

Sea-level change and hydro isostasy in Gujarat, western India: implication for the development of Indus civilization

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The sea-level rise of about 120 m during the last deglaciation had a significant impact on the development of prehistoric human civilization, and the effect of subsequent crustal movement also significantly constrained the development of prehistoric human society (e.g. Lambeck, 1996). Accordingly the estimation of late Quaternary relative sea-level change, which includes isostatic and tectonic crustal deformations, based on the analysis of fluvial environment, geomorphological evidences and numerical modelling is very important to provide a powerful lens through which to view the relation between history of civilization and environmental change. However, the geological environment of Gujarat is the result of complex interactions between sea-level change and tectonic crustal deformation in Quaternary (e.g. Chmyal et al., 2003). In order to estimate the contribution of the crustal deformation to relative sea-level variation in this region numerically, we try to separate the isostatic and tectonic components from geological observations based on the glacio-hydro isostatic adjustment model. In particular the hydro isostasy caused by the last deglaciation is very sensitive to change of the coastline geometry and a significant crustal tilting is expected in this region because the shallow seafloor around the Gulfs of Karachchh and Cambay is well developed. Evaluation of Holocene crustal movement at sites away from glaciated region at last glacial maximum is also important for examining the upper mantle rheological structure. In this study, we compare the observational evidences for relative sea-level change during the late Quaternary with the predictions of a model of glacio-hydro isostatic adjustment, and discuss their implications for the development of Indus civilization.

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