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Processes of arc-continent collision involved in the Paleozoic evolution of East Tianshan (NW China): accretion mode of the southern Central Asian Orogenic Belt

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The Tianshan range, in its Chinese part, provides good evidence of the processes involved in the Paleozoic welding of Tarim and Junggar continental blocks; it is a key area for testing the contrasting tectonic models so far advocated to explain the evolution of the Central Asian Orogenic Belt, especially its southern part: the Altaids. Two main accretionary stages have been previously recognized; but the proposed vergence of structures, direction of paleo-subductions, intra-oceanic or continental nature of volcanic arcs, and precise age and significance of suture zones were poorly documented.

The Tianshan shows three Paleozoic suture zones : the South Tianshan Suture Zone (STSZ), the Central Tianshan Suture Zone (CTSZ), and the North Tianshan Suture Zone (NTSZ).

The STSZ and CTSZ are the result of the first accretionary stage, post-dated by the Lower Carboniferous unconformity. A Central Tianshan (CTS) volcanic arc was active during Ordovician to Early Devonian time, due to the southward subduction (present coordinates) of a CTS ocean. The Ordovician-Silurian volcanic and volcaniclastic rocks, as well as the recently dated granodiorites of its deep part (Silurian to Early Devonian ages) belong to calc-alkaline series; their geochemistry argue for a continental basement of the arc, including old crust. Initially built on the northern margin of the Tarim microcontinent, it was rifted off by the opening of the South Tianshan (STS) back-arc basin, during Silurian-Early Devonian. The CTSZ, marked by mélange units

including MORB-type ophiolitic relics and HP rocks, resulted from the closure of the CTS ocean, and the collision between the northern Yili-North Tianshan (NTS) continental block and the CTS arc, at Middle-Late Devonian. Subsequently, the Late Devonian closure of the STS back-arc basin led to the collision between Tarim and CTS, and the emplacement of STSZ, marked by several mélange units, including ophiolitic mélanges and bodies (of back-arc affinity) and HP rocks. These tectonic events built the "Eo-Tianshan" orogen, gathering Tarim, CTS, and Yili-NTS blocks. All the related macro- and microstructures are verging north, unconformably covered by the Lower Carboniferous strata and/or intruded by Lower Carboniferous post-collisional granites. Unlike several models proposed in Kazakhstan and in China, this first accretion: 1) pre-dated the Visean; 2) followed an episode of southward subduction beneath the CTS arc, the Tarim being the passive margin of a back-arc basin; 3) built north-verging structures: nappes and folds.

The NTSZ resulted from the second accretionary stage. Due to Cenozoic thrusting, it is often hidden now, better preserved in West Tianshan, where ophiolitic mélanges remain visible. A NTS volcanic arc developed on the northern margin of the "Eo-Tianshan", during Late Devonian-Carboniferous, in response to the southward subduction of a NTS ocean. After oceanic closure, the subsequent collision between the Junggar passive margin and NTS, at the end of Carboniferous, induced north-verging folds and thrusts in NTS, but also secondary south-verging structures in CTS. At that time, the southernmost unit of the Mongolian Fold Belt, namely the Harlike arc, was already accreted to the northern side of the Junggar block, due to a Carboniferous collision following a northward subduction.

During Permian, the Gondwana-derived units (Eo-Tianshan units and Kazakhstan-Junggar) and peri-Siberian ones (Mongolian Fold Belt), all already welded, suffered from huge wrenching, dextral in Tianshan, sinistral in the Mongolian Fold Belt.