6.1 Introduction

The Great Rann of Kachchh (~300 km in length and 80-100 km in width) is a unique landscape in western India which gets inundated during the monsoon by wind-driven marine storm surges and continental fluvial influxes (Glennie and Evans, 1976). The Rann is bound by the Nagar Parker Fault (NPF) on the north and Kachchh Mainland Fault (KMF) on the south (Biswas, 1987) as shown in Figure 6.1a.

Western Great Rann is known for its tectonic instability. Paleoseismological investigations in the vicinity of 1819 earthquake indicate the occurrence of an older earthquake around 800–1000 years ago (Rajendran and Rajendran, 2001). According to Merh (2005) and Maurya et al. (2008), the present Rann is an uplifted floor of the former gulf. In a recent study, Chowksey et al. (2010) suggested uplift of the Rann after 2 ka based on the
occurrence of raised notches and abraded platforms. The most recent one was the 1819 Allah Bund earthquake which not only created a NE-SW trending scarp (Figure 6.1b) but was known to have significantly modified the geomorphic processes in the region (Oldham, 1926).

Sedimentation in the Great Rann has been controlled by the interplay between continental and marine processes (Glennie and Evans, 1976; Roy and Merh, 1982; Srivastava, 1971). The occurrence of clay and silt with sandy lenticles is interpreted as deposition in a low energy, protected tidal flat environment (Srivastava, 1971). Based on the limited sedimentological and geochemical studies, Glennie and Evans (1976) suggested that the Great Rann was probably occupied by shallow marine gulfs following the rise in sea level after the glacial epoch, whereas continental sediment influx dominated during the transgressive phase. According to them, clay mineral assemblages dominated by illite, kaolinite, chlorite and montmorillonite suggest the influence of the Indus River drainage system.

In present thesis an attempt was made to understand the processes responsible for terrain configuration in the vicinity of Allah Bund with an assumption that (i) presence of scarp and relict raised channels may point to tectonic and seismic activities and (ii) evidence for both continental and marine processes may be well preserved. The other objectives of the study include, to (i) ascertain the process responsible for Rann sedimentation in terms of marine and continental, assign chronology to various depositional events and environments and to reconstruct paleoseismic events. To address these issues a detailed field stratigraphy of the Rann sediments, relict and raised fluvial channels was undertaken. Due to the paucity of organic matter in fluvial sediment and the problem of the reservoir correction in marine sediments, Optical dating technique have been employed for constraining various geomorphic/climatic processes.

6.2 Study area

The present study is focused on the western part of the Great Rann between the Nara River in the west (240 07’ 36” N and 690 07’ 15”E) and Shakti Bet in the east (240 03’ 16” N and 690 34’ 13”E; Figure 6.1b). The rationale behind selection of the studied area was (i) the terrain was severely affected by 1819 Allah Bund earthquake, (ii) it preserves both Rann and
Bet sequences, and (iii) was drained by the Nara River in the past. Climatically the area lies in arid zone. The mean annual rainfall ranges from 200–380 mm and is contributed by the southwest summer monsoon (Pramanik, 1952). Vegetation is scant, dominated by shrubs and grows along a few linear tracts containing fine sand <1 m below the surface, which probably represent past stream courses. The shallow sedimentary sequences investigated as a part of this study are north of the Allah Bund scarp and are well above present-day tidal inundation (Figure 6.1b). The field stratigraphy and sedimentology of the sections studied are discussed below.

### 6.2.1 Bet sequences

**Karim Shahi:** At Karim Shahi (24º 07′ 42″ N and 69º 30′ 73″ E), a 200 cm-thick micaceous sedimentary sequence, shows four distinct fining-upward units and overlies the clayey-silt dominated Rann sediment (Figure 6.2, Karim Shahi). From the bottom upwards, unit-1 consists of a 15 cm-thick light grey crudely laminated, fine micaceous sand overlain by a 6 cm-thick light brown silty-clay. The unit-2 is succeeded by a 35 cm-thick fine, light grey micaceous sand with dispersed clay laminae overlain by a 5 cm-thick compact light grey silty-clay. The overlying unit-3 has a 10 cm-thick light grey fine micaceous sand overlain by a 10 cm-thick light grey compact silty-clay. The uppermost unit-4 is dominated by a 30 cm-thick dark grey crudely laminated, fine micaceous sand capped by a 10 cm-thick light grey silty-clay. Finally, the succession terminates with a 25 cm-thick crudely laminated light grey medium to fine sand. The grain size analyses of unit-1 and 2 show dominance of sand (50–51%), followed by silt (46–47 %) and clay in traces (0.5–0.4%). To the west of the Bet sequence, a few archeological mounds are located in the low-lying areas overlying the Rann sediment. One such mound was excavated during the investigation in order to document the stratigraphy and to collect samples for optical and radiocarbon dating. The stratigraphy of the mound from the bottom upwards shows a 30 cm-thick crudely layered mixture of dark grey silty-clay, containing dispersed charcoal and bones. This is overlain by a 20 cm-thick light grey silty-clay with broken potsherds and finally capped by 60 cm of assorted archaeological debris containing bones, potsherds and charcoal (Figure 6.2, Archaeological mound).
Chapter 6: Luminescence studies of Tectonic Events in western India

