



FACULTY OF MATHEMATICS
UNIVERSITY OF BELGRADE



NATIONAL CENTRE
FOR DIGITIZATION



MATHEMATICAL INSTITUTE
SANU - BELGRADE

The Fourth SEEDI Conference

Digitization of cultural and scientific heritage

Belgrade, Serbia, June 12-15, 2008

Book of Abstracts

CONFERENCE IS ORGANIZED BY

Faculty of Mathematics, Belgrade

Mathematical Institute SANU, Belgrade

CONFERENCE IS SUPPORTED AND FINANCED BY

Ministry of Sciences of Republic of Serbia

Ministry of Culture of Republic of Serbia

National Center for Digitization, Belgrade

Project *Digitization of Scientific and Cultural Heritage*, proj.no. 6201



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ABOUT THE CONFERENCE

The aim of the Conference is to present and exchange experiences with new information technologies, standards and the other fields in the area of digitization of cultural and scientific heritage, including, but not limited to:

- digital capture and transformation from analogue to digital form,
- describing and representations of heritage objects and documentation about them,
- processing of digitized content,
- presentation and long term preservation of digitized content.

The conference will have a satellite workshop on the Text Encoding Initiative.

PROGRAM COMMITTEE

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Jelena Vukmirović
Tijana Zečević

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**THE FOURTH SEEDI INTERNATIONAL CONFERENCE:
DIGITIZATION OF CULTURAL AND SCIENTIFIC HERITAGE,
JUNE 12-15, 2008,
BELGRADE, SERBIA**

CONFERENCE PRELIMINARY PROGRAM

Thursday, 12.06.

9:00 Registration

9:30 - 10:00 Opening ceremony

10:00 - 11:00 chairman Žarko Mijajlović

- **10:00 - 10:30** Invited speaker, **Dr. Ahmed N. Tantawy, Technical Director IBM Middle East & North Africa** - *The Eternal Egypt Project - IBM Innovation in the Digitization of Heritage*
- **10:30 - 11:00** Invited speaker, **Sreten Ugričić, director National Library of Serbia** - *Culture as Dematerialization*

11:00 - 11:30 coffee break

11:30 - 13:30 chairman Nikola Ikonomov

- **11:30-11:45** **Sergey Antiufeev, Anna Boulyonkova, Irina Kraineva, Andrei Nemov** - *Creation and Scientific Interpretation of Acad. Ershov's Electronic Archive*
- **11:45-12:00** **Nina Vodopivec** - *Sistory.si - ideas, problems and questions*
- **12:00-12:15** **Mile Jovanov, Smile Markovski, Marija Mihova, Nevena Ackovska** - *Directory Search of Digitized Content: An Implemented Solution*
- **12:15-12:30** **Dunja Seiter-Šverko, Lana Križaj** - *Web-portal "Croatian cultural heritage"*
- **12:30-12:45** **Miodrag Mihaljević, Zoran Marković** - *On Basic Cryptographic Techniques and Information Security Management System for Protection of Digitized Documents*
- **12:45-13:00** **Nicoleta Rahme** - *The digitization of the cultural heritage in the National Library of Romania - Objectives and Perspectives*

- 13:00-13:15 **Nikolay Kirov Kirov** - *A software tool for searching in binary text images*
- 13:15-13:30 **Giuliana De Francesco** - *From MINERVA to ATHENA through MICHAEL: Standards and Guidelines fostering Quality Digital Cultural Services*

13:30 - 15:30 lunch

15:30 - 17:30 chairman Smile Markovski

- 15:30-15:45 **Vanja Jovišić, Selma Rizvić** - *Photo-realistic reconstruction and multimedia presentation of the medieval fortress in Travnik*
- 15:45-16:00 **Vladimir Risojević, Dalibor Pančić, Bojana Milošević, Ranko Risojević** - *Digitization Projects at the National and University Library of the Republic of Srpska*
- 16:00-16:15 **Maria Chalkou** - *Arithmetical operations, fractions, progressions, linear equations and roots of real numbers, according to the Codex Vindobonensis phil. gr. 65 of the 15th century*
- 16:15-16:30 **Pavel I. Pavlov, Maria M. Nisheva-Pavlova** - *Some IT Aspects of Building Digital Libraries with Learning Materials*
- 16:30-16:45 **Vesna Aleksandrović, Milan Milovanović, Dragoljub Pokrajac** - *Digitization, preservation and presentation Serbian Sound Heritage*
- 16:45-17:00 **Gordana Pavlović-Lažetić** - *NXD Technologies In WORDNET - Based Document Classification In Serbian*
- 17:00-17:15 **Stevo Šegan, Dušan Marčeta** - *EPHEMERIS CALCULATIONS CONCEPTS: An algorithm for chronology of historical events by principal phenomena of Sun and planets*
- 17:15-17:30 **Sanja Bauk, Ruža Danilović, Nataša Kovač, Snežana Pejović** - *The Central Electronic Maritime Catalogue - A Segment Of Montenegrin Cultural Inheritance Digitalization*

17:30 - 18:30 poster session

- **Žarko Mijajlović, Vesna Vučković** - *The project Digitization of scientific and cultural heritage*

- **Stefana Janićijević** - *Institutions in development process of digitization heritage with standards, policies and strategies in Serbia; Case study: Mathematical digital library with proposals, initiatives and projects*
- **Tamara Butigan-Vučaj** - *Zotero and Greasemonkey: the new web technologies*
- **Milena Vukmirović** - *Applying digital maps in attendance variation hydrographic morphology in Serbia*
- **Tijana Zečević, Nada Đorđević Veselinović** - *Virtual Library - Electronic Library of Old Books and Other Documents*
- **Miloš Milovanović** - *Digitalization of The Book The Eternal Callender by Zacharius Orphelin*

Saturday, 14.06.

9:30 - 10:00 Invited speaker, **Milena Dobрева, HATII, University of Glasgow (Scotland) and IMI-BAS (Bulgaria)** - *Preservation of Digital Content: Interoperability into the Future*

10:00 - 11:30 chairman Jelena Đurović

- 10:00-10:15 **Boyan Bontchev, Manoela Margaritova** - *Inetrnet Portal For Cultural and Historic Landmarks*
- 10:15-10:30 **Aleksandar Vukajlović** - *Archiving of Documentation About Digitalized Materials*
- 10:30-10:45 **Teo Eterović, Nedim Šrndić** - *Introducing the Unified eBook Format and a Hybrid Library 2.0 application model based on it*
- 10:45-11:00 **Vladimir Pajić, Dušan Jovanović, Miro Govedarica** - *Modelin City Hall's Fasade Using Laser Scanning Technology*
- 11:00-11:15 **Miroslav Vraneš** - *Data consolidation: secure and permanent storing and easy exploitation*

- 11:15-11:30 **Stevo Šegan, Sonja Vidojević** - *Orthodox Church Ecclesiastical Calendrics and Serbian Language:: 1 Algorithm, 11 Notionals and 111 Synonyms*

11:30 - 12:00 coffee break

12:00 - 13:30 chairman Dženana Alađuz

- 12:00-12:15 **Nadežda Pejović, Žarko Mijajlović** - *Review of the digitized book "Fundamentals of mathematical and physical geography" by Pavle Vujevic*
- 12:15-12:30 **Poposki Dimitar** - *Digitization and Translation Memory as a building block for Cultural Heritage preservation in the context of Machine Assisted Translation*
- 12:30-12:45 **Nikola Ikonov** - *The making of - digital Books*
- 12:45-13:00 **Snežana Nenezić** - *Digitization of Local Historical Contents Typewriting Manuscripts From Public Library Krusevac and Historical Archive Krusevac*
- 13:00-13:15 **Nenad Mitić, Saša Malkov** - *Database Management System Selection for Storing and Retrieving Digitized Material*
- 13:15-13:30 **Dubravka Bošković, Srđan Popov, Miro Govedarica** - *Site View Reconstruction Using 3D Modeling Techniques*

13:30 - 13:45 coffee break

13:45 - 14:45 chairman Dragan Blagojević

- 13:45-14:00 **Miodrag Živković** - *Selective encryption of Huffman compressed text*
- 14:00-14:15 **Milorad Tošić** - *Social tagging, semantics, annotations and wikis for digital repositories*
- 14:15-14:30 **Aleksandra Fostikov** - *Internet search: medieval Serbia*
- 14:30-14:45 **Ivana Zorić** - *Processing of documents and digitization of photographs from Nikola Tesla`s Personal fund*

- **14:45 - 16:00** lunch
-

Sunday, 15.06.

9:30 - 10:00 Invited speaker **Darko Jevremović** - *Serbian Virtual Observatory*

10:00 - 11:15 chairman Milena Dobрева

- 10:00-10:15 **Bogdan Trifunović** - *Digitization of Local History Collections In Public Library "Vladislav Petkovic DIS" In Chachak: Digitization of The Newspaper "The Voice of Chachak"*
- 10:15-10:30 **Zoran Ognjanović, Bojan Marinković** - *National Catalogue of Digitized Cultural Heritage*
- 10:30-10:45 **Neda Jevremović, Goran Gavrilović, Srđan Kosovac, Nenad Nikolić, Branimir Dotlić** - *Museum Information System Of Serbia Development of A Unified Database*
- 10:45-11:00 **Žarko Mijajlović, Nadežda Pejović, Zoran Ognjanović** - *The Web portal of doctoral dissertations in mathematical sciences*
- 11:00-11:15 **Gordana Tomić, Jacques Hoffman, Aleksandar Đokić** - *Processing of documents From Persona Legacy of Nikola Tesla Using Cutting Edge Document Knowledge Software Solutions*

11:15 - 11:30 coffee break

11:30 - 13:00 chairman Zoran Ognjanović

- 11:30-11:45 **Aleksandra Mirčić, Nenad Jeremić** - *Presentation of the Project for Digitization of Art Documentation Department: READ ABOUT..*
- 11:45-12:00 **Aleksandar Pejović** - *Application of IP MULTICAST in distribution of digitized media*
- 12:00-12:15 **Miroslav Mitrović, Anđa Srdić** - *Ethnographic Museum in Belgrade and Protection of Traditional Dances*

- 12:15-12:30 **Dragan Golubović** - *Presentation of Digitalized "Newsletter of BIH National Museum BIH" and Its Conservation In Digital Format*
- 12:30-12:45 **Stevo Šegan, Sonja Vidojević, Kristina Racković** - *"GODIŠNJAK NAŠEG NEBA" As An Astronomical Heritage*
- 12:45-13:00 **Zana Karkin, Selma Rizvić** - *Virtual 3D Reconstruction of the Orthodox Cathedral of the Holy Trinity in Mostar*

ABSTRACTS

Milica Milosavljević
Digitization and sound restoration engineer
Dragoljub Pokrajac
Delaware State University, Dover USA

DIGITIZATION, PRESERVATION AND PRESENTATION SERBIAN SOUND HERITAGE

National Library of Serbia is carrying out project Digitization of 78 rpm Gramophone records for four years and it goes to the final phase. Working hard on this project, National Library of Serbia preserved and made available recordings which present Serbian sound cultural heritage by its everlasting artistic, social, cultural, ethnological dimensions. Going deeper in researching and exploring of cultural Serbian sound heritage it has come to light that many institutions and collectors all over the country possess various sound recordings on so many different carriers. These recordings can be lost for good by leaving them in inadequate conditions and far from public. Therefore, National Library of Serbia is willing to enlighten National Sound Archive, with one and most important goal - to collect, preserve and present (to domestic and foreign public) oldest Serbian sound heritage.

