GEODYNAMICS & TECTONOPHYSICS

PUBLISHED BY THE INSTITUTE OF THE EARTH'S CRUST
SIBERIAN BRANCH OF RUSSIAN ACADEMY OF SCIENCES

2017 VOLUME 8 ISSUE 3 PAGES 421–427 ISSN 2078-502X

https://doi.org/10.5800/GT-2017-8-3-0252

Proceedings of the Second Russia–China International Meeting on the Central Asian Orogenic Belt (September 6–12, 2017, Irkutsk, Russia)

TECTONICS AND GEODYNAMICS OF THE ALTAI-JUNGGAR OROGEN IN THE VENDIAN-PALEOZOIC: IMPLICATIONS FOR THE CONTINENTAL EVOLUTION AND GROWTH OF THE CENTRAL ASIAN FOLD BELT

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For citation: *Buslov M.M., Cai K.*, 2017. Tectonics and geodynamics of the Altai-Junggar orogen in the Vendian-Paleozoic: Implications for the continental evolution and growth of the Central Asian fold belt. *Geodynamics & Tectonophysics* 8 (3), 421–427. doi:10.5800/GT-2017-8-3-0252.

In the end of the 20th century folded structures of central Asia were regarded as formed by accretion and collision of the Paleo- Asian oceanic plate and Siberia continent [*Berzin et al., 1994; Dobretsov, 2003; Dobretsov et al., 2004; Didenko et al., 1994; Mossakovsky et al., 1993; Simonov et al., 1994; Zonenshain et al., 1990*]. This concept assumes several accretion-collision zones of different age to be resulted from the successive accretion of island arcs, microcontinents, and oceanic seamounts to Siberia during the Vendian – Early Carboniferous. The collision of these structures with one another and the Siberian continent during opening and closure of the Paleo-Asian ocean is believed to be the primary mechanism of crustal growth and recycling in Central Asia during the Paleozoic. An innovative model was proposed by Şengör, Natal'in, and Burtman [*Şengör et al., 1993*]. They suggested that one single, giant island arc, the Kipchak arc, existed over Vendian–Paleozoic subduction zone through the entire history of the Paleo-Asian ocean. The rotation and drift of Siberia and East Europe in Paleozoic time deformed the island arc into numerous oroclines and large-scale strike-slip faults transecting the arc into many fragments. In the accretionary collage of Central Asia the most important are Late Carboniferous dextral Late Permian sinistral movements of terranes. This model assumes that by the Late Paleozoic, the Central Asian fold belt (the Altaids, according to *Şengör et al.* [*1993*] represented

