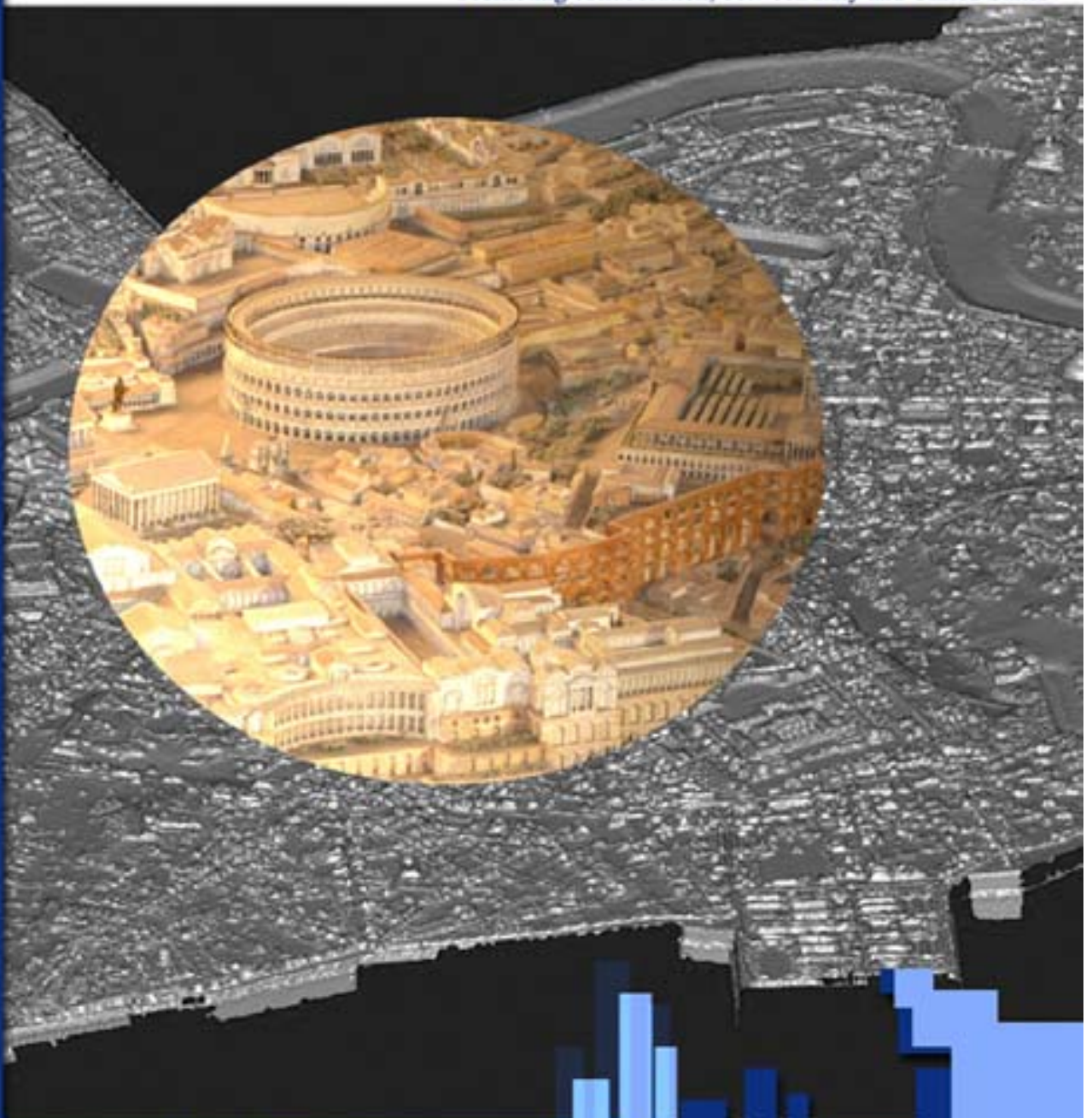


Italy-United States Workshop 2003

CNR, Piazzale Aldo Moro 7, Roma
Alua Marconi, November, 3-4

Università "La Sapienza", Piazza Aldo Moro 5, Roma
Aula "Odeion", November, 5

Promoting collaboration, between Italy and United States



**The reconstruction
of archaeological landscapes
through digital technologies**



The proposed workshop is the second of what is planned to be an ongoing program of sharing information between scientists and scholars in Italy and in the US. In following the direction outlined in the first workshop (Boston, 2001), the second will involve reports and projects dealing with the use of new technologies to advance cultural understanding. The main goal of the workshop is the reconstruction of the archaeological landscape, with special reference to the application of GIS, Spatial Analysis, Remote Sensing, Virtual Reality and use of time enabled software .

The Second Workshop will allow scholars from the technical fields, anthropology and archaeology to interact with those from the humanities and the social sciences. It is this interaction that can provide the impetus needed for the use and application of the digital technology in research and teaching in the most efficient manner, in the following topics:

- ◆ Archaeological landscapes and power relationships
- ◆ CRM, cultural heritage and archaeological parks
- ◆ 3-D, GIS and virtual reality
- ◆ Geomorphology, pedogenesis and landscape evolution
- ◆ Genetic algorithm and GIS
- ◆ Multispectral classifications
- ◆ Radar classifications
- ◆ New high resolution satellites
- ◆ 3-D models and cognitive models
- ◆ Paleoenvironmental analyses
- ◆ General perspective on the use of remote sensing in terms of landscape archaeology
- ◆ Virtual Heritage Applications



Il workshop proposto rappresenta la seconda occasione di discussione e cooperazione scientifica tra scienziati e studiosi italiani e americani. Rispettando le indicazioni fissate nel primo workshop (Boston 2001) ora si punta ad implementare le relazioni e i progetti concordati con l'utilizzo di nuove tecnologie, per integrare al meglio le reciproche applicazioni e competenze. Lo scopo principale è la ricostruzione del paesaggio archeologico mediante applicazioni GIS, analisi spaziali, Telerilevamento, Realtà Virtuale con l'utilizzo di software che elabora, oltre alla dimensione spaziale, anche la componente temporale .

Questo secondo momento di studio permetterebbe agli studiosi appartenenti a settori più tecnici e interdisciplinari, quali l'antropologia e l'archeologia, di interagire con coloro che, invece, provengono dal campo delle scienze umanistiche e sociali. Lo scambio reciproco può fornire la spinta necessaria all'applicazione delle tecnologie digitali nella ricerca e nell'insegnamento. Tra gli argomenti possibili:

- ◆ paesaggi archeologici e relazioni di potere;
- ◆ CRM, beni culturali e parchi archeologici;
- ◆ 3-D, GIS e Realtà Virtuale;
- ◆ geomorfologia, pedogenesi e trasformazione del paesaggio;
- ◆ algoritmi genetici e GIS;
- ◆ classificazioni multispettrali;
- ◆ classificazioni radar;
- ◆ satelliti ad alta risoluzione;
- ◆ modelli 3-D e modelli conoscitivi;
- ◆ analisi paleoambientali;
- ◆ prospettive generali sull'uso del telerilevamento nell'archeologia del paesaggio
- ◆ Applicazioni di virtual heritage

Programma/Program



3 Novembre, lunedì/Monday
CNR – Aula Marconi

mattina/morning:

- h 09.30 Registrazione/Opening Reception
h 10.00 Saluti delle autorità e introduzione ai lavori/Welcome of the
authorities
h 10.45 Introduzione/ Introductory Comments

h 11.00 coffee break

h 11.30-13.30 Sessioni/sessions:
Virtual Heritage and Desktop Virtual Reality Applications
Chair: De Mattei R.

