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1 INTRODUCTION

On the 29th of September 1997, the ArchTerra Consortium submitted proposal 977054, entitled *ArchTerra: extending the European Archaeology Web over Bulgaria, Romania, and Poland* to the European Commission under the INCO Copernicus programme. The proposal was initially placed on a reserve list but was subsequently accepted for funding by the European Commission on the 13th of November 1998.

The ArchTerra project ran for a period of two years beginning in January 1999; the document that lies before you is its final report to the European Commission. The core of this report consists of the descriptions of the work done and the results produced by the Consortium, divided into six work packages (chapter 2). These are preceded by an introduction to the ArchTerra Consortium itself (the current chapter), and followed by a concluding chapter in which overall outcomes are assessed (chapter 3).

The networking and internationalisation of existing academic resources, historical and cultural achievements, as well as the research efforts of the academic community in the field of Archaeology using computer, information and communication technologies is a recent trend with a rapidly growing impact on archaeological research, management and education. Since the mid-1990s, Internet services have completely changed the way scientists work: e-mail, usenet, FTP and finally WWW architecture now allow scientists to collaborate on distributed resources, e.g. databases and exhibitions over the WWW. Although the countries of Eastern Europe have an important place in the historical and cultural development of Europe, they could not participate substantially in this process of intensifying information exchange, due to their past closedness and current economic problems. There is thus the spectre of an ever widening 'information gap' between the affluent countries of western Europe, and those countries struggling at the margins.

The **ArchTerra** Consortium has aimed to help redress the imbalances in access to European networking facilities for professional archaeologists from Bulgaria, Romania and Poland, and to provide the impetus for an active expansion of archaeological Internet communication and information services both within CEC and between EU and CEC. Accordingly, the objectives of the Consortium were:

- To establish the technical infrastructure and software tools needed to allow researchers in the field of IT in Archaeology from CEC to join the EAW, in the form of national WWW hosts of the ArchWeb network in the three participating CEC (Bulgaria, Romania, Poland). These hosts were to be located at the main research organizations responsible for archiving, maintenance and supply of information in these countries.
- To provide practical demonstration of the trans-national nature and urgency of archaeological research and management, and the benefits and efficiencies of Internet use, to professional and general users alike. End users were to be able to access both the presently available on-line electronic resources and a core set of demonstration resources from CEC (including Web-pages, museum-databases, live presentations and virtual tours).
- To strengthen existing scientific relations between EU and CEC and to foster long-term joint initiatives for collaboration, demonstrating the richness and fragility of the European archaeological heritage, by bringing together partners and collections from across Europe. To this end, solutions to specific hurdles to international collaboration (translation schemes for languages with different alphabets, multilanguage and multicultural thesauri of terms and articles, international heritage legislation) were to be explored.

A subsidiary objective of the Consortium has been to publish its activities and results as widely as possible, in order to enable all segments of the European archaeological community to sample the deliverables on offer. To this end, publication was to be web-based, by multimedia CD-ROM, and by scientific publication.

The ArchTerra project developed out of a number of earlier projects in which the Consortium co-ordinators participated, and it was influenced by other EC projects which ran previously or concurrently. This background will be briefly sketched here.

The partners in the ArchTerra Consortium are computer scientists and archaeologists from four countries of the European Union (The Netherlands, United Kingdom, Italy, and Germany) and three countries of central and eastern Europe (Bulgaria, Romania and Poland):

Groningen, Netherlands State University of Groningen (RUG)

- Participants: Martijn van Leusen (administrative coordinator; editor, ARGE virtual library for European Archaeology)

Sofia, Bulgaria Institute of Information Investigations (III)

- a private IT research group established in 1996 which aims to promote the penetration of the Global Information Society in Bulgarian science and society.
- Participants: Dr Vassil Vassilev, Dr Petko Staynov (database specialists, scientific coordinators)

Institute of Archaeology with Museum (AIM)

- one of the oldest institutes of the Bulgarian Academy of Sciences and one of the largest Archaeological museums in Europe, AIM coordinates and controls all archaeological research in Bulgaria.
- Participants: Dr Stefan Alexandrov (researcher, head of Museum records digitisation project), Georgi Nekhrizov (Ministry of Culture, Dept for Monuments), Dr Ivan Gatsov (lecturer, New Bulgarian University, Dept of Archaeology), Dr Hans-Peter Uerpmann (professor of archaeobiology, University of Tübingen, Institute of Pre- and Protohistory)

Poznan, Poland Poznan Archaeological Museum (MAP)

- one of the major archaeological institutions in Poland, MAP acts as part of the State Service for the Protection of the Archaeological Heritage department for Poznan Province
- Participants: Dr Andrzej Prinke (Director, State Archaeological Service for Poznan Province; member of ICOM-CIDOC working group on Archaeological Sites)

Bucharest, Romania Centrul de Informatica si Memorie Culturala (CIMEC)

- A public institution under the Romanian Ministry of Culture, CIMEC was founded in 1978 as a national centre for the digital inventory of the Romanian cultural heritage.
- Participants: Irina Oberländer-Târnoveanu (deputy Director; member of ICOM-CIDOC working group on Archaeological Sites), Dr Dan Matei (Director), Corina Bors

Segrate (Milan), Italy Consorzio Interuniversitario Lombardo Elaborazione Automatica (CILEA)

- Non-profit academic organisation providing IT training and support to universities in Lombardy.
- Participants: Maurizio Camnasio (head, section database development), Dr Guiseppina Negroni Catacchio (researcher, State University of Milan, Dept of Archaeology)

Despite the academic background of many of the partners, ArchTerra is not primarily aimed at conducting new research. Rather, its aim is to implement standards and concepts already widely agreed upon, and thereby demonstrate the practical feasibility of Internet solutions to information bottlenecks in the field of European Archaeology. Thus, the project builds on the work of the International Committee for Documentation of the International Council of Museums (ICOM - CIDOC) which resulted in *International Guidelines for Museum Object Information: The CIDOC Information Categories*, as well as on some of the earlier EU funded projects in the cultural domain, such as ACQUARELLE.

2 THE WORK

The work and results of the ArchTerra project are reported in the current chapter. It is divided into six main sections, each representing one of the work packages as defined in the Consortium's proposal for a revised Project Description (Annex I to the Contract, dated May 15, 1999), as follows: 2.1 Project Management, 2.2 Infrastructural Facilities, 2.3 Web Hosts and Content, 2.4 Museum Information Systems, 2.5 Research and 2.6 Dissemination and Exploitation.

2.1 PROJECT MANAGEMENT

Whilst Mr Van Leusen at RUG was the administrative co-ordinator for the project, III played an important role as scientific co-ordinator, in managing the work involved in the technical installation and in the creation of new content. Following a job change of the original scientific co-ordinator (Mr Vassilev), Mr Staynov became the project's new scientific co-ordinator in September 1999. The management of the ArchTerra project was hampered throughout by a combination of two factors – the lack of previous experience of the co-ordinators with the administration of EU projects, and the extremely short period available for contract negotiations. The influence this has had on the work and results will be assessed in section 2.1.5.

The general methodology adopted by the ArchTerra project is that of a *non-interleaving workflow of separate work packages*, implemented by research teams established by the project partners especially for this project, a methodology also known as COMMUNICATING SEQUENTIAL PROCESSES or CSP. The project requires six different groups of tasks to be completed:

- project management (meetings, reviews, reports)
- installation of infrastructure (hardware, software, networks);
- web host implementation (server installation, content creation, service implementation);
- museum information system implementation (design of templates, prototype implementation, testing);
- research (workshops, visits); and
- dissemination and exploitation (international conference, CD-ROMs, guides and manuals)

The ArchTerra workplan was controlled by a series of meetings during which tasks and deliverables were specified, progress was monitored, and common technical problems resolved. The organizational form adopted for the work allows gradual stepwise transfer and further expansion of the intermediate results towards reaching the final goal: establishing a research network in the form of common resources (unified and interconnected infrastructure, multilanguage glossaries and technical guides), end technical products (databases, interfaces, servers) and mutual scientific cohesion (long-term research contacts, mutual visits, joint teams).

2.1.1 The Work Plan

Since the organisation of the work and the interrelationship of work packages and deliverables as originally set out in Annex I to the Contract were too complicated and restrictive, the then project officer (Mr Gonthier) arranged for a less complex and restrictive set of work packages to be agreed upon at a later stage in the form of

a Contract Amendment. Following the Consortium startup meeting in Sofia, such a new version was agreed on, as set out in the table below¹.

WP / TASK	WORK PACKAGE TASK	DELIVERABLE (M = milestone)	Co-ord. Partner	Old WP
1	PROJECT MANAGEMENT			15
1.1	1. specification meeting	1: specification report	III	1
1.2		consortium agreement	RUG	
1.3	2. progress/review meeting 1	10: progress report period 1	RUG	-
1.4	3. progress/review meeting 2	14: progress report year 1	RUG	5
1.5	4. progress/review meeting 3	progress report period 3	RUG	-
1.6	5. final report/review meeting	25: final report	RUG	14
2	INSTALLATION OF INFRASTRUCTURE			
2.1	1. hardware installation AIM, MAP, CIMEC	2, 3, 4: functioning networks & database servers	III	2
2.2	2. network access (modem, cable) installation AIM, MAP, CIMEC	-	III	2
3	WEB HOST IMPLEMENTATION			
3.1	1. web server installation, script design & implementation	8 (M): Yahoo! Registration	CILEA	3
3.2	3. local web host content creation & publication NBU, MAP, CIMEC	9 (M): web site publication	CIMEC	6
3.3	5. national archweb implementation NBU, MAP, CIMEC	6 (M), 23: web site publication	NBU	10
4	MUSEUM INFORMATION SYSTEM IMPLEMENTATION			
4.1	1. museum site template design	7: generic description 10: software & guides	III	4
4.2	2. virtual museum implementation AIM, MAP, CIMEC	15 (M), 24: web site publication	MAP	7, 11
4.3	6. software polishing	5, 21, 22: script libraries, software prototypes and documentation	III	13
5	RESEARCH			
5.1	1. multilingual solutions workshop	12, 13: working paper, thesauri	CIMEC	8
5.2	2. multimedia database solutions workshop	16, 17: working paper	III	9
6	DISSEMINATION AND EXPLOITATION			
6.1	1. EAA2000 conference	18 (M); proceedings	NBU	12
6.2	2. multimedia CD production	19, 20: Multimedia CD	AIM	

Table 2.1 - ArchTerra Work Packages and Tasks

The ArchTerra contract defines a total 25 deliverables, which are summarised in the schedule below. Deliverables 1, 10, 14, and 25 are intermediate or final reports on administrative stages of the project; the publication of major project web resources marks a series of Milestone deliverables - the publication of the ArchTerra project web pages (deliverable 8), the local hosts and central services maintained by the partners (deliverables 9 and 15), the national hosts maintained by the partners (deliverable 23), and the joint demonstration website for international co-operative exhibits (deliverable 24).

¹ The column 'Old WP' refers to the work package numbers used in the contractual version of the project description (dated 04/12/98).

ID	Description (Title)	Type	Availability R - P ²	Task reference	Sent in period ³
YEAR 1					
1	Detailed equipment, software and networking specification	Specification	P	1.1	2
2	Installing of a fully functional LAN with DB server, Web server and online Internet connection	Installation	R	2.1	2 ⁴
3	Extending the available LAN with one DB server	Installation	R	2.1	
4	Extending the available LAN with one DB server	Installation	R	2.1	
5	Software script libraries and guides	Tool	R	4.3	2
6	Generic ArchWeb node description	Specification	P	3.3	2
7	Generic museum database description	Specification	P	4.1	2
8	Project registration at Yahoo!	Milestone	P	3.1	2
9	Publication of Web resources	Milestone	P	3.2	2
10	Internal progress report	Report	R	1.3	3
11	Museum site database software and guides	Prototype	R	4.1	3
12	Internet report on use of Multilingual Thesauri	Report	P	5.1	4
13	Multilingual thesaurus of archaeological search terms	Specification	P	5.1	4
14	Progress Report for the first year	Report	R	1.4	3
YEAR 2					
15	Virtual Regional Museums BG, RO, PL	Milestone	P	4.2	4
16	Generic Database Access System	Prototype	R	5.2	N/A ⁵
17	Internet report on Multimedia Databases	Report	P	5.2	
18	Academic session at EAA 2000 conference	Demonstration	P	6.1	4
19	Multimedia CD's presentation	Prototype	R	6.2	4 ⁶
20	Publication of Conference Proceedings	Report	P	6.1	
21	Manual for Web server and database server administration	Report	R	4.3	4
22	Guide for museum information system development	Report	R	4.3	4
23	Publication of ArchWeb hosts BG, PL and RO	Milestone	P	3.3	4
24	Publication of Virtual Archaeological Museums demo mining pages	Milestone	P	4.2	4
25	Final project report to European Commission	Report	R	1.6	N/A

Table 2.2 - ArchTerra schedule of deliverables.

Other than the reports and milestones marking administrative stages of the project, and the preparatory installation of hardware infrastructure at each of the CEC partners (deliverables 2, 3, and 4), the work done by the project is being documented in series of specifications, prototypes, and manuals and guides describing these.

² Availability of the deliverables - R = Restricted; P = Public.

³ The numbers in this column refer to the four reporting periods of the project: period 1 runs from January to June 1999, period 2 from July until December 1999, period 3 from January to June 2000, and period 4 from July 2000 to January 2001.

⁴ These three deliverables were combined and sent to the project officer as one document.

⁵ These two deliverables were dropped because the corresponding task was removed from the work plan (see section 2.1.6 of this report)

⁶ Because no suitable single publication of conference proceedings will be forthcoming from EAA 2000, these two deliverables have been combined into one CD-ROM (included with the current report).

Thus, the implementation of web hosts and services (work package 3) starts with specification of their structure (deliverable 6) and ends with their announcement on the Internet (milestones 8, 9, 15, 23 and 24); the implementation of museum information systems (work package 4) begins with specifications (deliverable 7), followed by software tools and prototypes (deliverables 5 and 11), which are described in manuals and guides (deliverables 21 and 22); research into multilingual and multimedia solutions (work package 5) led, first, to a specification of requirements for multilingual archaeological thesauri (deliverable 12), then to their prototyping (deliverable 13). The full details of all these deliverables are given in the appropriate section of Chapter 2; and the work is reviewed in Section 3.1.

2.1.2 Financial Overview

The following table presents an overview of the amounts (total costs) spent by each Consortium partner, per budget item, in comparison to the contractual budgeted amounts. Where significant deviations between the budgeted and actual amounts have occurred, the reasons for this are explained in footnotes.

	RUG		III		NBU		AIM		CIMEC		MAP		CILEA		totals	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Personnel⁷	47.0	39.5	7.0	9.4	4.0	4.5	8.0	9.6	11.3	-	14.3	19.0	55.9	54.0	147.5	136.0
Equipment⁸	12.4	11.4	-	-	1.7	1.5	3.6	3.6	8.3	11.0	14.9	8.5	0.1	-	41.0	36.0
Travel / Subsistence⁹	3.3	7.2	6.0	3.6	2.0	2.0	3.1	2.0	9.5	10.0	7.0	7.2	6.3	8.0	37.2	40.0
Consumables	1.8	0.9	-	-	-	-	-	-	2.1	2.4	3.0	4.5	-	-	6.9	7.8
3rd party assistance¹⁰	10.0	14.9	-	-	-	-	0.6	0.6	-	-	-	-	7.7	4.0	18.3	19.5
Other costs	-	-	-	-	-	-	1.2	1.2	-	-	-	-	-	-	1.2	1.2
Overheads¹¹	3.4	5.7	0.1	0.6	0.1	0.4	0.3	0.8	3.7	15.0	4.8	4.8	-	4.0	12.4	31.3
Adjustments	2.8	-	1.4	-	0.5	-	1.1	-	-	-	-	-	-	-	5.8	-
totals	80.6	79.6	14.4	13.6	8.4	8.4	17.8	17.8	34.8	38.4	44.0	44.0	70.0	70.0	270.3	271.8

Table 2.3 - Totals claimed (A) versus totals budgeted (B) per partner per budget item

⁷ RUG overran its budgeted personnel costs but compensated by reducing 3rd party costs and overheads; a misinterpretation of EU budgeting rules led CIMEC to include its expected personnel costs as ‘overhead costs’ in the budget, but the error was fixed in subsequent periodic cost claims; MAP employed fewer personnel in order to finance higher than expected equipment costs.

⁸ MAP overran its budgeted equipment costs as a result of the decision, for reasons of network security, to install two servers (data and WWW) instead of one as planned.

⁹ The III/AIM travel budget was increased following the mid-term reviewers’ recommendation that more effort be put into international collaboration; RUG was able to match half of its costs from other sources; CILEA did not spend funds budgeted for one Consortium meeting, which was cancelled.

¹⁰ RUG reduced expenditures for 3rd Party Assistance is due to the fact that part of the work was done by internal personnel; CILEA had additional unplanned external work done by the University of Milan.

¹¹ Deviations between budgeted and claimed overheads are all due to partners’ incomplete understanding of how and when to claim overhead costs.

Since the budget of two Consortium partners (RUG and CILEA) is based on full cost reporting while the Commission reimburses only 50%, the following two tables present a breakdown of the costs and claims to the EC per partner for each of the four reporting periods.

Partner	Period 1 Costs	Period 2 Costs	Period 3 Costs	Period 4 Costs	Cumulative Costs	Projected Costs
RUG	27563	17630	15422	18599	79214	79600
III	1160	5208	2785	5255	14408	13600
NBU	2674	580	1688	3461	8403	8400
AIM	3806	2640	2952	8247	17645	17800
CIMEC	7100	16000	8892	6603	38595	38400
MAP	1074	15424	16903	10632	44033	44000
CILEA	9657	13120	35423	11800	70000	70000
Total	53035	70604	84068	64601	272308	271800

*Table 2.4 - Reported costs per partner per period, set against projected costs.
All amounts in EUR.*

Partner	Period 1 Claims	Period 2 Claims	Period 3 Claims	Period 4 Claims	Cumulative Claims	Projected EU contr.
Date claimed	26/1/2000	2/5/2000	1/10/2000	13/3/2001		
Date paid	18/7/2000		27/6/2001			
RUG	13782	8815	7711	9299	39607	39800
III	1160	5208	2785	5255	14408	13600
NBU	2674	580	1688	3461	8403	8400
AIM	3806	2640	2952	8247	17645	17800
CIMEC	7100	16000	8892	6603	38595	38400
MAP	1074	15424	16903	10632	44033	44000
CILEA	4829	6560	17711	5900	35000	35000
Total	34425	55227	58642	49397	197691	197000

*Table 2.5 - Costs claimed per partner per period, set against projected Community contribution.
All amounts in EUR.*

2.1.3 Summary Effort

The table below may be used to compare the projected division of labour as specified in the Consortium's proposal for contract amendment, form 5.3, to the reported effort.

