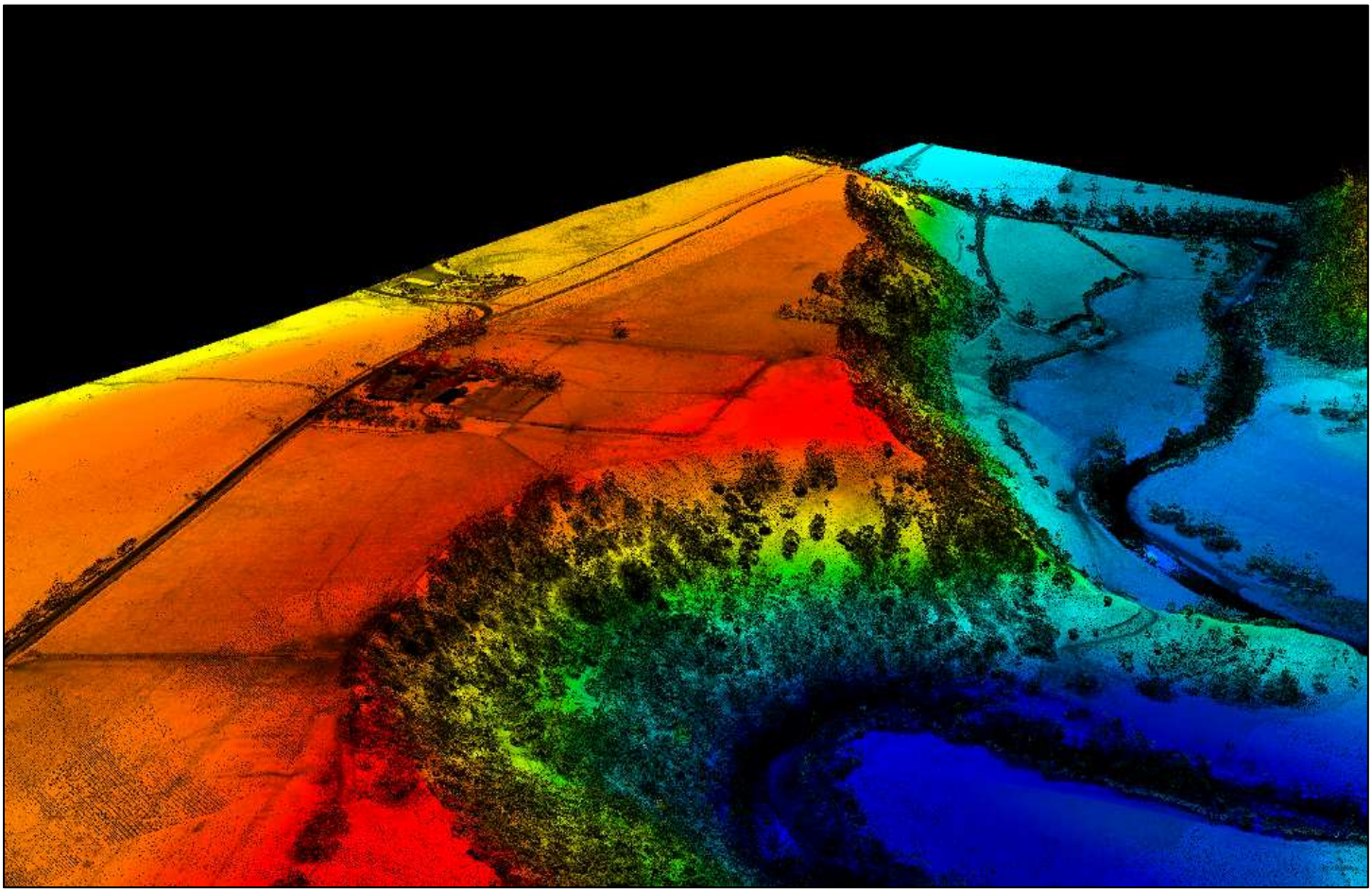
Archaeology Special Interest Group Newsletter

