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Tectonic evolution of West Junggar (NW China): implications for accretionary orogens processes in Central Asia

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Understanding the development and evolution of accretionary orogens is crucial for characterizing continental crust growth in time and space. In the Altaids tectonic collage of Central Asia, conflicting geodynamic models have been proposed about the Paleozoic evolution, during which juvenile continental crust has been extensively formed. This study focuses on West Junggar (NW China), a key region that has not been extensively studied yet. A multidisciplinary approach, including detrital zircon provenance study, geochemistry, field structural analysis and paleomagnetism provides new constraints on the Paleozoic evolution of West Junggar.

Oceanic subduction predominates in Early Paleozoic time, as indicated by ophiolitic mélanges, fore-arc volcaniclastic turbidites and magmatic arc suites. However, the development of an olistostrome supplied by a subcontemporaneous carbonate platform, the occurrence of continental molasse, and the chronology and geochemistry of magmatic events reveal interruptions of subduction. Discrete collisions of volcanic arcs and micro-continent are inferred from the tectonic structure of the belt, which displays allochthonous units rooted in the suture zone. Early Paleozoic magmatic and sedimentary rocks of West Junggar bear some resemblance to contemporaneous analogues in Eastern Kazakhstan, and suggest a lateral connection.

During Late Paleozoic, tectonic features that develop in response to plate convergence are strongly controlled by geometry of two new subduction zones. A Carboniferous accretionary complex composed of fore-arc sedimentary rocks and ophiolitic mélanges has been identified. The occurrence of quasi-synchronous upright folds and folds with vertical axes suggests that transpression plays a significant role in the Late Paleozoic tectonic evolution of the West Junggar. Latest Carboniferous (ca. 300 Ma) alkaline plutons postdate this early phase of folding, which was synchronous with accretion of the Carboniferous complex. The Permian Dalabute sinistral fault overprints Carboniferous ductile shearing and split the West Karamay Unit ca. 100 kilometres apart. Oblique convergence may have been provoked by the buckling of the Kazakh orocline and relative rotations between its segments. Depending upon the shape of the convergence zone, either upright folds and fold with vertical axes, or alternatively, strike-slip brittle faults developed in response to strain partitioning. Sinistral brittle faulting may account for the Late Paleozoic lateral imbrication of units in the West Junggar accretionary complex.

On the basis of these new results, we propose a geodynamic evolution in four steps: 1) Early to Middle Ordovician intra-oceanic subduction forming island arcs, 2) Late Ordovician tectonic accretion of island arcs against the Kazakhstan continental margin, 3) Early to Middle Silurian resumption of subduction and active continental margin magmatism, 4) Late Silurian-Early Devonian micro-continent collision, 5) development of oblique subduction zones, evolving toward a tectonic collage during the Late Carboniferous-Permian transcurrent regional event. This scenario, consistent with the successive formations of the Kazakhstan Block and the Kazakh Orocline, supports a model of multiple episodic accretions for the Altaids tectonic collage rather than a continuous continental margin evolution. These results also suggest that, in Central Asia, continental crust growth results from alternating vertical and horizontal growth episodes throughout the Paleozoic.