Along with help from administration, National Sound Archive has to acquire equipment, software for sound restoration, servers and to create user-friendly database and interface for digital objects and metadata presentation. As pioneer institution in Serbia, National Library of Serbia would like to take active role in NSA establishment and help all institutions which are ready to start digitization, by placing its technical resources, staff and experience at disposal.

Goal, structure and organization of NSA will be provided by walking through test database and metadata along with explanation of each step of digitization and sound restoration process.

Keywords: Digitization, Sound, sound archive, Cultural heritage, Database, Metadata, Sound archive, Sound restoration

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Keywords: Digitization, Sound recordings, Cultural heritage, Database, Interface, Sound archive, Sound restoration

**Sergey Antiufeev, Anna Boulyonkova,
Irina Kraineva, Andrei Nemov**
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CREATION AND SCIENTIFIC INTERPRETATION OF ACAD. ERSHOV'S ELECTRONIC ARCHIVE

Academician Andrei Ershov belongs to the generation of first Russian programmers. He is justly regarded as the creator of the Siberian School of Informatics. His substantial contribution to the establishment of informatics as a new branch of science and a new social phenomenon is universally acknowledged, both nationally and worldwide. Andrei Ershov was a member of the IFIP Algol Working Group from the day of its creation in 1962. In 1974 Ershov was awarded the title of Honorary Member of the British Computer Society along with C. Strachey, E. Dijkstra, H. Hopper, and others. In 1980 he was given an IFIP Silver Core for organizing IFIP Congresses.

In 2000, the creation of the electronic version of Andrei Ershov's archive began. The project was initially supported by Microsoft Research and is carried on by the joint efforts of IIS employees and xTech, a Russian IT company. It is supported by grants from RFBR and RHF; Novosibirsk IT companies UniPro and Atapy Software also contributed to the project.

**Sanja Bauk, Ruža Danilović,
Nataša Kovač, Snežana Pejović**

THE CENTRAL ELECTRONIC MARITIME CATALOGUE – A SEGMENT OF MONTENEGRIN CULTURAL INHERITANCE DIGITALIZATION

Central Electronic Montenegro Maritime Catalogue (CEMMC) is multimedia electronic data base which represents, by the contemporary technology and due to the bibliographic standards, described and processed library, archival (and partly museum) materials related to the maritime affairs, from the earliest written and printed documents to the newest official materials and publications placed in the variety of libraries, archivals and museums (government, private and church), maritime organizations, institutions, agencies and associations located in Kotor, Boka Kotorska and Montenegro.

The aims of CEMMC creating are: the realization to an objective insight into the present condition of the materials about maritime affairs, gathering information, enabling uninterrupted and quick users' access to the information, defining and applying adequate measures of preservation for all owners of the materials.

The CEMMC is supported by ACCESS. We assumed this software satisfies the catalogue requirements and offers solid searching spectra, and it is open for searching techniques upgrading by SQL and VBA software tools, through the concepts of usability and users' evaluation. In the domain of the data base exporting to the Internet, typically, besides IIS, ASP has been used as an active complement of the presentation platform created in HTML. Within the next phase, the CEMMC shall be upgraded by the digitalizing the most important maritime hand-written and early-printed documents, and museum artifacts.

The multimedia dimension of the CEMMC will be encircled by adding sound records (e.g. »Bokelian fleet dance«, etc). The project primarily has the educational dimension, as a logic supplement to the maritime educational and scientific and research processes in the maritime affairs.

The project is suitable for integration with the similar data bases, firstly from the Mediterranean countries, and the NGO »Notar« is open for the collaboration at that plane.

Key words: Central Electronic Montenegro Maritime Catalogue (CEMMC), digitalization

Boyan Bontchev

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Manoela Margaritova,

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INTERNET PORTAL FOR CULTURAL AND HISTORIC LANDMARKS

Nowadays, there is more and more information about the cultural and historic heritage published on the Internet. However, for the moment the present materials are uncompleted, not well structured and internationalized, and scattered between many Web sites. Many cultural and historic details are not described while, on other side, users may find a lot of advertisements of nearby resorts, hotels and restaurants.

The goal of the present paper is to describe both software architecture and facilities of a newly developed Web portal for culture and historic landmarks in Bulgaria, where registered users can enter, locate on the map and edit multimedia information about geographical objects by using predefined metadata templates and, finally, publish it by choosing a suitable presentation transformation. The portal offers means for convenient search and landmarks localization on dynamic zoomable geographic map with good navigation, with opportunity for searching objects by location and types or other object characters. The object types and all templates with are to be defined by the portal administrators, without any limitation for any object type.

The portal supports three different user roles: unregistered users, editors and portal administrators. The administrators can create, describe and manage the object types, which define available landmarks type at the portal. The creation of a particular object is executed by editors, who may also edit or delete their objects after approval by administrators. Unregistered users have access to the entire information, but they do not have right to change it.

The object type itself is described by determining metadata multimedia attributes of objects (including image for visualization on the map) and by a XSLT style for representation of the object content (internally stored in XML). The process of creation of an object is separated into five steps: selecting the object type, determining the geographic location of the

object, filling values for the objects attributes in supported languages (Bulgarian and English) and choosing of a style for representation of XML content.

The technology used for the development is Microsoft ASP .NET. For providing a dynamic map, GoogleMap API is used and in addition a second layer is laid over the picture. The layer contains data for settlement, rivers, roads, railroads and lakes in Bulgaria. The additional second layer is used in order to provide detailed information for faultlessly orienting of the users in the territory of Bulgaria. WMS (Web Map Service) of MapGuide is used to generate the layer. The database used is MySql 5.1 – open and free, and providing an easy and fast access to stored data.

In the portal covers the entire process of definition and publication of the objects types and the concrete objects but we plan its extension in near future. The main direction for future development is providing communication between the users, defining paths for visits and sharing pictures of the impressions from the visits of landmarks.

Key words: cultural heritage, metadata templates, portal, geographic maps

Dubravka Bošković, Srđan Popov
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SITE VIEW RECONSTRUCTION USING 3D MODELING TECHHIQUES

We describe concepts related to generating 3D scene based on data acquisition and 3D modeling. The purpose of combining these techniques is creation of a scene which reconstruct site view when data are complete, or probabilistic study of site view when data are only partial. 3D digital spatial model for the area of Campus of University of Novi Sad has been created, which uses digital terrain model as a basic layer. Various other raster and vector layers have also been added to facilitate spatial data interpretation, including 3D model layer which presents artificial objects. For the realization of this 3D scene it is necessary to acquire data using different technologies for data acquisition like photogrammetry, remote sensing, GPS survey and laser scanning.

Key words: 3D scene, 3D modeling, site view reconstruction, visualization

ZOTERO AND GREASEMONKEY: THE NEW WEB TECHNOLOGIES

Zotero and Greasemonkey are the Firefox extensions for improving the web cruising for Mozilla Firefox users. Both software tools are free and open source.

Zotero is aimed for gathering, organizing and analyzing online resources from the Zotero compatible databases. It collects the bibliographic references, whole documents and files, notes, and other items like images and snapshots of web pages. The record could be saved by a simple click on a button, in order to use it later, or just to keep track of it, even in offline mode. Target users are researchers and students, but can be useful to anybody. GreaseMonkey allows writing scripts that alter visited web pages, modifying the content or the usability in order to make a web site more readable or more usable. It is possible to convert the web page to Braille, or to retrieve data from other sites and make two sites connected. Installation of Greasemonkey isn't enough to get all these effects. The user scripts are necessary, containing the Javascript code and some additional elements telling to Greasemonkey where to run it. User script could refer to one web page, one web site or more web sites. There is a Greasemonkey user scripts repository but users are free to write them on their own.

Maria D. Chalkou

Department of Mathematics, University of Athens.

**ARITHMETICAL OPERATIONS, FRACTIONS, PROGRESSIONS,
LINEAR EQUATIONS AND ROOTS OF REAL NUMBERS,
ACCORDING TO THE CODEX VINDOBONENSIS
PHIL. GR. 65 OF THE 15TH CENTURY.**

I present some few results of my study on the mathematical content of the published part (f. 11r-126r) [8] of the Codex Vindobonensis phil. Graecus 65 (Tractatus Mathematicus Vindobonensis Graecus or TractMathVindGr) which the author is anonymous. The other part f. 126v-140r. has been published by H. Hunger and K. Vogel in 1963. This 15th century (1436) Byzantine MS includes the solution of problems of practical arithmetic, and algebra, the roots of which can be traced back to antiquity and their comparison with modern mathematical methods and terminology [9] reveals -apart from some differences- many identities and similarities showing the unbroken continuity of mathematical tradition through the centuries.

The symbols, which are used in TractMathVindGr are the letters of the Greek alphabet but the calculations are carried out with the new decimal Hindu-Arabic system of numeration. Even though the author is not used to the new symbolisation, it should be emphasised that the use of letters and not numbers does not affect the result, since it concerns a system in which the arithmetical value of a letter depends upon its place [62].

In TractMathVindGr the way of defining a fraction is based on the condition that the numerator must be smaller than the denominator. The same notion is extended, within the same Codex to fractions with numerators greater than denominators.

The author of TractMathVindGr works on progressions, particularly with various types of arithmetical ones for which he recommends the group methods of solutions. Although the term "arithmetical progression" belongs to Diophantus [14], whose work copied and commented upon it Maximus Planudes (13th cen.) [13], the author of Codex 65 does not name the sums "arithmetical progression".

In an other chapter the author deals with problems, which are easily solved today by using linear equations, despite the fact that he himself however solves them with practical arithmetic. Because, the author teaches in the following chapters, the methods of solution of quadratic, cubic and

biquadratic equations, anyone would have expected him to solve these problems using equations, so that his students would have had kept less operations in memory.

A customary method used at that time was the one of “false assumption”. Although the use of this method of “false assumption” leads the author, as is to be expected, to a false conclusion result, he reaches the correct answer by applying the qualities of proportions [69].

