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CHINA-PORTUGAL BELT AND ROAD JOINT LABORATORY
ON CULTURAL HERITAGE CONSERVATION SCIENCE

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前沿研究 Research Fronts

历史建筑及遗址的重建：保护原则与文化背景

Reconstruction of Historic Buildings and Sites: Conservation Principles and Cultural Contexts

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《阿拉伯湾的城市保护与重建——会议论文集》. 迪拜市政府 / 国际文物保护与修复研究中心 - 阿拉伯地区建筑考古物质遗产, 2016.

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Urban Conservation and Reconstruction in the Arabian Gulf - Seminar Proceedings. DUBAI MUNICIPALITY/ICCROM-ATHAR, 2016.

“重建”一词可定义为将一栋不完整但具有价值的建筑或创造性的艺术品恢复到它原初的完整状态，从而增强其可读性。重建在历史物证的保护领域一直是一个极具争议的议题。自19世纪末以来，保护理论一直在讨论修复可以进行到何种程度，这就包括了近来在世界遗产语境下的讨论，因为近期被提名及一些已被列入世界遗产名录的遗址由于采用了重建的干预措施而受到了审查。

该领域的专业人士最为熟悉的是约翰·拉斯金对十九世纪的批判，以及维欧勒·勒·杜克对历史建筑的“风格性修复”，相较于尊重建筑在历史中积累的年代价值，它更意在复兴早期的风格。尽管诸如可逆性、最小干预等原则一直是保护理论的核心，但涉及重建的规则却很有限。

重建在战后或灾后的语境下更易于被接受，因为此时群体渴望重建联系。然而，我们亟需构建一种满足需求的重建方法，它既能够提升艺术作品的可读性与可理解性，也可兼顾历史建筑的活化利用目标以及不同文化背景下对“重建”概念的差异化认知。

因此，有必要彻底审视近来支持与反对重建的论点，以制定由专业人士指导可接受的“重建”的基本原则。在全球化时代的当下，关于“真实性”概念的争论也极其重要，对传统连续性

"Reconstruction" can be defined as re-establishing an incomplete valued building or a creative artwork to its original whole in order to increase the legibility. The practice of reconstruction has continued to be a controversial issue in the field of conservation of historic material evidence. Since the late 19th century the conservation theory has discussed the extent to which restoration can be undertaken; this includes more recent discussions in a World Heritage context, as several sites more recently nominated to include in the World Heritage list or some which have been listed were scrutinized due to interventions conducted at them with reconstruction work.

Professionals working in the field are most familiar with John Ruskin's critique of the nineteenth century, and of Viollet Le Duc's "stylistic restoration" of historic buildings that aimed at reviving earlier styles, rather than respecting the age value that a building had accumulated through its history. While principles such as reversibility and minimal interventions have been at the heart of conservation doctrine, rules as to how far reconstruction should be conducted are limited.

Reconstruction is often more acceptable in post-war or post-disaster contexts due to group desires to re-establish connections; however, there is a great need to address requirements of an informed reconstruction approach with other intentions related to increasing the legibility and understanding of artwork, or any other motives such as the reuse of historic structures and perceptions of the notion of "reconstruction" in different cultural contexts.

的破坏在如海湾地区在内的一些区域内已司空见惯。

1964年《威尼斯宪章》的第15条规定“然而对任何重建都应事先予以制止,只允许重修,也就是说,把现存但已解体的部分重新组合。”这一观点在之后的章程和指导方针中得到了回应。例如,《实施〈世界遗产公约〉操作指南》对重建问题作了如下规定:“在真实性问题上,考古遗址或历史建筑及街区重建只有在极个别情况才予以考虑。只有依据完整且详细的记载,不存在任何想象而进行的重建,才可以接受。”此外,国际古迹遗址理事会澳大利亚国家委员会1999年修订的《巴拉宪章》通过是否引入新材料将重建与修复区分开来(第1.8条)。它指出:“重建可用作保留遗产地文化重要性的用途使用和实践的一部分。”另一方面,2000年的《里加宪章》规定,在该地区生存所必须的情况下;在场所因破坏或改动而变得不完整时;在可以恢复某地的文化意义,或可应对自然及人为灾害所造成的悲惨损失时,重建是可以被接受的。前提是重建不应基于任何推测,且不损害现存遗址。重建应具有可识别性及可逆性,并严格遵循保护与展示所需的最低限度原则。

尽管这些文件给了“重建”一词以定义并为其应用提供了一些指导,但仍存在一些模糊之处,包括重建必要性的论证依据、运用新材料的限度、新材料的类型以及这些新材料本身是否应被视为文化遗产的组成部分。然而,国际文件中由专业人士所倡导的原则中亦具有共性:即强调干预的真实性,伪造是保护中的根本性错误。这构成了过去二十年有关1994年奈良会议所倡导的真实性概念的讨论的本质。

毋庸置疑,对于公众及遗产的保管人而言,重建历史建筑和遗址仍是有吸引力的。它常常以超越美学、历史及年代价值的其他价值来证明其合理性。其中包括了民族象征或身份价值,譬如重建的场所对社会具有独特的象征价值。例如,巴林堡被重建为巴林人民的民族象征(图1)。同属这一类别的是,重建往往是对破坏的

Therefore, there is a need to thoroughly review recent trends concerned with present justifications relevant to the practice of reconstruction and arguments against them, and to devise basic principles aimed at guiding acceptable "reconstruction" by the professional community. Recent debates concerned with the notion of "authenticity" are also important in a globalization era, where disruption of traditional continuity has become commonplace in some world regions such as the Gulf.

The Venice Charter of 1964 stipulates in its Article 15 that "all reconstruction work should ... be ruled out. Only anastylosis, that is to say, the reassembling of existing but dismembered parts is permitted". This view has been echoed in subsequent charters and guidelines. For example, the World Heritage Operational Guidelines address the issue of reconstruction as follows: "In relation to authenticity, the reconstruction of archaeological remains or historic buildings or districts is justifiable only in exceptional circumstances. Reconstruction is acceptable only on the basis of complete and detailed documentation and to no extent on conjecture". Moreover, the revised version of the Burra Charter of Australian ICOMOS (1999) refers to reconstruction as distinguished from restoration by the introduction of new material (article 1.8). It states that "Reconstruction may be appropriate as part of use or practice that retains the cultural significance of the place". The Riga Charter (2000), on the other hand, states that Reconstruction is acceptable in circumstances where it is necessary for the survival of the place; where a "place" is incomplete through damage or alteration; where it recovers the cultural significance of a place; or in response to tragic loss through disasters whether of natural or human origin, ... providing that reconstruction can be carried out without conjecture or compromising existing in situ remains, and that any reconstruction is legible, reversible, and the least necessary for the conservation and presentation of the site.

While these documents give definitions of "reconstruction" and provide some guidance for its application there remain several ambiguities including justifications to reconstruction necessity, the extent to which new materials are introduced, the types of new materials and if these form part of cultural heritage assets per se. Nevertheless, what is common in all the principles advocated

回应，是恢复那些有时受到威胁的价值认同的一种表达（图2）。例如，重建迪拜的辛达加历史街区是对1990年代破坏的一种回应，也是恢复人们身份认同的一种表达，这里曾是统治家族及商贾阶层的聚居地。



图1：巴林堡，巴林。该堡垒被重建为巴林人民的民族象征。
Figure 1. Qal'at Al-Bahrain, Bahrain. The fort was reconstructed as a national symbol to the Bahraini people.



图2：辛达加历史街区，迪拜，为应对1990年代的破坏而重建，旨在恢复包括统治家族及商人在内的人们的身份认同。
Figure 2. Al-Shandagha historic district, Dubai, rebuilt as a response to destruction in 1990s and is an expression to restore the identity of people's values including the Ruling family and merchants.

重建的正当性还体现在“使用价值”。重建可以继续发挥建筑之前的功能，或提供新的功能，例如将剧场遗址用于庆典活动。位于约旦安曼的罗马剧场和戏院就被重建以继续服务于其先前的庆典功能（图3）。此外，重建被用于游客的教育手段的“教育及信息价值”往往由“经济与旅游价值”所驱动。

然而，重建往往会充满争议，其原因包括：因缺乏历史证据，真实性难以保证；废墟具有浪漫的吸引力；错误及不准确信息的传达会误导观者；景观环境质量的破坏以及多时期遗址常被单一时期叙事主导等。不过一些保护原则可适用于“重建”，在此背景下，从事重建项目的专业人员需重视并参考以下保护原则：

by the professional community included in international instruments is the truthfulness of interventions, as fakery is a fundamental error in conservation; this forms the essence of discussions made in the past two decades in relation to the notion of authenticity advocated at the Nara Conference in 1994.

Needless to mention, the reconstruction of historic buildings and sites is still appealing to both the public and custodians of heritage properties. It has often been justified on the basis of values that are beyond aesthetic, historic or age values. These have included national symbolic or identity values such as the reconstruction of a place with exceptional symbolic value to society. For example, Qalat Al-Bahrain fort was reconstructed as a national symbol to the Bahraini people (Figure 1). Also under this category, reconstruction is often a response to destruction and is an expression to restore the identity of people's values that are sometimes under threat (Figure 2). For example, at Al-Shandagha historic district in Dubai rebuilding of the area and houses was as a response to destruction in 1990s and is an expression to restore the people's identity where the Ruling family and merchants used to live.

Reconstruction has also been justified by the "use value" for which reconstruction can continue to serve its previous function or provides a new function such as the reuse of Archaeological theatres for festivities; for example, the archaeological Roman Theatre and Odeon in Amman, Jordan, was reconstructed to continue to serve its previous function for festivities (Figure 3). In addition, "educational and information values" where reconstruction is used as a didactic tool for visitors are often driven by "economic and tourism values".

