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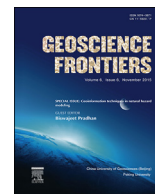


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Research paper

# Quaternary tectonic control on channel morphology over sedimentary low land: A case study in the Ajay-Damodar interfluvium of Eastern India



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## ABSTRACT

The style of active tectonic on the deformation and characterization of fluvial landscape has been investigated on three typical strike-slip fault zones of the Ajay-Damodar Interfluvium (ADI) in Eastern India through field mapping, structural analysis and examination of digital topography (ASTER-30 m), multi-spectral imageries, and Google Earth images. Channel morphology in Quaternary sediment is more deformed than Cenozoic lateritic tract and igneous rock system by the neotectonic activities. The structural and lithological controls on the river system in ADI region are reflected by distinct drainage patterns, abrupt change in flow direction, offset river channels, straight river lines, ponded river channel, marshy lands, sag ponds, palaeo-channels, alluvial fans, meander cutoffs, multi-terrace river valley, incised compressed meander, convexity of channel bed slope and knick points in longitudinal profile. Seven morphotectonic indices have been used to infer the role of neotectonic on the modification of channel morphology. A tectonic index map for the ADI region has been prepared by the integration of used morphotectonic indices, which is also calibrated by Bouguer gravity anomaly data and field investigation.

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## 1. Introduction

As a part of Bengal Sedimentary Basin, the Ajay-Damodar Interfluvium (ADI) region is a complex zone in eastern India. The interfluvium region is characterized by active tectonic actions with number of active sub-surface faults in different direction (Bagchi and Mukherjee, 1979; Singh et al., 1998; Nath et al., 2014). Tectonically, the study area is located near the subduction zone, where the Indian plate is subducting below the Eurasian plate at ~2–4 mm/yr rate of subduction (Goodbred et al., 2003; Mukherjee et al., 2009; Mukul et al., 2014) and also near the interaction zone of three plates, namely the Indian, Tibetan (Eurasian) and Burma (West Burma Block) plates (Nath et al., 2014). Tectonic sensitivity of the ADI region has been perceived from the seismic map of the eastern India (Nath et al., 2014). Average magnitude of earthquakes in the region is above four in seismic scale. This study has focused upon the three pre-defined sub-parallel faults in the NE–SW direction (Fig. 1a) and their role on the deformation of alluvial