The chapter on the roots belongs to material, which is clearly algebraic even though the solutions are also given within the well-known form of recipes. However they are thoroughly distinguished by what to being said previously because of their subject and classification by the author in the second book. In the first part of his 2nd book (chapter 117, f. 62v) the author relates, that there are problems, which cannot be solved using the methods in the first book. He also writes that he prefers to give “alternative and dissimilar handling” with which the following problems are solved.

Milena Dobрева

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**PRESERVATION OF DIGITAL CONTENT:
INTEROPERABILITY INTO THE FUTURE**

Digital preservation is an issue that affects every single citizen in the information society. It covers a whole spectrum of concerns, from the long-term access to and use of personal digital objects, to the complex area of information objects' lifecycle management in big institutions from the engineering, governmental, research and cultural heritage sectors. e-government, e-science and e-culture hugely depend on proper storage and access to huge collections of digital resources which should not be affected by the changes in the technological environment.

The importance of this area had been recognised within the European Commission which launched the Digital Library Initiative which as one of the four flagship initiatives in the i2010 programme¹. Digitalization, accessibility online and digital preservation are the basic areas of work in the digital libraries domain. From these three areas, *digital preservation* has a special place because it *guarantees the interoperability of the digital resources in the future*.

The paper will discuss the following topics:

- What is the current understanding of digital preservation?
- What is the current place of automation in digital preservation?
- How to understand better user needs? How adequate to the user needs are the current approaches?
- What are the general and specific application scenarios in digital preservation?

- What are the recent achievements of DigitalPreservationEurope, Planets, CASPAR and SHAMAN projects supported by the European Commission?

We will also discuss what preservation elements should be considered by projects aimed to develop digital resources in the cultural and scientific heritage sector.

Keywords: automation, ingest, workflows, user requirements

INTRODUCING THE UNIFIED EBOOK FORMAT AND A HYBRID LIBRARY 2.0 APPLICATION MODEL BASED ON IT

We are introducing Unified eBook Format (UeBF) and an example Hybrid Library 2.0 application model based on it. The UeBF is a file format for storing electronic books and related metadata we have designed and developed. It differs from other electronic book file formats in its ability to store an electronic book in multiple file formats and related metadata using multiple metadata standards, all in a single file. The format is open and extensible, and the contents can be accessed using a ZIP archiver. Using the said file format, we have succeeded in designing an application model that combines the Hybrid Library and Library 2.0 concepts. We named it Hybrid Library 2.0. It leverages the advantages of a Hybrid Library using the UeBF, like the ability to provide users with paperback and electronic books, and offers Web 2.0 presentation possibilities, such as user interactivity, social aspects and a multimedia experience.

INTERNET SEARCH: MEDIEVAL SERBIA

Rad predstavlja rezultate istraživanja Internet stranica posvećenih srednjovekovnoj istoriji sa posebnim osvrtom na strane povezane sa istorijom srednjovekovne Srbije, čiji spisak je priložen, kao i bibliografija strana sa časopisima u elektronskom obliku važnim za proučavanje srednjovekovne istorije Balkana.

Ključne reči: Internet, srednji vek, Srbija

Giuliana De Francesco

Ministero per i beni e le attività culturali

**FROM MINERVA TO ATHENA THROUGH MICHAEL:
STANDARDS AND GUIDELINES FOSTERING
QUALITY DIGITAL CULTURAL SERVICES**

The MINERVA project, Ministerial NETwoRk for Valorising activities in digitisation (2002-2005) and its enlargement MINERVAplus (2005-2006), were funded by the EC IST - 5th and 6th Framework Programme, with the aim of creating a network of European ministries and national agencies in charge of the national cultural policy, in order to discuss, coordinate and harmonise the activities in the field of digitisation and digital access to cultural and scientific heritage.

The objectives of the project were two-fold: on one hand, the coordination of national policies and programmes, on the other hand, the development of an agreed set of handbooks, recommendations and guidelines, enabling cultural project planners and managers to learn more about digitisation practices and standards and thus carry out higher quality digital cultural services.

Since October 2006, MINERVA activities are being carried on by the eContentplus funded project MINERVA eC, a thematic network in the area of digitisation and digital access to cultural and scientific heritage, cultural information and scholarly content. The consortium brings together stakeholders and experts from all over Europe and supports the European Commission initiative i2010 – Digital Libraries

The results and achievements of the MINERVA projects are disseminated through a set of publications which have proven their worth, as they have been providing support for all kind of cultural institutions engaged in the field of digitisation.

On the basis of MINERVA results in the field of inventories and multilingualism, the project MICHAEL, Multilingual Inventory of Cultural HeritAge in Europe (2004–2007) was designed, then funded by EC eTEN programme. With its enlargement MICHAELplus (2006–2008), MICHAEL has by now created the European Inventory of digital cultural collections, accessible via online services. The European service MICHAEL Culture provides to the European Digital Library ‘Europeana’ the registry of digital collections and a collection-level catalogue of digital cultural items. The

catalogue is created, maintained and increased basing on the contribution of a cross-domain network of thousands of cultural organisations belonging to every heritage and scientific sector.

At the moment of writing, MICHAEL/plus projects are about to close (May 2008) and MINERVAeC goes towards its conclusion (September 2008). A new project, ATHENA, Access To cultural HERitage Networks Across Europe, builds upon MINERVA and MICHAEL, whose achievements will make evolve and develop towards Europeana. Currently under negotiation, ATHENA will encourage and support the involvement and contribution to Europeana of museums and heritage institutions, on the basis of shared standards and in cooperation with other international projects contributing to the European Digital Library. ATHENA's partnership includes 109 museums and heritage institutions belonging to 21 EU member states.

Key words: Digitisation, Interoperability, Digital access to cultural heritage

Dragan Golubović
INFOBIRO digital archive

**PRESENTATION OF DIGITALIZED „NEWSLETTER OF BIH
NATIONAL MUSEUM BIH“ AND ITS CONSERVATION
IN DIGITAL FORMAT**

Digitalization of cultural heritage and provision of access to digitalized collections is standard practice in EU countries. Press, as part of cultural heritage, represents a big challenge to digitalization process. Press material is interesting for a number of reasons (historical, sociological, cultural, etc.)

Author presents a model of digitalization of the „National Museum newsletter“ and its online presentation through INFOBIRO digital archive, and outlines an offline system of preservation of digitalized publications. „National museum newsletter“ is the oldest scientific publication in BiH. Its first issue was published in 1889.

Author will also present experiences of Mediacentre and INFOBIRO digital archive in digitalization of BiH print media and related cooperation with state institutions.

Institutions in development process of digitization heritage with standards, policies and strategies in Serbia

Case study: Mathematical digital library with proposals, initiatives and projects

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and

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Scotland, UK

THE MAKING OF ... DIGITAL BOOKS

The paper can be considered as a practical guide in the process of making digital books from printed editions, especially in regard to the digital imaging part. It summarizes the experience gathered at the Digital Humanities Department of the Institute for Mathematics and Informatics in Sofia. The proposed workflow is put together and tested at the Digitization Centre using a professional Book Scanner Omniscan 5000 TT and standard computer workstations and software.

Keywords: digitization, scanning, image processing, image enhancement, OCR

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INSTITUTIONS IN DEVELOPMENT PROCESS OF DIGITIZATION HERITAGE WITH STANDARDS, POLICIES AND STRATEGIES IN SERBIA

Case study: Mathematical digital library with proposals, initiatives and projects

The paper is about summarizing present situation of institutional digitalization in Serbia. It is as well about analyzing digitization practice of all relevant institutions who were themselves considering the cultural and scientific heritage in new information era.

Present day situation concerning cultural and scientific heritage in Serbia refers on transition and weak socio economical aspect in national institutions, as well as on adoption European standards, policies and procedures. Dominant approach toward collection, selection, conservation, presentation and exploitation of cultural and scientific heritage in Serbia still needs to be redefined according to contemporary European strategy, which was represented in MINERVA reports.

Also, in case study, it will be presented The Virtual Mathematical Library as a cooperative, distributed, hybrid library. Describing an ongoing project carried out by the Mathematical Institute of Serbian Academy of Sciences and Arts, and the Faculty of Mathematics, Belgrade, it concerns building of electronic resources and presentations of electronic editions of mathematical works in Serbia, including retro-digitization of old books, articles and the other mathematical works and development of the corresponding virtual library.

These projects are included in a recent initiative on the foundation and development of the National Center for Digitization.

Conclusion is that the world-wide mathematical community seeks to digitise the existing scientific mathematical literature in order to create a Digital Mathematics Library available on the Internet to all mathematicians

in the world. Serbia could also find position in this cultural-scientific world project.

Key words: cultural and scientific heritage, digitization, digital documents and libraries, standardization, strategies, policies, mathematical digital library, virtual library, scientific journals, retro digitization, digital archives, www, EMS, IMU, MINERVA

Darko Jevremović

Astronomical Observatory in Belgrade

SERBIAN VIRTUAL OBSERVATORY

I will review the newly established project of Serbian Virtual Observatory. In the last few years Virtual Observatories are becoming a new concept in the world astronomy. The main point is to make accessible astronomical data to astronomers regardless of their geographical location. Project of Serbian Virtual Observatory aims to achieve the following goals:

1. Establishing SerVO and join the EuroVO and IVOA.
2. Establishing SerVO data Center for digitizing and archiving astronomical data obtained at Serbian observatories.
3. Inclusion of BelData and other theoretical and simulated data in SerVO
4. Developments of some tools for visualization of data.

Neda Jevremović, Goran Gavrilović

National Museum, Belgrade

Srđan Kosovac, Nenad Nikolić, Branimir Dotlić

Softver informacioni sistemi, Belgrade

MUSEUM INFORMATION SYSTEM OF SERBIA DEVELOPMENT OF A UNIFIED DATABASE

Development of a unified museum database for museums of Serbia is determined by a Strategic Study of MISS (Museum Information System of Serbia) according to which 11 subsystems – modules are derived.

Main subsystems:

Central Register of Serbia

Museum Fund Acquisition

Scientific Research

Museum Fund Storage

All indicated subsystems are based on International Standards for Museum Documentation of ICOM (the International Council for Museums), MDA (Museum Documentation Association), the standards of the J. Paul Getty Institute, the recommendations of the Council of Europe, as well as by the National Standard of Museum Documentation.

The Central Register subsystem for museums of Serbia is functional and is also based on the international standard – base identification card with minimum data for description of heritages.

Relational SQL server database, in the domain of the three remaining subsystems, is created in the Nation Museum in Belgrade in the period from January to April 2008.

The Microsoft framework technology was utilized for realization. Software support for database modeling was Microsoft Visio for Enterprise Architect which contains the Object Role Modeling (ORM).