Figure 6.1: (a) Map showing the location of the study area, NPF—Nagar Parker Fault, KMF—Kachchh Mainland Fault (after Biswas, 1987). (b) Geomorphological map of the area (after Rajendran and Rajendran, 2001; Merh, 2005).
Figure 6.2: Stratigraphy and optical chronology of the shallow sedimentary sequences investigated in the present study. (1) Allah Bund (Rann sediment), (2) Rann sediment (incised channel), (3) Nara River bank, (4) Nara River Bed, (5) Karim Shahi (Bet sediment), (6) Karim Shahi (Archaeological mound) and (7) Rann sediment (at Shakti Bet). Radiocarbon ages are shown in italic bold font. Dashed upward arrow indicates land movement, whereas the downward arrow indicates river incision.
Depositional environment: The deposition of fining-upward sequence is attributed to a flood-plain environment for the following reasons; (i) sand horizons are parallel laminated (unlike the coastal fining-upward sequences which are largely cross-laminated), (ii) it overlies lenticular bedded clayey-silt (tidal flat) and (iii) it is associated with micaceous-rich elevated sandy Bets. In view of this the depositional environment is interpreted as a flood-plain adjacent to the trunk channel (Reineck and Singh, 1980). For flood-plain aggradation the channel should have a consistent flow path, well-defined channel morphology (e.g. a meandering course) and episodic over-spilling of fine sediment on to the adjacent floodplains (Juyal et al., 2000).

The Indus River sediments are rich in mica (Chauhan, 1994) because a significant contribution comes from the higher Himalayan crystalline lithologies (Alizai et al., 2011). Presently, the Indus River flows nearly 100 km west of the study area. The Nara River, an eastern branch tributary of the Indus River that once flowed into the Great Rann (Oldham, 1926), was the major source of sediment into the western Great Rann. In view of this, the presence of micaceous sand in the Bet sediment at Karim Shahi can be attributed to the contribution from the Indus alluvial plain. However, it is also likely that a part of the sand could have been reworked by the ephemeral streams from the parabolic dune fields located in the north of the study area (Figure 6.1).

Near Karim Shahi, the archaeological site is proximal to the line of present-day tidal inundation. Therefore, it is logical to assume that during the time of human occupation, the site would have been well above the tidal reach and its present elevation can be attributed to land-level changes caused due to an earthquake. That is because the historical evidence suggests that prior to the 1819 Allah Bund earthquake, a large tract of the land north-east of Kori Creek was above high tide level. After the 1819 earthquake, a terrain north of Kori Creek was subsided by about 1–5 m, which led to the creation of Sindri basin (Wynne, 1872). The archeological site is located towards the northern margin of the subsided Sindri basin; hence it is reasonable to suggest that the present elevation of the archaeological site is due to the earthquake-induced land subsidence.
6.2.2 Rann Sequences

Allah Bund Scarp: At the mouth of the dried bed of the erstwhile Nara River (24° 12’ 63” N and 69° 11’ 84” E), a 160 cm scarp developed on Rann sediment shows the dominance of laterally impersistent clayey-silt punctuated very fine micaceous sand laminae (Figure 6.2, Allah Bund Rann sediment).

Incised Rann sediment: A 45 cm-thick section incised by ephemeral streams was exposed along a raised NW-SE trending channel on the Allah Bund scarp (24° 07’ 39.32” N and 69° 07’ 05.32” E). The lower-most 15 cm-thick unit is dominated by cherry brown clayey-silt and is overlain by a 7 cm-thick ripple laminated, fine grain sand. This is succeeded by a 30 cm-thick clayey-silt with fine sand lenticles, which is capped by recent aeolian sand (Figure 6.2, Rann sediment, incised channel).