It can be seen that the main deviation in totals per work package occurs in Work Packages 3 and 4; almost double the projected effort was put into the implementation of web hosts (half of which due to MAP), while significantly less effort than projected was put into the implementation of museum information systems (almost all of the difference being due to CIMEC).

When we look at the deviations in totals per partner, it should be noted that many partners struggled with the Commission's guidelines for effort reporting (see also the footnotes attached to the table). There are only two significant deviations due to projected effort being off the mark, both related to the planning of work package 4: partner CIMEC, as noted above, reported 19 rather than 50 person/months because they took only a minor part in the MIS implementation; the Bulgarian partners (NBU, AIM, and III) collectively overran their projected effort mainly because partner III spent more effort than projected in customising MIS software for use at partner AIM.

	CIMEC	CILEA	RUG	MAP	III	AIM	NBU	Total
1 Project Management	1.75 (5)	3 (1.7)	6.0 (4.7)	3.25 (5)	11 (12)	2 (2)	1.5 (1.5)	28.5 (31.9)
2 Project Infrastructure	0.5 (4)	0.9 (-)	1.5 (0.1)	1.75 (4)	1 (1)	1 (2)	1 (1)	7.65 (12.1)
3 Implementation of Web hosts	8.95 (9.5)	3.5 (-)	4.4 (0.5)	21.75 (9.5)	9 (4)	- (-)	9.3 (9.5)	56.9 (33)
4 Implementation of Museum Information System	4.75 (27)	- (5)	- (0.7)	9.75 (21)	14.5 (8)	22.2 (20)	- (-)	51.2 (81.7)
5 Research	0.25 (3.5)	- (1.2)	1.25 (0.7)	1.5 (3.5)	4.5 (4)	8 (8)	7 (3)	22.5 (23.9)
6 Dissemination and Exploitation	2.5 (1)	1 (0.5)	1.7 (0.5)	2.5 (1)	0.25 (1)	5 (2)	1 (1)	13.95 (7)
Totals	18.7 (50)	8.4¹² (8.4)	14.85¹³ (7.2)	40.5 (44)	40.25 (30)	38.2 (34)	19.8 (16)	180.7 (189.6)

Table 2.6 - Reported versus projected (in parentheses) total effort in person/months per partner per work package.

2.1.4 Consortium Meetings

Five plenary Consortium meeting were held in order to specify and coordinate the work, and to monitor progress. Numerous other meetings were held between partners working on individual work packages and tasks, as listed below.

Plenary Meetings

1999, March - For reasons outlined in section 2.1.5, the project started after an initial two month delay (Jan-Feb). The start-up meeting was held at the premises of the three Bulgarian partners in Sofia. The main activity was the specification of the project's work plan and technical infrastructure. (→ deliverable 1)

1999, November – This meeting was held at the premises of partner CILEA and the Section of Archaeology, University of Milan in Italy. It was mainly concerned with the detailed specification of the workplan for the period until June 2000, and the adjustments that were judged necessary following the project's mid-term review meeting which took place in Luxembourg in October 1999 (see section 2.1.6).

2000, April – At this meeting, held at the premises of the Slovenian Academy of Sciences in Ljubljana, the main topic of discussion and planning were the software prototypes for the ArchWebs and the Museum Information System. On the occasion of the CAA/UISPP Commission IV conference, which was held in Ljubljana just prior to the meeting, the Consortium organised a workshop on the subject of multilingual indexing and retrieval tools in the domain of archaeology.

2000, June – A planned meeting of the Consortium at the premises of partner MAP in Poznan, Poland, was cancelled because of the delays in receiving the EC contributions toward project costs.

2000, September – The fourth plenary meeting was held at the premises of the Portugese Institute of Archaeology in Lisbon, on the occasion of the 6th Annual Conference of the EAA. The main topics of discussion were the joint virtual exhibition, the mirroring of project web pages by CILEA, and the exploitation plan. The Consortium also presented the ArchTerra project and many of its deliverables in papers, posters, leaflets and a round table session at the EAA conference. (→ deliverable 20 and section 2.6)

¹² Here, the full CILEA effort (including work done by staff at the University of Milan) is being reported; the management reports only contain effort charged to the Commission.

¹³ The projected effort for RUG was based on AC accounting principles, and is therefore only about 50% of the actual effort (on FC basis) being reported to the Commission.

2001, January – The final plenary meeting of the Consortium took place at the premises of partner CIMEC in Bucharest, Romania. During this meeting the main activities were the preparation of the final project report and the remaining deliverables, including final versions of the virtual exhibition and the exploitation plan.

Task meetings

- 1999, April Visit of I. Gatsov (NBU) to Prof H-P Uerpmann at the University of Tübingen (DE), for the preparation of materials for ArchWeb-BG.
- 1999, August Visit of Prof. Uerpmann to NBU, for finalisation of materials for ArchWeb-BG.
- 1999, September Scientific co-ordinator V. Vassilev and B. Gaydarska from III visited CILEA in order to present the generic model of the Museum Information System and to discuss the participation of the Italian partners in the further implementation process, both in Bulgaria and in Italy. Meeting of partners RUG, CIMEC, and MAP during the EAA1999 conference in Bournemouth (UK)
- 1999, October The new scientific co-ordinator P. Staynov (III) visited RUG for the purposes of preparing the mid-term report for the project review in Luxembourg , and the guidelines for ArchWeb structure. (→ deliverable 6)
Visit of S. Alexandrov from AIM to CIMEC, for preparation of the multilingual glossary.
- 2000, April Meeting of partners CIMEC, MAP, AIM, NBU and III in Sofia at the premises of AIM, to prepare the content of the virtual exhibition demo (see section 2.3.4).
Visit of R. Ferrari and L. Guidetti (CILEA) to RUG, for the preparation of the final version of Mediolanvm field work brokering service (see section 2.3.1.2).
- 2001, January Visit of P. Staynov to RUG, for the preparation of the final project report.

Review meeting

In October 1999 a project mid-term review meeting was held at the offices of the project officer in Luxembourg, at which the consortium was represented by its administrative and scientific co-ordinators. The reviewers recommendations were the main topic of discussion for the subsequent Consortium meeting in Milan, and action was taken to correct the deficiencies pointed out in the review. A written response to the review report was sent to the Project Officer, and through him to the reviewers, in December 1999 (→ deliverable 10).

2.1.5 Evaluation

As already noted briefly at the beginning of section 2.1, the administrative management of the ArchTerra project was seriously hampered throughout by the lack of previous experience of the project co-ordinators with the administration of EU projects, by the extremely short period available for contract negotiations, and by a breakdown in contact with the project officer during and following the transfer of the project to a different Unit within DG 13. A few further remarks are needed here to substantiate this.

The co-ordinators' lack of previous experience with the submission and management of EC projects was a contributing cause to scheduling and management problems both internally and with the EC's offices in Luxemburg. In particular, their unfamiliarity with EC financial reporting and rules and reimbursement practise meant that the work plan had to be revised repeatedly to cope with the belated arrival of funds needed to carry out core activities by the CEC partners. In addition to this, it was found that cultural differences between partners from widely separate countries, between archaeologists and IT people, and between people speaking different languages made smooth co-operation much more difficult than anticipated. For example, archaeological practise in eastern Europe at times ignores 'international' standards such as the CIDOC standard for the description of museum collections, and IT solutions developed (and considered standard) in western Europe. It must be noted that the project review meeting held in October 1999 did help to identify such potential bottlenecks and allowed us to redirect some project resources toward them.

Since the project was approved in late November 1998, and contracts had to be finalised before the end of that year, contract negotiations were hurriedly conducted between the project's administrative co-ordinator Mr van Leusen and its then project officer at DG13 / C4 in Brussels, Mr Gonthier. Contracts were signed on the understanding that a simplified work plan would be adopted later in a contract amendment. Following this, a reorganisation of DG13 in early 1999 meant that responsibility for the project was transferred in April 1999 to another unit (DG13 / E2, located in Luxembourg) and project officer (Mr Poliart). The latter was apparently not

brought fully up to date regarding the planned amendment, and he and the project co-ordinators subsequently worked at cross-purposes between April and September of 1999.

These causes were to result in substantial disruptions to the project's administration and timetabling, in that the Consortium was 'straightjacketed' into the overly specific work schedule agreed in December 1998, while the *de facto* period in which the work could be carried out was shortened by two months because of the later arrival of the Commission's initial advance on the project's budget. Although the formal start date of the project was January 1st 1999, ArchTerra effectively started on March 1, with a project specification meeting in Sofia (BG) at which the details of the project work plan and the partners' responsibilities and budgets were worked out. With some project partners conducting archaeological field work over the summer months, the project completed the work planned for its first 6-month period only by the end of September 1999. The mid-term project review, which took place at the offices of the project officer in October 1999, was hampered by misunderstandings as the project co-ordinators were still expecting to discuss their proposal for contract amendment, whereas the reviewers (Mr Alain Michard and Mr Peter Holm Christensen) and project officer were only concerned with reviewing the project's progress and fulfillment of contractual obligations.

Following the reviewers' recommendations, several changes to the work plan and timetable were made, which helped to alleviate some problems. Additional Consortium meetings were organised and regular contact was maintained via a dedicated electronic mailing list. The project nonetheless did experience problems collaborating, especially due to occasional communications breakdown with partners AIM and CIMEC, the problem of being forced to arranging visa for the Romanian and Bulgarians partners before meetings could be held, and delays in the receipt of EC cost reimbursements. Further changes to the work plan were prompted by external events such as a change in Bulgarian tax law effected in 2000 which added an unexpected retroactive 38 % to the personnel costs of Bulgarian project staff over 1999. For such reasons, the initial 2-month startup delay could not be caught up with in subsequent reporting periods, and some planned tasks and meetings had to be cancelled in order to be able to finish the work on time. In the end, the project slightly overran its allotted time in that the final Consortium meetings intended to complete deliverables and reports were held in January 2001.

In sum, the project management turned out to be more time-consuming and labour intensive than the contractual effort table in section 2.1.3 suggests.

2.2 INFRASTRUCTURAL FACILITIES

The objectives of the Consortium under Work Package 2 were:

- to establish and/or extend existing LANs at the CEC partners' offices with the aim of ensuring Intranet access to each CEC partners' digital museum holdings;
- to establish and/or extend existing external (dialup) facilities with the aim of creating Internet restricted access to each CEC partners' digital holdings and limited hosting services within each national ArchWEB;
- to provide portable systems for the creation, demonstration, and dissemination of the project's digital deliverables;
- to provide stability to the project's Internet presence.

This work is presented in section 2.2.1.

In order to allow efficient and effective information exchange and distribution both within the Consortium and externally, some basic standard were established. These are outlined in section 2.2.2.

2.2.1 Hardware, software & network infrastructure

The hardware, software, and network infrastructure for the project were implemented, and web and database server software installed, as per the contract, with the following minor deviations:

- MAP installed two LAN servers rather than one for reasons of network stability;
- MAP and CIMEC postponed the acquisition of PC's and/or peripherals until a later project phase in order to profit from falling prices;
- The implementation of network connectivity at AIM has been completed only at the end of the project (due to technical, administrative and financial problems).

	MAP	CIMEC	CILEA	NBU	AIM	RUG
Servers	data: Pentium III/450, 3 x 10 Gb HDD in a matrix, 8 Gb streamer www: Pentium II/450, 10 Gb HDD	DigiTech 2 Pentium III	www: ULTRA 2 SUN 2 x 200 MHz list: Intel machine (Linux)	128 MB RAM for Sun UltraSPARC 1	AMDK6-2 300MHZ, 128 MB RAM, CD ROM, 4+15GB HDD, 15" Trinitron ¹⁴	www: HP-UX 712-80, Apache 1.3
LAN/Internet	20 PC clients (Windows_98)				Windows NT 4.0 server (5licenses) Ethernet 10BaseT LAN / 2-channel leased line to BAS network, 33.6 Kb modem	
Laptops/Desktops	Compaq Armada 1750C laptop	Compaq Armada 1750 laptop		Pentium 266, 32MB RAM, 2GB HDD, 32x CD ROM, 12" TFT	Pentium 233 desktop, 64MB RAM, 4GB HDD Pentium 233 laptop, 32MB RAM, 1GB HDD	Toshiba 4030CDS
Digital cameras	Agfa ePhoto 1680	Olympus C-2000 Zoom			Olympus 1024x768 dpi	Kodak 240D
Other Peripherals	HP Deskjet 1220C A3 printer	HP PhotoSmart S20 slide scanner	9 GB harddisk		UMAX PowerLook III scanner	ZIP drive

Table 2.7 - Overview of ArchTerra hardware infrastructure (Grey boxes: 'matching' equipment)

¹⁴ In the final configuration; 32 MB RAM and 15 GB memory were added halfway through the project.

The table below presents the networking resources implemented by the Consortium. The general aim was to establish and maintain both Internet services (rows: Internet Server, Internet Scripting) and database services (rows: DB Server, DB Client). The main concerns of the Consortium have been to make as much use as possible of the existing software and expertise at the partners' organisations, to ensure a basic level of compatibility between the partners' systems. A subsidiary concern was to keep the costs of the deliverable scripts and applications down to encourage their eventual uptake by third parties.

Web hosts were already available at RUG, CILEA, and MAP at the outset of the ArchTerra project in 1999. These existing servers were augmented under ArchTerra with a second dedicated web host at RUG, using Apache 1.3 under HP-UX, in October 1999, and new web servers were installed at CIMEC, AIM and NBU. The CIMEC web server, using MS IIS under Windows NT 4.0, was installed with client-side tools by October; the NBU web server, using Apache 1.3 under Sun Solaris 2.5, has been operational since May 1999; MAP also implemented its web host (**no further data available**); while AIM's web server only came online at the very end of the project (in January 2001).

	MAP	CIMEC	CILEA	NBU	AIM	RUG
Server OS	Windows NT	Windows NT	UNIX	Linux	Windows NT	UNIX
Internet Server	MS IIS	MS IIS	Majordomo	Apache	Oracle WebDB	CERN httpd / Apache
Internet Scripting	Perl / CGI	ASP		PHP	PL/SQL	Perl / Lite
DB Server	MS Foxpro	MS Access	Informix	MySQL	Oracle 8i	W3-MSQL
DB Client	ODBC, SQL	ODBC, SQL			HTML	

Table 2.8 - Overview of ArchTerra project networking software

2.2.2 Standards for Information Interchange

All project deliverables intended for use on the Internet or an IntraNet conform to the following basic Consortium guidelines regarding information exchange, digital file formats and rights management.

The exchange of information between DBMS adheres to the RDF (Dublin Core) metadata scheme and uses XML for its syntax.

The following digital file format standards apply:

- 1) UNICODE for text encoding
- 2) JPEG for still images; originals are to be stored at a minimum resolution of 300 dpi and 24 bit color depth; lower resolution and reduced color versions are allowed for use within the MIS.
- 3) MPEG for video files; MP3 for sound files
- 4) QuickTime VR for 3-D representations; VRML for 3-D reconstructions

Control over rights in database applications is managed by a system of user profiles. The database systems managed by the Consortium partners have modules for the definition of such profiles. The following general set of user profiles was defined in accordance with the recommendations made in the mid-term project review:

- ✓ Database Administrator / Superuser (full rights)
- ✓ Editor (rights to add/change/delete specified records and fields; eg, museum staff members in the case of the MIS, or subject editor in the case of ARGE)
- ✓ Translator (special case of Editor, with rights to change only specific database records and fields in a specific language)
- ✓ Client (special case of Editor of the MIS; with rights only to those records entered by him/herself)
- ✓ Registered user (privileged access rights; eg, a field project manager in MEDIOLANVM)
- ✓ Anonymous user (public access rights)

No standards for digitised content other than those proposed in the CIDOC Model for museum information systems (MIS) were adopted by the Consortium.

2.2.3 Evaluation

The installation of hardware, software, and networking infrastructure for the ArchTerra project has generally gone well, despite delays due to problems in submitting cost claims and receiving reimbursements at an early stage. The additional PC's and servers installed by partners MAP, CIMEC, and AIM have extended their existing LANs with the capacity for Internet and Intranet serving of data (in the case of AIM such a LAN was established for the first time), and these systems have been in successful operation at least since the middle of 2000. The laptop computers have been intensively used by the Consortium partners as portable data entry and presentation machines; in combination with the scanning and digital camera equipment they were used to digitise materials for the Museum Information Systems (see section 2.4.4) and the project's web resources (see section 2.6.2), and they were used as presentation machines during Consortium meetings, conferences, workshops, etc.

The only problematic item in this work package was the implementation of technical infrastructure at AIM. The management at AIM could not provide an appropriate room for the hardware and personnel working for ArchTerra, and there were also many administrative and technical problems relating to the installation by Bulgarian Telecom of the leased line between AIM and the computing centre of the Bulgarian Academy of Sciences - needed for the permanent connection of the AIM server to the Internet. Even though this line is now operating, the Internet infrastructure of the Bulgarian Academy of Sciences remains very poor - the 8,000 researchers have a total available bandwidth of only 198 Kb – so that access to the AIM server may still not function properly. The alternative, of using a commercial Internet provider, is at present unfortunately outside the financial reach of AIM. The Consortium has established a periodical mirror of all three 'CEC' web sites in order to alleviate any problem resulting from poor network access.

The potential for further use / development is explored in the exploitation plan (section 2.6.3).

2.3 ARCHTERRA'S INTERNET PRESENCE

The Consortium's decision to take advantage of access via Internet was motivated by the great expansion that the Web has had over recent years, the ever-increasing number of its users, the simplicity and practicality of access to resources in Internet, and the great potential that on a daily basis is being developed and transformed into ever more interesting and wide-ranging services, whose usefulness meets the needs of its continually expanding subscribers.

One development in particular has influenced the approach taken by the ArchTerra Consortium: the move from static to dynamic information provision. All the principal manufacturers of data management software have in recent years dedicated considerable resources and attention to the Internet universe, equipping their top-range products in the DBMS (database management systems) sector with modules that permit management of information (databases) within the Internet environment. This commitment has immensely increased the potential of the Web: Internet applications have moved rapidly from a static to a dynamic modality. Alongside the classic Web pages that are conceived, designed and created in static terms, many (perhaps most) pages now provide information content that is dynamically created on the request of the user. The information feeding this type of page is held in DBMS structures and between the two (page and database) a fruitful "collaboration" is set up.

