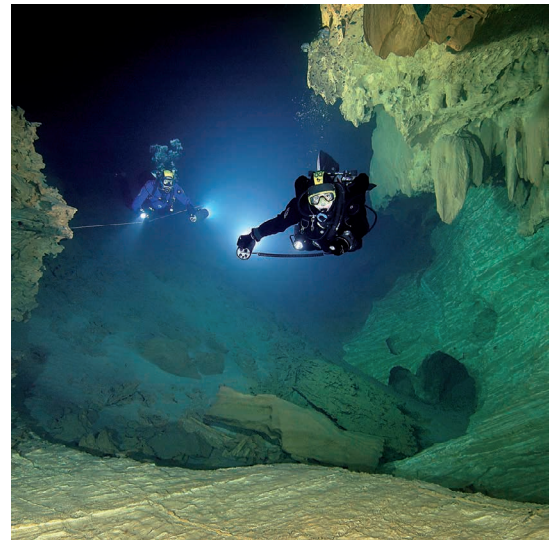


16th INTERNATIONAL CONGRESS OF SPELEOLOGY

Proceedings

VOLUME 2



16th INTERNATIONAL
CONGRESS OF SPELEOLOGY



WHERE HISTORY MEETS FUTURE



Edited by
Michal Filippi
Pavel Bosák

**16th INTERNATIONAL CONGRESS
OF SPELEOLOGY**

Czech Republic, Brno

July 21–28, 2013

Proceedings

VOLUME 2

Edited by
Michal Filippi
Pavel Bosák

2013

16th INTERNATIONAL CONGRESS OF SPELEOLOGY

Czech Republic, Brno

July 21–28, 2013

Proceedings

VOLUME 2

Produced by the Organizing Committee of the 16th International Congress of Speleology.

Published by the Czech Speleological Society and the SPELEO2013 and in the co-operation with the International Union of Speleology.

Design by M. Filippi and SAVIO, s. r. o.

Layout by SAVIO, s. r. o.

Printed in the Czech Republic by H.R.C. spol. s r. o.

The contributions were not corrected from language point of view. Contributions express author(s) opinion.

Recommended form of citation for this volume:

Filippi M., Bosák P. (Eds), 2013. Proceedings of the 16th International Congress of Speleology, July 21–28, Brno. Volume 2, p. 507. Czech Speleological Society. Praha.

ISBN 978-80-87857-08-3

© 2013 Czech Speleological Society, Praha, Czech Republic.

Individual authors retain their copyrights. All rights reserved. No part of this work may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or any data storage or retrieval system without the express written permission of the copyright owner. All drawings and maps are used with permission of the authors. Unauthorized use is strictly prohibited.

KATALOGIZACE V KNIZE - NÁRODNÍ KNIHOVNA ČR

International Congress of Speleology (16. : Brno, Česko)
16th International Congress of Speleology : Czech Republic,
Brno July 21–28,2013 : proceedings. Volume 2 / edited by Michal
Filippi, Pavel Bosák. -- [Prague] : Czech Speleological Society
and the SPELEO2013 and in the co-operation with the
International Union of Speleology, 2013
ISBN 978-80-87857-08-3 (brož.)

551.44 * 551.435.8 * 519.86/.87

- speleology
- karstology
- modeling and simulation
- proceedings of conferences
- speleologie
- karsologie
- modelování a simulace
- sborníky konferencí

551 - Geology, meteorology [7]

551 - Geologie. Meteorologie. Klimatologie [7]

Cover photos (some photos were adjusted/cropped)

Top left – A gallery along the “Rio de los Venezuelanos” in the Imawari Yeuta Cave system in quartz sandstones, Auyan Tepui, Venezuela. Photo V. Crobu. For details see the paper by Sauro et al.

Top right – The 15th siphon of Ramo Nord in the Grotta del Bue Marino, Sardinia. Photo by R. Husák. For details see the paper by D. Hutňan.

Bottom left – Using an Xbox Kinect equipment to survey a cave. Photo by J. Gulley. For details see the paper by Covington et al.

Bottom right – Inclined workings of the Voskresenskyi Mine, Ural Mountains, Russia. Photo by A. Cunko. For details see the paper by A. Cunko.

Scientific Committee

Chairman

Pavel Bosák (Czech Republic) – Karst and Pseudokarst

Vice-Chairman

Michal Filippi (Czech Republic) – Karst and Pseudokarst

Members

Jiří Adamovič (Czech Republic) – Pseudokarst
Philippe Audra (France) – Speleogenesis
Jean-Pierre Bartholeyns (France) – Management and Protection
Aaron Bird (USA) – Exploration
Didier Cailhol (France) – Speleogenesis
Matt Covington (USA) – Modelling in Karst and Caves
Robert Eavis (USA) – Exploration
Anette S. Engel (USA) – Geomicrobiology
Lukáš Faltejsek (Czech Republic) – Biospeleology
Derek Ford (Canada) – Climate and Paleoclimate
Franci Gabrovšek (Slovenia) – Modelling
Mladen Garašič (Croatia) – Survey, Mapping and Data Processing
Martin Golec (Czech Republic) – Archeology and Paleontology
Christiane Grebe (Germany) – Management and Protection
Nadja Zupan Hajna (Slovenia) – Extraterrestrial Karst
Ivan Horáček (Czech Republic) – Biospeleology
Stephan Kempe (Germany) – History
Aleksander A. Klimchouk (Ukraine) – Speleogenesis
Jiří Kyselák (Czech Republic) – Exploration
Peter Matthews (Australia) – Survey, Mapping and Data Processing
Iona Meleg (France) – Management and Protection
Mario Parise (Italy) – Artificial Underground
Bohdan P. Onac (USA) – Mineralogy
Yavor Shopov (Bulgaria) – Climate and Paleoclimate

The names of the Committee members are given along with their home countries and fields of research they represented as convenors.

