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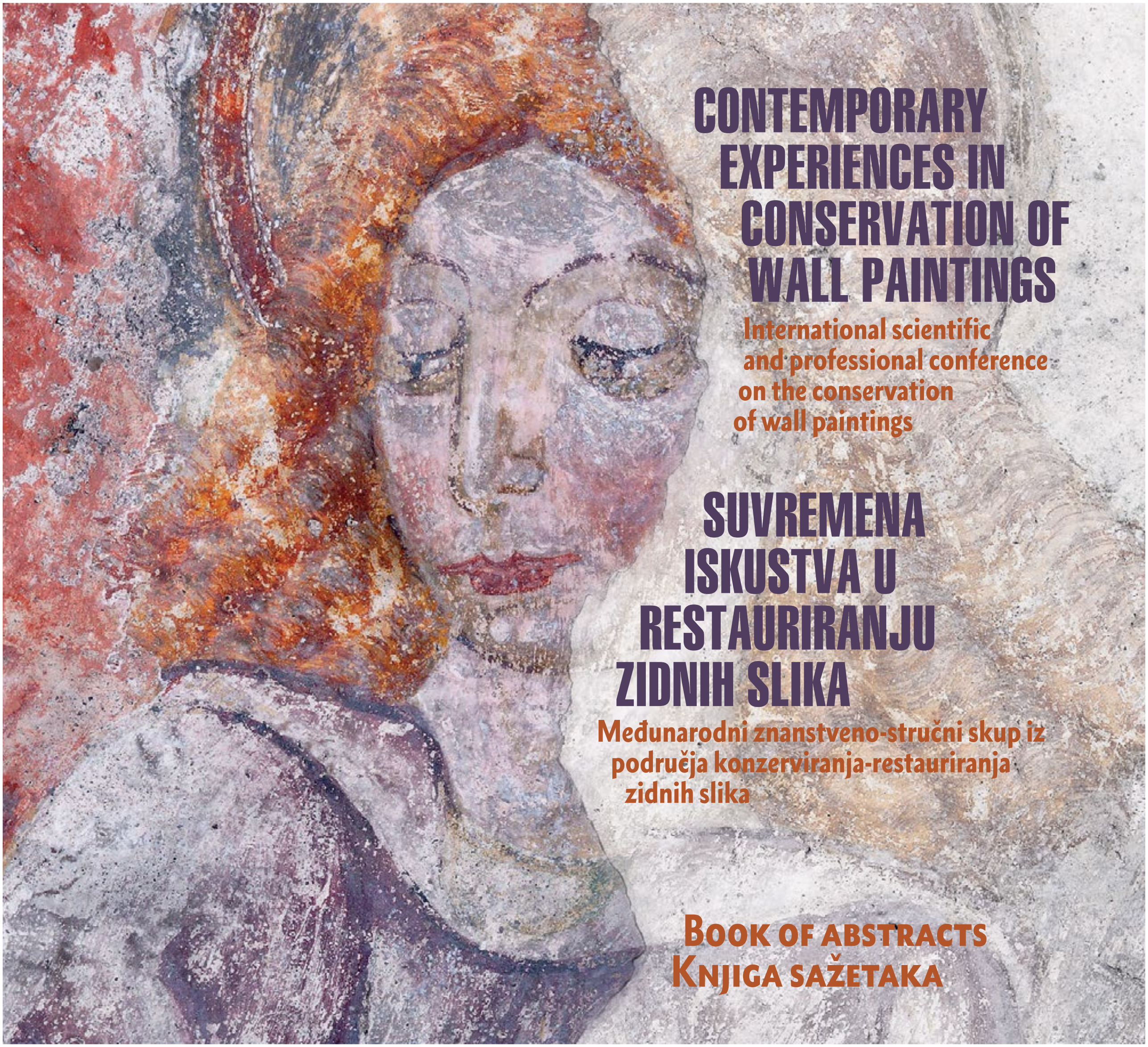

CONTEMPORARY EXPERIENCES IN CONSERVATION OF WALL PAINTINGS

International scientific and professional conference on the conservation of wall paintings

SUVREMENA ISKUSTVA U RESTAURIRANJU ZIDNIH SLIKA

Međunarodni znanstveno-stručni skup iz područja konzerviranja-restauriranja zidnih slika

Book of abstracts
Knjiga sažetaka

HRVATSKI RESTAURATORSKI ZAVOD

ISTARSKA ŽUPANIJA REGIONE ISTRIANA

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Draguć, 8th-10th July 2015

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Draguć, 8.-10. srpnja 2015.

Draguć, House of Frescoes, 8 – 10 July 2015
Draguć, Kuća fresaka, 8. – 10. srpanj 2015.

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EUROPSKA TERITORIJALNA SURADNJA

HRVATSKI RESTAURATORSKI ZAVOD

Naložba v vašo prihodnost
Operacijo delno financira Evropska unija
Evropski sklad za regionalni razvoj

Ulaganje u vašu budućnost
Operaciju dijelomično financira Europska unija
Europski fond za regionalni razvoj

ISTARSKA ŽUPANIJA REGIONE ISTRIANA

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Forewords
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Vladimir Torbica
Head of Project Activity
Voditelj projektne akttivnosti

Movable images record our daily lives, fast-paced and trivial... Wall paintings steadfast and durable, are a sign of the times when different values ruled people's lives. And one should pause in front of these wall paintings, take a closer look, ponder on their messages, and preserve them for the future.

Places where we can pause to enjoy the beauty bestowed upon us by the art of masters, the sweat of farmers, and the riches of landowners are scattered all over Istria. From St. Catherine's to Sts. Primus and Felician's, from St. Barnabas' to St. Rocco's, from St. Nicholas' to the Euphrasian Basilica, in tiny village churches and world-known cathedrals, the wealth of spirit and art that we find here inspires us to awe, but also obliges us to commit.

Istria had throughout the Middle Ages been a bustling region that affected the lives of many masters. Wall painting was considerably influenced by medieval folk plays, namely their stage decoration. By drawing from these sources, the masters have found ways to depict Biblical ideas for the common folk, often with humor and narration that pleased to the tastes of medieval people.

International scientific and professional conference in the field of wall painting conservation titled "Contemporary Experiences in Conservation of Wall Paintings", organized by the Croatian Conservation Institute and held in Draguć at the House of Frescoes, is a tool for us to warn of the present condition of wall paintings and seek even better ways of preserving this fragile art form. It is financially supported by the REVITAS II project.

REVITAS II is a cross-border project co-financed by the European Union within the Operative Programme Slovenia–Croatia 2007–2013, with the total value of 843.058,49 EUR. Partners of the REVITAS II project are: Municipality of Koper (as lead beneficiary), Region of Istria, Istria Tourist Board, Town of Buzet, Town of Vodnjan, Municipality of Izola, and Municipality of Piran. The REVITAS II project is a follow-up to the REVITAS project, which expands on its activities, with an emphasis on innovation and application of state-of-the-art information technologies in designing Istria as a cross-border tourist destination.

It is our effort to preserve the exceptional heritage that has come down to us and must be left behind for future generations. An effort to gain knowledge, find ways and train conservators who would restore the original glory and darkness of Istrian wall paintings. Just as we can imagine the bewildered commoners who learned from the frescoes and stood in awe, so we can imagine Istrian wall paintings as world cultural heritage visited by well-meaning connoisseurs who can appreciate beauty.

Vincent, Ivan, Albert… came to Istria and depicted beauty to us. We shall preserve it.

Region of Istria
Administrative Department for Culture
Istarska županija / Regione Istriana
Upravni odjel za kulturu / Assessorato alla cultura

Pokretne slike obilježavaju našu svakodnevicu, brzu i površnu…. Zidne slike svojom postojanošću i trajnošću znak su vremena kojima su vladale drugačije vrijednosti. Ali pred tim zidnim slikama vrijedno je stati, pomno ih promotriti, promisliti o njihovim porukama i sačuvati ih za budućnost.

Istra je prebogata mjestima na kojima možemo zastati i uživati u ljepoti koja nam je darovana umjetnošću majstora, znojem zemljoradnika i bogatstvom zemljovlasnika. Od sv. Katarine do sv. Prima i Felicijana, od sv. Barnabe do sv. Roka, od sv Nikole do Eufrazijane, u malim seoskim crkvicama i svjetski poznatim katedralama duhovno i umjetničko bogatstvo koje u njima nalazimo izaziva u nama divljenje, ali i obvezuje na zalaganje.

Istra je u srednjem vijeku bila izrazito živo područje što je djelovalo i na život majstora. Važan segment koji je utjecao na slikarstvo je bila srednjovjekovna pučka drama, odnosno njena scenografija. Crpeći takve uzore, majstori su pronašli način kako prikazati određenu biblijsku ideju običnom puku, najčešće na određen humoristični i narativni način, zadovoljavajući potrebe tadašnjeg čovjeka.

Međunarodni znanstveno-stručni skup iz područja zidnog slikarstva i tema skupa "Suvremena iskustva u restauriranju zidnih slika", u organizaciji Hrvatskog restauratorskog zavoda u Draguću, u Kući fresaka – Casa degli affreschi, alat je kojim upozoravamo na današnje stanje te kojim tražimo načine da još kvalitetnije očuvamo krhku umjetnost slikanja, a održava se uz financijsku potporu projekta REVITAS II. Projekt REVITAS II prekogranični je projekt sufinanciran sredstvima Europske unije u okviru Operativnog programa Slovenija-Hrvatska 2007.-2013. u sveukupnom iznosu od 843.058,49 EUR. Partneri projekta REVITAS II su: Grad Kopar (vodeći partner), Istarska županija, Turistička zajednica Istarske županije, Grad Buzet, Grad Vodnjan, Općina Izola i Općina Piran. Projekt REVITAS II temelji se na nastavku i nadgradnji aktivnosti projekta REVITAS i u tom smislu nadovezuje se na stare aktivnosti i njihov nastavak, uz naglasak na inovativnosti kako u aktivnostima tako i u primjeni najsuvremenije informatičke tehnologije pri oblikovanju prekogranične turističke destinacije Istre.

Zalaganje da očuvamo iznimnu baštinu koju smo naslijedili i koju moramo proslijediti slijedećim naraštajima. Zalaganje da steknemo znanje, pronađemo načine i osposobimo stručnjake koji će oživjeti izvorni sjaj i tamu istarskih zidnih slika. Baš kao što možemo zamišljati neuke koji su zadivljeno učili iz fresaka i čudili im se, tako možemo zamisliti i istarske zidne slike kao svjetsku kulturnu baštinu koju dolaze pohoditi dobronamjerni znalci, zaljubljenici u lijepo.

Vincent, Ivan, Albert…. pohodili su Istru i oslikali nam ljepotu. Mi ćemo ju sačuvati.

Mario Braun
Director
Ravnatelj

In cooperation with the Region of Istria, the Croatian Conservation Institute is organizing the first international scientific and professional conference "Contemporary Experiences in Conservation of Wall Paintings" that marks the opening of the newly-established premises the House of Frescoes in Draguć.

It is hard to find a region in the world where wall paintings in small local churches had in the long period from the 11th to 16th century been so organically intertwined with the landscape as is the case in Istria. Unfortunately, this idyllic space is becoming increasingly endangered by aging, which inexorably and relentlessly destroys material structures, but even more so by the impact of humans, when they recklessly disturb this precious and fragile lace of buildings and surroundings that draw such harmonious picture of the human existence in the landscape of Istria. Therefore it is today necessary to act with consideration and caution, not just on the part of conservators but everyone who cares for heritage and environment. Connecting into a family and working together is imperative in order to better preserve the heritage, the portions of this unique rustic-country-urban space and landscape.

Croatian Conservation Institute marks with this conference the thirtieth anniversary of its presence and activity in Istria; we recall the forming of the first summer and later permanent workshops. The Institute first started operating here "on a small scale and with patience", so to speak, while to this day as many as 1000 conservation treatments have been performed on buildings and movable objects that have in the meantime been either investigated or conserved or restored. The Institute's activities have expanded from restoring paintings and polychrome wooden sculptures to architectural heritage, archaeological explorations, mosaics, wall paintings, and to organizing this international conference, whereby through an exchange of experiences of European and Croatian experts we aim to ensure the implementation of new knowledge and technologies in the daily conservation practice. This conference will also cover the theme of researching traditional methods through new technologies and by bringing together heterogeneous interdisciplinary research and different practices. Our aim is to disseminate and exchange knowledge, not only among our conservator colleagues but also students or future colleagues, and in addition to raise interest in heritage and the ways to better preserve it on the whole.

