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# Structural and geochronological evolution of an accretionary orogenic wedge during Altai orogeny: An example from the Kalasu area (Chinese Altai)

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A detailed geological and structural mapping was carried out in the Kalasu area located in the southern Chinese Altai, a small segment of the giant Altai accretionary orogenic wedge, in order to understand its polycyclic evolution. The Kalasu area is predominated by felsic metavolcanic rocks in the northeastern domain and mainly by a metapelitic sequence with subordinate metavolcanic layers, intruded by gneissic granitoids cropping out over the whole area. Structural investigations reveal the presence of three deformation events with variable intensity and degree of preservation. D1 is characterized by a metamorphic S1 foliation moderately to steeply dipping to the NW or locally to the SE, preserved in the northeastern and southwestern domain. The D2 deformation is responsible mainly for the variability in dip of the originally sub-horizontal S1 fabric due to NNW-SSE F2 folding, which is not associated with penetrative metamorphic reworking. Such a structural template was subsequently reworked by orthogonal D3 deformation. This last deformation is characterized by NW-SE steeply plunging isoclinal to close F3 folds, steeply dipping S3 axial planes and S3 foliation, which is delineated by cordierite–K-feldspar leucosome in the central domain where the S1 foliation is entirely transposed.

To establish the absolute age of magmatic and metamorphic events, several samples were selected for U-Pb isotope analysis on zircon using the LA-ICPMS technique. In the northeastern domain, metavolcanic rocks reveal that bimodal volcanism occurred between ca. 388 to 405 Ma. In the central and southwestern domains, the detrital zircons indicate that the source provenance of the sequence was dominated by Cambrian to Early Ordovician rocks. The earliest gneissic granite intruded the sequence in form of S1 foliation parallel sheets during ca. 402 and 412 Ma, whereas a migmatization synchronous with the D1 event took place between ca. 392 and 374 Ma recorded by the presence of a younger peak in the detrital zircons. Consequently, in the central domain, a HT migmatization overprinted the Devonian metamorphic rocks during ca. 277 to 299 Ma, registered in resetted zircons from cordierite-bearing leucosome and gneissic granitoids. Associated with this HT Permian metamorphism, undeformed gabbroic and granite bodies were emplaced at ca. 280 Ma in the central and southwestern domain, respectively.

In conclusion, HT polycyclic evolution similar as the other hot collisional orogens worldwide can be shown in the Altai accretionary orogen: a Devonian event is characterized by a sub-horizontal orogenic S1 fabric intruded by syntectonic granite sheets in deep metamorphic zones, almost contemporaneously with extrusions of rhyolitic lavas in the supracrustal levels. This Devonian edifice is compatible with important vertical shortening and horizontal flow in all crustal levels. Subsequently, the whole system was affected by regional NNE-SSW F2 folding of supposed Late Devonian age and finally, the Devonian orogenic architecture was affected by Early Permian N-S shortening, producing extensive migmatization and intrusions of gabbros and anatectic granitoids. The hot Permian event is related to collision of the Junggar arc with the Chinese Altai belt that produced a large-scale perturbation of thermal structure of the mantle lithosphere.