Autumn 2010



Cover Image: An airborne laser scan of Birdoswald Roman Fort © Heritage3D

ArchSIG Chair: Chris Brooke (archsig@rspsoc.org)

Editors: Rebecca Bennett & Keith Challis

Contents

Welcome note from the ArchSIG steering group

Hello and welcome to the shiny new Archaeology Special Interest Group newsletter. ArchSIG aims to encourage the exchange of research and methodology between remote sensing and photogrammetry scientists and archaeologists, especially those concerned with methods of site prospection and novel applications.

The group hopes to promote the development and use of remote sensing and photogrammetry in archaeological surveying, encouraging research and collaboration in all aspects of remote site location, recording, analysis and interpretation and to provide a forum for the exchange of information and ideas. Additionally the group provides an opportunity for collaboration between archaeologists and heritage professionals and the wider environmental remote sensing community via events supported by RSPSoc. More details are available via the ArchSIG website - www.rspsoc.org/information-zones/sigs/archaeology/

Articles in this newsletter will concentrate on a mixture of exploring case studies and developing methodology and include ground-based methods, photogrammetry, LIDAR, laser scanning, and geophysical prospection, as well as aerial photography, UAVs and spectral / thermal imaging. Contributions are welcomed from across the sphere of archaeological remote sensing specialists to give a diverse and interesting insight into current projects.

RSPSoc ArchSIG welcomes new members from the wider heritage community and is particularly seeking contributions for the next newsletter (see Call for Contributions below). Please contact Chris Brooke to join the mailing list.

Rebecca Bennett
on behalf of ArchSIG Steering Group
Chris Brooke, Paul Bryan, Keith Challis and Danny Donoghue

Call for contributions

The editors are looking for contributions for the next issue of the ArchSIG Newsletter (Spring 2011). These should be introductory articles with text (up to 500 words) and an image which give a flavour of your current research in remote sensing techniques for archaeology and heritage management. We are looking for a diverse range of topics from visualisation to mapping and imagery along with more technical studies, at a scale ranging from landscape to artefact.

The newsletter provides an excellent way to introduce your research to other archaeological remote sensing specialists. The editors welcome all expressions of interest as it is intended to issue the newsletter quarterly.

Contributions should consist of the following:

text (up to 500 words),

image (300dpi in jpeg or png format)

your contact details.

Please send your articles to Rebecca Bennett (rbennett@bournemouth.ac.uk) or Keith Challis (k.challis@bham.ac.uk) for inclusion.

Heritage3D: Ongoing professional guidance on 3D recording and survey in cultural heritage

Jon Mills and Simon Abele, Newcastle University
Fabio Remondino, FBK Trento, Italy
Paul Bryan, English Heritage

Survey techniques such as digital photogrammetry and 3D laser scanning now allow for the accurate and rapid collection of 3D measurements at a variety of scales. Coupled with the ubiquitous increase in computing power and rising user expectations, archaeology and architecture can now call upon these techniques to provide data essential to developing the level of understanding necessary for making key decisions about the management of an artefact, monument or landscape (e.g. Figures 1a and 1b). As a result of the wide application of 3D measurements and the ongoing development of new techniques, there is a need for impartial professional advice to help ensure best value for those commissioning work, and to direct priorities for the future development of 3D survey.

