Abstract

Quaternary is the youngest period in Earth's history, spanning from 2.6 Ma to the present. The extreme climatic conditions during this period carved the earth-surface to its present form. The human civilization came into existence during the late phase of this period. Studying past environmental records is the best way to understand the geomorphic evolution during the Quaternary. The most faithful record keepers of the surficial processes are the sedimentary deposits. The western part of the Indian sub-continent is home to a huge repository of Quaternary sediments representing different climatic and geomorphic regimes. The well-watered floodplains of the Indus and its tributaries border the vast expanse of arid Thar Desert, devoid of any major rivers. Just south of the great sand sea lies the salt encrusted low lands of the Great Rann of Kachchh, unique of its kind, which was probably a shallow marine gulf during the early Holocene. Eastern boundary of the desert is demarcated by the alluvial deposits of seasonal rivers originating from the ancient mountain ranges of the Aravallis. In this enigmatic backdrop of extreme climatic conditions and contrasting landscapes, appeared the Bronze Age Harappan Civilization. In an attempt to understand the geomorphological evolution of these terrains and its role in the evolution of the Harappan Civilization, I have studied the sedimentary archives of this region in my Ph.D. The present work involves establishment of stratigraphy using field relationships and geochronology. Using trace element and isotope geochemistry, I have determined the sources of sediments in these vast sediment sinks and their depositional pathways, which are critical to our understanding of the evolution of the fluvial landscape during the Harappan period. My work involving the alluvium of the river Ghaggar, an ephemeral river located at the northern most boundary of the Thar, suggests that the river had a glacial past during the late Pleistocene. Sedimentary records indicate that the discharge in the river decreased during the last glacial maxima with deposition of locally reworked sediments by the channel. During the beginning of the Holocene, sediments originating from the glaciated Higher and Lesser Himalaya again started depositing in the Ghaggar alluvium. The pathways for the sediments were probably the distributaries of the Sutlej. This rejuvenated phase of the river sustained until the mid-Holocene (~5 ka), after which the river became a rain-fed ephemeral system. The beginning of the agro-pastoral farming settlements of the pre-Harappan people coincides with the

rejuvenated phase of the Gahggar during the early Holocene. Therefore, we believe that the reactivation of the river system triggered the nucleation of early settlements along the banks of the Ghaggar. However, before beginning of the mature Harappan phase, the river began having dwindling water supply. This led us to conclude that the demise of the river may not be a triggering factor for the decline of the mature Harappan phase. Our geochemical provenance study of the sedimentary deposits of western Great Rann of Kachchh indicates that a continuous Ghaggar-Hakra-Nara channel used to deliver sediments into the GRK until about 1 ka. The deposition, however, was not continuous and was related to occasional monsoonal floods only. Therefore, the ephemeral channel of the Ghaggar river continued to exist up to ~1 ka even though the river system started declining dring the mid-Holocene. The geochemical provenance study of the sediments deposited along the margins of the rocky islands of the eastern GRK indicates that the sediments in this part of the basin were derived locally. We also found that the depositional environment of these sediments was mainly estuarine. The study involving the source identification and quantification of the Thar desert sand reveals that the desert sand was mainly derived from local sources, contrary to that previously proposed: a distant Indus delta. The influence of the Indus river derived sediments are maximum in the western margin of the desert (up to 60%), which decreases significantly towards the eastern and central part of the desert. We determined that the sedimentary rocks of the Proterozoic Marwar Supergroup in Rajasthan were the major sediment contributors to the desert sand. Towards the south eastern part of the desert, the Luni river alluvium becomes the main source of the aeolian sand. The Luni river alluvium on the other hand received its sediments from the Aravalli ranges in the east. The main sources for the Luni sediments were the pockets of mafic/ultrafic rocks exposed along the western flank of the Aravalli ranges. Other major lithologies of this region (e.g. granitoids and felsic volcanics) contributed comparatively fewer amounts to the sedimentary budget. Rare Earth Element (REE) composition of the Luni river sediments suggests that their abundances are primarily controlled by the weathering intensity and sediment sorting. The incipient chemical weathering and dominant physical weathering in the catchment region might have been the main reason for this.