Contents

Preface	10
Session: Exploration and Cave Techniques	13–176
RECENT INVESTIGATIONS IN THE GÁLAPAGOS ISLANDS, ECUADOR Aaron Addison, Theofilos Toulkeridis, Steven Taylor, Glenn Osburn, Geoffery Hoese, Vicente Delgado	15
QUARTZ SANDSTONE CAVES ON TABLE MOUNTAINS OF VENEZUELA Marek Audy, Richard Bouda	20
NORTHERN VELEBIT DEEP CAVES Darko Bakšić, Dalibor Paar, Andrej Stroj, Damir Lacković	24
BEST-PRACTICE TRAINING APPROACHES FOR MITIGATING CAVING HAZARDS AND ENHANCING CAVE EXPLORATION TECHNIQUES FOR SMALL GROUPS OF CAVERS Aaron Bird, Melissa Sawa	30
CAVING IN THE ABODE OF THE CLOUDS – MEGHALAYA, NORTH EAST INDIA Simon Brooks	36
CAVE EXPLORATION IN IRAN Simon Brooks	41
CAVE EXPLORATION IN PAKISTAN Simon Brooks	46
CLUB OF CLIMBERS AS A BASIS FOR TRAINING PROCESS OF CAVERS Anatoliy Bulychov, Tatyana Sorokina	49
EXPLORATIONS AND DOCUMENTATION ON THE ATEPETACO KARST SYSTEM (HUEYTAMALCO, PUEBLA, MEXICO) Alberto Buzio, Federico Confortini, Claudio Cruz-García, Victor Cruz-García, Rosalia Davì, Jesus Domínguez-Navarro, Giovanni Currieri, Angelo Iemmolo, Diego Marsetti, Enrique Méndez Torres, Francesco Merisio, Giorgio Pannuzzo, Marzia Rossi, Sergio Santana-Muñoz, Marco Vattano	52
DISCOVERY AND EXPLORATION OF EVKLIDOVA PIŠČAL, JULIAN ALPS, SLOVENIA Matthew D. Covington, Matic Di Batista	58
GLACIER CAVE EXPEDITIONS 2012: NEPAL AND SVALBARD Matt Covington, Jason Gulley, David Ochel	59
SPELEOLOGICAL EXPEDITIONS TO THE SHAN PLATEAU IN MYANMAR (BURMA) Joerg Dreybrodt, Imogen Furlong, Fleur Loveridge, Peter Talling	62
TEN YEARS OF EXPLORATION AND OVER 100 KM OF CAVES SURVEYED IN NORTHERN LAOS Joerg Dreybrodt, Michael Laumanns, Helmut Steiner	68
CZECH DISCOVERIES IN THE MAGANIK MTS., MONTENEGRO Zdeněk Dvořák, Vít Baldík	74
EXPLORATION OF THE CHESTNUT RIDGE CAVE SYSTEM BATH AND HIGHLAND COUNTIES, VIRGINIA Mike Ficco	78
CAVES OF TONGZI, TUDI, JIELONG, WULONG COUNTY, CHONGQING, CHINA – SIX YEARS AND COUNTING Mike Futrell, Mike Ficco, Erin Lynch	84
THE HISTORY AND CURRENT STATUS OF EXPLORATION IN YANTANGPING CAVE SYSTEM OF WULONG COUNTY, CHINA Stephen Gladioux	88
UNDERWATER EXPLORATION OF THE BJURÄLVEN VALLEY CAVE (SWEDEN) UNDER EXTREME WINTER CONDITIONS Dmitri Gorski, Nicklas Myrin, Bosse Lenander, Markus Nord, Mark Dougherty	92
GROTTA DEL BUE MARINO – SARDINIA Daniel Hutňan	97
EXPLORATIONS IN THE LOFERER STEINBERGE Oliver Kube, Jochen Hartig, Renato Serôdio	102
THE LONGEST LIMESTONE CAVES OF ISRAEL Boaz Langford, Amos Frumkin	105
A GENERAL ASSESSMENT OF THE GREAT CAVES AND THE KARST OF SOUTHEAST ASIA Michael Laumanns, Liz Price	110
THE LONGEST CAVE IN HUNGARY Szabolcs Leél-Őssy	116
EU PROTEUS – EU PROJECT FOR RAISING AWARENESS AND IMPROVING EFFECTIVENESS OF CAVE RESCUING Maks Merela, Darko Bakšić	119
ON THE SEARCH FOR KING BARBAROSSA IN UNTERSBERG Ulrich Meyer	124
K OOX BAAL – 4 th LONGEST UNDERWATER CAVE SYSTEM IN THE WORLD Zdeněk Motyčka	130

GEOLOGY AND DEEP VERTICALS: CASE STUDY FROM MAGANIK MTS., MONTENEGRO Jiří Otava, Vít Baldík	134
KAČNA JAMA (THE SNAKE CAVE) – DIVAČA, SLOVENIA Tomáš Roth, Karel Kocourek	137
IMAWARİ YEUTA: A NEW GIANT CAVE SYSTEM IN THE QUARTZ SANDSTONES OF THE AUYAN TEPUI, BOLIVAR STATE, VENEZUELA Francesco Sauro, Freddy Vergara, Antonio De Vivo, Jo De Waele	142
EXPLORATION OF HIGH ALTITUDE CAVES IN THE BAISUN-TAU MOUNTAIN RANGE, UZBEKISTAN Evgeny Tsurikhin, Vadim Loginov, Francesco Sauro, Sebastian Breitenbach	147
KES MOUNTAIN SINKHOLE (KAHRAMANMARAS – SOUTHEASTERN TURKEY) Ali Yamaç, Murat Eğrikavuk	153
PREMIER EXPLORATION OF THE CAVES OF HOLY MT. ATHOS, GREECE Alexey Zhalov, Magdalena Stamenova	156
EXPLORATION OF THE JASANKA CAVE IN BANAT, ROMANIA Vít Kaman, Petr Barák	161
CAVE EXPLORATION OF THE BELIĆ MASSIF IN THE PROKLETIJE MOUNTAINS (MONTENEGRO) Ditta Kicińska, Krzysztof Najdek	165
VOLCANIC CAVES AND PETROGLYPHS OF BORLUK VALLEY – KARS (EASTERN TURKEY) Ali Yamaç	168
TRAPIÁ CAVE: EXPLORATION, SURVEY, BIOLOGY AND GEOSPELEOLOGY OF THE BIGGEST CAVE OF RIO GRANDE DO NORTE STATE Leda A. Zogbi, Diego Bento, Francisco W. Cruz, Daniel S. Menin	170

Session: Speleological Research and Activities in Artificial Underground	177–270
---	----------------