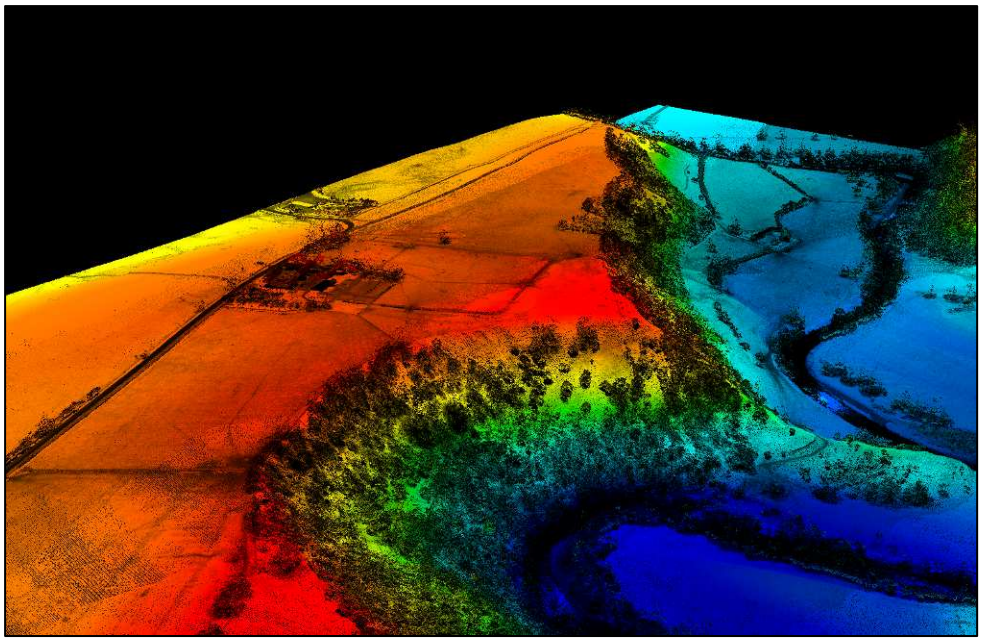


Figure 1: Cultural heritage can now call upon three-dimensional techniques such as laser scanning to inform conservation at a variety of scales, as seen here in an airborne laser scan of Birdoswald Roman Fort (above) and a terrestrial laser scan of an archaeological dig at the same site (below).

In October 2006 Newcastle University completed a two year English Heritage supported project entitled "Developing professional guidance – laser scanning in archaeology and architecture". The project, which adopted the working name "Heritage3D", sought to provide guidance to archaeologists, local planning authorities, instrument manufacturers and software developers on the use of 3D laser scanning in the conservation of cultural heritage. The primary aims of this project were to develop and support best practice in laser scanning for archaeology and architecture, and disseminate this best practice to users, along with the education of likely beneficiaries. A guidance note and revised specification arising from Heritage3D were delivered at the end of 2006. These documents represented the culmination of a number of activities undertaken, however perhaps the most successful element of the project was the establishment and maintenance of the project website (http://www.heritage3d.org) which acted as the project's primary dissemination and information channel.

After a break of a couple of years, the aim of the next phase of the Heritage3D project is to provide general news and independent information about all forms of 3D survey and recording, in-depth guidance and discussion on specific applications and techniques, and to provide access to a network of relevant organisations and individuals that could provide information and advice. This differs from the original Heritage3D project in that it will cover all documentation techniques, not just laser scanning. The website has been re-launched and is now driven by a bespoke content management system. Regular updates to the website will provide ongoing interest, and in order to stimulate discussion and raise awareness on specific issues, themed updates to the site will be made. An editorial board has been appointed to oversee and advise on the work of the project, as well as provide diverse and interesting content to the website. To ensure that the project is not limited to

disseminating domestic activity, and to ensure input is received on the very latest international developments, the project is being undertaken in a three-way collaboration between English Heritage, Newcastle University and FBK Trento, Italy. Anyone wishing to participate as a project associate is welcome to do so – just visit the website www.heritage3d.org

Heritage 3d is an English Heritage Historic Environment Enabling Programme (HEEP) supported project (5496 MAIN).

The DART project: Developing the roadmap for archaeological remote sensing in the 21st century

Anthony Beck, University of Leeds

Aerial and geophysical survey have substantially increased our understanding of the nature and distribution of archaeology. However, there is variable understanding of the physical, chemical, biological and environmental factors which produce the archaeological contrasts that are detected by the sensor technologies. These factors vary geographically, seasonally and throughout the day, meaning that the ability to detect features changes over time and space.