The project team was composed of the museum and information technology parts. The museum experts from various fields were consulted during the development of the model, so all heritage types will be described by the database.

The created database is the basis for the next step, namely, the creation of a the user application.

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DIRECTORY SEARCH OF DIGITIZED CONTENT: AN IMPLEMENTED SOLUTION

Following the tendency of digital communication as a way of successful information sharing, a need for cultural heritage digitization occurs. But digitization of the cultural heritage solves only a part of the problems. Effective ways of data organization for achieving simple but reliable information access must be found. A system with characteristics of fast data access using the directory data search by some of the attributes can be a possible solution for one searching for digitized information.

In this paper, a simple implementation of directory search system is presented. The system is implemented as a part of the portal of the Center for Digitization of National Heritage in Macedonia, a site that includes over 3000 photographs, 30 3D visualizations, 100 panoramas, 150 videos etc, from places all around Macedonia, covering different areas such as tradition, customs, music and folk dances, natural beauties of Macedonia, historically important people, sacred object and archaeological sites.

Key words: digitization, directory search, CDNH Macedonia

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PHOTO-REALISTIC RECONSTRUCTION AND MULTIMEDIA PRESENTATION OF THE MEDIEVAL FORTRESS IN TRAVNIK

"Fortress" Old Town in Travnik represents one of the most beautiful and most preserved facilities of medieval Bosnia, on which later historical periods left their specific marks. Combining modern methods of 3D reconstruction with different methods of visualization such as making photo-realistic, high-resolution renderings, video-compositing of animated sequences from 3D environment with video sequences that illustrate life in the fortress in the past, building interactive virtual environment integrated into user-friendly, multimedia interface, it was aimed to provide comprehensive user experience and raise awareness about cultural and historical importance of the reconstructed object.

The paper covers all phases in creation of multimedia presentation starting with data collection, planning and design of presentation structure, modeling of the object and the environment, application of photo-realistic textures, camera animation, production other planned multimedia content and combining all into final presentation form.

Key words: virtual heritage, cultural heritage digitalization

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VIRTUAL 3D RECONSTRUCTION OF THE ORTHODOX CATHEDRAL OF THE HOLY TRINITY IN MOSTAR

Destroyed during the war, the Orthodox Cathedral of the Holy Trinity in Mostar is not reconstructed yet. The aim of our project is a recreation of the largest orthodox cathedral in BH, its reconstruction in virtual 3D mode applying computer graphics techniques. The implementation process of this project encompasses a information gathering, modeling the outside and the inside of the cathedral, visualization through Radiance and Maxwell renderers, comparison of these techniques, and in the end, web implementation of the project through a web-site with the additional information on the cathedral.

This project will allow virtual visit to the Orthodox Cathedral of the Holy Trinity in Mostar, a virtual tour of its outside and inside, and learning more on the church history. The most important aspect of this project is the endeavor of the virtual reconstruction and preservation of the Orthodox Cathedral of the Holy Trinity in Mostar as a Bosnian and Herzegovinian religious and cultural-historical heritage. The progress of the project and the information on further plans of the project are specified throughout the work.

Nikolay Kirov Kirov

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A SOFTWARE TOOL FOR SEARCHING IN BINARY TEXT IMAGES

In this paper we present a software tool for searching word images in scanned text documents. We consider that the document pages are represented as files in tif, jpg, gif, png, bmp and other graphic file formats. Our experiments prove the efficiency of the proposed approach-h and show that such type of searching can be successful. Examples of using various languages are presented. Our software is user oriented and can be applied to any collection of scanned documents.

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Zoran Marković
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**ON BASIC CRYPTOGRAPHIC TECHNIQUES AND
INFORMATION SECURITY MANAGEMENT SYSTEM
FOR PROTECTION OF DIGITIZED DOCUMENTS**

High importance of information security of digitized documents has been pointed out as well as certain particular technical elements and the related system framework. Relevant cryptographic techniques are discussed which provide integrity, authenticity and access control of the digital data. The system issues are addressed via consideration of the information security management system dedicated to the digitized documents.

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THE WEB PORTAL OF DOCTORAL DISSERTATIONS IN MATHEMATICAL SCIENCES

We present the Web portal of retro-digitized and new doctoral dissertations in electronic form in mathematical sciences (mathematics, astronomy, mechanics, computer science, theoretical physics) written primarily, but not only, by Serbian scientists. At this moment, this electronic archive of theses is a part of the NCD (National Center for Digitization) Virtual library (<http://elib.matf.bg.ac.yu:8080/virlib/home.jsp>) and it consists of about 200 theses. The first theses, written before the First World War (altogether 11 items) were digitized already in 1996, but the project started in the full extent in 2005. Metadata were developed since then and an Internet oriented database of doctoral dissertations was build. The project is realized in Java as a document management Web application. The project is managed by the Faculty of mathematics and NCD and it is partially supported by the Serbian Ministry of science. Our further plans are twofold. The first one consists of further software development, including OCR, and the technical improvement of the portal, in particular we plan to arrange the better visibility of the archive on Internet. The second one includes the offer to the South-East European countries to join the project according to the SEEDI initiative, as it was discussed at the previous SEEDI conference in Cetinje. We see that this goal could be achieved by networking institutions interested in the project and similar digital libraries, or by building a mechanism for direct submission of dissertations in the electronic form from diverse points to the existing collection of the NCD Virtual library. Also, we compare in the paper our project with similar initiatives in the World, as NDLTD of the Virginia University, European e-theses, UMI and Diplomica.

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THE PROJECT DIGITIZATION OF SCIENTIFIC AND CULTURAL HERITAGE

The project Digitization of scientific and cultural heritage (project number 6201), is as its name explains the project in the area of digitization. The project lasted for three years and four months (January 2005 - April 2008) and it was financed by the Serbian Ministry of Science. Five Serbian institutions were gathered around it, three scientific institutions: the Faculty of Mathematics in Belgrade, the Mathematical institute SANU, the Archeological institute SANU, and two leading Serbian institutions in the area of the culture: National museum and the Museum "Nikola Tesla". The project leader was Žarko Mijajlović. The main objective of the project was development and implementation of standards in the area of digitization and metadata for digitized objects, in particular for textual and image data. On the other hand, the main achievements of the project were development of the Virtual library which now contains more than 300 old and rare books related to culture and science in Serbia. An important sub-collection of the library is the database of doctoral dissertations in electronic form in mathematically oriented sciences of the authors which obtained their degree at the Serbian universities, but also at universities of former Yugoslavia (until 1990). It now contains about 200 theses (of about altogether 600 in the printed form). Further, the date base of clippings was developed, now containing about 500 clippings, from journals and news papers which Nikola Tesla collected, and which are now at the possession of the Museum "Nikola Tesla". Also, two leading Serbian mathematical journals were completely retrodigitized, Publication's de l'Institute Mathematique (since 1932), and Publications of the Faculty of the Electrical Engineering, Ser. Math. and Physics (since 1956). The project participants service the NCD (National Center for Digitization) and it's Web page, and maintain and edit the journal NCD Review (SEEDI communication). Members of the project published more than 20 papers in the area of digitization and more than 20 scientific papers in the area of mathematics and computer science during the term of

the project. Fine cooperation was developed with similar centers in neighboring countries and for these activities Zoran Ognjanović is in particular meritorious.

Miloš Milovanović
Mathematical Institute SANU
Belgrade

**DIGITIZATION OF THE BOOK
THE ETERNAL CALLENDER BY ZACHARIUS ORPHELIN**

In the National Center for Digitization, for a few years, we have been creating a virtual library. It contains some works in mathematical disciplines, corresponding to our country. In this paper, we present digitization of the book *The Eternal Calendar* written by Zacharius Orphelin owned by the Library of Serbian Academy of Art and Science. Zacharius Orphelin is one of the most important Serbian writers of the eighteenth century. He is seen like a founder of the modern Serbian literature. *The Eternal Calendar* is our first book in modern astronomy, so it could be important for scientists interested in history of astronomy. Digitization of this book is done at the Mathematical Institute of Serbian Academy of Art and Science and it will be published in the Virtual Library of NCD.

Aleksandra Mirčić,
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Museum of Contemporary Art, Belgrade

**PRESENTATION OF THE PROJECT FOR DIGITIZATION
OF ART DOCUMENTATION DEPARTMENT:
READ ABOUT...**

Art documentation department gathers, prepares, categorizes and stores professional literature (books, catalogues, periodicals and electronic editions), daily press, archive material and photo documentation from the field of visual arts, especially modern and contemporary international, Yugoslav and Serbian art. Thanks to the systematic gathering of materials, which followed the forming of various collections and the MoCA exhibition activity, the department is now in possession of the finest and most complete documentation, including all the materials about both the art and artists from the territory of ex-Yugoslavia. Regarding the scope, the thoroughness and the quality of the fund itself, the department represents a local research-documentation center of great importance for the studying of 20th century art.

We chose to start with separate digitization of artists' bibliographies. This first project is entitled Read about... We started the whole project in collaboration with the National Library of Serbia as the institution with the most experience in digitization, and with National Center for Digitization.

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DATABASE MANAGEMENT SYSTEM SELECTION FOR STORING AND RETRIEVING DIGITIZED MATERIAL

We are witnesses of increasingly use of database management systems (DBMS) for storing and retrieving digitized material. Database management system is one of key factors for digitalization project success. Different modern DBMS have different characteristics important for storing and retrieving digitized material. Therefore DBMS selection depends on project goals. In this paper a short overview of modern DBMS characteristics is given, as well as some recommendations for DBMS selection with respect to project goals.

Miroslav Mitrović,
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Ethnographic Museum, Belgrade

**ETHNOGRAPHIC MUSEUM IN BELGRADE
AND PROTECTION OF TRADITIONAL DANCES
(a presentation)**

The presentation will include 12 slides, which will be divided into three sections.

The first section of four slides will present museum work in Serbia, with a highlight on statistical data, then Belgrade museums which are in charge of all museums in Serbia, and particularly the Ethnographic museum in Belgrade.

The second section of four slides will present the definition of the museum and intangible cultural heritage. These slides will also present the work of the Ethnographic museum in Belgrade on protection of intangible cultural heritage and particularly the methods of documenting and protection of traditional dances.

The last, third section of four slides will present different types of recording and documenting traditional dances, (Laban, videos, silent video recordings) as well as different types of documented Balkan area dances which are divided into several categories: individual dances, dances within costumes and rituals, naïve choreographies, professional choreographies of national folk dance ensembles etc.

