Editorial

Starting with issue 61, the *Archaeological Computing Newsletter* will resume regular publication on a bi-annual basis as a supplement to the international journal *Archeologia e Calcolatori*. Building on the success that the newsletter has enjoyed in the twenty years since publication began, it has been decided to leave the editorial format unchanged, although the collection and editing of articles will be organised by the Italian staff. We continue to encourage newsletter-type short articles and, especially, reviews of conferences, books and software, notices of forthcoming events, in fact anything of interest to computer-using archaeologists.

It is therefore in a spirit of collaboration and with an eye to the international dimension of research, that we enter into this new phase in the life of *Archaeological Computing Newsletter*, whilst retaining our focus on the development and diffusion of computer archaeology.

JEREMY HUGGETT GARY LOCK PAOLA MOSCATI

GIS and databases in Aegean prehistory: Current progress, future strategy [1]

The disciplines of Aegean and Near Eastern prehistory were founded by pioneering archaeologists – Tsountas, Boyd-Hawes, Schliemann, Evans, Petrie, Woolley and Myers to name some of the best-known – in the nineteenth and twentieth centuries. These pioneers produced voluminous tomes with militarily precise floor plans, meticulously crafted drawings of vessels and potsherds, and acres of densely printed and/or written material, analysis and interpretation. The result was a discourse deeply rooted in, for example, Evans's tripartite scheme of Minoan (Bronze Age Cretan) chronology, whose "Early, Middle and Late" partitions still form the framework and basis for present-day discussion of this subject (e.g. Hood 1996: 10-16; Warren 1991: 319-340). These partitions, their semantics, descriptions, taxonomies and typologies, are rooted in analysis of pottery decorations and shapes (for a useful recent summary, see Driessen and Macdonald 1997, Chapter 2, 15-23). In the past this analysis has made little or no use of Information & Computing Technology (ICT) in any form. But in recent years, as ICT has developed, and as the importance of the material record's context in time and space has been recognised as being of equal importance to its content, a nascent plethora of ICT based, or at least ICT-guided, applications has sprung up in Greece. Of particular importance are the two generic forms of ICT application whose outcomes are, arguably, of most use to both researchers themselves and to the wider community: analysable and easily distributable databases containing various types of information, and Geographic Information Systems (GIS).

An important recent volume in the Aegaeum series, *Metron: Measuring the Aegean Bronze Age*, the proceedings of the 9th International Aegean Conference held at Yale in 2002 (Foster and Laffineur 2003), contains many important new contributions on this topic. The theoretical ability of database techniques to quantify and qualify very large datasets is well attested, and current applications in the Aegean reflect this. Numerous well developed and user-friendly database packages detailing archaeological information include the *Sphakia Survey* (Nixon *et al*. 2000), where the user can search the survey's outputs by chronological, artefactual or geographical keyword; this information is then tied into the topographic context. The *Mycindex 3.2 Project*, under the direction of Professor Albert Leonard at the University of Tucson, and part of the SCIEM 2000 programme at the University of Vienna, pursues a similar goal with regard to some 6000 pieces of Mycenaean pottery found at various sites throughout the East Mediterranean, allowing the user to explore the corpus with a search engine, rather than dredge

[1] I should like to point out that the conclusions reached in this paper are my personal perspectives, and do not reflect any official position of the Arts and Humanities Research Board, the Arts and Humanities Data Service or the Archaeology Data Service.

through it visually. Louise A. Hitchcock has adopted a similar approach to ashlar architectural fragments and mason's marks from pre-classical Cyprus. Hitchcock notes that «Although such blocks are critical to the reconstruction of classical buildings, their documentation and preservation varies from detailed to non-existent» (Hitchcock 2003: 259). She argues that to remedy this situation it is necessary to systematically define and catalogue such fragments in future scholarship, and is currently using the open ended database package Filemaker to do so in this case (personal communication, 31 March 2004).

At the more spatial end of the field, a new survey planned for the *Knossos area*, revisiting the ground-breaking study of Sinclair Hood and David Smyth (Hood and Smyth 1981) will be making use of GIS and databasing, and archiving Hood's inventory study of the area (I thank Todd Whitelaw for this information). In the same vein, the *Kythera Island Project*, GIS has been «the primary analytical vehicle for exploring patterning in the archaeological dataset» (Conolly 2003: 498). This project has also stressed the multi-scalar and interoperable aspects of GIS with regard to micro-survey of the Kastri, Mitata and Livadi regions of the island (Bevan 2003: 496). On the mainland, the *Digital Thebes* programme has stressed not only the investigative potential of GIS in archaeology, but also the role which the method can play in site administration, planning and prospection (Dakouri-Hild *et al*. 2003: 53). Such issues, brought to world media prominence in 2003 and 2004 by large scale construction for the 2004 Athens Olympics (see, for example, Smith 2002) further highlight the need for integrated and flexible approaches to cultural resource management. As Dakouri-Hild *et al*. point out, GIS, its interoperable flexibility and its ability to inter-calibrate with other projects provides an infrastructure for such a system (Dakouri-Hild *et al.* 2003: 54, n. 33).

There are other resources. A team from the Selcuk University of Turkey has initiated a programme which approaches the geospatial dimensions of the Aegean Sea as whole using GIS (Goksel *et al*. 2001: 1548), a good example for the intellectual context of these developments. But forming a backdrop to the recent advances has been a somewhat futile debate pitting the relative merits of large-scale survey, small-scale survey and excavation against each other (Walberg 2003: 27-28). To suggest that one of these exploratory methods is "better" than the other two is absurd, as it should be immediately obvious that they provide appropriate answers to very different kinds of question. Excavation (and do not forget that the gentleman explorers were all excavators) deals with the stratigraphic, the intra-stratigraphic and the relationships between different occupation horizons at a highly localised and tightly focused level. This is true even for the very largest excavations. By the same token, the intensive survey proceeds on an inch-by-inch basis, providing highly local and specific information. The broad survey, however, deals with a constituency of features, sites, networks of sites and regions. There is little profit in asking "which resource is the most valuable". Rather it is better to ask "how can the three resources be alloyed?" The projects outlined above highlight a continued and growing importance of databases and GIS in the field, based on their fundamental interoperability. In addition to the obvious benefits to individual projects, these techniques thus provide a fluid and flexible environment for uplinking information from these three diverse sources.

When it comes to applying these methods in the field, however, a situation exists which broadly reflects the picture emerging from the Arts and Humanities Research Board's ICT in Arts and Humanities Research Programme (hereafter ICT/AHRP: see www.ahrb.ac.uk/ict). This picture shows an intellectual landscape of Arts and Humanities computing which, although thriving and innovative at an individual and institutional level, nonetheless lacks a pan-disciplinary coordination and approach, which gives rise to problems of fact and interpretation at a general level. To quote the Centre for Data Digitisation and Analysis at the Queen's University of Belfast, one of the UK's leading research centres in the application of GIS to Arts and Humanities data, «[GIS] are not well developed in the Arts and Humanities. They tend to cope poorly with data commonly used in the Humanities which might be a mix of qualitative and quantitative information, might be incomplete, or might be interpreted in different ways» (unpublished response to ICT/AHRP computing usage survey questionnaire, quoted with the permission of Dr. Paul S. Ell, for which I am most grateful). The cases outlined above, although taking knowledge forward in the ways described, nonetheless highlight the need for holistic considerations in order to maximise the potential which GIS and databases undoubtedly hold in this highly specialised and data-intensive field. To access this potential, there are questions which have to be addressed in each case: How big is the dataset to be recorded, both in terms of the number of records and how much information will be held on each record? What outcomes will the user require of the databases? Is statistical or comparative analysis necessary? Or is presentation a priority? Or preservation and storage? How will this be achieved? How will it be delivered? With the answers to these questions in mind, which database package will best suit the application? Will the database be disseminated online, and if so, which scripts will be used and which Internet platforms? Which GIS package is most appropriate, and which database packages will it best link with? The problem with these questions is that those who have the archaeological knowledge to know what information is needed often lack the computer expertise to ask them. Conversely, computer specialists who could provide optimal solutions to archaeological problems often lack the expert archaeological knowledge to know what analysis is needed of the information.

