



New interdisciplinary approaches for understanding ancient irrigation

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The importance of access to and management of water in ancient societies is recognized by archeologists for a long time, and irrigation has been considered as a critical base for agriculture in areas where precipitation is insufficient. How to understand ancient irrigation as a multi-level concept is a matter for many fields. Investigations of ancient irrigation have traditionally included considerable attention to hydrology, geomorphology and water infrastructure *per se*. Research on social, economic, and political factors is prominent too. What is lacking is integrating these two fields, although human activities play an important role in shaping the material context of irrigation schemes and vice versa. Actually, the close connection among human civilization, natural environment and water infrastructure is the fascinating perspective of irrigation.

In fact, ancient irrigation is an interdisciplinary field combined archeology and irrigation, and both archeology and irrigation have become interdisciplinary fields of scientific research gradually with the rapid development of technology. Studying hydraulic and hydrological aspects of ancient irrigation is already confronted with challenges, but the situation is even more complex when involving the human dimension and its connection with environment. Available methods almost inescapably have to concentrate on one or the other, and face significant challenges on the interaction of human, environment, and water systems' physical construction. In order to perceive ancient irrigation explicitly, archeology calls for new approaches to explore insights in greater depth.

The paper conceptualizes irrigation systems consisting of three basic domains: hydrology, hydraulics and human; nevertheless, the overlapping of these domains is key for the understanding of ancient irrigation, involving human-environment-physical construction interaction. Obviously, the interaction among the three "H" domains adds to the complexity for the exploration of ancient societies characteristics. It is necessary to incorporate the human related factors into the hydrological and hydraulic models.

The paper aims to capture the reality of the case of ancient irrigation in the Zhengguo Canal of China area with regard to different periods based on a timeline of implementation and reconstruction. The Zhengguo Canal was built at BC246 and is regarded as one of the greatest Farmland Water Conservancy Projects in Chinese history. The canal is located in the heart of Ancient China, the present Shaanxi province of China. A hydraulic model will be applied to analyse water flow process and water delivery within the canal system, and a hydrological model will be used to simulate the dynamics of the water system. The models demonstrating the human influence (e.g. population, settlement pattern and cropping behavior) will be built based on object-oriented architecture. Compared with pure physical modeling, the models developed by the paper will take into account multiple components of irrigation as a truly integrative discipline.