Forte M. (CNR ITABC, Rome IT)
From Realtime GIS to Virtual Reality in Archaeology

Lancaster L. (ECAI Director - International and Area Studies, University of California, Berkeley)
Immersive Technology and the Humanities: Applications of Virtual Reality to traditional tasks

Scopigno R., Callieri M., Cignoni P., Montani C., Pingi P. (Istituto Scienza e Tecnologie dell'Informazione ISTI - CNR, Pisa - IT)
Improving efficiency of 3D Scanning Tools

Frischer B., Abernathy D., Johnson C., Steinmetz C. (UCLA Cultural Virtual Reality Laboratory)
Recent Projects of the Ucla Cultural Virtual Reality Laboratory

pomeriggio/afternoon:

h 14.30-18.00 Sessioni/sessions:
Virtual Heritage and Desktop Virtual Reality Applications
Chair: Garraffo S.

Cremaschi M., Ferraro F., Pizzi C., Putzolu C., (Dipartimento di Geologia, Università di Milano)
Spatial Intra-Site analyses at the Terramara of Poviglio Santa Rosa (Reggio Emilia - IT): the enclosure vs. the hydraulic system.

Basso P., Bondesan A., Sonetto J., Buana M.S., Miola A., Mozzi P., Valentini G. (Dipartimento di Geografia, Università di Padova)
Setting Archaeological Landscapes within palaeoenvironmental dynamics in The Ca' Tron Area, Venice (Italy).

Nash J. D. (The Field Museum Chicago), Ryan Williams P.(The Field Museum Chicago), Keefer D.K. (United States Geological Survey), Kenneth Y. S. (University of Michigan)
Envisioning the invisible: reconstructing the taphonomy of ancient andean agricultural landscapes through GIS Slope Stability Models

h 16.00 coffee break

Francovich R., Campana S. (Dipartimento di Archeologia e Storia delle Arti, Università di Siena)
Multistage Remote Sensing techniques in combination with "traditional" ground survey methods to the study of archaeological landscapes. The case study of Tuscany

Estrada-Belli F., Fowler W.R., Hamilton C., Bales J., Reynolds M. and Kvamme K.L. (Vanderbilt University)
Ciudad Vieja, El Salvador: Remote Sensing and urban landscape of a Spanish-conquest city

Cavalli R.M. (CNR IIA – LARA), Colosi F. (CNR ITABC), Marino C.M. (Dipartimento di Scienze dell'Ambiente e del Territorio, Università Statale di Milano Bicocca), Poscolieri M. e Pignatti S. (CNR IMAAA)
A new approach to study archaeological sites by means of Airborne Hyperspectral Sensors



4 Novembre, martedì/Tuesday **CNR – Aula Marconi / Aula Volterra**

mattina/morning:

h 9.30-10.30 Sessioni/sessions (Aula Volterra):
DEMO Session: VIRTUAL REALITY
in cooperation with Barco

h 10.30–13.30 Sessioni/sessions:
Virtual Heritage
Chair: Lon Addison

Guidazzoli A., Calori L., Mauri M.A. (CINECA Supercomputing Center, Visit Lab., Bologna Italy); Liguori M.C., Diamanti T. (VISMAR Project)
Frameworks for managing and inquiring into virtual cultural scenarios

Pescarin S., Pietroni E., Forte M., Gómez L., Vico L. (CNR ITABC, Rome - Italy)
Integrating Technologies: The Appia Antica Project

h 11.30 coffee break

Salonia P., Negri A., Valdarnini L., Scolastico S., Bellocchi V. (CNR ITABC, Rome IT)
Innovative Quick Photogrammetric Systems for 3D Cultural Heritage Documentation: The Appia Antica Project

Gaiani M., Micoli L. (INDACO - Industrial Design, Arts & Comunication, Politecnico di Milano)
A Framework to Build 3D Models from Real World data for historical architecture and archaeology

Duncan L. (Museum of London Archaeology Service), Shahina Farid (Museum of London)
Huseyin Caner (Plowman Craven & Associates), Ashley López M. (Berkeley University)
A 21st Century "Neolithic Revolution" at Çatalhöyük

pomeriggio/afternoon

h 15.00-18.00 Sessioni/sessions:
Remote Sensing and GIS
Chair: Lew Lancaster

Bard K. A., D'Andrea C., DiBlasi M.C., Fattovich R., Harris M.S., Koch M., Johnson G.H., Manzo A., Perlingieri C., Schmid T. (Boston University, Istituto Universitario Orientale di Napoli)
GIS and Remote Sensing for an archaeology of development: the case of Bieta Giyorgis (Aksum, Northern Ethiopia)

Laurenza S., Martire V., Putzolu C. (Università di Roma La Sapienza)
Re-thinking landscape archaeology's theory and spatial analyses techniques in GIS.

h 16.00 coffee break

Vannini G., Nucciotti M. (Dipartimento Studi Storici e Geografici - Archeologia Medievale, Università di Firenze), Gabrielli R. (CNR ITABC, Roma)
Stratigraphy and virtual modeling: an interdisciplinary approach to the study of the archaeological site of Santa Maria di Rescamone (France - Corsica).

Piro S. (CNR ITABC, Roma), Goodman D. (Geophysical Archaeometry Laboratory – Nakajima, Otsubu, Japan), Nishimura Y. (Nara National Cultural Properties Research Institute, Nara, Japan)
Identification and visualization of Roman archaeological sites using high-resolution GPR method

De Guio A. (Dipartimento di Archeologia, Università di Padova)
Palimpsestic fossil landscapes: a flight through an analytical frontier



5 Novembre, mercoledì/Wednesday
Università La Sapienza – Aula Odeion, P.le Aldo Moro 5

mattina/morning

h 9.30–13.00 **Sessioni/sessions:**
Virtual Heritage
Chair: Ryan Williams

Buckland M.K. (Electronic Cultural Atlas Initiative, University of California, Berkeley)
Searching for documents by place and time: Gazetteers, Maps and Catalogs

Germano D., Neweman D., Rourke W. (Center for Hymalayan and Tybetan Studies, University of Virginia, Charlottesville, VA)
Integrated digital documentation of Tibetan cultural sites using Gazetteers, Immersive technologies and Databases

Buccellati G., Buccellati M., Buccellati F. (IIMAS), Dell'Unto N., Forte M. (CNR ITABC, Roma)
The Mozan/Urkesh archaeological project: an integrated approach of spatial technologies

h 11.00 coffee break

Cattani M., Fiorini A., Rondelli (Università di Bologna)
Virtual Archaeology or Time Machine: scientific paths for a reconstruction of archaeological landscape

Ashley López M. and Ristevski J. (University of California, Berkeley)
Documenting the visible and the invisible: an approach to recording archaeological landscapes through integrated digital spatial technologies

pomeriggio/afternoon

h 14.30-17.00 **Sessioni/sessions:**
Remote Sensing and GIS
Chair: Guarino Angelo

Vilbrandt C. W. (University of Aizu), Goodwin J.M., Goodwin J.R. (Department of East Asian Studies, UCLA Los Angeles)
Archaeological reconstruction and Open Source software

Ryan Williams P. (Archaeological Science Department of Anthropology, The Field Museum of Natural History, Chicago), Janusek J.W. (Vanderbilt University), Dayton C. (Boston University), Vining B. (Boston University), Couture N. (University of Chicago), Blom D. (University of Vermont)
Visualizing the urban and monumental components of the Tiwanaku state: new perspectives from Geophysics in the Andean altiplano

Pizziolo G., De Silva M. (Dipartimento di Archeologia e Storia delle Arti, Università di Siena)
*Signs, Place, Continuity and Changes: chronological and typological integration of sources
for landscape archaeology investigation in Tuscany*

h 16.00

Guarino A. (Progetto Finalizzato Beni Culturali, CNR)
CONCLUSIONS AND FINAL REMARKS

LIST OF ABSTRACT ALPHABETICAL ORDER

ASHLEY LÓPEZ M. and RISTEVSKI J. (University of California, Berkeley)

DOCUMENTING THE VISIBLE AND THE INVISIBLE: AN APPROACH TO RECORDING ARCHAEOLOGICAL LANDSCAPES THROUGH INTEGRATED DIGITAL SPATIAL TECHNOLOGIES

This paper explores the development of a digital field methodology that has been preliminarily tested at Tambo Colorado, an Inca palace complex located on the south coast of Peru. The methodology highlights an integrated approach to the collection of spatial data at multiple scales utilising technologies such as GPS, laser scanning and associated texture data capture through the collection of spatially registered, high resolution digital photography. The research proposes a multi-layered sampling approach to the collection of spatial data, combining geometric information of varying degrees of accuracy and sampling rates into a coherent spatial data-set. A corresponding digital metadata system is deployed through the use of PDAs equipped with mobile databases and integrated GPS to obtain spatially registered metadata 'live' during the data collection phase. The vision for the project is to teach these techniques in spring 2004 in an interdisciplinary course in Archaeology and Architecture at UC Berkeley. This course will be a prerequisite for an archaeological field-school in Peru during the 2004 summer season where the students will participate in the implementation of the program.