As an additional guarantee of the project's web presence, the CILEA web server mirrors services maintained by the other project partners, and supports the project's activities with such services as Majordomo list serving and hypermail archives. CILEA also hosts the project's official web pages at archterra.cilea.it. An 'umbrella' domain (european-archaeology.org) has been registered with InterNic, to be used to provide a gateway to all eligible Internet services in the field of European Archaeology.

This section describes the central (international) services and national services (ArchWebs) run from the internet hosts set up under ArchTerra, and the institutional services also run by individual partners.

2.3.1 *Central Services*

The ArchTerra Consortium has undertaken to develop and maintain three 'central' services for the European Archaeological community. The first of these is ARGE, a so-called 'virtual library' storing information about Internet resources for European Archaeology; a prototype web management system was developed in order to facilitate the maintenance of such virtual libraries. The current version, ARGE VLMS 3.0, is available at www.let.rug.nl/arge. The second central service for European Archaeology is an internet 'brokering' service for archaeological field work, based on a prototype developed in 1997-8 by the EC-Thematic Network *ArcheoNet*. This service, named MEDIOLANVM, is available at archeonet.cilea.it/archeosite. The third central resource developed under ArchTerra consists of a series of glossaries and thesauri for the indexing and retrieval of archaeological objects and information.

ARGE VLMS version 3.0

Attempts to harness the Internet for communication and information about European archaeology data back to the early 1990's, when one of us (Van Leusen, then at the University of Amsterdam) began a guide to

archaeological Internet resources using the Gopher protocol. In 1994 Van Leusen teamed up with Sara Champion at Southampton University to produce the first web version of this guide, which became known as ARGE, at the University of Birmingham. Soon it became clear that the guide's content could only be managed efficiently if it were served from a database rather than as a series of static web pages, and that ARGE's functions were being duplicated by very similar guides maintained elsewhere. It was decided to team up with the maintainers of two of these guides in a UKOLUG¹⁵-funded research project named BAUD (for *British Archaeological URL Database*) which sought to address these two problems. Figure 2.3.1 gives the schema designed for this project. At about the same time ARGE also became a partner in the Archeonet European research network, which part funded its maintenance and several improvements to its web interfaces in the period 1997-1998.

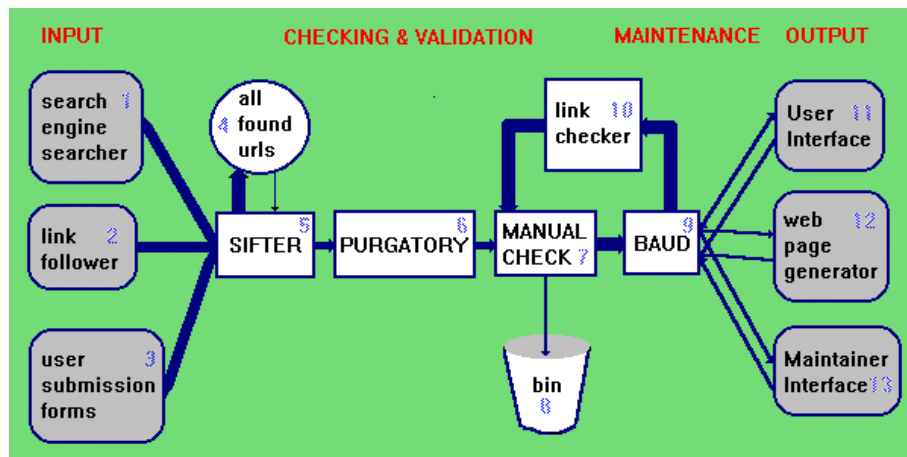


Figure 2.1 – BAUD schema for the maintenance of an Internet database of British Archaeological URLs.

At this stage, ARGE version 2 was moved to the server at the University of Groningen where it still resides at present. Under the ArchTerra contract a 3rd version was developed, comprising a prototype online management system for virtual libraries (VLMS). This system was developed for use on a generic UNIX OS using Apache as the internet server and the freeware mSQL as the database server. The VLMS design and prototype implementation were evaluated by external experts on two occasions; first in September 1999 by Dr Allard Mees of the Römisch-Germanisches Zentral-Museum in Mainz (Germany); secondly in December 2000 by Dr Paul Tyers, an independent consultant working in the UK. These evaluations resulted in notable improvements to the overall speed and reliability (reduced downtime, faster response to requests) and in more effective user and maintenance interfaces. An experimental thesaurus module, added to the prototype VLMS in an attempt to enhance URL classification and retrieval procedures, was evaluated separately by Dr Leonard Will of Willpower Services (UK).

¹⁵ United Kingdom OnLine Users Group.

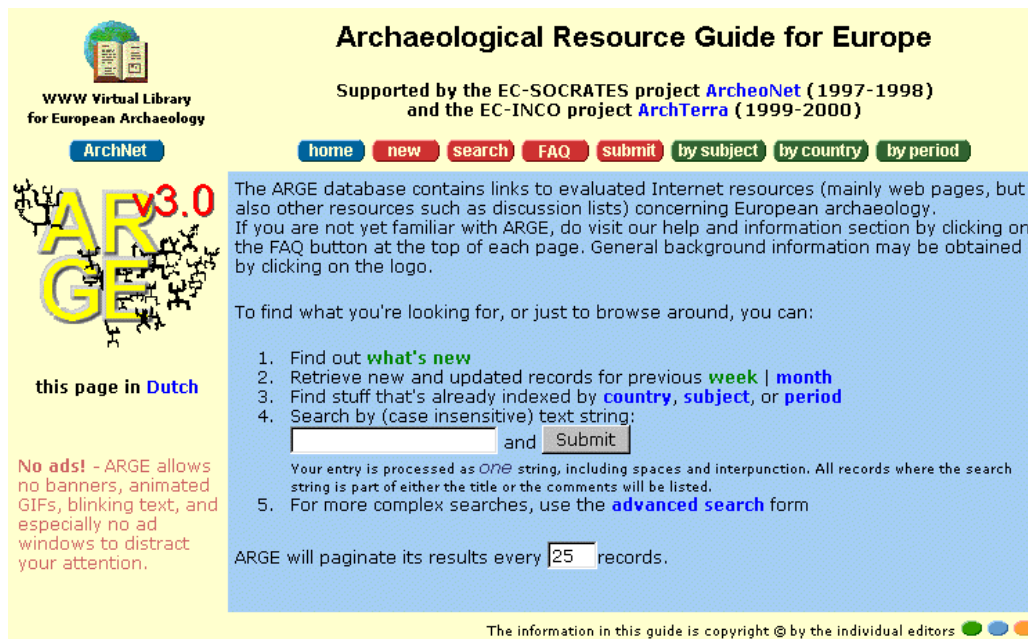


Figure 2.2 – ARGE 3.0 homepage at www.let.rug.nl/arge

The effects of these improvements can best be gauged by considering the following usage statistics for ARGE:

- During the ArchTerra project, between October 1998 and February 2001, the weekly number of users (hosts) of ARGE grew 6-fold from about 380 to 2250; at the same time, navigation efficiency was doubled so that the average weekly number of page requests has increased only by less than 3-fold, from 2500 to 6700. The number of page ‘hits’ and the total amount of MB downloaded have followed suit.
- In the same period, almost 400 new evaluated URLs were added to ARGE (a 33% growth), 340 other URLs were updated, and 50 ‘dead’ URLs were deleted. ARGE content continues to grow at roughly the same rate, with maintenance interventions (updates and removals of database records) beginning to exceed the addition of new records in 2000.
- Between 10 and 35 % of page requests is originated by any of several general or specialised web indexing robots (25 at current count).

ARGE VLMS 3.0 received the following unsolicited web awards and listings (see www.let.rug.nl/arge/General/prizes.html for details): *Meilleur site 2000* (bonweb.com), listing in MicrosoftPress 2000 Guide of Best Websites, Britannica Internet Guide Award, listing in ISI *Current Web Contents*, Links2Go *Key Resource*, Highly Rated by *Schoolzone*, listing in the UNESCO *Millennium Guide to Cultural Resources on the Web* (CD-ROM with UNESCO World Culture Report 2000).

Mediolanvm

The Mediolanvm web service was created for ArchTerra by the Department of Antiquity Sciences - Archaeological Section of the University of Milan and the Lombard Academic Computing Centre CILEA. Its goal is to facilitate international cooperation in the planning and execution of archaeological field work throughout Europe. It does this mainly by maintaining an easy-to-use web site for information exchange between those who offer and search for field work opportunities. An online database allows students and researchers to find out about, and take part in, archaeological fieldwork projects conducted all over Europe; conversely, it allows European universities and other organisations planning archaeological fieldwork to post full information on the Internet.

The name MEDIOLANVM expresses both its location in Milan and its mediating role in promoting archaeological fieldwork in Europe. The application is driven by an INFORMIX database which serves and personalizes the forms and navigation pages as the user travels through the web site. It has been designed to require minimum maintenance and to automate, as far as possible, communication with the user. A series of forms leads the user through the main steps involved in searching for, or submitting, information on archaeological field work.

The MEDIOLANVM service aims to achieve three main results:

- To facilitate the participation of students and researchers in archaeological research projects in various European countries. The project originated from the need to put people interested directly in contact with European universities or other institutions who are conducting archaeological excavations or surveys.
- To enable those in charge of an archaeological excavation or survey to announce their project and insert it directly onto the Website, so as to offer students and researchers opportunities for jobs or to gain cultural and scientific experience by taking part in archaeological excavations or surveys.
- To place at the disposal of academics and site directors a special type of electronic bulletin board that facilitates communications among these persons and on which to post proposals, researches, suggestions and exchange cultural and scientific information.

MEDIOLANVM offers the following choices:

- To search for archaeological field work using either a geographical search based on clickable maps, or a direct search on chronological period, project type, site type, field work director, teaching level, or project date;
- To apply to take part in a field work project by filling out a web form and sending to the project's director;
- To announce a new archaeological field work project and add it to the database, by filling out a series of forms;
- To exchange news and information regarding any aspect of European archaeological field work on an electronic bulletin board.

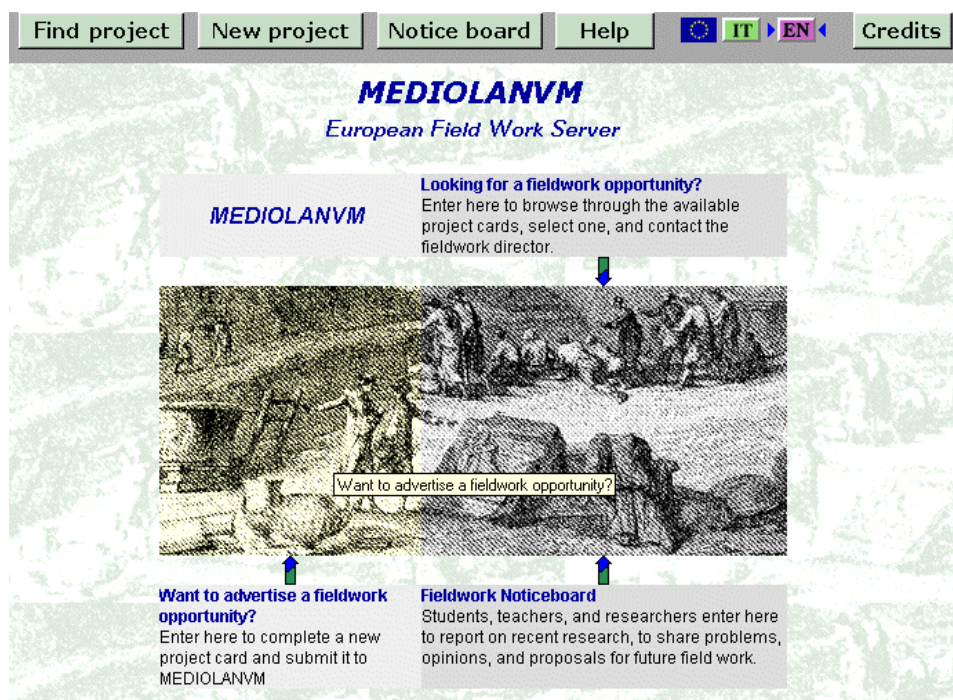


Figure 2.3 – MEDIOLANVM homepage at archeonet.cilea.it/archeosite

Technical documentation

(General introduction available as E:/Technotes/MEDIOLANVM_CAA2000.doc)

MEDIOLANVM is an application that constructs and manages dynamic Web pages. In other words, it is based on a database in which the necessary information is stored and which is consulted, managed and updated by procedures that are activated in the form of Web pages. MEDIOLANVM runs on an HP L1000 2 x 440 MHz Biprocessor under HP-UX 11.0, and has been designed using Informix products (Informix Foundation 2000, Informix Dynamic Server 2000, and Informix Web DataBlade). A special Java applet has been created in order to manage the location of excavation sites on regional maps.

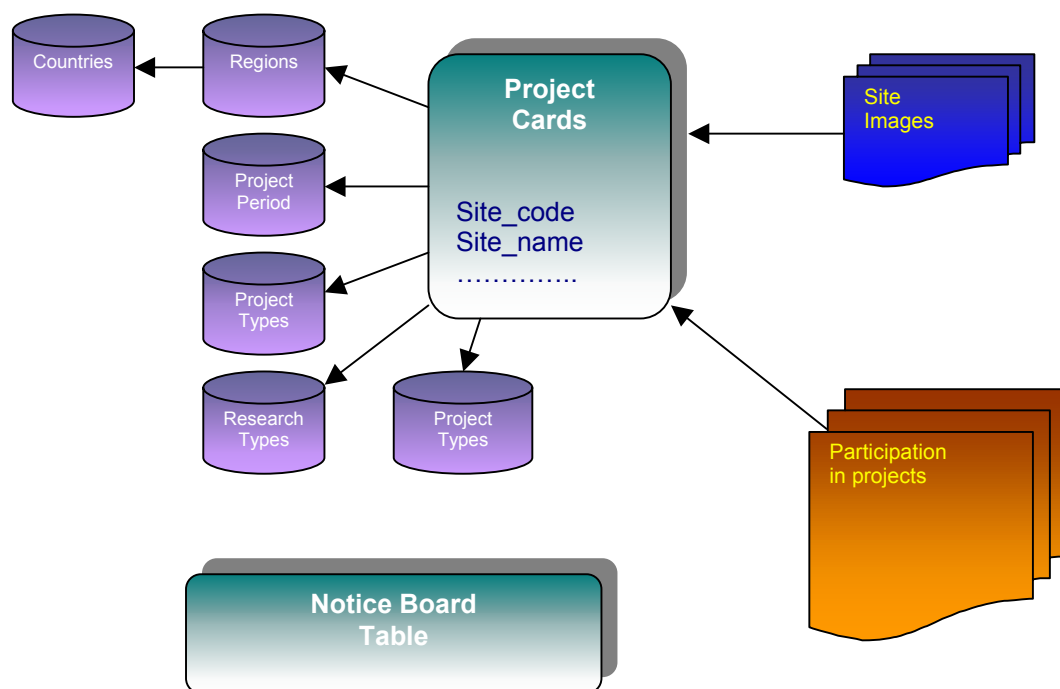


Figure 2.4 - MEDIOLANVM database structure

The database consists of three principal files, linked to each other and to other supporting tables:

- **Project Cards** - MEDIOLANVM uses the concept of 'project cards' to refer to all the information held about a particular field work project, and provides easy-to-follow paths through its services by breaking them into manageable chunks called steps. Cards consist of compulsory data (blue fields) and optional data (grey fields). A Card will not be accepted by MEDIOLANVM unless all compulsory fields are filled, and all new Cards will be evaluated for relevance by the MEDIOLANVM site manager before they are published; a set of temporary tables is employed for this intermediate step (see figure 2.2). When a project Card is accepted, MEDIOLANVM automatically sends an e-mail containing a URL address and a personal code (userID and password) to the project's "Contact person", with which to access and manage the project data records (adding, updating or correcting data, consulting and editing the list of participation requests, and so on).
- **Participation Cards** - To participate in any project, the user searches MEDIOLANVM for field work opportunities and requests participation from the director of a project. First, the user selects the general field work area of interest; from the short list of available projects they then select those that are of interest and check out its details on the Project Card. If the user decides to apply for it, a participation request card window is opened. When this card is completed and submitted, it is automatically sent to the project's director, and further negotiations are conducted privately.
- **Notice board** - A notice board is a place where you can leave notices for others to read, who can then contact you. The MEDIOLANVM notice board also allows you to attach documents to your notices.

The database configuration is supported also by some look-up tables which improve the structure of the database and allow faster retrieval of the projects:

- Chronological periods (Prehistoric and Protohistoric, Preroman and Greek, Roman, Medieval, Recent, Multi-period, ...)
- Site types (Settlement, Cemetery, Sanctuary, Cave, Urban, Underwater,...)
- Project types (Excavation, Multi-level excavation, Underwater excavation, Geophysical Survey, Survey,...)
- Research types (Educational, Academic & Educational, Academic,...)
- Countries
- Regions

Further tables contain the country and region maps used in MEDIOLANVM's interface and the images attached to the field work project cards.

Glossaries and Thesauri (→ deliverables 12 and 13)

One of the core objectives of the ArchTerra project has been to break down existing language barriers to the communication of archaeological information and resources. To this end a Multilingual Interfaces Workshop was held at the joint Computer Applications in Archaeology / Union Internationale des Sciences Prehistoriques et Protohistoriques Commission IV (CAA/UISPP) conference in April 2000. The resultant *Internet report on the use of multilingual thesauri* (deliverable 12), and the archaeological glossaries and thesauri themselves (deliverable 13), are appended to this report. We therefore restrict ourselves to some brief introductory remarks here.

Deliverable 12 consists of an on-line report, the latest version of which is available as a Word file from www.let.rug.nl/arge/Work/thesaurus.html. The document, which discusses the reasons for wanting to have a multilingual thesaurus application for indexing and retrieval of archaeological Internet resources, the design guidelines, and the prototype application built at Groningen University, has been reviewed twice. In the early months of 2000 it was reviewed by the members of FISHEN (a UK-centred discussion list dedicated to the creation of a period thesaurus for British archaeology); in April 2000 it was presented and discussed during the workshop mentioned above. It will be published as a paper in the forthcoming proceedings of that meeting.

Deliverable 13 consists of three linked documents:

A) the thesaurus of indexing terms implemented within the Museum Information System of the Archaeological Institute with Museum of Sofia (AIM; English version; the implementation itself is bilingual Bulgarian-English);
B) a multilingual dictionary of archaeological terms, covering periods and cultures in the archaeology of Central Europe. The five languages used by the dictionary are: Bulgarian, Polish, Romanian, Italian, and English;
C) the thesaurus of indexing terms implemented within ARGE Virtual Library Management System 3.0 (English version; the implementation itself is language independent).