THE MAN-MADE UNDERGROUND CAVITIES OF NORTH-WEST RUSSIA I.A. Agapov, Y.S. Lyakhnitsky, I.U. Hlebalin	179
GOLD MINES OF THE 18 th CENTURY: PAST AND PRESENT Iure Borges de Moura Aquino, Thiago Nogueira Lucon, Hernani Mota de Lima	185
THE SUGANO MINES OF ORVIETO (ITALY): ALUMINIUM FROM VOLCANIC FIRE Edoardo Bellocchi, Chemical Technician, Marco Morucci	190
WORKSHOPS AND SURVEY RESULTS IN THE CHRIMA CINP PROJECT (EU PROGRAMME CULTURE 2007–2013) Carmela Crescenzi	194
THE AUGUSTEAN AQUEDUCT IN THE PHLEGRAEAN FIELDS (NAPLES, SOUTHERN ITALY) Graziano W. Ferrari, Raffaella Lamagna	200
NERO'S OVEN: TEN SURVEYS ARE NOT ENOUGH Graziano W. Ferrari, Raffaella Lamagna	206
RESEARCH PROSPECTS OF OLD MINE WORKINGS IN THE URAL MOUNTAINS Alexey Gunko	213
KUNGSTRÄDGÅRDEN, A GRANITIC SUBWAY STATION IN STOCKHOLM: ITS ECOSYSTEM AND SPELEOTHEMS Magnus Ivarsson, Johannes E. K. Lundberg, Lena Norbäck Ivarsson, Therese Sallstedt, Manuela Scheuerer, Mats Wedin	217
UNFINISHED RAILWAY TUNNEL AND BUNKER AT GODOVIČ Andrej Mihevc, Aleš Lajovic, Mateja Ferk, Jure Tičar	221
RECOGNITION OF INSTABILITY FEATURES IN ARTIFICIAL CAVITIES Mario Parise	224
CLASSIFICATION OF ARTIFICIAL CAVITIES: A FIRST CONTRIBUTION BY THE UIS COMMISSION Mario Parise, Carla Galeazzi, Roberto Bixio, Martin Dixon	230
AN OVERVIEW OF THE GEOLOGICAL AND MORPHOLOGICAL CONSTRAINTS IN THE EXCAVATION OF ARTIFICIAL CAVITIES Sossio Del Prete, Mario Parise	236
THE ANCIENT MINES OF USSEGLIO (TORINO, ITALY) MULTI-YEAR PROGRAMME OF RECORDING, STUDY, PRESERVATION AND CULTURAL DEVELOPMENT OF THE ARCHAEOLOGICAL MINING HERITAGE IN AN ALPINE VALLEY Maurizio Rossi, Anna Gattiglia, Daniele Castelli, Claudia Chiappino, Renato Nisbet, Luca Patria, Franca Porticelli, Giacomo Re Fiorentin, Piergiorgio Rossetti	242
SAFE CAVES: THE DISTINCTIVE FEATURES OF HIDEOUT COMPLEXES IN THE GALILEE IN THE EARLY ROMAN PERIOD AND PARALLELS IN THE JUDEAN LOWLANDS (SHEPHELAH) Yinon Shvitiel	247
ARTIFICIAL CAVITIES OF GAZIANTEP (SOUTHEASTERN TURKEY) Ali Yamaç, Murat Eğrikavuk	253

SUBTERRANEAN “BELL-SHAPED” QUARRIES IN THE JUDEAN FOOTHILLS, ISRAEL Boaz Zissu	257
THE ETHNO-CULTURAL FEATURES OF MAN-MADE CAVES CARVED IN THE NEOGENE PYROCLASTIC FORMATION WITHIN THE ARMENIAN HIGHLAND AND NEIGHBORING AREAS Smbat Davtyan	263
UNDERGROUND MINES IN MOSCOW CITY Yuri Dolotov	265

Session: Karst and Cave Survey, Mapping and Data Processing	271–336
--	----------------

1000 AND 1 CAVES IN “LEFKA ORI” MASSIF, ON CRETE, GREECE Kostas Adamopoulos	273
MAQUINÉ CAVE, BRAZIL – OVER 170 YEARS OF CAVE MAPPING Luciana Alt, Vitor Moura	279
STATISTICAL EVALUATION OF CAVE LOCATION PRECISION BASED ON CARTOGRAPHIC SOURCES Miha Čekada	285
RESURVEY AND RESOURCE INVENTORY OF THREE FINGERS CAVE, NEW MEXICO, USA Andrea Croskrey, Jennifer Foote, Pat Kambesis	290
VIRGINIA SPELEOLOGICAL SURVEY (VSS) GEOSPATIAL DATABASE Mike Futrell	293
LESSONS FROM DRAFTING PROJECT STARTUP AND SUMMARY OF EXPLORATION ADVANCES IN FISHER RIDGE CAVE SYSTEM, HART COUNTY, KENTUCKY, UNITED STATES OF AMERICA Stephen Gladioux	294
HUMPLEU CAVE (ROMANIA): WHAT’S UP? Philipp Häuselmann	299
THE AURIGA PDA FREEWARE THE ELECTRONIC SWISS KNIFE OF CAVE SURVEYORS Luc Le Blanc	302
QUICK 3D CAVE MAPS USING CAVEWHERE Philip Schuchardt	306
THE UNIFIED DATABASE OF SPELEOLOGICAL OBJECTS OF THE CZECH REPUBLIC AS PART OF NATURE CONSERVANCY INFORMATION SYSTEM Ivan Balák, Olga Suldovská	310
SPELEOLOGICAL MAP OF THE KANIN MASSIF Miha Čekada, Petra Gostinčar, Miha Staut	315
INTEGRATED THREE-DIMENSIONAL LASER SCANNING AND AUTONOMOUS DRONE SURFACE-PHOTOGAMMETRY AT COMANTONG CAVES, SABAH, MALAYSIA D.A. McFarlane, M. Buchroithner, J. Lundberg, C. Petters, W. Roberts, C. Van Rentergen	317
NATURAL AND ANTHROPOGENIC FACTORS INFLUENCING THE KARST DEVELOPMENT IN THE NE ATHENS AREA, GREECE Papadopoulou-Vrynioti Kyriaki, Bathrellos George D., Skilodimou Hariklia D.	320
THE SPATIAL DISTRIBUTION OF KARST ECOSYSTEM USING GIS IN ATTICA, GREECE Skilodimou Hariklia D., Bathrellos George D., Papadopoulou-Vrynioti Kyriaki	326
CLAUDE CHABERT AND THE MAPPING OF AYVAINI CAVE – TURKEY Ali Yamaç	332
RE-MAPPING OF INSUYU CAVE (BURDUR – WESTERN TURKEY) Ali Yamaç, Murat Eğrikavuk	335

Session: Modelling in Karst and Cave Environments	337–376
--	----------------

MICROMETEOROLOGY OF MT CRONIO CAVES, SICILY Giovanni Badino	339
NEW ACQUISITION, 3D MODELLING, AND DATA USE METHODS: THE LASER SCANNING SURVEY OF RE TIBERIO CAVE Erminio Paolo Canevese, Paolo Forti, Roberta Tedeschi	340
A THEORETICAL FRAMEWORK FOR UNDERSTANDING THE RELATIVE IMPORTANCE OF CHEMICAL AND MECHANICAL EROSION PROCESSES IN CAVE STREAMS Matthew D. Covington, Franci Gabrovšek	346
EVOLUTION OF CONDUIT NETWORKS IN TRANSITION FROM PRESSURISED TO FREE SURFACE FLOW Franci Gabrovšek, Matija Perne	347
ANALYTICAL MODELS TO DESCRIBE THE EFFECTS OF TRACER MIXING BEFORE AND AFTER ADVECTION AND DISPERSION Sid Jones	349
IS THE HELMHOLTZ RESONATOR A SUITABLE MODEL FOR PREDICTION OF THE VOLUMES OF HIDDEN CAVE SPACES? Marek Lang, Jiří Faimon	354
ANTHROPOGENIC BIAS ON POWER-LAW DISTRIBUTIONS OF CAVE LENGTHS Stein-Erik Lauritzen, Rannveig Øvrevik Skoglund, Silviu Constantin, Fernando Gázquez, Johannes E.K. Lundberg, Andrej Mihevc, Christos Pennos, Rabbe Sjöberg	358