Rann sediment at Shakti Bet: In a low-lying area near Shakti Bet (24° 03’ 46″ N and 69° 29’ 54″ E), a 260 cm-thick sedimentary succession was exposed in a dried channel section (Figure 6.2, Rann sediment near Shakti Bet). The succession shows a 20 cm-thick light to dark grey clay containing discrete sand lenticles. This is overlain by a 105 cm-thick ripple-laminated dark to light brown medium to fine micaceous sand. The sand horizon is succeeded by a 60 cm-thick cherry brown laminated clayey-silt horizon punctuated by cm-thick mottled lenticular fine sand. This is overlain by a 35 cm-thick brown, sticky silty-clay alternating with light to dark grey laminated sand. The succession is terminated with a 40 cm-thick cherry brown sticky clay interspersed with sandy laminae.

Nara River bed: A 120 cm-deep pit was dug into the Nara River bed (24° 07’ 36.7” N and 69° 07’ 15.1” E) where it cuts through the 1819 Allah Bund fault scarp (Figure 6.2, Nara River bed). The Nara River has incised the tidal flat sediment containing bivalve shells (preserved in their living position). The lowermost 10 cm-thick clayey-silt layer has abundant unbroken Turritella shells overlain by 20 cm-thick medium to fine laminated micaceous sand with clay streaks. Overlying this is a 30 cm-thick cherry brown silty-clay with laminated fine sand intercalations in the upper part. This is overlain by a 25 cm-thick rippled and planar laminated, medium to fine sand with convolutions. Finally, a sandy-clay alteration marks the top of the river bed succession.
Depositional environment: Texturally, the fine grained nature of the Rann sediment (clayey-silt with occasional fine sand) suggests deposition in a tidal flat environment (Christiansen et al., 2006). On tidal flats, clay and fine silt is transported in suspension, whereas sand is carried by traction (Krögel and Flemming, 1998). Sand is deposited during flood and ebb tide and develops ripple bed forms with internal cross- lamination, whereas, clay is deposited during slack water condition and drapes the ripple surfaces or settles in inter-ripple troughs (Chakrabarti, 2005). The dominance of a tidal flat environment is further suggested by the occurrence of lenticular and wavy bedding with current ripple bedforms (Reineck and Singh, 1980). The presence of 105 cm-thick, current-laminated micaceous sand at Shakti Bet suggests deposition under changing tidal and wave currents. Deposition of sand occurred during the periods of moderate current activity whereas clay was deposited during calm water conditions (Le Hir et al., 2000; Yang et al., 2006). Conventionally the sand dominated areas in a tidal flat are located close to the low tide mark, which are exposed to the stronger tidal currents (Bungenstock and Schäfer, 2009), 2009). It is therefore likely that deposition of rippled-laminated 105 cm-thick sand horizons took place on low to moderate energy areas; viz. the coastline was close to the Shakti Bet. The infrequent presence of cherry brown clayey-silt suggests periodic sub-aerial exposure (Srivastava, 1971). The fossil evidence, such as the in-situ bivalve and the unbroken Turritella shells, further indicates that the Rann sedimentation occurred under intertidal-marine environment (Desai and Patel, 2008).

6.3 Evidence of Past seismic events

Truncated nature of the raised channel suggests episodic uplift of the channel bed due to seismic activity. Rajendran et al. (1998) based on the presence of truncated dry channels and absence of incipient drainage suggested existence of pre 1819 scarp. This would imply that the raised channels suggest an earthquake similar to the 1819 event. Evidence of tectonic activity is further supported by the presence of contorted horizon (flame structures) in the N-S trending raised channel sediments. Flame structures are the direct expression of the seismic activity associated with faults and are generated under the same regional or local stress field that originates in the fault slip (Rodríguez–Pascua et al., 2001). These features are generated due to liquefaction/ fluidization process (Owen, 1996) and the lowest magnitude that can
Figure 6.3: Drainage pattern in the vicinity of Allah Bund. Western segment shows higher density of embryonic streams (W) compared to the Eastern segment (E). Channels show a preferential south west side trend.
generate such features is ~M 5 (Atkinson, 1984). Maurya et al. (2006) also suggested the possibility of the type of liquefaction features based on their Ground Penetrating Radar study for 2001 earthquake in Banni region. However, the silty-clay dominated with occasional sandy lenticles in NE-SW trending raised channel suggests that it was carved on pre-existing Rann sediments that were deposited under tidal influence and was brought to the present elevation due to the past earthquake. Absence of prominent sand horizons is interpreted as reduced continental flux. Evidence for active seismicity in the study area is also suggested by the westward deviation of the streams behind the scarp Figure 6.3. Such deviations have been attributed to high rate of structural uplift relative to erosion rates in which case transverse rivers encountering a growing anticline will often be deviated rather than cutting across the structure, following the areas of structural weakness, such as transverse faults (Seeber and Gornitz, 1983; Gupta, 1997).