Snežana Nenezić

Narodna biblioteka Kruševac

**DIGITIZATION OF LOCAL HISTORICAL CONTENTS
TYPEWRITING MANUSCRIPTS FROM PUBLIC LIBRARY
KRUŠEVAC AND HISTORICAL ARCHIVE KRUŠEVAC**

We present our new project, a new digital collection in Public Library Kruševac. Our Local History Collection include original papers of individuals and organizations, many from the second half of XX century. Since the library digitization efforts are initially focused on its local history we selected a small collection of typewriting manuscripts (16). The same collection have and Historical Archive Kruševac. Author of this collection is from Kruševac, Kuzman Nikolić, man who was a in Second World War. These typewriting manuscripts for subject have a Second World War in Kruševac and they are very interested for our community.

Every one of this digital documents consist of complex system of digital files. One typewriting manuscript has 300 pages this is more than 1500 digital files (Gallery, View, Internet) and we have a set of graphic files. This documents are only text, and in two colours, black and white.

Our aim is to provide access to the objects that are subject of research of specific groups. We offer access and added-value services to individuals.

Keywords: digitization, local history collection, typewriting manuscripts, archive, long-term preservation, accessibility

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NATIONAL CATALOGUE OF DIGITIZED CULTURAL HERITAGE

During the last SEEDI meeting we presented a recommendation for the national standard for describing digitized heritage. Now, we are going one step further. We have developed an XML scheme and a data base based on this standard, as a pilot project and proposal for the national catalogue of digitized heritage. In this paper we will present methodology, tools that we have used and the realized software solution.

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MODELING CITY HALL'S FAÇADE USING LASER SCANNING TECHNOLOGY

We describe concepts related to facade modeling based on laser scanning. The City Hall of Novi Sad was chosen as object of interest. City Hall's facade scanning was performed using Leica HDS6000 scanner. Scans were taken from three different locations to acquire all pieces of the facade. A GPS receiver was used to measure coordinates of three different points on the facade, so that scans may be georeferenced later in the process. At the end of scanning process there were three point clouds which represented front, west and east parts of the City Hall's facade. Further, Leica Cyclone 5.7 were used to process point clouds. Point clouds were processed to remove all the points that did not belong to the facade. Refined point clouds were exported in DXF and 3DS formats and visualized in Leica Virtual Explorer Architect.

Key words: facade modeling, laser scanning, visualization

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SOME IT ASPECTS OF BUILDING DIGITAL LIBRARIES WITH LEARNING MATERIALS

We present some initial results of a project directed to the development of a methodology and corresponding software tools for building academic digital libraries. A particular functional model of academic digital library has been discussed. The emphasis falls on some solutions of the large set of problems concerning the development of proper mechanisms for semantics oriented search in multilingual digital libraries. A model and a prototype of an academic digital library providing different categories of users with proper access to learning materials in the fields of procedural, object oriented and functional programming will be the final result of the project. The paper discusses the requirements of the basic types of users of such digital library and suggests some relevant solutions.

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NXD TECHNOLOGIES IN WORDNET-BASED DOCUMENT CLASSIFICATION IN SERBIAN

Since document retrieval is usually performed on proper names, document classification may be based on an ontology of proper names (Grass et al. (2002)). Proper names for document classification in Serbian may be extracted from the semantic lexical database - Serbian wordnet (Krstev et al. (2004)), containing around 11000 concepts, 9% of which being proper names. Classification criteria may be constructed from the hierarchy rooted in the most productive concept which is in hypernym relation with the proper name i.e., in the proper name's ontology term. They consist of all the concepts that are in hyponym, hollo / member and other relations defined in the wordnet. For example, for the proper name "Zemlja" (Engl. Earth), third-level hypernym, "nebesko telo" (Engl. celestial body), would correspond to a proper name ontology term, and the hierarchy, rooted at "nebesko telo", would constitute the basis for definition of the corresponding class.

On the other side, document classification may be based on the most productive concepts in each of the Wordnet ontology term hierarchies. Classification criteria are then constructed from all the terms from the hierarchies rooted in such concepts.

Native XML databases are the natural framework for dealing with such issues. Such a framework is presented in the paper and illustrated by examples, showing that technologies underlying NXD may greatly simplify the tasks.

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Pavlović-Lažetić, G. *Native XML databases vs. relational databases in dealing with XML documents*, Kragujevac J. Math. 30 (2007), 181–199

APPLICATION OF IP MULTICAST IN DISTRIBUTION OF DIGITIZED MEDIA

IP MULTICAST is a method which makes possible distribution of IP data to anonymous and unknown number of users. Pay-TV operators and some educational institutions with significant on-campus student housing have deployed IP multicast to successfully deliver one-way streaming media such as high-speed video to large groups of receivers. Comparing to the similar technologies, the main advantage of IP multicast is in distribution of data via only one shared connection. In this way, the minimal work load of the server and the traffic load of the network are achieved, and distribution of data is practically independent of the number of users. We see the application of this technology in the area of digitization in distribution of IP mass data such as digitized video and audio material, 3D scans and presentations and other massive multimedia data. The aim of this paper is to warn the specialists working in the digitization to this IP technology and its competitive advantages in possible applications in this area such as building IP portals containing massive data suitable for one-way streaming.

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**REVIEW OF THE DIGITIZED BOOK FUNDAMENTALS
OF MATHEMATICAL AND PHYSICAL GEOGRAPHY
BY PAVLE VUJEVIĆ**

The book *Fundamentals of mathematical and physical geography* (in Serbian *Основи математичне и физичке географије*) is one of the first university textbooks on geography written in Serbian. The author of the book is Pavle Vujević (1881–1966), the notorious Serbian climatologist, the professor of the Belgrade University and the member of the Serbian Academy of Science and Art. The book consists of two volumes. The first volume is printed in 1923, while the second one is printed in 1926. For many generations of students of geography, even today, this textbook was an entering point into mathematical and physical geography and astronomy. This book is rather comprehensive; it consists of 815 pages and four sections. The first volume is made up of two sections, *Mathematical geography* and *Physical geography*, while the second volume covers the atmosphere and Oceans. The first book is in fact an introduction in astronomy. It covers in details all basic notions and facts of this science known at the time when the book was written. In the second volume there are explanations of the chemical composition of the Earth atmosphere, climate types and their secular changes, then composition and physical characteristics of World oceans, the ebb-tide phenomena and the characteristics of the seabed. The book is well and methodically written and contains many illustrations. Having in mind its influence on the geographical community in Serbia and it's in many aspects the mathematical character, we decided to digitize it and include into the NCD Virtual library (<http://elib.matf.bg.ac.yu:8080/virlib/>). Digitization of the books as the presented one is a part of the project of retrodigitization and electronic archiving of books with topics in mathematical sciences (mathematics, astronomy, mechanics, theoretical physics and mathematical geography) written by the Serbian authors in the past. In this article we present the content of the book, also some interesting facts related to this book, including changes in terminology and definitions in this area since the book was published, in particular in astronomy.

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**DIGITIZATION AND TRANSLATION MEMORY
AS A BUILDING BLOCK FOR CULTURAL
HERITAGE PRESERVATION IN THE CONTEXT
OF MACHINE ASSISTED TRANSLATION**

Digitization is often used as a model for building up scientific repositories that preserve most of the scientific data that can not be found today in a digital format. This case study concentrates on the digitization of the Terminology books once made by the Macedonian Academy of Science and Art for the purpose of building up various dictionaries with valuable terminology data. Unfortunately, none of the terminology dictionaries was actually used for the translation process until today. With the raise of awareness and the importance of (Computer Assisted Translation) CAT it is very valuable to preserve this scientific terminology databases and to convert them into digital format usable for the translators community. The first stage of the process includes Scanning, Image Enhancement, Optical Character Recognition, proofreading and the conversion of the terminology dictionaries into Microsoft Excel Tables. The second stage continues with the conversion of the data into translation memory database using Multiterm, which later can be used in the CAT process (i.e. Trados, SYSTRAN).

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National Library of Romania

THE DIGITIZATION OF THE CULTURAL HERITAGE IN THE NATIONAL LIBRARY OF ROMANIA OBJECTIVES AND PERSPECTIVES

The National Library of Romania is an important institution constantly focused in the process of long-term preservation and permanent access to the cultural heritage. The purpose of this document is to set out two action areas: first, strengthen efforts to expand and improve access to the digital knowledge and joining partnerships with the libraries from the national system of libraries in order to sustain the sharing of the documentary, technical, human and material resources, and secondly, to define a Public Policy for the digitisation of cultural resources and the creation of the Digital Library of Romania, already adopted since January 2008. In this regard, a feasibility research study on digitization, digital preservation and online accessibility of library resources has been conducted among the cultural institutions that own cultural material eligible for digitization. The results of the study give us a proper evaluation and an approach of the documentary corpus of the national library system, the stage of the digitization process, the technical infrastructure, as well as the training level of the staff. Also, a coherent and integrated digitization solution at a national level has been established in compliance with the requests and standards established by The European Digital Library, thus ensuring the interoperability with EDL. The National Library of Romania, by its legal functions, by its structure and organization, by its methodological functions, can coordinate at the level of the national system of libraries the activity of digitization and organization of the National Digital Library.

Keywords: National Library of Romania; Digitization; Digital library; Public policy; Projects.

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Bosnia and Herzegovina

DIGITIZATION PROJECTS AT THE NATIONAL AND UNIVERSITY LIBRARY OF THE REPUBLIC OF SRPSKA

We present two digitization projects at the National and University Library of the Republic of Srpska. These are digitizations of magazines „Razvitak“ and „Školski vjesnik“. We describe the material, as well as procedures for scanning and creation of metadata. We briefly describe Greenstone, software for creation and distribution of digital collections. We also describe the design and implementation of web-based user interface for accessing these collections. The collections we created are searchable by titles, keywords and authors' names, and hierarchically browsable by volumes and issues or by the index of authors.

Key words. Digitization, cultural heritage, Greenstone, Web-portal
„Croatian cultural heritage“

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WEB-PORTAL „CROATIAN CULTURAL HERITAGE“

The web-portal „Croatian cultural heritage“ is the central networking point that enables accessibility and browsing through digital collections which already have been or will be developed within the National project of digitisation of archival, library and museum holdings. It contains digitisation guidelines and instructions as well as other information and thereby offers support not only to this project but also to other projects, institutions and individuals who deal with or wish to deal with digitisation of their holdings.

The portal has several fundamental functions: the presentation and the promotion of Croatian cultural heritage and creation of new possibilities for the use of material presented on the portal enabling the viewing, searching through and access to digital collections supporting the National programme of digitization dissemination of information, content and experiences support for the development of the digitisation standards and implementation of standardised procedures as the key presumptions for interoperability encouraging the cooperation between institutions already involved in digitization dissemination of educative contents

From the technical point of view the portal fulfils following basic requirements:

- visibility/clarity
- simple navigation
- simple, functional, sophisticated and recognisable design
- active web-pages with dynamic contents
- quick downloading
- searchability
- optimised for print

Beside the main contents, the portal also contains general information on National programme of digitisation, information on activities conducted within the framework of the Project, register of the submitted subprojects, access to searchable digital collections created through the Project, standards, guidelines and technical specifications prepared or applied within the Project, and the selection of the representative objects of the Croatian cultural heritage.

