

Micro-textural features of heavy mineral beach placers along the southeastern coast of Sri Lanka: implications for their paleoenvironment

Sandaruwan G. B. C.^{1*}, Madugalla T. B. N. S.², Adikaram A. M. N. M.², Pitawala H. M. T. G. A.^{1,3}, Udagedara D. T.⁴

The beach placers are largely composed of resistant heavy minerals and are known as one of the most easily exploitable mineral deposits in the world. Such placers are commonly deposited along the edges of large water bodies due to the gravity separation processes. The southeastern coast of Sri Lanka contains extensive depositional beaches, lagoons, and estuaries, and shows signs for occurrences of valuable mineral placers. We investigated the mineralogy and micro textural features of placer and non-placer sediments in the lagoonal beaches (Periya Kalapuwa, Korai, Komari, Pottuvil and Arugam Kalapuwa) and Heda Oya riverine beach of the southeastern part of Sri Lanka. The study aimed to compare transport and depositional processes, and paleoenvironmental histories of placer and non-placer deposits. The field and mineralogical results revealed that the sediments in the lagoonal shores are black-colored ilmenite placers with abundant ilmenite and accessory zircon while the sediments from Heda Oya riverine shore are red-colored titanium placers with almandine. The non-placer deposits are mostly composed of quartz, albite and magnesian calcite. The micro-textural analyses of 240 quartz grains from placer and non-placer deposits showed the presence of twenty-five predefined micro-textures indicating the prevailed influences of subaqueous-beach, fluvial, aeolian and chemical alteration processes on the sediments. Also, these textures showed a decrease in source-sinking distances and subaqueous beach processes, while an increase in fluvial processes from non-placer, red placer to black placer deposits. Chemical alteration processes such as cracks and solution pits are higher in heavy placer deposits revealing the deposition in the steady low energy environment. Further, the cross-cutting relationships between environment specific micro-textures show crystalline overgrowth cross-cutting on chemically modified surfaces, upturned plates with cracks and solution pits, and large conchoidal fractures cross-cutting on surfaces that contain V-shaped percussion cracks. The cross-cutting relations indicate prevailed pre-aeolian processes and post-chemical alteration processes on placer deposits. Further, they are more recently controlled by subaqueous beach processes with sparse aeolian contributions. Large conchoidal fractures, arcuate and straight steps micro-textures, and mineralogical contents of the placer deposits indicated crystalline rock sources. Hence, these placer deposits probably have been derived from granitic gneiss, granodioritic gneiss, charnockites and garnet-bearing granulites of the Precambrian Vijayan Complex and Highland-Vijayan tectonic boundary zone.

Keywords: Beach placers, Micro-texture, Paleoenvironment, Quartz grains, Scanning electron microscope, Southeast coast of Sri Lanka

¹Postgraduate Institute of Science, University of Peradeniya, Sri Lanka

² Department of Physical Sciences, Faculty of Applied Sciences, South Eastern University, Sammanthurai, Sri Lanka

³ Department of Geology, Faculty of Science, University of Peradeniya, Sri Lanka

⁴ Department of Applied Earth Sciences, Faculty of Applied Sciences, Uva Wellassa University, Badulla, Sri Lanka

* chaturangasandaruwangbcs@gmail.com