

---

## TABLE OF CONTENT

---

### **CHARACTERISATION OF DAMAGE PHENOMENA OF STONE AND RELATED BUILDING MATERIALS (PLASTER, RENDERING, MORTAR ETC.)**

R. Snethlage

<b>Risk Number: Documentation and Objective Assessment of Environmental Damage to Marble and Sandstone Sculpture .....</b>	<b>35</b>
--	-----------

R. Bugini, L. Folli

<b>New marbles for the Italian architecture (1920–40) .....</b>	<b>41</b>
---	-----------

K. Ekinci, A. Karagöl, G. G. Küçükosmanoğlu, I. Polat Pekmezci

<b>Characterization and deterioration of materials of Rumelifeneri Fortress in Istanbul .....</b>	<b>47</b>
---	-----------

A. Kück, Ch. Pötzl, R. López-Doncel, R. Dohrmann, S. Siegesmund

<b>Tuffs in pre-Columbian and colonial architecture of Oaxaca, Mexico .....</b>	<b>53</b>
---	-----------

J. Diaz, B. Menéndez

<b>Sustainable lime restoration mortars: Physical properties and durability assessment .....</b>	<b>59</b>
--	-----------

C. Noël, B. Menéndez

<b>Comparison of physico-chemical properties between ancient and restoration renders in the Vexin Français area (NW of Paris) .....</b>	<b>65</b>
---	-----------

S. Ahmadinezhad, A. Sansonetti, A. Pane, D. Biondelli

<b>Study of decay patterns and damage assessment of the Achaemenian rock-reliefs of Naqsh-e Rustam .....</b>	<b>71</b>
--	-----------

---

E. Vasanelli, A. Calia, G. Quarta, D. Melica, M. Masieri, A. Monte, F. Micelli <b>Effect of fire on the durability of a porous calcarenite: the case study of a tobacco factory in Tricase (Lecce, Southern Italy) .....</b>	77
M. Drdácký, D. Frankeová, Z. Slížková <b>Variations of characteristics of sandstone subjected to weathering and conservation interventions .....</b>	83
N. Freudenberg, T. Frühwirt, K.-J. Kohl, M. Kutz, H. Siedel, J. Wichert <b>Thermal behavior of building sandstone: laboratory heating experiments vs. real fire exposure .....</b>	89
L. Schröer, T. De Kock, N. Boon, V. Cnudde <b>Exploring microbial communities inhabiting gypsum crusts of weathered natural building stones .....</b>	95
M. Haselberger, M. Milchin, K. Fuchs, G. Enkhbat, Ts. Tsolmon, J. Weber, G. Krist <b>Stone Cultural Heritage in Mongolia – Model-like Study and Condition Assessment of the Site of Ikh Khöshööt .....</b>	101
M. Morales Demarco, E. Cocorel <b>Characterization and deterioration assessment of Kösseine Granite in Palacio Salvo, Montevideo, Uruguay .....</b>	107
A. Eckart, R. Sobott, H. Kletti, T. Burkert, W. Jäger <b>2000 years of use of plaster as building and restoration material for the „Takht-e Soleyman“ in Western Azerbaijan, Iran .....</b>	113
A. Kück, Ch. Pötzl, R. López-Doncel, R. Dohrmann, S. Siegesmund <b>Effects of zeolites and swellable clay minerals on water-related properties and thermal dilatation in volcanic tuff rocks .....</b>	119
M. Saba, J. Lizarazo-Marriaga, N. L. Hernandez-Romero, C. Tedeschi, E. Quiñones-Bolaños <b>Physico-chemical characterization of the Cartagena Wall and quarry material stone used for its restoration .....</b>	125
Á. Török, L. Germinario, R. López-Doncel, Ch. Pötzl, S. Siegesmund <b>Comparative analysis of volcanic tuffs from Europe, Asia and North-America .....</b>	131
W. Wedekind, E. Harutyunyan, S. Siegesmund <b>The Cathedral-ruins of Zvartnots and Avan (Armenia) – a comparative study on decay and restoration .....</b>	137

L. Sousa, J. Menningen, S. Siegesmund  
**Notes of a bowing behavior on limestone .....** 145

L. Lazzarini, E. Tesser  
**The four sculpted columns of the St. Mark basilica' ciborium, Venice:  
marbles, polychromy, past treatments .....** 151