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**EPHEMERIS CALCULATIONS CONCEPTS:
AN ALGORITHM FOR CHRONOLOGY
OF HISTORICAL EVENTS BY PRINCIPAL PHENOMENA
OF SUN AND PLANETS**

In the age of intensive exploring of solar system, the many professionals and non-professionals becoming interested in calculating of basic data regarding Sun and planets. We have considered some concepts of the planet's physical ephemeris calculation as a task in a rounding of increasing number of powerful computers available to everyone. Elementary information and international conventions in this calculation practice is done as an effective tool for practical identifying historical events.

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**ORTHODOX CHURCH ECCLESIASTICAL CALENDRICS
AND SERBIAN LANGUAGE: 1 ALGORITHM,
11 NOTIONALS AND 111 SYNONYMS**

The notionals met historically in the ecclesiastical calendrics of the Orthodox Church are given and presented through the algorithm for Easter calculating (1) which will involve (still does not involve!) all 11 notionals with 111 synonyms and expressions from the church calendar practice and secular interpretations. The aim is to achieve a more simple identification of historical events since the moment of arising can be easily identified for some notionals. The algorithm has also a controlling character for all algorithms concerning the Easter determination formed up to now because it has been developed on the basis of a detailed comparison.

Key words: Algorithm for Easter determination, Orthodox Church, identification of historical events.

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**“GODIŠNJAK NAŠEG NEBA”
AS AN ASTRONOMICAL HERITAGE**

The first volume of 'Godišnjak našeg neba' for the year 1930, published in 1929, has been fully digitized. For the period between 1930 and 1962, we have identified and digitized the cover pages and pages with contents for all other volumes which exist as published issues, except for 1959, 1960 and the last one for 1963. These three volumes have been declared as manuscripts which were not published due to lack of finances.

Key words: digitization, astronomical heritage, “Godišnjak našeg neba”

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THE ETERNAL EGYPT PROJECT - IBM INNOVATION IN THE DIGITIZATION OF HERITAGE

Information Technology can enable numerous innovative approaches in support of the various activities related to Cultural Heritage. Examples of such activities include the archiving and dissemination of historical information, the scanning and preservation of ancient manuscripts, the three-dimensional reconstruction of artifacts, and the virtual reality rendition of monuments and cities that no longer exist.

In return, Cultural Heritage is providing very stimulating challenges that the Information Technology specialists need to address. Examples of technologies that have to be pushed beyond current limits include imaging technology, pattern recognition, database architecture, mobile computing, speech processing, and automatic translation. To illustrate this, let us consider the complexity of scanning and processing images of broken and deformed artifacts, especially those that have transparent or shining parts, such as crystal or gold. Let us also imagine the possibilities of exploration that a well designed database that links artifacts to their original sites, their current display locations, and other artifacts that they were usually associated with or attached to. Let us now couple that with a full virtual reality rendition(s) of scenes of the past, showing people using temples, homes, fields, and palaces where such objects were located. Let us go one step further and consider designing such systems in a way that simplifies their evolution to accommodate the corrections and refinements that reflect the new theories that new discoveries bring about.

The rich interaction between Cultural Heritage and Information Technology is offering a very interesting challenge that fascinates many but one that very few can address. IBM has embarked in a journey of exploration, pushing the frontiers of Information Technology alongside those who need to push the limits of the exploration, documentation, and preservation of Cultural Heritage.

This presentation highlights the challenges that our team of over 200 technologists and culture experts has faced and the results it has achieved in the Eternal Egypt Project. It should be noted that this project has benefited

from the technical advances that were developed during previous projects in places such as Italy and Russia. The lessons learned in Eternal Egypt led to innovation that is made available to subsequent projects in America, China, and elsewhere.

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**PROCESSING OF DOCUMENTS
FROM PERSONAL LEGACY OF NIKOLA TESLA
USING CUTTING EDGE DOCUMENT
KNOWLEDGE SOFTWARE SOLUTIONS**

The paper proposes the basic suppositions of optical text recognition (OCR), short summary and current trends in the development of these technologies. Main areas and advantages of these technologies are presented, especially in the field of protection and use of written cultural heritage. Possibilities of processing various documents from Tesla's ample personal legacy are shown as an example of use.

SOCIAL TAGGING, SEMANTICS, ANNOTATIONS AND WIKIS FOR DIGITAL REPOSITORIES

The potential for the digital repositories of scientific and cultural heritage to make an unprecedented social impact is great. The digital repositories introduce a fundamental change comparing to the traditional setting including archival, indexing, and knowledge management methods, to name just a few. The change is mainly due to the virtually unlimited scaling along two dimensions: 1) The number of artifacts in the digital repository; and 2) The number of users (both professionals and visitors). As a consequence, the big challenge is how to manage the semantics of a set of the huge number of digital artifacts as well as how to organize the interaction with large number of users with different cultural needs. In this paper, we present an overview of the current developments in the Web science that may help us address the challenge, with a focus on Wikis and Social Tagging. We describe basic mechanisms that may be used to supplement the data architecture of the repository with an emergent semantics approach. Finally, we present an illustrative practical example of using a wiki based social tagging Web platform for a hypothetic museum application.

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Čačak, Serbia

**DIGITIZATION OF LOCAL HISTORY COLLECTIONS
IN PUBLIC LIBRARY “VLADISLAV PETKOVIĆ DIS”
IN CHACHAK: DIGITIZATION OF THE NEWSPAPER
“THE VOICE OF ČAČAK”**

This paper includes description of digitization program of Local History Collections, introduced in Public library “Vladislav Petković Dis” in 2006. It emphasis examples from practice, which for two years were applied and modified in Library at Čačak, through development of own software solution and project management. Particular part of the paper is dealing with digitization of the most important newspaper published in Čačak, “The Voice of Čačak”. This project introduced requisite framework (digitization rules, database, search engine, user-friendly interface, etc) for all future digitization of Local History Collections and building of all new Digital Library, which is going to replace the existing one.

Sistory.si is an education and research portal of Slovene historiography. In addition to digitising Slovene historical sources and literature it provides a platform for international and interdisciplinary discussions on current events, findings or new publications. Its aim is also to open up the space for local, national and international connections in the field of research and education. The portal has just recently been opened to the public (in 2008), even though, it is considered to be an on-going process. The paper will discuss initial ideas, problems and further questions accompanying the establishment of the portal.

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ARCHIVING OF DOCUMENTATION ABOUT DIGITALIZED MATERIALS

Increase of quantity of digitalized material has caused a need for searchable database about digitalized collections. Documentation about digitalized material could be stored only in one database and data could be extracted from database when ever it's needed. Reports can contain different type of data (scanned documents by type of collections, by issuing date, by date of scanning or photography, etc.). This presentation is aiming to present one of possible solutions of using Microsoft Access database for storing data about digitalized material in one institution. It uses experience of digitalization in Public library "Vladislav Petković Dis" in Čačak as a foundation for proposed solution for archiving.

**APPLYING DIGITAL MAPS
IN ATTENDANCE VARIATION
HYDROGRAPHIC MORPHOLOGY IN SERBIA**

We describe digital maps whose tracking variation on hydrographic morphology in Serbia. Those digital maps were doing in ratio 1:100.000. Also, we describe precision and reliability those maps to illustrate physically-geographic elements of maps, then their cultural and educational value and importance.

DATA CONSOLIDATION: SECURE AND PERMANENT STORING AND EASY EXPLOITATION

We point the importance of storing data on safe and secured systems which will help and allow us to keep data permanently safe for future usage and new born generations with focus on cultural heritage. In todays world, we can keep and store data in two ways, digitized or in old fashionable «paper» way. Digitization of cultural heritage is giving us millions of new photographs, videos, 3D animations, historical documents, songs, music etc... that appears in different file formats. Permanent and secure storing of this data is a must for all of us. If keeping data unsecured there can always be a risk in loosing entire generation's cultural history. Virtual data will give endless possibilities to all people of interest to search, learn from, and use all the given data without their physical presence. Other important moment is fast access to requested data and easy usage for all people of interest.

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VIRTUAL LIBRARY – ELECTRONIC LIBRARY OF OLD BOOKS AND OTHER DOCUMENTS

The aim of the Virtual Library is the development of a suitable technology for the creation and maintenance of a virtual, distributed library of retro-digitized mathematical books and other digital documents. Virtual Library contains useful tools for those involved in the implementation of programs, as well as information and publicity material for the general public. The final aim is to allow mathematical documents to be presented, received and processed on the Web.

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PROCESSING OF DOCUMENTS AND DIGITIZATION OF PHOTOGRAPHS FROM NIKOLA TESLA'S PERSONAL FUND

The work presents methods and results of processing and digitization of Tesla's photographs undertaken in order to systemize the data they're containing in the best possible way, as well as to provide them protection and make them available to the wider circuit of users.

Due to specific and unique nature of materials, techniques and various templates, although registered as archive subject matter, photo materials from Nikola Tesla's Personal fund presents, according to many parameters, an individual group and demand a special treatment in means of description and preservation. This task is highly important, especially considering that UNESCO has, in 2003, enlisted Tesla's Archives into the register "Memory of the World", which is the highest form of preserving the cultural heritage.

The project of digitization considered choosing the methods of digitization, hardware support, digital formats, data storage media and ways of protection of digital data, as well as creating a relation database organized in such manner to make it possible to explicitly identify, locate, label and describe each photograph, but also to record data of its museum "life". The computer application Tesla_Photo has been produced, made in order to enable an efficient search of all available digital records and information on photographs, as well as efficient realization, recording, filing and tracking of external and internal demands for the use of the materials.

Objective point of the processes of digitization in the Nikola Tesla Museum, apart from protecting of the materials, is to make a unique information system to join all museum collections.

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SELECTIVE ENCRYPTION OF HUFFMAN COMPRESSED TEXT

In order to improve encryption efficiency, it is possible to partially encrypt the result of plain text compression. We carried out experiments with the selective encryption of Huffman compressed text files. Some possible trade-offs between the encryption efficiency and the encryption strength are discussed.