There is a further point. In the descriptions of most of the projects outlined above, the investigators involved have, to a certain extent, had to create their own resources from scratch, be it digitisation, platform creation or data entry. L. Hitchcock notes that, for example, «The task of cataloging architectural fragments could be assigned to a graduate student or volunteer in every field project just as other categories of artefact are currently assigned» (Hitchcock 2003: 259, n. 26). Such exercises, although to a degree inevitable in any archaeological computing application of this type, are costly in both time and resources. It would surely be desirable if these expenses could be limited wherever possible.

It is perhaps obvious to state that, without a focal point, the archaeological computing field in Aegean prehistory will remain unfocused. One possible solution would be to establish, in Greece, some form of interdisciplinary digital research and analysis centre for Aegean archaeology. Organisations that provide generic support exist nationally, such the highly successful UK Archaeology Data Service (see http://ads.ahds.ac.uk/index.html) and the Humanities Computing Group at New York University (http://www.nyu.edu/its/humanities). Yet such is the specialised data-intensiveness of Aegean archaeology, and such is the potential of computing within it (as demonstrated by the projects mentioned here), that a separate and specialised centre working alongside national organisations (where they exist), and the foreign schools in Greece (and other Near Eastern and Mediterranean countries) would greatly facilitate humanities computing in this field, and serve the discipline as a whole. Such a centre would best be international in character, reflecting the number of countries which have produced Aegean scholars. It could act as a library for generic and semi-generic digital resources, such as digitised GIS maps with layer files (for example) detailing Late Helladic settlement patterns, or the findspots of Early Cycladic figurines. It could develop such resources for specific, as well as general use, saving individual scholars the time and money needed to create them from scratch. Successful database templates (and databases themselves) could be shared online via such a centre, with the experiences of excavators and surveyors pooled. In addition to creating, storing and preserving metadata, a digital centre could provide expert regional-specific advice and support in Greece, helping archaeological investigators with the questions on application and execution highlighted above. In short, it could take the interdisciplinary spirit which characterised so much Aegean archaeology in the twentieth century, and place it squarely in the twenty-first.

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Ethnoarchaeology and Spatial Analysis of a potters' quarter at Moknine, Tunisia

Moknine and pottery production in Tunisia

Moknine is situated on the eastern Mediterranean coast of Tunisia about 180 km south of the capital city of Tunis (Fig. 1)[1]: it is an industrial city with a population of 50,000 inhabitants. The potters' quarter (in Arabic referred to as *Kalalet*) in Moknine lies at the eastern part of the city and, over the last century, expanded to cover ca. 140,000 square meters. Currently it houses 41 workshops, employing around 100 craftsmen[2] who specialize in unglazed coarseware ceramics of small to medium size (20-60 cm in height); among the most popular are the *gargoulette*, the *nigueli* and *habiya* in standardized sizes. The added salt in the clay paste accounts for the distinctive yellowish appearance of this local pottery[3]. Some potters' families have continued the craft tradition for at least three generations and excavations in the western part of the city uncovered Roman kilns, confirming the strong local ties with pottery throughout history (Fig. 2) (Ben Lazreg 1984). A few miles to the northeast, in Lamta (ancient *Leptiminus*), an extensive pottery workshop of the 2nd century AD was discovered (Stirling *et al.* 2001). The modern visitor will immediately notice the pride of the city of Moknine and its neighboring cities in their ceramic legacy, celebrated in public, highly visible, monuments.

[1] The Ethnoarchaeological Project at the Potters' Quarter in Moknine was directed by Eleni Hasaki: its first phase lasted from 2000-2003. Erin Nell was responsible for GPS data collection and GIS processing. N. Bayrem and D. Weibel prepared the architectural drawings. We would like to thank Dr. N. Ben Lazreg at the Institut de la Patrimoine National in Tunis for the permission to undertake this project and S. Ben Baaziz from the Cartography Office for his valuable help; our thanks also to the governor of Sousse, H. Mokni, to L. Stirling and D. Stone from the Leptiminus Archaeological Project for supporting wholeheartedly the project, as well as to A. Ben Abdelali, M. Bousrih, and S. Abderrazak for their hospitality at Moknine and at Lamta. Our deep gratitude to Gary Christopherson, Director of the Center for Applied Spatial Analysis (CASA) at the University of Arizona for making available to us not only technical equipment but most importantly his precious time and his vast knowledge. Funds for this project were provided by the University Summer Research Grant and the Rawson Summer Fellowship at the University of Cincinnati as well as the Faculty Small Research Grants Program at the University of Arizona.

[2] Sethom (1964) recorded 120 active potters in Moknine while Nabeul maintained 635 potters. Many crafts flourished in Moknine in the last few centuries, primarily jewelry-making by a thriving – but now non-existent – Jewish community.

[3] For the scientific investigation of added salt or sea water to the clay matrix, see Sherriff *et al.* 2002.

Fig. 1 – Map of Tunisia with traditional pottery production centers mentioned in the text and two major cities (Tunis and Carthage).

Tunisia has enjoyed a long tradition in pottery making both in ancient and recent times. In antiquity, it housed a large number of workshops producing the famous North African red slip *Sigillata* ware that dominated the markets in the Mediterranean (Mackensen and Schneider 2002; see also Peacock *et al.* 1989 for excavated kilns of the Roman period at Maklouba). In the last few centuries Tunisian potters continued their craft primarily on Djerba (allegedly the island of the Lotus-eaters in the Homeric epics), Nabeul, and Moknine. All three featured extensive potters' quarters called *Kallala* in Nabeul and *Guellala* in Djerba; these terms along with the *Kalalet* in Moknine are derivatives of the *gargoulette*, or *qallala* in Arabic, a hallmark shape of traditional Tunisian pottery (Lisse and Louis 1954).

Project objectives and methods

The purpose of this project was to document the potting traditions and familial connections of the Moknine potters before their workshops were relocated to a new site in the same city (Fig. 3). This fairly unusual process of relocating an

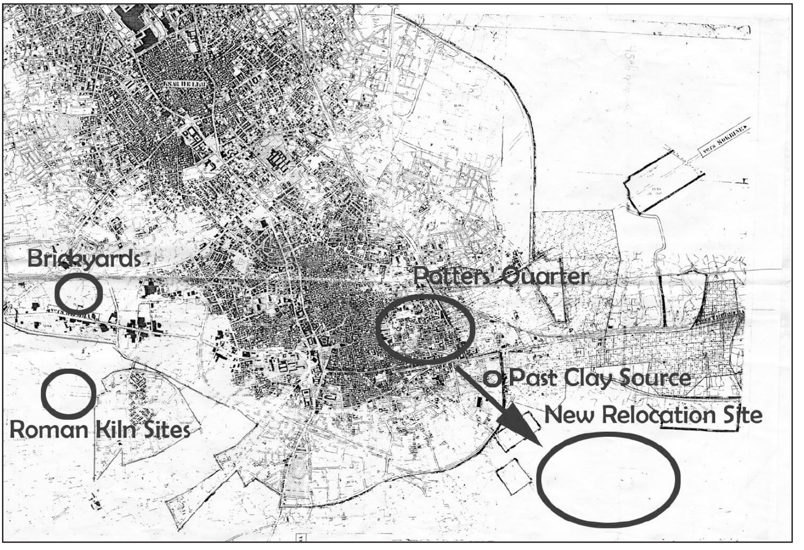

Fig. 2 – Topographical map of Moknine (originally in 1:50,000 scale) indicating the major sites connected with ancient and modern pottery production.

entire potters' quarter provided a unique opportunity for both a multi-faceted investigation of the old vanishing *Kerameikos* but also of the development and adaptation strategies of this unit in its new location.