## METHODS FOR THE INVESTIGATION OF STONE DECAY; IN-SITU AND NON-DESTRUCTIVE TESTING

R. Livingston, C. Grissom, Y. Gorokhovich  
**Portable XRF study of the geographic distribution and growth rate of  
mn-rich rock varnish .....** 161

B. Sacchi, E. Cantisani, T. Salvatici, C. A. Garzonio  
**Microdrilling resistance measurements system and mortar penetrometer:  
two methods for evaluating in situ mortar resistance .....** 167

Ma H., Dai Sh., Zhou Y., Qian B., Tang Zh., Zhang G., Xiang J., Zhen G.  
**Ultrasonic testing of the dolomite marble statue of Soong Ching-ling  
with respect to the depth of cracks and deterioration state .....** 173

T. Waragai, T. Takemura  
**Acoustic emission behavior of rocks subjected to temperature changes .....** 179

St. Pirskawetz, J. Menningen, S. Siegesmund  
**Acoustic emissions – insights into the decay mechanisms of thermally  
treated marbles .....** 185

D. Benavente, M. de Jongh, J.J. Galiana-Merino, C. Pla, J. Martinez-Martinez,  
M. Lee, M.E. Young  
**Automatic estimation of the P- and S-wave onset-times in weathered  
sandstones by salt crystallisation .....** 191

H. Yang, D. W. Kim, C. H. Lee, J. H. Yoo  
**A study on nondestructive diagnosis and conservation scheme of  
Korean dinosaur egg fossil sites in Hwaseong Gojeongri .....** 197

H. Y. Park, S. Y. Park, C. H. Lee, J. H. Park  
**Material Characteristics and Non-Destructive Diagnosis of Stone Standing  
Buddha and Stone Chamber of Mireukri Temple Site in Chungju, Korea .....** 203

Ch. Pötzl, A. D. Öcal, T. Cramer, S. Siegesmund	
<b>Decay of Pre-Columbian phallic stone monoliths .....</b>	<b>209</b>
St. Pfefferkorn, Ch. Franzen	
<b>Evaluation of effective compression strength of natural stone by drilling resistance measurements .....</b>	<b>215</b>
L. Germinario, C. T. Oguchi	
<b>Historical man-made caves in Japan: Vulnerability of rocks and cultural assets in the underground environment .....</b>	<b>221</b>
F. Dursun	
<b>Material Characterization And Decay Of The Limestones Used In Historical Structures Of Mardin, Turkey .....</b>	<b>227</b>
M. Drdácký, M. Eisler, R. Krompholz	
<b>In-situ investigation of stone consolidation effects with immersed ultrasonic double-probe .....</b>	<b>233</b>
F. Tiefensee, C. Degel, P. Weber, W. Bost, M. Moses, M. Schmieger	
<b>A new system for fast ultrasound-tomography at marble sculptures .....</b>	<b>239</b>
D. M. Freire-Lista, L. Sousa	
<b>Fuente de Cibeles of Madrid and decay of Montesclaros marble .....</b>	<b>245</b>
O. Sánchez Rovira, D. Giovannacci, J.-D. Mertz, J. Wassermann, B. Ledésert, R. Hébert, Y. Mélinge	
<b>Water content estimation using non-destructive tools applied to archaeological materials .....</b>	<b>251</b>
W. Wedekind, E. Harutyunyan, N. Novakovic, S. Siegesmund	
<b>Experimental conservation and first investigations on the weathering of Geghard Monastery (Armenia) .....</b>	<b>257</b>
W. Wedekind, Ch. Schmidt	
<b>The three funerary Stelae Project .....</b>	<b>263</b>
C. Tedeschi, M. Taccia	
<b>Monitoring and evaluation of damaging of traditional cleaning techniques of stones with 3D optical microscopy profilometry .....</b>	<b>269</b>
M. Deprez, G. De Schutter, V. Cnudde, T. De Kock	
<b>Freeze-thaw weathering: Digging deeper in the temperature and length evolution of natural stones .....</b>	<b>275</b>

---

G. Cardani	
<b>The evaluation of the masonry quality in historical load-bearing stonework .....</b>	<b>281</b>
P. Kozub	
<b>Karsten Tube Penetration Test – new findings and new evaluation method .....</b>	<b>287</b>
S. T. Park, S. H. Kim, C. H. Lee	
<b>Evaluation on Reusability and Damage of Stone Properties for Repair</b>	
<b>of Wolnamsaji Temple Site Stone pagoda for Gangjin Korea in 13th Century .....</b>	<b>293</b>