We hereby thank a group of renowned lecturers, from home and abroad, whose attendance has lent support to our pioneering endeavor as this conference starts ab ovo; it does not yet have a tradition and represents a newborn initiative for wall paintings, which is among the most endangered heritage ensembles, not only in the region of Istria. We hope that our conference will in the upcoming years and in its existing venue only grow and expand in order to support and strengthen the process of preserving wall paintings, not only in Istria or Croatia but also in other countries with whom we plan to cooperate closely, and which already have or are only just setting up their capacities in this field.

We also thank the Region of Istria for their support in organizing the conference, and especially to all employees of the Institute and colleagues engaged on this project, in particular to Kristina Krulić and Andrea Šimunić as the driving forces of our conference.

Croatian Conservation Institute
Hrvatski restauratorski zavod

U suradnji s Istarskom županijom koja u Draguću ovim skupom otvara "Kuću Fresaka", Hrvatski restauratorski zavod (HRZ) organizira u novouređenom prostoru prvi međunarodni stručno-znanstveni skup "Suvremena iskustva u restauriranju zidnih slika".

Teško je u svijetu naći regiju u kojoj je zidno slikarstvo u malim lokalnim crkvicama u dugom vremenskom razdoblju od 11. st. do kraja 16. st. tako organski uraslo i vezalo se uz krajolik kao što je to slučaj u Istri. Nažalost, taj idilični prostor postaje sve ugroženiji starenjem koje neumoljivo i stalno razara materijalnu strukturu, ali još više ljudskim djelovanjem, kada svojom nepromišljenošću razara tu dragocjenu i fragilnu čipku okoliša i građevina koje svojim skladom obilježavaju ljudsko postojanje u istarskom krajoliku. Stoga je danas nužno, promišljeno i obzirno djelovanje ne samo restauratora, već svih ljudi kojima je stalo do baštine i okoliša. Udruživanje u svojevrsnu obitelj i zajedničko djelovanje neophodno je kako bi se čim uspješnije očuvala baština, dijelovi neponovljivog rustično-ladanjsko-urbanog prostora i krajolika. Hrvatski restauratorski zavod ovim skupom obilježava i tridesetu godišnjicu prisutnosti i djelovanja u Istri, prisjećamo se formiranja prvih ljetnih, a potom i stalnih restauratorskih radionica. Djelovanje Zavoda je započelo kako se reklo po domaći "po malo i s pacijencom", a do danas se materijaliziralo u gotovo 1000 obavljenih zahvata na objektima i pokretnim spomenicima, koji su u međuvremenu ili istraženi ili konzervirani ili restaurirani. Djelatnost HRZ-a se proširila od restauriranja slikarstva i polikromne skulpture i na graditeljsku baštinu, arheološka istraživanja, mozaike, zidno slikarstvo, a evo dolazi i do organiziranja međunarodnog skupa, u kojem kroz razmjenu iskustava europskih i hrvatskih stručnjaka nastojimo osigurati implementaciju novih znanja i tehnologija u svakodnevnu restauratorsku praksu. Na skupu će se obraditi i tema istraživanja tradicionalnih metoda kroz nove tehnologije te povezivanja raznorodnih interdisciplinarnih istraživanja i različitih praksi. Cilj je širenje i razmjena znanja, ne samo između kolega restauratora, već i studenata ili budućih kolega, kao i poticanje interesa za baštinu i načine poboljšanja čuvanja baštine u cjelini.

Zahvaljujemo međunarodnoj i domaćoj grupi etabliranih predavača što su svojim dolaskom pružili podršku našem pionirskom poduhvatu, jer ovaj skup počinje ab ovo; još nema tradiciju i predstavlja novorođenu inicijativu za zidno slikarstvo, što je jedna od ugroženijih baštinskih cjelina, ne samo u istarskom prostoru. Nadamo se da će naš skup u narednim godinama i u već izgrađenoj kući odrasti i ojačati, kako bi svojim rastom i razvojem podupirao i jačao proces čuvanja zidnog slikarstva, ne samo u Istri ili Hrvatskoj, već i u drugim zemljama s kojima planiramo intenzivnu suradnju, i koje već imaju ili tek grade svoje kapacitete na tom području.

Zahvaljujemo Istarskoj županiji na potpori pri realizaciji, a posebno zahvaljujemo svim djelatnicima Zavoda i kolegama koji su se angažirali na ovom projektu, a ponajviše Kristini Krulić i Andrei Šimunić kao pokretačkim silama našeg skupa.

Kristina Krulić

Croatian Conservation Institute
Hrvatski restauratorski zavod

Over the past few decades we have witnessed a gradual yet continuous development in the restoration and conservation of wall paintings. Problems that conservators encounter in practice are always alike, however, the approach, choices of methodology and materials are constantly changing, with increasing importance given to establishing the criteria of compatibility and the non-destructive interventions.

This scientific and professional conference is aimed at examining the applications and results of new technologies, methods and materials, the importance and presence of the interdisciplinary approach, as well as the development of practice in the field of wall painting conservation in general.

The theme of the conference "Contemporary Experiences in Conservation of Wall Paintings" comprises both research and theoretical part of work, as well as the presentations of complete projects of wall painting conservation. Contribution to the conference will come from the lectures of an international group of experts, conservators and scientists from Slovenia, Italy, Germany, France, Spain, Portugal and Croatia. Emphasis is put on collaboration of various scientific disciplines, the solving of problems and challenges from practice while tracing the development of latest technologies and knowledge. In accordance, part of the lectures focuses on diagnostics, i.e. the identification of original techniques and causes of deterioration. Presentations will also be given of the results of applications of new materials and analytical methods when researching the state of wall paintings and creating stable conditions for their preservation. These are all factors that contribute to the better understanding of conservation issues and how to conduct future treatments. The new and more precise methods of documenting wall paintings is another of the featured themes. Aside from the comprehensive treatments of wall paintings, there will also be discussions of the problems of reintegration, the valorisation of historical restoration interventions, as well as the approach to preventive conservation and continual maintenance of wall paintings within larger historical ensembles.

This type of scientific and professional conference is of great importance for the further development of conservation and restoration practise in Croatia. Precisely by bringing together experts and scientists, and by presenting an array of topics will propel an exchange of experience and establishment of even better communication and cooperation among institutions and individuals.

The conference venue at the House of Frescoes marks the symbolic launch of this institution, while through the Revitas II project we are able to introduce the importance of expertise in the conservation of wall paintings to the wider public and the local community, and in that way inspire the recognition of values of cultural heritage and its renovation for the purpose of revitalizing Istria, especially its hinterland.

U proteklih nekoliko desetljeća svjedočimo postupnom, no stalnom razvoju u restauriranju i konzerviranju zidnih slika. Problemi s kojima se restauratori susreću u praksi uglavnom su uvijek slični, no pristup, odabir metodologije i materijala neprekidno se mijenjaju dajući sve veći značaj uspostavljanju kriterija kompatibilnosti i ne destruktivnih intervencija.

Ovim znanstveno-stručnim skupom nastoje se razmotriti primjene i rezultati novih tehnologija, metoda i materijala, važnost i prisutnost interdisciplinarnog pristupa kao i razvoj restauratorske djelatnosti u području zidnog slikarstva općenito.

Tema skupa "Suvremena iskustva u restauriranju zidnih slika" obuhvaća istraživački i teorijski dio rada, kao i predstavljanje cjelovitih projekata konzerviranja-restauriranja zidnih slika. Doprinos skupu svojim će predavanjima dati međunarodna grupa stručnjaka konzervatora-restauratora i znanstvenika iz Slovenije, Italije, Njemačke, Francuske, Španjolske, Portugala i Hrvatske. Naglasak je na suradnji više znanstvenih disciplina, rješavanje problema i izazova iz prakse prateći razvoj suvremenih tehnologija i znanja. U skladu s time, dio je predavanja posvećen dijagnostici, odnosno identifikaciji izvornih tehnika i uzroka propadanja. Prikazani će biti i rezultati primjene novih materijala i analitičkih metoda kod istraživanja stanja zidnih slika te stvaranja stabilnih uvjeta u kojima se nalaze. Sve su to čimbenici koji utječu na bolje razumijevanje problematike konzerviranja–restauriranja i usmjeravanja budućih zahvata. Nove i preciznije metode dokumentiranja zidnih slika još je jedna od zastupljenih tema, a osim cjelovitih zahvata na zidnim slikama, raspravljat će se i o problemima reintegracije, valorizacije povijesnih restauratorskih intervencija kao i o pristupu preventivnom konzerviranju i kontinuiranom održavanju zidnih slika unutar većih povijesnih cjelina.

Ovakav znanstveno stručni skup od velike je važnosti za daljnji razvoj konzervatorsko-restauratorske djelatnosti u Hrvatskoj. Upravo okupljanjem stručnjaka i znanstvenika te predstavljanjem raznovrsnih tema potaknuti će se razmjena iskustava i uspostavljanje još kvalitetnije komunikacije i suradnje između institucija i pojedinaca.

Održavanje skupa u Kući fresaka simbolički je početak rada ove nove institucije, a kroz projekt Revitas II u mogućnosti smo važnost stručnih znanja u konzerviranju-restauriranju zidnih slika približiti široj javnosti i lokalnoj zajednici te na ovaj način utjecati na prepoznavanje vrijednosti kulturne baštine i njene obnove u svrhu revitalizacije Istre, naročito njene unutrašnjosti.

Abstracts
Sažeci

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A Historical Overview of Conservation Efforts on Medieval Wall Paintings in Istria

The presentation will give and overview of the history of conservation work on medieval wall paintings in Istria, from the "pre-restoration" efforts in Svetvinčenat and Božje Polje, over to the systematic care initiated by the work of K. K. Zentralkommission für die Erforschung und Erhaltung der Kunst- und Historischen Denkmale, and continued by Soprintendenza Regionale alle Opere d'Antichità e d'Arte di Trieste, the Conservation Department in Rijeka and nowadays the Conservation Department in Pula and the Department for Wall Paintings and Mosaics in Rijeka of the Croatian Conservation Institute. Although in methodological terms the development of conservation profession in Croatia has reached a high scientific level, when it comes to organization there is still much room for improvement. Preventive conservation of wall paintings is often complicated by the still prevailing model of applying individual protection programmes. The care for Istrian frescoes is presently standing at a crossroad and we can finally overcome the discontinuity of the profession. The recently opened "Centre for Medieval Wall Painting in Istria" is destined to become not only a place to bring together, keep and draw up documentation on Istrian frescoes, but also a place for professionals, from both the conservation and the field of art history, to meet with the wider interested public.

Povijesni prikaz konzervatorsko-restauratorskih zahvata na srednjovjekovnim zidnim slikama u Istri

Izlaganje će prikazati povijest konzervatorsko-restauratorskih zahvata na srednjovjekovnim zidnim slikama u Istri od „predrestauratorskih" zahvata u Svetvinčentu i Božjem polju, preko sustavne skrbi koja započinje radom K.K. Zentralkommission für die Erforschung und Erhaltung der Kunst- und historischen Denkmale, a koji nastavljaju Soprintendenza Regionale alle Opere d'Antichità e d'Arte di Trieste, Konzervatorski zavod u Rijeci te sadašnji Konzervatorski odjel u Puli i Odsjek za zidno slikarstvo Hrvatskog restauratorskog zavoda u Rijeci. Iako je metodološki razvoj restauratorske struke u Hrvatskoj dosegao visoku znanstvenu razinu, organizacijski postoje brojne mogućnosti za unapređenje. Preventivno konzerviranje zidnih slika često je otežano jer se još uvijek primjenjuje model pojedinačno prijavljenog zaštitnog programa. Skrb o istarskim freskama danas se nalazi na prekretnici kada konačno možemo prevladati diskontinuitet struke. Novootvoreni „Centar za srednjovjekovno zidno slikarstvo u Istri" može postati ne samo mjesto na kojem će se objediniti, čuvati i stvarati dokumentacija o istarskim freskama već i mjesto susreta struke, kako konzervatorsko-restauratorske tako i povijesno-umjetničke, sa širom zainteresiranom javnošću.

| Self-taken photo of Branko Fučić during the discovery of wall paintings in the church of St. Michael in Pićan (photo archive of the Conservation Department in Rijeka)
Autosnimak Branka Fučića prilikom otkrivanja zidnih slika u crkvi sv. Mihovila u Pićnu (fototeka Konzervatorskog odjela u Rijeci)

|| Anton Gnirs, from 1902 to 1916 the state conservator of the K.K. Zentralkommission für die Erforschung und Erhaltung der Kunst- und historischen Denkmale in Istria
Anton Gnirs, od 1902. do 1916. zemaljski konzervator Središnje komisije za istraživanje i očuvanje građevnih spomenika u Istri

| Conservator Radovan Oštrić in the course of restoring wall paintings in the chapel of St. Florian in Pomer
Konzervator-restaurator Radovan Oštrić u tijeku restauracije zidnih slika u kapeli sv. Flora u Pomeru

mr. sc. Tonči Borovac
Consultant conservator-restorer

mr. umj. Antonija Gluhan
Conservator-restorer

Croatian Conservation Institute, Croatia

Conservation Work on the Ceiling Paintings by Antonio Zuccaro in the Bajamonti-Dešković Palace in Split

The Bajamonti-Dešković Palace is probably the most outstanding residential building of the mid-19th century in Dalmatia. It was built in 1858 and had rooms of various functions (offices of the mayor, the court, postal service, and municipal authorities). The residential area, located on the first floor, was richly decorated and furnished, with paintings in the salon standing out for their artistic execution. In the central salon, the ceiling was adorned with depictions of Zeus, Hera, muses and allegories. The remaining two salons were painted with symbolic and landscape motifs and idealized Arcadian scenes. These paintings were attributed to Antonio Zuccaro from Trieste, while the decorations were probably executed by Josip Voltini.

