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Reading carbonate deposits from ancient water installations: why are they useful for geoarchaeology?

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Water has always been a basic need of life, to remain alive and clean, and to irrigate fertile land, which provides food to people. While looking for a source of water suitable for their requirements, ancient civilizations considered three important factors: to have a reliable supply of water; in sufficient amount and quality; and at affordable costs to transport it to where it was needed. Water lifting and distribution devices were therefore selected and improved with these essential factors in mind.

Our understanding of the development of water technology in ancient cultures is mainly based on archaeology and textural sources, focusing on details of the construction of water works and water machines, and on their location in individual settlements. However, the geographic distribution of water technology in Mediterranean and Middle East is poorly understood: both the local economical basis and palaeo-environmental conditions may have played a role in the choice of certain water technologies. As a consequence, some water-lifting devices, e.g. the bucket-chain and Archimedean screw, were only used where favorable conditions prevailed.

The use of ancient water installations, however, cannot easily be studied from architectural remains alone: carbonate deposits in and around such installations can provide information, not only on their use but also on palaeo-environmental conditions during their functioning and on local economical conditions. This applies mostly to water installations of Roman or Medieval age. Since the Romans maintained their water technologies routinely, any thick carbonate deposit may give information on periods of economical hardship, too.

Carbonate deposits (calcareous sinter) are presently mainly used to study palaeo-environmental changes from Roman aqueducts, but water lifting machines and water mills, which are commonly build of wood, can also be studied in this way. The Romans were the first to apply waterpower to several industrial applications, but little is known about their use. For example, did Roman water-powered flour mills operate continuously, or was their use interrupted because of water scarcity or decline in the Roman economy? Carbonate was deposited in the water channels that fed and drained these machines, and on the wood of the machines themselves. Theoretically, it should therefore be possible to see the frequency of use of the machines from the stable isotope cyclicity and other data stored in carbonate deposits. We are presently applying this technique to incrustations from the Barbegal watermill complex near Arles, France. Carbonate deposits can therefore act as archives that provide us an understanding of palaeo-environmental and economic changes over the last two thousand years and provide information on the use, distribution and age of water structures by means of annual lamina counting. With this great potential, we aim to generate new tools and techniques to study the history of science in the framework of geo-archaeology.