Received: 19 September 2019 | Revised: 18 July 2020 | Accepted: 27 September 2020

DOI: 10.1002/gj.4023

SPECIAL ISSUE ARTICLE

WILEY

Physicochemical characteristics and spatial distribution pattern of the Yercaud Lake surface sediments, South India

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Handling Editor: R. Nagarajan

Freshwater lakes and sediments need to be monitored continuously for environmental assessment and geochemical explorations. Lake sediments are major sinks for organic matter and for all geochemical elements. In the present study, total organic matter (TOC), nitrogen (TN), and geochemical analysis of major oxides was carried out on Yercaud Lake surface sediments, located at a higher elevation in South India to infer sediment distribution pattern and source for organic matter. Particle size distribution of lake surface sediments suggests that the sediments are predominantly silty sand and sandy silt, poorly to very poorly sorted and symmetrically skewed. TOC/TN ratio (6.54–12.65) reveal that the organic matter (OM) is derived from the in situ lake sources particularly from the vascular plants and lake biota accumulation. Weathering indices that fall from [chemical index of alteration (CIA)] 88.59–93.08 values and A-CN-K plot reflects intense chemical weathering of the bedrock exposures in the source area, which was accelerated under warmer and humid climate conditions in the sub-tropical regions. Al_2O_3/TiO_2 ratio (6.94–26.62) indicates weathering particularly of the exposed charnockite rocks around the lake basin.

KEYWORDS

geochemical classification, major oxides, provenance, South India, weathering indices, Yercaud lake

1 | INTRODUCTION

Over the past few decades, the atmosphere in the high-elevated zones of the tropical and subtropical regions has warmed faster than anywhere else on the Earth (Huang et al., 2017) impacting dramatically the socioeconomic and ecological consequences of the region. Accurate estimates of the amplitude of environmental impacts have also been compounded by an imprecise understanding of the ecological indicators of past environmental conditions (Miller et al., 2010). Freshwater lake ecosystems, whose development is archived in the sediments, act as sensitive sentinels of environmental changes (Adrian et al., 2009), while even minor changes in climate can severely deteriorate the lake ecosystem services (Saulnier-Talbot et al., 2014). Assessments of the impact of climate change in lake systems rely on careful interpretation of suitable proxy data. Proxy information on present and past ecological conditions is provided by various biological and physicochemical properties of the sediment components (Meyer, Chapligin, Hoff, Nazarova, & Diekmann, 2015; Nazarova et al., 2017; Solovieva et al., 2015). However, the spatial within-lake distributions of preserved remnants of ecosystem inhabitants and associated sediment-geochemical properties depend on habitat differences between the epilimnion and the hypolimnion (Raposeiro, Saez, Giralt, Costa, & Goncalves, 2018) and are therefore expected to be non-uniform.

Freshwater bodies such as the lakes and ponds are a major source of water to the population residing around. And these water bodies need to be monitored regularly for chemical pollutants and sediment accumulation. The lake sediments have high binding capacity for organic matter and geochemical constituents and are major sinks for carbon. Lake sediments normally obtain organic material

