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Late Cambrian-Early Ordovician Orogenic Events in Central Asia

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Several Late Cambrian - Early Ordovician collisional episodes have been recognized in Central Asia(east to west): the Siberian continent collided with the Khamar-Daban(Transbaikalia), Altai-Mongolian(Altai-Sayan) and Tuva-Mongolian(Tuva) microcontinents, and the Kokchetav microcontinent collided with the Stepnyak island arc(Northern Kazakhstan). Those collisional zones compose an EW-trending collisional belt extending to more than 4000 км and broken by Late Paleozoic-Mesozoic transversal strike-slip faults. The western segment of the belt(Northern Kazakhstan) is dominated by tectonic and thrust sheets comprising high-pressure rocks and ophiolites. The central segment(Altai-Sayan) is characterized by thrust sheets(early stages) and strike-slip faults and occurrence of blueschists and ophiolites, whereas the eastern segment is dominated by strike-slip fault structures. All these collisional events could be related to an active margin geodynamic environment existed in the Late Cambrian - Ordovician. The active margin with island arcs separated the Siberian continent from the Paleoasian Ocean, which oceanic crust incorporated Gondwana-derived blocks and microcontinents(Kokchetav-Ulutau, Altai-Mongolian, Tuva-Mongolian and Khamar-Daban). The subduction of the oceanic crust and subsequent collision of the microcontinents with the island arcs resulted in formation of such a huge orogenic belt, large granitic massifs and thick molasse units. Northern Kazakhstan. The Vendian-Early Cambrian subduction of Kokchetav microcontinent to great depths(up to 150-200 km) resulted in the 535 Ma UHP-HP metamorphism of basic magmatic and graphite-bearing sedimentary rocks and in partial melting of granite-gneissic basement rocks. At the exhumation stage(535-528 Ma) the felsic melts captured UHP-HP rocks and ascended to a depth of 90 km. During the next 5 Ma the UHP and HP rocks were uplifted to the base of the accretionary prism to depths of 60-30 km. At 528 Ma the Kokchetav microcontinent closed the subduction zone and the UHP-HP rocks ascended along lower crust fault zones(528-500 Ma) traced by garnet-mica-bearing schists. Later, at 505-480 Ma, the subduction zone jumped oceanwards and a new island arc(Stepnyak) was formed. The 480-460 Ma microcontinent-new island arc collision led to the thrusting of the fore-arc trough and formation of a nappe-sheeted structure and syntectonic olistostrome. A big accretion-collisional orogenic belt formed in the latest Early Ordovician, which later was destructed to form a Middle Ordovician molasse and intruded by the 460-440 Ma Zerenda collisional granites(Dobretsov et al., 2005 a, b). Altai-Sayan. The boundary zone between the Altai-Mongolian microcontinent and Siberia is marked by Charysh-Terekta, Ulagan and North-Sayan fault zones and comprises numerous

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fragments of Late-Cambrian-Early Ordovician oceanic crust. Gabbro, peridotite, serpentinite and serpentinitic mélange, blueschist, OIB- and N-MORB-type basalts occur in association with sedimentary rocks, in particular, siliceous units containing conodonts and radiolarians. Ar-Ar dating of amphibole and phengite from blueschist showed two age intervals: 491-484 and 455-400 Ma(Buslov et al., 2004; Volkova et al., 2005). Tuva. The amalgamation of Vendian and Early Cambrian island arcs to the Tuva-Mongolian microcontinent and closure of marginal and inter-arc seas resulted in the formation of the Sangilen orogen in Caledonian time (Vladimirov et al., 2004). The collision of the Tuva-Mongolian microcontinent and Siberian continent occurred at 525-490 Ma and was accompanied by high-grade metamorphism and magmatism. The 490-430 strike-slip faulting and general extension of the Sangilen orogen favored intrusion of meso-abyssal granitoids. Transbaikalia. The Khamar-Daban microcontinent is separated from the Siberian continent by a zone of deformation dominated by strike-slip faults. The zone comprises tectonics sheets consisting of granulite to epidote-aphibolite metamorphic rocks. Several tectonic, magmatic and metamorphic events occurred at an interval of 530-400 Ma. The rocks in the granulite facies formed at the deepest levels of the collisional system at 496-490 Ma(Khromykh et al., 2004). References: 1. Buslov M. M., Watanabe T., Fujiwara Y., Iwata K., Smirnova L. V., Safonova I. Yu., Semakov N. N., Kiryanova A. P. Late Paleozoic faults of the Altai region, Central Asia: tectonic pattern and model of formation // Journal of Asian Earth Sciences, 2004, V.23, P.655-671. 2. N. L. Dobretsov, M. M. Buslov, and F. I. Zhimulev. Cambrian-Ordovician tectonic evolution of the Kokchetav metamorphic belt, Northern Kazakhstan // Russian Geology and Geophysics, 2005, V.46, № 8, P.806-816. 3. N. L. Dobretsov, M. M. Buslov, F. I. Zhimulev, and A. V. Travin. The Kokchetav Massif as a Deformed Cambrian–Early Caradocian Collision–Subduction Zone // Doklady RAN, 2005, V.402, no.2, p.1–5. 4. Volkova N. I., Stupakov S. I., Tretyakov G. A., Simonov V. A. Travin A. V. and Yudin D. S. Blueschists from the Uimon zone as Evidence for Ordovician accretionary-collisional events Gorny Altai //Russian Geology and Geophysics, 2005, v.46, pp.367-382 5. Vladimirov A. G., Vladimorov V. G., Gibsher A. S., Travin A. V., Yudin D. S., Rudnev S. N., Shemelina I. V., Barabash N. V., Savinykh Ya. V. Early Caledonides of the Tuva-Mongolian microcontinent: model for the evolution of the collisional orogen(Sangilen upland, SE Tuva, as example) // Proc. Conf. "Geodynamic evolution of the Central-Asian mobile belt lithosphere(from ocean to continent)", Irkutsk: Inst. Georgaph. Publ., 2004, V.1, P.72-76. 6. Khromykh Ye. V., Sergeev S. A., Matukov D. I., Vladimirov A. G., Mekhonoshin A. S., Fedorovskii V. S., Volkova N. I., Rudnev S. N., Khlestov V. V., Yudin D. S. U-Pb age(shrimp-II) of hypersthene plagiorganites of the Chernorydnaya granulite zone(Ol'khon region, western Transbaikalia) // Proc. Conf. "Geodynamic evolution of the Central-Asian mobile belt lithosphere(from ocean to continent)", Irkutsk: Inst. Georgaph. Publ., 2004, V.1, P.141-145.