Moknine, while perhaps geographically inferior to the exotic locations of Djerba and Nabeul, received only brief mentions by ethnographers in the 1950s (Sethom 1964). Djerba and Nabeul, on the other hand, attracted the first ethnographers in the mid 1950s and 1960s, mostly francophones (Louis and Lisse 1954 on Nabeul; Combés and Louis 1967 on Djerba). More recently a regional survey on Djerba emphasized the relationship between wine and pottery production locales (Fentress 2001). Traditional pottery-making has been revived in Djerba due to governmental initiatives, but Nabeul has surrendered entirely to tourism for its main source of income.

The documentation of the Moknine potters was done by means of personal interviews, digitized architectural drawings, and topographical mapping (GIS). Additionally, Martina Dalinghaus undertook a chemical and mineralogical analysis of the local and regional clay pastes used in Moknine. The extensive questionnaire covered biographical information on the potters (age, extent of the family, migration attempts to other countries, family tradition in the craft, and beginning age of their potter's career), organization of their business (number and occupation degree of their personnel), specialization and scale of productivity, raw material and fuel sources and requirements, and quantification of modern vs. traditional technology in the workshops (e.g. electrical wheels and mixing machines).

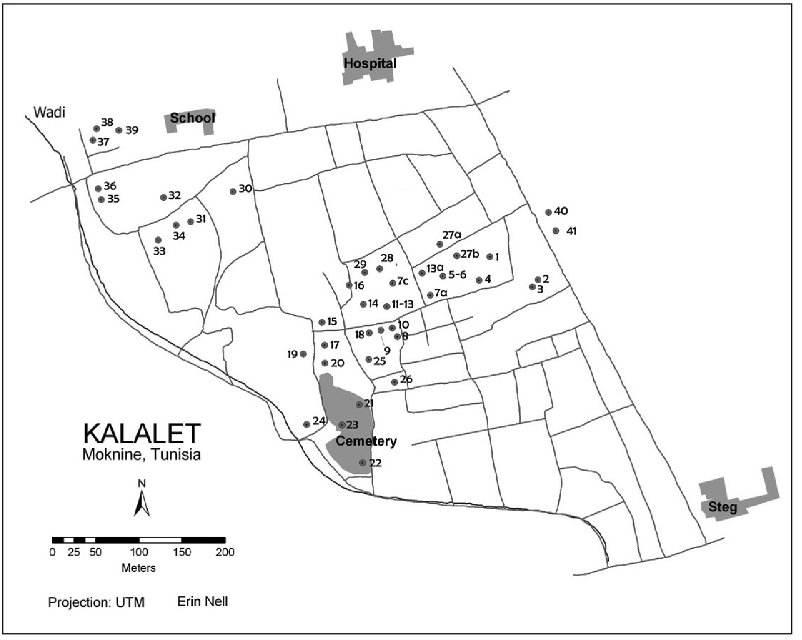

Fig. 3 – Digitized map of the Potters' Quarter (*Kalalet*) in Moknine. Produced by Erin Nell.

GIS survey of the potters' quarter: method, equipment, and analysis

The area of interest (the *Kalalet*) is approximately 140,000 square meters and is located on the western side of the city of Moknine (Fig. 2). The eastern, northern, and southern sides of the *Kalalet* are bordered by major streets; the western side by a minor street and *wadi* (dried river bed). Its original kernel coexisted with a Jewish cemetery in the southwestern part of the area. Currently the *Kalalet* has many single and multi-level low income structures and open areas that function as homes, ceramic workshops, and retail businesses.

The area of the *Kalalet* was generally divided by a network of planned streets but because many structures have been either erected or demolished, this originally organized area was now orthogonally distorted. The last official topographical map of Moknine (1:5000) was produced in 1989. Due to the evolving structural nature of the area, the workshop locations in the *Kalalet* needed to be geographically documented to correspond with this 2002 ethnographic survey.

The organization of the *Kalalet* on the city map and its current physical composition were compared during a preliminary field survey. Later, the location of 41 workshops and associated kilns, the central areas of each workshop (hereafter referred to as "centroids"), a local cemetery (as a landmark feature), and the perimeter of the *Kalalet* as designated by three major streets and a *wadi*, were collected (Fig. 3).

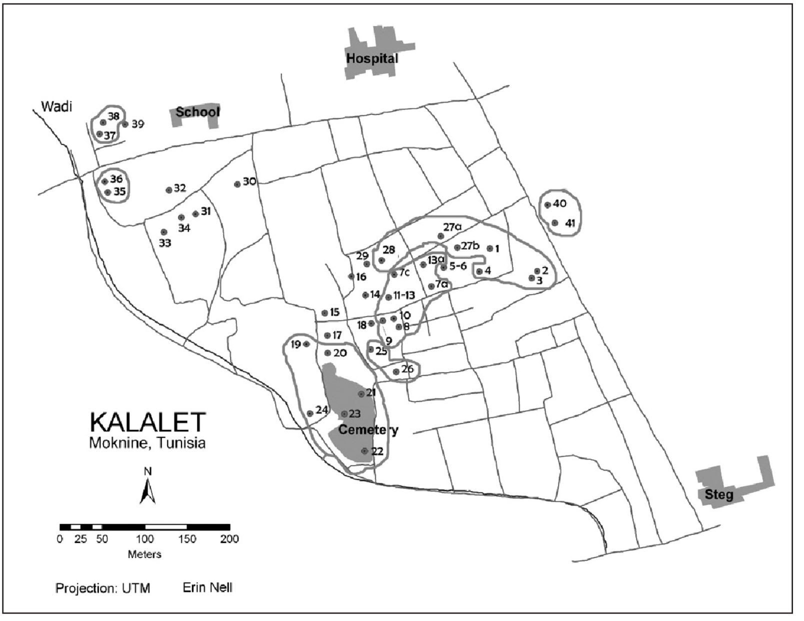

Fig. 4 – Digitized map of the Potters' Quarter (*Kalalet*) in Moknine indicating workshops operated by extended families. Produced by Erin Nell.

Equipment

A Garmin 12cx GPS (Global Positioning System) unit was used to collect the geographical coordinates of the previously listed structures and features. Along with the advantages of a hand-held GPS unit (quick data collection and non-invasive nature) came some disadvantages as well which pertained mainly to workshops that were located on the first floor of two-story buildings: the second floors interfered with the reception of the GPS unit and available satellites. As a result, sometimes geographical coordinates of only three corners of square or rectangular workshops were collected.

Observation technique

Before GPS data collection began a rough sketch was made of each workshop or prospective survey location which designated consistent areas of each workshop such as the perimeter areas (highlighted by property line or structural corners), the location of each workshop's kiln(s), and the centroid of each structure. From each of those designated locations (hereafter referred to as "stations"), six GPS waypoints were collected at 30-second intervals, for a grand total of six to 80 waypoints per workshop. Geographical data, observation times, and serial waypoint numbers were recorded in the field log as well. A series of GPS waypoints were also collected which designated the location of the cemetery and the borders of the *Kalalet* (including the main streets and *wadi*).

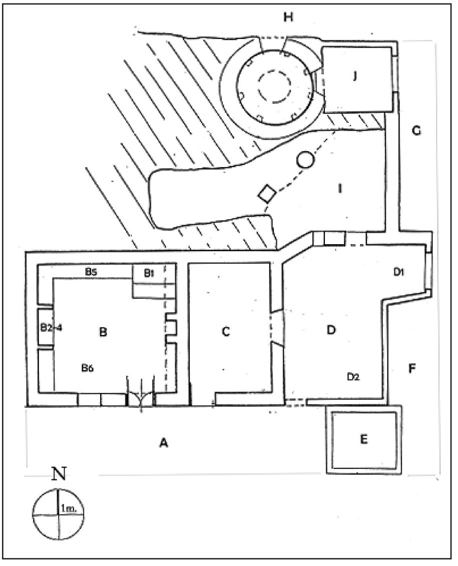

Fig. 5 – Plan of the pottery workshop of Mr. Ben Abdelai specializes at *niguelis* (amphora-like jars) at Moknine, Tunisia. A: Exterior space for initial drying of pottery; B1: Wheel; B2-5: Vertical shelves for drying pottery; C: Room for drying pottery; D (D1-D2): Preparation and storage of clay; E: Levigation tank; F and G: Exterior space for storing fired pottery; I: Interior space for storing fired space; J and H: Kiln (plan by N. Bayrem and D. Weibel; adapted by E. Hasaki).