Reconstruction has nonetheless been questionable as it is mostly impossible to achieve authenticity due to a lack of historic evidence, the romantic appeal of ruins, the conveying of false information and inaccuracies misleading the viewer, the disruption of the setting and landscape qualities, and the frequent focus on one period at multi-period sites. However, some conservation principles can be applied to "reconstruction". In this context, professionals working on reconstruction projects should underline and make reference to the following conservation principles:

(1) Distinguishability: it's important to

(1) 可区分性: 必须明确区分新建部分与需要保护的原有结构, 基于证据的新增材料需可被清晰识别;

(2) 完整记录“原状”: 应通过全面记录保存可体现原状及现状的档案;

(3) 尊重各历史时期层积的实物证据: 在重建过程中应确保遗产的保存和稳定, 在此背景下必须考虑到, 曾发生的重建工程本身已成为该遗址的历史的组成部分;

(4) 坦率的说明: 向访问者清晰地呈现重建的形式与原始证据是至关重要的;

(5) 利益相关方的共识: 当地的利益相关方必须达成这一共识, 即重建的建筑与环境为受损状态所带来的附加价值能得到社会认可。



图3: 约旦安曼的罗马剧场进行部分重建, 延续先前的庆典功能。
Figure 3. The Roman Theatre in Amman, Jordan partially reconstructed to continue to serve its previous function for festivities.

尽管由于技术发展和“虚拟现实”的使用, 原址重建正在兴起, 但什么是“真实”或什么是“伪造”这一问题不仅指向物理属性, 它更需考量关联建筑遗产所承载价值的社会文化语境, 以及它在多大程度上依托于真实可靠的信息源体系。因此, 公众视角的内在价值意义非凡, 即使遗产不复存在, 它也根植于记忆之中。故而建筑物的重建也意味着对传统营造技艺的传承, 并在社区民众、参观者及重建建筑间构建起关联。无论采取原址重建还是易地重建的方式, 都应确保干预措施的真实和高质量。虽然保护工程的个案情况各异, 但若管理者和建筑师能基于本文讨论及国际宪章中所反映的原则, 采用明智的建筑设计手法, 将能有效提升历史环境的可读性、连贯性及可理解性。

distinguish new work from the original fabric (which should be protected), where new material based on evidence should be clearly identified;

(2) Full documentation and recording "as found": record of original state and surviving evidence should be made available with full documentation;

(3) Respect of the historic periods or accumulations with their physical evidence, so that they are preserved and stabilized in the process of reconstruction; in this context it is important to consider that historic or former reconstruction becomes part of the history of a site;

(4) Honest interpretation: clear presentation to the visitor of a reconstructed form and original evidence is essential;

(5) Stakeholders' consensus: it is important that local stakeholders agree that a reconstructed building and its setting are appreciated by the society with added value to the damaged state.

While reconstruction en situ (at interpretation centres) is on the rise due to technological development and use of "virtual reality", what is 'authentic' or what is 'fake' need not only refer to the physical attributes but also to the social and cultural contexts associated with the meaning or significance of a historic building or a site, and to the degree by which these ultimately are based on authentic or honest information sources. Therefore, the inner meaning viewed by the community is of great importance. It is retained in the memory even when the heritage no longer exists. The reconstruction of buildings thus also implies the reconstruction of traditional skills and traditions associated with the building and the establishment of a relationship between the community or the visitor and the building reconstructed, in an honest approach ensuring a good quality of any new intervention in situ (on site) or ex situ. While conservation is case-specific, a sensible architectural and interpretation approach by custodians and architects based on the principles discussed in this paper and reflected in international charters would ensure an improved legibility, connectivity, and understanding of the historic environment.

实践案例 Case Study

世界遗产城市的重建：以华沙为例

Reconstruction in World Heritage Cities: The Case of Warsaw

资料来源：

《阿拉伯湾的城市保护与重建——会议论文集》，迪拜市政府 / 国际文物保护与修复研究中心 - 阿拉伯地区建筑考古物质遗产，2016。

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Urban Conservation and Reconstruction in the Arabian Gulf - Seminar Proceedings. DUBAI MUNICIPALITY/ICCROM-ATHAR, 2016.

1980年，世界遗产委员会决定将华沙老城列入世界遗产名录。该遗址于1944年华沙反抗纳粹占领的起义期间被毁，当时距纳粹德国战败、二战结束不足六个月，此后，华沙进行了重建。值得强调的是，这是联合国教科文组织世界遗产名录中唯一被完全摧毁，其后又完全重建的。联合国教科文组织的这一决定对当时的整个波兰民族意义非凡，它是对华沙人前所未有的决心和努力的尊重，他们通过重建努力恢复了历史与文化认同。



图1：1945年的华沙老城废墟

Figure 1. The ruins of Warsaw Old Town in 1945

列入世界遗产名录对于波兰及更广域的保护专家来说具有特别的意义。他们等待了四分之一世纪，以期该领域的国际准则和理论观点能跟上现代实践的步伐。他们必须等待当时社会广泛呼吁的重建成为被保护哲学接受的

In 1980, the World Heritage Committee decided to inscribe the historic centre, or Old Town, of Warsaw in the World Heritage List. The site had been reconstructed following its destruction in 1944 during Warsaw's uprising against Nazi occupation, less than six months before the defeat of Nazi Germany and the end of World War II. It is worth emphasizing that this is the only site included on the UNESCO World Heritage List that has been completely destroyed and, subsequently, totally rebuilt. The decision of UNESCO, which was of great significance for the entire Polish nation at that time, honoured the unprecedented determination and effort of Varsovians, who through the act of reconstruction had endeavoured to restore their historical and cultural identity.

This inclusion on the World Heritage List was particularly meaningful for Polish conservators, and conservation specialists more widely. Those working in the field of conservation had been waiting a quarter of a century for international doctrines and theoretical views of conservation to catch up with modern practices in this field. They had to wait for reconstruction, which was widely called for by society at the time, to be recognized as an approach that was embraced by the philosophy of conservation. They had to wait for local communities to become supportive of them engaging in certain preservation actions, to become a key element in the process of heritage preservation and city development. Time was needed for the common attitude towards authenticity to evolve and, in turn, weaken the Eurocentric notion of an authentic structure as originating from Christian

方法。他们必须争取到当地社会群体的支持, 其行动才能成为遗产保护与城市发展过程中的关键要素。对真实性普遍态度的演变需假以时日, 进而削弱认为真实结构源于基督教文化以及十九世纪古迹保护理论的欧洲中心主义观念。此外, 在于远东、中东、非洲和世界其他地区的文化对话中, 真实性的概念也会随时间被重新定义。

很多人参观过重建的华沙老城。这是一个非常特别的地方, 充满生机却依然保持着温馨而亲切的氛围。对于华沙的许多居民来说, 这个地区具有神奇的品质, 一种能唤起深刻情感的象征价值, 在历史上与众多当地家庭悲惨地交织。这一活跃的公共空间受所有华沙人的欢迎, 他们对其充满了特殊的情感与喜爱。尽管如此, 许多学者仍认为华沙的重建只是一个等比例的仿制品, 这个模型几乎无法反映这座城市在被摧毁前的真实样貌。这些学者认为, 我们今天所看到的在表达和感知上无法被视为“真实的”城市, 即使一座城市被视为是经过独特的重建。为了挑战这种片面且不平衡的观点, 本文试图论证:

1) 第一, 作为华沙重建工作基础的文献、调研及清查的重要性。这表明了在城市保护与历史城市环境构建方面, 这些思考具有前瞻性。可以说, 这种将文献作为古迹遗产保护不可或缺的一部分的工作方法, 在当时是很超前的。

2) 第二, 华沙中世纪老城及新城的真实结构有多少保留了下来, 并在随后融入到了重建的城市形态中。

这些论据涉及华沙老城及新城的保护原则和重建方法的关键性问题。这些问题源自1989年6月4日波兰的首次自由选举以及一年后柏林墙拆除所带来的政治及经济变化, 特别是私有化进程、自由市场的出现以及全球现象所带来的压力。

1 文献依据

需要强调的是, 华沙老城的重建是建立在卓越的专业战前文献调研的基础上的。华沙以

culture and the nineteenth-century theory of monument preservation. Furthermore, it took time before the concept of authenticity was redefined in a dialogue with the cultures of the Far and Middle East, Africa and other parts of the world.

Many have visited the rebuilt Old Town in Warsaw. It is a very special place, full of life yet retaining an atmosphere of warmth and intimacy. For many inhabitants of Warsaw, this area has a magical quality, a symbolic value that evokes deep emotions, tragically entwined in the history of so many local families. It is an active public space fully embraced by all Varsovians and regarded with a special sentiment and affection. Nevertheless, many scholars continue to express the opinion that the reconstruction of Warsaw is only a life-size impression, a model that reflects little of what the city was before its destruction. These scholars argue that what we see today cannot be considered a 'real' city in its expression and perception, even if a city is deemed to have been uniquely re-built. To challenge this view, which seems partial and imbalanced, this paper intends to demonstrate:

1) Firstly, the importance of the role of documentation, survey, and inventory that were used as the basis for the Warsaw reconstruction works. This demonstrates how modern the thinking was with regards to urban conservation and shaping the historic urban environment. It could be argued that this approach, which drew on documentation as an indispensable part of monument conservation and heritage protection, was ahead of its time.

2) Secondly, how much of the authentic structure of the medieval Old Town and New Town of Warsaw has actually been preserved, and subsequently incorporated into the rebuilt urban form.

These arguments touch upon key conservation issues with regard to the principles of protection and methods of reconstruction as applied to Warsaw Old and New Town. These issues resulted from the political and economic changes in Poland after 1989, the year of the first free election in Poland, which took place on June 4 and the subsequent demolition of the Berlin Wall one year later, in particular the re-privatisation process and the emergence of the free market, as well as pressure of global phenomena.