BARD K. A., D'ANDREA C., DIBLASI M.C., FATTOVICH R., MANZO A., PERLINGIERI C., HARRIS M. S., KOCH M., JOHNSON G. H., SCHMID T. (Boston University, Istituto Universitario Orientale di Napoli)

GIS AND REMOTE SENSING FOR AN ARCHAEOLOGY OF DEVELOPMENT: THE CASE OF BIETA GIYORGIS (AKSUM, NORTHERN ETHIOPIA)

This paper explores the contributions of GIS and remote sensing data to an archaeological analysis of land use within the context of a traditional African culture (northern Ethiopia), from the mid-1st millennium BC to recent times. The basic assumption of this study is that archaeologists working in developing countries where there is long-term cultural continuity, such as in Ethiopia, can provide models of social and environmental co-evolution, which can be used for improved responses to present-day social and environmental stresses.

In this paper models of settlement patterns are presented in relationship to the geology, geomorphology, hydrology, and evidence of off-site man-made features of the different culture periods (Proto-Aksumite, 400-150 BC; Aksumite 1, 150 BC- AD 150; Aksumite 2, AD 150-400; Aksumite 3, AD 400-550; Aksumite 4, AD 550-700; Post-Aksumite, AD 700-1500; and recent times). These models are assessed in terms of continuity and change in land use at a local level, within the context of the regional Aksumite ecosystem and changes in this through time. The models have been generated using an IKONOS image of the investigated area for land use and land cover mapping, and a Digital Elevation Model for slope and slope aspect analysis.

Data used in this paper are from fieldwork of the "Joint Archaeological Expedition at Aksum," the University of Naples "L'Orientale" (Naples, Italy) and Boston University (Boston, USA) conducted in 1993-2003 on Bieta Giyorgis hill, to the northwest of Aksum, the ancient capital of Ethiopia, under the direction of Kathryn Bard and Rodolfo Fattovich.



BASSO P., BONDESAN A., SONETTO J., BUANA M. S., MIOLA A., MOZZI P., VALENTINI G.
(Dipartimento di Geografia, Università di Padova)

SETTING ARCHAEOLOGICAL LANDSCAPES WITHIN PALAEOENVIRONMENTAL DYNAMICS IN THE CA' TRON AREA, VENICE (ITALY)

If the landscape is the theatre in which Man performs the representation of himself (Turri, 1998), the reconstruction of archaeological landscapes may be regarded as the effort of understanding “how the scene looked like in the past”, with the aim of perceiving the conceptual architecture which supported the characters’ actions. But Man has never been the only actor in this play. Geological, as well as vegetational processes, have always been interfingering with human activities in shaping the landscapes. The analysis of the sum of signs observable in the land needs a multi-facet approach in order to be effective. Within the framework of a geoarchaeological research project started in 2000, funded by Fondazione Cassamarca, archaeologists, geologists, palynologists, remote sensing specialists and geophysicists are carrying out joint investigations in the Ca’ Tron area, in the low venetian plain by the inner border of the Lagoon of Venice (Ghedini, Bondesan, Busana, 2002). This, in order to try to understand how human settlements have been interacting with the dynamic environmental conditions of this coastal area. The prominent archaeological feature in the study area is a stretch of the Roman via Annia, built in the 2nd century B.C., but archaeological evidences span, at the moment, since the Eneolithic to the Middle Ages, according to the continuity of use of the roman road. The archaeological landscapes which are being reconstructed, related to the different time slices and cultural phases, are frames within the overall palaeoenvironmental evolution of the area during the last 20,000 years.

The mapping of the main landforms, with particular attention to the identification of the palaeohydrographic network and of the system of tidal channels of lagoonal environment, has been carried out on an area of about 140 km², through the interpretation of a large set of multiscale and multitemporal images (large scale panchromatic and near infrared aerial photographs spanning since 1944 to 2001; Spot and Landsat TM satellite images). A detailed DTM has been derived from 0.5 m contour lines and spot heights with decimetric resolution, and used both as a tool for geomorphological analysis and as a support for 3D digital modelling. The subsurface sediments and soils have been investigated on an area of ca. 11 km² through the boring of ca. 50 cores within a depth of 5 m, and 13 down to a maximum depth of 20 m. Several radiocarbon datings of peat and wood fragments helped in tracing the chronostratigraphic framework. Pollen analyses are being performed on selected samples, gathered in both archaeological and natural suitable contexts, detected by remote sensing. As the archaeology of the area was poorly known at the beginning of the research project, remote sensing also served as a guide to the archaeological survey, leading to the detection of traces of anthropic origin. Some of these latter are being investigated with geophysical prospections, while, in other cases, trial trenches and archaeological excavations are being carried out. The trenches cut two branches of different ages of the via Annia. The site where a small stone bridge allowed the roman road to cross a palaeochannel is being excavated extensively, and is going to be plotted by laser scan. All spatial data are arranged in a georeferenced data base, managed with the GIS software Microstation™.



BUCCELLATI G., BUCCELLATI F., BUCCELLATI M. K. (IIMAS), FORTE M., DELL'UNTO N. (CNR ITABC, ROMA)

THE MOZAN/URKESH ARCHAEOLOGICAL PROJECT: AN INTEGRATED APPROACH OF SPATIAL TECHNOLOGIES

Urkesh, today a small village known as Tell Mozan, was a major political and religious center of the Hurrians – an elusive population of the ancient Near East. Archaeological excavations have shown that they had developed a strong urban civilization, at the very dawn of history, some 5000 years ago.

A temple dominated the ancient skyline, at the top of a built-up terrace that rivaled the nearby mountains. A large royal palace, currently under excavation, has yielded written evidence that has allowed us to identify the ancient city. The excavation of Urkesh at Tell Mozan started in 1984 and through the year 2002 there have been 15 seasons of excavation. Excavations are carried out under a permit from, and with the collaboration of The Directorate General of Antiquities and Museums, The Ministry of Culture, The Syrian Arab Republic The expedition is under the aegis of IIMAS - The International Institute for Mesopotamian Area Studies.

In this context, in 2003, an international collaboration between IIMAS and CNR-ITABC is started in order to use, during the fieldwork, 2d and 3d integrated technologies of archaeological survey: DGPS with Rascal system, PDA, GIS mapping, remote sensing and 3D photomodeling. All these portable technologies address the archaeological excavations and intrasite surveys towards a complete digital mapping, 2d at the beginning of the acquisition and 3D in the final processing. In fact the use of DGPS with the Rascal satellite correction allows an accuracy of 25-30 cm in real time (without post processing); in this way it is possible to create a GIS while spatial data are acquired and to plan geo-links with the archaeological layers. In the same time the use of photomodeling techniques has permitted, through calibrated sequences of digital photos, to construct 3d detailed photogrammetric models of the main archaeological structures, in order to geo-link these spatial data with a GIS background (already during the fieldwork).

Therefore, in the next, we could imagine to create a real time spatial information system during the fieldwork, so that it is possible to map digitally all the archaeological contexts (Uss, artifacts, structures, etc.) in geographic coordinates and, finally, to reconstruct a complete archaeological landscape.



