

Depositional Environment and Geochemical Characterization of Quaternary Sediments along National Highway in Samba and Kathua Districts, Jammu and Kashmir, India

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Abstract

The Quaternary sediments are well exposed along the National Highway between Samba and Kathua districts of Jammu and Kashmir, India. These sediments represented by loose / unlithified sediments ranging in size from boulder conglomerate to fine clay particles. In the present study, three sections viz. Basanter North, Samba South East and Dhalta West has been chosen for facies and grain size analyses, geochemical characterization and X-ray diffraction (XRD) analysis to know the depositional environment, provenance and mineralogical composition of Quaternary sediments. Based on the facies study and grain size analysis, a mixed type of depositional environment suggested for Basanter North, Samba South East and Dhalta West sections. Major Oxides, Trace and REE elemental data and XRD analysis indicate that the source was felsic in composition and sediments are from lesser and Outer Himalayas.

Keywords: Quaternary Sediments, Depositional Environment, Provenance, Mineral Composition, Jammu and Kashmir

Introduction

Quaternary sediments are primarily recognized for their unconsolidated nature (sand, silt, clay, gravel, pebble, boulders). These unconsolidated sediments play an important role to shape the distinct landform produced on the earth surface with help of different weathering agencies (glaciations, fluvial, colluvial, alluvial, aeolian). The composition of sediments is influenced by a variety of factors, including the characteristics of the source rock, the extent of chemical weathering, hydraulic sorting, adsorption, diagenesis, and metamorphism (Roy *et al.*, 2008). At global level, various authors carried out work on Quaternary sediments for tectonic and provenance (Bhatia, 1983; Bhatia and Crook, 1986; Herron, 1988; McLennan *et al.*, 1993; Bracciali *et al.*, 2007; Basu *et al.*, 2016; Bastia *et al.*, 2020; Kettanah *et al.*, 2021; Khan *et al.*, 2025), and mineral composition (Loubser and Verry, 2008; Quader and Majeed, 2022; Xiao *et al.*, 2024). From time to time the work on paleoclimate, grain size analysis and depositional environment by the authors (Miall, 1977; Shrivastava *et al.*, 2012; Kanhaiya *et al.*, 2017; Kanhaiya *et al.*, 2019; Irfan *et al.*, 2022; Abishek *et al.*, 2024).

The Quaternary sediments of Jammu region stretching along foothills of Siwalik, is least studied for their provenance,

depositional environments and grain size attributes (De Terra and Paterson, 1939; Dasarathi, 1968; Ganjoo, 1990; Verma *et al.*, 1990; Ganjoo, 1993; Ganjoo *et al.*, 2002; Ganjoo and Kumar, 2012). De Terra and Paterson (1939) studied the Quaternary sediment deposited in the foot of Siwalik hill and concluded that the deposition of Potwar plateau (Pakistan), was the result of gigantic windstorms with intermittent rains. Dasarathi (1968) gave a detailed account on the geological aspects of Tawi river valley. On the basis of LANDSAT imagery studies, Ganjoo (1990) discussed that the entrenchment by the Tawi River at foot of Trikuta limestone and presence of deep gorges indicate neotectonism and this is the result of the integration of river system. He also suggested the presence of some rock material of lesser Himalaya in the Late Pleistocene deposits. Verma *et al.* (1990) divided post-Siwalik silts of the Jammu region into two subdivisions, Older Alluvium and Newer Alluvium. The Older Alluvium, which is situated above the flood level, comprises beds that are gradually depleted, whereas the Newer Alluvium is composed of current flood deposits, actively forming in the region. Ganjoo *et al.* (2002) worked on the early Pleistocene palaeosol of Jammu region for its genesis and climatic significance and reveal that the warm humid to semi-arid climatic conditions for the late Pleistocene palaeosol deposits of Jammu. Ganjoo and Kumar (2012) conducted study on Quaternary fine silt deposits in the Jammu province, focusing on genesis, climatic significance, grain size characteristics, and depositional environment. They suggested a fluvial depositional environment for certain areas, where fluctuating water budgets and periods of