As a result of reconstructions and the replacement of the wooden floor with a concrete one in the story topping the central portion of the palace, considerable damages were inflicted to the ceiling paintings, so the project of the wall paintings' restoration was initiated in 2004. Given the conditions encountered and a lack of access to the paintings from the upper side, the restoration was carried out in two ways: in the southwestern room the ceiling had to be detached and after the treatment mounted to the newly set-up structure, while in the southeastern room the restoration was performed *in situ*, which offered us the possibility to compare the two approaches. The extent of damages to the ceiling paintings of the southeastern room was not such that it would require detaching them from the ceiling beam structure, and we were able to provide stability to the ceiling by anchoring, embedding wooden joints at certain portions. Ensuring the stability of the ceiling was a prerequisite for the work that ensued.

The highly demanding task of restoring the frescoes was performed by experts of the Croatian Conservation Institute, Section for Wall Paintings, Mosaics and Stucco in Split.

Konzervatorsko-restauratorski zahvati na stropnom osliku Antonia Zuccara u palači Bajamonti Dešković u Splitu

Palača Bajamonti-Dešković, vjerojatno najreprezentativnija stambena građevina iz sredine 19. stoljeća u Dalmaciji, izgrađena je 1858. godine i u njoj su bile prostorije različitih funkcija (gradonačelnikov stan, sud, pošta i prostorije općinske uprave). Stambeni je prostor, smješten na prvome katu, bio bogato uređen i opremljen, a po kvaliteti umjetničke izrade izdvajaju se oslici salona. U središnjem je salonu strop ukrašen prikazima Zeusa, Here i muza te alegorijama. Ostala dva salona oslikana su simboličkim i pejzažnim motivima i idealiziranim arkadijskim krajolicima. Smatra se da je autor tih oslika Antonio Zuccaro iz Trsta uz kojeg je dekorativni dio izveo najvjerojatnije Josip Voltini.

Uslijed građevinskih radova i zamjene drvenog poda betonskim na katu iznad reprezentativnog dijela palače, došlo je do znatnih oštećenja stropnih oslika i projekt restauracije zidnih slika započeo je 2004. godine. S obzirom na zatečene uvjete i nemogućnost pristupa oslicima s gornje strane zahvati su izvođeni na dva načina: u jugozapadnoj prostoriji strop je bilo nužno odvojiti te nakon zahvata montirati na novopostavljenu konstrukciju dok je u jugoistočnoj prostoriji zahvat proveden *in situ*, što pruža mogućnost poredbe dvaju pristupa. Oštećenja zidne slike na stropu jugoistočne prostorije nisu bila takve naravi da bi zahtijevali njeno odvajanje od stropne gredne konstrukcije te je stabilnost stropa bilo moguće ostvariti sidrenjem, mjestimičnim umetanjem drvenih poveznica. Osiguranje stabilnosti stropa bio je preduvjet za radove koji su uslijedili.

Iznimno zahtjevni zahvat obnove fresaka izveli su stručnjaci Hrvatskog restauratorskog zavoda, Odsjeka za zidno slikarstvo, mozaik i štuko u Splitu.

| The southeastern room, ceiling painting after conservation
Jugoistočna prostorija, zidna slika na stropu nakon radova

The southwestern room
Jugozapadna prostorija
| pre-existing condition of the ceiling paintings
zatečeno stanje stropnog oslika
|| ceiling paintings after the conservation
stanje nakon završenih restauratorskih zahvata

Dr. Pilar Bosch Roig
Post-doc researcher
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Microbial Biotechnology for Cleaning Wall Paintings

Wall painting cleaning methodologies based on the use of microorganisms will be presented in this conference. The basic idea of this new restoration application came from the observation that only few microorganisms have a negative role, whilst the majority of them are responsible for natural processes that biotechnology can use for our benefit. Biotechnology is a discipline in which biological organisms are exploited to develop new technologies, tools and products that are useful for research, agriculture, industry, clinic and why not also in restoration? Recent researches in the field of cultural heritage conservation have shown that the use of microorganisms is an interesting alternative to traditional solvents or other aggressive methods. This research in the laboratory and on real artworks has confirmed the freedom from danger of these methodologies application and their ability to recover artworks that present serious alterations without producing any damage to the artwork or to the restorer or the environment due to their lack of toxicity. In this conference the principle of this biotechnology and its application on real-scale wall paintings will be presented.

Mikrobna biotehnologija u čišćenju zidnih slika

Izlaganjem će biti predstavljene metode čišćenja zidnih slika koje se temelje na korištenju mikroorganizama. Osnovna ideja njihove primjene u restauriranju temelji se na opažanju kako tek nekolicina mikroorganizama ima negativnu ulogu, dok je većina zaslužna za prirodne procese koje biotehnologija može koristiti na našu dobrobit. Biotehnologija je disciplina koja koristi biološke organizme za razvoj novih tehnologija, alata i proizvoda primjenjivih u istraživanju, poljoprivredi, industriji i medicini, pa zašto ne i u restauriranju? Novija istraživanja u području zaštite kulturne baštine pokazala su kako korištenje mikroorganizama predstavlja zanimljivu alternativu tradicionalnim otapalima i drugim agresivnim metodama. Istraživanja u laboratoriju i na samim umjetninama potvrdila su kako se ove metode mogu sigurno primijeniti u obnovi teško oštećenih umjetnina jer ne predstavljaju opasnost za restauratore ili okoliš, budući da nisu toksične. Na ovoj će se konferenciji predstaviti načela ovakvih biotehnologija te njihova primjena na zidnim slikama.

| Application of the microbial biotechnology for cleaning of the wall painting "La Navicella", Vatican Museum
Primjena mikrobne biotehnologije kod čišćenja zidne slike „La Navicella", Vatikanski muzej

Miroslav Jelenčić
Conservator-restorer
Croatian Conservation Institute, Croatia

Conservation Work and Presentation of Fragments of Roman Wall Paintings

Fragments of Roman wall paintings, now kept in the Museum of Slavonia, were found at the archaeological site of ancient Mursa in Osijek, in 1983. Due to the historical and artistic value of the fragments, as well as the fact that they were archaeological and museological material, the basic approach in the course of conservation was to present as much as possible the original layers, with minimum restorers' intervention. In addition, fragments were not flattened by removing the plaster layers from the back side and then gluing them to the new support – a still recurrent practice among restorers, but one that leads to irreversible destruction of original technological layers of the wall painting – and no synthetic materials were used in the course of work that would alter the original structure. Analysis of the fragments was carried out in the Natural Science Laboratory of the Croatian Conservation Institute without physical sampling, so as not to damage the painted layer. The conservation work performed included minimum cleaning of the painted and plaster layers, assembling of the fragments into coherent wholes, and reconstruction of the plaster layers, depending on their state of preservation but without reconstructing the painted layer. The joined fragments were then set between two rectangular plexiglas panels, bound together at the corners. The cut shape of the upper panel was set in such a way in that it precisely traced the original form of the fragments, which prevented them from sliding horizontally or rotating during the transfer. Therefore it was unnecessary to glue or fixate in any way the back side of the fragments to the bottom panel. The procedures described resulted in the visibility of all fragments, as the panels were transparent and the necessary joints were mechanical and easy to remove. The approach chosen for presentation rendered visible the artistic and material intricacy of all assembled portions, without reconstructing the painted layer.

Konzervatorsko-restauratorski radovi i prezentacija fragmenata antičkih rimskih zidnih slika

Fragmenti rimskih zidnih slika, deponirani u Muzeju Slavonije, pronađeni su na arheološkom nalazištu antičke Murse u Osijeku, 1983. godine. Zbog povijesne i likovne vrijednosti fragmenata te činjenice da je riječ o arheološkom i muzejskom materijalu, osnovni pristup prilikom konzervatorsko-restauratorskih radova bio je u što većoj mjeri prezentirati izvorne slojeve s minimalnom restauratorskom intervencijom. Također, fragmenti nisu stanjivani uklanjanjem žbukanih slojeva s poleđine i potom lijepljeni na novi nosilac, što je još uvijek česta restauratorska praksa koja dovodi do nepovratnog uništenja izvornih tehnoloških slojeva zidne slike, niti su tijekom radova korišteni sintetički materijali koji bi promijenili izvornu strukturu. Analiza fragmenata provedena je u Prirodoslovnom laboratoriju HRZ-a bez fizičkog uzorkovanja tako da nije došlo do oštećenja slikanog sloja. Izvedeni restauratorski radovi uključili su minimalno čišćenje slikanih i žbukanih slojeva, spajanje fragmenata u povezane cjeline i rekonstrukciju žbukanih slojeva ovisno o očuvanosti, bez rekonstrukcije slikanog sloja. Povezani fragmenti potom su postavljeni između dvije kvadratne pleksiglas ploče međusobno učvršćene u kutovima. Izrezani oblik gornje ploče namješten je na način da vrlo precizno prati izvornu formu fragmenata čime je spriječen vodoravni pomak ili rotacija prilikom prenošenja. Time nije bilo potrebe na bilo koji način lijepiti ili učvršćivati poleđinu fragmenata za donju ploču. Opisani zahvati rezultirali su vidljivošću svih fragmenata budući da su ploče prozirne, a izvedeni nužni spojevi su mehanički i vrlo lako uklonjivi. Izabrani pristup prezentaciji omogućio je sagledavanje likovne i materijalne slojevitosti svih povezanih dijelova bez rekonstrukcije slikanog sloja.

| Fragment with a floral ornament, after conservation
Fragment s cvjetnim ornamentalnim ukrasom, nakon radova

| Joined fragments with a depiction of a bird, after conservation
Povezani fragmenti s prikazom ptice, nakon radova

|| Fragments laid on the sand ground, before conservation
Fragmenti položeni na pješčanu podlogu, prije radova

Anita Kavčič Klančar
Senior Conservator-restorer

Ajda Mladenovič
Conservator-restorer

Maja Gutman
Geologist

Institute for the Protection of Cultural Heritage of Slovenia, Restoration Centre Ljubljana, Slovenia

The Removal of Lime Wash, Insoluble Salts and Dirt from Wall Paintings of Škofja Loka Castle Chapel

Wall paintings in the chapel of Škofja Loka castle were painted in 1915 by Anton Jebačin. They were completely covered with several layers of lime wash in 1959. Restoration Centre of the Institute for the Protection of Cultural Heritage of Slovenia started the conservation research of the paintings in 2013 and a year later, the conservation and restoration on the wall paintings in the dome began.

The analyses of layers revealed that the paintings had been done in three different techniques, namely using egg tempera, wax tempera and lime paint. The removal of dirt and lime wash over layers was problematic in parts where the lime paint technique was used. There a thick film of insoluble salts (calcium carbonate), dirt and lime wash remains had formed. After the difficult removal of the top overcoat layers of white paint, using scalpels and rotary tools, a thin semitransparent layer of carbonated dirt still remained on the surface of the original. This layer most probably originates from the process of insoluble calcium carbonate salts crystallization. Following many probes and tests, the problem of removal of this crystallized layer was solved with the use of triammonium citrate and ethylenediaminetetraacetic acid (EDTA) solutions. The ratio of the solutions and the time of the application varied slightly, depending on how well the original part of the painting was preserved and how thick and hard the secondary layer was. In later stages the process was combined with the application of cationic resins, manual brushing and repeated cleaning with water. This combination was only possible because the original painting was in a good condition with a very stable colour layer and well preserved plaster.

