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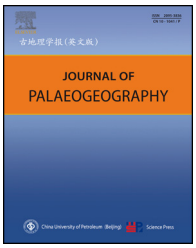

Correction of two Upper Paleozoic stratigraphic units in the Tianshan Mountains region, Xinjiang Uygur Autonomous Region and implications on the Late Paleozoic evolution of Tianshan tectonic complex, Northwest China

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ABSTRACT

The present paper addresses two tectonostratigraphic concerns on the Late Paleozoic Tianshan tectonic complex (TTC), Xinjiang, Northwest (NW) China: (1) stratigraphic succession and age constraint of the Bayingou ophiolite mélange, eastern Tianshan Mountains and (2) timing of closure of the southern Tianshan ocean and accretion of the Siberian craton recorded in the Aiweiergou (AWEG) area, eastern Tianshan Mountains by integrating stratigraphy, palaeontology, tectonopalaeogeography and palaeobiogeography. In the Bayingou area, the detailed palaeontological survey denies the presence of brachiopod *Gigantoproductus* fauna, typical of the Early Carboniferous faunas in central–south Tianshan complex, in the Anjihai Formation. In contrast, the Anjihai brachiopod assemblage, as a whole, appears to have a high affinity with the Late Devonian faunas of the eastern Junggar Basin, northern Xinjiang, suggesting a Late Devonian age for the Anjihai Formation. The overlying Shadawang Formation yields the Early Carboniferous radiolarians. These two units form the main part of the Bayingou ophiolite mélange, which therefore is likely Late Devonian to Early Carboniferous in age. The Bayingou area has been likely part of the northern Tianshan-Junggar block since the Late Devonian, although it may have been part of the Central Tianshan tectonostratigraphic province prior to the Late Devonian. The topmost strata of the Bayingou ophiolite mélange are characterized by alternation of volcanics, conglomerate and mudstone, and are better re-assigned to the Taoxigou Group rather than the Keguqingshan Formation. The Bayingou ophiolite mélange comprises the Late Devonian Anjihai Formation, the Carboniferous Bayingou and Shadawang Formations, and the Early Permian Taoxigou Group. In the AWEG area, the Permian and Triassic rocks were previously misinterpreted as the Late Permian turbidites and Late Triassic red beds, respectively. In fact, the Permian successions in AWEG consist of the Early Permian Taoxigou Group and early Middle Permian Lucaogou Formation. The former represents a foreland molasse succession, while the latter yields abundant non-marine fossils of plants, bivalves, and gastropods, and represents typical lacustrine facies deposits. The

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unconformity between the Permian and the Triassic rocks cannot represent the closure of the Tianshan Ocean, but indicates tectonic uplifts in the foreland basins. In contrast, the molasse-type sediments of the Lower Permian Taoxigou Group may have resulted from the post-orogenesis uplifting and mark the closure of the Tianshan Ocean prior to the Early Permian. Thus, the closure of the Tianshan Ocean and the final tectonic accretion of the South Tianshan block might have taken place over the Permo-Carboniferous transition, strengthened by faunal assemblages obtained from both southern and northern sides of the TTC.

