

## INTRODUCTION

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The archaeology of construction is a relatively new discipline within the broader field of Roman architecture. It was given a major impetus by the efforts of an active international group of researchers to create a series of workshops on the subject. Thanks to Antonio Pizzo of the Archaeological Institute of Mérida, Stefano Camporeale of the University of Siena, and Hélène Dessales of the Ecole normale supérieure in Paris, the initial series of workshops began in 2007 at Mérida, quickly followed in 2008 at Siena, and in 2010 at Paris. Given their enormous success, and with the invaluable contribution of Jacopo Bonetto of the University of Padua, it was decided to extend the series with a further workshop in 2012.<sup>1</sup>

The great success of these previous four workshops demonstrated the very strong interest which exists among scholars of Roman history and archaeology in the constructional aspects of Roman architecture. This discipline can be briefly defined as the study of the processes involved in Roman construction projects, covering the production and supply of materials, the techniques used in construction, and the problems of logistics, manpower, and the economics. The archaeology of Roman construction is seen as complementary to the more traditional areas of the study of Roman architecture, such as building typologies and use, design and decoration, or the func-

tion of the finished buildings in society, but also uniquely has the potential to contribute much to ongoing debates about the size and shape of Roman urban economies.

The previous workshops looked at the question of ‘cantieri’ – building sites and processes – first in Italy and west (Mérida) and then Italy and the eastern Roman provinces (Siena), while the Paris meeting focused on the economic aspects, and the Padua workshop concentrated on the quarrying and supply of building stone. The broad focus of this present workshop is on the development of specific technologies for solving constructional or structural problems, including the production and supply of man-made materials, the contribution of engineering and machines to the functioning of building sites, and the nature and division of labour these require. It has also tried – with some success – to bring into the discussion the north-western provinces, and less-frequently discussed materials as diverse as metals, mud-brick and *pisé de terre*.

Alongside the naturally occurring materials of stone and timber, Roman builders used a wide variety of materials that had to go through one or more sequences of processing, usually at a separate production site or more rarely, for example in the case of mortar, on site. The supply of bulk materials such as brick and mortar are key in the logistics of site construction, while speciality products such as metal elements usually represent special and sometimes unique solutions to specific structural and constructional problems. Man-made materials also often required high levels of skilled manpower and specialised equipment or plant in their processing, thus contributing substantially to the cost of construction.

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<sup>1</sup> For the archaeology of construction see DeLaine 1997; *Cantieri antichi* 2002; and the chapter by Hélène Dessales in Bukowiecki *et al.* 2008: 19-24. For the proceedings of the workshops see Camporeale *et al.* 2008; Camporeale *et al.* 2010; Camporeale *et al.* 2012; Bonetto *et al.* 2014; syntheses of the results of the first workshops are in Pizzo 2009 and Camporeale 2010.

The volume is divided into eight sections, corresponding to the four pairs of sessions which constituted the workshop. The first session, on concrete technology and use, began with the most common and most typically Roman of all man-made materials – pozzolanic mortar. Here advances in scientific analyses are proving fundamental in advancing our understanding not only of what materials were used and how, but also where, geographically, and in what contexts they were used, and the chronology of use. In contrast, metal (session II) is much less well-known as a building material in the Roman world; the papers on the structural and constructional uses of metal give new insights into both bronze and iron technology and its applications.

The third and fourth sessions were devoted to the production, supply and use of building materials made of fired clay and of earth. Building materials of fired clay (which the British call CBM or ‘ceramic building materials’) and including brick, tile, wall tubes, and vaulting tubes, are, like mortar, one of the hallmarks of Roman construction, and one of the most ubiquitous and certainly the most widespread materials in the archaeological record. Yet they have tended not to be treated as a main focus of study, although the recent conference in Rome has gone a considerable way to redressing the situation.<sup>2</sup> Even more neglected in standard accounts of Roman construction, however, are materials made of unfired earth, mud brick and *pisé de terre*, often very difficult to detect in the archaeological record; furthermore they are certainly rarely brought into the same discourse as fired brick and pozzolanic mortar. Yet the papers presented here argue that they were at least as common, and not only in earlier periods or rural vernacular constructions.

In the fifth session attention was focused on engineering and machines. The Romans have long been admired for their engineering skills, but this is an area which has so far attracted relatively little interest within the archaeology of construction. Large-scale construction is not possible without the use of complex lifting machines, or devices such as the truss, used in supporting large formwork, yet all of these require specialised equipment and skills, and have an impact on the scheduling of work and the division of labour. Machines, especially the lifting machines essential for large-scale construction, are particularly

under-researched in relation to construction processes, something that the papers in the section on lifting machines in theory and practice go part way to addressing. The papers in the sixth session looked specifically at practical solutions to engineering problems, and in particular the problems of foundations – another often invisible element in construction – in relation to actual site conditions, helping to throw light on construction processes, the choices made by builders and architects, and their responses to building on unstable ground.

The final pair of sessions returned to themes more familiar from earlier workshops, especially the infrastructure and organisation of construction. These provided some rare surviving evidence of building work in progress, and discuss strategies used for construction where resources were limited. The final pair of papers continue the theme but with a chronological emphasis, examining seasonal demands for resources and manpower in the Republican period, and identifying networks of production in pre-Republican Italy. These papers all bring us as close as possible to the individual human actors – the builders – who are, ultimately, the real focus of our common interest, the archaeology of Roman construction.

The workshop in Oxford attracted a great deal of interest, with almost 60 proposals for papers, and over 80 delegates and speakers, from 10 different countries. One of the guiding principles for the workshop was to maintain the wide range of approaches and the multidisciplinary nature which characterised the earlier four. As befits a workshop, the emphasis was on discussion and the exchange of ideas, elements which made the previous ones so fruitful and enjoyable. Given the very large number of high quality proposals for papers, it was therefore decided for the first time to include posters as an integral part of the workshop, divided into their appropriate sessions and included in the discussion at the end of each session. Several of these are being published in the journal *Arqueología de la arquitectura*, forming an important complement to the papers presented in this volume.

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<sup>2</sup> Bukowieki *et al.* 2015.

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