After cleaning and removal of the film, the process of consolidation, plaster patching and injecting followed. Retouching and reintegration of the missing parts is still in progress.

Uklanjanje vapnenih premaza, netopivih soli i nečistoća sa zidnih slika u kapeli dvorca u Škofjoj Loki

Zidne slike u kapeli dvorca u Škofjoj Loki djelo su Antona Jebačina iz 1915. godine. Godine 1959. u cijelosti su prekrivene s nekoliko slojeva vapnenih premaza. Restauratorski centar Zavoda za zaštitu kulturne baštine Slovenije započeo je konzervatorska istraživanja zidnih slika 2013. godine, a godinu kasnije konzervatorsko-restauratorske radove na zidnim slikama u kupoli.

Analize slojeva su pokazale da su slike izvedene trima različitim tehnikama – jajčanom temperom, voštanom temperom i vapnenom bojom. Uklanjanje nečistoća i vapnenih premaza predstavljalo je problem na onim dijelovima na kojima je korištena tehnika vapnene boje, gdje se formirao debeli sloj netopivih soli (kalcijevog karbonata), nečistoća i ostataka vapnenog premaza. I nakon zahtjevnog uklanjanja završnog premaza sloja bijele boje, pomoću skalpela i rotacijskih alata, na površini izvorne slike još su se zadržale poluprozirne naslage karbonatizirane nečistoće. Taj sloj najvjerojatnije potječe od procesa kristalizacije netopivih soli kalcijevog karbonata. Nakon brojnih proba i ispitivanja, problem uklanjanja ovoga kristaliziranog sloja je riješen pomoću otopina triamonij citrata i etilendiamintetraacetatne kiseline (EDTA). Omjeri otopina i trajanje primjene donekle su varirali, ovisno o očuvanosti pojedinih dijelova izvorne slike te debljini i tvrdoći sekundarnog sloja. U kasnijim fazama postupak je kombiniran s primjenom kationskih smola, ručnog uklanjanja kistom i opetovanog čišćenja vodom. Takva kombinacija bila je moguća samo zato što je izvorna slika bila u dobrom stanju, s vrlo stabilnim slojem boje i dobro očuvanom žbukom.

Nakon čišćenja i uklanjanja naslaga, uslijedio je postupak konsolidacije, nanošenja žbukanih nadoknada i injektiranja. Retuš i reintegracija dijelova koji nedostaju su u tijeku.

| Removal of lime wash overlayers
Uklanjanje vapnenih premaza

|| Aplication of sepiolite poultice (of triammonium citrate and EDTA solution)
Nanošenje sepiolitne pulpe (od triamonij citrata i otopine EDTA)

| Retouching
Retuš

Prof. Dipl. Rest. Werner Koch

Potsdam University of Applied Sciences, Germany

Conservation and Restoration of Plaster and Murals from the Perspective of Higher Education – Two Different Aspects of Experience in Theory and Practice

The curricular balance between theory and practice at the undergraduate and graduate studies of Conservation and Restoration at the University of Applied Sciences in Potsdam will be presented and explained on two examples. One refers to a past research project that was focused on plastering, while the other is an ongoing project within the study of conservation and restoration of wall paintings.

The project focusing on fine plaster and stone mortar, co-financed by the German Federal Environmental Foundation, was linked to the comprehensive research of the modern" dry "mortar of the first half of the 20th century and investigating the conditions of the actual respective buildings. The natural-science analyses and later practical examinations of selected buildings in Berlin and Potsdam supplemented the basic information and formed a basis for practical research aimed at conserving the architectonic surfaces. It was already at this point, based on practice-oriented research activities, that we managed to achieve a successful synthesis of theory and practice and encourage students to take part in the project as motivated partners. Even if all the conservation goals that were set could not be achieved, it was possible to once again scrutinize this universal problem and examine it in practice.

The project that was part of the students' curriculum focused during the last semester on the theme of façades and early-20th-century wall paintings in the Zwingli-church in Berlin-Friedrichshain. Apart from a research into the history of the building's construction, it was mostly centered on conservation and restoration of the sections of the gable above the entrance and the so-called "memorial war painting" commemorating the victims of WWI in the interior of the church. In addition to the research and testing the plastering techniques and taking photographs, recording the pre-existing condition and gradually developing and testing the materials used in conservation and restoration, the work included in-depth discussions that allowed us to better understand the colourations, aimed at recovering the original visual identity.

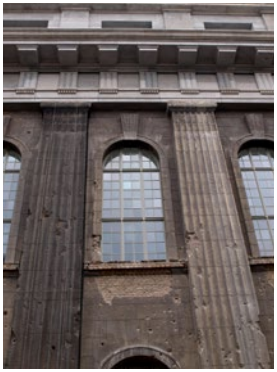
Konzerviranje i restauriranje žbuka i zidnih slika iz perspektive visokoškolskog obrazovanja – dva različita aspekta iz iskustva u teoriji i praksi

Programska prevaga između teorije i prakse na preddiplomskom i diplomskom studiju „Konzerviranje i restauriranje" na Viskoj školi u Potsdamu bit će predstavljena i objašnjena na temelju dvaju primjera.

S jedne strane radi se o prošlom istraživačkom projektu na temu žbuka, a s druge strane o aktualnom projektu u sklopu studija na temu konzerviranja i restauriranja zidnih slika.

Projekt na temu „Edel-und Steinputz" kojeg je financirala Njemačka zaklada za okoliš bio je povezan sa opsežnim istraživanjima tog „modernog" mokrog morta iz prve polovice 20. stoljeća te snimanja stanja odgovarajućih referentnih objekta. Prirodno-znanstvena analiza i praktično razmatranje na temelju odabranih objekata u Berlinu i Potsdamu nadopunilo je osnovne informacije te su bili temelj praktičnih istraživanja s ciljem konzervatorskog očuvanja arhitektonskih površina.Već je ovdje na temelju praktično orijentiranih istraživačkih aktivnosti pošlo za rukom uspostaviti uspješnu sintezu između teorije i prakse te potaknuti studente da sudjeluju na projektu kao motivirani partneri. Čak i ako se svi postavljeni konzervatorski ciljevi nisu mogli ostvariti, bilo je moguće prekogranični problem očuvanja arhitekonskih površina iznova problematizirati i primijeniti u praksi.

U sklopu projekta koji je pratio studij tijekom posljednihe semestara obrađena je tema pročelja i zidnog slikarstva ranog 20. stoljeća na crkvi Zwingli u Berlin-Friedrichshain. Uz istraživanja povijesti izgradnje objekta u načelu se radilo o konzerviranju i restauriranju polja timpanona iznad ulaza te o takozvanom „spomeničkom ratnom slikarstvu" za poginule u Prvom svjetskom ratu u unutrašnjosti crkve. Uz Istraživanja i ispitivanja tehnike žbukanja i slikanja, snimku postojećeg stanja i postupan razvoj i ispitivanje materijala primjenjenih za konzerviranje i restauriranje dodane su i opširne diskusije koje su razjasnile obojenja s ciljem ponovnog uspostavljanja vizualnog dojma.



| Advertisement brochure TERRANOVA || Detail of the Pergamon Museum façade ||| Samples of the DOLOMITIN mortar
| Propagandna brošura TERRANOVA || Dio pročelja Pergamon muzeja ||| DOLOMITIN uzorci žbuke

| Zwingli church in Berlin || Conservation work on the façade ||| Wall painting in the church interio
| Zwingli crkva u Berlinu || Konzervatorski radovi na pročelju ||| Zidni oslik u unutrašnjosti

Anabelle Križnar, PhD
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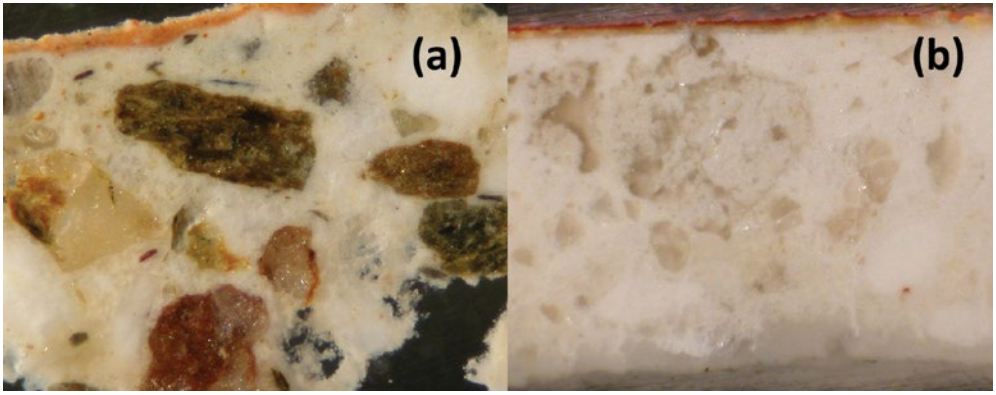
Medieval Mural Paintings in Slovenia: Materials, Techniques and Authorships as the Results of the Interdisciplinary Approach

The interdisciplinary approach to an artwork consists in a collaboration of different humanistic and nature-science fields with the common objective to obtain the most complex results possible. In Slovenia, such an approach is still quite rare but there are some exceptions, normally related to a specific artwork or monument, which finds itself in a conservation-restoration process. Among the most important groups of monuments in this country are Gothic mural paintings which can be found practically in every parish church. The Slovene Gothic heritage is well known, but only in few cases the materials and artistic research have been carried out. In order to get more information on materials applied by the artists and the painting techniques used, a scientific approach is needed, which can offer specific information on the number and structure of plasters, selection of pigments and binders. Also, painting procedures from the use of incisions, preparatory drawings, under-paintings to colour modelling and the construction of paint layers can be studied, which gives an insight into the whole artist's process and in some cases can even confirm authorship. The first step is always a precise study of the selected mural *in situ*. Next, small samples of plasters, pigments and colour layers are extracted for further examination in the laboratory by different analytical techniques, such as OM, SEM-EDX, XRD and FT-IR, which are generally mostly used. On basis of the results obtained, the relation between artists (workshops) can be outlined, as it will be shown with some examples, as well as their technical connection to other neighbouring countries, like Italy and Austria.

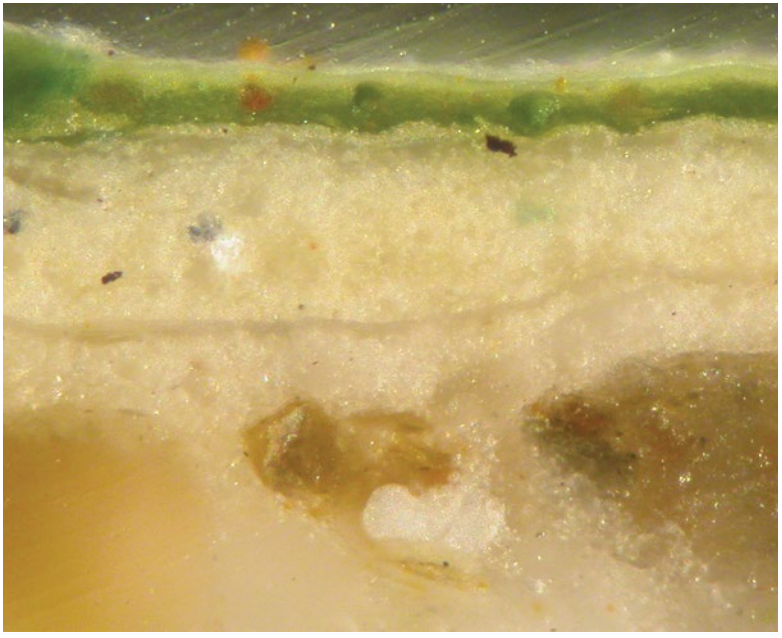
Srednjovjekovne zidne slike u Sloveniji: materijali, tehnike i autorstva kao rezultati interdisciplinarnog pristupa