BUCKLAND M. K. (Electronic Cultural Atlas Initiative, University of California, Berkeley)

SEARCHING FOR DOCUMENTS BY PLACE AND TIME: GAZETTEERS, MAPS, AND CATALOGS

Providing the context for virtual reconstructions is crucial in scholarly use of the technology. Historical and cultural studies can benefit from better capabilities for searching bibliographies and other databases by place and by time. While Geographic Information Systems (GIS) has become a major tool for archaeologists, the place names used in texts and inscriptions are often difficult to locate. Place names change over time and the same name may be given to many different sites. There is a need to built digital gazetteers that list place names, duplicate names for the same location, latitude and longitude designation, and information about the feature of the name (for example: a shrine, a storage building, a wall). When there is the rich immersive multimediate documentation for a sites, this needs to be complemented by ethnographic and historical scholarly projects. Finding the sources for information will depend on having the gazetteer as a place name index. Gazetteers can be used to provide more effective searching by place in online databases, e.g. in online library catalogs. Historical studies requires search by both time and by place. Named periods of time (reigns, wars, and eras) can be used similarly to the use of place names in gazetteers.



CATTANI M., FIORINI A., RONDELLI (Università di Bologna)

VIRTUAL ARCHAEOLOGY OR TIME MACHINE: SCIENTIFIC PATHS FOR A RECONSTRUCTION OF ARCHAEOLOGICAL LANDSCAPE

Virtual archaeology has recently developed proposals and results with several examples of reconstruction of archaeological landscape. Since we consider virtual archaeology as a reasoning tool for current research we need also to proceed with scientific process in collecting and evaluating records for a better understanding of ancient environments and settlements. Virtual archaeology becomes a virtual time machine to go back in the past and observe each detail as appropriate as possible in order to interpret and reconstruct ancient landscape.

We need to follow a scientific path with rules, choices and hypothesis coherent with the predictive process. We prefer artificial and symbolic representation, even photo realistic, instead of useless contemporary texture (aerial or satellite images) to evaluate the anthropic impact in ancient environment. Each of these representations can easily interrelate within a GIS environment and become a fundamental part in the direction of future research or as interpretative model.



CAVALLI R.M. (CNR IIA – LARA), COLOSI F. (CNR ITABC), MARINO C.M. (Dipartimento di Scienze dell'ambiente e del Territorio, Università Statale di Milano Bicocca), POSCOLIERI M. (CNR – IASF) e PIGNATTI S. (CNR IMAAA)

A NEW APPROACH TO STUDY ARCHAEOLOGICAL SITES BY MEANS OF AIRBORNE HYPERSPECTRAL SENSORS

Remote Sensing in archaeological field can be defined as the whole of techniques and methodologies related to the localisation and definition in a quantitative way of areas possibly inhabited by the man during the prehistoric and historical ages.

Without the human intervention, the soil of these areas would form over time as a consequence of the alteration of rocks and the transport of thin materials, both organic and mineral, by means of the action of water and wind: this complex ecosystem would be then completed by the growing of natural vegetation. When an anthropic structure is settled, this natural development order is disturbed and induced variations keep persistent.

The analysis of remotely sensed data enables the archaeologists to recognise soil discontinuities connected to buried anthropic structures based on geometric and spectral properties which differ from those of neighbouring natural materials: this difference can be evinced through variations in colour shade, texture, and brightness levels.

The last improvements of remote sensor technology have enabled the production of images at high spatial resolution, sometimes associated with a spectral resolution as much detailed. This association is linked to the introduction of hyperspectral scanners, by means of which investigation techniques coming from spectroscopy have been developed, allowing to identify surface materials analysing even slight variations peculiar of their spectral signature. For example the availability of data recorded by means of airborne hyperspectral scanners, such as AVIRIS (Airborne Visible-Infrared Imaging Spectrometer), CASI (Compact Airborne Spectrographic Imager), DAIS (Digital Airborne Imaging Spectrometer) and MIVIS (Multispectral Infrared and Visible Imaging Spectrometer), has increased and improved those information deriving from surface soil units, related to ancient human evidences.

By exploiting the high spatial and spectral resolution of MIVIS data, buried archaeological structures could be located in a more precise and definite way compared to traditional analysis methods based on aerial photography and satellite remote sensing. In particular the processing of MIVIS hyperspectral data recorded over Selinunte site has enabled to find a series of lineaments plausibly corresponding to the road network of Megara ancient colony, only partially recognized by means of traditional archaeological techniques.

The encouraging results obtained so far in the definition of archaeological buried remnants have induced to apply and verify the methodology developed on other sites of particular archaeological interested, like Arpi, Marsala, Mothia and Villa Adriana.



CREMASCHI M., FERRARO F., PIZZI C., PUTZOLU C. (EDPA, Dipartimento di Scienze della Terra, Università di Milano)

SPATIAL INTRA-SITE ANALYSES AT THE TERRAMARA OF POVIGLIO SANTA ROSA (REGGIO EMILIA – ITALY): THE ENCLOSURE VS. THE HYDRAULIC SYSTEM

Recent excavations in the Bronze age site of Santa Rosa indicated that the village was delimited by complex structures, consisting of : a) the enclosure ; b) an hydraulic system managing the water and distributing it to the surrounding fields.

The enclosure of the village consisted of a moat (that we can now follow for ca. 116 m.) and two parallel fences with regular posts (one each meter), interrupted by two gates. In the late phase of the village a rampart, obtained with the sediment dug from the moat, replaced the wood structures.

The hydraulic system is composed by forty pits 1.5 to 5 meters in diameter and up to 3.5 meters in depth, fed by the local water table , which are connected through small canals to reservoirs located inside the moat.

All the structures were digitally surveyed and GIS based spatial analyses were elaborated to improve our perception of the spaces of the site, to improve our knowledge of the functions of its structures and of the relationships between the inside and the outside of the terramara.

A DTM was also created to understand of the dynamics of the hydraulic system and the relationships of enclosure and internal structures of the village.

This study represents a first step in creating a GIS for the excavation of Poviglio S. Rosa and, once implemented the system many other analyses will be available to study the internal dynamics of this fascinating bronze age civilisation.



DE GUIO A. (Dipartimento di Scienze dell'Antichità, Università di Padova)

PALIMPSESTIC FOSSIL LANDSCAPES: A FLIGHT THROUGH AN ANALYTICAL FRONTIER

This contribution is mainly devoted to the illustration of an analytical path that led us to detect crucial instances of “off-site fossil landscapes” in a 20 years critical sequence of pilot-projects in Northern Italy, in particular:

in the Low Po Plain: the first clear and detailed evidence of a very complex hydraulic and agrarian management system connected to the local central places - banked and ditched settlements (Terramara sites) - in the context of the first appearance of a formal landscape of power (a complex chiefdom polity);

in the Berici hills: what seems to be the oldest known "road" in the world archaeological literature: our "dirt-road" to Brendola” (VI), with a calibrated radiocarbon central date of 4805 BC: 4915-4735 cal. BC; (Beta- 107672). It is in fact a proper “road” –not a simple wooden track- and is one thousand years older than the much more famous “Sweet Track to Glastonbury” in the English Somerset Levels.

in the plateaux of Asiago and Vezzena - Luserna -Lavarone: extraordinary and growing evidence for a complex diachronic palimpsest of Bronze Age connectivity, terracing, land division and boundaries. At the end of the Bronze Age we also find exceptional instances of a large-scale metallurgical exploitation of copper ore, with a supporting extensive infrastructure and a dramatic impact on the environment.

This has revealed itself as a critical path to approach archaeological complexity in its key domain of “landscapes formation processes” at quite different levels of temporal, spatial, and functional resolutions: from the Neolithic to the present, from remote to “near-sensing” and from geomorphology to landscapes of power and landscapes of the mind.

A number of issues closely related to the present analytical frontiers, between high-tech and high-theory, are investigated and a few emerging research lines are traced.