Each of these explores different aspects of the international and multilingual indexing and retrieval of archaeological information. Document A, produced by staff at AIM, exemplifies the specialist use of exhaustive restricted hierarchical terms lists (in this case for the classification of the holdings of AIM according to the classes *materials*, *chronology*, and *subjects*). Document B, the result of a collaboration between several Consortium partners co-ordinated by CIMEC, concentrates on problems in the translation and multinational / multicultural use of archaeological thesauri in a first attempt to define a set of terms valid across Central Europe and find equivalents in several important languages. Document C, produced by RUG, represents a more generalist, 'opportunistic', approach to the construction of archaeological thesauri by attempting to organise indexing terms of the Internet resources listed in ARGE, and explores in particular problems relating to the process of construction itself.

Together, these documents provide the materials needed to present the potential benefits and problems of European archaeological thesauri to a wider professional public, to open up discussion, and to prepare proposals for follow-up projects.

2.3.2 The ArchWebs

ArchWebs are national nodes for accessing archaeological web resources. Though no formal organisation exists, ArchWebs have been formed and maintained in a number of western European countries, and the ArchTerra project has set out to implement similar nodes for Romanian, Polish, and Bulgarian archaeology. To this end, a document giving guidelines for the structure of an ArchWeb site was produced (deliverable 6), and some software tools were developed in order to be able to provide the functionality required by these guidelines.

ArchWeb tools and guidelines (→ deliverables 5, 6)

Since the ArchWeb concept is based on voluntary adherence to a joint navigation structure, the Consortium has decided to produce guidelines, rather than a set of mandatory rules, for the content and structuring of national archaeological gateways of the ArchWeb type which could be used to help the CEC consortium partners build their own ArchWeb nodes. These guidelines were based on an examination of four existing national archaeological web pages – the page of Romanian Archaeology (part of the CIMEC web site), the page of French Archaeology (part of the Archdata web site), the web site of German Archaeology, and the CBA Guide to UK Archaeology online, plus an analysis of the materials proposed by Bulgarian archaeologists to be included in the Bulgarian national ArchWeb. They are being made freely available through the Consortium's web pages to archaeologists elsewhere in Europe who intend to build similar nodes in their own countries. The full

guidelines may be consulted in deliverable 6; here, we will review only its general considerations and design principles.

General Considerations

The structure of an ArchWeb must follow from its objectives. There is no consensus among existing ArchWebs as to what these objectives should be, but all current implementations live somewhere on the continuum between two extremes – that of the ‘gateway’ and that of the ‘service provider’. An intermediate objective is that of providing an introductory overview of national archaeology.

There is usually a trade-off between the level of service you want to provide through an ArchWeb, and the level of maintenance you can afford. This problem may be alleviated by structuring as many services as possible in a self-organising and self-maintaining manner.

Design principles

The following design principles guide the organisation of the national Archwebs in the framework of the ArchTerra project:

- (1) A general distinction should be made between the static or background information (relating to the existing administrative, research and educational infrastructure, as well as to the existing national and international legislation), and the dynamic information concerning current and upcoming projects, events, exhibitions, etc. Such a distinction was, for example, only partially realised in the web page of Romanian Archaeology, due to the subordinate position of the archaeological page to the CIMEC Home page. We consider that the distinction between static and dynamic information should be expressed at the graphical level, too.
- (2) A second distinction is to be made between the different functions of the ArchWeb: representative (providing official information), informational (providing the possibility for intelligent information retrieval), hosting (of individual and institutional archaeological web pages), communication (a place for information exchange, discussion groups, feedback information), income generation (CD-ROMs, books, space- and subject- limited possibilities for advertising and online shopping). As far as the latter is allowed by the hosting organisation, income may be generated in order to ensure the continuation of the ArchWeb node.
- (3) A third, and relatively straightforward, distinction is to be made between meta-information concerning the web site itself – the ArchTerra project, respectively the INCO programme, the partners, etc., and the archaeological information and services it was created to provide. These two different types of information should also be differentiated at the graphical level.
- (4) Fourthly, access to dynamic information should be controlled by a system of user profiles, as listed below:
 - Database Administrator / Superuser (full rights)
 - Editor (rights to add/change/delete specified records and fields)
 - Translator (special case of editor, with rights only in a specified language)
 - Client (of the MIS; has editors rights only to those records entered by him/herself)
 - Registered user (privileged access rights)
 - Anonymous user (public access rights)
- (5) Finally, as each ArchWeb site will be accessible in at least two languages – English and the national language of the site – both versions should be adapted to the needs of the different types of users. We consider that the English version has two main objectives: to present national archaeology to outsiders, and to allow a certain level of searching and participation by foreign archaeologists (for example in local excavations). This means that the English version must contain most of the items from the background information, certain dynamic information which is of international interest, and (where applicable) a section concerning special regulations for foreign participation in fieldwork and other research, and for studying archaeology in the country of interest. Where sections of the site are translated, it is very important that professional translations are provided. Specific matters, like legislative texts for instance, could be presented in bilingual format, accompanied by comments both in English and in the local language.

ArchWeb tools

The HTML development tool of choice for the three ArchWebs was DreamWeaver 3. JavaScript applications were used for enhancing the interfaces with pull-down menus, hover buttons, and the like. PHP, ASP and CGI scripts were used for the creation of dynamic pages providing access to underlying MySQL, MS-SQLServer and MS-Access, and FoxPro databases containing information about persons, organisations, events, and archaeological sites and objects. These tools can be adapted to the needs of further ArchWebs and other archaeological web sites which are developing throughout Eastern Europe, and will be made available by the Consortium partners on request. The PHP/MySQL tools, being based on freeware, are included in the project CD-ROM (→ deliverables 19, 20).

ArchWeb-Bulgaria

ArchWeb-BG follows the structural guidelines by the Consortium. It presents contemporary archaeological investigations in Bulgaria in a thematic manner and gives a concise overview of the major interdisciplinary domains and achievements. Its structure is subordinated to the archaeological periodization schemes used in Bulgarian archaeology. Our aim is to present, in a summary form, the basic development stages of Bulgarian archaeology as a profession. The panel of 15 academic contributors consists of the best known specialists in the respective domains and also includes foreign scientists that have worked or are currently working in Bulgaria. All approximately 100 pages of texts are richly illustrated and are hyperlinked throughout in order to allow fast 'vertical' and 'horizontal' switches within the frame of the presentation of Bulgarian archaeology.

The institutional aspect of Bulgarian archaeology is also presented. This section includes a brief history of archaeology in Bulgaria, a listing of archaeological museums, relevant legislation, current projects, and an overview of the organization of education in archaeology. A special accent is put on the changes that have occurred in the structure of education in archaeology following the political changes of 1989 – eg, the increasing number of academic archaeology departments in the country.

The leading archaeological periodicals and their addresses are also presented.

ArchWeb-BG also provides on-line means, on the principle of equal opportunity, to all professional archaeologists in Bulgaria to upload personal webpages presenting their individual interests and work. The same offer of hosting web pages has been extended to those archaeological organisations which still do not have, or cannot afford, a well-developed Internet presence.



Figure 2.5 – ArchWeb-Bulgaria

ArchWeb-Poland

ArchWeb-PL was developed according to the guidelines for national archaeology gateways set out by the Consortium as well. It contains basic data on Polish archaeology, addressing both local and foreign professionals and advanced amateurs; among the resources present are databases on Polish archaeologists and archaeological institutions which contain basic data on all graduated archaeologists that are professionally active at the moment (ca 850 records), as well as all institutions which are fully or partly active in archaeological research, education, museology, conservation, etc (ca 230 records). This is followed by a choice of legal acts (full text) that are crucial for archaeological activities as well as for the protection of archaeological sites and monuments.

Another section presents Polish archaeological journals, and contains data on their editors, reproductions of the cover and contents of the latest volume (ca 60 titles, from which 20 are fully presented, to be continued beyond the ArchTerra project). A set of on-line publications is also included in this section, with a choice of the newest, rare and/or important texts, currently including articles on air photos in archaeology, ethics of the archaeological profession, and a richly illustrated album on the results of giant rescue excavations along the Polish part of a trans-European gas pipeline.

Other sections cover conferences and exhibitions – both coming in the near future and already executed, so that it is both a sort of calendar for professionals and an archive of past events; a section on Field Research presents excavations carried out by Polish archaeologists at home and abroad, mainly in Africa (Egypt, Sudan); and one page offers links to other related Web pages (ARGE, Mediolanvm, EAA) and to the individual home pages of Polish archaeologists.

Because of its significance as a national service for Polish archaeology, a few words must be said here about the dynamic part of ArchWeb-PL. The on-line database of Polish archaeologists and archaeological institutions uses a specially designed textual data format with inserted HTML tags to facilitate data retrieval. Queries are entered from a web page using a form with a JavaScript driven system of menus where the user can restrict the query by institution type and/or administrative district. The request is sent to a script written in Perl which searches the data according to criteria defined by the user and returns a Web document with a list of entries found. In the case of individuals, the data displayed include his/her e-mail address and the name of the institution where he/she is employed; both are hyperlinked so that the user can send a message directly to the person in question or see the details of the institution. The latter data is generated by another script which returns the name, postal address, e-mail and Web page (if any) for that institution. Clicking on the institution name link sends another request to still another script which returns a list of all the people working for that institution. If the initial search is performed on institutions, then the first Web page generated displays a list of all institution names containing the keyword or string entered in the query form (as restricted by type or area). Alternatively, full lists of people and institutions for a given area can also be accessed from a clickable map interface of Poland, linked to the same set of scripts.

The maintenance of the underlying data is shared by the database administrator and the users. The latter may use a web form to add a new individual and/or institution to the database but the process is moderated by the administrator who validates the incoming data.

Figure 2.6 – ArchWeb-Poland

ArchWeb-Romania

ArchWeb-RO was based on the pre-existing website of CIMEC, the Center for the Cultural Heritage of the Romanian Ministry of Culture. As suggested by the Consortium guidelines, it has sections providing access to Romanian institutions, publications, and legislation, indexes of journals, and presentations of important archaeological sites: Targul de Floci, Histria, Targisor. The CIMEC databases of archaeological sites and of archaeological excavations in Romania 1983 – 2000 can also be accessed from ArchWeb-RO. The current number of visits per month is nearing 1500 (some 60 visits per day, of which more than half from outside Romania).



Figure 2.7 – ArchWeb-Romania

2.3.3 Institutional Web Pages

At the outset of the project, partners MAP and CIMEC already possessed fairly extensive web pages, whereas partner AIM had only a very brief web page hosted by the Bulgarian Academy of Sciences. A full set of institutional web pages was therefore developed for the latter under ArchTerra, and published on the AIM server. The web presences of MAP and CIMEC were significantly enhanced by the addition of new content, functionality, and layout, as briefly described in the sections below. These institutional web pages have an important exemplary function on the national level, demonstrating as they do the power of Internet for the dissemination of information, opening up communication channels between the public and professionals, and the use of up-to-date web interface and database applications.

Archaeological Institute with Museum (AIM)

Figure 2.8 - AIM bulgarian home page

For the home page of the Archaeological Institute with Museum in Sofia, go to <http://aim.bas.bg> (in Bulgarian and English). The AIM web site is divided into 7 sections, relating to Historical background & structure; Administration; Research departments; National archaeological museum; International projects; Publications; and the Museum Information System. The content of each is detailed below.

- The first section describes the more than 100 years of history of the National Archaeological Museum and the Institute of Archaeology which were united after World War II in the present-day AIM, which is part of the Bulgarian Academy of Sciences.
- The second section lists the names of administrative personnel as well as telephone and fax numbers of all the administrative bodies of the AIM - BAS.
- The third section describes briefly the six research departments of the AIM - BAS with the number of members, the research priorities as well as some of the major excavations directed by the department members.
- The fourth section describes the collections held by the Museum under the following headings: Prehistoric; Thracian and Classic; Medieval; Numismatic; Epigraphic; and Treasures. It also contains information about the temporary and permanent expositions of the Museum.
- The fifth section lists the foreign institutions that AIM-BAS has permanent contacts with, as well as the international projects which AIM - BAS participates in.
- The sixth section lists all the periodicals and series edited and published by AIM - BAS.
- The seventh section offers two types of access to the Museum Information System: one for the general public (anonymous access), the other for registered users.

Muzeum Archeologiczne w Poznaniu (MAP)

The homepage of the Archaeological Museum of Poznan (MAP) was enhanced with the addition of sections on permanent and temporary exhibitions (the former on "Prehistory of Greater Poland" and "Death and Life in Ancient Egypt", the latter on "Gods, Graves and Mummies: way to eternity in Ancient Egypt" and "Flight into the past. Aerial archaeology in Britain"), on the management of Archaeological Heritage (including a slide presentation "Air Photos in Archaeological Prospection"), and on excavations carried out by the Museum in Poland and abroad. Pages were also added on the Museum's seat - the Renaissance Palace of the Gorka Family (photo tour), on the archaeological staff of the Museum (including CV's), its publications (the yearbook, a series on African Archaeology, and a series on computer applications), and its other activities. User statistics for the MAP home page indicate that it is already functioning as one of the main gateways to Polish archaeology within Poland itself, with over 400 hits in January 2001.

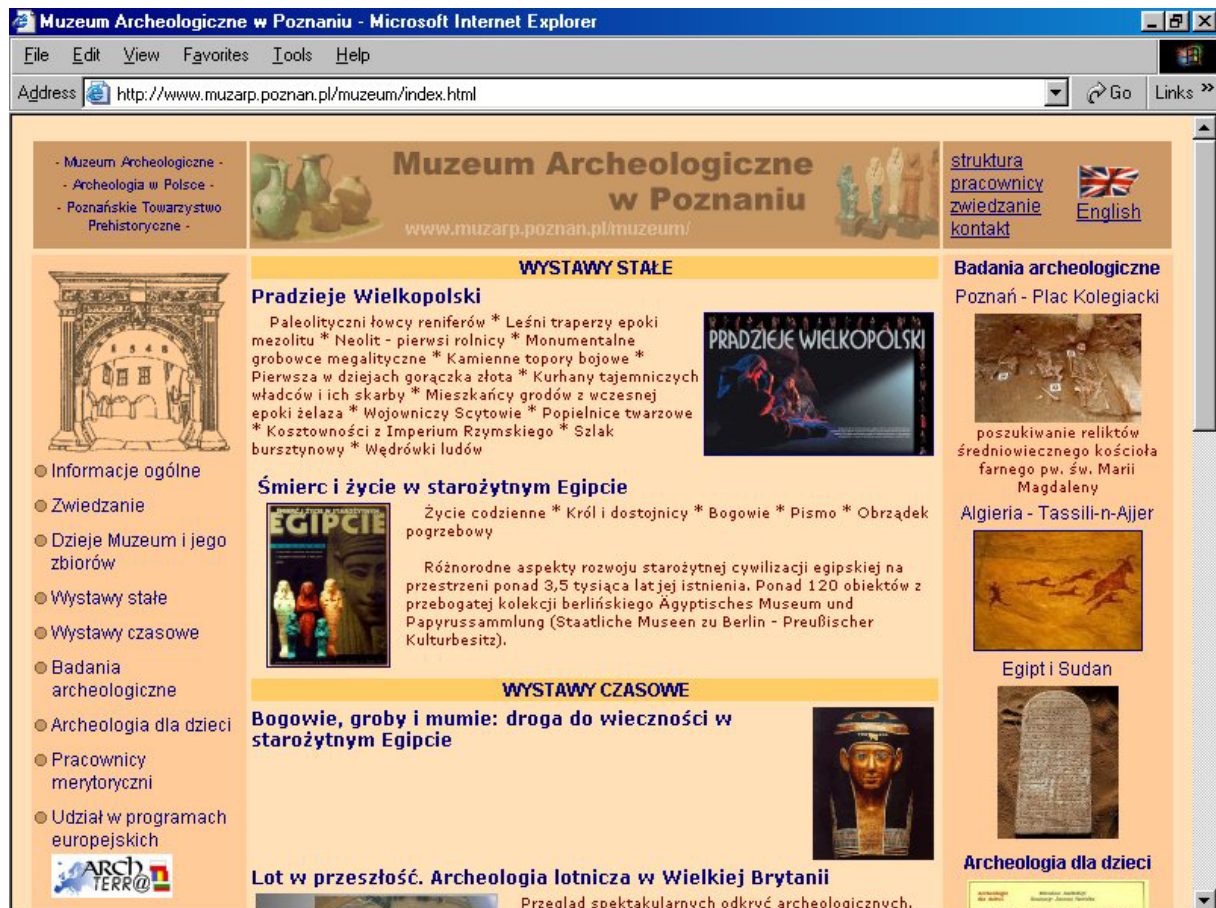


Figure 2.9 – first section of MAP Polish home page

To visit the museum's web pages, go to http://www.muzarp.poznan.pl/muzeum/muz_pol/muzeum0.htm (or, for the English-language home page, to <http://www.muzarp.poznan.pl/museum.htm>).

Institutul de Memorie Culturala (CIMEC)

Founded in 1978, cIMEC (Institute for Cultural Memory) is a public institution under the Romanian Ministry of Culture and Cults, and a national organisation for the computerised cultural heritage record. CIMEC is an institutional member of ICOM (International Council of Museums) and is financed mainly by the Ministry of Culture and Cults on a contractual basis. Among its activities CIMEC:

- collects, processes, develops and disseminates information concerning movable and immovable cultural heritage, theatre performances, cultural institutions, bibliographic records and cultural events;
- maintains the national databases and other computerised cultural information resources;
- develops tools for the collections documentation (artefacts description rules, data standards, terminological thesauri, authority files, software etc.);
- is an editor of various publications, in both classical and digital formats;
- provides consulting and technical assistance for museums, libraries and other cultural institutions.



Figure 2.10 - CIMEC Romanian home page

CIMEC also maintains (mainly) computerised records about the movable heritage (760,000 museum objects and 87,000 rare books), 32,500 monuments and sites that constitute the immovable heritage, some 11,000 theatre performances, 1,000 archaeological excavations, 2,400 museum specialists. In the 2 years of the ArchTerra project, the server capacity of CIMEC increased threefold (both in storage capacity and processing speed). Besides, the mirroring of the CIMEC site by project partner CILEA improves considerably the access of our foreign visitors (the quality of our communication infrastructure is still low). For the home page of the Institute for the Cultural Memory in Bucharest (Institutul de Memorie Culturala), go to <http://www.cimec.ro> (in Romanian & English). The (Romanian) Archweb site is now one of the most successful parts of CIMEC's website, attracting a daily average of 2,000 visitors.