In order for a GPS unit to function properly it must have an unobstructed access to specific satellites orbiting the earth. At times visual access was impeded by high walls, ceilings, roofs or a shop owner's reluctance to allow us access to certain areas of his workplace. In these circumstances waypoints were not collected and their omissions were duly noted in the field log.

All waypoints for each workshop, its features, and the perimeter of the *Kalalet*, were downloaded into the Excel spreadsheets and averaged in order to find the arithmetic mean of each separate station, thus determining the coordinates of each structure and feature.

Off-site GIS analysis

The second phase of the GIS analysis was conducted in the Center for Applied Spatial Analysis (CASA) at the University of Arizona, under the supervision of Gary Christopherson (CASA director). The GPS data was organized for compatibility with CASA's software ArcView; longitudinal and latitudinal coordinates were converted into decimal degrees.

After the coordinates were converted all waypoints representing one station (such as a particular corner of a workshop or a specific kiln) were gathered together; the arithmetic mean of each station was determined. Then, the arithmetic means of each station were arranged in separate "point" and "polygon" files. Point files represented individual features such as kilns, centroids, and front doors: polygon files corresponded to the perimeters of each workshop, the local cemetery, and the *Kalalet* (as designated by bordering streets and the *wadi*). These point and polygon files were then imported and generated into the ArcInfo Workstation. Then, these generated files were joined with specific workshop information files which included the names of each shop owner, the number of kilns in each shop, and the time and date of GPS waypoint collection.

Digitizing maps

Certain areas of the 1989 Moknine map (1:5000) needed to be digitized so the ethnographic survey's GPS generated files could be imported and plotted onto them. The 140,000 square meter area of the *Kalalet* was digitized from this city map into four separate files. Two of those files were line files: one file designated all of the streets within the *Kalalet* (including the northern, eastern, and southern perimeter streets), and the other line file represented the *wadi* (which bordered the western perimeter of this potters' quarter). The remaining two digitized files were polygon files: one represented the blocks of major streets, while the other illustrated landmarks within the *Kalalet*, such as the "Steg" (the local power plant), the cemetery, the school, and the hospital.

Unfortunately the 1:5000 city map of Moknine that was digitized did not have a recognizable coordinate system. Although it used the Carthage coordinate system and its transformation method was the Lambert Conic Conformal/Orthomorphic, when the GPS generated files were overlaid onto the digitized map files, the coordinate locations of each of these files were kilometers apart. In order to correct this problem, we needed to determine the first and second standard parallels for the Lambert Conformal. The Tunisian government sent us this information but it still did not resolve the problem. Therefore, we decided to use a UTM projection.

Final GIS result

The GPS files were then coordinated with the digitized files. The following files were then combined into a new file in ArcMap: point files (including workshop centroids, and kilns), polygon files (the ceramic workshops), and digitized files (streets, *wadi*, wall, and landmarks).

Macro and micro- Spatial Analysis of the potters' quarter in Moknine

The study of an entire potters' quarter differs from the majority of anthropological, ethnoarchaeological, and ethnographic projects which often focus on a single workshop. It enables us to detect patterns and to quantify production and consumption of clay and fuel at a much larger scale. The spatial analysis through GIS conveys not only the compact arrangement of a large number of workshops, but also highlights the proximity of workshops belonging to the same extended family (Fig. 4). The three dominating families in the *Kalalet* are the Nacefs, and two branches of the Ben Adlelali kin. The absence of patterns, such as concentration of workshops with the same specialization on pots or type specialization across families in the same kin, is also noticeable.

The micro-scale spatial analysis of each workshop (based on digitized architectural drawings) seeks to quantify the total space of a workshop and to establish a "minimum" viable space for workshops which produce small, medium, or large size pots (Fig. 5). It also aims to quantify how space is allocated to each phase of pottery production such as clay levigation, wheel-throwing, firing, or storage of fuel and products[4]. Another set of questions aims to employ data from existing workshops to aid archaeologists in extrapolating the original size of an ancient workshop: specifically how much space in a workshop is roofed and how much is left open to the air and how much space is occupied by archaeologically discernible features – such as basins or kilns, or benches adjacent to wheels. For each measurement both actual numbers and percentages were recorded, the latter in an attempt to compare workshops of different actual sizes, and allow general patterns to be detected. This spatial analysis emphasized the "invisible space" inside a workshop (permanent or temporary shelves for drying pottery which vertically increase the usable space), but also the space outside the workshop.

These calculations could later be juxtaposed to the spatial reconfigurations of the workshops in the new location at Sabkha. A dataset of spatial information will allow comparisons among pottery workshops of different periods and cultures ultimately leading us to the recognition of space allocations which are recurrent independently of cultural associations. Finally, spatial analysis can be extended to other crafts such as metallurgy, weaving or carpentry highlighting the specific organizational and other needs that determine the spatial layout of a working space.

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[4] See Arnold's characterization of activities relating to pottery manufacture as "spatially flexible" and "spatially inflexible" (Arnold 1991: 99-119). Also Williams 1995 for a first attempt to study pottery production space in Mexico.

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A system for recording surface artifacts using Trend Surface Analysis

Introduction

Trend surface analysis is now widely used in spatial analysis in Archaeology although it is hardly used for recording or analysis in Sri Lankan Archaeology. This is a pioneer attempt of such a study applied to the site of Hakbelikanda

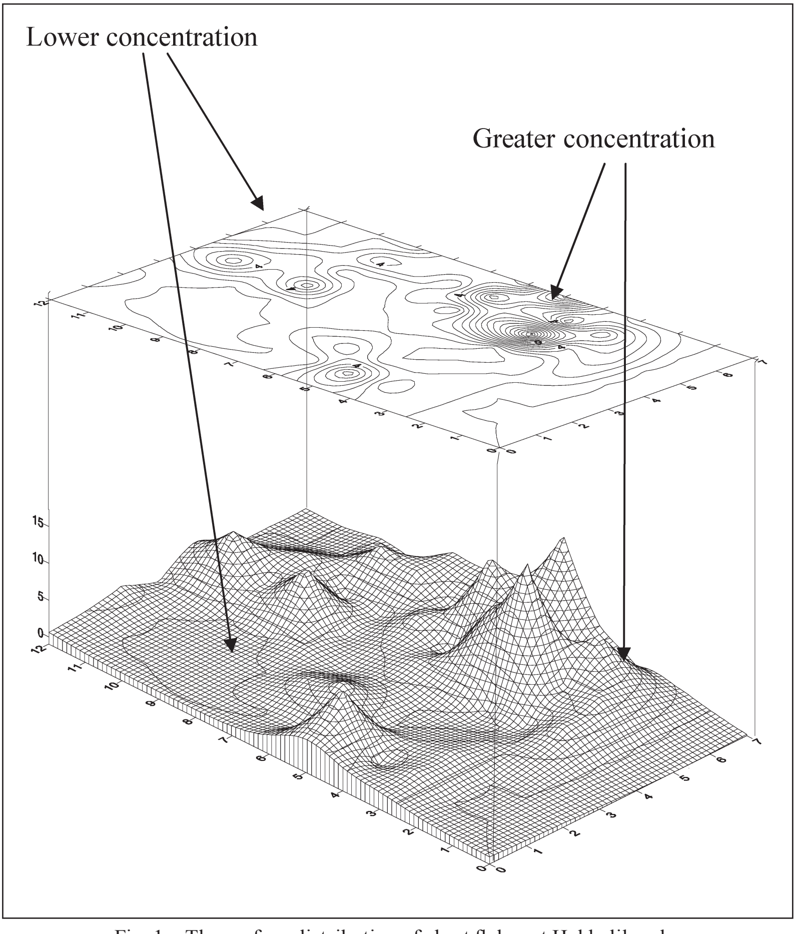
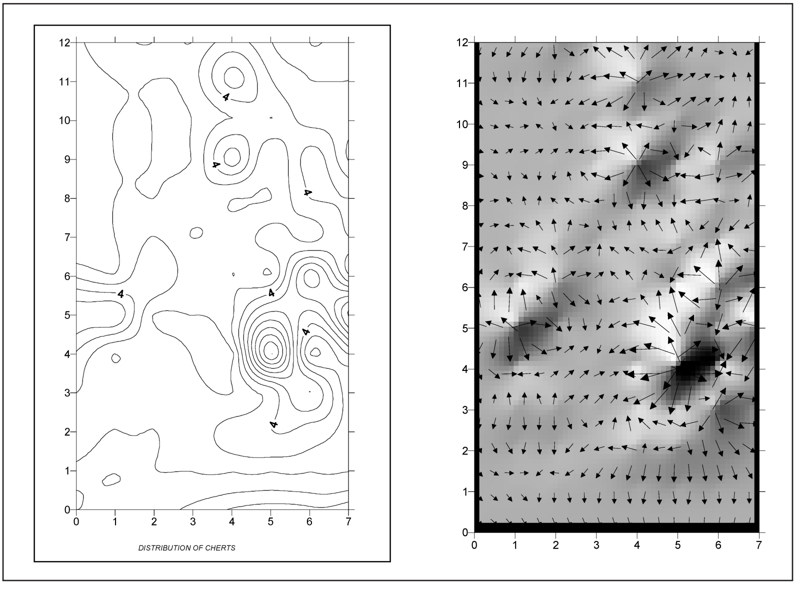


