Detrital zircon U-Pb and Hf isotopic constraints on the magmatic and crustal evolution in Georgia

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Georgia, i.e., Georgian Caucasus, is located at the most northern part of the Caucasus-Iran-Anatolia region elevated by the collision between Arabia and Eurasia. U-Pb age and Hf isotopic results of detrital zircons were obtained from samples representative of Jurassic to Miocene sedimentary formations in Georgia to investigate magmatic records and crustal evolution related to the development of Tethys oceans. Two Jurassic rocks among all samples have ages distributing from Proterozoic to Paleozoic time, and no separates younger than ~250 Ma. By contrast, the Miocene rock displays ages spreading from the Ordovician to Eocene, and no separates older than ~480 Ma. Furthermore, our data suggest several significant magmatic events in the Phanerozoic: (1) a major activity from ~500 to 420 Ma, (2) a major activity at ~320 Ma, (3) minor activities at ~220 and 170 Ma, (4) a major activity from ~110 to 90 Ma, and (5) a major activity at ~45 Ma. The Hf isotopes show not only positive/depleted but negative/enriched values/compositions in two episodes of ~500 to 420 Ma and ~320 Ma, and are mainly positive-dominant since ~220 Ma. This scenario is also observed for magmatic zircons of a few igneous rocks, central to south Georgia with abundant inherited zircons (~700 to 500 Ma) and significant magmatism marks (~320, ~220, ~90 and ~45 Ma). The former is probably associated with the occurrence of a juvenile Arabian-Nubian Shield crust as the mantle component compared to the old curst. The later denotes the existence of a juvenile crust all over Georgia since the Carboniferous, representing the extensively continental crust growth during the Phanerozoic in Georgia. We propose that two stages of old crustal evolution (Proterozoic to ~500 Ma and ~500 to ~320 Ma) accompanied by two apparent episodes of young crust growth at ~500 Ma and after ~320 Ma. And the results in this study could be applicable to different stages of magmatism related to a Gondwana domain provenance, closure of the northern Neotethys and the Arabia-Eurasia collision identified in many previous researches about evolution of the Alpine-Himalayan Orogeny.