## **LONG-TERM MONITORING OF STONE MONUMENTS AND BUILDINGS**

S. Hamilton, C. Graham, Ch. Gerdwilker, J. Hepher, S. Mirashrafi, E. Hyslop	
<b>Challenges of investigating decay in an enclosed bedrock monument:</b>	
<b>Fossil Grove, Glasgow .....</b>	<b>303</b>
O. E. Gilbert, L. Mol, O. Campbell, T. Blenkinsop	
<b>The Influence of Angle of Ballistic Impact on Stone Weathering .....</b>	<b>309</b>
J. H. Park, C. H. Lee, Y. H. Jo	
<b>A Study on Conservation Management System of Fortress Cultural Heritage</b>	
<b>by Behavior Monitoring and GIS .....</b>	<b>315</b>
S. H. Kim, C. H. Lee	
<b>Change of Environmental Stability by Improved Airtightness in the</b>	
<b>Korean Ancient Royal Tombs from the 6th Century Baekje Kingdom .....</b>	<b>321</b>
A. G. Costa	
<b>Long-Term Monitoring Of Processes Affecting Stone Materials</b>	
<b>Applied To Historical And Contemporary Buildings In Brazil .....</b>	<b>327</b>
J. Menningen, S. Siegesmund, R. Krompholz, Y. Rieffel	
<b>Comparative, Non-destructive analysis of the marble sculptures</b>	
<b>General von Bülow and von Scharnhorst in Berlin .....</b>	<b>333</b>
O. A. Cuzman, S. Rescic, P. Tiano	
<b>A new portable technique to evaluate the compatibility of</b>	
<b>protective treatments applied on monumental stones .....</b>	<b>339</b>
S. Laue, C. Schaab, D. Drese, D. Krauthäuser, G. Helfmeier, J. Vogt	
<b>Long-Term investigations and monitoring of the salt loaded Crypt</b>	
<b>of St. Maria im Kapitol, Cologne .....</b>	<b>345</b>

---

K. Wilhelm, D. Gulotta, A. Leslie, M. Krus, V. Thome, R. Kilian, H. Viles <b>Reviving 'Asterixe': a unique long-term archive for built heritage research .....</b>	<b>351</b>
S. Siegesmund, M. Morales Demarco, R. Wittenbecher, M. Pfeifer, K.-J. Stein <b>Koelga Marble as building veneer at the Town Hall of Wermelskirchen (Germany): Weathering dynamics, bowing potential and risk assessment: Part I .....</b>	<b>357</b>
S. Siegesmund, M. Morales Demarco, R. Wittenbecher, M. Pfeifer, K.-J. Stein <b>Koelga Marble as building veneer at the Town Hall of Wermelskirchen (Germany): Weathering dynamics, bowing potential and risk assessment: Part II .....</b>	<b>363</b>
A. Bordi, M. Matteini, F. Piqué <b>2-step DAP consolidation of marble busts on the facade of Lugano's Cathedral .....</b>	<b>369</b>
I. Kisilewicz <b>The Impact of Natural Climate Hazards impact on the Restoration of Dragomirna Church .....</b>	<b>375</b>
J. M. Quadrizius, E. Wendler, J. Meinhardt <b>Improved Evaluation of Karsten Water Uptake Measurements: Visualisation of the Soaking Front by Absorption of Dye Solutions .....</b>	<b>381</b>
Y. Praticò, F. Girardet, R.J. Flatt <b>New insights on the causes of contour scaling in Swiss sandstones .....</b>	<b>385</b>

## SIMULATION AND MODELLING OF DECAY

Xiaolin C. <b>Performance Simulation of Solid Brick Construction under the Impacts of Increased Precipitation as a Consequence of Climate Change .....</b>	<b>395</b>
F. Dursun, T. Topal <b>Effect of weathering tests on microfracture properties of the massive and vesicular basalts .....</b>	<b>401</b>
Mengjun J., Ling H. <b>The implication from the Na<sub>2</sub>SO<sub>4</sub> Crystallization behaviors on Dafosi sandstones during salt-loaded hygrothermal aging cycles .....</b>	<b>407</b>