Interdisciplinarni pristup umjetnini uključuje suradnju različitih humanističkih i prirodoznanstvenih disciplina, sa zajedničkim ciljem dobivanja najkompleksnijih mogućih rezultata. U Sloveniji je takav pristup još uvijek razmjerno rijedak, no postoje neke iznimke, obično vezane uz pojedinačne umjetnine ili spomenike koji su podvrgnuti konzervatorsko-restauratorskom postupku. Među najznačajnije skupine spomenika u ovoj zemlji spadaju gotičke zidne slike koje nalazimo u gotovo svakoj župnoj crkvi. Slovenska baština iz razdoblja gotike dobro je poznata, no tek je u nekolicini primjera provedeno istraživanje materijala i povijesno-umjetničko istraživanje. Kako bismo dobili što više podataka o materijalima koje su umjetnici koristili ili slikarskim tehnikama kojima su se služili, nužan je znanstveni pristup, koji nam može pružiti konkretne informacije o broju i strukturi žbuka te odabiru pigmenata i veziva. Također je moguće proučavati slikarske postupke, od urezivanja, pripremnih crteža i podslika do modeliranja bojom i građenja slikanih slojeva, što nam može pružiti uvid u cjelokupan umjetnikov postupak, a u nekim slučajevima čak i potvrditi autorstvo. Prvi korak uvijek je precizna studija odabrane zidne slike *in situ*. Zatim se uzimaju manji uzorci žbuka, pigmenata i slojeva boje zbog daljnjih laboratorijskih ispitivanja različitim analitičkim tehnikama poput OM, SEM-EDX, XRD i FT-IR analiza, koje se općenito najčešće koriste. Na temelju dobivenih rezultata može se objasniti odnos između umjetnika (radionica), na način na koji će biti predočeno kroz neke primjere, kao i tehničku povezanost sa susjednim zemljama, Italijom i Austrijom.



| Differences in mortar composition shown by two cross-sections. (a) made of lime and sand (x50). Bodovlje. (b) made of lime and crushed marble of lime-rock (x25). Veliki Otok near Postojna
Razlike u sastavu žbuke prikazane na dvama poprečnim presjecima. (a) izvedena od vapna i pijeska (x50). Bodovlje. (b) izvedena od vapna i drobljenog mramora vapnenačke stijene (x25). Veliki otok kraj Postojne

| Incisions made in fresh mortar for St. George's figure. Famlje.
Urezi u svježoj žbuci na prikazu sv. Jurja. Famlje.



|| Cross-section (x200) showing the use of lime technique: a layer of lime was applied on a dry mortar; a layer of green colour was applied *a fresco* on the lime layer. Bodešče
Poprečni presjek (x200) prikazuje upotrebu vapnene tehnike: sloj vapna nanesen je na suhu žbuku; sloj zelene boje nanesen je *a fresco* preko sloja vapna. Bodešče

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Two Late Medieval Cycles of Wall Paintings in Istria - Valorisation, Restoration Interventions, Documentation

The cycle of wall paintings in the presbytery of the parish church of St. Nicholas in Pazin is the first such ensemble adapted for the architecture of the oldest star-ribbed vault in Istria. It stands out with its iconography which uses templates from the Biblia Pauperum to depict scenes from the Genesis on the vault. Recent research has tested the hypothesis that the Pazin painter originated from the workshops of Southern Tirol. The Gothic wall paintings in the presbytery of the parish church of St. George in Lovran fit within the wider cultural circle of subalpine artistic expression in their iconography and morphology, and they were executed by several painters from the local workshops of Kastav.

The presbyteries of both churches have over the course of the 20th century undergone major restoration interventions. Therefore the present-day conservation research and treatments employ an interdisciplinary approach, aimed at valorising all efforts to reintegrate the wall paintings and where conservators can agree upon the final presentation. In order to precisely diagnose the condition of the wall paintings and set the methods for the conservation procedure, laboratory research of the pigments, binders, salts and microorganisms were conducted, as well as *in situ* research, such as the cleaning probes and pre-consolidation.

Along with an overview of previous conservation efforts, this presentation will show the process of documenting wall paintings, as exemplified by the presbytery of the church of St. Nicholas in Pazin. The distinct complexity of the architectural model called for the application of new, more precise methods of documentation, such as 3D laser scanning, as well as a thus far too rarely used method of photogrammetry, which is the starting point for a comprehensive database with multiple possibilities of presentation.

Dva kasnosrednjovjekovna ciklusa zidnih slika u Istri - valorizacija, restauratorske intervencije, dokumentiranje

Ciklus zidnih slika u svetištu župne crkve sv. Nikole u Pazinu prvi je zidni oslik prilagođen arhitekturi najstarijeg zvjezdasto-rebrastog svoda na istarskom prostoru. Ističe se svojom ikonografijom koristeći kao predložak Bibliju pauperum te prikazujući scene Geneze na svodu. Novijim se istraživanjima preispituje hipoteza o porijeklu pazinskog slikara iz južnotirolskih radionica. Gotičke zidne slike u svetištu župne crkve sv. Jurja u Lovranu svojom ikonografskom posebnošću i slikarskom morfologijom uklapaju se u širi kulturni krug subalpskog likovnog izričaja, a u njihovoj je izvedbi sudjelovalo nekoliko slikara lokalnih kastavskih radionica.

Svetišta obje crkve su tijekom 20. stoljeća doživjela veće restauratorske intervencije. Stoga se interdisciplinarnim pristupom kod recentnih konzervatorsko-restauratorskih istraživanja i zahvata nastoje valorizirati svi napori u reintegraciji zidnog oslika u cilju donošenja zajedničkog konzervatorskog stava o završnoj prezentaciji. Utvrđivanje precizne dijagnoze zidnog oslika i određivanje metoda konzervatorsko-restauratorskog postupka temeljeni su na laboratorijskim ispitivanjima uzoraka pigmenata, veziva, soli i mikroorganizama te na istraživačkom radu *in situ*, poput proba čišćenja i predkonsolidacije.

Ovim izlaganjem će se uz opise dosadašnjih konzervatorsko-restauratorskih radova, prezentirati i proces dokumentiranja zidnih slika na primjeru svetišta crkve sv. Nikole u Pazinu. Izrazita složenost arhitektonskog modela iziskivala je primjenu novih, preciznijih metoda dokumentiranja, poput 3D laserskog skeniranja, te primjenu do sad za zidno slikarstvo nedovoljno korištene metode fotogrametrije, što je početak stvaranja iscrpne baze podataka s mnogobrojnim prezentacijskim mogućnostima.

| Church of St. Nicolas in Pazin - Orthophotos of wall paintings integrated in 3D model of the church interiour acquired with several 3D scanning techniques (Vektra d.o.o.)
Crkva sv. Nikole u Pazinu - ortofoto zidnih slika integriran u 3D model unutrašnjosti crkve dobiven korištenjem nekoliko tehnologija 3D skeniranja (Vektra d.o.o.)

| The vault of the presbytery - church of St. George in Lovran
Svod svetišta crkve sv. Jurja u Lovranu

|| Cleaning probe - church of St. George in Lovran
Proba čišćenja - crkva sv. Jurja u Lovranu

Prof. Dr. Steffen Laue
Professor in natural science in conservation and restoration
Potsdam University of Applied Sciences, Germany

Climate Controlled Salt Weathering of Wall Paintings

Salt weathering due to climate changes frequently plays a major role in the disintegration of wall paintings. If the relative humidity of the air is lower than the deliquescence humidity of the salt, crystallization will occur. If, on the other hand, the relative humidity exceeds the deliquescence humidity the salt, it remains in solution. Finally, if the deliquescence humidity of the salt falls within the range of variation of the ambient relative humidity, cyclic dissolution and crystallization will accelerate the deterioration of the wall painting.

Thus, the processes which are causing the damage to the wall painting have to be determined to develop an appropriate conservation approach. The climate measurements combined with the periodic observation of the crystallized salts permit the determination under which climatic situation different salts are crystallizing and what kind of damage they are producing. This method is called Monitoring of salt crystallization in combination with climate measurement.

If, additionally, quantitative salt ions analyses of the wall painting are existing, the thermodynamic behaviour of the salts can be modelled with the ECOS/RUNSALT software, capable of predicting the crystallization behaviour of salt mixtures in function of temperature and relative humidity.

In the presentation several case studies are given which demonstrate the interaction between building materials, moisture, salts, and environmental conditions. The monitoring of damage in combination with salt analyses and climate measurements is a useful tool to understand the climate controlled salt weathering processes on wall paintings leading to appropriate conservations and restoration measures.

Kontrola klimatskih uvjeta u kojima soli oštećuju zidne slike

Degradacija soli uzrokovana atmosferskim promjenama često igra značajnu ulogu u propadanju zidnih slika. Ako je relativna vlažnost zraka niža od točke topivosti soli, dolazi do kristalizacije. S druge strane, kada relativna vlažnost premašuje točku topivosti soli, sol ostaje u otopini. Konačno, ukoliko točka topivosti soli pada unutar raspona variranja relativne ambijentalne vlažnosti, propadanje zidne slike će se ubrzati uslijed cikličkog otapanja i kristalizacije.

Iz tog razloga potrebno je ustanoviti procese koji uzrokuju oštećenja zidnih slika kako bi se razvio primjereni pristup njihovu konzerviranju. Klimatska mjerenja u kombinaciji s periodičkim promatranjem kristaliziranih soli omogućuju da se odrede klimatski uvjeti u kojima se soli kristaliziraju i oštećenja koja prouzrokuju. Ova se metoda naziva praćenjem kristalizacije soli u kombinaciji s klimatskim mjerenjima.

Nadalje, ako postoje kvantitativne analize iona soli na zidnim slikama, moguće je pratiti termodinamičko ponašanje soli pomoću ECOS/RUNSALT softvera koji može predvidjeti kristalizaciju mješavina soli prema funkcijama temperature i relativne vlage.

Izlaganjem će biti obuhvaćeno nekoliko studija koje prikazuju međudjelovanje građevnih materijala, vlage, soli i okolišnih uvjeta. Praćenje oštećenja u kombinaciji s analizama soli i klimatskim mjerenjima predstavlja koristan alat za razumijevanje procesa degradacije zidnih slika koje uzrokuju soli pod utjecajem klimatskih uvjeta, te odabir prikladnih konzervatorsko-restauratorskih zahvata.

| Defined area (size: 5 cm2) used for monitoring of new salt crystallizations in the Crypt of St. Maria im Kapitol in Cologne, Germany
Ograničena površina (veličine 5 cm2) za praćenje novonastalih kristalizacija soli u kripti crkve sv. Marije na Kapitolu u Kölnu, Njemačka

| Climate controlled salt crystallization on wall paintings in Neustadt/Mußbach, Rhineland-Palatinate, Germany
Klimatski kontrolirana kristalizacija soli na zidnim slikama u Neustadtu/Mußbachu, Rhineland-Palatinate, Njemačka

Prof. Monica Martelli Castaldi
Freelance Conservator-Restorer, Consultant for the *Pompeii Sustainable Preservation Project*
University of the Studies Suor Orsola Benincasa in Naples, Italy

Wide Surfaces, a Respectful Approach to Their Diversity

The approach to conservation of decorated surfaces has enormously changed in the last decades. Criteria and materials used for the consolidation and treatment are more and more similar to the original materials, allowing the surfaces to find an easier equilibrium with the environment. However the damage caused by the era of organic consolidants is still visible, leading to difficult choices, both in respect to the work of art and to the professional in charge of its rescue. At the same time, the idea of continuous care, maintenance and preventive conservation are gaining space in the day to day practice and in the field of public tenderings.

Based on varied experiences gathered along her carrier, such as the understanding of how to approach a wide archaeological site as one single object, or the sudden and unexpected shift from a normal emergency intervention on a surface which revealed so fragile and delicate to oblige a change in the intervention into a punctual consolidation of each single damaged element of the surface as in a "miniature", the author will present to the audience some interesting and very diverse worksite cases and projects (Pompeii , Herculaneum, Bagan in Myanmar, S. Gennaro catacombs in Naples), which will lead to a discussion on the specificities of architectural surfaces decorations, their values, and the challenges in defining critical, but sane, methodologies of intervention, sharing the considerations and the changes in thinking reached in more than 30 years of experience

Prostrane površine, pristup s uvažavanjem njihove raznovrsnosti

Pristup se konzerviranju dekoriranih površina značajno promijenio tijekom posljednjih nekoliko desetljeća. Kriteriji kao i materijali koji se koriste u konsolidaciji i drugim zahvatima postaju sve sličniji izvornim materijalima, što omogućuje lakše postizanje ravnoteže između površina i okoline. Unatoč tome, oštećenja nastala tijekom ere organskih učvršćivača još uvijek su vidljiva, što dovodi do teških odluka, koja se odnose i na samu umjetninu kao i na stručnjaka zaduženog za njezino očuvanje. Istovremeno, ideja o kontinuiranoj brizi, održavanju i preventivnom konzerviranju dobiva sve više prostora u svakodnevnoj praksi, kao i u području javnih natječaja.