1 The documentation basis

及波兰的其他历史城镇、建筑群和古迹，在二战前都以平面图和剖面图等形式记录了建筑和城市的测绘数据。这一文献记录工作由华沙理工大学的学生完成，旨在进行专业的建筑实践练习。二战后，这些文献构成了华沙重建的基础，不仅包括中世纪的老城和新城，也包括了自皇家城堡沿克拉科夫郊区街至诺维谢维茨的皇家路线，沿途分布着许多十七世纪的贵族宫殿以及十九世纪的纪念性公共建筑和广场。这些文献的价值不仅体现在历史建筑的重建上，它还揭示了考古研究和发掘中发现的中世纪城市布局。

重建方案的首要目标是重现该城镇发展历程中的中世纪阶段。这意味着发掘中世纪城墙及护城河的遗迹，在留存下来的基础及地下室之上重建市民住宅，同时拆除那些被评估为价值不大的十九世纪加建的建筑。如此一来，华沙老城的城市肌理降低了密度，更多的自然光线被引入，也为进一步改善公共设施及绿地空间创造了机会。重建方案的设计者，建筑师瓦茨拉夫·波德莱夫斯基和扬·扎赫瓦托维奇教授（二战后被任命为波兰古迹保护局局长），



图2：华沙老城 - 房屋及城市防线中的哥特元素清查，1932-1939（波兰建设部档案）。
Figure 2. Warsaw Old Town - Inventory of Gothic elements in houses and the lines of the city defence, 1932-1939 (The archive of Polish Architecture Department - ZAP).

It should be stressed that the reconstruction of Old Warsaw was based on excellent pre-war professional survey documentation. Warsaw, as well as other historical towns, complexes and monuments in Poland, had architectural and urban measurements recorded in plans and sections, documented before World War II. This documentation process had been undertaken by students of the Faculty of Architecture at Warsaw University of Technology as a professional, architectural, practical exercise. After World War II, the documents underpinned all the projects involving the reconstruction of the historic structures in Warsaw, not only the medieval Old Town and the New Town, but also the Royal Route leading from the Royal Castle along Krakowskie Przedmieście and Nowy Świat, with many noble palaces from the seventeenth century, as well as monumental public buildings and squares dating to the nineteenth century. Such documentation was valuable not only in the reconstruction of all historic buildings, but also in revealing a medieval urban layout which was uncovered during archaeological research and excavation.

One of the main objectives of the reconstruction plan was to bring out the medieval phases in the development of the town. This meant uncovering the remains of the medieval town walls and moats, and rebuilding burgher houses on preserved foundations and cellars, eliminating all nineteenth-century additions that were assessed to be of little significance. In this way, the urban fabric of Old Warsaw became less dense, filled with more natural light and created opportunities for further enhancement with public facilities and green spaces. The authors of the reconstruction project design, architects Waclaw Podlewski and Professor Jan Zachwatowicz (who was appointed Conservator of Monuments in Poland after World War II), imagined rebuilt Old Warsaw as a capital city residential quarter, equipped with all-modern facilities, as if newly built.

The reconstruction project design, which formed a general plan for the entire area, was developed in the Capital Reconstruction Bureau (BOS). It did not focus only on a reconstruction of individual houses, assumed also unveiling the medieval walls and the Barbican, freeing them from the nineteenth-century buildings. Deciding how to rebuild

设想将华沙重建为首都住宅区, 就像那些新建建筑一样配备全套的现代化设施。

重建计划由首都重建局制定, 形成了整个地区的总体规划。它不仅关注单体建筑的重建, 还试图揭开中世纪城墙和碉堡的面纱, 将它们从十九世纪的建筑中解放出来。决定如何重建整座城市并不容易, 直到 1949 年年中, 政府才决定是否重建及如何重建。当时, 仍在进行清除瓦砾以及记录建筑遗存的工作。扬·扎赫瓦托维奇后来写到: “重建华沙古迹的想法, 使我们建筑保护者站在了保护基本原则的对立面, 这些原则只考虑保护原始构建的真实物质实体。然而, 波兰古迹的破坏具有特殊性。纳粹有条不紊地进行破坏, 他们认为, 为了摧毁一个民族, 就必须摧毁其文化古迹。”他进一步评论到, 华沙城约 80% 遭到了破坏, 这种惨烈的破坏程度使得抛开当代的保护评估原则则有可能。相反, 它可以遵从人民的判断, 尤其是那些从纳粹战俘营和劳改营返回他们已不复存在的家园的华沙居民。

1939 年的建筑清查展示了老城在被毁前的发展状况, 例如市民住宅的地下室和一层平面等。这些图纸是重建项目的基础。每栋房子都有一段立面, 它们共同构成了市场广场的整个立面形态。



图 3: 插图展示了市场广场的立面形态。在上图中, 深色表示清除瓦砾后核定的建筑遗迹, 背景的浅灰色为战前的测绘图。下图是重建项目的设计图。(波兰建设部档案)
Figure 3. Illustrations show the Market Square frontages. In the top elevation, the dark colour indicates remains of houses assessed after the removal of rubble, against the background of the pre-war survey, which is in light grey. The bottom elevation is a drawing for the reconstruction project design. (The archive of Polish Architecture Department - ZAP)

the whole city was not easy and it took political authorities until mid-1949 to reach the decision, whether and how to rebuild. By then, the work had continued with the removal of rubble and recording the existing remains of buildings. Jan Zachwatowicz wrote some time later: "... Taking the idea of reconstruction of monuments in Warsaw, we architects restorers stood on opposing positions with the basic principles of conservation which consider only the preservation of original objects with authentic material substance. However, destruction of monuments in Poland had a special character. This was carried out by the Nazis deliberately and methodically with the assumption that in order to destroy the nation they must destroy the monuments of its culture." He further commented that the tragic scale of the destruction of Warsaw, amounting to approximately 80 percent of the city, made it possible to move away from contemporary conservation principles and assessments. Rather it could defer to the judgment of the people, in particular those inhabitants of Warsaw who returned from Nazi prison camps and labour camps to their homes that were no longer there.

The inventory plans which were prepared in 1939 show the state of development of the Old Town before the destruction of the sections of buildings in question, such as burgher houses at the basement and first-floor levels. These drawings served as the basis for the reconstruction project. Each house had a length of façade, which comprised the entire frontage of the Market Square.

It is not difficult to notice how closely the reconstruction project design (the dark colour) and the pre-war survey (in light grey) correspond to each other. It is clearly visible how much of the original structures was preserved. Where the existing structures demonstrated suitable technical conditions for reconstruction they were integrated into the rebuilt buildings and façades. Since the original foundations were reused, most of the cellars remained authentic, as did many walls and details at ground-floor level as well as on the upper floors. This also applies to some of the stone window casements and some original portals, either in part or in whole; elements that are Gothic, Renaissance or Baroque, corresponding to the style of the original pre-war buildings.

Other authentic elements that have

不难发现重建项目设计（深色）和战前测绘（浅灰色）高度吻合。可以清晰得看到有多少原始构建被保存了下来。对于具备适宜技术修复条件的现存构件，都被整合到了重建后的建筑及其外立面中。由于利用了原来的基础，大多数地下室都保留了原状，底层及上层的很多墙体和细部也保留了原样。这一原则也或多或少地应用于石质窗扉和原有大门中，哥特、文艺复兴、巴洛克等元素，都与战前原有的建筑风格相呼应。

重建建筑中还保留了一些真实的特征要素，其中包括一些原有的装饰，例如：中世纪房屋的哥特装饰图案、墙壁装饰、文艺复兴时期立面的拉毛粉饰片段、居民住宅中的壁画、中世纪的防御墙以及大量的塔楼。一种特殊的砂浆被用于原有构件及重建部分的分界线。防御墙被设计为“新的如画的构图”，根据视觉感知，呈现出和谐的景观。

扬·扎赫瓦托维奇教授在中世纪主要的商业街斯维托扬斯卡街的设计研究中，为圣约翰大教堂设计了一个新的立面。该项目的设计灵感来源于中世纪晚期马佐夫舍地区典型的所谓维斯瓦哥特式风格砖砌宗教建筑。它取代了由十九世纪华沙著名建筑师塔德乌什·伊兹科夫斯基设计的十九世纪新哥特式立面，因为根据当时生效以及持续至1970年代中期的古迹保护准则，该立面被认为不具备任何价值。

华沙大教堂旁边有一座耶稣会教堂，始建于十七世纪初。它几乎是全部重建的，但在它的地下室里，我们仍然能看到保存下来的，真实的哥特市民住宅的基础。1610年，耶稣会士买下了这里，计划建设一个包括教堂、学院及学校的建筑群。在重建过程中，教堂塔楼被略微抬高，以便在集市广场上获得更好的观看视角，这也正是当初耶稣会建筑师所期望的效果。值得强调的是，决定在原有基础上重建市民房屋并保留原有的哥特式地下室，使得修复工作能体现现实性，并以中世纪华沙老城历史建筑的形式予以重建。我们可以从平面图以及市场广场的立面形态中看到这一点，这些立面是典

survived and feature in the reconstructed buildings include some original decoration, such as: Gothic motifs in medieval houses; wall decoration; fragments of Renaissance sgraffito on the façades; wall paintings inside burgher houses; and medieval defence walls and substantial areas of turrets, in which a special kind of mortar used marks the division line between the original structure and the reconstructed fragments. Defence walls which were designed as "a new picturesque composition" present a view of a harmonious landscape, according to visual perception roles.