2.3.4 The Joint Demo

This collaborative web site was constructed by the CEC partners in the ArchTerra Consortium in an attempt to demonstrate how the Internet may be used to bring central and eastern European archaeology to the attention of the general public, and how providers of archaeological information in those areas may benefit from sharing and exchanging information. Accordingly, this web site:

- brings to the fore the archaeology of Eastern Europe, which has until now been severely underrepresented on the Internet, as in western printed media; and
- demonstrates the international character of the archaeological heritage - past cultures did not respect modern national boundaries, and mineral resources (for example) were traded and transported across large stretches of Europe.

This web site will be enhanced in the future with a demonstration that 'distributed' online exhibitions can be constructed by a collaboration between information providers (eg, archaeological museums) from several countries. An online artefact database, to be run at CILEA, will demonstrate how building blocks for an online exhibition can be assembled over the Internet. In the meantime, the 'look and feel' of the three sections supplied

by the participating organisations are largely left intact so that the user remains aware of the distributed nature of the information.

Content/Scenario

The demo allows visitors to pursue their interests in particular raw materials (flint, gold, silver) or in aspects of the production chain (mining, processing). Within each topic, information is ordered geographically; for example, if the user is interested in raw materials processing, then he or she can follow links to pages on the making of jewelry in Thracian and Medieval Bulgaria (pages produced and served by the Bulgarian project partners), or on Neolithic flint working near the mines at Krzemionki Opatowskie in Poland (pages produced and served by the Polish project partner). The 'look and feel' of these local web pages has not been altered; rather, the unity of the exhibition is preserved by the navigation interface.

The joint demo virtual exhibition can be visited via the ArchTerra project home page at archterra.cilea.it/exhibits/ (→ Deliverable 24).

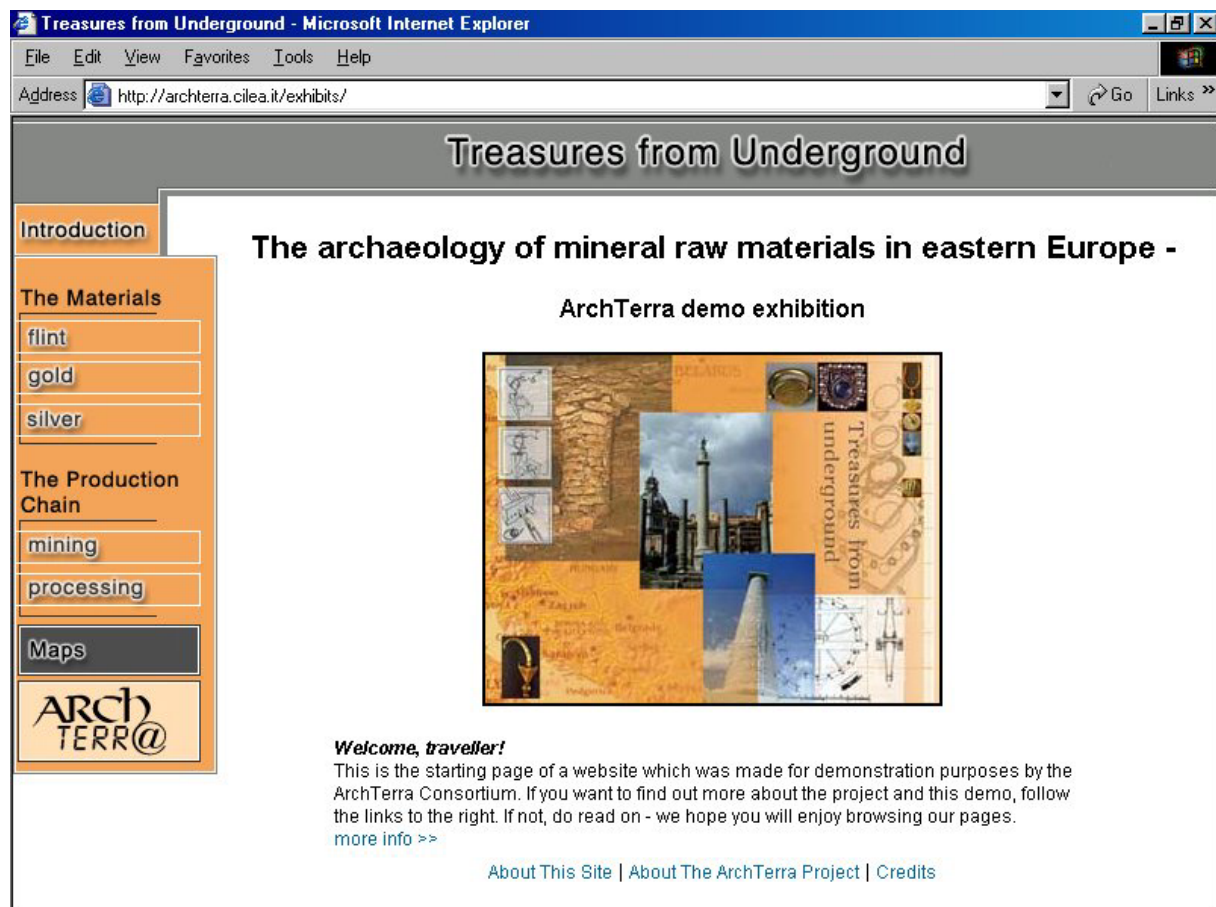


Figure 2.11 – joint demo home page

Credits

The exhibition web site was produced by a collaboration of organisations active in studying and preserving the archaeological heritage in eastern Europe. From Bulgaria, the Archaeological Institute with Museum (AIM) and the Department of Archaeology of New Bulgarian University (NBU), both of Sofia, participated. From Romania, the Centre for the Cultural Memory (CIMEC) at Bucharest, and from Poland, the Archaeological Museum of Poznan (MAP). The scenario was prepared by Dr Andrzej Prinke of MAP.

The content (texts and images) were prepared by the staff of the four archaeological institutions involved, and the HTML coding as well as the user interface was performed by III, Ltd., of Sofia (Bulgaria). Dr Stefan Alexandrov and Mr Michail Vaklinov were responsible at AIM for the preparation of the materials; Prof Gatsov at NBU; Dr Irina Oberlander-Tarnoveanu and Ms Corina Bors at CIMEC; and Dr Andrzej Prinke at MAP.

2.4 INFORMATION SYSTEMS FOR EASTERN EUROPEAN ARCHAEOLOGICAL MUSEUMS

Eastern European archaeological museums, like most of their western counterparts, are small and poorly staffed. Often the staff is unaware of the possibility, or unable to afford, migration of its records to a digital Museum Information System. Such migration is a precondition for being able to share information about its holdings over Intranets and the Internet. One of the core objectives of the ArchTerra project has therefore been to supply a model information system for archaeological museums according to existing international standards, which could then be adapted to the needs of each individual museum and could be implemented at a relatively low cost. The current section describes the software developed by ArchTerra in order to offer CIDOC-compliant MIS to archaeological museums, and the work done to implement such an MIS at partner AIM.

2.4.1 *The CIDOC Model and its Implementation*

The CIDOC Model

The data model developed under the project was initiated as an implementation of the CIDOC model of Information groups and Information categories. During the course of the work it was essentially enhanced in line with the CIDOC Object-oriented data model recommendations as well as existing practice at the Archaeological Museum in Sofia, so as to fully match current practice. The result is a set of three models which are fully CIDOC compliant and can be used for implementation of a broad range of museum information systems in Archaeology and other domains of cultural heritage:

- **Object-oriented museum data model.** This is developed in a standard subset of Universal Modeling Language (UML) and can be used for implementing either an object-relational or a standard relational database with museum information;
- **Procedural data processing model.** This is developed in a standard subset of a highly intuitive visual flowchart language and can be used as a technical reference specification for developing desktop, client/server and Internet/intranet information systems;
- **Set covering user profile.** This is developed as a list of overlapping role sets with attached functions and can be used for implementing flexible database access discipline and for database administration of different types of information systems.

From this model two different databases have been generated: an object-relational database for Oracle 8 RDBMS, and a standard relational database for Oracle/MS SQL Server RDBMS. In addition to these databases, three separate client/server development tools have been experimented with for actual implementation of the museum information system:

- **Oracle Developer** for implementation of both client/server and Internet/intranet information systems using Oracle Designer generated Forms/PL/SQL code;
- **Oracle Jdeveloper** for implementation of both client/server and Internet/intranet information systems using visually programmed Java code;
- **Oracle WebDB** for implementation of a simple Internet/intranet information systems using visual templates.

From these experiments it became clear that the best combination would be to use a Developer generated forms application for local client/server operation together with visually programmed Java servlet applications for remote Internet access to the museum database.

Implementation of a CIDOC-compliant Information System

The full CIDOC model was implemented as a model for a museum information system according to the recognized international standard for networked museum information systems with several clients and a centrally located server. Since the CIDOC model is generic, applicable to any type of museum, it must be adapted whenever a MIS for a specific museum is implemented. In the case of AIM, the CIDOC model was both reduced in some respects, and extended in others; in the case of MAP, the CIDOC model had already largely been implemented, and therefore did not need to be replaced – it only had to be interfaced with the other two systems following the CIDOC standard (see deliverable 5).

An overview of the ArchTerra CIDOC data model implementation was given by Dr. Vassilev and his colleagues in Vassilev, V. et al. 1999, *Museum Information Systems: CIDOC data model implementation in the ArchTerra project*, *Bollettino CILEA* 69 (= Deliverable 7). In addition, two technical reports by the same authors are available as well: Vassilev, V.T. & B. Gaydarska, *Reducing the complexity of CIDOC Object-oriented model through ontological minimization, The ArchTerra experience*; and Vassilev, V. et al. forthcoming, *Drill-down Navigation inside Archaeological Museum Database: Dynamic Classification and Controlled Terminology Implementation*, Proceedings of the 6th Annual Meeting of the European Association of Archaeologists, Lisbon 2000. All three reports are included here in Appendix A2.

In addition, there appeared some legal problems relating to rights of access to certain types of information. Because of this, III has implemented a second, scaled-down version of the system, which more closely follows the existing practice at AIM; it is much lighter and can be used equally well by other small museums in the country. The full CIDOC-compliant information system was implemented as a server-side intranet/internet application using Oracle WebDB. It behaves as a Web site, generated dynamically from database content and controlled from a single point. It is administered using series of Web templates for site, user and content management. A listing of the templates is provided in Appendix A3.

Museum Site Template

The Museum Site template developed under Archterra consists of two parts. Both components of the template are consistent with the CIDOC Model of information groups and categories, and can be used for implementing museum information systems for heritage institutions across Europe. Both templates have been developed using CASE methodology and tools from Oracle, Corp (see Appendix 6).

- **Museum Database.** This part of the template is entirely independent from the database in use, since it relies on features found in any standard relational databases, including Oracle, Informix, Microsoft, Sybase and public domain databases like MySQL. Initially this part was developed as an object-relational database after the Object-oriented enhancement of CIDOC, but for efficiency and universality it was also developed as an entirely relational database. Three different databases have been generated on the basis of this template under the project – one relational database compatible with Oracle 7 Server, one object-relational database compatible with Oracle 8 Server and one relational database for Microsoft SQL Server.
- **Museum Information System.** This template, although designed using specific Oracle client modules for interaction with the database (Forms and PL/SQL), is relatively universal; it can be directly implemented for other clients, such as Microsoft Visual Basic, and adapted for any public domain tools such as Java.

Scaled-down Implementations

Characteristically, the main potential users of museum information systems under Archterra – AIM, MAP, and CIMEC – had widely varying work practises and software environments – thus, Oracle was used in AIM, Foxpro in Poznan and MS SQLserver in Bucharest. None of them saw any advantage in relinquishing their current practice for the full CIDOC standard; they therefore implemented their own versions of museum information systems as follows:

- **AIM:** Based on the experience gained during development of the CIDOC-compliant information system, III has implemented scaled-down version of it after the recommendations of AIM and using the same technologies – Oracle as a backend database server and WebDB as a dynamic site for approaching the museum database over the intranet/Internet. See Deliverable 11 for the AIM IS installation manual and user guide.
- **MAP:** A new, upgraded version of the existing database system MuzArp, based on VisualFoxPro with SQL data retrieval, has been developed. This information system combines data on archaeological sites, their study (excavations), and results (museum objects as well as multi-aspect information on them), covering all basic needs of the staff of an archaeological museum: research, inventory, management of collections and of sites & monuments. It follows the complex data model (351 data fields) developed and tested in practice in the earlier DOS version of the system.

- **CIMEC:** Together with CILEA, CIMEC implemented, tested and customised the data models and database applications built by III. Further to the work done at III, CIMEC has developed (and is currently refining) a UML model for the following categories: places, sites, finds; terminology, topics, subject headings; time, events, entities having time spans; agents: people and organisations/groups; and bibliographic entities (conforming to the IFLA Functional Requirements for Bibliographic Records). Based on this UML model an MS-Access database schema was developed and data acquisition and browsing applications of the model were programmed.

2.4.2 *Controlled terms for indexing and retrieval*

No MIS could function without proper controls on the information that is being entered into it. One of the main tasks has therefore been to establish new, or convert existing, controlled term lists (vocabularies, glossaries) for use in the AIM IS. For AIM, the controlled term lists were established according to CIDOC standards, resulting in 21 lists of terms which describe material, technical, scientific and administrative aspects of the museum's holdings (see section 2.3.1 and Deliverable 13 A). Besides being directly incorporated into the AIM information system, the terms have served as a 'seed' for the building of a multilingual glossary of archaeological terms (→ deliverable 13 B).

2.4.3 *Digitisation of holdings*

It was originally intended that several thousand of AIM's holdings would be fully digitised during the course of the project. In the event, the start of this work at AIM was much delayed by practical problems of access to the equipment installed under ArchTerra, and even to the data itself. The internal administrative and security procedures at AIM made it impossible to set up efficient digitisation procedures. Notwithstanding this, by the end of the contract period almost all the prehistoric holdings of AIM have been digitised, and the first 100 of these enhanced with digital images.

2.4.4 *Evaluation*

The Consortium's experience with the implementation of MIS according to the CIDOC Model highlights the many practical difficulties in promoting state-of-the-art IT solutions, not just in eastern European archaeological museums, but in small museums anywhere in Europe. These difficulties appear to be caused by two separate sets of factors. Firstly, the climate of (sometimes extreme) financial hardship under which archaeological institutions in large parts of Europe must operate, translates itself both directly in a lack of (IT and financial) resources needed, and indirectly in inadequately trained personnel and conservative administrative procedures. Whereas the ArchTerra project successfully addressed the former, the latter result in an institutional climate of resistance to innovative IT approaches to Museum Information Systems.

The second set of factors is related to the basic question of why should museums adopt the CIDOC Model. Undoubtedly the replacement of an existing MIS by a new one is a much more difficult process than the initial adoption of an MIS would be. On the one hand the work involved in data migration, changing work practise, and re-training staff, plus the fact that software revisions and bug fixing are no longer handled in-house, could justifiably deter museum staff from supporting such a change-over; on the other, the advantages of the CIDOC Model over the existing data model might not be apparent or sufficiently large to warrant it. Considerations of international best practise may appear irrelevant to most museums, which are merely looking for an MIS that will make their existing practise more efficient and effective.

A more general set of problems that became apparent in the course of the work reported here, was the unfamiliarity of most professional archaeologists and museum staff with modern concepts of information structuring. Thus, ArchTerra consortium partners had to spend more time than expected in first learning about, then explaining to others, such basics as the difference between glossaries, restricted term lists, and thesauri. It must be noted that even if professionals *are* aware of proper methods for information structuring, they often do not follow these methods; for example, it was found that the set of archaeological terms in the Dutch National Central Catalogue system (NCC), constructed in the 1990s by subject specialists, was severely polluted with illogical and missing entries.

The administrative barriers to data entry imposed at AIM, added to the delays implementing a scaled-down MIS, have led to disappointing results in the development of digital content. Although AIM staff is now in a position to continue digitisation of all its holdings, at the end of the project the work had not progressed sufficiently to allow an evaluation of the software interfaces and digital records to take place.

The experience gained on these issues by the project partners, if properly disseminated, will come to good stead in future attempts to modernise information systems in small museums across Europe.

2.5 RESEARCH¹⁶

The ArchTerra Consortium conducted research in the area of knowledge organising systems (NKOS), specifically into the development of structured term lists, their use as thesauri in user interfaces, and their translation into multiple European languages and scripts. Two prototype NKOS were built; one forms part of the MIS discussed in section 2.4, the other is presented in abridged version in section 2.5.1 (the full version is appended as Deliverable 12). Three sets of term lists, produced to explore different aspects of international and multilingual indexing and retrieval of archaeological information, are briefly introduced in section 2.5.2 (the documents themselves are appended = deliverable 13). Together, these documents provide the materials needed to present the potential benefits and problems of European archaeological thesauri to a wider professional public, to open up discussion, and to prepare proposals for follow-up projects.

2.5.1 *Indexing and Retrieving Archaeological Resources on the Internet*

Introduction

The field of Archaeology shares in the general exponential growth of the amount of information that is being published on the Internet. Whereas the first such publications in Europe date to ‘gopher’ sites of the early 1990s, the major search engines currently report anything up to 100,000 pages relevant to European archaeology. Over the intervening years many have lamented the resulting chaos and lack of quality control, although knowledgeable users could still reduce the chaos by using the various information filtering mechanisms offered by web index sites such as AltaVista. Champion (1997) and Van Leusen et al. (1996) provide a good overview of the situation in 1995/6, and over the past five years the general public too has been educated in the use of such mechanisms.

As the Internet became a potential source of information for professional archaeologist too, the need for more sophisticated retrieval mechanisms (and their obverse, indexing mechanisms) becomes ever more pressing. Among the early solutions were Internet ‘guides’ such as ARGE¹⁷, which provide access to a manually indexed subset of web resources, and metadata schemes such as that of the Dublin Core¹⁸, which allow the author of a web page to include descriptive information which can then be retrieved by web indexing robots. While these solutions provide short-term relief, the need for long-term, cross-national, and effective solutions to the problem of finding information on the Internet has been well recognised. The AQUARELLE project “Sharing cultural heritage through multimedia technologies”¹⁹ represents an industry-driven approach to the problem, while professional archaeologists themselves have opted for the distributed, co-operative approach represented by the ArchTerra Consortium.

A thesaurus is a dictionary of words and phrases, grouped together according to similarities in their meaning. It contains ‘terms’ and explanations (or ‘scope notes’) of how those terms should be applied, and it defines relations between the terms. *Which* of these terms, explanations, and relations one selects depends on the intended use(s) and audience(s) of the thesaurus. For detailed retrieval of information from the scientific

¹⁶ In addition to the research reported on here, the ArchTerra work plan originally called for research into multimedia databases as well; this line of research was later dropped because it was not an essential part of the project and could not be fitted in the reduced project timetable.