DOCUMENTING SWISS KARST AQUIFERS USING KARSYS APPROACH – EXAMPLES OF RECENT APPLICATIONS Arnauld Malard, Pierre-Yves Jeannin, Jonathan Vouillamoz, Eric Weber	360
CAN DRIPWATER HYDROGEOCHEMISTRY HELP US TO DISCOVER HIDDEN UPPER-LYING CAVE FLOOR? Pavel Pracný, Jiří Faimon	366
CAVE EXPLORATIONS AND APPLICATION OF HYDROLOGICAL MODEL IN RAŠPOR CAVE (ISTRIA, CROATIA) Andrija Rubinić, Lovel Kukuljan, Ivan Glavaš, Josip Rubinić, Igor Ružić	369
TEMPERATURE AND KINETIC CONTROL OF CAVE GEOMETRY Rannveig Øvrevik Skoglund, Stein-Erik Lauritzen	375
Session: Cave Climate and Paleoclimate Record	377–503
AN EXTENDED LATE PLEISTOCENE RECORD OF WATER-TABLE FLUCTUATIONS IN DEVIL'S HOLE, NEVADA Yuri Dublyansky, Christoph Spötl, Gina Moseley, R. Larry Edwards	379
REVIEW OF PALEOCLIMATE STUDIES IN TURKEY: THE ROLE OF SPELEOTHEM-BASED DATA Gizem Erkan, C. Serdar Bayari	382
ISOTOPES OF GYPSUM HYDRATION WATER IN SELENITE CRYSTALS FROM THE CAVES OF THE NAICA MINE (CHIHUAHUA, MEXICO) Fernando Gázquez, José-María Calaforra, David Hodell, Laura Sanna, Paolo Forti	388
FORTY YEARS OF PHREATIC OVERGROWTHS ON SPELEOTHEMS (POS) RESEARCH IN COASTAL CAVES OF MALLORCA Angel Ginés, Joaquín Ginés, Joan J. Fornós, Paola Tuccimei, Bogdan P. Onac, Francesco Gràcia	394
AIR CO ₂ IN COMBLAIN-AU-PONT CAVE (BELGIUM) RELATIONSHIPS WITH SOIL CO ₂ AND OPEN AIR METEOROLOGY Jean Godissart, Camille Ek	400
CLIMATIC AND ENVIRONMENTAL CHANGES BETWEEN 130-230 KA RECORDED IN AN ALPINE STALAGMITE FROM SWITZERLAND Anamaria Häuselmann, Daniel Tabersky, Detlef Günther, Hai Cheng, Lawrence R. Edwards, Dominik Fleitmann	406
SPURIOUS THERMOLUMINESCENCE IN SPELEOTHEM: IMPLICATION FOR PALEOCLIMATE Chaoyong Hu, Qing Li, Jin Liao, Quanqing Yang	407
PRESENTATION OF A WATER INJECTION SYSTEM TO CONTROL THE GROWTH OF SPELEOTHEMS AT THE MILANDRE TEST-SITE, JU, SWITZERLAND Pierre-Yves Jeannin, Philipp Häuselmann, Marc Lütscher, Denis Blant, Pierre-Xavier Meury	408
HIGH RESOLUTION TEMPERATURE SAMPLING OF CAVE CLIMATE VARIATION AS A FUNCTION OF ALLOGENIC RECHARGE, COLDWATER CAVE, IOWA, USA Patricia Kambesis, John Lovaas, Michael J. Lace	413
PERCOLATION INTO DRAGON'S TOOTH CAVE, FLORIDA, USA Karina Khazmutdinova, Doron Nof	417
PRELIMINARY RESULTS ON PALEOCLIMATE RESEARCH IN MECSEK MTS, HUNGARY Gabriella Koltai, Sándor Kele, Gergely Surányi, Beáta Muladi, Ilona Bárány-Kevei	423
A STUDY OF TEMPERATURE CHARACTERISTICS IN THE SHALLOW KARSTIC VELIKA PASICA CAVE, SLOVENIA Allen Wei Liu, Anton Brancelj	427
CLIMATIC FEATURES OF DIFFERENT KARST CAVES IN HUNGARY B. Muladi, Z. Csépe, L. Mucsi, I. Puskás, G. Koltai, M. Bauer	432
HOLOCENE PALEOCLIMATE RECONSTRUCTION BASED ON STALAGMITE STUDIES FROM LEBANON Fadi H. Nader, Hai Cheng, Rudy Swennen, Sophie Verheyden	438
PHYSICAL RESEARCH IN CROATIA'S DEEPEST CAVE SYSTEM: LUKINA JAMA-TROJAMA, MT. VELEBIT Dalibor Paar, Nenad Buzjak, Darko Bakšić, Vanja Radolić	442
GROWTH AND DIAGENETIC HISTORY OF ARAGONITE-CALCITE SPELEOTHEMS, IMPLICATIONS FOR ENVIRONMENTAL STUDIES Christine Perrin, Laurent Prestimonaco, Guilhem Servelle, Romain Tilhac, Marion Maury, Patrick Cabrol	447
ULTRA- HIGH RESOLUTION SPELEOTHEM RECORDS – HOW FAR WE CAN PUSH THE TIME RESOLUTION? Yavor Shopov	450
VARIATIONS OF ANNUAL KARST DENUDATION RATES IN THE LAST TWO MILLENNIA OBTAINED FROM SPELEOTHEM RECORDS Y. Shopov, D. Stoykova, L. Tsankov, U. Sauro, A. Borsato, F. Cucchi, P. Forti, L. Piccini, D. C. Ford, C. J. Yonge	453
A PRONOUNCED EXTENDED NEGATIVE TEMPERATURE GRADIENT IN THE POMERANZEN CAVE, SWITZERLAND Hans Stünzi	458