Detection of Archaeological Residues using remote sensing Techniques (DART) is a three year, £815,000 Science and Heritage funded initiative led by the School of Computing at the University of Leeds. The Science and Heritage programme (www.heritagescience.ac.uk) is funded jointly by the Arts and Humanities Research Council (AHRC: www.ahrc.ac.uk) and the Engineering and Physical Sciences Research Council (EPSRC: www.epsrc.ac.uk). To examine the complex problem of heritage detection DART has attracted a consortium consisting of 25 key heritage and industry organisations and academic consultants and researchers from the areas of computer vision, geophysics, remote sensing, knowledge engineering and soil science.

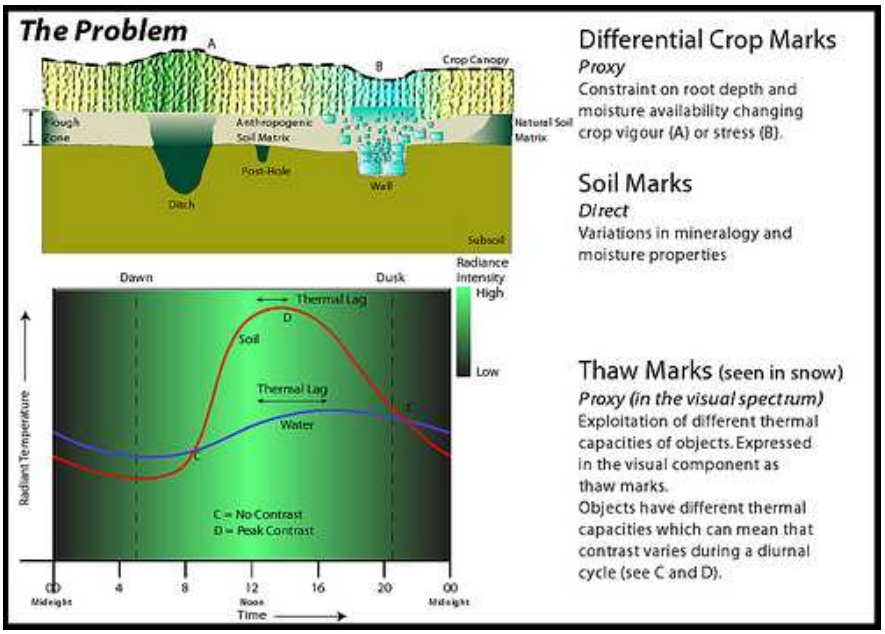


Figure 2: The processes of archaeological site detection.

Enhanced knowledge of archaeological residues is important for the long-term curation and understanding of a diminishing heritage. There are certain geologies and soils which can complicate the collection and interpretation of heritage remote sensing data. In some of these 'difficult' areas traditional detection techniques have been unresponsive. DART will develop a deeper understanding of the contrast factors and detection dynamics within 'difficult' areas. This will allow the identification of appropriate sensors and conditions for feature detection. The successful detection of features in 'difficult' areas will provide a more complete understanding of the heritage resource which will impact on research, management and development control.

Detection techniques rely on the ability of a sensor to measure the contrast between an archaeological residue and its immediate surroundings or matrix. Detection is influenced by many factors - changes in precipitation, temperature, crop stress/type, soil type and structure and land management techniques. DART will increase the foundational knowledge about the remote sensing of sub-surface archaeological remains. This research will increase the understanding of how archaeological residues can be detected and the impact that physical, chemical, biological and environmental processes have on the detection process.