DUNCAN L. (Museum of London Archaeology Service), SHAHINA FARID (Museum of London)
HUSEYIN CANER (Plowman Craven & Associates), ASHLEY LOPEZ M. (Berkeley University)

A 21ST CENTURY “NEOLITHIC REVOLUTION” AT ÇATALHÖYÜK

2003 has seen the beginning of a new methodology for the collection, presentation and interrogation of spatial, image and attribute data at the Çatalhöyük Research Project. The existing database structure is being overhauled to provide a truly relational server based structure that is linked to the spatial and image data in a web served GIS. Furthermore, a programme of terrestrial laser scanning has commenced to precisely record the previously problematic extant 3D form of the 9000-year-old Neolithic buildings. This, and all other spatial data captured by the project, are referenced to a single coordinate system that provides the framework for the GIS.

This paper will demonstrate the initial results of the digital data capture on the site and report upon the progress made in creating the relational database and GIS that will facilitate the work of the geographically dispersed project team and ultimately allow the public access to the full data sets.

The Çatalhöyük site, reopened in 1993 by Professor Ian Hodder of Cambridge and Stanford Universities, is a British excavation under the auspices of the Ministry of Culture in Turkey and the BIAA and includes partners from USA, Turkey, Britain, Yugoslavia and Poland amongst many others. The Çatalhöyük Research Project team of around 250, including academics, professional archaeologists team and the whole gamut of other specialists, is both multinational and multidisciplinary and thus provides a role model for other projects of this scale and with these wide-ranging aspirations.



ESTRADA-BELLI F., FOWLER W. R., CANARD H., BALES J., REYNOLDS M. and KVAMME
K. L. (Vanderbilt University)

CIUDAD VIEJA, EL SALVADOR: REMOTE SENSING AND URBAN LANDSCAPE OF A SPANISH-CONQUEST CITY

Recent geophysical research and digital mapping at the site of Ciudad Vieja, El Salvador, have begun to reveal the internal organisation and spatial relations of a Spanish American city of the Conquest period. Ciudad Vieja was founded as the first villa of San Salvador in 1525 and later abandoned in 1545. The site is unique among mainland Spanish American conquest-period cities for its excellent state of preservation and level of accessibility.

It is located in a rural area with no modern city covering it, and it has suffered little damage or disturbance in the five centuries since its abandonment. Archaeological research conducted there since 1996 has included digital mapping, surface collection, excavations, and geophysical remote sensing with magnetic gradiometry, electrical conductivity, and magnetic susceptibility. The 2002-2003 season combined remote sensing and excavation, demonstrating a high degree of correlation between the two methods and a high efficiency level of these remote sensing techniques to survey a large area of the site.



FORTE M. (CNR ITABC, Roma)

FROM REAL TIME GIS TO VR IN ARCHAEOLOGY: TOWARDS THE CREATION OF A TOTAL REAL TIME SYSTEM FOR INTERACTION AND ACCESSIBILITY OF SPATIAL DATA

Observation, interpretation, mapping and reconstruction of an archaeological landscape are key factors in the fieldwork and in the post-processing digital phase. The faculty to get spatial data in real time with a very good accuracy is fundamental for any further reconstruction and interpretation.

This paper describes different approaches of 2D and 3D spatial mapping integrating the use of DGPS with Rascal system (Landstar) of real time correction with PDA, 3D laser scanning, 3D photomodelling, remote sensing and VR technologies. This methodological approach redraws a new protocol in the domain of the digital archaeology and it suggests a creation of a specific system for integrating and visualising all the data. Actually we plan this methodological and technological sequence: DGPS real time acquisition (GIS phase, Rascal, Arcpad, Arcview), intra site 3D modelling (3D laser scanners, photomodeling, Photomodeler), remote sensing (satellite, aerial, total stations, Er Mapper, PCI), landscape 3D visualisation and interaction (Terravista), VR accessibility through behaviours (Trainz, C++).

Final aim of the protocol is to create a complete desktop VR system dedicated to the interaction of 3D spatial data interconnected with metadata and accessible in real time; for reaching this result, anyway, it is fundamental to project and manage a very detailed conceptual model with different typological "behaviours" and layers. In this preliminary experimental work the graphic engine of a video game, called Trainz, is used for collecting all the models in the same format (OpenFlight) and for the C++ programming.

Finally this paper will show some recent archaeological case studies where we have started to implement this protocol: Aksum (Ethiopia), Tambo Colorado (Peru), Appia Antica (Italy), Chavin (Peru), Tell-Mozan (Syria).



FRANCOVICH R., CAMPANA S. (Dipartimento di Archeologia e Storia delle Arti, Università di Siena)

MULTISTAGE REMOTE SENSING TECHNIQUES IN COMBINATION WITH "TRADITIONAL" GROUND SURVEY METHODS TO THE STUDY OF ARCHAEOLOGICAL LANDSCAPES. THE CASE STUDY OF TUSCANY

There is increased interest today in making scientific progress through the use of remotely sensed data in social science research. On this topic it is important to remember that remote sensing is not a new technology. Archaeological studies have a long tradition of aerial photography application, from the earliest air photographs taken from balloons at the end of XIXth century to the crucial works of O.G.S. Crawford and many others aerial archaeologists, until the actually National Mapping Programmes. What is changed in recent years about remote sensing application it is the development of new sensors (in particular multi-spectral, hyper-spectral, microwave) and the availability of new tools for the management and for the integration of spatial information.

The Department of Medieval Archaeology at the University of Siena has been actively engaged in programmes of landscape archaeology for over thirty years. Territorial studies have been based for the most part on three methodologies of investigation: field survey in sample areas (with 20-30% of the total landscape and replicated collection); field examination to assess the significance of individual monuments (known roman villa, medieval castles, churches, etc.); and analysis of vertical air photos combined with selective ground-truthing.

Since the end of 1998 we turned the attention to increase our experience in remote sensing techniques. Within the Department of Medieval Archaeology, the Laboratory of Aerial Photographic Interpretation has been active since 1984. Despite good archaeological results, we have been conscious throughout of the inherent limitations of this method of survey. The main problem is the cartographic nature of the data and the impossibility of planning the flights to coincide with times

when conditions for the detection of archaeological features are at their best. To try and overcome these limitations in pursuit of our own objectives we have changed our focus to the experimental application and evaluation of new techniques in the study of the Tuscan landscape.

This is the reason why we turned to oblique aerial photography, to the latest generation of multi-spectral high-resolution satellite imagery (Ikonos-2 and QuickBird-2), to geophysical survey and to micro-digital terrain modelling using differential GPS.

Our progress in developing this approach can be highlighted by looking at five sample areas, representative of the landscape complexities and settlement patterns of Tuscany. The total extent of these sample areas is around 670 square km. All areas have recently been the subject of numerous socio-archaeological studies, field-walking surveys, excavations, vertical air-photo interpretation, geological and geomorphologic analysis. When setting up the research project we paid particularly close attention to the systematic collection of data. The first methodological objective of the operation was to arrange the greatest possible number of elements for comparison - using GIS technology - with satellite imagery and with oblique aerial photographs. In a second stage it will be useful to integrate the whole information and propose new settlement patterns.

Even at this early stage, By applying multistage sensing techniques to our landscape projects, we can say that the introduction of this approach, running hand in hand with continuing programmes of field-walking, has transformed both our way of working and our understanding of ancient landscapes increasing the value and impact of our research.



FRISCHER B., ABERNATHY D., JOHNSON C., STEINMETZ C. (UCLA Cultural Virtual Reality Laboratory)

RECENT PROJECTS OF THE UCLA CULTURAL VIRTUAL REALITY LABORATORY

This talk will present a number of recent projects undertaken at UCLA in the past year that utilize 3D computer technology to represent the archaeological landscape, natural and built. The goal of each project was set by a specific research or instructional issue, but common to all of them is the idea of reconstruction, or restoration of a site to a previous condition that can no longer be seen or experienced. Computer modelling can enable us, for example, to reconstruct a landscape dramatically changed by natural disaster (the English colony of Port Royal, destroyed by an earthquake in 1692) ; and to restore the earth's position to a moment in time when a religious sanctuary was built to take advantage of a temporary earth-sun alignment (the Inca Temple of the Sun on the Island of the Sun); or to test a commonplace about the alleged efficiency of a complex structure to move people in and out (the Colosseum).