GEOMORPHOLOGY OF FOSSIL SPRING MOUNDS NEAR EL GEDIDA VILLAGE, DAKHLA OASIS, WESTERN DESERT OF EGYPT Magdy Torab	464
PALAEOCLIMATIC INVESTIGATION USING CAVE SPELEOTHEMES IN LIME DECORATED LAVA TUBE CAVES ON JEJU ISLAND, SOUTH KOREA Kyung Sik Woo, Kyoung-nam Jo, Hyoseon Ji, Seokwoo Hong, Sangheon Yi	468
POSSIBLE EVIDENCE OF THE STAGES OF KARST DEVELOPMENT IN THE PINEGA REGION OF NORTHERN EUROPEAN RUSSIA A. Ashepkova, V. Malkov, E. Shavrina, A. Semikolennykh	471
THE 5.3 KA BP EXTREME/WEAKENING EVENT IN THE ASIAN MONSOON DURING THE MIDDLE HOLOCENE; A RECORD IN A STALAGMITE FROM WANXIANG CAVE, WESTERN CHINA LOESS PLATEAU Yijun Bai, Pingzhong Zhang, Xiaofeng Wang, Hai Cheng	474
AQUEOUS ISOTOPE ANALYSES IN TWO LITTORAL CAVES IN MALLORCA, SPAIN: PRELIMINARY RESULTS Liana M. Boop, Jonathan G. Wynn, Bogdan P. Onac, Joan J. Fornós, Antoni Merino, Marta Rodríguez-Homar	475
RADON MEASUREMENTS IN AUSTRIAN AND SLOVENIAN CAVES WITH AN ALPHAGUARD INSTRUMENT Christina Bonanati, Ingo Bauer, Stephan Kempe	479
ELEMENT AND STABLE ISOTOPE AQUEOUS GEOCHEMISTRY FROM BAYSUN TAU, UZBEKISTAN – TRACING THE SOURCE OF THE DRIPWATER Sebastian F. M. Breitenbach, Ola Kwiecien, Francesco Sauro, Vadim Loginov, Yanbin Lu, Evgeny Tsurikhin, Antonina Votintseva	485
HOLOCENE TEMPERATURE FLUCTUATIONS IN CENTRAL EUROPE RECORDED IN STALAGMITE M6 FROM MILANDRE CAVE, SWITZERLAND Anamaria Häuselmann, Adam Hasenfratz, Hai Cheng, Lawrence R. Edwards, Dominik Fleitmann	489
A MULTIPROXY APPROACH TO RECONSTRUCTING PALEOENVIRONMENTAL CONDITIONS FROM SPELEOTHEMES IN BARBADOS TO ADDRESS GROUNDWATER VULNERABILITY Gilman Ouellette, Jr., Jason S. Polk	490
GENETIC ALGORITHMS AS CORRELATION TOOLS – SPELEOTHEMES STABLE ISOTOPE RECORDS AS AN EXAMPLE Jacek Pawlak, Helena Hercman	494
DIFFERENT TYPES OF LAMINAE IN A FLOWSTONE FROM LA CIGALERE CAVE (PYRENEES, S. FRANCE) Christine Perrin, Laurent Prestimonaco	495
CLIMATE SIGNIFICANCES OF SPELEOTHEM ¹⁸ O FROM MONSOONAL CHINA: COMPARISON AND VERIFICATION AMONG STALAGMITE, INSTRUMENTAL AND HISTORICAL RECORDS Liangcheng Tan, Yanjun Cai, Hai Cheng, Haiwei Zhang, Chuan-Chou Shen, R. Lawrence Edwards, Zhisheng An	498

Partners, Sponsors	504
---------------------------	------------

Authors Index	506
----------------------	------------

Preface

Dear readers, the Proceedings volumes you are holding in your hands were issued within the 16th International Congress of Speleology (hereafter 16thICS) on July 21–28, 2013 in Brno, Czech Republic. Let us welcome you to its reading. In total, over 320 contributions (over 250 oral presentations and over 70 posters) by more than 750 authors have been received to be included within the Congress Proceedings. This represents over 2,300 received e-mails and a similar number of responses during the last 6 months, approximately 4,300 electronic files and over 1,450 printed pages of the text. To put it simply, “really, really much interesting stuff concerned with cave and karst subject”. The author’s guidelines stipulated that the particular contributions should not exceed 6 pages of text and we were delighted to find that most authors prepared contributions close to this upper limit. Only very few contributions did not exceed one page of text. This illustrates a clear willingness of the cavers and karst scientist to share their discoveries and research conclusions.

The presented contributions (abstracts/papers) stand for both oral and poster presentations as indicated in the headings. Contributions in each session are arranged alphabetically by the last name of the first author. All contributions were reviewed from the viewpoint of technical quality and scientific content by members of the scientific committee and invited reviewers. The authors had the opportunity to revise their papers in response to reviewer’s comments and we were pleased to see that the reviews have improved the clarity and readability of the contributions. However, profound improvement of the English language could not be arranged due to the shortage of time and insufficient human resources; the authors themselves are therefore responsible for the linguistic level of their contributions.

Thirteen thematically different sessions and six special sessions were scheduled within the call for your contributions to cover the whole range of subjects to be discussed within the wide scope of the 16thICS. The low number of contributions for some of these “detailed” sessions necessitated their merging with others. As a result, eleven original and three joint sessions are presented within the Proceedings. The contributions were grouped into three separate volumes. The purpose of this arrangement was that each particular Volume is filled with a certain logical hierarchy of topics, and that related topics are presented together. It was also the intention that the content of each Volume is topically balanced and contains both generally interesting (popular) topics with rich photographic documentation and hardcore scientific topics dominated by tables and plots.

Volume I starts with three plenary lectures representing three global topics related to 16thICS subject. Further it contains papers concerned with history of research (session “History of Speleology and Karst Research”), archeology and paleontology (sessions “Archaeology and Paleontology in Caves”), topics focused on management and preservation of caves and karst areas and other social-related aspects (sessions “Protection and Management of Karst, Education”; “Karst and Caves: Social Aspects and Other Topics”). In the

last mentioned session you can also find a small part devoted to extraterrestrial karst. Volume I is ended by a relatively large portion of biology-oriented papers placed within the session “Biospeleology, Geomicrobiology and Ecology”.

Volume II contains the traditionally heavily attended session “Exploration and Cave Techniques” and by the related session “Speleological Research and Activities in Artificial Underground”. These exploration topics are, we believe, logically supplemented with contributions from the field of “Karst and Cave Survey, Mapping and Data Processing”. The content of the second Volume is completed with a somewhat more specialized session “Modelling in Karst and Cave Environments” and with session “Cave Climate and Paleoclimate Record”. The last mentioned session probably better fits to the end of Volume III, but it was placed into Volume II in order to reach balance in the extent of the individual volumes.

Volume III also starts with traditional, heavily attended topics organized in two sessions: “Karst and Caves in Carbonate Rocks, Salt and Gypsum” and “Karst and Caves in Other Rocks, Pseudokarst”. These topics are supplemented by the related session “Speleogenesis”. This last volume of the Proceedings is ended by the study of cave minerals, included in a specific session “Cave Minerals”.