6.4 Luminescence Studies of Rann Samples

A suite of 13 sediment samples and one pottery sample were analyzed. The pottery sample was analyzed using the Thermoluminescence (TL) dating technique (Zimmerman, 1971a), whereas optical dating was used for sediment samples employing the Single Aliquot Regeneration (SAR) protocol. In absence of coarse grains in sample SBTL-1, the Multiple Aliquot Additive Dose (MAAD) technique on polymineral fine grained extracts was used (Singhvi et al., 2001).

Figure 6.4 shows the preheat plateau test for samples KSTL-2 and ABT1-1 for preheat temperature ranging from 180–280 °C. It is evident from the figure that a preheat temperature from 220 to 260 °C can be used for D_e measurements.

Figure 6.5 (a) and (c) shows the dose recovery tests for samples KSTL-1 and KSTL-2 along with the SAR growth curves for same samples (b) and (d). The shine down curves for these samples are shown in upper right corners of (b) and (d) along with the SAR growth curves.

To visualize the dose distribution of samples radial plot as well as histograms were used Figure 6.6 (a), (c), (e) and (g) show the radial plots of samples ABTL-1, ABTL-2, KSTL-2 and ABP-1 and (b), (d), (f) and (h) shows the histograms of these samples.
Figure 6.4: Preheat plateau test for samples (a) KSTL-2 and (b) ABTL-1
Figure 6.5: Dose Recovery test for 10 discs of sample (a) KSTL-1 and (c) KSTL-2, SAR Growth curve and Shine down curve for sample (b) KSTL-1 and (d) KSTL-2
Figure 6.6: (a), (c), (e) and (g) shows radial plots for the samples ABTL-1, ABTL-2, KSTL-2 and ABP-1 and (b), (d), (f) and (h) showing the histograms of these samples. Total number of discs (n) shown on the upper right corner of the figures.
The ages obtained on Rann sediment ranged from $5.5 \pm 1.0$ to $1.0 \pm 0.2$ ka, whereas the Bet sediments were dated between $5.0 \pm 0.5$ and $3.0 \pm 0.3$ ka (Table 6.1, Figure 6.2). The pottery sample was dated to $3.0 \pm 0.5$ ka. The temporal changes in sedimentation rate were obtained for the Shakti Bet Rann sequence by linear interpolation between two dated depths viz. 233−133 cm ($5.5$ to $5$ ka) and 133−50 cm ($5$ to $3$ ka) (Fig. 5), which gives a decreasing rate from 2 to 0.4 mm/yr. Additionally, three samples were dated using the conventional radiocarbon method. These included a charcoal from the archaeological site and two shell samples, one each from the incised tidal flat terrace surface (~2 m above the Nara River bed) and one sample at 125 cm below the Nara River bed. The charcoal sample collected from 30 cm below the archaeological mound at Karim Shahi was radiocarbon dated to $3100 \pm 350$ cal yr BP. Within error, this age accords well with the OSL age of $3.0 \pm 0.5$ ka obtained on a pottery sample, suggesting that the site belongs to the late-Harappan period. The dead bivalve shells found in the living position on the river bank surface at 2 m were dated to $2220 \pm 130$ cal yr BP whereas the Turritella shells collected 125 cm below the present Nara River gave an age of $1420 \pm 130$ cal yr BP (Figure 6.2, Nara River bank and Nara River bed).

