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Finding the lost arches of the Medieval Avignon's Bridge (Avignon, Provence, South France): a geoarchaeological approach

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This papers aims to precisely locate the medieval arches of the so called Avignon's (Saint Bénézet) Bridge (South France) and to reconstruct the fluvial dynamics of the Rhone River from Early Medieval Times to the 19th century. Until now, just four remnant arches are still visible (near Avignon) and it is estimated that 22 arches (which represents a total length of approximately 920 meters) were built to span over one of the largest French Rivers. The late roman and early mediaeval dates of several foundation poles extracted from the river bed might suggest the existence of an earlier bridge, though it remains uncertain if any of such an earlier structure was still visible when the first mediaeval bridge was built. The mediaeval bridge was erected from 1177 until 1185 (in less than 10 years), but modified a few decades later when stone arches were erected, thus raising the road level substantially. The structure of the bridge being vulnerable, seasonal floods proved a neverending threat and cause of damage which was frequently repaired with masonry or wood. Final abandon of the edifice could be placed in the late 1660s – Early 1670s according to historical sources. Questions arose about the location of the "lost arches" and evident flood events dated back to the Little Ice Age (e.g. 1500 to 1850) could be responsible of the partial destruction of the bridge. Few archaeological, architectural, historical and palaeoenvironmental works have been undertaken in order to determine the precise shape of the Saint Bénézet Bridge at certain stages of its history. Since 2010, a joint team composed by laboratories affiliated to the French Public Research Centre (CNRS) and to Universities of Avignon and of Aix-Marseille 1 is trying to link the different phases of constructions/destructions of the monument with the fluvial dynamics of the Rhone River for the concerned period (ANR PAVAGE). The geoarchaeological approach adopted comprises bathymetric surveys (SONAR and Acoustic camera techniques) together with geophysical prospections (Electric Resistivity Tomography and Magnetic Cartography methods) in order to reveal potential locations of arches within the modern Rhone River channels (Villeneuve Lez Avignon and Avignon's arms) and on the Barthelasse fluvial island. In addition historical sources, such as maps, were integrated together with the acquired geophysical data in a Geographic Information System in order to identify possible remnant arches. Finally, boreholes have been drilled and later linked with the geophysical data, to reveal the alluvial litho-stratigraphy and describe the geomorphic the changes in the fluvial system. Results clearly reveal the presence of large carved stone accumulation at a regular interval in the Villeneuve-Lez-Avignon and Avignon's branches. An interpretation concerning the shape of the Saint Bénézet Bridge, in a changing morpho-dynamic context, can be assumed and fits well with various sketches and maps established from the 16th to the 17th Centuries.

Keywords: Rhone River, Saint Bénézet Medieval Bridge, city of Avignon, Geoarchaeology, Fluvial palaeoenvironments, bathymetric surveys, geophysics, coring, building techniques, building archaeology, iconography