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The Late Silurian ultramafic-mafic complexes in the Qilian Fold Belt, NW China: inkling the end of Caledonia Orogeny

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Field relationships, mineralogy, petrology, geochemistry, geochronology, and Nd-Hf-O isotopes of the ultramafic-mafic rocks from the east part of the Qilian block are studied in the present work. The Aganzheng intrusive body only exposed in the Zhigoumen, Shiguanzi, Xianggoumen outcrops and includes olivine pyroxenite, clinopyroxenite, pyroxene hornblendite, hornblendite, dioritic norite. The gabbroic and dioritic rocks are also layered or massive cumulates with rock types varying continuously from noritic gabbro through hornblende gabbro to dioritic norite. Contact metamorphic zones are well developed between the Aganzheng intrusive body and the country rock.
Major element contents of Aganzheng ultramafic-mafic rocks show subalkalic series and are characterized by low SiO_2 contents (38.09-54.96 %), low TiO_2 contents (0.09 -0.72 %), low P2O5 contents (0.00 -0.36 %) and alkali contents (Na2O+K2O 0.01-5.35 %), but high MgO contents (9.68-33.06 %), Ni contents (116-1505 ppm), Cr contents (713-2808 ppm). Similar LREE-rich pattern ((Ce/Yb)N =0.95-3. 80 except two Samples) and tiny Eu anomaly (Eu/Eu* =0.6-1.2) indicate the Aganzheng ultramafic-mafic rocks have the same magma source. Trace elements are enriched in LILE (Rb, Th, U, K), relatively depleted in HFSE (Nb and Ta), and the La/Yb, Ce/Yb, Th/Yb, Nb/La, La/Sm values suggest the limited crustal contamination during the rise of the magma.
The εNd (430 Ma) values are -6.9–$+2.5$ and TDM values are 3.6–1.4 Ga.
The SHRIMP ages are 433 ± 2 Ma for the Zhigoumen pyroxenite (101-2101A), 434 ± 3 Ma for Shiguanzi gabbro (101-2104A) and 412 ± 3 Ma for the Xianggoumen serpentinite (101-2107A). In situ zircon O-Hf isotope, the δ18O compositions of vary from +9.03 to+9.50 (except three points +11.33, +12.38, +12.44) andεHf(t) value is +0.29 to +4.13 for the Zhigoumen pyroxenite (101-2101A), the δ18O compositions of vary from +6.39 to +7.12 andεHf(t) value is +7.76 to +13.26 for Shiguanzi gabbro (101-2104A). and the δ18O compositions of vary from +4.68 to+5.31 andεHf(t) value of +0.28 to +2.79 for the Xianggoumen serpentinite (101-2107A).
According to the above datum, we suggest the late Silurian magmatism last $\sim$20 m.y. (434-412 Ma) on the northern margin of the Qilian Block was related to the Early Paleozoic continental collision between the Qilian and Alax blocks, and to subsequent subduction, thermal underplating and inkling the end of Caledonia Orogeny.