J. Bartholdy, P. Klenz Larsen, J. Bredal-Jørgensen <b>The damaging effect of “eco-friendly” deicing salts on building materials .....</b>	413
A. Stahlbuhk, M. Steiger <b>Investigations on the Supersaturation and Damage Potential of Nitrate Salts Relevant for Objects of Cultural Heritage .....</b>	419
E. Huby, C. Thomachot-Schneider, P. Vázquez, G. Fronteau, J. Menningen, S. Siegesmund <b>Dilatation behavior of building stones repaired with a restoration mortar .....</b>	425
J. Frick, N. Sakiyama, B. Hejazi, F. Lehmann, S. Gambarelli, J. Ožbolt, H. Garrecht <b>Real time monitoring of moisture and salt transport and related modelling .....</b>	431
M. Michette, H. Viles, C. Vlachou, I. Angus <b>Modelling the effect of repointing and galleting on moisture dynamics in historic masonry at the Wardrobe Tower, Tower of London .....</b>	437
D. Zhiyan, S. Wakiya, Y. Kohdzuma <b>Deterioration Mechanism of Japanese Sandstone During the Drying and Wetting Cycles .....</b>	443
C. Blaeuer, B. Rousset, A. Loeffel, P. Voelkle, H. Haeberli <b>Tests on repair mortars for sandstones at Berne Cathedral .....</b>	449
E. Mizutani, D. Ogura, M. Abuku, H. Derluyn <b>Preliminary investigation of change of pore structure due to salt precipitation during evaporation in brick with X-ray computed tomography .....</b>	455
M. García-González, M. A. Soto-Zamora, R. A. López-Doncel <b>The behavior of the Cantera Hermosa tuff to the process of salt crystallization, using water with different levels of pollution – Preliminary results. ....</b>	461
E. Wendler, S. Endemann, G. Klapprott <b>Stress-strain-adapted Involvement of Cross-iron in Soft Sandstone Material .....</b>	467
Y. Wang, Sh. Yang, Z. Yu, Q. Guo, H. Viles <b>Evaluation of the impact of salts on the deterioration of a sandstone rock-hewn cave-temple in NW China through the combination of in situ salt extraction and salt behaviour modelling .....</b>	473

## TECHNOLOGY AND DEVELOPMENT OF IMPROVED TREATMENTS AND USE OF STONE IN NEW BUILDINGS

C. Franzen, H. Ettl, G. Grassegger, F. Grüner, R. Lenz, H. Siedel, E. Wendler <b>Desalination of porous building material by means of poultices, the new revised WTA-Guideline .....</b>	483
I. Rörig-Dalgaard, A. E. Charola <b>A new method for evaluating the condition of fired clay bricks: Preliminary results .....</b>	489
J. Otero, A. E. Charola <b>Reflections on Nanolime Consolidation .....</b>	495
T. Wangler, A. M. Aguilar Sanchez <b>Potential damage mechanism in Swiss molasse .....</b>	501
J. Orlowsky, F. Braun <b>Comparison of different evaluation methods concerning water absorption .....</b>	507
E. Mascha, J. Weber <b>Assessment of the Spatial Distribution of Consolidating Solids in the Pore Space by SEM .....</b>	513
B. Sena da Fonseca, A. P. Ferreira Pinto, S. Piçarra, A. Rodrigues, M. F. Montemor <b>Comparative behavior of commercial and laboratory-developed alkoxysilane-based products as consolidants for carbonate stones .....</b>	519
E. Mascha, M. Ban, A. Rohatsch, J. Weber <b>Silicates for the Consolidation of Stone: Nano Silica vs. Ethyl Silicate .....</b>	525
E. Sassoni, E. Franzoni, S. Siegesmund, G. W. Scherer <b>10 years of marble conservation by ammonium phosphate: laboratory and field data on protection, consolidation and mitigation of bowing .....</b>	531
J. Engel <b>Development of a New Cleaning Product for Heavy Metals Containing Facades .....</b>	537
L. Masson, J.-S. Guédon, J.-D. Mertz, E. Keita, M. Duc, A. Bourgès <b>Swelling inhibitors for clay materials: Comparison of industrial and natural surfactants .....</b>	543
N. M. E. Stucchi, E. Tesser, A. Benedetti, F. Antonelli, G. Zaccariello <b>Experimental silica nanoparticles products for the consolidation of silicate stones .....</b>	549