The design study for Świętojańska Street, the main medieval commercial road, proposed a new façade for St. John's Cathedral, designed by Professor Jan Zachwatowicz. The inspiration for this project design was the religious brick architecture typical of the so-called Vistula Gothic style of Mazowsze Region in late Middle Ages. It replaced the Neo-Gothic nineteenth-century façade designed by Tadeusz Idzkowski, the notable nineteenth-century Varsovian architect, because according to the conservation doctrine of conservation of monuments in force at that time and lasted until the mid 1970s it was without any value.

Next to the Cathedral in Warsaw there is a Jesuit church, originally built in the early seventeenth century. Almost all of it is reconstructed but in its cellars we can still see preserved the authentic, Gothic foundations of burgher houses bought out by the Jesuits in 1610, when they were planning the construction of the complex: church, college and schools. During the reconstruction works, the church tower was raised slightly to be more visible from the Market Square, highlighting the desired effect of the original Jesuit architects. It is worth stressing that the decision to rebuild burgher houses on their existing foundations and to preserve the original Gothic cellars made it possible to renovate them authentically and rebuild in a form that was characteristic of the historic structure of the medieval Old Warsaw. We can see this in the ground plan and views of the Market Square façades that are typical of the burgher houses, tripartite structures with lanterns providing light into the internal areas where the stairways were located. Lanterns contribute to the characteristic and picturesque appearance of the Market Square frontages.

This method of rebuilding preserved the

型的市民住宅，三段式划分，并设有天窗为内部楼梯区域提供采光。天窗为市民广场的临街立面增添了特色，形成了如画般的视觉表现。

这种重建方法保留了中世纪建筑的大体布局，每一栋建筑都与其附属建筑及庭院相连。因此，在大多数情况下，重建并没有改变不动产的原始边界，尽管市政土地国有化仍在进行，但这仍是一项相当大的成就。小地块保持不变，通过地面高度、平台及围栏的变化来形成边界。如果几个后院合并为了一个大空间，那么沿着背立面清晰的分隔则提示了原先的布局。

除历史照片和图纸外，重建所参考的特定资料还包括贝纳多·贝洛托（又名卡纳列托）绘制的十八世纪城镇风光。这对于重建从维斯瓦河看到的老城全景尤其有效。贝洛托使用暗箱来绘制他的风景画，使得画作几乎与照片一样精确。他热衷于将街道和宫殿描绘到画布上。他所绘制的华沙宫殿在重建所谓皇家路线沿途的建筑和古迹的工作中发挥了巨大作用，这条路线从克拉科夫郊区街的皇家城堡一直延伸到维拉努夫的巴洛克风格皇家乡村住宅，这所住宅采用了类似凡尔赛宫的设计风格。老城的重建工作始于1949年，历时不到四年。然而，对于波兰的知识分子来说，在象征意义上，它并没有完工。直到1983年，重建的皇家城堡重新开放，它才是波兰民族的真正象征，这座城堡是1918年波兰独立后第一届政府所在地。

重建工作进展如此之快，过程中出现错误



图4：贝纳多·贝洛托，从克拉科夫郊区街看华沙老城的景色，1767。
Figure 4. Bernardo Bellotto, view to the Warsaw Old Town from Krakowskie Przedmieście, 1767.

medieval arrangement of buildings in the form of lots, in which each house was connected with its outbuilding and yard. As a result, in most cases the reconstruction did not change the original property boundaries, which was a considerable achievement despite the ongoing nationalisation of municipal grounds. The small lots remained unchanged and their boundaries were marked with differences in the ground level, terraces or fences. In cases where several backyards were merged to form a single larger space the clear separation visible along the back façades testifies to the original arrangement.

A specific source that was drawn on for the reconstruction, in addition to old photographs and drawings, were eighteenth-century townscape painted by Bernardo Bellotto known as Canaletto. These were particularly useful in the reconstruction of the Old Town panorama as viewed from the Vistula River. Bellotto painted his vedute using a camera obscura, resulting in an exactness that was almost photographic. His passion for putting on canvas the streets, palaces and palaces of Warsaw helped immensely in rebuilding the buildings and monuments situated along the so-called Royal Route, which leads from the Royal Castle through Krakowskie Przedmieście Street to the Royal Baroque country residence in Wilanów, designed in the style of Versailles. The reconstruction of the Old Town started in 1949 and took less than four years to complete. Nevertheless, for the Polish intelligentsia it was not finished, in a symbolic sense, until 1983, with the reopening of the rebuilt Royal Castle, which was the site of the first Polish government after the regaining of independence in 1918 and, as such, was a real symbol for the Polish nation.

It is unsurprising that with reconstruction progressing at such a fast pace there were errors and inaccuracies in its undertaking. Archaeological and architectural research was not always sufficient or properly documented. Precise reconstruction according to the historical documentation and measurements was only carried out in the most important parts of the Old Town and the New Town: the Market Squares in both towns, main streets, ramparts and also interiors. Lack of archival sources replace modern design and modern detail: modernist contemporary painting and sgraffito

和不准确之处也就不足为奇了。考古和建筑研究并不总是拥有充足的文献记录。只有老城和新城最重要的部分依据历史文献及测绘进行了精确的重建，其范围包括两个城镇的市场广场、主要街道、城墙及其内部。缺乏档案资料支撑的部分则采用了现代的设计和细部：包括整个立面上的现代主义当代绘画及拉毛粉饰、大门的雕刻细节、后院的绿植构图等。很多著名的波兰艺术家、画家和雕刻家在技艺精湛的工匠的协助下，参与了这项工作。在一些案例中，融入修复工程的艺术作品具有象征意义，它展示了这座城市及其人民的战争经历。

当时的状况，尤其是政治环境，迫使保护工作者、研究人员、工程师、项目设计师、艺术家和工匠争分夺秒，在很多个案中采用了妥协的做法。他们不得不反复采取非常规策略来捍卫既定的重建理念，以便在政治认可无望时制造既成事实。一个典型例证是，在政治当局计划将集市广场东侧立面向维斯瓦河打开的背景下，出现了“我们不能拆毁社会主义工人亲手建设的成果”的声明。不过，结果是令人满意的，尤其是得到了国际保护专家群体的盛赞，重建后的华沙旧城和新城于1980年被正式列入世界遗产名录。这种赞誉不只是让人感到欣慰，它更意味着重大的责任。下文我将就此进行阐述。

2 世界遗产城镇监测的必要性



图5：华沙老城。从城堡广场到大教堂和耶稣会教堂塔楼的景色，2008年（摄影：克洛谢克·科兹洛夫斯卡）
Figure 5. Warsaw, the Old Town. View from Zamkowy Square to Cathedral and the tower of the Jesuit Church, 2008. (Photo: D. Klosek-Kozłowska)

on whole façades, sculptural details of portals, the compositions of greenery in backyards. Many famous Polish artists, painters and sculptors contributed to the work, assisted by highly skilled craftsmen. In some cases the works of art incorporated into the restoration works are symbolic, representing the experience of the war for the city and its people.

The circumstances at the time, in particular the political situation, forced the conservators, researchers, engineers, project designers, artists and craftsmen to work hurriedly and in consequence, in many cases, compromise their approaches. They were repeatedly required to adopt unusual strategies in defence of established concepts of reconstruction, in order to create a fait accompli when political acceptance was unlikely to be forthcoming. An example of this is the declaration, "We cannot tear down the work of the socialist workers' hand", in the case of the eastern frontage of the Market Square, which was intended by the political authorities to be open to the Vistula River. Nevertheless, the results were rewarding, especially in the appreciation expressed by the international community of conservation experts, which was formalised with the inscription of rebuilt Warsaw - the Old Town and the New Town - on the World Heritage List in 1980. Such appreciation leads not only to great satisfaction but also significant responsibility. Let me elaborate on the latter point.

2 The need for monitoring of world heritage towns

With the rise of the market economy in Poland in 1989, the Old Town and the New Town began to attract economic investment and transformations, which brought with them a number of threats to the cultural heritage. The lack of proper management can endanger the concept of reconstruction, that is today's cultural heritage of the world on the UNESCO List. Being particularly attractive to economic investment, this area of Warsaw is primarily vulnerable to impulsive adaptations, especially within the basement and ground-floor areas of burgher houses – areas that include the most valuable remains of authentic historic urban structures. The issue is further complicated now by the poor technical condition of many buildings in the area, the deterioration of the overburdened infrastructure and the economic and social issues that the city faces,

1989 年, 随着波兰市场经济的兴起, 老城和新城开始吸引经济投资进行改造, 这给文化遗产带来了诸多威胁。对于现今被列入联合国教科文组织名录的世界文化遗产来说, 缺乏妥善管理可能会危及重建理念。华沙这一区域对经济投资有着较强的吸引力, 因此也易受到冲动改造的影响, 尤其是市民住宅的地下室和首层, 这些区域保存着最为珍贵的历史城市构件的真实遗迹。现今, 这一问题更加复杂, 因为该区域内很多建筑的技术状况不佳, 基础设施不堪重负, 城市面临的经济及社会问题也不断恶化, 例如人口老龄化问题, 该地区 40% 的居民都超过了 60 岁。另一个挑战则是如何为旅游业创造持续发展的条件。

作为国际古迹遗址理事会对波兰的世界遗产进行监测的一部分, 1997 年针对华沙古城编制了一份特别报告, 旨在识别所有的挑战及面临的问题。该报告不仅着眼于防止文化遗产受破坏, 还是投资者、居民及地方当局进行沟通的工具, 从而规范保护区内的任何改变。它评估了历史环境, 并确定了它所面临的有形及无形风险。

因此, 我们启动了对老城新一阶段的研究, 旨在寻找该地区管理的新策略。该项目的一个关键要素是对私有化进程的展望, 如果不加控制, 它将可能危及重建建筑底层及地下室的遗产真实性。当务之急是探究在自由经济和投资者需求的驱动下, 改造可以进行到什么程度, 同时需兼顾对建筑原真性的结构要素以及重建的建筑形式的保护。众所周知, 适当的私有化政策有助于深化对保护对象的理解, 此类提升区域价值的契机不应被忽视。

新的调查研究所得出的结论也应该被纳入考虑, 由于缺乏时间和财政支持, 这些调研在重建期间没有进行。例如此类工程实践中, 针对维斯瓦河沿岸不稳定状况的研究不仅揭示了东部城墙的位置, 而且识别出了在老华沙的前景中可见的旧粮仓的基址。这类问题只能在区域空间发展规划中解决。

3 结论

华沙老城的重建是城市保护领域的一次实

for example with an ageing population where 40 percent of the inhabitants are over 60 years of age. An additional challenge is to create the right conditions for the sustainable development of tourism.