Na temelju raznovrsnih iskustava stečenih tijekom karijere, poput razumijevanja kako pristupiti prostranom arheološkom nalazištu kao jedinstvenom objektu ili pak naglim i neočekivanim promjenama iz uobičajene u hitnu intervenciju na površini za koju se otkrije da je toliko krhka i osjetljiva da zahtjeva preciznu konsolidaciju svakog pojedinog elementa kao na „minijaturi", autorica će ovim izlaganjem predstaviti neke zanimljive i međusobno različite slučajeve iz svoje terenske prakse (u Pompejima, Herkulaneju, Baganu u Mjanmaru, katakombama sv. Januarija u Napulju) kako bi potakla raspravu o specifičnostima dekoracija arhitektonskih površina, njihovoj valorizaciji i izazovima u određivanju ključnih ali primjerenih metoda intervencije, i kako bi razmotrila konceptualne te promjene u pristupu do kojih je došla tijekom više od 30 godina iskustva.

| Italy, archaeological site of Herculaneum - one of the various ceilings still preserved with its painted decoration
Italija, arheološki lokalitet Herkulanej – jedan od brojnih svodova sačuvanih sa slikanom dekoracijom

|| Myanmar, archaeological site of Bagan - some temples preserve still untouched the 13th c. mural decoration, while Buddha sculptures are generally renewed
Mjanmar, arheološki lokalitet Bagan – u nekim hramovima su sačuvane intaktne zidne dekoracije iz 13. st., dok su kipovi Bude većinom obnovljeni

| Italy, archaeological site of Herculaneum, House of Neptune and Amphitrite - a complex case of two decorations coexisting, one in mural paintings and one in mosaic
Italija, arheološki lokalitet Herkulanej, Kuća Neptuna i Amfitrite – složen slučaj postojanja dvaju tipova dekoracije, odnosno zidnih slika i mozaika

Andreja Pondelak Luka Škrlep Sabina Kramar Martina Lesar Kikelj* Andrijana Sever Škapin

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In Situ and Laboratory Testing of Efficiency of Newly Developed and Commercially Available Consolidants

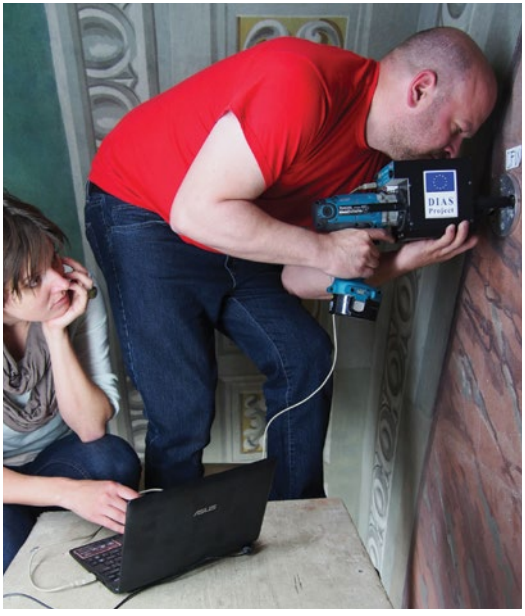
Consolidation of important carbonate-based historical objects with compatible materials is of great importance; therefore a new consolidant based on soluble calcium compound has been developed. To evaluate consolidation efficiency, different methods were performed to investigate the hardness of material, any changes in colour and penetration depth of the newly developed consolidant compared to other currently mostly used commercial consolidants. Before testing real historical objects, consolidation efficiency was tested on model substrates. *In situ* testing is currently in progress on two test sites: Gothic wall paintings in St. Vincent's church in Svetvinčenat in Croatia and 20th century wall paintings in the Church of the Annunciation in Ljubljana. The new water based consolidant along with some consolidants based on lime nanoparticles in different alcohols was applied on test areas on the wall paintings, where before application and periodically after application, the test areas were analysed with different non-destructive and micro destructive methods to monitor colour changes and consolidation efficiency. Colour changes were monitored by visual assessment and with colorimeter by measuring colour coordinates before and after the application of consolidants. Consolidation efficiency was monitored with ultrasound velocity method and surface hardness measurement, while DRMS method was used to determine consolidation efficiency through the profile of the wall paintings.

The main advantage of the new consolidant is deeper consolidation, where re-cohesion between the particles of deteriorated historic materials is established, compatibility with carbonate-based substrates and good appearance with no whitening effect and minimal colour change on the surface of the historic material.

In situ i laboratorijska ispitivanja učinkovitosti novo razvijenih i komercijalno dostupnih učvršćivača

Izuzetno je važno da se konsolidacija povijesnih objekata karbonatnog sastava provodi kompatibilnim materijalima, zbog čega je razvijen novi učvršćivač na bazi topivog kalcijevog spoja. Kako bi se procijenila učinkovitost konsolidacije korištene su različite metode ispitivanja tvrdoće materijala, promjene u boji i dubini prodiranja novo razvijenih učvršćivača, u usporedbi s ostalim komercijalnim učvršćivačima koji su trenutno najčešće u uporabi. Prije ispitivanja na samim povijesnim objektima, testiranje učinkovitosti konsolidacije rađeno je na priređenim standardima. U tijeku je *in situ* testiranje na dvama lokalitetima: gotičkim zidnim slikama u crkvi sv. Vincenta u Svetvinčentu u Hrvatskoj i zidnim slikama iz 20. stoljeća u crkvi Marijina Navještenja u Ljubljani. Na probnim područjima na zidnim slikama je primijenjen novi učvršćivač na bazi vode zajedno sa učvršćivačima na bazi vapnenih nano čestica u različitim alkoholima, a prije i periodički nakon primjene testirana mjesta su analizirana različitim ne destruktivnim i mikro destruktivnim metodama kako bi se pratile promjene u boji i učinkovitost konsolidacije. Promjene u boji praćene su vizualnom procjenom i kolorimetrijom tako što su vrijednosti boje mjerene prije i poslije nanošenja učvršćivača. Učinkovitost konsolidacije provjerena je mjerenjem brzine ultrazvučnih valova te mjerenjem površinske tvrdoće, dok je DRMS metoda korištena kako bi se odredila dubinska učinkovitost konsolidacije.

Glavna je prednost novoga učvršćivača prodiranje dublje u materijal, gdje je utvrđena ponovna kohezija čestica oštećenoga povijesnog materijala, kompatibilnost sa podlogom na bazi karbonata te zadovoljavajući izgled umjetnine, bez učinka pobjeljivanja i uz minimalnu promjenu boje na površini povijesnoga materijala.



| Application of newly developed consolidant to the test site
Primjena novo razvijenih učvršćivača na probnom području

|| Measuring the consolidant efficiency with non-destructive ultrasound velocity method
Provjera učinkovitosti učvršćivača ne destruktivnim mjerenjem brzine ultrazvučnih valova

| Monitoring the consolidant efficiency with micro destructive DRMS method
Praćenje učinkovitosti učvršćivača mikro destruktivnom DRMS metodom

José Artur dos Santos Pestana
Conservator-restorer of mural paintings
Mural da História – Restauro de Pintura Mural (Private ateliê), Portugal

From earth to granite - A Journey through Portuguese Wall Paintings, from the lime's South to the granitic North, with a Detour to Goa, India

When speaking of the natural sources of materials used we can divide Portuguese wall paintings into two groups – wall paintings from the South and those of the North. The South is dominated by architecture built with mud and adobe – probably a remnant of the long Arab occupation. This is also an area extremely rich in lime (see photo 1). The fresco wall paintings found in this area usually present two or more plaster layers - arriccio and intonaco. These two layers are rich in lime and are of a considerable thickness. The North, on the contrary, is poor in lime. The architecture uses mainly stone as a construction material, and granite dominates (see photo 2). This brings about substantial technical difference in execution in relation to the South. In the North, we observe a decrease in the number of plasters applied to the wall, down to only one layer and a great reduction in thickness, which is a result of the scarcity of lime.

We can find another case of plaster not based on limestone on wall paintings in Goa, the youngest of the Indian states that until 1961 was part of the Portuguese Empire. There the lime is produced essentially from sea shells and the only fresco technique known is restricted to the strongly chromatic sgraffiti (see photo 3).

Od zemlje do granita - Putovanje kroz portugalsko zidno slikarstvo, od vapnenačkog juga k granitnom sjeveru, do posjeta Goi u Indiji

Kada govorimo o prirodnim izvorima upotrebljenih materijala, portugalsko zidno slikarstvo možemo podijeliti u dvije skupine – zidno slikarstvo s juga i ono sa sjevera. Jugom dominira arhitektura građena od blata i ćerpiča – vjerojatno kao ostavština dugotrajne arapske vladavine. Ovo područje također je izuzetno bogato vapnom (slika 1). Fresco zidne slike koje tu nalazimo obično imaju dva ili više slojeva žbuke – arriccio i intonaco. Ta su dva sloja bogata vapnom i znatne su debljine. Suprotno tome, sjever je siromašan vapnom. U arhitekturi se kao građevni materijal koristi kamen, pri čemu dominira granit (slika 2), što znači da postoji značajna razlika u tehnici građenja u odnosu na jug. Na sjeveru zamjećujemo manji broj žbuka nanesenih na zid, katkad samo u jednom sloju, kao i njihovu znatno tanju debljinu, što je rezultat oskudice vapnom.

Još jedan slučaj žbuke koja se ne temelji na vapnencu nalazimo na zidnim slikama u Goi, najmlađoj od indijskih država, koja je do 1961. godine bila dijelom portugalskog imperija. Ovdje se vapno proizvodi uglavnom iz morskih školjaka i jedina poznata fresko tehnika je kromatski snažan sgraffito (slika 3).

| Ermida de S. Sebastião, Alvito, Beja, classified building of public interest, building from early 16th c.
Ermida de S. Sebastião, Alvito, Beja. Zaštićeno javno dobro, građevina s početka 16. st.

| Igreja de Santo Izidoro, Marco de Canavezes, Porto, classified national heritage, probably constructed in the 12th c.
Igreja de Santo Izidoro, Marco de Canavezes, Porto. Zaštićena nacionalna baština, crkva vjerojatno izgrađena u 12. stoljeću

|| Sgraffito in the vestry of Santa Monica Convent, Old Goa, Goa, India (during removal of covering layers of lime), end of 16th or beginning of 17th c.
Sgraffito u sakristiji samostana sv. Monike, Stara Goa, Goa, Indija (tijekom uklanjanja slojeva vapnenih premaza), kraj 16. ili početak 17. st.

Ivan Srša
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The Substance Fourth from Nature (Mimetic reintegration)

The paper reflects on the origin of the name and meaning of the term mimetic reintegration in the restoration of the painted layer, as exemplified by medieval wall paintings, with questions raised as to whether this manner of restoration really stands in contradiction to the modern ethics of conservation.
The term mimesis (mimoýmai) – imitation – is discussed by Plato in The Republic (Politeía) and Aristotle in Poetics (Poiètikós). For Plato, painting is an imitation of appearance and a painter an imitator of objects. To Aristotle, all arts are imitation, differing from one another in terms of medium, object and manner. Painting is to Plato a substance third from nature, and the painter is its maker. If the painter is an imitator of objects, is then not the restorer an imitator of an imitator of objects and a maker of restoration (imitation of an imitation of appearance), a substance fourth from nature? In fact, every (re) integration of the painted layer is an attempt to imitate the original, regardless of the method of choice.
Integration stands for "combining individual portions into a whole", of minor or major damages that have disrupted the original integrity of the paining. The term reintegration (rěd+ĭntěgro) is somewhat confusing as it can be interpreted to mean combining anew, i.e. a new restoration treatment.
Contemporary techniques enable us to clearly discern subsequent treatments of the painted layer, deeming the ethical insistence on discriminating the (re)integrated portions from the original redundant.
From a greater distance, it is anyhow difficult to discern a well performed (re) integration of the painted layer from the original, regardless of the method used. Viewed from up close, a (re)integration performed in one of the differentiating methods (tratteggio, selezione cromatica) will more often than not draw attention away from the original, which should by no means be its purpose. In that case, mimetic (re)integration is still a more acceptable solution.