GAIANI M. (INDACO - Industrial Design, Arts & Communication, Politecnico di Milano)

A FRAMEWORK TO BUILD 3D MODELS FROM REAL WORLD DATA FOR HISTORICAL ARCHITECTURE AND ARCHAEOLOGY

In the last years the broadening of digital photogrammetry and 3D active vision techniques allowed the rise of 3D modeling techniques as working practice on historical buildings and archaeological artifacts. Nevertheless, an equally rapid methodological growth didn't follow up to the incredibly pace of the technological evolution. This paper aims to show some key steps to shape a methodology to build digital models of historical architecture and archaeology, from real world data. It also describes the attempts made by Politecnico di Milano in building and structuring an educational center to train skilled operators in such field. Relevant passages of the paper includes problem statement, pipeline

description, operating criteria definition, focus on usually underestimated key questions (problems concerning materials, laser quality, environmental conditions and others).



GERMANO D., NEWEMAN D., ROURKE W. (University of Virginia)

INTEGRATED DIGITAL DOCUMENTATION OF TIBETAN CULTURAL SITES USING GAZETTEERS, IMMERSIVE TECHNOLOGIES AND DATABASES

At the University of Virginia, the scholars have been working on environmental and cultural issues in the geography of Tibet (<http://iris.lib.virginia.edu/tibet/collections/cultgeo/index.html>). The Virginia team is composed of geographers, humanists, social scientists and environmental scientists who are producing a comprehensive model of the region using GIS. At the core of this work is the Tibet and Himalayan Digital Library Gazetteer, which offers a multilingual and descriptive guide to Tibetan and Himalayan places. The gazetteer is a historical Geographical Information System (GIS) for Cultural Tibet covering the period from Prehistory to the 20th Century.

The Prehistoric section of the Tibet Historical GIS focuses on locating ancient sites associated with the early development of Tibetan civilization. These data are derived from extended field trips in the north and west of the Tibetan Plateau -- the regions of Ngari (mnga 'ris) and Jangtang (byang thang). The Virginia team and collaborators have georeferenced over 500 ancient archaeological sites, including fortresses, settlements, tombs, stelae and rock art (pictographs, petroglyphs, monoliths).



GUIDAZZOLI A., CALORI L., MAURI M.A. (CINECA), LIGUORI M.C., DIAMANTI T. (VISMAN Project)

FRAMEWORKS FOR MANAGING AND INQUIRING INTO VIRTUAL CULTURAL SCENARIOS

Complex 3D reconstructions and multimedia contents, organized in databases, can be integrated in order to convey more valuable applications for Cultural Heritage promotion and can also improve context awareness by means of effective landscape visualizations.

Important features are: flexibility, multi platform outputs (ranging from desktop VR, immersive environments and Virtual Sets), realism, access to data, numerical simulations integration (i.e. behavioral studies), communicative qualities and natural kinds of interaction. Following these inputs, the VisMan framework, currently developed at CINECA ViSit Lab, can manage virtual cultural environments in an effective way. Several applications will be presented as Bologna Certosa museum.



LANCASTER L. (Director of the Electronic Cultural Atlas Initiative of the International and Area Studies at the University of California, Berkeley; Department of East Asian Languages and Culture)

IMMERSIVE TECHNOLOGY AND THE HUMANITIES: APPLICATIONS OF VIRTUAL REALITY TO TRADITIONAL TASKS

The scholars of archaeology have been in advance of other fields in the application and development of immersive technology. The creation of virtual reality landscapes for the study of human activity is one of the most promising developments. The Electronic Cultural Atlas Initiative (ECAI) is exploring

ways in which these landscapes can be used to advance the study of cultural heritage. ECAI, in collaboration with hundreds of affiliates around the world, has established best practices for the use of time and place as metadata categories for the archiving and serving large amounts of information about a location on the face of the earth within a defined time frame. As part of the next generation of ECAI activities, there is a plan to geo-register distributed sites that provide virtual reality recreations for a cultural feature. In this way, the archaeological landscapes can become interoperable with hundreds of data sets that provide text, imagery, and history. It is possible to conceive of a dynamic map of the world with exact coordinates marked with all of the available virtual reality projects. This layering of the information would allow users to explore the specific recreation but display it within a wider range of influences. Adding the dimension of time, permits the comparison of sites within the same periods of activities. Having time and place integrated into the data permits the user to note the changes over time, the range of certain features such as burial practices, and the contextualization of the information. These activities offer the possibility for advanced research where the sources for any point of latitude and longitude are made available for display in virtual reality, maps, and animations. When the tools of analytic softwares are added to these multiple sources and hundreds of locations identified with appropriate times, it may be possible for us to see patterns in the data that have never been noted before.

While immersive technology has been little used by the humanities, it has a potential for the field that is quite different from reconstructions of human habitation. The sources for the humanities are still firmly lodged in the texts. Each year the number of texts available in digital format is increasing at a rapid rate. For the first time, scholars have millions of words available for computer applications. One approach to explore, will be the use of imagery to display word clustering and other divisions of texts. These divisions will be the result of analytic tools that offer rapid recognition of patterns. The landscapes that exist within the literature may prove to be as interesting as the physical landscapes. This presentation will give suggestions for how this type of display can advance research in textual editing, analysis, and interpretation. Through collaboration and sharing of approaches and software development, a larger community of scholars may eventually make use of the archaeological landscapes and the technology that made them possible. Such collaboration has the potential of providing enhancement to all those who enter into the pioneering efforts of the new technology.



LAURENZA S., MARTIRE V., PUTZOLU C. (Università di Roma La Sapienza)

RE-THINKING LANDSCAPE ARCHAEOLOGY'S THEORY AND SPATIAL ANALYSES TECHNIQUES IN GIS

Our paper will start from exploring briefly the situation of GIS applications in the archaeological research fieldwork at the beginning of our century, looking at the capabilities and limits until now reached and discovered and will continue by proposing a new theoretical and practical Object-Oriented relational approach for the study in itself entire complexity of an archaeological landscape.

Most of archaeologists have been captured finally by new computing technologies believing still now that sophistication of powerful and expensive GIS software will be enough for high quality outputs and high levels of interpretation.

For us, GIS is a set of techniques that at this stage help archaeologists to visualize and to manage huge amounts of georeferenced data and to execute some basic spatial analyses.

The field of Spatial Analysis contains other tools to allow archaeologists to move to more complex explanations.

Therefore, the purpose of our paper will be to show how with a well defined archaeological problems and starting from a well based theory, we can integrate some already existing tools in a GIS framework, moving in such way from beautiful images to complex analyses.

Nowadays, most of GIS based archaeological projects are simple databases with a discrete representation of archaeological data in a 2D static space, with functionalities limited to primitive geometric operations used for the calculation of simple and basic relationships or for execute queries and summary descriptions between points (sites) or lines (ancient roads, streams, etc.) or areas (artifact concentrations) in a space. The result is that we have GIS used for the inputs of a huge quantities of data indiscriminately over a map, producing as final results a lot of maps but with a lack

of theories or hypotheses about the kind of problems archaeologists need to solve and about the relationships between spatial data.

On the other hand, archaeologists are working today almost only with environmental variables (topography, lithology, hydrology, etc.) of an area forgetting the importance of social relationships and their interactions in the analyses.

Our paper will finally focus on the hypothesis to introduce some elements able to develop a “theory of spatial relationships” needed to study human activities and social spaces. So, we propose a multidimensional and an Object-Oriented Relational approach in order to define and integrate in a GIS framework “activity areas” starting at a first level from the basic features found by archaeologists during the survey (some post-holes, a grave, a hearth, an artifact concentration, etc.), anyway considered as “activity features”, and working on the relationships between them, in order to define other more complex levels of analyses.

