

Geochronological and geochemical constraints on petrogenesis of Late Mesozoic I- and A-type granites from the coastal area of northeastern Fujian Province, SE China

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Late Mesozoic granitic plutons of I-type and A-type coexist in the coastal area of northeastern Fujian Province, SE China. In this study, we dated four I-type plutons (Nanzhen, Dacengshan, Sansha and Dajing) using LA-ICP-MS zircon U-Pb method with ages of 96.1 ± 2.7 , 93.1 ± 2.4 , 91.5 ± 1.5 , 93.8 ± 1.8 Ma, respectively. Two A-type granites (Yaokeng and Taimushan) show similar or slightly younger ages of 91.3 ± 2.5 and 92.8 ± 0.6 Ma. Geochemically, the A-type granites show higher SiO_2 , FeO^* , Nb, Zr, Hf, Ga, Rb/Sr, Rb/Ba and Ga/Al, but lower Al_2O_3 , MgO, CaO, P_2O_5 , Sr, Ba, and less fractionated REE patterns with more pronounced negative Eu anomalies than those of the I-type rocks. The $\text{K}_2\text{O} + \text{Na}_2\text{O}$ contents decrease with increasing SiO_2 from I-type to A-type granites, and no distinct fractional crystallization trend has been documented on the Harker diagrams. Geochemical modelling indicates that the I-type and A-type granites evolve along different trends. Zircon saturation temperatures of the A-type granites ($816\text{--}921^\circ\text{C}$) are clearly higher than that of the I-type ($730\text{--}779^\circ\text{C}$). These data suggest that the A-type granites could not be generated by fractional crystallization from the I-type magma.

The A-type granites show a significantly higher $\varepsilon_{\text{Nd}}(t)$ values (-0.65 to -1.39) than the I-type rocks (-4.20 to -5.49), which also can not be explained by the fractionation model as the Nd isotopic compositions are scarcely changed during fractional crystallization. The higher $\varepsilon_{\text{Nd}}(t)$ values of the A-type granites require a higher proportion of mantle input in their generation process. We therefore conclude that the I- and A-type granites have different sources, and have underwent different rock-forming process.

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Carbonate weathering in response to monsoon changes

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Chinese loess-paleosol sequences are valuable archives for the response of carbonate weathering under long-term evolutions of East Asian monsoon system. However, the precipitation of secondary calcite caused difficulty in quantifying the weathering of carbonate in loess by its content.

The weathering of detrital calcite in loess deposits may be reconstructed by the amount of Mn bonded in calcite, since it is characterized by extremely high Mn content (~ 2000 ppm) while the authigenic carbonate shows very low Mn content. Thus, the dissolution of detrital calcite in loess will be reflected by decrease of calcite-bonded Mn no matter how much the secondary calcite are precipitated. Here, the calcite-bonded Mn are released by acetic acid leaching (0.2 mol/L) over 12h and then measured on an ICP-AES. Repeated experiments show that the uncertainty associated with the whole procedure is $\pm 5.1\%$ (standard deviation, $n=5$).

Weak dissolution of calcite in L_1LL_1 and L_1LL_2 loess layers is indicated by high Mn content, corresponding to the weak summer but strong winter monsoon condition in marine isotopic stage 2 and 4, while intensive calcite weathering with strong summer but weak winter monsoon in S_0 , L_1SS_1 and S_1 layers (MIS1, 3, 5) is indicated by low Mn content (Fig. 1). We propose that the winter monsoon influences the weathering of calcite through controlling the weathering time (sedimentation rate), while the summer monsoon achieves its influence by changing the precipitation amount.

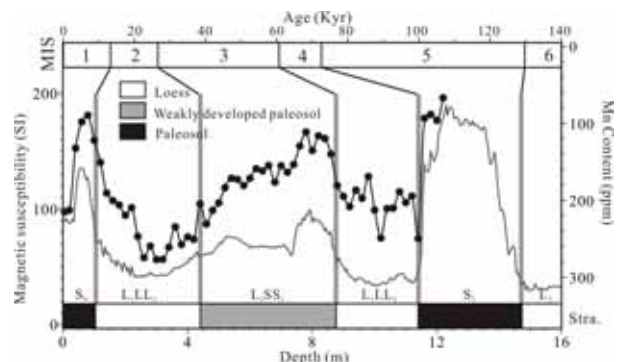


Figure 1: Variations of calcite bonded Mn content and susceptibility changes in upper part of loess-paleosol sequence.