

Zircon U–Pb geochronology and geochemistry of the Lajimiao mafic complex in the Shangdan Suture Zone, Qinling orogen: Petrogenesis and tectonic implications

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The Shangdan Ocean represents the eastern branch of the Proto-Tethys Ocean, which is important to decipher the evolution of the Central China Orogenic Belt. However, its evolution is still in debated. In this contribution, we carried out petrological and geochemical data for the Lajimiao mafic complex in the Shangdan Suture Zone from the North Qinling orogen. The complex is composed of coarse-grained gabbros to norite-gabbros (Group 1) in the inner and small-grained diorites (Group 2) in the outer part. The Group 1 samples are predominantly comprised of salite to augite ($Mg^{\#} = 75\text{--}80$), magnesi-hornblende ($Mg^{\#} = 65\text{--}67$) and Ca-rich plagioclase ($An = 45\text{--}67$); the Group 2 samples are mostly comprised of magnesi-hornblende ($Mg^{\#} = 60\text{--}66$) and plagioclase ($An = 28\text{--}53$). Zircon U-Pb dating for a gabbro and a diorite sample yielded similar formation ages of 412 ± 4 Ma and 414 ± 2 Ma. The Group 1 samples have relatively low SiO_2 (49.56–50.78 wt.%), high MgO (6.67–7.70 wt.%) contents, compared to the Group 2 samples. They are enriched in LILEs, LREEs and depleted in HFSEs, which are typical of arc-related rocks. Both of them have enriched initial Sr (0.7049–0.7054), and chondritic to slightly depleted Nd ($\epsilon_{Nd}(t) = -0.09\text{--}+1.50$), but depleted whole-rock and zircon Hf isotopic compositions ($\epsilon_{Hf}(t) = 7.81\text{--}8.10$ and $8.2\text{--}9.1$). The Hf–Nd isotopic systems are decoupled with positive ϵ_{Hf} values. They have high zircon $\delta^{18}O$ of 6.3 to 6.5‰ values. Their whole-rock Pb isotopic compositions are close to those of the GLOSS-II. The Lajimiao complex was derived from relatively depleted mantle that had been metasomatized by 2–5% subducted zircon-barren oceanic sediments. Accordingly, the Lajimiao complex was generated by the subduction of the eastern branch of Proto-Tethys Ocean, which might have not been closed until the early Devonian.