

Ages, origin and tectonic significance of the Altay associated deposit granites from the northwestern part of China

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The Altay associated deposit granites exposed in the central Altay tectonic belt are mainly composed of granodiorite, monzogranite and syeno-granite. In-situ zircon LA-ICPMS U-Pb dating analyses yielded a crystallization age of 454.8 ± 2.4 Ma (MSWD=0.32), indicating that the Altay associated deposit granites are closely related to the late Ordovician magmatic activity. The Altay associated deposit granites are characteristic of highly enriched in silicon, alkali and potassium ($K_2O/Na_2O > 1$), and show low titanium, magnesium and phosphorus contents. A/CNK average value is 1.05 and corundum norm content of CIPW calculation is higher than 1, indicating the characteristics of high potassium calc-alkaline peraluminous granite. The rocks enrich in light rare earth elements (LREE), while the patterns of heavy rare earth elements (HREE) are flat with significant Eu negative anomaly. The enrichment of Th and Rb, depletion of Sr, Ti and P elements and pronounced Nb, Ta and Ti negative anomalies, which shows the initial arc characteristic of magmatic rocks. The $\epsilon_{Nd}(t)$ value (2.0–0.5) approaching 0 and the older two-stage model (T_{DM2}) age (1.15–1.35 Ga) suggest that its source area contain fairly high crust source components but with a certain amount of mantle source material. Several lines of evidence of geochemistry suggest that the Altay associated deposit granites may be formed by partial melting of argillaceous graywackes enriched in biotite and muscovite under low pressure and high temperature conditions. Its source area has retained plagioclase, ilmenite and apatite and is mixed with mantle source materials at the mean time. In the compressive tectonic setting of active continental margin, the local decompression due to extension together with the heat energy provided by inhomogeneous uplift of abnormal mantle had led to the partial melting of the upper crust sediments and mix with minor mantle source material and thus forming the Altay associated deposit granites.