J. Menningen, E. Sassoni, S. Siegesmund <b>Marble bowing: Prevention by the application of Hydroxyapatite – a systematic study .....</b>	555
M. Cicardi, C. Corti, O. Salvadori, F. Piqué <b>Endolithic microorganisms in carbonatic rocks and conservations problems .....</b>	561
G. Sikorowski, F. Piqué, M. Matteini, Y. Praticò <b>Planar Abrasion Meter .....</b>	567
A.-L. M. Hoyt, H. Cölfen <b>Stone pore imitating artificial test systems: Current prototypes and potential for cultural heritage care .....</b>	573
A. Suzuki, C. Riminesi, B. Salvadori, S. Vettori, M. Ricci, L. Bartoli, A. Zanini <b>Graphic vandalism: preliminary cleaning tests on stone materials by (Yb:YAG) active fiber laser system .....</b>	579
L. M. Ottosen <b>A short review on electro-desalination and its application for chlorides and nitrates .....</b>	585
C. L. Nunes, K. Mlsnová, J. Válek <b>Limewashes with linseed oil: effect on the moisture transport of natural stone .....</b>	591
S. Rucker, C. Pötzl, E. Wendler, R. Dohrmann, R. López-Doncel, S. Siegesmund <b>Improved consolidation of volcanic tuff rocks with TEOS .....</b>	597
M. Teipel, Ch. Pötzl, W. Wedekind, B. Middendorf, S. Siegesmund <b>Approach on developing stone replacement mortars for the cultural heritage of Armenia .....</b>	603
V. Vergès-Belmin, L. Leroux, J. Hénin, S. Duchêne <b>Stone conservation issues after the 2019 fire at Notre-Dame cathedral .....</b>	609

## ASSESSMENT OF LONG-TERM EFFECTS OF TREATMENTS

A. Thorn <b>Two case studies on the usefulness of surface water absorption as a meaningful property of sandstone .....</b>	621
---	-----

A. Kieferle	
<b>Conservation of a Recent Conservation Based on Silicic-Acid-Ether and Silica Sol .....</b>	<b>627</b>
F. Braun, J. Orlowsky	
<b>Single-Sided NMR Experiments on Hydrophobic and Long-Term</b>	
<b>Weathered Natural Stones .....</b>	<b>633</b>
L. Normand, D. Giovannacci, V. Vergès Belmin, St. Duchêne, J. Hénin	
<b>Terahertz time-domain imaging (THz-TDI):</b>	
<b>A new non-destructive method for the determination of consolidation depth on stone .....</b>	<b>639</b>
M. Milchin, C. Pesce, J. Weber, G. Krist, M. Ban, M. Anghelone	
<b>An Evaluation of Shelter Coats for the Protection of Outdoor Stones .....</b>	<b>645</b>
T. Meier, M. Auras, R. Sobott, C. Leonhardt, J. Heller, H. Drengemann,	
D. Köhn, T. Steinkraus, Y. Esel, S. Hintz, E. Erkul, D. Schulte-Kortnack	
<b>Investigating Surficial Alterations of Natural Stone, Bricks, and Plaster</b>	
<b>by Ultrasonic Surface Measurements .....</b>	<b>651</b>
T. Schade, B. Middendorf	
<b>Microstructural investigations regarding the recrystallization process of</b>	
<b>gypsum based mortars for historic exterior masonry .....</b>	<b>657</b>
D. Odgers, N. Cox	
<b>Wells Cathedral, West Front sculpture – detailed assessment of</b>	
<b>conservation repair techniques .....</b>	<b>663</b>
K. Fuchs, F. Pintér	
<b>Performance of lime-based sacrificial layers for the conservation of</b>	
<b>porous limestone in an urban environment: a case study .....</b>	<b>669</b>
M. Groh, F. Braun, J. Orlowsky	
<b>Contact angle measurements on hydrophobic natural stones .....</b>	<b>675</b>
R. Manganelli Del Fà, B. Sacchi, A. Sansonetti, S. Vettori, C. Riminesi,	
F. Fratini, S. Lugli, G. Tirelli, G. Grassi, M. Laurenzi Tabasso	
<b>Hydration-Dehydration decay on sandstone: Possible remedy and evaluation</b>	
<b>of the effects of a specific anti-swelling product .....</b>	<b>681</b>
B. T. Gemedo, L. Fusade, H. Viles	
<b>Efficacy of traditional conservation methods for the protection of</b>	
<b>rock-hewn heritage sites: Lessons from Lalibela, Ethiopia .....</b>	<b>687</b>

T. Ishizaki, N. Araki  
**Evaluation Of The Deterioration Of A Stone Gate (Torii) And Its Protective Measure .....** 693

Jinhua W., Shu J., Shibing D.  
**A Brief Analysis of the Conservation Status and Prospect of Grotto Temples in China .....** 699