Fig. 1 – The surface distribution of chert flakes at Hakbelikanda.



Figs. 2-3. The same distribution of chert flakes displayed in two digital forms namely, contour map (Fig. 2) and shaded relief and grid vector maps (Fig. 3).

The History of Hakbelikanda

Hakbelikanda was previously known only as a Buddhist monastic site of the early historic period although recent studies have shown that the history of Hakbelikanda goes back to the prehistoric era. There is a cluster of rock shelters on the top of Hakbelikanda hill which has clear evidence of prehistoric occupation, including rock art. We selected one rock shelter, which looked to have most potential where fragments of chert and quartz were scattered on the surface. The distribution pattern of chert only was used for this study because chert is not found in the vicinity and must have been transported from a distance. The data were collected during an exploration conducted by the Department of Archaeology in the University of Kelanya in 2003.

When exploring an ancient settlement it is necessary to scrutinize the surface artifacts left by the occupants although it is a debatable question as to whether it is always possible to ascertain a true picture of the buried culture from those artifacts that are scattered on the surface. There are arguments for and against using surface scatters of artifacts in the interpretation of an archaeological context and one of the main challenges faced by a field archaeologist is to identify correctly the archaeological value of the surface. Another practical problem faced by the field archaeologist in the absence of structures, whether the remains of buildings or foundations, is basing analysis solely on stray potsherds, stone tools and beads. The aim of this study is to discuss the possibilities of arriving at conclusions in and through the examination of the artifacts scattered on the surface. In order to understand archaeological value in the light of surface findings various analytical methods are being experimented with using computer applications.

Methodology and data analysis

What is described in this paper is an attempt to record surface artifacts using the application of Surfer 7.0 software. We have mapped out the distribution of the chert flakes over the entire surface and applied trend surface analysis. This is not just an attempt to observe artifacts scattered in a particular area but also to identify human association or dissociation with the artifacts. Digital recording is systematized through its presentation by digital maps and by comparison with the land surface through the use of trend surface analysis. There are two main results of this approach, greater and lesser concentrations. Greater concentrations represent the accumulation of artifacts in a particular spot in large numbers while lower concentration is vise verse, results are best shown graphically as in Figs. 1, 2 and 3.

Conclusions

This analysis clearly shows the places of greater and lower concentrations of chert flakes. But, by closer study of these areas and their comparison with the topographic characteristics of the surface it is clear that they have resulted from later disturbances to the site, and are not related to the primary pattern of deposition of the artifacts. However, the usefulness of trend surface analysis in field archaeology for both recording and analysis is obvious.

Acknowledgement

My sincere thanks are due to Mr. Anura Manatunga and Prishantha Gunawardhana for the encouragement and guidance given to me when doing this study.

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Geophysics for archaeologists: Review essay of *Revealing the Buried Past* by Chris Gaffney and John Gater

Since the first significant applications of geophysical techniques to archaeology were undertaken in the late 1940's, several books have emerged which have marked the progress and development of the technique. In 1961 Martin Aitken, who three years earlier had successfully developed a proton magnetometer for archaeological surveying, published the book *Physics and Archaeology*. As well as discussing scientific dating techniques in archaeology (such as radiocarbon and thermoluminescent dating), he also described the field applications of electrical resistivity and magnetic prospecting. However, it was not until 1990 that the next two most influential books were published, Irwin Scollar's *Archaeological Prospecting and Remote Sensing* and Anthony Clarke's popular *Seeing Beneath the Soil*. Clarke introduced some useful guidelines for archaeological geophysical practice and discussed the diverse techniques and field methodologies available to the archaeologist. This publication, of which an updated second edition was published in 1996, has been a core reference guide for geophysical practitioners and those wishing to understand the fundamentals of the technique.

Revealing the Buried Past (Stroud 2003, Tempus), written by Chris Gaffney and John Gater, two of the most experienced archaeological geophysical practitioners in Britain, represents perhaps the third generation of archaeological geophysical literature. The authors draw upon their wealth of experience in geophysical consultancy and their involvement in a long-running popular television programme "Time Team", through which they introduced the discipline to a much wider audience. This well researched book follows a similar structure to that which was adopted by Clarke, differing only in that it is divided into two distinct sections. The first details the history, science and methodology of archaeological geophysics and the second offers a range of case studies, divided by period, mostly selected from their archive of over 1700 surveys conducted over the last 17 years undertaken using a range of differing techniques.

The discipline of archaeological geophysics developed from applications used in geology and physics, but has been refined in order to be sensitive to physical anomalies closer to the earth's surface. The inclusion, therefore, of a discussion and definition of the subject at the beginning of the book is a useful starting point for those wishing to explore the technique. The authors' definition of archaeological geophysics as «the examination of the Earth's physical properties using non-invasive ground survey techniques to reveal buried archaeological features, sites and landscapes» (p. 12) appears to adequately define the discipline, as it emphasizes the key areas of studying the structure, composition and development of the earth as well as the passive nature of the technique, as directly opposed to the destructive process of excavation.

Since the introduction of this technique to a wider audience and the publication of the results of many spectacularly successful surveys, the expectation of the ability of these instruments has grown. It is useful therefore, that Gaffney and Gater discuss some of the existing limitations with the techniques. Firstly they highlight the difficulty in differentiating in the results of a survey what may be archaeological in nature and what may be created by other causative bodies, such as strong underlying geology. Secondly, and perhaps most importantly, they emphasise that there is «never any certainty that a successful archaeological result will be achieved» (p. 15) and rather colourfully note that a «geophysicist is not a magician». However, this is an important point that it is wise to remind both clients and fellow researchers: that a geophysical survey cannot always be guaranteed to provide the desired results. Furthermore, it is also possible, as the authors note, that «if features are not discovered in a survey it is possible that even the best documented or topographic evidence can be wrong» (p. 15).