It is clear already from the previous ICS meetings that the range of the published topics becomes wider and wider, including localities in the whole world but also – owing to the access to high-quality spacecraft images – from other planets. The range of the instrumental, analytical and software methods employed in cave and karst research is remarkable and shows that the topic of “cave & karst exploration” attracts an ever increasing number of researchers even from already established scientific disciplines.

Let us also say a few words about the selection of the cover photos for the Proceedings volumes. The idea was to select such photos which would best represent all topics (especially those enjoying the highest interest) in each particular volume and be of high technical quality. Since we believe the cover page is a place for a serious presentation of the inner content, we made our selection from photos used in the presented papers. In one case the additional photo was requested to get a better representation of the topic. For our purpose, we decided to place several photos on the cover page of each volume. We hope that you enjoy them.

We wish to take this opportunity to apologize for the all mistakes which might have possibly originated within the operations with different versions of the manuscripts and other related files and e-mails which passed through our computers. We believe that everybody find their interesting reading in the Proceedings and we wish that the whole publication (Volumes I–III) becomes a valuable record of the 16th meeting of enthusiasts addicted to the fascination of the underground world.

Finally we wish to thank all the authors for their contributions. Enormous thanks belong to the reviewers and especially convenors (members of the scientific committee) of the particular sessions for their time and effort in the improvement of the overall message of the texts. We also wish to thank Michal Molhanec who significantly helped with the on-line form for the contribution submission, to Jiří Adamovič who repeatedly helped us with the improvement of our English, and to Jan Spružina, Zdeněk Motyčka, Jana Holubcová, and Renata Filippi who contributed to the preparation of the Proceedings.

After the few introductory words, let's now enjoy the papers from localities all over the world, presenting all forms of activities in karst, caves and other related surface and subsurface environments!

Michal Filippi and Pavel Bosák
Proceedings editors

THE ANCIENT MINES OF USSEGLIO (TORINO, ITALY) MULTI-YEAR PROGRAMME OF RECORDING, STUDY, PRESERVATION AND CULTURAL DEVELOPMENT OF THE ARCHAEOLOGICAL MINING HERITAGE IN AN ALPINE VALLEY

**Maurizio Rossi¹, Anna Gattiglia¹, Daniele Castelli², Claudia Chiappino³, Renato Nisbet⁴,
Luca Patria⁵, Franca Porticelli⁶, Giacomo Re Fiorentin⁷, Piergiorgio Rossetti²**

¹*Civic Alpine Museum “Arnaldo Tazzetti”, Usseglio (Torino), museocivicoalpinousseglio@antropologiaalpina.it*

²*Department of Earth Sciences, Torino University, daniele.castelli@unito.it; piergiorgio.rossetti@unito.it*

³*Artificial Cavities Commission of SSI – National Mining Engineer Association, Torino, c.chiappino@7srl.eu*

⁴*Archaeobotany Laboratory, Venezia University Ca’ Foscari, renisbet@tin.it*

⁵*Alpine Culture Research Centre, Exilles (Torino), temaranata@gmail.com*

⁶*National University Library, Torino, franca.porticelli@beniculturali.it*

⁷*ARPA Piemonte, Tematic Department of Geology and Instability, Torino, giacrefi@arpa.piemonte.it*

The programme started in 2001 and developed a large set of operations in order to create a geo-topographic and historical-environmental database, to rebuild the chronology (relative and absolute) of mining works in the Punta Corna complex (high Arnàs and Servin valleys) and the extractive activities’ effects on the Usseglio economy and more broadly on Lanzo Valleys economy.

The main part of the operations has been conducted directly by the Civic Alpine Museum staff, but in some aspects (such as deciphering medieval documents, mineralogy, petrography, GNSS surveys, aerial photography, restoration of the steel archaeo-mining finds, and so on), a strict co-operation with university teachers and other specialists or qualified technical figures was requested and realized.

This open and multi-disciplinary approach will guarantee, also into the future, the best exploration and knowledge of this enormous heritage.

According to the experience of the senior archaeologists (responsible to the Civic Alpine Museum), a group of underground experts – mining engineers and speleologists specialized in artificial cavities – will carry out explorations and surveys, to collect precious information connected to the external records.

1. Topography and Geology

The Punta Corna mountain mining complex is located on the left side of the Arnàs stream valley (western Po basin), spreading from 2,250 to 2,900 m a.s.l. (main peaks attain 2,930 up to 3,108 m a.s.l.), between Rossa Lake (hydroelectric storage near French border, 2,718 m a.s.l.) westwards and Torre d’Ovarda mountain group (3,075 m a.s.l.) eastwards.

The siderite and Co-Fe-Ni arsenides mineralisations belong to a trending system of post-metamorphic hydrothermal veins, mainly within the metabasites of the Piemonte Zone. These veins formed because of the circulation of hydrothermal fluids along extensional structures linked to brittle deformation events which affected the rocks at the end of the Alpine orogenesis.

The mining complex is protected by the institution of a 10 km² area, wherein the mineral collection and the removal of man-made objects are totally forbidden.

2. Aerial reconnaissance and field survey of archaic mines

Aerial reconnaissance and field survey point out a strip of some kilometres long, up to 10 m wide and 12 m deep, open air trenches, issued from archaic iron ores mining; their

order of magnitude is equal to today’s industrial plants, like roads, hydroelectric power plants or dams.

These trenches are associated with pits, ditches, descending galleries (often intentionally back-filled after the end of the exploitation), sinkholes, undermined boulders, spoil banks, remnants of little rough-stone half-buried buildings and also walls, used for terracing, ore crushing and picking, sheltering gallery entrances and closing natural rock-shelters.

3. Technical features of archaic exploitation

The exploitation was focused on iron hydroxides (limonite, goethite), resulting from siderite decay. The fragmentation was strictly limited to mineralised veins, particularly in upper and softer levels; it halted when reaching inner and harder levels of massive, un-weathered iron carbonates (siderite). No drill holes and only rare tool marks are visible on the trench sidewalls. Miners used steel hand tools, occasionally found near the trenches during field survey.

4. Present look of trenches

Today, iron ores are seldom visible in the open air, because they have been nearly completely removed by the exploiters. Trenches are partly occupied by unremoved

boulders and panels of the embedding rock, so their bottom is presently unattainable; nevertheless, they seem sometimes to be connected to descending gallery entrances in lower levels. Sidewalls are generally stable; widespread spoil banks run along the ditches.

5. Present look of pits, ditches and sink-holes

All these features are excavated under main boulders, which shelter the access to veins; they are circular, oval or funnel-shaped, placed above buried veins, flanked by little, mound-shaped spoil banks, obstructed by post-functional collapses



Figure 1. Trenches R1-201 and R1-202 (left); iron hydroxides and embedding rock panels in trench T1-202 (right).

