Tectonic Evolution of the Altaids and Continental Evolution in Asia in the Paleozoic and Mesozoic

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Asia north of the Alpine-Himalayan mountain ranges contains the largest area of continental growth during the Phanerozoic. This growth may have been as much as 108 km3 and occurred in the Altaid orogenic system, which includes the Tien Shan and the Altai and their continuations both westward into the Porte of Turgay and the basement of the West Siberian basin and eastward into the Trans-Baykal and the low-lying ranges in the Gobi. The Altaids grew mostly around the Angaran Craton during the Vendian (±600 Ma) through latest Jurassic (±144 Ma) interval. Their structure is dominated by a trio of rock types consisting of (1) turbidites and their low-grade metamorphic equivalents, which collectively constitute forming greenschists extensive flysch and metaflysch terrains; (2) pelagic sediments such as cherts and limestones in addition to shales closely associated with the flysch; and (3) mafic and ultramafic igneous rocks commonly forming incomplete ophiolite suites. This trio is complexly deformed, in many places displays mlange characteristics (where neritic carbonate blocks are also seen), and most commonly displays a steep schistosity throughout the Altaids. In certain areas older gneisses outcrop from amidst terrains formed by the trio and are present in narrow, linear belts. Felsic to intermediate igneous rocks are common and intrude, and extrusively cover, both the trio and the older, higher grade terrane. Younger cover sequences are commonly continental red beds ranging in age from the Ordovician to the Jurassic. The entire Altaid edifice is formed from many narrow, long, curvilinear belts bounded by large strike-slip fault systems. The largest of such systems, the Irtysh-Gornostaev orogen, divides the entire Altaid structure into an eastern and a western domain and shows evidence of displacement exceeding 2000 km.

Palinspastic analysis of the Altaids reveals that they began in the Vendian as a continental margin arc that grew atop the Baykalide/Uralide basement fringing a combined Europe/Angara continent. This arc separated from the continent in the Early Cambrian, forming a long Kipchak island arc. The loose end of this arc was in Europe. As the Russian and the Angaran cratons rifted and began rotating toward each other, the loose end of the Kipchak arc collided with the Russian Craton. This collision led to internal strike-slip stacking and formed what is known as the ‘‘Kazakhstan microcontinent.’’ This entity was finally squashed between the Russian and the Angaran cratons in the Late Carboniferous. By the Middle Jurassic, all motion between the two cratons had ceased. To the (present) south of the Angaran Craton, the Mongolian and the Russian Far East parts of the Altaids developed mostly within the hairpin of the Tuva-Mongolian basement between the Vendian and the Late Jurassic. Altaid evolution was terminated by the final docking of the pieces of what is called the ‘‘Intermediate Units’’ in Asia, including the Tarim basement and the North China continental block. Tethyan evolution had commenced south of the Intermediate Units long before these units came to rest with respect to the Altaids during the Jurassic. The Altaid evolution involved a complex and protracted deformation leading to the formation of not only mountain ranges rich in mineral resources, but also complex basin types that today house some of the world’s largest hydrocarbon reserves. Their tectonic style is very reminiscent of

that seen in the basement of many Archean shields and thus may provide a sound, testable model for tectonic evolution involving continental growth since the earliest times.