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VIMINACIUM - A TOURIST ATTRACTION

Introduction

The ancient city of Viminacium is unique in many aspects. It is exceptional with respect to the number of excavated graves (over 13,500 graves have been identified) as well as the quantity of artifacts found in them (over 32,000 objects); it is exceptional in terms of the surface area unencumbered for archaeological investigation (over 1,100 acres/450 hectares for the greater metropolitan area and 540 acres/220 hectares in the city territory proper). The remains of Viminacium extend entirely over cultivated fields, and both fragmentary and sometimes whole ancient artifacts lie scattered on the ground surface. All of these factors had to be taken into consideration in defining the objectives of the Viminacium Project, and, consequently, in devising the methods of exploration in the ancient city and military camp at Viminacium. That is why established scientists in various fields - mathematicians, electrical engineers, geophysicists, geologists, petrologists, and experts in artificial intelligence, remote sensing, three-dimensional modeling and formal analysis - were assembled for this project. A step forward had to be taken to move on from just exploring cemeteries, the cities of the dead, undertaken during the last quarter of the twentieth century, to investigating the city and the military camp proper.

The reputation of the cultural richness of Viminacium has drawn the attention of not only the domestic but also the international public, who eagerly anticipate that Viminacium will take its rightful place in the first rank of the world's cultural monuments. It is our expressed intention to uncover this city which has been buried for centuries, to explore it in detail and to interpret the remains for the general public. We sincerely hope that in the years to come Viminacium will become a distinguished symbol of Kostolac and its region and a significant part of the world's cultural heritage.

The information gathered to date leads us to conclude that the present-day territories of the villages of Stari Kostolac and Drmno, which are located about 2 miles/3 kilometers from Kostolac and 60 miles/100 kilometers southeast of Belgrade, lie within the limits of the urban territory of the ancient city of Viminacium, the capital of the Roman province of Moesia Superior, which was called Moesia Prima in the late Empire.

Historical Sources

The military camp at Viminacium certainly came into existence when the Roman Empire spread to the Balkans, probably during the early decades of the 1st century AD when the Romans first reached the Danube. The discovery of a Celtic necropolis at the "Pećine" site at Viminacium clearly attests to its beginnings on the territory of the Celtic Scordisci. The size and importance of the base originated from a number of factors, among which should certainly be mentioned the rich agricultural hinterland in the Mlava River valley where Viminacium is situated and its important strategic location within the defensive system of the northern frontier of the Empire and also in regional communications and trade networks. Also important was the location of the legionary camp, and later the city, at a junction of roads linking the northern part of the Balkan peninsula with other parts of the Empire in all directions. One road led south in the Balkan Peninsula through Moesia Superior towards Macedonia and Greece.

A second road, starting in Pannonia, extended along the Danube to the mouth of the river at the Black Sea. Another road connected Viminacium to the north with the Roman province of Dacia through the neighboring camp at Lederata, the modern village of Ram. Although the primary function of these roads was military and strategic in nature, they were also in constant use by commercial travelers throughout antiquity and certainly contributed to Viminacium's role as a prosperous trading and manufacturing center.

Viminacium's importance is also reflected in the number of times it is mentioned in ancient literary sources, extending from the 2nd to the 9th century. References are made by Ptolemy, by Iulius Honorius in his *Cosmographia* and in Hierocles' *Synecdemus*. Viminacium appears in all the known Roman itineraries: the *Tabula Peutingeriana*, *Itinerarium Antonini* and *Itinerarium Burdigalense*. There are also references in later writers, Theophylactus Simocatta, Theophanes the Confessor and Anastasius Bibliothecarius.

In Latin sources, it is sometimes designated as *Viminatio*, for example, in the *Tabula Peutingeriana* (217,5); sometimes as *Viminacio* or *Euminacio*, for example in the *Itinerarium Antonini Augusti* (133,3); and also as *civitas Viminacio* in the *Itinerarium Burdigalense* (564)

In Greek sources, Viminacium is mentioned for the first time in Ptolemy's *Geography* (III 9,3), appearing as *Uiminakion*. On Ptolemy's map Viminacium features prominently. Priscus (frag. 2, 280 and 8, 305 *et*

passim.) refers to it as *Biminakion*, and Procopius (*De aedif.*, IV, 5) uses the same designation, while Theophanes (Chron., 24) calls it *Bimenakion*. In a profane geographical manuscript from the first half of the 6th century, known as Hierocles' *Synecdemus* (657,2), Viminacium is designated as *Bimenakion metropolis*. In the *Notitia Dignitatum utriusque imperii*, which reflects the situation on the Danube frontier before the year 376, more specifically in the era of Valentinian I and Valens, Viminacium is mentioned as the base of the VII Claudia Legion (*legio VII Claudia*). The legion is indicated as having a *praefectus legionis septimae Claudiae*, as well as having a *cuneus equitum promotorum*. It is also a base for the Danube fleet with a *praefectus classis Histicae Viminacio*. According to the standard historical interpretation, primarily relying on Priscus' text, Viminacium perished in a Hunnic attack in 443, which is also documented by finds of coin hoards. The best-known coin found from that period to date is an issue of Theodosius II. Later, in the 9th century, the presbyter-cardinal Anastasius Bibliothecarius, in his work *Chronographia Tripartita* (23), refers to Viminacium as *Viminacium*.

In itineraries, Viminacium is always on a crossroads. In the *Tabula Peutingeriana*, Viminacium is described as a place with connections in all directions. From the west, a road comes from Sirmium via Singidunum and Margum, and continues on eastward and southward. The itineraries mention that Viminacium is 10 miles distant from Margum. To the south, the road went on to Naissus, the first stop on the way being *Munecipio* (*Chronogr. Tripartita*, 23) or *Municipio* (*Tab. Peut.* and *Itin. Ant.* 134,1), 18 *milia passuum* distant from Viminacium. A somewhat different picture is shown in the *Itinerarium Burdigalense* (564, 10) which indicates a *mutatio Ad Nonum* between Viminacium and *Municipium*. The roads to Dacia and down along the Danube did not diverge at Viminacium but at some distance to the east of the city.

According to the *Tabula Peutingeriana*, the road to Dacia branched off at a distance of 10 *milia passuum* from Viminacium *via Lederata*, then passed through Apofl at 12 *milia passuum* further on, and on to Arcidava on the left bank at a distance of 12 *milia passuum*. Lederata (Byzantine *Litterata*) is usually taken to be at present-day Ram and across from it, Banatska Palanka, where fortifications secured the Danube crossing.

The locations of the camp gates and the cemeteries at Viminacium partially indicate the directions of the Roman roads leading south and east. We know for a fact that the left and right banks of the Mlava River were

spanned by a bridge, whose remains were recorded by Jireček, Kanitz and Milićević. Still to this day the local toponym for this site is “Kameniti brod (the stone boat)”. Today, when the water level is low, a stone structure in fact is sometimes visible. To the east of the bridge, on the right bank of the Mlava, traces of an old road have been identified.

Priscus, an author who writes in Greek, tells us that in 441, after they crossed the Danube, the Huns sacked numerous towns and forts, including Viminacium. It is only from Procopius (*De aedif.*, IV, 5) that we learn that the old Viminacium had been razed to the ground and that the Emperor Justinian erected a totally new city. Although Priscus’s text states that the Huns devastated towns and forts, it is not quite clear whether the same fate befell Viminacium. On his part, Procopius explicitly says that “the city was razed to the ground”, but this statement may only refer to an assumed Roman settlement on the left bank of the Mlava, on the ruins of which a Byzantine city could have been built.

An episcopate was definitely located within the city (Hier. *Synecdemus* 657,2), and Viminacium was under the jurisdiction of Justiniana Prima, as we learn from *Nov. IV (De privilegis archiepiscopi Primae Justinianae)*.

Even though in 584 the Avars invaded Viminacium (Theoph. Sira., *Historiae*, I 3-V), this event nevertheless did not mark the end of its history. Around 600 A.D., the Byzantine Empire went on the offensive. The Roman army assembled at Viminacium, from where it crossed over to the other bank of the Danube. Interestingly is that the descriptions of these events speak of Viminacium as an island. Theophylactus Simocatta (*Hist.*, VIII, 1), writing in the time of the Emperor Heraclius (610-640), refers to this. The notice that Roman troops had arrived at *Viminakion*, an island in the River Istar, was repeated by Theophanes the Confessor in the second half of the 8th century and by Anastasius Bibliothecarius, a knowledgeable source on the Slavic apostles. This warrants the conclusion that the island and the bend in the Danube played an important strategic role for Viminacium in the early Byzantine, and perhaps even already in the Roman era, as Jireček had assumed long ago.

We know even less about the medieval city. Bulgarian historians believe that in the Middle Ages Viminacium was a Bulgarian fortified stronghold known under the name of Braničevo. What is important, however, is that the episcopal tradition in the city was preserved in the Middle Ages. This is indicated by the *Sigillum primum* of Basil II from

1019, in a reference to the Ohrid Archiepiscopate. However, at that time, the mid-12th century travelogue of Odo de Deogilo describes Braničevo as only a miserable little town, *Brundusium civitatem pauperulam*. In Ansbert, an itinerary writer from the third Crusade (1189-1190), Braničevo appears as *Brandiez*. At the time of the aggressive expansion of the Latin church during the papacy of Innocent III, Braničevo with its strategic position attracted the attention of the territorially acquisitive pope.

The question of the Braničevo episcopate is linked to the question of the restoration of Christianity on the Danube in the 9th century and must be viewed against the backdrop of the political and ecclesiastic aspirations of Rome and Constantinople with respect to the lands of the Slavs in general. It is well-known that Basil I and Photius made great efforts to reorganize the church hierarchy in the north. Thus, the Acts of the Constantinople Council from 879 feature Agathonos Moravan among the bishops present. When Methodius was the Morava bishop, P. Dvornik probably rightly concludes that a location at the confluence of the Morava and the Danube rivers was in question. This indicates that the tradition of Roman episcopal seats in Viminacium and Margum had been revived already in the period of the restoration of Christianity.

It is generally accepted that the Legion VII *Claudia pia fidelis* formed the garrison stationed at Viminacium. In fact, this legion, which was transferred from the Roman province of Dalmatia, earned the epithet *pia fidelia* in 42 AD when it demonstrated exceptional loyalty during Scribonian's rebellion in Dalmatia. However, the first legions stationed at Viminacium were the legio IV Scythica and the legio V Macedonica, which by general consensus occurred around 15 AD. According to other scholars, it is also possible that these two legions were transferred to Viminacium in 33/34 AD, during Tiberius' road-building operations on the Danube. Alternatively the two legions could have been in Viminacium only during the summer period and spent the winters downstream on the Danube or in the hinterland in the legionary camps at Oescus, Ratiaria or Naissus. Tacitus mentions in the *Annals* that the legions also had their own small winter camps, the so-called *hibernae*. In any case, by the mid-1st century or some time shortly before that there already was a legion permanently stationed at Viminacium. It is even possible that two legions were stationed at Viminacium into the 80's AD and Domitian's campaigns on the Danube. According to Suetonius, after the rebellions led by Saturninus in 89 of the Legions XIV Gemina and XXI Rapax at their base in Mainz (*Mogontiacum*),

Domitian prohibited the stationing of two legions in a single camp. Up until that time, two or even three legions could be assigned to the same camp.