¹⁷ The World Wide Web Virtual Library for European Archaeology, at <http://www.let.rug.nl/arge/> (since 1995).

¹⁸ For more information about this, go to <http://www.purl.org>.

¹⁹ 1996 - 1998, EC Telematics 2c program, at <http://www.inria.fr>; http://www.prosoma.lu/cgi-bin/show_new.py?id=4482&page=description.

literature a large and complex thesaurus will be needed²⁰, but for our goal of unlocking web resources for a very diverse audience, a very much simpler approach (targeting the proverbial intelligent 12-year old) may be taken.

Towards a prototype multilingual thesaurus application

The work of the ArchTerra Consortium is aimed at reaching the following interrelated goals:

- To establish a short list of terms adequately covering the presently available internet resources for European archaeology, with appropriate scope notes (a glossary) and translations;
- To structure these terms in a thesaurus;
- To implement a browseable user interface to the thesaurus, for submission / retrieval;
- To implement a browseable maintenance interface to the thesaurus, for submitting / discussing / activating new terms, definitions, relations, and translations.

Progress toward these goals is discussed in more detail below.

Design Considerations

The goals specified above have been used to provide further parameters for the design of the prototype application. Parameters relating to the content of the thesaurus, the types of relations that will be recognised, the implementation of multilinguicity, and the use of standards are discussed each in turn below. It should be noted in advance that many desiderata have not been implemented in the prototype – rather, it is hoped that they may feed further and wider discussion and development at a later stage.

Multilinguicity

The requirement of multilinguicity (or, more properly, language-independence) is relevant to the design of the thesaurus application in two ways. How do we build a language independent system that will allow us to add languages as needed? And how do we ensure that submissions and retrievals will be handled correctly irrespective of the language or script being used? The latter question is a technical one, to do with the problematic representation of various European character sets by web browsing software, which we will not explore any further here. The former question leads off to the deeper issue of what constitutes a translation. True one-to-one mapping of terms in two different languages does not occur very often, and a successful thesaurus application must therefore be able to deal with the existence of multiple – multicultural – and conflicting meanings of the same term. Among the practical approaches to consider are:

- a) taking an arbitrary decision, e.g. to abide by the definitions given by some authority, and
- b) ensuring professionalism in the translators (avoiding debates about the quality of a translation)²¹.

Although the ArchTerra Consortium's original plan was to implement the prototype in four languages versions (English, Polish, Romanian and Bulgarian), restrictions in the available time, funding, and expertise meant that only the English version was in fact developed. However, as the prototype is language-independent, the addition of languages should be a relatively simple task.

In order to preserve language independent storage of thesaurus information, three linked database tables are used in the ARGE database structure to store information about relations, terms, and relations between terms. Another three linked tables store information about terms assigned to URLs (see Figure 1). Terms, Classes, Relations and Languages are all numerically coded, and 'lookup' tables are used to translate these codes into words in the user's chosen language.

²⁰ See, for example, the RCHME thesaurus of Monument Types and the MDA thesaurus of archaeological objects (both at http://www.rchme.gov.uk/thesaurus/thes_splash.htm), the Bronze Age glossary produced by the *Bronze Age Campaign* project (Council of Europe, at <http://www.cimec.ro/arh/bronz/>), and the January/February 2000 archives of the FISHEN e-conference (at <http://www.mailbase.ac.uk/lists/fishen/archive.html>).

²¹ This is discussed in some detail in the international standard ISO5964-1985 "Documentation - guidelines for the establishment and development of multilingual thesauri".

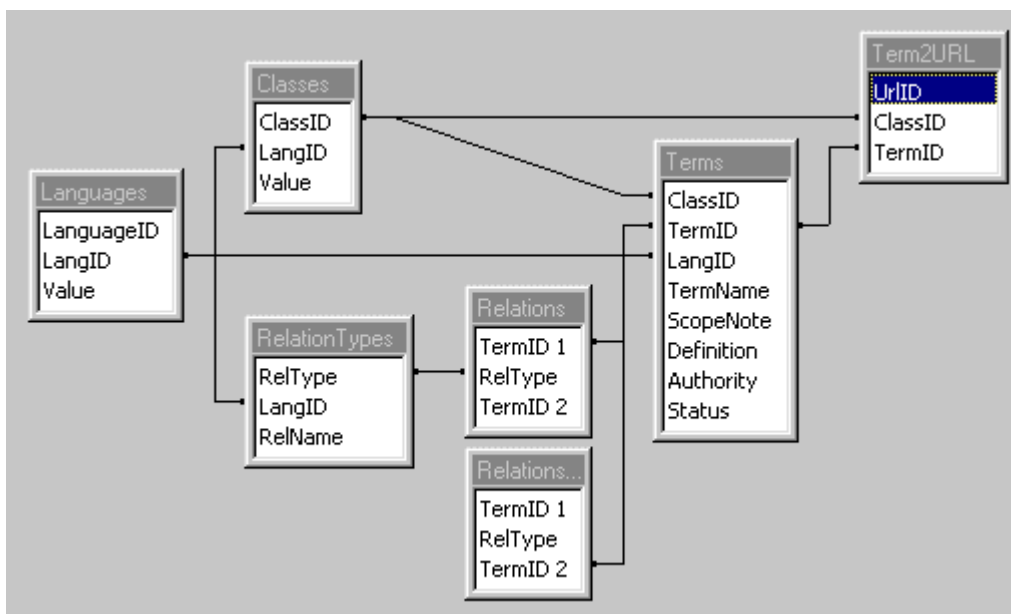


Figure 2.8 - Representation of the structure of the language-independent prototype thesaurus under MS-Access. Term specifications are stored in table Terms, their relations in table Relations (which occurs twice because it creates 'internal' links), and their assignment to URLs in table Term2URL; Tables Classes, Languages, and RelationTypes are 'lookup' tables.

Standards

As a matter of principle, the thesaurus should, where-ever possible, make use of existing international standards. For example, ISO standards or draft standards²² for the recording of character sets, country names, and language names can be applied without difficulty. But other standards may not be applicable for a variety of reasons; for example, the ISO date standard does not cope well with the needs of archaeological dating, because it uses hyphens as a wildcard character (so -999 expands to the year 0999 or 1999 or 2999) and does not allow the BC/AD system or negative dates. The best system for numeric representation of dates is the astronomical system, where 0 = 1 BC, -1 = 2 BC, etc. It goes without saying that, where such standards differ from generally accepted usage, the standard should be used internally while the generally accepted version is presented to the user.

Existing national standards and draft standards for professional terminology, such as the English MIDAS and INSCRIPTION standards²³, may also be relevant to the thesaurus. MIDAS, the Monument Inventory Data Standard, is a 'content' standard for recording architectural or archaeological monuments; INSCRIPTION is a set of standard 'word lists' covering things like the Type of a Monument, or terms to describe archaeological periods. It should be recognised, however, that no effective standards exist in many areas of archaeological terminology, and the creation of such standards is far outside the scope of the ArchTerra Consortium. International professional organisations such as the European Association of Archaeologists (EAA)²⁴ and the Union Internationale des Sciences Préhistoriques et Protohistoriques (UISPP)²⁵ should provide the forum for such work.

Worldwide standards also apply to the coding of the interfaces to the thesaurus (see sections 3 to 5), which should operate well across a range of platforms and browsers. In addition to adhering to the HTML standard, the UTF-8 (UNICODE) character set may be used by the interfaces so that western and central European, Baltic, Greek and Cyrillic scripts are all displayed correctly. It should be noted that, while the implementation of multilinguicity *per se* is straightforward, dealing with multiple character sets is not. Although the major browsers now recognise UNICODE encoding of web content, appropriate fonts may not be available to the client software to display all character sets in use across Europe correctly. We can only hope that ongoing standardisation will remove this obstacle before long.

²² For example, ISO draft standard 15924 prescribes terminology for character sets such as Latin and Cyrillic (see <http://www.egt.ie/standards/iso15924/document/index.html>).

²³ On the Museums Documentation Association (MDA) web site at <http://www.mda.org.uk/fishen/>.

²⁴ At <http://www.e-a-a.org.uk>.

²⁵ At <http://allserv.rug.ac.be/~jbourgeo/uispp.html>.

Content

Despite the relatively restricted goals that we have set for the content of the thesaurus, this is probably the most difficult issue to settle. Relying on the experience gained earlier with ARGE, the ArchTerra Consortium settled on a guideline of including some 100 subject terms, some 30 period terms, and another 100 geographic terms in the thesaurus²⁶.

The biggest problem doubtlessly lies in how to avoid/resolve complexities or lack of clarity in the *meaning of* and *relations between* the terms. For example, archaeological periods are defined by a mixture of chronological, cultural, technological, political, and architectural criteria; it is not always clear to which area they are applicable and what are their absolute start and end dates (if any). Does ‘eneolithic’ indicate the last phase of the Neolithic period, coming after the Late Neolithic phase (as the name implies), or is it a transitional period in its own right (in between the Neolithic and Bronze Age)? The ‘Roman’ period begins and ends at different times in different parts of Europe, and does not exist in others. Can this be dealt with in the Scope note or is a more complex solution called for?

A second problem can be summarised in the question of how to ensure that the thesaurus provides truly equal ‘coverage’ of all subjects, periods, and regions of Europe. For example, terminology for post-Roman periods is generally less precise than that for later prehistory; ‘non-preferred’ terms such as ‘cave men’ may have to be included because these are likely to be used by the public or to occur in older literature; and *local terms* (such as ‘sub-Apennine’ for the Early Iron Age in Italy) may be needed to allow the effective inclusion of many parts of Europe.

Two approaches are available to avoid or alleviate endless disagreements about the content of the thesaurus. Firstly, definitions and scope notes describing the meaning and clarifying the applicability of terms in language appropriate to the audience will, whenever practicable, be taken verbatim from an authoritative source. Scope notes should also specify the amount of ‘fuzziness’ in the meaning of the term. Secondly, the thesaurus will be ‘coarse-grained’ in its description of archaeological internet resources, i.e., many potential conflicts of interpretation will be avoided because specific terms such as ‘Flavian’ will be mapped to more general terms such as ‘Early Roman Empire’. As a further antidote to the potential confusion, at least in the area of chronological terminology, we can include absolute chronology in our thesaurus by offering *millennia* and *centuries BC/AD* as indexing options (the BP and Cal systems of dating are not familiar to the general user, but could also be added if the need arose).

Relation Types

The following standard thesaurus relations will be recognised initially by the system:

- Class (CL; top-level descriptive category to which the term belongs, e.g. ‘Chronological Period’)
- Scope Note (SN; a brief statement about the scope of the term which could include a named authority for the definition used, geographic and temporal ranges, etc.)
- Broad Term (BT; indicates the generic term of which the current term is a specific; a.k.a. ‘is a kind of’)
- Narrow Term (NT; indicates the specific terms of which the current term is the generic; a.k.a. ‘contains’)
- Related term (RT; indicates all relation types not covered by BT and NT)
- Used for (UF; indicates any alternative but non-preferred terms with the same meaning; a.k.a. ‘is a preferred term for’)
- Use (USE; indicates which other term of the same meaning is preferred over the current term; a.k.a. ‘is a non-preferred term for’)

This can be extended at a later stage with relation types that are more specific to archaeology, e.g., Precedes (P; i.e. chronologically) and Succeeds (S; i.e. chronologically).

The importance of defining the relation types themselves may be illustrated by an example. The ISO standard for monolingual thesauri²⁷ recommends that the use of BT and NT for part/whole relationships should be restricted to a few specific types of term: (a) systems and organs of the body; (b) geographical locations; (c) disciplines or fields of discourse; (d) hierarchical social structures. This would allow a BT/NT relation to exist between (a) skull and lower jaw, (b) Scandinavia and Norway, (c) Geophysics and GPR, and (d) tribe and moiety, but it would not allow (e) arms and sword.

One useful feature is the fact that terms need not be fully ‘linked up’ to other terms in the thesaurus. For many colloquial search terms (that is, terms that non-specialist users would like to use) a simple mapping to one or more of the existing ‘preferred’ terms in the thesaurus should be sufficient for effective retrieval. The thesaurus application would contain only the non-preferred term, its scope note, and its USE relation (to a preferred term), and any searches would take place ‘behind the scenes’ using the preferred term. The same solution could be applied to the use of *local terms* as mentioned above, although here the relation type would be RT (related term) rather than USE.

²⁶ Following the NUTS-2 and NUTS-3 system of geographic subdivision of Europe.

²⁷ ISO2788-1986.

The User Interface

End users of the thesaurus will want to do two things with it – retrieval and submission of web resources. Logically, retrieval with the help of a thesaurus is just one among several search mechanisms, and the thesaurus option should therefore be offered in the ‘Search Page’ of a web site. To keep the user’s retrieval interface efficient and effective, the thesaurus must be activated in two stages. Primary retrieval of archaeological records should be achieved through a limited and hierarchical (i.e. using only the BT/NT relations in the thesaurus) interface, implemented either as a series of foldout menus or as a collapsible, Windows Explorer-like menu. The results of the primary search will be accompanied by dynamically generated options for widening or narrowing searches which constitute the secondary retrieval system.

The code for the primary retrieval menu, presenting the BT/NT part of the thesaurus, may have to be periodically generated off-line in order to prevent the application from becoming unacceptably slow and complex (many menus with many options in the user interface). The ‘root’ menu would contain CLASSES such as *period*, *region*, *organisation type* and *data provider*, each with no more than 10 options. The peculiar nature of the user community – a mixture of old and young, lay and professional – puts specific requirements on the design of the user interface. While users should be made aware that their actions are ‘filtered’ by the thesaurus application, the presence of the thesaurus should be non-obtrusive and unnecessary use of jargon should be avoided. Since archaeological terminology is neither consistent nor logical, a heavy burden rests on the *definitions* and/or *scope notes* attached to the terms. These should therefore be accessible to the user at all times. Contextual information about each term can be presented to the user by employing an ‘onMouseOver’ method (JavaScript) to show the scope note for each term; the terms selected by the user should also be echoed to the screen so that the user keeps track of his/her actions. A thorough study of interface design will be needed to upgrade the current prototype to a working ‘alpha’ version.

The secondary retrieval menu (part of the output page resulting from a particular thesaurus query) will allow users to refine or widen their queries by hyperlinking each key term of the currently selected web resources to its thesaurus relations (see Figure 2). Whilst a direct user search using the thesaurus has not been implemented at this date, a demonstration of the secondary retrieval system was implemented, and is shown below. A preliminary series of hierarchical relations (NT, BT) have been defined between the terms on the shortlist for testing purposes.

File Edit View Go Window Help

ARGE (Europe) What's New? Site Search HELP/INFO Subject Index Country Index
ArchNet (World) ARGE: mSQL query result Period Index Add / Change

ARGE 3.0 3 records found as a result of your query.
Link status: ● Reliable ● Less reliable ● Unreliable

1074 ● english [America's Stonehenge](#) – an astronomical complex in New England, USA, similar to European sites. Many believe it was built by Celts who visited America a few thousand years ago. One of those is Barry Fell, a Harvard Professor known for his book *America B.C.* In English. [ARGE]
Keywords: united states Fringe:Pre-Columbian Europeans **Last updated:** 17-Aug-2000 **Thesaurus:**

79 ● english [Simon James's Ancient Celts page](#) – general information, battle re-enactment, etc. [ARGE]
Keywords: Private site european union Iron Age Peoples:Celts **Last updated:** 21-Aug-2000 **Thesaurus:** Celts; Europe; Iron Age;

142 ● english [The Celts](#) – historical sources. [ARGE]
Keywords: united states Iron Age Peoples:Celts **Last updated:** 13-Sep-1999 **Thesaurus:**

Arge Project
Last modified: Mon Jul 01 15:10:00 CET 1999



Figure 2.9 - A user query on the string 'celts' results in 3 URL records being displayed by ARGE. URL 79 (Simon James's Ancient Celts page) has attached thesaurus terms 'Celts', 'Europe', and 'Iron Age'. When the user clicks on any thesaurus term, a helper window displays the current thesaurus relations of that term; when the user selects any of these, a new query is executed and new results are written to the main window. This cycle can be repeated at will.

All of the above assumes that the user will be happy to use only the terms offered by the thesaurus for searching, but this is an unlikely scenario. Could the thesaurus application be taught to understand free-form keywords submitted by the user? Are there others ways in which the user can be shielded from the very structured search environment offered by a thesaurus? Among the potentially useful tools and techniques that can be explored are 'mapping' terms or sets of terms to others, parsing the user's search strings to allow orthographic and syntactical variation, and searching by example:

- One of the most useful concepts in the enormously complex issue of creating an acceptable thesaurus for European archaeology is that of 'mapping'. A multiplicity of period terms deriving from cultural, political, chronological, and architectural criteria, for example, can perhaps be mapped to the single 'yardstick' of absolute dates. 'Flavian' would map to AD 68 \Leftrightarrow AD 95 (or whatever), which would map to 'Roman' in France but to 'Late Iron Age' in Denmark. The implications of such mapping must be investigated. What happens if such dates change? How should overlapping periods be handled? Mapping can also be used to link two or more thesauri together, so that, for example, users can use the familiar terms from a local archaeological thesaurus for constructing queries which will be 'translated' to equivalent terms in the European thesaurus before execution;
- A parser, to resolve orthographic and syntactical variation, including errors, in search strings. Many search engines already implement this as 'near' searching. One simple approach would be to search case-insensitive and to ignore everything that isn't a letter, e.g., `/post[^a-z]*media?eval/i` is an expression that will match most of the possible spellings of that term, including the American ones;
- Searching 'by example'. While a lay public may not be able to handle archaeological terms well (e.g., being unaware that they should ask for 'Palaeolithic' to get information about Neanderthals), this would not be a problem if they could 'search by example'. The thesaurus could include a list of likely 'examples' (the Iceman, Stonehenge) for this purpose, and 'map' these to one or more proper archaeological terms.

The Maintenance Interface

The maintenance of our prototype thesaurus application involves two separate issues: the maintenance of the thesaurus itself (adding, editing, or deleting terms and relations), and the indexing of web resources using that thesaurus. The following sections review both these issues, using examples from ARGE's prototype thesaurus maintenance interface.

Indexing web resources

Once the thesaurus itself is complete and available, the main task awaiting the maintainer of a web guide is to index new URLs, and to check/edit indexed URLs submitted by users²⁸. The indexing interface will present all currently available information on any URL, with options to add/change/delete key words and to visit the URL itself in a separate window. The regular maintenance interface of ARGE, which already allows key words to be added to a URL record, was extended with options to add/change/remove any number of terms from any number of CLASSES. An option to call up the helper window containing the current thesaurus terms and descriptions was also added.

