

Plate Tectonics of the Altai

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The Altai consist in a huge accretionary-type belt extending from Siberia through Mongolia, northern China, Kyrgyzstan and Kazakhstan. They were formed from the Vendian through the Jurassic by the accretion of numerous displaced and exotic terranes (e.g. island arc, ribbon microcontinent, seamount, basaltic plateau, back-arc basin). The number, nature and origin of the terranes differ according to the palaeotectonic models of the different authors. Thanks to a geodynamic study (i.e. definition of tectonic settings and elaboration of geodynamic scenarios) and plate tectonics modelling, this work aims to present an alternative model explaining the Palaeozoic palaeotectonic evolution of the Altai.

Based on a large set of compiled geological data related to palaeogeography and geodynamic (e.g. sedimentology, stratigraphy, palaeobiogeography, palaeomagnetism, magmatism, metamorphism, tectonic...), a partly new classification of the terranes and sutures implicated in the formation of the Altai is proposed. In the aim to elaborate plate tectonics reconstructions, it is necessary to fragment the present arrangement of continents into consistent geological units. To avoid confusion with existing terminology (e.g. tectonic units, tectono-stratigraphic units, microcontinents, terranes, blocks...), the new concept of "Geodynamic Units (GDU)" was introduced. A terrane may be formed by a set of GDUs. It consists of a continental and/or oceanic fragment which has its own kinematic and geodynamic evolution for a given period. With the same approach, the life span and type of the disappeared oceans is inferred thanks to the study of the material contained in suture zones. The interpretation of the tectonic settings within the GDUs completed by the restoration of oceans leads to the elaboration of geodynamic scenarios. Since the Wilson cycle was presented in 1967, numerous works demonstrated that the continental growth is more complex and results from diverse geodynamic scenarios. The identification of these scenarios and their exploitation enable to elaborate plate tectonics models. The models are self-constraining (i.e. space and time constraints) and contest or confirm in turn the geodynamic scenarios which were initially proposed.

The Altai can be divided into three domains: (1) the Peri-Siberian, (2) the Kazakhstan, and (3) the Tarim-North China domains. The Peri-Siberian Domain consists of displaced (i.e. Sayan Terrane Tuva-Mongolian, Lake-Khamsara Terrane) and exotic terranes (i.e. Altai-Mongolian and Khangai-Argunsky Terrane) accreted to Siberia from the Vendian through the Ordovician. Following the accretion of these terranes, the newly formed Siberia active margin remained active until its part collision with the Kazakhstan Superterrane in the Carboniferous. The eastern part of the active margin (i.e. East Mongolia) continued to act until the Permian when the North-China Tarim Superterrane collided with it. The geodynamic evolution of the eastern part of the Peri-Siberian Domain (i.e. Eastern Mongolia and Siberia) is complicated by the opening of the Mongol-Okhotsk Ocean in the Silurian. The Kazakhstan Domain is composed of several continental terranes of East Gondwana origin amalgamated together during the Ordovician-Silurian time. After these different orogenic events, the Kazakhstan Superterrane evolved as a single superterrane until its collision with a Tarim-North China related-terrane (i.e. Tianshan-Hanshan

Terrane) and Siberian Continent during the Devonian. This new organisation of the continents imply a continued active margin from Siberia, to North China through the Kazakhstan Superterrane and the closure of the Junggar-Balkash Ocean which implied the oroclinal bending of the Kazakhstan Superterrane during the entire Carboniferous. The formation history of the Tarim-North China Domain is less complex. The Cambrian northern passive margin became active in the Ordovician. In the Silurian, the South Tianshan back-arc Ocean was open and led to the formation of the Tianshan-Hanshan Terrane which collided with the Kazakhstan Superterrane during the Devonian. The collision between Siberia and the eastern part of the Tarim-North China continents (i.e. Inner Mongolia), implied by the closure of the Solonker Ocean, took place in the Permian. Since this time, the major part of the Altaids was formed, the Mongol-Okhotsk Ocean only was still open and closed during the Jurassic.