At Viminacium, after the large-scale archaeological excavations carried out in the last quarter of the 20th century, knowledge of the city slowly emerged from the background of the scattered historical references to reveal a complex of archaeological sites that had experienced vigorous development over the six centuries of its long history.

Given its location and river connections, Viminacium always stood at a junction where cultural influences from the eastern and western parts of the Empire met and interacted. The recovered archaeological material clearly demonstrates an impressively high level of development for the various branches of arts and crafts, and merchants from all over the Roman Empire came to trade their wares here. It appears that the thriving economy of the city, where goods were also produced for export to markets outside the province, also spurred the development of various workshops in the area. In the 4th century some of these workshops produced significant contributions to tomb fresco painting in late antiquity.

The settlement at Viminacium was granted municipal status during Hadrian's reign around 117 AD, when it was given the title *Viminacium municipium Aelium Hadrianum*.

The continued development of Viminacium was briefly interrupted by an epidemic of the plague during Marcus Aurelius' reign, but indications in the archaeological record show that the economic prosperity of Viminacium was not seriously diminished by the plague because in the early years of the 3rd century commerce was again flourishing.

There was virtually no Roman emperor who did not pass through Viminacium or spend some time there. Significantly enough, when the Roman Empire started to decline, Viminacium gained in importance, and from the end of the 2nd to the end of the 4th century, for almost two hundred years, Roman emperors even more frequently visited and sojourned at Viminacium because of its exceptional strategic importance. Numerous times in its six hundred year history, for example at the end of the 3rd century, Viminacium played a key role in resolving questions of the disposition of ruling power in the Empire.

Among visits by Roman emperors, mention should certainly be made of Hadrian's residency when hunts were organized for him at Viminacium on two occasions; the Emperor Septimus Severus visited twice; later on other emperors stayed there: Gordian III, Phillip the Arab, Trebonius

Gallus, Hostilian, Diocletian, Constantine The Great, Constans I and Julian. Gratian was the last emperor known to have visited Viminacium.

The sojourn of the Emperor Hostilian was of exceptional significance because, as the 5th century writer Zosimus reports, he spent almost an entire year here with his mother Etruscilla. Zosimus is well informed because he draws on earlier authors from the 2nd and 3rd centuries, such as Eutropius, Deuxipus, Aurelius Victor, Pseudo-Aurelius Victor and Eusebius. After the deaths of his father and brother, Hostilian came to Viminacium at the beginning of 251 and organized the deployment of Roman troops along the middle to the lower course of the Danube. The ancient sources state that in November of 251 Hostilian died of the plague, probably at Viminacium.

Today most histories of the Roman Empire make little mention of the Emperor Trajanus Decius and his sons Herennius Etruscus and Hostilian. These men are not numbered among the so-called military emperors, but they do come from good Roman blood lines. Trajanus Decius came from a family of consuls who resided at Sirmium. His son Herennius Etruscus was born in Pannonia between 220 and 230 and, together with his father, was very much involved with the military. Not much is known about Hostilian, but, judging from his coin portraits, he was considerably younger than his brother. He lived in Rome with his mother Herennia Etruscilla and served as a senator, obviously in the shadow of his father and brother. Trajanus Decius elevated both his sons to the rank of Caesar. Although the title of *princeps iuventutis* is attested only for the elder son, Hostilian might have also received it in 251. Usually the title of *Augustus* was only granted to the elder son; it was conferred on Hostilian only after the death of his father and brother. As emperor, Hostilian bore the title of *Imperator Caesar Caius Valens Hostilian Messius Quintus Augustus*, and his brother Herennius Etruscus the title of *Imperator Caesar Quintus Herennius Etruscus Messius Decius Augustus*.

In the 3rd century, during the reign of Gordian III, Viminacium attained colonial status and was granted the right to mint coins. According to the historical sources, in 284 a decisive battle was fought in the immediate vicinity of Viminacium for supremacy in the empire by the Emperors Diocletian and Carinus. An important survival from this period is a marble portrait of Carus's son Carinus, which is stored in the Požarevac Museum.

In the 4th century, Viminacium was an important episcopal seat. In mid-5th century the city was definitively destroyed by a Hunnic attack.

However, it is also possible that the city and the military camp suffered serious damage around 380 from invading Goths. The city was never reconstructed on its original location, and its revival and restoration during Justinian's reign in the 6th century can only be conjectured on the basis of data provided by Theophylactus Simocatta and the 6th century archaeological remains at the Todića crkva site.

Viminacium and the European Public

European cultural circles were informed about Viminacium early in the 18th century when Count Marsigli passed through this area; in 1726 in the Hague he published his impressions of his travels in his famous work *Danubius Panonico-Mysiscus observationibus* and included sketches of Viminacium. The distinguished Count, who was first employed in the service of Vienna and later of Venice, traveled along the Danube in the last decades of the 17th century and left us valuable testimony about and the first map of the ancient city and military camp at Viminacium.

Europeans became aware of this area, and painters and travel writers came to pay homage to the ruins in their work, for example Herring and Bartlett, who produced a series of lithographs with scenic views of the general area. These two painters set out from London for Istanbul but on the way were captivated by the beauty of the Đerdap gorge and its environs and felt compelled to leave behind visual testimony of their visit.

Several decades later in the mid-19th century, a scholar, Felix Kanitz, traveled through these parts and published not only sketch maps of the layout of the ruins of city and camp, but also descriptions of the remains of Viminacium he saw at the site.

In his *The Kingdom of Serbia*, Kanitz wrote as follows: "I arrived at the village of Kostolac and found there 4,000 carts [sic !], that is, 4,000 carts loaded with Roman brick ready for sale in the Požarevac market at a price of between 10 and 15 paras per brick."

The First Archaeological Explorations

In the 19th century, the contours of the ancient city and military camp of Viminacium were still visible: wide streets intersecting at right angles, public squares, an amphitheater, baths, water supply conduits, city walls and towers.

Viminacium also drew the attention of the local educated class, for example Aćim Medović, a “*doctor of medicine and physician of the Požarevac district*”, who recorded that “*in Kostolac, hither and thither on the Mlava river*” there were artifacts from antiquity. Yet another researcher, Dragašević, who studied the antiquities of Moesia Superior, wrote about the significance and importance of Viminacium.

All this formed the background with which the fathers of archaeology in Serbia, Mihajlo Valtrović and Miloje Vasić, a professor at the Gymnasium in Belgrade, undertook the first systematic explorations of Viminacium in 1884 and 1902/3 respectively.

Towards the end of the 19th and at the beginning of the 20th century, Valtrović and Vasić carried out archeological investigations at the Čair site on the right bank of the Mlava River, which demonstrated that the military camp had had a rectangular plan with dimensions of 1450 x 1263 ft./442 x 385 meters and that to the west of the camp there was a civilian settlement which covered an area of approximately 178 acres/72 hectares. The *Serbske Novine* from 1902 recorded that Queen Draga of Serbia with her entourage came to visit Viminacium. At the time of the royal visit Prof. Vasić, who was educated in Germany and by then an archaeologist with an international reputation, was excavating a colonnaded street, which he named Queen Draga Street in her honor. The newspaper went on to say that the Queen presented him with 100 ducats that he used to continue the archaeological excavations at Viminacium.

Major Salvage Excavations

Almost three quarters of a century passed, however, before large-scale archaeological excavations were resumed at Viminacium in the 1970's, directed by Dr. Ljubica Zotović. Dr. Zotović launched the whole project initially in collaboration with Prof. Vladislav Popović and Dr. Vladimir Kondić; from 1976 to 1997 Dr. Kondić was personally in charge of salvage excavations at Viminacium. This work produced numerous significant finds.

From 1977 to 1997 explorations were completed in the ancient cemeteries which extend to the south and west of the city. Over 13,000 graves were uncovered which contained both cremated and inhumed burials with various types of artifacts. The tombstones and the sarcophagi often featured sculpted reliefs depicting mythological or scenes from everyday life. Numerous built grave structures were also identified, with the fresco-

decorated tombs from the 4th century being the most remarkable. A fresco depicting a young woman represents one of the finest examples of the art of painting in late antiquity. Additionally a cemetery from an even later period, the time of the migration of nations, has been partially explored.

It is important to stress that of all the legionary camps that existed on the territory of the former Roman Empire, from Great Britain to Iraq, today very few are located in uninhabited places. One of these, located on the Danube like Viminacium, is the legionary camp at *Carnuntum* (Petronel) in Austria, not far from Vienna, which has been the object of excavation for over a hundred years.

The legionary camp and the city at Viminacium are very important because it is one of the few sites of this type where the application of modern methods can yield a rich range of objects of material culture and invaluable information about the nature of the Roman imperialism. Moreover, researchers at Viminacium have the exceptional opportunity to advance our understanding of not only settlement in and around the city and camp at Viminacium but also of human culture in the Balkan provinces of the Empire.

The archaeological situation at Viminacium today is unusual because the ruins and associated artifacts are buried in the shallow topsoil layer, making its remains easily accessible to archaeologists but also, regrettably, to looters.

It is painful to admit that due to illicit excavations on the site outstanding but plundered finds from Viminacium are better known in the world than are the results from many years of scientific investigation. Unfortunately, even objects recovered in legitimate field investigations and housed in the Požarevac Museum have been repeatedly plundered. In the storerooms of the National Museum in Požarevac there is a treasure from Viminacium which contains over 40,000 artifacts and which has become a real magnet for looters. This exceptional collection, which includes over 700 objects wrought in gold and silver, contains numerous pieces which are priceless in a European or even world context.

Viminacium - An Exceptional Archaeological Site

The following factors contribute to Viminacium's status as a world-class archaeological complex:

- Viminacium was the capital of the Roman Province of Moesia Superior, which in antiquity covered approximately the same territory as present-day Serbia;
- Today the relatively shallow depth of the archaeological remains at Viminacium facilitates access for scientific investigation and historic preservation.

Those factors guide our present considerations for future research at Viminacium. That research, on one hand firmly builds on the results of earlier investigations by our distinguished colleagues, and on the other, expands the scope of exploration to provide new knowledge for experts in the field and, above all to a general public interested in the preservation and presentation of our common cultural heritage.

It is our firm intention to show that the inhabitants of Viminacium and its environs were once part of global developments in their day and that the numerous emperors who passed through or lingered here, appreciated its significance and donated many important monuments to the city.

Exploratory excavations of the urban fabric and the legionary camp have revealed that the ramparts, streets, public squares, temples and amphitheater have been preserved to a height of several yards and that when they are cleared of the debris accumulated through the centuries, Viminacium will be presented to the world in its full splendor.