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Sub-surface mapping of the west-flowing paleo-Yamuna river in the alluvial plains of NW India using geophysical surveys and drill cores

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The abrupt abandonment of Harappan Civilization (5700-3300 BP) in NW India at ∼3500 BP has often been linked to drying (climatic) or diversion (tectonic) of rivers, popularly known as River-Culture hypothesis. While the collapse of the culture is fairly well-documented, the demise of the rivers is not, primarily due to the lack of chrono-stratigraphic data of river sediments. Based on limited evidences from the satellite imageries, it has been documented that the major paleo-drainage system in the NW India was fed by the Sultlej from the west and the Yamuna from the east. However, the subsurface existence of these two major tributaries has remained unexplored for a very long time. Recent work from IIT Kanpur has established a sound chrono-stratigraphic framework for the paleo-Sultluj and peleo-Ghaggar rivers and this paper presents the evidence of the paleo-Yamuna flowing west and feeding the large river network that once drained this region. We deployed geophysical surveys and raised five undisturbed sediment drill cores down to ∼50m along a transect trending NW-SE between paleo-Ghaggar and present day Yamuna river to map the large-scale subsurface geometry and alluvial architecture of the paleo-Yamuna. The subsurface geophysical model generated by integrating 1D and 2D resistivity data for a total stretch of ∼50 km reveals presence of subsurface fine to coarse sand bodies (20 to 30m thick) interbedded with silty clay layers that are laterally stacked. The occurrence of thick and wide subsurface sand bodies implies that these are the deposits of a large river system and very likely represent the buried paleo-Yamuna channels. Based on five drill core records penetrating down to a depth of ∼50 m, six major litho stratigraphic units are identified consisting of channel facies, channel margin facies and floodplain facies. On-going detailed sedimentological analysis will better characterize the paleo-Yamuna sedimentary environments. Further chronological data are being generated to establish the timing of different fluvial episodes and the abandonment of the Yamuna to its eastward course.