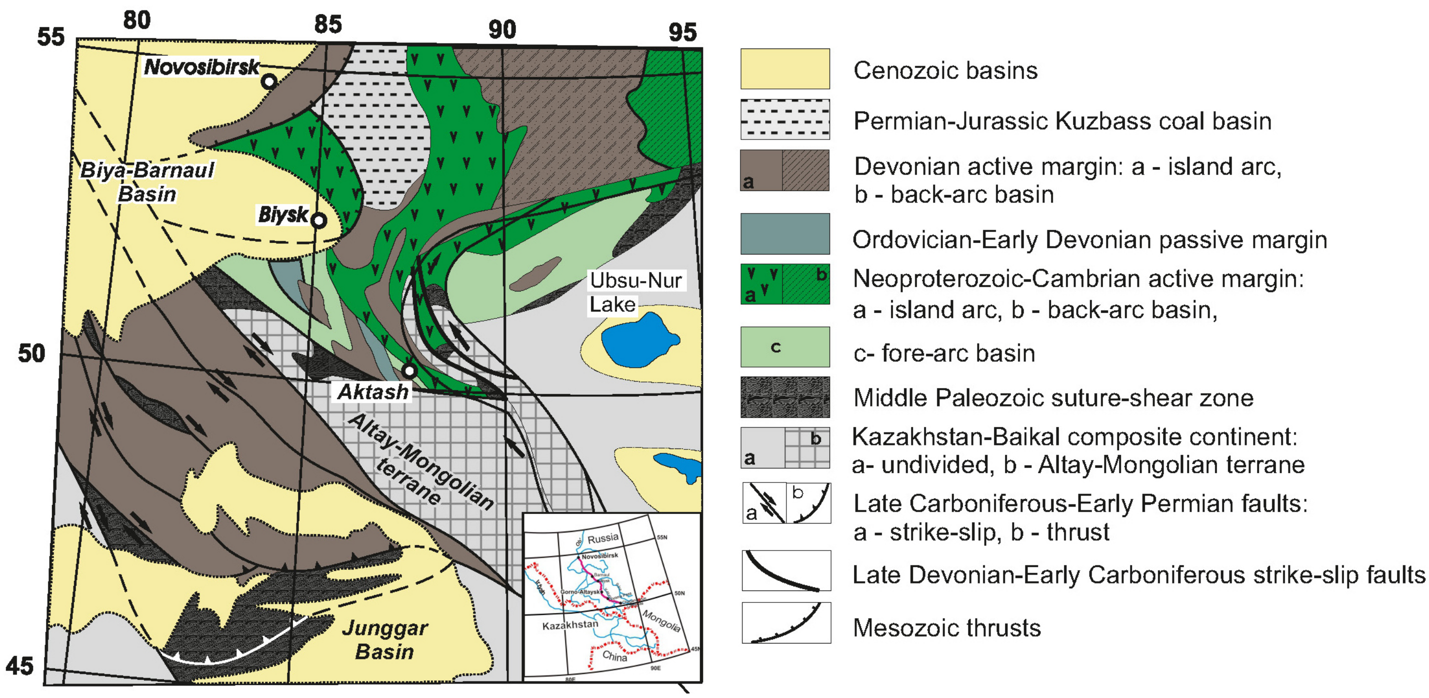

Fig. 1. Scheme showing major geodynamics unites of the Altai-Junggar intracontinental orogeny.

an amalgamation of fragments of the Siberian and East European continental margins. The model is now the most popular in explaining the complex structure of the Central Asian Fold belt.

The recent results from detailed geological mapping, structural analysis and geochronological studies [*Buslov et al., 2001, 2002, 2003, 2004; Korobkin, Buslov, 2011; Smirnova et al., 2002; Cai et al., 2011a, 2011b, 2011c, 2014; Chen et al., 2015*] were used to identify the following tectonic elements of the Central Asian fold belt [*Buslov, 2011; Dobretsov, Buslov, 2007, 2011; Buslov et al., 2013*] (Fig. 1):

1. The Late Proterozoic – Paleozoic continental margin complexes on the western margin of the Siberian craton (in present coordinates), which include the Late Proterozoic – Cambrian Kuznetsk–Altai island-arc, Ordovician – Early Devonian passive margin, and Devonian – Early Carboniferous active margin. The accretionary wedges of the island arc contain the Late Proterozoic – Early Cambrian oceanic crust fragments, mostly paleo-islands and ophiolites. The absence of Gondwana-derived terranes on the western margin of the Siberian craton suggests that it may have formed at the convergent boundary with the Paleo-Pacific.

2. The composite Kazakhstan–Baikal continent has a basement that was formed in the Late Proterozoic – Cambrian during subduction of the Paleo-Asian oceanic plate, comprising a collage of Precambrian Gondwana-derived microcontinents and terranes, beneath the Late Proterozoic Kazakhstan-Tuva-Mongolian island arc along the southeastern margin of the Siberian craton (in present coordinates). Oceanic plate subduction and subsequent collision of microcontinents and terranes with the island arc led to the crustal growth and formation of the basement of a composite continent. In the Early–Middle Paleozoic this continent was separated from Siberia by the Ob’–Zaisan oceanic basin.

3. The Middle Paleozoic Charysh–Terekta–Ulagan–Sayan suture-shear zone (CTUSs), which separates the continental-margin complexes of the Siberian and Kazakhstan–Baikal continents. In the Altai–Sayan segment (Charysh–Terekta, Ulagan, and Western Sayan zones), the CTUSs consists of fragments of Late Vendian – Early Ordovician oceanic crust of the Ob’–Zaisan oceanic basin, Ordovician blueschists and Cambro-Ordovician turbidites, Ordovician–Silurian syncollisional granites and metamorphic rocks in thrust and shear zones. In the eastern segment, in Tuva and Cisbaikalia, this zone comprises high grade metamorphic rocks of the Sangilen and Olkhon shear zones, as well as fragments of multiply deformed oceanic crust. The westward movement of the Kazakhstan–Baikal continental masses along the southeastern margin of Siberia brought about the gradual closure of the Ob’–Zaisan oceanic basin. Its fragments are seen in the Late Paleozoic thrust and shear zones of Junggar and eastern Kazakhstan.

