuunbayan; F_5−Yilan−Yitong; F_6−Dunhua−Mishan. Names of oceans: I−Northern branch of the Paleo-Asian Ocean; II−Southern branch of the Paleo-Asian Ocean: II_1−Western segment of the southern branch; II_2−Central segment of the southern branch; II_{2A}−Dundgovi oceanic basin, II_{2B}−Dalandzadgad oceanic basin, II_{2C}−Engger Us oceanic basin; II_3−Eastern segment of the southern branch; II_{3A}−East Inner Mongolian oceanic basin, II_{3B}−Solonker oceanic basin. Names of Late Neoproterozoic−Early Cambrian ophiolites: Ac−Agardagh Tes-Chem; Oz−Ozemaya belt; Bn−Bayannur; Kt−Khantaishir; By−Bayanhongor.