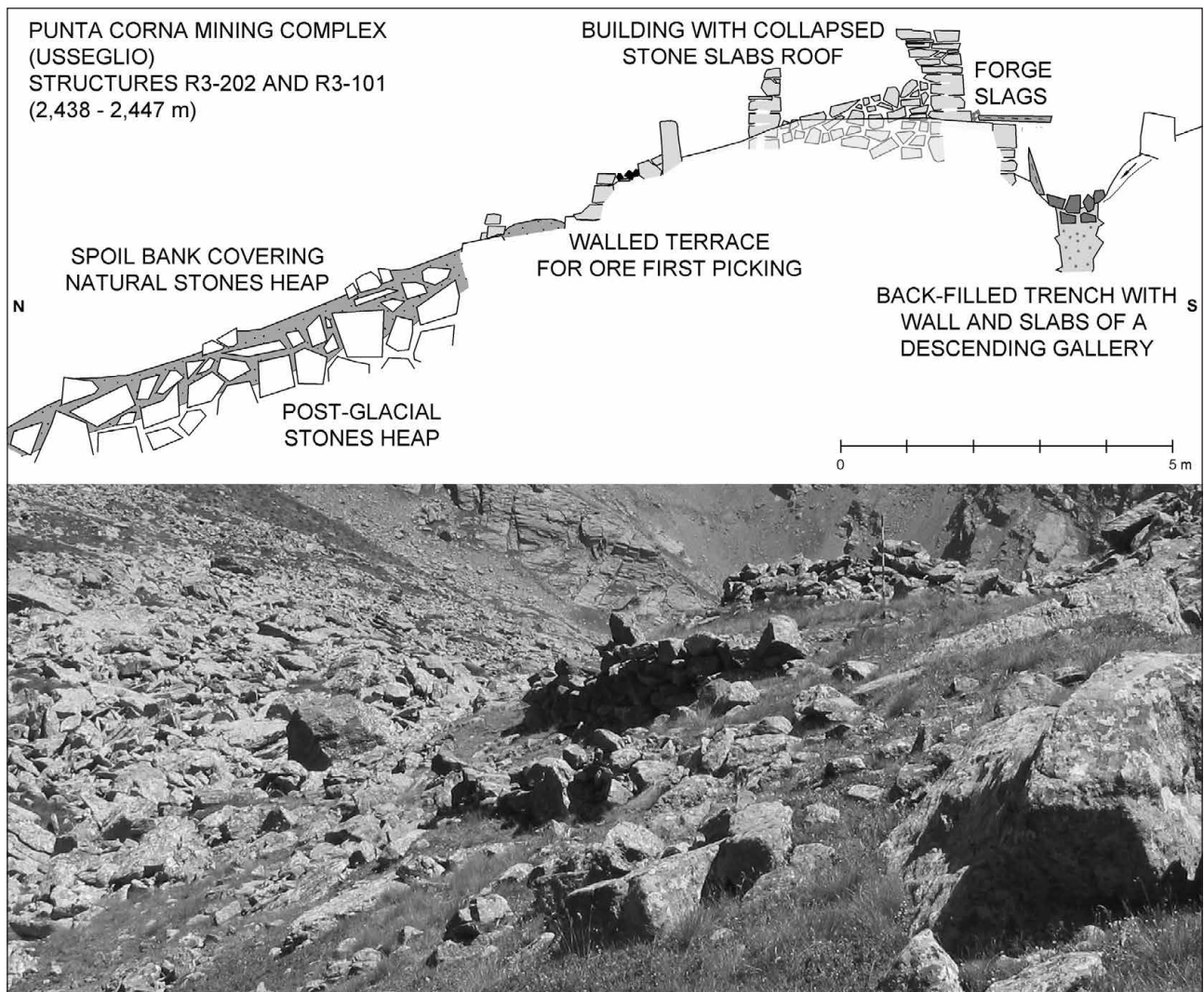


Figure 2. Vertical section and photographic view of a typical archaic plant.

or back-filled after the end of the exploitation. Underground, rough-stone walls, slabs and stairs are preserved for few metres.

In general, the structures are well preserved in comparison with their working time, because of scarce post-functional colluvium.

6. Pre-blasting mining

Gunpowder use in mining activities begins in the 17th century: the first statements in the Duchy of Savoy date from 1671, in the Duchy of Milan from 1665.

The organization of a pre-blasting mining exploitation, possibly similar to the Usseglio examples, can be observed in the polyptych by Hans Hesse (1522) for the altar of mine workers in the Church of St. Anne at Annaberg-Buchholz (Herzgebirge, Sachsen, Germany).

7. Chronology

The dating of archaic exploitation to the middle ages is based on archaeological finds, particularly steel tools (12th–14th century) and pottery (11th–13th century), and on historical documents, referring to mining activity, cast iron, steel and silver production, and ore thefts, in the years 1264 (already carrying on previous contracts), 1316, 1318, 1333, 1335, 1402, 1438, and 1515.

8. The age of cobalt

Since 1753, after a long period of scarce production, a new chapter begins, because of the discovery of cobalt ores, exploited by Counts Rebuffo di Traves alongside copper and silver (cobalt-iron-nickel arsenides with tetrahedrites).

Two maps, dating to 1758–1772, mark the exact positions and directions of several veins. In 1758, a building named

“Casere”, much larger than medieval ones, was built at an altitude of 2,625 m a.s.l. near Veil Lake to house the workers.

9. A proto-industrial perspective

The exploitation is no longer opencast mining, but moves mainly underground, with several multi-level grids, sometimes intercepting former works, in an incoming proto-industrial perspective.

Two new buildings are constructed before 1815, at 2,374 and 2,439 m a.s.l. respectively. Both are recorded in a mine section dating to 1823, near the entrance of crosscuts.

10. Paper maps and material reality

Even today, veins, galleries, spoil banks and buildings reported by mine sections and maps can be identified in the field. However, galleries and stopes are mostly inaccessible, because of landslides, or dangerous, because of the collapse of timbering.

Documents reveal to us that sometimes miners lived in very hard conditions: the “Dwelling of Workers” (“*Abitazione de Lauoranti*”), recorded by a map, in 1758–1772, at the foot of “St. Mary Mine” (“*Caua di S. Maria*”), was a walled prehistory-like rock-shelter, still used occasionally in the 1920s by the last prospectors.

11. Protecting the entrances

To reach the deposit bed, that was hidden by a thick layer of debris, miners built some long galleries into such sediments, protected by side walls and roofed by rough-stone slabs. One of the most impressive linked a dwelling to the real lower entrance of a mine, that was cut in hard rock: in that way, miners avoided blockages of the entrance by landslides or by avalanches and avoided long removal works in spring, when restarting the exploitation after the



Figure 3. Ruins of a modern dwelling, linked to an underground grid by a gallery, built into the debris (left); an example of a subterranean vein (right).