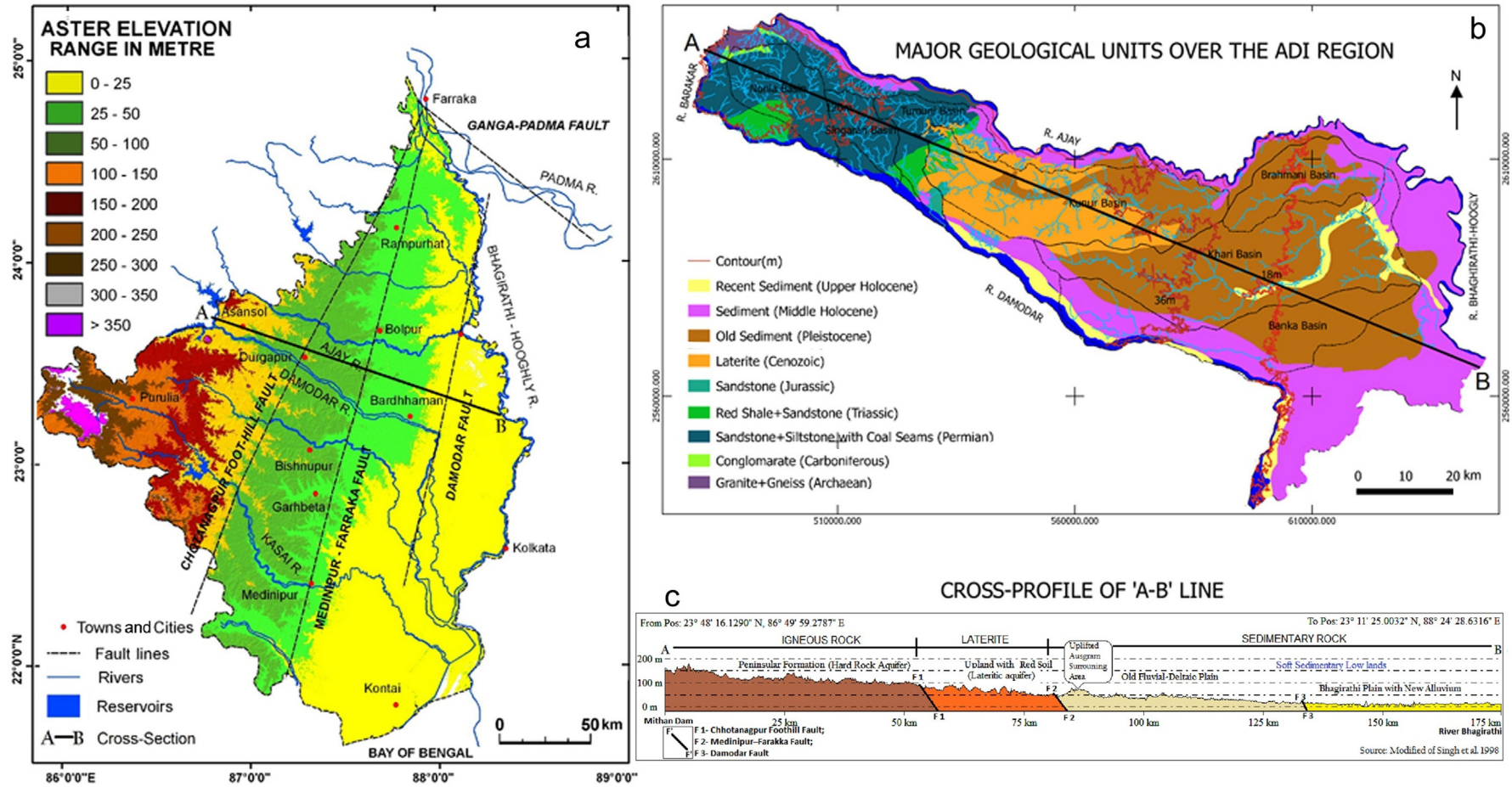
channel morphology. These faults were reactivated by the stress of neotectonic activities during the early Pleistocene epoch (Singh et al., 1998), which are Chhotanagpur Foothill Fault (CFF) in the western part, Medinipur Farakka Fault (MFF) in the middle of the ADI region and Damodar Fault (DF) in the eastern sedimentary low land. As a result, the entire ADI region was divided into four geotectonic blocks in the NW–SE direction and figured up a step-like landscape along the entire region (Fig. 1c). According to Nath et al. (2014), the western part of CFF comes under the 'Indian Shield' and entire eastern part is under 'Bogra Shelf' or western Foreland Shelf of Bengal Basin.

There are several intensive works related to the geological formation of the Gangetic Delta region (Rao et al., 1999; Alam et al., 2003; Acharya and Shah, 2007, 2010; Mukul et al., 2014) and influence of neotectonic on the formation of Bengal Basin (Raj et al., 2008; Mukherjee et al., 2009; Mallick and Mukhopadhyay, 2011; Nath et al., 2014), but drainage systems of this region have received little attention in respect to neotectonic controls on channel pattern and their geometric settings. Singh et al. (1998) mentioned about the reactivation of some basement faults in the western part of lower Gangetic stable shelf region during the early Pleistocene and discussed on segmentation of three major tectonic blocks and associated landforms and soils development (Fig. 1c).

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**Figure 1.** Location map of the study area; (a) digital elevation map of the Rarh Bengal and location of the pre-defined faults, (b) major geological units of the ADI region with delineated drainage basins and their streams, brown color contours (m) are dividing the mentioned geomorphological units, (c) West (23°48'16.1290"N, 86°49'59.2787"E) to East (23°11'25.0032"N, 88°24'28.6316"E) topographical cross-section (AB) of the ADI region with major geotectonic blocks.

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