As part of the monitoring process undertaken by ICOMOS for World Heritage in Poland, a special report for Warsaw Old Town was prepared in 1997, in order to identify all the challenges and issues that were being faced. This document is intended to not only prevent damage to the cultural heritage but also function as an instrument of communication with investors and residents, as well as local authorities, leading to regulation of any change within the protected area. It evaluated the historic environment and identified the risks that it faced: both tangible and intangible.

Thus, we initiated a new phase of research in the Old Town, which was to result in finding a new strategy of administering the area. A crucial element in this project was a vision of the privatisation process, which, if uncontrolled, threatened to endanger the authenticity of heritage in the ground floors and basements of the reconstructed buildings. The most urgent task was to find out how far new adaptations as a result of free market economy and investor demands could go, bearing in mind the need to protect the authentic structural elements and the reconstructed forms of the buildings. As we know, a proper privatisation policy could help to develop a more detailed understanding of certain objects and such an opportunity to enhance the area should not be neglected.

Another factor taken into consideration was the outcome of new research and studies, which could not have been undertaken during the reconstruction owing to the lack of time and financial support. In the context of these works, for instance, studies of instability along the bank of the River Vistula revealed the location of the eastern part of the town walls, as well as the foundations of old granaries that are visible in the foreground of scenes of old Warsaw. Such issues could only be addressed in a spatial development plan of the area.

3 Conclusion

The rebuilding of the Old Town of Warsaw was one of those experiments in urban conservation that stimulated the development of its theoretical foundations and led to the revaluation of many of the

验，它促进了城市保护理论基础的发展，致使从前被奉为神圣的诸多规则得到了重新评估。我们甚至可以大胆断言，它是实施综合保护原则的先驱者之一。这种保护理念是一种跨学科的系统行动，不仅涵盖了符合当代需求的技术和经济维度，更体现了强大的社会驱动力，即倾听居民的心声与期望，这正是我们今天不断完善保护哲学的核心。

华沙的重建可能是证明了专业文献记录是保护实践的关键的最早案例，它通过建档为寻回失落之宝奠定了基础。由于战争和自然灾害而造成文化遗产损失的风险——从那些近期遭受此类灾难的国家的经历中可见一斑——这要求我们重视通过开展详细调查和规划来可靠记录建筑遗产的重要性。华沙的案例表明，文献记录是保护实践的重要组成部分。

rules that had previously been considered hallowed. We might even risk a claim that it was one of the first enterprises that implemented the principles of integrated conservation, understood as interdisciplinary actions involving not only the technical and economic aspects of contemporary need but above all a great social pressure - the voice of inhabitants and their expectations, the philosophy of conservation that we are developing today.

The case of Warsaw has probably been one of the first to prove that professional documentation is a key part of conservation practice and may serve as the basis for regaining lost treasures. The risk of losing cultural heritage as a result of war and natural disaster - as can be seen experienced by nations that have recently suffered such catastrophes - calls for an emphasis on the importance of reliably documenting the built heritage by carrying out detailed surveys and plans. The lesson of Warsaw shows that, among other things, documenting is a vital part of the conservation process.

平台动态 Platform Dynamics

关于油画保护的研究：对微生物污染和艺术家材料的评估

On the Conservation of Easel Paintings: Evaluation of Microbial Contamination and Artists' Materials

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1 引言

油画起源于中世纪, 至今仍是最重要的艺术表现形式之一, 具有重要的历史和文化价值, 是重要的文化遗产。这些艺术品包含多种有机材料, 例如作为不同颜料层的介质和添加剂的蛋白质材料、多糖和油脂, 以及作为支撑材料的木材、织物、纸张或羊皮纸。这些成分容易因物理、化学和生物因素(如光、温度、湿度和微生物作用)的影响降解, 导致肉眼可见的结构和美学损伤。

本研究采用基于酶联免疫吸附测定(ELISA)的方案, 针对油画中处于明显劣化状态且需要立即干预的部位, 快速且特异性地识别其微量样本中的蛋白质材料。研究分析可以为油画的保护和修复过程提供针对性策略。

2 方法

研究团队选取了乔治·马里尼(1836-1905)的四幅油画, 这些作品存在明显的色彩和结构变化。其中一幅作品是《弗雷·曼努埃尔·多·塞纳库洛》肖像画(ME1281, 1887年), 保存于埃武拉博物馆(图1A), 另外三幅来自私人收藏, 其中两幅是一位留胡子的男士和一位女士的肖像画(1897年)(图1B、C), 另一幅是女士肖像(1886年)(图1D)。

1 Introduction

Easel paintings emerged in the middle ages and have been since then one of the most important art expressions, constituting today relevant cultural heritage assets with important historic and cultural value. These artworks contain a diversity of organic materials, namely proteinaceous materials, polysaccharides and oils, used as mediums and additives in the different paint layers, as well as support materials like wood, fabric, paper or parchment. These components are easily degraded by several physical, chemical and biological factors such as light, temperature, humidity and microorganism action, causing visible structural and aesthetic damages.

In this paper we use an ELISA-based protocol for a rapid and specific identification of proteinaceous materials present in micro-samples collected from easel paintings that are in evident decay and require immediate intervention. These analyses aim to provide relevant information for a focused strategy of conservation and restoration process.

2 Methodology

In this study, four easel paintings by Giorgio Marini (1836-1905) with evident chromatic and structural alterations were selected. One of the paintings, the portrait of Frei Manuel do Cenáculo (ME1281, dated 1887), belongs to the Museum of Évora (Figure 1A), and three other are from

采样过程遵循保护原则,在靠近缺失部分、边缘或裂缝处采集了测试所需的最小计量,从而避免对艺术品造成结构和美学损伤。研究采用非侵入和微侵入方法,在无菌条件下收集了多份画作样本。最终,通过无菌棉签收集生物膜样本共 28 份,用于可培养的真菌群落表征,其中画作正面 18 份(图 1A-D),背面 10 份(图 1B/R、C/R)。

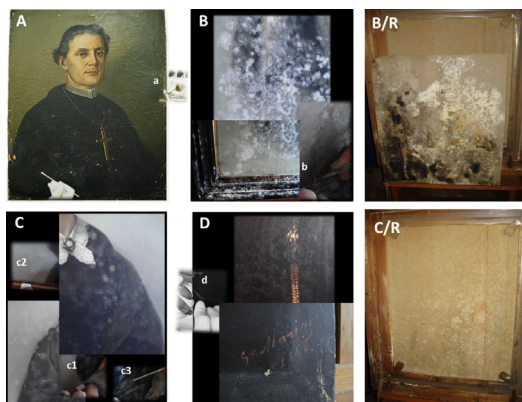


图 1: 乔治·马里尼肖像画, 标记采样区域: A. 《弗雷·曼努埃尔·多·塞纳库洛》, 1887 年 (ME1281), 埃武拉博物馆; B. 留胡子的男士肖像, 1897 年; C. 女士肖像, 1897 年, 私人收藏(葡萄牙埃武拉); D. 女士肖像, 1886 年, 私人收藏(葡萄牙埃武拉)。B/R 表示 B 画作背面, 由纸板覆盖, C/R 表示 C 画作背面。小写字母 (a、b、c1、c2、c3 和 d) 表示为材料表征收集的微片。Figure 1. Portraits by Giorgio Marini with evidenced sampling areas: A portrait of Frei Manuel do Cenáculo, 1887 (ME1281), Museum of Évora; B portrait of a bearded gentleman and C portrait of a lady, 1897, private collection (Évora, Portugal); D portrait of a lady, 1886, private collection (Évora, Portugal). B/R Reverse side of the painting B covered by a cardboard and C/R reverse side of the painting C. Small letters (a, b, c1, c2, c3 and d) indicate the micro-fragments collected for materials characterization.

经棉签收集的样本在最大修复稀释液 (MRD) 培养基中再水合后, 在 28°C 以 100 转/分的转速振荡培养过夜, 随后在针对不同的生态位的培养基中进行无菌培养: 营养琼脂 (NA, HiMedia)、麦芽提取物琼脂 (MEA, HiMedia) 和孟加拉玫瑰红 (CRB, HiMedia)。所有培养物均用保鲜膜密封, 并在 28°C 的黑暗环境中培养 5-7 天, 保证真菌生长; 在 30°C 环境中培养 24-48 小时, 保证细菌生长。

在此期间生长的不同宏观形态特征的所有菌落均按顺序编号。随后依次转接到新的含有 MEA 或 NA 培养基的灭菌培养皿中, 并在

private collections, two that comprise the portrait of a bearded gentleman and a lady (dated 1897) (Figure 1B,C) and another portrait of a lady (dated 1886) (Figure 1D).

