



## Geochemical and detrital zircon studies of meta-sedimentary rocks from the Teletsk and Ulagan blocks, Russian Altai: Implications on their tectonic affinity and geodynamic evolution

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**Abstract:** A combined whole-rock geochemical and detrital zircon geochronological and Hf-isotope study was conducted on meta-sedimentary sequences of the Teletsk and Ulagan blocks in order to trace their provenance, depositional setting and tectonic affinity. Samples from the Teletsk and Ulagan blocks underwent epidote-amphibole- and greenschist-facies metamorphism, respectively, but all of them show comparable geochemical characteristics. They are characterized by high  $\text{Al}_2\text{O}_3/\text{SiO}_2$  ratios and ICV (Index of Chemical Variability) values, while  $(\text{Gd}/\text{Yb})_N$  ratios and REEs compositions are comparable to those of the upper continental crust, indicating that their protoliths were immature and probably deposited proximal to the source areas without significant sedimentary sorting. The low CIA (Chemical Index of Alteration) values for these samples (47.3-74.5 and 52.5-74.5, respectively) further suggest that the source rocks underwent mild to moderate chemical weathering. All the samples show major elements (e.g.,  $\text{Al}_2\text{O}_3/\text{TiO}_2$ ,  $\text{TiO}_2/\text{Fe}_2\text{O}_3^T$ ,  $\text{Fe}_2\text{O}_3^T/\text{Al}_2\text{O}_3$ ), REEs concentrations, HFSEs and transition elements compositions between the typical andesites and granites, but deviate from those of basaltic rocks, implying that intermediate-felsic rocks served dominant sources during the sedimentation. These geochemical characteristics are consistent with the continental island arc setting, which is discriminated by the  $\text{TiO}_2$ ,  $\text{Al}_2\text{O}_3$  and  $\text{Fe}_2\text{O}_3^T + \text{MgO}$  concentrations higher than those of passive marginal depositions, but  $\text{La}/\text{Sc}$ ,  $\text{Ti}/\text{Zr}$ ,  $\text{La}/\text{Th}$ ,  $\text{La}/\text{Sc}$  and  $\text{Zr}/\text{Th}$  ratios comparable to those of depositions in continental island arc settings. Two samples from the Teletsk and Ulagan blocks yield similar detrital zircon age spectra, with the most prominent population of ca. 620-470 Ma old and a subordinate one of ca. 943-743 Ma old. Comparison with surrounding tectonic units shows that the Tuva-Mongolian terrane and surrounding island arcs in western Mongolia probably provided substantial sources to the protoliths. The similarities in geochemical compositions and detrital zircon patterns with those for the Altai-Mongolian terrane suggest that the Teletsk and Ulagan blocks possibly represented the northern margin of this terrane with different crustal levels. Our study places further constraints that the whole Altai-Mongolian terrane possibly represented a large subduction-accretion complex built upon the active margin in the western Mongolia during the early Paleozoic.