4. Late Paleozoic strike-slip faults and nappes form an orogenic collage of terranes, which arose in the Late Devonian – Early Carboniferous as a result of strike-slip accretion and subsequent collision and amalgamation of the composite Kazakhstan–Baikal continent and

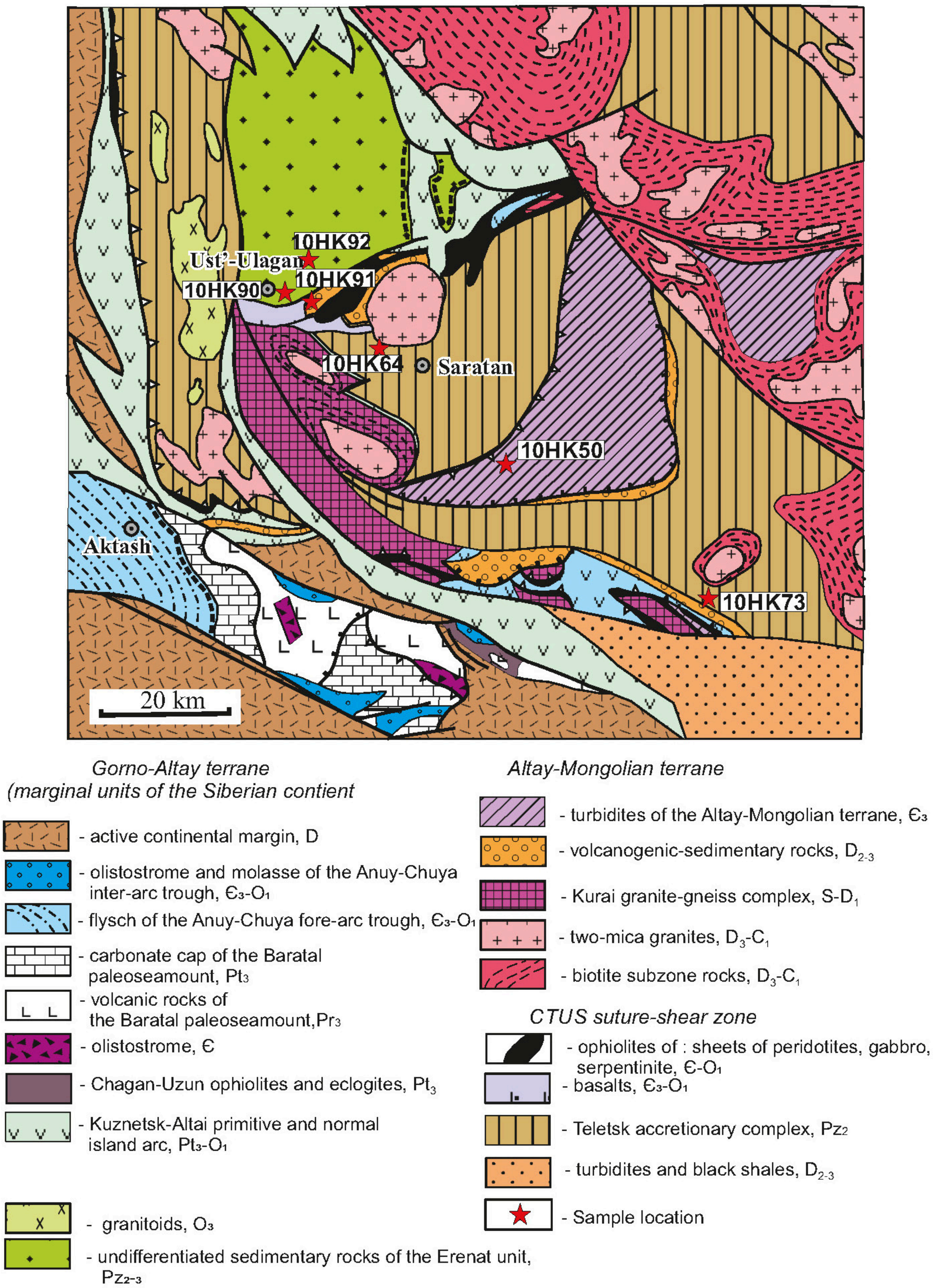

Fig. 2. Scheme showing major geodynamics unites in the border region between CTUSs and the Altai-Mongolian terrane.

Siberia to form the North Asian continent, and in the Late Carboniferous – Permian as a result of the colliding East European and North Asian continents.

