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Denudation history of the coastal area of NW South China Sea: implications for the development of the deep anomalous progress

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There are a large amount of alkaline basalts developed in the Leiqiong area, NW South China Sea during the Late Cenozoic. Seismic tomography shows that just below the Leiqiong region, there is a mantle plume-like low-velocity thermal anomalous structure. Thus, the northwestern continental margin of the South China Sea is an ideal region for studying the coupled relationship between present Deep Earth processes and surface processes, and investigating the possible influence of the deep Earth processes on the development and evolution of sedimentary basins and the South China Sea. To obtain the information of crustal vertical isostatic movement due to the deep processes, we present 15 apatite fission track data and 10 zircon and apatite (U-Th-Sm)/He ages of granite samples to elucidate the denudation history of the coastal area of the NW South China Sea. Fifteen samples analyzed yield apparent AFT pooled ages ranging from 20.8±1.3 Ma to 71.3±4.7 Ma, all of which are substantially younger than their host emplacement age. Most of these ages are Eocene and Early Oligocene, and are consistent with the rifting stage of the Zhu III depression, Pearl River Mouth Basin. Ten samples yield Cretaceous through Early Cenozoic AHe and ZHe ages, eight of which also have AFT data. On the whole, except for one or two single-grain ages showing obvious dispersion, these samples yield single aliquot ZHe ages within a relatively restricted range, showing that these ages are relatively robust. Thermal history modelling with HeFTy shows that all these samples have experienced a broadly similar three-stage cooling history since the Late Cretaceous, characterised by a relatively rapid cooling episode during Late Cretaceous, and then a much slow cooling episode at around 110 ˚C followed by another rapid cooling episode. During the last cooling episode, which is well constrained by AFT data, the samples cooled relatively rapidly through the PAZ from ∼>110˚C to ∼60˚C, and then to the surface temperature of 20 ˚C. The timing of inflections of the cooling paths varies from sample to sample, depending on their tectonic locations. Analyses suggest that the first rapid cooling stage is related with the widespread extension in the South China during the Late Cretaceous, while the last rapid cooling episode, which is also recorded by basin subsidence and other low temperature thermochronology data, might be caused by the Cenozoic rifting, the extrusion due to the India-Tibet collision, or paleo-deep processes. The present deep process might be local and in small scale, and its effect on the vertical surface movement, which has other evidences, is local and not yet large enough to be recorded by the above low temperature thermochronology data.