At the end, the purpose of our work is to demonstrate as it is possible to build a pattern of social interactions between different “activity features” (units), starting from a well defined archaeological theory, creating an Object-Oriented model, and integrating some already existing analytical tools in a GIS software (geostatistic, intra-site spatial testing, visibility, etc.) in order, in such a way, to better define and clarify an historical lecture of the archaeological landscape.



NASH J.D. (The Field Museum Chicago), RYAN WILLIAMS P. (The Field Museum Chicago),
KEEFER D.K. (United States Geological Survey), KENNETH Y. S. (University of Michigan)

ENVISIONING THE INVISIBLE: RECONSTRUCTING THE TAPHONOMY OF ANCIENT ANDEAN AGRICULTURAL LANDSCAPES THROUGH GIS SLOPE STABILITY MODELS

The expansion of the Wari state of Peru around AD 600 heralded in a new era of agrarian expansion into the high sierra zones of the South-Central Andes. This agricultural technology re-invented the Andean landscape for generations to come and was fundamental in the rise of the Inka Empire between AD 1200 and AD 1532. The systemic changes high sierra terraced agriculture brought to the landscape is also crucial for understanding the long term ecology of the region. However, the dynamic landscape of the Andes, visited by large earthquakes and occasional torrential rains in an otherwise hyperarid environment, has wreaked havoc on these ancient abandoned field systems built 1400 years ago. In order to understand the evolution of agrarian systems, we must be able to model the taphonomic processes that have erased large parts of these ancient landscapes from the archaeological record. This paper incorporates slope stability models and soil chemical testing along with archaeological survey and excavation data in a geographic information system to analyse the taphonomy of the landscape around the Wari center of Cerro Baul between AD 600 and 1000.

We reconstruct the ancient agricultural landscape around this impressive southern frontier colony and demonstrate the extents and complexity of the system are much more profound than indicated by an initial visual survey.

In so doing, we enhance the scientific understanding of the evolution of these agrarian systems and the historical processes that created them.



PESCARIN S., PIETRONI E., FORTE M., GÒMEZ L., VICO L. (CNR ITABC, Rome - Italy)

INTEGRATING TECHNOLOGIES: THE APPIA ANTICA PROJECT

The paper presents activities, technologies and digital solutions connected with the interdisciplinary project, carried out by CNR ITABC and the Municipal Archeological Superintendency of Rome.

The goal of the project is to realise a digital archive of the monuments of the park, employing many different technologies for 3D representation of the landscape and integrating instruments for topographic relief and methodologies of surveying on site (DGPS, laser total station, photogrammetry, 3D laser scanning, photo and video acquisition), according to the level of detail required. All the data are successively elaborated to obtain a correct geometric model of the landscape, implemented in a real time OpenGL application where the user can interact with many hierarchical levels of contents. The paper presents our methodological approach, oriented towards real time desktop OpenGL applications, in which the incremented cognitive value of scientific 3D reconstruction can be fully integrated with the complex informative system, composed by metadata associated. This approach could change the state of the art in the field of 3D representation of archaeological contexts. A multidisciplinary critical interpretation of the landscape, considered as an ecosystem, becomes possible, the virtual archaeology becomes cognitive archaeology, the virtual reality augmented reality.



PETACCO L., SASSO D'ELIA L. (Seconda Università di Napoli)

CULTURAL HERITAGE ATLAS IN “TERRA DI LAVORO”: THE INFORMATION SYSTEM

The Second University of Naples with the economical support of MURST and European Committee's has start, since 1999, an advanced project on the cultural heritage of the country “Terra di Lavoro” (around Caserta).

We are working at the survey for developing an atlas with large chronological limit from the antiquity to the recent past with the support of many professional skills: archaeologists, history of art's scholars, geologies etc.

The project's first goal is developing a GIS with an open architecture for storing alpha-numeric, raster and geographical data in four dimensions: three spatial plus a time line dimension.

We have restructured our GIS software for adequate it to the very long time excursion. The system have now a modular structure with a module for excavation data with tools for pottery classification, a web GIS module and data entry modules.

The data base engine is SQL server 2000 supporting internet/intranet solutions and the first PSP application for images data entry with RAS internet. The webGIS engine is ESRI and the local i/o clients are developed with VBA Microsoft Access 2000.

We have concentrate our effort in codifying the different information about archaeology or history of arts allowing one way queries on the whole territorial heritage and spatial analysis on the whole history of the landscape.



PIRO S. (CNR ITABC Rome Italy), GOODMAN D. (Geophysical Archaeometry Laboratory – Nakajima, Otsubu, Japan), NISHIMURA Y. (Nara National Cultural Properties Research Institute, Nara, Japan)

IDENTIFICATION AND VISUALIZATION OF ROMAN ARCHAEOLOGICAL SITES USING HIGH-RESOLUTION GPR METHOD

There are many methods available to the field archaeologist that enable them to remotely detect subsurface structures before beginning an excavation. Ground Penetrating Radar (GPR) is one of the most useful geophysical tools being employed. GPR equipment is capable of measuring structures to depths of several meters which is suited for many shallow archaeological sites. Because of the high quality of ground penetrating radar, it is now possible with new imaging software to easily manipulate the large datasets to create a variety of useful visualization displays. Data presentation and analysis can include: 3D time slices, amplitude isosurface rendering, render slicing, subsurface horizon

correction, image overlay and anomaly enhancement. The unique and inherent value of GPR images are that they enable the archaeologist to distinguish shallower and more recent structures from ancient structures preserved at deeper levels.

GPR surveys have been used to detect structures in some Roman archaeological sites, in Italy. These sites are: Forum Novum (Vescovio, Rieti), Altopiani di Arcinazzo (Subiaco, Roma), Villa dei Centroni (Roma). Examination of the data indicate that the location, size and shape of the burial remains are successfully detected



PIZZIOLO G., DE SILVA M. (Dipartimento di Archeologia e Storia delle Arti, Università di Siena)

SIGNS, PLACE, CONTINUITY AND CHANGES: CHRONOLOGICAL AND TYPOLOGICAL INTEGRATION OF SOURCES FOR LANDSCAPE ARCHAEOLOGY INVESTIGATION IN TUSCANY

The paper illustrates, through some case studies of Grosseto and Firenze plane areas, a geo-historical analysis within the framework of landscape archaeology studies. The research is focused on exploring continuity and changes occurred in the landscape looking at ancient settings emerging from the analysis of historical sources. Attention has been dedicated to “signs”, as human or natural land markers, which have populated territories and places providing identities to the landscapes of the past. The study has been mainly undertaken through the analysis of historical series of maps and aerial photographs. The integration of these sources, within a GIS environment, may reveal latent information otherwise not explicit, obtaining new complementary and stimulating interpretation.



RYAN WILLIAMS P. (Archaeological Science Department of Anthropology, The Field Museum of Natural History, Chicago), JANUSEK J. W. (Vanderbilt University), DAYTON Christopher (Boston University), VINING B. (Boston University), COUTURE N. (University of Chicago), BLOM D. (University of Vermont)

VISUALIZING THE URBAN AND MONUMENTAL COMPONENTS OF THE TIWANAKU STATE: NEW PERSPECTIVES FROM GEOPHYSICS IN THE ANDEAN ALTIPLANO

The Tiwanaku emerged in the 6th century AD as the first state of the Andean altiplano. While fieldwork in recent decades has opened new avenues of inquiry into the characteristics of the Tiwanaku polity, archaeology has been hampered by the inability to make large scale characterizations of the organization of urban and monumental space due to the depositional processes which interred its cities and monuments in layers of silts. In this paper, we use several geophysical techniques, including magnetometry, electrical resistivity, and ground penetrating radar to begin to visualize some of these spaces. In doing so, we outline a methodology for recreating the urban spatial structure of the four square kilometer Tiwanaku capital and outlying provincial centers, like Khonko Wankane. Our preliminary work compares excavations at the Putuni, Akapana East, and Khonko Wankane with geophysical data that has expanded our understanding of these elite residential and monumental spaces to provide a first glimpse at the potential of imaging Tiwanaku’s buried urban structure.