6.5 Discussion

Field stratigraphy, sedimentology and optical dating of the shallow sedimentary sequences in the western Great Rann indicate that during the last 5.5 to 2 ka, the major part of the western Great Rann was under the influence of tidal flat sedimentation. Low energy fluvial sedimentation was limited to the north and north-eastern margins implying that compared to the tidal flat environment, fluvial activity was much more subdued during the last 5.5 ka. This negates the suggestion that Nara-Hakra Rivers were receiving waters from the Himalaya and were flowing through the Great Rann of Kachchh (Oldham, 1893; Stein, 1942; Ghose et al., 1979). The low-lying western Great Rann opens into the Arabian Sea through the macrotidal Kori Creek, which serves as a conduit for seawater to seasonally enter inland and flood the Great Rann of Kachchh during the monsoon (Roy and Merh, 1982; Inam et al., 2007; Prizomwala et al., 2010). Thus, in such a morphological setting, a marginally high sea level can inundate a large area. However, the sedimentological observations indicate marginal fluctuations in high sea level during 5.5 to 2 ka. This observation is in accordance with the suggestion of a high sea level in the western India during 6 and 2 ka (Chamyal et al.,
2003 and reference therein). There is no estimate on the height of this high sea level from the western Great Rann of Kutchh during the mid-Holocene. However, studies carried out in the Little Rann (Gupta, 1975) and the Saurashtra coast of India (Juyal et al., 1995; Mathur et al., 2004; Gaur et al., 2006) suggested that relative to present, sea level was 2−4 m high during 6 and 2 ka. Considering the above, it is reasonable to assume that the western Great Rann was under the dominance of a marginally high sea between 5.5 and 2 ka.

The sediment distribution in the tidal flats is governed by the tidal current and wave energies. Near the level of low tide (lower part of the tidal flat), both current and wave energies are greater than the high tide area (Heineck, 1967). Dellwig et al. (2000) used the geochemical proxies, in particular the trace and heavy minerals, along with the grain size to ascertain the temporal changes in tidal current velocities. The illite-dominated Indus River is the major source of suspended sediment, which is dispersed eastward towards the Gulf of Kachchh by the long shore-current (Rao and Rao, 1995; Prizomwala et al., 2010). The significant proportion of the sediments in western Great Rann was derived from the Indus River source which was transported into the tidal flat through the Kori Creek during marginally higher sea level (Glennie and Evans, 1976).

The western part of the Great Rann is known for experiencing earthquakes in the historical past (Burnes, 1835; Oldham, 1926; Rajendran and Rajendran, 2001; Rajendran et al., 2008). Thus, it is reasonable to consider the role of earthquakes in the evolution of the landforms. River course is one of the sensitive indicators of past earthquakes. For example, Rajendran et al. (1998), based on the presence of truncated dry channels and the absence of incipient drainage in the east of the Nara River bed, suggested the existence of a pre-1819 earthquake. According to Rajendran and Rajendran (2001), the Allah Bund represents a compound scarp formed by repetitive earthquakes. The above suggestion seems to be reasonable as discussed below. The bivalves (Bernea truncata and Mya sp.) dated to 2.2 ka were residing on a surface that was incised by the Nara River to a depth of ~ 2 m and below 1.25 m of the Nara River bed, where the Turritella shells are dated to 1.4 ka (Figure 6.2, Nara River bank). This implies that the Nara River occupied the present course (westward shift) after 2.2 ka and incised to a depth of 3 m before the channel aggradation began with tidal flat sedimentation. The bivalves are filter feeders; Mya sp. makes deep burrows, while Bernea truncata is mechanical borer which prefers to colonize on the dewatered sediments/firm mud and live in...
Table 6.1: Equivalent dose (De), Dose Rate and ages obtained on the western Great Rann sediments.

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>U (ppm)</th>
<th>Th (ppm)</th>
<th>K (%)</th>
<th>CosmicRay (µGy/a)</th>
<th>a value</th>
<th>De (Gy)</th>
<th>Dose rate Gy/ka</th>
<th>Age (ka)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABP-2</td>
<td>3.6±0.7</td>
<td>10±2</td>
<td>2.4±0.1</td>
<td>205±20</td>
<td>-</td>
<td>8.7±0.4</td>
<td>3.8±0.3</td>
<td>2.0±0.2</td>
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<tr>
<td>ABP-1</td>
<td>4.0±1.0</td>
<td>10±4</td>
<td>1.6±0.1</td>
<td>200±20</td>
<td>-</td>
<td>10.3±0.2</td>
<td>3.1±0.4</td>
<td>3.3±0.4</td>
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<tr>
<td>ABTL-2</td>
<td>3.1±0.5</td>
<td>6 ±2</td>
<td>2.6±0.1</td>
<td>210±21</td>
<td>-</td>
<td>9.6±0.3</td>
<td>3.0±0.2</td>
<td>3.0±0.2</td>
</tr>
<tr>
<td>ABTL-1</td>
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<td>8±2</td>
<td>2.6±0.1</td>
<td>194±19</td>
<td>-</td>
<td>11.7±0.2</td>
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<td>4.0±0.2</td>
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<td>KRM OSL-2</td>
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<td>22±0.4</td>
<td>2.35±0.02</td>
<td>195±20</td>
<td></td>
<td>11.8±0.1</td>
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<td>1.0±0.2</td>
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<td>KS-ARCH</td>
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<td>4±2</td>
<td>2.2±0.1</td>
<td>214±21</td>
<td>0.04</td>
<td>11.0±2.0</td>
<td>4.1±0.2</td>
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</tr>
</tbody>
</table>
the subtidal zone (Desai and Patel, 2008). Considering this, it is logical to interpret the mortality of these bivalves in response to the withdrawal of the subtidal environment. The withdrawal of the sea after 2.2 ka could either be gradual due to the onset of regional aridity (climatically induced) in western, central and southern India (Kale, 1999; Thomas et al., 2007a; Roy et al., 2008), or abrupt due to the land-level change caused by an earthquake. At this stage, due to limited data, it is difficult to ascertain the relative contribution of either of the two factors in the withdrawal of subtidal environment from the western Great Rann.