Yet, despite these necessary caveats, archaeological geophysics certainly in Britain has grown to become an expected and essential part of the tools available in archaeological research. Indeed the technological, methodological and political challenges now faced in the UK perhaps differ from those elsewhere in Europe. The introduction of PPG16 in Britain in 1990, whilst not writing geophysics into research, did much to encourage its uptake. In Italy for instance, geophysical survey still remains firmly a technique that is applied in the domain of institutional research, rather than a technique applied prior to the development of land. The likely cause of this is the differing methods in which archaeology is taught at a higher educational level. In 1971 the first post-graduate degree in Scientific Methods in Archaeology was offered in the UK and was shortly followed in 1975 by an undergraduate degree in Archaeological Science. Currently, the study of geophysics is offered to all students studying archaeology on the majority of undergraduate archaeology degree courses. However, in Italy the opportunity to study the field of archaeological geophysics is only offered by a few courses at a master's level. The result therefore is generations of archaeologists who are perhaps only partly aware of the techniques and the instruments available when undertaking archaeological research.

There exist a number of different survey techniques available to the archaeological geophysicist each with their own individual strengths and weaknesses. The most commonly applied are resistivity, magnetometry and ground penetrating radar (GPR) and these receive a full discussion by Gaffney and Gater who provide a well-balanced assessment of each of the methods. A shorter discussion is also made of less usually applied techniques, such as seismic, microgravity and dowsing, the latter of which, in the opinion of the authors, does not work as an archaeological tool (p. 54). What is made apparent is that there is no single instrument that will detect everything, evaluations must be made of the most suitable technique to apply to a site. Together with this, a survey must consider conditions on the ground, the type of geology expected and the field strategy to be employed.

A key part in the process of conducting geophysics is the post-survey analysis of the data. It is fundamental that the correct procedures are followed and that information that is not in the raw data is not added to the data-set. Gaffney and Gater conveniently provide a series of flow diagrams that act as a useful guide for those processing data. However, an area that the authors fail to fully explore is the potential that CAD and GIS packages have in aiding the interpretation and presentation of results. GIS in particular, rather than being a vector-based computer program as described by the authors (p. 115), is in fact an environment that allows the combination of both raster image data (such as geophysics results) and vector data. As well as allowing the integration of these two formats, further exploration can be made of the information through applications such as 3D analysis. Furthermore, the environment is also useful for the geo-referencing of datasets and their archiving.

The second section of *Revealing the Buried Past* presents a series of case studies divided into three general categories: prehistoric, early historic, later historic/modern. The well-illustrated examples include surveys undertaken using various forms of prospection. As the authors draw most of their case studies from their own archives, the majority are examples of surveys conducted in the British Isles. Indeed their background as geophysical consultants in the UK has meant that the book considers geophysics from a British perspective as well as regarding geophysics from a commercially-led archaeology viewpoint rather than educational research. A noticeable attempt is made to include a few examples from the United States and Japan, the latter leaders in the development and application of GPR.

Whilst a chapter is devoted to each of the three periods, and the responses discussed that may be expected from the archaeological features associated with the period, it is clear that a majority of geophysical surveys have been carried out on sites of the Roman period. Although the authors partly attribute this to the greater number of these sites, it is also very true that «geophysical techniques tend to work well on archaeological remains from this period» (p. 142). The clarity of acquired data has enabled projects studying this period to base the core of their research on the results achieved. The Roman Towns Project (Keay *et al*. 2004), which studies Roman urbanism in the Tiber valley in Italy, has undertaken surveys over many large sites (over 30 hectares) and produced some impressive results, such as those obtained at *Falerii Novi* (Keay *et al*. 2000) which revealed a detailed town plan of a Roman city from the late 3rd century BC. Typically the settlements and structures associated with this period, such as villas, roads and towns have a strong response to geophysical prospection methods due to their style of construction, typically using fired material, and the durability of the walls and foundations.

The final chapter of Gaffney and Gater's book considers the current progress of archaeological geophysics and some possible future developments. As in all areas of computer applications in archaeology, the ever-improving processing speeds and data storage capacities of computers is likely to have a profound effect. Indeed the authors note that the quality of analytical software may mean "machine" interpretation of geophysical data will soon reach an acceptable level, especially when multi-sensors or multi-techniques are used. Whilst this is possible, the experience and knowledge of a geophysical practitioner would be difficult to replicate.

Each of the main three geophysical techniques has seen a marked improvement in the last decade, yet with each the authors correctly identify areas where they could improve. Firstly, they are concerned by the overriding use of the twin-probe array in resistivity, but acknowledge that this is both quicker to use in the field and the responses easier to interpret. Secondly, with the appearance of Geoscan's FM256 a couple of years ago, many improvements have been made in magnetometry, although practitioners identify the slow data transfer method and rate as an area of possible improvement. Recent surveys, such as the Wroxeter Hinterland Project which collected some 3 million data points over an area of 78 hectares (Gaffney *et al.* 2000) or the *Falerii Novi* survey which collected some 668,000 readings over 30 hectares emphasise the need for rapid data transfer. Thirdly, the use of GPR, which has been fully discussed by Conyers and Goodman (1997), has seen a more restricted application than the other techniques, due to the inhibitive cost of the equipment and the required expertise. However, it is clear that this is an area that will advance particularly in terms of hardware.

As well as identifying areas for technological improvement, the authors also highlight a need for greater communication between the geophysicist and archaeologist. The importance of feedback from sites that have been surveyed and subsequently excavated cannot be underestimated, as the geophysicist has the opportunity to compare data interpretation with what has been found in the ground. Indeed, the authors conclude their book with a final cautionary note, that it would be sad if revealing the buried past became divorced from understanding the past. The authors are right to emphasise this need for the two parties to work closely together, as indeed this is when the best overall results are achieved.

Revealing the Buried Past presents a timely review of the state of the discipline of archaeological geophysics. Whilst the authors follow in the same vein as Clarke (1990), they approach the subject from a different perspective, namely the commercial side. The influence of commercially-led archaeology has created a need for clarity and speed of results that has transformed the way in which the science is approached. Since the early applications of geophysics, the discipline has become more fully developed and accepted by the archaeological community. Indeed, although in some areas geophysics has simply provided an additional tool to the archaeologist, in others it has offered a unique opportunity, in particular in the field of landscape studies, where it provides a unique solution for looking at large tracts of land.

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Moving into the third dimension: Three-dimensional data capture and manipulation

On 28th November, Dave Fellows, Eddie Lyons, Jen Heathcote and myself from English Heritage's Centre for Archaeology headed north to the British Geological Survey for a symposium regarding laser-scanning. The aim of the day was to put the new technology of laser-scanning into context both in terms of the technology itself and the applications which stem from it. To this end, there were presentations by a number of interested parties representing facets of the heritage industry as well as hardware/software vendors.

David Barber (Newcastle University) began by describing the potential of laser-scanning for archaeology and an overview of how laser-scanners actually work, based on his doctoral work funded by English Heritage. This was followed by Chris Brayne (Wessex Archaeology) who described some of the advantages and disadvantages of laser-scanning technologies applied within commercial archaeology, based in part on field trials undertaken earlier this year at Stonehenge. Derry Long (PCA Ltd.) described some of PCA's projects on which laser-scanning has brought considerable benefits while Chris Gaunt (Simmons Aerofilms) described how this new way of gathering data relates to and can be seen as complementary to more traditional modes of survey such as aerial photogrammetry.

The afternoon began with a series of short presentations from each of the major hardware/software vendors followed by a presentation by Alistair Carty (Archaeoptics Ltd.) in which he described suitable ways of working with such complex datasets. Finally, Bill Blake (English Heritage) highlighted some of the fundamental problems associated with the data with which he has been working, collected in a heritage-based architectural context, which make archaeological and other heritage-based applications different from some of the more widespread commercial applications of laser-scanning.

The days proceedings not only showcased what is bound to become a very powerful means of gathering survey data, but also prompted a useful discussion about some of the issues that currently pose problems for the application of laser-scanning within archaeology. Proponents of the technology were clear in stating that laser-scanning is not here to replace all other forms of survey and become the panacea of the survey world, rather it is another tool, or set of tools, in the archaeologists toolkit which should be selected according to the specific demands of a given project. Indeed, it was stated that there is much variation between different scanning hardware platforms in terms of effective range, resolution and mode of operation and as such, the technology should be seen as a family of related tools rather than a single entity. While there was discussion regarding the quality and nature of the data collected using laser-scanners, by far the most important discussion revolved around what can and should be done with the data.