## **IMPACT OF CLIMATE CHANGE ON STONE DECAY OF CULTURAL HERITAGE**

S. Siegesmund, St. Pirskawetz, F. Weise, R. Plagge, Y. Rieffel  
**Winter Shelters For Marble Sculptures Of The Schlossbrücke Berlin:  
Climatic Constraints .....** 709

D. McCaughey, I. Simpson, E. Hyslop, C. Graham, A. Turmel  
**Baselining Sandstone Heritage for Conservation in a Climate Change(d) Future .....** 717

Yiding W., Shibing D.  
**Challenges of Conservation of Sand-stone Architectural Heritage  
in Tsada Basin of Ngari Prefecture, Tibet, China .....** 723

D. Guilbert, St. Caluwaerts, K. Calle, N. Van Den Bossche, V. Crudde, T. De Kock  
**The urban heat island impact on frost weathering of natural building stones  
in Ghent, Belgium .....** 729

L. Mertens, C. Sabatzki  
**Suevite, a Rare Impact Stone: Research and Development of Conservation Materials .....** 735

S. Laratte, C. Thomachot-Schneider, G. Fronteau, A. Guillaneuf, P. Vazquez  
**Salt sensitivity of the stones of the Porte de Mars of Rheims caused by  
the impact of an acid atmosphere exposure .....** 741

J. Meinhardt, K. Schmeikal  
**Investigations of aversive conditioning of biogenous growth on exposed  
sandstone objects .....** 747

A. Nielsen, M. Brancucci  
**Characterisation of pollutant deposits: possible relationships between  
areas of origin and degradation of marble monuments. ....** 753

P. Brimblecombe  
**Future Climate and Stone Decay .....** 759

---

O. Bilal, N. Rozgonyi-Boissinot <b>Diagnosis of Stone Deterioration in Crac des Chevaliers</b>	765
K. Sterflinger, A. Rohatsch, L. Belanyecz, A. Huber <b>Live and let die? Biofilms on Stone: Possibilities, Limits and Risks of Combating</b>	771
D. Badreddine, K. Beck, X. Brunetaud, A. Chaaba, M. Al-Mukhtar <b>Stone-mortar compatibility:</b> <b>Thermo-hygric cycling induced aging of masonries polluted by salt</b>	777
Shibing D., Jizhong H., Jinhua W., Hongsong L. <b>Stone Conservation in China – with Focusing on Carbonate Stone Conservation Practice</b>	783

## REPORTS ABOUT STONE CONSERVATION: CASE STUDIES AND PROJECTS

T. Dettmering, Z. Liu, Y. Tang, Y. Wang, S. Dai <b>Preliminary study on lime mortars used for stone masonry of the Great Wall built by Ming Dynasty in China</b>	793
Š. Govže, S. Dolenc, A. Pondelak <b>Consolidation Of The Bioclastic Limestone Using Three Different Carbonate-Forming Consolidants: In Situ Study</b>	799
M. Stuff, K. Rübner, C. Prinz, N. Rische, M. Chronz, H.-C. Kühne <b>Towards a better understanding of tuff stone deterioration</b>	805
G. H. Lee, C. H. Lee, J. H. Park <b>Material Characteristics and Provenance Presumption for Stone Properties of the Korean Ancient Tomb in Seoul Songpa District</b>	811
N. Maklada, Y. Saad, Y. Schaffer, P. Gendelman, Y. Sha'altiel, E. Greenfeld, I. Rosenthal <b>The Crusader Wall of Caesarea Resurrected: A Conservation Stonework Project</b>	817
D. Kowalik-Kociszewska <b>Examination of Historical Sandstone Epitaphs as a Searching For a New Method of Conservation</b>	823
V. Marinković, D. Mudronja, S. Dolenc, A. Pondelak <b>Case study: Stone Consolidation of Reliefs inside the Cathedral of St. Lawrence, Trogir – Results and Doubts of Field Treatment</b>	829