The programme of research has been designed specifically to identify physical, chemical and biological contrast factors that may allow the detection of archaeological residues (both directly and by proxy) using sensing devices. To determine contrast factors samples and measurements will be taken on and around different sub-surface archaeological features at different times of the day and year to ensure that a representative range of conditions is covered. Field measurements will include geophysical and hyperspectral surveys, thermal profiling, soil moisture and spectral reflectance. Laboratory analysis of samples will include geochemistry and particle size. Models will be developed that translate these physical values into spectral, magnetic and electrical measures in order to determine detection parameters. This will allow DART to address the following research issues:

- What are the factors that produce archaeological contrasts?
- How do these contrast processes vary over space and time?
- What processes cause these variations?
- How can we best detect these contrasts (sensors and conditions)?

The key will be to understand the dynamic interaction between soils, vegetation and archaeological residues and how these affect detection with sensing devices. This requires understanding how the archaeology differs from, and dynamically interacts with, the localised soils and vegetation and how these differences can be detected.

Student Research Profile – Laser Scanning for Coastal Archaeology

Heather Papworth, Bournemouth University

hpapworth@bournemouth.ac.uk

The National Trust has joined forces with Bournemouth University to match-fund a 3 year PhD research project to assess the utility of laser scanning for documenting coastal archaeology. The impetus for this research is driven by the risks posed to coastal archaeology by future 'climate change', which is expected to accelerate over the next 100 years (Murphy, Thackray and Wilson 2009). As one of the largest landowners in the country, the National Trust currently manage approximately 710 miles of coastline and are faced with the challenge of addressing the documentation and management of a large and transient resource.

Historic asset loss is not a new phenomenon and coastal change continues to threaten the unique structures and artefacts related to maritime cultural activity at a rate that makes the recording of archaeological sites and landscapes in the coastal zone problematic. Whilst it is not feasible to save every site from destruction Murphy et al. (2009) suggest 'preservation by record' as an alternative; a policy that is ratified by ICOMOS.

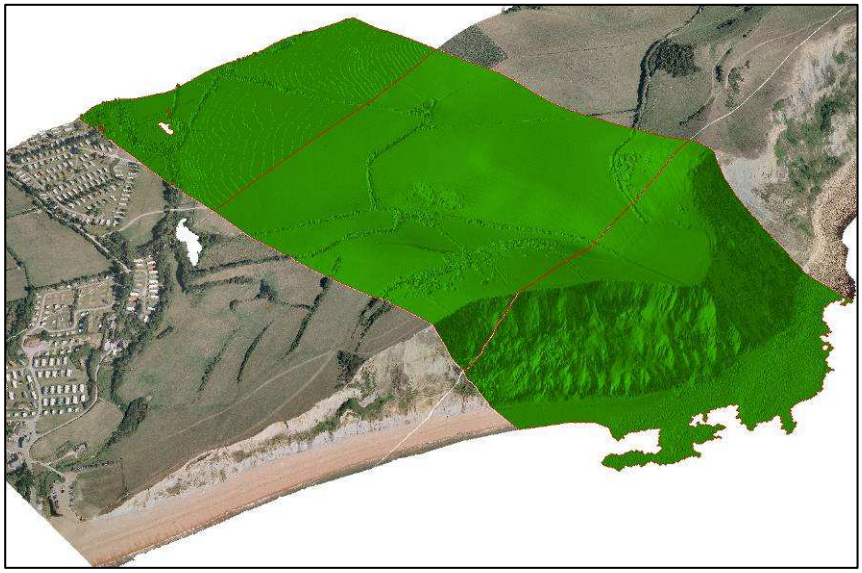


Figure 3 Overlaying terrestrial and airborne laser scanning at Golden Cap, Dorset

Developing a suitable recording methodology is difficult because of the wide variety of cultural features, coastal zone types and protective designations found along the coast. Such sites can be easily disturbed and, as a remote sensing technique, particularly in its airborne guise, laser scanning may balance the requirement to record a site in a manner that potentially eliminates the need to physically traverse it to do so. To some degree this may also address access and safety issues which have hampered recording efforts in the

past. Intertidal archaeological features in particular are notoriously hard to identify and present challenges for any survey technique.