SALONIA P., NEGRI A., VALDARNINI L., SCOLASTICO S., BELLUCCI V. (CNR ITABC, Rome IT)

INNOVATIVE QUICK PHOTOGRAMMETRIC SYSTEMS FOR 3D CULTURAL HERITAGE DOCUMENTATION: THE APPIA ANTICA PROJECT

The critical process in reading the artefacts has been helped by the introduction of Computer science in the field of documentation and acquisition of architectonic heritage. In fact, computer based techniques have strongly modified the acquisition phases and successive operations such as computation and management of information coming from different fields. For instance, it is possible to add further information - such as qualitative data, morphology, colour information and so on - to photogrammetry acquisition. These operations can be performed avoiding the plot which represents a subjective abstraction from reality.

This becomes even more important in the case of reconstruction of an archaeological landscape, where the difficulties of relief are diversified and the complexity of representation, transfer and communication of acquired information, directed or not to a 'specialist' user, is of particular value to the goals of sharing knowledge.

This paper is focused to illustrate methodology and results reached during the experimentation of innovative systems of instrumental relief in the research project finalised to the constitution of an Informative System for the Appia Antica archaeological heritage.

The product aims to get three-dimensional models, geometrically controlled and spatially inserted in the archaeological landscape, also virtually reconstructed and explorable in real-time, with the possibility to integrate, to the geometric models, descriptive information coming from different fields. The artifacts are surveyed with techniques of instrumental traditional relief (acquisition of coordinates of topographical points) to support and verify innovative systems of stereoscopic photogrammetry, that not putting aside from a vectorial phase, furnish an informative baggage deriving from the geometrically controlled raster images, qualitatively and quantitatively more rich of a traditional relief.

The Information and Communication Technology (ITC) therefore attends in the process of valorization of the artifacts and, not necessarily involving a direct contact with them, makes however possible to navigate through knowledge in an optimal way, allowing users to get ready to the visit or to deepen how much just seen.

Here are exposed the results till now achieved within the project above mentioned and other experimentations, in progress, within another research project for the documentation and the relief of the Roman city wall in Aosta, where, otherwise from how much happens for the Appia Antica, the value of the archaeological landscape doesn't compares with a natural landscape but with an urban scenery.



SCOPIGNO R. (Istituto Scienza e Tecnologie dell'Informazione ISTI – CNR, Pisa - IT), CALLIERI M., CIGNONI P., MONTANI C., PINGI P.

IMPROVING EFFICIENCY OF 3D SCANNING TOOLS

In this paper we describe a 3D scanning software suite which gives support to most of the processing phases of a complex 3D scanning project. The suite can manage data produced with scanners based either on the triangulation or the time-of-flight approach. In particular, our tools support: range maps alignment, range maps merge, mesh editing, mesh simplification/multiresolution and finally colour attribute management. The software suite has been implemented by scratch by our group in the last three years and encompasses both up-to-date solutions and some original methods (merging, simplification, colour data processing and, in part, alignment). The two main advantages of our solution are the improved efficiency (post-processing time is much lower than with other commercial solutions) and the large datasets which can be processed (we treated up to 600 range maps representing a single object). The architecture of the software suite is described and an evaluation of its use in the framework of some complex acquisitions in the Cultural Heritage domain is reported (3D scanning of statues and of the rear facade of the Duomo in Pisa).



VANNINI G. (University of Florence – Dipartimento Studi Storici e Geografici – Archeologia Medievale), GABRIELLI R. (CNR – ITABC), NUCCIOTTI M. (University of Florence – Dipartimento Studi Storici e Geografici – Archeologia Medievale)

STRATIGRAPHY AND VIRTUAL MODELING: AN INTERDISCIPLINARY APPROACH TO THE STUDY OF THE ARCHAEOLOGICAL SITE OF SANTA MARIA DI RESCAMONE (FRANCE - CORSICA).

The paper presents the results of a joined research on the medieval archaeological site of Santa Maria di Rescamone in Corsica (France - Bastia – Golo Valley). Within the collective research programme “Mariana et la baisse vallée du Golo de l’age du fer au Moyen Age” directed by Philippe Pergola (CNRS – Aix En Provence) a research team directed by Guido Vannini (University of Florence) and composed by researchers of ITABC-CNR and medieval archaeologists (Univ. of Florence) is carrying out a territorial analysis on settling dynamics and settlement patterns in the Golo Valley during the period: early-late middle ages. ‘Light Archaeology’s methods and practices have been chosen to accomplish this specific task both in terms of implementing archaeological data-collecting strategies (especially on the field of the so-called ‘archaeology of the upstandings’) and of development of innovative methodologies for collecting geometrical and morphological data at territorial and site scale. The outlined case-study demonstrates how the analysis of archaeological stratification on an architectural complex whose life-span covers about 10 centuries (from Late Antiquity to Late Middle Ages) can (and in fact has to) take into consideration hydro-geological phenomena and issues enlightened by D-GPS’ DTM to be accounted for structural weaknesses also recorded in the buildings’ stratigraphy. Only an interdisciplinary approach to the study of the site has in fact allowed researchers to identify not only building/collapse/restoring processes involved in the stratigraphy but also to enquire about the causes of the above.



VILBRANDT C. W. (University of Aizu, Aizu-Wakamatsu, Japan), GOODWIN J. M. (Department of Computer Science, UCLA, Los Angeles), GOODWIN J. R. (Aizu History Project, Los Angeles)

ARCHAEOLOGICAL RECONSTRUCTION AND OPEN SOURCE SOFTWARE

We explore problems involved in the computer reconstruction of Enichiji Golden Hall, a Japanese Buddhist monastic building dating from the tenth century. The building, no longer extant, was reconstructed virtually using archaeological evidence and general knowledge of construction techniques of the period. The process of decision-making is compared with that involved in modeling an extant structure, the eighteenth-century Sazaedo. We examine the difficulties involved in using incomplete archaeological data and the need to use supplementary historical materials and comparable extant models. We also discuss our concerns with long-term preservation of our models, a problem faced by other digital library projects. Our models were constructed using proprietary software (AutoCad and 3D Studio), which will eventually become obsolete. One solution to the issue of preserving data resources lies in the development of open-software tools. As part of the demonstration, we will introduce some of the tools that our team is constructing. Such open source tools should produce more robust models in the future.

Chair: Maurizio Forte



Co-Chairs: Lon Addison, Bernard Frischer, Salvatore Garraffo, Lew Lancaster, Patrick Ryan Williams.

Organizers: CNR-ITABC (Istituto per le Tecnologie Applicate ai Beni Culturali), ECAI (Electronic Cultural Atlas Initiative), University of California, Berkeley, Field Museum of Chicago, UCLA, Cultural Virtual Reality Lab, Los Angeles, Virtual Heritage Network (US, Italy).



Sponsored by: CNR, Consiglio Nazionale delle Ricerche, Istituto per le Tecnologie Applicate ai Beni Culturali, Progetto Finalizzato Beni Culturali, ECAI, University of California, Berkeley, Field Museum of Chicago, UCLA, Cultural Virtual Reality Lab, Los Angeles



Secretary: Caterina Cittadini, Nicolò Dell'Unto, Oleg Missikoff, Sofia Pescarin.



Contact Information

General Chair: Maurizio Forte (maurizio.forte@itabc.cnr.it)



General Information: Sofia Pescarin (sofia.pescarin@itabc.cnr.it)



Help Desk: Caterina Cittadini (caterinacittadini@katamail.com)
Oleg Missikoff (omissikoff@luiss.it)

Accommodation: Nicolò Dell'Unto (nicolo.dellunto@fastwebnet.it)

Web: www.mlib.cnr.it/itabc/workshop