1. Introduction

Central Asia is one of the last relatively unstudied/unresolved, and potentially the most exciting, tectonic collages on Earth. This region comprises some 13 tectonically independent blocks/terranes (Coleman, 1989). Several important tectonic terranes and complexes such as the Tarim Basin, Altaid Mountains, Qaidam Basin, Tianshan Mountains, Junggar Basin, and Kunlun Mountains are situated at Northwest China. During the Late Paleozoic this region comprised a complex mosaic of continental fragments, island arcs, and ocean basins, scattered across the Palaeo-Tethyan ocean and tectonically similar in many respects to Southeast Asia today (Carroll et al., 1990; Windley et al., 1990, 2007). Of these, the Tianshan Mountains record the collisional history of the Tarim and Kazakhstan palaeo-plates (Allen et al., 1993; Gao et al., 1998; Windley et al., 2007; Zhou et al., 2002). The eastward growth of the Kazakhstan Plate was conspicuous during the Paleozoic (Heinhorst et al., 2000), when many Central Asian blocks (such as the Yili Terrane and Tarim Plate) had accreted to this palaeo-plate (Chen et al., 1999; Windley et al., 2007; Xiao et al., 2008; Zhou et al., 2002). On the one hand, the Tianshan tectonic complex (TTC) remains one of the last frontiers in geologists' endeavour for unravelling the complex geological history and geodynamics of Central Asia in relation to the tectonic evolution of the closure of the Tianshan Ocean and consolidation of the Tarim and Yili palaeo-plates. On other hand, the TTC and its neighbouring sedimentary basins are of enormous economic potential as they host numerous metalliferous deposits and hydrocarbon resources in the Tarim, Turpan and Junggar Basins, Northwest China. Accordingly, studies of these northwestern Chinese tectonic complexes and sedimentary basins have enjoyed a surge in scientific interest over the past 30 years that shows no sign of abating (Allen et al., 1993; Chen and Shi, 2003a, 2003b; Coleman, 1989; Gao et al., 1998, 2009; He et al., 1994; Li et al., 1989, 2010; Shu et al., 2013; Su et al., 2006a, 2006b, 2010; Wang et al., 1994; Windley et al., 1990, 2007; Xiao et al., 1992, 2008; Zhang and Zhai, 1993).

Many new geochemical approaches and isotopic dating analytical techniques have greatly advanced tectonic studies of the TTC and facilitated the proposal of many new tectonic models (Xiao et al., 2008; and references therein). However, geological models for the sedimentary history and tectonic evolution of this tectonically complicated region are still, at the best, controversial due to lack of sound tectonostratigraphic studies constraining plate tectonic/geophysical models. Tectonostratigraphic successions and patterns based on sound palaeontology and palaeobiogeography have been far less studied in comparison with the growing number of geochemical studies of this tectonic complex. In contrast, growing evidence shows that palaeobiogeography is very powerful in determining various tectonostratigraphic provinces and interpretation of tectonic models (Chen, 2004). Here, we document two outstanding examples that explained incorrectly tectonic evolution and models in the Aiweiergou and Bayingou areas, eastern and middle Tianshan Mountains, respectively in Xinjiang Uygur Autonomous Region, Northwest China (see below) due to lack of sound palaeontological and palaeobiogeographic data.

2. Carboniferous tectonostratigraphic successions of the Bayingou area, eastern Tianshan Mountains and regional correlations

The Bayingou (BYG) area is situated at the northern end of the Dushanzi–Kuqa (DK) highway across the Tianshan Mountains, Xinjiang Uygur Autonomous Region, Northwest China (Fig. 1). This area is of high geological importance due to the presence of the Late Paleozoic ophiolite mélange, which has been believed to have formed in the Carboniferous or the Late Devonian–Early Carboniferous interval (Wang et al., 1994, 1997; Xiao et al., 1992; Zhang and Wu, 1985). The BYG area is generally assigned to the Yilianhabierzha tectonostratigraphic district of the Junggar–North Tianshan tectonostratigraphic Province (He et al., 1994; Li et al., 1989; Wang et al., 1990, 1994, 1997; Xiao et al., 1992; Zhang and Wu, 1985). However, most tectonic models on the BYG ophiolite complex lack solid tectonostratigraphic and palaeobiogeographic evidence. In BYG, the Late Paleozoic succession comprises the Anjihai, Shadawang, Bayingou and Keguqingshan Formations in ascending order (Wang et al., 1994, 1997). Of these, the Anjihai Formation yields some important fossils. The Anjihai fossil assemblages therefore are critical in interpreting palaeobiogeographic provincialism, and thus crucial in understanding of tectonic models of the TTC.