Limited studies have hinted at the utility of laser scanning to provide a variety of outputs from a data-set that is often large, pre-processed by survey providers and difficult to manipulate and archive appropriately. Only a small number of projects have applied this technology to the coastal zone, mainly as a part of a rapid coastal zone assessment survey, and these have focused upon the use of pre-flown airborne scans which are provided by the UK Environment Agency or via another supplier. Although airborne laser scanning has been tested extensively on inland archaeological sites, there is a clear need to establish its capabilities and limitations in the coastal zone for archaeological purposes, particularly for the application of terrestrial scanners to coastal recording. The coast will present unique challenges for this technology that are not encountered elsewhere.

This doctoral research project has many facets that require examination to ensure that the implications of utilising laser scanning in the coastal zone are understood. Whether airborne and terrestrial laser scanning can significantly improve our understanding of the under recorded and researched maritime cultural heritage remains to be seen. Regardless of the outcomes generated by this research, a recording strategy must be formulated to document assets that cannot be saved before being lost to the sea forever along with their irreplaceable contribution to archaeological knowledge.

Murphy, P., Thackray, D. & Wilson, E. (2009) Coastal Heritage and Climate Change in England: Assessing Threats and Priorities. *Conservation and Management of Archaeological Sites,* 11, 9-15.

Student Research Profile – Qanat Systems in the Balikh Valley

Louise Rayne, Durham University

Louise.Rayne@durham.ac.uk

The Balikh Valley is a narrow, cultivable region in Northern Syria. In the past, it was the foci of successive phases of settlement: initially rain-fed agriculture was practised and a system of tell-based sites was the norm. Later, however settlement dispersed into a more economically productive system, eventually also associated with extensive irrigation networks, (e.g. see Wilkinson, 1998). In terms of power, industry and importance, this reached a peak in the Abbasid period (Challis, 2002-2004, p141), the caliph Harun al-Rashid making the town of Raqqa the administrative capital of his Empire and sponsoring the construction of canals, (Toueir, 1983, p298).

The early Islamic water systems of the area can be examined and recorded using techniques of remote sensing and GIS. In this case the principal datasets used were CORONA images and ASTER DEM. The CORONA images show a preserved landscape before without the damage caused by recent destructive changes. This renders them extremely useful for archaeological applications. In the 1967 image of the Balikh Valley, the remains of many sites and water features are apparent. These include canals, often recognisable by their characteristic morphology of dark central void and lighter upcast banks. Qanats can also be observed. These are underground channels, maintained via vertical air shafts, which collect groundwater and deliver it to the surface, (see Beaumont, 1989, p17). It is the shafts that can be observed in the imagery. Once these features are recognised, they can then be examined in relation to the