The sampling process was made according to the conservation ethics, collecting the minimum amount required for testing, near lacunae, edges or fissures, avoiding thus structural and aesthetic damage to the artwork. Several samples of the artworks were collected using non-invasive and microinvasive methods, in sterile conditions. A total of 28 biofilm samples using sterile cotton swabs were collected, 18 from the obverse side of the paintings (Figure 1A-D) and 10 from the reverse side (Figure 1B/R, C/R) for characterization of the cultivable fungal communities.

The samples collected with cotton swabs, after cells rehydration with MRD medium and incubated overnight at 28°C with agitation of 100 rpm, were aseptically cultured in different culture media specific to several ecological niches: nutrient agar (NA, HiMedia), malt extract agar (MEA, HiMedia) and Cook Rose Bengal (CRB, HiMedia). All cultures were sealed with cling film and incubated in the dark during 5-7 days at 28°C for fungal growth and 24-48 h at 30°C for bacteria growth.

All the colonies with different macro-morphological characteristics that grew during this period were sequentially numbered. The colonies were successively sub-cultured to new sterilized Petri dishes containing MEA or NA media and incubated at 28°C , until the development of pure fungal colonies.

In order to obtain a full characterization of the painting layer structure and the painting materials used by the artist, a set of several analytical techniques are usually used for which micro-sampling is required. In order to identify the painting materials used by Marini, two micro-samples from the portraits of a man and a lady (Figure 1B, C) were collected and analyzed by optical microscopy, scanning electron microscopy with energy-dispersive X-ray spectroscopy (SEM-EDS), μ -Raman spectroscopy, X-ray diffraction (XRD) and micro-Fourier transform infrared spectroscopy (μ -FTIR). The portrait of Frei Manuel do Cenáculo has already been studied by which further sampling of this painting was not necessary.

The detection of the protein binders

28° C 下培养至形成纯真菌菌落。

为获得绘画层结构和画家使用的绘画材料的完整表征, 通常需要多种分析技术对微采样进行分析。为了识别马尼里使用的绘画材料, 从男女肖像 (图 1B、C) 中收集了两份微量样本, 并通过光学显微镜、扫描电子显微镜与能量色散 X 射线光谱 (SEM-EDS)、拉曼光谱、X 射线衍射 (XRD) 和微傅里叶变换红外光谱 (μ -FTIR) 进行分析。《弗雷·曼努埃尔·多·塞纳库洛》肖像画已经过研究, 因此无需进一步采样。

在优化操作条件后, 通过免疫酶测定检测蛋白质粘合剂 (卵清蛋白、胶原蛋白和酪蛋白), 例如抗原和一级抗体的温度以及培养时间、浓度等。在测定过程中, 进行了以下阴性对照以验证测定结果: 未添加抗原、一级抗体、二级抗体和底物。使用标准蛋白 (商用卵清蛋白、胶原蛋白和酪蛋白) 进行阳性对照, 以确认一级抗体单克隆和多克隆抗体的特异性。

每个样本均进行至少三次 ELISA 测试。阳性结果以每毫升抗体单位表示, 一个抗体单位定义为在标准 ELISA 条件下, 经二抗碱性磷酸酶结合物催化, 与底物对硝基苯磷酸二钠盐 (p-NPP) 反应 30 分钟后, 使吸收率在 405nm 处变化 1.0 所需的抗体量。

3 结果与讨论

3.1 生物膜分析

显而易见的是, 在采样过程中, 油画表面微生物的存在似乎是可见污渍 / 生物膜形成的根源。通过扫描电子显微镜 (SEM) 对这些受影响区域收集的微片进行分析, 可以直接观察到高倍率和分辨率图像中的微生物群落, 从而检测到这些艺术品的微生物群落。能量色散光谱 (EDS) 微分析可以识别无机成分 (如铝、硅和钙) (图 2A), 以及与有机物 (如碳、氮、氧和硫) (图 2B) 的结合, 这是微生物污染存在的有力证据。在图 2C-F 中, 还可以清楚地区分出丝状真菌以及绘画表面的真菌孢子的微观形态特征, 这些区域有肉眼可见的表面生物膜。

(ovalbumin, collagen and casein) was carried out by immunoenzymatic assay (ELISA) with a previous optimization of the procedure conditions, such as temperature and incubation time of antigens and primary antibodies concentrations. During the assay, the following negative controls were performed to validate the assay: without the addition of antigen, primary antibodies, secondary antibodies and substrate. Positive controls using standard proteins, commercial ovalbumin, collagen and casein were made for confirming the specificity of the primary monoclonal and polyclonal antibodies.

All the ELISA tests were performed at least three times on each sample. The positive results were expressed in antibody units per millilitre, being one antibody unit defined as the amount of antibody required to give a change in absorbance of 1.0 at 405nm per 30 min of reaction of secondary antibody alkaline phosphatase conjugate with the substrate p-NPP, under the standard conditions of ELISA early described.

3 Results and discussion

3.1 Biofilms analysis

During sampling it became clear that the presence of microorganisms on the easel painting surface seems to be the cause of the visible stains/biofilms formation. The micro-fragments collected in these affected areas were analyzed by SEM allowing to detect the microbial communities that colonize these artworks by direct observation of the high magnification and resolution images. EDS micro-analyses of micro-fragments allow the identification and spatial distribution of the inorganic constituents, such as aluminium, silicon and calcium (Figure 2A), and the association of the organic material detected, such as carbon, nitrogen, oxygen and sulphur (Figure 2B), is a strong indicator of the microbiological contamination presence. In Figure 2C-F, it is also possible to distinguish clearly the micro-morphological features of filamentous fungi as well as fungal spores on the painting surface corresponding to areas with visible superficial biofilms. SEM observations confirmed that the presence of filamentous fungi and a high hyphae proliferation developed in close contact with the material of the paint layer and promoting their proliferation in deeper layers of the samples, may explain the presence of some cracks in the paintings. The results showed that the fungal proliferation seems to be the

SEM 观察结果证实, 丝状真菌的存在以及菌丝在与颜料层材料的密切接触中大量增殖, 并进一步在样本深层扩散, 这或许可以解释画作中一些裂缝的产生。结果表明, 真菌增殖似乎是这些油画美学和结构退化的主要因素。

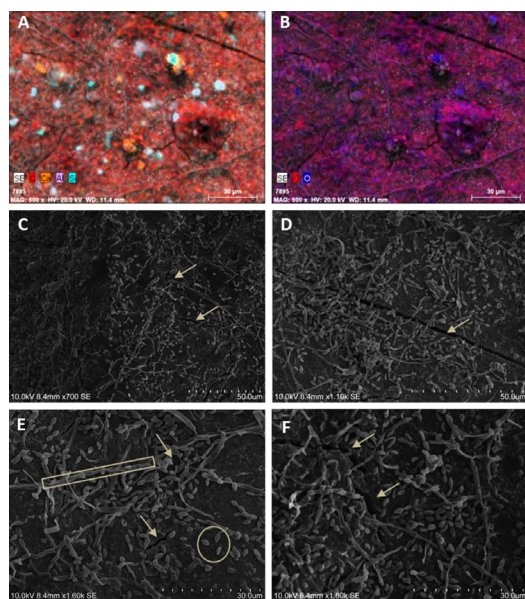


图 2: 通过二维映射进行的化学分析 (A、B) 和从可见受影响区域采集的油画微片的扫描电子显微镜图像 (C-F)。箭头指示了丝状真菌大量增殖和菌丝深入内部的位置, 这些位置的画作表面均出现了裂缝, E 图的方框和圆形分别显示了一根菌丝和真菌孢子。

Figure 2. Chemical analyses by 2D mapping (A, B) and SEM micrograph of easel paintings micro-fragments collected from visible affected zones (C-F). The arrows indicate the appearance of cracks in the surface of paintings with the presence of high proliferation of filamentous fungi and the penetration of the hyphae in depth and the box and circle E evidence one hypha and fungal spores, respectively.

3.2 微生物群落表征

基于培养的方法是艺术品生物劣化研究的有效手段。它能够从所分析画作的受影响区域分离并表征出更多的真菌多样性, 分离出的微生物可用于高细胞密度的抗真菌活性或模拟研究。共分离出 24 种不同的真菌菌株, 分别属于青霉菌属 (占总群落的 58.3%)、曲霉菌属 (12.5%)、芽枝霉属 (8.3%)、根霉属 (8.3%)、乌洛霉属 (4.2%)、枝孢霉属 (4.2%) 和卷枝毛霉 (4.2%)。

研究结果表明, 除 B 画作的纸板外, 与博物馆中展示的画作相比, 私人收藏的油画正面

main factor for the aesthetical and structural degradation observed in these easel paintings.

3.2 Microbial population characterization

Culture-based approaches are useful in mycological research on biodeterioration in artworks. This approach allowed to isolate and to characterize a greater fungal diversity from the affected areas of the analyzed paintings, being possible the use of these isolated microorganisms for antifungal activity or simulation studies that require high density of cells. Twenty-four different fungal strains belonging to the genera *Penicillium* (58.3% of total population), *Aspergillus* (12.5%), *Cladosporium* (8.3%), *Mucor* (8.3%), *Ulocladium* (4.2%), *Scopulariopsis* (4.2%) and one identified as *Mucor circinelloides* (4.2%) were obtained.

The results obtained in this study showed a higher microbial density and complexity on the obverse side of the investigated paintings from private collections, with the exception of the cardboard in the painting B. This fact may be related to the poorly controlled environment where the easel paintings were stored, being subjected to sudden environmental changes that occur during the different seasons.

Relatively to the painting that is exposed in the museum, although there is no strict record of the environmental conditions in which it is exposed, there is a control of temperature and humidity which has been shown to influence the reduction of the microbial population found, with only *Penicillium* species being isolated.

3.3 Material characterization

Optical microscopy revealed a typical stratigraphy, being composed of an ochre ground layer, intermediary white and a top green colour layer (Figure 3).