To explore tectonic evolution and continental growth of Altai-Junggar orogen , the sedimentary sequences of the Russian Altai have been sampled for detrital zircon U-Pb dating and Hf isotope analyses [*Cai et al., 2016*]. Samples were collected in the border region between CTUSs and the Altai-Mongolian terrane and undifferentiated sedimentary rocks of the Erinat unite, which is located inside the CTUSs (Fig. 2). All the detrital zircon ages (Fig. 3) of the investigated sedimentary sequences in the border region between CTUSs and the Altai-Mongolian terrane share two most prominent age populations at ca. 520 Ma and ca. 800 Ma. Whereas, a few Archean to Mesoproterozoic

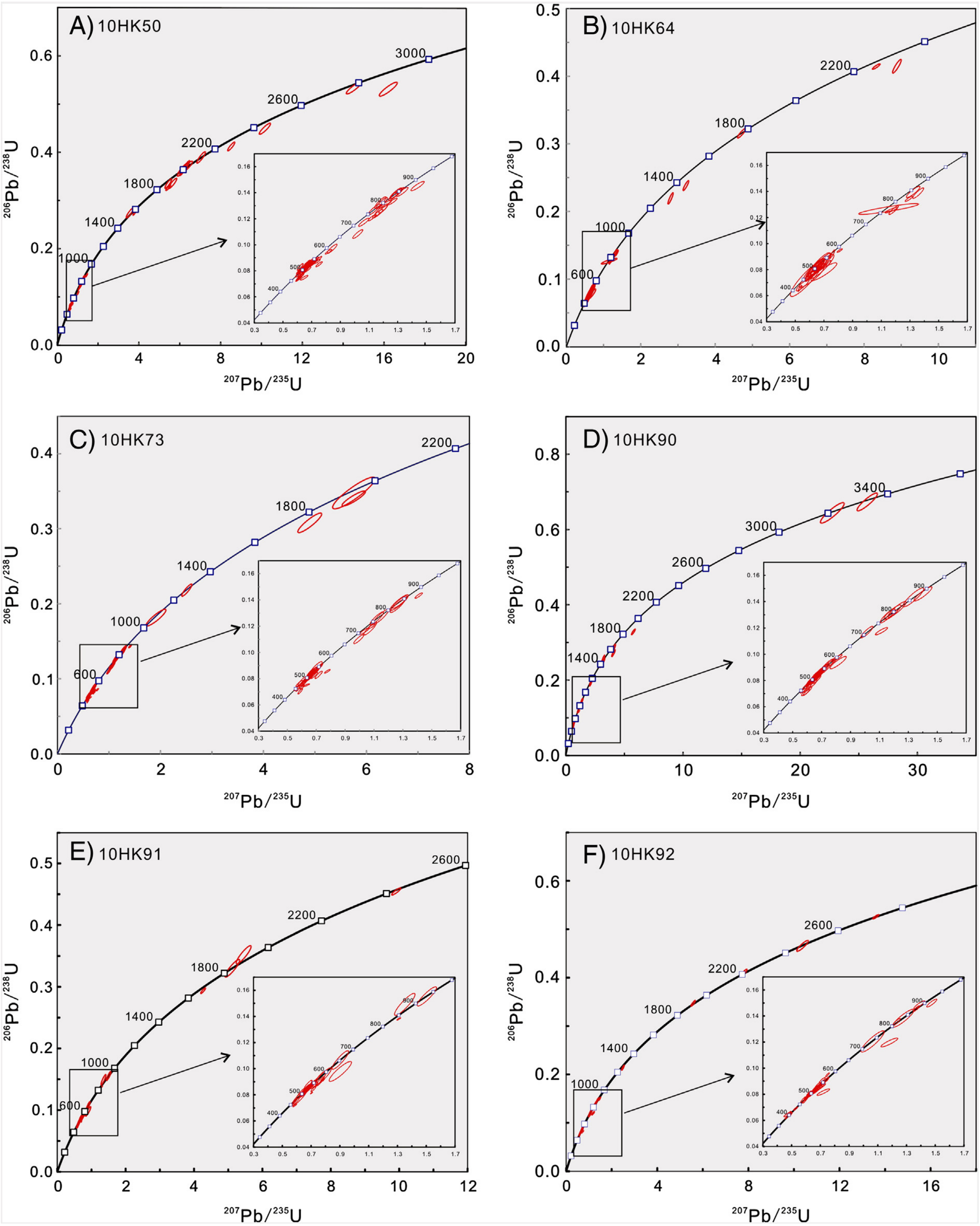

Fig. 3. U–Pb concordia diagrams of zircon ages from the investigated sedimentary sequences in the Russian Altai [*Cai et al., 2016*].

ones with complex structures were probably recycling materials derived from the Tuva–Mongolian and associated microcontinent fragments in the vicinity. The detrital zircon from Vendian-Paleozoic sedimentary rocks of the Gorny Altai terrane (Fig. 4) share only own most prominent age populations at ca. 520 Ma.

In combination with petrological and geochemical studies of the region, our data support the idea that the Altai-Mongolian terrane lacks a crystallized Precambrian basement and was a subduction-accretion complex formed in the margin of the Tuva-Mongolian microcontinent and associated blocks in the Early Paleozoic.