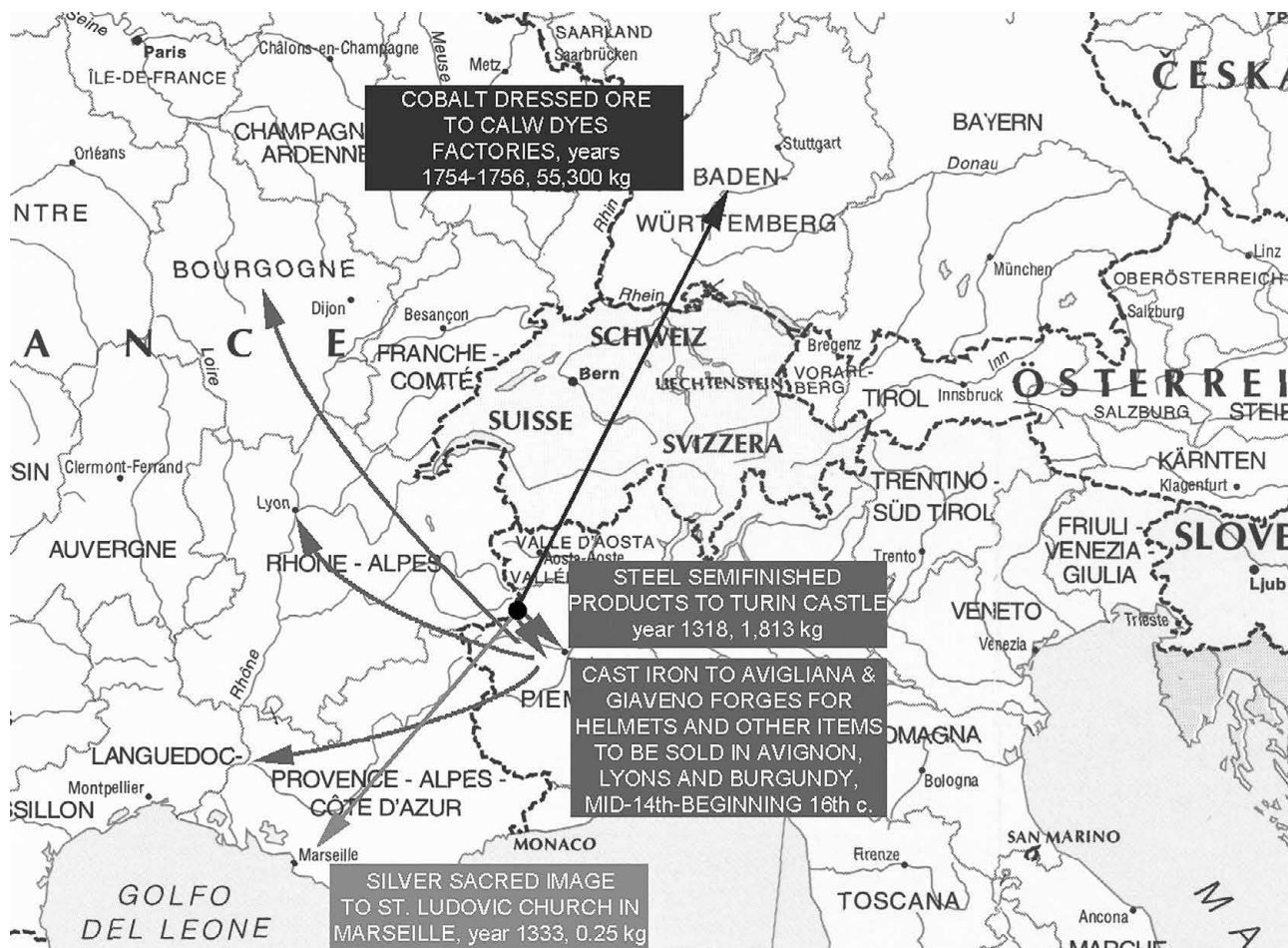


Figure 4. Not just a local market: international routes from Usseglio to European destinations.

winter inactivity (documents inform us that the season lasted no more than four to six months).

12. Observing the veins

Veins can be observed underground, where the exploitation stopped: they show a series of parallel, almost vertical bands, with a lot of gangue.

13. The “cobalt factory”

The Usseglio built-up area still hosts the “Cobalt Factory”, at 1,290 m a.s.l. in Crot hamlet, built in 1755–1757 according to a plant model imported from Saxony and Bohemia by S.B. Nicolis di Robilant (1724–1801), general inspector of the mines of the Kingdom of Sardinia (1752–1773).

The dressed ore that was produced by this plant was exported to Württemberg (55 tons up to 1756). The original look of the building is recorded by maps and drawings dating to the period 1823–1854.

14. From factory to hotel

The factory was then enlarged and modified, in 1896 becoming one of the earlier hotels devoted to the rising mountain tourism, with the evocative appellation “Albergo Miniere” (“Mines Hotel”). Today it is a stop on the external itinerary of the Civic Alpine Museum.

15. Working plan 2013

Following the Museum programmes, in order to increase and to develop our knowledge of the territory, in summer 2013 a lot of new studies are going to start:

- recording and topography of archaic mines located in the area, in safe conditions;
- underground survey of mining, according to speleological/archaeological standards;
- multidisciplinary study of cavities and associated evidence (mineralogical, mining, wildlife, archaeobotanic, etc.).

16. In conclusion

One of the statutory aims of the Civic Alpine Museum of Usseglio, entirely volunteer-conducted, is the “systematic recording and cultural development of the historic heritage of sciences and techniques”. The Museum’s researchers, with the decisive aid of several colleagues of other institutions, are carrying out a full survey of archaeological mining structures in relationship to geological, technological, historical and iconographic data.

The state of preservation of this heritage is remarkably good, as the area is geologically stable, vegetation is almost absent, mining has been suddenly abandoned and no subsequent activities but pastoral farming have taken place.

Several sites are accessible to the public in summer and at the beginning of autumn, as the Museum organizes workshops including guided tours in the Punta Corna protected area.

References

Rossi M, Gattiglia A (ed.), 2011. Terre rosse, pietre verdi e blu cobalto. Miniere a Usseglio. Prima raccolta di studi. Usseglio – Torino: Museo Civico Alpino “Arnaldo Tazzetti” – Biblioteca Nazionale Universitaria – Dipartimento di Scienze Mineralogiche e Petrologiche, A4, 236 pages, 18 authors, broadly illustrated.

Czech Republic, Brno
July 21–28, 2013



© Czech Speleological Society
www.speleo.cz

ISBN 978-80-87857-08-3



9 788087 857083