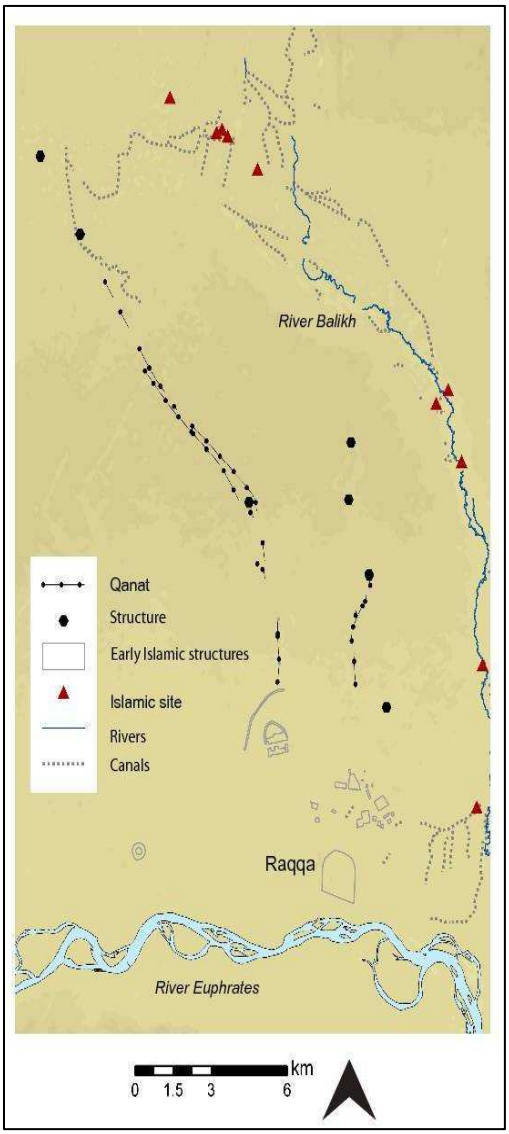


Figure 4 (left) The qanat systems shown appear to be drawing water from the cultivated region around the Southern Balikh and delivering it to the Early Islamic buildings around Raqqa, transporting it across the largely uninhabited and dry uplands. Small, square and circular structures are associated with the qanat channels themselves. The background is an ASTER DEM

topographical data contained within the DEM's. In this case the features that appeared to have some early Islamic association with elements of the landscape that have been field-checked in the past (Wilkinson, 1998) were recorded.

An extensive system of qanat shafts near Raqqa can be examined in detail here. The feature seems to originate in the form of an open channel close to what was, in the past, an area of marshes. It then flows across the limestone steppe and fades out in the vicinity of some of the early Islamic palace buildings to the north of Raqqa. The gradient of the extant feature is relatively steep at about 1:25. Associated with this qanat, and also with other qanat traces, are small rectangular structures, and another that resembles a barracks building. Given the location of the channel it seems reasonable to suggest it may be associated with the early Islamic remains around Raqqa, although this does not rule out later continued reuse. Modern settlements in the area contained the word 'bir' ('well') in their names, suggesting that their may have been knowledge or even use of the qanat relatively recently. The rectangular structures may also therefore be part of the general infrastructure of the channel. Circular features, which may also be associated with the channel, (possibly water mills of some kind) are visible in the southern reaches of the qanat. The complexity of this landscape of water management, settlement and industry reflects the political importance with which the region was favoured during the Abbasid period.

Beaumont, P., The qanat: a means of water provision from groundwater sources, in Beaumont P, Bonine M, McLachlan K, (eds), 1989, Qanat, Kariz and Khattara: Traditional Water Systems in the Middle East and North Africa, Soas

Challis, K., Priestnall, G., Gardner, A., Henderson, J., O'Hara, S., 2002-2004, CORONA Remotely sensed imagery in dryland archaeology: the Islamic city of al-Raqqa, Syria, Journal of Field Archaeology 29(1/2), pp.139-153

Toueir K., 1983, Heraqlah, a unique victory monument of Harun-ar-Rashid, World Archaeology 14(3): 296-304

Wilkinson, T.J., 1998, Water and Human Settlement in the Balikh Valley, Syria: Investigations from 1992-1995, Journal of field archaeology, 25 (1), pp.63-87

Announcements / Notices

This section will announce upcoming conferences, meetings, seminars. If you have an item for inclusion in the next issue please send details to the editors.

16th-18th Sept 2010	Aerial Archaeology Research Group Conference, Bucharest aarg2010.cimec.ro
21st-24th Sept 2010	VAST 2010 - The 11th Symposium on Virtual reality Archaeology and Cultural Heritage, Paris www.vast2010.org
21st -22nd Oct 2010	3rd Annual Workshop on Visualisation in Archaeology www.viarch.org.uk
25th Oct 2010	Electronic Heritage and Digital Art Preservation, Second eHeritage International Workshop, held jointly with ACM Multimedia in Florence, Italy www.imago.ufpr.br/ehw10
12th -13th Feb 2011	Archaeology of wooded landscapes, a day of presentations held 10am to 5pm at Meridian Hall, East Grinstead. www.sussexpastshop.co.uk