The results show that the first layer, which is applied over the support, is composed of a mixture of iron, aluminosilicates and lead white while the upper white layers are composed of lead white and minor amounts of calcium carbonate (also used in paints as extender or bulking agent). These results are in accordance with what is expected for nineteenth-century easel paintings. EDS also found barium in the first ground layer of both portraits (Figure 4A). Barium is an indicator of the presence of barium white (barium sulphate) which was primarily used

的微生物密度和复杂性更高。这可能与油画存放环境控制不佳有关, 油画在不同季节会受到环境突变的影响。

相较于博物馆展示的画作, 尽管没有严格记录其暴露的环境条件, 但只分离出青霉菌属群落, 这证实了控制温度和湿度可以减少发现的微生物群体。

3.3 材料表征

光学显微镜观察到典型的分层结构, 由赭石底层、白色中间层和绿色顶层组成(图3)。

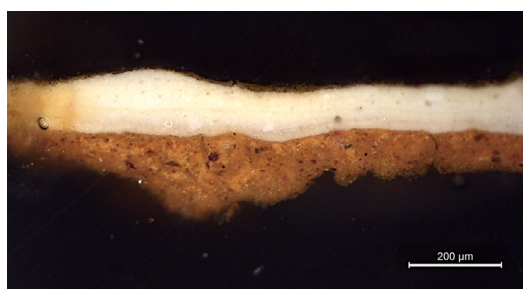


图3:《弗雷·曼努埃尔·多·塞纳库洛》(ME1281)的样本横截面, 显示了赭石底层、白色中间层和绿色顶层。
Figure 3. Cross section of a sample from the portrait of Frei Manuel do Cenáculo (ME1281) showing a ochre ground layer, intermediary white layer and a top green colour layer.

研究结果显示, 涂在支撑架上的第一层材料由铁、铝硅酸盐和铅白的混合物组成, 而上一层白色则由铅白和少量碳酸钙(也用作颜料中的填充剂或增稠剂)组成。这些结果与十九世纪画作的预期一致。能量色散光谱还在两幅肖像的第一层底料中发现了钡(图4A)。钡是硫酸钡(即钡白)存在的指标, 这种物质在1820年后主要用作铅白的填充剂。由于钡白仅出现在图4A的第一层底料, 而未出现在上层中, 这表明它并非艺术家所用铅白的商业配方之一。鉴于当时的普遍做法, 这可能是因为艺术家购买的画布已经预先涂有工业底料。

研究对男性肖像画的暗部区域进行EDS分析, 确认了钙和磷的存在, 这是一种常用的黑色颜料——骨黑存在的标志(图4B)。

3.4 通过ELISA检测蛋白质粘合剂

为分析提取的蛋白质, 研究采用ELISA优

as extender for lead white after the 1820s. Being present in the first applied ground layer of Figure 4A and not in the upper layers, it is indicative that barium white was not part of the commercial formula of lead white used by the artist. Given the practice at the time, it is also possible that the artist had bought the canvas with an industrial ground layer already applied.

EDS analysis in a dark area of the portrait of a man confirmed the presence of calcium and phosphorus, a marker for the presence of bone black, one of the most used black pigments (Figure 4B).

3.4 Proteinaceous binders detection by ELISA

For analyzing the extracted proteins, we used an optimized immunoassay based on indirect ELISA, with commercial antibodies Anti-Ovalbumin, Anti-Collagen and Anti-Casein. This procedure was previously optimized, and the conditions of the ELISA were adjusted allowing increased detection signals with low levels of proteins and aged protein. The dose-response curves for each antibody were made to select the optimal concentrations of primary antibodies for their application in this type of samples. The results show that it is possible to detect and quantify the protein binders of ovalbumin in all samples analyzed. Residual contents of collagen and casein were also detected in some samples; however, quantification was not possible since they were under the limit levels. These results show that a mixture of protein binders was used in the different paint formulae of these paintings. On the other hand, the detection of more than one protein binders may be explained for the migration of materials, for example penetrating from other paint layers or were introduced during conservation treatments with adhesives or from the application of surface coatings.

The confirmation of these organic compounds presence in these paintings may explain the increased microbial colonization detected which together with the favourable environmental factors that are subject, greatly promotes filamentous fungi proliferation on the painting surface and the propagation in depth, promoting cracking and detachment of some areas.

4 Conclusions

Four easel paintings from the late nineteenth century with chromatic and

化免疫分析方法，使用商业抗体抗卵清蛋白、抗胶原蛋白和抗酪蛋白。该方法已经过预先优化，ELISA 的条件也进行了调整，以便在低水平蛋白质和老化蛋白质的情况下提高检测信号。研究针对每种抗体制作了剂量-反应曲线，以选择适用于此类样本的一级抗体最佳浓度。结果显示，该方法可以在所有分析样本中检测并定量卵清蛋白的蛋白质粘合剂。在某些样本中还检测到了胶原蛋白和酪蛋白的残留含量；但由于其含量低于检测限度，无法进行定量。这些结果表明，这些画作的不同颜料配方中使用了多种蛋白质粘合剂。另一方面，研究检测到多种蛋白质粘合剂的存在，这可能是由于材料发生了迁移，例如从其他颜料层渗透而来，或来自修复过程中的粘合剂或表面涂层。

绘画中有机化合物的存在可以解释检测的微生物群落的增加。微生物群落与环境因素（如温湿度）带来的有利条件相结合，极大促进了丝状真菌在画作表面的增殖和向更深层的扩散，因此导致了画作部分区域出现开裂和剥落。

4 结论

研究对四幅存在色彩和结构退化及高微生物污染的十九世纪末油画进行了分析，目的是确定生物污染源和绘画材料。这些画作色彩较为单一，因此所用颜料范围有限，包括铅白、方解石、钡白、骨黑、石英、红色氧化铁和铝硅酸盐。尽管这些画作的横截面结构符合当时的典型特征，它们最大的区别在于底料层：在私人收藏的两幅肖像画中，第一层底料含有钡白，而《弗雷·曼努埃尔·多·塞纳库洛》肖像画中则没有。这组油画的绘画媒介主要由干性油和蛋白质组成。通过提取和定量蛋白质化合物，并通过免疫分析鉴定主要蛋白质，结果显示可能存在与使用的某些颜料和蛋白质粘合剂的对应关系。另一方面，通过扫描电子显微镜检测到这些画作上微生物群落的增殖。鉴定出的主要微生物群落为丝状真菌，包括曲霉属、芽枝霉属、根霉属、青霉菌属、乌洛霉属和枝孢霉属。分析表明，真菌群落的增殖与绘画中观察到的结构退化有关。

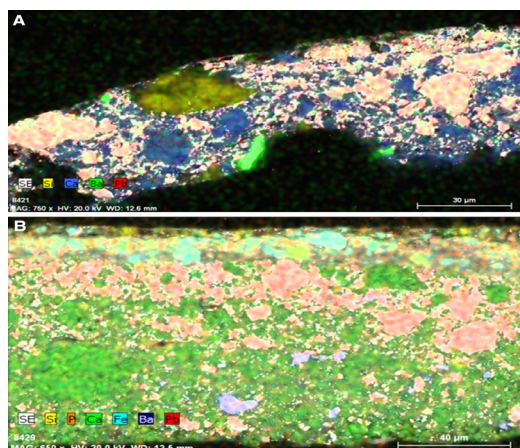


图4：女性肖像（A）样本横截面的显微照片，显示了不同层中铅、钡、钙和硅的元素分布；男性肖像（B）的样本横截面，显示了不同层中铅、钡、铁、钙、磷和硅的元素分布。
Figure 4. Micrograph of the cross section of a sample from the portrait of a lady (A) showing the elemental distributions of the different layers with lead, barium, calcium and silicon; and the portrait of a man (B) showing the elemental distributions of the different layers with lead, barium, iron, calcium, phosphorus and silicon

structural decay and high microbial contamination were analyzed in order to identify the biocontamination source and the painting materials. The paintings in study are quite monochromatic, demanding thus a limited range of pigments: lead white, calcite, barium white, bone black, quartz, a red iron oxide and aluminosilicates. While the paintings' cross sections are typical for that period, the biggest difference among the paintings is in their ground layers: in both portraits from a private collection, the first ground layer applied contained barium white while the portrait of Frei Manuel do Cenáculo does not. The painting media of this set of paintings is composed mainly of siccative oil combined with protein. Protein compounds were extracted and quantified and immunological assays allowed to identify the main proteins present, showing a possible correspondence with some pigments and protein binder used. On the other hand, proliferation of microbial communities that colonizes these artworks was detected by SEM. The predominant microbial population was identified as being filamentous fungi of the genera *Aspergillus*, *Cladosporium*, *Mucor*, *Penicillium*, *Ulocladium* and *Scopulariopsis*. The analyses showed that their proliferation seems to be associated with the structural degradation observed in the paintings.