However, the present study allow us to suggest that around 5.5 ka the low tide region was located around Shakti Bet and the high tide zone was further inland (towards east of Shakti Bet, Figure 6.7a). Based on this analogy, the decreased concentration of the trace elements and major element ratios and the dominance of clayey-silt during 5 and 3 ka can be interpreted as the westward shift in the high tide zone caused due to the relative lowering of sea level.

According to Rajendran and Rajendran (2001), the 90 km-long Allah Bund Fault Scarp (ABFS) is a compound scarp formed by more than one event, with a cumulative height of 5.3 m. Continued activity along the ABFS led to the westward migration of the Nara River. Abrupt lateral migrations of alluvial rivers in tectonically active areas are quite common (Schumm, 1986). This would imply that ABFS was in existence before the 1819 earthquake and probably prior to 2.2 ka. Until the subsurface topography is ascertained using detailed geophysical surveys, the antiquity of the ABFS as suggested in the present study (Figure 6.7c) remains preliminary and tentative. Historical evidence indicates existence of moderate fluvial activity in the Nara River until 1768 AD (Burnes, 1835). The northward tilting of the 1819 Allah Bund scarp created a natural a barrier for the river which had already lost its stream power due to the construction of dams in the upstream (Wynne, 1872). The 1819 Allah Bund earthquake of magnitude 7.5 not only uplifted the Rann sediment to variable height (3 to 6 m) to a distance of ~90 km (Rajendran and Rajendran, 2001), but also caused a coseismic subsidence of 1–5 m in the south which led to the creation of Sindri basin (Wynne, 1872; Oldham, 1926; Figure 6.7c). Based on the presence of abandoned channels, meander scrolls, shifting of stream courses, it has been estimated that around 15 km-wide zone lying north of the ABFS was affected by the 1819 earthquake (Rajendran and Rajendran, 2001). This earthquake led to the complete disruption of the Nara River channel which flowed into the Kori Creek and was used for navigation (Oldham, 1926). Thus, based on above it can be
suggested that the present day topography is an outcome of the 1819 earthquake (Figure 6.7c).

6.6 Conclusions

Sedimentation during 5.5 and 2 ka was dominated by a tidal flat environment implying a higher sea level than today. Fluvial sediment contribution in the western Great Rann sedimentation was limited, confined to the northern fringe of the study area. Thus, contrary to the earlier suggestions, our study did not find evidence for the existence of a major river draining through the western Great Rann during the last 5.5 ka. The geochemical characteristics of the Rann and Bet sediments suggest that the Indus River was a major contributor of sediment into the Western Great Rann which was largely routed through the Kori Creek. After around 2.2 ka and before 1.4 ka a combination of climate and tectonic activity probably led to the withdrawal of intertidal environment from the major part of the western Great Rann. The present-day landform and earth surface processes are largely modulated by the 1819 Allah Bund earthquake.
Figure 6.7: (a) Marginal lowering of the sea between 5 and 3 ka caused by low energy environment around Shakti Bet and the river activity was limited to the north-eastern fringes. Surface expression of the Allah Bund Fault Scarp (ABFS) may have appeared at this time. Human settlement probably also came around this period. (b) Fluvial system began to weaken along with withdrawal of marginally high sea; first major earthquake probably caused initiation of Allah Bund Fault during 2.2 and 1.4 ka. (c) Weakening of fluvial regime continued, development of Allah Bund scarp and submergence of Sindri after 1819 earthquake to achieve present land form.