



Irrigation agriculture and the sedimentary record in the Palpa valley, southern Peru

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The hyperaridity of the coastal desert of southern Peru restricts agriculture to valley areas which can be irrigated using the seasonal water flow of exoreic rivers originating in the high Andes. Human populations have used these valleys since at least 3000 BP. A significant role of climate change or extreme events in the development and decline of several pre-Columbian cultures in the Palpa valley (14°32'S, 75°11'W, ca. 400 km south of Lima) has been suggested by several authors, generally presenting these cultures as rather passive beneficiaries or victims of alleged favourable or detrimental natural conditions.

Sedimentological and geochronological techniques as well as aerial photography interpretation were used to reconstruct the sedimentary history and to create a geomorphological-geochronological model of the Palpa valley. A generalized stratigraphy displays (1) basal fluvial gravels corresponding to former braided river beds, (2) well-sorted, bedded fluvial sands and/or poorly sorted, massive hyperconcentrated flow deposits and (3) poorly sorted, crudely banked silty sand with ubiquitous traces of human activity (i.e. ceramic shards, marine mollusc shells, charcoal). A large part of the fine-grained sediments is shown to be of anthropogenic (irrigation) origin, i.e. these sediments are irrigic anthrosols according to the FAO soil classification scheme.

Data from embedded charcoal and other artefacts show that irrigation agriculture in the Palpa valley began around 3000 cal. BP. Since the time of the Paracas culture, sizable areas of the valley bottom have been subject to seasonal fine-grained sedimentation (with the inclusion of anthropogenic artefacts and traces) irrespective of the vertical position relative to the river bed. This is evidence for extensive and sustainable irrigation agriculture. The comparison of sedimentation rates calculated from

(a) radiocarbon date sequences in several profiles and (b) measurements of recent irrigation-induced sediment input confirm the plausibility of the model and show that irrigation sedimentation is an ongoing process. Pre-Columbian cultures have actively shaped their physical environment and developed an agricultural landscape by means of irrigation since at least 3000 BP.