Četvrta tvorevina iza prirode (Mimetska reintegracija)

U tekstu se razmatra podrijetlo naziva i značenje termina mimetska reintegracija u restauriranju slikanog sloja na primjeru srednjovjekovnih zidnih slika i preispituje je li taj način restauriranja doista u opreci s modernom etikom konzerviranja.
O pojmu mimesis (mimoýmai) – oponašanje - govore Platon u Državi (Politeía) i Aristotel u Poetici (Poiètikós). Za Platona slikarstvo je oponašanje priviđanja, a slikar je oponašatelj predmeta. Za Aristotela sve su umjetnosti oponašanje, a međusobno se razlikuju s obzirom na sredstvo, predmet i način. Slikarstvo je za Platona tvorevina treća iza prirode, a slikar je njezin tvorac. Ako je slikar oponašatelj predmeta nije li restaurator oponašatelj oponašatelja predmeta i tvorac restauriranja (oponašanje oponašanja priviđanja), četvrte tvorevine iza prirode? U biti svakom se (re)integracijom slikanog sloja nastoji oponašati izvornik, bez obzira na odabranu metodu.
Integracija je "spajanje više pojedinačnih dijelova u cjelinu", manjih ili većih oštećenja koja su narušila izvornu cjelovitost slike. Pojam reintegracija (rěd+ĭntěgro) donekle zbunjuje jer ga se može tumačiti kao ponovno spajanje ili novi restauratorski zahvat.
Suvremena tehnika omogućuje jasno razlikovanje naknadnih zahvata na slikanom sloju, pa je etičko inzistiranje za razlučivanjem (re)integriranih dijelova od izvornika nepotrebno. Na većoj udaljenosti svaku kvalitetno izvedenu (re)integraciju slikanog sloja ionako je teško golim okom razlikovati od izvornika, bez obzira na metodu kojom je ona ostvarena. Promatrana iz blizine, (re)integracija izvedena nekom od razlikovnih metoda (tratteggio, selezione cromatica) nerijetko na sebe odvlači pozornost s izvornika, što nikako ne bi smjela biti njezina svrha. Mimetska (re)integracija u tom je slučaju ipak prihvatljivije rješenje.

| Požega, crkva sv. Lovre. Sveta Margareta i Sveta Katarina, južni zid glavnoga broda (cca 1380.). Stanje prije i nakon radova
Photographed in 2014 (I. Srša)
Požega, crkva sv. Lovre. Sveta Margareta i Sveta Katarina, južni zid glavnoga broda (cca 1380.). Stanje prije i nakon radova. Fotografirano 2014. (I. Srša)

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St. Vincent's Church, Svetvinčenat: Results of Recent Conservation Research

The cycle of wall paintings in the church of St. Vincent in Svetvinčenat is known to the professional public and relatively well documented in the literature that has nevertheless failed to valorize it accordingly. The cycle stands out for its comprehensive depiction of scenes from the life of St. Vincent and the signature of the earliest recorded author of wall paintings in Istria, Ognobenus of Treviso. Recent research has revealed that the iconography and style of the cycle, originating from the second half of the 13th century, introduce the elements of early Gothic art. The provenance of Svetvinčenat wall paintings places them in a wider stylistic context, with origins that can be traced to both Italy and the medieval art of France and Spain. It is also important to note that the commissioner was not the Benedictine order, but more probably the Bishop of Poreč himself or the Castropola family.

Research works were commenced in 2013 by recording and analyzing the pre-existing condition and drawing up graphic documentation, which revealed the wall paintings' condition to be rather poor. In some portions, the original plasters have swollen and are flaking and in danger of falling off, while the pigment is peeling or is pulverized. The wall paintings are partially covered with remains of subsequent lime coatings and a layer of dirt. Due to the specific problems that the upcoming conservation efforts would face, and in cooperation with colleagues from the Institute for the Protection of Cultural Monuments of Slovenia (ZVKDS), a professional workshop was organized that focused on the cleaning and consolidating of wall paintings *in situ*. Trials were accompanied with an analysis of activity and efficiency of the materials chosen for consolidation, which were applied to the painted surface using DRMS method and ultrasound measurements prior to and after the treatment. Apart from the already tried, Nanolime RC (ZVKDS) and Nanostore (C.T.S.), for the first time a CFW consolidant (Slovenian National Building and Civil Engineering Institute) was used.

Crkva sv. Vincenta, Svetvinčenat - Rezultati dosadašnjih konzervatorsko-restauratorskih istraživanja

Ciklus zidnih slika u crkvi sv. Vincenta u Svetvinčentu poznat je stručnoj javnosti te o njemu postoji relativno obimna literatura koja ga, međutim, nedovoljno valorizira. Ciklus se ističe po opsežnosti prikaza scena iz života sv. Vincenta te po navođenju imena najstarijeg poznatog autora zidnih slika u Istri, Ognobena iz Trevisa. Nove su znanstvene spoznaje utvrdile kako ikonografija i stil ciklusa zidnih slika nastalog u drugoj polovini 13. stoljeća donose elemente rane gotike. Provenijencijom se svetvinčentske zidne slike uklapaju u šire stilske tokove čije izvorište možemo tražiti koliko u Italiji toliko i u srednjevjekovnoj umjetnosti Francuske i Španjolske, a važno je napomenuti da njihov naručitelj nije bio benediktinski red već vjerojatnije sam porečki biskup ili obitelj Castropola.

Istraživački radovi započeti 2013. godine snimanjem i analizom zatečenog stanja te izradom grafičke dokumentacije pokazali su vrlo loše stanje zidnog oslika. Izvorne su žbuke mjestimično podbuhle, osipaju se i prijeti im otpadanje, a pigment se mjestimično ljuska ili je pulveriziran. Oslik je mjestimično pokriven ostacima naknadnih vapnenih premaza i slojem prljavštine. Zbog specifičnosti problema planiranih restauratorskih zahvata, u suradnji sa slovenskim kolegama iz Zavoda za varstvo kulturne dediščine Slovenije (ZVKDS), organizirana je stručna radionica na temu čišćenja i konsolidiranja zidnih slika *in situ*. Izvođenje proba popraćeno je analizom djelovanja i učinkovitosti izabranih materijala za učvršćivanje nanesenih na slikanu površinu upotrebom metoda DRMS i ultrazvučnog mjerenja prije i nakon zahvata. Pored već iskušanog Nanovapna RC (ZVKDS) i Nanorestore (CTS), ovdje je prvi puta korišten učvršćivač CFW (ZAG).

| View of the triumphal arch and apses in the interior of St. Vincent's church in Svetvinčenat
Pogled na trijumfalni luk i apside u unutrašnjosti crkve sv. Vincenta u Svetvinčentu

| Applying consolidant based on soluble calcium compounds onto the wall painting
Nanošenje učvršćivača na osnovi topljivih kalcijevih spojeva na zidnu sliku

|| Consolidation of swollen plaster
Konsolidacija podbuhle žbuke

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Pitting Phenomena in Plasters of Wall Paintings

Damaging phenomena in the form of small pits or eruptions are occurring on surfaces of various kinds of natural or artificial porous materials. They are particularly harmful in plasters of historic wall paintings since they are the cause for irreparable loss of the original paint layer. Therefore, it is important to understand the mechanism of pitting to apply appropriate conservation and restoration measures for prevention or reduction of further decay.

In Slovenia the pitting decay was studied in more detail for the first time in the 1990s in the case of Gothic wall paintings of the church in Hrastovlje (by I. Bogovčič and I. Nemec). The researchers have proved that pitting can be caused by repeated swelling and shrinkage of hygroscopic particles in plaster. Further study of the phenomena along with *in situ* and the laboratory research in the last ten years have given even more insight into the issue. In general, the reason for eruptions which later transform into pitting lies in eruptive particles occurring in the material. These particles produce pressures to the surrounding material through changes in form and volume due to moisture and temperature changes. Depth, size and other patterns of pitting differ, regarding the type and position of the eruptive particle since it can be found deeper in plaster or closely under the paint surface. Water-soluble salts are most often described as eruptive factors. *In situ* investigations on more than 200 medieval wall paintings on exteriors of monuments in Slovenia have shown that the pitting decay is present on nearly 80% of all the paintings and in more than one tenth the phenomena seriously endanger the painting. The experimental research on test samples in the laboratory has confirmed that the water-soluble salts are the reason for pitting phenomena. Besides, the eruptive potential of crystallized water was also detected.

Fenomeni jamičastog raspadanja u žbukama zidnih slika

Štetni fenomeni nastanka jamica ili izbočina pojavljuju se na površinama raznih prirodnih ili umjetnih poroznih materijala. Osobito su štetni u žbukama povijesnih zidnih slika jer uzrokuju nepovratan gubitak izvornog sloja boje. Stoga je važno razumjeti mehanizam njihovog nastanka kako bi se mogle primijeniti odgovarajuće konzervatorsko-restauratorske mjere kojima bi se spriječilo ili smanjilo daljnje propadanje.

U Sloveniji su prva detaljnija istraživanja propadanja uzrokovana jamičastim raspadanjem provedena 1990-ih, na primjeru gotičkih zidnih slika u crkvi u Hrastovlju (I. Bogovčič i I. Nemec). Istraživači su dokazali kako jamice mogu nastati kao rezultat ponavljanog bubrenja i skupljanja higroskopnih čestica u žbuci. Daljnja proučavanja ovog fenomena, zajedno s *in situ* i laboratorijskim istraživanjima, u proteklih deset godina dala su još više uvida u problematiku. Općenito se razlog nastanka izbočina, koje se kasnije pretvaraju u jamice, nalazi u eruptivnim česticama prisutnima u materijalu. Te čestice vrše pritisak na okolni materijal promjenom oblika i volumena uslijed promjena vlage i temperature. Jamice se razlikuju dubinom, veličinom i oblikom, ovisno o vrsti ili položaju eruptivne čestice, budući da ih možemo naći dublje u žbuci ili ispod same površine boje. Najčešće se kao eruptivni faktori opisuju soli topive u vodi. *In situ* istraživanja na više od 200 srednjovjekovnih zidnih slika na eksterijerima spomenika u Sloveniji pokazala su da je jamičasto propadanje prisutno na gotovo 80% zidnih slika, a u više od jedne desetine slučajeva ti ih fenomeni ozbiljno ugrožavaju. Eksperimentalno istraživanje na probnim uzorcima u laboratoriju potvrdilo je da su soli topive u vodi uzrok fenomena nastanka jamica. Osim toga, primijećen je i eruptivni potencijal kristalizirane vode.

| Pitting decay and colour fading occurring on wall painting on the exterior of St. Thomas's church in Velike Poljane, Slovenia
Jamičasto propadanje i blijeđenje boje na zidnim slikama na fasadi crkve sv. Tome u Velikim Poljanama, Slovenija

| Active phase of eruption caused by water crystallization on the test sample during freeze-thaw cycle
Aktivna faza erupcije nastala kristalizacijom vode na testnom uzorku tijekom ciklusa smrzavanja i otapanja

| Formation of eruptions due to thenardite salts crystallisation on test samples. Photos taken in 10 min interval range
Formiranje izbočina djelovanjem tenarditnih soli na testnim uzorcima. Fotografije snimljene u 10-minutnim intervalima

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Multidimensional Databases and NDT Toolbox Dedicated to the Wall Painting Conservation