L. Mol, C. Brassey, L. Clarke, O. Gilbert, O. Campbell, T. Blenkinsop <b>Heritage in the Crossfire .....</b>	835
M. Avrahami, J. Neguer <b>The conservation of the Lintels of the Church of the St. Sepulchre .....</b>	841
B. Brunet-Imbault, Ph. Bromblet, H. de La Boisse, B. Reidiboym, C. Guinamard <b>Conservation of delaminated stone: Diagnosis and tests for the restoration of the medieval church of Sainte-Croix de Celleneuve (Montpellier, France) .....</b>	847
S. Godts, C. De Clercq <b>Analysis of the Salt Content during Water Bath Desalination of a Polychrome Limestone Relief .....</b>	853
J. De Roy, S. Huysmans, L. Fontaine, C. De Clercq, S. Godts <b>A pilot study to define the restoration for 68 sandstone sculptures of the Calvary of the St. Paul's Church in Antwerp (Belgium) .....</b>	859
E. Steindlberger <b>Conservation of northern Hessian tuffstones – A building material used for the monuments in the Bergpark Wilhelmshöhe .....</b>	865
R. Will, K. Lange <b>Restoration of the 172 facade sculptures of the New Palace, Potsdam – development and transfer of an economic concept .....</b>	871
J. Meinhardt, J. Gutglück, K. Schmeikal, G. Hauff <b>Exemplary conservation of the polychromy on the Gothic sandstone sculptures of the Halberstadt cathedral using facing-technology .....</b>	877
K. Lange, R. Will <b>The marble sculpture collection in front of the palace of the New Chambers, Potsdam Outlining current research and practice in sculpture restoration .....</b>	883
E. İpekci, R. Aydın, M. Taykurt Daday, H. Yüceer, H. Böke <b>Weathering of Limestone at Anavarza Archaeological Site in Turkey .....</b>	889
A. Logreira, L. Ashton <b>Conservation of the Cloisters at Norwich Cathedral, UK .....</b>	895
A. Sobhi, H. Marey Mahmoud, A. Brania <b>The burial tombs of Tell-Basta: the building materials and restoration attempt .....</b>	901

---

M. Uggeri, E. Concina, A. Sansonetti, R. Bugini <b>Study of the lithotypes used in the mosaics of artificial grottoes and nymphaea in Lombardy .....</b>	<b>907</b>
S. Fujii, K. Kiriyama, S. Wakiya, T. Koezuka, Y. Kohdzuma <b>Influence of heat and moisture environment inside the shelter on sodium and calcium sulfate behavior .....</b>	<b>913</b>
F. Grüner, J. Zöldföldi <b>Natural stone exchange and quality assurance in the case of the Ulm Minster in Baden-Württemberg .....</b>	<b>919</b>
Ch. Burris <b>The Discovery, Analysis and Replication of a Blue Romanesque Revival Stopping Mortar .....</b>	<b>925</b>
E. Stadlbauer, G. D'ham, A. Ehling, R. Niemeyer, C. Reulecke, A. Rinne, F. Schlütter, B. Skasa-Lindermeir <b>Preservation and conservation of Goslar slate – The example of the Mönchehaus in the world heritage historic city of Goslar, Germany .....</b>	<b>931</b>
J. Zöldföldi, L. Holzkamp, R. Lenz, A. L. Krautheimer, F. Grüner <b>On-site tests to assess wet vacuum cleaning technology for salt reduction on sandstones .....</b>	<b>937</b>
M. Auras, O. Hahn, C. Germann-Janssen, K. Keller, K. Petersen, B. Skasa-Lindermeir, E. Wendler <b>Moisture, salt and mould – conservation problems in a medieval Mikveh .....</b>	<b>943</b>
T. Pinkale, K. Bommes, P. Kozub <b>Drachenfels Trachyte – Research into the preservation of Cologne Cathedral's medieval radiating chapels .....</b>	<b>949</b>
A. Steyer, M. Steyer, M. Auras, E. Riemer <b>Possibilities and limitations of the computed tomography as a non-destructive testing tool using a Jupitercolumn as an example .....</b>	<b>955</b>
E. van Plehwe-Leisen, H. Leisen, A. Pranz <b>Stone Conservation in Bagan, Myanmar, and Training of Conservation Professionals .....</b>	<b>961</b>

**DIGITALIZATION AND DOCUMENTATION IN STONE CONSERVATION**

M. Rahrig, A. Karl, P. Bellendorf

- Evaluation of conservation measures for historical stone surfaces by using Opto-Technical Monitoring .....** 971

C. Franzen, S. Fuchs, A.-H. Hamdan, K. Hiemann, P. Katranuschkov, K. Luig,

D. Mustedanagic, R. Schülbe, M. Seeaed, R. Scherer

- BIM-SIS Adaptive Knowledge Based System for Identification of Stone Damages in Building Information Modeling Working Environment .....** 977

