



Vendian-Early Ordovician Geodynamic Evolution of the Kokchetav Subduction-Collisional Zone (Northern Kazakhstan): Exhumation of UHP and HP Rocks

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Our performed synthesis of new and already published geochronological, petrological and structural data coupled with detailed geological mapping results allowed us to recognize several stages of evolution of the Kokchetav subduction-collisional zone (KSCZ). The stages are related to the Vendian-Early Ordovician subduction of the Paleo-Asian Ocean. The subducting of the Paleo-Asian Ocean lithosphere containing fragments of continental crust and the collision of the Kokchetav microcontinent with a Vendian island-arc system resulted in the subsequent formation and further exhumation of UHP and HP rocks.

During the first, Vendian-Early Cambrian stage the subduction of microcontinent rocks 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. The age of metamorphism was determined by Sm/Nd dating of eclogites and SHRIMP dating of zircons from diamondiferous rocks. At the second, exhumation stage (535-528 Ma) the felsic melts incorporated UHP-HP rocks and ascended to a depth of 90 km during a short time of 1 Ma at a speed of up to 1 m/year. 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 a speed of 0.6-1 cm/year. This stage is fixed by the age of zircons (rims) from diamondiferous rocks. At 528 Ma the Kokchetav microcontinent closed the subduction zone and the UHP-HP rocks were ascending along lower crust fault zones (528-500 Ma, SHRIMP dated zircon rims, Ar-Ar dating of micas) which can be traced by garnet-mica-bearing schists. At 500-480 Ma (Ar-Ar age of muscovite from the schists) the microcontinent collided with the island arc and the paleosubducted rocks were squeezed out along the fault

zones to form garnet-muscovite and muscovite schists, blastomylonites and mylonites. The crustal exhumation of the UHP-HP rocks proceeded along such zones. Later, the subduction zone jumped oceanwards and a new island arc was formed. The 480-460 Ma microcontinent-island arc collision led to the thrusting of the KSCZ over the fore-arc trough of the new island arc and formation of a nappe-sheeted structure and syntectonic olistostrome. The Early Ordovician KSCZ comprises Vendian-Cambrian rocks exhumed from different depths of the subduction zone, terranes detached from the Kokchetav microcontinent, island-arc rocks, accretionary prism units and tectonic sheets of ophiolites, Early Ordovician turbidites and olistostromes.

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.