Building and maintaining the thesaurus

Building and maintaining the thesaurus itself is a task that should be restricted to an editorial board affiliated to an appropriate professional organisation²⁹. The maintenance interface should have the following functionality:

- a) Authority to perform actions should be stored in user profiles;
- b) An Editor must be able to view current relations between terms, to add and edit terms, scope notes, relation types, and relations between terms; the use of definitions in the scope note requires the addition of an 'authority' field;
- c) A Translator should be able to add and edit translations.

2.5.2 Multilingual Dictionaries and Thesauri for European Archaeology

The ArchTerra project produced three sets of terms in order to explore different aspects of international and multilingual indexing and retrieval of archaeological information:

- A) the thesaurus of indexing terms implemented within the Museum Information System of the Archaeological Institute with Museum of Sofia (AIM; English version; the implementation itself is bilingual Bulgarian-English);
- B) a multilingual dictionary of archaeological terms, covering periods and cultures in the archaeology of Central Europe. The five languages used by the dictionary are: Bulgarian, Polish, Romanian, Italian, and English;
- C) the thesaurus of indexing terms implemented within ARGE Virtual Library Management System 3.0 (English version; the implementation itself is language independent).

Each of these explores different aspects of the international and multilingual indexing and retrieval of archaeological information. Document A, produced by staff at AIM, exemplifies the specialist use of exhaustive restricted hierarchical terms lists (in this case for the classification of the holdings of AIM according to the classes *materials*, *chronology*, and *subjects*). Document B, the result of a collaboration between several Consortium partners co-ordinated by CIMEC, concentrates on problems in the translation and multinational / multicultural use of archaeological thesauri in a first attempt to define a set of terms valid across Central Europe and find equivalents in several important languages. Document C, produced by RUG, represents a more generalist, 'opportunistic', approach to the construction of archaeological thesauri by attempting to organise indexing terms of the Internet resources listed in ARGE, and explores in particular problems relating to the process of construction itself.

2.5.3 Evaluation

The exponential growth in the amount of archaeological data being published on the Internet has in recent years brought to the fore a more professional and structured approach to retrieving and indexing web resources. The use of a thesaurus to structure a body of information, as proposed and developed in prototype by the ArchTerra Consortium, is just one example of the way in which 'metadata' are likely to transform our personal and professional use of the web.

²⁸ Many people are uncomfortable with the idea of the 'power' such an editor has. The gist of my reply to such concerns (Van Leusen et al. 1996) has been to note that it is not a matter of power but one of authority; any editor (whether traditional or online) has to earn, and can lose, his or her authority by the quality of his or her work. ARGE has piloted a system of remote online editors, whose contributions are tagged with their identity so that users can evaluate their authority if they wish to do so. Optionally, the quality of the editors could be safeguarded by a professional accreditation system.

²⁹ For example, the Association of European Archaeologists (EAA).

The discussion, design and development of the prototype have brought to light a large number of issues which will need a follow-up. In no particular order these are:

- **Speed and Stability.** The prototype was developed on an HP 9000/180 workstation under a CERN HTTP server and Hughes mSQL 2.09; a more stable and fast platform will be needed for the development of an alpha version.
- **Content.** Although the database structure underlying the thesaurus application is now in place, its current content is temporary and incomplete. In particular, relations between terms have only been inserted for testing purposes so far, and all content is in English. A priority for further work is therefore to complete the short (~250 term) thesaurus envisaged originally by the ArchTerra Consortium, and to verify that the prototype works in at least one other language. The medium of online discussion lists has been found to work well for this sort of work, which should preferably take place under the auspices of a professional organisation such as the Association of European Archaeologists. If an editorial board is established, it should have a forum and archive for discussing thesaurus maintenance, and for receiving proposals for new terms and relations from users. This implies that some sort of status tracking should also be implemented.
- **Interface design.** Little effort has gone into the on-screen layout of the prototype, and further work will have to include serious investment in studying the requirements of effective interfaces. The thesaurus environment is unlikely to be familiar to the general public, so extra care must be taken to remove unnecessary jargon, complex layout, etc.
- **Natural searching.** Among the potentially useful tools and techniques that can be explored to create a more natural user interface are ‘mapping’ terms or sets of terms to others, parsing the user’s search strings to allow orthographic and syntactical variation, and searching by example.
- **Trust and Authority.** Many archaeologists have expressed concern with the ‘power’ wielded by an editor of a web guide and, by implication, of the editor of a thesaurus. The gist of my reply to such concerns (Van Leusen et al. 1996) has been to note that it is not a matter of power but one of trust or authority; any editor (whether traditional or online) has to earn, and can lose, the user’s trust by the quality of his or her work. ARGE has piloted a system of remote online editors whose contributions are tagged with their identity, so that users can evaluate their authority if they wish to do so³⁰. Optionally, the quality of the editors could be further safeguarded by a professional accreditation system, for example with the Association of European Archaeologists (EAA).
- **Multicultural translation.** Although databases may be structured to be language-independent, and web interfaces to those databases may be made available in multiple translations and transliterations, and the technical problem of mixing and correctly displaying two or more *scripts* (eg, Latin and Cyrillic) in a single frame within a web page is largely solved, coding multilingual Internet applications remains far from trivial³¹. Even more intractable than the immediate and practical problems of translation, the challenge in constructing generic European archaeological thesauri is in dealing with multi-culturality and shifting meanings of terms; these may require thesauri to be abstracted into semantic structures rather than relying on a single ‘base’ term set and language.

³⁰ The idea of users ‘voting with their feet’ has recently been translated into the concept of a web ‘e-pinion’. See also <http://www.epinions.com/help/index.html?show=faq>.

³¹ A good place to find further information on this subject is the TERENA ‘multilingual support’ page at <http://www.terena.nl/multiling/>.

2.6 DISSEMINATION AND EXPLOITATION

In view of the unfamiliarity of most professional archaeologists and staff of archaeological museums with the issues confronting the ArchTerra Consortium, the dissemination of its aims, objectives, approaches and results is an important part of the project's work. During the project's run-time, active dissemination has mainly been done through a series of papers presented at various international symposia, many of which have already been published or will be published in the near future (section 2.6.1). As passive means of dissemination, an extensive Internet presence has been established for the project (section 2.6.2).

However, the aims and the objectives of the Consortium also require that much of the work must remain 'in progress', and will be maintained and developed further both by the current Consortium partners and, after dissemination, by others. For this reason a detailed exploitation plan has been established (section 2.6.3).

2.6.1 *Presentations and Publications*

Presentations

The Consortium partners presented posters and distributed leaflets during the annual international conferences of the two most relevant organisations of professional archaeologists: the European Association of Archaeologists (EAA), established in 1993, is the main international professional organisation, currently with almost 2000 members; the Computer Applications and Quantitative Methods in Archaeology (CAA) annual meetings provide the primary venue for European researchers involved in archaeological computing.

- At the 1999 CAA Annual Meeting (Dublin, IE), Dr A Prinke gave a paper "Extending the European Archaeology Web over Bulgaria, Romania, and Poland", presenting the ArchTerra project. The paper was subsequently revised and will appear in the proceedings of the CAA 2000 conference.
- At the 5th EAA Annual Meeting (Bournemouth, UK, September 99) two papers were presented by partners from RUG and CIMEC.
- At the 1999 Digital Resources in the Humanities Conference (London, UK, September 99), a paper was presented by Mr Van Leusen on the subject of "Serving Archaeology: the ARGE Virtual Library management system".
- At the annual meeting of the UK chapter of CAA (Durham, UK, February 2000), Dr Vassilev gave a paper on 'Reducing the complexity of CIDOC OO model through ontological minimisation: the ArchTerra experience'.
- At the 2000 Annual Meeting of CAA/UISPP (Ljubljana, SI), a poster and leaflets presenting the three national ArchWebs of Romania, Bulgaria, and Poland was displayed, and a workshop on approaches to multilingual indexing and retrieval of archaeological information was held. A paper presenting these approaches will be published in the conference proceedings.
- At the June, 2000, Raphael Programme conference "Mapping the Future of the Past. New Information Technologies for Managing the European Archaeological Heritage" (Seville, ES), A. Prinke presented a paper on 'The activities of Poznań Archaeological Museum in introducing information technology to archaeological heritage management (1986-2000)'
- At the 6th EAA Annual Meeting (Lisbon, PT, September 2000), the project was represented with multiple posters, leaflets, papers, and a workshop (→ deliverable 18). A poster on the ArchTerra project was presented; leaflets on ArchTerra and Mediolanvm were handed out. Dr Vassilev and others presented a paper on 'Drill-down navigation inside archaeological museum databases'. In the workshop on ArchWebs, project members presented papers on "East European Archaeology at your fingertips: Archaeological Web Nodes for Bulgaria, Poland and Romania", "ArchWeb-PL: Gateway to Polish Archaeology", "ArchWeb-

BG: Gateway to Bulgarian Archaeology", and "LASE, MEDIOLANVM, ArchAgenda: Central services for national ArchWebs". Abstracts of all papers were published in the pre-conference handbook of the 6th EAA.

The ArchTerra project was also presented by project member CIMEC in a radio broadcast on Radio "Romania Cultural", with national coverage), and by MAP during the Eurokonferenca "Virtual Archaeology between Scientific Research and Territorial Marketing" (Arezzo, IT), the NATO Advanced Research Workshop in Leszno (Poland), and the International Colloquium on computer applications in archaeology at European University Viadrina (S³ubice - Frankfurt a/Oder), all in November 2000.

Publications

Articles on several aspects of the project appeared in ICOM-News (the newsletter of the International Council of Museums), and in two separate issues of the bulletin published and distributed widely within Italy by CILEA (see following section); scientific articles will appear beginning in early 2001 with the publication of the proceedings of the CAA2000 conference.

Negrone Catacchio, N, L Guidetti, M Camnasio, R Ferrari, & M van Leusen 2000
MEDIOLANVM European Fieldwork Server (CAA Conference – April 18-21, 2000 Ljubljana, Slovenia), in *Bollettino del CILEA* 73 (Giugno 2000): 7-12.

Oberländer-Târnoveanu, I 2000
ArchTerra: Sharing Archaeological Knowledge across Europe, *ICOM News. Newsletter of the International Council of Museums*, volume 53(3):7.

Van Leusen, PM, 2001
Indexing and Retrieving Archaeological Resources on the Internet: A prototype multilingual thesaurus application, in *Computing Archaeology for Understanding the Past, CAA 2000* (BAR International Series 931): 303-8.

Vassilev, V, I Stoiev, B Gaydarska, S Alexandrov, G Nehrizov, & M Vaklinov 1999
Museum Information Systems: CIDOC data model implementation in the ArchTerra project, in *Bollettino del CILEA* 69 (Settembre 1999): 15-30.

2.6.2 Internet presence

ArchTerra's Internet presence makes itself felt at several levels: internationally, nationally, and at the level of individual institutions. The project itself of course has a home page as well, giving access to all the resources developed under it.

Project web pages and services

The ArchTerra home page, for general access to and information about project resources, is available at archterra.cilea.it. To increase its chances of being found by interested Internet users, this URL was submitted to several international search engines (eg, Yahoo!, Google, DMOZ) in July 1999, and missing project details were added to the CORDIS database maintained by the EU in August 2000.

The central internet service for field work opportunities MEDIOLANVM (see section 2.3.1) was officially opened on June 1st, 2000, for general use, at archterra.cilea.it/mediolanum/. The ARGE Virtual Library, for general use, remained accessible throughout the project at www.let.rug.nl/arge/. Finally, the demonstration pages for 'distributed' archaeological exhibitions are available at archterra.cilea.it/exhibits/demo1/.

National hosts and services (ArchWebs)

Of the three ArchWebs developed under ArchTerra, two (for Romania and Poland) have been accessible (barring network problems) from the start of the project while the third (for Bulgaria) came online only as the project ended (see section 2.3.2). To improve the accessibility of these web pages, CILEA mirrors the ArchWeb sites at <http://archterra.cilea.it>. The Romanian ArchWeb node will be found at www.archweb.cimec.ro; the Polish ArchWeb node at www.muzarp.poznan.pl/archweb/; and the Bulgarian ArchWeb node at archweb.nbu.bg.

Partner hosts and services

In the course of the ArchTerra project, the institutional web pages for each of the CEC partners were significantly enhanced in order to provide exemplars for archaeological institutions across Europe (see section 2.3.3). For the Archaeological Museum of Poznan (Muzeum Archeologiczne w Poznaniu), go to <http://www.muzarp.poznan.pl/muzeum/> (in Polish and English); for the home page of the Centre for the Cultural Memory in Bucharest (Centrul de Memorie Culturala), go to <http://www.cimec.ro> (in Romanian); for the home page of the Archaeological Institute with Museum in Sofia, go to <http://aim.bas.bg> (in English).

2.6.3 *Exploitation plan*

The ArchTerra Consortium consists of partners that have no overriding commercial interest in the exploitation of project deliverables. Instead, they are more concerned to allow unhindered distribution of prototypes, tools and guides to other archaeological user communities on a 'shareware' basis (that is, on the basis of distribution and maintenance cost recovery). The goals of the ArchTerra project call for a continued activity of the Consortium partners after the formal end of the project. The partners' intentions to continue the work and exploit the results of the project may be grouped under the headings of maintenance of services, creation of additional content, further dissemination activities, and further development and enhancement of software products. These themes are set out in detail in the exploitation plan below.

Maintenance of services

Under 'maintenance' we here understand both the upkeep of the service itself, and the continued updating of its contents.

1. Partners RUG and CILEA will maintain, respectively, the ARGE and MEDIOLANVM central services for a period of at least 3 years from the end of the contract;
2. Partners CIMEC, MAP, and NBU will maintain, respectively, the national ArchWeb sites of Romania, Poland, and Bulgaria;
3. Partners CIMEC, MAP, and AIM will maintain, respectively, their database information services;
4. Partner CILEA will continue to host and maintain the ArchTerra project web site and mirror sites of the three national ArchWebs of Romania, Poland, and Bulgaria for a period of at least 3 years from the end of the contract.

Creation of additional content

1. AIM – will continue the digitisation of its holdings within its MIS; it will add the following new sections to ArchWeb-BG: Archaeological sites excavated by AIM-BAS members, Contents of the AIM-BAS editions, Exhibition projects and descriptions, and New archaeological and museum projects;
2. MAP – will extend its web pages with the full contents of the Poznan Museum's yearbooks;
3. CIMEC, MAP, AIM – will use the "know-how" gained within the ArchTerra project for realising further virtual on-line exhibitions;
4. Other related activities include the publication in 2002 of a multimedia CD-ROM on Trajan's column as a result of the collaboration between partners CIMEC CILEA and III.

Dissemination activities

All partners will remain active in the promotion of access to Internet resources on European archaeology. Specifically, they will provide practical aid in setting up (and, where necessary, hosting) new ArchWeb nodes in other countries of Europe; and they will continue to disseminate leaflets on project deliverables.

1. CIMEC – will organise workshops on ArchWeb-RO at the Faculty of History of the University of Bucharest (special seminary for Methods in Archaeology) and at the Annual Meeting of Romanian Archaeologists (mid-summer 2001). It will also continue to provide its museum information system and conversion software to Romanian museums at low cost;

2. MAP – will organise the XIIIth Report Conference on Archaeological Research in Greater Poland in 1998-2000 (April, 2001), during which the ArchTerra project will be the subject of the keynote speech, and the MAP and ArchWeb-PL web pages will be presented;
3. CILEA – will publish papers on the ArchTerra project and the Mediolanum service in Italian language scientific journals;
4. AIM – will organise a presentation of its MIS and the ArchWeb-BG web pages at a meeting of archaeologists from the regional archaeological museums of Bulgaria on the premises of AIM (February 2001);
5. NBU – will organise a presentation of the ArchWeb-BG web pages during a special workshop to be organised by the Department of Archaeology of the NBU in March 2001;
6. III - will offer its implementation of the CIDOC data model developed under ArchTerra to CIDOC for the purposes of dissemination and further development.

Development and enhancement of software products

The partners will continue to work towards a joint ODBC database system for the storage of, and access to, national archaeological records (co-ordinated by CIMEC); and they will take part in a working party to plan for the establishment of an internet gateway to European Archaeology under the aegis of the European Association of Archaeologists (co-ordinated by RUG).

1. CILEA – will, in collaboration with the University of Milan and an Italian museum yet to be chosen, test implement another instance of the museum information system, in Italian.
2. III - the CIDOC based MIS will be proposed to all museums in Bulgaria which are willing to implement/adapt it for their own use; a national information system for the most important objects and documents in Bulgarian museums and archives is already under development by III and the National Chamber of Museums in Bulgaria. It is based on the CIDOC compliant MIS developed by Dr. Vassilev;
3. RUG, CIMEC – will continue development of multilingual thesauri and glossaries, and disseminate these through ARGE.
4. NBU, MAP, CIMEC, CILEA - III will develop a MySQL/PHP-based directory application for inclusion in the national ArchWebs, which will contain details of people and organisations related to archaeology; the contents of the three will be made available as a merged directory application through the ArchTerra web site at CILEA.

2.6.4 Technology implementation plan

The ArchTerra Contract (Annex II, Article 10) states that a Technology Implementation Plan (TIP), containing all potential 'Foreground rights' and exploitation intentions including a timetable, is to be submitted along with the Final report. The only technology developed by the Consortium which warrants such a TIP, is the MIS model.

1. General

This plan describes the activities to be carried out by the Institute of Archaeology with Museum - Bulgarian Academy of Sciences (the Museum) in order to implement and fully incorporate into its current practice the Museum Information System developed under the INCO Copernicus ArchTerra project.

2. Regulations

In order to comply with the external legal and internal organizational rules for operation the Museum will ensure meeting the following conditions:

- a) buying the necessary software licenses for running the system as follows
 - Oracle Server for Windows NT Standard Edition
 - Oracle WebDB for Windows NT
- b) approval of internal rules for system operation, including
 - reserving space for servicing of the system according to the technical requirements of the equipment
 - protection of the content stored in the database
 - rights to use the information matching the information system user roles
- c) appointing of staff responsible for administration of the information and its usage as follows
 - register new artifacts

- prepare and enter new descriptions
- produce documentation materials (texts and/or images)

3. Maintenance and Servicing

To ensure proper exploitation of the system the Museum will organize the following additional measures

a) establishing of a new permanent or contracted post with the following duties

- technical administration and servicing of the network server
- database administration
- Web server administration

b) preparing of Service Level Agreement for system auditing, customization and modification with the Institute of Information Investigations (III Ltd)

For all above measures the primary responsibility is solely under the authority of the Museum.