活动报道 Latest Events

“遗产和恢复：廓尔喀地震的十年经验”国际会议在尼泊尔召开

International Conference "Heritage and Recovery: A Decade of Learning from the Gorkha Earthquake" Held in Nepal

资料来源 Source:

<https://soscbaha.org/heritage-and-recovery-a-decade-of-learning-from-the-gorkha-earthquake/>



图 1：国际会议海报

Figure 1. The poster of the international conference

维多利亚与艾尔伯特博物馆文化危机项目与斯特林大学以及巴哈社会科学合作举办“遗产和恢复：廓尔喀地震的十年经验”国际研讨会。会议于 2025 年 4 月 2 日至 4 日在尼泊尔拉利特布尔召开。

2025 年是尼泊尔廓尔喀 2015 大地震十周年。此次地震导致近 9000 人死亡，对生命、生计及物质、社会与文化基础设施造成了灾难性破坏。地震对尼泊尔全国的遗产，从国际公认的纪念性建筑和遗产地，到社区和宗教遗产建筑与景观、文物和博物馆，以及丰富尼泊尔居民生活的众多文化实践，造成了巨大影响。廓尔喀地震后，遗产成为灾后恢复的重点领域，不仅是因为它在尼泊尔经济中的作用，还因为它作为集体记忆、国家和地方身份及社会和心理福祉的核心价值。

随着尼泊尔纪念廓尔喀地震十周年，并正式进入所谓的“长期恢复”阶段，人们是时候反思过去十年中发生的多种形式的恢复和重建过程了。

本次会议及研讨会汇聚了尼泊尔的遗产专业人士、活动家、学者以及参与各种遗产恢复工作的社区成员，共同讨论过去十年中的努力

The Victoria & Albert Museum's Culture in Crisis Programme in partnership with the University of Stirling and Social Science Baha, organized a major international conference "Heritage and Recovery: A Decade of Learning from the Gorkha Earthquake" held from 2 to 4 April 2025, in Lalitpur, Nepal.

2025 marks ten years since the 2015 Gorkha Earthquake(s) struck Nepal, killing nearly 9,000 people, and causing catastrophic damage to lives and livelihoods, as well as physical, social, and cultural infrastructure. The disaster left a deep impact on heritage across the country; from internationally recognised monuments and heritage sites to community and religious heritage buildings and landscapes, objects and museums, and the myriad cultural practices that enrich the lives of Nepal's inhabitants. In the aftermath of the Gorkha Earthquake, heritage has emerged as a key sector for post-disaster recovery, not only because of its role in Nepal's economy, but also as a central aspect of collective memory, national and local identity, and social and psychological well-being.

As Nepal commemorates ten years since the Gorkha Earthquake, entering what is officially referred to as "long-term recovery", it is time to reflect on the many forms of recovery and reconstruction processes that have taken place.

This conference and its workshops brought together Nepalese heritage professionals, activists, academics and

成果、面临的挑战和取得的成功，并探讨未来共享学习的机会。尤其是，旨在突出多样化观点，将不同规模和对遗产的概念化理解汇聚在一起。会议将分为三个环节：

- 社区主导的遗产恢复
- 国际机构与遗产恢复
- 地方治理、行动主义与遗产恢复

会议以 2015 年地震为中心议题，邀请国际专家共同探讨全球范围内的类似环境灾难，分享专业经验和最佳实践，提升面对未来威胁时更强的抗灾韧性。

community members involved in various forms of heritage recovery. Together they discussed their efforts across the past decade, their challenges and successes, as well as exploring shared learning opportunities for the future. In particular, this conference sought to highlight a diversity of voices, bringing together different scales and conceptualisations of heritage. The conference was divided into three sessions:

- Heritage recovery by and for communities
- International institutions and heritage recovery
- Local governance, activism and heritage recovery

Situating its central narrative around the 2015 earthquake, the conference brought together international experts to discuss comparable environmental disasters around the globe, sharing their experience and best practice, and promoting greater disaster resilience in the face of future threats.

“文化生态系统与生物文化遗产”工作坊在葡萄牙召开

"Cultural Ecosystem Services And Biocultural Heritage" Workshop Held in Portugal

资料来源 Source:
<https://www.bioculturalheritage.com/>



图 2：工作坊海报
Figure 2. The poster of the workshop

作为欧洲国家气候行动联合计划倡议和文化遗产联合计划倡议的合作行动，“文化生态系统机能与生物文化遗产：连接自然与文化，建设可持续未来”工作坊将于 5 月 20 日至 21 日在葡萄牙召开。

联合计划倡议承认理解和减轻全球变化影响对气候、生物多样性和文化遗产的重要性。

As a collaborative action of the the Joint Programming Initiative on Climate (JPI Climate) and the Joint Programming Initiative on Cultural Heritage (JPI CH) between European countries, "Cultural Ecosystem Services and Biocultural Heritage: Connecting Nature and Culture for a Sustainable Future" will be held from May 20 to 21 in Portugal.

These JPIs recognize the importance of understanding and mitigating the impacts of global change, whether on climate, biodiversity or cultural heritage. The workshop will highlight the synergies and further strengthen the links between the two initiatives. By joining forces, both JPIs can contribute more effectively to tackling global challenges and ensuring a more sustainable future for Europe and the world.

The workshop aims to provide a comprehensive assessment of Cultural Ecosystem Services (CES), combining theoretical, methodological, and practical

本次工作坊将突出两项倡议的协同作用，并进一步加强两者的联系。通过携手合作，这两项倡议可以更有效地应对全球挑战，为欧洲乃至全世界的可持续未来做出更大贡献。

工作坊旨在结合理论、方法论和实践方法，全面评估文化生态系统服务，促进对生态系统与文化遗产之间关系的深入理解，重点关注特定地区所拥有的遗产多样性。工作坊将分为三个主要部分：

- 理论部分：参与者将讨论与生态系统服务（ES）、文化生态系统服务（CES）相关的关键概念，包括生物文化遗产、生物文化多样性、生态系统服务以及自然环境与文化实践之间的复杂相互作用。

- 方法部分：参与者将探讨不同的框架和方法，包括理解、识别和共同创造 CES 的主题，特别关注公民科学和协作识别实践。该环节还将深入探讨地理定位、数字人文、人工智能等前沿工具在 CES 制图和分析中的应用。

- 实践部分：工作坊的实践环节将包括实地活动，参与者将参观当地遗产地，观察生物多样性及其与文化表达（如手工艺、旅游、历史特色和季节性迁移）之间的联系。实地考察可能包括自然徒步、生物多样性观察以及对音乐、美食和地方记忆等文化元素的探索。

此外，工作坊还将促进在联合国教科文组织框架内，以及在联合国大会通过的国际可持续发展科学十年（2024-2033）的背景下有关遗产分类的持续讨论。

approaches. It is designed to foster a deep understanding of the relationship between ecosystems and cultural heritage, with a focus on the diversity of heritage found in specific locales. The workshop will be structured into three main components:

- Theoretical Component: Participants will discuss key concepts related to ES, CES, including biocultural heritage, biocultural diversity, ecosystem services, and the complex interactions between natural environments and cultural practices.

- Methodological Component: Participants will explore different frameworks and approaches, including topics such as understanding, identification, and co-creation of CES, with a particular focus on citizen science and collaborative identification practices. The session will also delve into the application of georeferencing, digital humanities, artificial intelligence, and other cutting-edge tools for mapping and analyzing CES.

- Practical Component: The hands-on section of the workshop will involve field activities where participants will visit local heritage sites to observe biodiversity and its connections to cultural expressions such as craftsmanship, tourism, historical characterization, and transhumance practices. Field trips may include nature trails, biodiversity observation, and an exploration of cultural elements such as music, gastronomy, and local memory.

The workshop will also contribute to the ongoing debate on the classification of heritage, particularly within the framework of UNESCO, and in the context of the International Decade of Sciences for Sustainable Development adopted by the United Nations General Assembly (2024-2033).

联合国教科文组织“世界遗产经济学大会”在西班牙举行

UNESCO "International Convention on the Economics of World Heritage" Held in Spain

资料来源 Source:
<https://whc.unesco.org/en/events/1798>

3月20日至21日，国际文化经济学会（ACEI）和阿尔汉布拉宫及赫内拉里菲理事

From March 20 to 21, the Association for Cultural Economics International (ACEI) and the Alhambra and Generalife Council, in



图 3：大会海报
Figure 3. The poster of the conference

事会与联合国教科文组织世界遗产中心合作，在西班牙格拉纳达举办了一场名为“格拉纳达世界遗产经济学国际大会”的科学论坛。

本次会议从多个角度探讨世界遗产经济学，涉及经济价值评估、旅游影响、治理、可持续性、遗产保护的挑战、国际合作、社区参与以及遗产对创造力和地方经济发展的促进作用等议题。

此次论坛汇聚了来自世界各地不同大学的学者、该领域领先的专家以及世界遗产地的管理者，涵盖了广泛的世界遗产案例研究。它为文化遗产领域的专业人士和爱好者提供一个宝贵的平台，让他们能够参与当代问题的讨论，并为遗产经济学的可持续实践发展做出贡献。

在为期两天的活动中，学者、文化经济学家、遗产专家、遗产地管理者以及领先文化机构的代表分享了来自世界各地遗产地的见解和案例研究，促进知识的交流和有效的世界遗产管理与规划的实用策略。世界遗产中心副主任介绍了“文化 2030 指标”项目以及联合国教科文组织世界遗产中心相关的可持续发展视角和工具。

cooperation with the UNESCO World Heritage Centre organized a scientific forum "Granada International Convention on the Economics of World Heritage", in Granada, Spain.

The conference addressed the Economics of World Heritage from various perspectives. Topics such as economic valuation, tourism impact, governance, sustainability, preservation challenges, international cooperation, community involvement and the effects of heritage on creativity and local economic development, among others, were examined.

The Convention has been able to gather scholars from different universities around the world, together with experts from leading cultural institutions in the field, as well as a wide geographical representation of world case studies. It offered a valuable platform for professionals and enthusiasts in the field of cultural heritage to engage with contemporary issues and contributed to the advancement of sustainable practices in heritage economics.

Over two days, academics, cultural economists, heritage experts, site managers and representatives of leading cultural institutions share insights and case studies from world heritage sites worldwide, promoting a rich exchange of knowledge and practical strategies for effective world heritage management and planning. The Deputy Director of the World Heritage Centre presented the Culture 2030 Indicators programme as well as perspectives and tools related to sustainable development from the UNESCO World Heritage Centre.



历史建筑与遗产保护研究所
Research Institute for Historical Architecture and Heritage Conservation