E. Valero, F. Bosché, A. Forster, I. M'Beirick, L. Wilson, A. Turmel, E. Hyslop

- Development of a novel open tool for the segmentation of 3D point clouds of masonry walls .....** 981

G. Siedler, S. Vetter, J. Kaminsky

- Data acquisition, management and evaluation for stone conservation projects with digital mapping .....** 987

O. Campbell, T. Blenkinsop, O. Gilbert, L. Mol, T. Lik Lee

- Microstructural Damage from Bullet Impacts in Heritage Sandstones .....** 993

St. Duchêne, J.-L. Bodnar, K. Mouhoubi, D. Giovannacci

- Stimulated infrared thermography (SIRT) revealing the hidden decoration of the Vierge du trumeau in Reims Cathedral .....** 999

B. Kozub, P. Kozub

- 3D-structured light scanning technology in the field of cultural heritage .....** 1005

J. Menningen, T. Fetzer, A. Schäfer, G. Reis, S. Siegesmund

- Ultrasound tomography and 3D scanning Technologies as a tool to constrain the weathering state of objects made of marble .....** 1011

Young H. J., Chan H. L.

- Development and Application of Three-dimensional Digital Technology for Stone Heritage Conservation .....** 1019

K. Bommes, T. Pinkale, P. Kozub

- St Walburga – Local value of polychrome terracotta figure results in conservation intervention and 3D-Scan generated replacement .....** 1025

A. Sturm, B. Edelstein, C. Snyder

- Lifting Mountains: The Treatment of a 7th Century Cambodian Sandstone Krishna Sculpture .....** 1031

## OPEN TOPICS

M. I. Borges	
<b>Exposure of Rosa Arronches and Santa Eulália Granites to Aggressive Environments: Ice-Deicing and Acidic Solutions – Analysis of Performance .....</b>	<b>1041</b>
T. De Kock	
<b>Perceptions of stone. Some examples from the historical use of Lede stone, Belgium .....</b>	<b>1047</b>
S. Raneri, T. De Kock, A. Rohatsch, M. Ban	
<b>The Potential of Neutron Imaging in Stone Conservation .....</b>	<b>1053</b>
M. Snethlage	
<b>The interdisciplinary “Arbeitsgruppe Steinkonservierung der DDR” – a historical study on their scientific work (1972–90) .....</b>	<b>1059</b>
M. Schidlowski, F. Ruegenberg, T. Bader, A. Diekamp	
<b>A Study for Assessing the Relationship between Calcination Temperature and Mineralogical Composition of Natural Hydraulic Limes (NHL) .....</b>	<b>1065</b>
T. Bader, J. Gagl, A. Diekamp	
<b>DOLOMIA: A survey on the historic and present-day use of dolomite rock as building material in Tyrol, Austria .....</b>	<b>1071</b>
J. Kaminska, Ch. Fuchs, J. Meinhardt	
<b>Cleaning of discoloured objects made of low-fired gypsum .....</b>	<b>1077</b>
H. Simonsson	
<b>The implementation and use of standards as a means to meet climate change challenges .....</b>	<b>1083</b>
V. Pelin, B. Ratoi, B. Apavaloei, V. Vasilache, I. Sandu, M. Branzila	
<b>Conservation State Assessment of the Golia Monastery Enclosure Wall .....</b>	<b>1089</b>
Z. Hering	
<b>Related research of the loss compensation of the volcanic tuffs .....</b>	<b>1095</b>
Ch. Abitz, A. Richter, F. Klebe	
<b>Excavating and Preservation of Dinosaur Tracksites in Obernkirchen Sandstone .....</b>	<b>1101</b>
F. Schad	
<b>Cleaning Monuments: From Brooms to Numerical Simulation .....</b>	<b>1107</b>

A. Ehling	
<b>Global heritage Stone Resource (GHSR) – an initiative of the IUGS .....</b>	<b>1113</b>

## **EXCURSION**

S. Siegesmund, F. Wiese, J. Lepper, J.-K. Stein	
<b>Naturwerksteine in Göttingen und Umland .....</b>	<b>1121</b>
<b>Stadtexkursion Göttingen .....</b>	<b>1142</b>
R. Snethlage, B. Lammerer	
<b>Siegfried Siegesmund on his 65th birthday – A Laudation .....</b>	<b>1201</b>
<b>List of Authors .....</b>	<b>1217</b>