3

SUMMARY AND CONCLUSIONS

The results of the Archterra project are summarised in section 3.1. The two most immediately obvious questions to ask are: has it fulfilled its aims and objectives? If it has not, then why not? While the answers to these questions are given in section 3.2, the potential for further development of Internet services for unlocking the European archaeological heritage appears almost limitless. Some pointers are given in the final section 3.3.

3.1 *Summary Report*

The ArchTerra Project, subsidised by the EC under the INCO Copernicus programme contract no 977054, aims to 'extend the European Archaeological Heritage Web across Poland, Romania and Bulgaria'. It was run for the two years 1999-2000 by the ArchTerra Consortium, consisting of the following partners: Groningen State University (RUG; Groningen, The Netherlands; administrative co-ordination), the Institute for Information Investigations, Ltd (III; Sofia, Bulgaria; scientific co-ordination), the Inter-university Consortium of Lombardy (CILEA; Milan, Italy), the Centre for the Cultural Memory (CIMEC; Bucharest, Romania), the Poznan Archaeological Museum (MAP; Poznan, Poland), the Archaeological Institute with Museum (AIM; Sofia, Bulgaria), and the New Bulgarian University (NBU; Sofia, Bulgaria).

The stated objectives³² of the Project were: to establish and/or to expand local area networks at the partnering organisations in Bulgaria, Romania, and Poland; to establish and/or extend several popular Internet services for European archaeology; to develop free software products that allow Internet/Intranet access to the catalogues of museums with archaeological holdings; to digitise many of the actual holdings of the participating museums; and to demonstrate at the same time the archaeological richness that remain hidden in museums across eastern Europe, and the feasibility of conducting supra-national archaeological research using distributed access to museum databases. The workplan was conceptually divided into six packages (subdivided into a total of 18 tasks and organised in a goal driven workflow which exploits the complementary nature of the partners' expertise) - project management, installation of project infrastructure, creation of web hosts and content, creation and implementation of a generic museum information system, research, and dissemination and exploitation of results. The objectives and results of each of these are summarised and evaluated below.

- The **Project Management** was not successful in its objective of making the work progress smoothly and according to the original work plan and timetable. While the latter are recognised to have been overly detailed and ambitious, it is noted that established control and review mechanisms for INCO projects not only did not lead to a correction of this situation, but exacerbated it by insisting on formal compliance with the contract. The Project experienced relatively long delays in the submission of periodic reports and costs claims, causing further delays in reimbursement by the EC. A reduced workplan was executed using the total projected budget and just within original effort estimates, at a cost to the EC of 197 KEUR.
- The **Infrastructure** required for the Consortium plans consisted mainly of the computer hardware needed to establish and/or maintain web and database servers, extend LANs, and establish network connectivity. Mobile PCs and peripherals were bought to allow the creation and dissemination of project results and to facilitate its management. All objectives were reached, albeit with delays caused by funding problems, with one exception: at partner AIM, the establishment of a functional LAN with Internet connectivity was compromised by serious local administrative and technical delays.
- A core project objective, the creation of an **Internet Presence** for eastern European archaeology was achieved by establishing, first of all, a series of national archaeology gateways known as ArchWebs. These are highly visible and provide a solid core of information and services at the national level. Each CEC partner also developed exemplary institutional web sites according to previously established best practise; thirdly, the two international Internet services ARGE (Virtual Library for European Archaeology) and MEDIOLANVM (Brokering system for Archaeological Field Work) were developed. Finally, the

³² From ArchTerra project description.

ArchTerra web site and specially developed joint Internet exhibition on mining and raw materials technology present the Project's objectives and results.

- The second core project objective, the development and implementation of a generic **Museum Information System** based on the CIDOC model for [redacted] was partly achieved, in that a fully functional MIS was indeed designed and implemented. However, practical, cultural, and technical hurdles towards its adoption by the three eligible Partners were underestimated, and only one (reduced) MIS was eventually realised at Partner AIM-BAS. The Consortium considers this to be an extremely useful experience which future projects with similar aims should learn from.
- Basic **Research** plays a relatively minor part in the Project's plans. One of the two intended strands (concerning multimedia database applications) had to be cancelled when it became clear that the Consortium could not make a significant contribution in this area. The other research strand - exploring approaches to multilingual and distributed indexing and retrieval of Internet resources on European Archaeology - however led to the three intended deliverables (a scientific paper, a prototype software for on-line thesaurus building, and three sets of term lists each exploring aspects of multilingual archaeological indexing).
- The **Dissemination and Exploitation** of Project results are aimed at the local, national, and international audiences of professional archaeologists. Internationally, the Consortium presented its work primarily in scientific papers, posters, leaflets, and workshops at the annual gatherings of the European Association of Archaeologists (EAA) and the Computer Applications in Archaeology (CAA) society; nationally and locally, individual Project Partners used similar means. Its wide-ranging Internet presence, discussed above, provided (and continues to provide) a permanent but more passive means of dissemination of project outcomes. Because of the short project period however, much of its impact must be expected to arise from the continued dissemination and exploitation activities envisaged in the Exploitation Plan.

The original work plan established by the Consortium was overly ambitious and detailed, and the hurried contract negotiations and subsequent reorganisation of units within DG13 caused these initial failings not to be corrected early on, continuing to plague the Project throughout. Reducing the complexity of the work, cancelling a few non-vital tasks, re-allocating resources to strengthen project management, and defining less ambitious core objectives eventually led to a work plan that was successfully completed by the Consortium.

Evaluating the overall results against the costs and effort put into the work, the Consortium is satisfied that it has indeed significantly furthered the goal of integration of the professional archaeology and archaeologists of the three nations Poland, Romania, and Bulgaria into the European Archaeology Web. It has achieved, in addition to a direct improvement in the availability of archaeological information and means of communication within the partnering CEC, a lasting impact on the public and scientific perception of archaeology as shared heritage and as a non-renewable resource across Europe. In the course of these activities the project has furthered professional development of the CEC researchers during study visits to western partners, technical workshops, and an international conference.

3.2 Fulfillment of Project Aims and Objectives

It is clear that the Consortium did not succeed in achieving all its original aims. Specifically, the CIDOC model for museum information systems was only partially adopted at AIM, and not at all by MAP; planned research into multimedia databases was cancelled; and little progress was made in providing practical solutions to the problems associated with multilingual and distributed access to archaeological database records across Europe.

The proximate cause for this no doubt was that the original proposal as submitted by the co-ordinators for the ArchTerra project was too ambitious, with a budget and timetable too restricted to do all work; but ultimately the fact that these failings were neither corrected during contract negotiations nor later on in a contract amendment negotiated with the project officer, points to an underlying procedural cause. Apparently EC programmes and procedures are geared to handling large projects in which Consortia are able to muster the experience, personnel and financial resources that allow them to manage and absorb delays and cost overruns, rather than the relatively small academic projects such as ArchTerra. The cost reimbursement principle, in particular, does not work well with small CEC partners which are not able to advance substantial sums of their own – a type of partner which is presumably not uncommon within the INCO Copernicus programme. The Consortium feels strongly that the reimbursement principle makes INCO projects such as ours, in which sizeable chunks of the work are done by participants why must rely wholly on EC funding, particularly difficult to manage; the delays in getting cost claims accepted and reimbursed not only throw timetables into disarray, but they also demoralise participants.

Having admitted as much, the amount and wide range of the work that was done by the small team of Consortium partners in the very limited time of 2 years and under often difficult financial circumstances, has been impressive. Many avenues towards the project's goal of '*Extending the European Archaeological Heritage Web over Bulgaria, Romania, and Poland*' have been explored, and many of those have led to fully functional information resources and software prototypes. No less important in this respect are the documentation (in the form of papers, manuals and guides) accompanying the software applications, and the many dissemination activities undertaken among local, national and international groups of archaeological professionals.

A few results may be highlighted here:

- ✓ The ArchTerra project successfully re-developed efficient and effective versions of two Internet services originally developed by the EC Thematic Network 'ArcheoNet': the management system for the ARGE virtual library for European archaeology was made significantly more powerful while use grew almost 6-fold and response speed was increased to a few seconds; the brokering system for archaeological field work EARP was redesigned and redeveloped as the user friendly and low maintenance MEDIOLANVM service.
- ✓ The significance of the project especially for the partnering institutions and the target audience of eastern European professionals may be illustrated by one example here: for the 15 Bulgarian specialists who wrote most of the material for the ArchWeb-BG web pages it was not only their first encounter with the Internet, but also with the wider issues involved in successfully addressing its invisible audience of mixed backgrounds. The three ArchWebs developed under ArchTerra thus not only provide the type of world-wide access to resources for central and eastern European archaeology that is not even available for many western countries today, but also provide a training ground in modern IT applications for those professionals.

Reviewing the results of the ArchTerra project as reported in chapter 2 of this report, we may conclude that the ArchTerra Consortium has been quite successful in fulfilling the more realistic aims and objectives set when it became clear that the original work plan was overly ambitious. ArchTerra has resulted in the acquisition by, and transfer of, experience in a wide variety of Internet applications to the participating archaeologists – for example through the implementation and evaluation of prototype solutions. It is that experience which must now be transferred and disseminated more widely through the project's web presence and other activities specified in the exploitation plan. Since active dissemination is a low intensity time-consuming task (because of the occasional nature of contacts with the intended audience) this is to a large extent to occur only after closure of the project.

Finally, a brief word about the potential for further development of the knowledge and services developed by the ArchTerra consortium. It is envisaged that the CEC project partners will continue to participate in EC projects under the 5th Framework, especially in such programmes as Culture 2000. One particularly exciting area is the further development of the current term lists and thesauri into generalised knowledge management systems (www.netsquirrel.com/pepperdine/edc634/km/) for European Archaeology, including:

- further implementation of standards for the interoperability of thesaurus structures and data-sharing technologies such as XML and RDF schemas (alexandria.sdc.ucsb.edu/~lhill/nkos/; www.w3.org/TR/rdf-schema/) and
- more intuitive user interfaces such as Cmap (cmap.coginst.uwf.edu), Topic Maps (www.topicmaps.com; www.infloom.com), and the Semantic Web (www.w3.org/2001/sw/; www.scientificamerican.com/2001/0501issue/0501berners-lee.html).

Another area of potential development lies in multilingual information structures. ArchTerra has had some results in the language-independent programming of web-database interfaces and of multilingual interfaces, but has made no contribution to solving the underlying technological issues. The experience gained by the partners will be an asset in future projects involving multilingual and multicultural work, e.g. the LIMBER project on Language Independent Metadata Browsing of European Resources (venus.cis.rl.ac.uk/limber/).

DELIVERABLES

The following substantial project deliverables are not fully featured in the body of this report. Full digital versions of all software, manuals and reports are available on the accompanying CD-ROM.

Deliverable 5 (Restricted)

Software script libraries and guides, updated version includes PageMe (Application for on-line personal web page generation, full scripts on CD-ROM), PageIt (idem for objects), and Dan's description of XML interface DTD.

Deliverable 6 (Public)

Generic ArchWeb node description, updated version.

Deliverable 7 (Public)

Generic Museum database description.

Deliverable 11 (Restricted)

Generic Museum site database template (prototype) and guide, updated version to include AIM MIS User Guide

Deliverable 12 (Public)

Internet report on the use of multilingual thesauri.

Deliverable 20 (Public)

Publication of Conference Proceedings.

Deliverable 21 (Restricted)

Manuals for web & database servers administration.

Deliverable 22 (Restricted)

AIM IS Installation and User Manual; a document describing how to implement and use the MIS in a museum.

APPENDICES

A 1: Consortium Agreement

A 2: CIDOC-compliant Museum Information System Descriptions

A 3: CIDOC-compliant Museum Information System Templates

A 1: Consortium Agreement

General principles

- The copyright for information assets produced and published within the project belongs to the author(s) unless specified otherwise. Re-use rights for such assets belong to the Consortium unless specified otherwise.
- Rights to the 'look and feel' of the project's digital products: these belong with the Consortium. With 'rights belonging to the Consortium' we mean that all partners in the Consortium share the rights.
- Any deviations from this Consortium Agreement are to be specified in the Exploitation Plan.

Software rights

Software rights are applicable to both the Museum Information System (MIS) and the script-based applications coded by the partners. Software rights belong with the author(s); the Consortium has re-use and copy rights for all non-commercial purposes.

Publication rights

Publication rights (of both hard copy and online publications) belong to the relevant Consortium partner; the Consortium has re-use and copy rights for all non-commercial purposes provided the source of the material is appropriately acknowledged.

Rights to (re-) use digital data

These rights belong to its author(s); the Consortium has unrestricted rights to the non-commercial use of such data.

A 2: CIDOC-compliant Museum Information System Descriptions

An overview of the ArchTerra CIDOC data model implementation was given by Dr. Vassilev and his colleagues in Vassilev, V. et al. 1999, Museum Information Systems: CIDOC data model implementation in the ArchTerra project, *Bollettino CILEA* **69** (= Deliverable 7).

In addition, two technical reports by the same authors are available as well: Vassilev, V.T. & B. Gaydarska, *Reducing the complexity of CIDOC Object-oriented model through ontological minimization, The ArchTerra experience*; and Vassilev, V. et al. forthcoming, *Drill-down Navigation inside Archaeological Museum Database: Dynamic Classification and Controlled Terminology Implementation*, Proceedings of the 6th Annual Meeting of the European Association of Archaeologists, Lisbon 2000.

All three reports are included in this Appendix.

A 3: CIDOC-compliant Museum Information System Templates

There are a total of 49 different templates for interactive forms needed for building a museum information system as defined by the CIDOC standard; these are listed below. Each contains of 1, 2 or 3 levels of master-detail linked tables on which to base 1, 2 or 3 page interface screens for the implementation of the procedures foreseen in the CIDOC standard. All templates have been developed in an implementation independent manner, so that they can be used with any CIDOC-compliant database implemented as a standard relational database, either in client/server mode of operation from within a local network or in web mode of operation over the Internet/intranet. They can therefore be used as a guideline for the implementation of a fully featured system compliant with the procedures and specifications in the CIDOC document.

Registration of persons, institutions, letters, and sites

- 1 - **Individual Registration:** registration of a person who is playing an individual role (both museum staff members and external archaeologists)
- 2 - **Institutional Registration:** registration of a separate legal body as and when relevant to the museum institution, e.g. Ministry of Culture, universities, institutes, etc.
- 3 - **Letter Registration:** registration of a letter to/from an external institution.
- 4 - **Site Registration:** registration of an important archaeological site (address should be entered first).

Registration, description, retrieval and other handling of museum objects

- 5 - **Artefact Collection:** Acquisition of an artefact directly from an excavation.
- 6 - **Artefact registration:** registration of an artefact as a museum object.
- 7 - **Object Description:** general description of a museum object in free text format.
- 8 - **Object Classification:** Classification of the museum objects according to a specific museum cataloguing system.
- 9 - **Object Find:** finding a museum object according to its specific characteristics.
- 10 - **Object Drill-down:** Browsing the museum object according to the cataloguing principle endorsed by the museum.
- 11 - **Type Find:** Searching museum objects according to the explicit classification based on the type of usage.
- 12 - **Type Drill-down:** browsing museum objects according to their classification into a hierarchy of types.
- 13 - **Virtual Museum Visit:** looking at a particular museum object in the museum holdings via the Web.
- 14 - **Virtual Site Tour:** Looking at the representation of a particular site via the Web.
- 15 - **Virtual Exhibition:** Attending a virtual exhibition via the Web.
- 16 - **Publication Registration:** registering scientific and professional publications (publisher should be registered as a separate legal body).
- 17 - **Object Assessment:** evaluation and recording of the current physical state of a museum object.
- 18 - **Object Measurement:** description of the quantitative characteristics of an object through measurement.
- 19 - **Object Description:** general description of a museum object in free text format.
- 20 - **Object Documentation:** registration of object related documents in different formats: eg, text documents, graphical images and video films.
- 21 - **Object Publications:** describing the publications relevant to a museum object.
- 22 - **Object Classification:** Classification of museum objects according to a specific museum cataloguing system.
- 23 - **Object Move:** moving of an object from one place to another.
- 24 - **Object Deaccession:** Temporary unregistering of a museum object which will not be exposed anymore for some specific reason.
- 25 - **Object Destroyed:** Permanent removal of an object from the museum and destroying it.
- 26 - **Object Lost:** permanent de-accessioning of a lost museum object.
- 27 - **Transfer of Custody:** transferral of an object to another legal body for permanent use.
- 28 - **Object Restauration:** description of the physical status of an object under restauration.

Rights and activities of users and sections

- 29 - **Individual Activity:** description of the professional activities of a registered person (both staff member and external archaeologist).
- 30 - **Individual Publications:** description of the individual publications of a registered person (both staff member and external archaeologist).

- 31 - **Institution Activity:** describing the professional activities of a registered legal body (eg, digging at sites).
- 32 - **Section Registration:** registration of a museum department as a subject of museum activities.
- 33 - **Section Activity:** description of museum department activities.
- 34 - **User Registration:** registration of the information system users with their authentication credentials and authorization rights.
- 35 - **Normative Registration:** registration of a legislative document which is relevant to the museum; both internal documents and documents of national or international validity.

Registration of archaeological sites

- 36 - **Site Description:** general description of an important archaeological site (free format textual description by a museum staff member).
- 37 - **Site Survey:** qualitative description of the most important site characteristics.
- 38 - **Site Documentation:** registration of relevant documents which exist as files, not necessarily available at the museum (text documents, graphic images and video films).
- 39 - **Site Publications:** description of publications relevant to an important archeological site.
- 40 - **Site Reproduction:** representation of an archaeological site in the museum through man-made visual objects (models, maps, drawings, schemes, etc.).

Artefact Copies

- 41 - **Artefact Copying:** acquiring of a copy of an artefact instead of the artefact itself, or producing a copy of an original artefact owned by the museum (the copy does not have to be unique).
- 42 - **Copy Registration:** registration of an artefact copy as a museum object owned by the museum.
- 43 - **Copy Association:** association of the reproduced features of a copy with the observed physical characteristics of an original artefact.

Icons

- 44 - **Icon Registration:** registration of a visual representation of a site as a museum object.
- 45 - **Icon Association:** association of the resulting features of the produced visual representation of a site with the original physical characteristics.

Exhibitions

- 46 - **Exhibition Registration:** registration of collective exhibition of some museum objects – archaeological artefacts, as well as visual representations of archaeological sites and copies of original artefacts.
- 47 - **Exhibition Documentation:** registration of text, graphical and video materials concerning an exhibition organized by the museum.
- 48 - **Exhibition Publications:** description of publications, related to an exhibition organized by the museum (eg, catalogues).
- 49 - **Virtual Exhibition:** Attending a virtual exhibition via the Web.