Making sense of the data collected was a recurrent theme running through the day. The data collected using a laser-scanner consists of millions of individual points located in three-dimensional space forming what is referred to as a *point cloud*. This data is collected by scanning a laser repeatedly across the subject and calculating range and bearing from the reflected signal by either triangulation or time-of-flight methods. In other situations to which laser-scanning is regularly applied this raw point cloud or surfaces fitted to the cloud or solids extruded to fit the cloud, using CAD, suffice for types of purposes to which the data is put. This approach is being driven by the engineering/architectural industries where the standard simple geometric shapes available in a CAD environment (called *Primitives*) are close enough in shape to surveyed objects that the surveyed objects can be satisfactorily represented using them.

In an archaeological situation, the complexity of shape of the objects means that this will rarely be the case. As with other archaeological techniques such as geophysical survey, photogrammetry or aerial photography, there needs to be a stage of interpreting the raw data to produce suitable interpretive data for the rest of the archaeological process: the point cloud can be seen as analogous to the primary raster (grid) data collected using a sampling process by either of the three aforementioned processes[1]. Some of the hardware manufacturers, however, seemed to be promoting the use of these vast point clouds as an entirely visual end-product despite their unwieldiness, a direction not suited to the archaeological process[1] where interpretation and dissemination of information are key factors.

Indeed, the dichotomy between seeing three-dimensional data as intelligent spatial data as opposed to a purely visual record may impede development of laser-scanning applications. This difference in perspective can be seen as analogous to that associated with the move from traditional cartography to GIS, where a different understanding of the same spatial data, based around the concepts of spatial entities and attributes rather than graphic conventions and artistic traditions alone, allows new and innovative methodologies to develop leading to novel or enhanced interpretations. In the same way that GIS can be used to produce traditional cartographic products, the tools emerging for manipulating laser-scan data are being driven towards producing traditional metric survey products such as elevation drawings and plans. This focus on surveyed edges of features represented as subjective lines rather than working with surfaces or even solids is limiting when working with truly three-dimensional, geometrically irregular spatial data: as previously stated, it should be remembered that new ways of understanding and using spatial data can produce new systems and products with the potential for enhancing the archaeological process.

[1] Due to the scanning process and unlike the three aforementioned processes which produce data of fixed linear resolution, the data produced has variable linear resolution across the scanned object which is inversely proportional to distance from the scanner. This is caused by the way in which scanners operate: the scanner scans across the surface with a fixed angular resolution thus collecting points closer together from surfaces nearer to the scanner ie the linear resolution of the dataset varies.

To move forward towards these new three-dimensional products, what is needed is a set of functions comparable to those found in a GIS environment whereby spatial entities are defined and assigned attributes – the data is contextualised and interpreted. In other words, for a laser-scan of a building, the archaeologist needs to be able to define individual elements that make up the building and these can then be related to other data sources pertaining to said elements or to other elements within the building. It is this level of interpretation that archaeologists require over and above cursory visual inspection. Discussions with Alistair Carty (Archaeoptics Ltd.) suggest that this kind of three-dimensional interpretation is technologically achievable, possibly as an extension to his Demon software, used for post-processing laser-scan data.

While the day was certainly highly informative, some issues were left unaddressed. Making sense of data collected using airborne Lidar would have been a valuable discussion, building on from Simmons Aerofilm's presentation. A discussion of the problems associated with filtering out unwanted data as well as issues regarding resolution and how to work effectively with such datasets would have been beneficial to those of us currently looking to incorporate Lidar datasets into our work.

To conclude then, attending the symposium was an interesting and productive experience. While it is clear that there is much work still to be done, particularly in the field of post-processing and using the collected data, it was pleasing to see some interesting results from archaeological applications such as at Grimes Graves and Stonehenge. The ability, for example, to analyse the surface of an arrowhead as one would analyse other three-dimensional surfaces in terms of its geometric properties is something that would be impossible using other techniques at the resolution afforded by a laser-scanner. Being able to use lighting scenarios that would not be possible in the real-world or the ability to exaggerate a given dimension are all useful and informative approaches afforded by working in a truly three-dimensional environment with data derived from laser-scanning. Of course, such approaches will not always be applicable and it may be that other technologies and/or methodologies are better placed to deliver the required deliverables: it will still be necessary to choose appropriate methodologies on a project by project basis, but it is undoubtedly true that we are just seeing the beginning of the application of laser-scanning in archaeology.

Proceedings of the symposium are anticipated to be published in some form in the near future.

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First Workshop on knowledge representation in a Semantic Web of culture

The MINERVA project is a direct offspring of the Lund meeting and aims at facilitating the adoption of the "Lund Action Plan". The first of the Lund Principles declares that: «Europe's cultural and scientific knowledge resources are a unique public asset forming the collective and evolving memory of our diverse societies and providing a solid basis for the development of our digital content industries in a sustainable knowledge society».

Digitisation, however, represents only one of the necessary steps for the full implementation of the Lund Action Plan. Actions 2b (Discovery of digitised content), 4a (Cooperative action plan for access to quality European digitised content), and 4b (Sustainable access to content) stress in fact the need to complement the acquisition of digital resources with the possibility for final users to discover and access them.

In order to cover this aspect it has been decided to create a Working Group on Ontologies and the Semantic Web for Cultural Heritage resources. The task of the WG should be to gather past and present experiences in the area, disseminate them among researchers and P.A. officers operating in Cultural Heritage sector, and stimulate future cooperation projects. The first event organised by the WG was held in Rome on the 6th of July, and gathered a group of national experts for discussing specific researches and projects on the topic, and for discussing a general framework.

The Workshop was structured in three main sections:

1. General framework
2. International context
3. Experiences and projects

The day was opened by Rossella Caffo, responsible of the Minerva project for the Italian Ministry of Cultural Heritage and Activities, who welcomed speakers and public and presented the Workshop. Fedora Filippi, coordinator of the Minerva WP5, described the activities in the Web Quality area.

Oreste Signore (CNR and W3C Office in Italy) reported on the context for Semantic Web applications in the Cultural Heritage. In this presentation it is highlighted that the Web, and the evolution of hypertexts, can be considered as the revolution of the nineties, and that the Semantic Web differs from the "traditional" for its emphasis on the machine-machine interaction. The applications in the Cultural Heritage domain seem to find in the context of the Semantic Web an ideal environment. The First Section was closed by Nicola Guarino (CNR) with a contribution on the role of ontologies in the Semantic Web.

After a short break the second session of the WS (the International Context) was opened by Oleg Missikoff (LUISS University of Rome), who talked about "The role of Core Ontologies in the life-cycle of a digital cultural resource: the case of CIDOC CRM". The objective of this contribution was to submit to the Minerva community a framework for defining the life-cycle of digital cultural resource. This framework, organised in six phases (identification, acquisition, description, binding, access, feedback) should help positioning the various activities in a workflow-like process. Considering the context of the Workshop (Knowledge Representation in a Semantic Web of Culture), the focus of the presentation was on the description phase and, more specifically, on the role of "core ontologies". The case study was represented by the CIDOC CRM.

The construction of libraries of ontologies which are designed for maximum reusability is in fact an important issue in the discipline of ontological engineering. Van Heijst suggested that a central part of ontology libraries is the definition of what they called a core ontology, containing elements that are as generic and method-independent as possible. According to this vision, the CIDOC CRM is a proposal for a Conceptual Reference Model promoted by the Comité International pour la DOCumentation of the International COuncil of Museums (ICOM). It has the form of an object-oriented domain ontology for the interchange of rich and heterogeneous Cultural Heritage information from museums, libraries and archives and its purpose is to provide a building block for supporting the development of a global Semantic Cultural Web. The model is maintained by the CIDOC CRM Special Interest Group, a diverse international group of museum information professionals, with an official mandate from ICOM/CIDOC to develop and promote the standard in preparation for publication by ISO, the International Organization for Standardization. The SIG has recently been joined by the Italian Ministry of Cultural Heritage and Activities and the Minerva WG5.