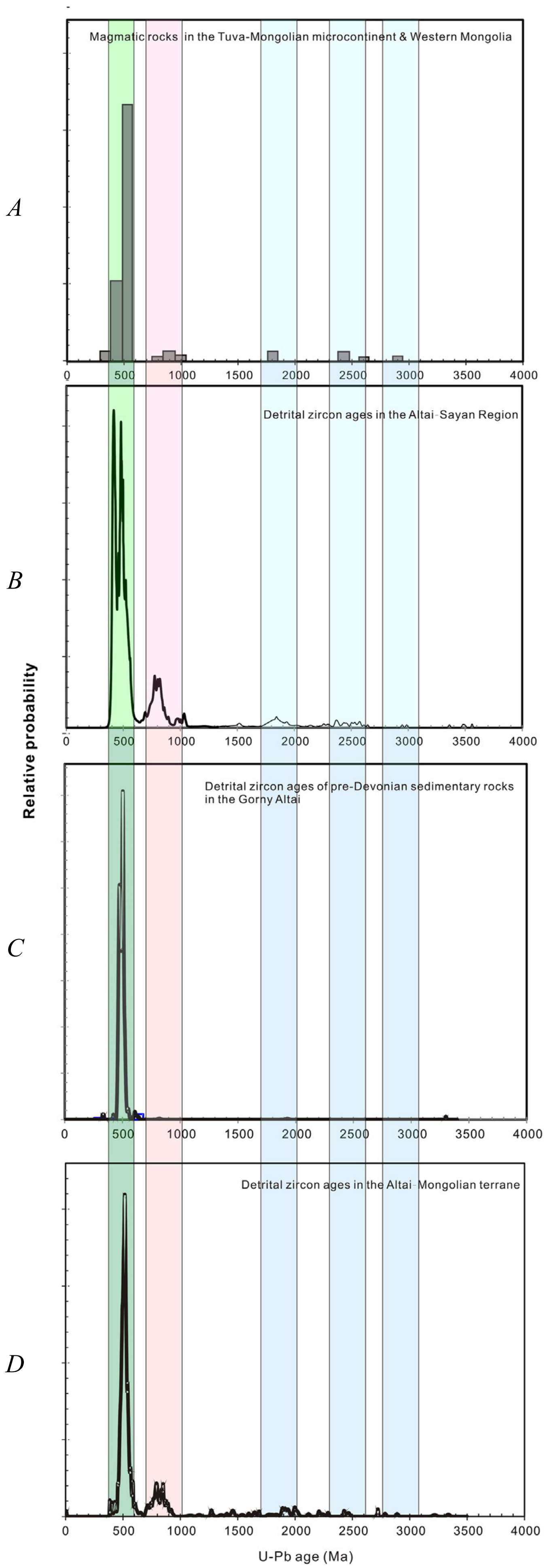

Fig. 4. Pooled U–Pb age–frequency diagram for magmatic rocks in the Tuva–Mongolian microcontinent and western Mongolia [*Cai et al., 2016*].

A – compared to the data compilations of the Altai–Sayan region, Gorny Altai and the Altai-Mongolian terrane. *B* – the zircon age-spectrum for the sedimentary sequences in the Altai–Sayan region (after [*Glorie et al., 2011*]). *C* – the zircon age-spectrum for the pre-Devonian sedimentary rocks in the Gorny Altai (after [*Chen et al., 2015*]). *D* – a compilation of detrital zircon U–Pb ages for sedimentary sequences in the Altai-Mongolian terrane [*Cai et al., 2016; Long et al., 2007, 2010; Sun et al., 2008; Chen et al., 2015; Jiang et al., 2012*].

Together, they are a part of the composite Kazakhstan–Baikal continent. The Gorny Altai terrane includes geodynamics complexes of the Siberian continent without Precambrian Gondwana-derived terranes.

Thus, within the Central Asian fold belt, the Pacific and Indo-Australian types of continental margins (oceanic and continental subductions) are combined. In the Altay-Junggar region, they are separated by the CTUSs. The concept of the Central Asian fold belt as a result of the evolution of a single Paleo-Asian ocean should be changed to the concept of a complex collage of terranes formed by the interaction of the Pacific and Indo-Australian tectonic plates. The modern analogy of the Central Asian fold belt is the active margins of South-East Asia.

Acknowledgements. This study was financially supported by the joint project of RFBR (grant 17-55-53048) and the state Fund for Natural Sciences of China (grant 41622205), and the Major Basic Research Project of the Ministry of Science and Technology of China (grant 2014CB448000).

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