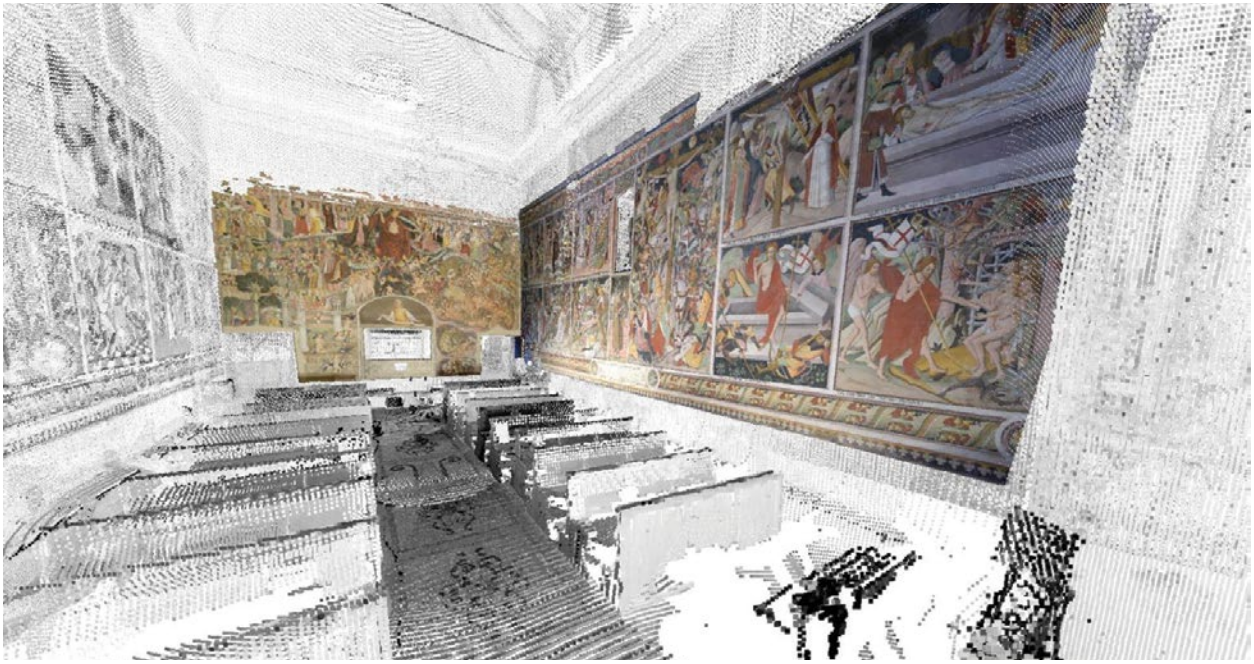
The recent advances in the area of digital 2D and 3D data management and in the development of non-destructive techniques (NDT) lead us to consider new conservation approaches for the expertise and the documentation of wall paintings. Current researches aim to make interactive the ancient and new conservation documents in order to know better the original techniques, the nature of the materials, the origin of the degradations and the effects of restorations in time. These new conservation data are acquired using numerous NDT techniques and can be completed by laboratory studies on samples. In a practical point of view, the combination and the fusion of the data coming from few selected NDT techniques and the existing documentation is expected to give enough information without any sampling. This fusion of heterogeneous data coming from images, mappings, surveys, plans, numerical data etc. is not easy and need automatic procedures in order to allow finally a practical use. The combination of data that allows analysing more accurately phenomenon affecting the studied wall painting must be structured and digital tools must be adapted or developed.

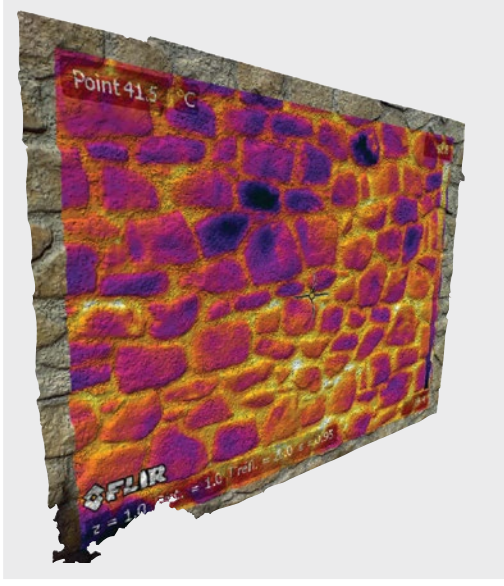
The presentation will present how a selection of few NDT tools in order to create a specific toolbox dedicated to the field of wall paintings conservation has been done. It will also show current developments of web platforms that aim to structure a large set of data including point clouds, images under different wavelengths, physic - chemical analyses etc. and the information that can be obtained in a conservation point of view.

Višedimenzionalne baze podataka i ne destruktivne metode testiranja u konzerviranju zidnih slika

Novija dostignuća u području upravljanja 2D i 3D podacima i u razvoju ne destruktivnih metoda (NDT) pozivaju nas na razmatranje novih pristupa u konzerviranju odnosno istraživanju i dokumentiranju zidnih slika. Recentna istraživanja imaju za cilj uspostaviti interaktivan odnos starijih i novih konzervatorskih dokumenata kako bismo što bolje razumjeli izvorne tehnike, prirodu materijala, uzroke propadanja te posljedice restauratorskih zahvata tijekom vremena. Do takvih se novih podataka u konzerviranju dolazi brojnim ne destruktivnim metodama testiranja koje se mogu dopunjavati laboratorijskim analizama na uzorcima. U praksi se očekuje da će kombiniranje i združivanje podataka dobivenih pomoću nekoliko odabranih ne destruktivnih metoda testiranja te postojeće dokumentacije pružiti dovoljno informacija bez da se uzimaju uzorci. Ovakvo spajanje raznovrsnih informacija koje dobivamo putem slika, mapiranjem, pregledima, planovima ili kao brojčane podatke itd., nije jednostavno te zahtjeva automatske postupke kako bi im se u konačnici omogućila praktična primjena. Kombiniranje podataka omogućuje da se preciznije analizira fenomen koji je zahvatio pojedinu zidnu sliku te ono mora biti strukturirano i za njega se moraju prilagoditi i razviti digitalni alati.

Prezentacijom će se pokazati kako odabirom nekolicine ne destruktivnih tehnika istraživanja stvoriti specifični skup alata namijenjenih konzerviranju zidnih slika. Također će biti predstavljen recentni razvoj mrežnih platformi kojima je za cilj strukturirati velike skupine podataka, uključujući oblake točaka, slike pod različitim valnim duljinama, fizikalno-kemijske analize itd., te informacije koje možemo dobiti konzervatorskim istraživanjima.





| Merging of points cloud and images; Notre Dame des Fontaines' chapel (La Brigue, 06, France) ; photo credit : MAP-E. Gattet & T. Messaoudi
Spajanje oblaka točaka i slika; kapela Notre Dame des Fontaines (La Brigue, 06, Francuska); fotografija: MAP-E. Gattet i T. Messaoudi

| Merging of IR thermography imaging and photo; photo credit: CICRP-JM. Vallet and MAP-E. Gattet
Spajanje snimka infracrvene termografije i fotografije; fotografija: CICRP-JM. Vallet i MAP-E. Gattet

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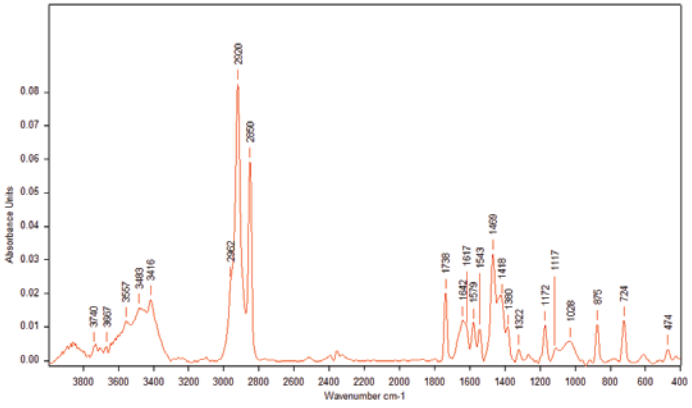
Materials Characterization of Beram Mural Paintings

The church of St. Mary at Škrilinah in Beram is decorated with the most famous mural paintings in Istria, late Gothic frescoes, painted by the master Vincent of Kastav. Like any cultural property besides its immaterial components, whose value is priceless, it is composed of material, tangible, more or less durable, without which the intangible value cannot be in fact preserved. Frescoes are made of lime, sand, crushed stone and the most precious – pigments. In the focus of the present study was the chemical characterization of pigments and plasters composing the frescoes, of materials added subsequently during past restorations and of alterations of the original materials caused by the presence of salts or microorganisms. Moreover, sampling of moulds present in the church and their identification was carried out as part of this research. All the samples taken were studied in detail; first of all by optical microscope in order to determine the structure, morphology, colour and function and to define further analytical methods and techniques to apply. The chemical composition of most of the pigments was determined by energy dispersive spectroscopy using a scanning electron microscope (SEM/EDS). Due to their presumed organic origin, some samples were analysed by Fourier transform infrared spectroscopy (FT-IR). Both analytical techniques require very small amount of samples, a few milligrams, and the results obtained have been correlated with data found in literature sources and mutually compared in order to confirm the results. According to past researches conducted on Beram frescoes, on the one hand some new outcomes have been achieved and the presence of pigments and materials not discovered so far have been confirmed, on the other the reliability of some past assumptions has been verified.

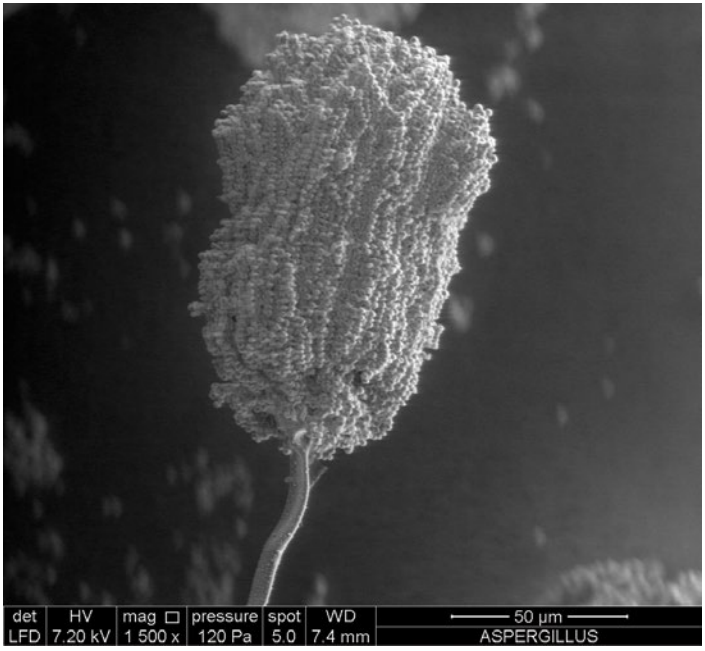
Karakterizacija materijala na zidnim slikama u Bermu

U crkvi sv. Marije na Škrilinah u Bermu nalaze se najpoznatije istarske zidne slike, kasnogotičke freske koje je naslikao majstor Vincent iz Kastva. Poput svakog kulturnog dobra, osim nematerijalne komponente čija je vrijednost neprocjenjiva, freske su nastale u materijalu, opipljivom, više ili manje trajnom, i bez kojega je zapravo nemoguće sačuvati njihovu nematerijalnu vrijednost. Freske se sastoje od vapna, pijeska, mrvljenog kamena i ono što je najvrijednije – pigmenata. U fokusu ovog razmatranja je kemijska karakterizacija pigmenata i žbuka od kojih se freske sastoje te materijala naknadno nanesenih tijekom prethodnih restauratorskih zahvata, kao i promjene u izvornim materijalima uzrokovane prisutnošću soli i mikroorganizama. Nadalje, kao dio istraživanja uzorkovane su i identificirane plijesni prisutne u crkvi. Svi su uzorci detaljno istraženi; prvo optičkim mikroskopom kako bi im se odredila struktura, morfologija, boja i funkcija, te donijela odluka o primjeni daljnjih analitičkih metoda i tehnika. Kemijski sastav većine pigmenata određen je energijskom disperzivnom spektroskopijom pomoću skenirajućeg elektronskog mikroskopa (SEM/EDS). Budući da se pretpostavljalo njihovo organsko podrijetlo, neki su od uzoraka analizirani infracrvenom spektroskopijom s Fourierovom transformacijom (FT-IR). Obje analitičke tehnike zahtijevaju vrlo malu količinu uzorka, tek nekoliko miligrama, a interpretacija rezultata provjerena je usporedbom s podacima iz literature i međusobnom komparacijom kako bi se nalazi potvrdili. U odnosu na ranija istraživanja beramskih fresaka, došlo se do nekih novih rezultata te je utvrđena prisutnost pigmenata i materijala koji dosad nisu bili pronađeni te je provjerena ispravnost nekih dosadašnjih pretpostavki.

| Detail of the northwestern wall where two green pigments are visible, green earth and a copper-based pigment
Detalj sjeverozapadnog zida s vidljiva dva zelena pigmenta, zelene zemlje i pigmenta na bazi bakra



|| FT-IR spectra of a surface coating found on the southwestern wall, probably a past restoration, identified as beeswax.
FT-IR spektri površinskog premaza pronađeni na jugozapadnom zidu, vjerojatno iz ranijeg restauratorskog zahvata, identificirani kao pčelinji vosak



| SEM/SE image of the mycelium of a mold found in the church, recognized as Aspergillus sp.
SEM/SE snimak micelija plijesni pronađenog u crkvi, prepoznatog kao Aspergillus sp.

Head of project activity of Revitas II project / Voditelj projektne aktivnosti projekta Revitas II:
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