Oleg Missikoff was followed by Aldo Gangemi (CNR), who presented a contribution on "Ontology Design Patterns: ontological design models for handling complexity. Some examples in the Cultural Heritage domain". The author reported that meaning encoding and "negotiation" over the Web are now supported in the Semantic Web programme. Ontologies are the key issue for it, but they require an intense development effort from domain experts, even if aided by ontology engineers. In Cultural Heritage, ontology development can start by reengineering existing terminological resources such as the Art and Architecture Thesaurus or the British Museum Thesaurus. On the other hand, reengineering is not enough, as the experience of CIDOC-CRM standard demonstrates: we need techniques to harmonise existing resources, local requirements, and application needs. Harmonisation in cultural knowledge is complex; just think of formalizing the notions related to works of art: multiple interpretations of a same work of art, originals and copies, symbolic and literal meaning, relations between different media, etc. A practical resource for complex ontology design is constituted by so-called "ontology design patterns", which provide generic (or local) frameworks to define the properties and the types of entities in a domain. An example of an ontology design pattern is a fragment of an ontology which is not bound to any domain, but includes a schematic structure of highly related entities (e.g. information objects, physical works, and ownership, or physical works, materials, and restoration), and describes the typical relations holding among them in a formal logic exploitable over the Semantic Web.

After the lunch break, the session on "Experiences and projects" was opened by Paola Moscati (CNR) with a presentation on "Metadata and ontologies for the research and communication in archaeology". The author reported on a positive experience carried out within the ISCIMA-CNR for the coding of non structured archaeological documents using declarative mark-up languages, that produced a method for online archiving, managing, and querying data concerning field archaeological researches in *Etruria* and *Sabina Tiberina*. In particular, integration between elements from the TEI Lite, archaeological markers, and RDF DC metadata has allowed to concentrate the attention to specific solutions for online fruition of documents and deepening questions related to the use of international coding standards. Basing on this experience, the research has been widened towards problems connected to the definition of ontologies in the archaeological domain, taking as a case study a class of Etruscan materials already classified for statistical analyses: the Hellenistic stone funerary urns from Volterra. This research, still in its early conceptual modeling phase, is carried out in collaboration with the IASI-CNR, that provided the SymOntoX system, and the LUISS "Guido Carli" University.

Paola Moscati was followed by Marco Berni and Fabrizio Butini who accounted on "The experience on the Semantic Web and ontologies at the Institute and Museum of Science History" (Istituto e Museo di Storia della Scienza, Florence). This presentation described the guidelines followed in the European Project Mesmuses and the scenario in which the methodology of ontologies was applied. Furthermore the concept of "itinerary" was introduced, and its objectives, together with the functionalities in relation with the ontology itself, were explained. Finally some of the identified operational and theoretic problems were reported, and the solution should be that the authors seek collaborations and exchanges within shared projects.

Francesco Nucci (Engineering) then presented "The Bricks approach to ontologies: the emergent semantics". The BRICKS Integrated Project (IP) aims at establishing the organisational and technological foundations of a digital library at the level of a European Digital Memory (EDM). A "digital library" in this context refers to a networked system of services over globally available collections of multimedia digital documents, providing different knowledge layers for a variety of users and access modes. The BRICKS vision is an integrated system that offers functionality for a new generation of digital libraries, a comprehensive term covering "digital museums", "digital archives" and other kinds of digital memory systems. The results of the project will constitute the main assets of a factory, which has been subsidised by the Consortium partners and the EU under the IP, but will be self-sustaining thereafter. The mission of the BRICKS Factory is the definition, development and maintenance of a user- and service-oriented space to share knowledge and resources in the Cultural Heritage domain.

The session was closed by Paola Velardi (Università di Roma "La Sapienza") with a contribution on "Methodologies of Semantic Annotation for the representation of cultural knowledge". In this talk interoperability and accessibility of Cultural Heritage resources is said to greatly benefit from the availability of semantic annotation tools for indexing, navigating, retrieving and classifying online documentation. OntoLearn, a methodology and a battery of software tools that use text mining and statistical techniques to construct a domain ontology for automatic semantic annotation, was also presented. OntoLearn uses available resources such as glossaries, document archives, databases, etc. to identify the relevant domain concepts and build formal definitions from informal ones. OntoLearn has been used in national and international projects in several domains, such as tourism, enterprise interoperability, computer networks, and finance. For the purpose of the presentation, a small semantic tree of pictorial techniques has been automatically constructed from available art glossaries.

The Workshop was closed with the definition of a work plan for the working group and the next meeting, within the MINERVA International conference, which will be held in Venice on the 25th and 26th of November.

Proceedings of the workshop are anticipated to be published in some form in the near future.

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Forthcoming conferences

SAA 70th Annual Meeting

Salt Lake City, Utah. March 30th-April 3rd

Session: Archaeology and GIS: Old Methods, New Uses

Session Abstract:

GIS research in archaeology has largely focused on making descriptive map displays and developing predictive models for site locations at a defined regional scale. However, GIS presents a powerful array of tools capable of much more elegant applications to archaeological problems. This session will be devoted to presenting research involved in other types of applications of Geographic Information Systems/Science to archaeological research. Special attention will be paid to GIS solutions addressing anthropologically derived behavioral questions.

For information on the session contact: Shaun Phillips (phill214@msu.edu)

For information on the conference visit: http://www.saa.org/

Computer Applications and Quantitative Methods in Archaeology, 2005

Tomar, Portugal. March 21st-27th.

For information visit: http://www.caa2005.ipt.pt/

13th European Conference on Information Systems Information Systems in a Rapidly Changing Economy

Session: Cultural Heritage

(Track chair: Gary Lock)

Regensburg, Germany. May 26th-28th

Session Abstract:

Heritage has never been higher on the world's agenda. Heritage resource managers around the world are using Information and Communication Technologies to enhance access to their collections, partly in response to global initiatives like those of UNESCO and also through individual governmental initiatives. Exciting new technologies and methodologies are being used to manage, present, exchange and study information from our past. From the managing of national collections databases to the public understanding of the past through VR modelling, ICT is becoming fundamental to the cultural heritage.

For information visit: http://www.ecis2005.de/

New books

[Enter the Past] The E-way into the Four Dimensions of Cultural Heritage. CAA2003. Computer Applications and Quantitative Methods in Archaeology. Proceedings of the 31st Conference, Vienna, Austria, April 2003. Edited by Magistrat der Stadt Wien, Referat Kulturelles Erbe and Stadtarchäologie Wien. Oxford 2004: BAR International Series 1227. 571 pages plus CD.

Making the Connection to the Past. Computer Applications and Quantitative Methods in Archaeology. Proceedings of the 27th Conference, Dublin, April 1999. Edited by K. Fennema and H. Kamermans. Leiden 2004: Faculty of Archaeology, Leiden University. 135 pages plus CD.

Einführung in Archäologische Informationssysteme (AIS). Ein Methodenspektrum für Schule, Studium und Beruf mit Beispielen auf CD. Edited by C. Häuber and F. X. Schütz. Mainz am Rhein 2004: Verlag Philipp von Zabern. 159 pages plus CD.

Emerging Technologies for the Cultural and Scientific Heritage Centre. DigiCULT Technology Watch Report 2. February 2004. Edited by S. Ross, M. Donnelly and M. Dobreva. 212 pages.

A GIS with a View: Social Interpretations and Cultural Agents in Modelling Human Perceptive Behaviour. Edited by U. Rajala, D. Van Hove. Internet Archaeology, Issue 16, 2004. `http://intarch.ac.uk/journal/issue16/index.html`